PHASE 1
OF

Amendment 14 to the Northeast Multispecies FMP
Amendment 14 to the Atlantic Scallop FMP
Amendment 3 to the Atlantic Herring FMP
Amendment 4 to the Monkfish FMP
Amendment 1 to the Deep-Sea Red Crab FMP
Amendment 2 to the Skates FMP
Amendment 3 to the Atlantic Salmon FMP

(Essential Fish Habitat Omnibus Amendment #2)

Prepared by the

New England Fishery Management Council

in consultation with

National Marine Fisheries Service
Mid-Atlantic Fishery Management Council

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COVER STATEMENT

Type of Statement:	Draft Supplemental Environmental Impact Statement
Responsible Agencies:	New England Fishery Management Council National Marine Fisheries Service Mid-Atlantic Fishery Management Council (Monkfish only)
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Type of Statement:

(X) DRAFT ( ) FINAL

Abstract:

The New England Fishery Management Council and the NOAA Assistant Administrator for Fisheries propose to review and amend the essential fish habitat (EFH) components of the Council's fishery management plans under one umbrella omnibus amendment persuant to the Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA or M-S Act). This action is Amendment 14 to the Northeast Multispecies FMP, Amendment 14 to the Atlantic Scallop FMP, Amendment 3 to the Atlantic Herring FMP, Amendment 4 to the Monkfish FMP, Amendment 1 to the Deep-Sea Red Crab FMP, Amendment 2 to the Skates FMP and Amendment 3 to the Atlantic Salmon FMP. Within the fishery management units (FMU) of these FMPs, the Council manages twenty-seven (27) species including: American plaice, Atlantic cod, Atlantic halibut, Atlantic herring, Atlantic salmon, Atlantic sea scallop, Barndoor skate, Clearnose skate, Deep-sea red crab, Haddock, Little skate, Monkfish*, Ocean pout, Offshore hake, Pollock, Red hake, Redfish, Rosette skate, Silver hake, Smooth skate, Thorny skate, White hake, Windowpane flounder, Winter flounder, Winter Skate, Witch flounder and Yellowtail flounder. Specifically, this action includes a range of EFH designation alternatives, a range of habitat area of particular concern (HAPC) alternatives, an analysis of the major prey species for each species in the FMU and an evaluation of the potential impacts of non-fishing activities on EFH. This document

includes all information and analyses required under the National Environmental Policy Act (NEPA), the M-S Act and other applicable laws.

Date by Which Comments Must Be Received: ________________________________

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List of Acronyms

AHE	Affected Human Environment
CEQ	Council on Environmental Quality
CZMA	Coastal Zone Management Act
DO	Dissovled Oxygen
DSEIS	Draft Supplemental Environmental Impact Statement
EEZ	Exclusive Economic Zone
EFH	Essential Fish Habitat
EIS	Environmental Impact Statement
ELMR	Estuarine Living Marine Resources
E.O.	Executive Order
ESA	Endangered Species Act
FMP	Fishery Management Plan
FMU	Fishery Management Unit
FSEIS	Final Supplemental Environmental Impact Statement
FY	Fishing Year
GB	Georges Bank
GOM	Gulf of Maine
GSC	Great South Channel
HAPC	Habitat Area of Particular Concern
HCA	Habitat Closed Area
HERC	Habitat Evaluation Review Committee
HEW	Habitat Evaluation Workshop
ITQ	Individual Transferable Quota
MA DMF	Massachusetts Division of Marine Fisheries
MAFMC	Mid-Atlantic Fishery Management Council
ME DMR	Maine Department of Marine Resources
MMPA	Marine Mammale Protection Act
MSA	Magnuson-Stevens Fishery Conservation and Management Act
MSFCMA	Magnuson-Stevens Fishery Conservation and Management Act
NAD	No Alternative Designation
NAO	North Atlantic Oscillation
NB	New Brunswick
NCIAC	North American Industry Assessment Code
NEFMC	New England Fishery Management Council
NEFSC	Northeast Fisheries Science Center
NEPA	National Environmental Policy Act
NGO	Non-Governmental Organization
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
PA	Preferred Alternative
PBR	Potential Biological Removal
PDT	Plan Development Team

RFP	Request For Proposals
RIR	Regulatory Impact Review
SFA	Sustainable Fisheries Act
TMS	Ten Minute Square of Latitude and Longitude
VEC	Valued Ecosystem Component
VMS	Vessel Monitoring System
VTR	Vessel Trip Report

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1.0 Executive Summary

This amendment document and draft supplemental environmental impact statement (DSEIS) presents and evaluates management measures and alternatives to achieve specific goals and objectives for the fisheries under the jurisdiction of the New England Fishery Management Council. This document was prepared by the New England Fishery Management Council and its Habitat Plan Development Team (PDT), in consultation with the National Marine Fisheries Service (NMFS, NOAA Fisheries) and the Mid-Atlantic Fishery Management Council (MAFMC). This amendment was developed in accordance with the Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA, M-S Act) and the National Environmental Policy Act (NEPA), the former being the primary domestic legislation governing fisheries management in the U.S. Exclusive Economic Zone (EEZ). In 1996, Congress passed the Sustainable Fisheries Act (SFA), which amended and reauthorized the MSFCMA and included a new emphasis on precautionary fisheries management. New provisions mandated by the SFA require managers to end overfishing and rebuild overfished fisheries within specified time frames, minimize bycatch and bycatch mortality to the extent practicable, and identify and protect essential fish habitat (EFH).

Although these FMP amendments (EFH Omnibus Amendment #2) have been prepared primarily in response to the requirements of the MSFCMA and NEPA, the EFH Omnibus Amendment #2 also addresses the requirements of the Marine Mammal Protection Act (MMPA) and the Endangered Species Act (ESA). When preparing a Fishery Management Plan or FMP amendment, the Council also must comply with the requirements of the Regulatory Flexibility Act (RFA), the Administrative Procedures Act (APA), the Paperwork Reduction Act (PRA), the Coastal Zone Management Act (CZMA), the Data Quality Act (DQA), and Executive Orders 13132 (Federalism), 12898 (Environmental Justice), 12866 (Regulatory Planning), and 13158 (Marine Protected Areas). These other applicable laws and executive orders help ensure that in developing an FMP/amendment, the Council considers the full range of alternatives and their expected impacts on the marine environment, living marine resources, and the affected human environment. This integrated document contains all required elements of the FMP amendment, including a DSEIS as required by NEPA and information to ensure consistency with other applicable laws and Executive Orders.

The purpose of the EFH Omnibus Amendment #2 (included in this action) is to address additional measures that are necessary in order to (1) To meet NMFS' published guidelines for implementation of the Magnuson-Stevens Act's EFH provisions to review and revise EFH components of FMPs at least once every five (5) years; and (2) To develop a comprehensive EFH management plan that will successfully minimize adverse effects of fishing on EFH through actions that will apply to all Council-managed FMPs. This DSEIS provides information to the New England Fishery Managemetn Council, Mid-Atlantic Fishery Management Council, the public and NMFS in order to select the best method of addressing the EFH responsibilities according with the law.

After the original Notice of Intent to prepare the EFH Omnibus Amendment #2 in February 2005, the Council declared its intent in September 2005 to complete the Omnibus Amendment in two-phases due to issues of public clarity and management complexity. Phase 1 (Volume 1 of the EIS) includes a review and update of EFH designations and consideration of HAPCs (not including consideration of management measures or restrictions), an update of prey species list, an update of non-fishing impacts, and an update of research and information needs (since moved to Phase 2). Phase 2 (Volume 2 of the EIS) would include a review and update of a gear effects evaluation and optimizing management measures for minimizing the adverse effects of fishing on EFH across all FMPs, including the potential consideration of management measures for HAPCs designated in Phase 1.

Essential Fish Habitat Designations

In addition to the no action alternative (i.e., status quo conditions in the Council's FMPs if this amendment is not completed), the Council reviewed and refined through four main alternative and two other minor alternatives the EFH designations of all twenty-seven (27) species under management by the Council (Table 5). A summary of the major methods used are in Table 1 and Table 2.

Table 1. General Description of Methods Used to Develop EFH Designation Alternatives For Most Species[1]

Alternative 1: No Action – current abundance-based EFH designation remains in place				
Inshore	Continental shelf	Off-shelf	Comments	Section
Certain bays and estuaries (ELMR)[2]	1963-1997 spring and fall NMFS trawl surveys, 1982-1997 summer scallop dredge surveys, and 1977-1987 egg and larval surveys	Not included	Based on 75th, 90th or 100th percentiles of catch or area[3]	4.1.1
Alternative 2: Modified abundance-based				
Inshore	Continental shelf	Off-shelf	Comments	Section
Certain bays and estuaries (ELMR) + 10%	1968-2005 spring and fall NMFS trawl surveys at 25th (Option 2A), 50th (2B), 75th (2C), and 90th (2D) percentiles of catch or area[3,4,5,6]	Not included	No alternatives for pelagic eggs and larvae unless adults or juveniles were used as proxies	4.1.2

occurrence in state surveys[4]				
Alternative 3: Habitat features plus abundance				
Inshore	Continental shelf	Off-shelf	Comments	Section
Same as alt 2	Distribution of depths and bottom temperatures associated with high catch rates in the 1963-2003 NMFS trawl surveys or identified in EFH source documents, plus abundance in 1968-2005 spring and fall NMFS trawl surveys at 25th (Option 3A), 50th (3B), 75th (3C), and 90th (3D) percentiles of catch or area[3,5,6,8]	Known or inferred presence by depth and geographic ranges	Substrate types also used to map habitat for some species; egg and/or larval alternatives only developed for 5 species; spatial extent of habitat layers for each option limited by range of survey data[9]	4.1.3
Alternative 4: Entire range in EEZ				
Inshore	Continental shelf	Off-shelf	Comments	Section
Same as alt 2	Same as alternative 3 using entire range of survey data	Same as 3	No alternatives for pelagic eggs and larvae unless adults or juveniles were used as proxies	4.1.4
Alternative 5: Additional options for scallops, offshore hake, and winter flounder[10]				4.1.5
Alternative 6: Additional options for winter flounder[11]				4.1.6

[1] *Methods described in this table generally apply to all species except deep-sea red crab and Atlantic salmon, but in some cases variations on the general methodology were used*

[2] *In most cases, where life stage and species was listed as common, abundant, or highly abundant*

[3] *For benthic life stages, cumulative percentage of average catch (number of fish per tow) per ten minute square (TMS) of latitude and longitude ranked in order of decreasing abundance, summed over all squares; for pelagic life stages, cumulative percentage of the area represented by TMS ranked in order of decreasing abundance*

[4] *TMS where target species and life stage was caught in 10% or more of survey tows*

[5] *Uses different survey areas and data transformation procedure than in the No Action alternatives*

[6] *Alternatives for scallops based on 1982-2005 summer scallop dredge survey*

[7] *Alternative 2E for cod eggs and larvae is the same as 2D, except that TMS south of 38º N latitude were not included, and alternative 2E for herring juveniles and adults is the same as 2C, with TMS added to fill in gaps*

[8] *3E alternatives added for benthic lifestages of cod, scallops, haddock, little skate, windowpane flounder, winter flounder, and winter skate based on 3D maps with TMS added to fill in gaps, 3E for adult witch flounder based on 3D for juveniles*

[9] *3A habitat layers limited by 50th percentile, 3B by 75th percentile, 3C by 90th percentile, and 3D by entire range of survey data*

[10] *For scallops, same as Alternative 4 with addition of TMS in Gulf of Maine; for offshore hake Alternative 3E for juveniles + 3C for adults; two options for winter flounder eggs and larvae same as Alternative 3 but excluding depths >20 meters in Nantucket Sound, with and without bays and estuaries where eggs and larvae are common or abundant (ELMR information)*

[11] *For eggs and larvae, includes area of continental shelf to maximum depth of 72 meters within range of coastal spawning areas*

Table 2. General Description of Methods Used to Develop EFH Designation Alternatives For Atlantic Salmon and Deep-Sea Red Crab

Atlantic Salmon					
Alternative	Riverine/Estuarine	Continental shelf	Off-shelf	Comments	Section
Alt 1 (No Action): current EFH designation remains in place	Watersheds of all rivers where salmon that are currently or were historically accessible for migration and certain coastal bays and estuaries (ELMR)[1]	Not included	Not included		4.1.7.1.1
Alt 2: ten year presence[2]	All rivers and streams in watersheds where presence of salmon was documented during 1996-2005 and certain coastal bays and estuaries (ELMR)[1]	Not included (option 1); out to 3-mile limit (option 2); entire EEZ south to 41°N latitude (option 3)	Option 3 only		4.1.7.1.2
Alt 3: three year presence[2]	All rivers and streams in watersheds where presence of salmon was documented during 2003-2005 and certain coastal bays and estuaries (ELMR)[1]	Same as 2	Same as 2		4.1.7.1.3
Deep-Sea Red Crab					
Alternative	Inshore	Continental shelf	Off-shelf	Comments	Section
Alt 1 (No Action): current EFH designation remains in place	Not applicable	Not included	Depth and geographic ranges by lifestage on continental slope	Level 1 information (presence only)	4.1.7.2.1
Alt 2: refined depth preferences on continental slope	Not applicable	Not included	Revised depth ranges by lifestage, same geographic ranges (slope only)	Level 2 information (relative abundance)	4.1.7.2.2
Alt 3: refined depth preferences on slope	Not applicable	Not included	Same as alt 2 with seamounts where crabs have	Level 2 on slope, level 1 on seamounts	4.1.7.2.3

and two seamounts			been observed3		
Alt 4: refined depth preferences on slope plus continental shelf	Not applicable	Depth range in the Gulf of Maine	Same as alt 2	Level 2 on slope, level 1 on shelf	4.1.7.2.4
Alt 5: refined depth preferences on slope plus continental shelf and two seamounts	Not applicable	Same as alt 4	Same as alt 3[3]	Level 2 on slope, level 1 on shelf and seamounts	4.1.7.2.5
Alt 6: refined depth preferences on slope plus continental shelf and three seamounts	Not applicable	Same as alt 4	Same as alt 2 with seamounts that meet depth criterion[3,4]	Level 2 on slope, level 1 on shelf and seamounts	4.1.7.2.6

[1] Where life stage is listed as rare, common, or abundant
[2] Text descriptions based on habitat types (option A) or life stage (option B)
[3] Seamounts mapped by maximum depth of occurrence (option A) or feature-defined polygons (option B)
[4] Includes two seamounts with minimum depths of 2000 meters or less where red crabs have been observed plus a third that meets the depth criterion, but where no red crabs have been reported

The preferred alternatives selected for public comment are listed in Table 3.

Table 3. Preferred Alternatives for EFH Designation Alternatives

Species	**Eggs**	**Larvae**	**Juveniles**	**Adults**
American plaice	NAD	NAD	3C	3C
Atlantic cod	2E	2E	3E	3E
Atlantic halibut	3	3	3	3
Atlantic herring	5	NAD	2E	2E

Species	**Eggs**	**Larvae**	**Juveniles**	**Adults**
Atlantic salmon	No PA	No PA	No PA	No PA
Atlantic sea scallop	NAD	NAD	5	5
Barndoor skate	NAD	N/A	3D	3D
Clearnose skate	NAD	N/A	3C	3C
Deep-sea red crab	NAD	3A	3A	3A
Haddock	NAD	N/A	3D	3E
Little skate	NAD	N/A	3E	3E
Monkfish	4	4	3C	3C
Ocean pout	2C	2	3C	3C
Offshore hake	NAD	NAD	5	5
Pollock	2D	2D	3D	3D
Red hake	3C	3C	3C	3D
Redfish	N/A	3D	3D	3D
Rosette skate	NAD	N/A	3C	3C
Silver hake	2D	2D	3C	3C
Smooth skate	NAD	N/A	3D	3D
Thorny skate	NAD	N/A	3C	3D
White hake	2D	2D	3D	3D
Windowpane flounder	NAD	NAD	3E	3E
Winter flounder	5A	5A	3E	3E
Winter Skate	NAD	NAD	3E	3E
Witch flounder	NAD	N/A	3D	3E
Yellowtail flounder	NAD	NAD	3D	3D

***No PA**: indicates no preferred alternative selected by Council*
***N/A**: indicates that this does not exist as a distinct life history stage for this species.*
***NAD**: indicates No Alternative Designation due to lack of new information.*

Impacts to Biological and Physical Environment

The alternatives for describing and identifying EFH comprise a range of options that use different methodologies and result in different geographic areas being identified as EFH for each of the species managed under the Council's FMPs. Describing and identifying EFH does not alone have any direct environmental impacts, but could lead to indirect impacts because EFH designation would trigger Magnuson-Stevens Act requirements to minimize adverse effects of fishing on EFH and to consider the effects of non-fishing actions on EFH. The effects of designating EFH are difficult to analyze because they are indirect and dependent on separate future actions by a variety of entities in addition to NMFS and the Council (e.g., federal agencies that may impose conditions on permits they issue for actions that could harm EFH).The comparison of alternatives rests almost entirely on improved methods for using the available information, not on differences in size of designated areas. However, description and identification of EFH, regardless of the alternative selected, generally would have a positive effect on habitat because the purpose of the designation is to identify important fish habitats that would be subject to potential measures to protect, conserve, and enhance them. The broader the area identified as EFH, the more habitat that would be subject to such measures. Additionally, considering different ways to designate EFH will lead to deliberations by the Council during Phase 2 about whether an how to restrict fishing gear and practices as a function of EFH attributes. Any new or expansion of current restrictions to protect EFH will have a positive effect on the physical and biological environment. However, until specific regulations are promulgated in Phase 2, no impact analysis can be conducted.

Impacts to Economic Environment
A main goal of Phase 1 of this Amendment is to review and update EFH designations and, as such, to continue the program created in 1998 to consult on federal actions. It does not, however, create any management rules or regulations that would impact the economy, small entities, or consumers either positively or negatively. It stands to reason, though, that considering different ways to designate EFH will lead to deliberations by the Council during Phase 2 about whether and how to restrict fishing gear and practices as a function of EFH attributes. Virtually every 10-minute-square in the EEZ is potentially EFH for some species or life stage depending on the designation process, so the potential for impacts is inherent to the Amendment. Nevertheless, until specific regulations are promulgated in Phase 2, no impact analysis can be conducted.

Impacts to Social Environment
This FMP does not create any management rules or regulations, so it does not have any direct impacts. However, it does designate EFH which may at some future date be used in the creation of fully closed areas or areas closed to particular gears or at particular times of year or other regulations. Thus the potential for impacts is already inherent in the designation of EFH. Until specific regulations are promulgated no true impact analysis can be conducted.

Habitat Areas of Particular Concern

The Council in this action has also considered and developed nine (9) major habitat area of particular concern (HAPC) alternatives of which many contain individual sub-alternatives. These alternatives range from the rivers of the inland areas for Atlantic salmon to the reaches of the exclusive economic zone on the seamounts for deep-sea red crab. There are no Council preferred alternatives in the range of alternatives presented by the Council for public comment.

The intent of the habitat areas of particular concern designation is to identify those areas that are known to be important to species which are in need of additional levels of protection from adverse impacts. Management implications do result from their identification. Designation of habitat areas of particular concern is intended to determine what areas within EFH should receive more of the Council's and NMFS' attention when providing comments on federal and state actions, and in establishing higher standards to protect and/or restore such habitat. Habitats that are at greater risk to impacts, either individual or cumulative, including impacts from fishing, may be appropriate for this classification.

In order to qualify as an HAPC, the area must meet at least one of the following four criteria:

- Criteria 1: Importance of Current or Historic Ecological Function
- Criteria 2: Sensitivity to Anthropogenic Stresses
- Criteria 3: Extent of Current or Future Development Stresses
- Criteria 4: Rarity of the Habitat Type

In addition, the Council encouraged the development of HAPC proposals that (in no particular order):

- Will improve the fisheries management in the EEZ.
- Include EFH designations for more than one Council-managed species in order to maximize the benefit of the designations.
- Include juvenile cod EFH.
- Meet more than one of the EFH Final Rule HAPC criteria.

All of the HAPC alternatives, with the exception of Alternative 9 which calls for the elimination of the status quo HAPCs on George's Bank for Atlantic cod and/or in rivers in Maine for Atlantic salmon, meet at least one of the HAPC criteria outlined in the EFH Final rule; in some cases all criteria are met and many of the Council preferences are addressed (Table 4). The Council will be looking for detailed public comment on each alternative so that they can determine which of the alternatives should be selected for implementation, if any.

Table 4. Summary of HAPC Criteria and Council Preference Determinations

Alternative	Ecological Function	Anthropogenic Stress	Development Stresses	Rarity	Improve Management	Multiple EFH Designations	Juvenile Cod EFH	Meets > 1 Criteria
1 – Status Quo								
1A	X	X			X		X	X
1B	X	X			X			X
2 - Seamounts	X	X		X	X			X
3 – Deep-Sea Canyons	X	X	X	X	X	X	X	X
4 – Cashes Ledge Area	X	X	X	X	X	X		X
5 – George's Bank / Northern Edge	X	X	X	X	X	X	X	X
6 – Jeffreys / Stellwagen Bank	X	X	X	X	X	X	X	X
7 – Inshore Cod	X	X	X		X	X	X	X
8 – Great South Channel Area	X	X	X	X	X	X	X	X
9 – Eliminate SQ HAPCs								
1A	X	X			X		X	X
1B	X	X			X			X

Impacts on Biological and Physical Environment

Designating an area an HAPC does not alone have any direct environmental impacts on the biolcgical and physical environment as no management rules or regulations are created by the designation alone. The full impact analysis does describe in detail the types of EFH that are included in the areas under consideration as well as whether or not each alternative meets the EFH Final Rule criteria and the Council stated preferences.

Impacts on Economic Environment

It does not, however, create any HAPCs, or management rules or regulations for HAPCs. That is, there is nothing in Phase 1 that would impact the economy, small entities, consumers, or the public either positively or negatively. It stands to reason, though, that because the Council solicited recommendations from the public, it will most likely include fishery restrictions in its alternatives in Phase 2. A Regulatory Impact Review (RIR) or study of small entities is not possible, though, until the Council selects areas and regulations for new HAPCs.

Impacts on Social Environment

This FMP does not create any management rules or regulations, so it does not have any direct impacts. However, it does designate HAPCs which may at some future date be used in the creation of fully closed areas or areas closed to particular gears or at particular times of year or other regulations. Thus the potential for impacts is already inherent in the designation of HAPCs. The only difference between general EFH designations and HAPC designations at this point is that HAPC designations are more likely to entail regulations in Phase 2 of the FMP. Until specific regulations are promulgated no true impact analysis can be conducted.

Evaluation of Prey Species

The Council has developed a description of the major prey species for each FMP and each fishery management unit (FMU) species under its jurisdiction and maps of these species locations.

Generally, major prey phyla are defined as those prey items exceeding, depending on the study, the 5% threshold for one or several of the following measures in the stomachs of a managed species: percent frequency of occurrence, percent numerical abundance, percent stomach volume, and precent prey weight. It should be noted that prey species, families, etc. mentioned in the text or tables, depending on the study from which they came, are sometimes just examples of the primary prey within a phyla; thus, the tables, for example, should not be taken as an exhaustive list of prey items.

One of two sources was used to produce the major prey species maps. Only those species which exceeded 5% occurrence in a managed species stomach were mapped. All fish species and squids maps were created using the NMFS Bottom Trawl Survey database for 1963-2005. These points represent catches of the prey species themselves. The data used was geographically limited to north of the border between North Carolina and South Carolina and west of the eastern most extent of U.S. waters. This was done to capture the entire designated ranges of all NEFMC managed species without including extraneous data. All other invertebrate prey were mapped from data in the Northeast Fisheries Science Center Bottom Trawl Survey Food Habits Database from 1973-2005. These are not actual catches of the species, but the location of any predator species (not limited to managed species) caught with the prey present in their stomachs.

Evaluation of Potential Impacts of Non-Fishing Activities on EFH

The purpose of this section and it's corresponding report (The *Impacts to Marine Fishery Habitats in the New England and Mid-Atlantic Regions from Non-Fishing Activities)* (Appendix D) is to:

1. Identify human activities that may adversely impact essential fish habitat (EFH). Since Stevenson *et al.* (2004) characterized the impacts to EFH from fishing activities in the Northeast region of the U.S., the focus of this report is on non-fishing activities;
2. Review and characterize existing scientific information regarding human induced impacts to EFH;
3. Provide best management practices (BMPs) and conservation measures that can be implemented for specific types of activities which avoid or minimize adverse impacts to EFH;
4. Provide a comprehensive reference document for use by federal and state marine resource managers, permitting agencies, professionals engaged in marine habitat assessment activities, the regulated community, and the public, and to;
5. Insure that the best scientific information is available for use in making sound decisions with respect to project planning, environmental assessment, and permitting.

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2.0 Background and Purpose

2.1 Management History

The Magnuson Fishery Conservation and Management Act of 1976, (renamed the Magnuson-Stevens Fishery Conservation and Management Act when amended on October 11, 1996) established a U. S. exclusive economic zone (EEZ) between 3 and 200 miles offshore, and established eight regional fishery management councils that manage the living marine resources within that area. The eighteen (18) member New England Fishery Management Council's (Council) authority extends from Maine to southern New England and, in some cases, to the mid-Atlantic because of the range of the species. The 1996 amendments to the Magnuson-Stevens Fishery Conservation and Management Act, known as the Sustainable Fisheries Act (SFA), changed the focus of the Act by emphasizing the importance of habitat protection to healthy fisheries and by strengthening the ability of the National Marine Fisheries Service (NMFS) and the Councils to protect and conserve the habitat of marine, estuarine, and anadromous finfish, mollusks, and crustaceans. This habitat is termed "essential fish habitat" and is broadly defined to include "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity."

<u>Requirements for NMFS, Councils, and Federal Agencies</u>

To improve fish habitat protection, the SFA requires or authorizes that the Councils, NMFS, and other federal agencies take new actions. Relevant to the goals of Phase 1 of the Omnibus Amendment #2, the SFA requires the Council amend its fishery management plans to:

1. Describe and identify of essential fish habitat (EFH)

2. Identify habitat areas of particular concern (HAPC)

3. List the major prey species for the species in the FMU and discuss their location

4. Identify non-fishing activities that may adversely affect EFH

<u>Species Under Management</u>
With respect to the New England Fishery Management Council (Council), the Council is charged with managing fishery resources throughout the species' range, generally from Maine south to the Mid-Atlantic. Table 5 lists the Fishery Management Plans (FMPs)

under jurisdiction by the Council and the species contained within the respective Fishery Management Units (FMU).

Table 5. List of species under management by the New England Fishery Management Council

FMP	Species	Common Names
Multispecies (Groundfish)	*Gadus morhua*	Atlantic cod (official) rock cod
Multispecies	*Glyptocephalus cynoglossus*	witch flounder (official) gray sole Craig fluke pole flounder
Multispecies	*Hippoglossus hippoglossus*	Atlantic halibut (official)
Multispecies	*Hippoglossoides platessoides*	American plaice (official) American dab Canadian plaice long rough dab
Multispecies	*Pleuronectes ferruginea*	yellowtail flounder (official) rusty flounder
Multispecies	*Macrozoarces americanus*	ocean pout (official) eelpout Congo eel muttonfish
Multispecies	*Melanogrammus aeglefinus*	haddock (official)
Multispecies	*Merluccius bilinearis*	whiting silver hake (official) New England hake
Multispecies	*Pollachius virens*	pollock (official) Boston bluefish coalfish green cod
Multispecies	*Pleuronectes americanus*	winter flounder (official) blackback Georges Bank flounder lemon sole sole flatfish rough flounder mud dab black flounder

FMP	**Species**	**Common Names**
Multispecies	*Scophthalmus aquosus*	windowpane flounder (official) sand flounder spotted flounder New York plaice sand dab spotted turbot
Multispecies	*Sebastes* spp.	redfish (official) rosefish ocean perch red sea perch red bream Norway haddock
Multispecies	*Urophycis chuss*	red hake (official) squirrel hake
Multispecies	*Urophycis tenuis*	white hake (official) Boston hake black hake blue hake mud hake ling
Multispecies	*Merluccius albidus*	Offshore hake (official) Blackeye whiting
Monkfish	*Lophius americanus*	monkfish (official) American goosefish angler allmouth molligut fishing frog
Sea Scallop	*Placopecten magellanicus*	Atlantic sea scallop (official) giant scallop smooth scallop deep sea scallop Digby scallop ocean scallop
Skates	*Amblyraja radiata*	Thorny skate (official) Mud skate Starry skate Spanish skate
Skates	*Dipturus laevis*	Barndoor skate (official)
Skates	*Leucoraja erinacea*	Little skate (official)

FMP	**Species**	**Common Names**
		Common skate Summer skate Hedgehog skate Tobacco Box skate
Skates	*Leucoraja garmani*	Rosette skate (official) Leopard skate
Skates	*Malacoraja senta*	Smooth skate (official) Smooth-tailed skate Prickly skate
Skates	*Leucoraja ocellata*	Winter skate (official) Big skate Spotted skate Eyed skate
Skates	*Raja eglanteria*	Clearnose skate (official) Brier skate
Deep-Sea Red Crab	*Chaceon quinquedens*	Deep-Sea red crab (official)
Atlantic Herring	*Clupea harengus*	Atlantic sea herring (official) Labrador herring sardine sperling brit
Atlantic Salmon	*Salmo salar*	Atlantic salmon (official) sea salmon silver salmon black salmon

2.2 Purpose and Need for Action

The New England Fishery Management Council (Council) is initiating the development of an Omnibus Essential Fish Habitat (EFH) Amendment under the authority of the Magnuson-Stevens Fishery Conservation and Management Act (M-S Act). This action will amend all of the fishery management plans (FMPs) managed by the Council and will become Amendment 14 to the Northeast Multispecies FMP, Amendment 14 to the Atlantic Sea Scallop FMP, Amendment 4 to the Monkfish FMP, Amendment 3 to the Herring FMP, Amendment 2 to the Skate FMP, Amendment 1 to the Red Crab FMP and Amendment 3 to the Atlantic Salmon FMP.

The Magnuson Fishery Conservation and Management Act of 1976, (renamed the Magnuson-Stevens Fishery Conservation and Management Act when amended on October 11, 1996) established a U.S. Exclusive Economic Zone (EEZ) between 3 and 200 miles offshore, and established eight regional fishery management Councils that manage the living marine resources within that area. The eighteen member New England Fishery Management Council's (Council) authority extends from Maine to southern New England and, in some cases, to the mid-Atlantic because of the range of the species. The 1996 amendments to the Magnuson-Stevens Fishery Conservation and Management Act, known as the Sustainable Fisheries Act (SFA), changed the focus of the Act by emphasizing the importance of habitat protection to healthy fisheries and by strengthening the ability of the National Marine Fisheries Service (NMFS) and the Councils to protect and conserve the habitat of marine, estuarine, and anadromous finfish, mollusks, and crustaceans. This habitat is termed "Essential Fish Habitat (EFH)" and is broadly defined to include "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity."

The purpose of the Omnibus EFH Amendment #1 (1998) was to identify and describe the EFH for all species of marine, estuarine, anadromous finfish and mollusks managed by the Council to better protect, conserve, and enhance this habitat. This was done through the following FMP amendments: Northeast Multispecies (11), Atlantic Sea Scallops (9), Atlantic Salmon (1), and Atlantic Herring (added to FMP later) FMPs. The 1998 EFH Amendment also identified the major threats to EFH from both fishing and non-fishing related activities and conservation and enhancement measures. The Council began implementation of the SFA's EFH requirements based on guidance provided by NMFS on interpreting the mandate and timelines. Amendments to the FMPs managed by the Council were initiated in 1998 and combined in one management action that was termed the "Habitat Omnibus Amendment of 1998." The Council approved the final EFH FMP amendments (EA) in September 1998 and the EA was submitted to NMFS in October 1998. The Secretary of Commerce approved the amendments to all FMPs, with the exception of the Monkfish FMP, on March 1999. The EFH requirements of FMPs that were not included in the Omnibus Amendment of 1998 were completed on the following schedule: Monkfish FMP (April 1999), Red Crab FMP (October 2002), and Skate FMP (July 2003).

The purpose of the EFH Omnibus Amendment #2 (included in this action) is to address additional measures that are necessary in order to (1) To meet NMFS' published guidelines for implementation of the Magnuson-Stevens Act's EFH provisions to review and revise EFH components of FMPs at least once every five (5) years; and (2) To develop a comprehensive EFH management plan that will successfully minimize adverse effects of fishing on EFH through actions that will apply to all Council-managed FMPs. The Council is not satisfied with its current practice of evaluating EFH and EFH management through individual plans and believes that it would be preferable to meet the EFH requirements by developing a comprehensive EFH Omnibus Amendment for all its FMPs. This DSEIS provides information to the New England Fishery Managemetn Council, Mid-Atlantic Fishery Management Council, the public and NMFS in order to select the best method of addressing the EFH responsibilities according with the law.

2.3 Notice of Intent and Scoping

On February 24, 2004, the Council published in the Federal Register a Notice of Intent (NOI) to prepare this EIS (FR Vol. 69, No. 36, p. 8367). The Council specifically solicited written comments to determine the issues of concern and the appropriate range of management alternatives to be addressed in the EIS and included notification regarding five scoping meetings in communities in Maine, Massachusetts, Connecticut and North Carolina (FR Vol. 69, No. 36, p. 8367). The Council received thirteen (13) written comments during the scoping period. The Council conducted scoping hearings in accordance with NEPA requirements (**Table 6**). The Chair of the Council's Habitat Committee, the Habitat Plan Development Team Chair and a member of the NMFS NERO Habitat Conservation Division attended each hearing. The hearings were organized and informational material was provided by the Council staff.

Table 6. Schedule of public scoping hearings

Date	Location	Number of Attendees
Friday, March 5, 2004 12:00 p.m.	Samoset Resort 220 Warrenton Street Rockport, ME 04846	22

Date	Location	Number of Attendees
Wednesday, March 10, 2004 7:00 p.m.	Whaling Museum 18 Johnny Cake Hill New Bedford, MA 02740	9
Monday, March 15, 2004 7:00 p.m.	Office of Public Safety 173 S. Broad St. (Route 1) Stonington, CT 06378	8
Tuesday, March 16, 2004 6:30 p.m.	Shell Island Suites 2700 N. Lumina Avenue Wrightsville Beach, NC 28480	17
Tuesday, March 23, 2004 6:00 p.m.	Tavern on the Harbor 30 Western Avenue Gloucester, MA 01930	19

Additionally, the Council accepts public comments at all its Council and Committee meetings on the topics pertinent to the Action that are on the agenda at each meeting. As such, the public has the ability to work iteratively with the Council on all aspects of the Action. Additionally, the Council maintains a Habitat Advisory Panel that includes twenty-three (23) members of the public. A summary of the issues raised by the public during the formal scoping period are found in Appendix H.

Due largely to public clarity and issues of complexity, on September 9, 2005, the Council published in the Federal Register a Supplemental Notice of Intent to declare its intention to complete Omnibus Amendment 2 in a two-phased approach, as further described below.

3.0 Goals and Objectives

Due largely to public clarity and issues of complexity, the Council published in the Federal Register a Supplemental Notice of Intent to declare its intention to complete Omnibus Amendment 2 in a two-phased approach. The two phases will be documented in on accompanying EIS with potentially two separate volumes. Separation of this large action into two phases (volumes) will allow for the continued sequential development of the Omnibus Amendment but avoids the creation of an extremely large and complex action that may not be decipherable from the public's perspective. Further, in order to meet the Sustainable Fisheries Act intention of the EFH mandate, it is prudent to take a step-wise approach. For instance, it is necessary to determine what is EFH prior to conducting an evaluation of the potential effects of fishing gear on EFH and to develop a range of alternatives to minimize, mitigate or avoid any impacts that are more than minimal and less than temporary in nature. The Council's approved goals and objectives for the two-phase EFH Omnibus Amendment are listed here. Bolded items denote those that apply to Phase 1 of the Amendment

GOALS

1. **Redefine, refine or update the identification and description of all EFH for those species of finfish and mollusks managed by the Council, including the consideration of HAPCs;**

2. Identify, review and update the major fishing activities (MSA and non-MSA) that may adversely affect the EFH of those species managed by the Council;

3. **Identify, review and update the major non-fishing activities that may adversely affect the EFH of those species managed by the Council;**

4. Identify and implement mechanisms to protect, conserve, and enhance the EFH of those species managed by the Council to the extent practicable;

5. Define metrics for achieving the requirements to minimize adverse impacts to the extent practicable;

6. Integrate and optimize measures to minimize the adverse impacts to EFH across all Council managed FMPs;

7. Update research and information needs;

8. **Review and update prey species information for each species in the FMU.**

OBJECTIVES

- **Identify new data sources and assimilate into the process to meet goals (state, federal and other data sources);**

- **Implement review of existing HAPCs and consider modified or additional HAPCs,**

- **Review EFH designations and refine or redefine where appropriate as improved data and analysis become available (Goal 1);**
- **Develop analytical tools for designation of EFH**, minimization of adverse impacts, and monitoring the effectiveness of measures designed to protect habitat (Goal 1, Goal 3 and Goal 5);
- Modify fishing methods and create incentives to reduce the impacts on habitat associated with fishing (Goal 4);
- Support restoration and rehabilitation of fish habitat which have already been degraded (by fishing and non-fishing activities) (Goal 4);
- Support creation and development of fish habitat where appropriate and when increased fishery resources would benefit society (Goal 4);
- Develop a strategy for prioritizing habitat protection (Goal 4);
- Develop criteria for establishing and implementing dedicated habitat research areas (Goal 7);
- Design a system for monitoring and evaluating the benefits of EFH management actions including dedicated habitat research areas (Goal 7).

In order to improve public input and reduce the complexity of the action under consideration, the Council has separated the overall Amendment into two phases. The purpose (four-fold) of Phase 1, which is the focus of this Draft Supplemental Environmental Impact Statement (DSEIS) and Fishery Management Plan Amendment, includes the following four main goals:

- Redefine, refine or update the identification and description of all EFH for those species of finfish and mollusks managed by the Council, including the consideration of HAPCs;
- Identify, review and update the major non-fishing activities that may adversely affect the EFH of those species managed by the Council
- Identify, review and update the major non-fishing activities that may adversely affect the EFH of those species managed by the Council;
- Review and update prey species information for each species in the FMU.

3.1 Defining Essential Fish Habitat

Essential fish habitat (EFH) means those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity. For the purpose of interpreting the definition of essential fish habitat: ''Waters'' 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.

3.1.1 EFH Text Descriptions

According to the EFH Final Rule (50 CFR Part 600.815(a)(1)(i)), FMPs must consider and include the following components with respect to the designation of EFH:

1. *Describe and identify EFH in text that clearly states the habitats or habitat types determined to be EFH for each life stage of the managed species.*

2. *Explain the physical, biological, and chemical characteristics of EFH and, if known, how these characteristics influence the use of EFH by the species/life stage.*

3. *Identify the specific geographic location or extent of habitats described as EFH. FMPs must include maps of the geographic locations of EFH or the geographic boundaries within which EFH for each species and life stage is found*.

In order to develop these components, *Councils need basic information to understand the usage of various habitats by each managed species. Pertinent information includes the geographic range and habitat requirements by life stage, the distribution and characteristics of those habitats, and current and historic stock size as it affects occurrence in available habitats.* The Council has utilized the NEFSC EFH Source Documents (Technical Memo series) developed for each managed species.

To *summarize the life history information necessary to understand each species' relationship to, or dependence on, its various habitats, using text, tables, and figures, as appropriate*, the Council developed and included EFH Designation Text for each species and life stage which is included in Section 4.1. Additionally, to settle on these concise descriptions, the Council created supplemental tables (Appendix B) for each species and life stage that contain information on the *patterns of temporal and spatial variation in the distribution of each major life stage (defined by developmental and functional shifts) to aid in understanding habitat needs*. These tables *summarize all available information on environmental and habitat* *variables that control or limit distribution, abundance, reproduction, growth, survival, and productivity of the managed species* as was included in the EFH Source Documents and other primary literature. The source of the information compiled in the supplementary tables and the subsequent EFH tables and text descriptions includes *peer-reviewed literature, unpublished scientific reports, data files of government resource agencies, fisheries landing reports, and other sources of information.* As is appropriate, the Council evaluated the efficacy and importance of each information source and utilized *different types of information according to its scientific rigor*. As such, the Council used the best scientific information available which is consistent with National Standard 2. For a more detailed explanation of the methods employed in generating the EFH text descriptions including a listing of the Levels of Data (as defined by the EFH Final Rule) or the level of information available on the species distribution, abundance, and habitat-productivity relationships, refer to the Methods Appendix (Appendix A). This appendix provides information on the analyses *conducted to distinguish EFH from all habitats potentially used by a species.*

3.1.2 EFH Map Representations

FMPs must include *maps that display, within the constraints of available information, the geographic locations of EFH or the geographic boundaries within which EFH for each species and life stage is found*. These maps, found in Section 4.1, identify the different types of habitat designated as EFH to the extent possible and explicitly distinguish EFH from non-EFH areas. The Council followed the guidance provided by the NEFSC Habitat Evaluation Review Committee (July 2005) in the development of methods to map EFH to the extent possible. A detailed look at the map representation methods is found in Appendix A.

3.2 Consideration of Habitat Areas of Particular Concern

The EFH Final Rule (50 CFR 600.815(8)) states that *FMPs should identify specific habitat types or areas within EFH as habitat areas of particular concern based on one or more of the following considerations:* Importance of historic or current ecological function, Sensitivity to anthropogenic stresses, extent of current or future development stresses and rarity of the habitat type. In addition to addressing these criteria, the Council encouraged the development of HAPC proposals that (in no particular order): 1) Will improve the fisheries management in the EEZ; 2) Include EFH designations for more than one Council-managed species in order to maximize the benefit of the designations; 3) Include juvenile cod EFH and/or 4) Meet more than one of the EFH Final Rule HAPC criteria (listed above).

A Request for Proposals soliciting ideas from the public on HAPCs, for consideration in the EFH Omnibus Amendment #2, was issued on December 18, 2004 and closed on March 25, 2005 during which time the public was freely able to prepare and submit candidate HAPC proposals for the Council's consideration. Nine (9) complete proposals were received by the Council. The Council reviewed these proposals through their Habitat Plan Development Team, Habitat Advisory Panel and Habitat Oversight Committee and developed *management alternatives* for Council consideration. These alternatives, along with maps of the areas, are included in Section 4.1.3.

3.3 Review of the Prey Species Information

The EFH Final Rule (50 CFR Part 600.815) requires that these FMPs *"list the major prey species for the species in the fishery management unit and discuss the location of prey species' habitat."* According to the Rule, *"loss of prey may be an adverse effect on EFH and managed species because the presence of prey makes waters and substrate function as feeding habitat, and the definition of EFH includes waters and substrate necessary to fish for feeding. Therefore, 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 EFH if such actions reduce the quality of EFH. … Adverse effects on prey species and their habitats may result from fishing and non-fishing activities."*

NOAA Fisheries (NMFS) has offered the Councils the following draft guidance (April 2006) on implementing the Prey Species Requirement of the EFH Final Rule as follows:

> The definition of EFH in the regulatory guidelines acknowledge that prey, as part of "associated biological communities", may be considered a component of EFH for a species and/or lifestage (50 CFR 600.10). However, including prey in EFH identifications and descriptions has considerable implications for the overall scope of EFH when those prey are considered during the EFH consultation process. It is important that prey do not become a vehicle for overly expansive interpretations of EFH descriptions. To avoid this pitfall, the following suggestions should be considered when including prey in an EFH description:
>
> 1. Prey species alone should not be described as EFH. Instead, prey should be included in EFH descriptions as a component of EFH (along with others components such as depth, temperature, sediment type).
>
> 2. If the FMP identifies prey as a component of EFH, the FMP should specify those prey species and how their presence "makes the waters and substrate function as feeding habitat" (50 CFR 600.815(a)(7)).

3. While prey may be considered a component of EFH, prey habitat should not be identified as EFH in FMPs unless it is also EFH for a managed species. Identifying prey habitat as EFH could be viewed as over-extending the scope of EFH which should consist of habitat necessary for the managed species (50 CFR Preamble). However prey species habitat should be discussed in the FMP (52 CFR 600.815 (a)(7)).

Accordingly, the New England Fishery Management Council has developed a description of the major prey species for each FMP and each fishery management unit (FMU) species under its jurisdiction and maps of these species location (Section 5.1).

3.4 Evaluation of the Potential Impact of Non-Fishing Activities on EFH

The EFH Final Rule (50 CFR Part 600.815(a)(1)) requires that FMPs *identify activities other than fishing that may adversely affect EFH…FMP should describe known and potential adverse effects to EFH. For each activity, the FMP should describe known and potential effects to EFH. In addition FMPs must identify actions intended to encourage the conservation and enhancement of EFH, including recommended measures to avoid, minimize or compensate for the identified adverse effects.* This requirement of the EFH final rules was originally completed for all federally managed FMPs in 1998-1999.

Accordingly, NOAA Fisheries (NMFS) (with support from the Council staff) conducted a Non-Fishing Impacts Workshop in January 2005 in order to evaluate and compile the best scientific information available on the potential effects of non-fishing activities on EFH. The purpose of the Workshop was to review and evaluate the existing information so that the FMPs can be updated as necessary. In addition to the above purpose, it was NOAA Fisheries' intent to broaden the overall scope of this activity to develop a reference document for use by professionals engaged in marine habitat assessment, permitting agencies, and state and federal marine resource managers. Conceptually, it is intended that this document will briefly describe the life history and habitat requirements of the species, the activities that may impact the habitat, and general conservation recommendations on how to avoid, minimize, or compensate for such impacts. The overall goal of the reference document is to insure that the best scientific information is available and used in making sound decisions with respect to the various environmental review and permitting processes. The document will focus on all federally-managed species managed through the NOAA Fisheries Northeast Regional Office.

As a result of the Workshop, NOAA Fisheries has produced a reference document that contains an evaluation of the potential impacts of non-fishing activities on EFH. In this evaluation the following main impact categories are explored:

- Coastal Development
- Energy-Related Activities
- Alteration to Freshwater Systems
- Marine Transportation
- Offshore Dredging and Disposal
- Chemical Effects: Water Uptake and Discharge Facilities
- Physical Affects: Water Uptake and Discharge Facilities
- Agriculture and Silviculture
- Aquaculture and Introduced Species
- Global Effects and Other Impacts

Each chapter provides detailed descriptions and scientific references of the types of fish and habitat impacts associated with each type of activity. Each chapter concludes with a list of best management practices and/or conservation recommendations that should be implemented for each type of activity which would avoid, minimize or mitigate those adverse impacts. Another component of the report is the results of the Workshop (2005) to assess non-fishing impacts on EFH. Summary tables developed at the Workshop, which reflect the types of impacts from various activities, are provided and reflect the potential effects from those activities as well as a categorization of the degree of impact caused by each effect for demersal and pelagic species located in riverine, estuarine and marine environments.

It is the intent of the Council to utilize this reference document as the best available information on the effects of non-fishing activities on EFH. The evaluation can be found in Section 5.2 and the complete reference document in Appendix D.

4.0 Management Alternatives Under Consideration

4.1 Alternatives to Designate Essential Fish Habitat (EFH)

4.1.1 Alternative 1 – No Action

Under the No Action alternative, the current essential fish habitat (EFH) designations remain in place.

4.1.1.1 Methods

EFH designations adopted by the NEFMC in the 1998 Omnibus EFH Amendment 1 and in the 2002 Skate FMP included areas of the continental shelf that were based on relative abundance data (mean of log transformed numbers caught per tow in individual ten minute squares of latitude and longitude) in 1963-1997 spring and fall NMFS bottom trawl surveys, 1982-1997 NMFS scallop dredge surveys, and 1977-1987 NMFS egg and larval survey data. Inshore bays and estuaries were included if the target species and life stage was identified as "common," "abundant," or "highly abundant" in the NOAA Estuarine Living Marine Research (ELMR) database, and, for some species, based on trawl survey data collected in Massachusetts state waters and Long Island Sound. In some cases, additional ten minute squares were added to represent areas of historical importance that were not well represented by survey data, areas identified by members of the fishing industry, and/or to fill in "blank" squares that were surrounded by designated squares. The text descriptions were based on depth, substrate, and bottom temperature information for each species and life stage that was identified in a NOAA Technical Memorandum series of EFH source documents that were produced to support the original EFH designation effort. Four optional EFH maps were developed for each species and life stage based on cumulative percentiles (50, 75, 90, and 100%) of catch rate data by ten minute square that represented spatial distributions of increasing size with more and more squares with lower mean catch rates. The Council selected alternatives that represented 75th, 90th, or 100th cumulative percentiles, based on maps which best depicted essential habitats. For a detailed description of the methods used to generate the Alternative 1 EFH designations, see Appendix A.

4.1.1.2 Text Descriptions and Map Representations

For each species currently managed by the Council this section includes a one-page text description of the essential fish habitat for each life history stage, a table identifying those bays and estuaries included in the EFH designation (based on information provided in NOAA's ELMR reports), and a series of maps representing the Council's EFH designations for each life history stage. The EFH maps reflect all information included in the Council's designations, including the ELMR bays and estuaries, other inshore data, the historic range of the species, areas identified by the fishing industry, and those ten minute squares filled in to "smooth" the designations. The captions accompanying maps for the EFH designations describe the information reflected in those designations and provide the Council's rationale for selecting the preferred alternatives.

4.1.1.2.1 *American plaice (Hippoglossoides platessoides)*

In its *Report to Congress: Status of the Fisheries of the United States* (September 1997), NMFS determined American plaice is currently overfished. This determination is based on the fishing mortality rate. Essential Fish Habitat for American plaice is described as those areas of the coastal and offshore waters (out to the offshore U.S. boundary of the exclusive economic zone) that are designated on Map 1 - Map 4 and in the accompanying table and meet the following conditions:

Eggs: Surface waters of the Gulf of Maine and Georges Bank as depicted on Map 1. Generally, the following conditions exist where most American plaice eggs are found: sea surface temperatures below 12° C, water depths between 30 and 90 meters and a wide range of salinities. American plaice eggs are observed all year in the Gulf of Maine, but only from December through June on Georges Bank, with peaks in both areas in April and May.

Larvae: Surface waters of the Gulf of Maine, Georges Bank and southern New England as depicted on Map 2. Generally, the following conditions exist where most American plaice larvae are found: sea surface temperatures below 14° C, water depths between 30 and 130 meters and a wide range of salinities. American plaice larvae are observed between January and August, with peaks in April and May.

Juveniles: **Bottom habitats with fine-grained sediments or a substrate of sand or gravel in the Gulf of Maine as depicted on Map 3Map 3. American plaice juveniles, Alternative 1 (No Action)**

. Generally, the following conditions exist where most American plaice juveniles are found: water temperatures below 17° C, depths between 45 and 150 meters and a wide range of salinities.

Adults: Bottom habitats with fine-grained sediments or a substrate of sand or gravel in the Gulf of Maine and Georges Bank as depicted on Map 4. Generally, the following conditions exist where most American plaice adults are found: water temperatures below 17° C, depths between 45 and 175 meters and a wide range of salinities.

Spawning Adults: Bottom habitats of all substrate types in the Gulf of Maine and Georges Bank as depicted on Map 4. Generally, the following conditions exist where most spawning American plaice adults are found: water temperatures below 14° C, depths less than 90 meters and a wide range of salinities. Spawning begins in March and continues through June.

All of the above EFH descriptions include those bays and estuaries listed on the following table, according to life history stage. The Council acknowledges potential seasonal and spatial variability of the conditions generally associated with this species.

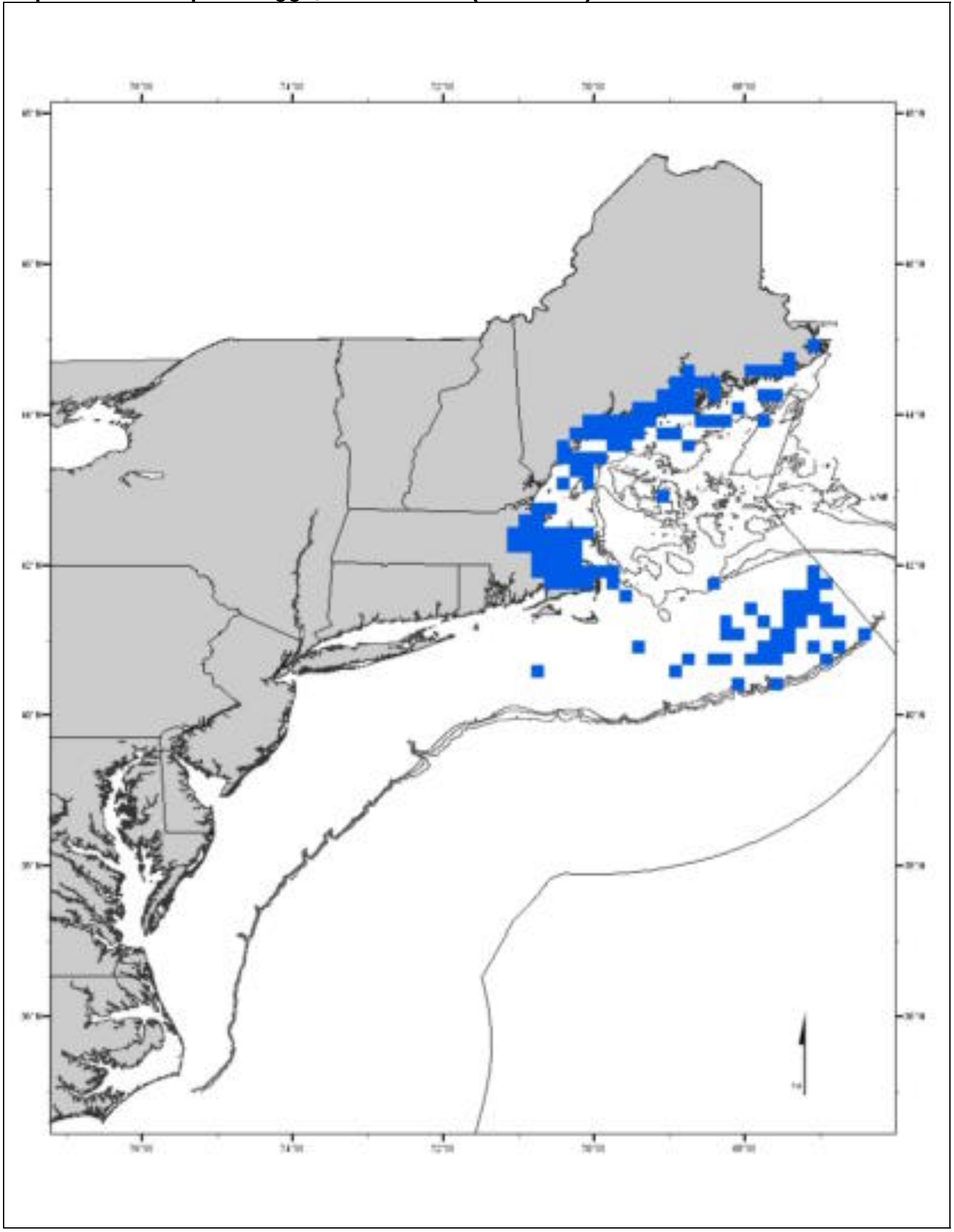
Table 7. EFH Designation of Estuaries and Embayments: American plaice (Hippoglossoides platessoides)

Estuaries and Embayments	Eggs	Larvae	Juveniles	Adults	Spawning Adults
Passamaquoddy Bay	s	s	m,s	s	s
Englishman/Machias Bay	s	s	m,s	s	s
Narraguagus Bay	s	s	m,s	s	s
Blue Hill Bay	s	s	m,s	s	s
Penobscot Bay	s	s	m,s	s	s
Muscongus Bay	s	s	m,s	s	s
Damariscotta River	s	s	m,s	s	s
Sheepscot River	s	s	m,s	s	s
Kennebec / Androscoggin Rivers	s	s	m,s	s	s
Casco Bay	s	s	m,s	s	s
Saco Bay	s	s	s	s	s
Wells Harbor					
Great Bay					
Merrimack River					
Massachusetts Bay	s	s	s	s	s
Boston Harbor	s	s	s	s	s
Cape Cod Bay	s	s	s	s	s
Waquoit Bay					
Buzzards Bay					
Narragansett Bay					
Long Island Sound					
Connecticut River					
Gardiners Bay					
Great South Bay					
Hudson River / Raritan Bay					
Barnegat Bay					
Delaware Bay					
Chincoteague Bay					
Chesapeake Bay					

S ≡ The EFH designation for this species includes the seawater salinity zone of this bay or estuary (salinity > 25.0‰).
M ≡ The EFH designation for this species includes the mixing water / brackish salinity zone of this bay or estuary (0.5 < salinity < 25.0‰).
F ≡ The EFH designation for this species includes the tidal freshwater salinity zone of this bay or estuary (0.0 < salinity < 0.5‰).

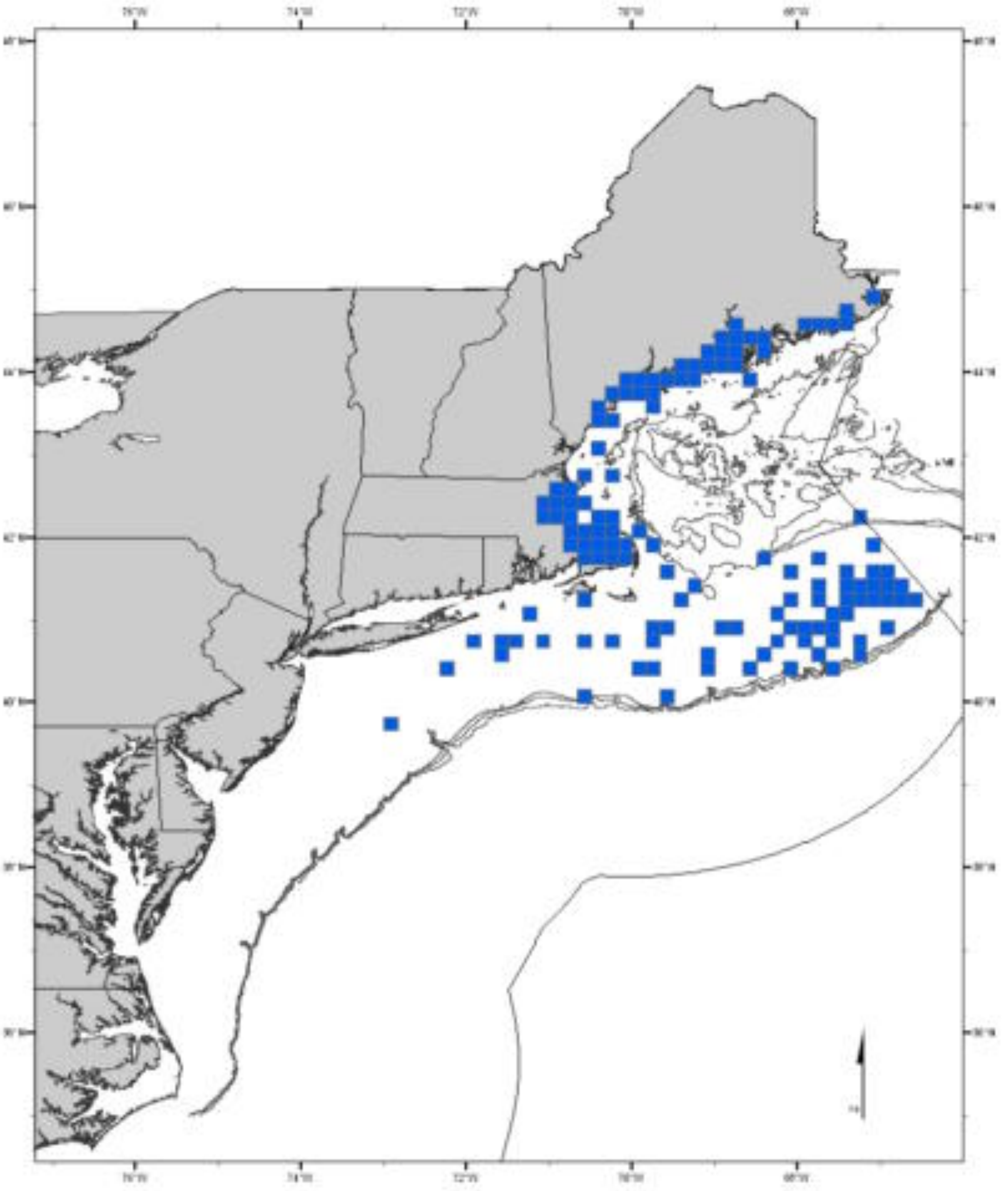
These EFH designations of estuaries and embayments are based on the NOAA Estuarine Living Marine Resources (ELMR) program (Jury et al. 1994; Stone et al. 1994). For a detailed view of the salinity zone boundaries, as described in the ELMR reports, please see Appendix B. The Council recognizes the spatial *and temporal variability of estuarine and embayment environmental conditions generally associated with this species.*

Map 1. American plaice eggs, Alternative 1 (No Action)



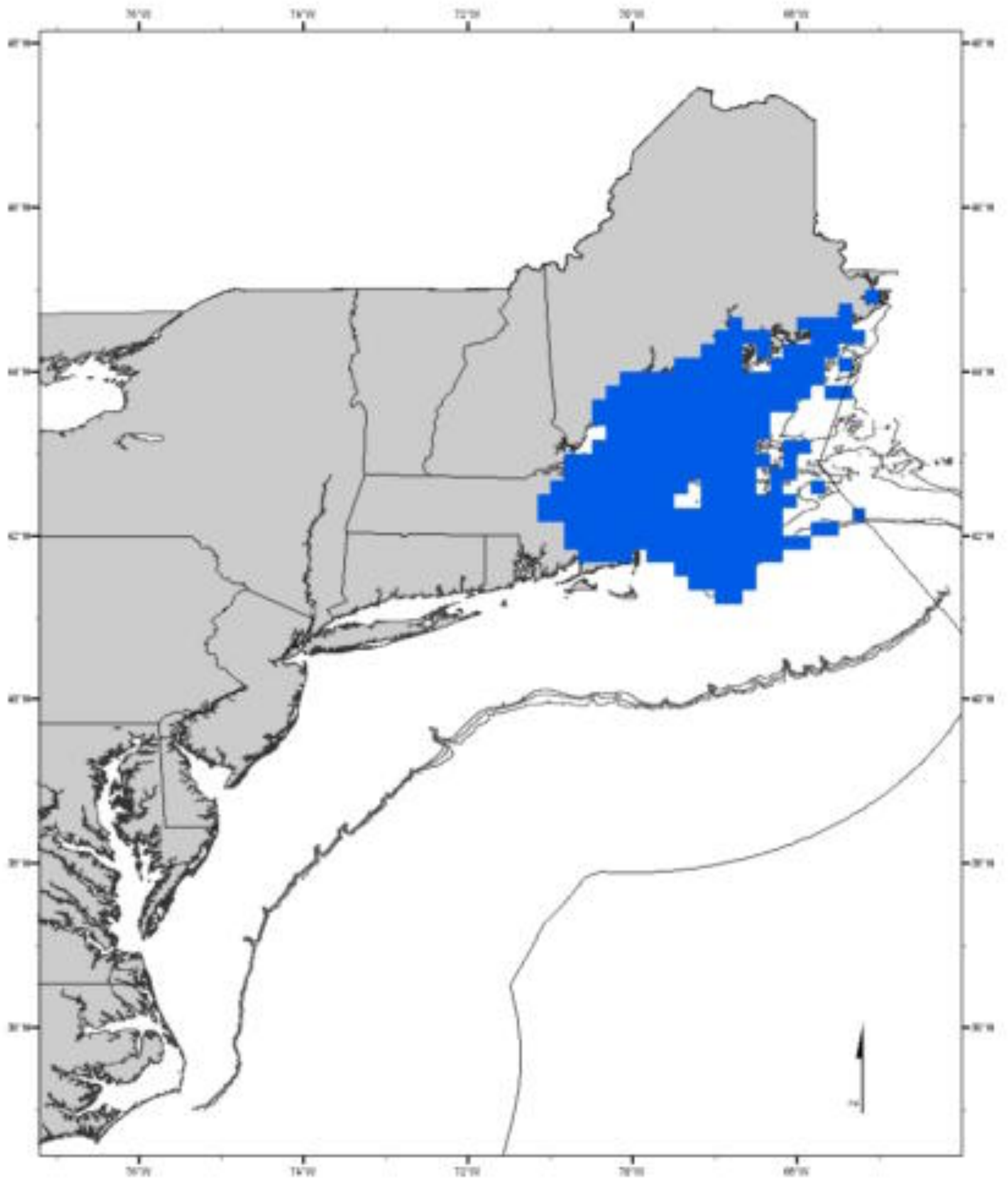
The EFH designation for American plaice eggs is based upon alternative 2 for American plaice eggs. This designation also includes those bays and estuaries identified by the NOAA ELMR program as supporting American plaice eggs at the "common" or "abundant" level. This alternative was selected to represent those areas most important to American plaice spawning and egg survival, while not including those areas where American plaice eggs occurred in relatively low concentrations.

Map 2. American plaice larvae, Alternative 1 (No Action)



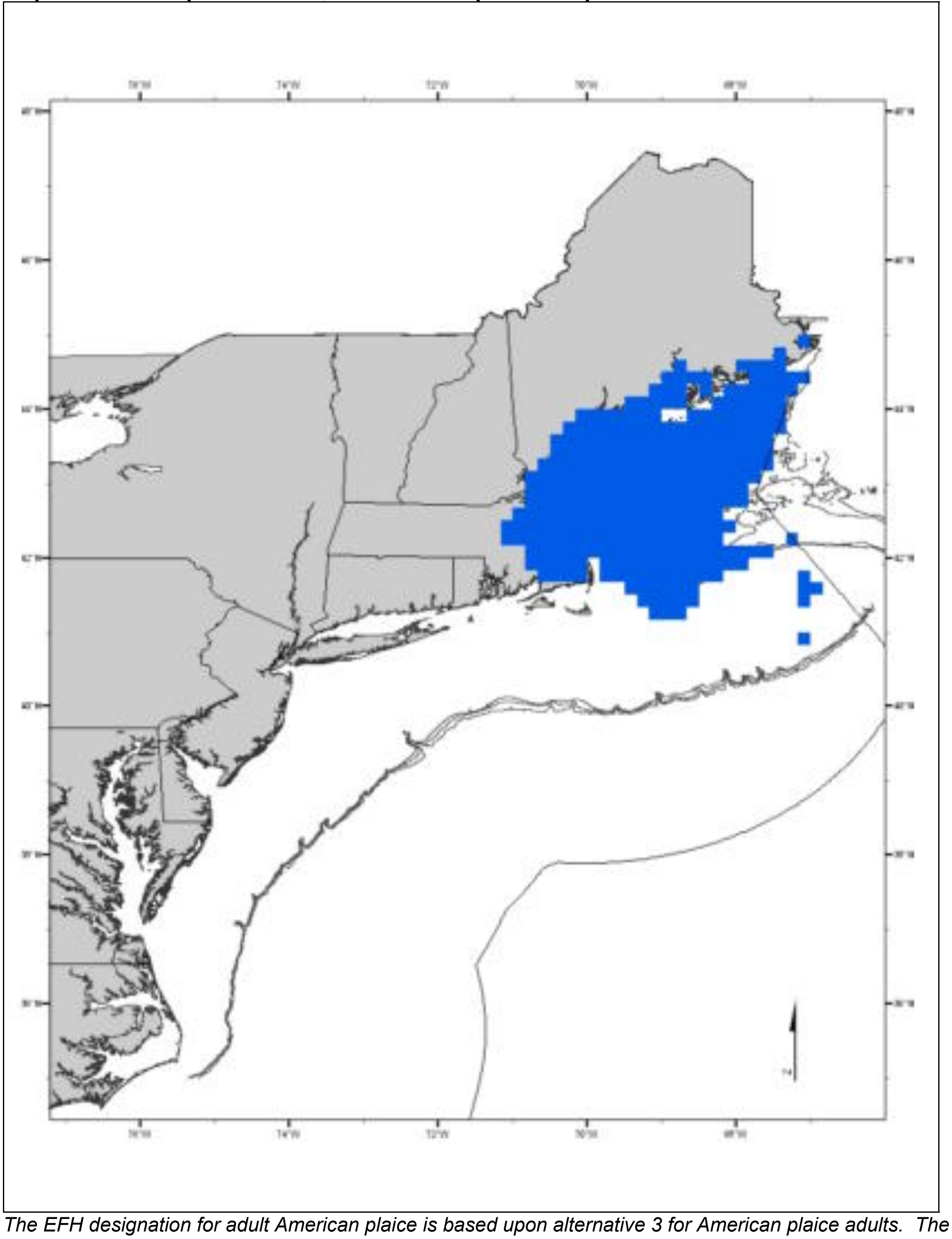
The EFH designation for American plaice larvae is based upon alternative 2 for American plaice larvae. This designation also includes those bays and estuaries identified by the NOAA ELMR program as supporting American plaice larvae at the "common" or "abundant" level. This alternative was selected to represent those areas most important to American plaice spawning and larval survival, while not including those areas where American plaice larvae occurred in relatively low concentrations.

Map 3. American plaice juveniles, Alternative 1 (No Action)



The EFH designation for juvenile American plaice is based upon alternative 3 for American plaice juveniles. The EFH designations also include the areas identified by the fishing industry and the inshore surveys as important for American plaice juveniles, as well as those bays and estuaries identified by the NOAA ELMR program as supporting American plaice juveniles at the "common" or "abundant" level. This designation was selected to include the areas where American plaice are most abundant, given that they are most concentrated in the Gulf of Maine and occur in relatively low concentrations on Georges Bank.

Map 4. American plaice adults, Alternative 1 (No Action)



The EFH designation for adult American plaice is based upon alternative 3 for American plaice adults. The EFH designations also include the areas identified by the fishing industry and the inshore surveys as important for American plaice adults, as well as those bays and estuaries identified by the NOAA ELMR program as supporting American plaice adults at the "common" or "abundant" level. This designation was selected to include the areas where American plaice are most abundant, given that they are most concentrated in the Gulf of Maine and occur in relatively low concentrations on Georges Bank.

4.1.1.2.2 Atlantic cod (Gadus morhua)

In its *Report to Congress: Status of the Fisheries of the United States* (September 1997), NMFS determined the Gulf of Maine stock of cod is considered overfished, based on the fishing mortality rate. The Georges Bank stock of cod is not considered overfished, also based on the fishing mortality rate associated with this stock. For both stocks of cod, essential fish habitat is described as those areas of the coastal and offshore waters (out to the offshore U.S. boundary of the exclusive economic zone) that are designated on Map 5 - Map 8 and in the accompanying table and meet the following conditions:

Eggs: Surface waters around the perimeter of the Gulf of Maine, Georges Bank, and the eastern portion of the continental shelf off southern New England as depicted on Map 5. Generally, the following conditions exist where cod eggs are found: sea surface temperatures below 12° C, water depths less than 110 meters, and a salinity range from 32 - 33‰. Cod eggs are most often observed beginning in the fall, with peaks in the winter and spring.

Larvae: Pelagic waters of the Gulf of Maine, Georges Bank, and the eastern portion of the continental shelf off southern New England as depicted on Map 6. Generally, the following conditions exist where cod larvae are found: sea surface temperatures below 10° C, waters depths from 30 - 70 meters, and a salinity range from 32 - 33‰. Cod larvae are most often observed in the spring.

Juveniles: Bottom habitats with a substrate of cobble or gravel in the Gulf of Maine, Georges Bank, and the eastern portion of the continental shelf off southern New England as depicted on Map 7. Generally, the following conditions exist where cod juveniles are found: water temperatures below 20° C, depths from 25 - 75 meters, and a salinity range from 30 - 35‰.

Adults: Bottom habitats with a substrate of rocks, pebbles, or gravel in the Gulf of Maine, Georges Bank, southern New England, and the middle Atlantic south to Delaware Bay as depicted on Map 8. Generally, the following conditions exist where cod adults are found: water temperatures below 10° C, depths from 10 - 150 meters, and a wide range of oceanic salinities.

Spawning Adults: Bottom habitats with a substrate of smooth sand, rocks, pebbles, or gravel in the Gulf of Maine, Georges Bank, southern New England, and the middle Atlantic south to Delaware Bay as depicted on Map 8. Generally, the following conditions exist where spawning cod adults are found: water temperatures below 10° C, depths from 10 - 150 meters, and a wide range of oceanic salinities. Cod are most often observed spawning during fall, winter, and early spring.

All of the above EFH descriptions include those bays and estuaries listed on the following table, according to life history stage. The Council acknowledges potential seasonal and spatial variability of the conditions generally associated with this species.

Table 8. EFH Designation of Estuaries and Embayments: Atlantic cod (Gadus morhua)

Estuaries and Embayments	Eggs	Larvae	Juvenile	Adult	Spawning Adults
Passamaquoddy Bay		s	s	s	
Englishman/Machias Bay	s	s	s	s	s
Narraguagus Bay	s	s	s	s	s
Blue Hill Bay	s	s	s	s	s
Penobscot Bay		s	s	s	
Muscongus Bay			s	s	
Damariscotta River			s	s	
Sheepscot River	s	s	s	s	s
Kennebec / Androscoggin Rivers			s	s	
Casco Bay	s	s	s	s	
Saco Bay	s	s	s	s	
Wells Harbor					
Great Bay	s	s			
Merrimack River					
Massachusetts Bay	s	s	s	s	s
Boston Harbor	s	s	m,s	m,s	s
Cape Cod Bay	s	s	s	s	s
Waquoit Bay					
Buzzards Bay	s	s	s	s	
Narragansett Bay					
Long Island Sound					
Connecticut River					
Gardiners Bay					
Great South Bay					
Hudson River / Raritan Bay					
Barnegat Bay					
Delaware Bay					
Chincoteague Bay					
Chesapeake Bay					

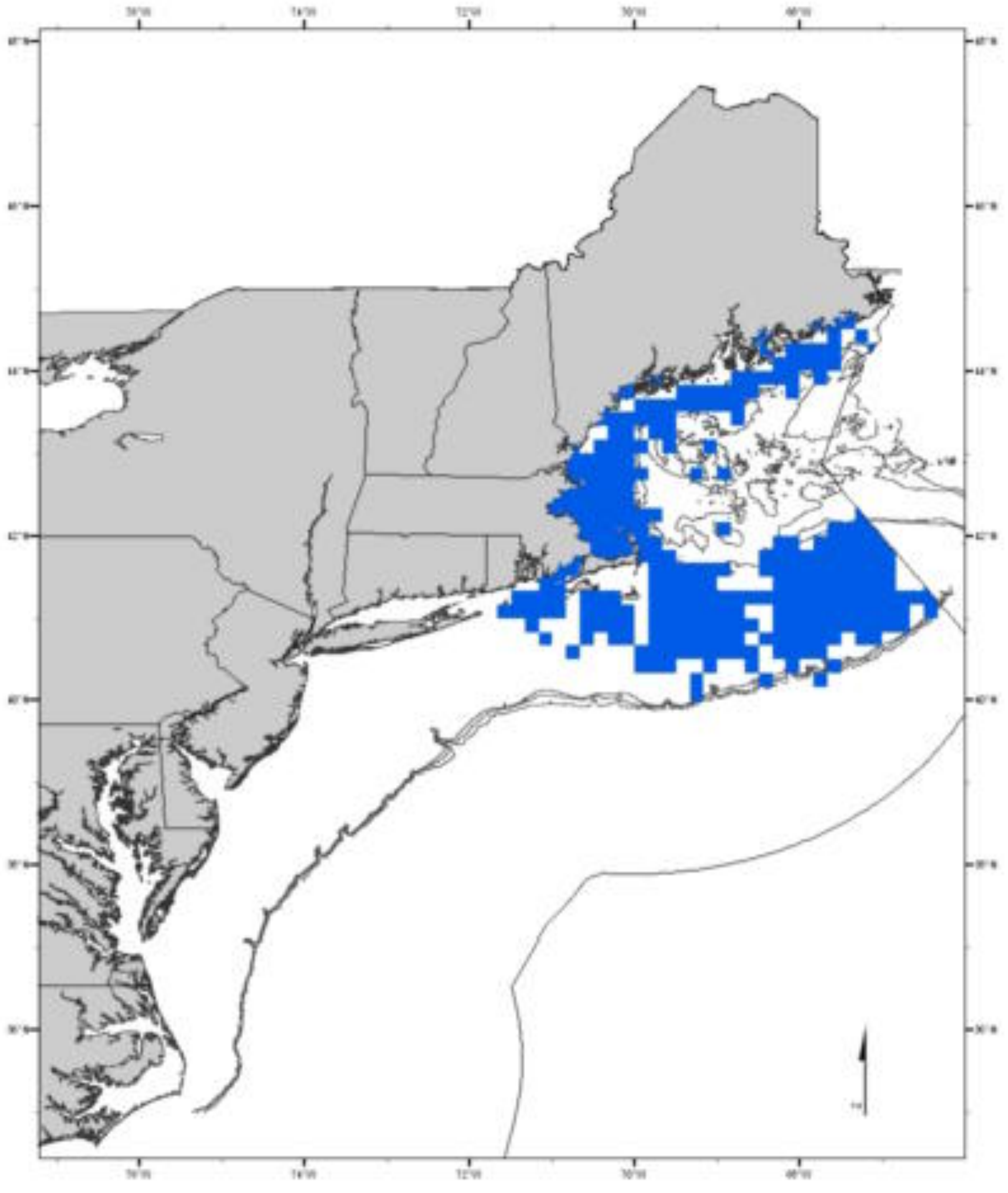
S ≡ The EFH designation for this species includes the seawater salinity zone of this bay or estuary (salinity > 25.0‰).

M ≡ The EFH designation for this species includes the mixing water / brackish salinity zone of this bay or estuary (0.5 < salinity < 25.0‰).

F ≡ The EFH designation for this species includes the tidal freshwater salinity zone of this bay or

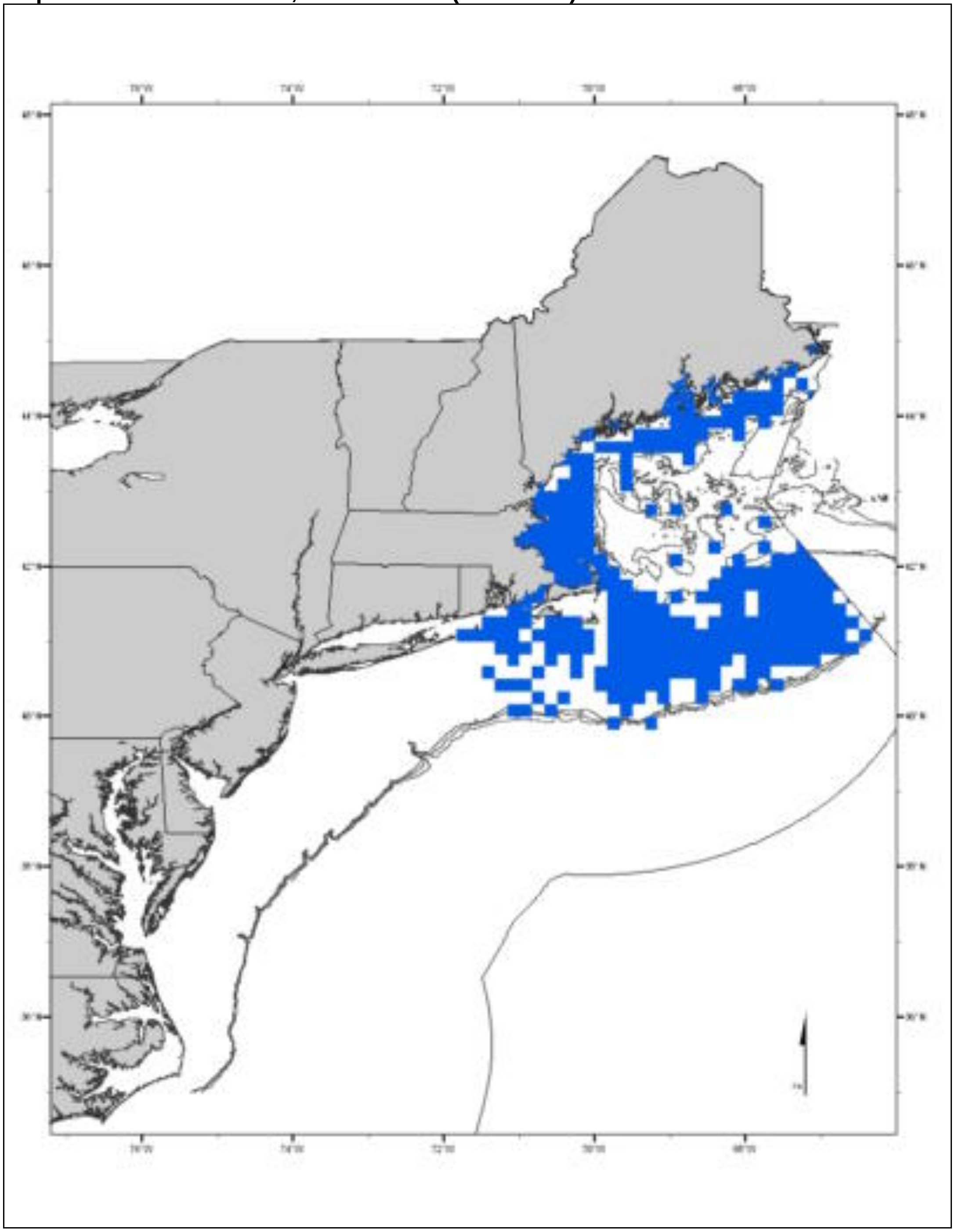
estuary (0.0 < salinity < 0.5‰).
These EFH designations of estuaries and embayments are based on the NOAA Estuarine Living Marine Resources (ELMR) program (Jury et al. 1994; Stone et al. 1994). For a detailed view of the salinity zone boundaries, as described in the ELMR reports, please see Appendix B. The Council recognizes the spatial and temporal variability of estuarine and embayment environmental conditions generally associated with this species.

Map 5. Atlantic cod eggs, Alternative 1 (No Action)



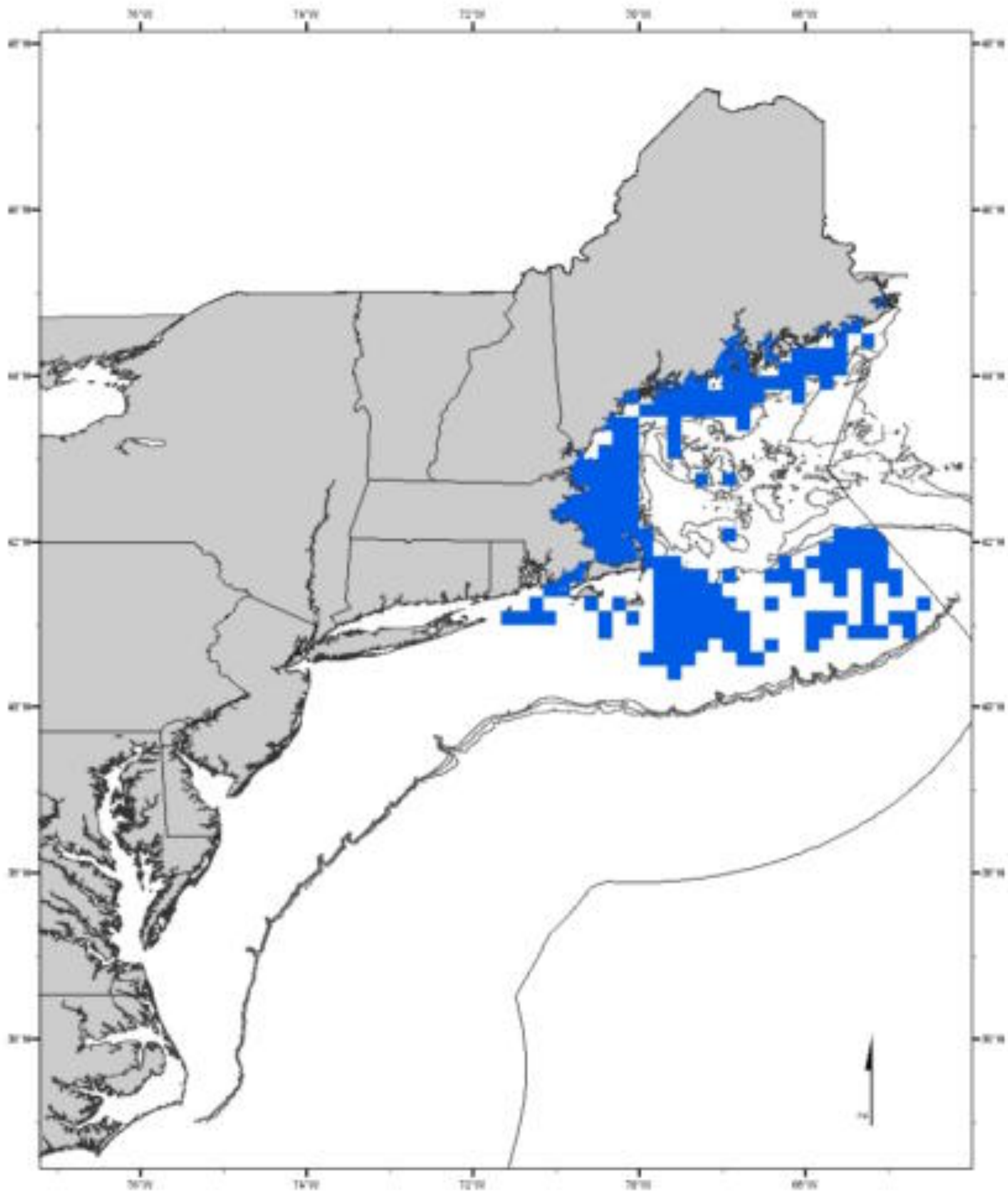
The EFH designation for Atlantic cod eggs is based upon a combination of alternative 3 for juvenile Atlantic cod plus alternative 3 for Atlantic cod eggs within the range of juvenile cod. This designation also includes those bays and estuaries identified by the NOAA ELMR program as supporting Atlantic cod eggs at a "common" or "abundant" level. This approach was selected because the data on the distribution of cod eggs include areas believed to be not conducive to their survival. Eggs that occur south of Long Island are either passively transported southward by currents or spawned by fish on the southern edge of the range and the environmental conditions in this area are believed to be not suitable for survival. The component of the adult cod population in this area is migratory in nature; thus, these eggs do not contribute to this population.

Map 6. Atlantic cod larvae, Alternative 1 (No Action)



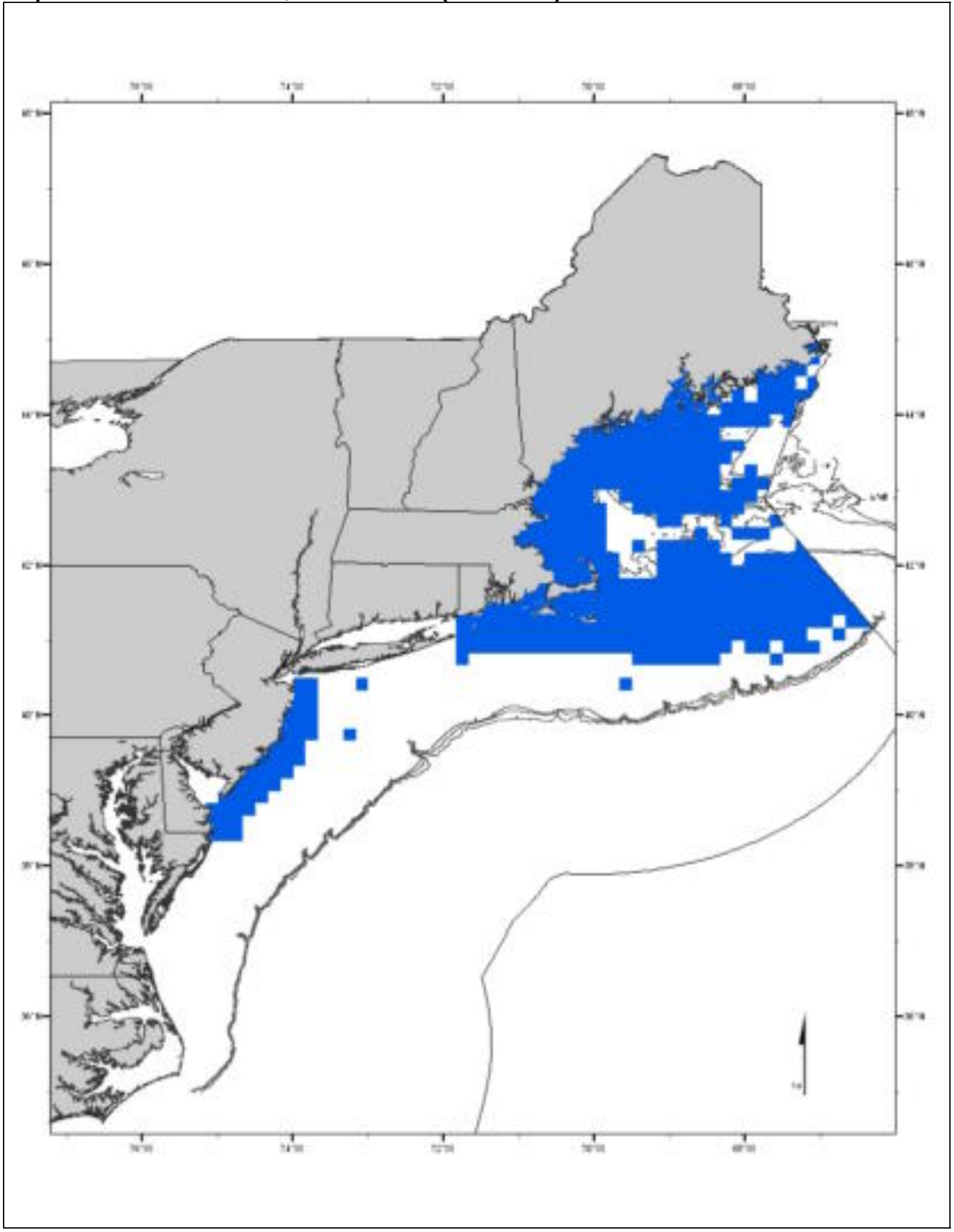
The EFH designation for Atlantic cod larvae is based upon a combination of alternative 3 for juvenile Atlantic cod plus alternative 3 for Atlantic cod larvae within the range of juvenile cod. This designation also includes those bays and estuaries identified by the NOAA ELMR program as supporting Atlantic cod larvae at a "common" or "abundant" level. This approach was selected because the data on the distribution of cod larvae include areas believed to be not conducive to their survival. Eggs and larvae that occur south of Long Island are either passively transported southward by currents or spawned by fish on the southern edge of the range and the environmental conditions in this area are believed to be not suitable for survival. The component of the adult cod population in this area is migratory in nature; thus, these larvae do not contribute to this population. .

Map 7. Atlantic cod juveniles, Alternative 1 (No Action)



The EFH designation for juvenile Atlantic cod is based upon alternative 3 for cod juveniles plus information from the fishing industry. This designation also includes those bays and estuaries identified by the NOAA ELMR program as supporting juvenile Atlantic cod at a "common" or "abundant" level and information from the Massachusetts Inshore Trawl Survey. The other alternatives were not selected because they either include too little area (less than half the range of this overfished species), or include areas where cod occur in relatively low concentrations.

Map 8. Atlantic cod adults, Alternative 1 (No Action)



The EFH designation for adult Atlantic cod is based upon alternative 3 for cod adults plus areas identified as important spawning grounds and information from the fishing industry. This designation also includes those bays and estuaries identified by the NOAA ELMR program as supporting adult Atlantic cod at a "common" or "abundant" level. The shaded areas south of Massachusetts and Rhode Island and along the coast of New Jersey and Delaware were selected for EFH designation based on their historical importance for a portion of the adult population that migrates to this area for feeding in the winter. The other alternatives were not selected because they either include too little area (less than half the range of this overfished species), or include areas where cod occur in relatively low concentrations.

4.1.1.2.3 Atlantic halibut (Hippoglossus hippoglossus)

According to the NMFS' *Report to Congress: Status of the Fisheries of the United States* (September 1997), Atlantic halibut is currently overfished. This determination is based on an assessment of stock level. Essential Fish Habitat for Atlantic halibut is described as the area of the coastal and offshore waters (out to the offshore U.S. boundary of the Exclusive Economic Zone) that is designated on Map 9 and meets the following conditions:

Eggs: Pelagic waters to the sea floor of the Gulf of Maine and Georges Bank as depicted on Map 9. Generally, the following conditions exist where Atlantic halibut eggs are found: water temperatures between 4 and 7° C, water depths less than 700 meters, and salinities less than 35‰. Atlantic halibut eggs are observed between late fall and early spring, with peaks in November and December.

Larvae: Surface waters of the Gulf of Maine and Georges Bank as depicted on Map 9. Generally, the following conditions exist where Atlantic halibut larvae are found: salinities between 30 and 35‰.

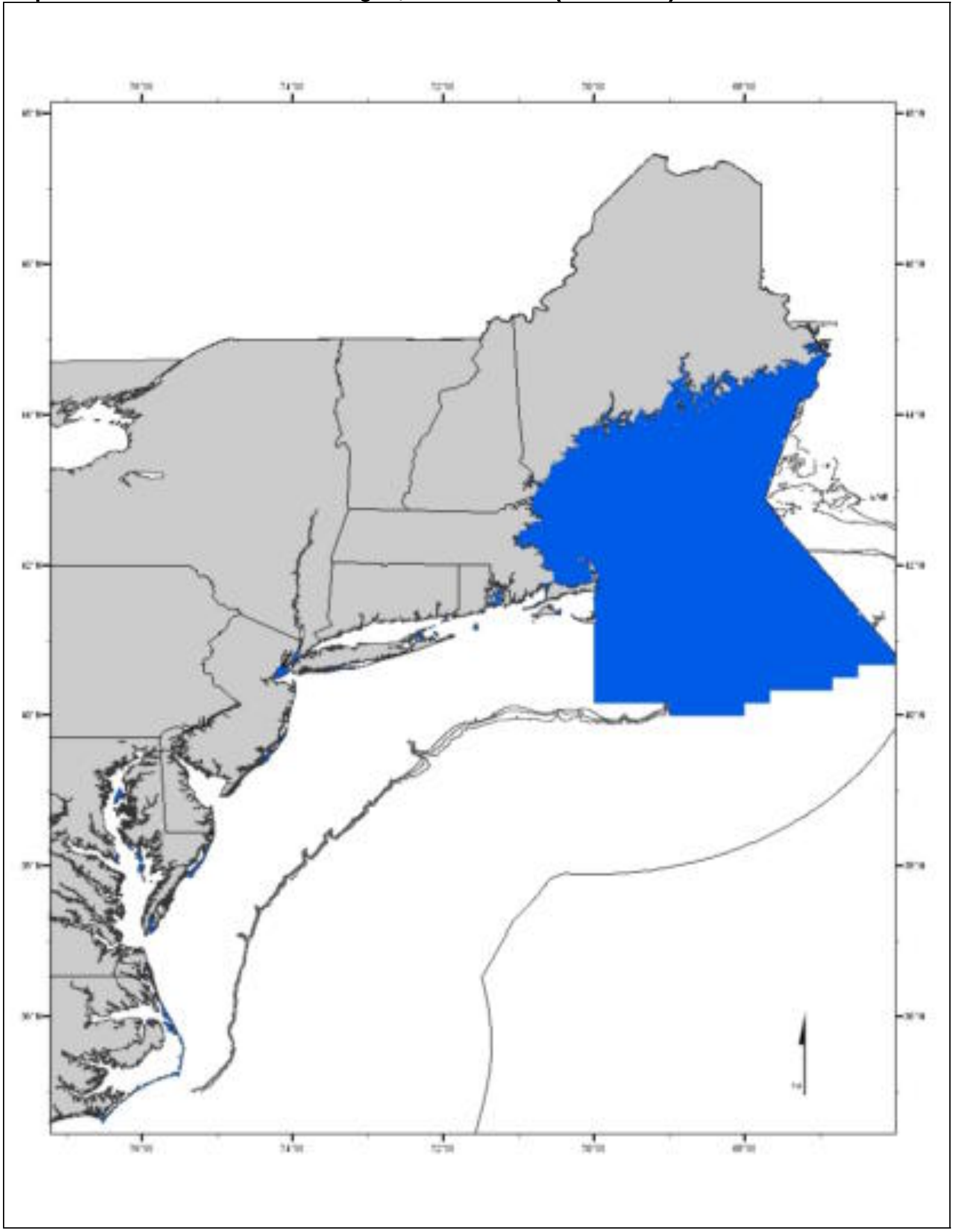
Juveniles: Bottom habitats with a substrate of sand, gravel, or clay in the Gulf of Maine and Georges Bank as depicted on Map 9. Generally, the following conditions exist where Atlantic halibut juveniles are found: water temperatures above 2° C and depths from 20 - 60 meters.

Adults: Bottom habitats with a substrate of sand, gravel, or clay in the Gulf of Maine and Georges Bank as depicted on Map 9. Generally, the following conditions exist where Atlantic halibut adults are found: water temperatures below 13.6° C, depths from 100 - 700 meters, and salinities between 30.4 - 35.3‰.

Spawning Adults: Bottom habitats with a substrate of soft mud, clay, sand or gravel in the Gulf of Maine and Georges Bank, as well as rough or rocky bottom locations along the slopes of the outer banks, as depicted on Map 9. Generally, the following conditions exist where spawning Atlantic halibut are found: water temperatures below 7° C, depths less than 700 meters, and salinities less than 35‰. Atlantic halibut are most often observed spawning between late fall and early spring, with peaks in November and December.

The Council acknowledges potential seasonal and spatial variability of the conditions generally associated with this species.

Map 9. Atlantic halibut All life stages, Alternative 1 (No Action)



The EFH designation for all life history stages of Atlantic halibut is based on the portion of the historic range of Atlantic halibut that coincides with entire observed range of Atlantic halibut (alternative 4). The historic range is based on a composite of areas known to support Atlantic halibut, described by: (1) Bigelow and Schroeder, 1953; (2) Goode and Collins, 1887; (3) Rich, 1929; and, (4) EFH Source Document, 1998. In the absence of other information, this portion of the historic range most accurately represents the areas used by and important to this species, where halibut are likely to be caught in the foreseeable future.

4.1.1.2.4 Atlantic herring (Clupea harengus)

In its *Report to Congress: Status of the Fisheries of the United States* (September 1997), NMFS determined Atlantic herring is not currently overfished. This determination is based on the fishing mortality rate. Essential Fish Habitat for Atlantic herring is described as those areas of the coastal and offshore waters (out to the offshore U.S. boundary of the exclusive economic zone) that are designated on Map 10 - Map 13 and in the accompanying table and meet the following conditions:

Eggs: Bottom habitats with a substrate of gravel, sand, cobble and shell fragments, but also on aquatic macrophytes, in the Gulf of Maine and Georges Bank as depicted on Map 10. Eggs adhere to the bottom, forming extensive egg beds which may be many layers deep. Generally, the following conditions exist where Atlantic herring eggs are found: water temperatures below 15° C, depths from 20 - 80 meters, and a salinity range from 32 - 33‰. Herring eggs are most often found in areas of well-mixed water, with tidal currents between 1.5 and 3.0 knots. Atlantic herring eggs are most often observed during the months from July through November.

Larvae: Pelagic waters in the Gulf of Maine, Georges Bank, and southern New England that comprise 90% of the observed range of Atlantic herring larvae as depicted on Map 11. Generally, the following conditions exist where Atlantic herring larvae are found: sea surface temperatures below 16° C, water depths from 50 - 90 meters, and salinities around 32‰. Atlantic herring larvae are observed between August and April, with peaks from September through November.

Juveniles: Pelagic waters and bottom habitats in the Gulf of Maine, Georges Bank, southern New England and the middle Atlantic south to Cape Hatteras as depicted on Map 12. Generally, the following conditions exist where Atlantic herring juveniles are found: water temperatures below 10° C, water depths from 15 - 135 meters, and a salinity range from 26 - 32‰.

Adults: Pelagic waters and bottom habitats in the Gulf of Maine, Georges Bank, southern New England and the middle Atlantic south to Cape Hatteras as depicted on Map 13. Generally, the following conditions exist where Atlantic herring adults are found: water temperatures below 10° C, water depths from 20 - 130 meters, and salinities above 28‰.

Spawning Adults: Bottom habitats with a substrate of gravel, sand, cobble and shell fragments, but also on aquatic macrophytes, in the Gulf of Maine, Georges Bank, southern New England and the middle Atlantic south to Delaware Bay as depicted on Map 13. Generally, the following conditions exist where spawning Atlantic herring adults are found: water temperatures below 15° C, depths from 20 - 80 meters, and a salinity range from 32 - 33‰. Herring eggs are spawned in areas of well-mixed water, with tidal currents between 1.5 and 3.0 knots. Atlantic herring are most often observed spawning during the months from July through November.

All of the above EFH descriptions include those bays and estuaries listed on the following table, according to life history stage. The Council acknowledges potential seasonal and spatial variability of the conditions generally associated with this species.

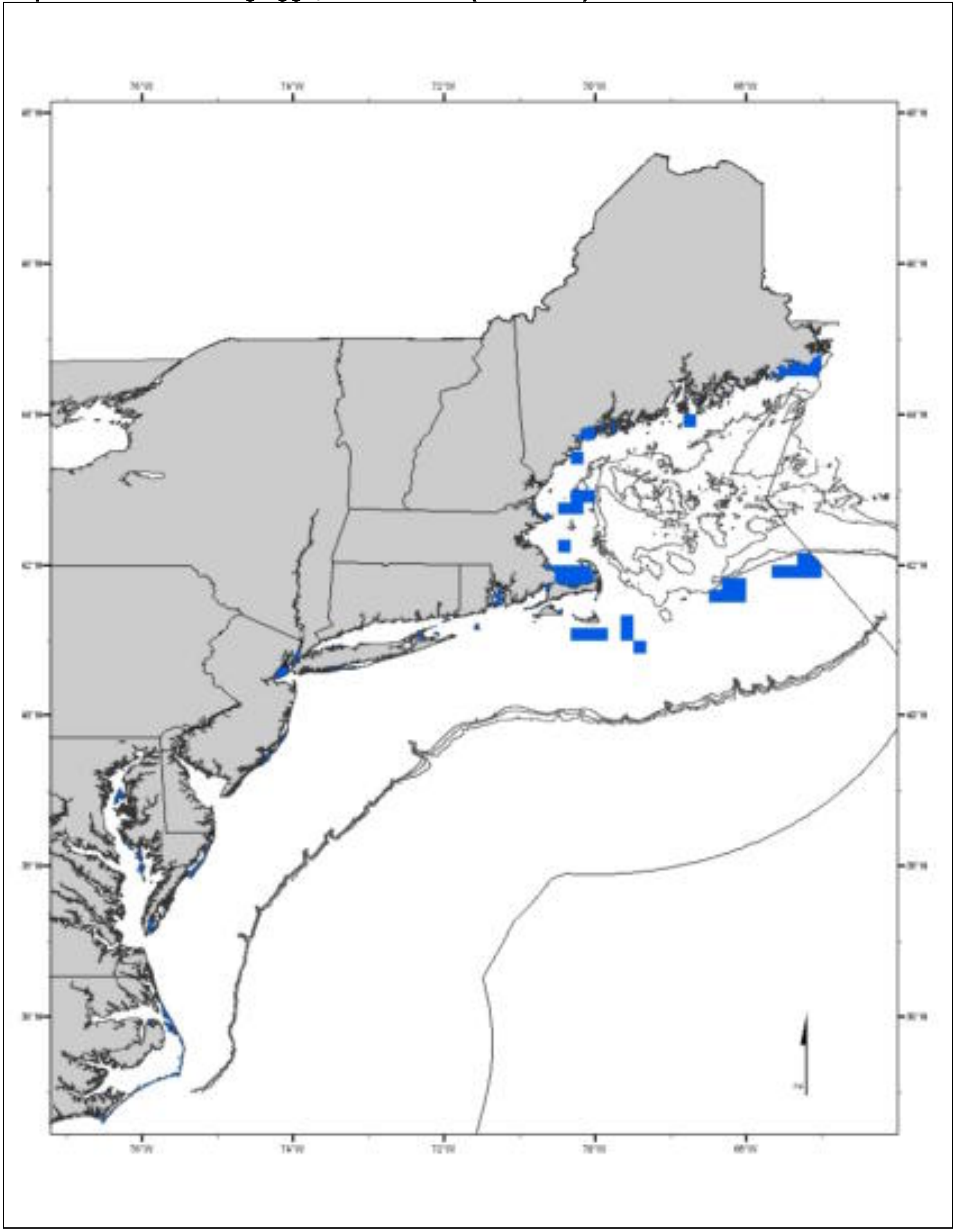
Table 9. EFH Designation of Estuaries and Embayments: Atlantic herring (Clupea harengus)

Estuaries and Embayments	Eggs	Larvae	Juveniles	Adults	Spawning Adults
Passamaquoddy Bay		m,s	m,s	m,s	
Englishman/Machias Bay	s	m,s	m,s	m,s	s
Narraguagus Bay		m,s	m,s	m,s	
Blue Hill Bay		m,s	m,s	m,s	
Penobscot Bay		m,s	m,s	m,s	
Muscongus Bay		m,s	m,s	m,s	
Damariscotta River		m,s	m,s	m,s	
Sheepscot River		m,s	m,s	m,s	
Kennebec / Androscoggin Rivers		m,s	m,s	m,s	
Casco Bay	s	m,s	m,s	s	
Saco Bay		m,s	m,s	s	
Wells Harbor		m,s	m,s	s	
Great Bay		m,s	m,s	s	
Merrimack River		m	m		
Massachusetts Bay		s	s	s	
Boston Harbor		s	m,s	m,s	
Cape Cod Bay	s	s	m,s	m,s	
Waquoit Bay					
Buzzards Bay			m,s	m,s	
Narragansett Bay		s	m,s	m,s	
Long Island Sound			m,s	m,s	
Connecticut River					
Gardiners Bay			s	s	
Great South Bay			s	s	
Hudson River / Raritan Bay		m,s	m,s	m,s	
Barnegat Bay			m,s	m,s	
Delaware Bay			m,s	s	
Chincoteague Bay					

Chesapeake Bay				s	

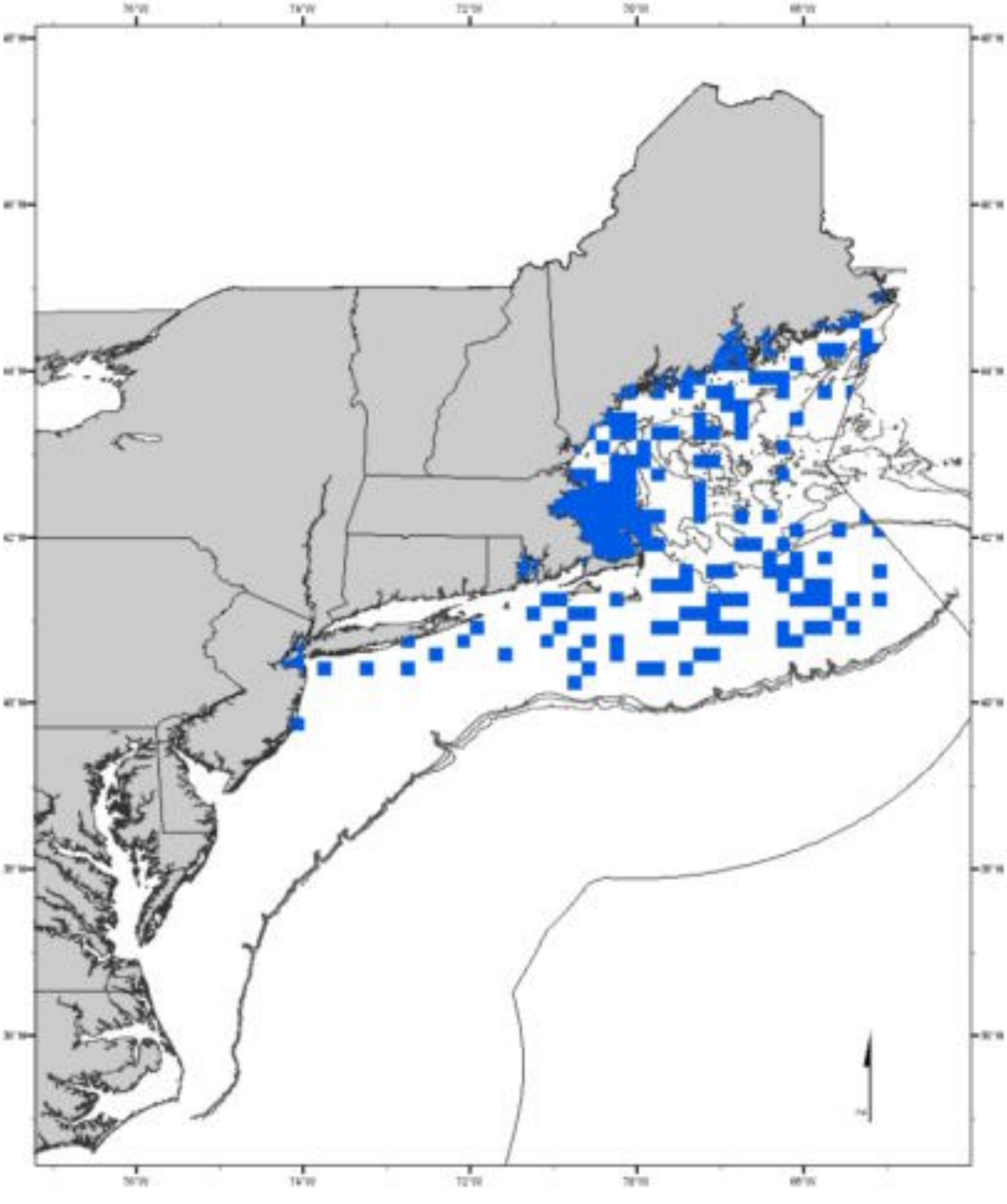
S ≡ The EFH designation for this species includes the seawater salinity zone of this bay or estuary (salinity > 25.0‰).
M ≡ The EFH designation for this species includes the mixing water / brackish salinity zone of this bay or estuary (0.5 < salinity < 25.0‰).
F ≡ The EFH designation for this species includes the tidal freshwater salinity zone of this bay or estuary (0.0 < salinity < 0.5‰).
These EFH designations of estuaries and embayments are based on the NOAA Estuarine Living Marine Resources (ELMR) program (Jury et al. 1994; Stone et al. 1994). For a detailed view of the salinity zone boundaries, as described in the ELMR reports, please see Appendix B. The Council recognizes the spatial and temporal variability of estuarine and embayment environmental conditions generally associated with this species.

Map 10. Atlantic herring eggs, Alternative 1 (No Action)



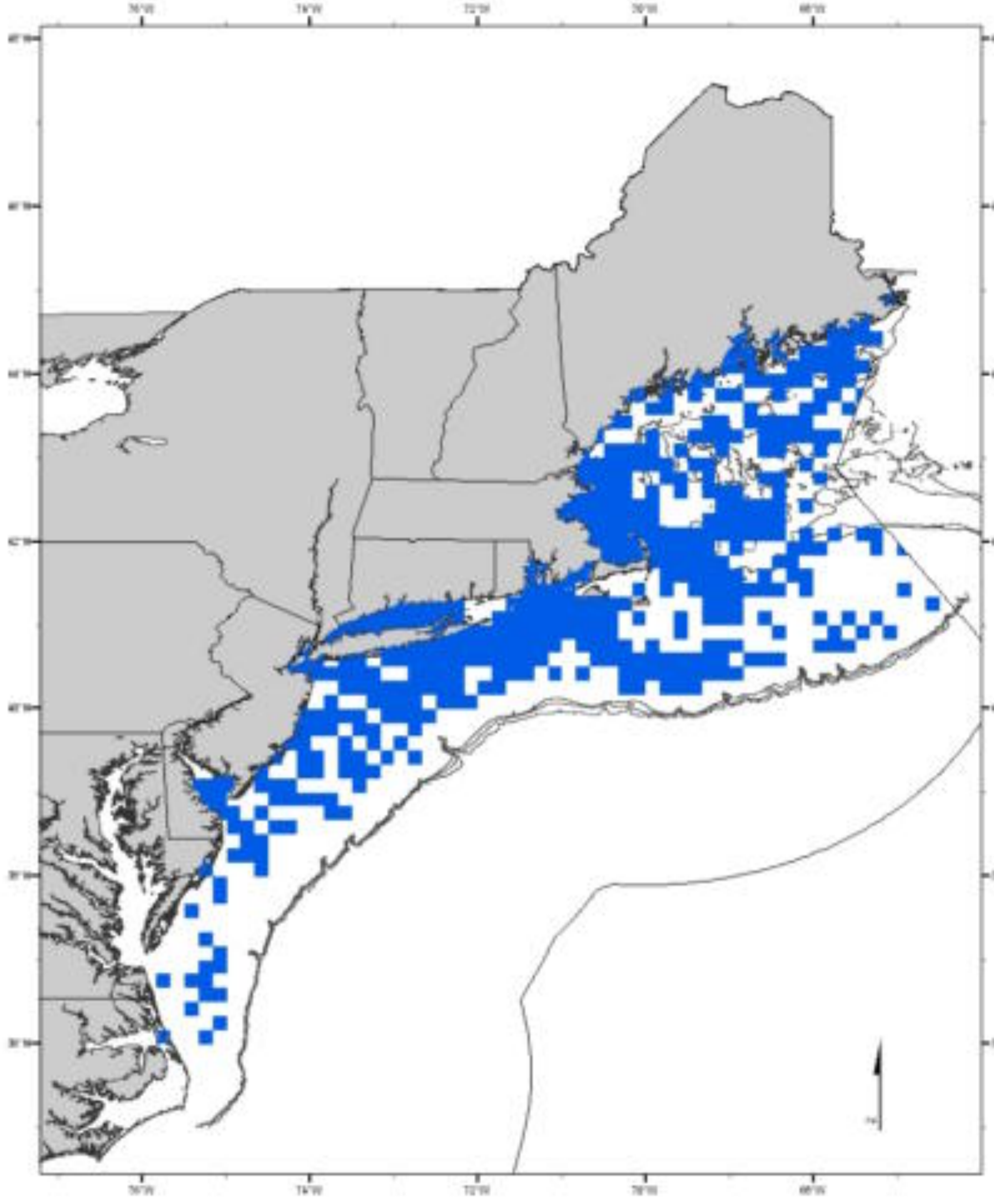
The EFH designation for Atlantic herring eggs represents 100% of the known Atlantic herring egg beds. These egg beds were identified based on a review of all available information on the current and historical herring egg bed locations. All known herring beds were identified for EFH designation to be as inclusive as possible for this critical life history stage, and because all known egg beds only represent a portion of all herring egg sites. In addition, this designation includes those bays and estuaries identified in the NOAA ELMR program as supporting herring eggs at the "rare", "common", or "abundant" level. There were no specific alternatives considered by the Council, although the Council did have the option to designate fewer than 100% of the known herring egg beds.

Map 11. Atlantic herring larvae, Alternative 1 (No Action)



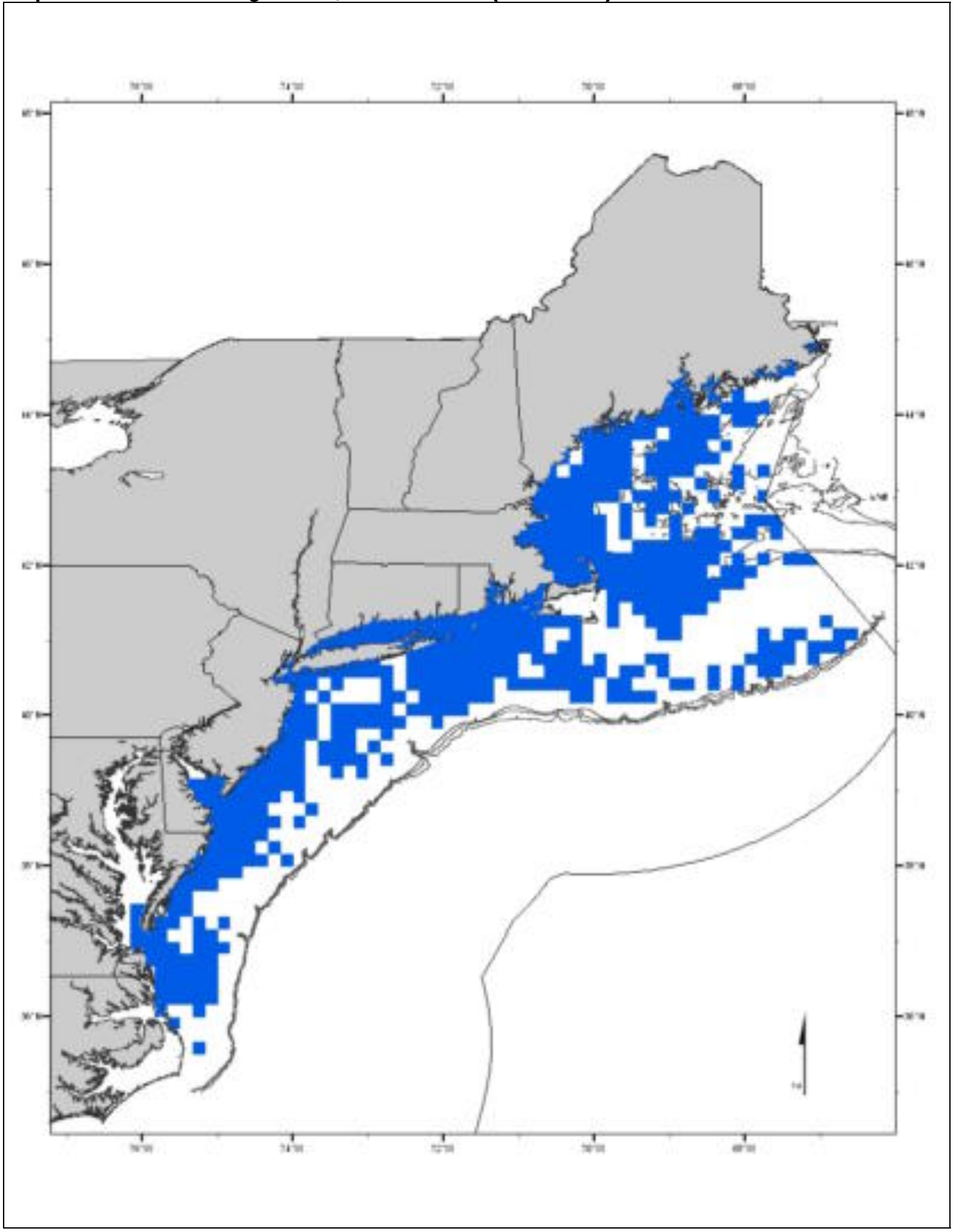
The EFH designation for Atlantic herring larvae is based upon alternative 3 for herring larvae. This designation also includes those bays and estuaries identified by the NOAA ELMR program as supporting Atlantic herring larvae at a "common" or "abundant" level. This alternative was selected to include all areas where herring larvae are found in relatively high concentrations, but not those areas where herring larvae are found in relatively very low concentrations.

Map 12. Atlantic herring juveniles, Alternative 1 (No Action)



The EFH designation for juvenile Atlantic herring is based upon alternative 2 for juvenile herring, plus areas of relatively high concentrations of juvenile herring from the State of Massachusetts inshore trawl survey. This designation also includes those bays and estuaries identified by the NOAA ELMR program as supporting juvenile Atlantic herring at a "common" or "abundant" level. This alternative was selected to ensure inclusion of all areas where herring occur in relatively high concentrations. The other alternatives were not selected because they either include too little area (less than half of the range of the species) or include areas where herring occur in relatively low concentrations.

Map 13. Atlantic herring adults, Alternative 1 (No Action)



The EFH designation for adult Atlantic herring is based upon alternative 2 for adult herring, combined with the 50% alternative of the 1997 recorded catch data. This designation also includes information from the fishing industry and those bays and estuaries identified by the NOAA ELMR program as supporting adult Atlantic herring at a "common" or "abundant" level. This alternative was selected to ensure inclusion of all areas where herring occur in relatively high concentrations. The other alternatives were not selected because they either include too little area (less than half of the range of the species) of include areas where herring occur in relatively low concentrations.

4.1.1.2.5 Atlantic sea scallop (Plactopecten magellanicus)

In its *Report to Congress: Status of the Fisheries of the United States* (September 1997), NMFS determined Atlantic sea scallops are currently overfished. This determination is based on the fishing mortality rate. Essential fish habitat for Atlantic sea scallops is described as those areas of the coastal and offshore waters (out to the offshore U.S. boundary of the exclusive economic zone) that are designated on Map 14 in the accompanying table and meet the following conditions:

Eggs: Bottom habitats in the Gulf of Maine, Georges Bank, southern New England and the middle Atlantic south to the Virginia-North Carolina border as depicted on Map 14. Eggs are heavier than seawater and remain on the seafloor until they develop into the first free-swimming larval stage. Generally, sea scallop eggs are thought to occur where water temperatures are below 17° C. Spawning occurs from May through October, with peaks in May and June in the middle Atlantic area and in September and October on Georges Bank and in the Gulf of Maine.

Larvae: Pelagic waters and bottom habitats with a substrate of gravelly sand, shell fragments, and pebbles, or on various red algae, hydroids, amphipod tubes and bryozoans in the Gulf of Maine, Georges Bank, southern New England and the middle Atlantic south to the Virginia-North Carolina border as depicted on Map 14. Generally, the following conditions exist where sea scallop larvae are found: sea surface temperatures below 18° C and salinities between 16.9‰ and 30‰.

Juveniles: Bottom habitats with a substrate of cobble, shells and silt in the Gulf of Maine, Georges Bank, southern New England and the middle Atlantic south to the Virginia-North Carolina border that support the highest densities of sea scallops as depicted on Map 14. Generally, the following conditions exist where most sea scallop juveniles are found: water temperatures below 15° C, and water depths from 18 - 110 meters.

Adults: Bottom habitats with a substrate of cobble, shells, coarse/gravelly sand, and sand in the Gulf of Maine, Georges Bank, southern New England and the middle Atlantic south to the Virginia-North Carolina border that support the highest densities of sea scallops as depicted on Map 14. Generally, the following conditions exist where most sea scallop adults are found: water temperatures below 21° C, water depths from 18 - 110 meters, and salinities above 16.5‰.

Spawning Adults: Bottom habitats with a substrate of cobble, shells, coarse/gravelly sand, and sand in the Gulf of Maine, Georges Bank, southern New England and the middle Atlantic south to the Virginia-North Carolina border that support the highest densities of sea scallops as depicted on Map 14. Generally, the following conditions exist where spawning sea scallop adults are found: water temperatures below 16° C, depths from 18 - 110 meters, and salinities above 16.5‰. Spawning occurs from May through October, with peaks in May and June in the middle Atlantic area and in September and October on Georges Bank and in the Gulf of Maine.

All of the above EFH descriptions include those bays and estuaries listed on the following table, according to life history stage. The Council acknowledges potential seasonal and spatial variability of the conditions generally associated with this species.

Table 10. EFH Designation of Estuaries and Embayments**:** Atlantic sea scallops (*Placopecten magellanicus*)

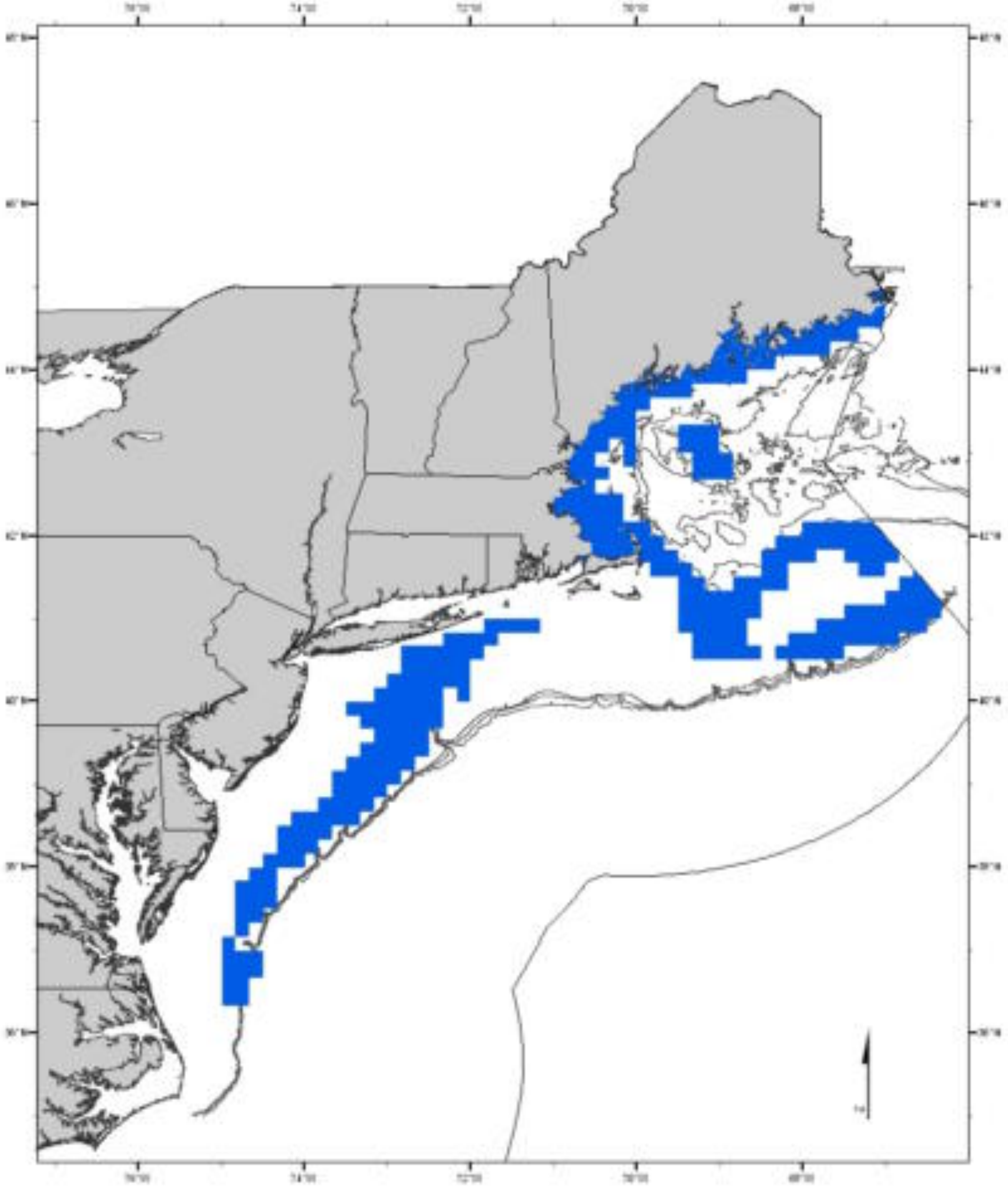
Estuaries and Embayments	Eggs	Larvae	Juveniles	Adults	Spawning Adults
Passamaquoddy Bay	s	s	s	s	s
Englishman/Machias Bay	s	s	s	s	s
Narraguagus Bay	s	s	s	s	s
Blue Hill Bay	s	s	s	s	s
Penobscot Bay	s	s	s	s	s
Muscongus Bay	s	s	s	s	s
Damariscotta River	s	s	s	s	s
Sheepscot River	s	s	s	s	s
Kennebec / Androscoggin Rivers					
Casco Bay	s	s	s	s	s
Saco Bay					
Wells Harbor					
Great Bay			s	s	
Merrimack River					
Massachusetts Bay	s	s	s	s	s
Boston Harbor					
Cape Cod Bay	s	s	s	s	s
Waquoit Bay					
Buzzards Bay					
Narragansett Bay					
Long Island Sound					
Connecticut River					
Gardiners Bay					
Great South Bay					
Hudson River / Raritan Bay					
Barnegat Bay					
Delaware Bay					

Chincoteague Bay					
Chesapeake Bay					

S ≡ The EFH designation for this species includes the seawater salinity zone of this bay or estuary (salinity > 25.0‰).
M ≡ The EFH designation for this species includes the mixing water / brackish salinity zone of this bay or estuaries (0.5 < salinity < 25.0‰).
F ≡ The EFH designation for this species includes the tidal freshwater salinity zone of this bay or estuary (0.0 < salinity < 0.5‰).

These EFH designations of estuaries and embayments are based on the NOAA Estuarine Living Marine Resources (ELMR) program (Jury et al. 1994; Stone et al. 1994). For a detailed view of the salinity zone boundaries, as described in the ELMR reports, please see Appendix B. The Council recognizes the spatial and temporal variability of estuarine and embayment environmental conditions generally associated with this species.

Map 14. Atlantic sea scallops All Life Stages, Alternative 1 (No Action)



The EFH designation for Atlantic sea scallops is based upon alternative 2, based on the NMFS scallop survey (1982 - 1997), plus areas identified by the fishing industry and by NMFS as important for sea scallops. The designation also includes the mid-Atlantic juvenile sea scallop closed areas (the Hudson Canyon Closed Area and the Virginia Beach Closed Area) and those bays and estuaries identified by the NOAA ELMR program as supporting sea scallops at the "common" or "abundant" level. The other alternatives were not selected because they either include too little area (less than half of the range of this overfished species), or include areas where sea scallops occur in relatively low concentrations.

4.1.1.2.6 Barndoor Skate (Dipturus laevis)

In its *Report to Congress: Status of the Fisheries of the United States* (January 2001), NMFS determined that barndoor skate is in an overfished condition, based on stock size assessment. Because recent assessments determined that more information is needed to draw valid conclusions regarding the status of this stock, it is not known whether overfishing is occurring. For barndoor skate, essential fish habitat is described as those areas of coastal and offshore waters (out to the offshore U.S. boundary of the exclusive economic zone) that are designated on Map 15 **-** Map 16 and meet the following conditions:

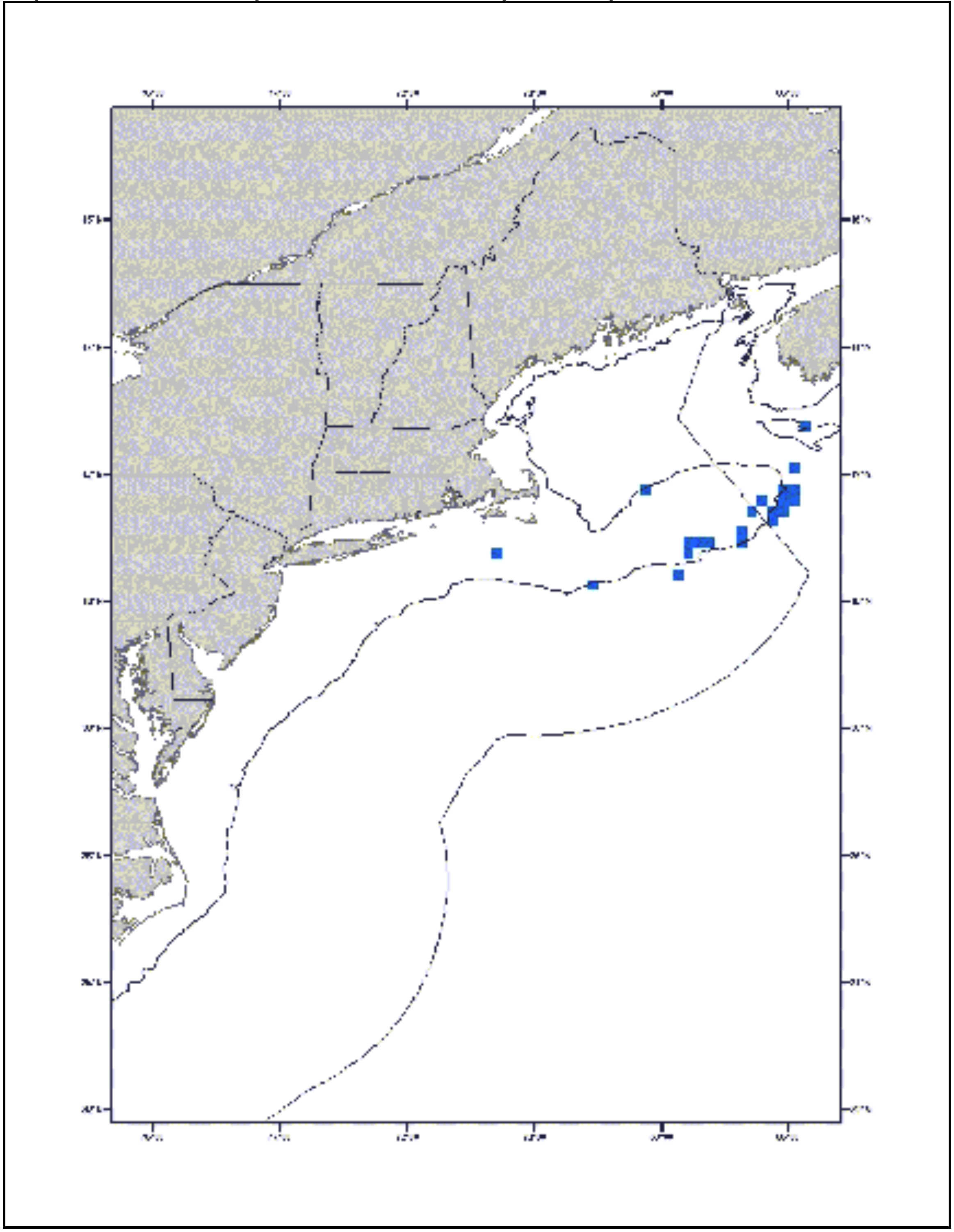
Eggs: There is no information available on the habitat associations or distribution of the egg stage for this species.

Larvae: No larval life stage exists for this species. Upon hatching, they are fully developed juveniles (ELMR Report Number 12, March 1994).

Juveniles: Bottom habitats with mud, gravel, and sand substrates in the eastern Gulf of Maine, eastern Georges Bank, southern New England and the Mid-Atlantic Bight down to the Hudson Canyon as depicted on Map 15. Generally, the following conditions exist where barndoor skate juveniles are found: *Depth:* Occurs from shoreline to 750 meters, but are most abundant at depths less than 150 meters. *Temperature:* Broad temperature range from 1.2-20 °C, but found in highest abundance between 4-11 °C. *Salinity:* Preferred range is 31-35 ppt.

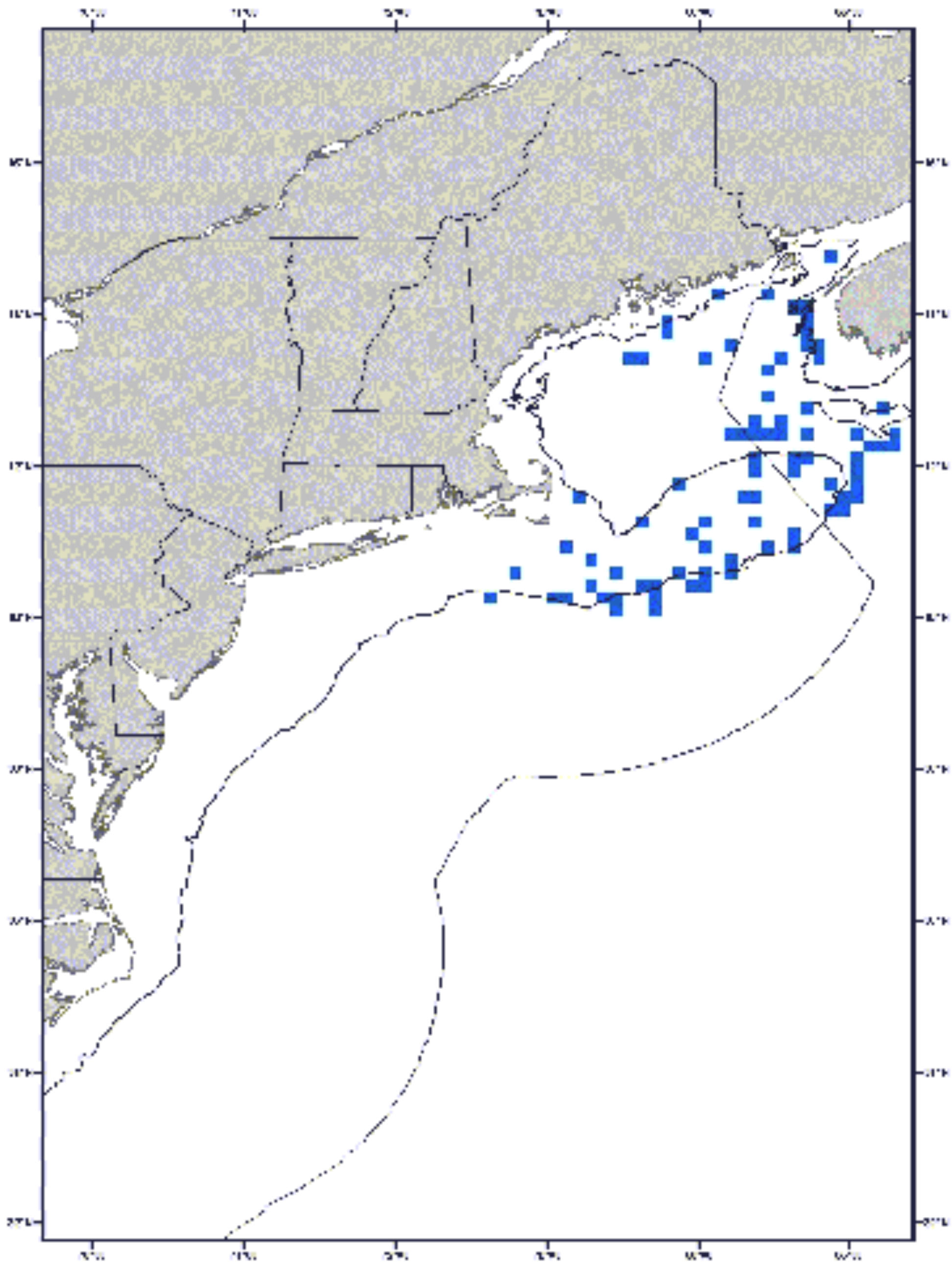
Adults: Bottom habitats with mud, gravel, and sand substrates in the eastern Gulf of Maine, eastern Georges Bank, southern New England and the Mid-Atlantic Bight down to the Hudson Canyon as depicted on Map 16. Generally, the following conditions exist where barndoor skate adults are found: *Depth:* Occurs from shoreline to 750 meters, but are most abundant at depths less than 150 meters. *Temperature:* Broad temperature range from 1.2-20 °C, but found in highest abundance over a range of 3-16 °C. *Salinity:* Preferred range is 31-35 ppt.

Map 15. Barndoor skate juveniles, Alternative 1 (No Action)



This map represents an option for the designation of EFH for this life history stage based on the areas of highest relative abundance of this species, based on the NMFS trawl survey (1963 - 1999). Only bottom habitats with mud, gravel, and sand substrates that occur within the shaded areas would be designated as EFH. This option represents 100% of the observed range of this life stage.

Map 16. Barndoor skate adults, Alternative 1 (No Action)



This map represents an option for the designation of EFH for this life history stage based on the areas of highest relative abundance of this species, based on the NMFS trawl survey (1963 - 1999). Only bottom habitats with mud, gravel, and sand substrates that occur within the shaded areas would be designated as EFH. This option represents 100% of the observed range of this life stage.

4.1.1.2.7 Clearnose Skate (Raja eglanteria)

In its *Report to Congress: Status of the Fisheries of the United States* (January 2001), NMFS determined that clearnose skate is not in an overfished condition, based on stock size assessment. Because recent assessments determined that more information is needed to draw valid conclusions regarding the status of this stock, it is not known whether overfishing is occurring. For clearnose skate, essential fish habitat is described as those areas of coastal and offshore waters (out to the offshore U.S. boundary of the exclusive economic zone) that are designated on Map 17 - Map 18 and in

Table 11 and meet the following conditions:

Eggs: There is no information available on the habitat associations or distribution of the egg stage for this species.

Larvae: No larval life stage exists for this species. Upon hatching, they are fully developed juveniles (ELMR Report Number 12, March 1994).

Juveniles: Bottom habitats with a substrate of soft bottom along the continental shelf and rocky or gravelly bottom, ranging from the Gulf of Maine south along the continental shelf to Cape Hatteras, North Carolina (the southern boundary of the NEFMC management unit) as depicted on Map 17. Generally, the following conditions exist where clearnose skate juveniles are found: *Depth:* Their full range is from the shore to 500 meters, but they are most abundant at depths less than 111 meters. *Temperature:* Occurs over a temperature range of 9-30 °C, but are most abundant from 9-21 °C in the northern part of its range and 19-30 °C around North Carolina.

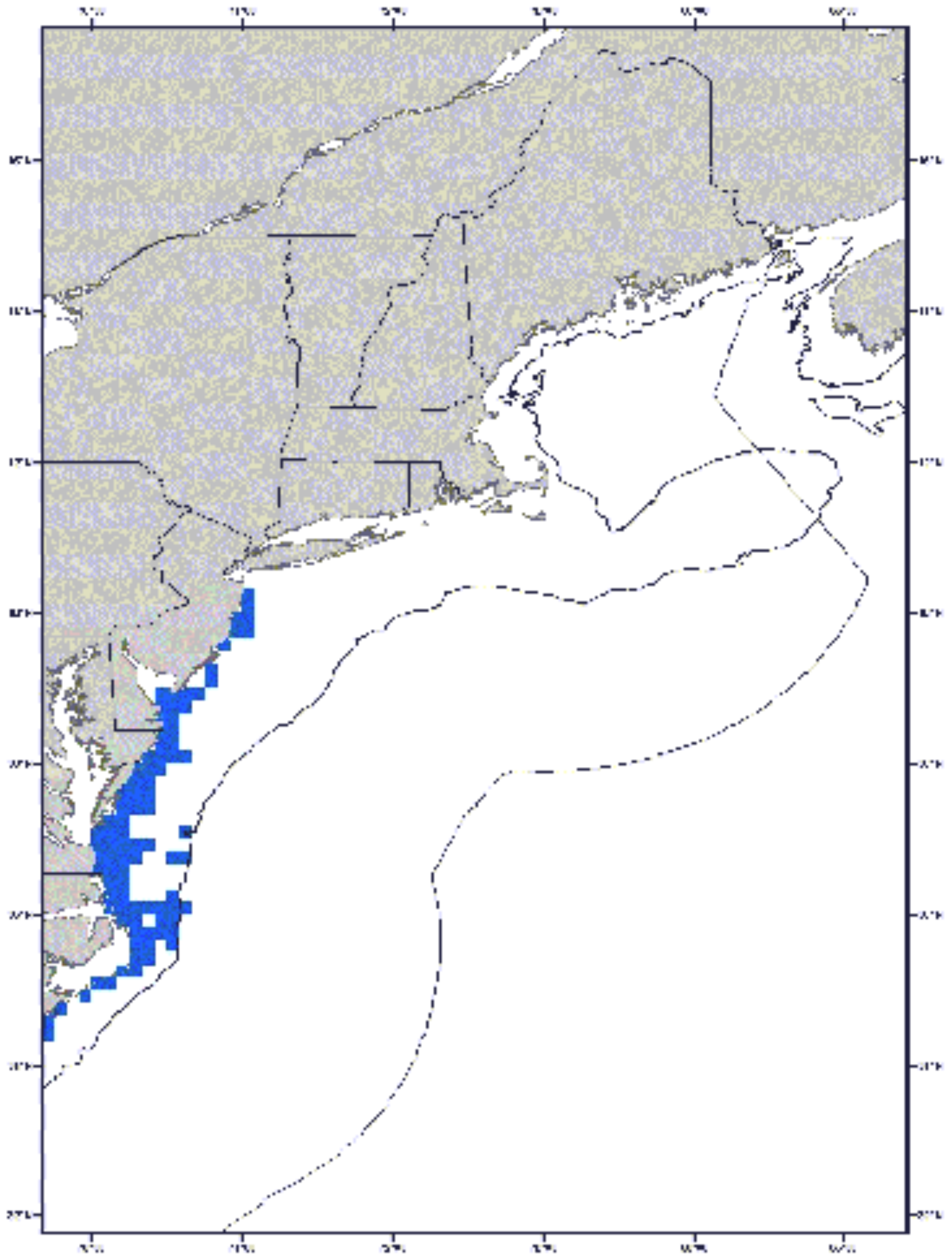
Adults: Bottom habitats with a substrate of soft bottom along the continental shelf and rocky or gravelly bottom, ranging from the Gulf of Maine south along the continental shelf to Cape Hatteras, North Carolina (the southern boundary of the NEFMC management unit) as depicted on Map 18. Generally, the following conditions exist where clearnose skate adults are found: *Depth:* Their full range is from the shore to 400 meters, but they are most abundant at depths less than 111 meters. *Temperature:* Occurs over a temperature range of 9-30 °C, but are most abundant from 9-21 °C in the northern part of its range and 19-30 °C around North Carolina.

Table 11. Distribution and Abundance of the Skate Complex in Northeast Bays and Estuaries

Estuaries and Embayments	Eggs	Juveniles	Mating	Adults
Waquoit Bay				
Buzzards Bay	L,W	L,W	L,W	L,W
Narragansett Bay	L,W	L,W	L,W	L,W
Long Island Sound	L,W	L,W	L,W	L,W
Connecticut River		L,W		L,W
Gardiners Bay		L,W		L,W
Great South Bay		L,W		L,W
Hudson River/Raritan Bay	C,L,W	C,L,W	C,L,W	C,L,W
Barnegat Bay				C,L,W
New Jersey Inland Bays				C,L,W
Delaware Bay				C,L,W
Delaware Inland Bays				C,L,W
Chesapeake Bay Mainstem	C,L,W	C,L,W		C,L,W

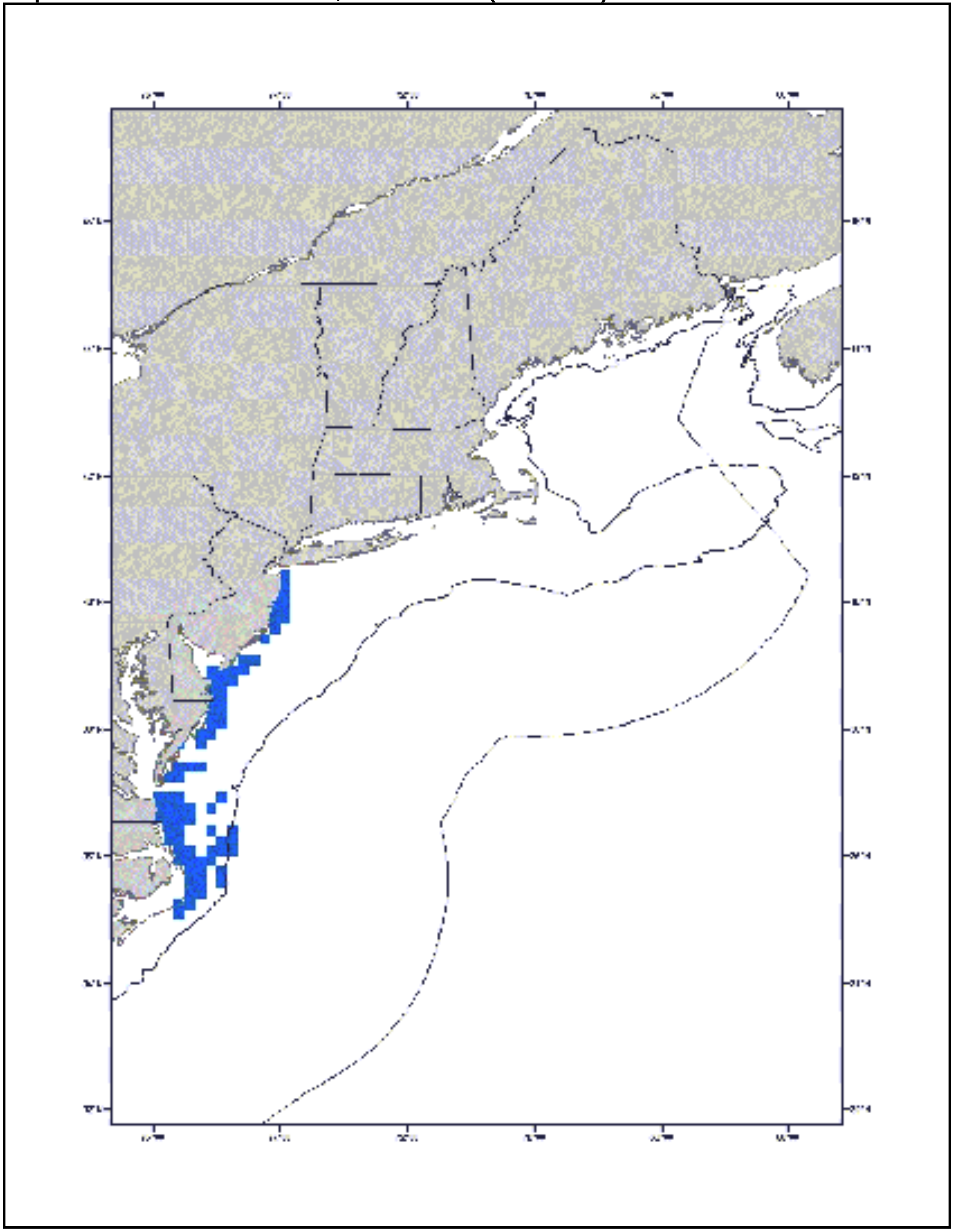
The EFH information presented in this table are based on the NOAA Estuarine Living Marine Resource (ELMR) program (Jury et al. 1994; Stone et al. 1994). Unfortunately, the information presented in the ELMR reports does not differentiate among the species of skates in the complex. Thus, we know that skates occur in these bays and estuaries, but we cannot be certain of the particular species. The above table has been prepared in an attempt to identify the skate species that occur most proximate to these bays and estuaries and are therefore most likely to occur in the bays and estuaries. For the purposes of designating EFH, the bays and estuaries listed above are incorporated into the EFH designations for the species identified in the table (C≡clearnose skate; L≡little skate; and W≡winter skate). The Council recognizes that there may be spatial and temporal variability in the environmental conditions generally associated with these species in the bays and estuaries identified above

Map 17. Clearnose skate juveniles, Alternative 1 (No Action)



This map represents an option for the designation of EFH for this life history stage based on the areas of highest relative abundance of this species, based on the NMFS trawl survey (1963 - 1999). Only habitats with soft bottom, rocky or gravelly substrates that occur within the shaded areas would be designated as EFH. This option represents 62% of the observed range of this life stage.

Map 18. Clearnose skate adults, Alternative 1 (No Action)



This map represents an option for the designation of EFH for this life history stage based on the areas of highest relative abundance of this species, based on the NMFS trawl survey (1963 - 1999). Only habitats with soft bottom, rocky or gravelly substrates that occur within the shaded areas would be designated as EFH. This option represents 67% of the observed range of this life stage.

4.1.1.2.8 Haddock (Melanogrammus aeglefinus)

In its *Report to Congress: Status of the Fisheries of the United States* (September 1997), NMFS determined the Georges Bank stock of haddock is neither currently overfished nor approaching an overfished condition. The report also concluded that there is not enough information to determine if the Gulf of Maine stock is overfished or approaching an overfished condition. For both stocks of haddock, essential fish habitat is described as those areas of the coastal and offshore waters (out to the offshore U.S. boundary of the exclusive economic zone) that are designated on Map 19 - Map 22 and in the accompanying table and meet the following conditions:

Eggs: Surface waters over Georges Bank southwest to Nantucket Shoals and the coastal areas of the Gulf of Maine as depicted on Map 19. Generally, the following conditions exist where haddock eggs are found: sea surface temperatures below 10° C, water depths from 50 - 90 meters, and salinity ranges from 34 - 36‰. Haddock eggs are most often observed during the months from March to May, April being most important.

Larvae: Surface waters over Georges Bank southwest to the middle Atlantic south to Delaware Bay as depicted on Map 20. Generally, the following conditions exist where haddock larvae are found: sea surface temperatures below 14° C, water depths from 30 - 90 meters, and salinity ranges from 34 - 36‰. Haddock larvae are most often observed in these areas from January through July with peaks in April and May.

Juveniles: Bottom habitats with a substrate of pebble gravel on the perimeter of Georges Bank, the Gulf of Maine, and the middle Atlantic south to Delaware Bay as depicted on Map 21. Generally, the following conditions exist where haddock juveniles are found: water temperatures below 11° C, depths from 35 - 100 meters, and a salinity range from 31.5 - 34‰.

Adults: Bottom habitats with a substrate of broken ground, pebbles, smooth hard sand and smooth areas between rocky patches on Georges Bank and the eastern side of Nantucket Shoals, and throughout the Gulf of Maine, plus additional area of Nantucket Shoals and the Great South Channel inclusive of the historic range as depicted on Map 22. This additional area more accurately reflects historic patterns of distribution and abundance. Generally, the following conditions exist where haddock adults are found: water temperatures below 7° C, depths from 40 - 150 meters, and a salinity range from 31.5 - 35‰.

Spawning Adults: Bottom habitats with a substrate of pebble gravel or gravelly sand on Georges Bank, Nantucket Shoals, along the Great South Channel, and throughout the Gulf of Maine, plus additional area inclusive of the historic range as depicted on Map 22. Generally, the following conditions exist where spawning haddock adults are found:

water temperatures below 6° C, depths from 40 - 150 meters, and a salinity range from 31.5 - 34‰. Haddock are observed spawning most often during the months January to June.

All of the above EFH descriptions include those bays and estuaries listed on the following table, according to life history stage. The Council notes the historic importance of areas where haddock were once commonly found (Rich 1929). The Council acknowledges potential seasonal and spatial variability of the conditions generally associated with this species.

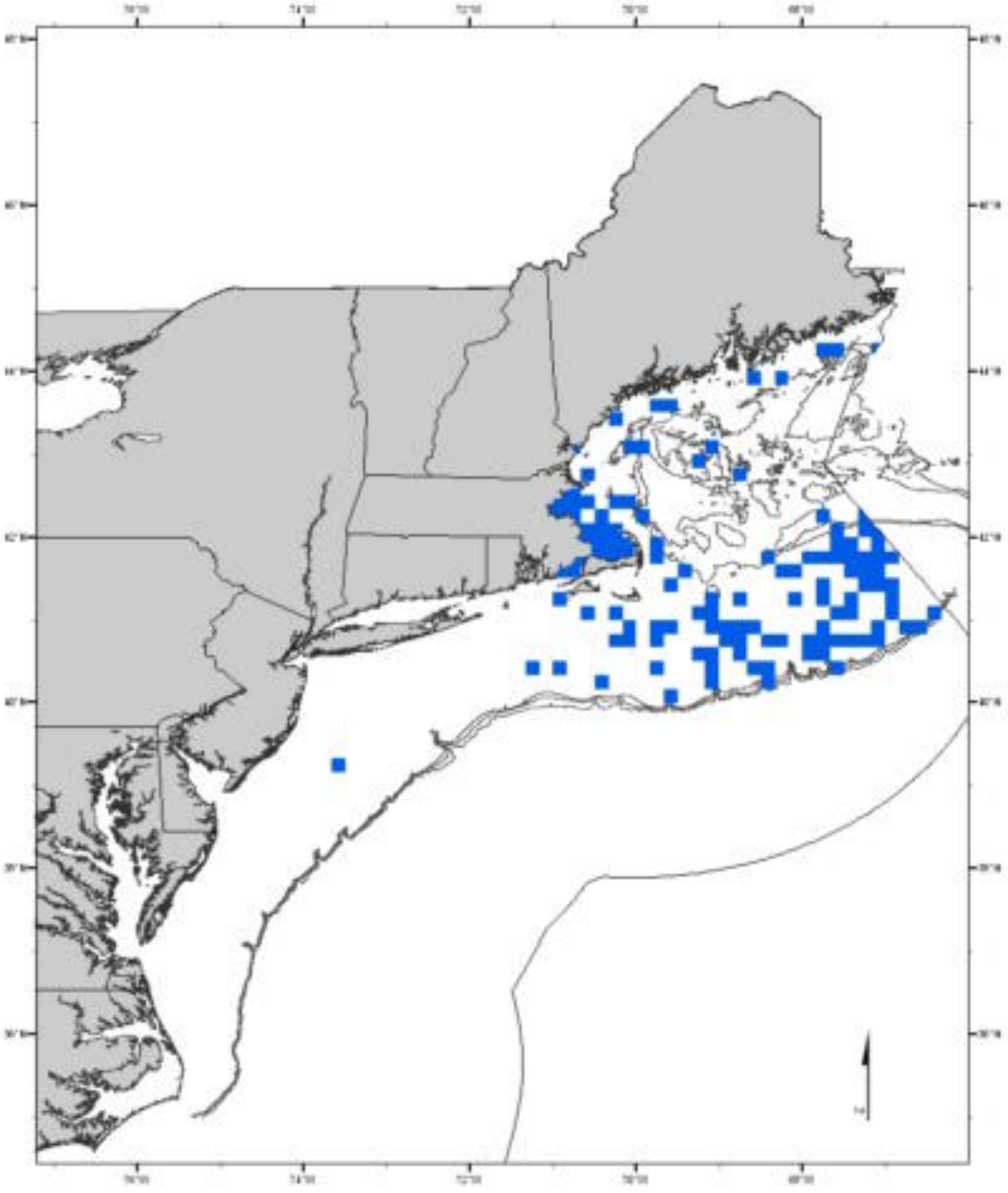
Table 12. EFH Designation of Estuaries and Embayments: Haddock (Melanogrammus aeglefinus)

Estuaries and Embayments	Eggs	Larvae	Juveniles	Adults	Spawning Adults
Passamaquoddy Bay					
Englishman/Machias Bay					
Narraguagus Bay					
Blue Hill Bay					
Penobscot Bay					
Muscongus Bay					
Damariscotta River					
Sheepscot River					
Kennebec / Androscoggin Rivers					
Casco Bay					
Saco Bay					
Wells Harbor					
Great Bay	s	s			
Merrimack River					
Massachusetts Bay	s	s			
Boston Harbor	s	s			
Cape Cod Bay	s	s			
Waquoit Bay					
Buzzards Bay	s	s			
Narragansett Bay		s			
Long Island Sound					
Connecticut River					
Gardiners Bay					
Great South Bay					
Hudson River / Raritan Bay					
Barnegat Bay					

Estuaries and Embayments	Eggs	Larvae	Juveniles	Adults	Spawning Adults
Delaware Bay					
Chincoteague Bay					
Chesapeake Bay					

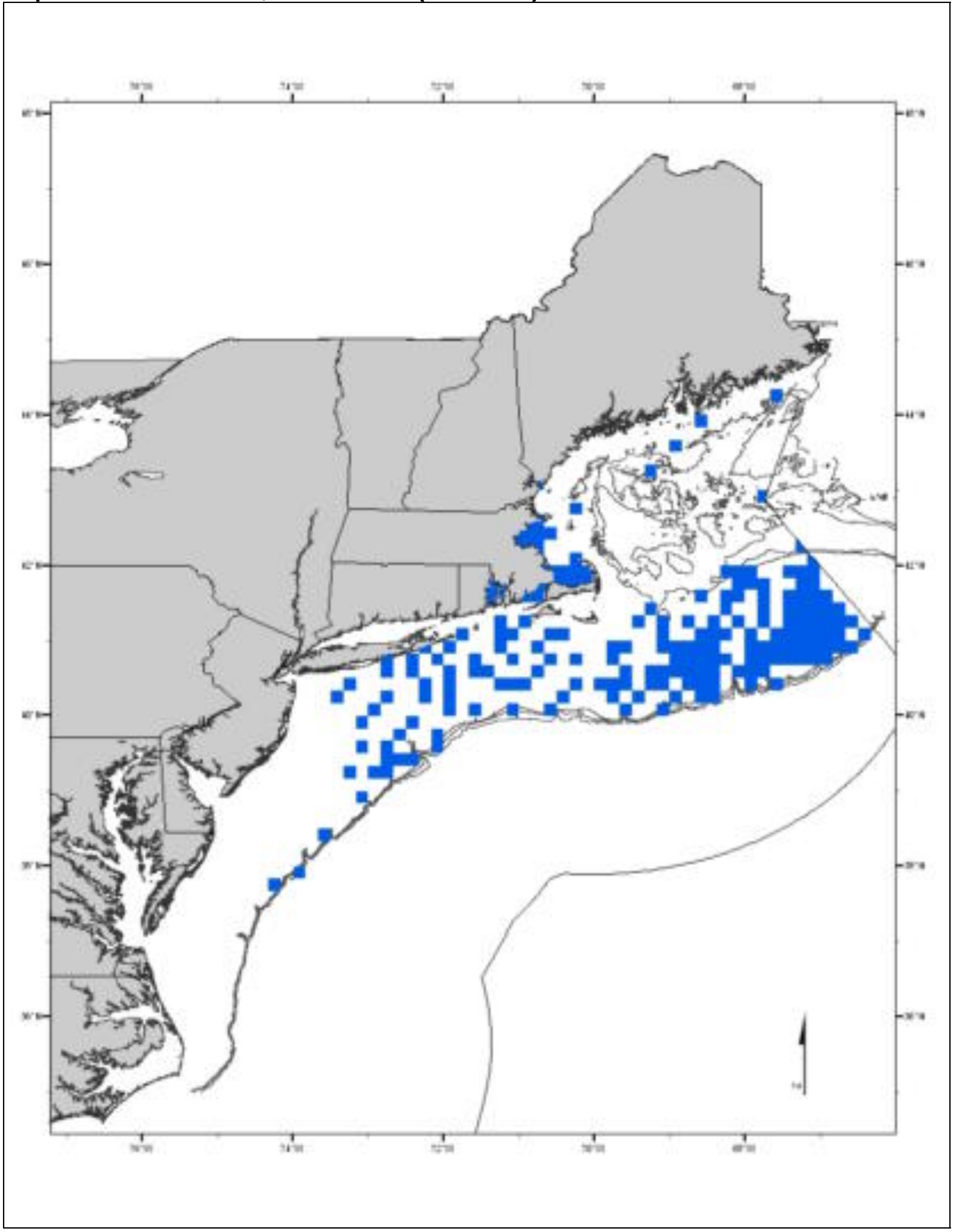
S ≡ The EFH designation for this species includes the seawater salinity zone of this bay or estuary (salinity > 25.0‰).
M ≡ The EFH designation for this species includes the mixing water / brackish salinity zone of this bay or estuary (0.5 < salinity < 25.0‰).
F ≡ The EFH designation for this species includes the tidal freshwater salinity zone of this bay or estuary (0.0 < salinity < 0.5‰).
These EFH designations of estuaries and embayments are based on the NOAA Estuarine Living Marine Resources (ELMR) program (Jury et al. 1994; Stone et al. 1994). For a detailed view of the salinity zone boundaries, as described in the ELMR reports, please see Appendix B. The Council recognizes the spatial and temporal variability of estuarine and embayment environmental conditions generally associated with this species.

Map 19. Haddock eggs, Alternative 1 (No Action)



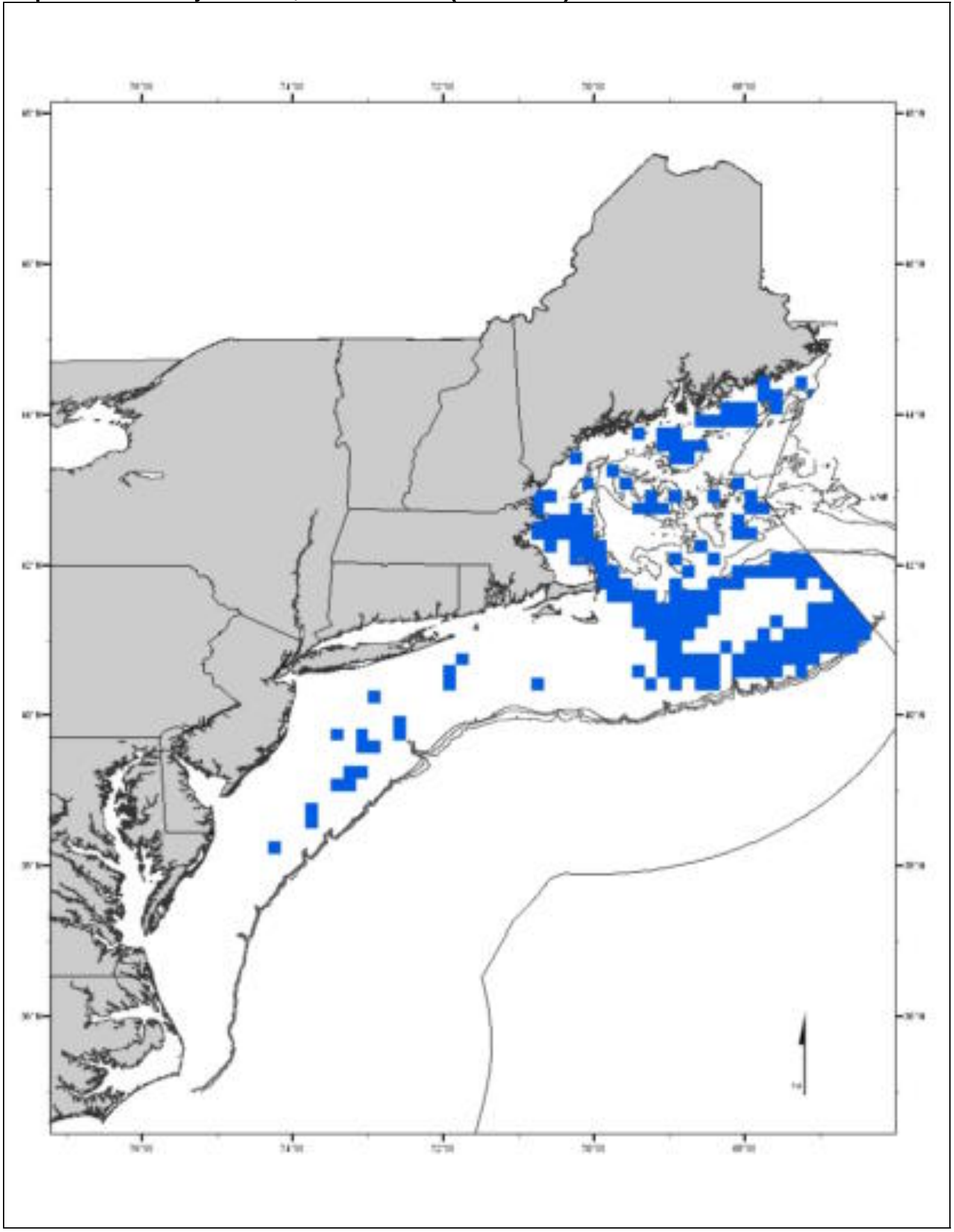
The EFH designation for haddock eggs is based upon alternative 4 for haddock eggs. In addition, this designation includes those bays and estuaries identified in the NOAA ELMR program as supporting haddock eggs at the "rare", "common", or "abundant" level. This alternative was selected to be as inclusive as possible, given the distribution of haddock eggs. .

Map 20. Haddock larvae, Alternative 1 (No Action)



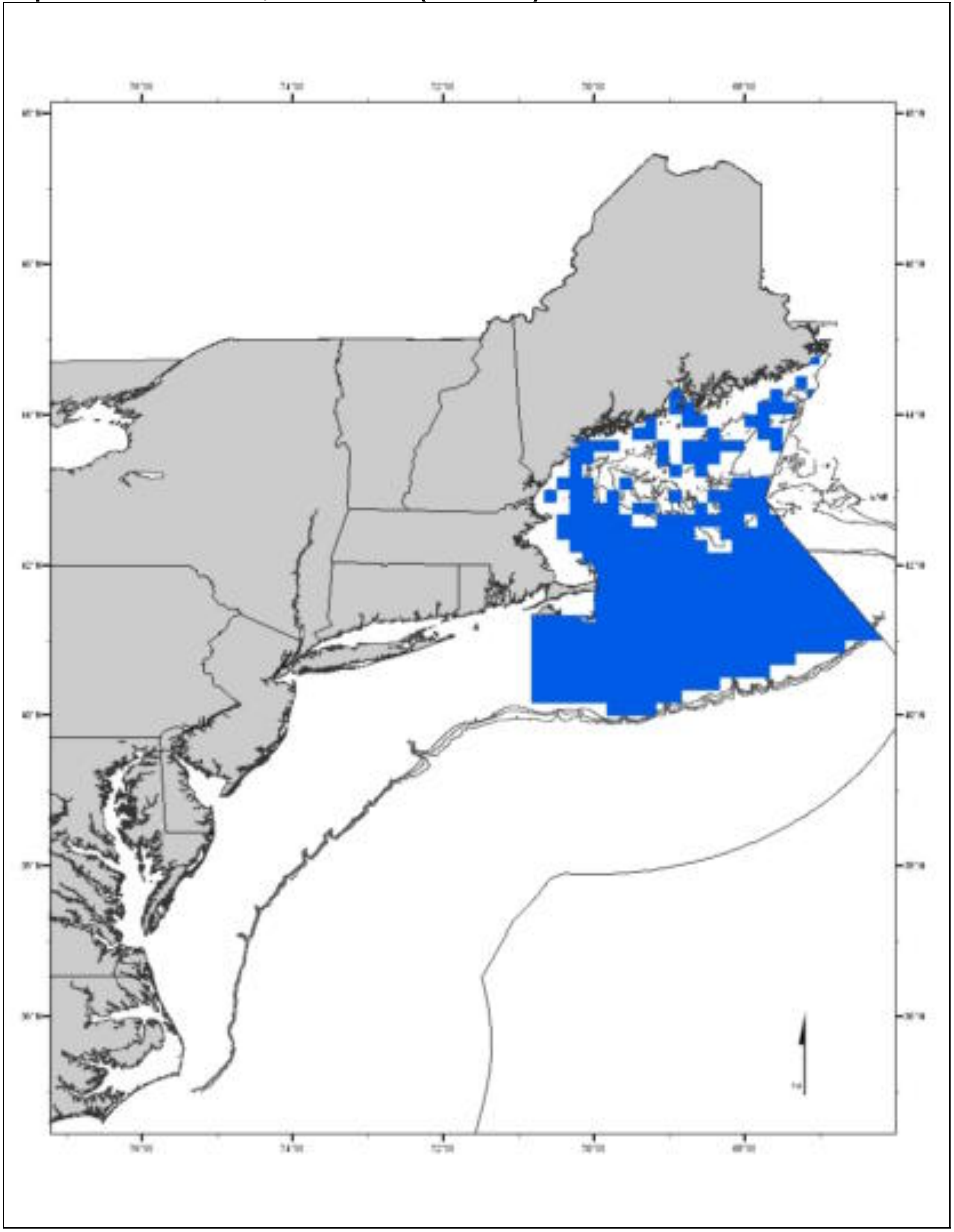
The EFH designation for haddock larvae is based upon alternative 4 for haddock larvae. In addition, this designation includes those bays and estuaries identified in the NOAA ELMR program as supporting haddock larvae at the "rare", "common", or "abundant" level. This alternative was selected to be as inclusive as possible, given the distribution of haddock larvae.

Map 21. Haddock juveniles, Alternative 1 (No Action)



The EFH designation for juvenile haddock is based upon alternative 3 for haddock juveniles. This alternative was selected because it included all areas where haddock juveniles were observed in relatively high concentrations, but did not include areas where they occurred in low concentrations.

Map 22. Haddock adults, Alternative 1 (No Action)



The EFH designation for adult haddock is based upon alternative 3 for haddock adults. In addition, this designation includes a portion of the historic range and known spawning areas to more accurately reflect traditional patterns of distribution and abundance. This alternative was selected because it included all areas where haddock adults were observed in relatively high concentrations, but did not include areas where they occurred in low concentrations. Areas of historic importance were included to ensure that potentially important historic habitat was reflected in the EFH designation.

4.1.1.2.9 Little skate (Leucoraja erinacea)

In its *Report to Congress: Status of the Fisheries of the United States* (January 2001), NMFS determined that little skate is not in an overfished condition and that overfishing of this stock is not occurring, based on stock size assessment. For little skate, essential fish habitat is described as those areas of coastal and offshore waters (out to the offshore U.S. boundary of the exclusive economic zone) that are designated on Map 23– Map 24 and in Table 13 and meet the following conditions:

Eggs: Bottom habitats with a sandy substrate from Georges Bank through to Southern New England to the Middle Atlantic Bight. Generally, the following conditions exist where little skate eggs are found: *Depths*: Less than 27 meters. *Temperature*: Greater than 7 ºC.

Larvae: No larval life stage exists for this species. Upon hatching, they are fully developed juveniles (ELMR Report Number 12, March 1994).

Juveniles: Bottom habitats with a sandy or gravelly substrate or mud, ranging from Georges Bank through the Mid-Atlantic Bight to Cape Hatteras, North Carolina as depicted on Map 23. Generally, the following conditions exist where little skate juveniles are found: *Depth:* Full range is from the shore to 137 meters, with the highest abundance from 73-91 meters. *Temperature:* Most found between 4-15°C.

Adults: Bottom habitats with a sandy or gravelly substrate or mud, ranging from Georges Bank through the Mid-Atlantic Bight to Cape Hatteras, North Carolina as depicted on Map 24. Generally, the following conditions exist where little skate adults are found: *Depth:* Full range is from the shore to 137 meters, with the highest abundance from 73-91 meters. *Temperature:* Most found between 2-15°C.

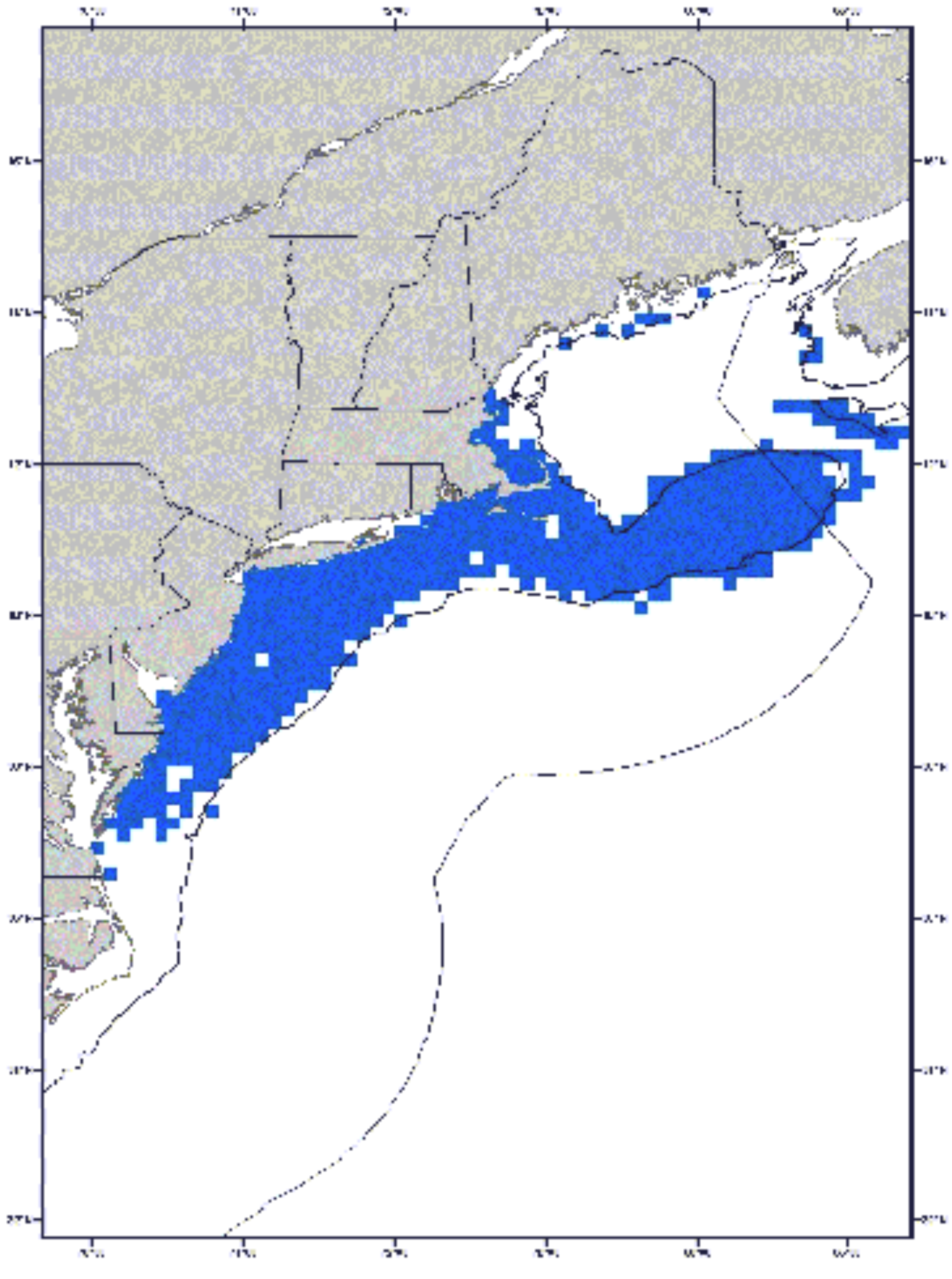
Table 13. Distribution and Abundance of the Skate Complex in Northeast Bays and Estuaries

Estuaries and Embayments	Eggs	Juveniles	Mating	Adults
Waquoit Bay				
Buzzards Bay	L,W	L,W	L,W	L,W
Narragansett Bay	L,W	L,W	L,W	L,W
Long Island Sound	L,W	L,W	L,W	L,W
Connecticut River		L,W		L,W
Gardiners Bay		L,W		L,W
Great South Bay		L,W		L,W
Hudson River/Raritan Bay	C,L,W	C,L,W	C,L,W	C,L,W

Estuaries and Embayments	**Eggs**	**Juveniles**	**Mating**	**Adults**
Barnegat Bay				C,L,W
New Jersey Inland Bays				C,L,W
Delaware Bay				C,L,W
Delaware Inland Bays				C,L,W
Chesapeake Bay Mainstem	C,L,W	C,L,W		C,L,W

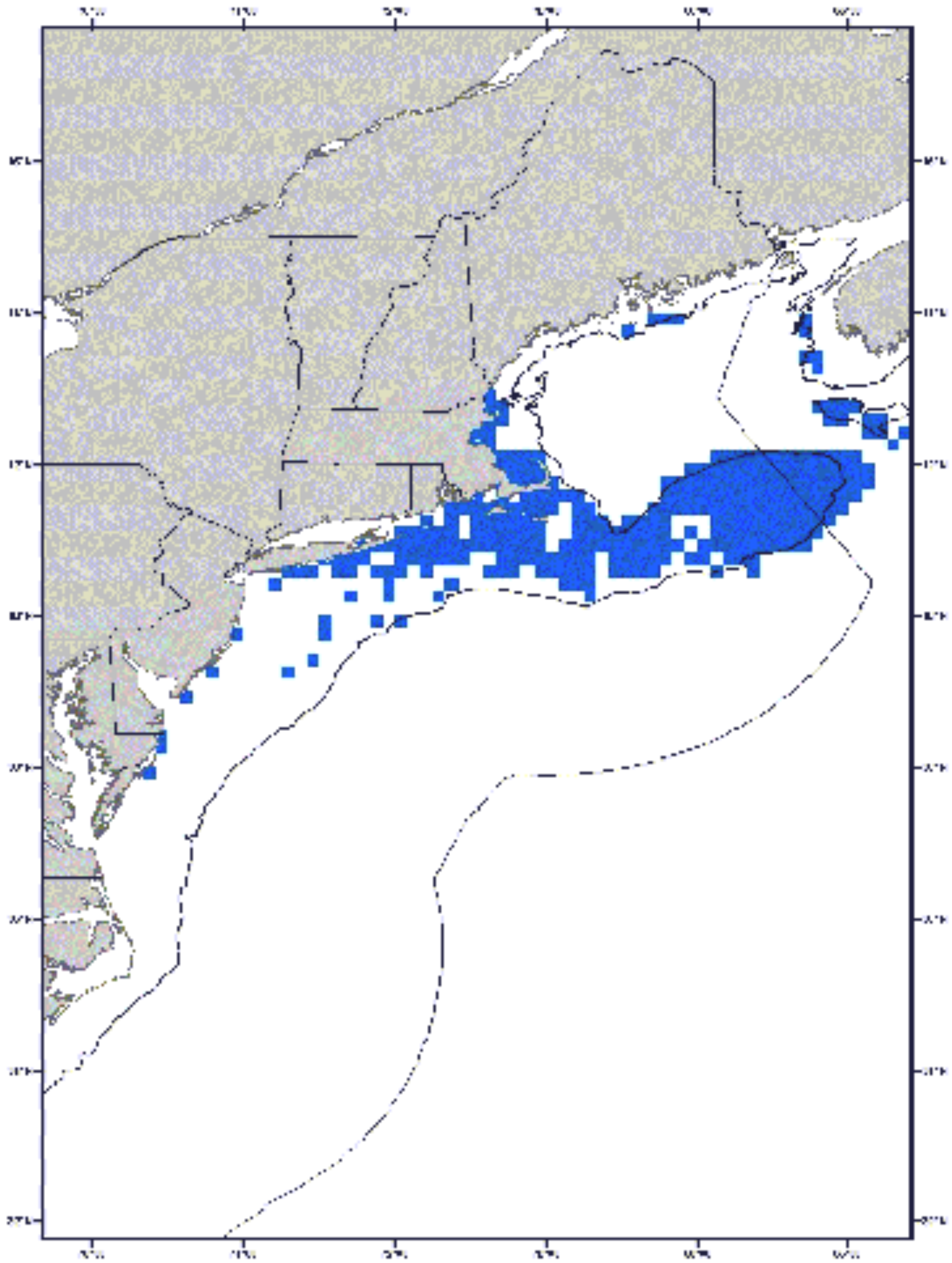
The EFH information presented in this table are based on the NOAA Estuarine Living Marine Resource (ELMR) program (Jury et al. 1994; Stone et al. 1994). Unfortunately, the information presented in the ELMR reports does not differentiate among the species of skates in the complex. Thus, we know that skates occur in these bays and estuaries, but we cannot be certain of the particular species. The above table has been prepared in an attempt to identify the skate species that occur most proximate to these bays and estuaries and are therefore most likely to occur in the bays and estuaries. For the purposes of designating EFH, the bays and estuaries listed above are incorporated into the EFH designations for the species identified in the table (C≡clearnose skate; L≡little skate; and W≡winter skate). The Council recognizes that there may be spatial and temporal variability in the environmental conditions generally associated with these species in the bays and estuaries identified above.

Map 23. Little skate juveniles, Alternative 1 (No Action)



This map represents an option for the designation of EFH for this life history stage based on the areas of highest relative abundance of this species, based on the NMFS trawl survey (1963 - 1999). Only habitats with sandy, gravelly, or mud substrates that occur within the shaded areas would be designated as EFH. This option represents 58% of the observed range of this life stage.

Map 24. Little skate adults, Alternative 1 (No Action)



This map represents an option for the designation of EFH for this life history stage based on the areas of highest relative abundance of this species, based on the NMFS trawl survey (1963 - 1999). Only habitats with sandy, gravelly, or mud substrates that occur within the shaded areas would be designated as EFH. This option represents 57% of the observed range of this life stage.

4.1.1.2.10 Monkfish (Lophius americanus)

In its *Report to Congress: Status of the Fisheries of the United States* (September 1997), NMFS determined monkfish is currently overfished. This determination is based on an assessment of stock size. Essential Fish Habitat for monkfish is described as those areas of the coastal and offshore waters (out to the offshore U.S. boundary of the exclusive economic zone) that are designated on Map 25 -

Map 28 and meet the following conditions:

Eggs: Surface waters of the Gulf of Maine, Georges Bank, southern New England, and the middle Atlantic south to Cape Hatteras, North Carolina as depicted on Map 25. Generally, the following conditions exist where monkfish egg veils are found: sea surface temperatures below 18° C and water depths from 15 - 1000 meters. Monkfish egg veils are most often observed during the months from March to September.

Larvae: Pelagic waters of the Gulf of Maine, Georges Bank, southern New England and the middle Atlantic south to Cape Hatteras, North Carolina as depicted on Map 26. Generally, the following conditions exist where monkfish larvae are found: water temperatures 15° C and water depths from 25 - 1000 meters. Monkfish larvae are most often observed during the months from March to September.

Juveniles: Bottom habitats with substrates of a sand-shell mix, algae covered rocks, hard sand, pebbly gravel, or mud along the outer continental shelf in the middle Atlantic, the mid-shelf off southern New England, and all areas of the Gulf of Maine as depicted on Map 27. Generally, the following conditions exist where monkfish juveniles are found: water temperatures below 13° C, depths from 25 - 200 meters, and a salinity range from 29.9 - 36.7‰.

Adults: Bottom habitats with substrates of a sand-shell mix, algae covered rocks, hard sand, pebbly gravel, or mud along the outer continental shelf in the middle Atlantic, the mid-shelf off southern New England, along the outer perimeter of Georges Bank and all areas of the Gulf of Maine as depicted on

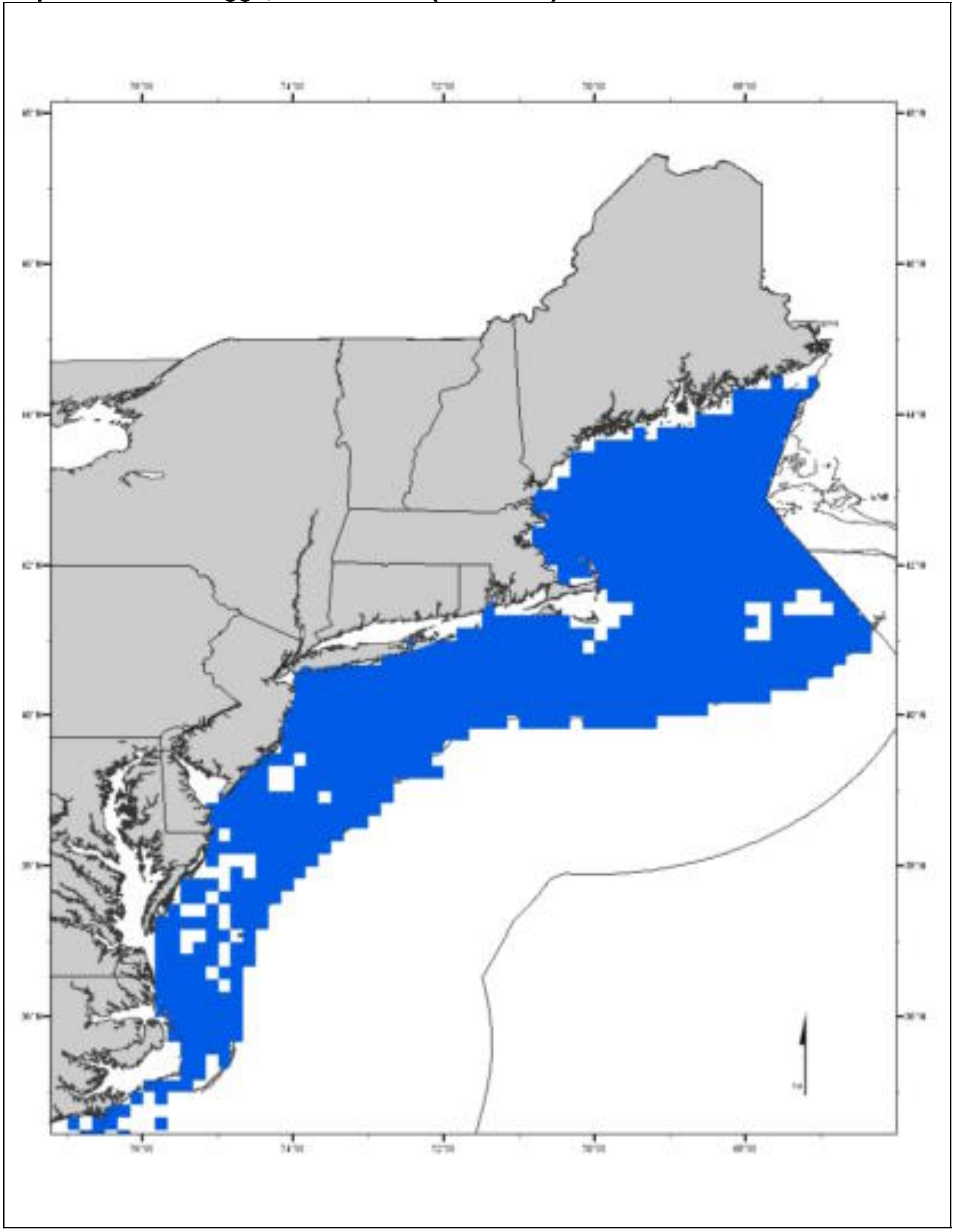
Map 28. Generally, the following conditions exist where monkfish adults are found: water temperatures below 15° C, depths from 25 - 200 meters, and a salinity range from 29.9 - 36.7‰.

Spawning Adults: Bottom habitats with substrates of a sand-shell mix, algae covered rocks, hard sand, pebbly gravel, or mud along the outer continental shelf in the middle Atlantic, the mid-shelf off southern New England, along the outer perimeter of Georges Bank and all areas of the Gulf of Maine as depicted on

Map 28. Generally, the following conditions exist where spawning monkfish adults are found: water temperatures below 13° C, depths from 25 - 200 meters, and a salinity range from 29.9 - 36.7‰. Monkfish are observed spawning most often during the months from February to August.

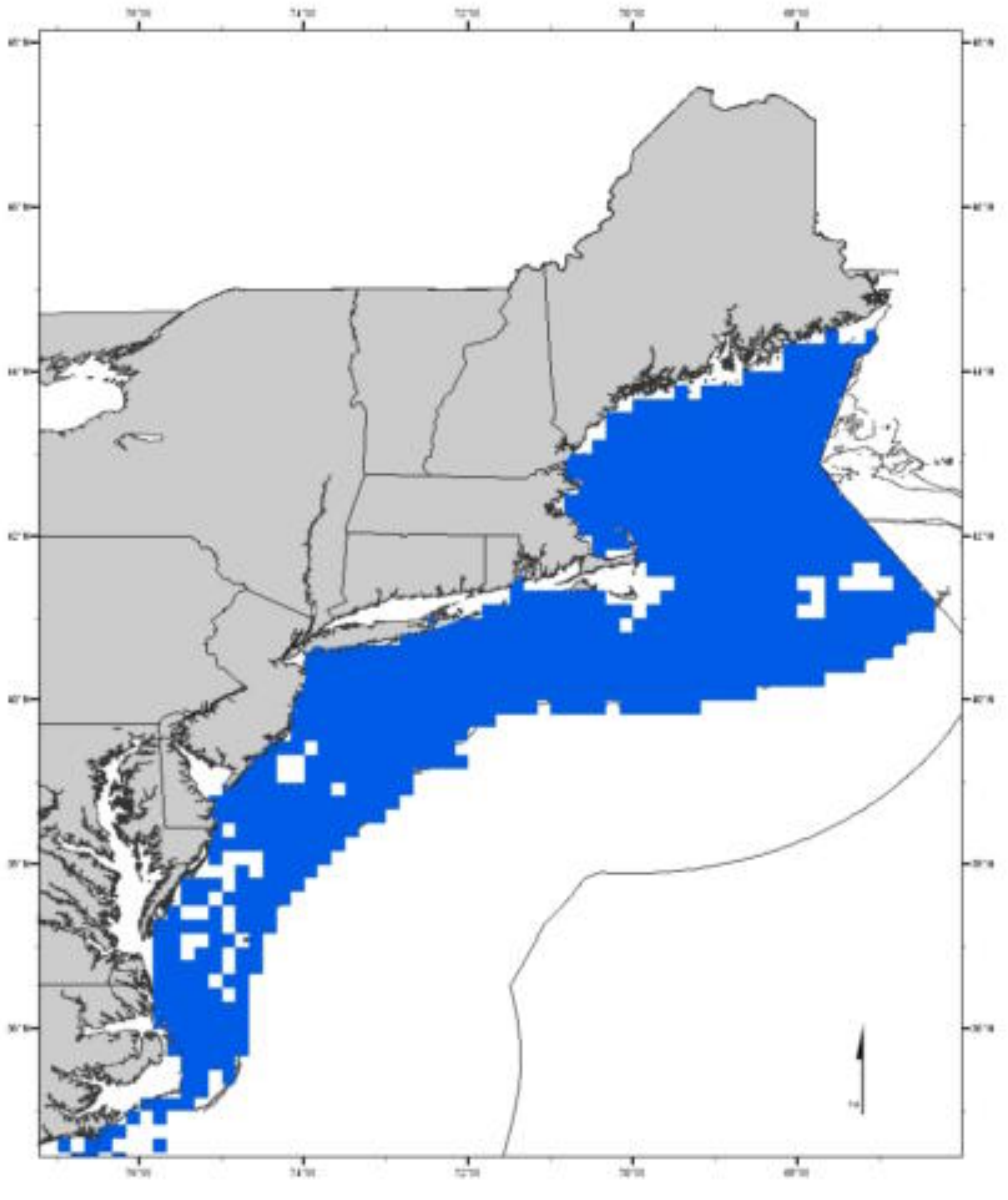
The Council acknowledges potential seasonal and spatial variability of the conditions generally associated with this species.

Map 25. Monkfish eggs, Alternative 1 (No Action)



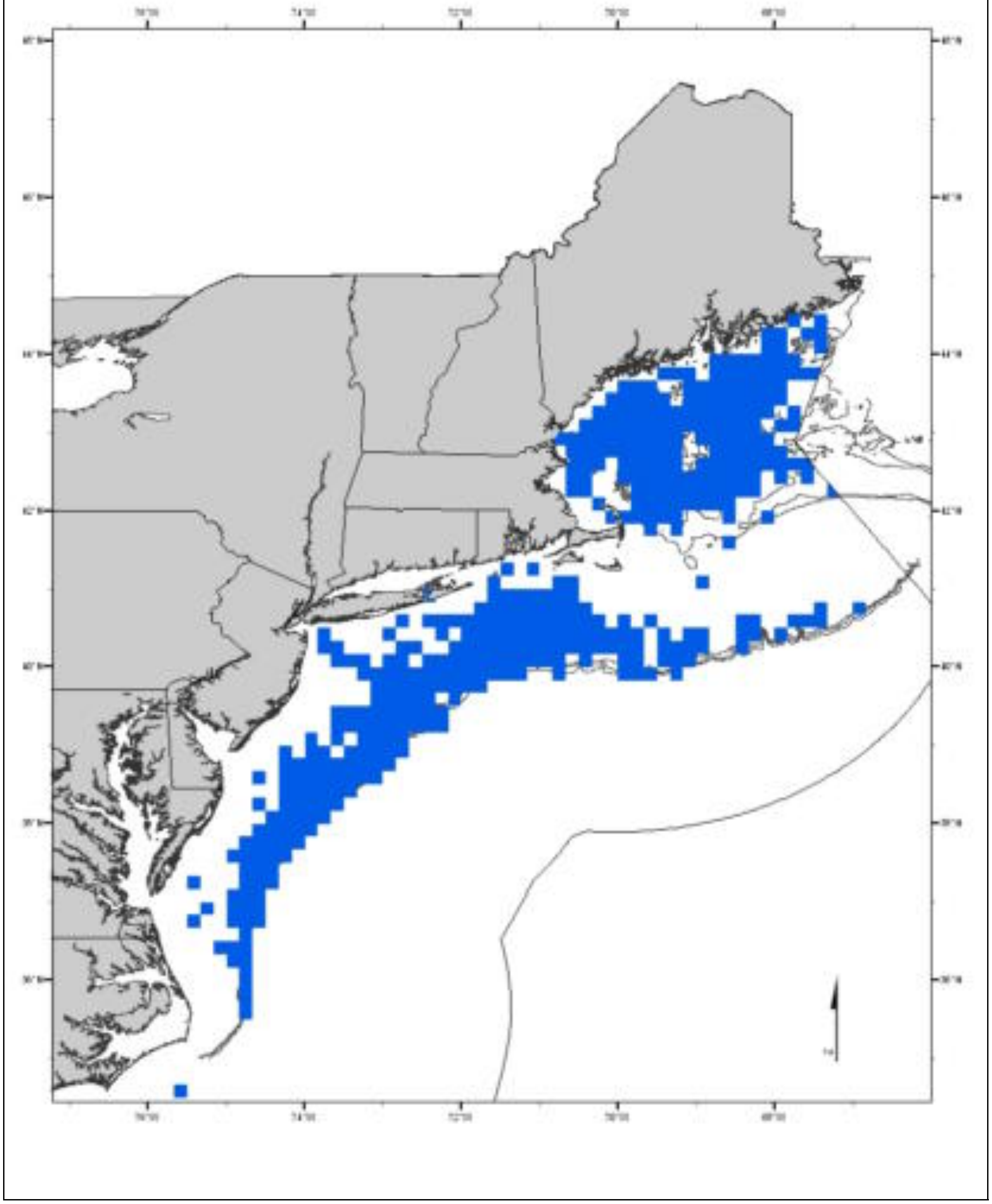
The EFH designation for monkfish eggs is based upon alternative 4 for monkfish larvae in combination with alternative 4 for monkfish adults. Due to the difficulty of sampling monkfish eggs, the combination of larvae and adults was used as a proxy. This alternative was selected to be as conservative as possible given the lack of information on the distribution of monkfish eggs.

Map 26. Monkfish larvae, Alternative 1 (No Action)



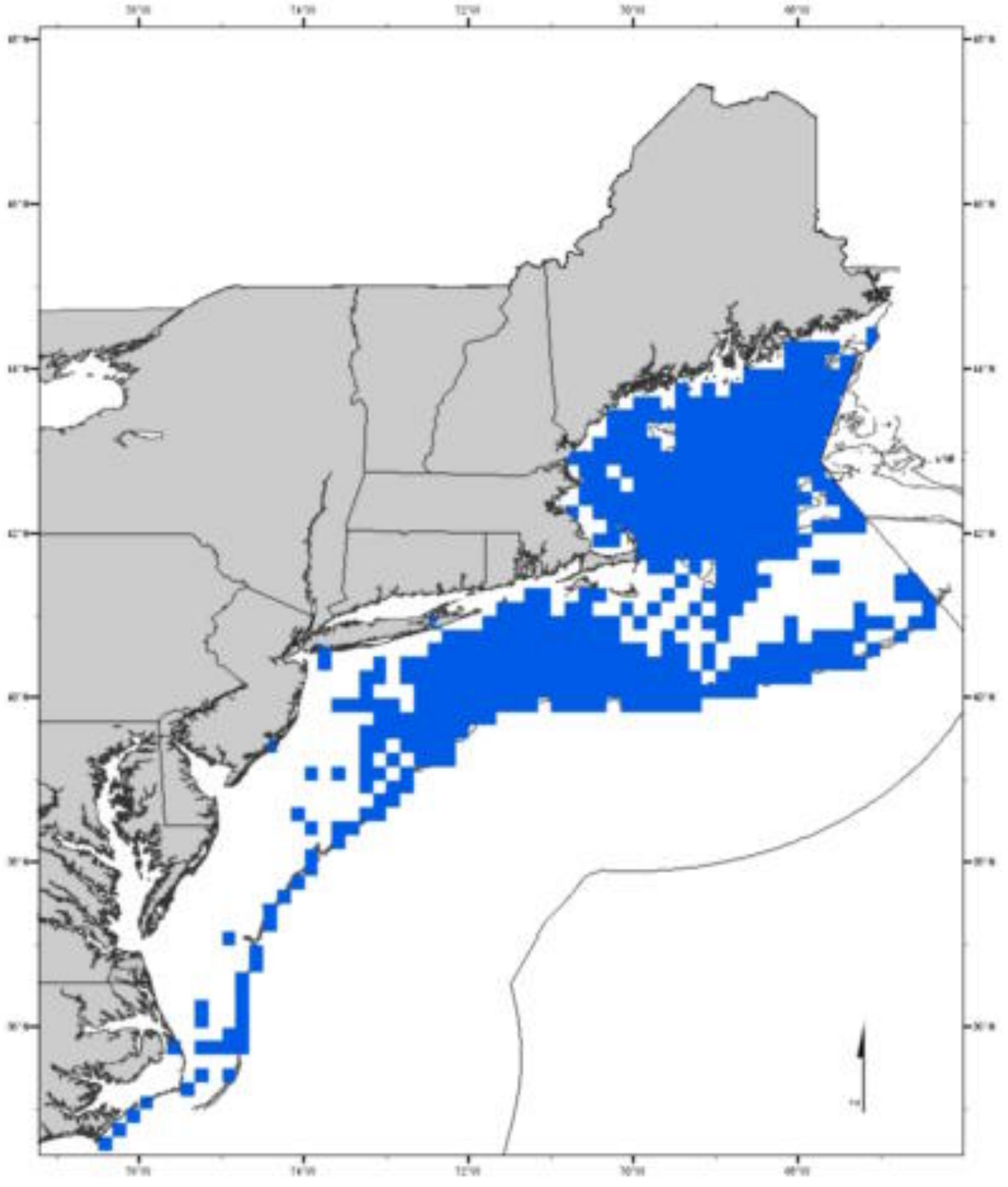
The EFH designation for monkfish larvae is based upon alternative 4 for monkfish larvae in combination with alternative 4 for monkfish adults. Due to the somewhat patchy and sparse distribution of monkfish larvae observations, the combination of larvae and adults was used as a proxy. This alternative was selected to be as conservative as possible given the patchy nature of the distribution of monkfish larvae.

Map 27. Monkfish juveniles, Alternative 1 (No Action)



The EFH designation for juvenile monkfish is based upon alternative 3 for monkfish juveniles. This alternative was selected because it included all areas where monkfish juveniles were observed in relatively high concentrations, but did not include areas where they occurred in low concentrations.

Map 28. Monkfish adults, Alternative 1 (No Action)



The EFH designation for adult monkfish is based upon alternative 3 for monkfish adults. This alternative was selected because it included all areas where monkfish adults were observed in relatively high concentrations, but did not include areas where they occurred in low concentrations..

4.1.1.2.11 Ocean pout (Macrozoarces americanus)

In its *Report to Congress: Status of the Fisheries of the United States* (September 1997), NMFS determined ocean pout is not currently overfished. This determination is based on an assessment of stock level. Essential Fish Habitat for ocean pout is described as those areas of the coastal and offshore waters (out to the offshore U.S. boundary of the exclusive economic zone) that are designated on

Map 29 -

Map 32 and in the accompanying table and meet the following conditions:

Eggs: Bottom habitats in the Gulf of Maine, Georges Bank, southern New England and the middle Atlantic south to Delaware Bay as depicted on

Map 29. Due to low fecundity, relatively few eggs (< 4200) are laid in gelatinous masses, generally in hard bottom sheltered nests, holes, or crevices where they are guarded by either female or both parents. Generally, the following conditions exist where ocean pout eggs are found: water temperatures below 10° C, depths less than 50 meters, and a salinity range from 32 - 34‰. Ocean pout egg development takes two to three months during late fall and winter.

Larvae: Bottom habitats in the Gulf of Maine, Georges Bank, southern New England and the middle Atlantic south to Delaware Bay as depicted on

Map 30. Larvae are relatively advanced in development and are believed to remain in close proximity to hard bottom nesting areas. Generally, the following conditions exist where ocean pout larvae are found: sea surface temperatures below 10° C, depths less than 50 meters, and salinities greater than 25‰. Ocean pout larvae are most often observed from late fall through spring.

Juveniles: Bottom habitats, often smooth bottom near rocks or algae in the Gulf of Maine, Georges Bank, southern New England and the middle Atlantic south to Delaware Bay as depicted on Map 31. Generally, the following conditions exist where ocean pout juveniles are found: water temperatures below 14° C, depths less than 80 meters, and salinities greater than 25‰.

Adults: Bottom habitats in the Gulf of Maine, Georges Bank, southern New England and the middle Atlantic south to Delaware Bay as depicted on

Map 32. Generally, the following conditions exist where ocean pout adults are found: water temperatures below 15° C, depths less than 110 meters, and a salinity range from 32 - 34‰.

Spawning Adults: Bottom habitats with a hard bottom substrate, including artificial reefs and shipwrecks, in the Gulf of Maine, Georges Bank, southern New England and the middle Atlantic south to Delaware Bay as depicted on

Map 32. Generally, the following conditions exist where spawning ocean pout adults are found: water temperatures below 10° C, depths less than 50 meters, and a salinity range from 32 - 34‰. Ocean pout spawn from late summer through early winter, with peaks in September and October.

All of the above EFH descriptions include those bays and estuaries listed on the following table, according to life history stage. The Council acknowledges potential seasonal and spatial variability of the conditions generally associated with this species.

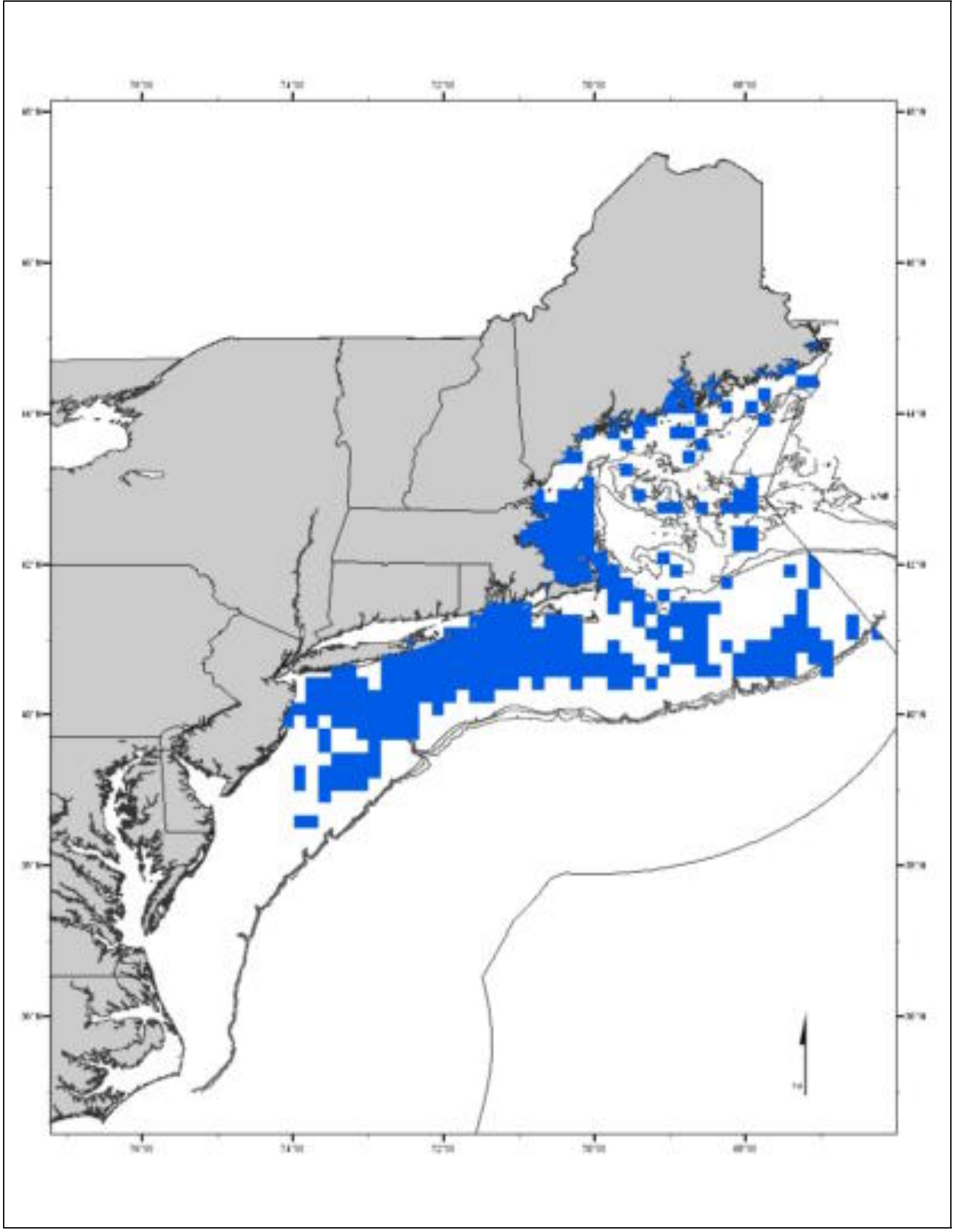
Table 14. EFH Designation of Estuaries and Embayments: Ocean pout (Macrozoarces americanus)

Estuaries and Embayments	Eggs	Larvae	Juveniles	Adults	Spawning Adults
Passamaquoddy Bay	s	s	s	s	s
Englishman/Machias Bay	s	s	s	s	s
Narraguagus Bay	s	s	s	s	s
Blue Hill Bay	s	s	s	s	s
Penobscot Bay	s	s	s	s	s
Muscongus Bay	s	s	s	s	s
Damariscotta River	s	s	s	s	s
Sheepscot River	s	s	s	s	s
Kennebec / Androscoggin Rivers	s	s	s	s	s
Casco Bay	s	s	s	s	s
Saco Bay	s	s	s	s	s
Wells Harbor					
Great Bay					
Merrimack River					
Massachusetts Bay	s	s	s	s	s
Boston Harbor			s	s	
Cape Cod Bay	s	s	s	s	s
Waquoit Bay					
Buzzards Bay					
Narragansett Bay					
Long Island Sound					
Connecticut River					
Gardiners Bay					
Great South Bay					
Hudson River / Raritan Bay					
Barnegat Bay					
Delaware Bay					

Estuaries and Embayments	Eggs	Larvae	Juveniles	Adults	Spawning Adults
Chincoteague Bay					
Chesapeake Bay					

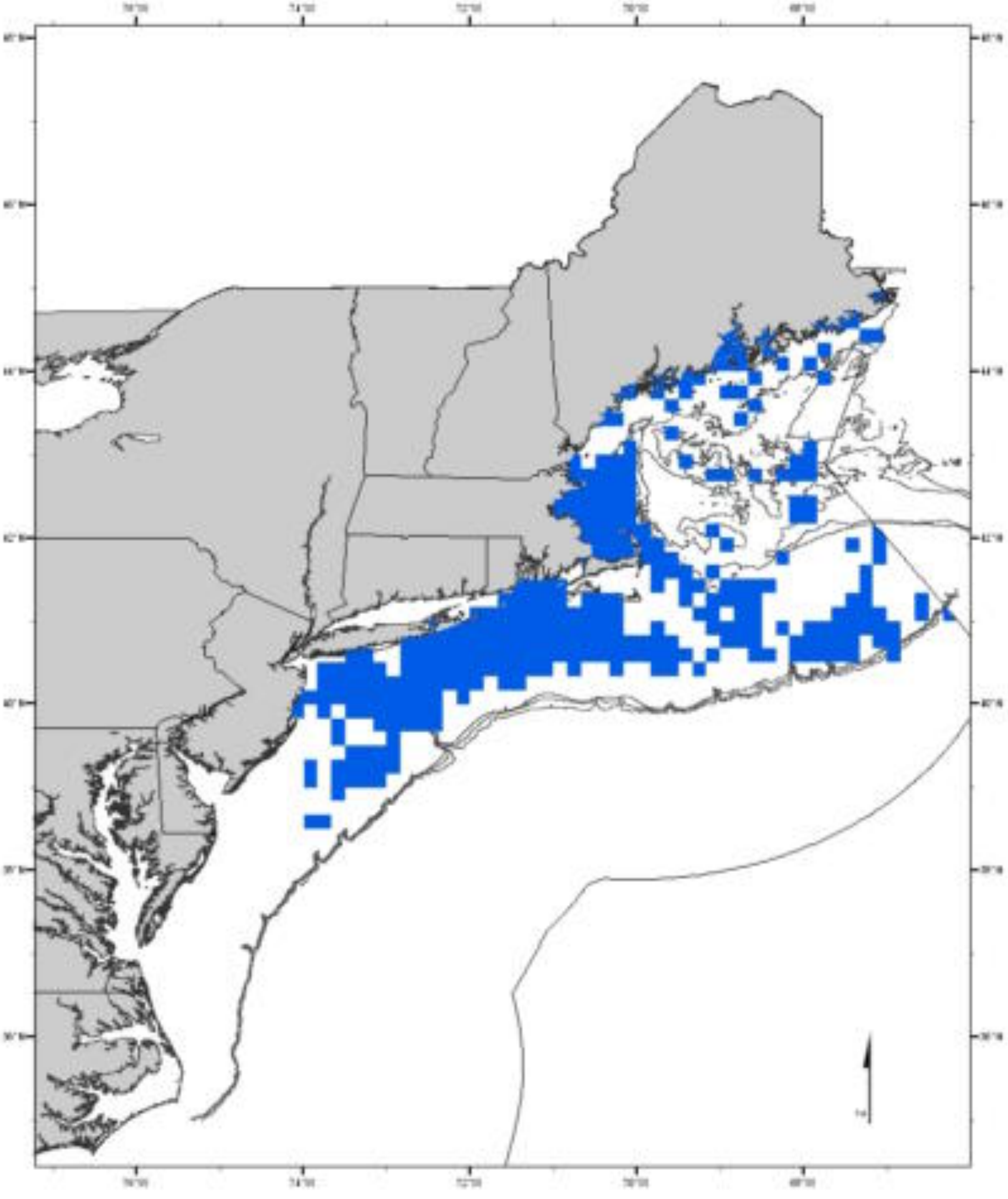
S ≡ The EFH designation for this species includes the seawater salinity zone of this bay or estuary (salinity > 25.0‰).
M ≡ The EFH designation for this species includes the mixing water / brackish salinity zone of this bay or estuary (0.5 < salinity < 25.0‰).
F ≡ The EFH designation for this species includes the tidal freshwater salinity zone of this bay or estuary (0.0 < salinity < 0.5‰).
These EFH designations of estuaries and embayments are based on the NOAA Estuarine Living Marine Resources (ELMR) program (Jury et al. 1994; Stone et al. 1994). For a detailed view of the salinity zone boundaries, as described in the ELMR reports, please see Appendix B. The Council recognizes the spatial and temporal variability of estuarine and embayment environmental conditions generally associated with this species.

Map 29. Ocean pout eggs, Alternative 1 (No Action)



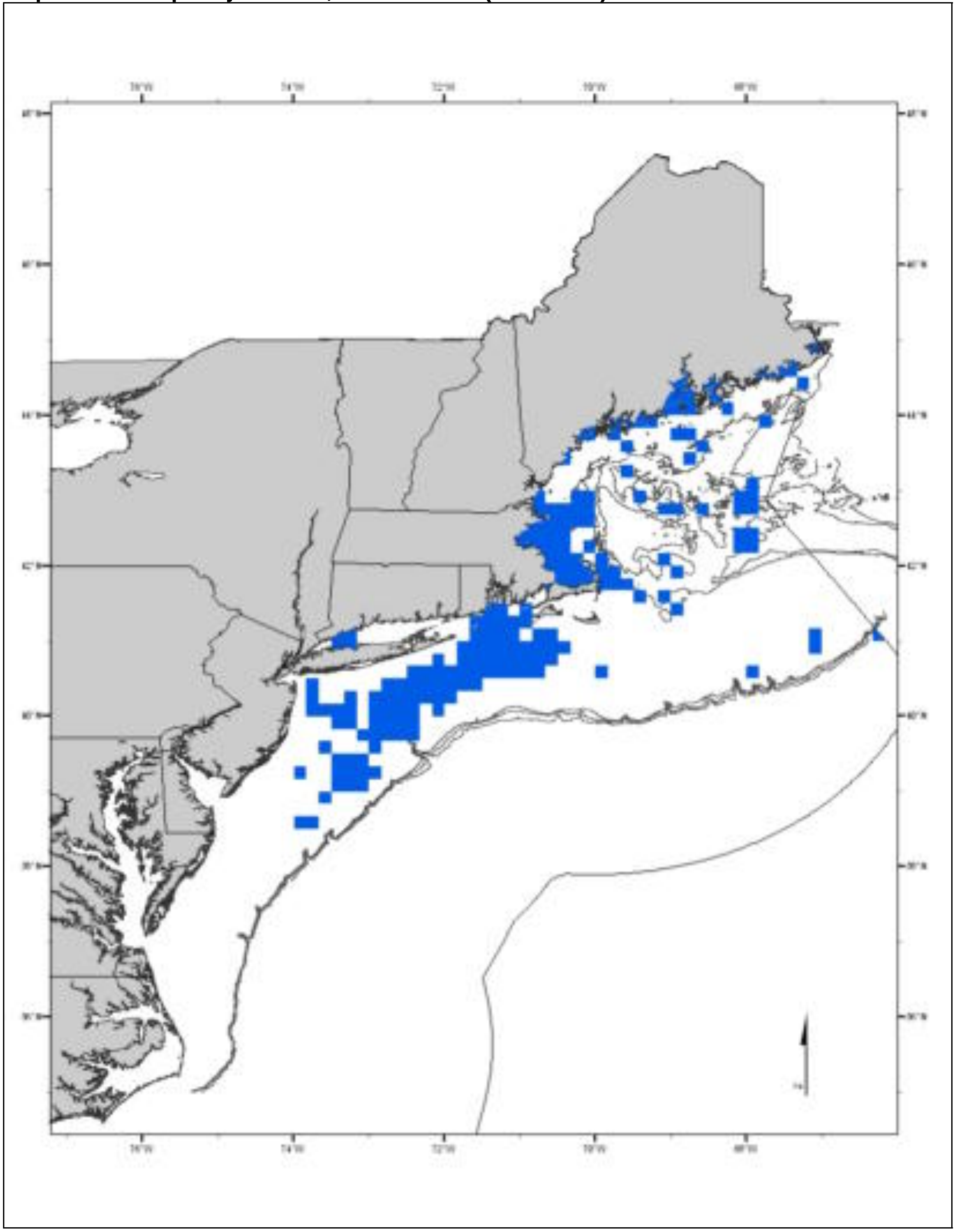
The EFH designation for ocean pout eggs is based upon the combination of alternative 3 for ocean pout juveniles and alternative 3 for ocean pout adults, in addition to those bays and estuaries identified by the NOAA ELMR program as supporting ocean pout eggs at a "common" or "abundant" level. This designation also includes areas of relatively high concentrations of ocean pout from the State of Massachusetts inshore trawl survey and the Connecticut Long Island Sound survey. Ocean pout eggs are found only in demersal nests, thus eggs are not sampled effectively with the MARMAP ichthyoplankton survey. The distribution of ocean pout juveniles and adults serves as a proxy for actual distribution data on eggs. This alternative was selected as most representative of where ocean pout eggs are likely to be found in relatively high concentrations.

Map 30. Ocean pout larvae, Alternative 1 (No Action)



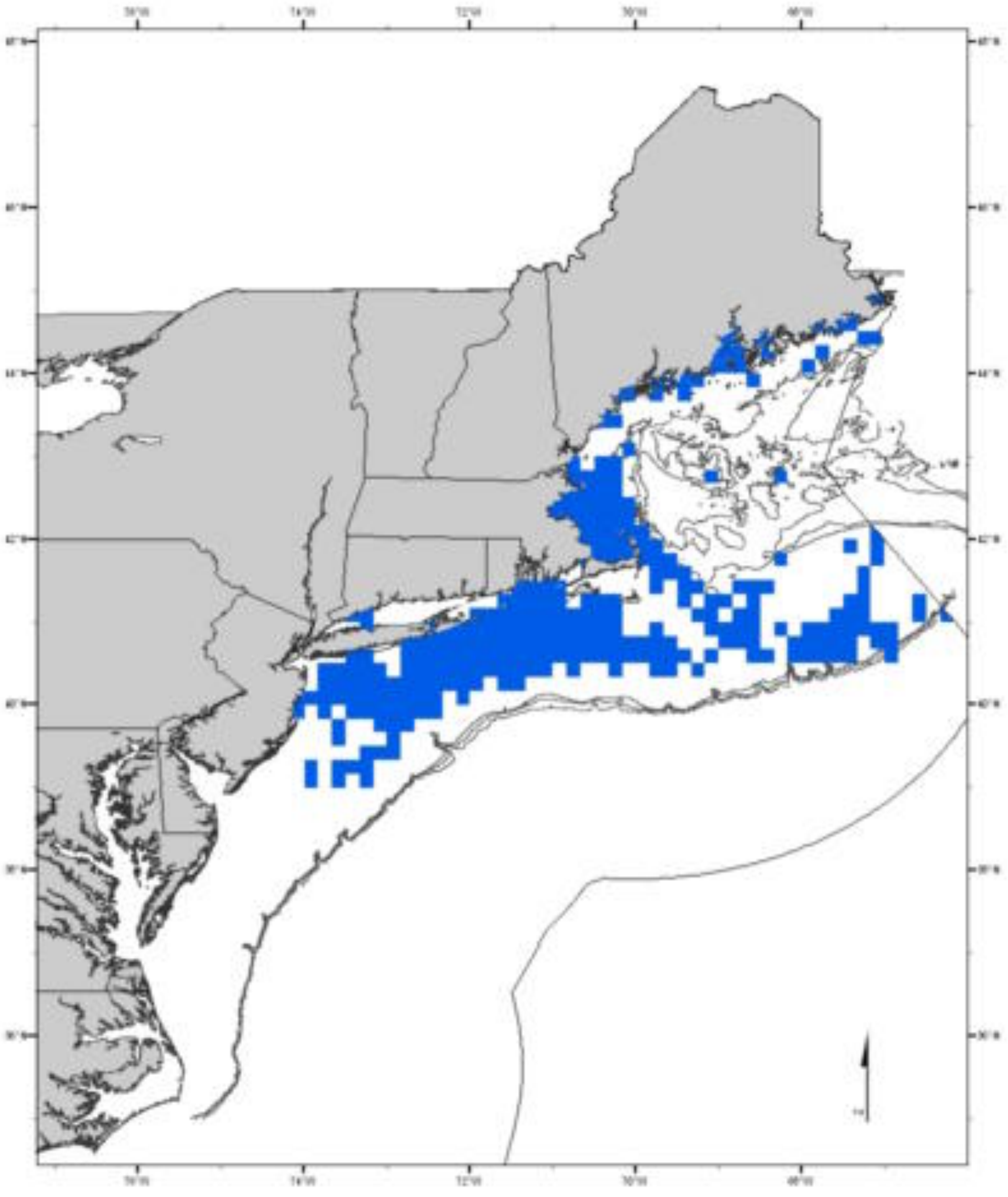
The EFH designation for ocean pout larvae is based upon the combination of alternative 3 for ocean pout juveniles and alternative 3 for ocean pout adults, in addition to those bays and estuaries identified by the NOAA ELMR program as supporting ocean pout larvae at a "common" or "abundant" level. This designation also includes areas of relatively high concentrations of ocean pout from the State of Massachusetts inshore trawl survey and the Connecticut Long Island Sound survey. Ocean pout larvae remain in close proximity with the nests, thus larvae are not sampled effectively with the MARMAP ichthyoplankton survey. The distribution of ocean pout juveniles and adults serves as a proxy for actual distribution data on larvae. This alternative was selected as most representative of where ocean pout larvae are likely to be found in relatively high concentrations.

Map 31. Ocean pout juveniles, Alternative 1 (No Action)



The EFH designation for juvenile ocean pout is based upon alternative 3 for juvenile ocean pout, plus those bays and estuaries identified by the NOAA ELMR program as supporting juvenile ocean pout at a "common" or "abundant" level. This designation also includes areas of relatively high concentrations of ocean pout from the State of Massachusetts inshore trawl survey and the Connecticut Long Island Sound survey. This alternative was selected to be inclusive of most areas where ocean pout occur in relatively high concentrations.

Map 32. Ocean pout adults, Alternative 1 (No Action)



The EFH designation for adult ocean pout is based upon alternative 3 for adult ocean pout, plus those bays and estuaries identified by the NOAA ELMR program as supporting adult ocean pout at a "common" or "abundant" level. This designation also includes areas of relatively high concentrations of ocean pout from the State of Massachusetts inshore trawl survey and the Connecticut Long Island Sound survey. This alternative was selected to be inclusive of most areas where ocean pout occur in relatively high concentrations.

4.1.1.2.12 Offshore hake (Merluccius albidus)

In its *Report to Congress: Status of the Fisheries of the United States* (September 1997), NMFS did not consider the status of offshore hake; however, this species is not thought to be overfished. Essential Fish Habitat for offshore hake is described as those areas of the offshore waters (out to the offshore U.S. boundary of the exclusive economic zone) that are designated on Map 33 **-** Map 36 and meet the following conditions:

Eggs: Pelagic waters along the outer continental shelf of Georges Bank and southern New England south to Cape Hatteras, North Carolina as depicted on Map 33. Generally, the following conditions exist where offshore hake eggs are found: water temperatures less than 20°C and water depths less than 1250 meters. Offshore hake eggs are observed all year and are primarily collected at depths from 110 - 270 meters.

Larvae: Pelagic waters along the outer continental shelf of Georges Bank and southern New England south to Chesapeake Bay as depicted in Map 34**.** Generally, the following conditions exist where offshore hake larvae are found: water temperatures less than 19°C and water depths less than 1250 meters. Offshore hake larvae are observed all year and are primarily collected at depths from 70 - 130 meters.

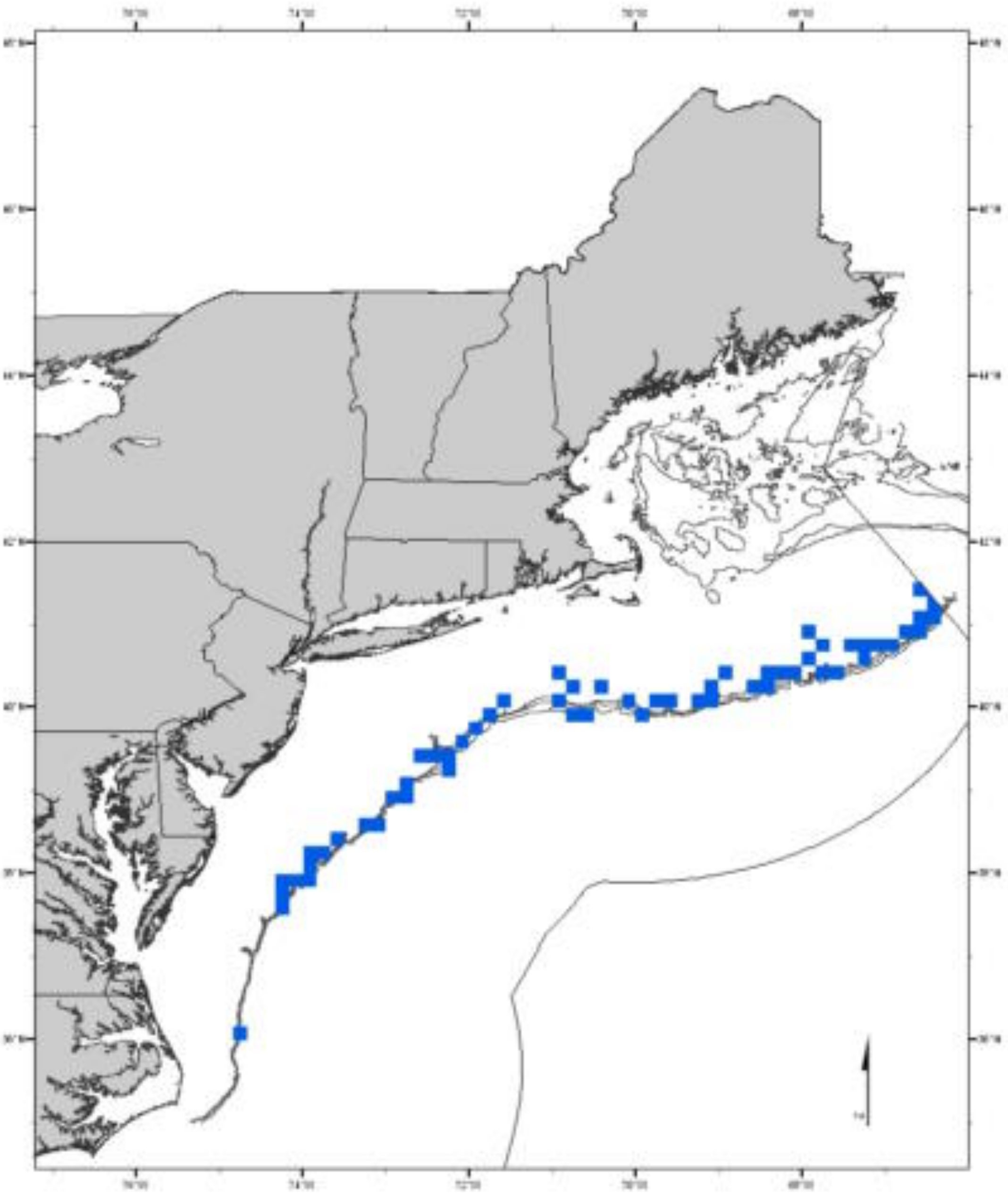
Juveniles: Bottom habitats along the outer continental shelf of Georges Bank and southern New England south to Cape Hatteras, North Carolina as depicted on Map 35**.** Generally, the following conditions exist where offshore hake juveniles are found: water temperatures below 12°C and depths from 170 - 350 meters.

Adults: Bottom habitats along the outer continental shelf of Georges Bank and southern New England south to Cape Hatteras, North Carolina as depicted on Map 36. Generally, the following conditions exist where offshore hake adults are found in highest abundance: water temperatures below 12° C and depths from 150 - 380 meters.

Spawning Adults: Bottom habitats along the outer continental shelf of Georges Bank and southern New England south to the Middle Atlantic Bight as depicted on Map 36. Generally, the following conditions exist where spawning offshore hake adults are found: water temperatures below 12° C and depths from 330 - 550 meters. Offshore hake are most often observed spawning throughout the year.

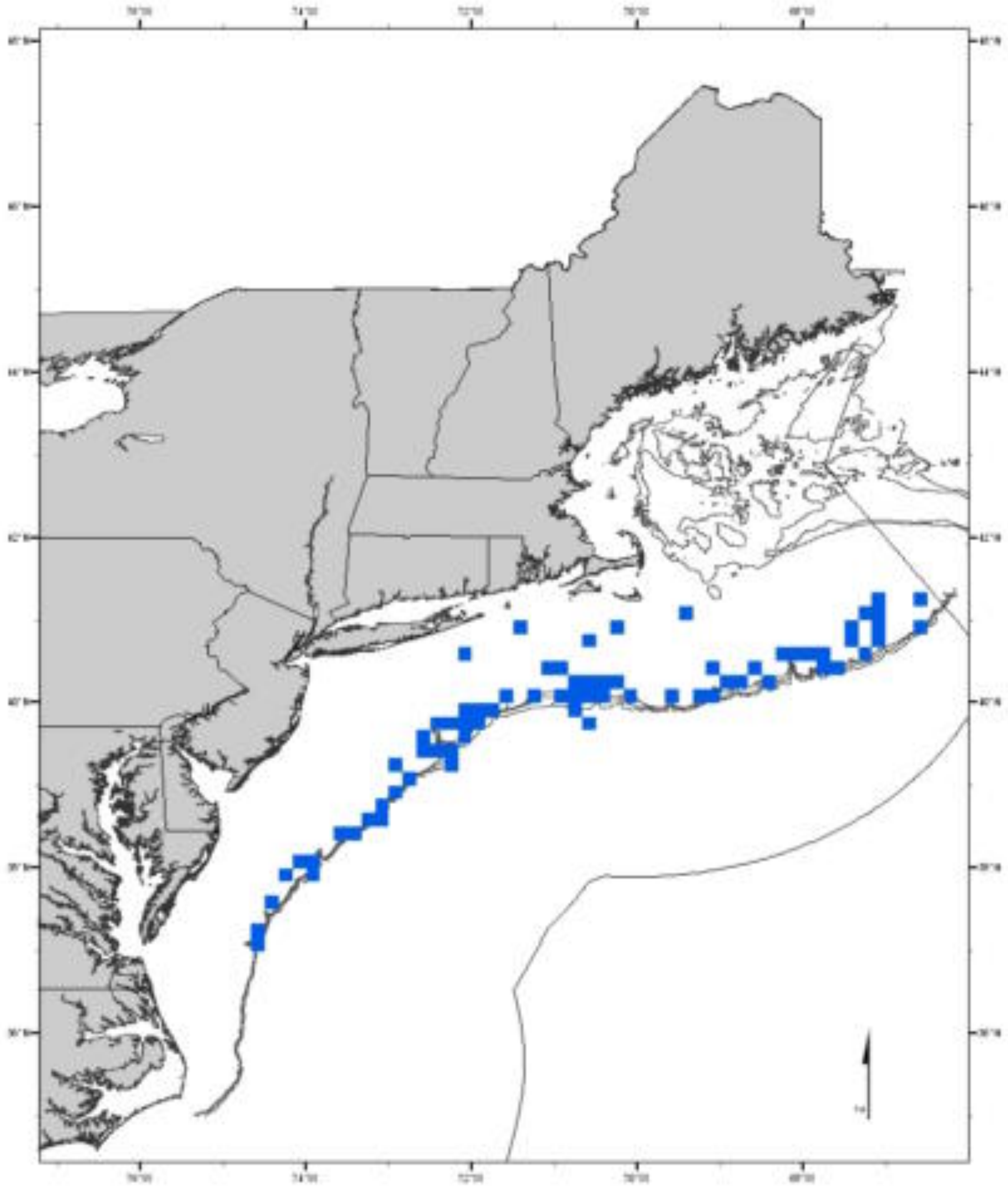
The Council acknowledges potential seasonal and spatial variability of the conditions generally associated with this species. The Council also acknowledges that there may be areas not surveyed by the NMFS bottom trawl survey (areas deeper than 200 meters) that are also essential fish habitat for offshore hake.

Map 33. Offshore hake eggs, Alternative 1 (No Action)



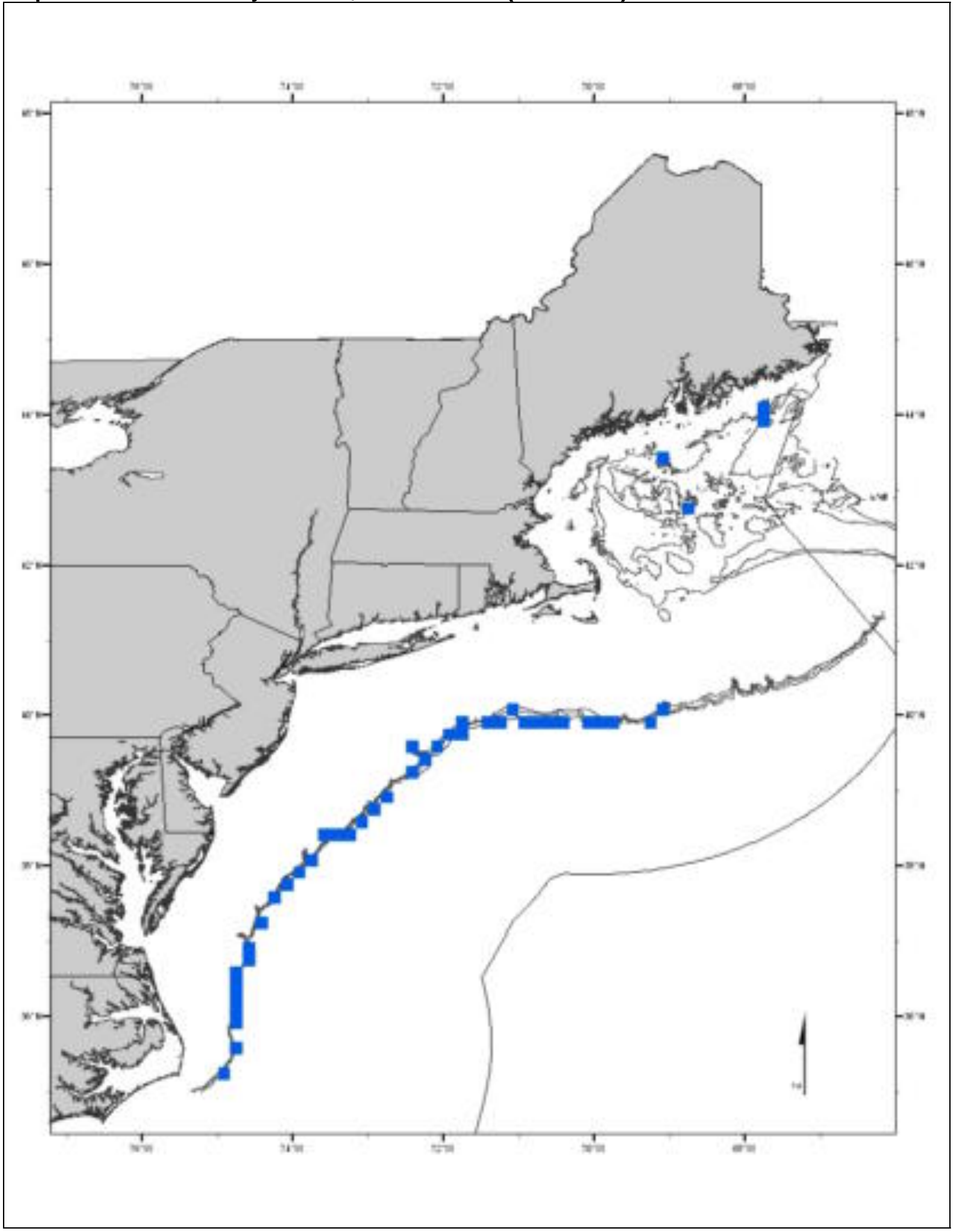
The EFH designation for offshore hake eggs is based upon alternative 2 for offshore hake eggs. This alternative was selected to be representative of the areas most likely to support offshore hake eggs in relatively high concentrations.

Map 34. Offshore hake larvae, Alternative 1 (No Action)



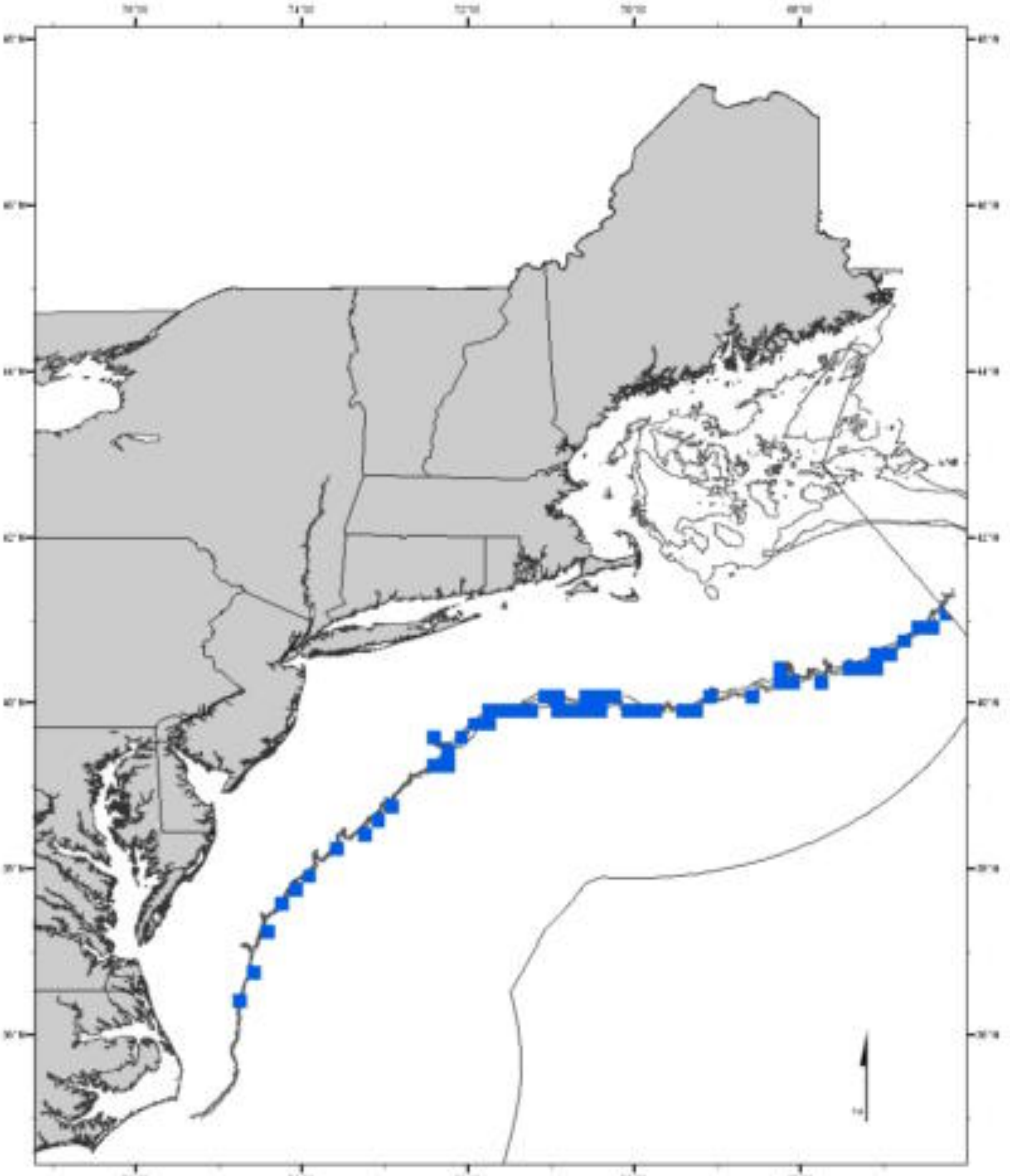
The EFH designation for offshore hake larvae is based upon alternative 2 for offshore hake larvae. This alternative was selected to be representative of the areas most likely to support offshore hake larvae in relatively high concentrations.

Map 35. Offshore hake juveniles, Alternative 1 (No Action)



The EFH designation for juvenile offshore hake is based upon alternative 2 for juvenile offshore hake. This alternative was selected to be representative of the areas most likely to support juvenile offshore hake in relatively high concentrations.

Map 36. Offshore hake adults, Alternative 1 (No Action)



The EFH designation for adult offshore hake is based upon alternative 2 for adult offshore hake. This alternative was selected to be representative of the areas most likely to support adult offshore hake in relatively high concentrations.

4.1.1.2.13 Pollock (Pollachius virens)

In its *Report to Congress: Status of the Fisheries of the United States* (September 1997), NMFS determined there is not enough information to determine if pollock is overfished or approaching an overfished condition. Essential Fish Habitat for pollock is described as those areas of the coastal and offshore waters (out to the offshore U.S. boundary of the exclusive economic zone) that are designated on Map 37 -

Map 40 and in the accompanying table and meet the following conditions:

Eggs: Pelagic waters of the Gulf of Maine and Georges Bank as depicted on Map 37. Generally, the following conditions exist where pollock eggs are found: sea surface temperatures less than 17° C, water depths 30 and 270 meters, and salinities between 32 - 32.8‰. Pollock eggs are often observed from October through June with peaks from November to February.

Larvae: Pelagic waters of the Gulf of Maine and Georges Bank as depicted on Map 38. Generally, the following conditions exist where pollock larvae are found: sea surface temperatures less than 17° C and water depths between 10 and 250 meters. Pollock larvae are often observed from September to July with peaks from December to February.

Juveniles: Bottom habitats with aquatic vegetation or a substrate of sand, mud or rocks in the Gulf of Maine and Georges Bank as depicted on Map 39. Generally, the following conditions exist where pollock juveniles are found: water temperatures below 18° C, depths from 0 - 250 meters, and salinities between 29 - 32‰.

Adults: Bottom habitats in the Gulf of Maine and Georges Bank and hard bottom habitats (including artificial reefs) off southern New England and the middle Atlantic south to New Jersey as depicted on

Map 40. Generally, the following conditions exist where pollock adults are found: water temperatures below 14° C, depths from 15 - 365 meters, and salinities between 31 - 34‰.

Spawning Adults: Bottom habitats with a substrate of hard, stony or rocky bottom in the Gulf of Maine and hard bottom habitats (including artificial reefs) off southern New England and the middle Atlantic south to New Jersey as depicted on

Map 40. Generally, the following conditions exist where pollock adults are found: water temperatures below 8° C, depths from 15 - 365 meters, and salinities between 32 - 32.8‰. Pollock are most often observed spawning during the months September to April with peaks from December to February.

All of the above EFH descriptions include those bays and estuaries listed on the following table, according to life history stage. The Council acknowledges potential seasonal and spatial variability of the conditions generally associated with this species.

Table 15. EFH Designation of Estuaries and Embayments Pollock (Pollachius virens)

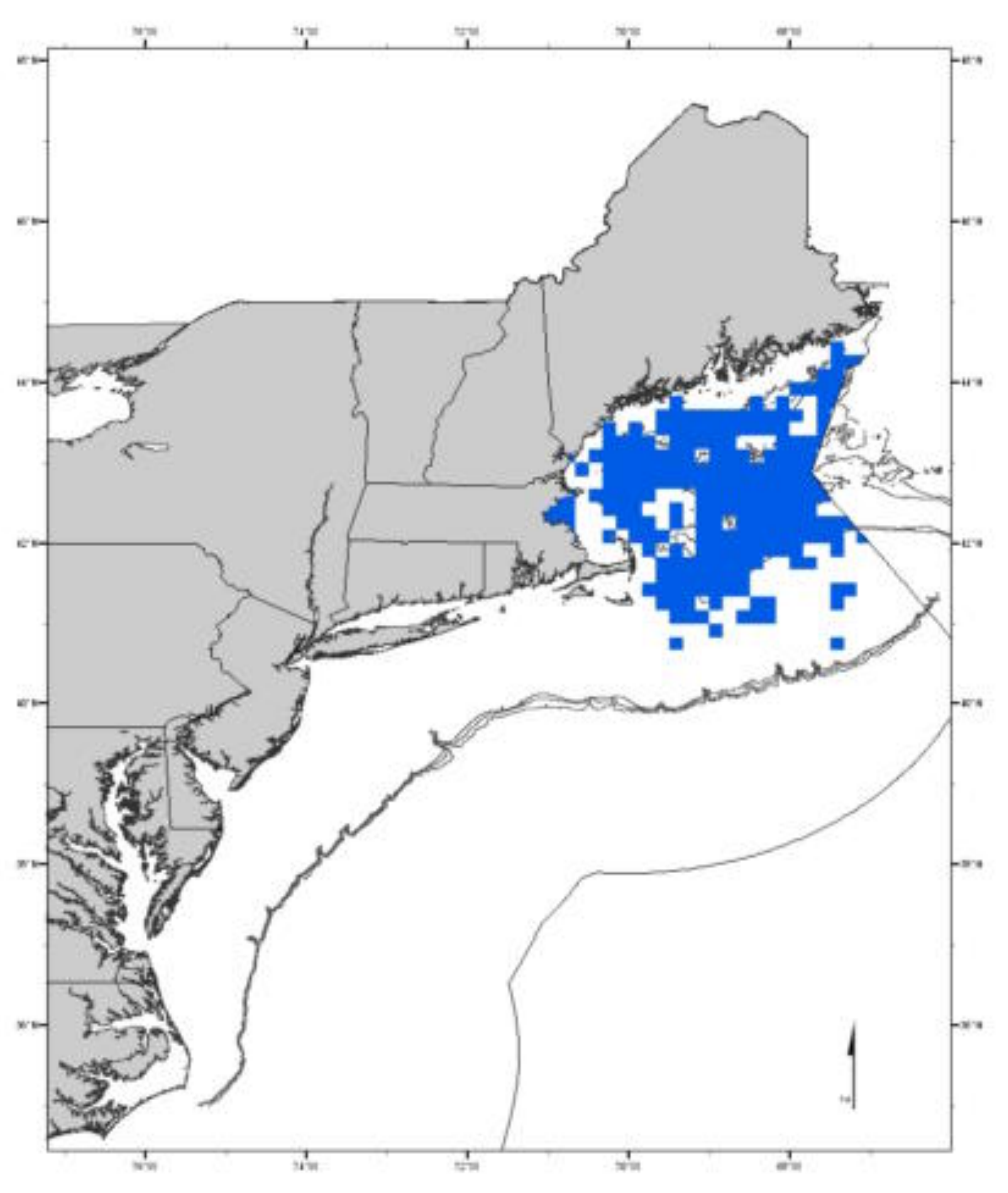
Estuaries and Embayments	Eggs	Larvae	Juveniles	Adults	Spawning Adults
Passamaquoddy Bay		s	m,s	s	
Englishman/Machias Bay			m,s		
Narraguagus Bay			m,s		
Blue Hill Bay			m,s		
Penobscot Bay			m,s		
Muscongus Bay			m,s		
Damariscotta River			m,s	s	
Sheepscot River		s	m,s		
Kennebec / Androscoggin Rivers			m,s		
Casco Bay			m,s		
Saco Bay			m,s		
Wells Harbor					
Great Bay	s	s	s		
Merrimack River	m	m	m		
Massachusetts Bay	s	s	s	s	s
Boston Harbor	s	s	m,s		
Cape Cod Bay		s	m,s	s	
Waquoit Bay			s		
Buzzards Bay					
Narragansett Bay					
Long Island Sound			s	s	
Connecticut River					
Gardiners Bay					
Great South Bay			s		
Hudson River / Raritan Bay					
Barnegat Bay					
Delaware Bay					
Chincoteague Bay					

Chesapeake Bay					

S ≡ The EFH designation for this species includes the seawater salinity zone of this bay or estuary (salinity > 25.0‰).
M ≡ The EFH designation for this species includes the mixing water / brackish salinity zone of this bay or estuary (0.5 < salinity < 25.0‰).
F ≡ The EFH designation for this species includes the tidal freshwater salinity zone of this bay or estuary (0.0 < salinity < 0.5‰).

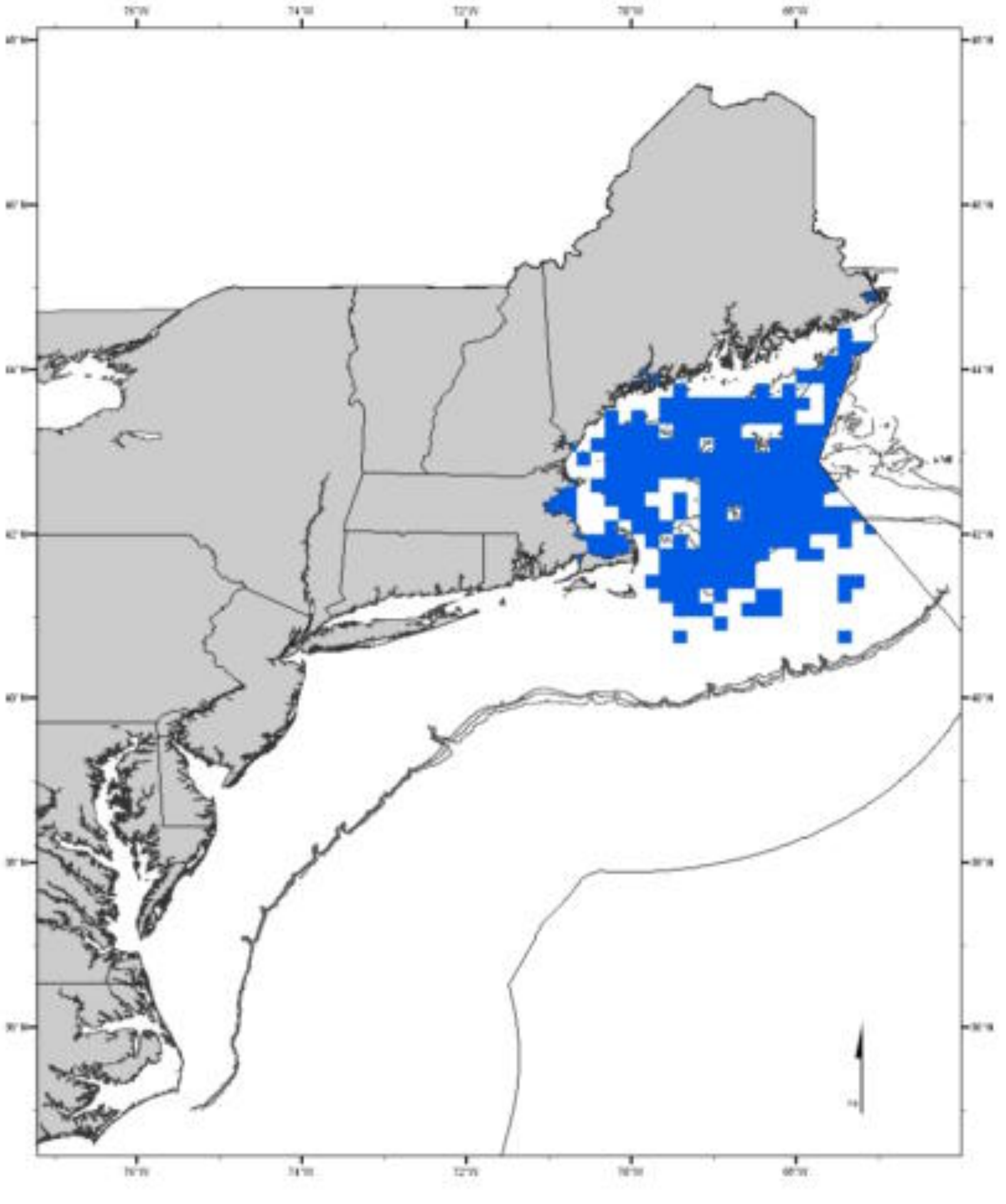
These EFH designations of estuaries and embayments are based on the NOAA Estuarine Living Marine Resources (ELMR) program (Jury et al. 1994; Stone et al. 1994). For a detailed view of the salinity zone boundaries, as described in the ELMR reports, please see Appendix B. The Council recognizes the spatial and temporal variability of estuarine and embayment environmental conditions generally associated with this species.

Map 37. Pollock eggs, Alternative 1 (No Action)



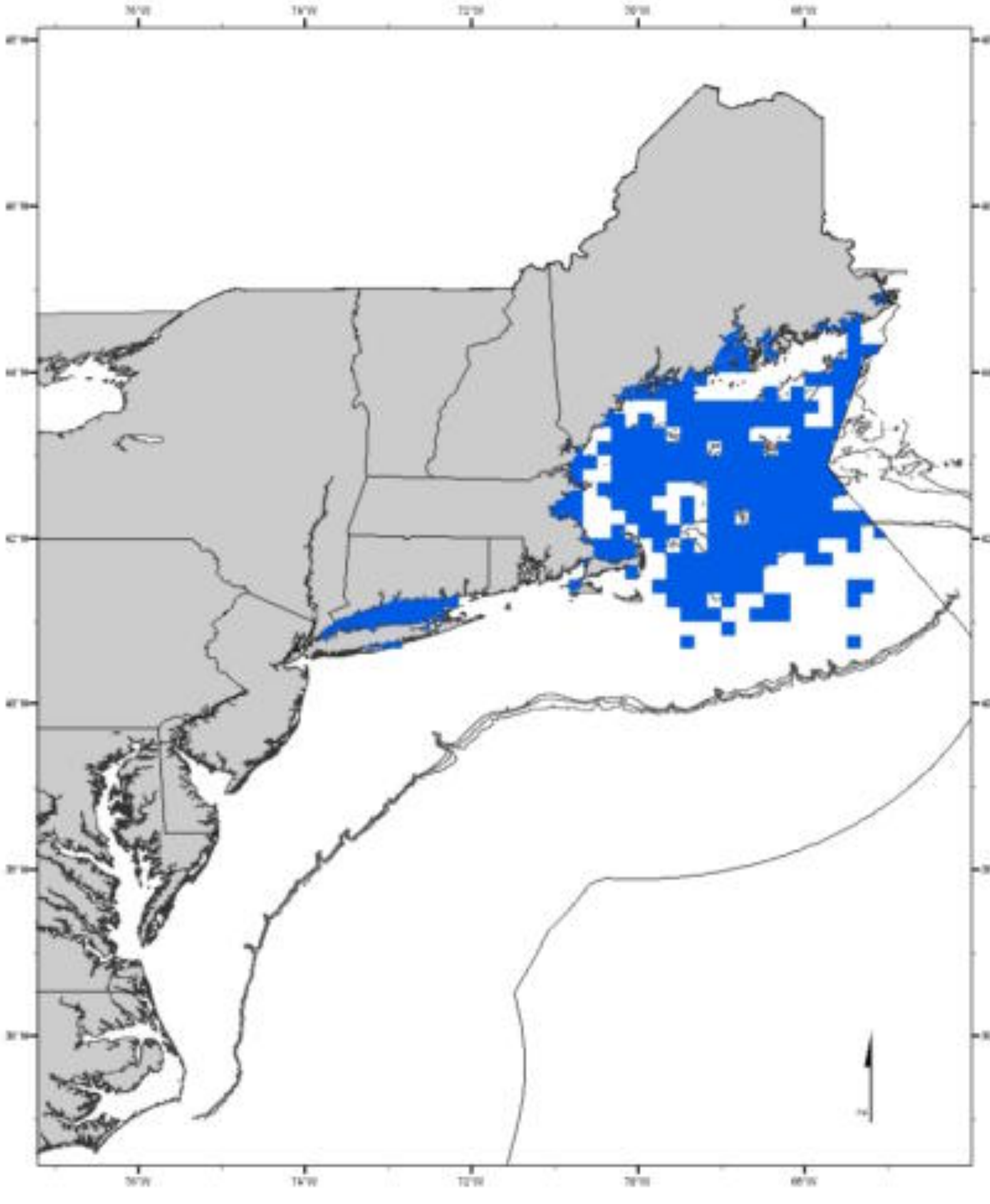
The EFH designation for pollock eggs is based upon alternative 3 for pollock adults. This designation also includes those bays and estuaries identified by the NOAA ELMR program as supporting pollock eggs at the "common" or "abundant" level. The observed distribution of pollock eggs is very patchy and widely dispersed and does not match up with distributions of juveniles or adults, thus the distribution of adults was used as a proxy. This alternative was selected as it appears to best identify that portion of the range of pollock most important to all life history stages.

Map 38. Pollock larvae, Alternative 1 (No Action)



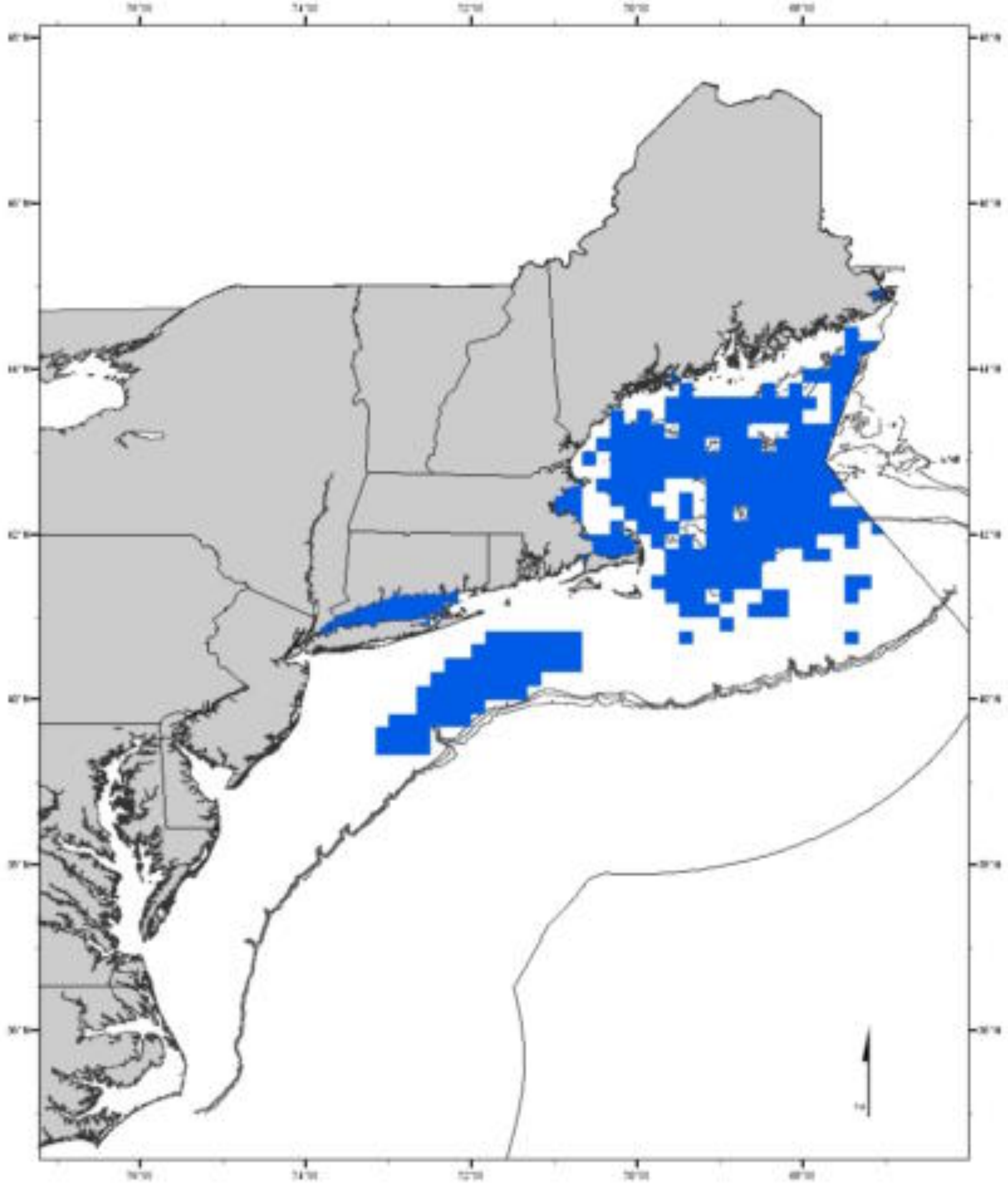
The EFH designation for pollock larvae is based upon alternative 3 for pollock adults. This designation also includes those bays and estuaries identified by the NOAA ELMR program as supporting pollock larvae at the "common" or "abundant" level. The observed distribution of pollock larvae is very patchy and widely dispersed and does not match up with distributions of juveniles or adults, thus the distribution of adults was used as a proxy. This alternative was selected as it appears to best identify that portion of the range of pollock most important to all life history stages.

Map 39. Pollock juveniles, Alternative 1 (No Action)



The EFH designation for juvenile pollock is based upon alternative 3 for pollock adults. This alternative was selected as it appears to best identify that portion of the range of pollock most important to all life history stages. The EFH designations also include the areas identified by the fishing industry and the inshore surveys as important for pollock, as well as those bays and estuaries identified by the NOAA ELMR program as supporting juvenile pollock at the "common" or "abundant" level.

Map 40. Pollock adults, Alternative 1 (No Action)



The EFH designation for adult pollock is based upon alternative 3 for pollock adults. This alternative was selected as it appears to best identify that portion of the range of pollock most important to all life history stages. The EFH designation also includes areas identified by the fishing industry and the inshore surveys as important for pollock, as well as those bays and estuaries identified by the NOAA ELMR program as supporting adult pollock at the "common" or "abundant" level.

4.1.1.2.14 Red hake (Urophycis chuss)

In its *Report to Congress: Status of the Fisheries of the United States* (September 1997), NMFS determined red hake is currently overfished. This determination is based on an assessment of stock size. Essential Fish Habitat for red hake is described as those areas of the coastal and offshore waters (out to the offshore U.S. boundary of the exclusive economic zone) that are designated on Map 41 - Map **44** and in the accompanying table and meet the following conditions:

Eggs: Surface waters of the Gulf of Maine, Georges Bank, the continental shelf off southern New England, and the middle Atlantic south to Cape Hatteras as depicted on Map 41. Generally, the following conditions exist where hake eggs are found: sea surface temperatures below 10° C along the inner continental shelf with a salinity less than 25‰. Hake eggs are most often observed during the months from May - November, with peaks in June and July.

Larvae: Surface waters of Gulf of Maine, Georges Bank, the continental shelf off southern New England, and the middle Atlantic south to Cape Hatteras as depicted on Map 42. Generally, the following conditions exist where red hake larvae are found: sea surface temperatures below 19° C, water depths less than 200 meters, and a salinity greater than 0.5‰. Red hake larvae are most often observed from May through December, with peaks in September - October.

Juveniles: Bottom habitats with a substrate of shell fragments, including areas with an abundance of live scallops, in the Gulf of Maine, on Georges Bank, the continental shelf off southern New England, and the middle Atlantic south to Cape Hatteras as depicted on Map **43**. Generally, the following conditions exist where red hake juveniles are found: water temperatures below 16° C, depths less than 100 meters and a salinity range from 31 - 33‰.

Adults: Bottom habitats in depressions with a substrate of sand and mud in the Gulf of Maine, on Georges Bank, the continental shelf off southern New England, and the middle Atlantic south to Cape Hatteras as depicted on Map **44**. Generally, the following conditions exist where red hake adults are found: water temperatures below 12° C, depths from 10 - 130 meters, and a salinity range from 33 - 34‰ .

Spawning Adults: Bottom habitats in depressions with a substrate of sand and mud in the Gulf of Maine, the southern edge of Georges Bank, the continental shelf off southern New England, and the middle Atlantic south to Cape Hatteras as depicted on Map **44**. Generally, the following conditions exist where spawning red hake adults are found: water temperatures below 10° C, water depths less than 100 meters and salinity less than

25‰. Red hake are most often observed spawning during the months from May - November, with peaks in June and July.

All of the above EFH descriptions include those bays and estuaries listed on the following table, according to life history stage. The Council acknowledges potential seasonal and spatial variability of the conditions generally associated with this species.

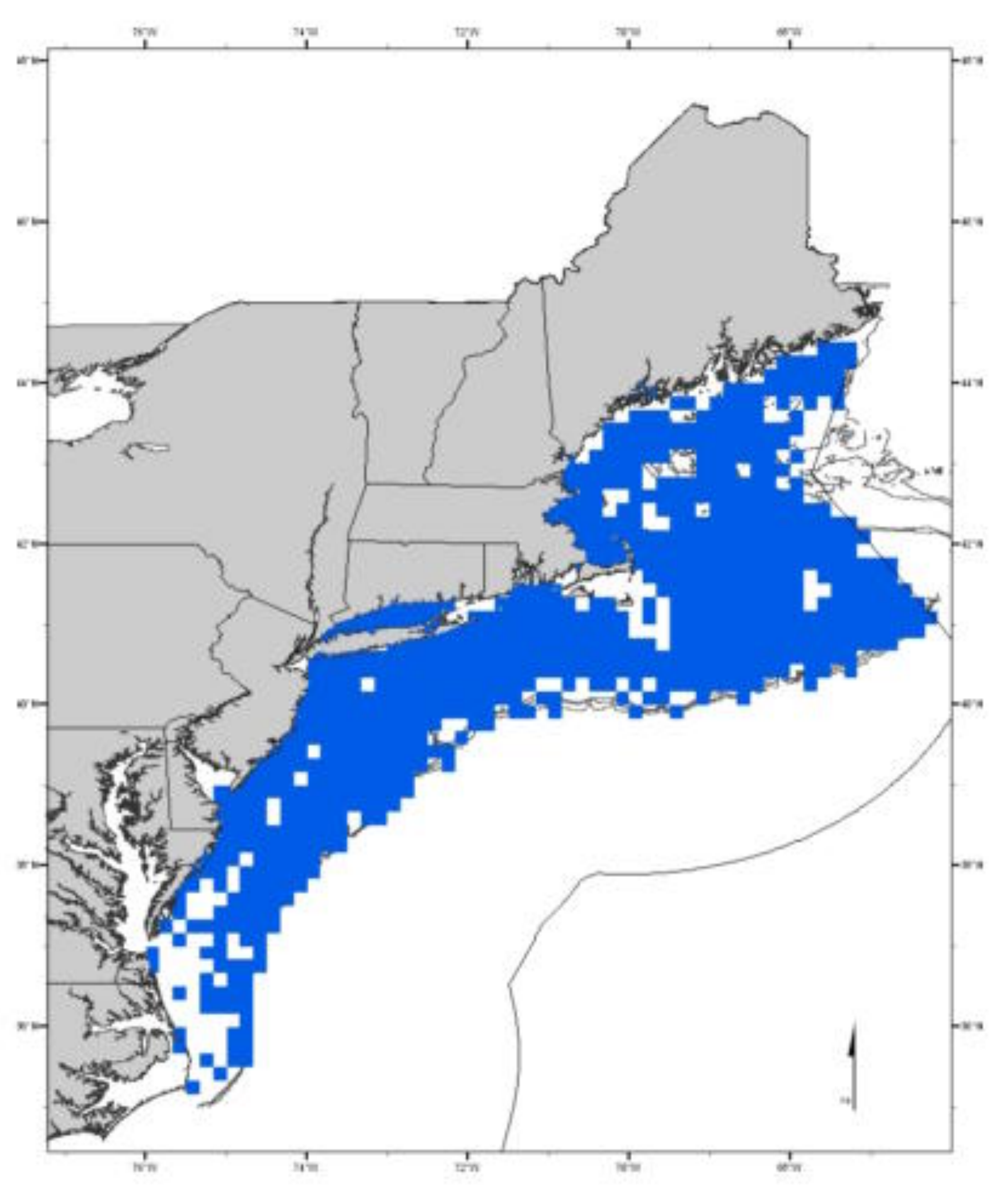
Table 16. EFH Designation of Estuaries and Embayments: Red hake (Urophycis chuss)

Estuaries and Embayments	Eggs	Larvae	Juveniles	Adults	Spawning Adults
Passamaquoddy Bay			m,s	m,s	
Englishman/Machias Bay			s	s	
Narraguagus Bay			s	s	
Blue Hill Bay			s	s	
Penobscot Bay			m,s	m,s	
Muscongus Bay			m,s	m,s	
Damariscotta River			m,s	s	
Sheepscot River		s	m,s	m,s	s
Kennebec / Androscoggin Rivers			m,s	m,s	
Casco Bay			s	s	
Saco Bay			s	s	
Wells Harbor					
Great Bay			s	s	
Merrimack River					
Massachusetts Bay		s	s	s	s
Boston Harbor		s	s	s	
Cape Cod Bay		s	m,s	m,s	s
Waquoit Bay					
Buzzards Bay		s	m,s	m,s	s
Narragansett Bay		s	s	s	s
Long Island Sound			m,s	m,s	
Connecticut River			m	m	
Gardiners Bay					
Great South Bay					
Hudson River / Raritan Bay		m,s	m,s	m,s	
Barnegat Bay					
Delaware Bay				s	
Chincoteague Bay					
Chesapeake Bay			s	s	

S ≡ The EFH designation for this species includes the seawater salinity zone of this bay or estuary (salinity >

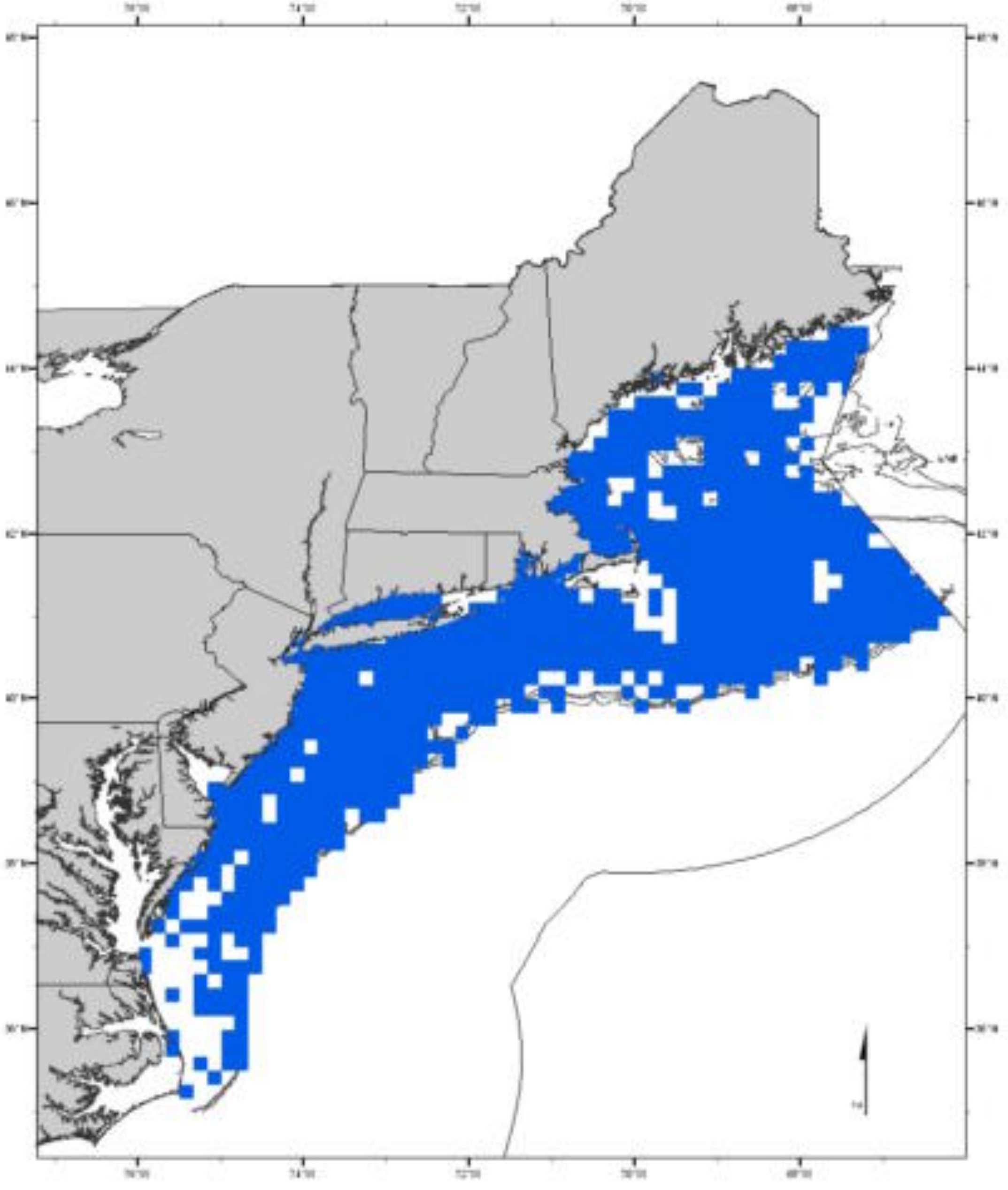
25.0‰).
M ≡ The EFH designation for this species includes the mixing water / brackish salinity zone of this bay or estuary (0.5 < salinity < 25.0‰).
F ≡ The EFH designation for this species includes the tidal freshwater salinity zone of this bay or estuary (0.0 < salinity < 0.5‰).
These EFH designations of estuaries and embayments are based on the NOAA Estuarine Living Marine Resources (ELMR) program (Jury et al. 1994; Stone et al. 1994). For a detailed view of the salinity zone boundaries, as described in the ELMR reports, please see Appendix B. The Council recognizes the spatial and temporal variability of estuarine and embayment environmental conditions generally associated with this species.

Map 41. Red hake eggs, Alternative 1 (No Action)



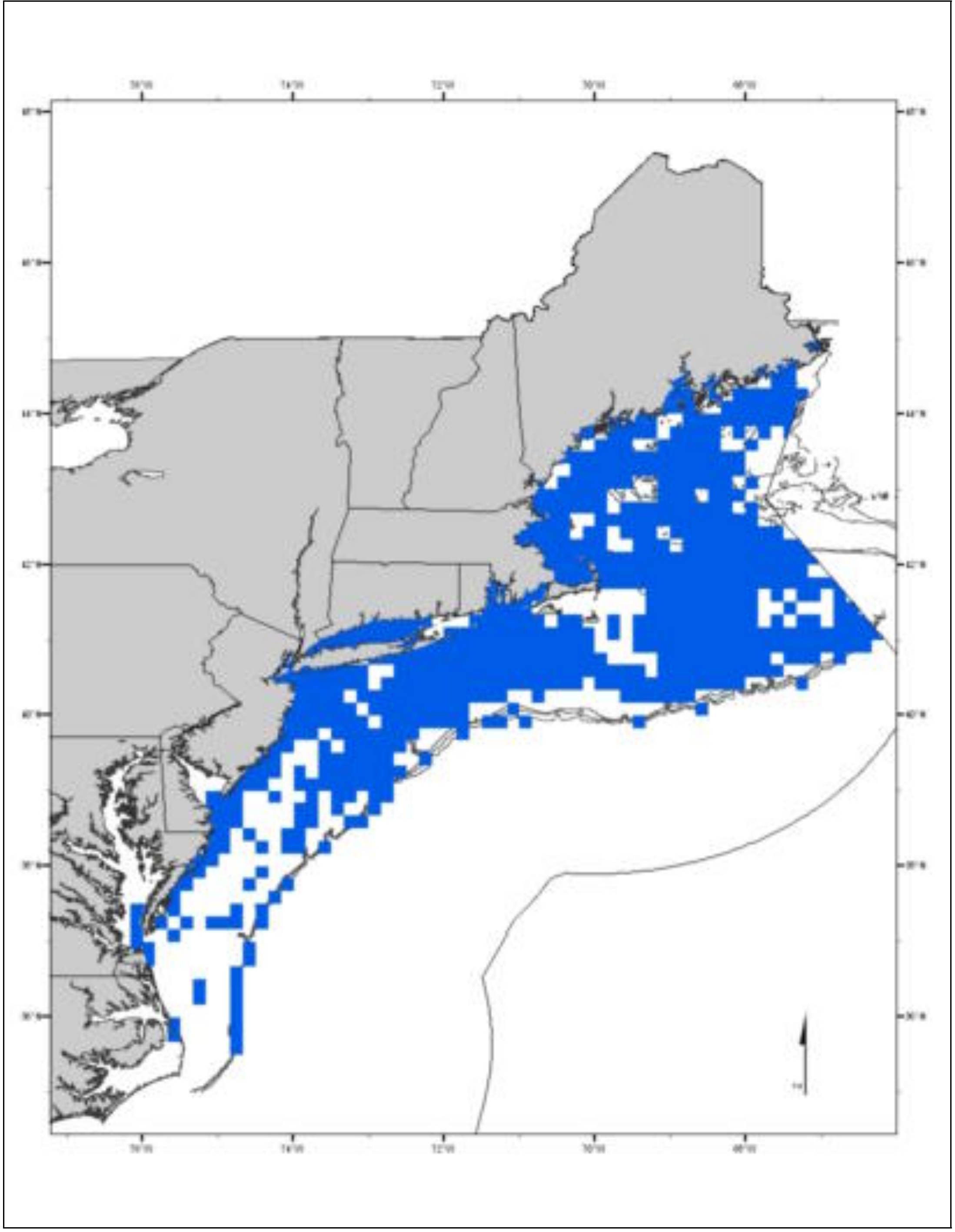
The EFH designation for red hake eggs is based upon alternative 3 for red hake juveniles in combination with alternative 3 for hake (Urophycis spp.) eggs. The observed distribution of hake eggs was not unique to red hake and did not reflect the portion of the population in the Gulf of Maine, so the combination of juveniles and eggs was used as a proxy to identify those areas important to red hake eggs. These alternatives were selected to cover the areas most important to red hake development. This designation also includes those bays and estuaries identified by the NOAA ELMR program as supporting red hake eggs at a "common" or "abundant" level.

Map 42. Red hake larvae, Alternative 1 (No Action)



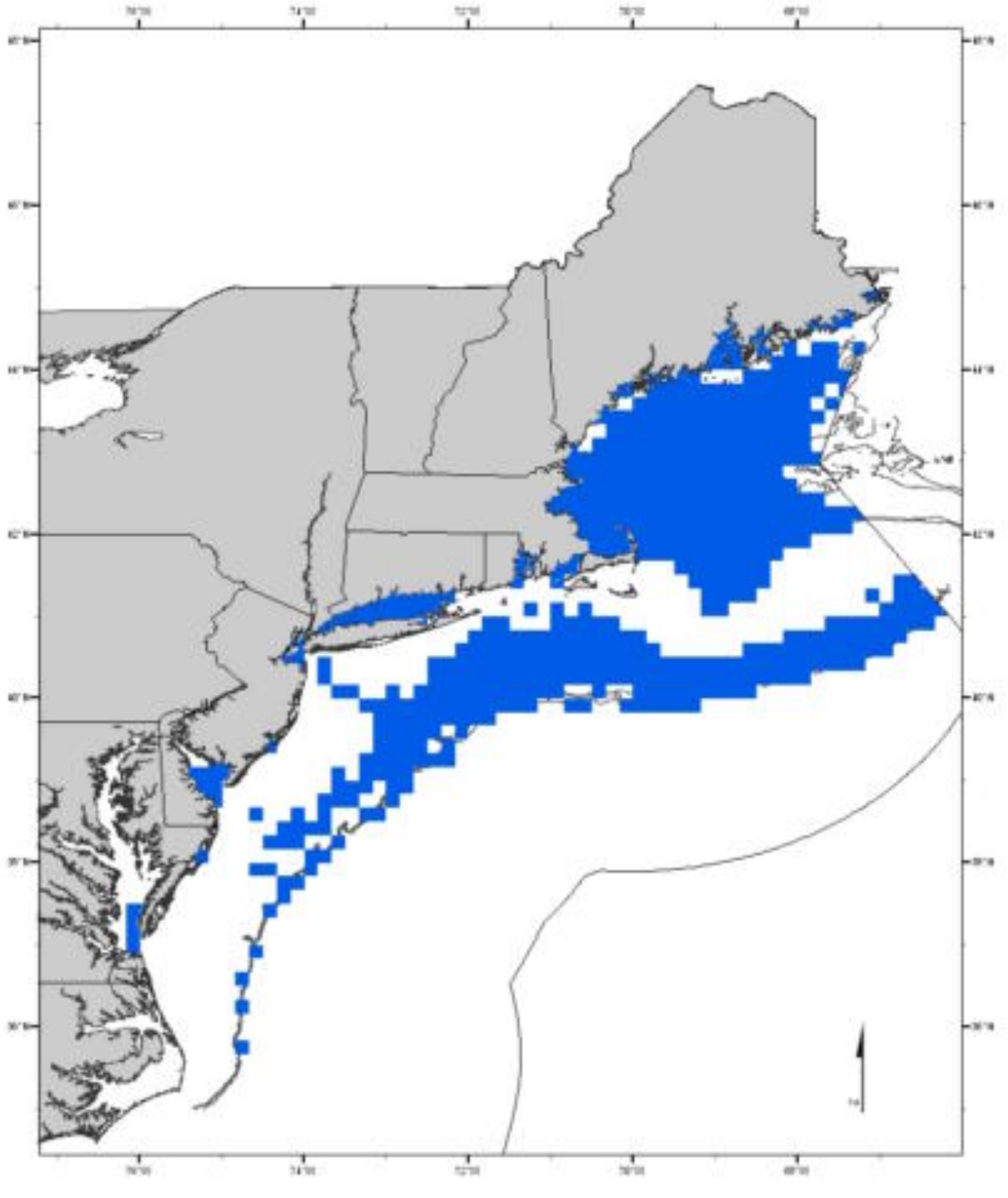
The EFH designation for red hake larvae is based upon alternative 3 for red hake juveniles in combination with alternative 3 for hake (Urophycis spp.) eggs. The observed distribution of red hake larvae was patchy and sparse, so the combination of juveniles and eggs was used as a proxy to identify those areas important to red hake larvae. These alternatives were selected to cover the areas most important to red hake development. This designation also includes those bays and estuaries identified by the NOAA ELMR program as supporting red hake larvae at a "common" or "abundant" level.

Map 43. Red hake juveniles, Alternative 1 (No Action)



The EFH designation for juvenile red hake is based upon alternative 3 for juvenile red hake. This designation also includes those bays and estuaries identified by the NOAA ELMR program as supporting juvenile red hake at a "common" or "abundant" level. This alternative was selected to be inclusive of most areas where red hake occur in relatively high concentrations.

Map 44. Red hake adults, Alternative 1 (No Action)



The EFH designation for adult red hake is based upon alternative 3 for adult red hake. This designation also includes those bays and estuaries identified by the NOAA ELMR program as supporting adult red hake at a "common" or "abundant" level. This alternative was selected to be inclusive of most areas where red hake occur in relatively high concentrations.

4.1.1.2.15 Redfish (Sebastes spp.)

In its *Report to Congress: Status of the Fisheries of the United States* (September 1997), NMFS determined redfish is neither currently overfished nor approaching an overfished condition. This determination is based on the fishing mortality rate. The identification and description of EFH for redfish includes two species, *Sebastes faciatus* and *S. mentella*. Essential Fish Habitat for redfish is described as those areas of the coastal and offshore waters (out to the offshore U.S. boundary of the exclusive economic zone) that are designated on Map 45 - Map 47 and meet the following conditions:

Eggs: Redfish are ovoviviparous. Redfish eggs are fertilized internally and develop into larvae within the oviduct. Therefore, there is no essential fish habitat identification or description for this life history stage.

Larvae: Pelagic waters in the Gulf of Maine and southern Georges Bank as depicted on Map 45. Generally, the following conditions exist where redfish larvae are found: sea surface temperatures below 15° C and water depths between 50 and 270 meters. Redfish larvae are most often observed from March through October, with a peak in August.

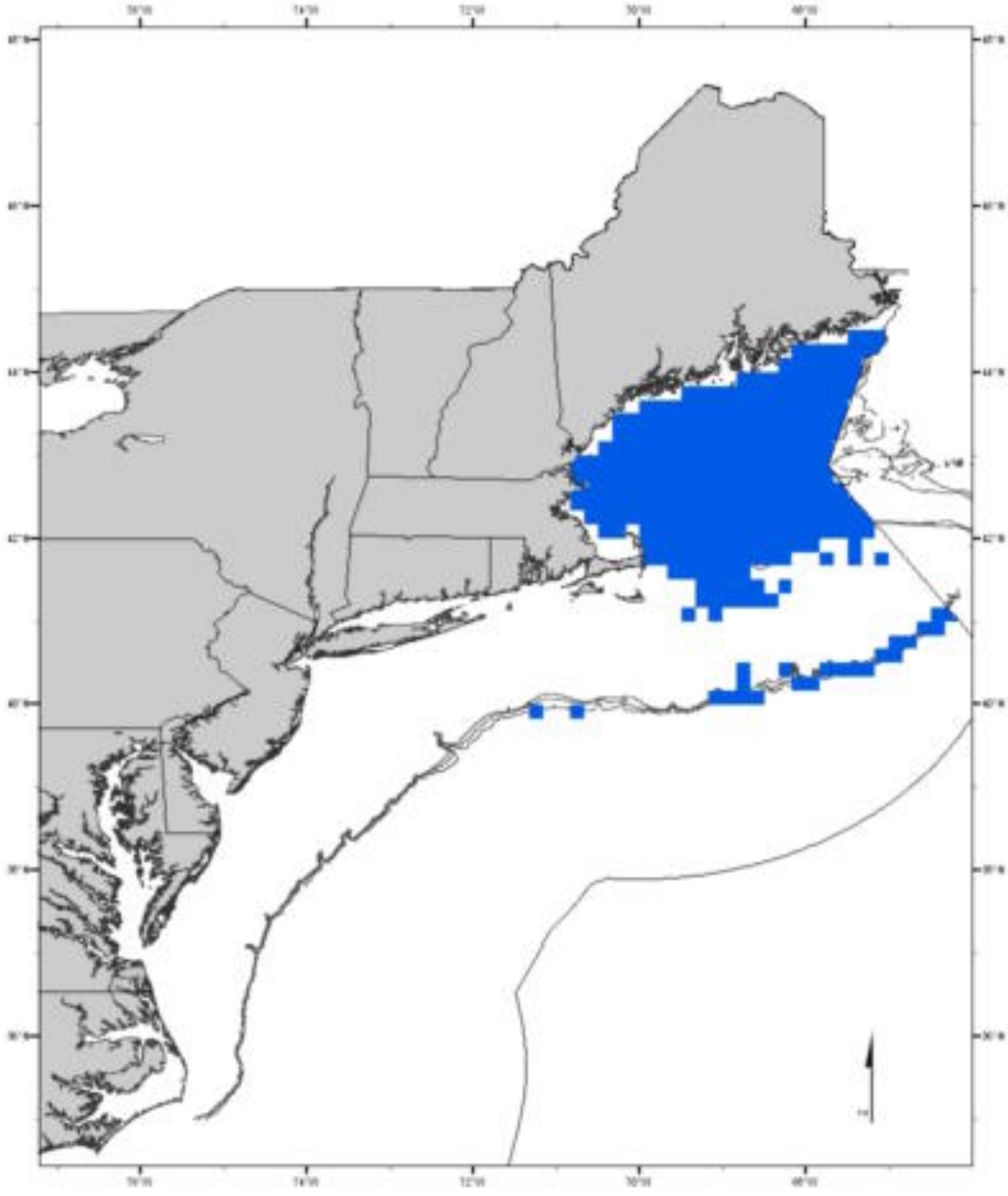
Juveniles: Bottom habitats with a substrate of silt, mud or hard bottom in the Gulf of Maine and on the southern edge of Georges Bank as depicted on Map 46. Generally, the following conditions exist where redfish juveniles are found: water temperatures below 13° C, depths from 25 - 400 meters, and a salinity range from 31 - 34‰.

Adults: Bottom habitats with a substrate of silt, mud or hard bottom in the Gulf of Maine and on the southern edge of Georges Bank as depicted on Map 47. Generally, the following conditions exist where redfish adults are found: water temperatures below 13° C, depths from 50 - 350 meters, and a salinity range from 31 - 34‰.

Spawning Adults: Bottom habitats with a substrate of silt, mud or hard bottom in the Gulf of Maine and on the southern edge of Georges Bank as depicted on Map 47. Generally, the following conditions exist where redfish adults are found: water temperatures below 13° C, depths from 50 - 350 meters, and a salinity range from 31 - 34‰. Redfish females are most often observed spawning (larvae) during the months from April through August.

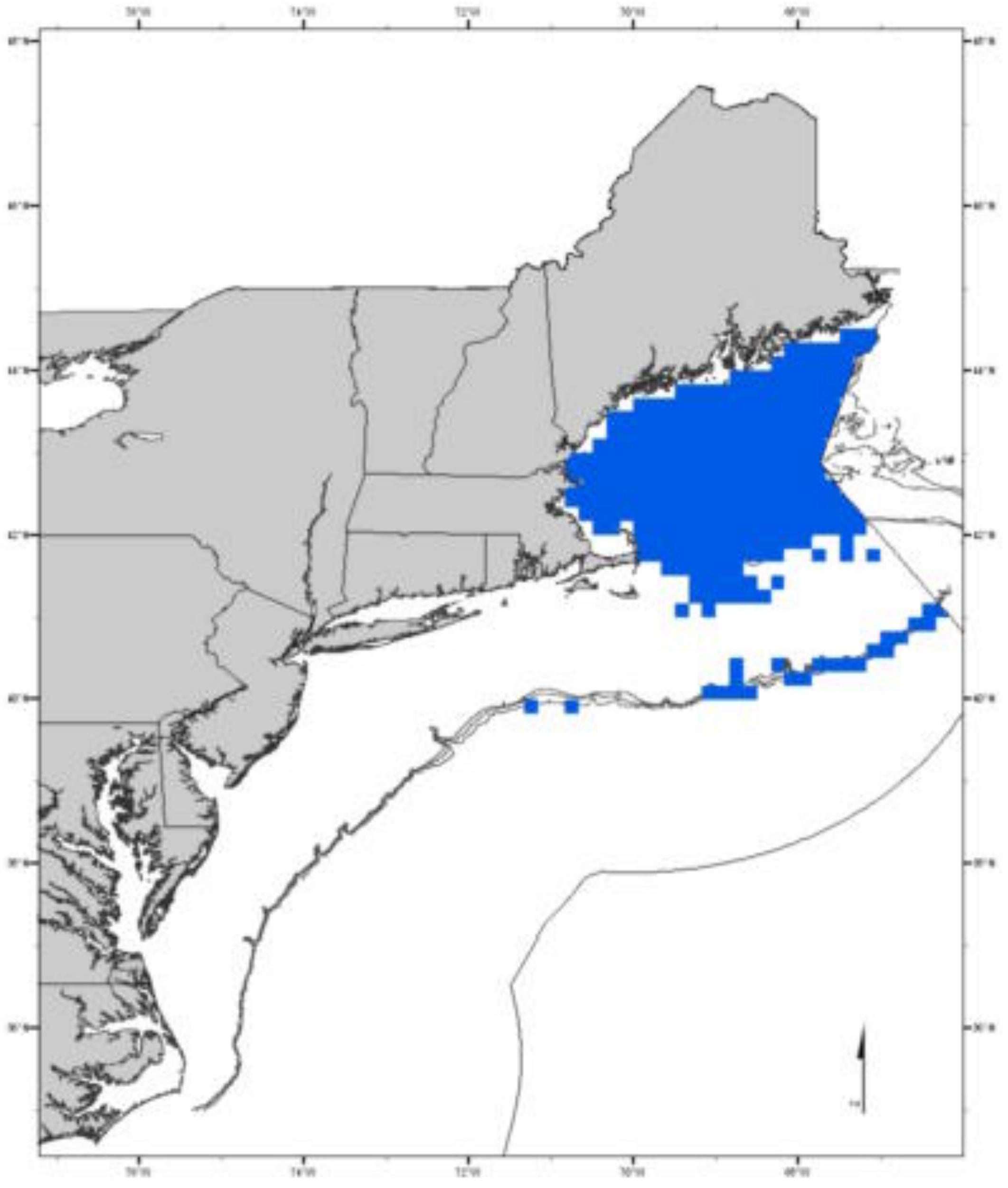
The Council acknowledges potential seasonal and spatial variability of the conditions generally associated with this species.

Map 45. Redfish larvae, Alternative 1 (No Action)



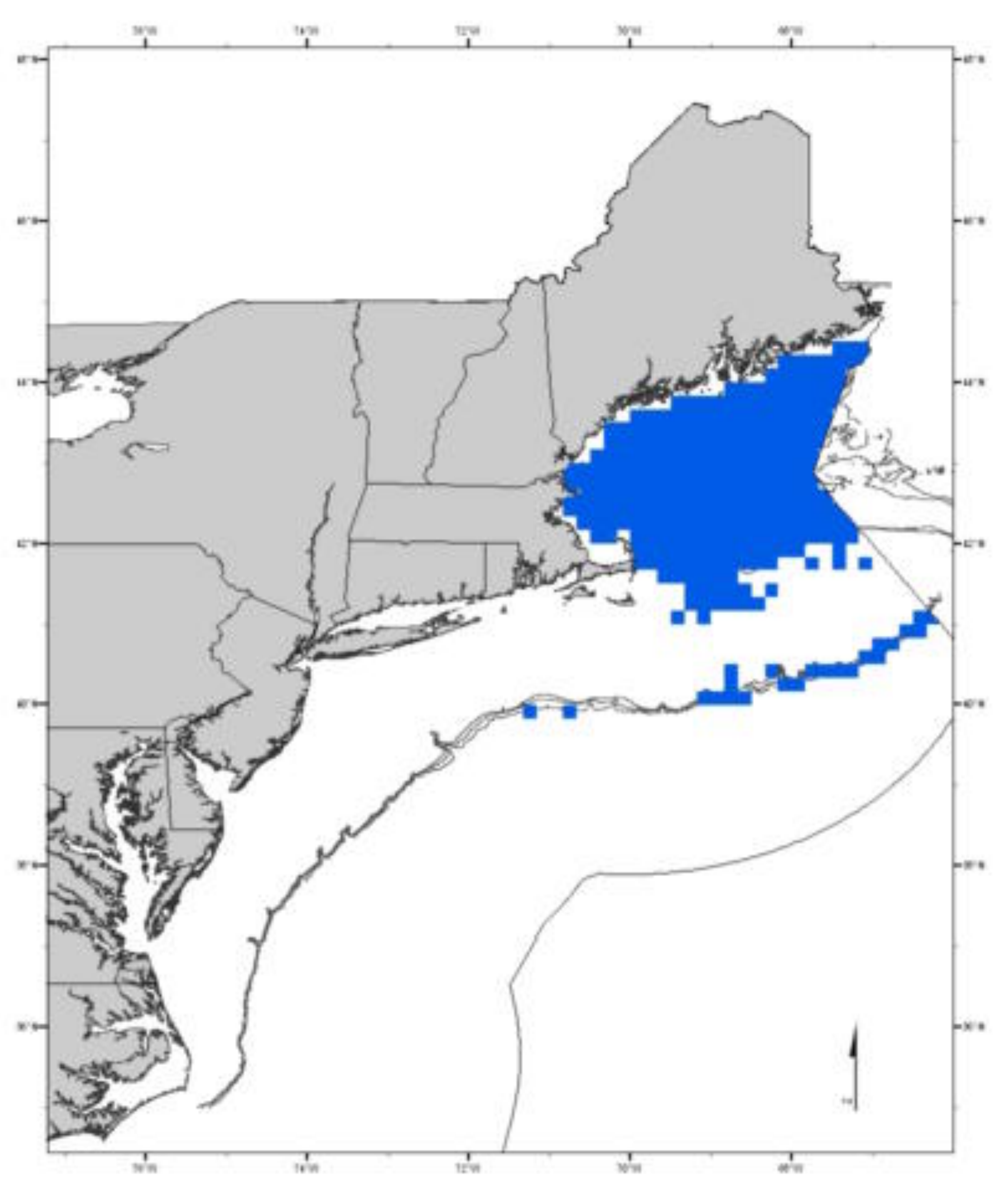
The EFH designation for redfish larvae is based upon alternative 4 for redfish adults. The larvae distribution was very patchy and does not point to areas of relatively high concentrations, so the adult distribution serves as a proxy to identify those areas where redfish larvae are most likely to be. This alternative was selected in order to include important areas in the historical range of redfish on the southeastern portion of Georges Bank, as well as to reflect that the entire Gulf of Maine is important redfish habitat.

Map 46. Redfish juveniles, Alternative 1 (No Action)



The EFH designation for juvenile redfish is based upon alternative 4 for redfish adults. This alternative was selected in order to include important areas in the historical range of redfish on the southeastern portion of Georges Bank, as well as to reflect that the entire Gulf of Maine is important redfish habitat. This species is very long lived and has tight habitat associations that are important to several life history stages, especially juveniles. The Council chose to be as conservative as possible in the EFH designation.

Map 47. Redfish adults, Alternative 1 (No Action)



The EFH designation for adult redfish is based upon alternative 4 for redfish adults. This alternative was selected in order to include important areas in the historical range of redfish on the southeastern portion of Georges Bank, as well as to reflect that the entire Gulf of Maine is important redfish habitat. This species is very long lived and has tight habitat associations that are important to several life history stages. The Council chose to be as conservative as possible in the EFH designation.

4.1.1.2.16 Rosette Skate (Leucoraja garmani)

In its *Report to Congress: Status of the Fisheries of the United States* (January 2001), NMFS determined that rosette skate is not in an overfished condition, based on stock size assessment. Because recent assessments determined that more information is needed to draw valid conclusions regarding the status of this stock, it is not known whether overfishing is occurring. For rosette skate, essential fish habitat is described as those areas of coastal and offshore waters (out to the offshore U.S. boundary of the exclusive economic zone) that are designated on Map 48 – Map 49 and meet the following conditions:

Eggs: There is no information available on the habitat associations or distribution of the egg stage for this species.

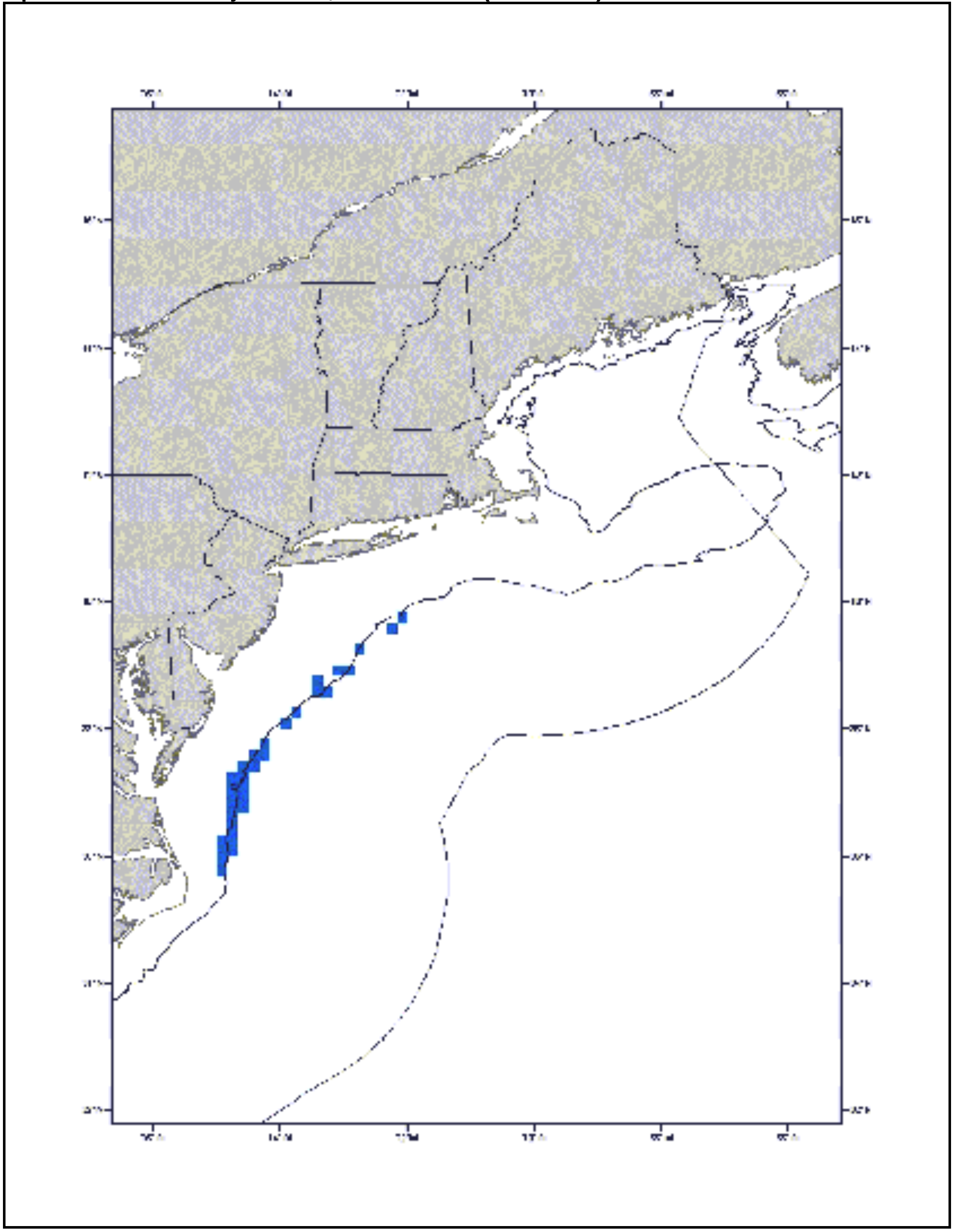
Larvae: No larval life stage exists for this species. Upon hatching, they are fully developed juveniles (ELMR Report Number 12, March 1994).

Juveniles: Bottom habitats with a soft substrate, including sand/mud bottoms, mud with echinoid and ophuiroid fragments, and shell and pteropod ooze, ranging from Nantucket Shoals and southern edge of Georges Bank to Cape Hatteras, North Carolina as depicted on Map 48. Generally, the following conditions exist where rosette skate juveniles are found: *Depth:* Occurs from 33-530 meters but is most common between 74-274 meters. Rosette skate may have a more limited depth range in the southern part of its geographic range. *Temperature:* Most found at a temperature range of 5.3-15 °C but collected in waters as low as 4 °C and high as 25 °C.

Adults: Bottom habitats with a soft substrate, including sand/mud bottoms, mud with echinoid and ophuiroid fragments, and shell and pteropod ooze, ranging from Nantucket Shoals and southern edge of Georges Bank to Cape Hatteras, North Carolina as depicted on Map 49. Generally, the following conditions exist where rosette skate adults are found: *Depth:* Occurs from 33-530 meters but is most common between 74-274 meters. Rosette skate may have a more limited depth range in the southern part of its geographic range. *Temperature:* Most found at a temperature range of 5.3-15 °C but collected in waters as low as 4 °C and high as 25 °C.

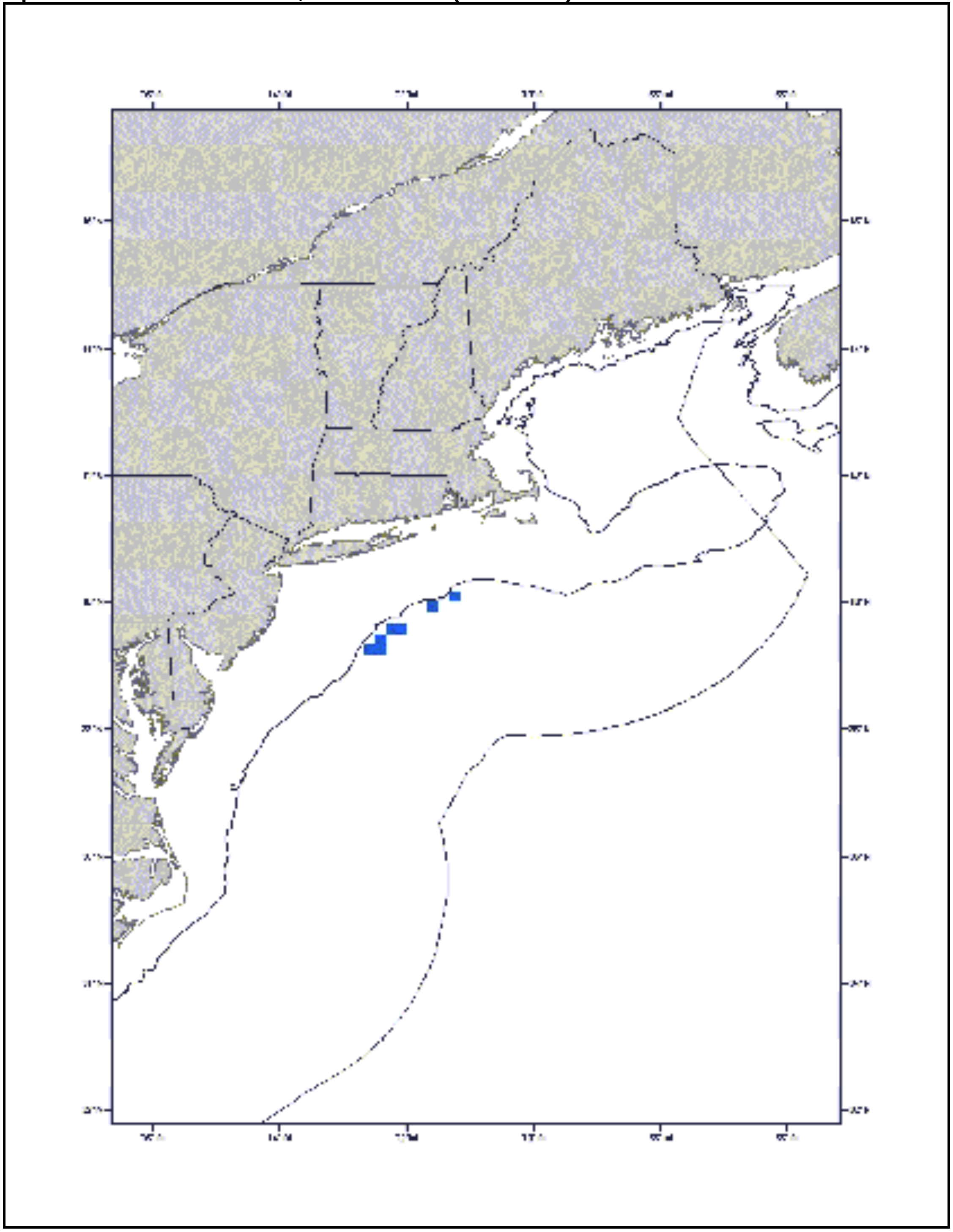
The Council acknowledges that there may be some potential seasonal and spatial variability of the environmental conditions generally associated with this species.

Map 48. Rosette skate juveniles, Alternative 1 (No Action)



This map represents an option for the designation of EFH for this life history stage based on the areas of highest relative abundance of this species, based on the NMFS trawl survey (1963 - 1999). Only habitats with a soft substrate, including sand/mud bottoms, mud with echinoid and ophuiroid fragments, and shell and pteropod ooze that occur within the shaded areas would be designated as EFH. This option represents 63% of the observed range of this life stage.

Map 49. Rosette skate adults, Alternative 1 (No Action)



This map represents an option for the designation of EFH for this life history stage based on the areas of highest relative abundance of this species, based on the NMFS trawl survey (1963 - 1999). Only habitats with a soft substrate, including sand/mud bottoms, mud with echinoid and ophuiroid fragments, and shell and pteropod ooze that occur within the shaded areas would be designated as EFH. This option represents 70% of the observed range of this life stage.

4.1.1.2.17 Silver hake (Merluccius bilinearis)

In its *Report to Congress: Status of the Fisheries of the United States* (September 1997), NMFS determined the Southern Georges Bank / Middle Atlantic stock of silver hake is considered overfished, based on an assessment of the stock level. The Gulf of Maine / Northern Georges Bank stock of silver hake is not considered currently overfished but it is considered to be approaching an overfished condition, also based on the stock level associated with this stock. Essential Fish Habitat for silver hake is described as those areas of the coastal and offshore waters (out to the offshore U.S. boundary of the exclusive economic zone) that are designated on Map 50 - Map 53 and in the accompanying table and meet the following conditions:

Eggs: Surface waters of the Gulf of Maine, Georges Bank, the continental shelf off southern New England, and the middle Atlantic south to Cape Hatteras as depicted on Map 50. Generally, the following conditions exist where most silver hake eggs are found: sea surface temperatures below 20° C and water depths between 50 and 150 meters. Silver hake eggs are observed all year, with peaks from June through October.

Larvae: Surface waters of the Gulf of Maine, Georges Bank, the continental shelf off southern New England, and the middle Atlantic south to Cape Hatteras as depicted on Map 51. Generally, the following conditions exist where most silver hake larvae are found: sea surface temperatures below 20° C and water depths between 50 and 130 meters. Silver hake larvae are observed all year, with peaks from July through September.

Juveniles: Bottom habitats of all substrate types in the Gulf of Maine, on Georges Bank, the continental shelf off southern New England, and the middle Atlantic south to Cape Hatteras as depicted on Map 52. Generally, the following conditions exist where most silver hake juveniles are found: water temperatures below 21° C, depths between 20 and 270 meters and salinities greater than 20‰.

Adults: Bottom habitats of all substrate types in the Gulf of Maine, on Georges Bank, the continental shelf off southern New England, and the middle Atlantic south to Cape Hatteras as depicted on Map 53. Generally, the following conditions exist where most silver hake adults are found: water temperatures below 22° C and depths between 30 and 325 meters.

Spawning Adults: Bottom habitats of all substrate types in the Gulf of Maine, on Georges Bank, the continental shelf off southern New England, and the middle Atlantic south to Cape Hatteras as depicted on Map 53. Generally, the following conditions exist where most spawning silver hake adults are found: water temperatures below 13° C and depths between 30 and 325 meters.

All of the above EFH descriptions include those bays and estuaries listed on the following table, according to life history stage. The Council acknowledges potential seasonal and spatial variability of the conditions generally associated with this species.

Table 17. EFH Designation of Estuaries and Embayments: Silver hake (Merluccius bilinearis)

Estuaries and Embayments	Eggs	Larvae	Juveniles	Adults	Spawning Adults
Passamaquoddy Bay			m,s	m,s	
Englishman/Machias Bay			m,s	m,s	
Narraguagus Bay			m,s	m,s	
Blue Hill Bay			m,s	m,s	
Penobscot Bay			m,s	m,s	
Muscongus Bay			m,s	m,s	
Damariscotta River			m,s	m,s	
Sheepscot River			m,s	m,s	
Kennebec / Androscoggin Rivers			m,s	m,s	
Casco Bay			m,s	m,s	
Saco Bay					
Wells Harbor					
Great Bay					
Merrimack River	m				
Massachusetts Bay	s	s	s	s	s
Boston Harbor	s	s	m,s	m,s	
Cape Cod Bay	s	s	m,s	m,s	s
Waquoit Bay					
Buzzards Bay					
Narragansett Bay					
Long Island Sound					
Connecticut River					
Gardiners Bay					
Great South Bay					
Hudson River / Raritan Bay					
Barnegat Bay					
Delaware Bay					
Chincoteague Bay					
Chesapeake Bay					

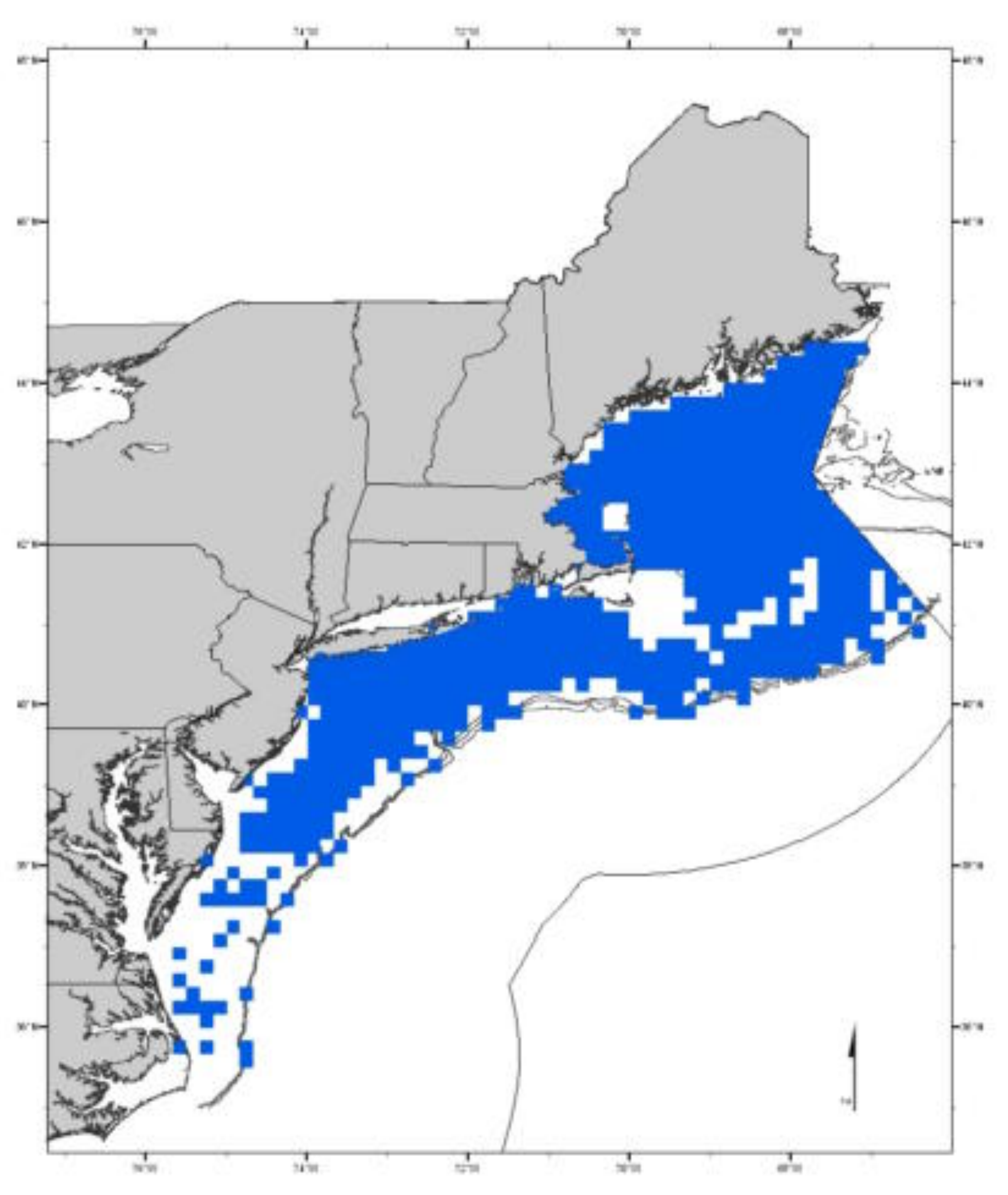
S ≡ The EFH designation for this species includes the seawater salinity zone of this bay or estuary (salinity > 25.0‰).

M ≡ The EFH designation for this species includes the mixing water / brackish salinity zone of this bay or

estuary (0.5 < salinity < 25.0‰).
F ≡ The EFH designation for this species includes the tidal freshwater salinity zone of this bay or estuary (0.0 < salinity < 0.5‰).

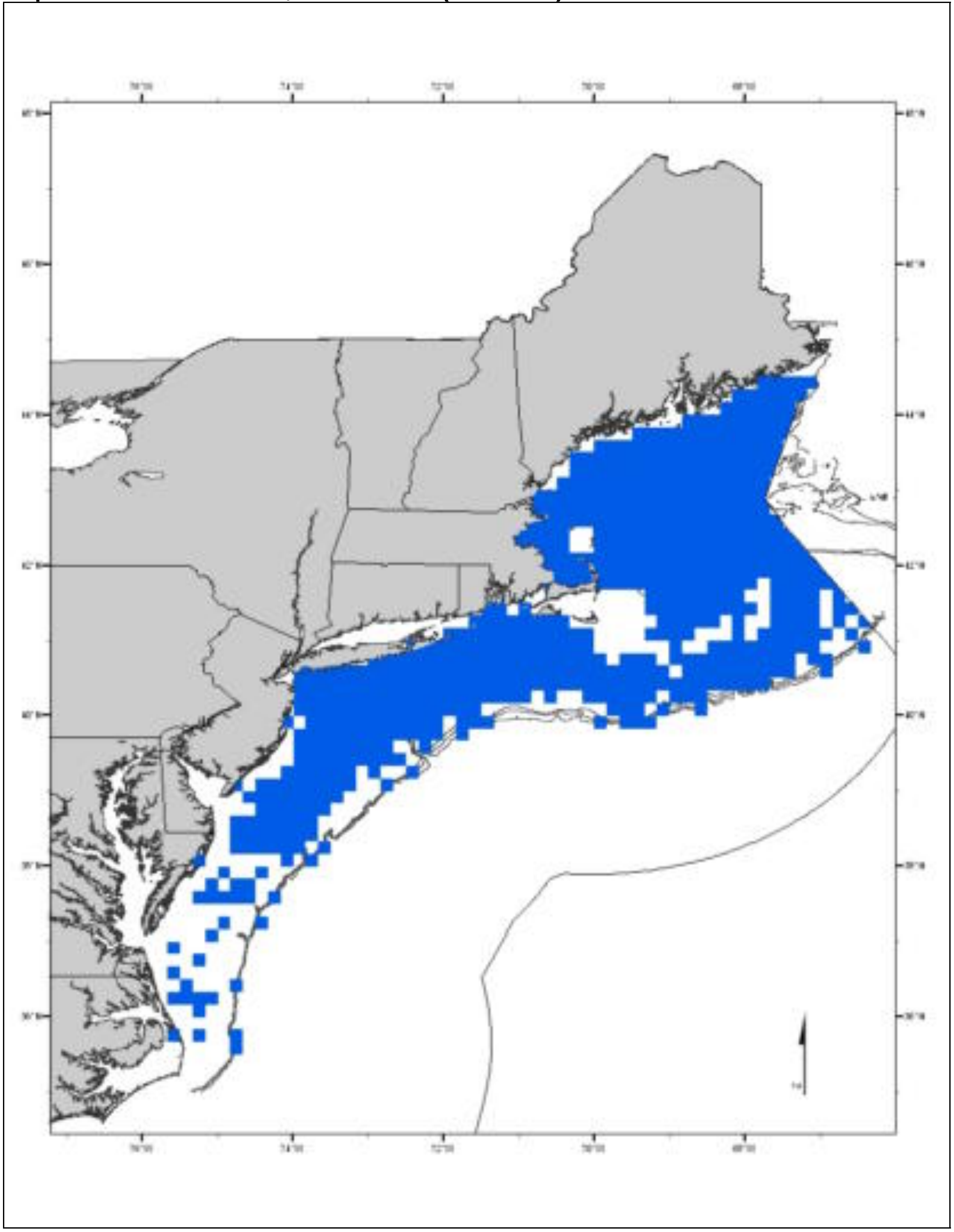
These EFH designations of estuaries and embayments are based on the NOAA Estuarine Living Marine Resources (ELMR) program (Jury et al. 1994; Stone et al. 1994). For a detailed view of the salinity zone boundaries, as described in the ELMR reports, please see Appendix B. The Council recognizes the spatial and temporal variability of estuarine and embayment environmental conditions generally associated with this species.

Map 50. Silver hake eggs, Alternative 1 (No Action)



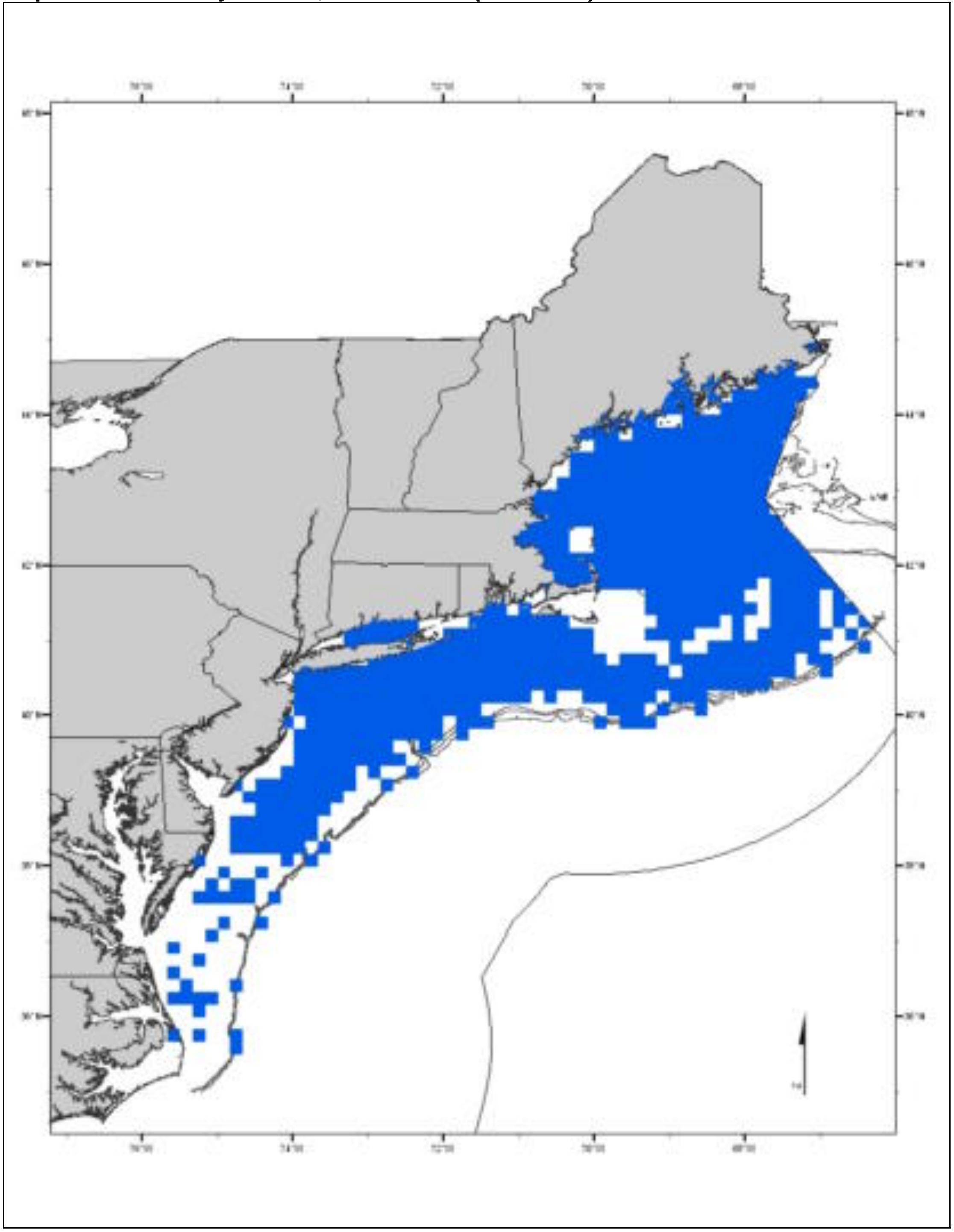
The EFH designation for silver hake eggs is based upon alternative 3 for silver hake juveniles. Silver hake spawn in the summer months in the Gulf of Maine, but there has been very limited MARMAP sampling during this period. This is thought to explain why there have been few eggs observed in the Gulf of Maine despite the high concentrations of juveniles and adults. The use of the juvenile distribution serves as a proxy to identify those areas where silver hake eggs are most likely to be. The EFH designation also includes those bays and estuaries identified by the NOAA ELMR program as supporting silver hake eggs at the "common" or "abundant" level.

Map 51. Silver hake larvae, Alternative 1 (No Action)



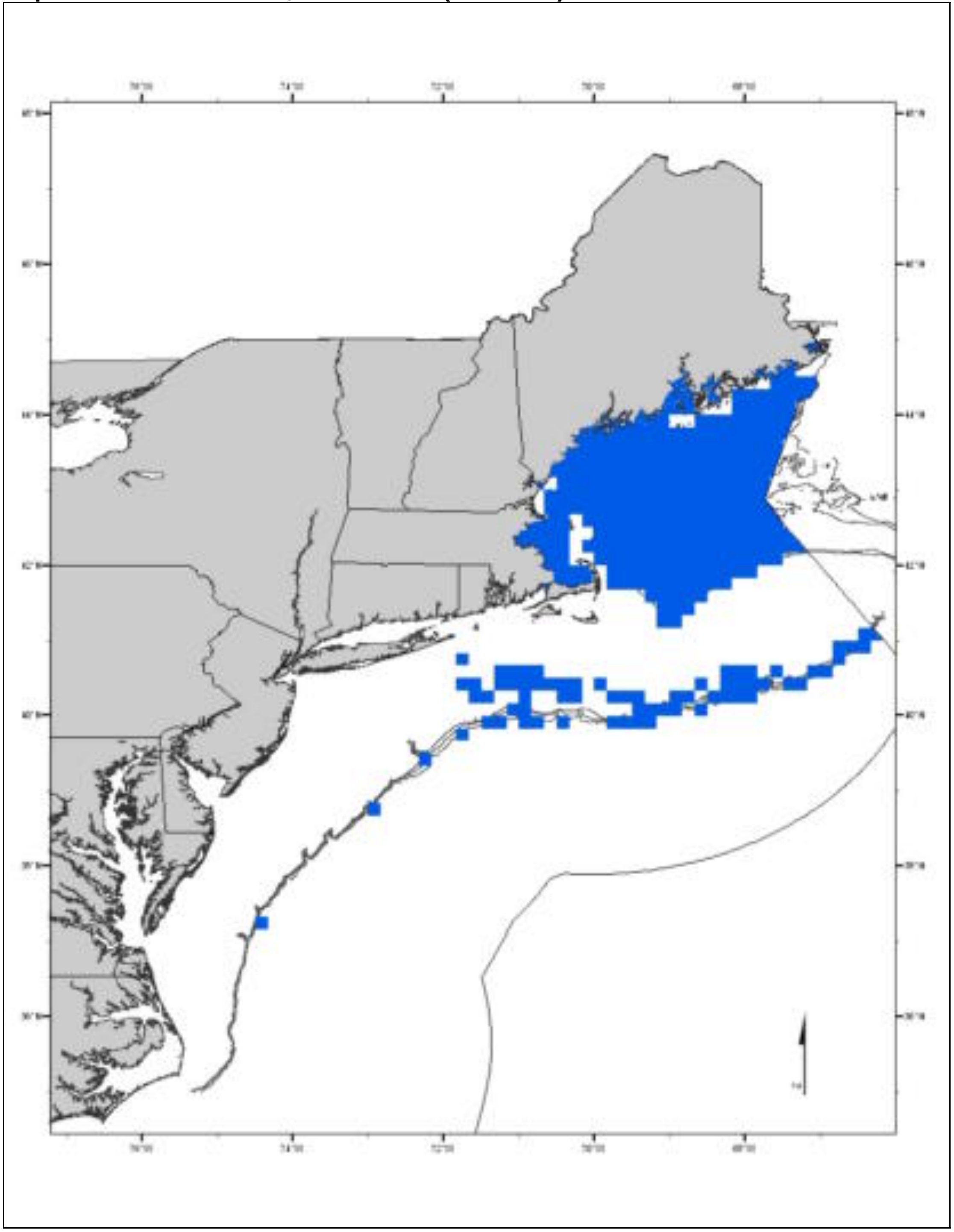
The EFH designation for silver hake larvae is based upon alternative 3 for silver hake juveniles. Silver hake spawn in the summer months in the Gulf of Maine, but there has been very limited MARMAP sampling during this period. This is thought to explain why there have been very few larvae observed in the Gulf of Maine despite the high concentrations of juveniles and adults. The use of the juvenile distribution serves as a proxy to identify those areas where silver hake larvae are most likely to be. The EFH designations also include those bays and estuaries identified by the NOAA ELMR program as supporting silver hake larvae at the "common" or "abundant" level. The light shading represents the entire observed range of silver hake larvae.

Map 52. Silver hake juveniles, Alternative 1 (No Action)



The EFH designation for juvenile silver hake is based upon alternative 3 for silver hake juveniles. The EFH designations also include the areas identified by the fishing industry and the inshore surveys as important for silver hake, as well as those bays and estuaries identified by the NOAA ELMR program as supporting juvenile silver hake at the "common" or "abundant" level. The other alternatives were not selected because they either include too little area (less than half of the range of this overfished species), or include areas where silver hake occur in relatively low concentrations.

Map 53. Silver hake adults, Alternative 1 (No Action)



The EFH designation for adult silver hake is based upon alternative 3 for silver hake adults. The EFH designations also include the areas identified by the fishing industry and the inshore surveys as important for silver hake, as well as those bays and estuaries identified by the NOAA ELMR program as supporting adult silver hake at the "common" or "abundant" level. The other alternatives were not selected because they either include too little area (less than half of the range of this overfished species), or include areas where silver hake occur in relatively low concentrations..

4.1.1.2.18 Smooth Skate (Malacoraja senta)

In its *Report to Congress: Status of the Fisheries of the United States* (January 2001), NMFS determined that smooth skate is in an overfished condition, based on stock size assessment. Because recent assessments determined that more information is needed to draw valid conclusions regarding the status of this stock, it is not known whether overfishing is occurring. For smooth skate, essential fish habitat is described as those areas of coastal and offshore waters (out to the offshore U.S. boundary of the exclusive economic zone) that are designated on Map 54 – Map 55 and meet the following conditions:

Eggs: There is no information available on the habitat associations or distribution of the egg stage for this species.

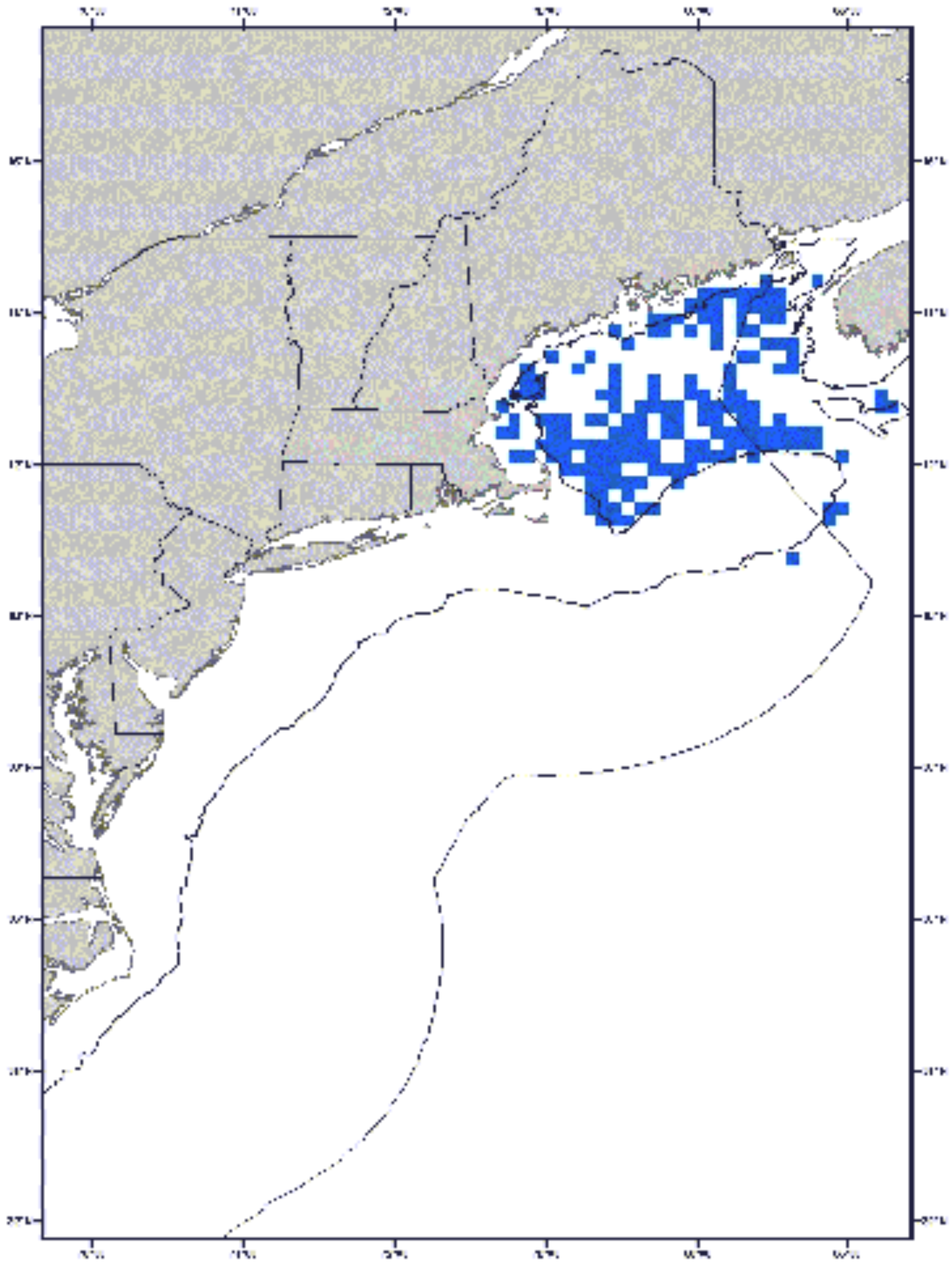
Larvae: No larval life stage exists for this species. Upon hatching, they are fully developed juveniles (ELMR Report Number 12, March 1994).

Juveniles: Bottom habitats with a substrate of soft mud (silt and clay) bottoms and also on sand, broken shells, gravel and pebbles on offshore banks of the Gulf of Maine as depicted on Map 54. Generally, the following conditions exist where smooth skate juveniles are found: *Depth:* Found at depths from 31-874 meters and most abundant between 110-457 meters. *Temperature:* Found over a range of 1-16 °C with most found between 5-7 °C.

Adults: Bottom habitats with a substrate of soft mud (silt and clay) bottoms and also on sand, broken shells, gravel and pebbles on offshore banks of the Gulf of Maine as depicted on Map 55. Generally, the following conditions exist where smooth skate adults are found: *Depth:* Found at depths from 31-874 meters and most abundant between 110-457 meters. *Temperature:* Found over a range of 1-16 °C with most found between 5-7 °C.

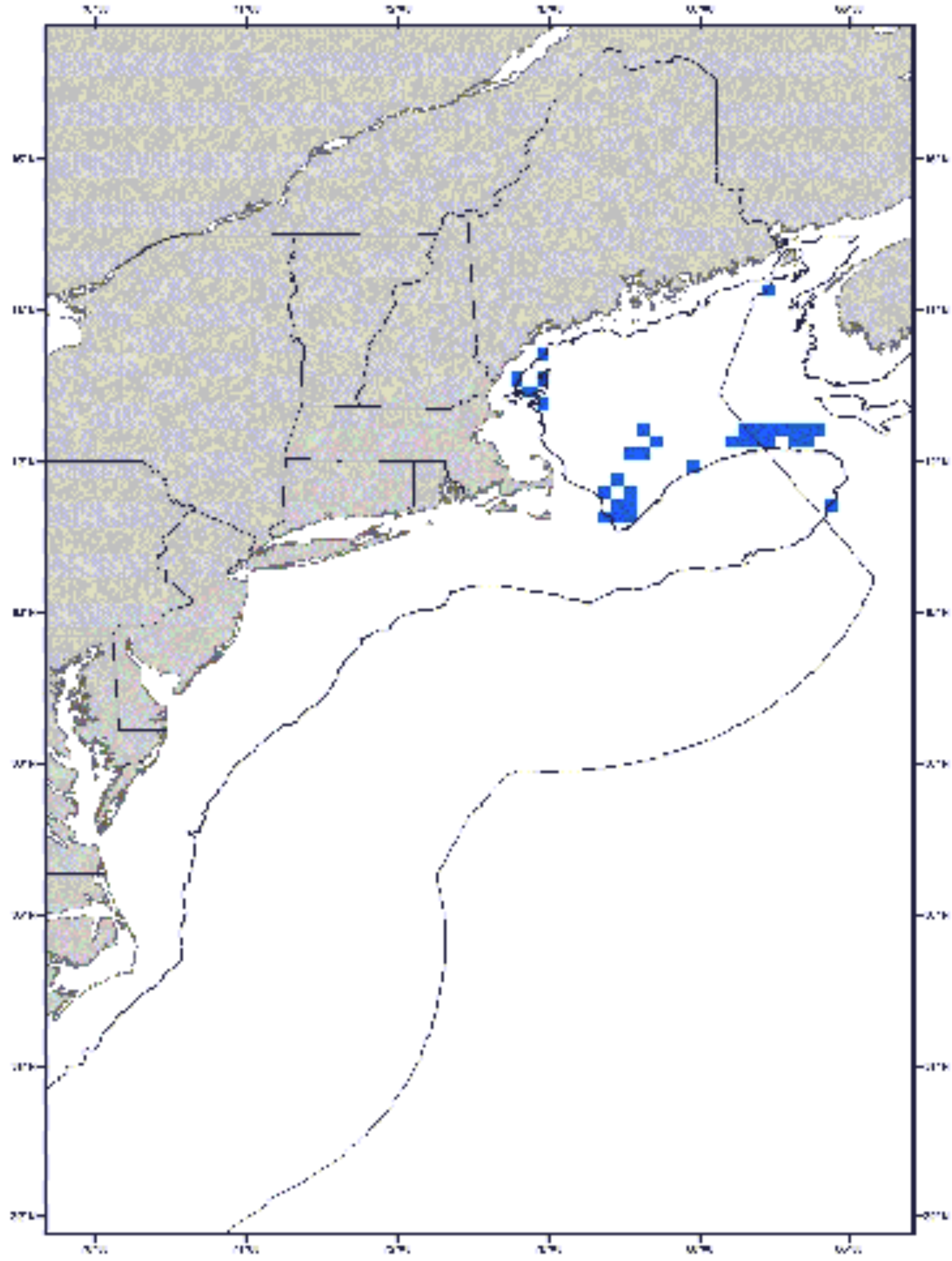
The Council acknowledges that there may be some potential seasonal and spatial variability of the environmental conditions generally associated with this species.

Map 54. Smooth skate juveniles, Alternative 1 (No Action)



This map represents an option for the designation of EFH for this life history stage based on the areas of highest relative abundance of this species, based on the NMFS trawl survey (1963 - 1999). Only habitats with a substrate of soft mud and also on sand, broken shells, gravel and pebbles that occur within the shaded areas would be designated as EFH. This option represents 63% of the observed range of this life stage.

Map 55. Smooth skate adults, Alternative 1 (No Action)



This map represents an option for the designation of EFH for this life history stage based on the areas of highest relative abundance of this species, based on the NMFS trawl survey (1963 - 1999). Only habitats with a substrate of soft mud and also on sand, broken shells, gravel and pebbles that occur within the shaded areas would be designated as EFH. This option represents 70% of the observed range of this life stage.

4.1.1.2.19 Thorny Skate (Amblyraja radiata)

In its *Report to Congress: Status of the Fisheries of the United States* (January 2001), NMFS determined that thorny skate is in an overfished condition, based on stock size assessment. Because recent assessments determined that more information is needed to draw valid conclusions regarding the status of this stock, it is not known whether overfishing is occurring. For thorny skate, essential fish habitat is described as those areas of coastal and offshore waters (out to the offshore U.S. boundary of the exclusive economic zone Map 56 – Map 57 and meet the following conditions:

Eggs: There is no information available on the habitat associations or distribution of the egg stage for this species.

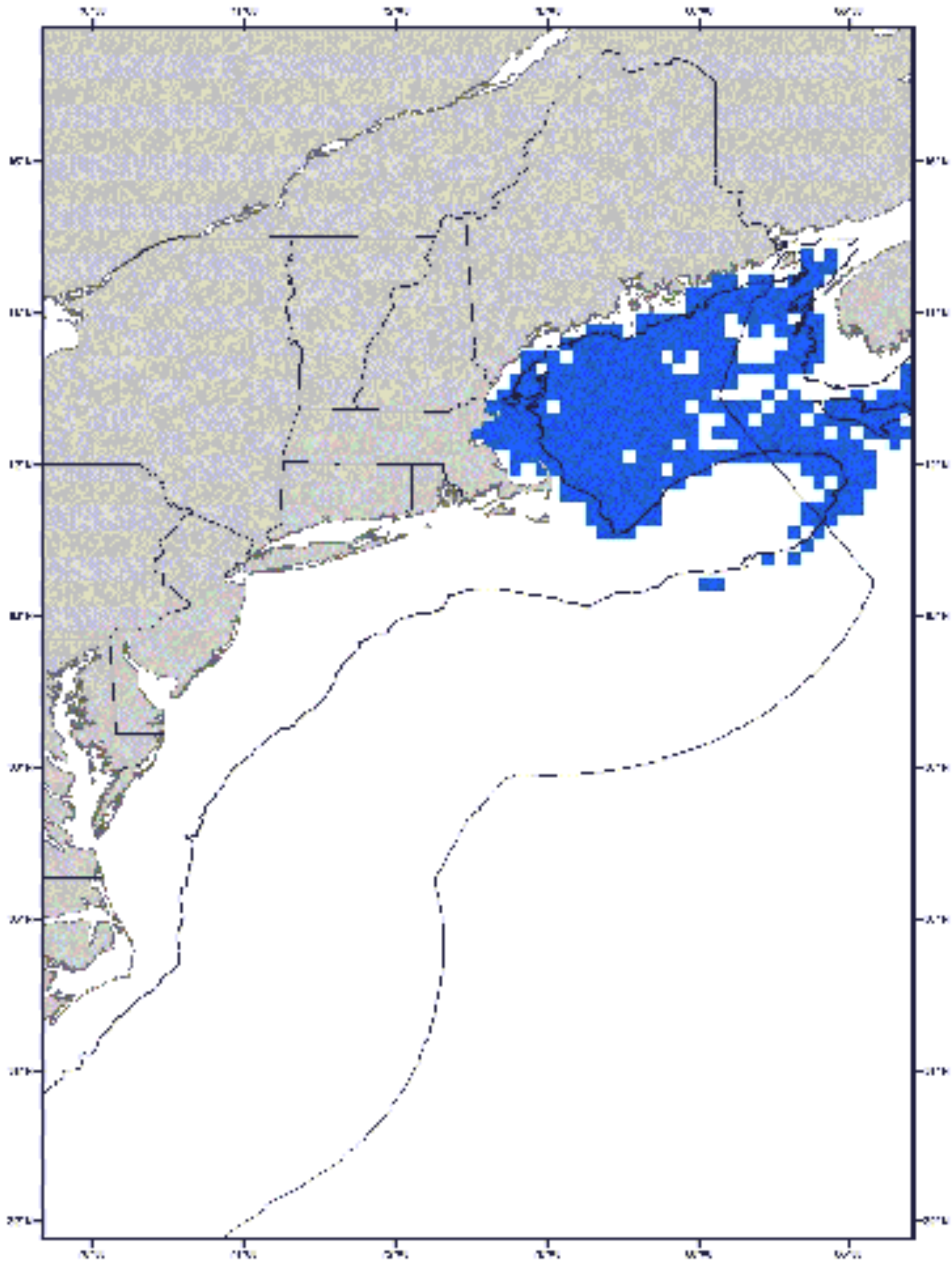
Larvae: No larval life stage exists for this species. Upon hatching, they are fully developed juveniles (ELMR Report Number 12, March 1994).

Juveniles: Bottom habitats with a substrate of sand, gravel, broken shell, pebbles, and soft mud in the Gulf of Maine and Georges Bank as depicted on Map 56. Generally, the following conditions exist where thorny skate juveniles are found: *Depth:* The full depth range is from 18-2000 meters, but they are most abundant between 111-366 meters. T*emperature:* Juveniles are found in waters with temperatures ranging from –1.3 °C to 17 °C, with most found between 5-9 °C.

Adults: Bottom habitats with a substrate of sand, gravel, broken shell, pebbles, and soft mud in the Gulf of Maine and Georges Bank as depicted on Map 57. Generally, the following conditions exist where thorny skate adults are found: *Depth:* The full depth range is from 18-2000 meters, but they are most abundant between 111-366 meters. *Temperature:* Adults are found in waters with temperatures ranging from –1.3 °C to 17 °C, with most found between 5-8 °C.

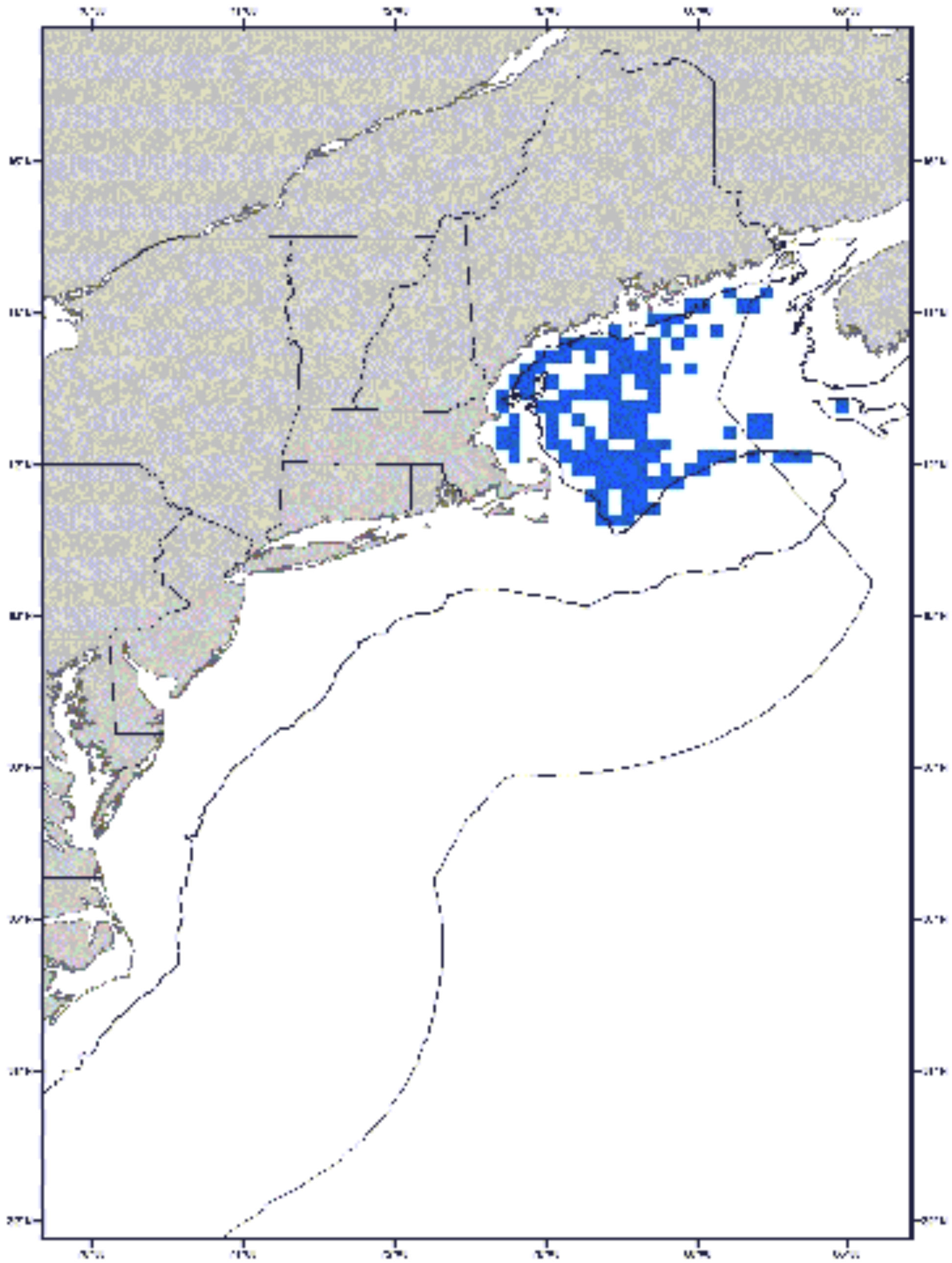
A table presenting summary information on the habitat affinities and requirements for each life stage of thorny skate is provided in Appendix A of Volume III of this FMP. The Council acknowledges that there may be some potential seasonal and spatial variability of the environmental conditions generally associated with this species.

Map 56. Thorny skate juveniles, Alternative 1 (No Action)



This map represents an option for the designation of EFH for this life history stage based on the areas of highest relative abundance of this species, based on the NMFS trawl survey (1963 - 1999). Only habitats with a substrate of sand, gravel, broken shell, pebbles, and soft mud that occur within the shaded areas would be designated as EFH. This option represents 66% of the observed range of this life stage.

Map 57. Thorny skate adults, Alternative 1 (No Action)



This map represents an option for the designation of EFH for this life history stage based on the areas of highest relative abundance of this species, based on the NMFS trawl survey (1963 - 1999). Only habitats with a substrate of sand, gravel, broken shell, pebbles, and soft mud that occur within the shaded areas would be designated as EFH. This option represents 66% of the observed range of this life stage.

4.1.1.2.20 White hake (Urophycis tenuis)

In its *Report to Congress: Status of the Fisheries of the United States* (September 1997), NMFS determined white hake is not currently overfished, but it is approaching an overfished condition. This determination is based on an assessment of stock level. Essential Fish Habitat for white hake is described as those areas of the coastal and offshore waters (out to the offshore U.S. boundary of the exclusive economic zone) that are designated on Map 58 - Map 61 and in the accompanying table and meet the following conditions:

Eggs: Surface waters of the Gulf of Maine, Georges Bank, and southern New England as depicted on Map 58. White hake eggs are most often observed in August and September.

Larvae: Pelagic waters of the Gulf of Maine, the southern edge of Georges Bank, and southern New England to the middle Atlantic as depicted on Map 59. White hake larvae are most often observed in May in the mid-Atlantic area and August and September in the Gulf of Maine and Georges Bank.

Juveniles: *Pelagic stage* -- Pelagic waters of the Gulf of Maine, the southern edge of Georges Bank, and southern New England to the middle Atlantic as depicted on Map 60. White hake juveniles in the pelagic stage are most often observed from May through September. *Demersal stage* -- Bottom habitats with seagrass beds or a substrate of mud or fine-grained sand in the Gulf of Maine, the southern edge of Georges Bank, and southern New England to the middle Atlantic as depicted on Map 60. Generally, the following conditions exist where white hake juveniles are found: water temperatures below 19° C and depths from 5 - 225 meters.

Adults: Bottom habitats with a substrate of mud or fine-grained sand in the Gulf of Maine, the southern edge of Georges Bank, and southern New England to the middle Atlantic as depicted on Map 61. Generally, the following conditions exist where white hake adults are found: water temperatures below 14° C and depths from 5 - 325 meters.

Spawning Adults: Bottom habitats with a substrate of mud or fine-grained sand in deep water in the Gulf of Maine, the southern edge of Georges Bank, and southern New England to the middle Atlantic as depicted on Map 61. Generally, the following conditions exist where white hake adults are found: water temperatures below 14° C and depths from 5 - 325 meters. White hake are most often observed spawning during the months April - May in the southern portion of their range and August - September in the northern portion of their range.

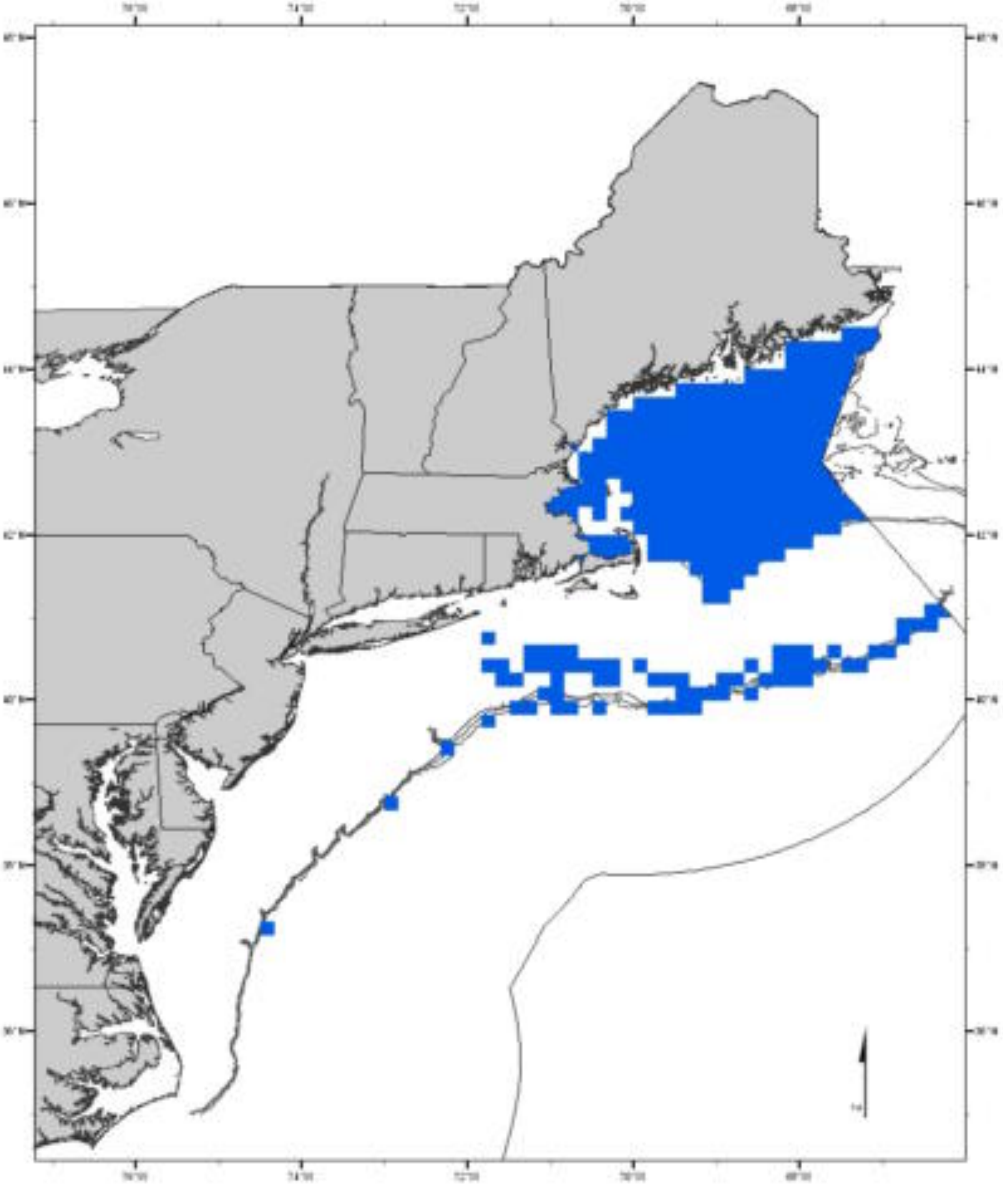
All of the above EFH descriptions include those bays and estuaries listed on the following table, according to life history stage. The Council acknowledges potential seasonal and spatial variability of the conditions generally associated with this species.

Table 18. EFH Designation of Estuaries and Embayments: White hake (Urophycis tenuis)

Estuaries and Embayments	Eggs	Larvae	Juveniles	Adults	Spawning Adults
Passamaquoddy Bay			m,s	m,s	
Englishman/Machias Bay			m,s	s	
Narraguagus Bay			m,s	s	
Blue Hill Bay			m,s	s	
Penobscot Bay			m,s	s	
Muscongus Bay			m,s	m,s	
Damariscotta River			m,s	m,s	
Sheepscot River			m,s	m,s	
Kennebec / Androscoggin Rivers			m,s	m,s	
Casco Bay			m,s	m,s	
Saco Bay			m,s	m,s	
Wells Harbor			m,s	m,s	
Great Bay	s		s	s	
Merrimack River	m				
Massachusetts Bay	s	s	s	s	
Boston Harbor	s	s	s	s	
Cape Cod Bay	s	s	m,s	m,s	
Waquoit Bay					
Buzzards Bay					
Narragansett Bay					
Long Island Sound					
Connecticut River					
Gardiners Bay					
Great South Bay					
Hudson River / Raritan Bay					
Barnegat Bay					
Delaware Bay					
Chincoteague Bay					
Chesapeake Bay					

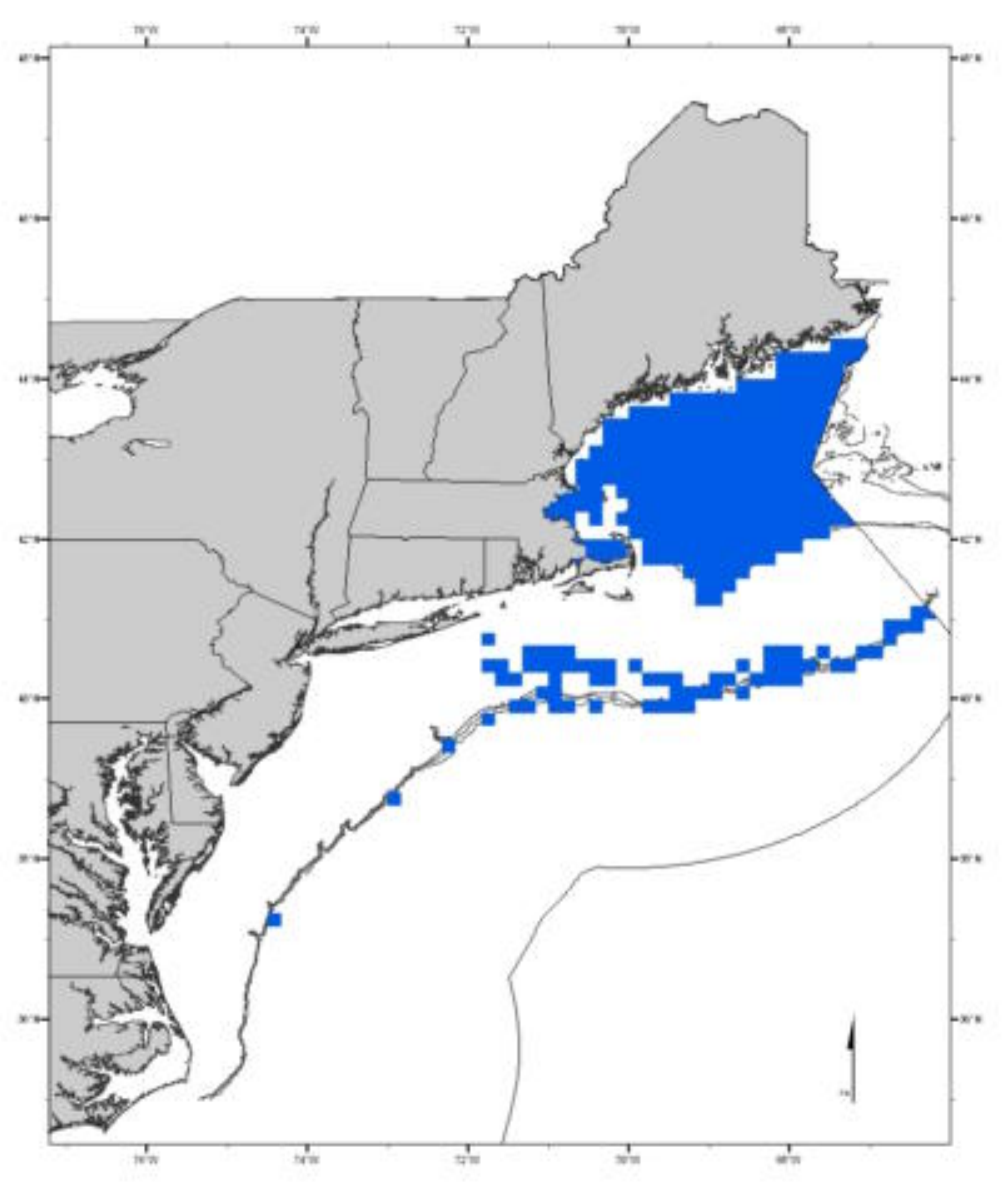
S ≡ The EFH designation for this species includes the seawater salinity zone of this bay or estuary (salinity > 25.0‰).
M ≡ The EFH designation for this species includes the mixing water / brackish salinity zone of this bay or estuary (0.5 < salinity < 25.0‰).
F ≡ The EFH designation for this species includes the tidal freshwater salinity zone of this bay or estuary (0.0 < salinity < 0.5‰).
These EFH designations of estuaries and embayments are based on the NOAA Estuarine Living Marine Resources (ELMR) program (Jury et al. 1994; Stone et al. 1994). For a detailed view of the salinity zone boundaries, as described in the ELMR reports, please see Appendix B. The Council recognizes the spatial and temporal variability of estuarine and embayment environmental conditions generally associated with this species.

Map 58. White hake eggs, Alternative 1 (No Action)



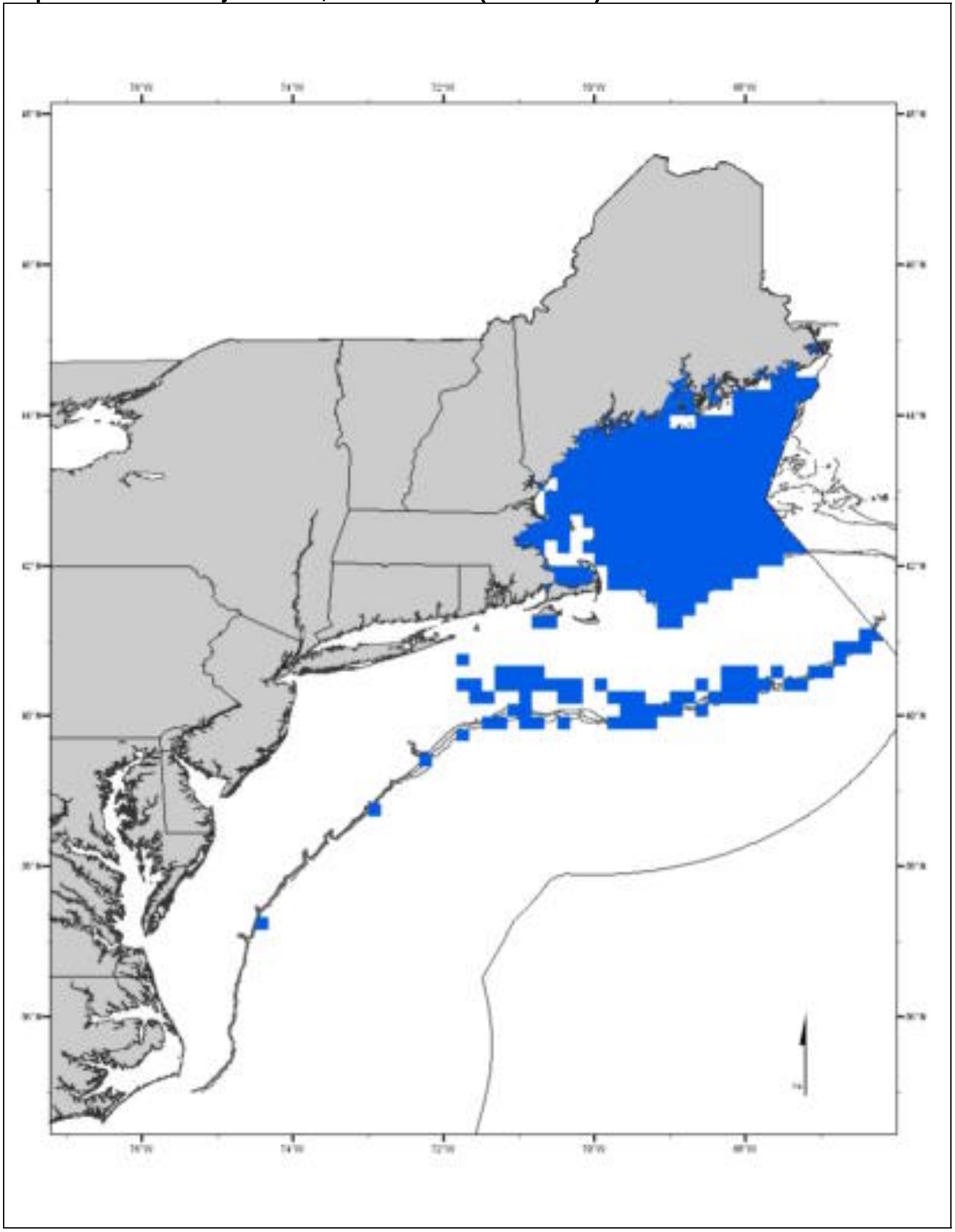
The EFH designation for white hake eggs is based upon alternative 3 for white hake adults. There are no data on white hake eggs, so the use of the adult distribution serves as a proxy to identify those areas where white hake eggs are most likely to be. Alternative 3 for adults includes all areas thought to be most important for eggs, including southern Georges Bank. The EFH designation includes those bays and estuaries identified by the NOAA ELMR program as supporting white hake eggs at the "common" or "abundant" level. The other alternatives were not selected because they either include too little area (not incorporating southern Georges Bank), or include areas where white hake occur in relatively low concentrations (throughout southern New England and the middle Atlantic).

Map 59. White hake larvae, Alternative 1 (No Action)



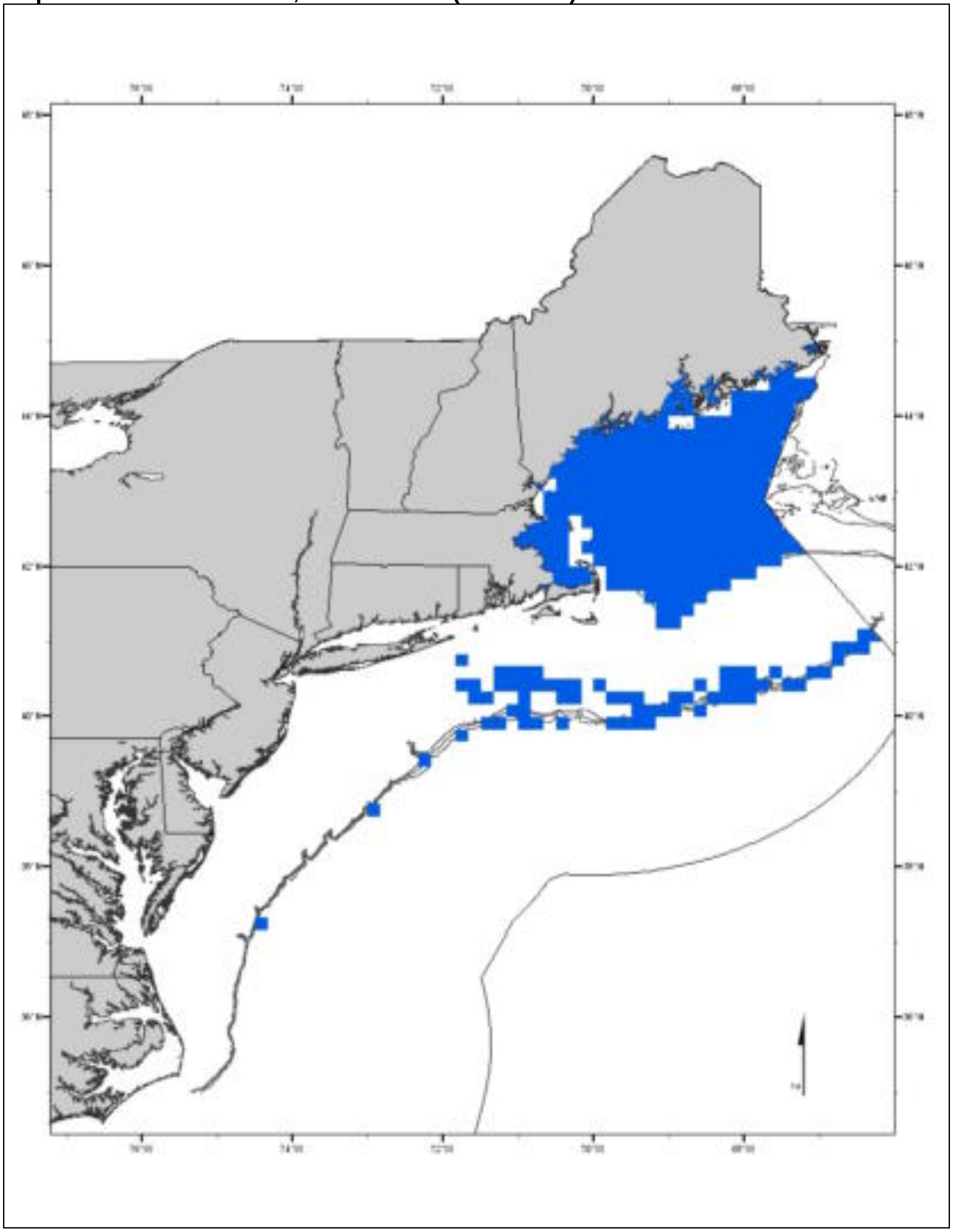
The EFH designation for white hake larvae is based upon alternative 3 for white hake adults. There are no data on white hake larvae, so the use of the adult distribution serves as a proxy to identify those areas where white hake larvae are most likely to be. Alternative 3 for adults includes all areas thought to be most important for larvae, including southern Georges Bank. The EFH designation includes those bays and estuaries identified by the NOAA ELMR program as supporting white hake larvae at the "common" or "abundant" level. The other alternatives were not selected because they either include too little area (not incorporating southern Georges Bank), or include areas where white hake occur in relatively low concentrations (throughout southern New England and the middle Atlantic).

Map 60. White hake juveniles, Alternative 1 (No Action)



The EFH designation for juvenile white hake is based upon alternative 3 for white hake adults. Alternative 3 for adults includes all areas thought to be most important for juveniles, including southern Georges Bank. The EFH designations also include the areas identified by the fishing industry and the inshore surveys as important for white hake, as well as those bays and estuaries identified by the NOAA ELMR program as supporting juvenile white hake at the "common" or "abundant" level. The other alternatives were not selected because they either include too little area (not incorporating southern Georges Bank), or include areas where white hake occur in relatively low concentrations (throughout southern New England and the middle Atlantic).

Map 61. White hake adults, Alternative 1 (No Action)



The EFH designation for adult white hake is based upon alternative 3 for white hake adults. Alternative 3 includes all areas thought to be most important to white hake, including southern Georges Bank. The EFH designations also include the areas identified by the fishing industry and the inshore surveys as important for white hake, as well as those bays and estuaries identified by the NOAA ELMR program as supporting white hake at the "common" or "abundant" level. The other alternatives were not selected because they either include too little area (not incorporating southern Georges Bank), or include areas where white hake occur in relatively low concentrations (throughout southern New England and the middle Atlantic).

4.1.1.2.21 Windowpane flounder (Scophthalmus aquosus)

In its *Report to Congress: Status of the Fisheries of the United States* (September 1997), NMFS determined windowpane flounder is currently overfished. This determination is based on an assessment of stock level. Essential Fish Habitat for windowpane flounder is described as those areas of the coastal and offshore waters (out to the offshore U.S. boundary of the exclusive economic zone) that are designated on Map 62 - Map 65 and in the accompanying table and meet the following conditions:

Eggs: Surface waters around the perimeter of the Gulf of Maine, on Georges Bank, southern New England, and the middle Atlantic south to Cape Hatteras as depicted on Map 62. Generally, the following conditions exist where windowpane flounder eggs are found: sea surface temperatures less than 20° C and water depths less than 70 meters. Windowpane flounder eggs are often observed from February to November with peaks in May and October in the middle Atlantic and July - August on Georges Bank.

Larvae: Pelagic waters around the perimeter of the Gulf of Maine, on Georges Bank, southern New England, and the middle Atlantic south to Cape Hatteras as depicted on Map 63. Generally, the following conditions exist where windowpane flounder larvae are found: sea surface temperatures less than 20° C and water depths less than 70 meters. Windowpane flounder larvae are often observed from February to November with peaks in May and October in the middle Atlantic and July through August on Georges Bank.

Juveniles: Bottom habitats with a substrate of mud or fine-grained sand around the perimeter of the Gulf of Maine, on Georges Bank, southern New England and the middle Atlantic south to Cape Hatteras as depicted on Map 64. Generally, the following conditions exist where windowpane flounder juveniles are found: water temperatures below 25° C, depths from 1 - 100 meters, and salinities between 5.5 - 36‰.

Adults: Bottom habitats with a substrate of mud or fine-grained sand around the perimeter of the Gulf of Maine, on Georges Bank, southern New England and the middle Atlantic south to the Virginia-North Carolina border as depicted on

Map 65. Generally, the following conditions exist where windowpane flounder adults are found: water temperatures below 26.8° C, depths from 1 - 75 meters, and salinities between 5.5 - 36‰.

Spawning Adults: Bottom habitats with a substrate of mud or fine-grained sand in the Gulf of Maine, Georges Bank, southern New England and the middle Atlantic south to the Virginia-North Carolina border as depicted on

Map 65. Generally, the following conditions exist where windowpane flounder adults are found: water temperatures below 21° C, depths from 1 - 75 meters, and salinities between 5.5 - 36‰. Windowpane flounder are most often observed spawning during the months February - December with a peak in May in the middle Atlantic.

All of the above EFH descriptions include those bays and estuaries listed on the following table, according to life history stage. The Council acknowledges potential seasonal and spatial variability of the conditions generally associated with this species.

Table 19. EFH Designation of Estuaries and Embayments: Windowpane flounder (Scophthalmus aquosus)

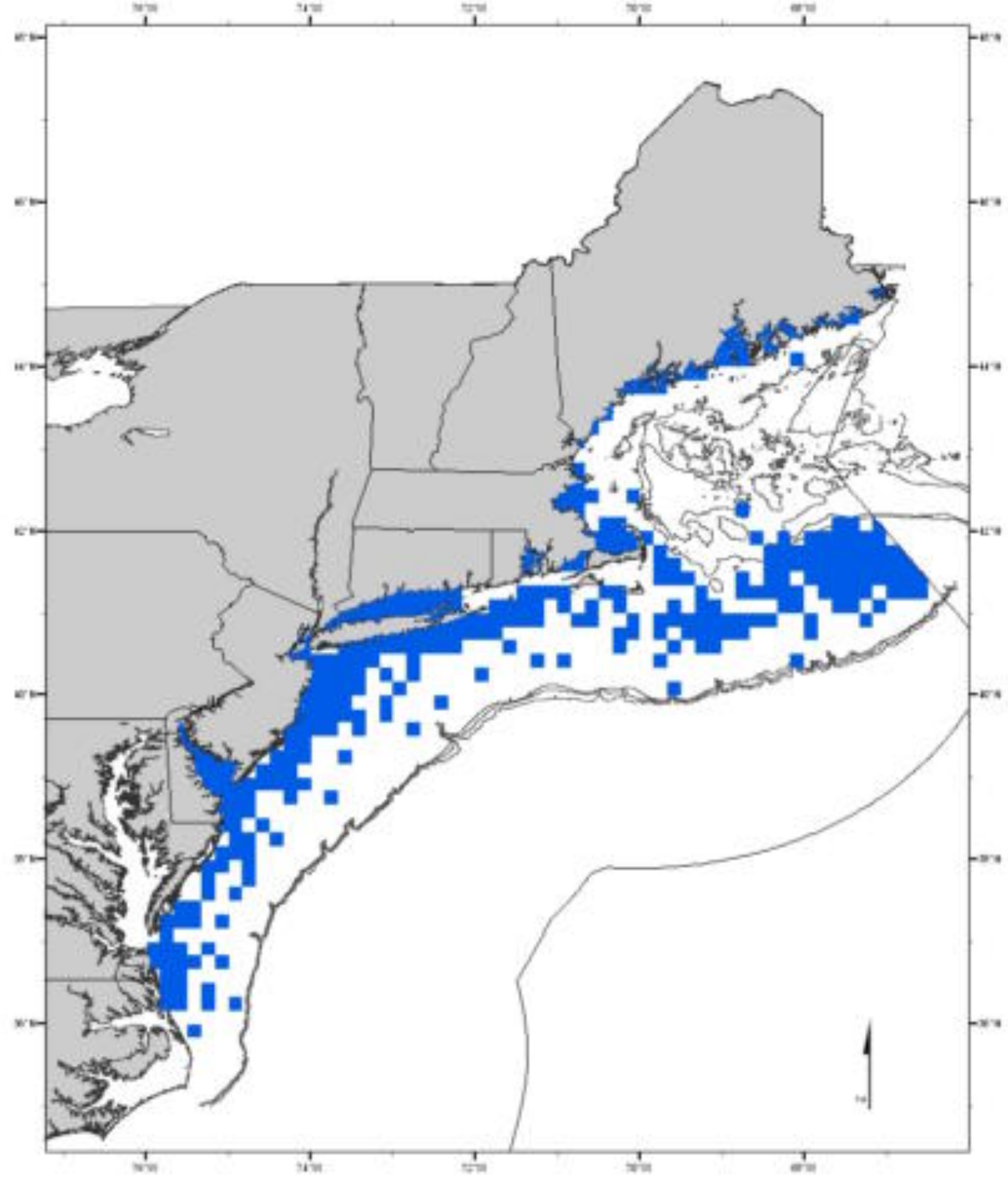
Estuaries and Embayments	Eggs	Larvae	Juveniles	Adults	Spawning Adults
Passamaquoddy Bay	m,s	m,s	m,s	m,s	m,s
Englishman/Machias Bay	m,s	m,s	m,s	m,s	m,s
Narraguagus Bay	m,s	m,s	m,s	m,s	m,s
Blue Hill Bay	m,s	m,s	m,s	m,s	m,s
Penobscot Bay	m,s	m,s	m,s	m,s	m,s
Muscongus Bay	m,s	m,s	m,s	m,s	m,s
Damariscotta River	m,s	m,s	m,s	m,s	m,s
Sheepscot River	m,s	m,s	m,s	m,s	m,s
Kennebec / Androscoggin Rivers	m,s	m,s	m,s	m,s	m,s
Casco Bay	m,s	m,s	m,s	m,s	m,s
Saco Bay	m,s	m,s	m,s	m,s	m,s
Wells Harbor	m,s	m,s	m,s	m,s	m,s
Great Bay	s	s	s	s	s
Merrimack River					
Massachusetts Bay	s	s	s	s	s
Boston Harbor	m,s	m,s	m,s	m,s	m,s
Cape Cod Bay	m,s	m,s	m,s	m,s	m,s
Waquoit Bay	m,s	m,s	m,s	m,s	m,s
Buzzards Bay	m,s	m,s	m,s	m,s	m,s
Narragansett Bay	m,s	m,s	m,s	m,s	m,s
Long Island Sound	m,s	m,s	m,s	m,s	m,s
Connecticut River	m	m	m	m	m
Gardiners Bay	m,s	m,s	m,s	m,s	m,s
Great South Bay	m,s	m,s	m,s	m,s	m,s
Hudson River / Raritan Bay	s	m,s	m,s	m,s	s
Barnegat Bay	m,s	m,s	m,s	m,s	m,s
New Jersey Inland Bays	m,s	m,s	m,s	m,s	m,s

Estuaries and Embayments	Eggs	Larvae	Juveniles	Adults	Spawning Adults
Delaware Bay	m,s	m,s	m,s	m,s	m,s
Delaware Inland Bays	m,s	m,s	m,s	m,s	m,s
Chincoteague Bay			s	s	
Chesapeake Bay			m,s	m,s	

S ≡ The EFH designation for this species includes the seawater salinity zone of this bay or estuary (salinity > 25.0‰).
M ≡ The EFH designation for this species includes the mixing water / brackish salinity zone of this bay or estuary (0.5 < salinity < 25.0‰).
F ≡ The EFH designation for this species includes the tidal freshwater salinity zone of this bay or estuary (0.0 < salinity < 0.5‰).

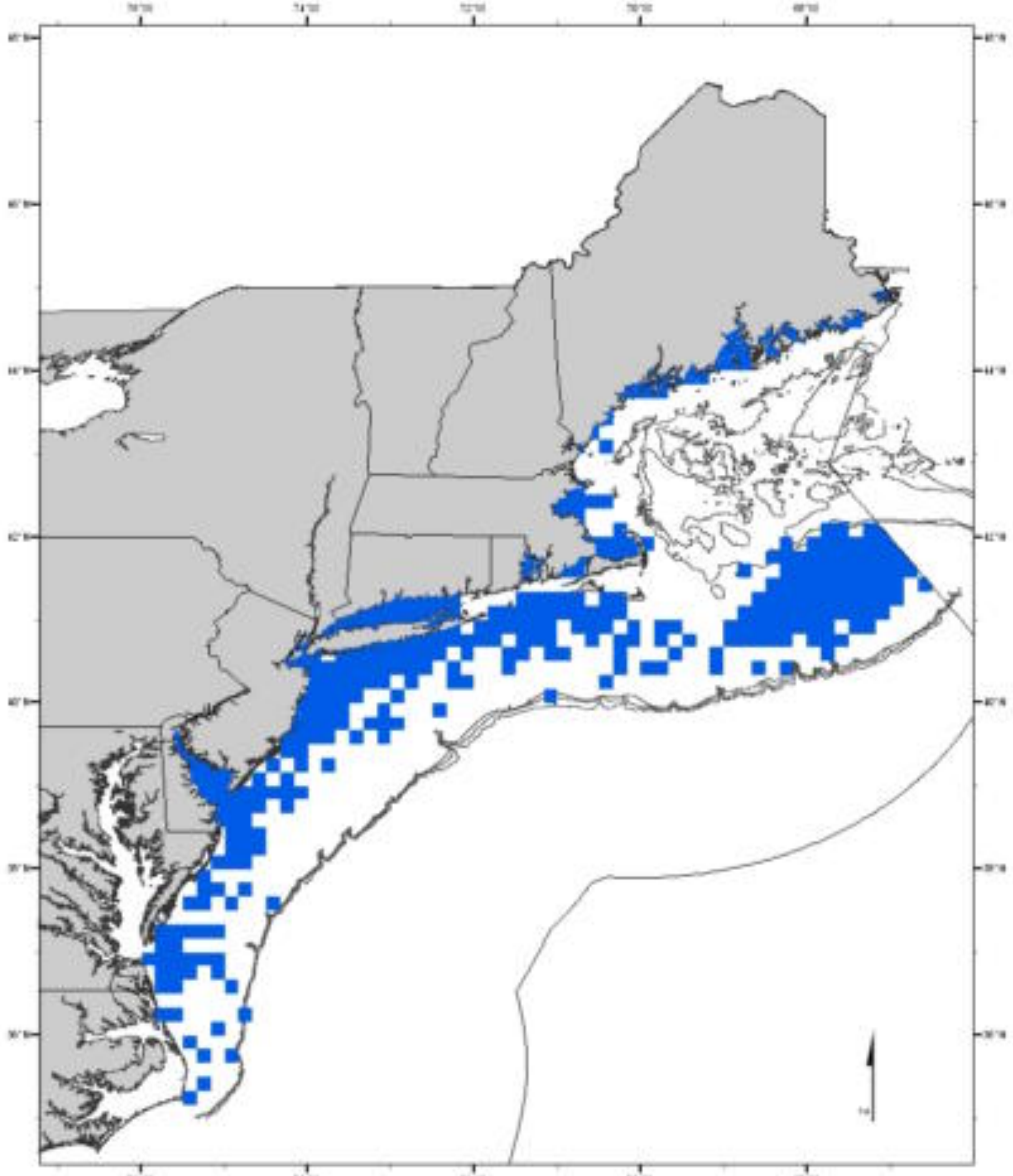
These EFH designations of estuaries and embayments are based on the NOAA Estuarine Living Marine Resources (ELMR) program (Jury et al. 1994; Stone et al. 1994). For a detailed view of the salinity zone boundaries, as described in the ELMR reports, please see Appendix B. The Council recognizes the spatial and temporal variability of estuarine and embayment environmental conditions generally associated with this species.

Map 62. Windowpane flounder eggs, Alternative 1 (No Action)



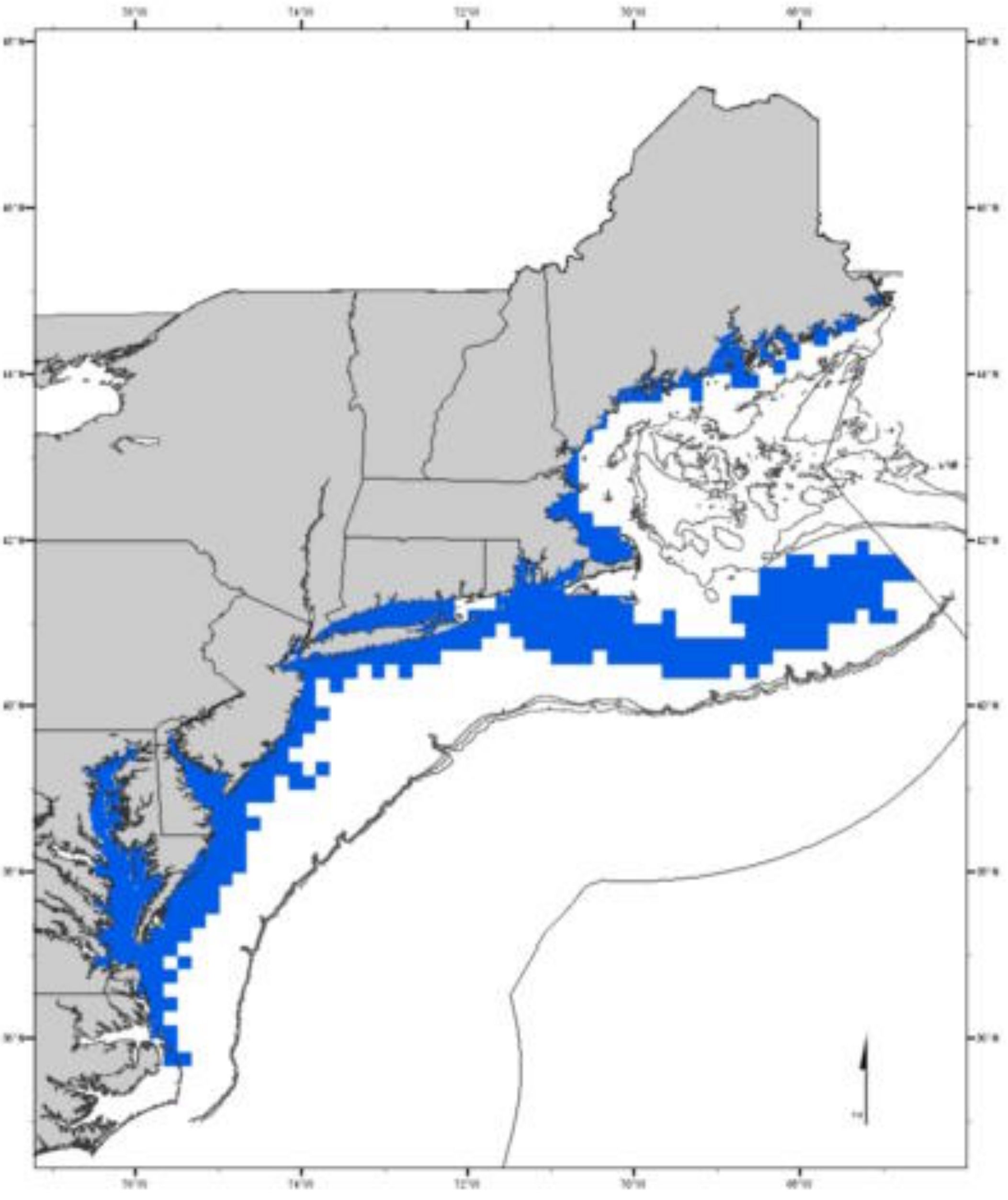
The EFH designation for windowpane flounder eggs is based upon alternative 3 for windowpane flounder eggs. The EFH designation also includes those bays and estuaries identified by the NOAA ELMR program as supporting windowpane flounder eggs at the "common" or "abundant" level. This alternative was selected to be as inclusive as possible, given the generally patchy nature of egg distribution, while not including areas with relatively very low concentrations of windowpane flounder eggs.

Map 63. Windowpane flounder larvae, Alternative 1 (No Action)



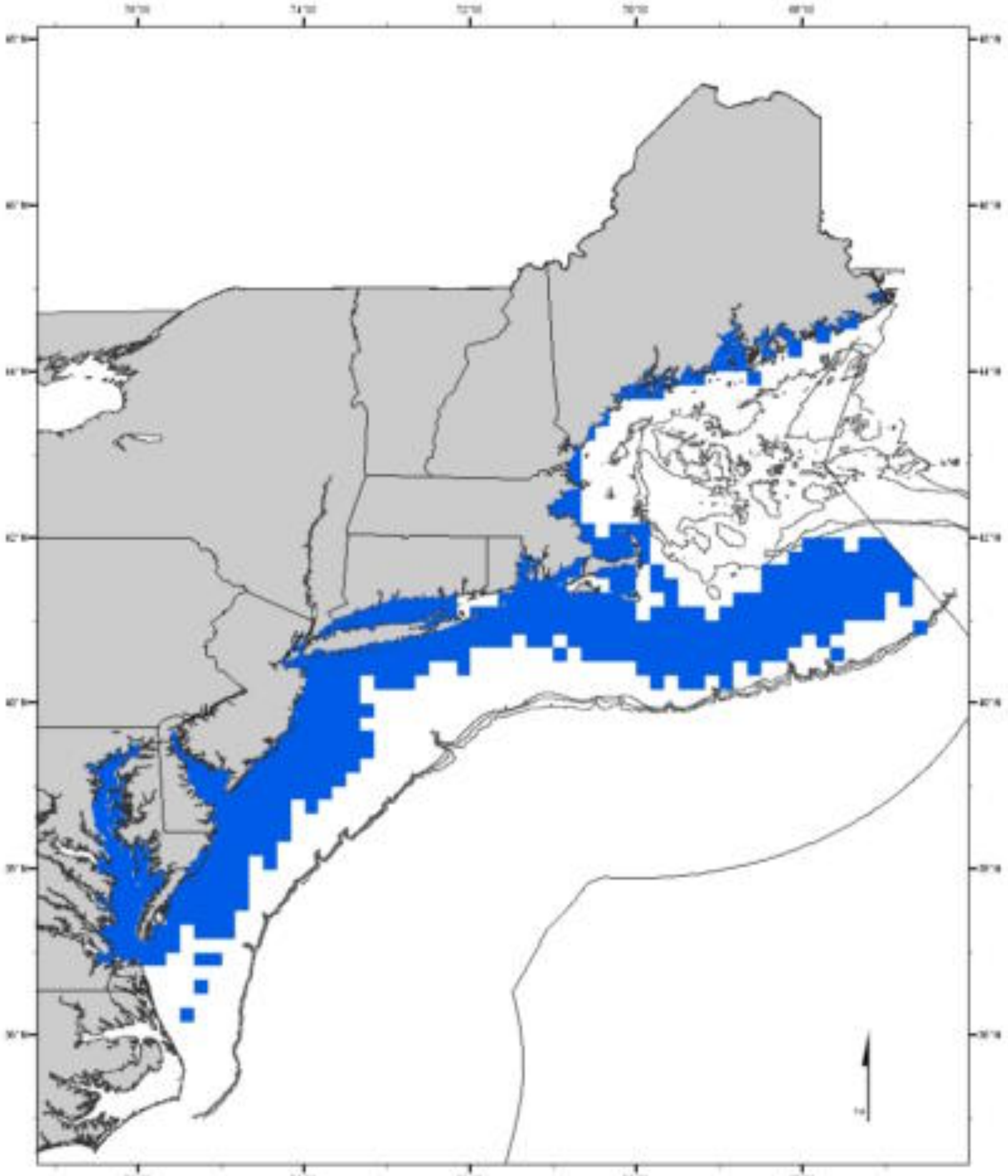
The EFH designation for windowpane flounder larvae is based upon alternative 3 for windowpane flounder larvae. The EFH designation also includes those bays and estuaries identified by the NOAA ELMR program as supporting windowpane flounder larvae at the "common" or "abundant" level. This alternative was selected to be as inclusive as possible, given the generally patchy nature of larval distribution, while not including areas with relatively very low concentrations of windowpane flounder larvae.

Map 64. Windowpane flounder juveniles, Alternative 1 (No Action)



The EFH designation for juvenile windowpane flounder is based upon alternative 3 for windowpane flounder juveniles. The EFH designations also include the areas identified by the fishing industry and the inshore surveys as important for windowpane flounder, as well as those bays and estuaries identified by the NOAA ELMR program as supporting juvenile windowpane flounder at the "common" or "abundant" level. The other alternatives were not selected because they either include too little area (less than half of the range of this overfished species), or include areas where windowpane flounder occur in relatively low concentrations.

Map 65. Windowpane flounder adults, Alternative 1 (No Action)



The EFH designation for adult windowpane flounder is based upon alternative 3 for windowpane flounder adults. The EFH designations also include the areas identified by the fishing industry and the inshore surveys as important for windowpane flounder, as well as those bays and estuaries identified by the NOAA ELMR program as supporting adult windowpane flounder at the "common" or "abundant" level. The other alternatives were not selected because they either include too little area (less than half of the range of this overfished species), or include areas where windowpane flounder occur in relatively low concentrations.

4.1.1.2.22 Winter flounder (Pseudopleuronectes americanus)

In its *Report to Congress: Status of the Fisheries of the United States* (September 1997), NMFS determined the Gulf of Maine and Southern New England stocks of winter flounder are currently overfished. This determination is based on the fishing mortality rate. There is not enough information to determine if the Georges Bank stock is overfished or approaching an overfished condition. Essential Fish Habitat for winter flounder is described as those areas of the coastal and offshore waters (out to the offshore U.S. boundary of the exclusive economic zone) that are designated on Map 66 - Map 69 and in the accompanying table and meet the following conditions:

Eggs: Bottom habitats with a substrate of sand, muddy sand, mud, and gravel on Georges Bank, the inshore areas of the Gulf of Maine, southern New England, and the middle Atlantic south to the Delaware Bay as depicted on Map 66. Generally, the following conditions exist where winter flounder eggs are found: water temperatures less than 10° C, salinities between 10 - 30‰, and water depths less than 5 meters. On Georges Bank, winter flounder eggs are generally found in water less than 8°C and less than 90 meters deep. Winter flounder eggs are often observed from February to June with a peak in April on Georges Bank.

Larvae: Pelagic and bottom waters of Georges Bank, the inshore areas of the Gulf of Maine, southern New England, and the middle Atlantic south to the Delaware Bay as depicted on Map 67. Generally, the following conditions exist where winter flounder larvae are found: sea surface temperatures less than 15° C, salinities between 4 - 30‰, and water depths less than 6 meters. On Georges Bank, winter flounder larvae are generally found in water less than 8°C and less than 90 meters deep. Winter flounder larvae are often observed from March to July with peaks in April and May on Georges Bank.

Juveniles: *Young-of-the-Year*: Bottom habitats with a substrate of mud or fine grained sand on Georges Bank, the inshore areas of the Gulf of Maine, southern New England and the middle Atlantic south to the Delaware Bay as depicted on Map 68. Generally, the following conditions exist where winter flounder young-of-the-year are found: water temperatures below 28°C, depths from 0.1 - 10 meters, and salinities between 5 - 33‰. *Age 1+ Juveniles*: Bottom habitats with a substrate of mud or fine grained sand on Georges Bank, the inshore areas of the Gulf of Maine, southern New England and the middle Atlantic south to the Delaware Bay as depicted on Map 68. Generally, the following conditions exist where juvenile winter flounder are found: water temperatures below 25°C, depths from 1 - 50 meters, and salinities between 10 - 30‰.

Adults: Bottom habitats including estuaries with a substrate of mud, sand, and gravel on Georges Bank, the inshore areas of the Gulf of Maine, southern New England and the middle Atlantic south to the Delaware Bay as depicted on Map 69. Generally, the following conditions exist where winter flounder adults are found: water temperatures below 25° C, depths from 1 - 100 meters, and salinities between 15 - 33‰.

Spawning Adults: Bottom habitats including estuaries with a substrate of sand, muddy sand, mud, and gravel on Georges Bank, the inshore areas of the Gulf of Maine, southern New England and the middle Atlantic south to the Delaware Bay as depicted on Map 69. Generally, the following conditions exist where winter flounder adults are found: water temperatures below 15° C, depths less than 6 meters, except on Georges Bank where they spawn as deep as 80 meters, and salinities between 5.5 - 36‰. Winter flounder are most often observed spawning during the months February - June.

All of the above EFH descriptions include those bays and estuaries listed on the following table, according to life history stage. The Council acknowledges potential seasonal and spatial variability of the conditions generally associated with this species.

Table 20. EFH Designation of Estuaries and Embayments: Winter flounder (Pseudopleuronectes americanus)

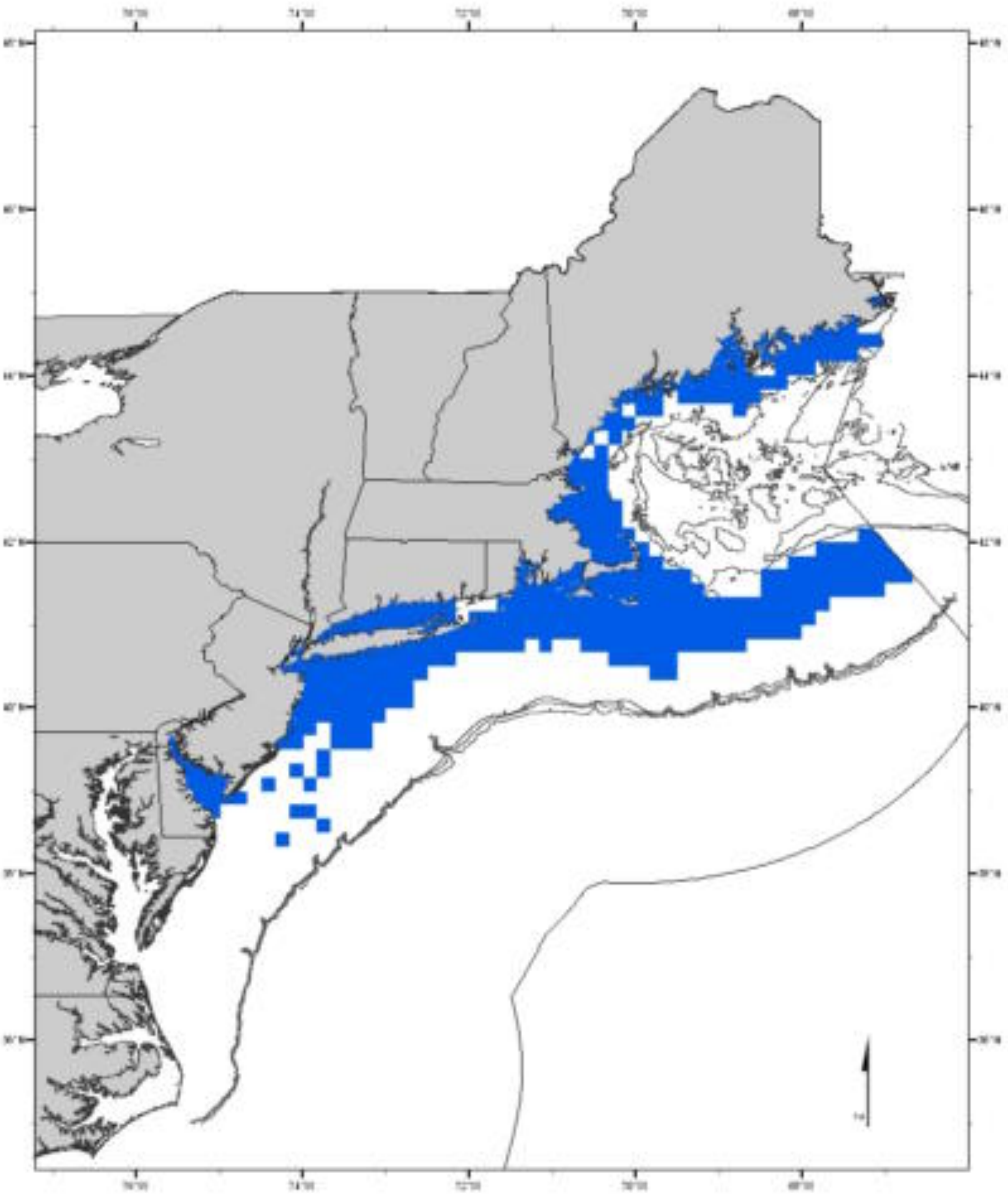
Estuaries and Embayments	Eggs	Larvae	Juveniles	Adults	Spawning Adults
Passamaquoddy Bay	m,s	m,s	m,s	m,s	m,s
Englishman/Machias Bay	m,s	m,s	m,s	m,s	m,s
Narraguagus Bay	m,s	m,s	m,s	m,s	m,s
Blue Hill Bay	m,s	m,s	m,s	m,s	m,s
Penobscot Bay	m,s	m,s	m,s	m,s	m,s
Muscongus Bay	m,s	m,s	m,s	m,s	m,s
Damariscotta River	m,s	m,s	m,s	m,s	m,s
Sheepscot River	m,s	m,s	m,s	m,s	m,s
Kennebec / Androscoggin Rivers	m,s	m,s	m,s	m,s	m,s
Casco Bay	m,s	m,s	m,s	m,s	m,s
Saco Bay	m,s	m,s	m,s	m,s	m,s
Wells Harbor	m,s	m,s	m,s	m,s	m,s
Great Bay	m,s	m,s	m,s	m,s	m,s
Merrimack River	m	m	m	m	m
Massachusetts Bay	s	s	s	s	s
Boston Harbor	m,s	m,s	m,s	m,s	m,s
Cape Cod Bay	m,s	m,s	m,s	m,s	m,s
Waquoit Bay	m,s	m,s	m,s	m,s	m,s
Buzzards Bay	m,s	m,s	m,s	m,s	m,s
Narragansett Bay	m,s	m,s	m,s	m,s	m,s
Long Island Sound	m,s	m,s	m,s	m,s	m,s

Estuaries and Embayments	Eggs	Larvae	Juveniles	Adults	Spawning Adults
Connecticut River	m	m	m	m	m
Gardiners Bay	m,s	m,s	m,s	m,s	m,s
Great South Bay	m,s	m,s	m,s	m,s	m,s
Hudson River / Raritan Bay	m,s	m,s	m,s	m,s	m,s
Barnegat Bay	m,s	m,s	m,s	m,s	m,s
New Jersey Inland Bays	m,s	m,s	m,s	m,s	m,s
Delaware Bay	m,s	m,s	m,s	m,s	m,s
Delaware Inland Bays	m,s	m,s	m,s	m,s	m,s
Chincoteague Bay			s	s	
Chesapeake Bay					

S ≡ The EFH designation for this species includes the seawater salinity zone of this bay or estuary (salinity > 25.0‰).
M ≡ The EFH designation for this species includes the mixing water / brackish salinity zone of this bay or estuary (0.5 < salinity < 25.0‰).
F ≡ The EFH designation for this species includes the tidal freshwater salinity zone of this bay or estuary (0.0 < salinity < 0.5‰).

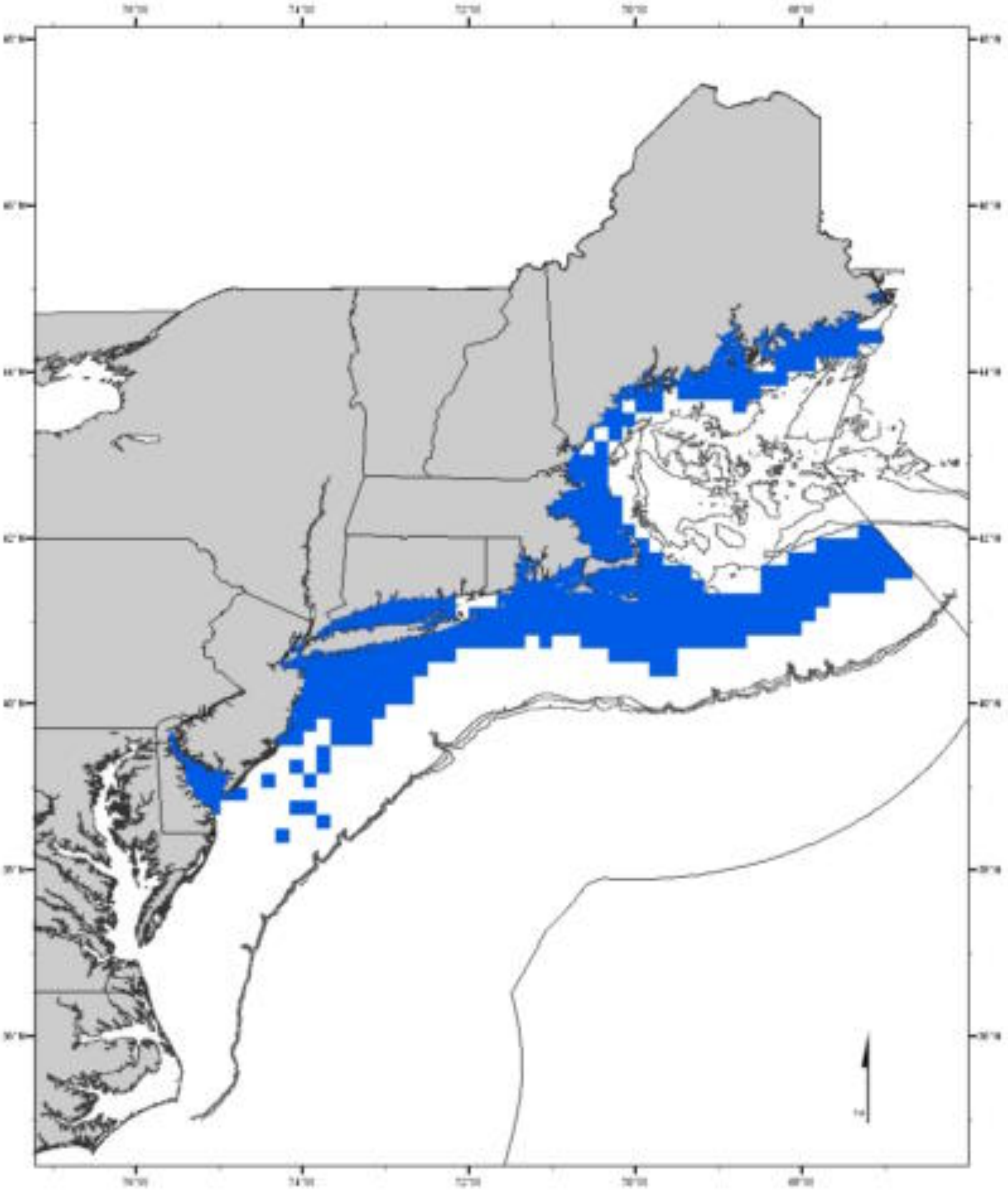
These EFH designations of estuaries and embayments are based on the NOAA Estuarine Living Marine Resources (ELMR) program (Jury et al. 1994; Stone et al. 1994). For a detailed view of the salinity zone boundaries, as described in the ELMR reports, please see Appendix B. The Council recognizes the spatial and temporal variability of estuarine and embayment environmental conditions generally associated with this species.

Map 66. Winter flounder eggs, Alternative 1 (No Action)



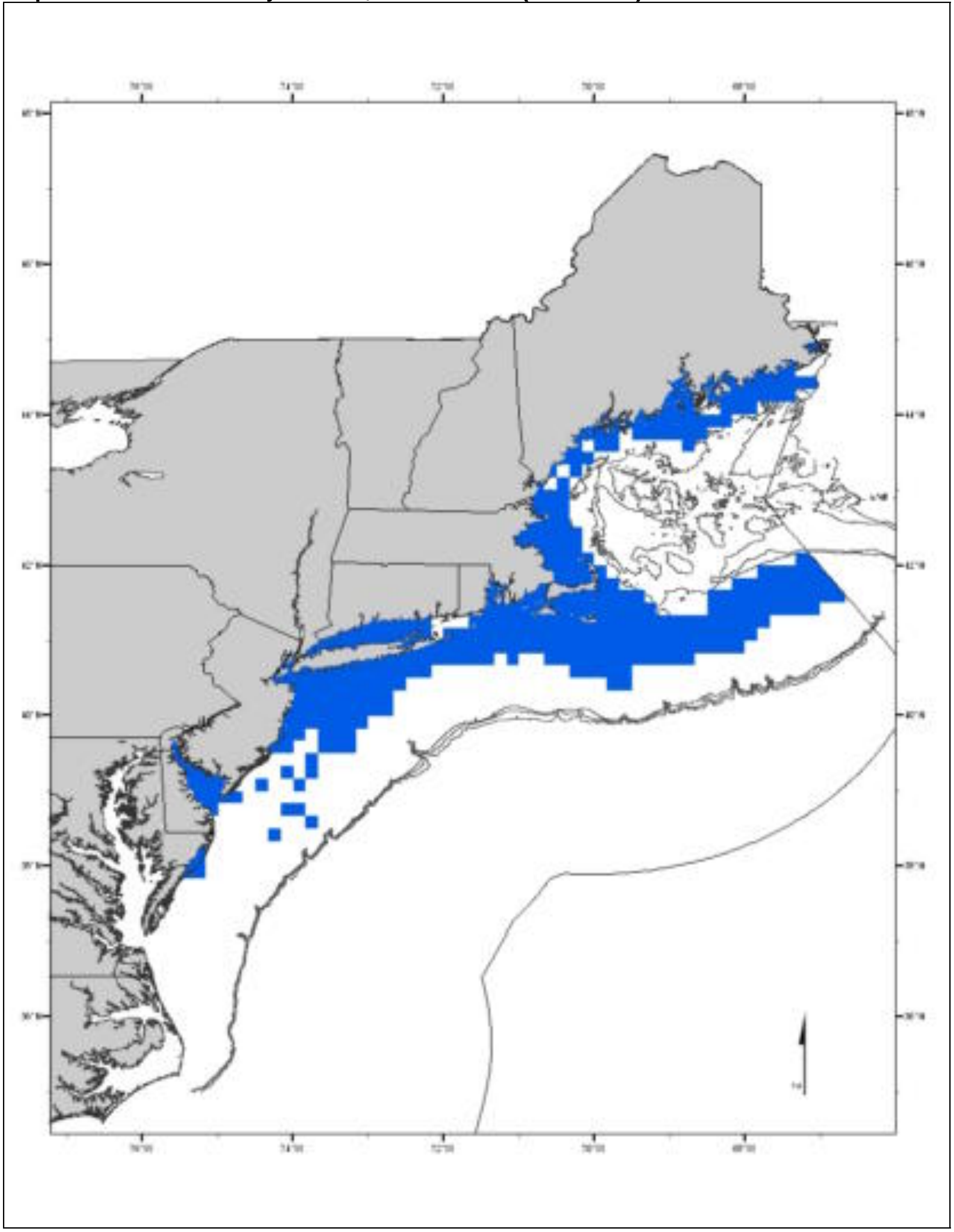
The EFH designation for winter flounder eggs is based upon alternative 3 for winter flounder adults. This designation also includes those bays and estuaries identified by the NOAA ELMR program as supporting winter flounder eggs at the "common" or "abundant" level. The observed distribution of winter flounder eggs is very patchy with very few observations, thus the distribution of adults was used as a proxy. This alternative was selected as it appears to best identify that portion of the range of winter flounder most important to all life history stages.

Map 67. Winter flounder larvae, Alternative 1 (No Action)



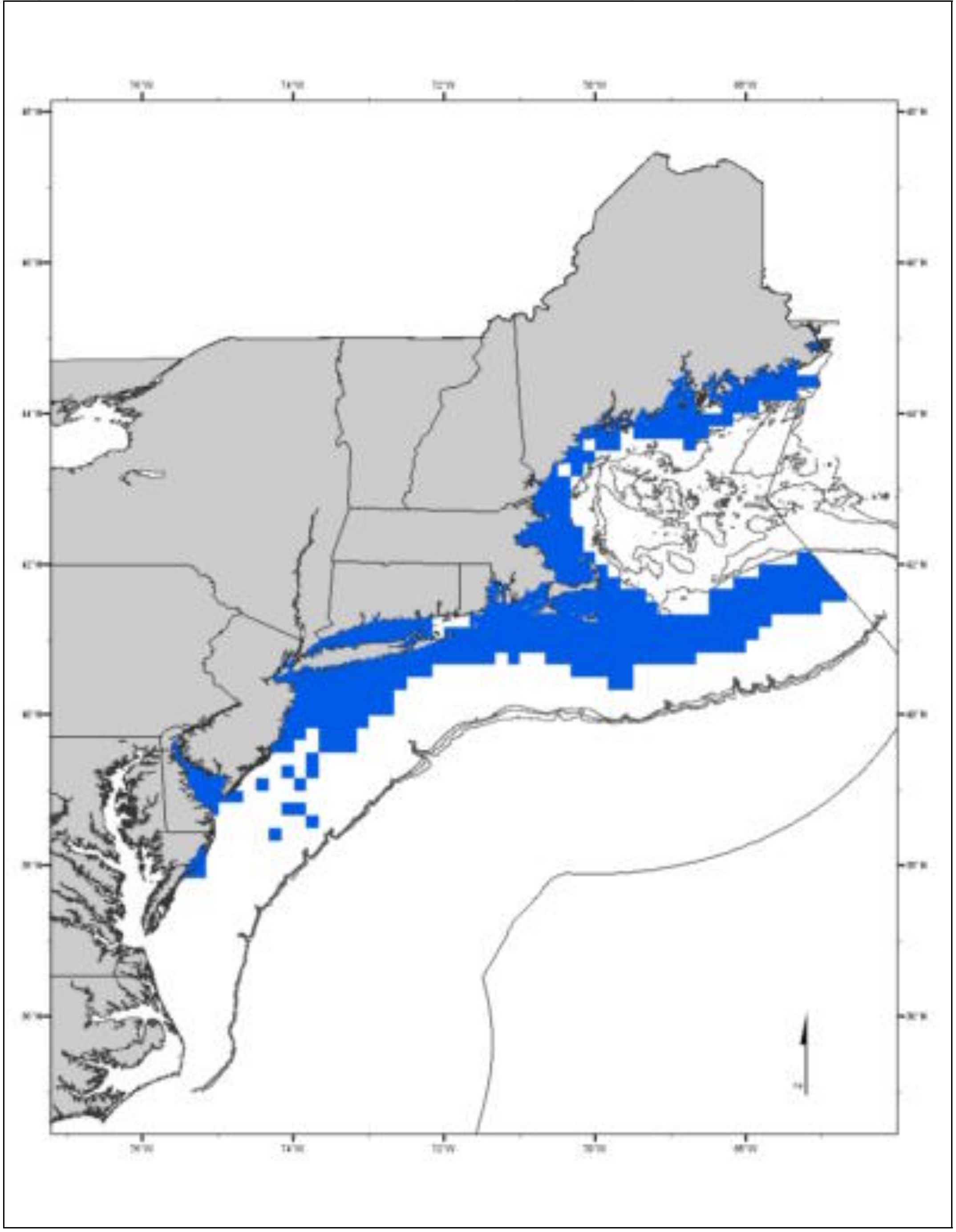
The EFH designation for winter flounder larvae is based upon alternative 3 for winter flounder adults. This designation also includes those bays and estuaries identified by the NOAA ELMR program as supporting winter flounder larvae at the "common" or "abundant" level. The observed distribution of winter flounder larvae is very patchy with very few observations, thus the distribution of adults was used as a proxy. This alternative was selected as it appears to best identify that portion of the range of winter flounder most important to all life history stages.

Map 68. Winter flounder juveniles, Alternative 1 (No Action)



The EFH designation for winter flounder juveniles is based upon alternative 3 for winter flounder adults. The EFH designations also include the areas identified by the fishing industry and the inshore surveys as important for winter flounder, as well as those bays and estuaries identified by the NOAA ELMR program as supporting winter flounder juveniles at the "common" or "abundant" level. This alternative was selected as it appears to best identify that portion of the range of winter flounder most important to all life history stages. The other alternatives were not selected because they either include too little area (less than half of the range of this overfished species), or include areas where winter flounder occur in relatively low concentrations.

Map 69. Winter flounder adults, Alternative 1 (No Action)



The EFH designation for winter flounder adults is based upon alternative 3 for winter flounder adults. The EFH designations also include the areas identified by the fishing industry and the inshore surveys as important for winter flounder, as well as those bays and estuaries identified by the NOAA ELMR program as supporting winter flounder adults at the "common" or "abundant" level. This alternative was selected as it appears to best identify that portion of the range of winter flounder most important to all life history stages. The other alternatives were not selected because they either include too little area (less than half of the range of this overfished species), or include areas where winter flounder occur in relatively low concentrations.

4.1.1.2.23 Winter Skate (Leucoraja ocellata)

In its *Report to Congress: Status of the Fisheries of the United States* (January 2001), NMFS determined that winter skate is in an overfished condition and that overfishing of this stock is occurring, based on stock size assessment. For winter skate, essential fish habitat is described as those areas of coastal and offshore waters (out to the offshore U.S. boundary of the exclusive economic zone) that are designated on Map 70– Map 71 and in

Table 21 and meet the following conditions:

Eggs: There is no information available on the habitat associations or distribution of the egg stage for this species.

Larvae: No larval life stage exists for this species. Upon hatching, they are fully developed juveniles (ELMR Report Number 12, March 1994).

Juveniles: Bottom habitats with a substrate of sand and gravel or mud in Cape Cod Bay, on Georges Bank, the southern New England shelf, and through the Mid-Atlantic Bight to North Carolina as depicted on Map 70. Generally, the following conditions exist where winter skate juveniles are found: *Depth:* Range from shoreline to about 400 meters and most abundant at depths less than 111 meters. *Temperature:* Range from -1.2°C to around 21°C, with most found from 4-16 °C, depending on the season.

Adults: Bottom habitats with a substrate of sand and gravel or mud in Cape Cod Bay, on Georges Bank, the southern New England shelf, and through the Mid-Atlantic Bight to North Carolina as depicted on Map 71. Generally, the following conditions exist where winter skate adults are found: *Depth:* Range from shoreline to 371 meters and most abundant at depths 111 meters. *Temperature:* Range from –1.2 °C to around 20 °C, with most found from 5-15 °C, depending on the season.

The bays and estuaries identified in

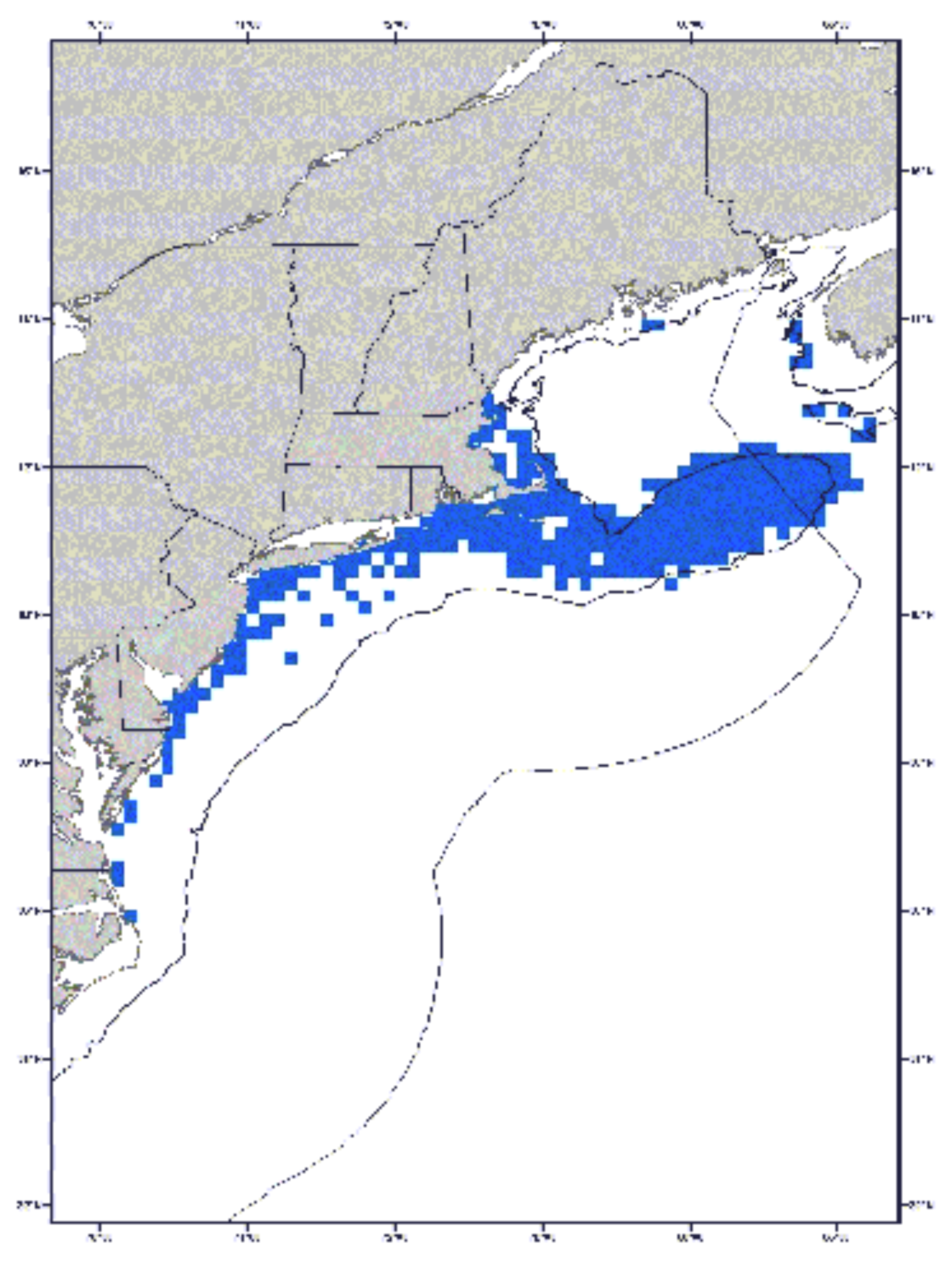
Table 11 for the skate species complex apply to the above winter skate descriptions. The Council acknowledges that there may be some potential seasonal and spatial variability of the environmental conditions generally associated with this species.

Table 21. Distribution and Abundance of the skate Complex in Northeast Bays and Estuaries

Estuaries and Embayments	Eggs	Juveniles	Mating	Adults
Waquoit Bay				
Buzzards Bay	L,W	L,W	L,W	L,W
Narragansett Bay	L,W	L,W	L,W	L,W
Long Island Sound	L,W	L,W	L,W	L,W
Connecticut River		L,W		L,W
Gardiners Bay		L,W		L,W
Great South Bay		L,W		L,W
Hudson River/Raritan Bay	C,L,W	C,L,W	C,L,W	C,L,W
Barnegat Bay				C,L,W
New Jersey Inland Bays				C,L,W
Delaware Bay				C,L,W
Delaware Inland Bays				C,L,W
Chesapeake Bay Mainstem	C,L,W	C,L,W		C,L,W

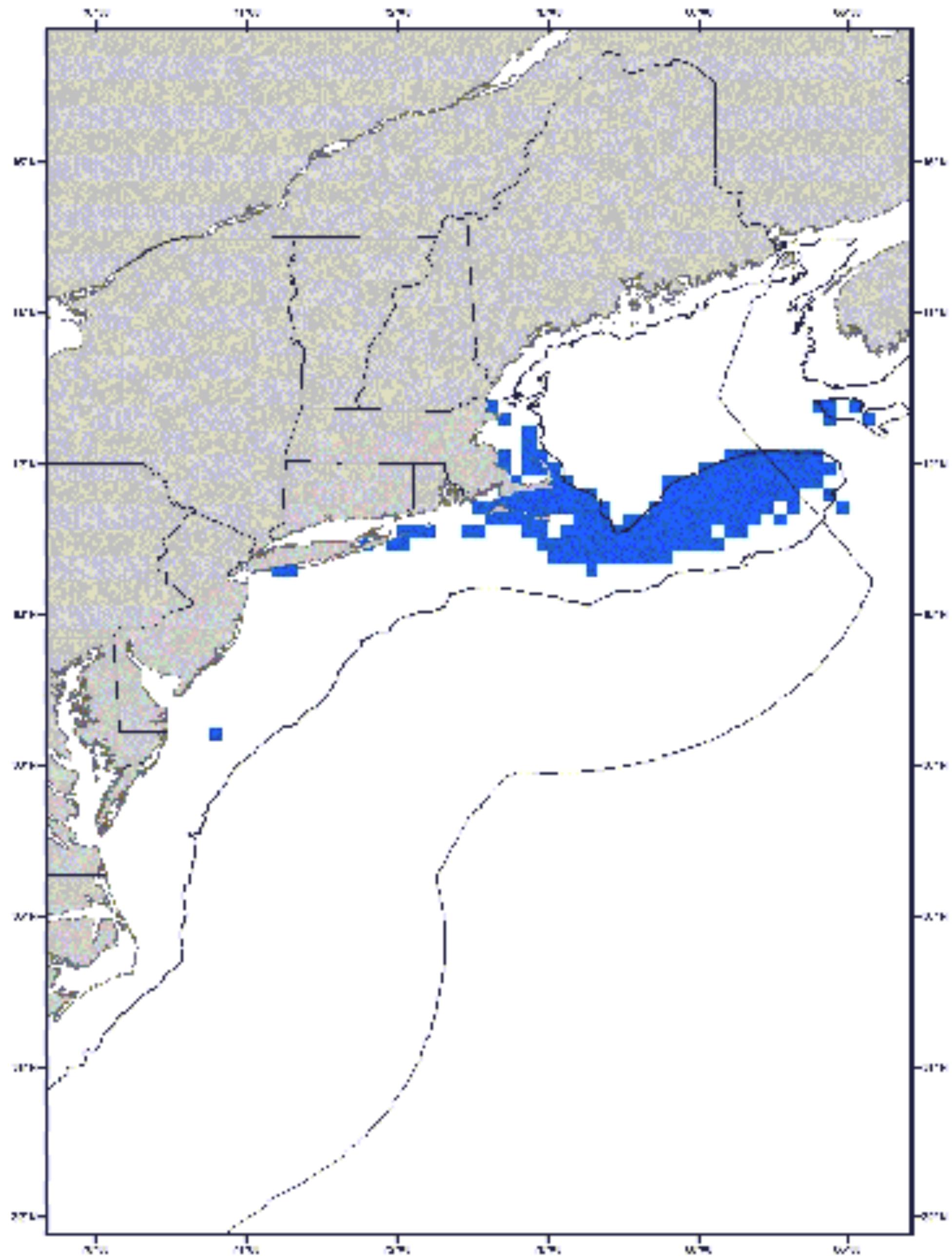
The EFH information presented in this table are based on the NOAA Estuarine Living Marine Resource (ELMR) program (Jury et al. 1994; Stone et al. 1994). Unfortunately, the information presented in the ELMR reports does not differentiate among the species of skates in the complex. Thus, we know that skates occur in these bays and estuaries, but we cannot be certain of the particular species. The above table has been prepared in an attempt to identify the skate species that occur most proximate to these bays and estuaries and are therefore most likely to occur in the bays and estuaries. For the purposes of designating EFH, the bays and estuaries listed above are incorporated into the EFH designations for the species identified in the table (C≡clearnose skate; L≡little skate; and W≡winter skate). The Council recognizes that there may be spatial and temporal variability in the environmental conditions generally associated with these species in the bays and estuaries identified above

Map 70. Winter skate juveniles, Alternative 1 (No Action)



This map represents an option for the designation of EFH for this life history stage based on the areas of highest relative abundance of this species, based on the NMFS trawl survey (1963 - 1999). Only habitats with a substrate of sand and gravel or mud that occur within the shaded areas would be designated as EFH. This option represents 48% of the observed range of this life stage.

Map 71. Winter skate adults, Alternative 1 (No Action)



This map represents an option for the designation of EFH for this life history stage based on the areas of highest relative abundance of this species, based on the NMFS trawl survey (1963 - 1999). Only habitats with a substrate of sand and gravel or mud that occur within the shaded areas would be designated as EFH. This option represents 44% of the observed range of this life stage.

4.1.1.2.24 Witch flounder (Glyptocephalus cynoglossus)

In its *Report to Congress: Status of the Fisheries of the United States* (September 1997), NMFS determined witch flounder is currently overfished. This determination is based on the fishing mortality rate. Essential Fish Habitat for witch flounder is described as those areas of the coastal and offshore waters (out to the offshore U.S. boundary of the eclusive economic zone) that are designated on Map 72 - Map 75 and meet the following conditions:

Eggs: Surface waters of the Gulf of Maine, Georges Bank, the continental shelf off southern New England, and the middle Atlantic south to Cape Hatteras as depicted on Map 72. Generally, the following conditions exist where witch flounder eggs are found: sea surface temperatures below 13° C over deep water with high salinities. Witch flounder eggs are most often observed during the months from March through October.

Larvae: Surface waters to 250 meters in the Gulf of Maine, Georges Bank, the continental shelf off southern New England, and the middle Atlantic south to Cape Hatteras as depicted on Map 73. Generally, the following conditions exist where witch flounder larvae are found: sea surface temperatures below 13° C over deep water with high salinities. Witch flounder larvae are most often observed from March through November, with peaks in May - July.

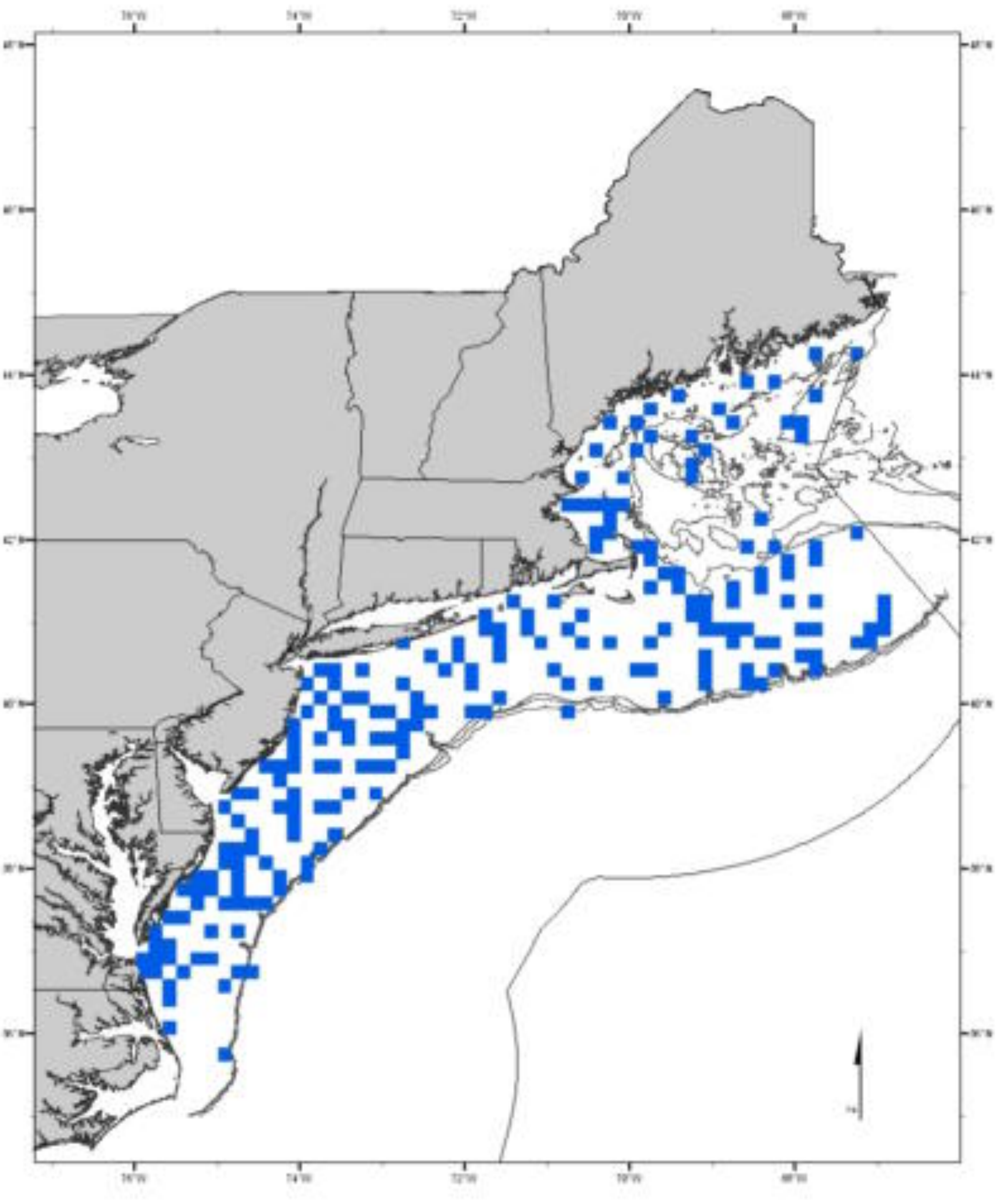
Juveniles: Bottom habitats with a fine-grained substrate in the Gulf of Maine and along the outer continental shelf from Georges Bank south to Cape Hatteras as depicted on Map 74. Generally, the following conditions exist where witch flounder juveniles are found: water temperatures below 13° C, depths from 50 - 450 meters, although they have been observed as deep as 1500 meters, and a salinity range from 34 - 36‰.

Adults: Bottom habitats with a fine-grained substrate in the Gulf of Maine and along the outer continental shelf from Georges Bank south to Chesapeake Bay as depicted on Map 75. Generally, the following conditions exist where witch flounder adults are found: water temperatures below 13° C, depths from 25 - 300 meters, and a salinity range from 32 - 36‰.

Spawning Adults: Bottom habitats with a fine-grained substrate in the Gulf of Maine and along the outer continental shelf from Georges Bank south to Chesapeake Bay as depicted on Map 75. Generally, the following conditions exist where spawning witch flounder adults are found: water temperatures below 15° C, depths from 25 - 360 meters, and a salinity range from 32 - 36‰. Witch flounder are most often observed spawning during the months from March through November, with peaks in May - August.

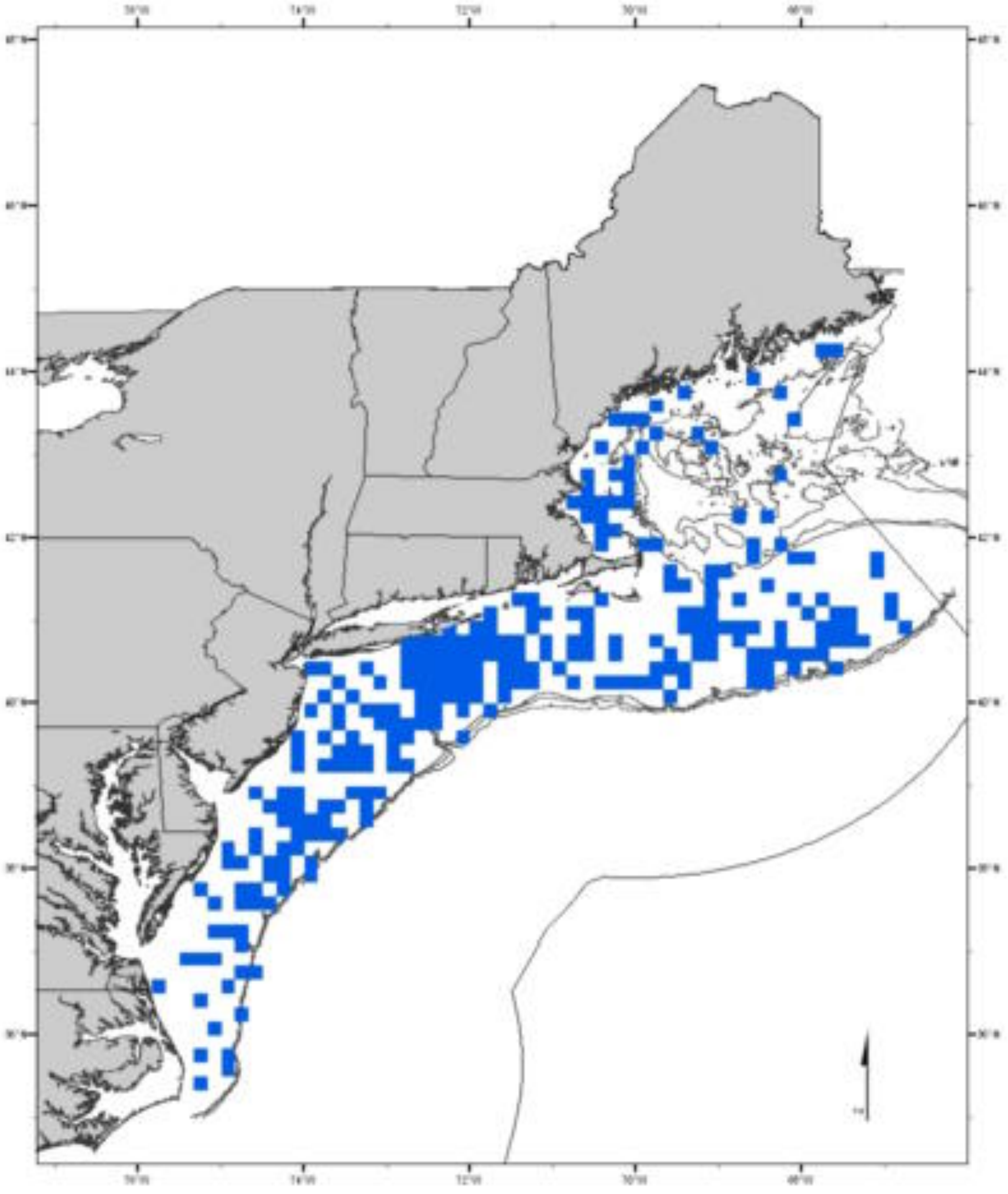
The Council acknowledges potential seasonal and spatial variability of the conditions generally associated with this species.

Map 72. Witch flounder eggs, Alternative 1 (No Action)



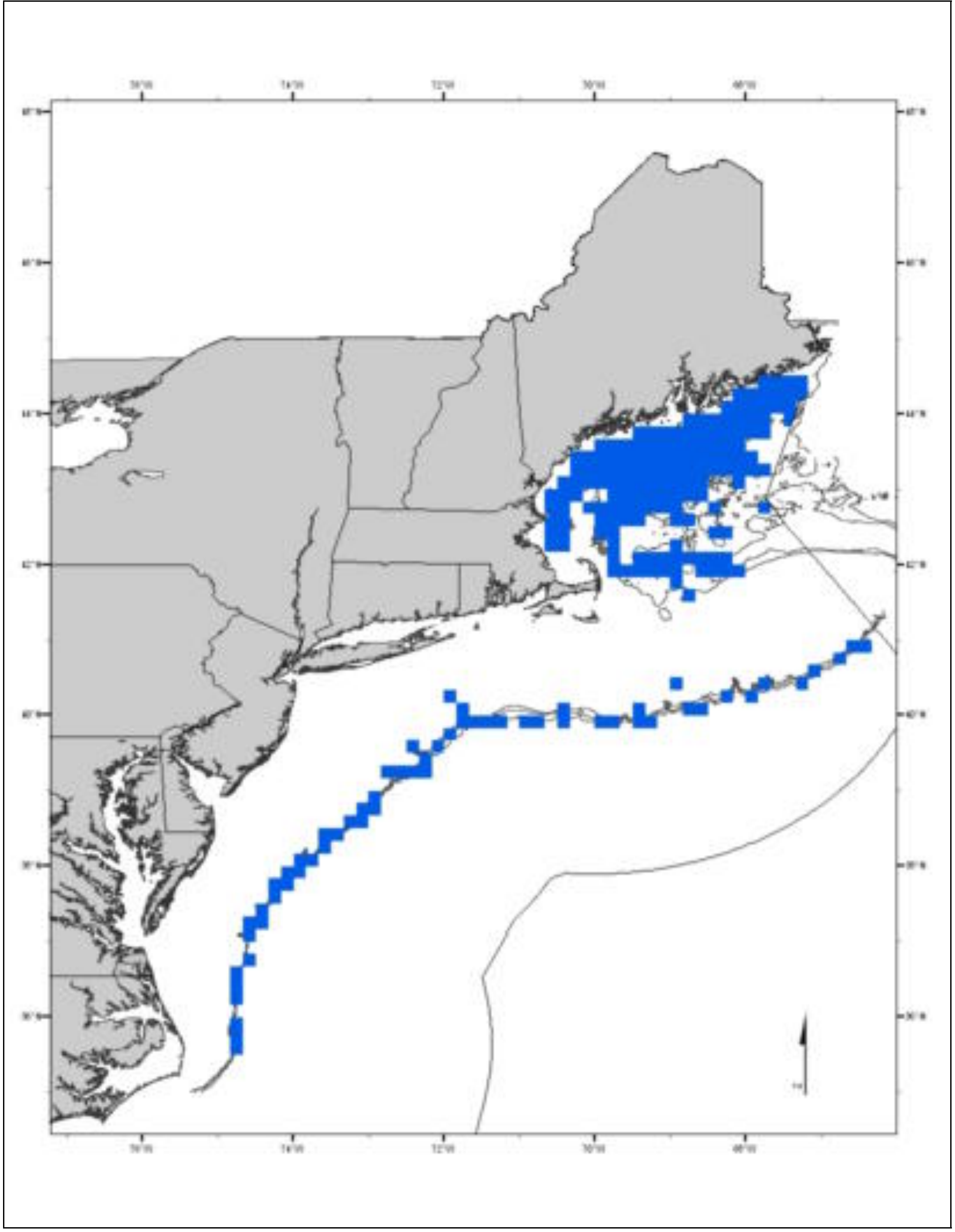
The EFH designation for witch flounder eggs is based upon alternative 4 for witch flounder eggs. This alternative was selected to be as inclusive as possible of areas likely to support witch flounder eggs.

Map 73. Witch flounder larvae, Alternative 1 (No Action)



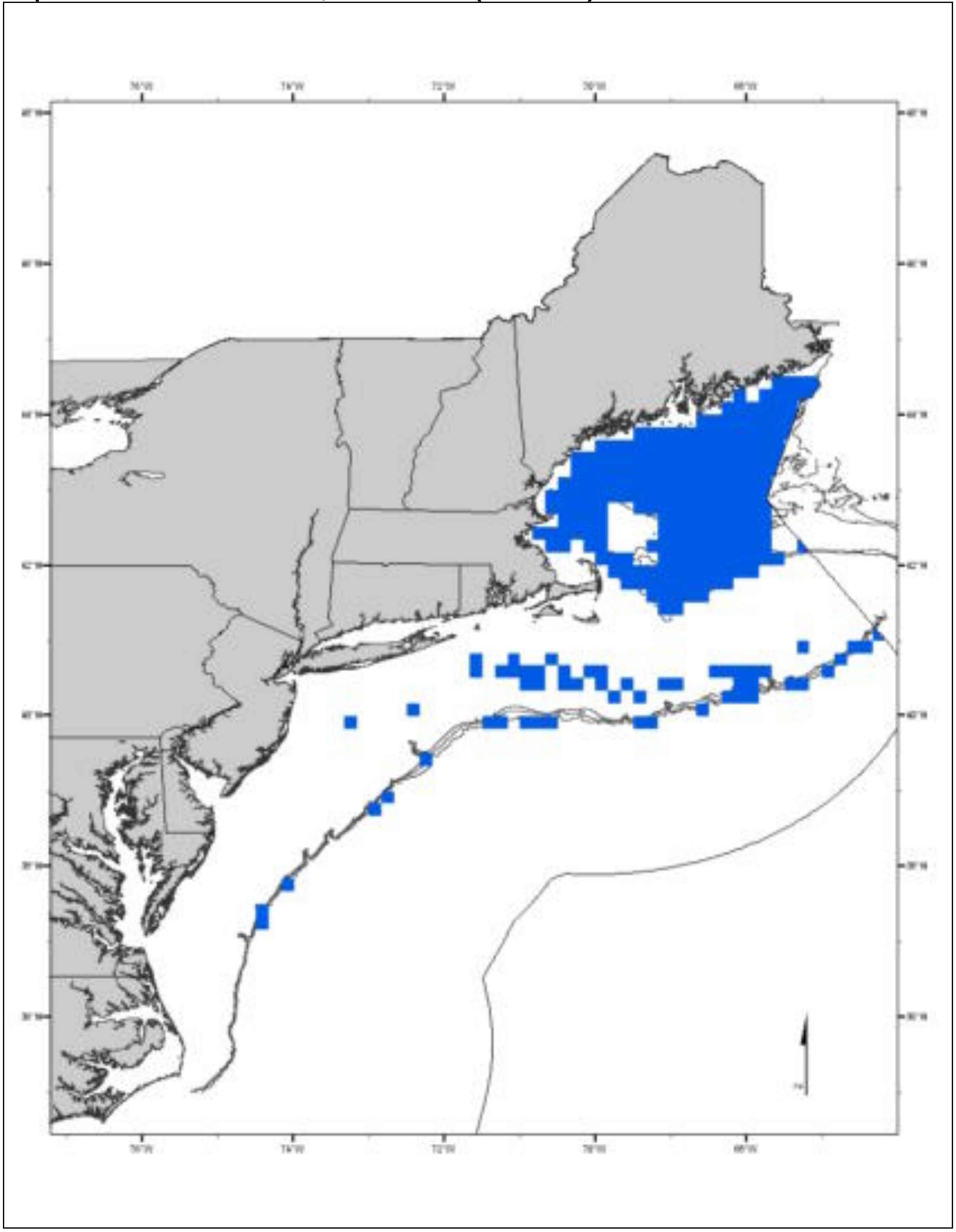
The EFH designation for witch flounder larvae is based upon alternative 4 for witch flounder larvae. This alternative was selected to be as inclusive as possible of areas likely to support witch flounder larvae.

Map 74. Witch flounder juveniles, Alternative 1 (No Action)



The EFH designation for juvenile witch flounder is based upon alternative 3 for witch flounder juveniles. This alternative was selected to include all areas where witch flounder occur in relatively high concentrations, but not areas where they occur in relatively low concentrations.

Map 75. Witch flounder adults, Alternative 1 (No Action)



The EFH designation for adult witch flounder is based upon alternative 3 for witch flounder adults. This alternative was selected to include all areas where witch flounder occur in relatively high concentrations, but not areas where they occur in relatively low concentrations.

4.1.1.2.25 Yellowtail flounder (Limanda ferruginea)

In its *Report to Congress: Status of the Fisheries of the United States* (September 1997), NMFS determined the Georges Bank and Southern New England stocks of yellowtail flounder are neither currently overfished nor approaching an overfished condition. There is not enough information to determine if the Cape Cod or Middle Atlantic stocks are overfished or approaching an overfished condition. For all four stocks of yellowtail flounder, essential fish habitat is described as those areas of the coastal and offshore waters (out to the offshore U.S. boundary of the exclusive economic zone) that are designated on Map 76 - Map 79 and in the accompanying table and meet the following conditions:

Eggs: Surface waters of Georges Bank, Massachusetts Bay, Cape Cod Bay, and the southern New England continental shelf south to Delaware Bay as depicted on Map 76. Generally, the following conditions exist where yellowtail eggs are found: sea surface temperatures below 15° C, water depths from 30 - 90 meters and a salinity range from 32.4 - 33.5‰. Yellowtail flounder eggs are most often observed during the months from mid-March to July, with peaks in April to June in southern New England.

Larvae: Surface waters of Georges Bank, Massachusetts Bay, Cape Cod Bay, the southern New England shelf and throughout the middle Atlantic south to the Chesapeake Bay as depicted on Map 77. Generally, the following conditions exist where yellowtail larvae are found: sea surface temperatures below 17° C, water depths from 10 - 90 meters, and a salinity range from 32.4 - 33.5‰. Yellowtail flounder larvae are most often observed from March through April in the New York bight and from May through July in southern New England and southeastern Georges Bank.

Juveniles: Bottom habitats with a substrate of sand or sand and mud on Georges Bank, the Gulf of Maine, and the southern New England shelf south to Delaware Bay as depicted on Map 78. Generally, the following conditions exist where yellowtail flounder juveniles are found: water temperatures below 15° C, depths from 20 - 50 meters and a salinity range from 32.4 - 33.5‰.

Adults: Bottom habitats with a substrate of sand or sand and mud on Georges Bank, the Gulf of Maine, and the southern New England shelf south to Delaware Bay as depicted on Map 79. Generally, the following conditions exist where yellowtail flounder adults are found: water temperatures below 15° C, depths from 20 - 50 meters, and a salinity range from 32.4 - 33.5‰.

Spawning Adults: Bottom habitats with a substrate of sand or sand and mud on Georges Bank, the Gulf of Maine, and the southern New England shelf south to Delaware Bay as depicted on Map 79. Generally, the following conditions exist where spawning yellowtail flounder adults are found: water temperatures below 17° C, depths from 10 - 125 meters, and a salinity range from 32.4 - 33.5‰.

All of the above EFH descriptions include those bays and estuaries listed on the following table, according to life history stage. The Council acknowledges potential seasonal and spatial variability of the conditions generally associated with this species.

Table 22. EFH Designation of Estuaries and Embayments: Yellowtail flounder (Limanda ferruginea)

Estuaries and Embayments	Eggs	Larvae	Juveniles	Adults	Spawning Adults
Passamaquoddy Bay	s	s			
Englishman/Machias Bay	s	s			
Narraguagus Bay	s	s			
Blue Hill Bay	s	s			
Penobscot Bay	s	s			
Muscongus Bay	s	s			
Damariscotta River	s	s			
Sheepscot River	s	s	s	s	
Kennebec / Androscoggin Rivers	s	s			
Casco Bay	s	s	s	s	
Saco Bay	s	s			
Wells Harbor		s			
Great Bay	s	s			
Merrimack River	s	s			
Massachusetts Bay	s	s	s	s	s
Boston Harbor	s	s	s	s	s
Cape Cod Bay	s	s	s	s	s

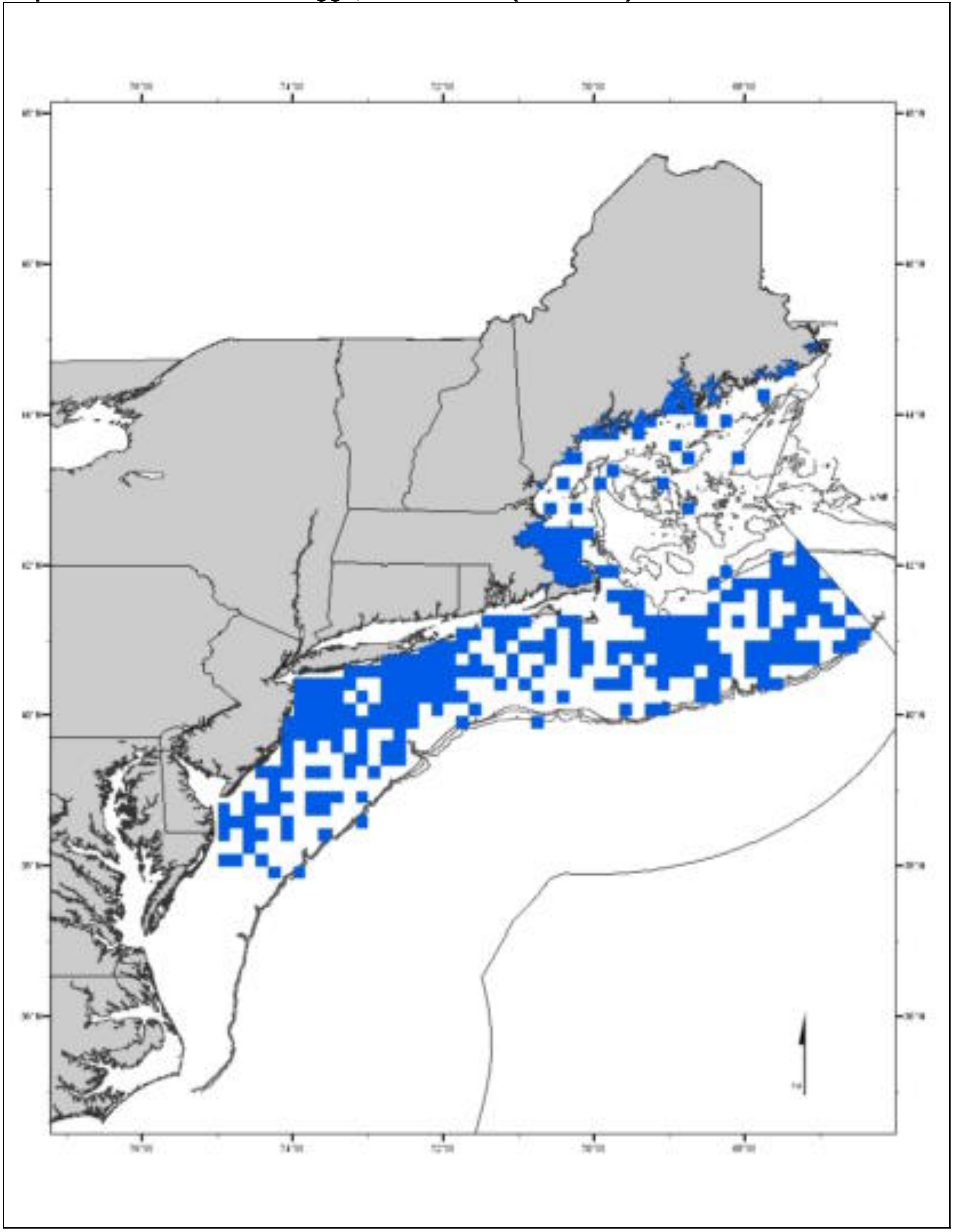
S ≡ The EFH designation for this species includes the seawater salinity zone of this bay or estuary (salinity > 25.0‰).

M ≡ The EFH designation for this species includes the mixing water / brackish salinity zone of this bay or estuary (0.5 < salinity < 25.0‰).

F ≡ The EFH designation for this species includes the tidal freshwater salinity zone of this bay or estuary (0.0 < salinity < 0.5‰).

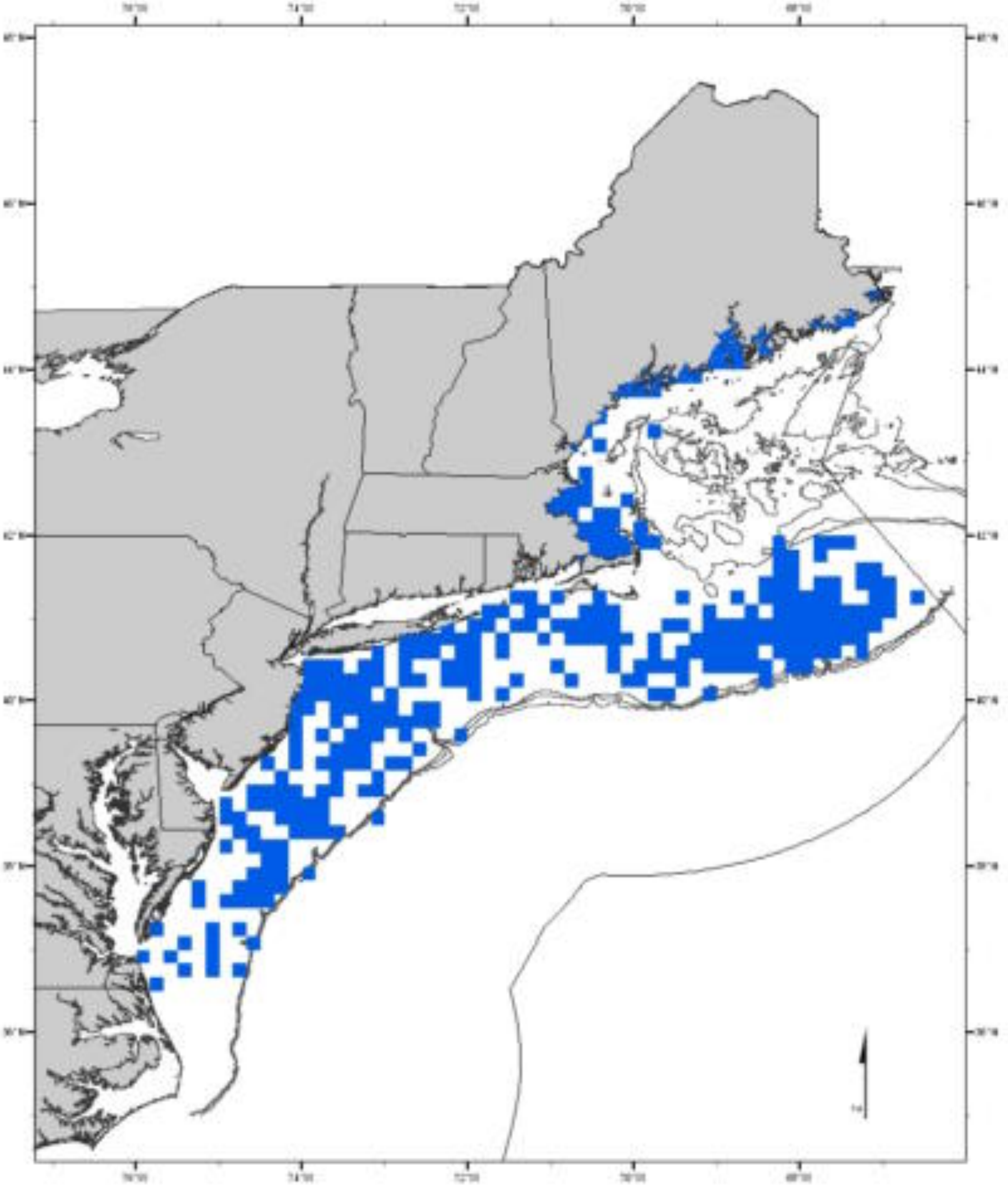
These EFH designations of estuaries and embayments are based on the NOAA Estuarine Living Marine Resources (ELMR) program (Jury et al. 1994; Stone et al. 1994). For a detailed view of the salinity zone boundaries, as described in the ELMR reports, please see Appendix B. The Council recognizes the spatial and temporal variability of estuarine and embayment environmental conditions generally associated with this species.

Map 76. Yellowtail flounder eggs, Alternative 1 (No Action)



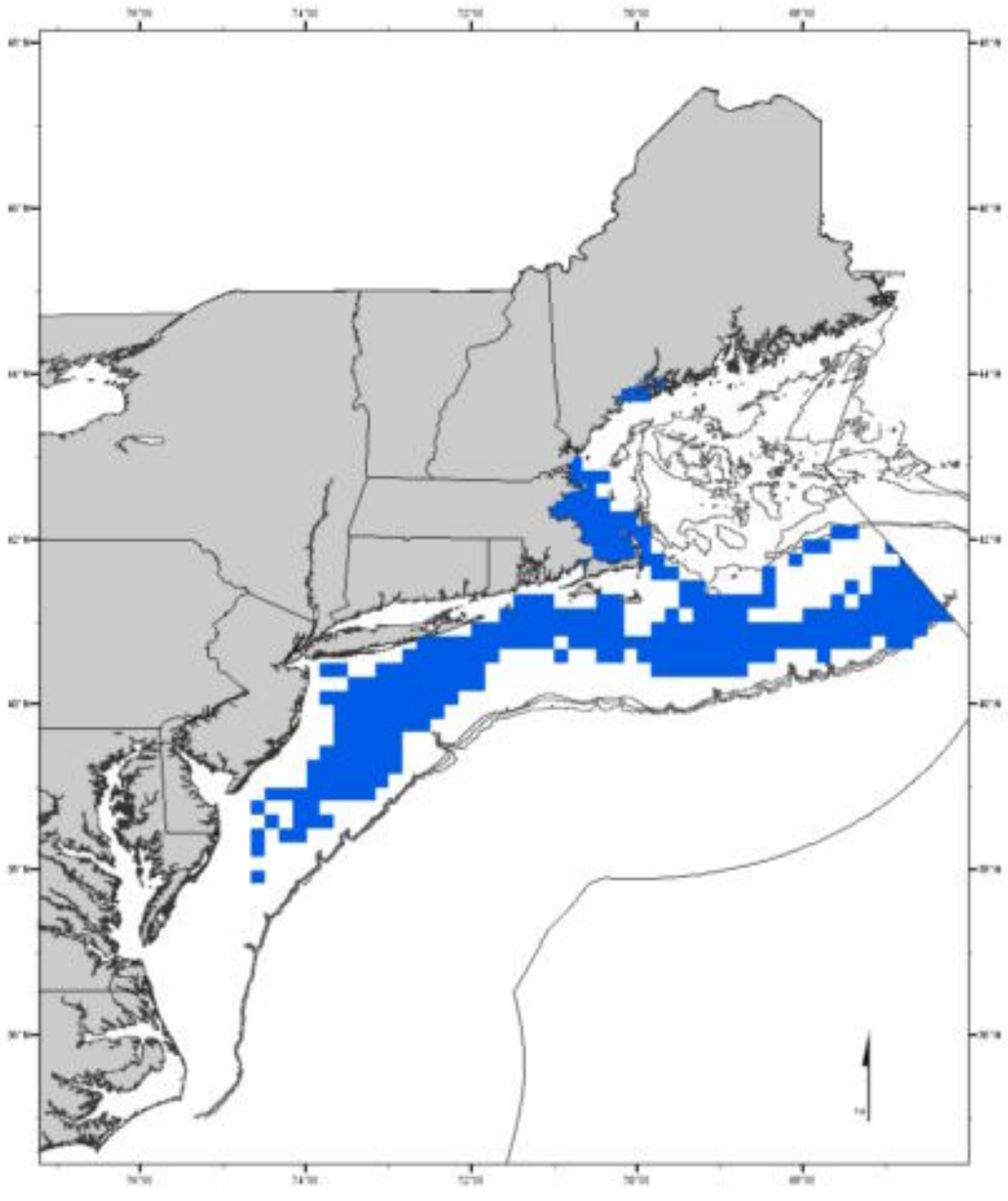
The EFH designation for yellowtail flounder eggs is based upon alternative 4 for yellowtail flounder eggs. In addition, this designation includes those bays and estuaries identified in the NOAA ELMR program as supporting yellowtail flounder eggs at the "rare", "common", or "abundant" level. This alternative was selected to be as inclusive as possible of areas likely to support yellowtail flounder eggs.

Map 77. Yellowtail flounder larvae, Alternative 1 (No Action)



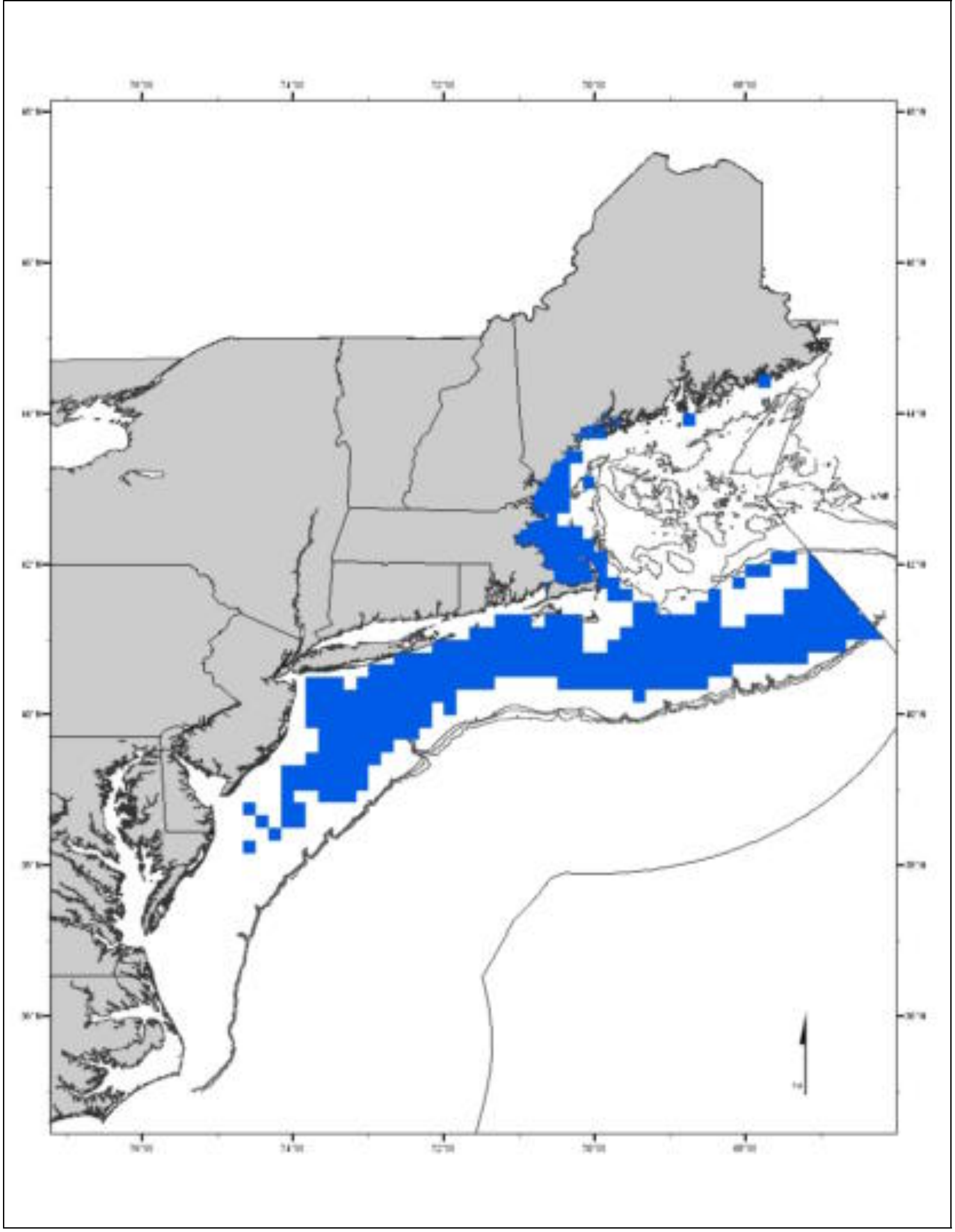
The EFH designation for yellowtail flounder larvae is based upon alternative 4 for yellowtail flounder larvae. In addition, this designation includes those bays and estuaries identified in the NOAA ELMR program as supporting yellowtail flounder larvae at the "rare", "common", or "abundant" level. This alternative was selected to be as inclusive as possible of areas likely to support yellowtail flounder larvae.

Map 78. Yellowtail flounder juveniles, Alternative 1 (No Action)



The EFH designation for juvenile yellowtail flounder is based upon alternative 3 for yellowtail flounder juveniles. In addition, this designation includes those bays and estuaries identified in the NOAA ELMR program as supporting yellowtail flounder juveniles at the "common" or "abundant" level. This alternative was selected because it included all areas where yellowtail flounder juveniles were observed in relatively high concentrations, but did not include areas where they occurred in low concentrations.

Map 79. Yellowtail flounder adults, Alternative 1 (No Action)



The EFH designation for adult yellowtail flounder is based upon alternative 3 for yellowtail flounder adults. In addition, this designation includes those bays and estuaries identified in the NOAA ELMR program as supporting yellowtail flounder adults at the "common" or "abundant" level, as well as areas identified by the fishing industry as important for spawning adults. This alternative was selected because it included all areas where yellowtail flounder adults were observed in relatively high concentrations, but did not include areas where they occurred in low concentrations.

4.1.2 Alternative 2 – MODIFIED ABUNDANCE-BASED

4.1.2.1 Methods

The Alternative 2 EFH designations employ a similar method as described above under Alternative 1 (No Action) except that the time series of NMFS bottom trawl survey data for the continental shelf includes data from 1968 to 2005 instead of 1963-1997. The cumulative catch rates were changed from 50%, 75%, 90% and 100% as considered in the No Action alternative to 25% (Alternative 2A), 50% (Alternative 2B), 75% (Alternative 2C) and 90% (Alternative 2D) to better reflect the range of level 2 relative abundance data. This is consistent with the approach used in Alternative 3. For juveniles and adults of species with distributions that are limited to the continental shelf, the text descriptions for this alternative are the same as the revised descriptions developed for Alternative 3. For juveniles and adults of other species with distributions that extend beyond the edge of the continental shelf, the Alternative 2 text descriptions only refer to the depth range where the NMFS trawl survey is conducted (out to a maximum depth of 500 meters). Survey catch data used in this alternative, and in alternatives 3 and 4, were processed slightly differently in order to further reduce the impact of high abundance tows on average catch rates for each ten minute square (moreso than was done originally). Lastly, state fisheries survey data were also included in the analysis. Any location in which the frequency of occurrence (number of positive tows) exceeds 10% for any managed species and life stage will be included as EFH. None of the EFH maps for this alternative include any off-shelf (>500 meters) area. The methods described here apply to all the species managed by the Council except Atlantic salmon and deep-sea red crab. For a detailed explanation of the methods used to develop Alternative 2, please refer to Appendix A.

4.1.2.2 Supplementary Information

The NEFSC Essential Fish Habitat Source Documents found at www.nefsc.noaa.gov and the supplementary EFH tables found in Appendix B are the basis for the EFH designation alternatives.

4.1.2.3 Text Descriptions and Map Representations

4.1.2.3.1 American Plaice

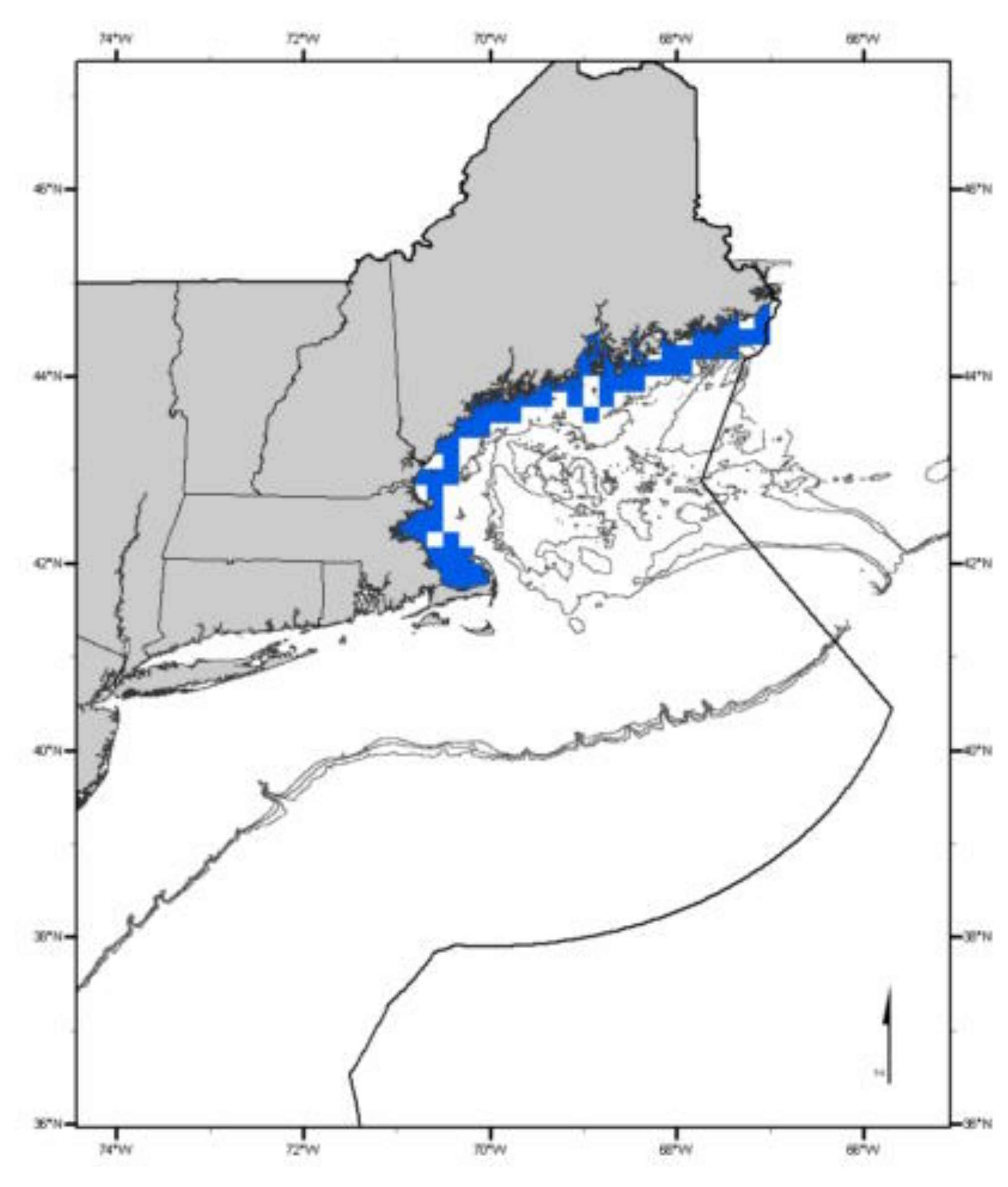
Eggs: No Alternative EFH designation.

Larvae: No Alternative EFH designation.

Juveniles: Continental shelf benthic habitats in depths of 40 – 180 meters with substrates of mud and/or mixtures of sand and mud, as depicted on Map 80 - Map 83. Other conditions that generally exist where EFH is found are bottom temperatures of 2.5 – 10.5ºC and salinities of 28 – 34.5 ppt. Primary benthic prey organisms for juvenile American plaice are nematodes, polychaetes, a variety of crustaceans, brittle stars, and bivalve mollusks.

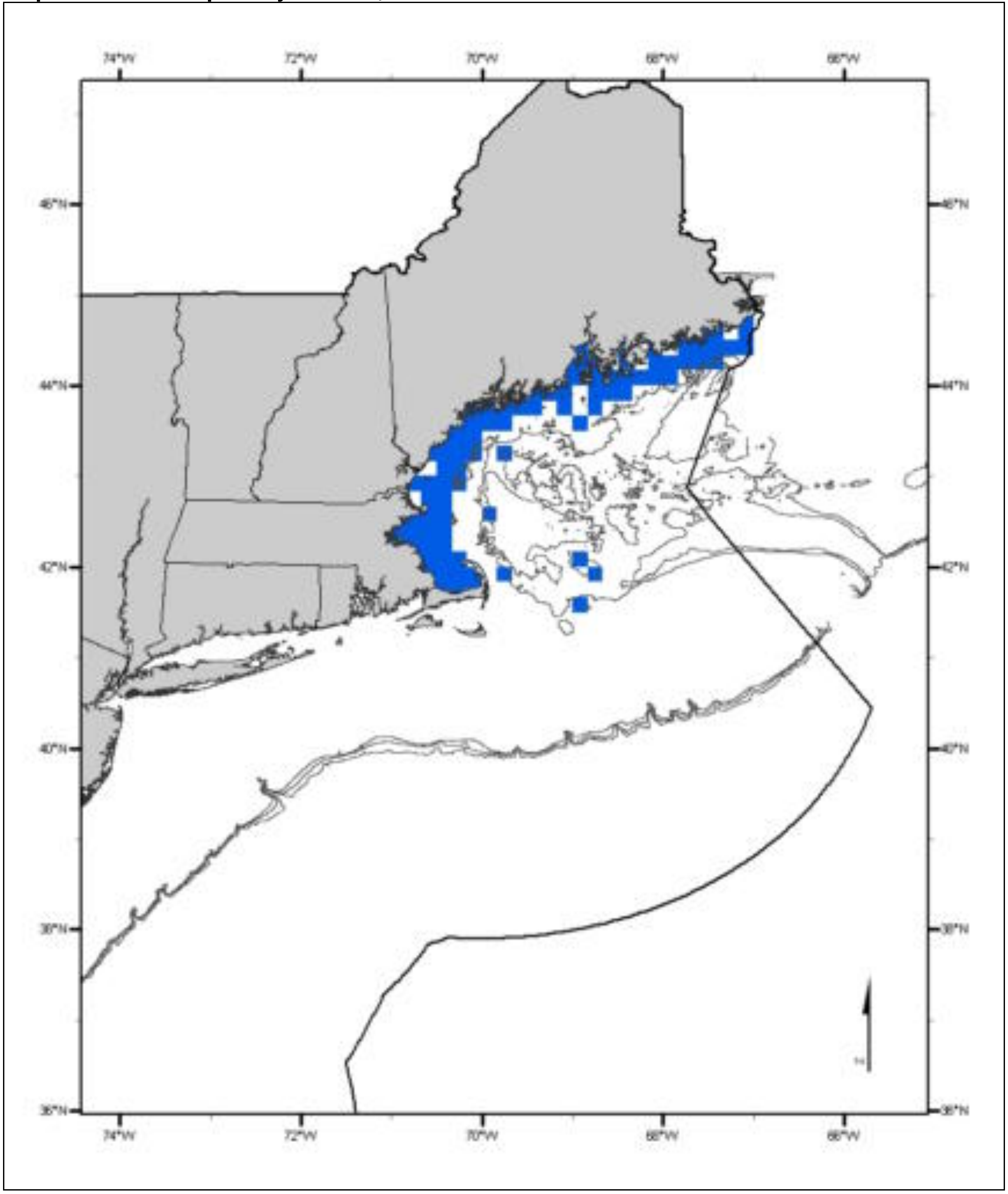
Adults: Continental shelf benthic habitats in depths of 40 – 200 meters with substrates of mud and/or mixtures of sand and mud, as depicted on Map 84 - Map 87. Other conditions that generally exist where EFH is found are bottom temperatures of 2.5 – 10.5ºC and salinities of 28 – 34.5 ppt. Spawning generally occurs in depths less than 90 meters and bottom temperatures of 3 – 6ºC. Primary prey organisms for adult American plaice are bivalve mollusks, a variety of crustaceans, brittle stars, starfishes, and sand dollars.

Map 80. American plaice juveniles, Alternative 2A



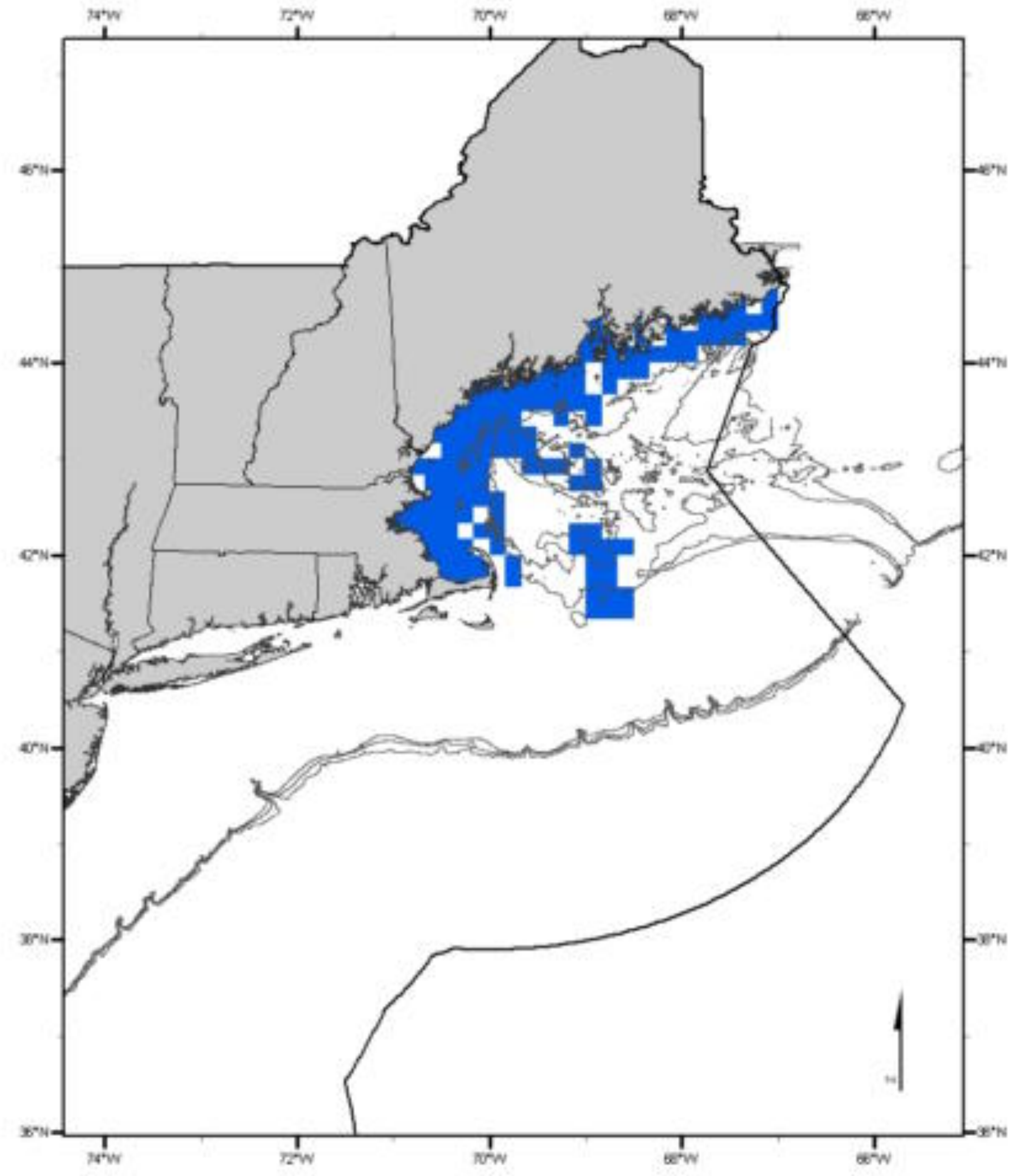
The Alternative 2A EFH designation for juvenile American plaice on the continental shelf is based upon relative abundance during 1968-2005 in the fall and spring NMFS trawl survey at the 25% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where juvenile American plaice were caught in state trawl surveys in more than 10% of the tows, as well as those bays and estuaries identified by the NOAA ELMR program where American plaice juveniles were "common" or "abundant."

Map 81. American plaice juveniles, Alternative 2B



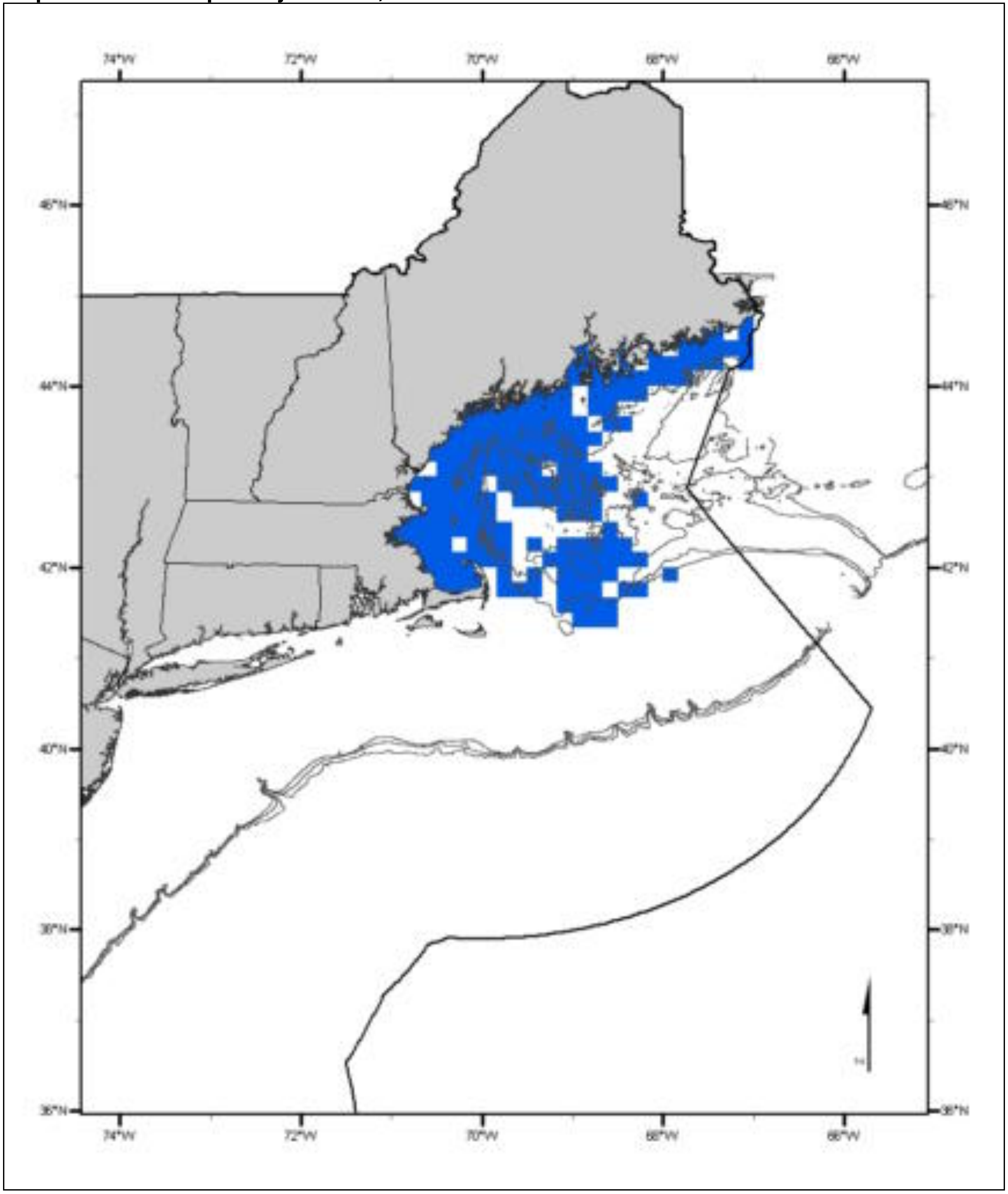
The Alternative 2B EFH designation for juvenile American plaice on the continental shelf is based upon relative abundance during 1968-2005 in the fall and spring NMFS trawl survey at the 50% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where juvenile American plaice were caught in state trawl surveys in more than 10% of the tows, as well as those bays and estuaries identified by the NOAA ELMR program where American plaice juveniles were "common" or "abundant."

Map 82. American plaice juveniles, Alternative 2C



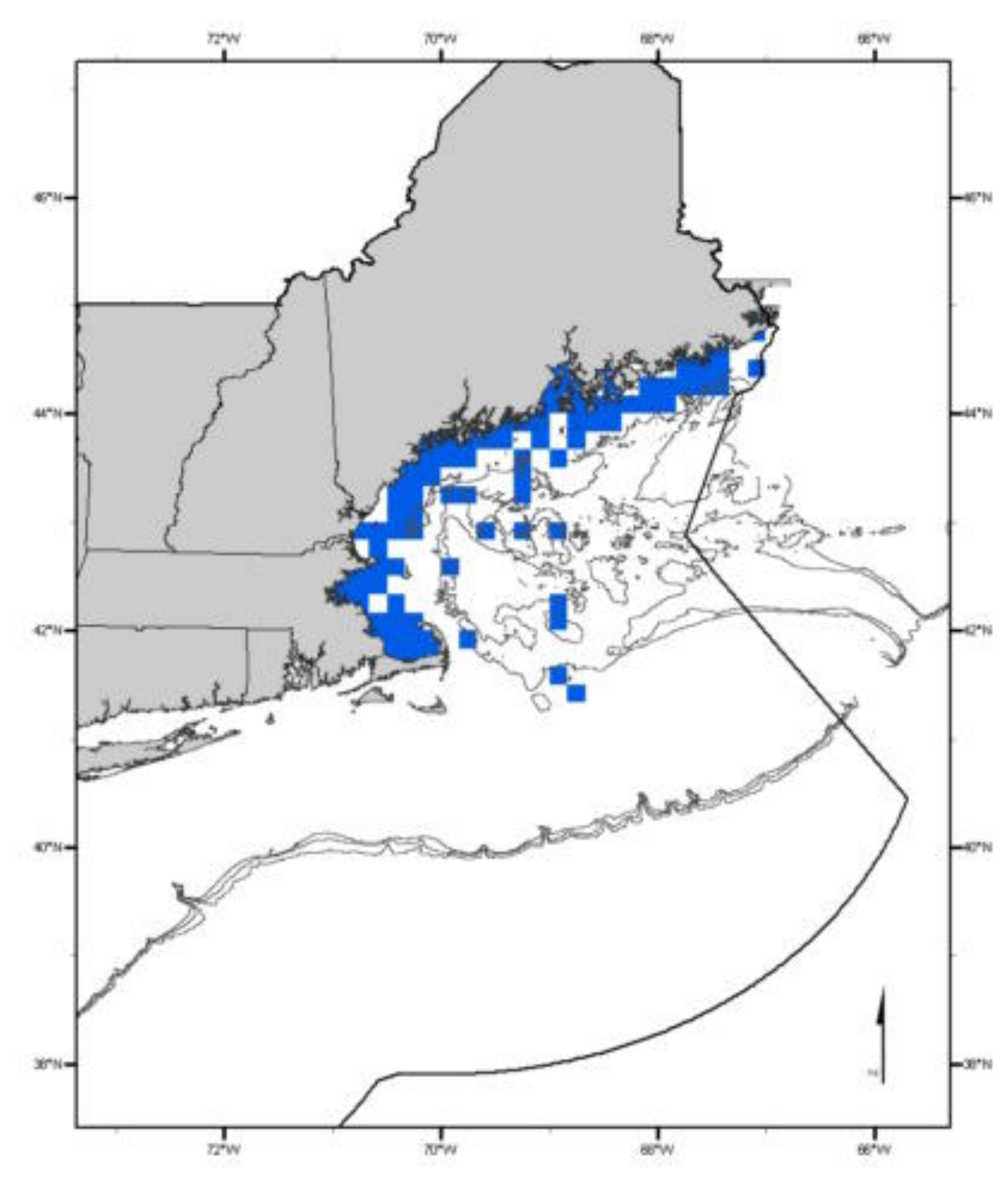
The Alternative 2C EFH designation for juvenile American plaice on the continental shelf is based upon relative abundance during 1968-2005 in the fall and spring NMFS trawl survey at the 75% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where juvenile American plaice were caught in state trawl surveys in more than 10% of the tows, as well as those bays and estuaries identified by the NOAA ELMR program where American plaice juveniles were "common" or "abundant."

Map 83. American plaice juveniles, Alternative 2D



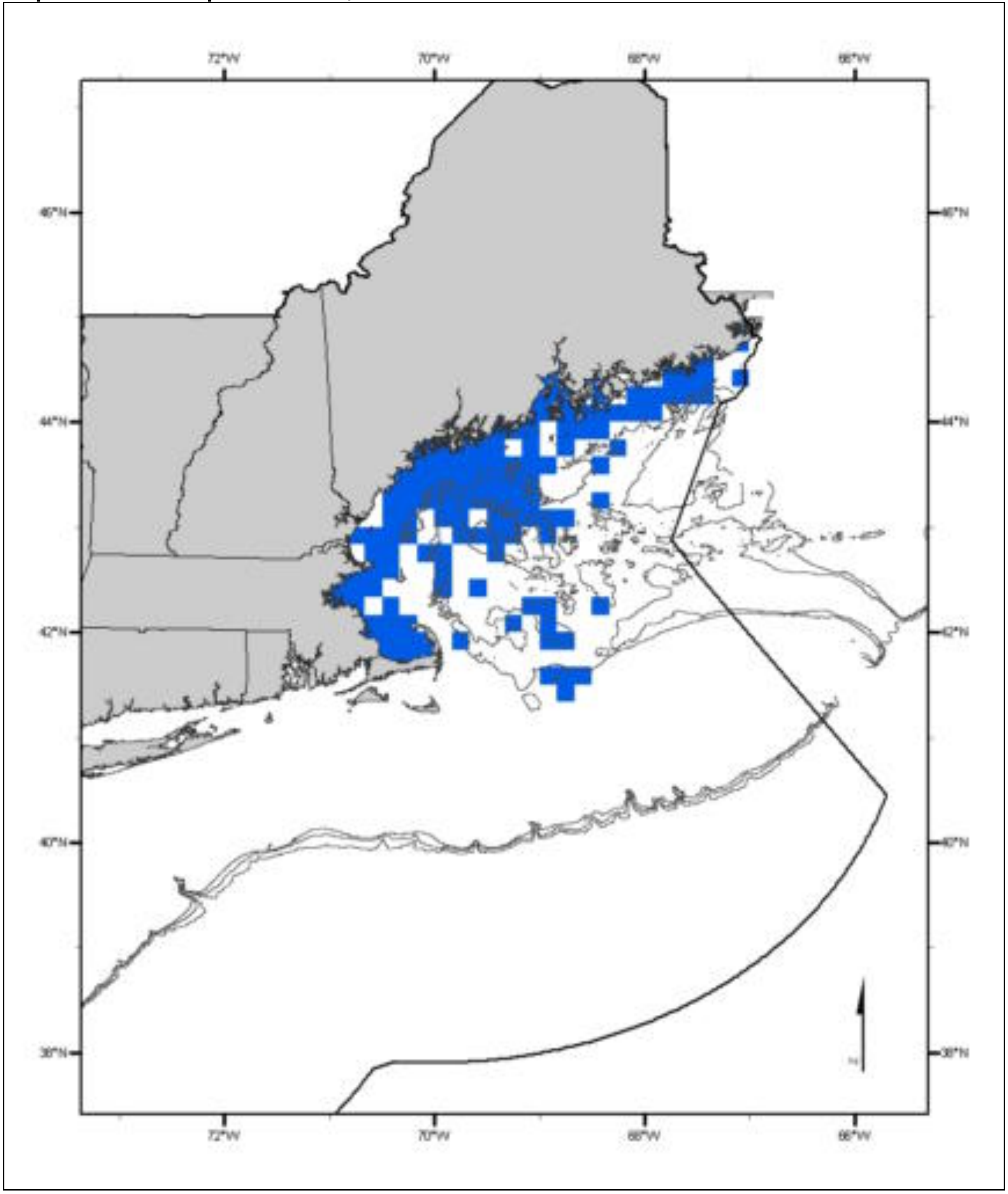
The Alternative 2D EFH designation for juvenile American plaice on the continental shelf is based upon relative abundance during 1968-2005 in the fall and spring NMFS trawl survey at the 90% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where juvenile American plaice were caught in state trawl surveys in more than 10% of the tows, as well as those bays and estuaries identified by the NOAA ELMR program where American plaice juveniles were "common" or "abundant."

Map 84. American plaice adults, Alternative 2A



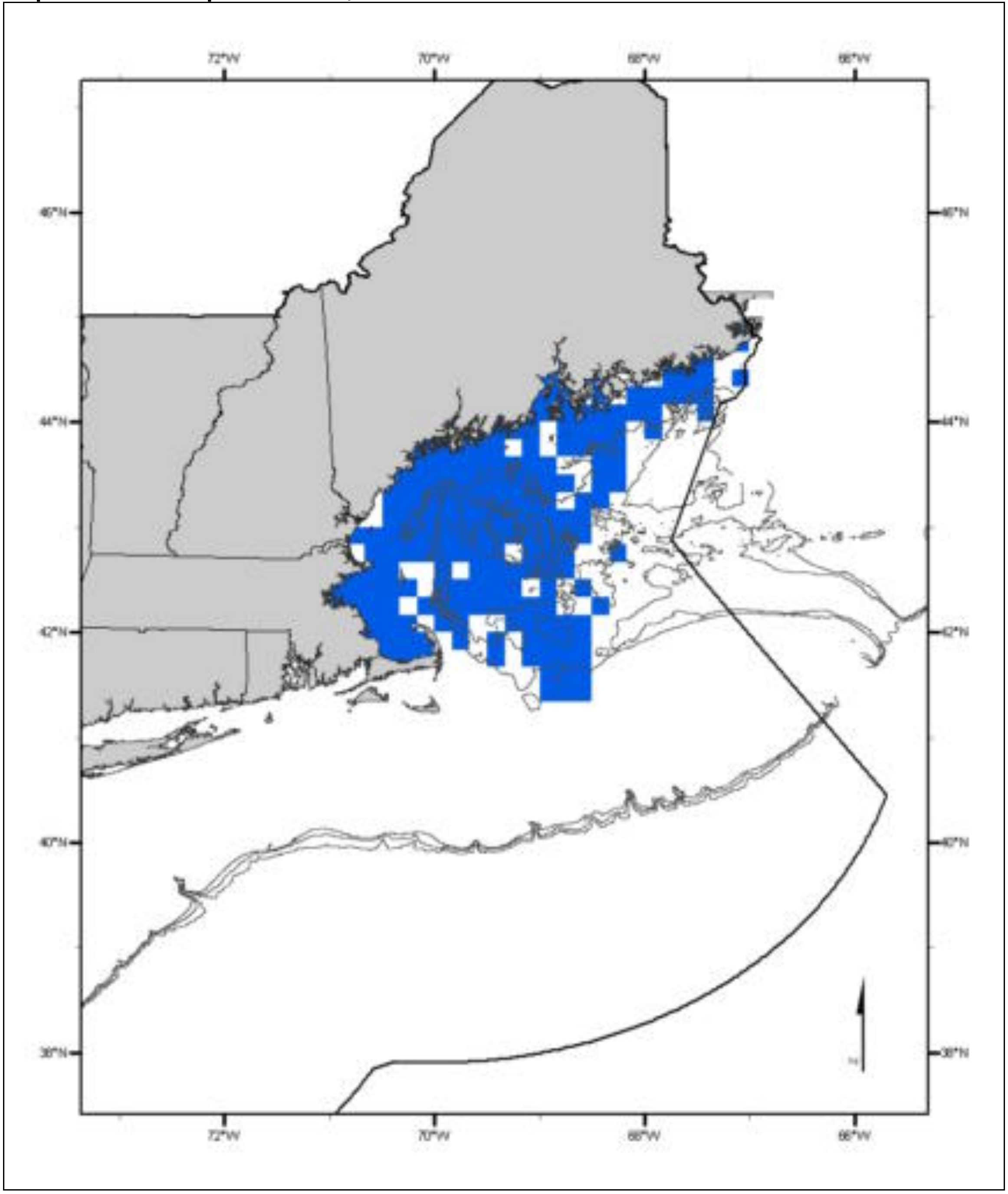
The Alternative 2A EFH designation for adult American plaice on the continental shelf is based upon relative abundance during 1968-2005 in the fall and spring NMFS trawl survey at the 25% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where adult American plaice were caught in state trawl surveys in more than 10% of the tows, as well as those bays and estuaries identified by the NOAA ELMR program where American plaice adults were "common" or "abundant."

Map 85. American plaice adults, Alternative 2B



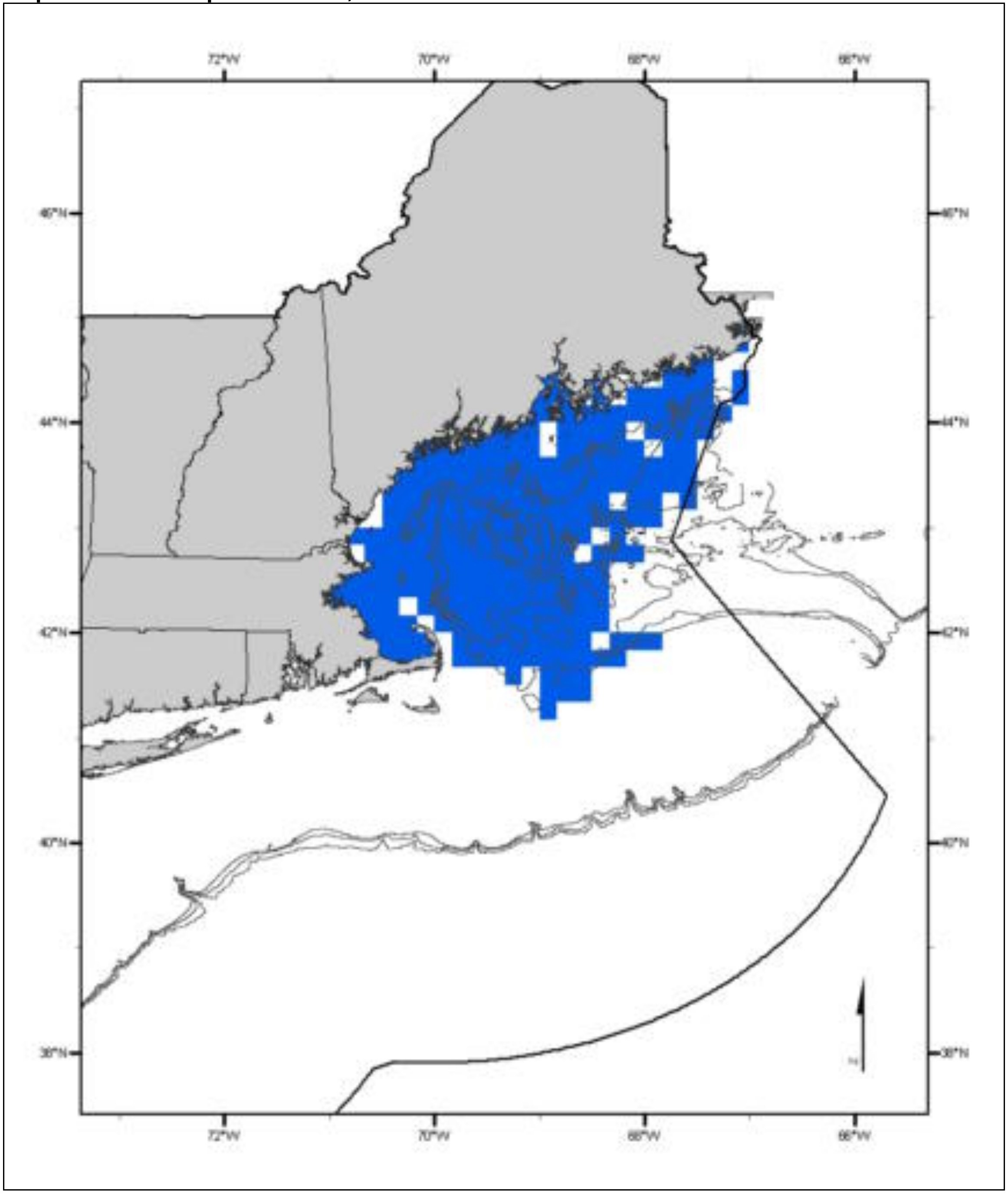
The Alternative 2B EFH designation for adult American plaice on the continental shelf is based upon relative abundance during 1968-2005 in the fall and spring NMFS trawl survey at the 50% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where adult American plaice were caught in state trawl surveys in more than 10% of the tows, as well as those bays and estuaries identified by the NOAA ELMR program where American plaice adults were "common" or "abundant."

Map 86. American plaice adults, Alternative 2C



The Alternative 2C EFH designation for adult American plaice on the continental shelf is based upon relative abundance during 1968-2005 in the fall and spring NMFS trawl survey at the 75% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where adult American plaice were caught in state trawl surveys in more than 10% of the tows, as well as those bays and estuaries identified by the NOAA ELMR program where American plaice adults were "common" or "abundant."

Map 87. American plaice adults, Alternative 2D



The Alternative 2D EFH designation for adult American plaice on the continental shelf is based upon relative abundance during 1968-2005 in the fall and spring NMFS trawl survey at the 90% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where adult American plaice were caught in state trawl surveys in more than 10% of the tows, as well as those bays and estuaries identified by the NOAA ELMR program where American plaice adults were "common" or "abundant."

4.1.2.3.2 Atlantic Cod

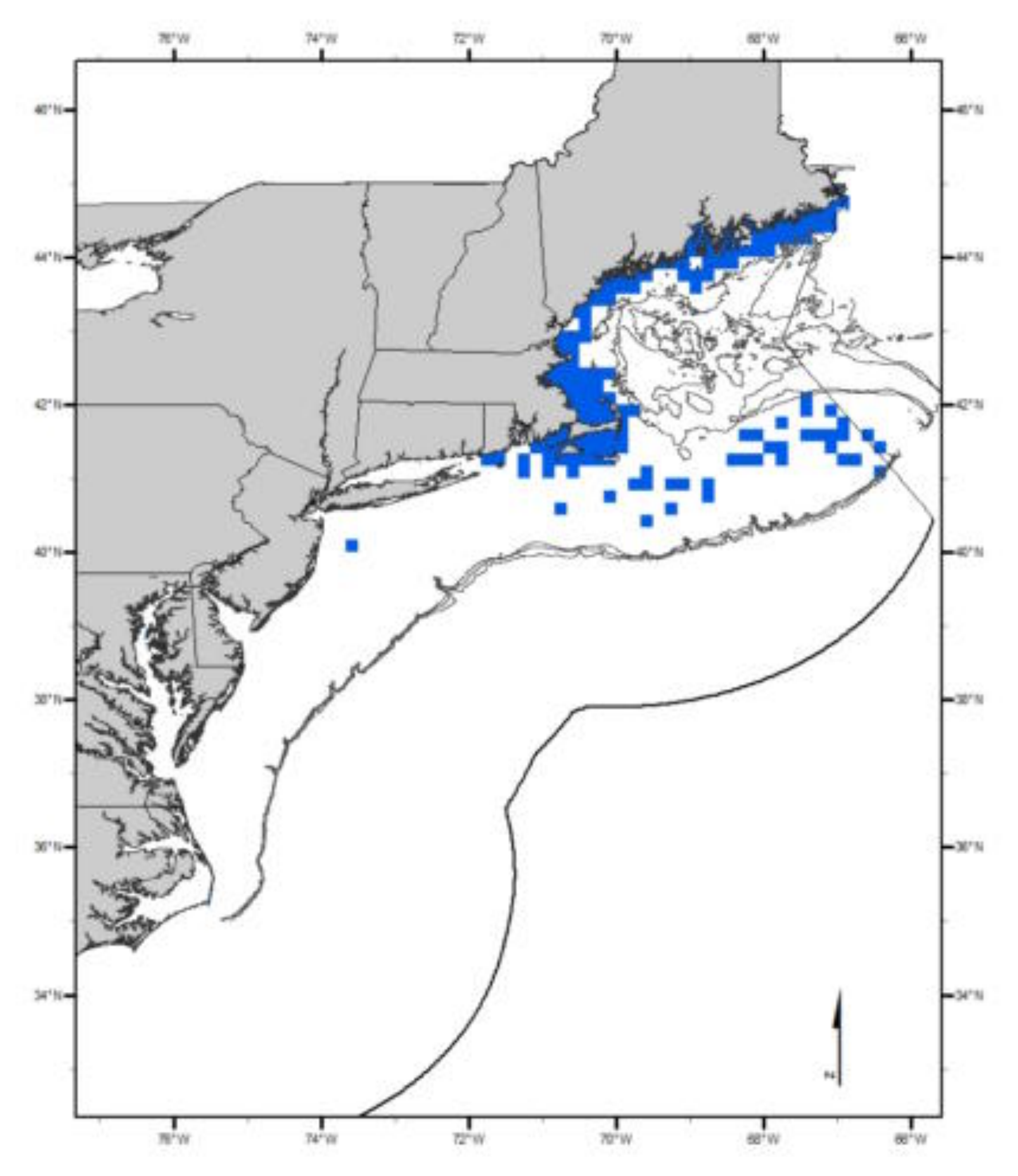
Eggs: Inshore and continental shelf water column habitats, as depicted on Map 88 - Map 91. The following conditions generally exist where EFH for Atlantic cod eggs is found: bottom depths of 20 – 140 meters; water column temperatures of 3.5–13.5ºC; and salinities of 32 – 33 ppt.
Preferred Alternative

Larvae: Inshore and continental shelf water column habitats, as depicted on Map 93-Map 96. The following conditions generally exist where EFH for Atlantic cod larvae is found: bottom depths of 20 – 120 meters; water column temperatures of 3.5 – 12.5ºC; and salinities of 32 – 33 ppt. Atlantic cod larvae feed on copepods.
Preferred Alternative

Juveniles: Inshore and continental shelf benthic habitats in depths of 1 – 120 meters (including the intertidal zone) with a wide variety of substrates, as depicted on Map 98 - Map 101. EFH for juvenile Atlantic cod includes boulders, cobbles, pebbles, gravel, sand, sand and mud, and/or sand and mud mixed with gravel, pebbles, and cobbles. Other conditions that generally exist where EFH is found are bottom temperatures of 2.5 – 12.5ºC and salinities of 28 – 34 ppt. YOY juveniles settle to the bottom in inshore and offshore waters, inhabiting seagrass and macroalgal beds and structurally–complex hard bottom substrates (*e.g.*, rock reef and cobble–pebble–gravel habitats with attached epifauna such as sponges). Recently–settled benthic juveniles feed primarily on mysids, while older juveniles feed on a variety of crustaceans.

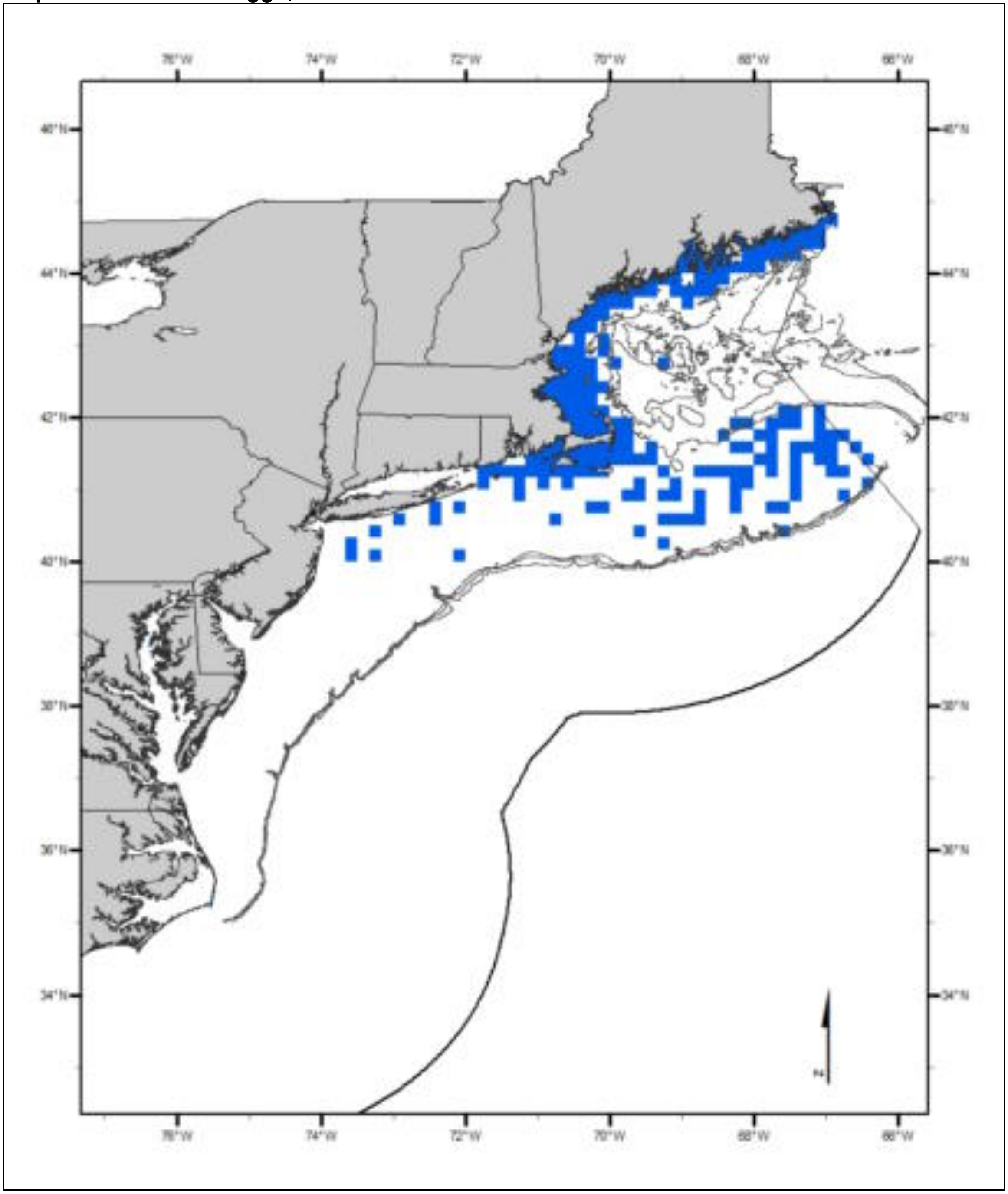
Adults: Inshore and continental shelf benthic habitats in depths of 20 – 140 meters with a wide variety of substrates, as depicted on Map 102 - Map 105. EFH for adult Atlantic cod includes rocky slopes and ledges, boulders, cobbles, pebbles, gravel, sand, and/or sand and mud mixed with gravel, pebbles, and cobbles. Other conditions that generally exist where EFH is found are bottom temperatures of 2.5 – 12.5ºC and salinities of 31 – 34 ppt. Spawning occurs in nearshore areas and on the continental shelf, usually in depths less than 73 meters. Adult Atlantic cod feed on squids and a variety of fishes and crustaceans.

Map 88. Atlantic cod eggs, Alternative 2A



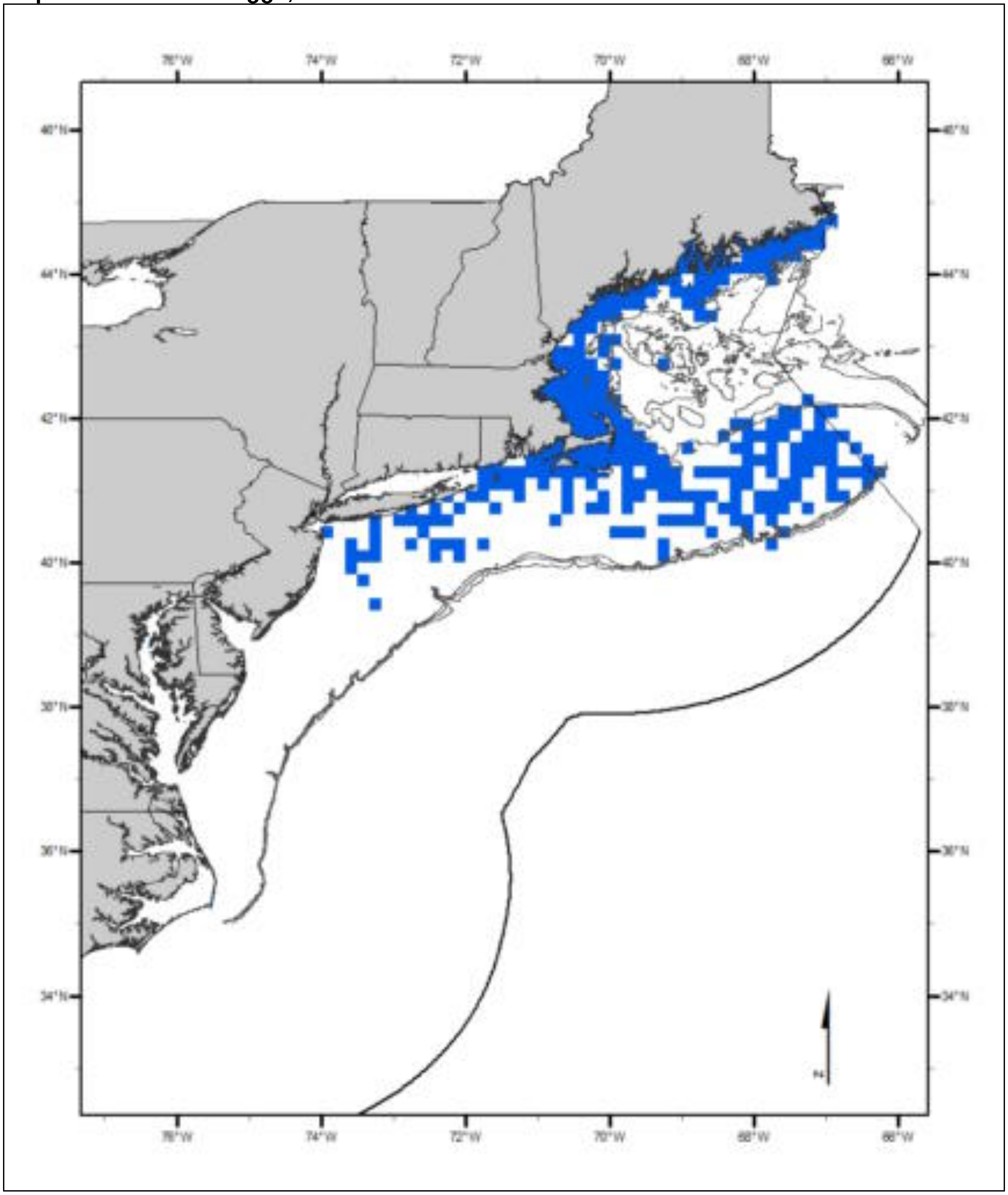
The Alternative 2A EFH designation for Atlantic cod eggs on the continental shelf is based upon the relative abundance of juveniles during 1968-2005 in the fall and spring NMFS trawl survey at the 25% cumulative percentage catch level and the relative abundance of eggs during 1978-1987 in the NMFS MARMAP ichthyoplankton survey at the 25% cumulative percentage area level. This alternative also includes those bays and estuaries identified by the NOAA ELMR program where Atlantic cod eggs were "common" or "abundant."

Map 89. Atlantic cod eggs, Alternative 2B



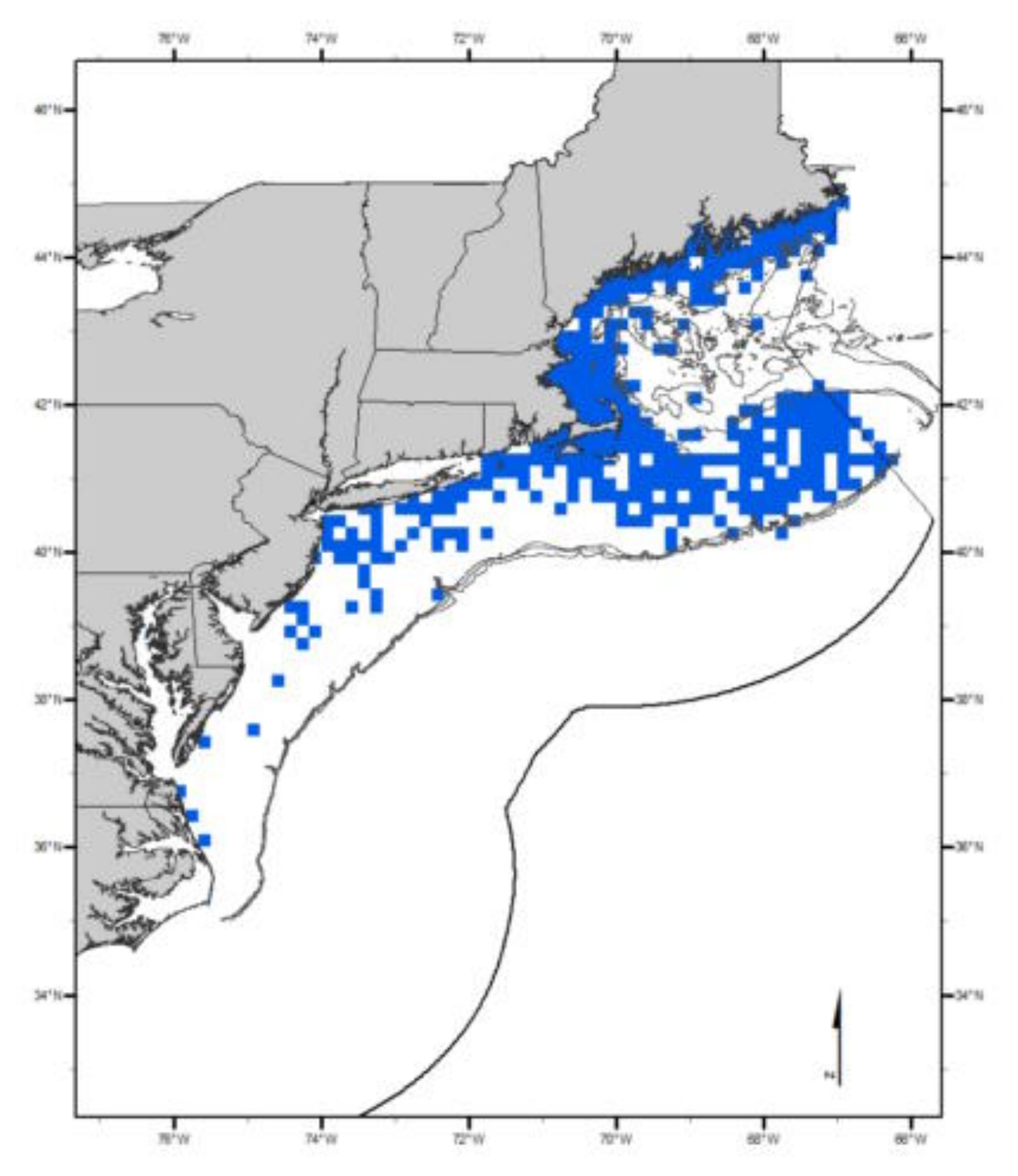
The Alternative 2B EFH designation for Atlantic cod eggs on the continental shelf is based upon the relative abundance of juveniles during 1968-2005 in the fall and spring NMFS trawl survey at the 50% cumulative percentage catch level and the relative abundance of eggs during 1978-1987 in the NMFS MARMAP ichthyoplankton survey at the 50% cumulative percentage area level. This alternative also includes those bays and estuaries identified by the NOAA ELMR program where Atlantic cod eggs were "common" or "abundant."

Map 90. Atlantic cod eggs, Alternative 2C



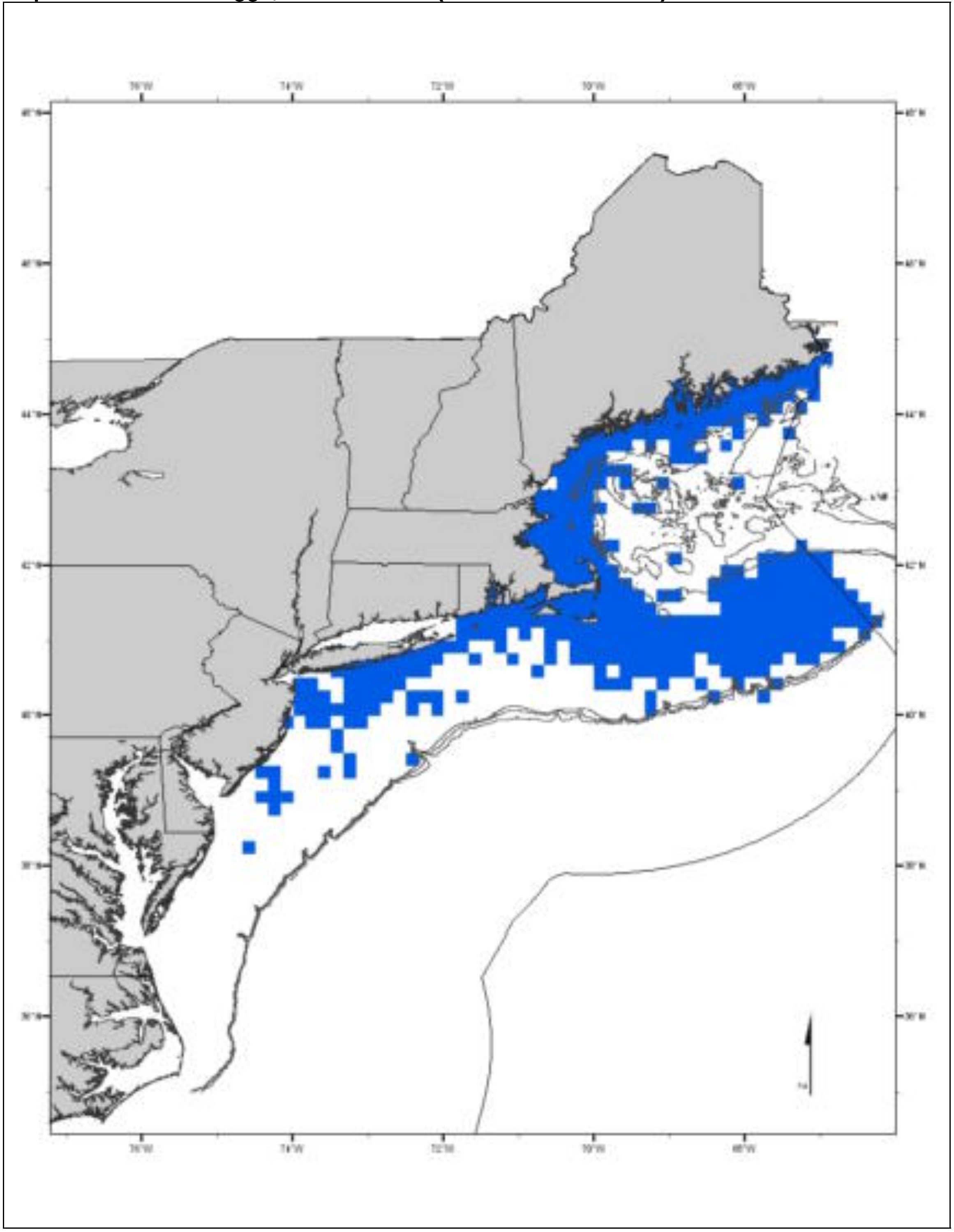
The Alternative 2C EFH designation for Atlantic cod eggs on the continental shelf is based upon the relative abundance of juveniles during 1968-2005 in the fall and spring NMFS trawl survey at the 75% cumulative percentage catch level and the relative abundance of eggs during 1978-1987 in the NMFS MARMAP ichthyoplankton survey at the 75% cumulative percentage area level.   This alternative also includes those bays and estuaries identified by the NOAA ELMR program where Atlantic cod eggs were "common" or "abundant."

Map 91. Atlantic cod eggs, Alternative 2D



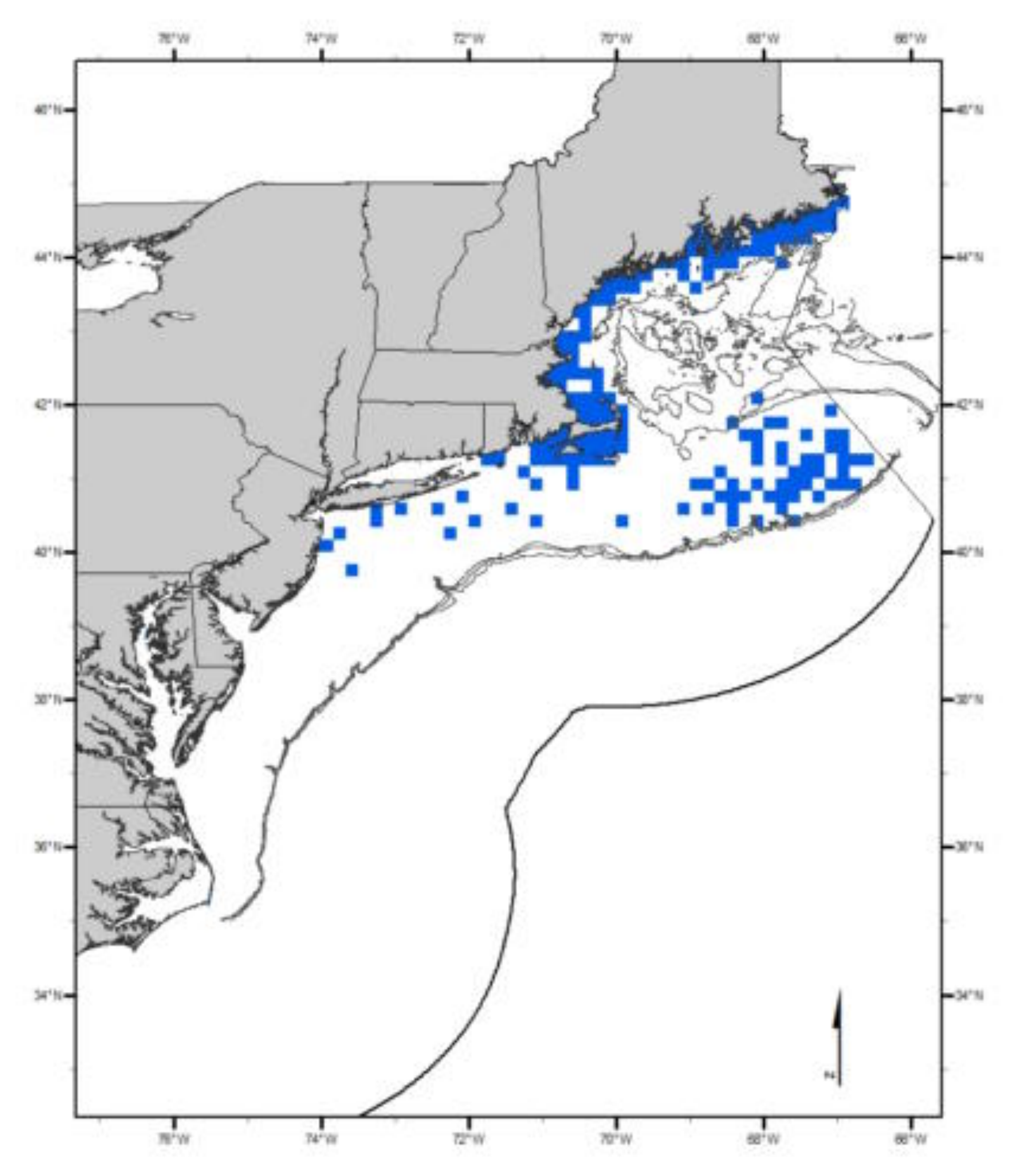
The Alternative 2D EFH designation for Atlantic cod eggs on the continental shelf is based upon the relative abundance of juveniles during 1968-2005 in the fall and spring NMFS trawl survey at the 90% cumulative percentage catch level and the relative abundance of eggs during 1978-1987 in the NMFS MARMAP ichthyoplankton survey at the 90% cumulative percentage area level. This alternative also includes those bays and estuaries identified by the NOAA ELMR program where Atlantic cod eggs were "common" or "abundant."

Map 92. Atlantic cod eggs, Alternative 2E (*Preferred Alternative*)



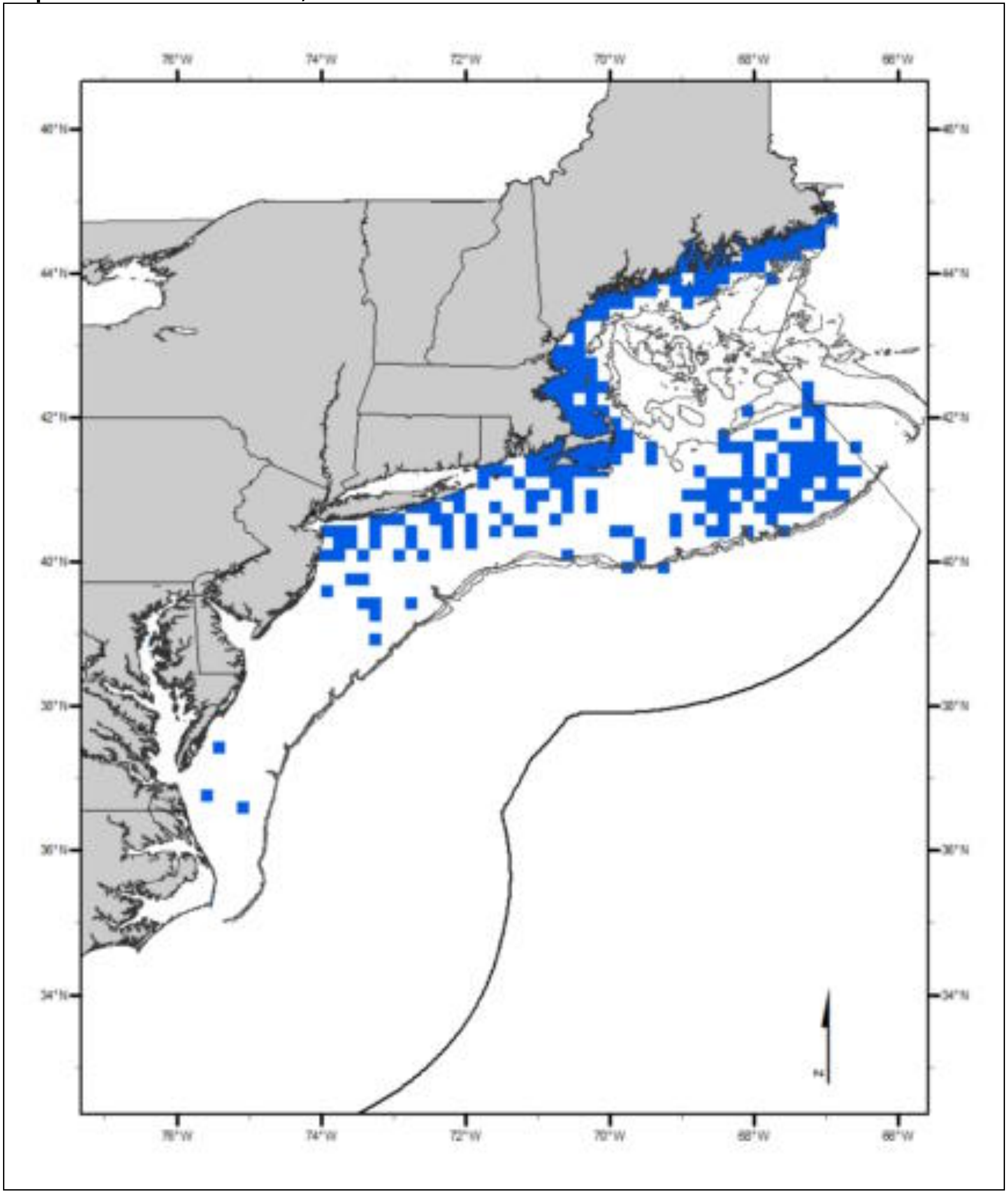
The Alternative 2E EFH designation for Atlantic cod eggs on the continental shelf is based upon the relative abundance of juveniles during 1968-2005 in the fall and spring NMFS trawl survey at the 90% cumulative percentage catch level and the relative abundance of eggs during 1978-1987 in the NMFS MARMAP ichthyoplankton survey at the 90% cumulative percentage area level. Ten minute squares located south of 38°N latitude were not included. This alternative also includes those bays and estuaries identified by the NOAA ELMR program where Atlantic cod eggs were "common" or "abundant."

Map 93. Atlantic cod larvae, Alternative 2A



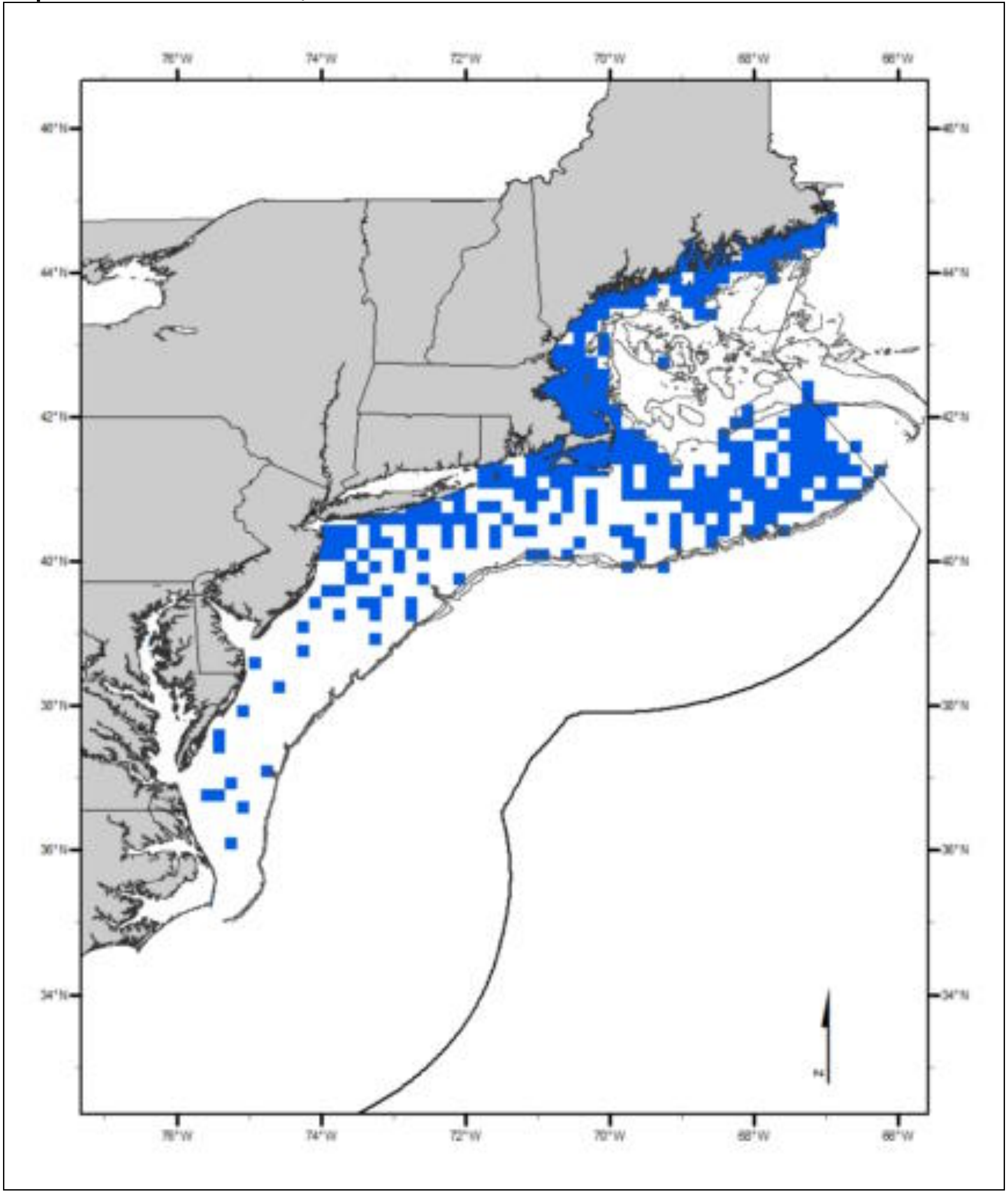
The Alternative 2A EFH designation for Atlantic cod larvae on the continental shelf is based upon the relative abundance of juveniles during 1968-2005 in the fall and spring NMFS trawl survey at the 25% cumulative percentage catch level and the relative abundance of larvae during 1978-1987 in the NMFS MARMAP ichthyoplankton survey at the 25% cumulative percentage area level. This alternative also includes those bays and estuaries identified by the NOAA ELMR program where Atlantic cod larvae were "common" or "abundant."

Map 94. Atlantic cod larvae, Alternative 2B



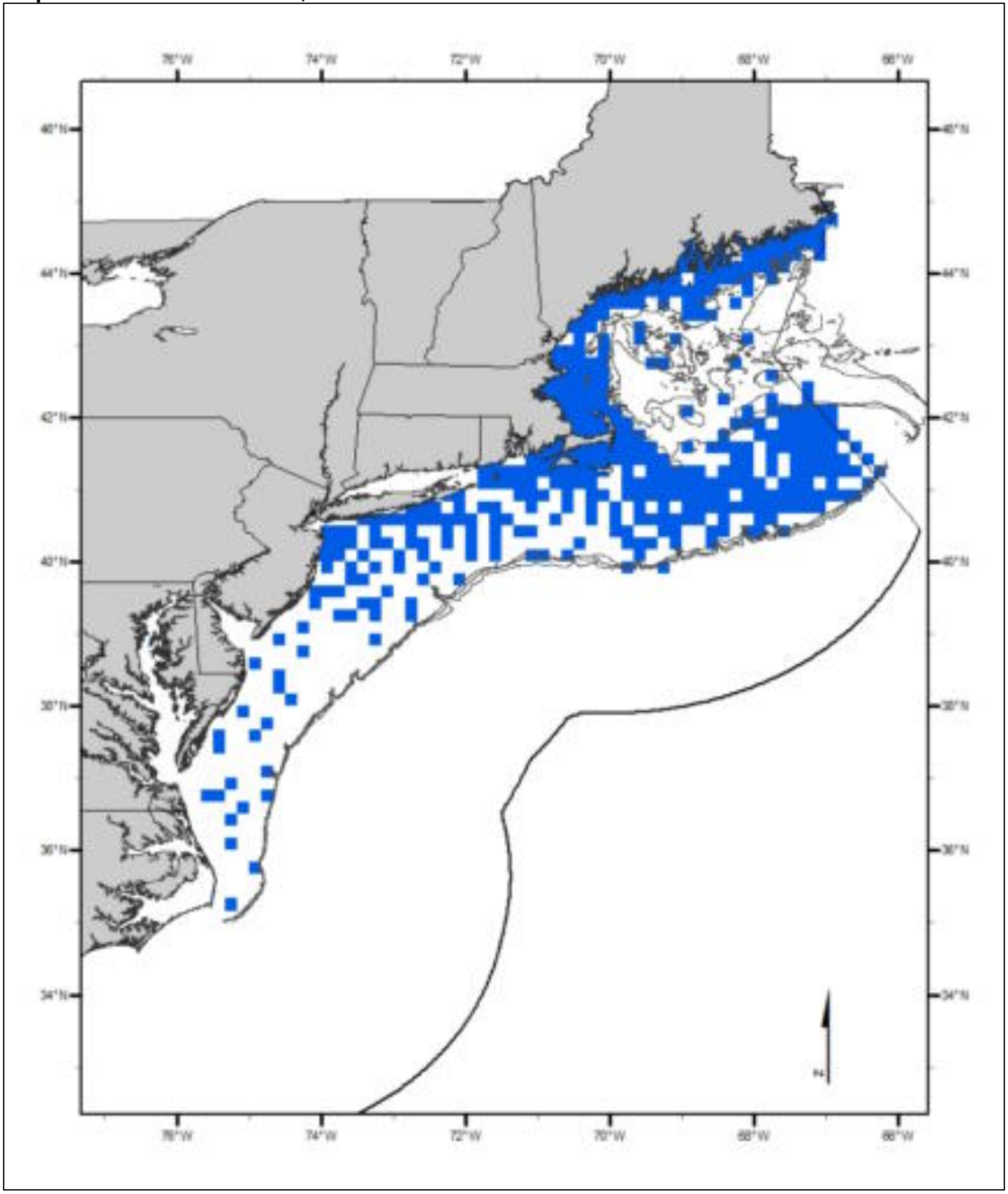
The Alternative 2B EFH designation for Atlantic cod larvae on the continental shelf is based upon the relative abundance of juveniles during 1968-2005 in the fall and spring NMFS trawl survey at the 50% cumulative percentage catch level and the relative abundance of larvae during 1978-1987 in the NMFS MARMAP ichthyoplankton survey at the 50% cumulative percentage area level. This alternative also includes those bays and estuaries identified by the NOAA ELMR program where Atlantic cod larvae were "common" or "abundant."

Map 95. Atlantic cod larvae, Alternative 2C



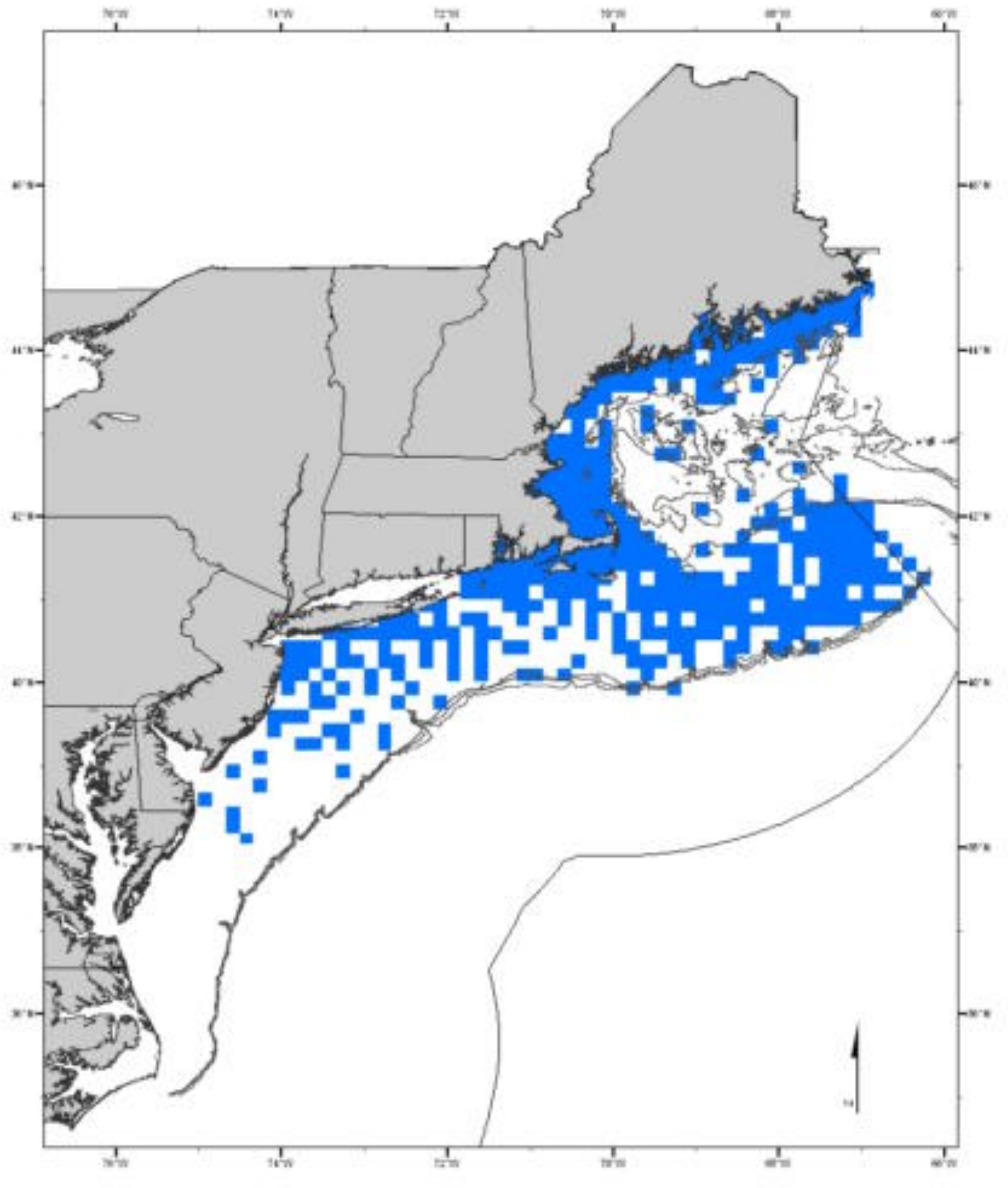
The Alternative 2C EFH designation for Atlantic cod larvae on the continental shelf is based upon the relative abundance of juveniles during 1968-2005 in the fall and spring NMFS trawl survey at the 75% cumulative percentage catch level and the relative abundance of larvae during 1978-1987 in the NMFS MARMAP ichthyoplankton survey at the 75% cumulative percentage area level. This alternative also includes those bays and estuaries identified by the NOAA ELMR program where Atlantic cod larvae were "common" or "abundant."

Map 96. Atlantic cod larvae, Alternative 2D



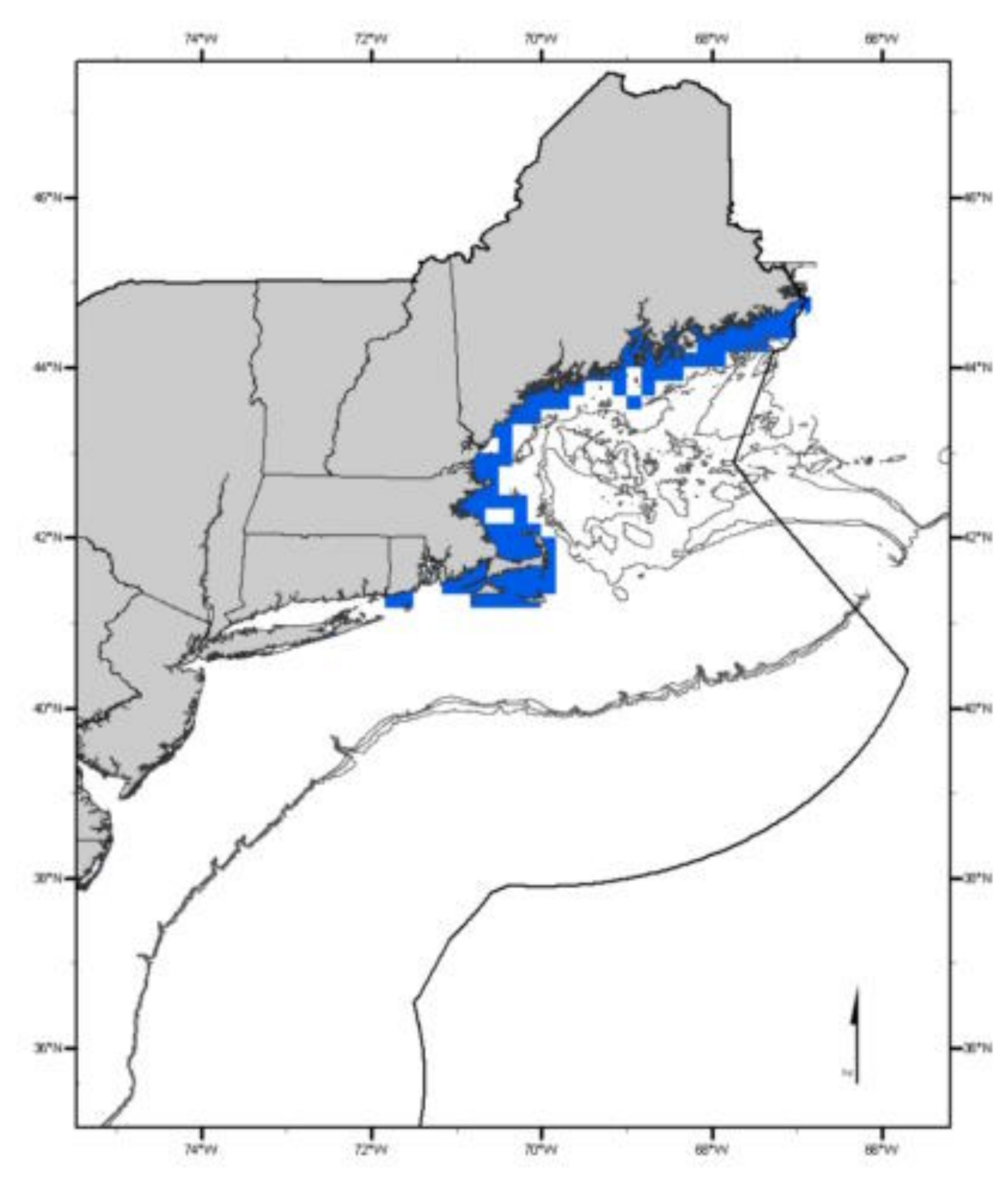
The Alternative 2D EFH designation for Atlantic cod larvae on the continental shelf is based upon the relative abundance of juveniles during 1968-2005 in the fall and spring NMFS trawl survey at the 90% cumulative percentage catch level and the relative abundance of larvae during 1978-1987 in the NMFS MARMAP ichthyoplankton survey at the 90% cumulative percentage area level. This alternative also includes those bays and estuaries identified by the NOAA ELMR program where Atlantic cod larvae were "common" or "abundant."

Map 97. Atlantic cod larvae, Alternative 2E (*Preferred Alternative*)



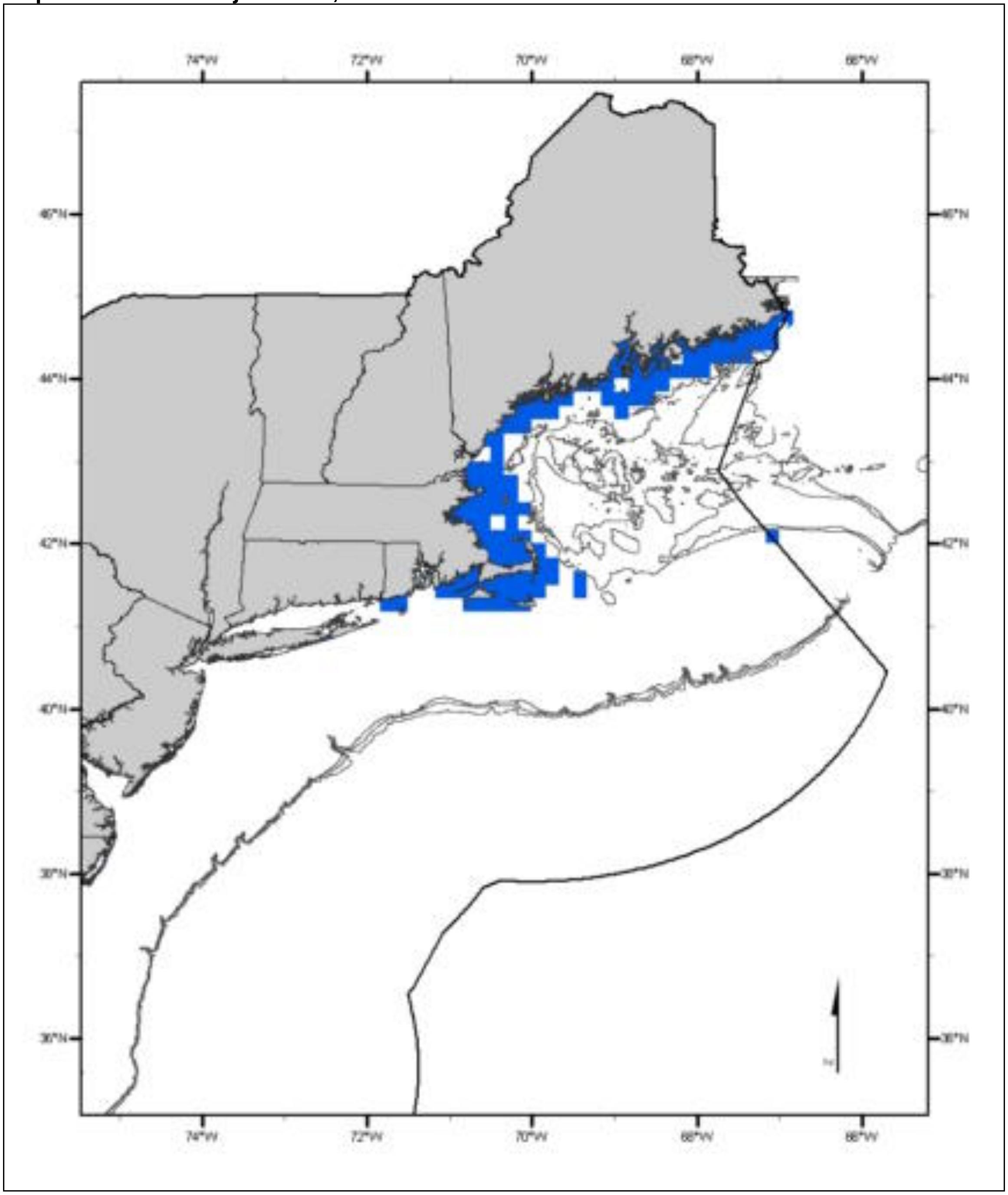
The Alternative 2E EFH designation for Atlantic cod larvae on the continental shelf is based upon the relative abundance of juveniles during 1968-2005 in the fall and spring NMFS trawl survey at the 90% cumulative percentage catch level and the relative abundance of larvae during 1978-1987 in the NMFS MARMAP ichthyoplankton survey at the 90% cumulative percentage area level. Ten minute squares located south of 38°N latitude were not included. This alternative also includes those bays and estuaries identified by the NOAA ELMR program where Atlantic cod larvae were "common" or "abundant."

Map 98. Atlantic cod juveniles, Alternative 2A



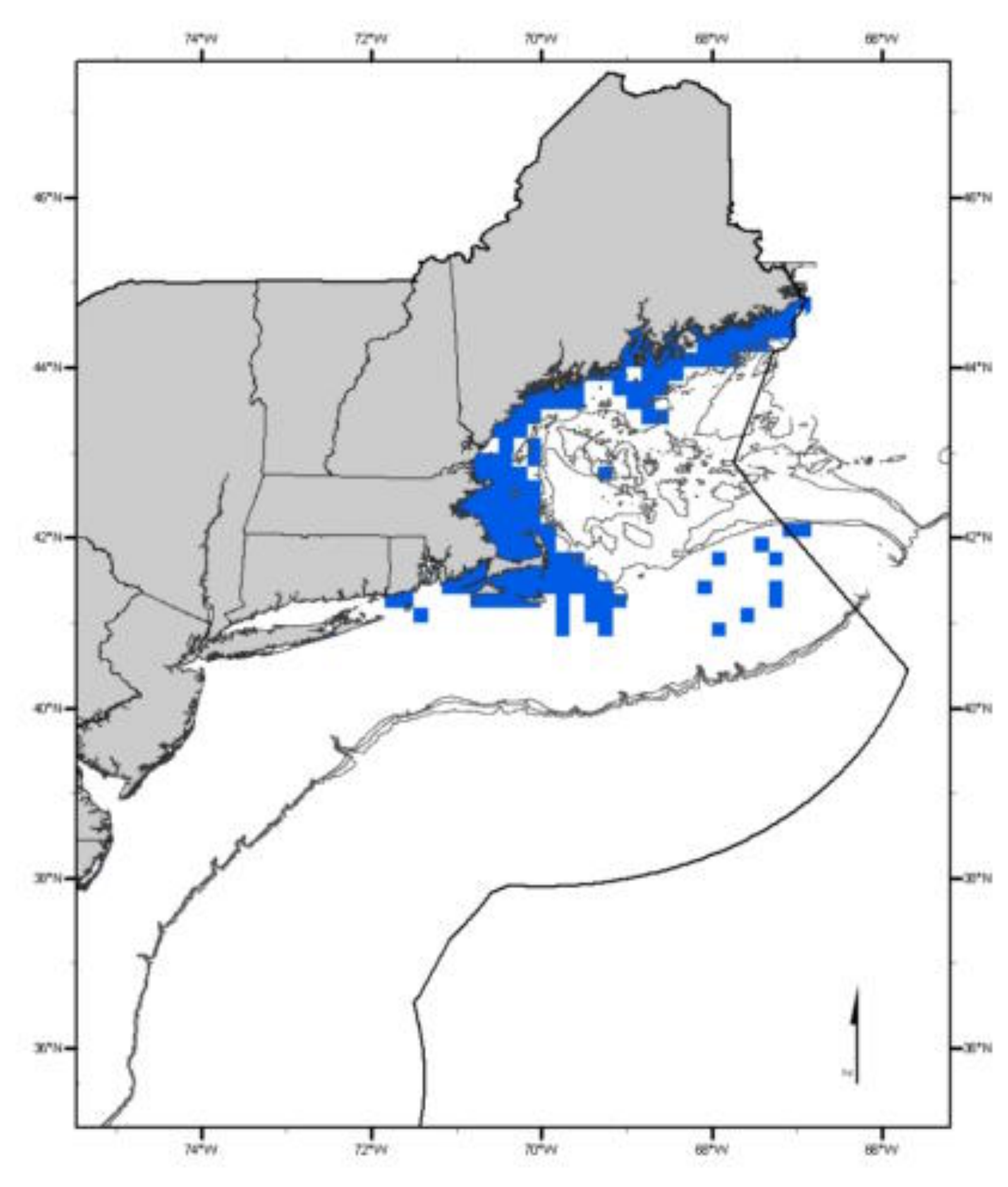
The Alternative 2A EFH designation for juvenile Atlantic cod on the continental shelf is based upon relative abundance during 1968-2005 in the fall and spring NMFS trawl survey at the 25% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where juvenile Atlantic cod were caught in state trawl surveys in more than 10% of the tows, as well as those bays and estuaries identified by the NOAA ELMR program where Atlantic cod juveniles were "common" or "abundant.”

Map 99. Atlantic cod juveniles, Alternative 2B



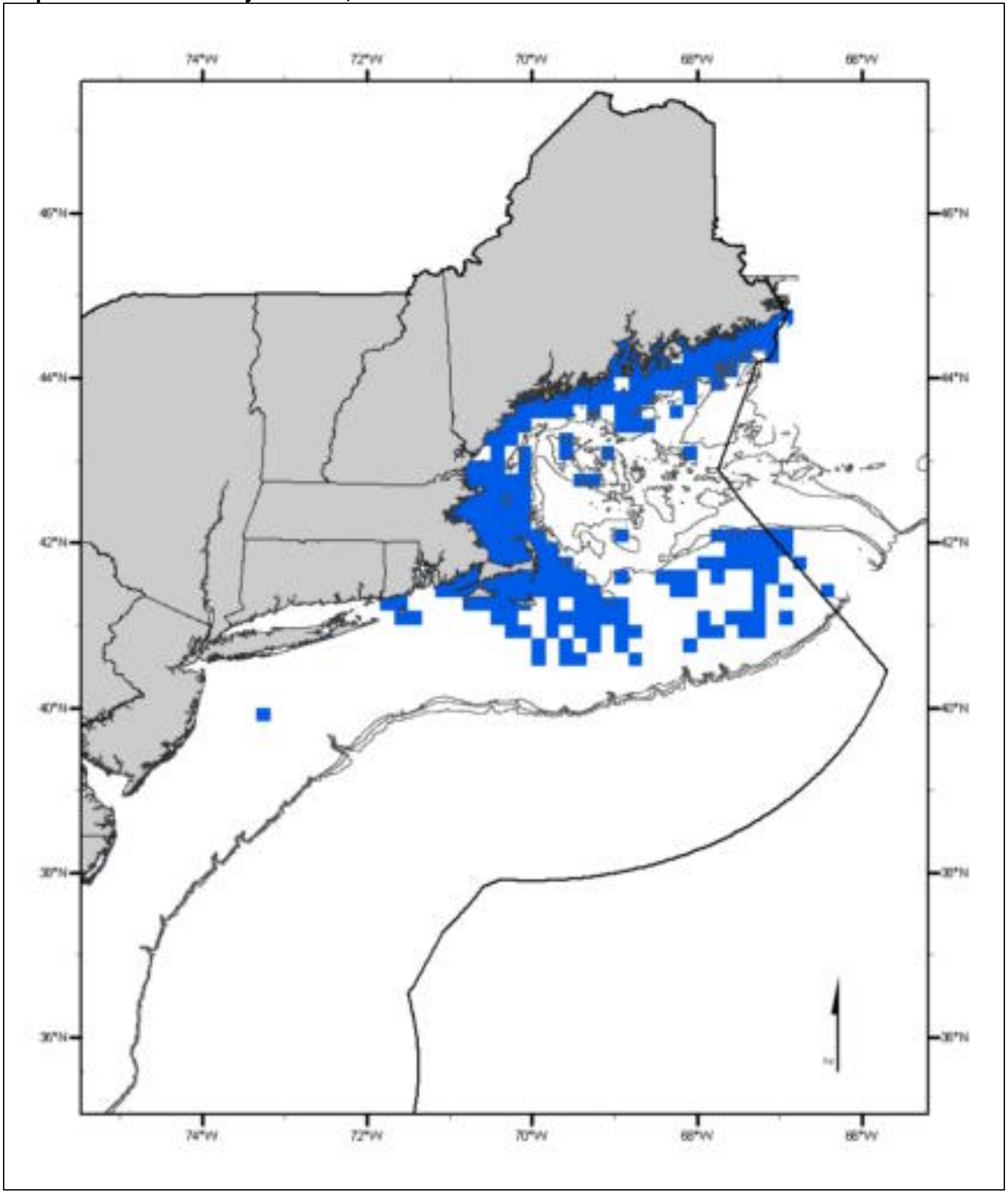
The Alternative 2B EFH designation for juvenile Atlantic cod on the continental shelf is based upon relative abundance during 1968-2005 in the fall and spring NMFS trawl survey at the 50% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where juvenile Atlantic cod were caught in state trawl surveys in more than 10% of the tows, as well as those bays and estuaries identified by the NOAA ELMR program where Atlantic cod juveniles were "common" or "abundant."

Map 100. Atlantic cod juveniles, Alternative 2C



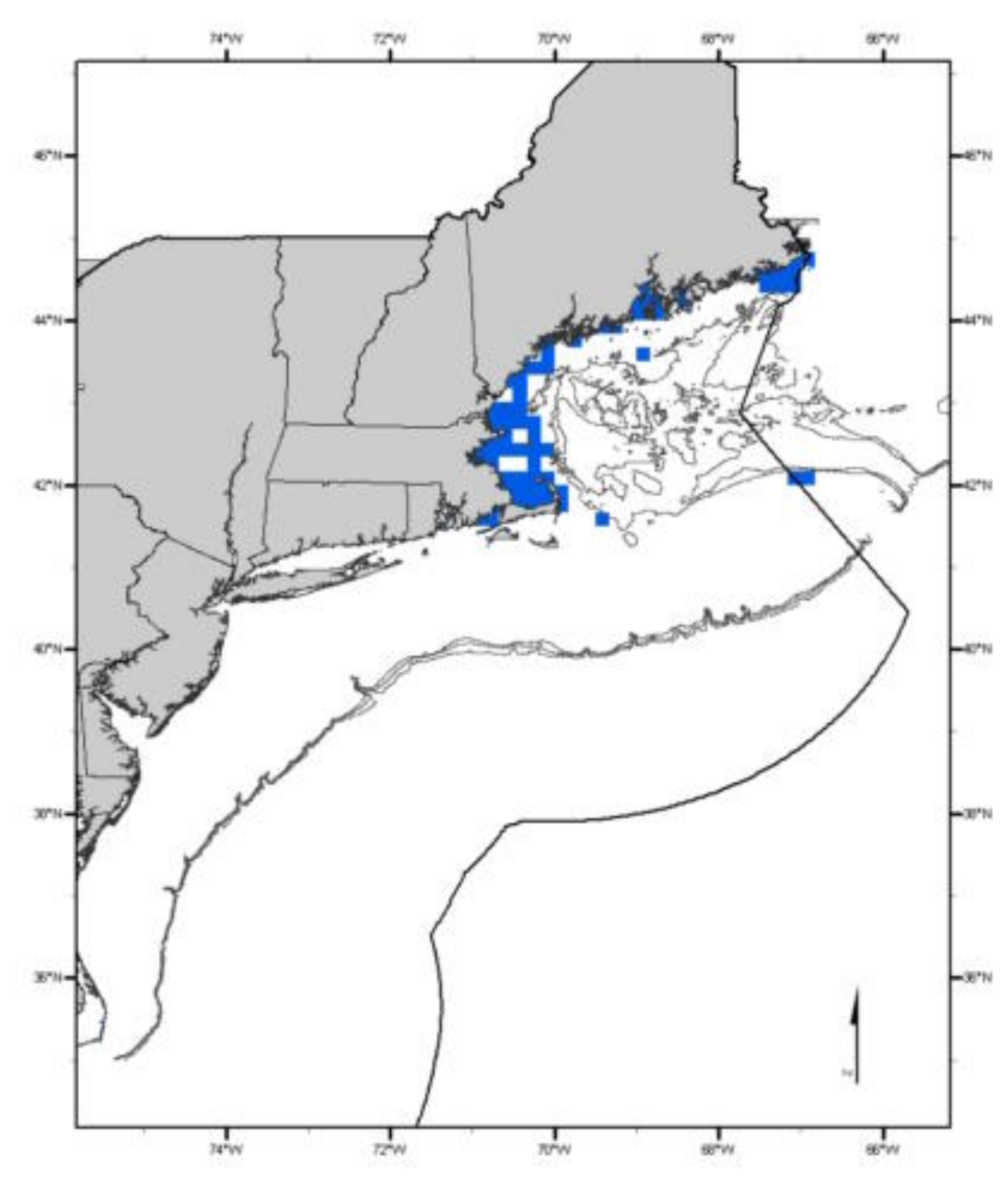
The Alternative 2C EFH designation for juvenile Atlantic cod on the continental shelf is based upon relative abundance during 1968-2005 in the fall and spring NMFS trawl survey at the 75% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where juvenile Atlantic cod were caught in state trawl surveys in more than 10% of the tows, as well as those bays and estuaries identified by the NOAA ELMR program where Atlantic cod juveniles were "common" or "abundant."

Map 101. Atlantic cod juveniles, Alternative 2D



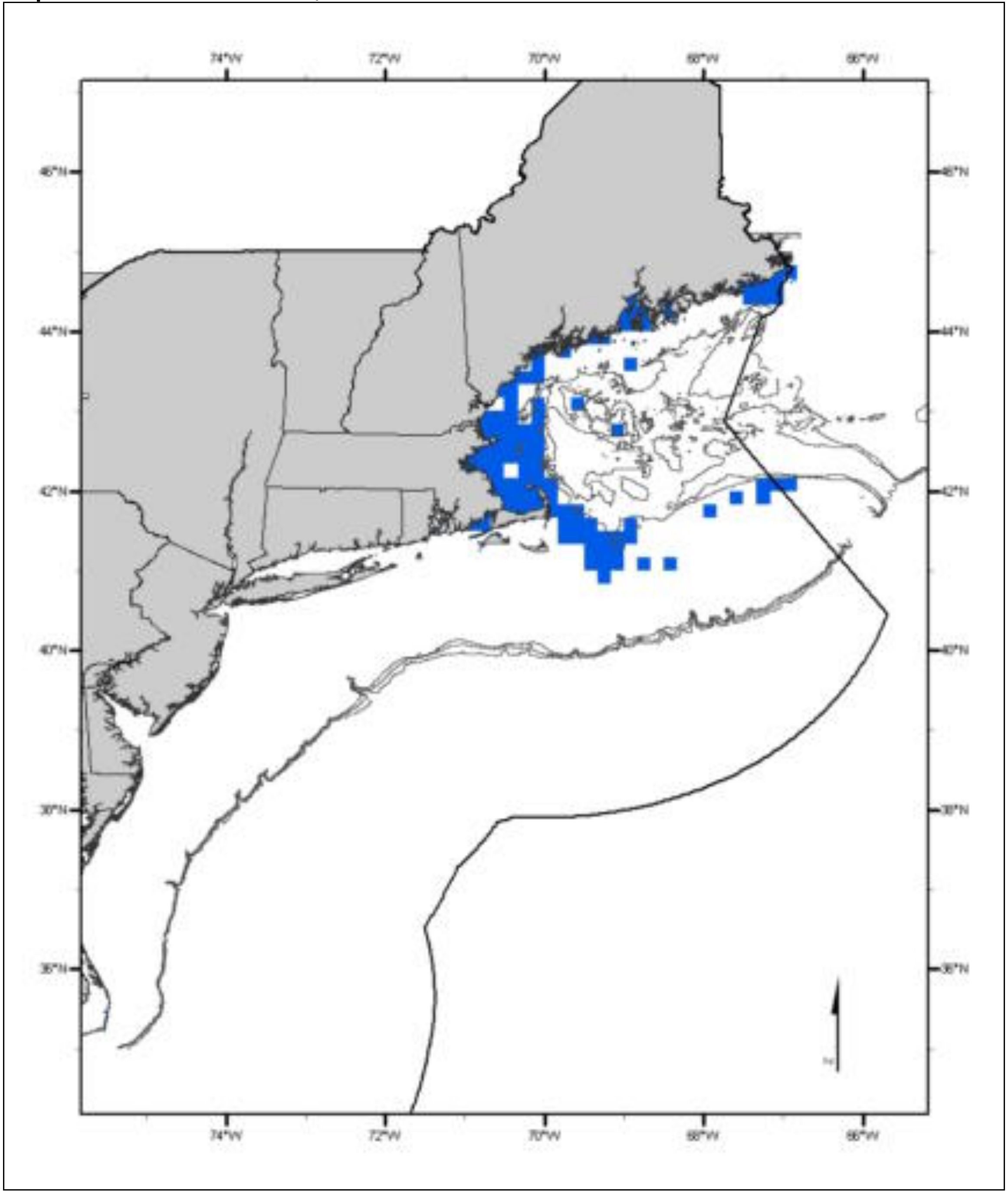
The Alternative 2D EFH designation for juvenile Atlantic cod on the continental shelf is based upon relative abundance during 1968-2005 in the fall and spring NMFS trawl survey at the 90% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where juvenile Atlantic cod were caught in state trawl surveys in more than 10% of the tows, as well as those bays and estuaries identified by the NOAA ELMR program where Atlantic cod juveniles were "common" or "abundant."

Map 102. Atlantic cod adults, Alternative 2A



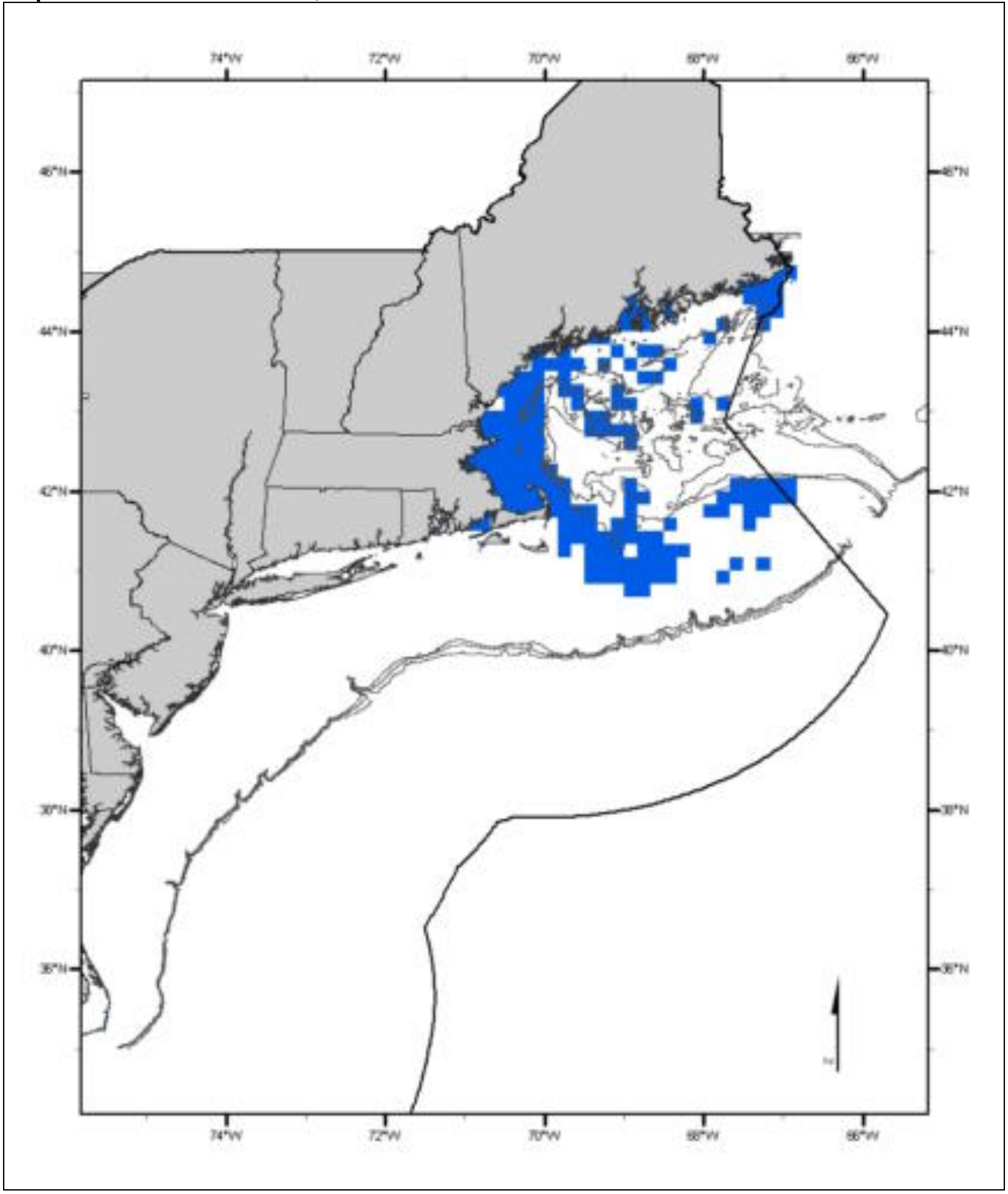
The Alternative 2A EFH designation for adult Atlantic cod on the continental shelf is based upon relative abundance during 1968-2005 in the fall and spring NMFS trawl survey at the 25% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where adult Atlantic cod were caught in state trawl surveys in more than 10% of the tows, as well as those bays and estuaries identified by the NOAA ELMR program where Atlantic cod adults were "common" or "abundant."

Map 103. Atlantic cod adults, Alternative 2B



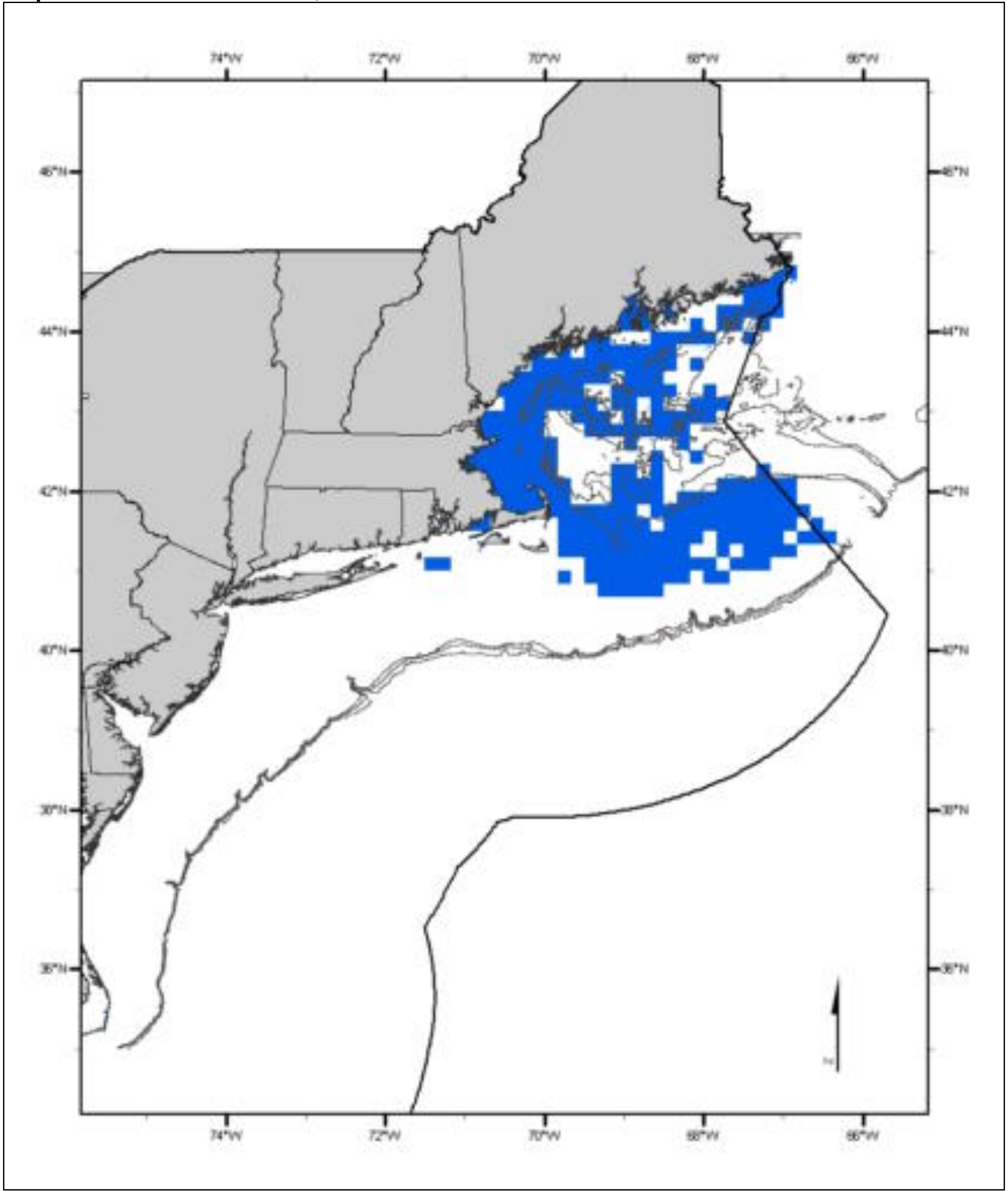
The Alternative 2B EFH designation for adult Atlantic cod on the continental shelf is based upon relative abundance during 1968-2005 in the fall and spring NMFS trawl survey at the 50% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where adult Atlantic cod were caught in state trawl surveys in more than 10% of the tows, as well as those bays and estuaries identified by the NOAA ELMR program where Atlantic cod adults were "common" or "abundant."

Map 104. Atlantic cod adults, Alternative 2C



The Alternative 2C EFH designation for adult Atlantic cod on the continental shelf is based upon relative abundance during 1968-2005 in the fall and spring NMFS trawl survey at the 75% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where adult Atlantic cod were caught in state trawl surveys in more than 10% of the tows, as well as those bays and estuaries identified by the NOAA ELMR program where Atlantic cod adults were "common" or "abundant."

Map 105. Atlantic cod adults, Alternative 2D



The Alternative 2D EFH designation for adult Atlantic cod on the continental shelf is based upon relative abundance during 1968-2005 in the fall and spring NMFS trawl survey at the 90% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where adult Atlantic cod were caught in state trawl surveys in more than 10% of the tows, as well as those bays and estuaries identified by the NOAA ELMR program where Atlantic cod adults were "common" or "abundant."

4.1.2.3.3 Atlantic Halibut

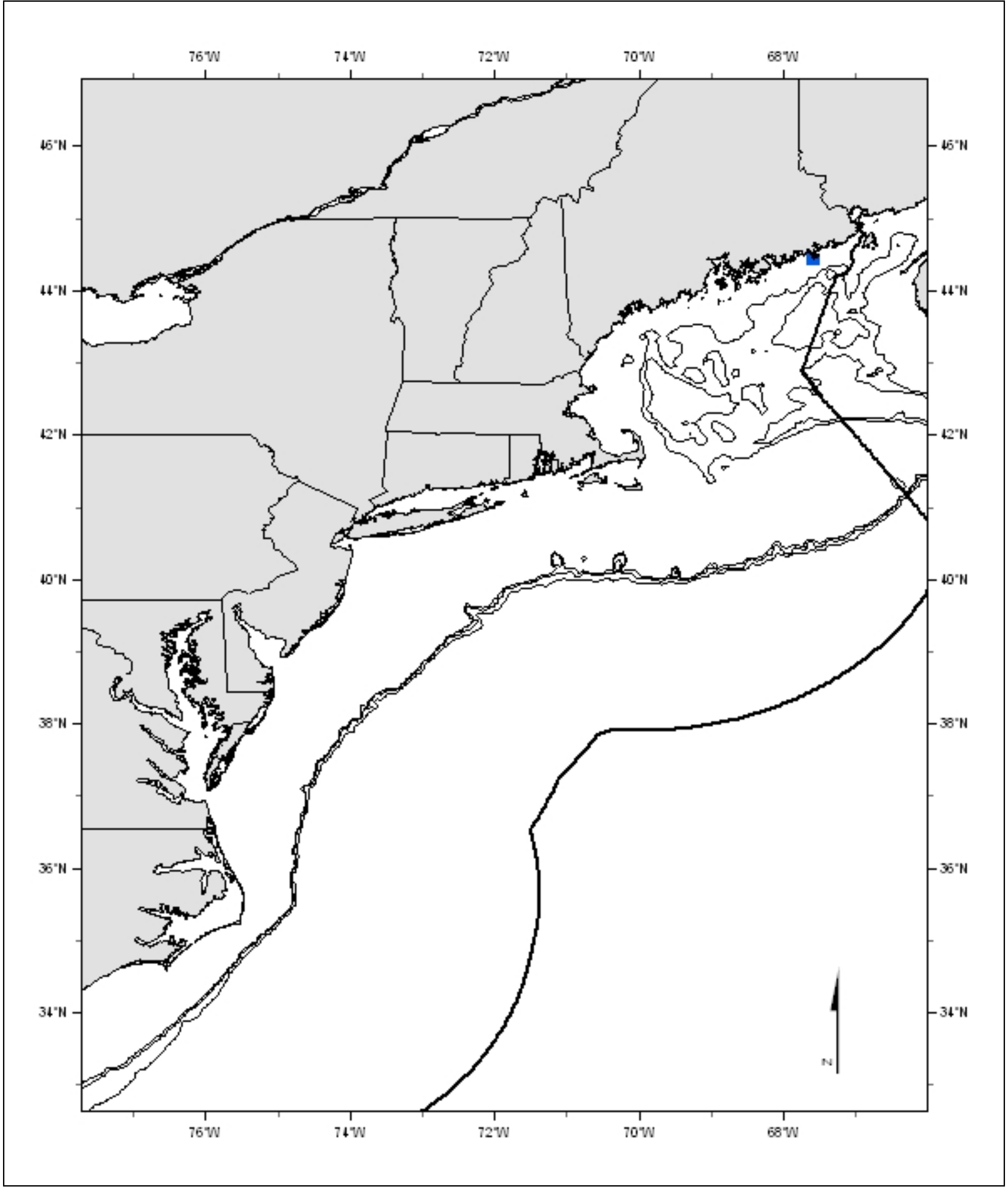
Eggs: No alternative EFH designation.

Larvae: No alternative EFH designation.

Juveniles: Benthic habitats on the continental shelf in depths of 60 – 140 meters with sand, gravel, and/or clay substrates, as depicted on Map 106 - Map 109. Other conditions that generally exist where EFH is found are bottom temperatures of 2.5 – 12.5ºC and salinities of 31.5 – 34.5 ppt. Primary prey organisms for juvenile Atlantic halibut are squids, crabs, a variety of fishes, pandalid shrimps, and sand shrimps.

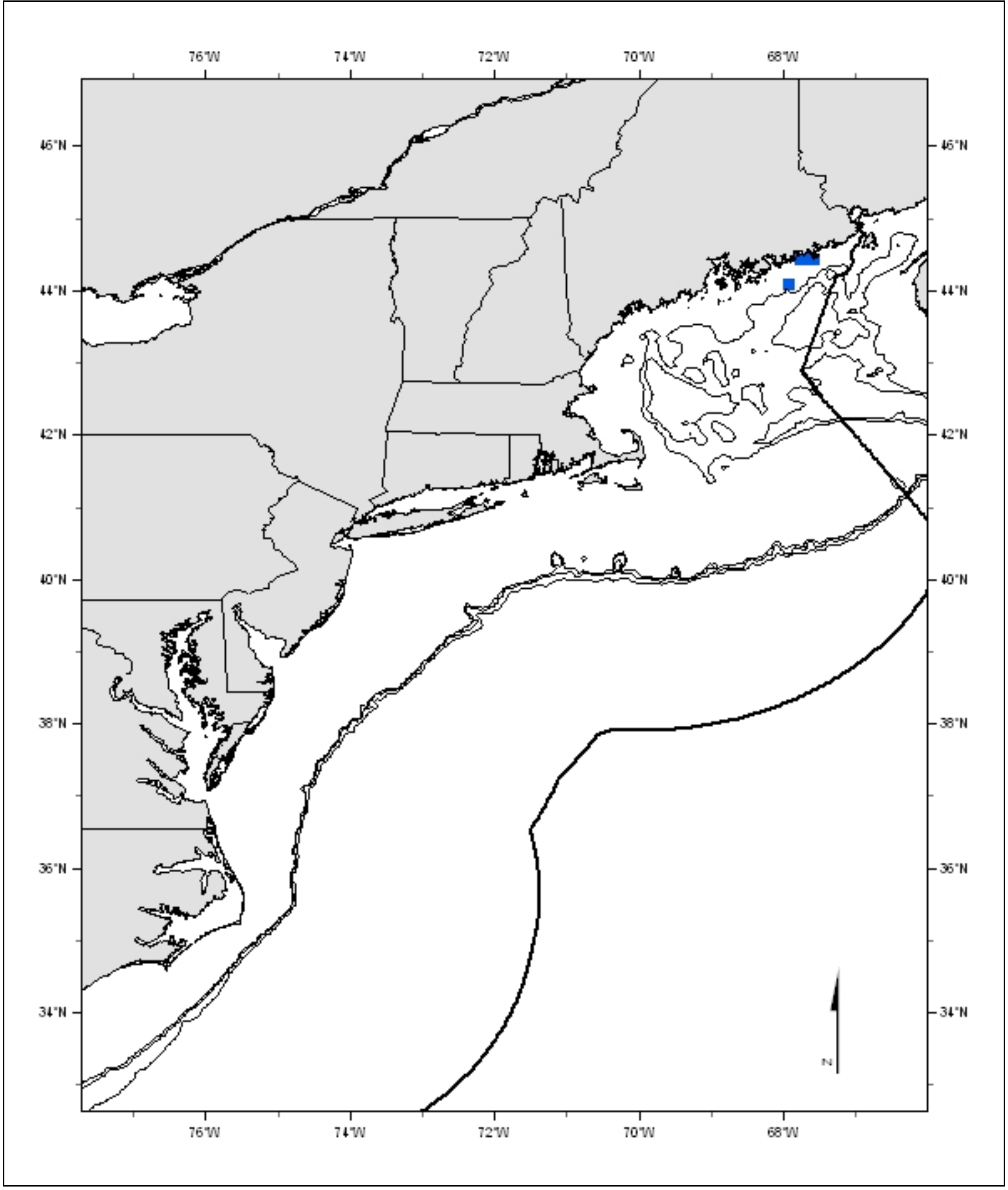
Adults: Benthic habitats on the continental shelf in depths of 60 – 140 meters with sand, gravel, and/or clay substrates, as depicted on Map 106 - Map 109. Other conditions that generally exist where EFH is found are bottom temperatures of 2.5 – 12.5ºC and salinities of 31.5 – 34.5 ppt. Spawning generally occurs over rough or rocky bottom on offshore banks in depths of at least 183 meters and on the continental slope as deep as 700 meters, at bottom temperatures of 4 – 7ºC, and salinities below 35 ppt. Primary prey organisms for adult Atlantic halibut are squids, crabs, a variety of fishes, pandalid shrimps, and sand shrimps.

Map 106. Atlantic halibut juveniles and adults, Alternative 2A



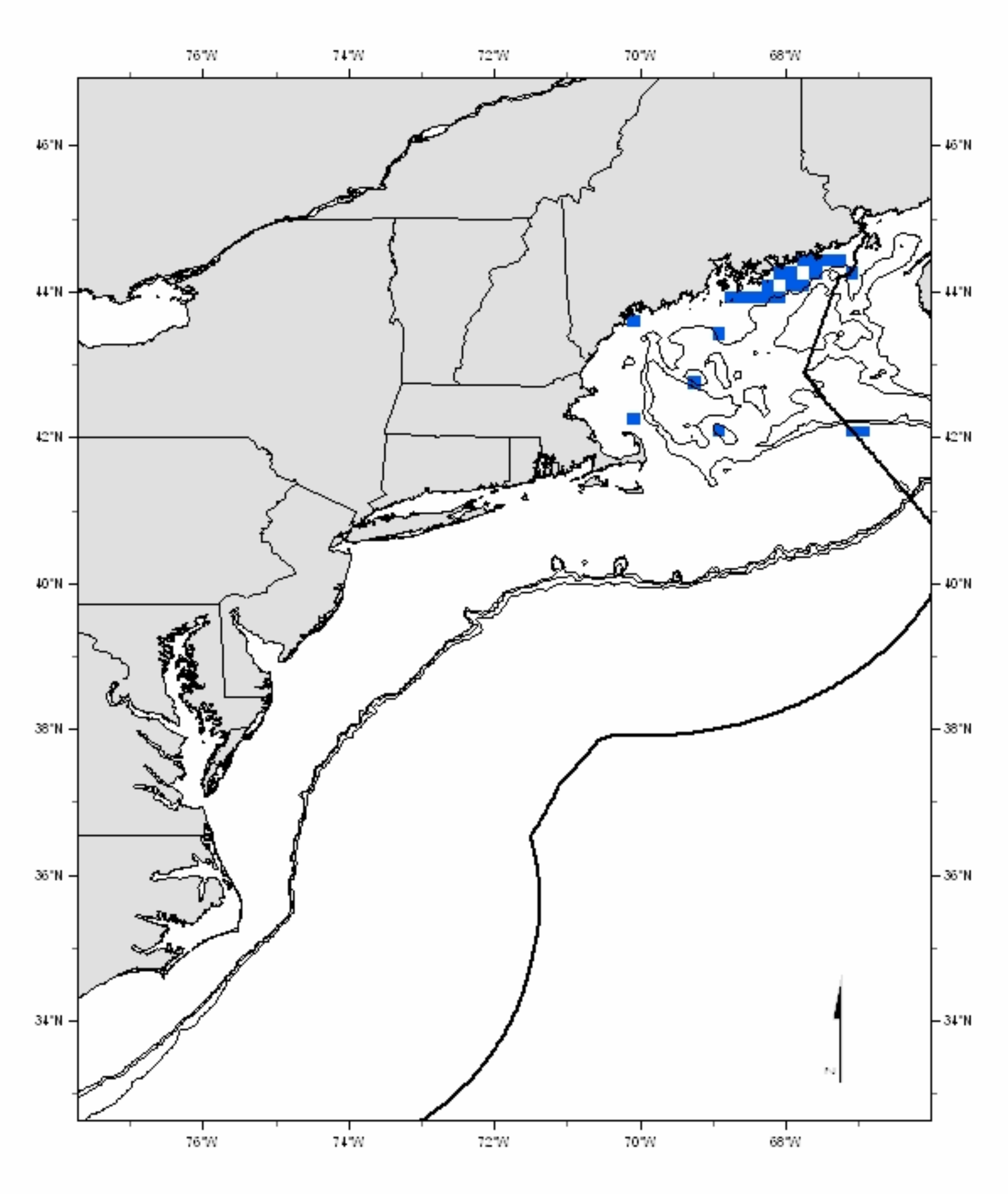
The Alternative 2A EFH designation for juvenile and adult Atlantic halibut on the continental shelf is based upon relative abundance during 1968-2005 in the fall and spring NMFS trawl survey at the 25% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where juvenile or adult Atlantic halibut were caught in state trawl surveys in more than 10% of the tows.

Map 107. Atlantic halibut juveniles and adults, Alternative 2B



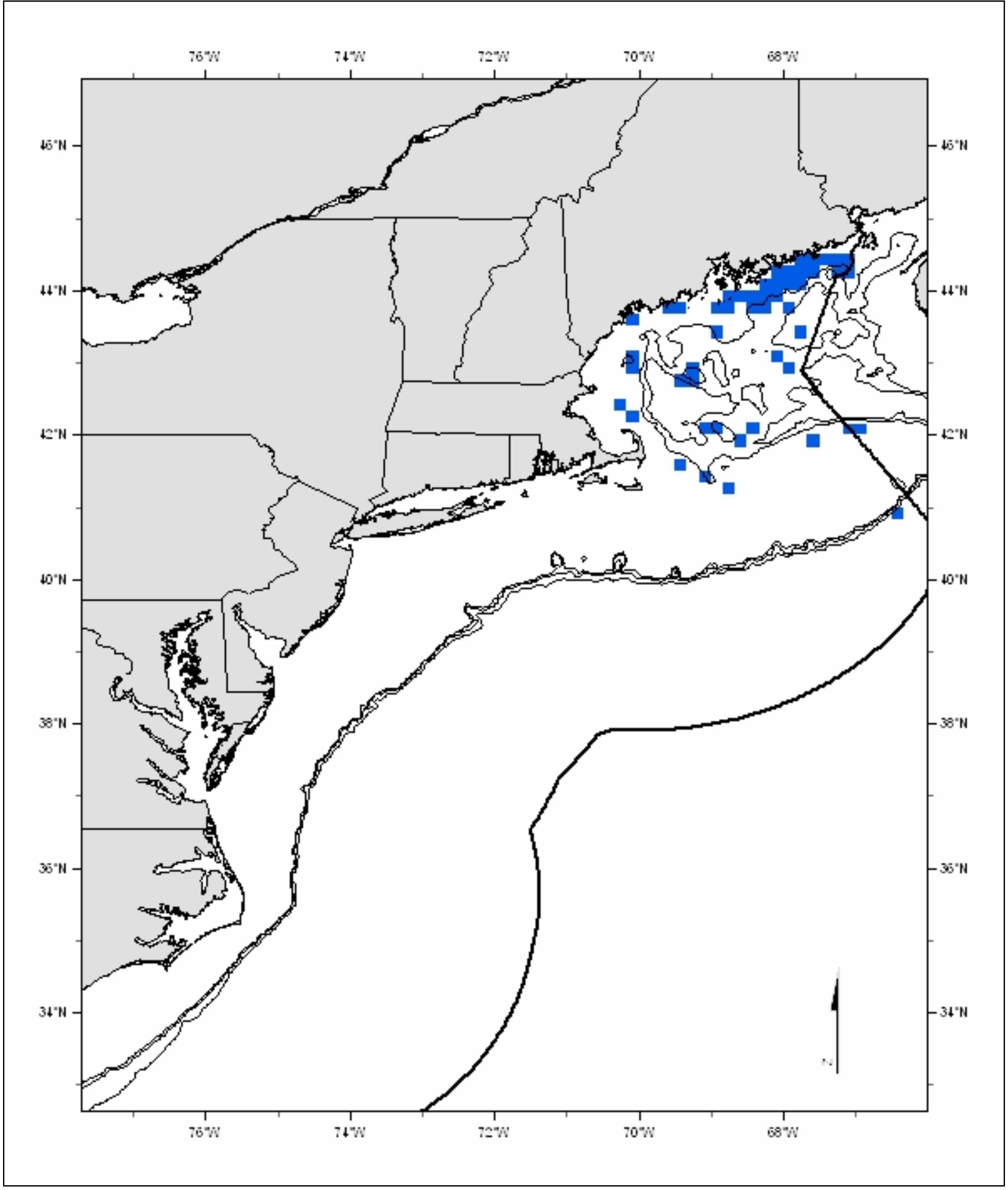
The Alternative 2B EFH designation for juvenile and adult Atlantic halibut on the continental shelf is based upon relative abundance during 1968-2005 in the fall and spring NMFS trawl survey at the 50% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where juvenile or adult Atlantic halibut were caught in state trawl surveys in more than 10% of the tows.

Map 108. Atlantic halibut juveniles and adults, Alternative 2C



The Alternative 2C EFH designation for juvenile and adult Atlantic halibut on the continental shelf is based upon relative abundance during 1968-2005 in the fall and spring NMFS trawl survey at the 75% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where juvenile or adult Atlantic halibut were caught in state trawl surveys in more than 10% of the tows.

Map 109. Atlantic halibut juveniles and adults, Alternative 2D



The Alternative 2D EFH designation for juvenile and adult Atlantic halibut on the continental shelf is based upon relative abundance during 1968-2005 in the fall and spring NMFS trawl survey at the 90% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where juvenile or adult Atlantic halibut were caught in state trawl surveys in more than 10% of the tows.

4.1.2.3.4 Atlantic Herring

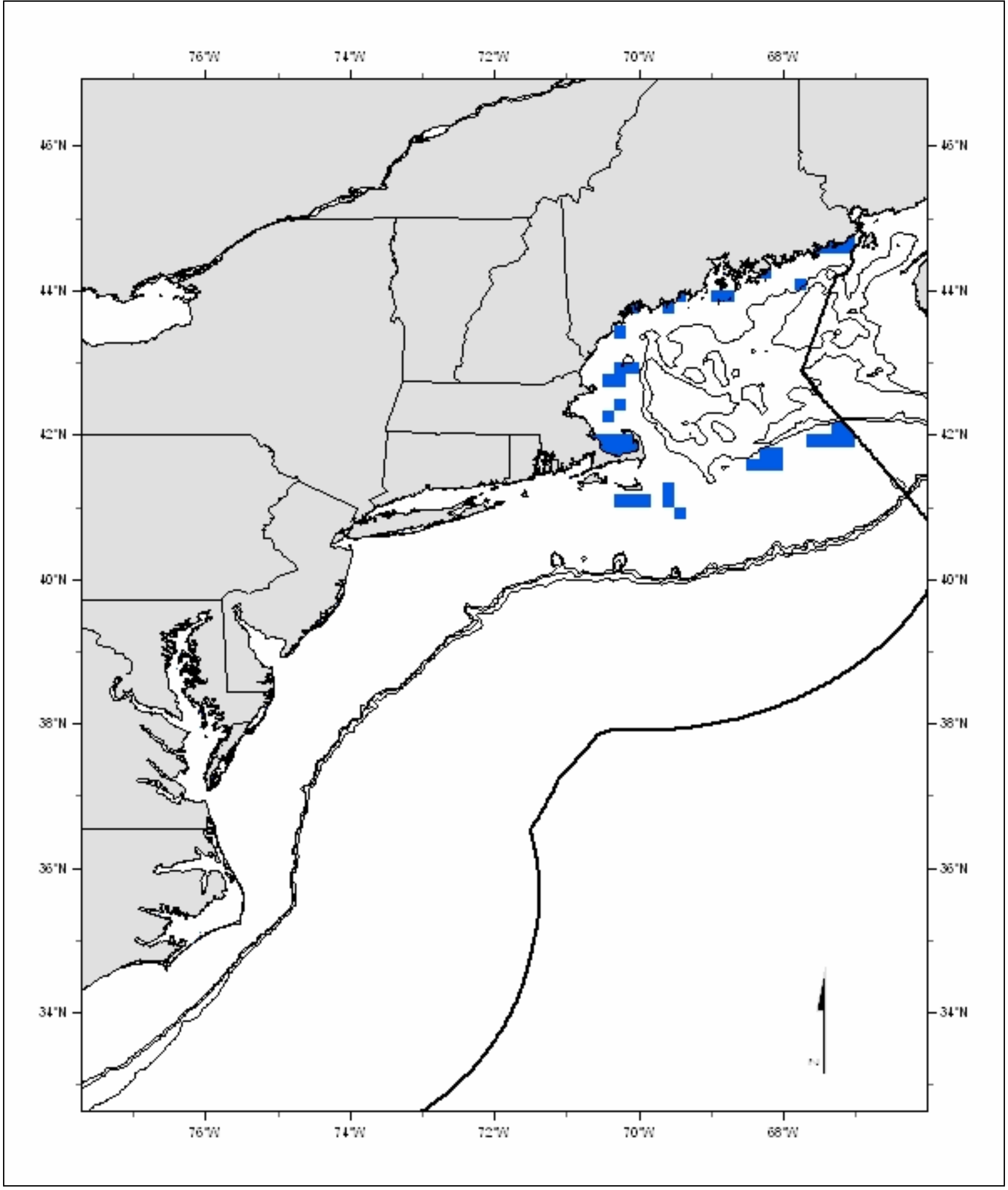
Eggs: Inshore and continental shelf benthic habitats with depths of 5 – 90 meters and substrates of boulders, cobble/pebble, gravel, coarse sand, and/or macroalgae, as depicted on Map 110. The following conditions generally exist where EFH for Atlantic herring eggs is found: bottom temperatures of 7 – 15ºC; salinities of 32 – 33 ppt; and strong bottom currents.

Larvae: No alternative EFH designation.

Juveniles: Coastal marine, estuarine, and continental shelf pelagic habitats with bottom depths of 5 – 300 meters, as depicted on Map 111 - Map 115. YOY juveniles utilize inshore marine and estuarine habitats, including intertidal waters, and can survive winter temperatures as low as -1.1ºC and salinities as low as 5 ppt. Older juveniles inhabit deeper water and prefer temperatures of 8 – 12ºC and salinities of 28 – 32 ppt. Juvenile Atlantic herring feed on zooplankton, primarily copepods, cladocerans, and invertebrate larvae.

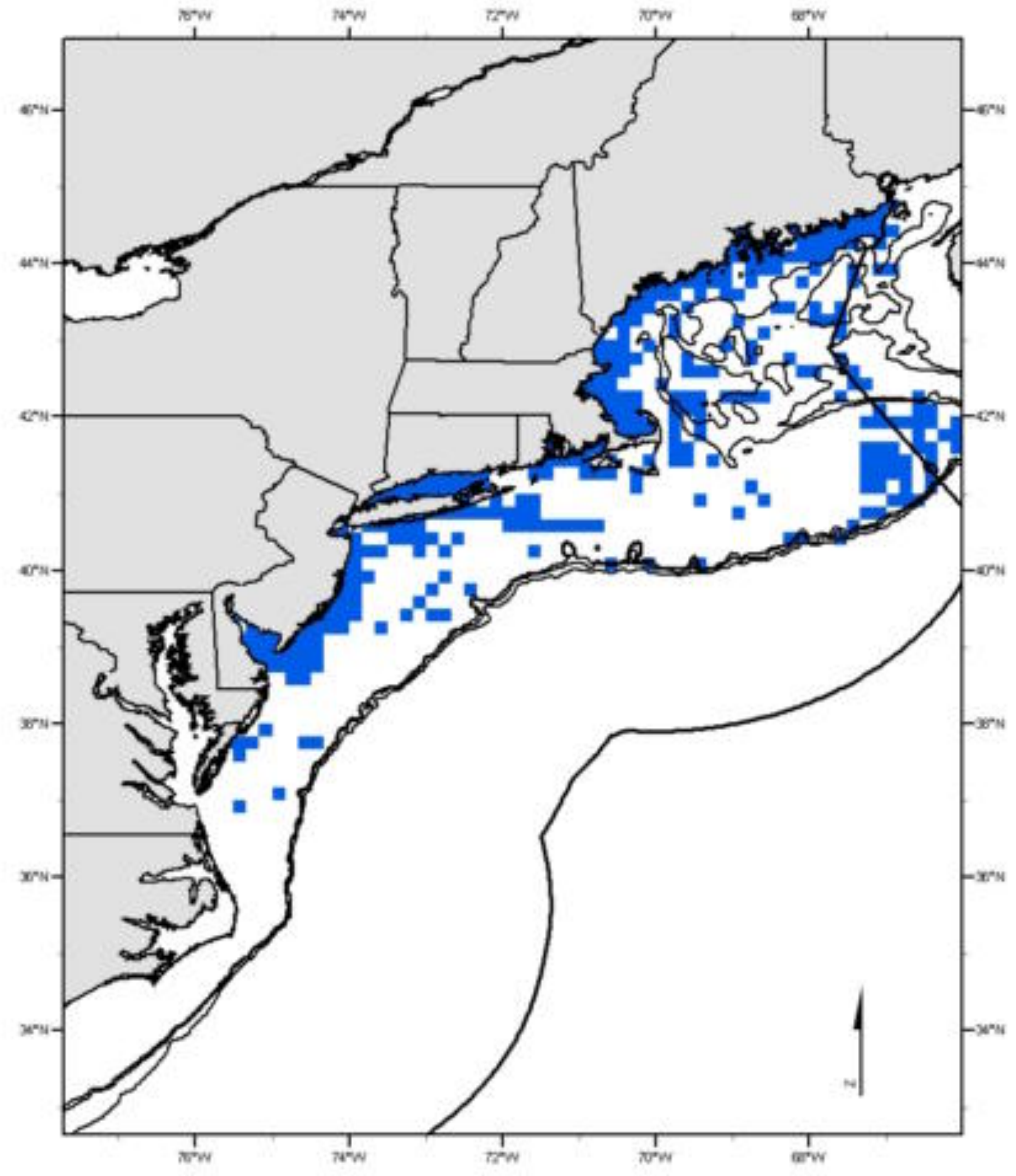
Adults: Inshore and continental shelf pelagic habitats with bottom depths of 10 – 300 meters, as depicted on Map 116 - Map 120. Spawning takes place on the bottom, generally in depths of 5 – 90 meters on a variety of substrates (see eggs). Adult Atlantic herring feed primarily on chaetognaths, pelagic crustaceans (euphausiids, amphipods, and copepods), and pelagic mollusks (pteropods).

Map 110. Atlantic herring eggs, Alternative 2



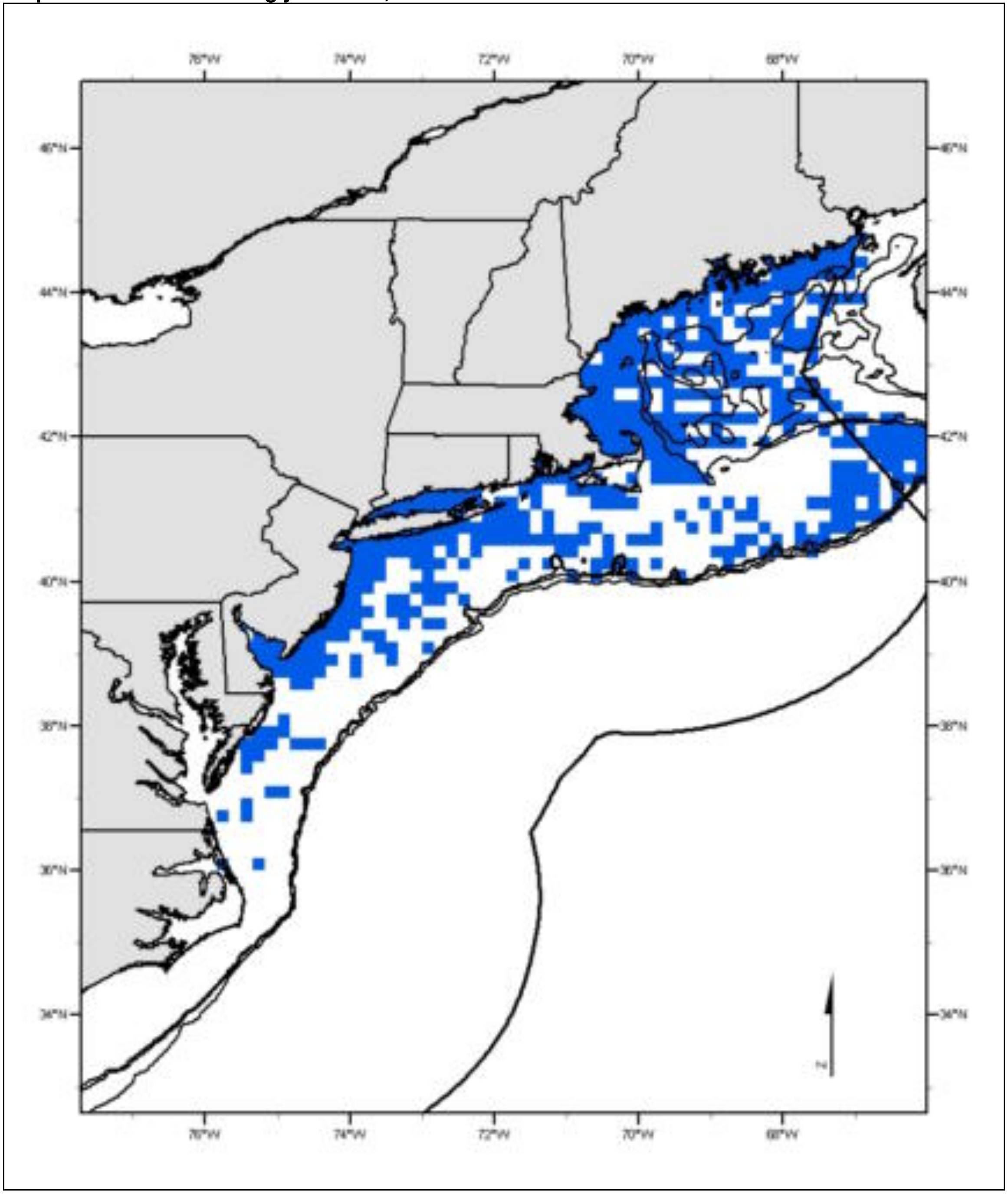
The Alternative 2 EFH designation for Atlantic herring eggs represents 100% of the known Atlantic herring egg beds. These egg beds were identified based on a review of all available information on current and historical herring egg bed locations. In addition, this alternative includes those bays and estuaries identified in the NOAA ELMR program where herring eggs were "rare", "common", or "abundant" and other ten minute squares on the continental shelf that are included in the No Action alternative where eggs have never been observed, but where recently-hatched larvae have been observed during larval herring surveys.

Map 111. Atlantic herring juveniles, Alternative 2A



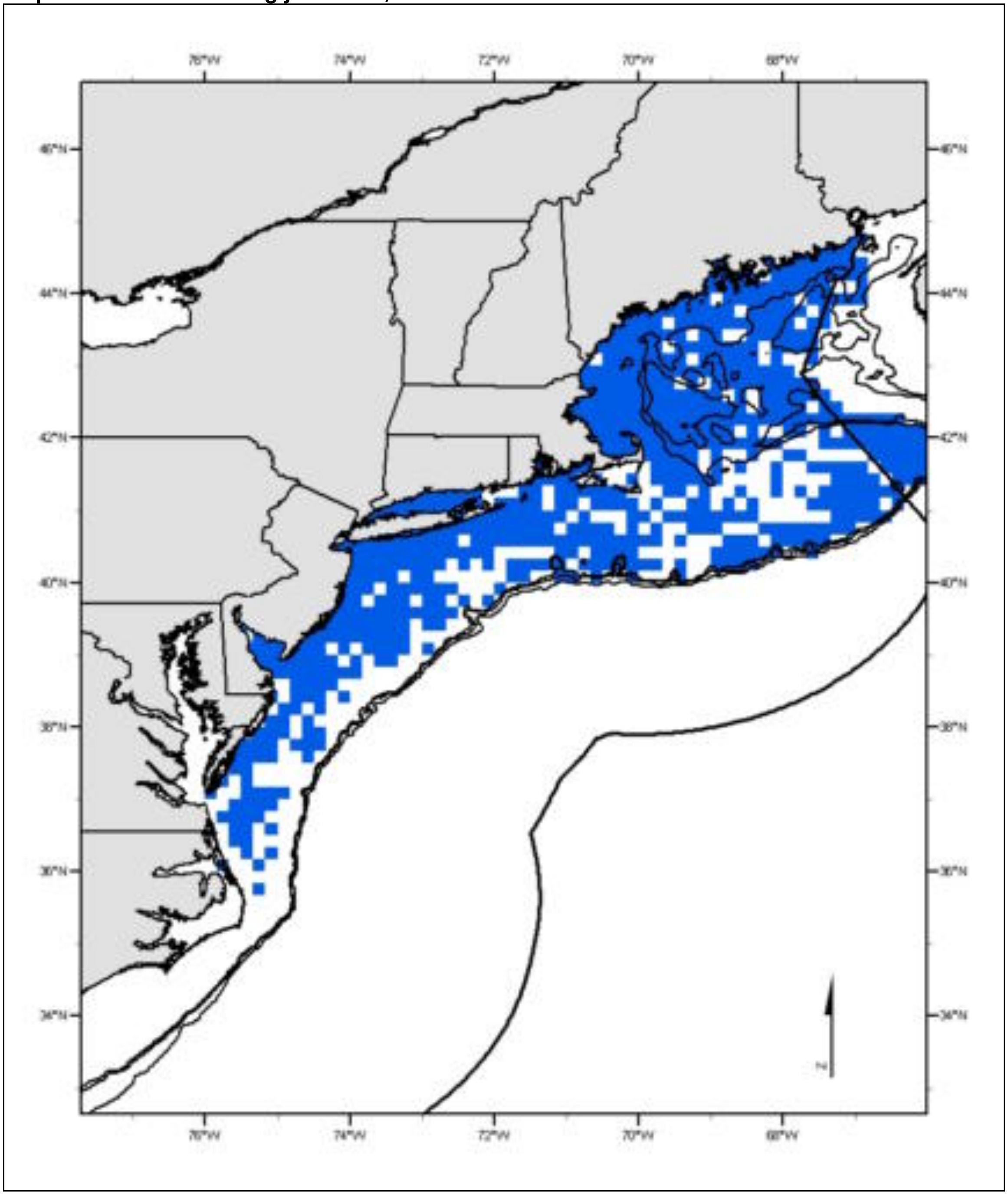
The Alternative 2A EFH designation for juvenile Atlantic herring on the continental shelf is based upon relative abundance during 1968-2005 in the fall and spring NMFS trawl survey at the 25% cumulative percentage level. Relative abundance was calculated on a percent of area rather than a percent of catch basis. This alternative also includes ten minute squares in inshore areas where juvenile Atlantic herring were caught in state trawl surveys in more than 10% of the tows, as well as those bays and estuaries identified by the NOAA ELMR program where Atlantic herring juveniles were "common" or "abundant."

Map 112. Atlantic herring juveniles, Alternative 2B



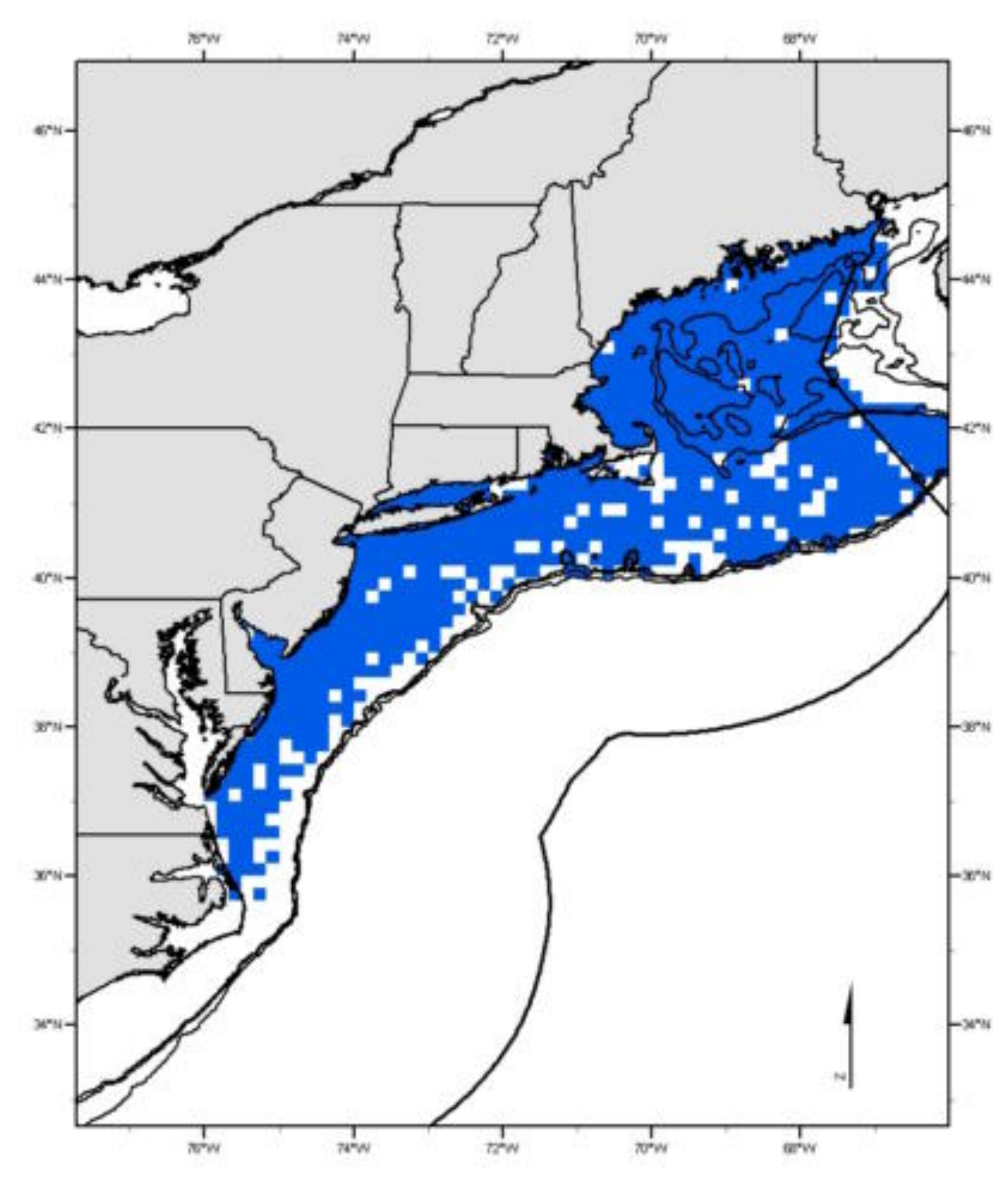
The Alternative 2B EFH designation for juvenile Atlantic herring on the continental shelf is based upon relative abundance during 1968-2005 in the fall and spring NMFS trawl survey at the 50% cumulative percentage level. Relative abundance was calculated on a percent of area rather than a percent of catch basis. This alternative also includes ten minute squares in inshore areas where juvenile Atlantic herring were caught in state trawl surveys in more than 10% of the tows, as well as those bays and estuaries identified by the NOAA ELMR program where Atlantic herring juveniles were "common" or "abundant."

Map 113. Atlantic herring juveniles, Alternative 2C



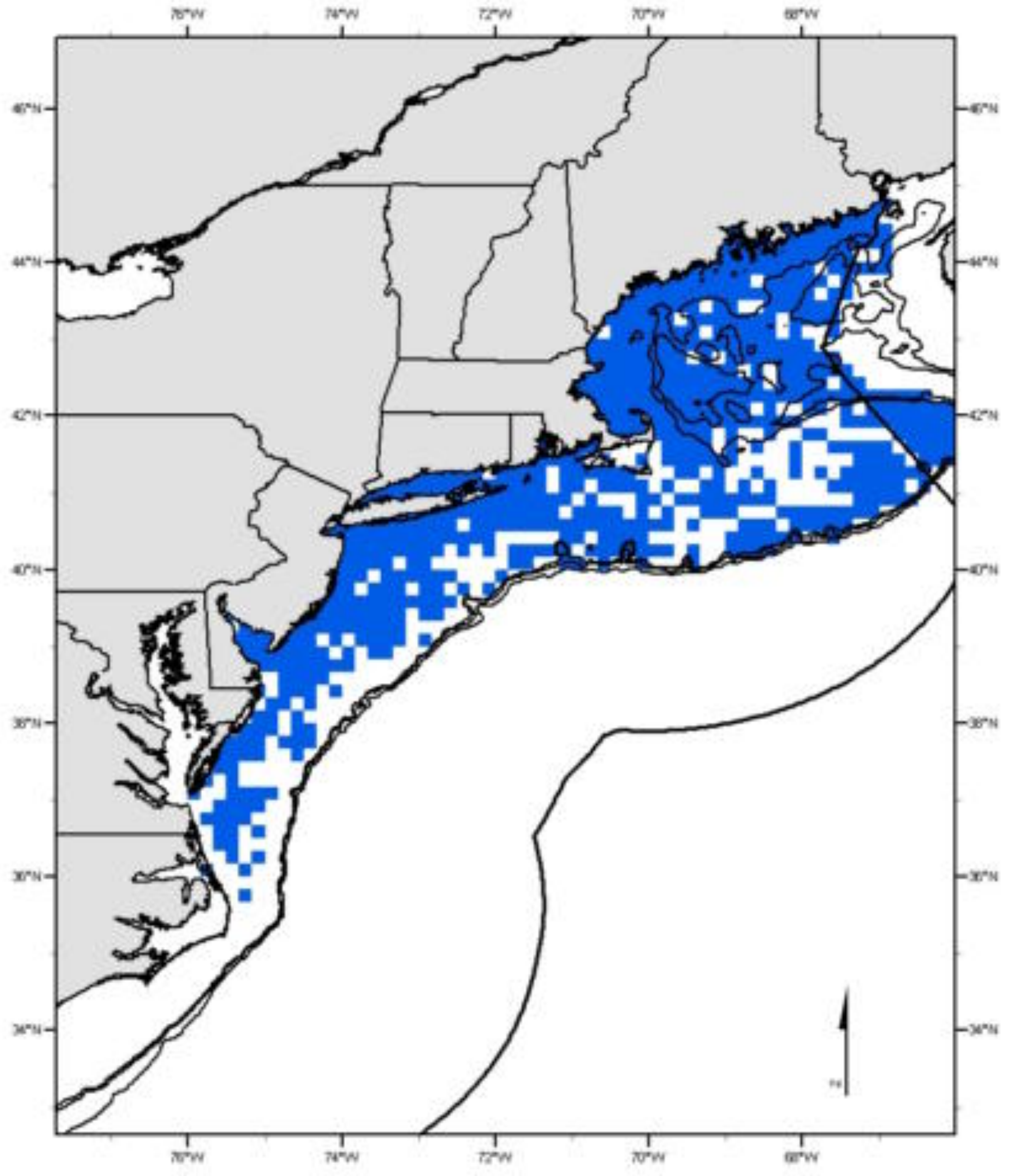
The Alternative 2C EFH designation for juvenile Atlantic herring on the continental shelf is based upon relative abundance during 1968-2005 in the fall and spring NMFS trawl survey at the 75% cumulative percentage level. Relative abundance was calculated on a percent of area rather than a percent of catch basis. This alternative also includes ten minute squares in inshore areas where juvenile Atlantic herring were caught in state trawl surveys in more than 10% of the tows, as well as those bays and estuaries identified by the NOAA ELMR program where Atlantic herring juveniles were "common" or "abundant."

Map 114. Atlantic herring juveniles, Alternative 2D



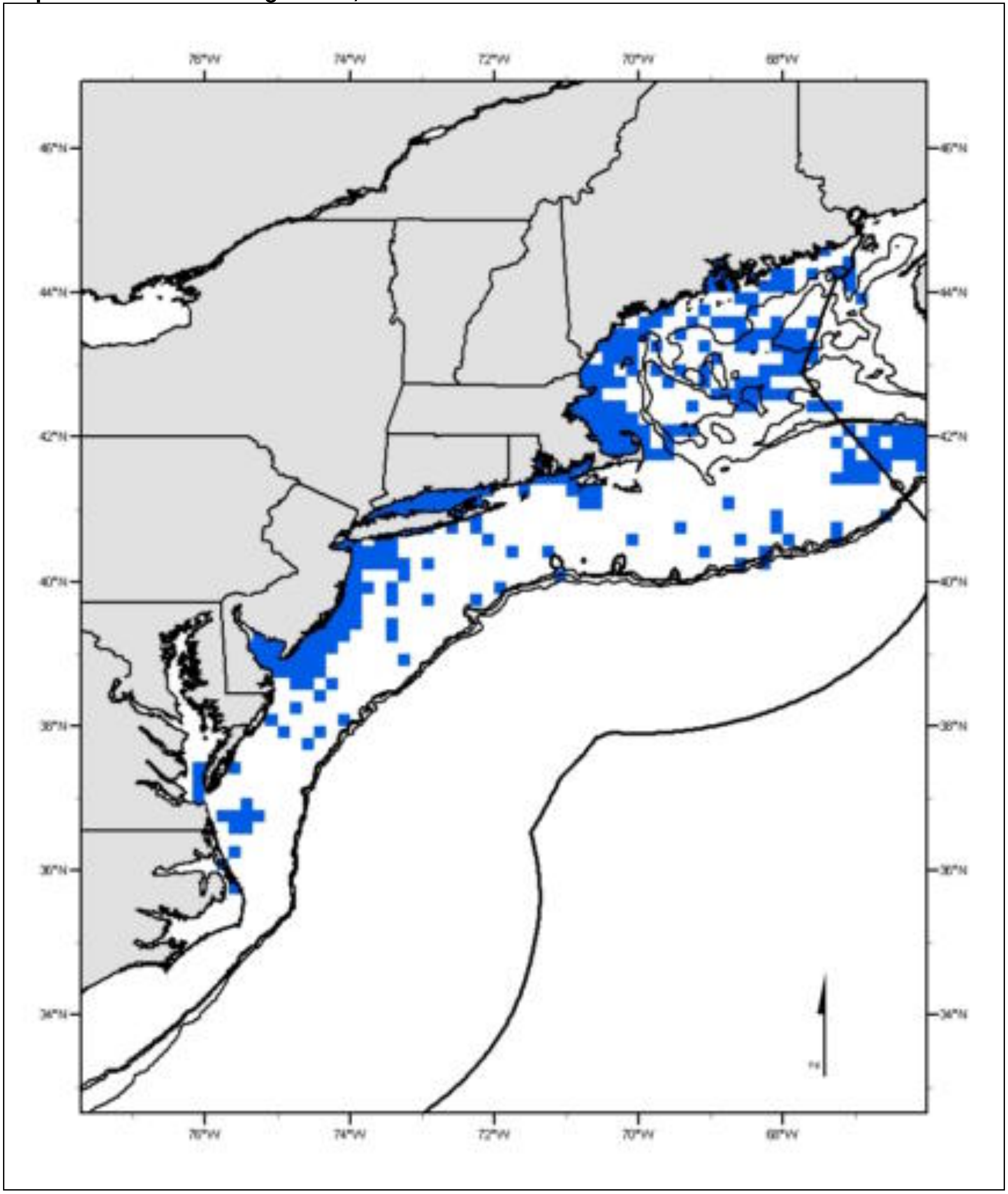
The Alternative 2D EFH designation for juvenile Atlantic herring on the continental shelf is based upon relative abundance during 1968-2005 in the fall and spring NMFS trawl survey at the 90% cumulative percentage level. Relative abundance was calculated on a percent of area rather than a percent of catch basis. This alternative also includes ten minute squares in inshore areas where juvenile Atlantic herring were caught in state trawl surveys in more than 10% of the tows, as well as those bays and estuaries identified by the NOAA ELMR program where Atlantic herring juveniles were "common" or "abundant."

Map 115. Atlantic herring juveniles, Alternative 2E



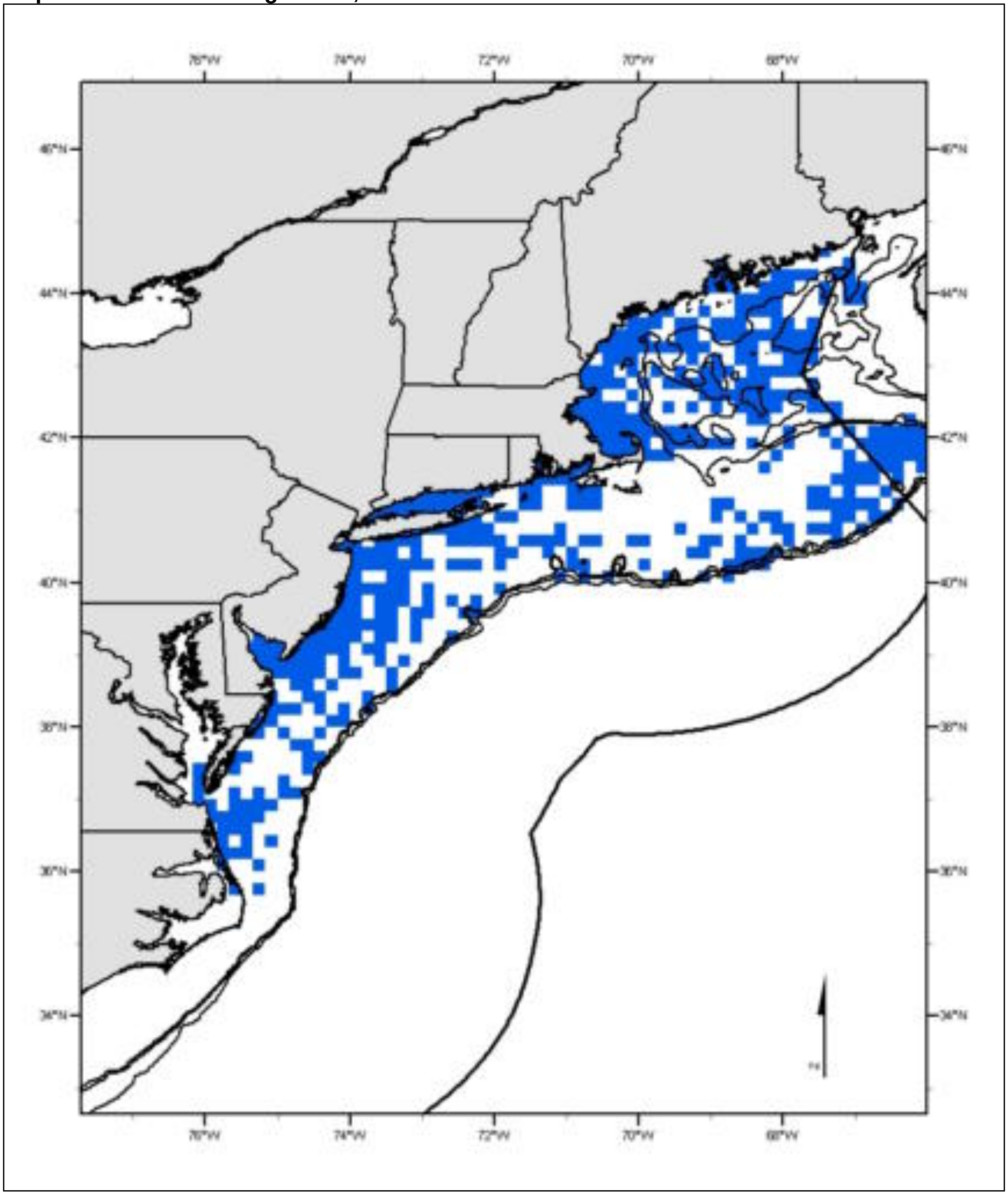
The Alternative 2E EFH designation for juvenile Atlantic herring on the continental shelf is based upon relative abundance during 1968-2005 in the fall and spring NMFS trawl survey at the 75% cumulative percentage level plus additional ten minute squares that were "filled in" along the CT and RI coasts . Relative abundance was calculated on a percent of area rather than a percent of catch basis. This alternative also includes ten minute squares in inshore areas where juvenile Atlantic herring were caught in state trawl surveys in more than 10% of the tows, as well as those bays and estuaries identified by the NOAA ELMR program where Atlantic herring juveniles were "common" or "abundant."

Map 116. Atlantic herring adults, Alternative 2A



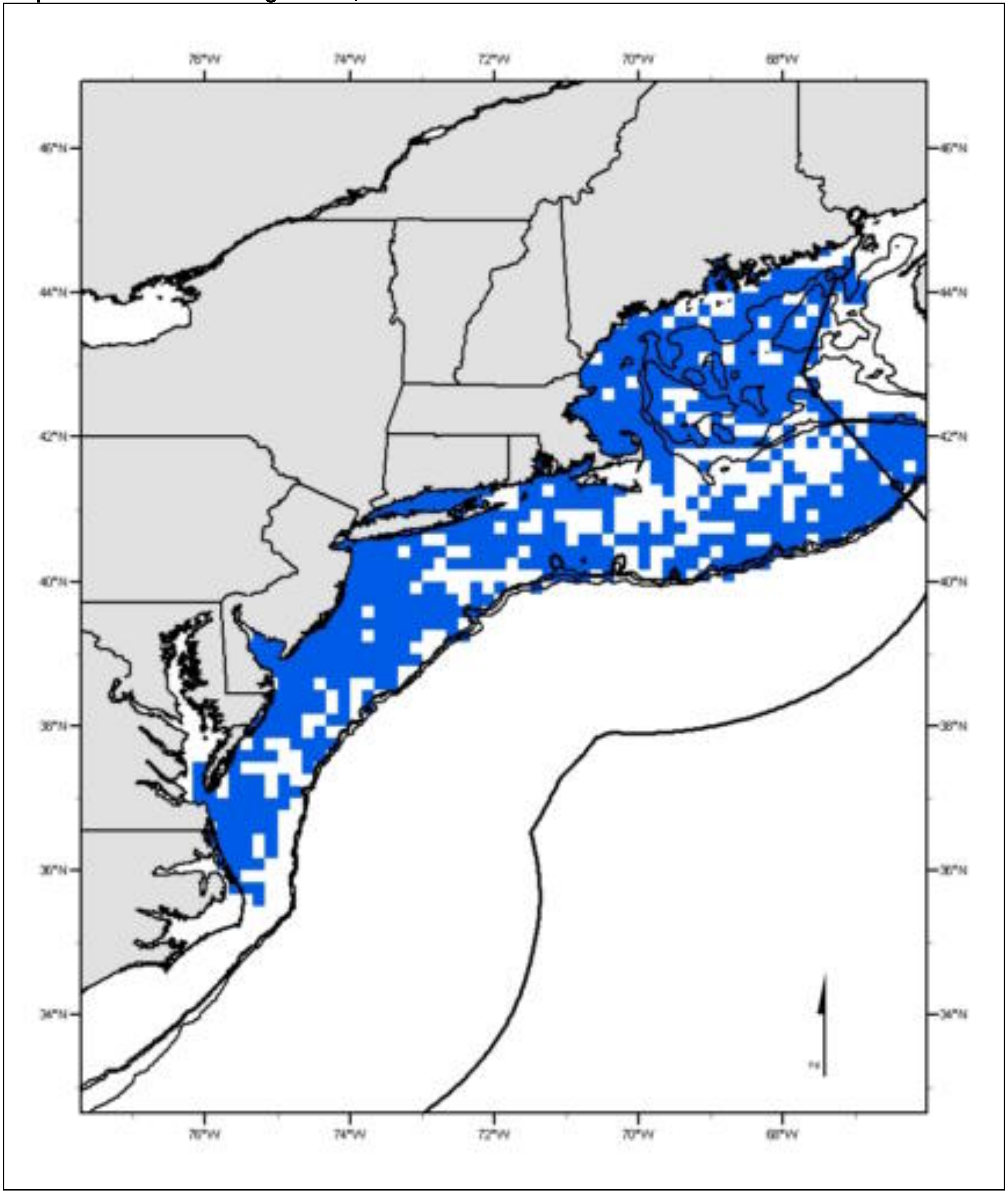
The Alternative 2A EFH designation for adult Atlantic herring on the continental shelf is based upon relative abundance during 1968-2005 in the fall and spring NMFS trawl survey at the 25% cumulative percentage level. Relative abundance was calculated on a percent of area rather than a percent of catch basis. This alternative also includes ten minute squares in inshore areas where adult Atlantic herring were caught in state trawl surveys in more than 10% of the tows, as well as those bays and estuaries identified by the NOAA ELMR program where Atlantic herring adults were "common" or "abundant."

Map 117. Atlantic herring adults, Alternative 2B



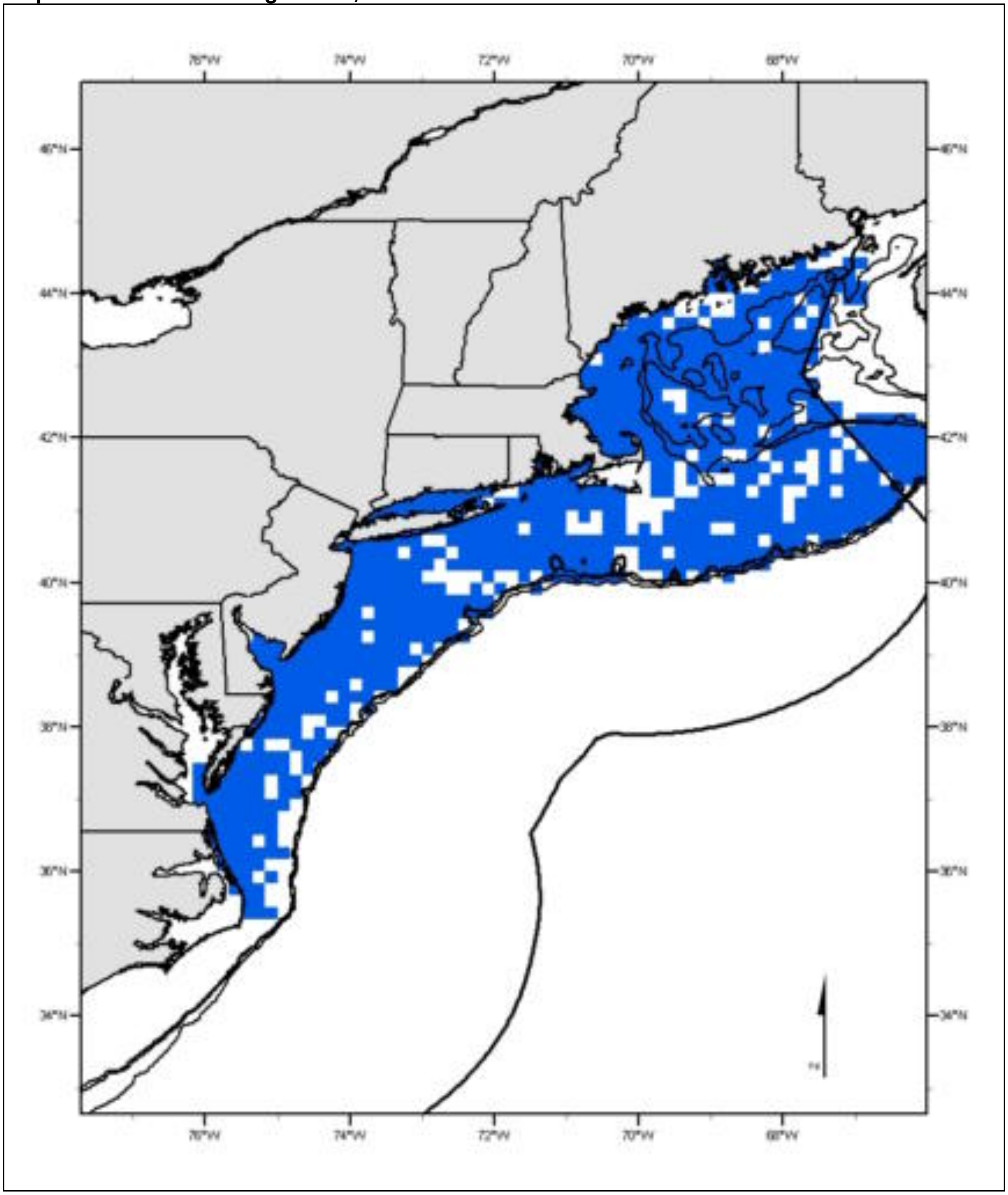
The Alternative 2B EFH designation for adult Atlantic herring on the continental shelf is based upon relative abundance during 1968-2005 in the fall and spring NMFS trawl survey at the 50% cumulative percentage level. Relative abundance was calculated on a percent of area rather than a percent of catch basis. This alternative also includes ten minute squares in inshore areas where adult Atlantic herring were caught in state trawl surveys in more than 10% of the tows, as well as those bays and estuaries identified by the NOAA ELMR program where Atlantic herring adults were "common" or "abundant."

Map 118. Atlantic herring adults, Alternative 2C



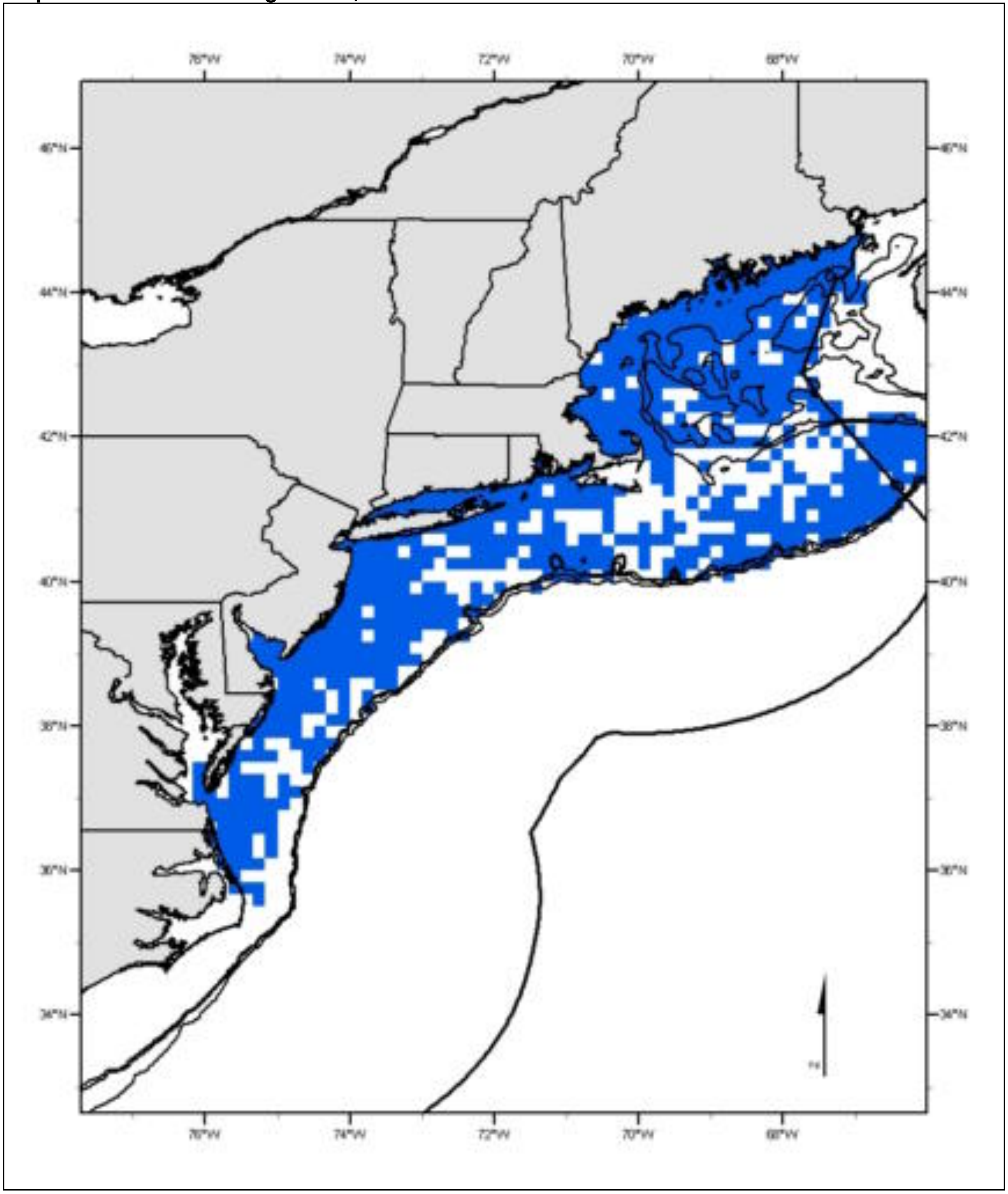
The Alternative 2C EFH designation for adult Atlantic herring on the continental shelf is based upon relative abundance during 1968-2005 in the fall and spring NMFS trawl survey at the 75% cumulative percentage level. Relative abundance was calculated on a percent of area rather than a percent of catch basis. This alternative also includes ten minute squares in inshore areas where adult Atlantic herring were caught in state trawl surveys in more than 10% of the tows, as well as those bays and estuaries identified by the NOAA ELMR program where Atlantic herring adults were "common" or "abundant."

Map 119. Atlantic herring adults, Alternative 2D



The Alternative 2D EFH designation for adult Atlantic herring on the continental shelf is based upon relative abundance during 1968-2005 in the fall and spring NMFS trawl survey at the 90% cumulative percentage level. Relative abundance was calculated on a percent of area rather than a percent of catch basis. This alternative also includes ten minute squares in inshore areas where adult Atlantic herring were caught in state trawl surveys in more than 10% of the tows, as well as those bays and estuaries identified by the NOAA ELMR program where Atlantic herring adults were "common" or "abundant."

Map 120. Atlantic herring adults, Alternative 2E



The Alternative 2E EFH designation for adult Atlantic herring on the continental shelf is based upon relative abundance during 1968-2005 in the fall and spring NMFS trawl survey at the 75% cumulative percentage level plus additional ten minute squares that were "filled in" along the ME, CT, and RI coasts . Relative abundance was calculated on a percent of area rather than a percent of catch basis. This alternative also includes ten minute squares in inshore areas where juvenile Atlantic herring were caught in state trawl surveys in more than 10% of the tows, as well as those bays and estuaries identified by the NOAA ELMR program where Atlantic herring juveniles were "common" or "abundant."

4.1.2.3.5 Atlantic Sea Scallop

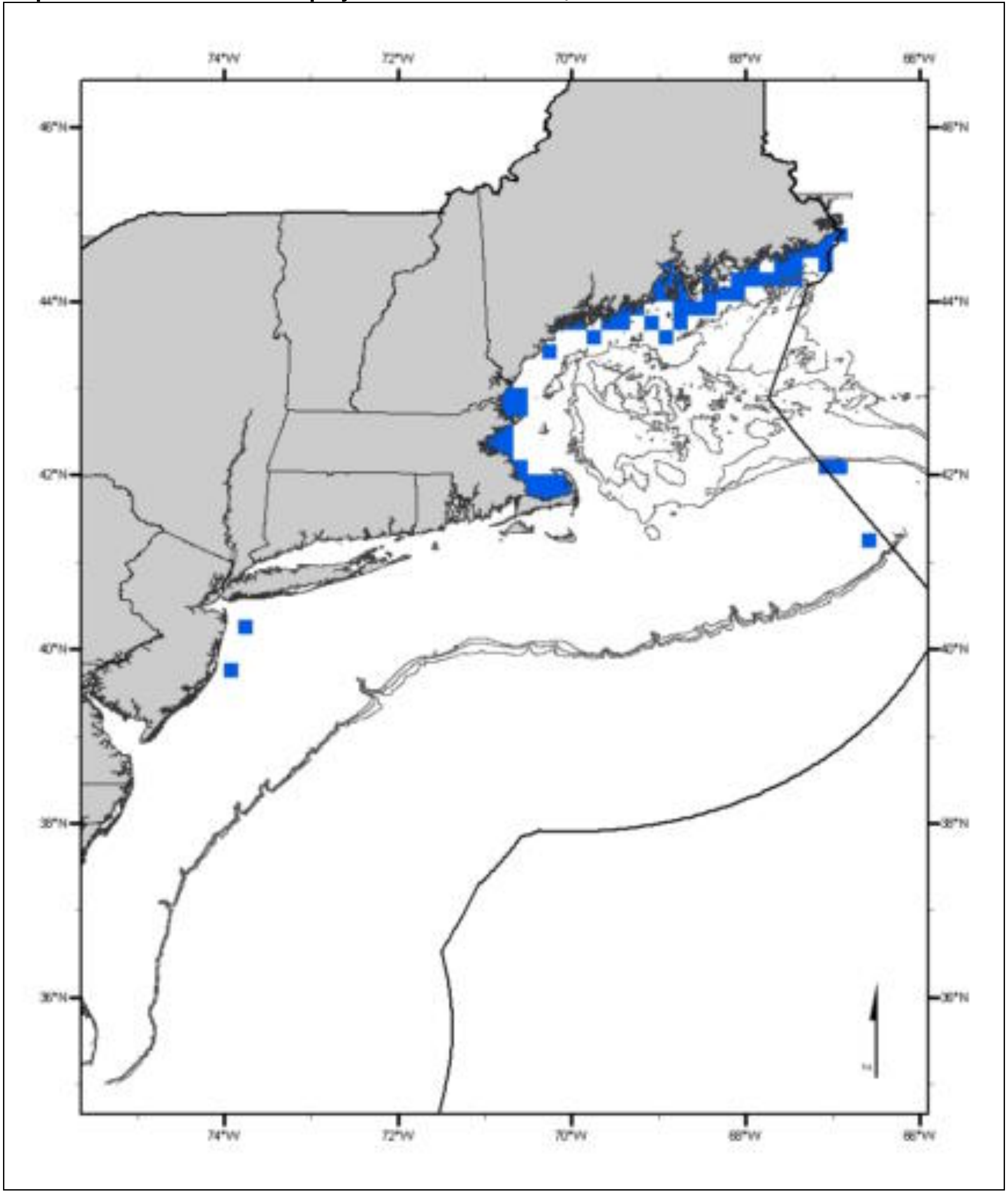
Eggs: No alternative EFH designation.

Larvae: No alternative EFH designation.

Juveniles: Inshore and continental shelf benthic habitats in depths of 18 – 120 meters with substrates of sand, gravel, and/or mixtures of gravel, mud, and sand , as depicted on Map 121 - Map 124. Other conditions that generally exist where EFH is found are bottom temperatures of 1 – 15ºC and salinities above 25 ppt. Juvenile sea scallops are filter–feeders, ingesting diatoms, detritus, microzooplankton, and bacteria.

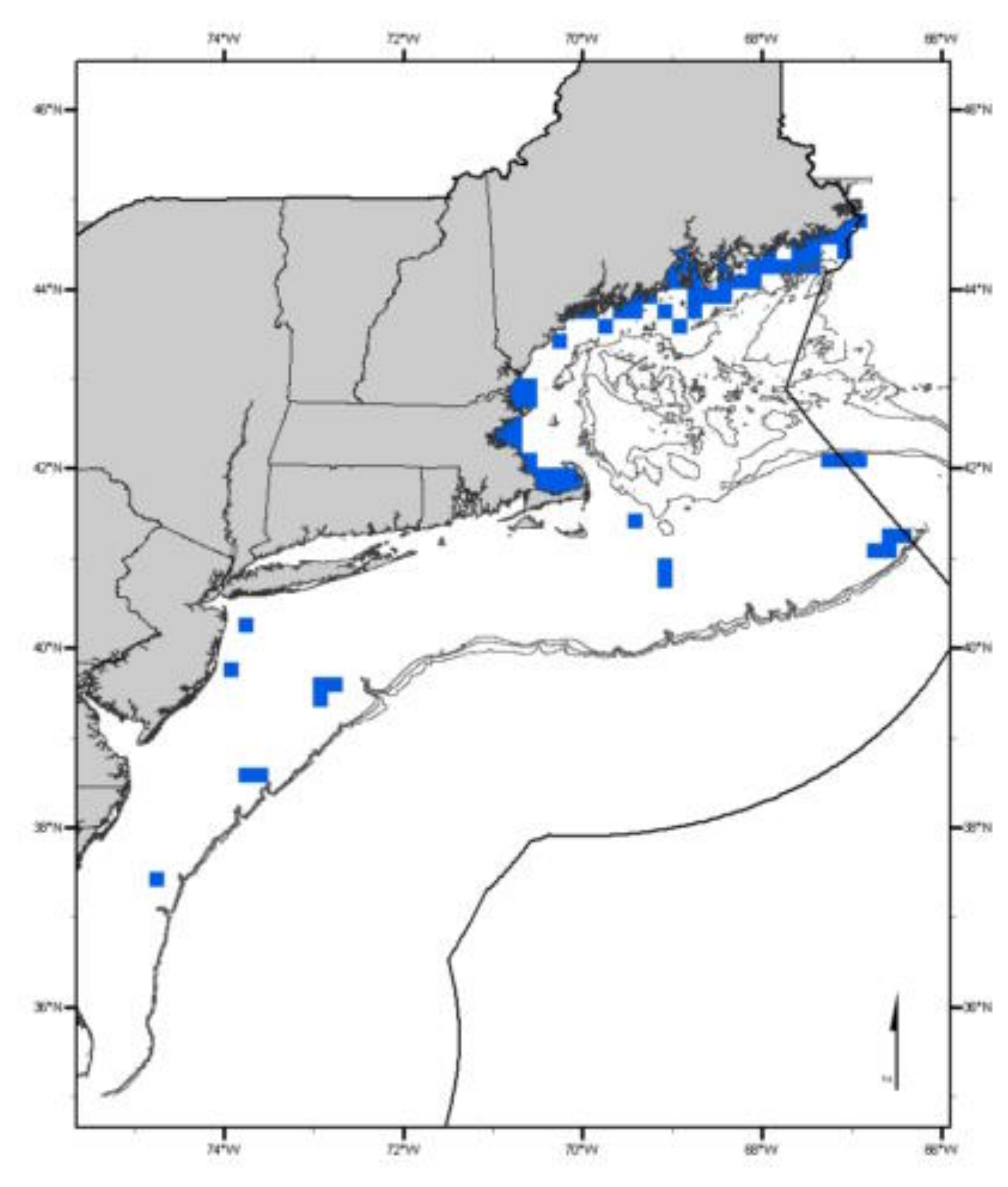
Adults: Inshore and continental shelf benthic habitats in depths of 18 – 120 meters with substrates of sand, gravel, and/or mixtures of gravel, mud, and sand , as depicted on Map 121 - Map 124. Other conditions that generally exist where EFH is found are bottom temperatures of 6.5 – 16ºC and salinities above 25 ppt. These same conditions generally prevail during spawning. Adult sea scallops are filter–feeders, ingesting diatoms, detritus, microzooplankton, and bacteria.

Map 121. Atlantic sea scallops juveniles and adults, Alternative 2A



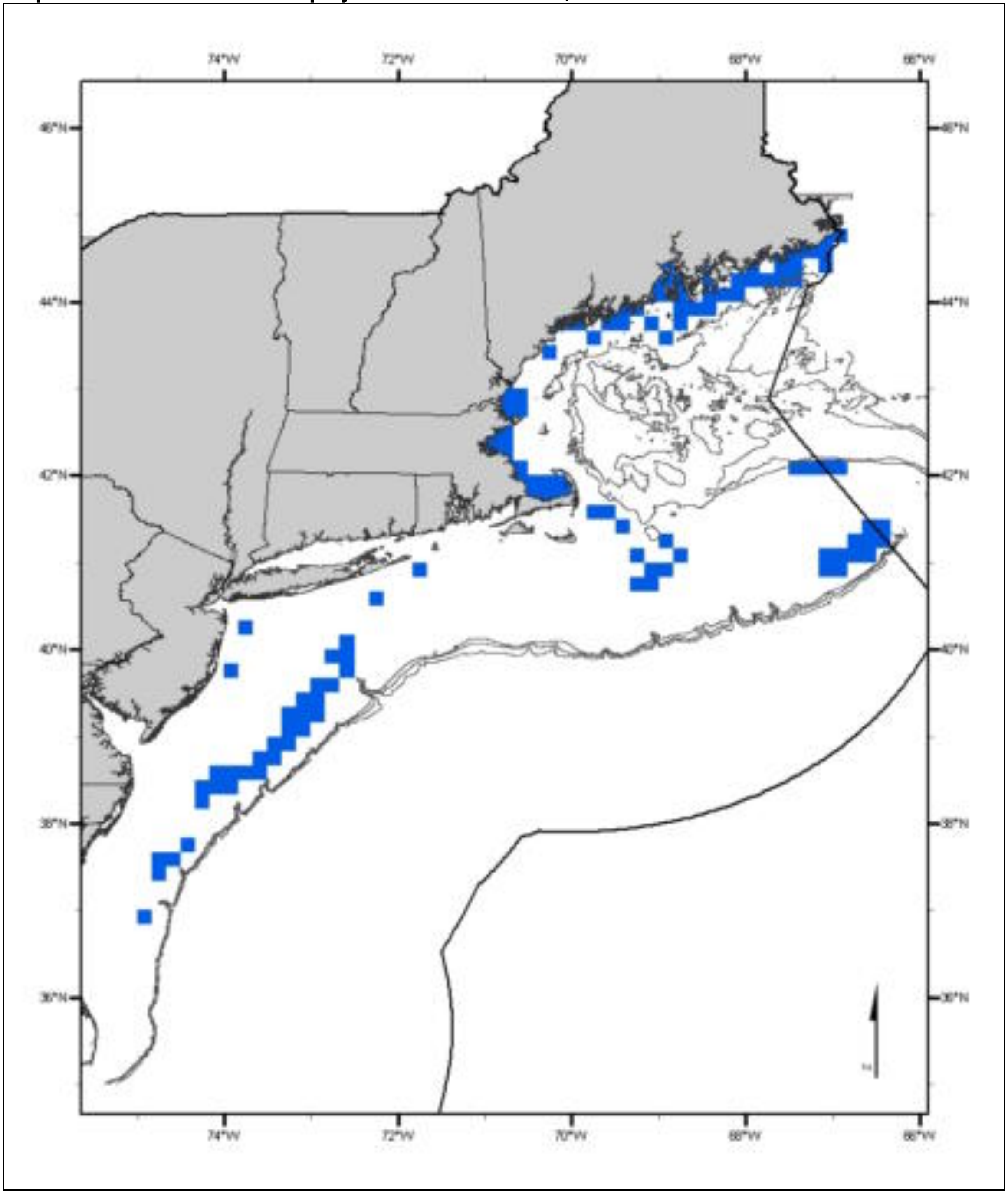
The Alternative 2A EFH designation for juvenile and adult Atlantic sea scallops on the continental shelf is based upon relative abundance during 1982-2005 in the summer NMFS sea scallop dredge survey at the 25% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where juvenile or adult Atlantic scallops were caught in state trawl surveys in more than 10% of the tows, as well as those bays and estuaries identified by the NOAA ELMR program where juvenile or adult sea scallops were "common" or "abundant."

Map 122. Atlantic sea scallops juveniles and adults, Alternative 2B



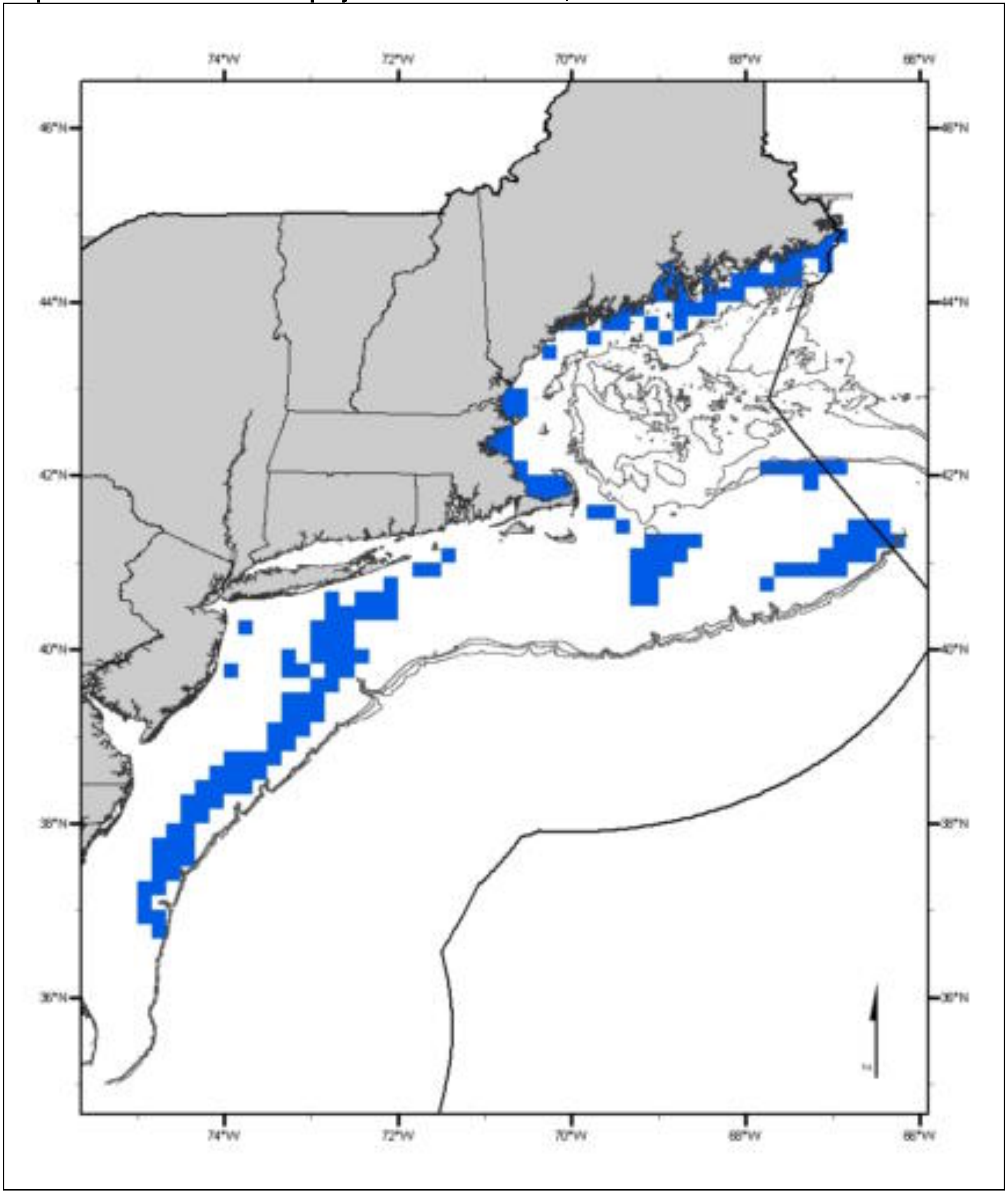
The Alternative 2B EFH designation for juvenile and adult Atlantic sea scallops on the continental shelf is based upon relative abundance during 1982-2005 in the summer NMFS sea scallop dredge survey at the 50% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where juvenile or adult Atlantic scallops were caught in state trawl surveys in more than 10% of the tows, as well as those bays and estuaries identified by the NOAA ELMR program where juvenile or adult sea scallops were "common" or "abundant."

Map 123. Atlantic sea scallops juveniles and adults, Alternative 2C



The Alternative 2C EFH designation for juvenile and adult Atlantic sea scallops on the continental shelf is based upon relative abundance during 1982-2005 in the summer NMFS sea scallop dredge survey at the 75% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where juvenile or adult Atlantic scallops were caught in state trawl surveys in more than 10% of the tows, as well as those bays and estuaries identified by the NOAA ELMR program where juvenile or adult sea scallops were "common" or "abundant."

Map 124. Atlantic sea scallops juveniles and adults, Alternative 2D



The Alternative 2D EFH designation for juvenile and adult Atlantic sea scallops on the continental shelf is based upon relative abundance during 1982-2005 in the summer NMFS sea scallop dredge survey at the 90% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where juvenile or adult Atlantic scallops were caught in state trawl surveys in more than 10% of the tows, as well as those bays and estuaries identified by the NOAA ELMR program where juvenile or adult sea scallops were "common" or "abundant."

4.1.2.3.6 Barndoor Skate

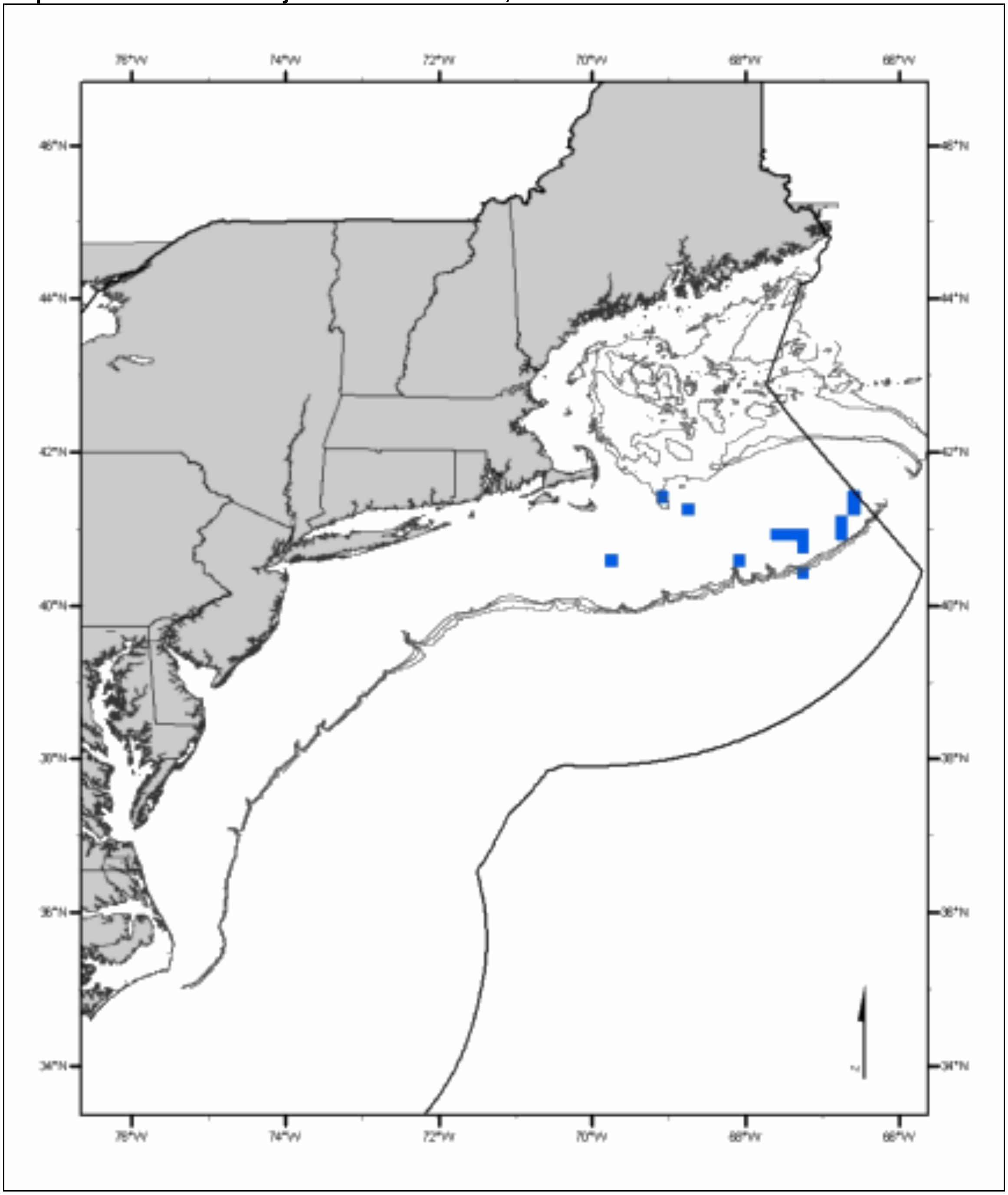
Eggs: There is no information available on the habitat requirements or distribution of the egg stage for this species.

Larvae: No larval life stage exists for this species. Upon hatching, they are fully developed juveniles.

Juveniles: Benthic habitats on the continental shelf in depths of 50 – 160 meters as depicted on Map 125 - Map 128. EFH for juvenile barndoor skates includes substrates composed primarily of sand, with some sand and mud, and/or sand and mud mixed with gravel, pebbles and cobbles. Other conditions that generally exist where EFH is found are bottom temperatures of 2.5 – 11.5ºC salinities of 20 – 34.5 ppt. Juvenile barndoor skates feed on benthic invertebrates such as polychaetes and a variety of crustaceans.

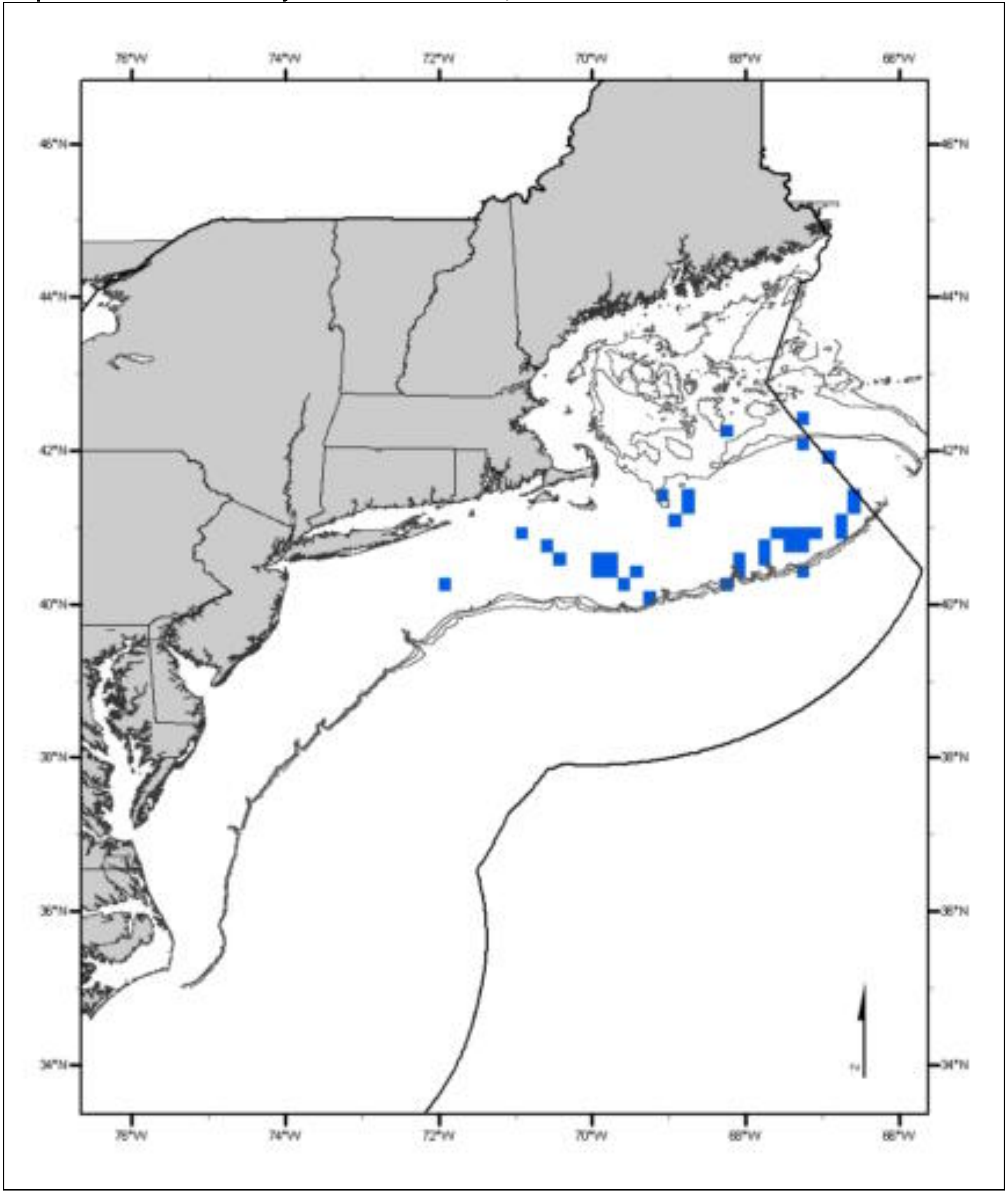
Adults: Benthic habitats on the continental shelf in depths of 60 – 400 meters as depicted on Map 125- Map 128. EFH for adult barndoor skates includes substrates composed primarily of sand, with some sand and mud, and/or sand and mud mixed with gravel, pebbles and cobbles. Other conditions that generally exist where EFH is found are bottom temperatures of 4.5 – 16.5ºC and salinities of 20 – 35.5 ppt. Adult barndoor skates feed on larger and more active prey than juveniles, including razor clams, large gastropods, squids, crabs, lobsters, and a variety of fishes.

Map 125. Barndoor skate juveniles and adults, Alternative 2A



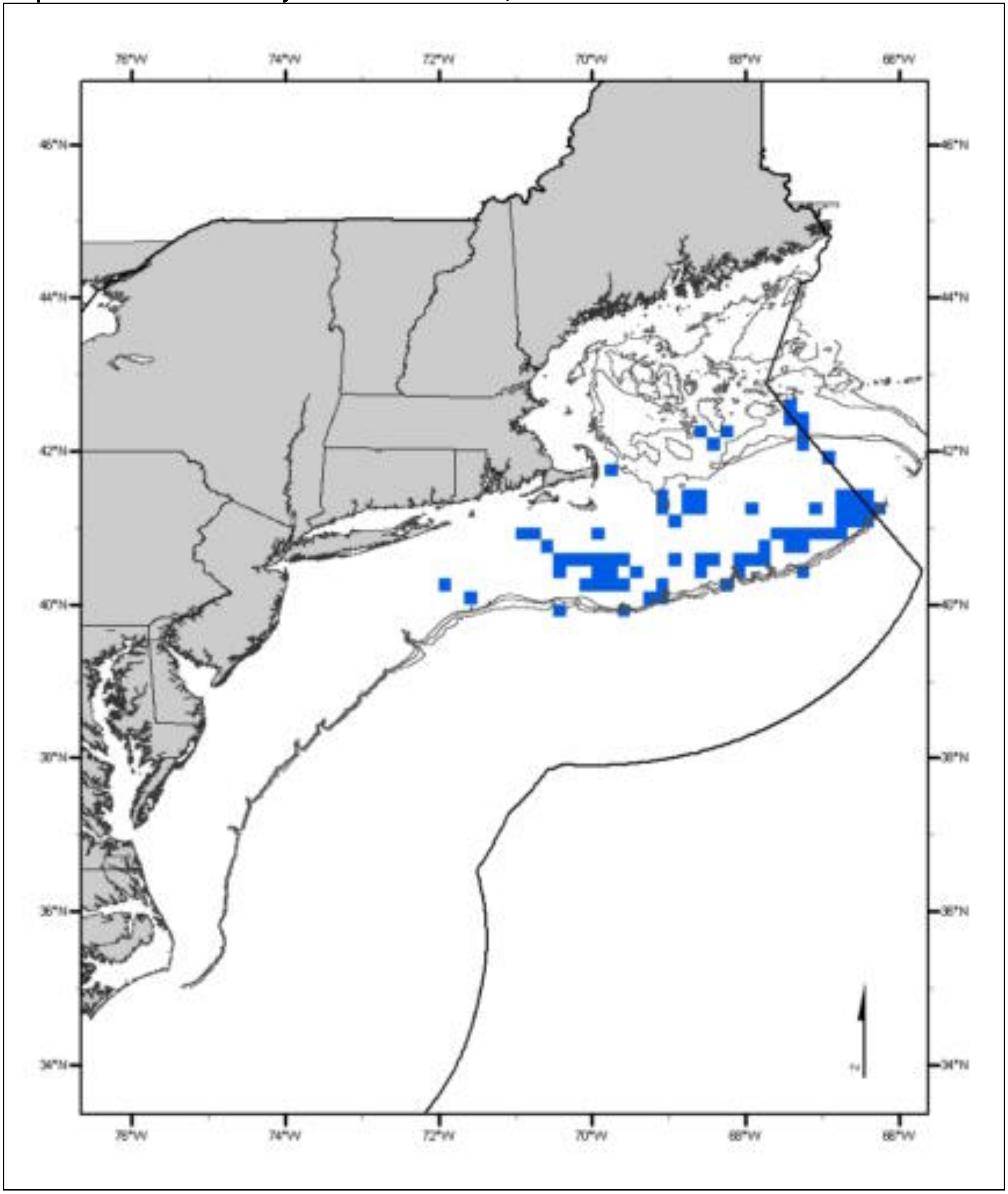
The Alternative 2A EFH designation for juvenile and adult barndoor skate on the continental shelf is based upon the relative abundance of juveniles during 1968-2005 in the fall and spring NMFS trawl survey at the 25% cumulative percentage level.

Map 126. Barndoor skate juveniles and adults, Alternative 2B



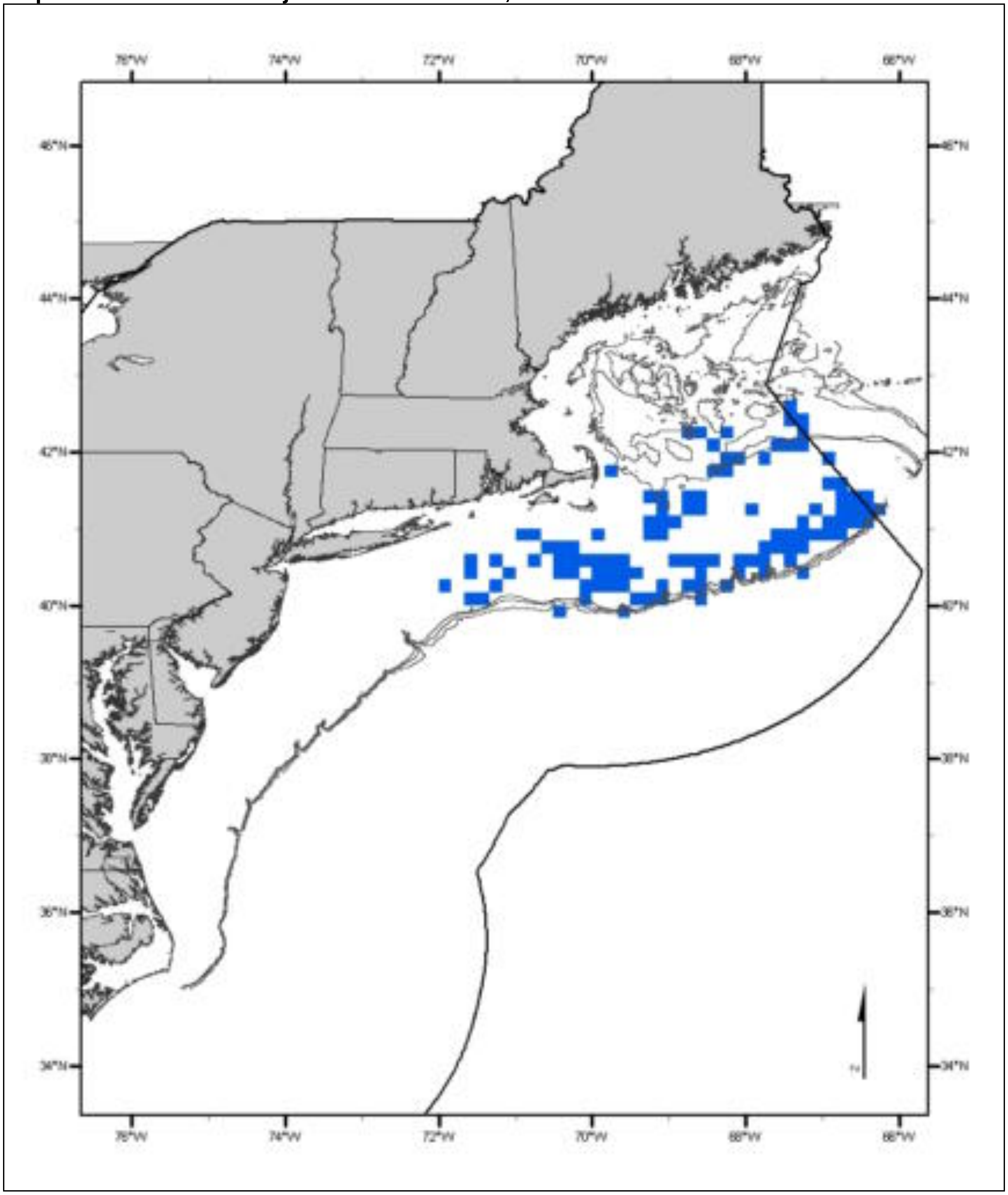
The Alternative 2B EFH designation for juvenile and adult barndoor skate on the continental shelf is based upon the relative abundance of juveniles during 1968-2005 in the fall and spring NMFS trawl survey at the 50% cumulative percentage level.

Map 127. Barndoor skate juveniles and adults, Alternative 2C



The Alternative 2C EFH designation for juvenile and adult barndoor skate on the continental shelf is based upon the relative abundance of juveniles during 1968-2005 in the fall and spring NMFS trawl survey at the 75% cumulative percentage level.

Map 128. Barndoor skate juveniles and adults, Alternative 2D



The Alternative 2D EFH designation for juvenile and adult barndoor skate on the continental shelf is based upon the relative abundance of juveniles during 1968-2005 in the fall and spring NMFS trawl survey at the 90% cumulative percentage level.

4.1.2.3.7 Clearnose Skate

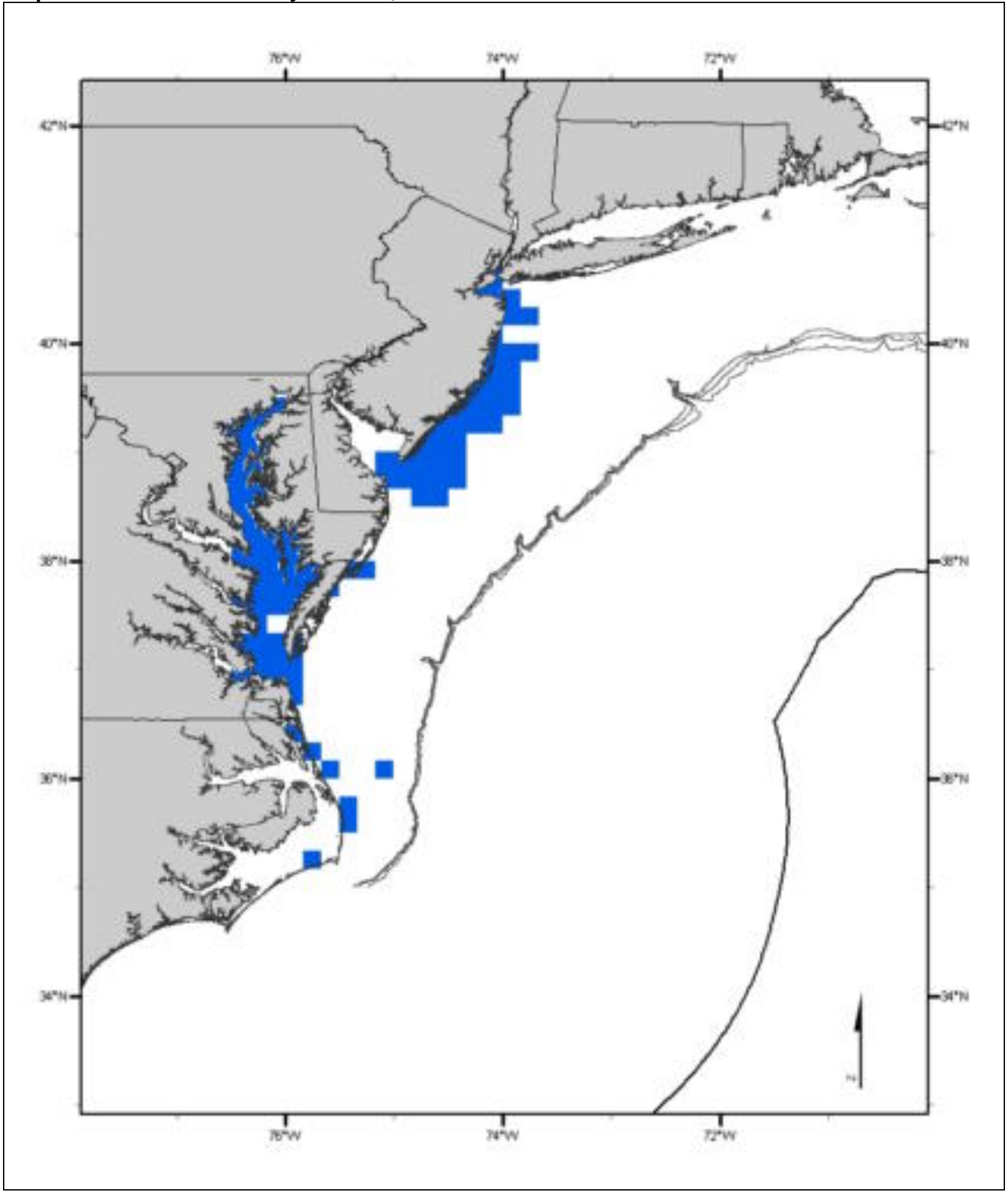
Eggs: There is no information available on the habitat requirements or distribution of the egg stage for this species.

Larvae: No larval life stage exists for this species. Upon hatching, they are fully developed juveniles.

Juveniles: Estuarine, coastal marine, and continental shelf benthic habitats in depths of 1 – 30 meters, as depicted on Map 133 - Map 136. EFH for juvenile clearnose skates occurs primarily on sand, but also on mud and sand with and without gravel, and rocky bottom, and includes the intertidal zone. Other conditions that generally exist where EFH is found are bottom temperatures of 10 – 24ºC and salinities of 19.5 – 36.5 ppt. Juvenile clearnose skates feed on a variety of crustaceans and fishes, and, in inshore waters, on razor clams.

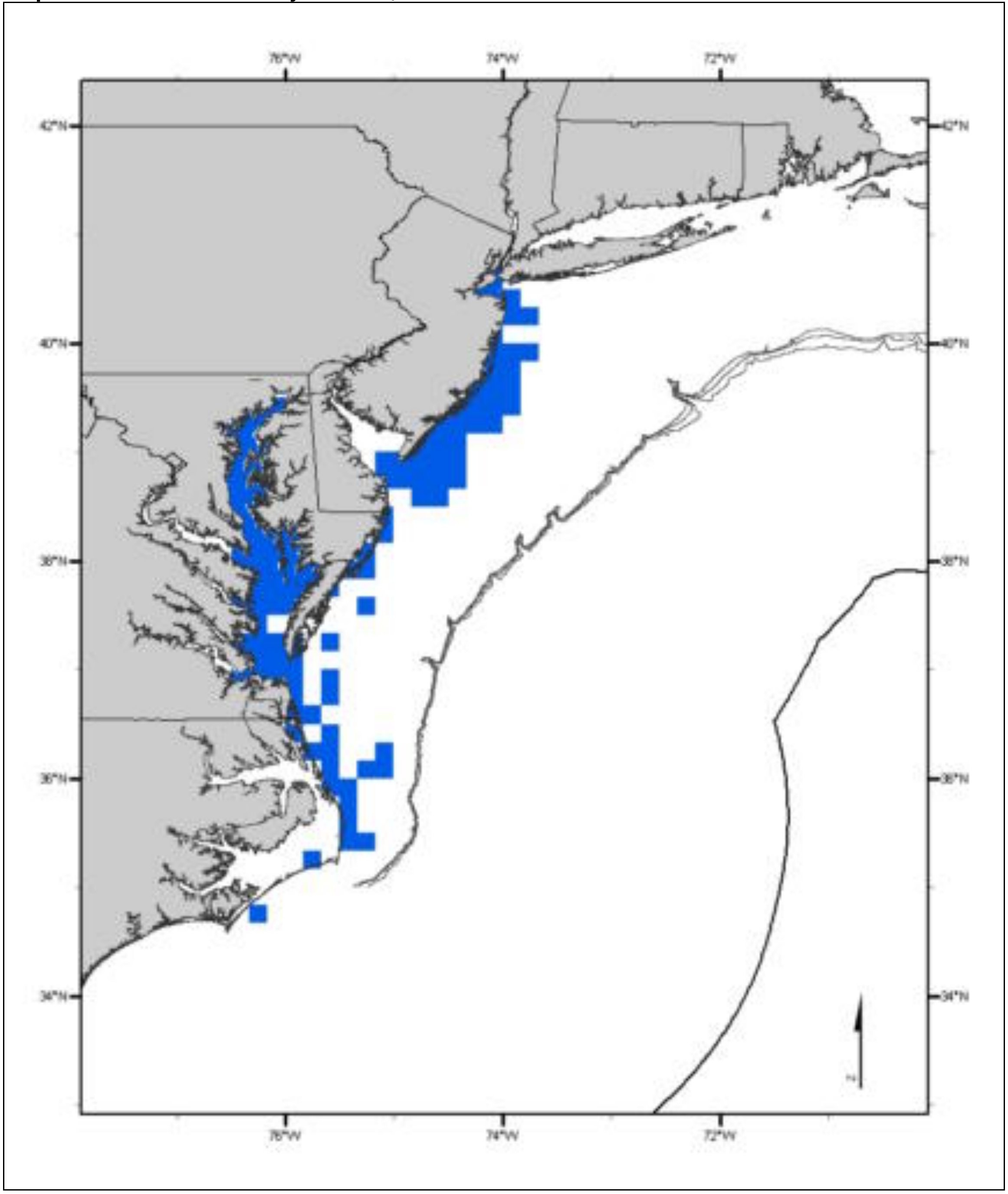
Adults: Estuarine, coastal marine, and continental shelf benthic habitats in depths of 1 – 30 meters, as depicted on Map 133- Map 136. EFH for adult clearnose skates occurs primarily on sand, but also on mud and sand with and without gravel. Other conditions that generally exist where EFH is found are bottom temperatures of 10 – 24ºC salinities of 19.5 – 36.5 ppt. Adult clearnose skates feed on a variety of crustaceans and fishes, and, in inshore waters, on razor clams.

Map 129. Clearnose skate juveniles, Alternative 2A



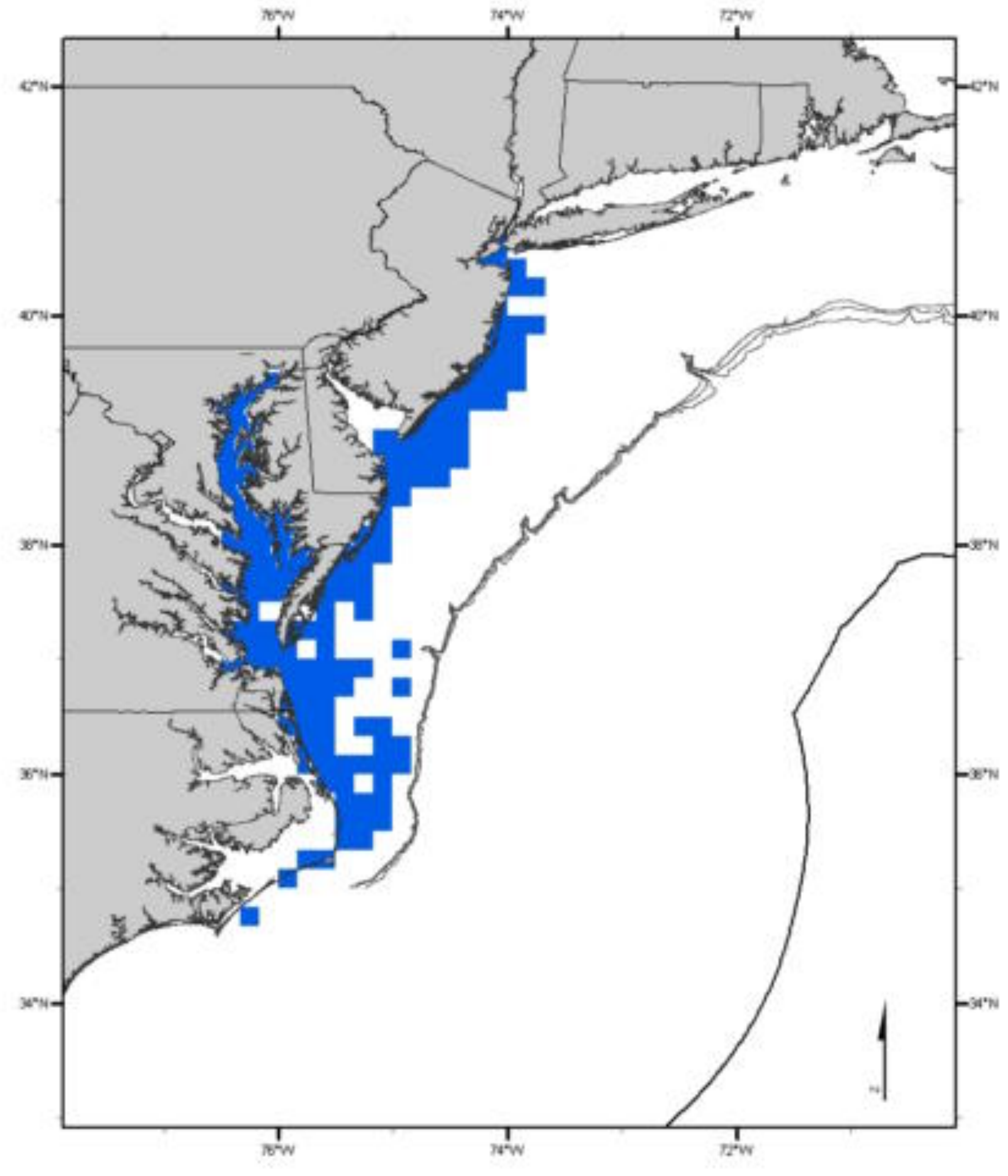
The Alternative 2A EFH designation for juvenile clearnose skate on the continental shelf is based upon relative abundance during 1968-2005 in the fall and spring NMFS trawl survey at the 25% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where juvenile clearnose skate were caught in state trawl surveys in more than 10% of the tows, as well as those bays and estuaries identified by the NOAA ELMR program where clearnose skate juveniles were determined to be "common" or abundant" (see Alternative 1).

Map 130. Clearnose skate juveniles, Alternative 2B



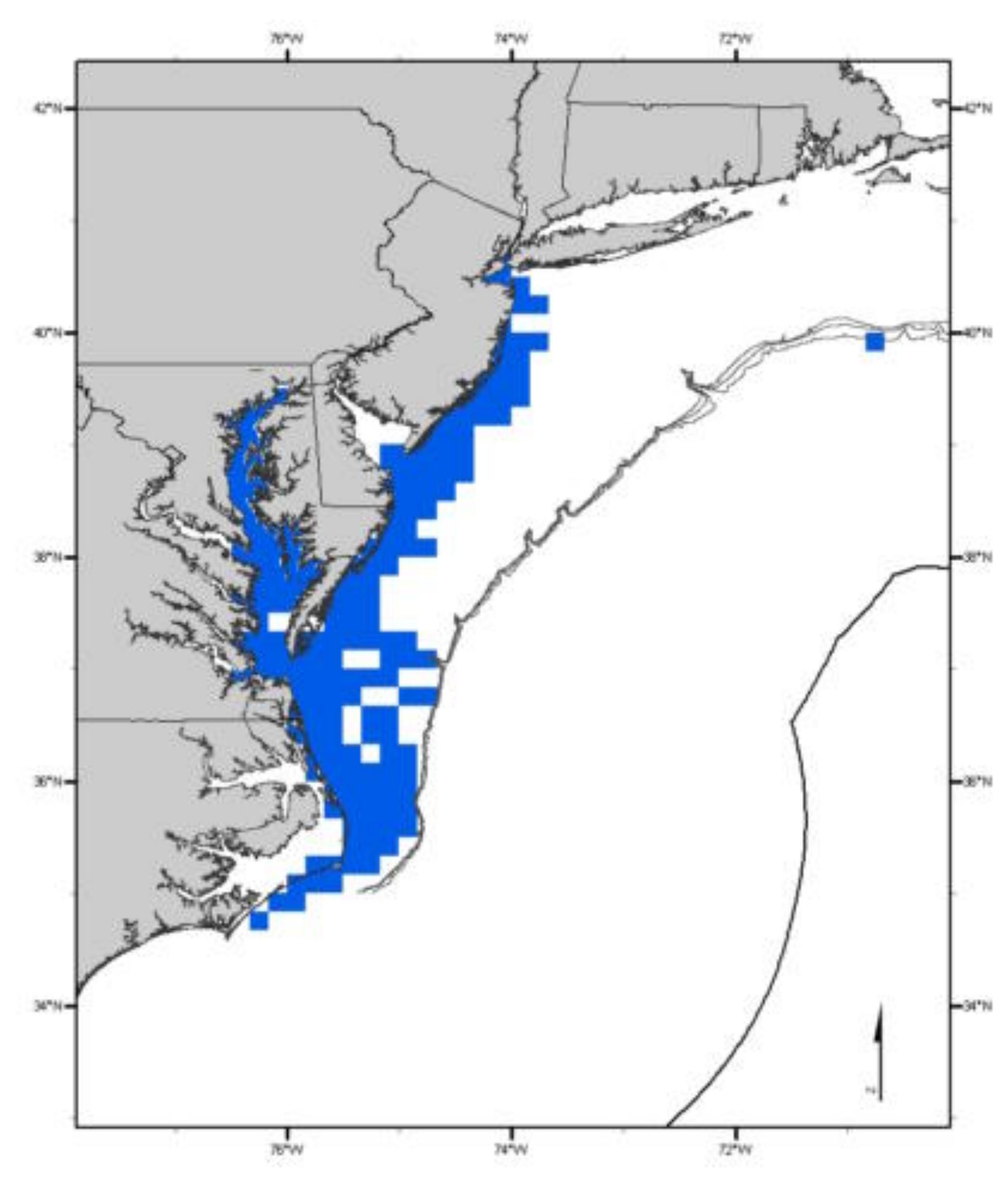
The Alternative 2B EFH designation for juvenile clearnose skate on the continental shelf is based upon relative abundance during 1968-2005 in the fall and spring NMFS trawl survey at the 50% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where juvenile clearnose skate were caught in state trawl surveys in more than 10% of the tows, as well as those bays and estuaries identified by the NOAA ELMR program where clearnose skate juveniles were determined to be "common" or abundant" (see Alternative 1).

Map 131. Clearnose skate juveniles, Alternative 2C



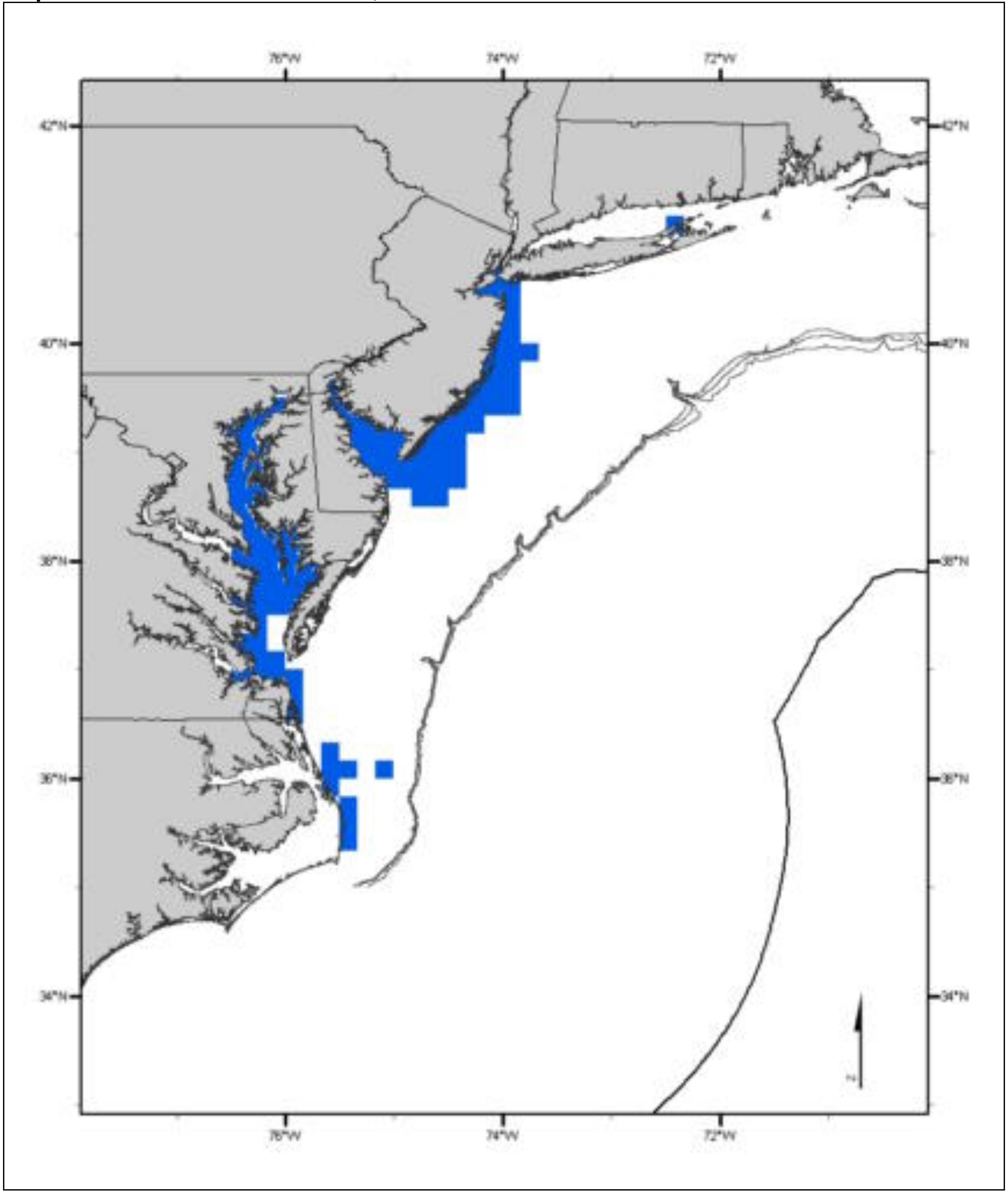
The Alternative 2C EFH designation for juvenile clearnose skate on the continental shelf is based upon relative abundance during 1968-2005 in the fall and spring NMFS trawl survey at the 75% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where juvenile clearnose skate were caught in state trawl surveys in more than 10% of the tows, as well as those bays and estuaries identified by the NOAA ELMR program where clearnose skate juveniles were determined to be "common" or abundant" (see Alternative 1).

Map 132. Clearnose skate juveniles, Alternative 2D



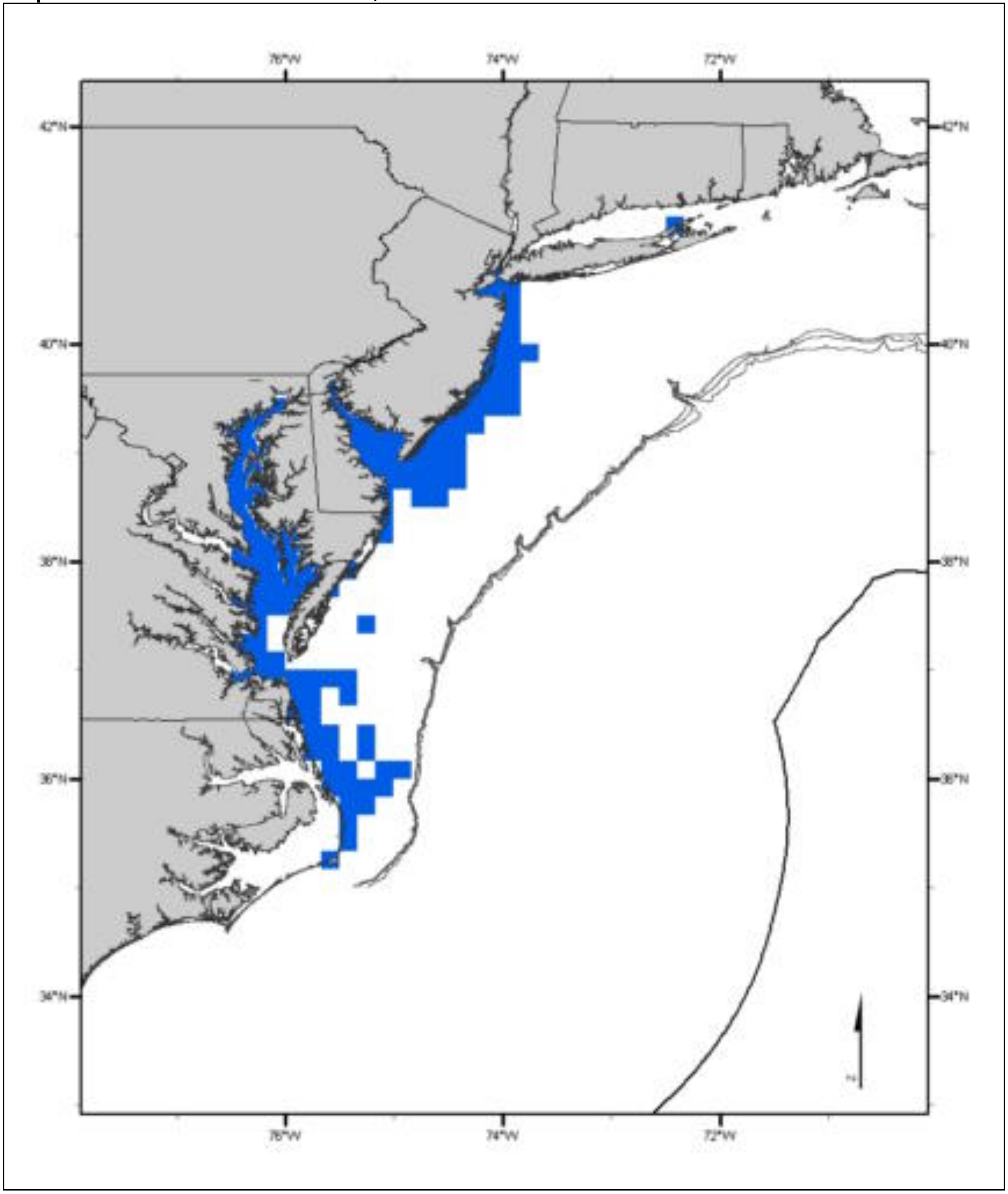
The Alternative 2D EFH designation for juvenile clearnose skate on the continental shelf is based upon relative abundance during 1968-2005 in the fall and spring NMFS trawl survey at the 90% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where juvenile clearnose skate were caught in state trawl surveys in more than 10% of the tows, as well as those bays and estuaries identified by the NOAA ELMR program where clearnose skate juveniles were determined to be "common" or abundant" (see Alternative 1).

Map 133. Clearnose skates adults, Alternative 2A



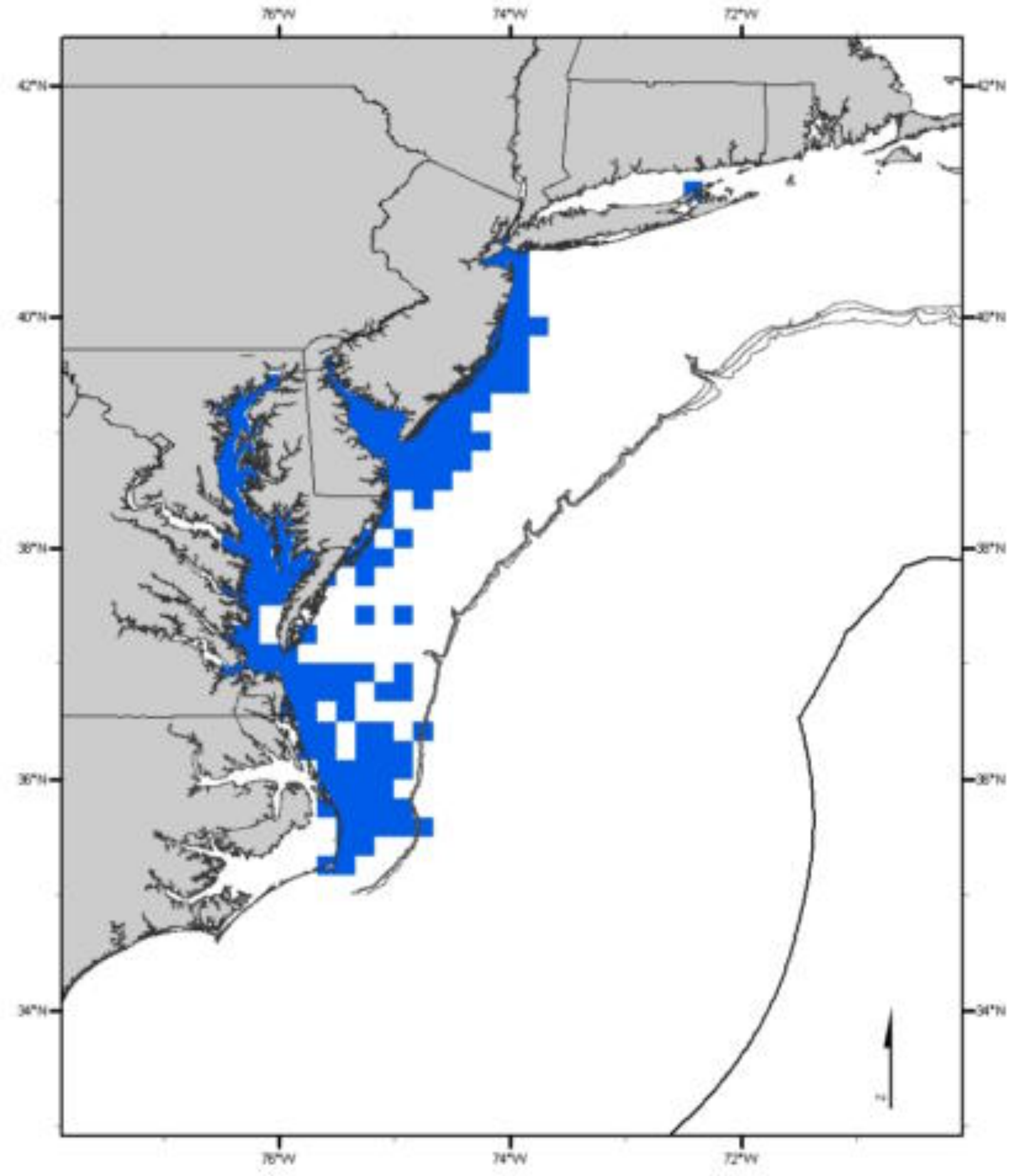
The Alternative 2A EFH designation for adult clearnose skate on the continental shelf is based upon relative abundance during 1968-2005 in the fall and spring NMFS trawl survey at the 25% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where adult clearnose skate were caught in state trawl surveys in more than 10% of the tows, as well as those bays and estuaries identified by the NOAA ELMR program where clearnose skate adults were determined to be "common" or abundant" (see Alternative 1).

Map 134. Clearnose skates adults, Alternative 2B



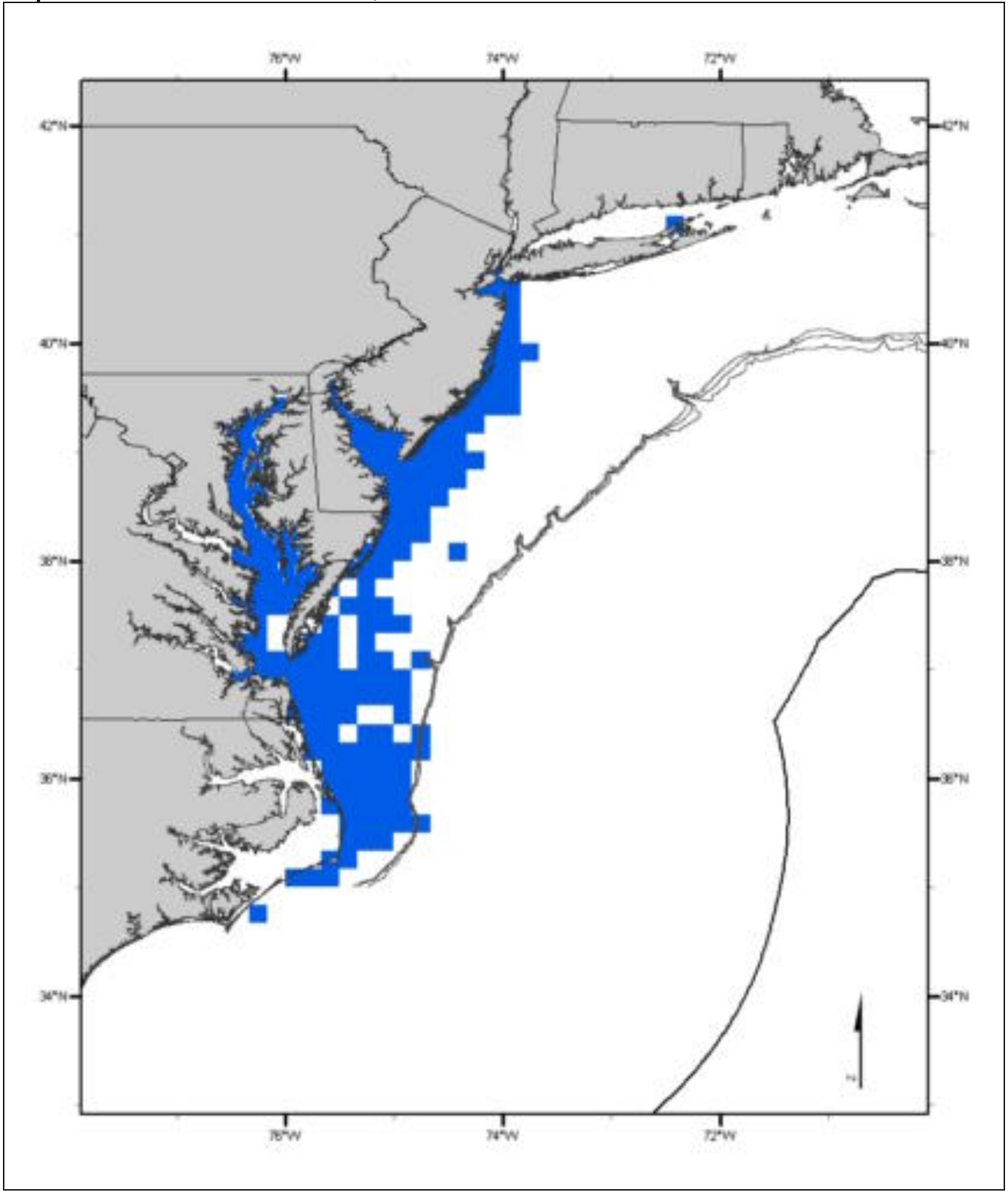
The Alternative 2B EFH designation for adult clearnose skate on the continental shelf is based upon relative abundance during 1968-2005 in the fall and spring NMFS trawl survey at the 50% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where adult clearnose skate were caught in state trawl surveys in more than 10% of the tows, as well as those bays and estuaries identified by the NOAA ELMR program where clearnose skate adults were determined to be "common" or abundant" (see Alternative 1).

Map 135. Clearnose skates adults, Alternative 2C



The Alternative 2C EFH designation for adult clearnose skate on the continental shelf is based upon relative abundance during 1968-2005 in the fall and spring NMFS trawl survey at the 75% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where adult clearnose skate were caught in state trawl surveys in more than 10% of the tows, as well as those bays and estuaries identified by the NOAA ELMR program where clearnose skate adults were determined to be "common" or abundant" (see Alternative 1).

Map 136. Clearnose skates adults, Alternative 2D



The Alternative 2D EFH designation for adult clearnose skate on the continental shelf is based upon relative abundance during 1968-2005 in the fall and spring NMFS trawl survey at the 90% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where adult clearnose skate were caught in state trawl surveys in more than 10% of the tows, as well as those bays and estuaries identified by the NOAA ELMR program where clearnose skate adults were determined to be "common" or abundant" (see Alternative 1).

4.1.2.3.8 Haddock

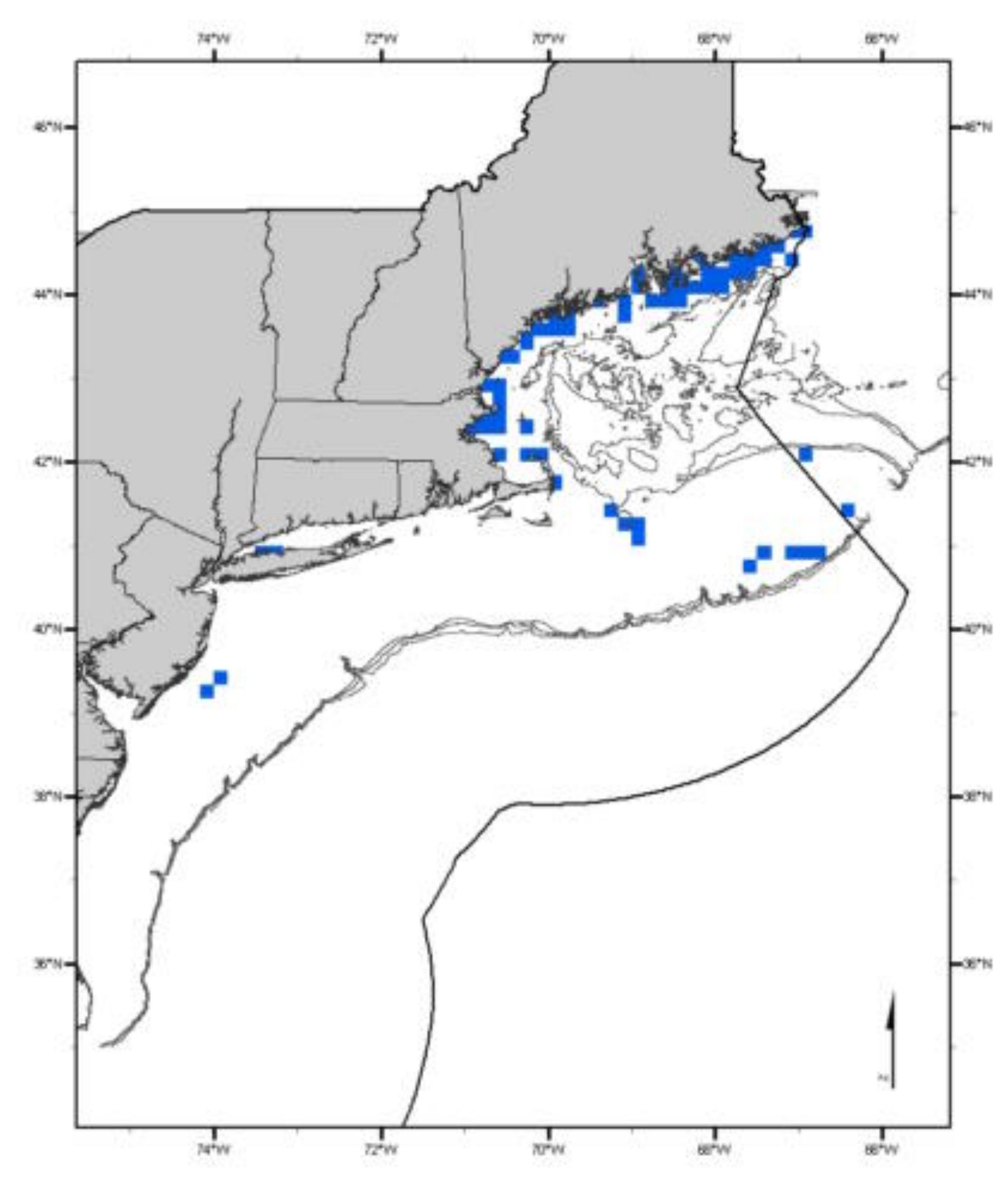
Eggs: No alternative EFH designation.

Larvae: No alternative EFH designation.

Juveniles: Inshore and continental shelf benthic habitats in depths of 30 – 120 meters with sandy–gravelly substrates, as depicted on Map 137 - Map 140. EFH for juvenile haddock occurs on sandy bottom, on pebble–gravel bottom, and on sand and mud mixed with gravel. Other conditions that generally apply where EFH is found are bottom temperatures of 4.5 – 12.5ºC and salinities of 31.5 – 35.5 ppt. Benthic juvenile haddock feed on crustaceans, small bivalve mollusks, brittle stars, polychaetes, and fishes such as sand lance.

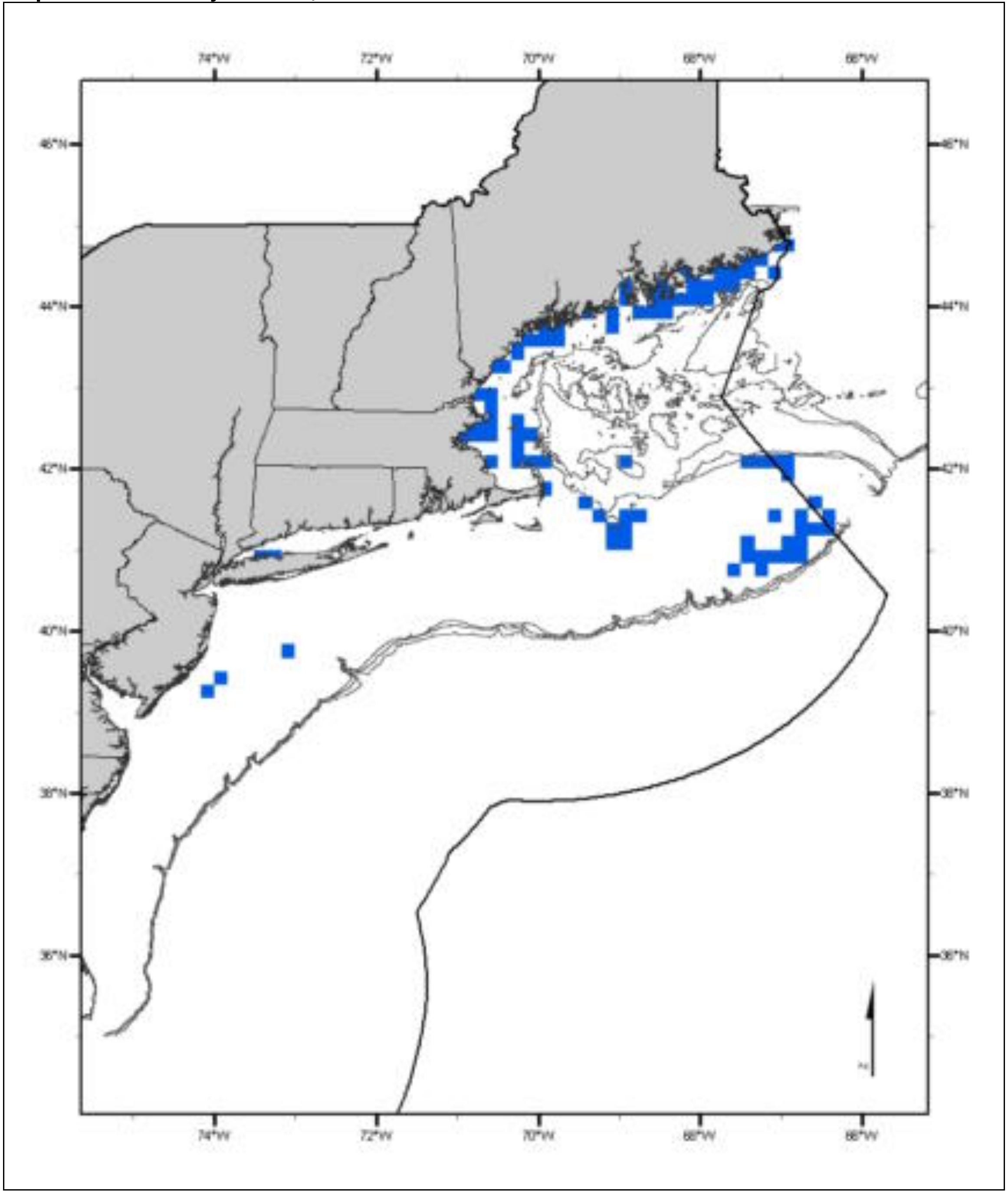
Adults: Continental shelf benthic habitats in depths of 60 – 140 meters with sandy–gravelly substrates as depicted on Map 141 - Map 144. EFH for adult haddock occurs on sandy bottom, on pebble–gravel bottom, and on sand and mud mixed with gravel. They prefer gravel, pebbles, clay, broken shells, and smooth, hard sand (especially between rocky patches), and are not common on rocks, ledges, kelp or soft mud. Other conditions that generally apply where EFH is found are bottom temperatures of 3.5 – 8.5ºC and salinities of 32.5 – 33.5 ppt. Spawning generally occurs at temperatures of 2 – 7ºC and salinities of 31.5 – 34 ppt. Primary prey organisms for adult haddock are fishes (*e.g.*, sand lance, mackerels, and herrings), amphipods, brittle stars, polychaetes, cnidarians, and euphausiids.

Map 137. Haddock juveniles, Alternative 2A



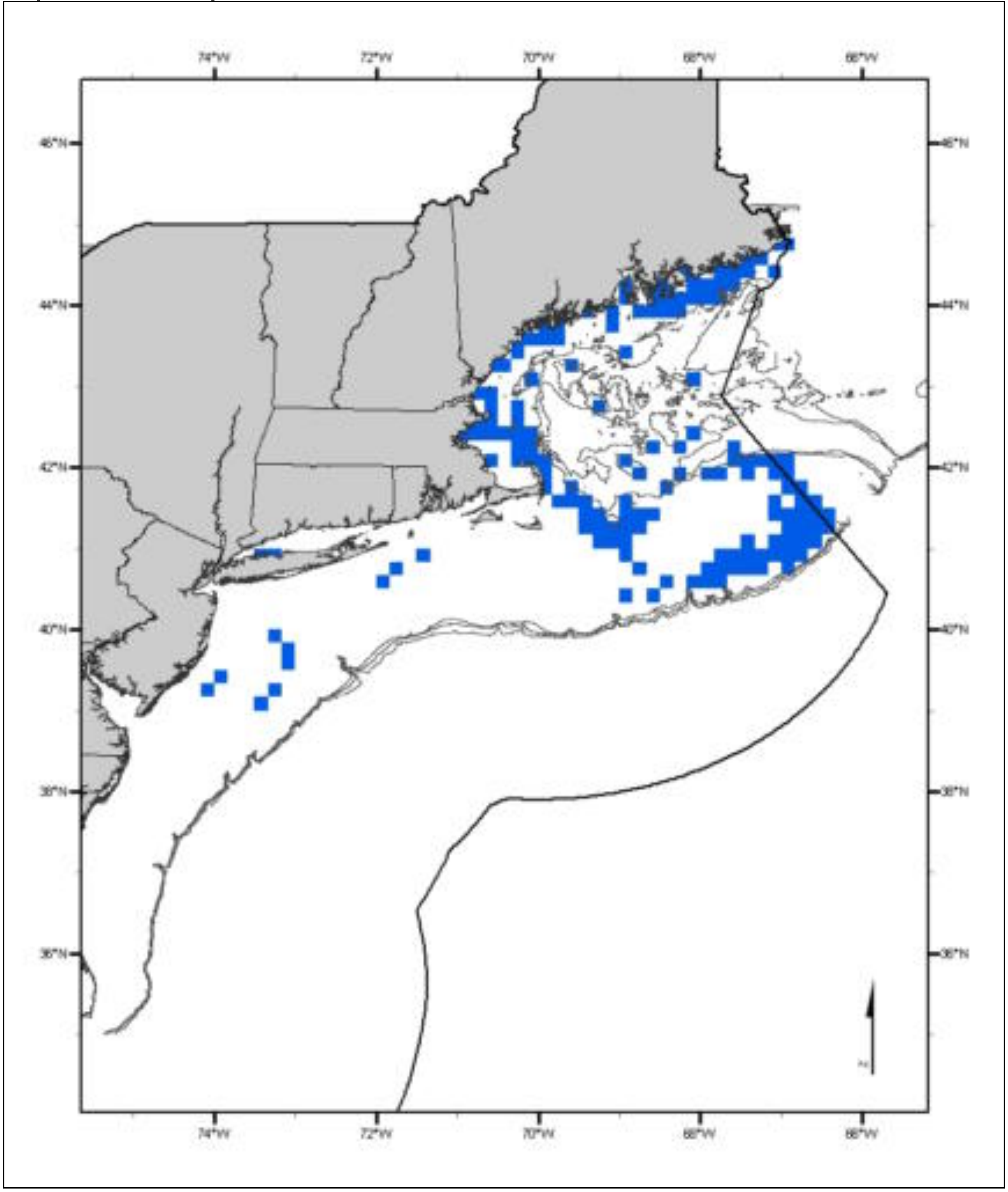
The Alternative 2A EFH designation for juvenile haddock on the continental shelf is based upon relative abundance during 1968-2005 in the fall and spring NMFS trawl survey at the 25% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where juvenile haddock were caught in state trawl surveys in more than 10% of the tows, as well as those bays and estuaries identified by the NOAA ELMR program where haddock juveniles were "common" or "abundant."

Map 138. Haddock juveniles, Alternative 2B



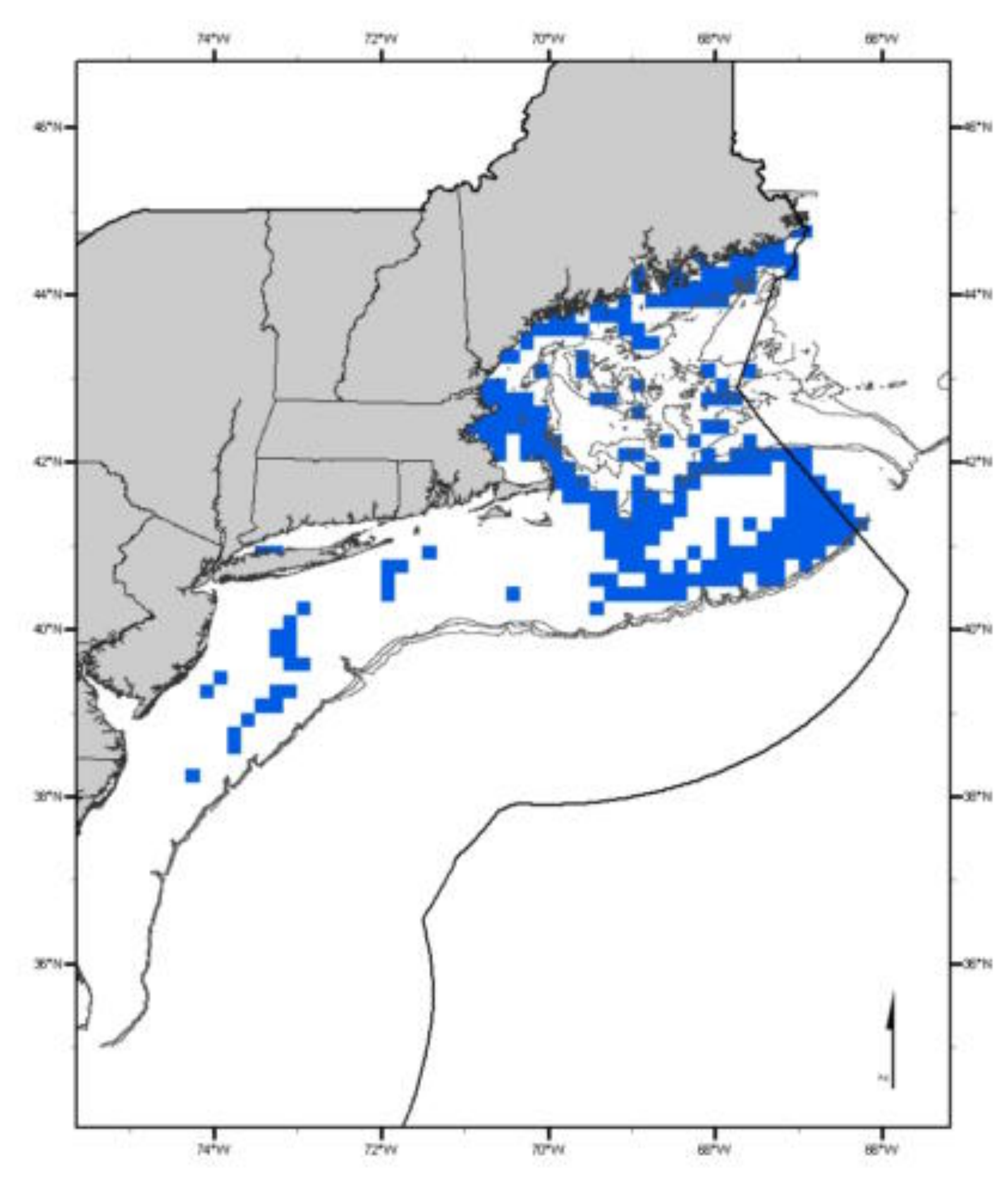
The Alternative 2B EFH designation for juvenile haddock on the continental shelf is based upon relative abundance during 1968-2005 in the fall and spring NMFS trawl survey at the 50% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where juvenile haddock were caught in state trawl surveys in more than 10% of the tows, as well as those bays and estuaries identified by the NOAA ELMR program where haddock juveniles were "common" or "abundant."

Map 139. Haddock juveniles, Alternative 2C



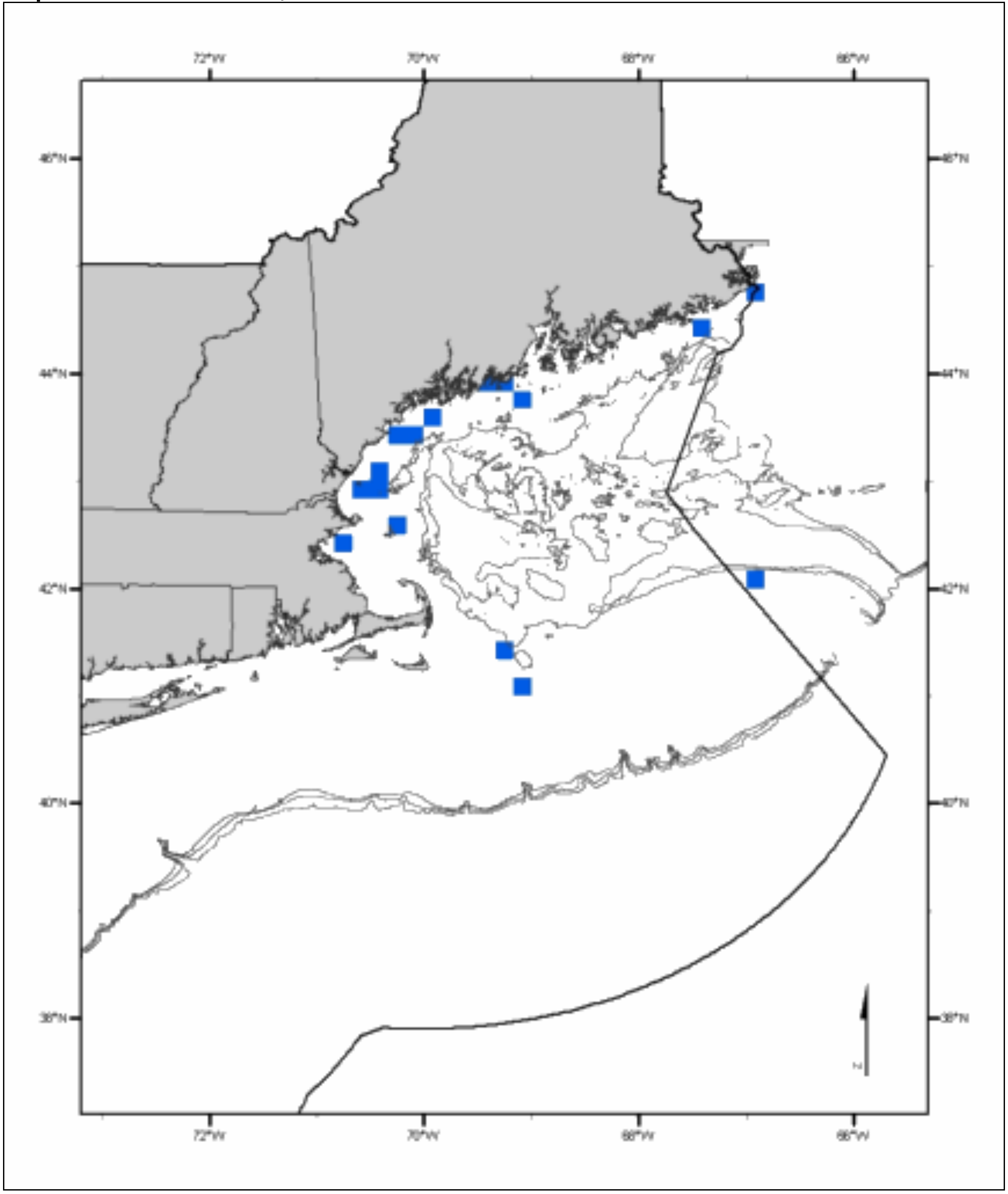
The Alternative 2C EFH designation for juvenile haddock on the continental shelf is based upon relative abundance during 1968-2005 in the fall and spring NMFS trawl survey at the 75% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where juvenile haddock were caught in state trawl surveys in more than 10% of the tows, as well as those bays and estuaries identified by the NOAA ELMR program where haddock juveniles were "common" or "abundant."

Map 140. Haddock juveniles, Alternative 2D



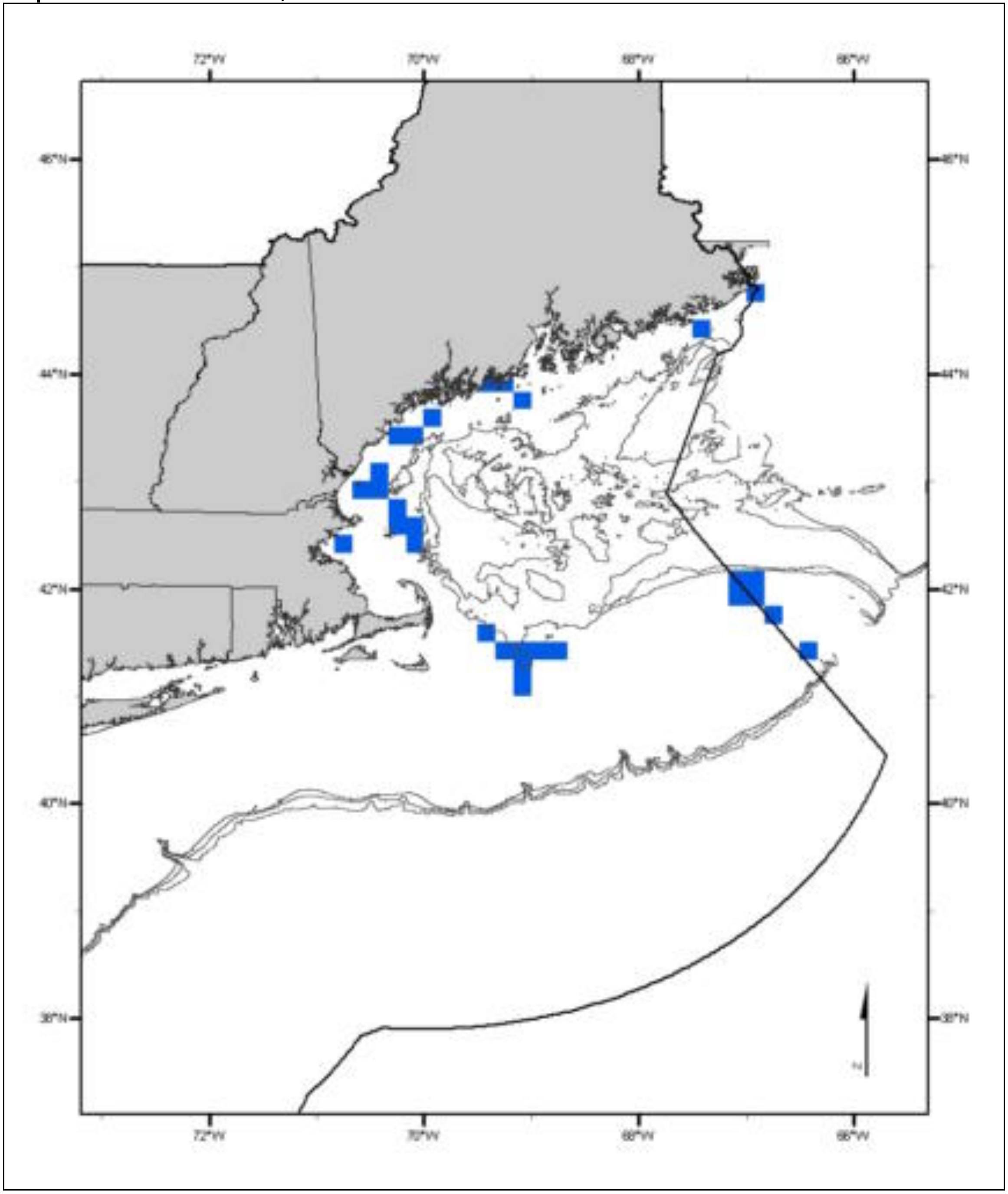
The Alternative 2D EFH designation for juvenile haddock on the continental shelf is based upon relative abundance during 1968-2005 in the fall and spring NMFS trawl survey at the 90% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where juvenile haddock were caught in state trawl surveys in more than 10% of the tows, as well as those bays and estuaries identified by the NOAA ELMR program where haddock juveniles were "common" or "abundant."

Map 141. Haddock adults, Alternative 2A



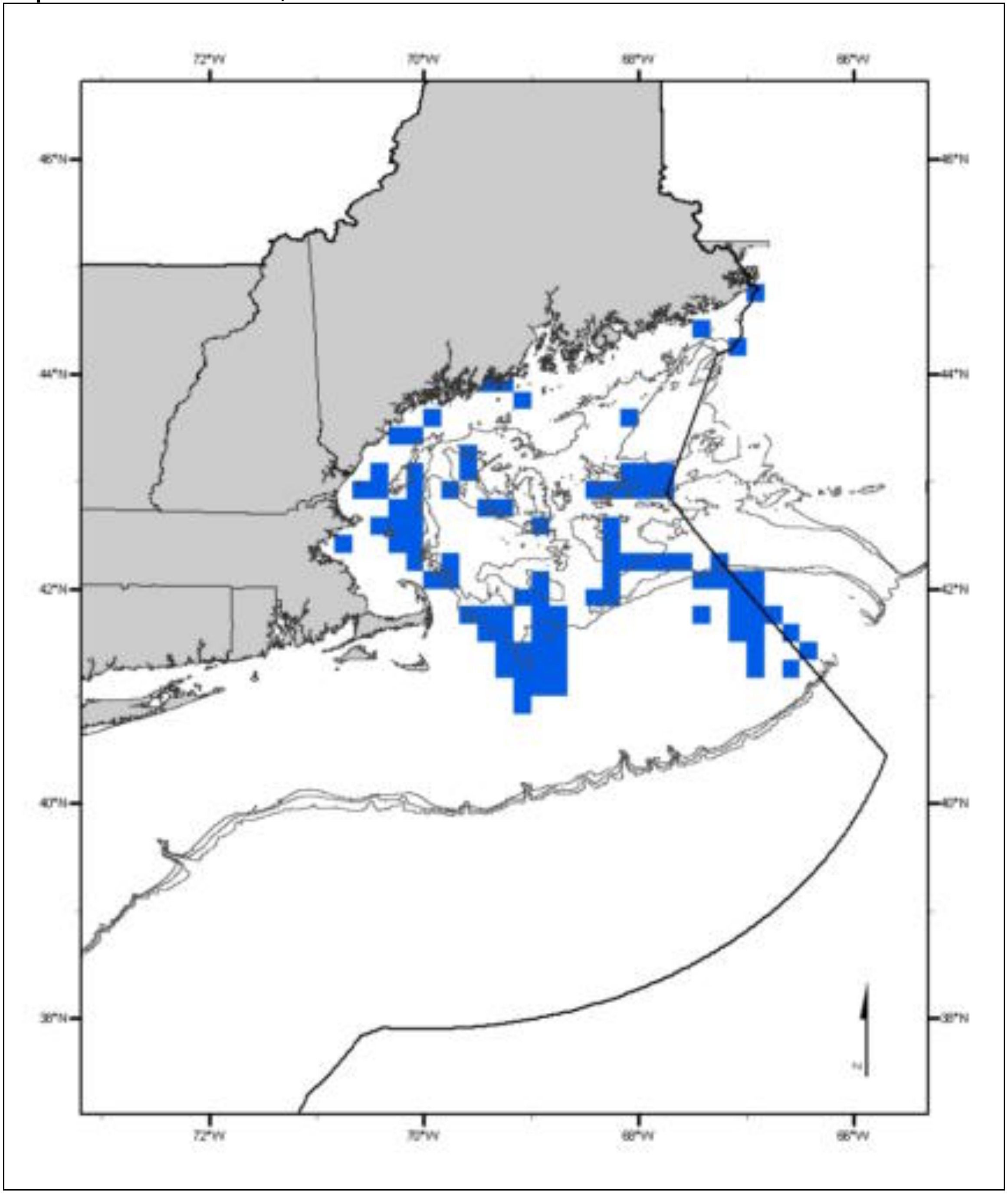
The Alternative 2A EFH designation for adult haddock on the continental shelf is based upon relative abundance during 1968-2005 in the fall and spring NMFS trawl survey at the 25% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where adult haddock were caught in state trawl surveys in more than 10% of the tows, as well as those bays and estuaries identified by the NOAA ELMR program where haddock adults were "common" or "abundant."

Map 142. Haddock adults, Alternative 2B



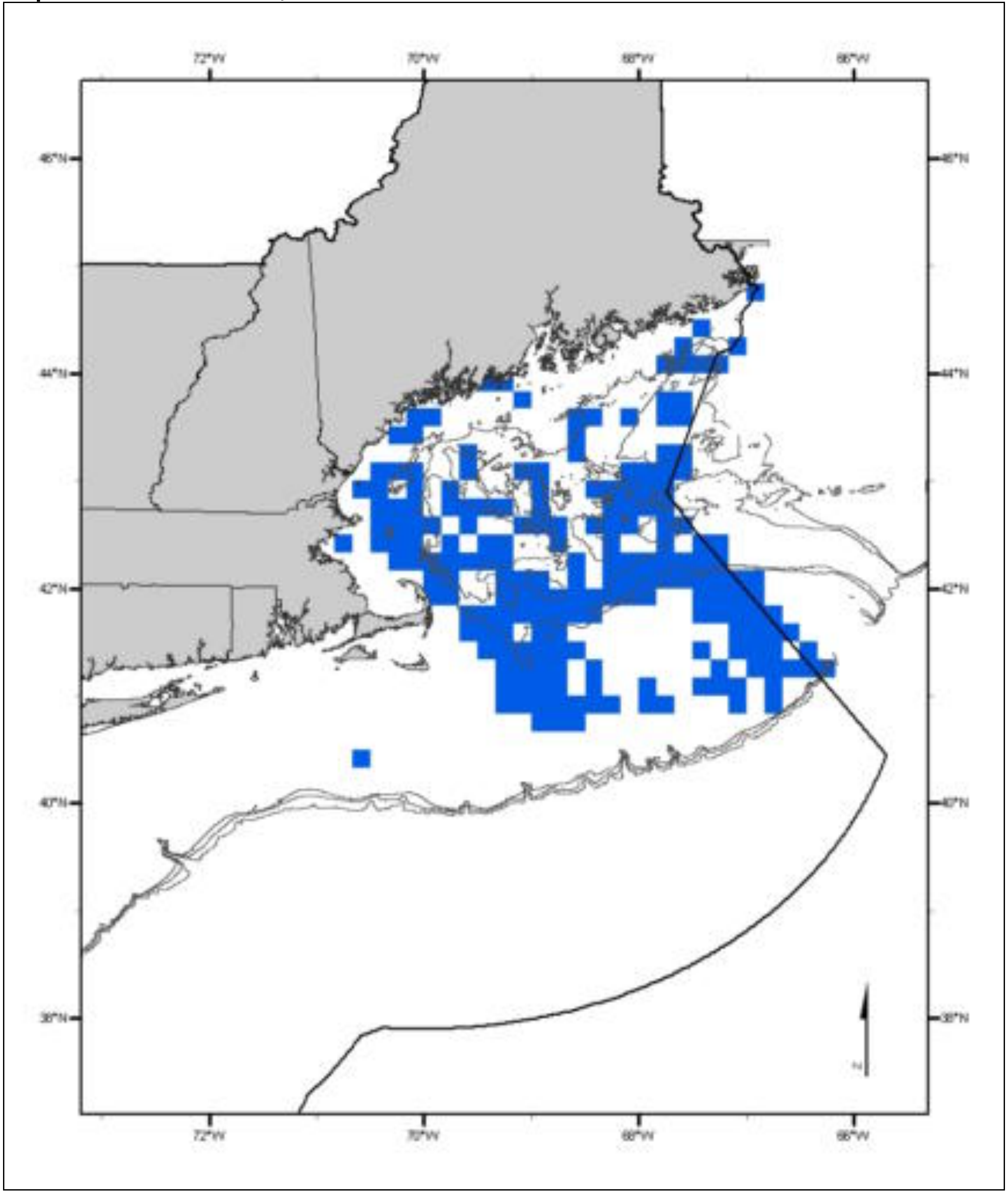
The Alternative 2B EFH designation for adult haddock on the continental shelf is based upon relative abundance during 1968-2005 in the fall and spring NMFS trawl survey at the 50% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where adult haddock were caught in state trawl surveys in more than 10% of the tows, as well as those bays and estuaries identified by the NOAA ELMR program where haddock adults were "common" or "abundant."

Map 143. Haddock adults, Alternative 2C



The Alternative 2C EFH designation for adult haddock on the continental shelf is based upon relative abundance during 1968-2005 in the fall and spring NMFS trawl survey at the 75% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where adult haddock were caught in state trawl surveys in more than 10% of the tows, as well as those bays and estuaries identified by the NOAA ELMR program where haddock adults were "common" or "abundant."

Map 144. Haddock adults, Alternative 2D



The Alternative 2D EFH designation for adult haddock on the continental shelf is based upon relative abundance during 1968-2005 in the fall and spring NMFS trawl survey at the 90% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where adult haddock were caught in state trawl surveys in more than 10% of the tows, as well as those bays and estuaries identified by the NOAA ELMR program where haddock adults were "common" or "abundant."

4.1.2.3.9 Little Skate

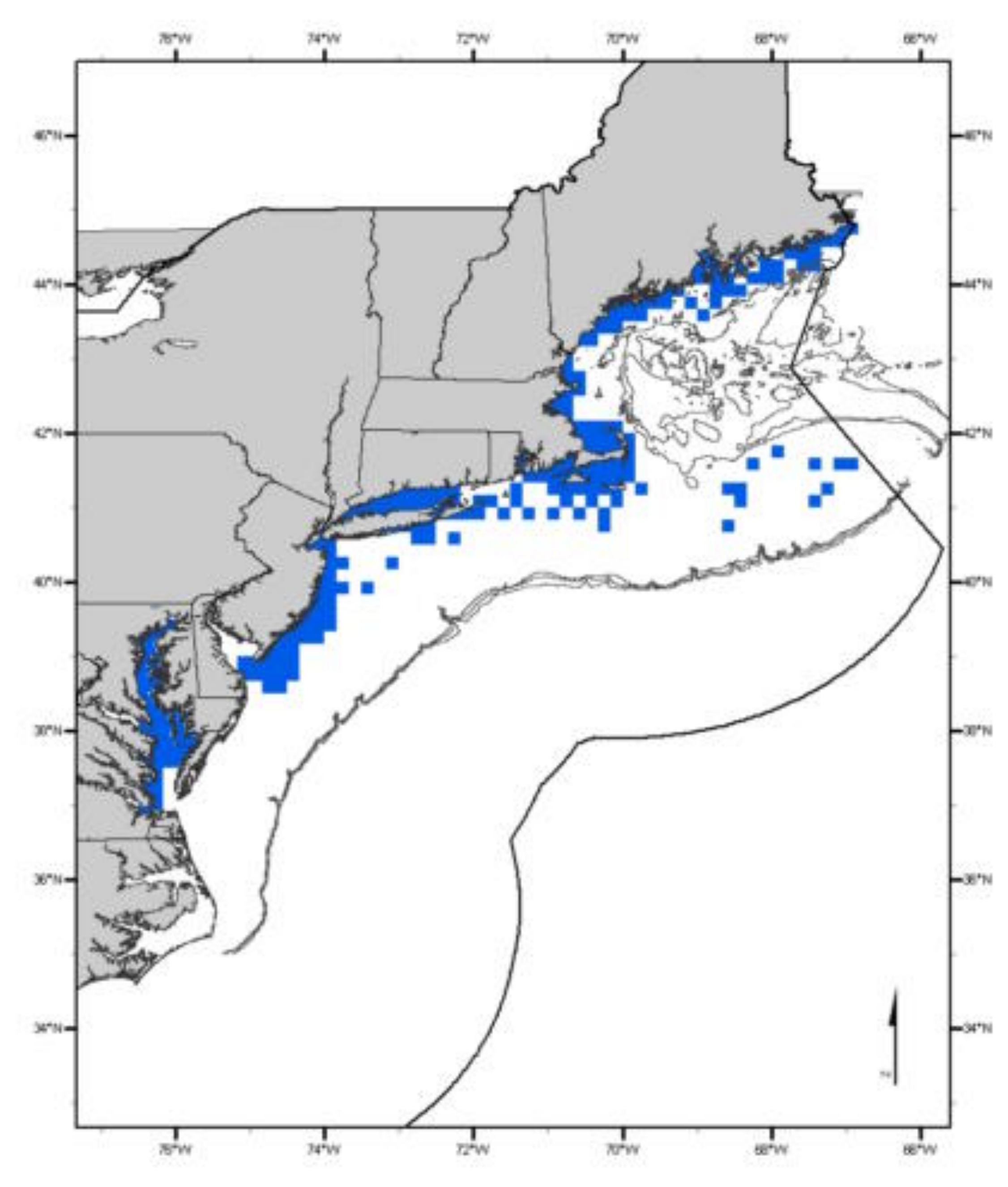
Eggs: There is no information available on the habitat requirements or distribution of the egg stage for this species.

Larvae: No larval life stage exists for this species. Upon hatching, they are fully developed juveniles.

Juveniles: Sandy benthic habitats in coastal bays and estuaries and on the continental shelf in depths of 8 – 70 meters as depicted on Map 145 - Map 148. Other conditions that generally exist where EFH for juvenile little skate is found are bottom temperatures of 1.5 – 18.5ºC and salinities of 22.5 – 33.5 ppt. They feed on crustaceans (primarily amphipods and a variety of decapods).

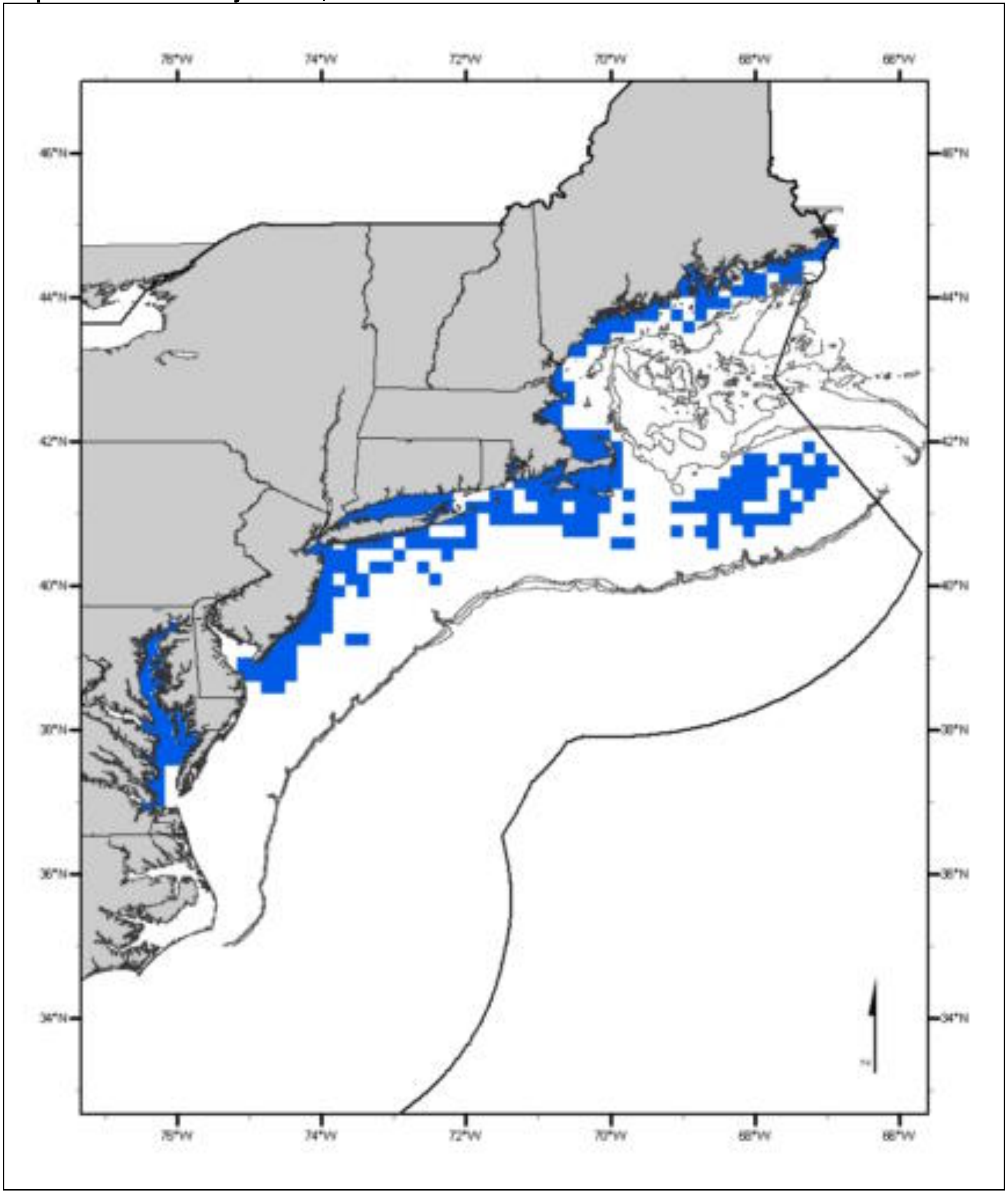
Adults: Sandy benthic habitats in coastal bays and estuaries and on the continental shelf in depths of 16 – 100 meters as depicted on Map 149 - Map 152. Other conditions that generally exist where EFH for adult little skate is found are bottom temperatures of 1.5 – 22.5ºC and salinities of 24.5 – 34.5 ppt. Adult little skate have a similar diet to juveniles, but feed on more decapods (sand shrimps and crabs), polychaetes, and fishes (*e.g.*, Atlantic herring), and fewer amphipods.

Map 145. Little skate juvenile, Alternative 2A



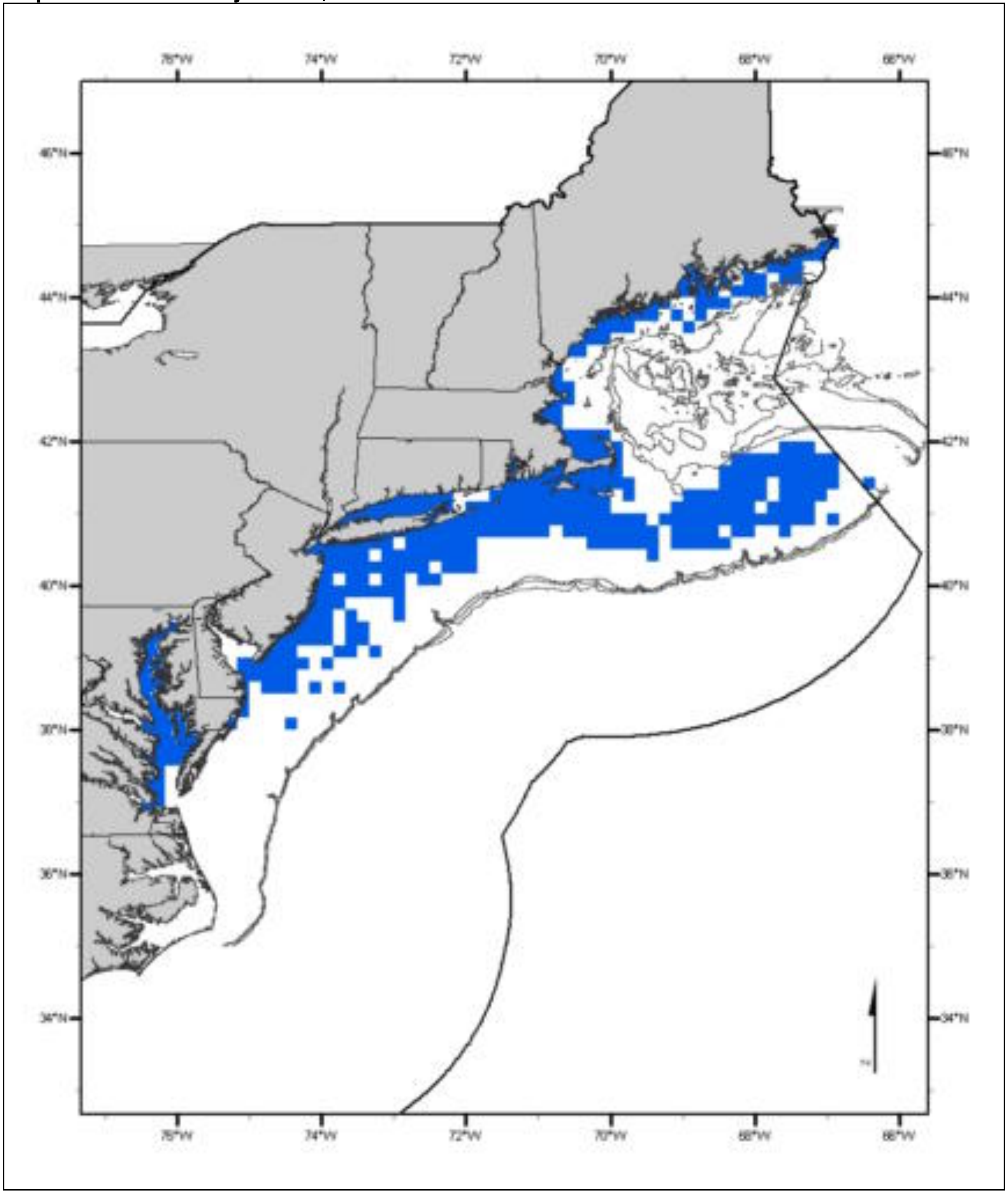
The Alternative 2A EFH designation for juvenile little skate on the continental shelf is based upon relative abundance during 1968-2005 in the fall and spring NMFS trawl survey at the 25% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where juvenile little skate were caught in state trawl surveys in more than 10% of the tows, as well as those bays and estuaries identified by the NOAA ELMR program where little skate juveniles were determined to be "common" or abundant" (see Alternative 1).

Map 146. Little skate juvenile, Alternative 2B



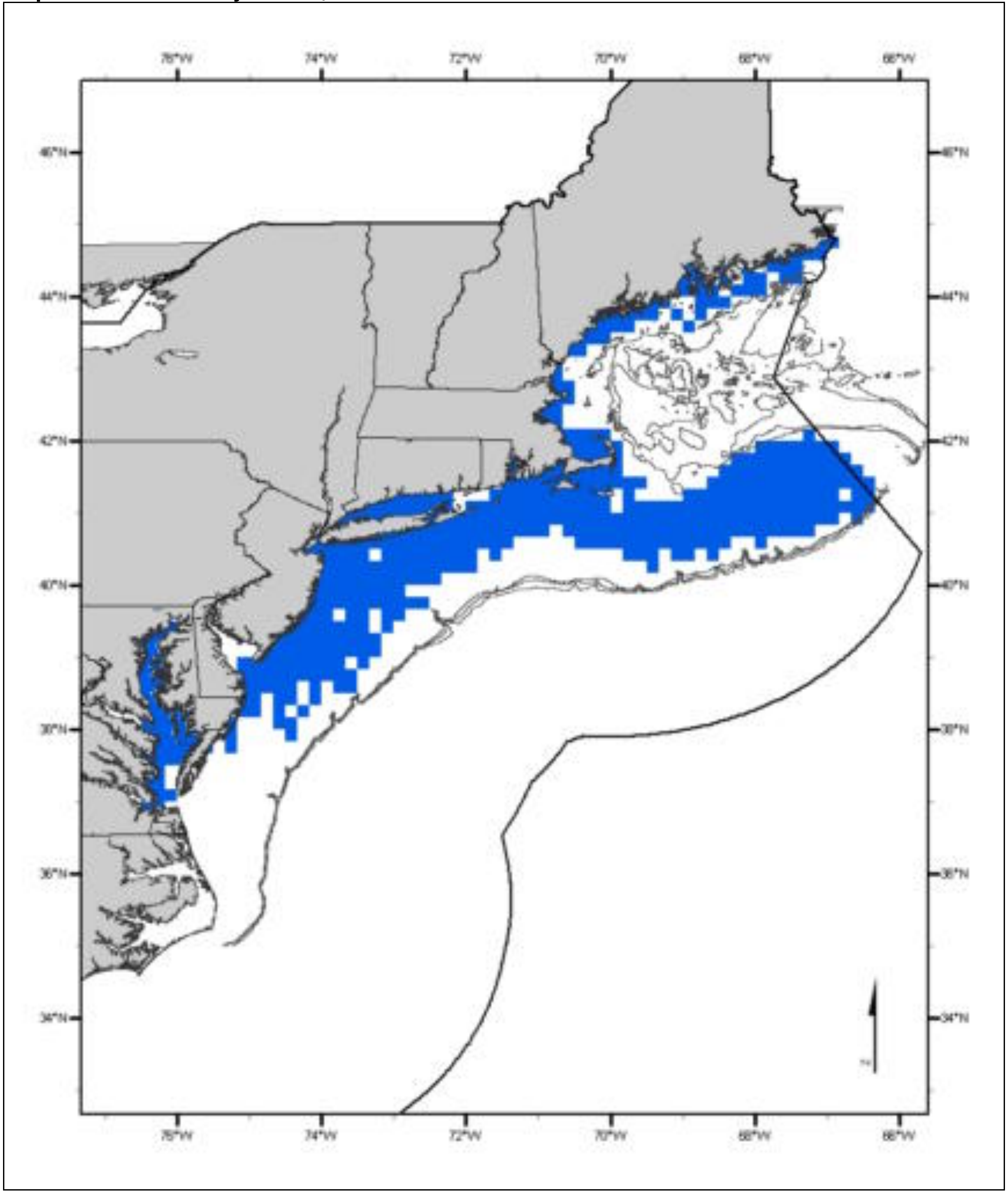
The Alternative 2B EFH designation for juvenile little skate on the continental shelf is based upon relative abundance during 1968-2005 in the fall and spring NMFS trawl survey at the 50% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where juvenile little skate were caught in state trawl surveys in more than 10% of the tows, as well as those bays and estuaries identified by the NOAA ELMR program where little skate juveniles were determined to be "common" or abundant" (see Alternative 1).

Map 147. Little skate juvenile, Alternative 2C



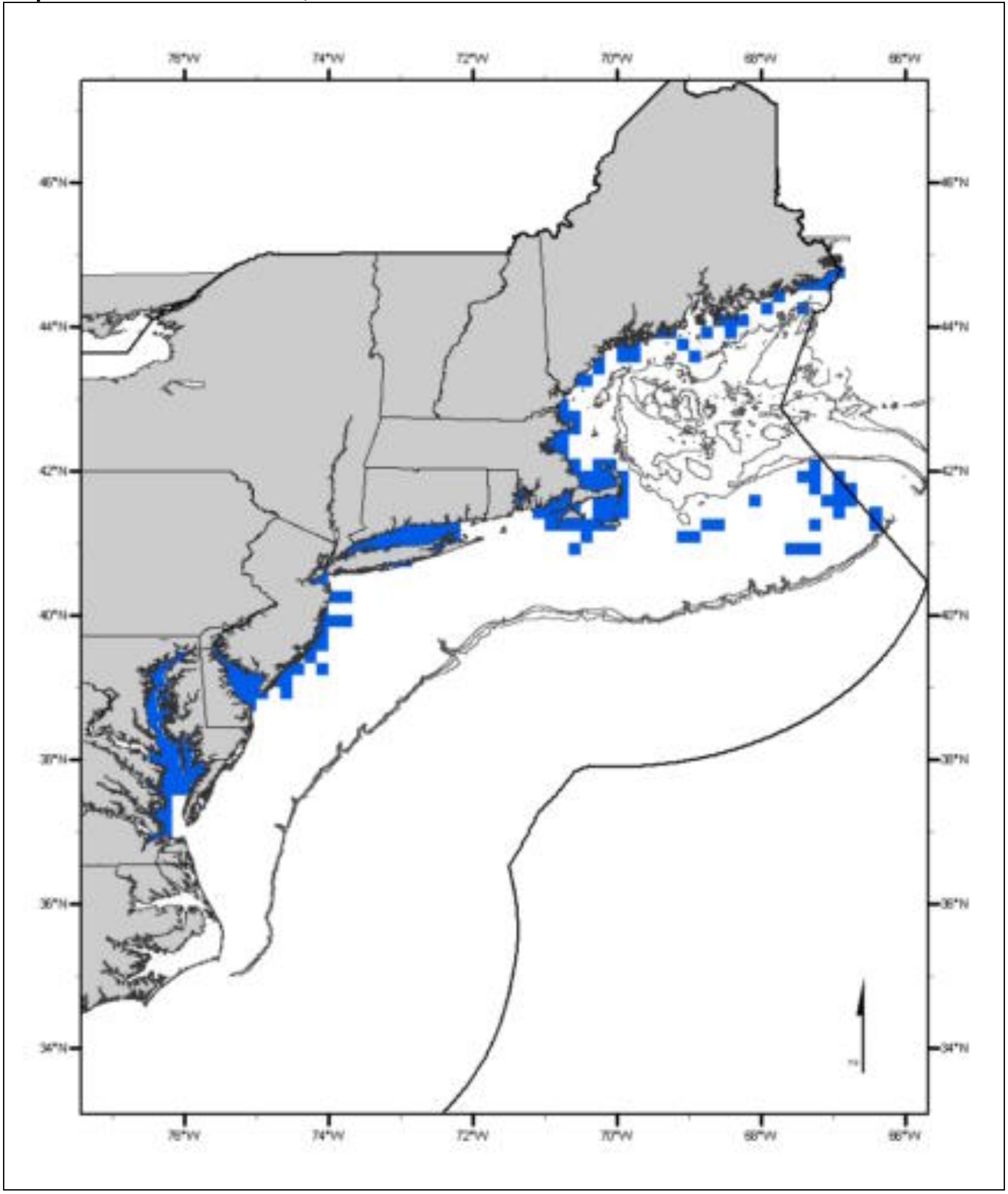
The Alternative 2C EFH designation for juvenile little skate on the continental shelf is based upon relative abundance during 1968-2005 in the fall and spring NMFS trawl survey at the 75% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where juvenile little skate were caught in state trawl surveys in more than 10% of the tows, as well as those bays and estuaries identified by the NOAA ELMR program where little skate juveniles were determined to be "common" or abundant" (see Alternative 1).

Map 148. Little skate juvenile, Alternative 2D



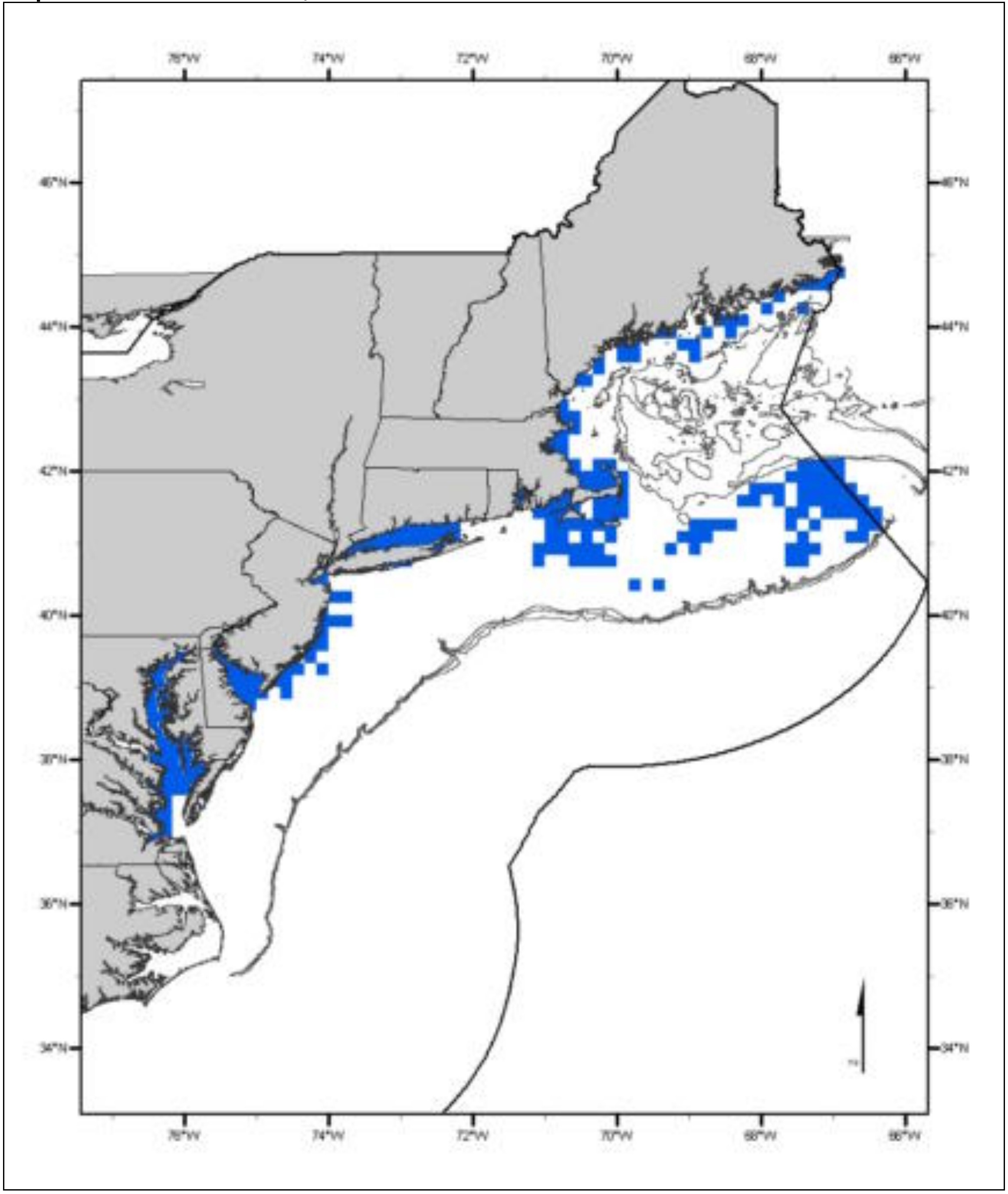
The Alternative 2D EFH designation for juvenile little skate on the continental shelf is based upon relative abundance during 1968-2005 in the fall and spring NMFS trawl survey at the 90% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where juvenile little skate were caught in state trawl surveys in more than 10% of the tows, as well as those bays and estuaries identified by the NOAA ELMR program where little skate juveniles were determined to be "common" or abundant" (see Alternative 1).

Map 149. Little skate adults, Alternative 2A



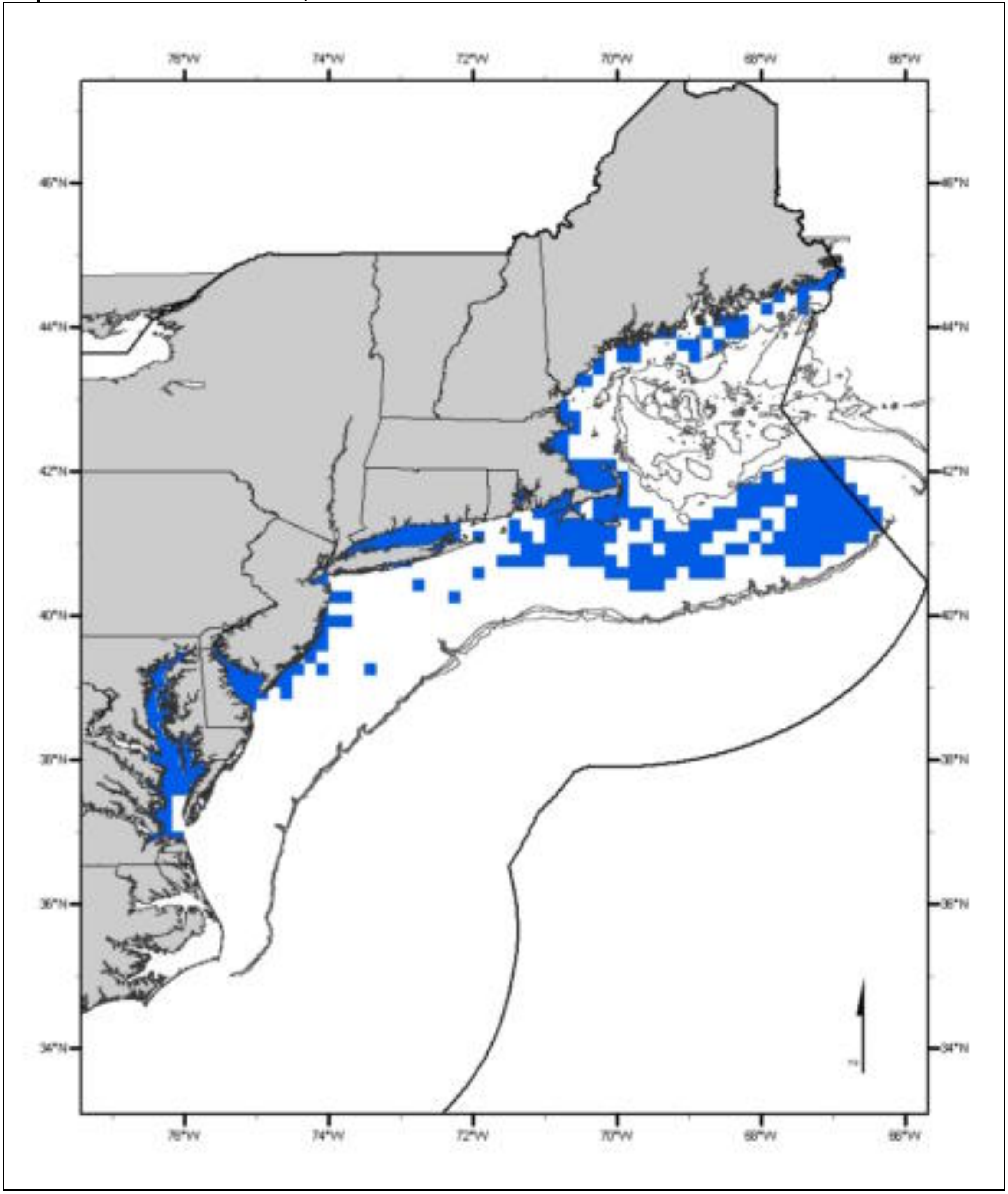
The Alternative 2A EFH designation for adult little skate on the continental shelf is based upon relative abundance during 1968-2005 in the fall and spring NMFS trawl survey at the 25% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where adult little skate were caught in state trawl surveys in more than 10% of the tows, as well as those bays and estuaries identified by the NOAA ELMR program where little skate adults were determined to be "common" or abundant" (see, Alternative 1).

Map 150. Little skate adults, Alternative 2B



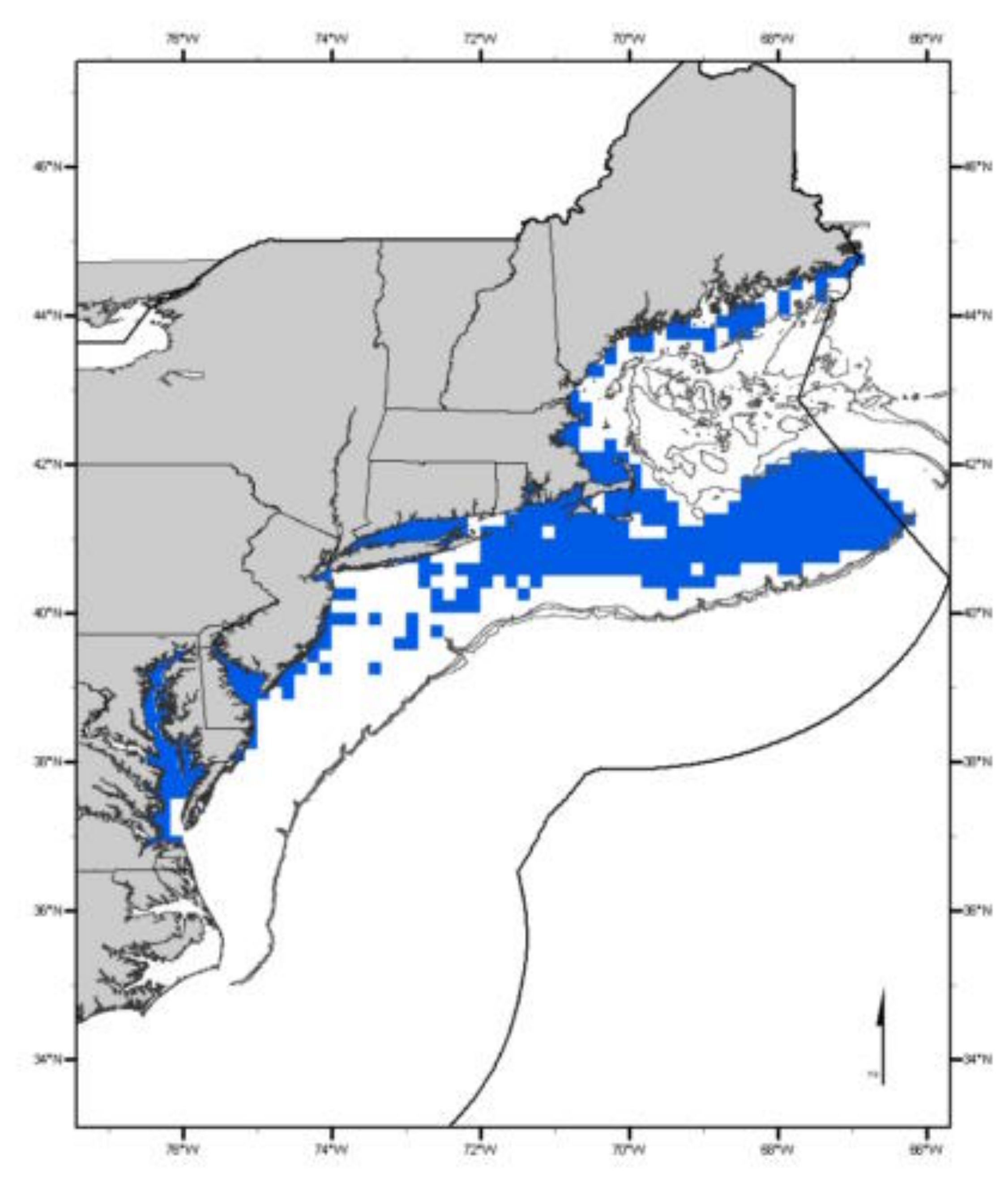
The Alternative 2B EFH designation for adult little skate on the continental shelf is based upon relative abundance during 1968-2005 in the fall and spring NMFS trawl survey at the 50% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where adult little skate were caught in state trawl surveys in more than 10% of the tows, as well as those bays and estuaries identified by the NOAA ELMR program where little skate adults were determined to be "common" or abundant" (see Alternative 1).

Map 151. Little skate adults, Alternative 2C



The Alternative 2C EFH designation for adult little skate on the continental shelf is based upon relative abundance during 1968-2005 in the fall and spring NMFS trawl survey at the 75% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where adult little skate were caught in state trawl surveys in more than 10% of the tows, as well as those bays and estuaries identified by the NOAA ELMR program where little skate adults were determined to be "common" or abundant" (see Alternative 1).

Map 152. Little skate adults, Alternative 2D



The Alternative 2D EFH designation for adult little skate on the continental shelf is based upon relative abundance during 1968-2005 in the fall and spring NMFS trawl survey at the 90% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where adult little skate were caught in state trawl surveys in more than 10% of the tows, as well as those bays and estuaries identified by the NOAA ELMR program where little skate adults were determined to be "common" or abundant" (see Alternative 1).

4.1.2.3.10 Monkfish

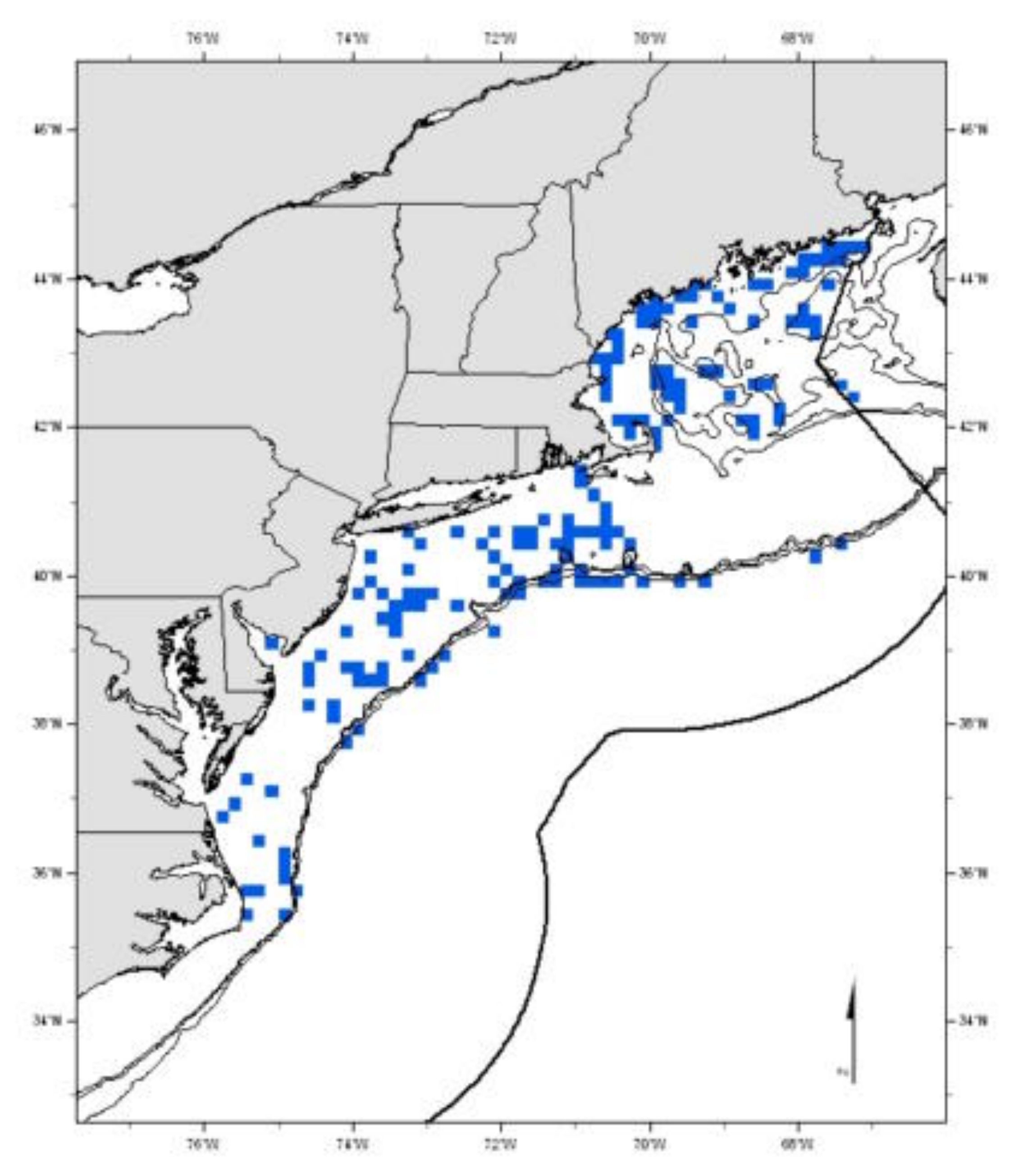
Eggs: Upper water column habitats in inshore areas, and on the continental shelf and slope, as depicted on Map 153 - Map 156. EFH for monkfish eggs generally occurs where bottom depths are 1 – 1500 meters and in water column temperatures of 10 – 20ºC.

Larvae: Inshore and continental shelf water column habitats, as depicted on Map 153 - Map 156. EFH for monkfish larvae generally occurs where bottom depths are 1 – 160 meters and in water column temperatures of 8.5 – 17.5ºC. Larval monkfish feed on zooplankton, including copepods, crustacean larvae, and chaetognaths.

Juveniles: Inshore and continental shelf benthic habitats in depths of 30 – 400 meters with mud, sand, and mud–sand substrates, as depicted on Map 157 - Map 160. Other conditions that generally exist where EFH is found are bottom temperatures of 3.5 – 13.5ºC and salinities of 30.5 – 36.5 ppt. Juvenile monkfish are found on a variety of substrates, including mud, sand, gravel, broken shells, and pebbles, but are reported to prefer clay and mud over sand and gravel. YOY have been collected as deep as 900 meters on the continental slope. Primary prey for juvenile monkfish is other fishes (*e.g.*, sand lances, silver hakes, and flounders), pandalid shrimps, and squids.

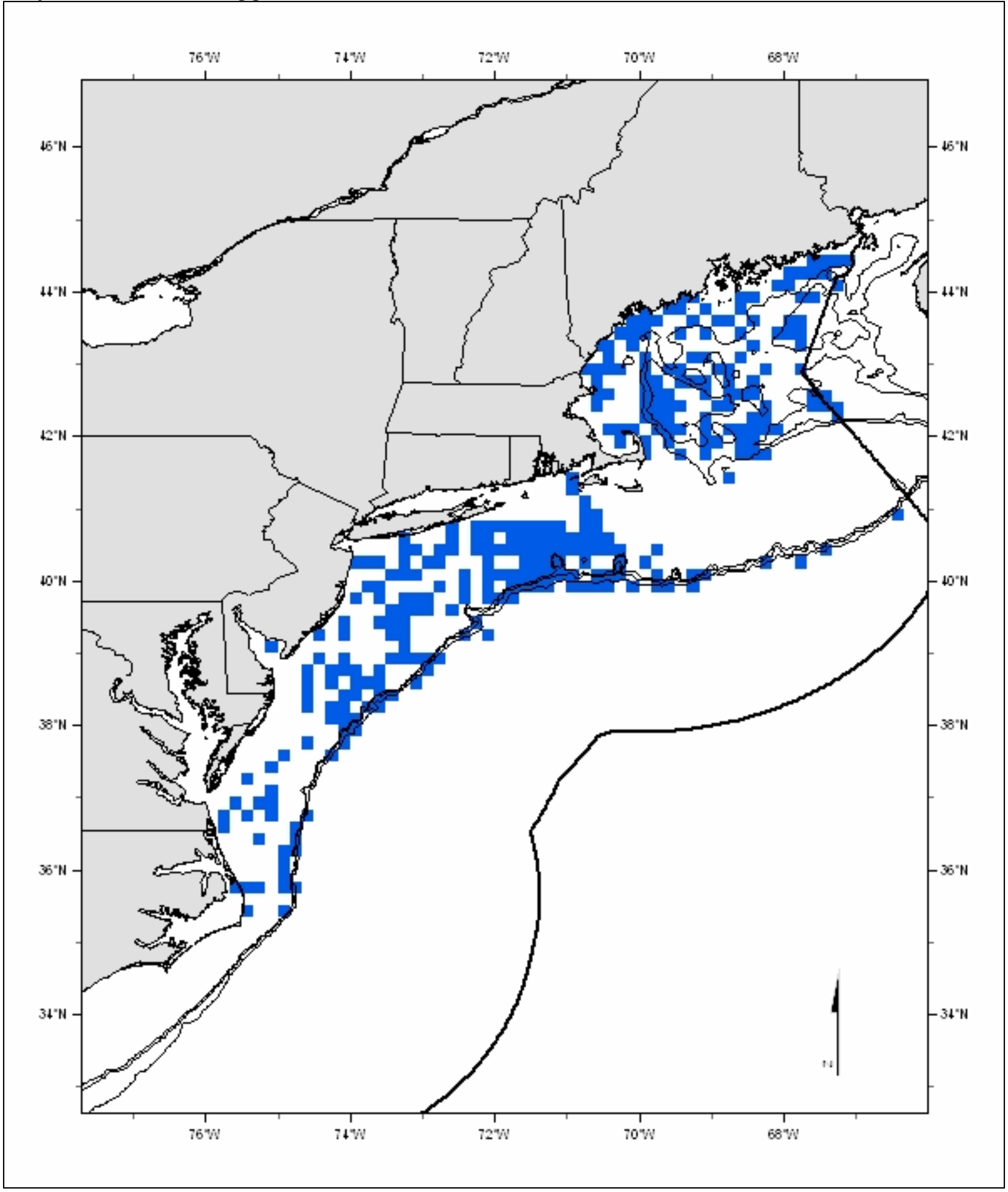
Adults: Inshore and continental shelf benthic habitats in depths of 20 – 400 meters with mud, sand, and mud–sand substrates, as depicted on Map 161 - Map 164. Other conditions that generally exist where EFH is found are bottom temperatures of 4.5 – 15.5ºC and salinities of 33.5 – 35.5 ppt. Adult monkfish are found on a variety of substrates, including mud, sand, gravel, broken shells, and pebbles, but are reported to prefer clay and mud over sand and gravel. They feed on a wide variety of other fishes and on squids.

Map 153. Monkfish egg and larvae, Alternative 2A



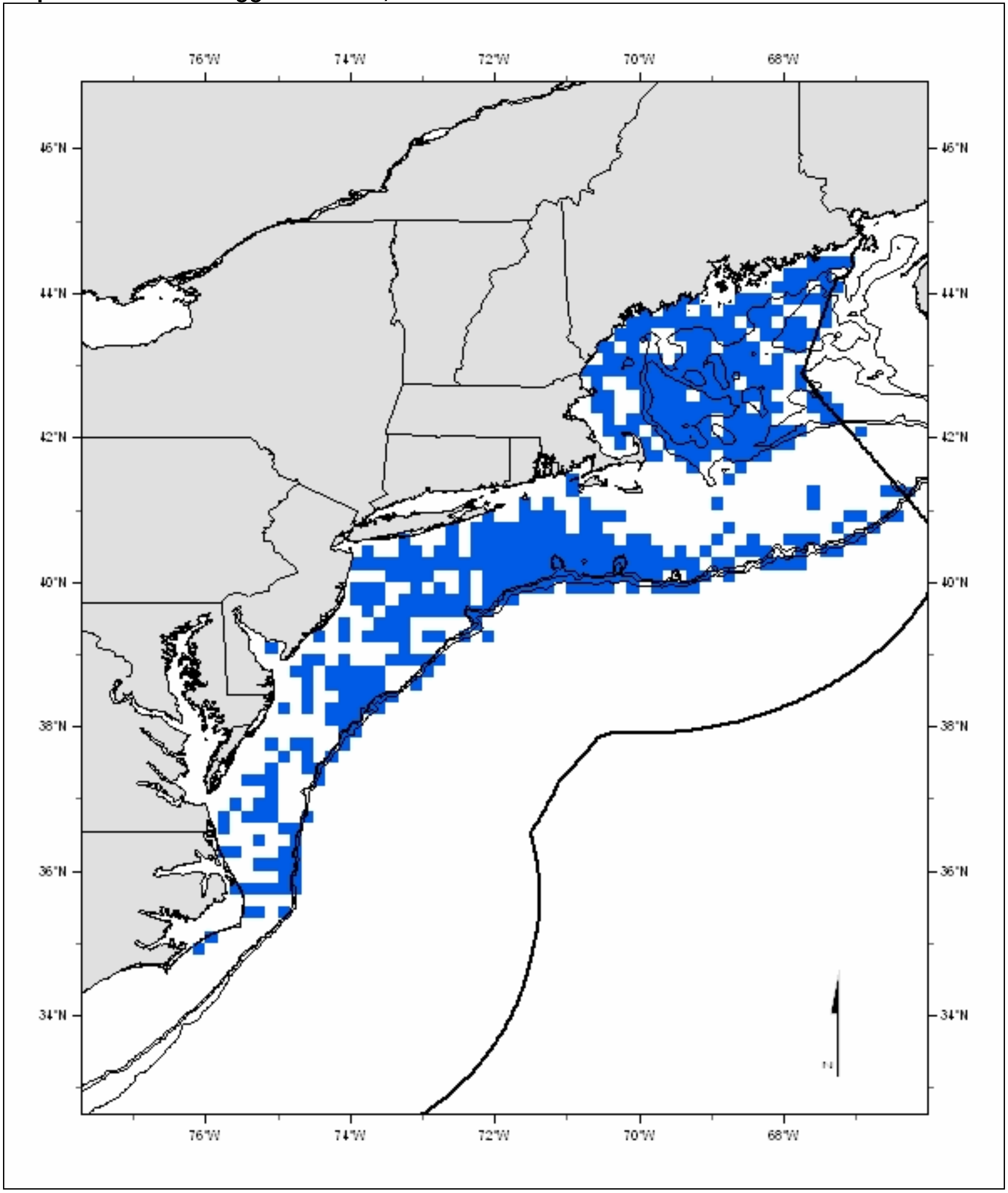
The Alternative 2A EFH designation for monkfish eggs and larvae on the continental shelf is based upon the relative abundance of adults during 1968-2005 in the fall and spring NMFS trawl survey at the 25% cumulative percentage catch level and the relative abundance of larvae during 1978-1987 in the NMFS MARMAP ichthyoplankton survey at the 25% cumulative percentage area level. This alternative also includes ten minute squares in inshore areas where adult monkfish were caught in state trawl surveys in more than 10% of the tows.

Map 154. Monkfish egg and larvae, Alternative 2B



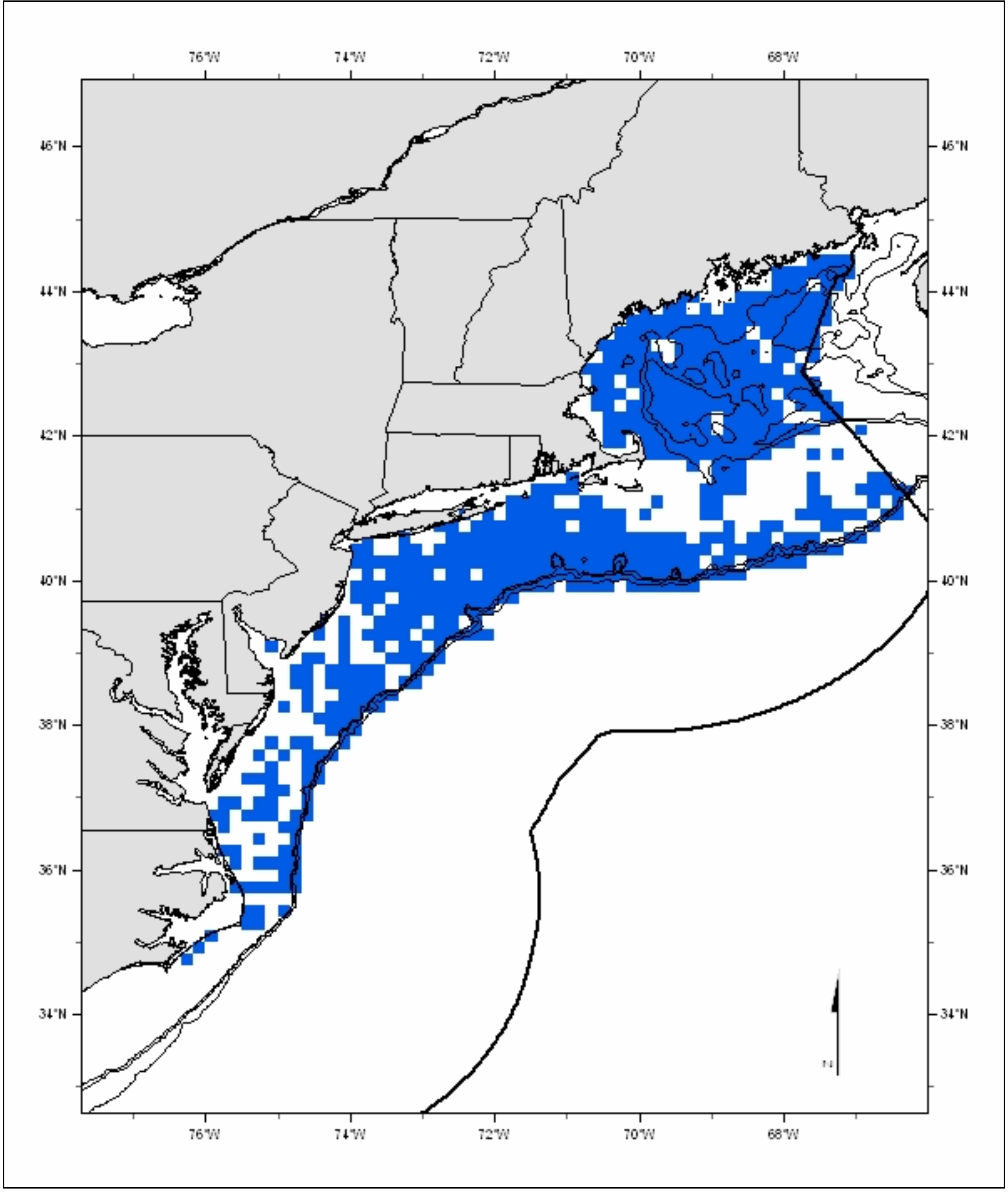
The Alternative 2B EFH designation for monkfish eggs and larvae on the continental shelf is based upon the relative abundance of adults during 1968-2005 in the fall and spring NMFS trawl survey at the 50% cumulative percentage catch level and the relative abundance of larvae during 1978-1987 in the NMFS MARMAP ichthyoplankton survey at the 50% cumulative percentage area level. This alternative also includes ten minute squares in inshore areas where adult monkfish were caught in state trawl surveys in more than 10% of the tows.

Map 155. Monkfish egg and larvae, Alternative 2C



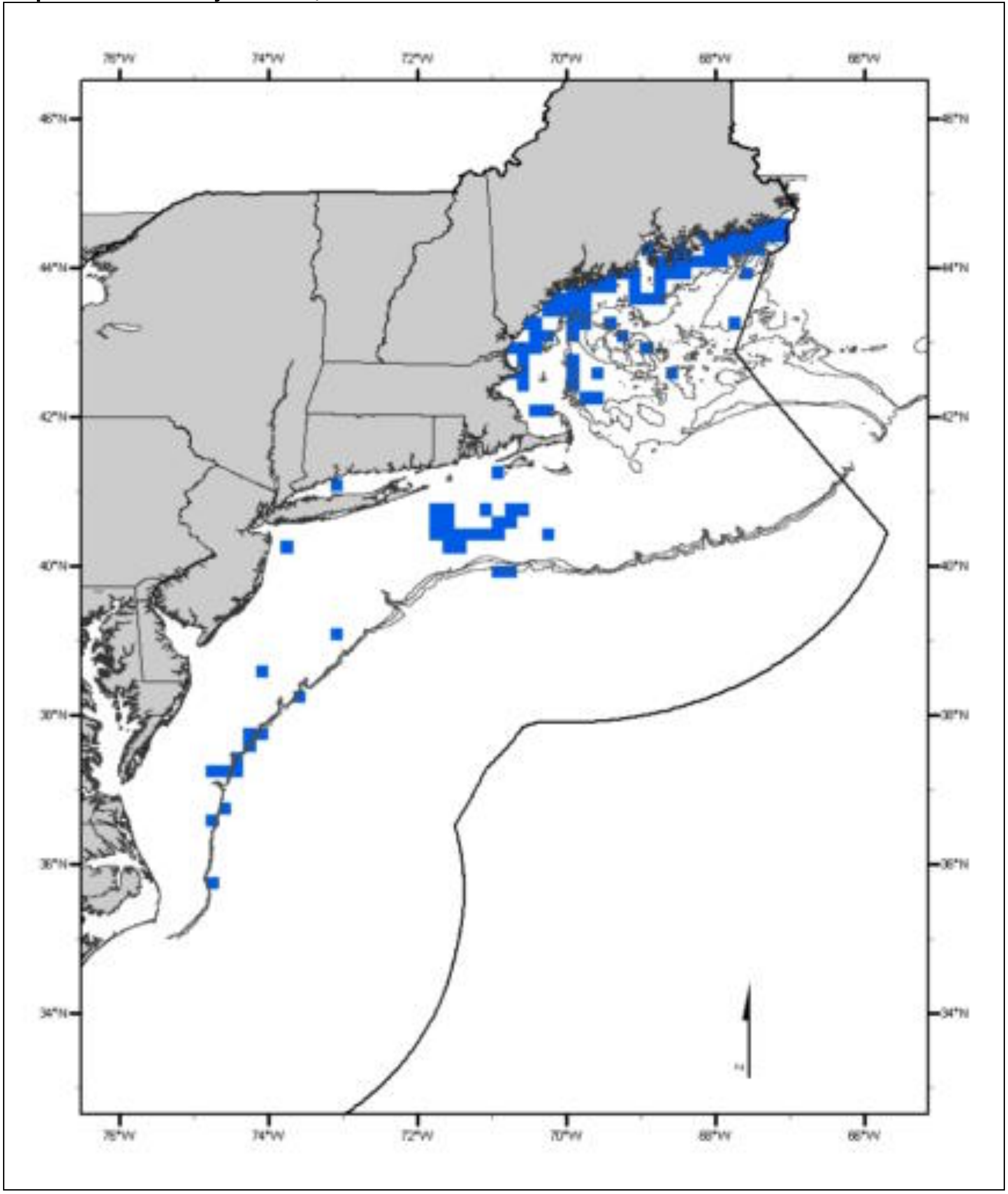
The Alternative 2C EFH designation for monkfish eggs and larvae on the continental shelf is based upon the relative abundance of adults during 1968-2005 in the fall and spring NMFS trawl survey at the 75% cumulative percentage catch level and the relative abundance of larvae during 1978-1987 in the NMFS MARMAP ichthyoplankton survey at the 75% cumulative percentage area level. This alternative also includes ten minute squares in inshore areas where adult monkfish were caught in state trawl surveys in more than 10% of the tows.

Map 156. Monkfish egg and larvae, Alternative 2D



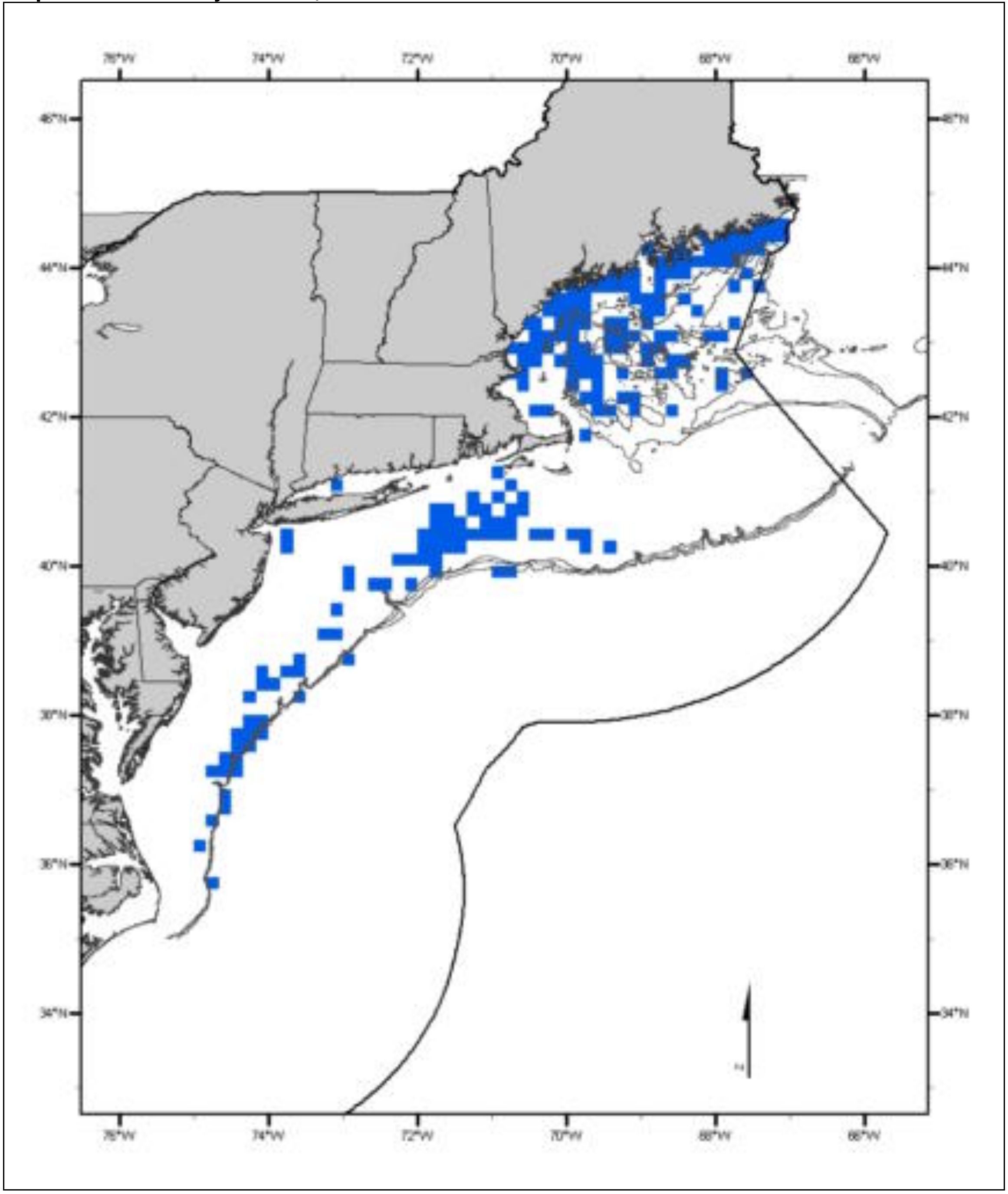
The Alternative 2D EFH designation for monkfish eggs and larvae on the continental shelf is based upon the relative abundance of adults during 1968-2005 in the fall and spring NMFS trawl survey at the 90% cumulative percentage catch level and the relative abundance of larvae during 1978-1987 in the NMFS MARMAP ichthyoplankton survey at the 90% cumulative percentage area level. This alternative also includes ten minute squares in inshore areas where adult monkfish were caught in state trawl surveys in more than 10% of the tows.

Map 157. Monkfish juveniles, Alternative 2A



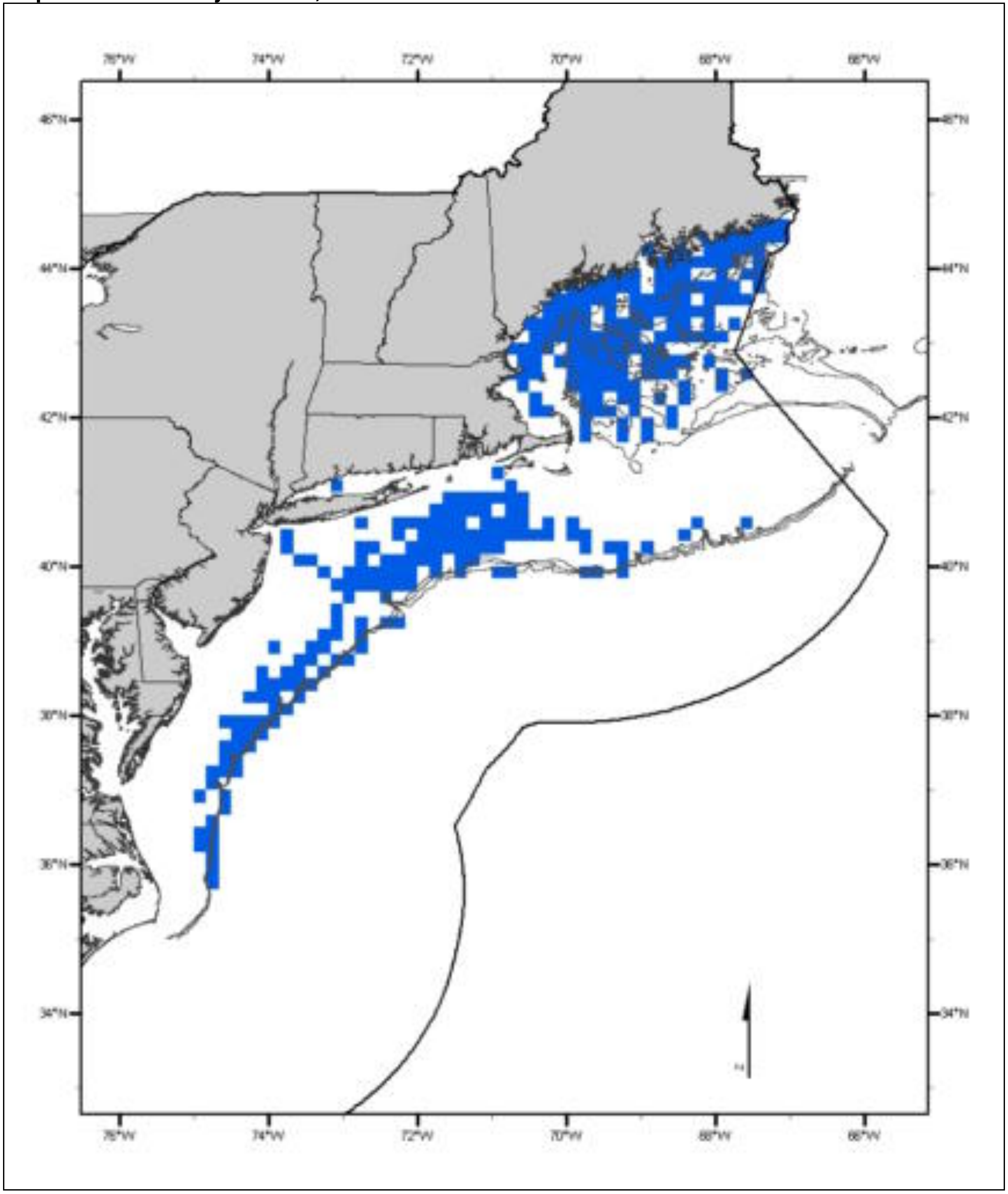
The Alternative 2A EFH designation for juvenile monkfish on the continental shelf is based upon relative abundance during 1968-2005 in the fall and spring NMFS trawl survey at the 25% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where juvenile monkfish were caught in state trawl surveys in more than 10% of the tows.

Map 158. Monkfish juveniles, Alternative 2B



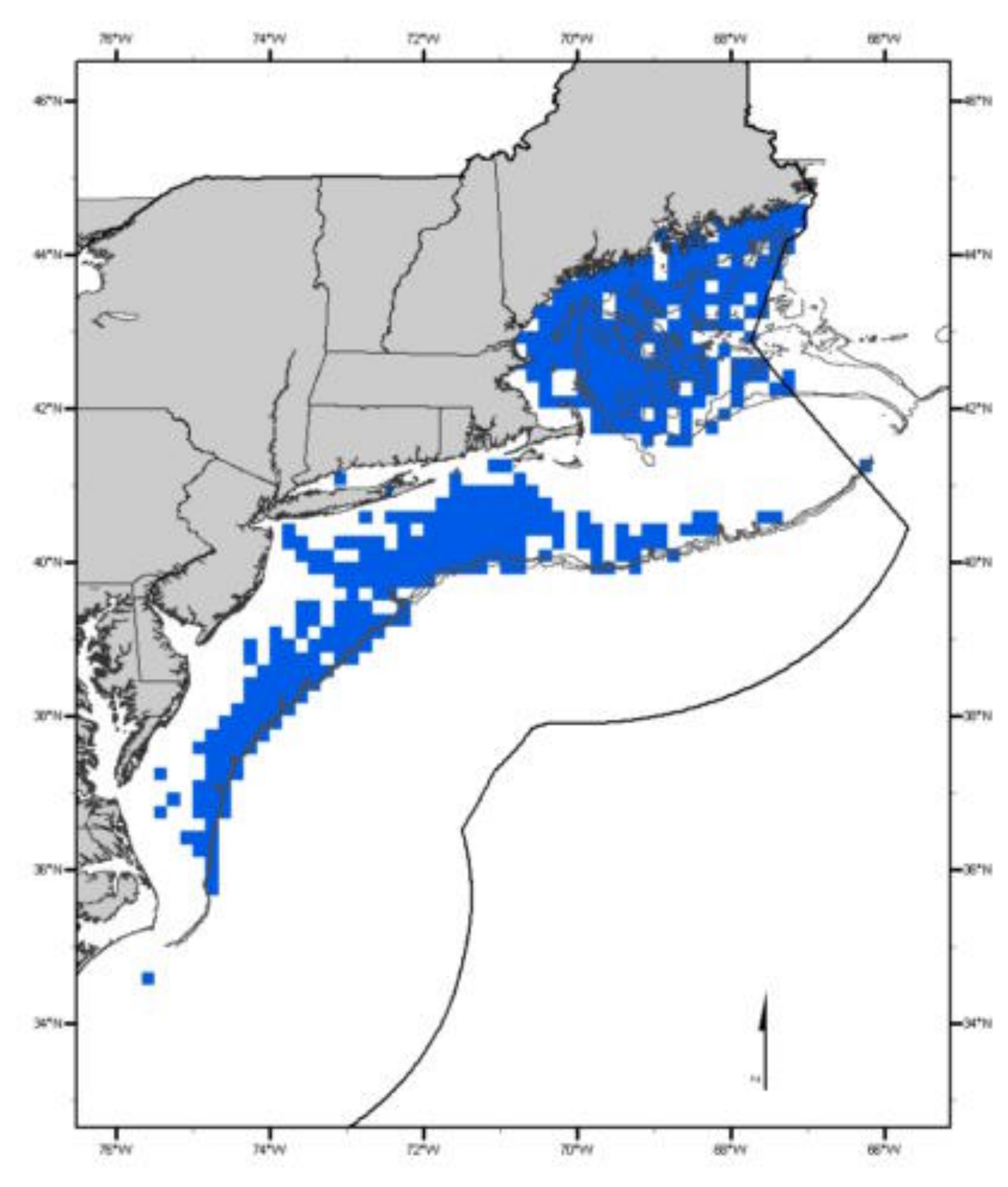
The Alternative 2B EFH designation for juvenile monkfish on the continental shelf is based upon relative abundance during 1968-2005 in the fall and spring NMFS trawl survey at the 50% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where juvenile monkfish were caught in state trawl surveys in more than 10% of the tows.

Map 159. Monkfish juveniles, Alternative 2C



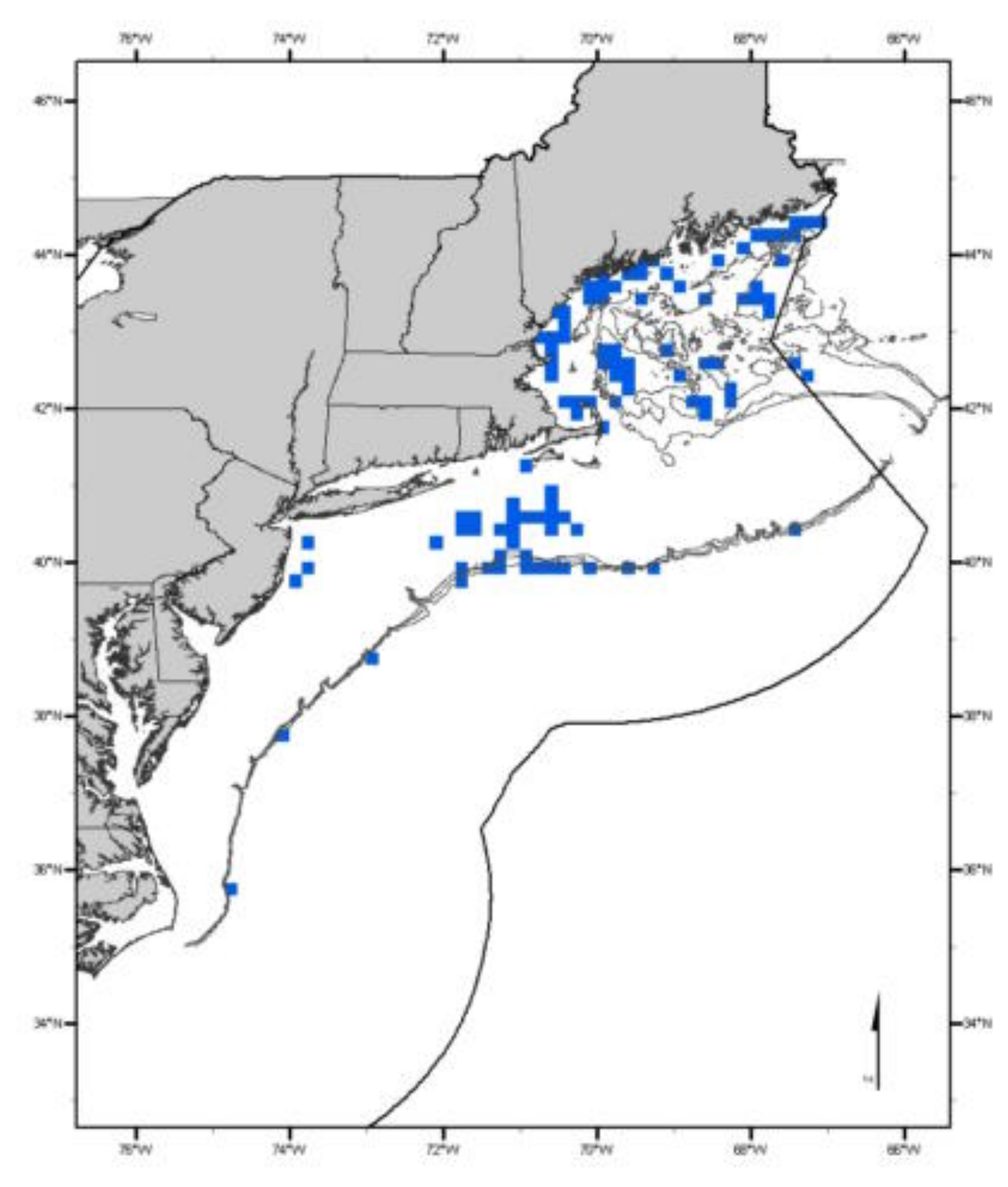
The Alternative 2C EFH designation for juvenile monkfish on the continental shelf is based upon relative abundance during 1968-2005 in the fall and spring NMFS trawl survey at the 75% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where juvenile monkfish were caught in state trawl surveys in more than 10% of the tows.

Map 160. Monkfish juveniles, Alternative 2D



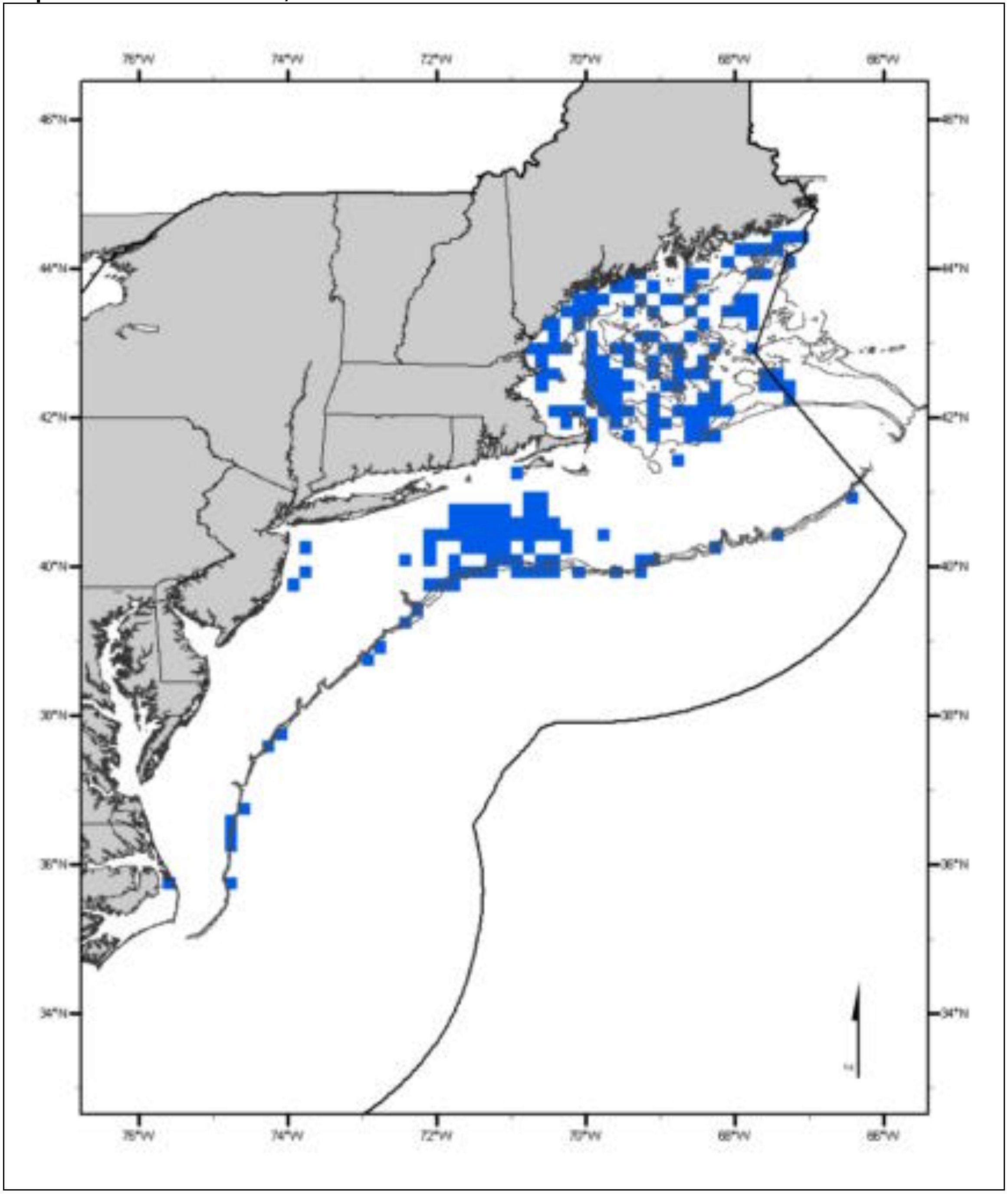
The Alternative 2D EFH designation for juvenile monkfish on the continental shelf is based upon relative abundance during 1968-2005 in the fall and spring NMFS trawl survey at the 90% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where juvenile monkfish were caught in state trawl surveys in more than 10% of the tows.

Map 161. Monkfish adults, Alternative 2A



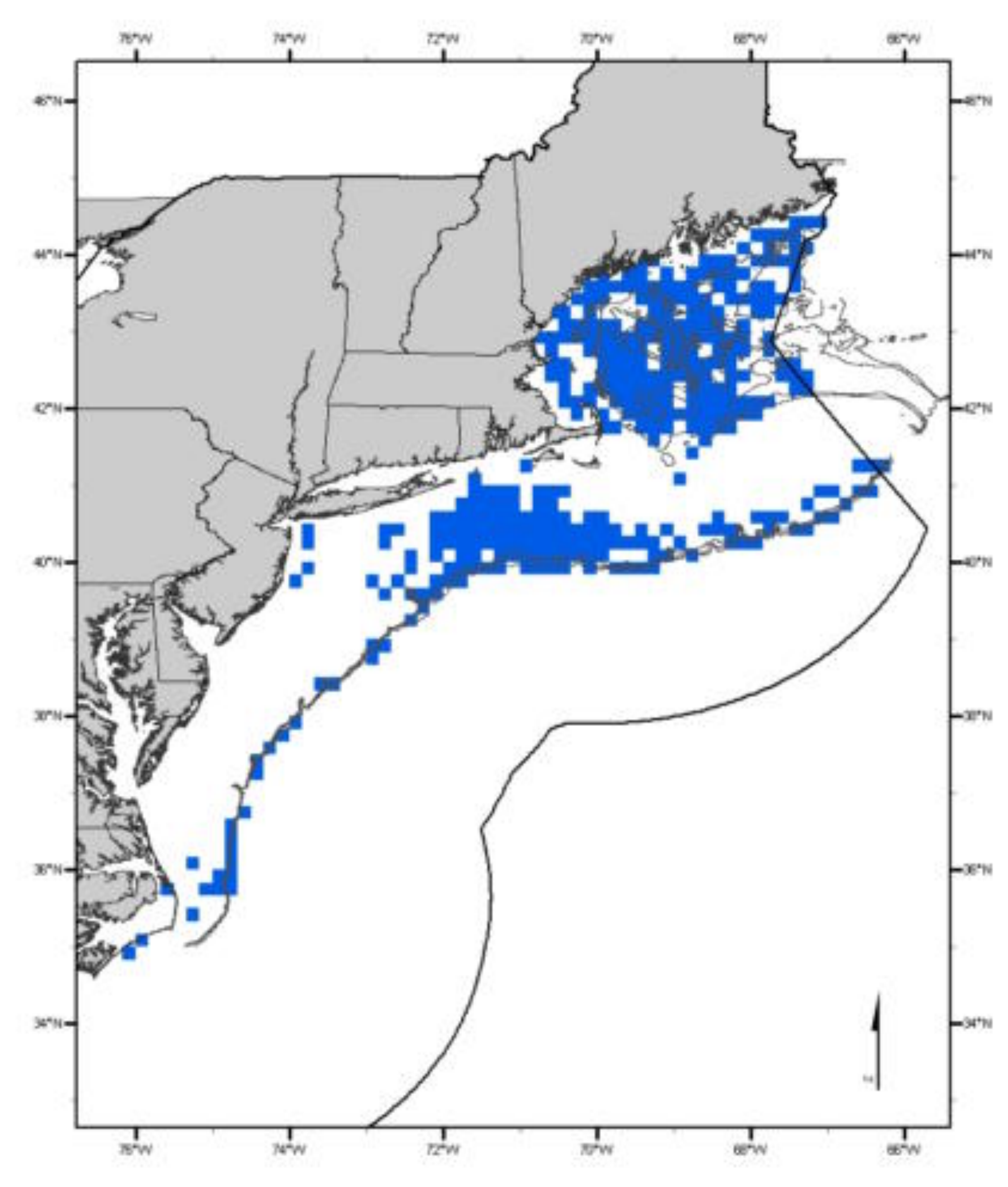
The Alternative 2A EFH designation for adult monkfish on the continental shelf is based upon relative abundance during 1968-2005 in the fall and spring NMFS trawl survey at the 25% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where adult monkfish were caught in state trawl surveys in more than 10% of the tows.

Map 162. Monkfish adults, Alternative 2B



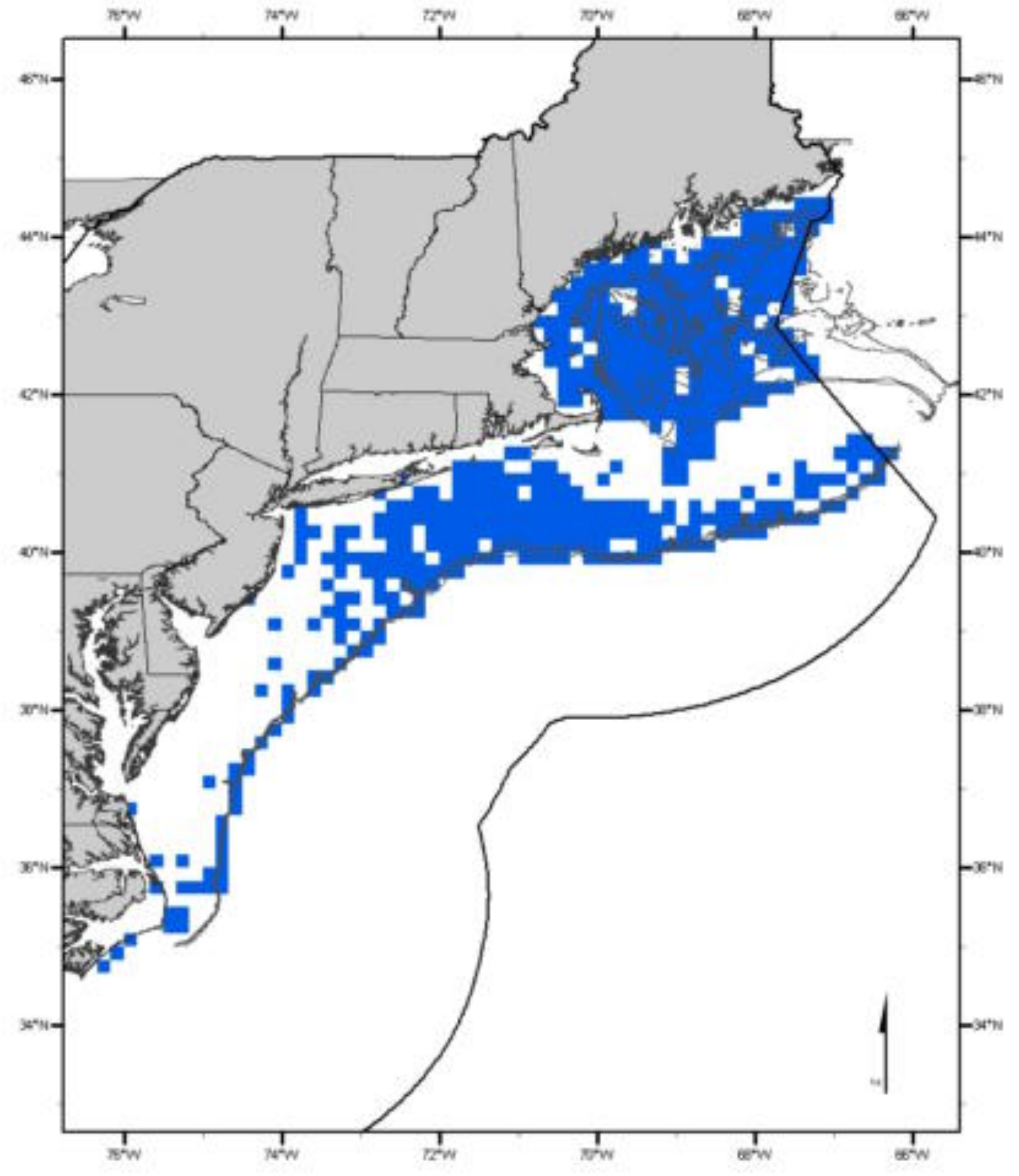
The Alternative 2B EFH designation for adult monkfish on the continental shelf is based upon relative abundance during 1968-2005 in the fall and spring NMFS trawl survey at the 50% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where adult monkfish were caught in state trawl surveys in more than 10% of the tows.

Map 163. Monkfish adults, Alternative 2C



The Alternative 2C EFH designation for adult monkfish on the continental shelf is based upon relative abundance during 1968-2005 in the fall and spring NMFS trawl survey at the 75% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where adult monkfish were caught in state trawl surveys in more than 10% of the tows.

Map 164. Monkfish adults, Alternative 2D



The Alternative 2D EFH designation for adult monkfish on the continental shelf is based upon relative abundance during 1968-2005 in the fall and spring NMFS trawl survey at the 90% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where adult monkfish were caught in state trawl surveys in more than 10% of the tows.

4.1.2.3.11 Ocean Pout

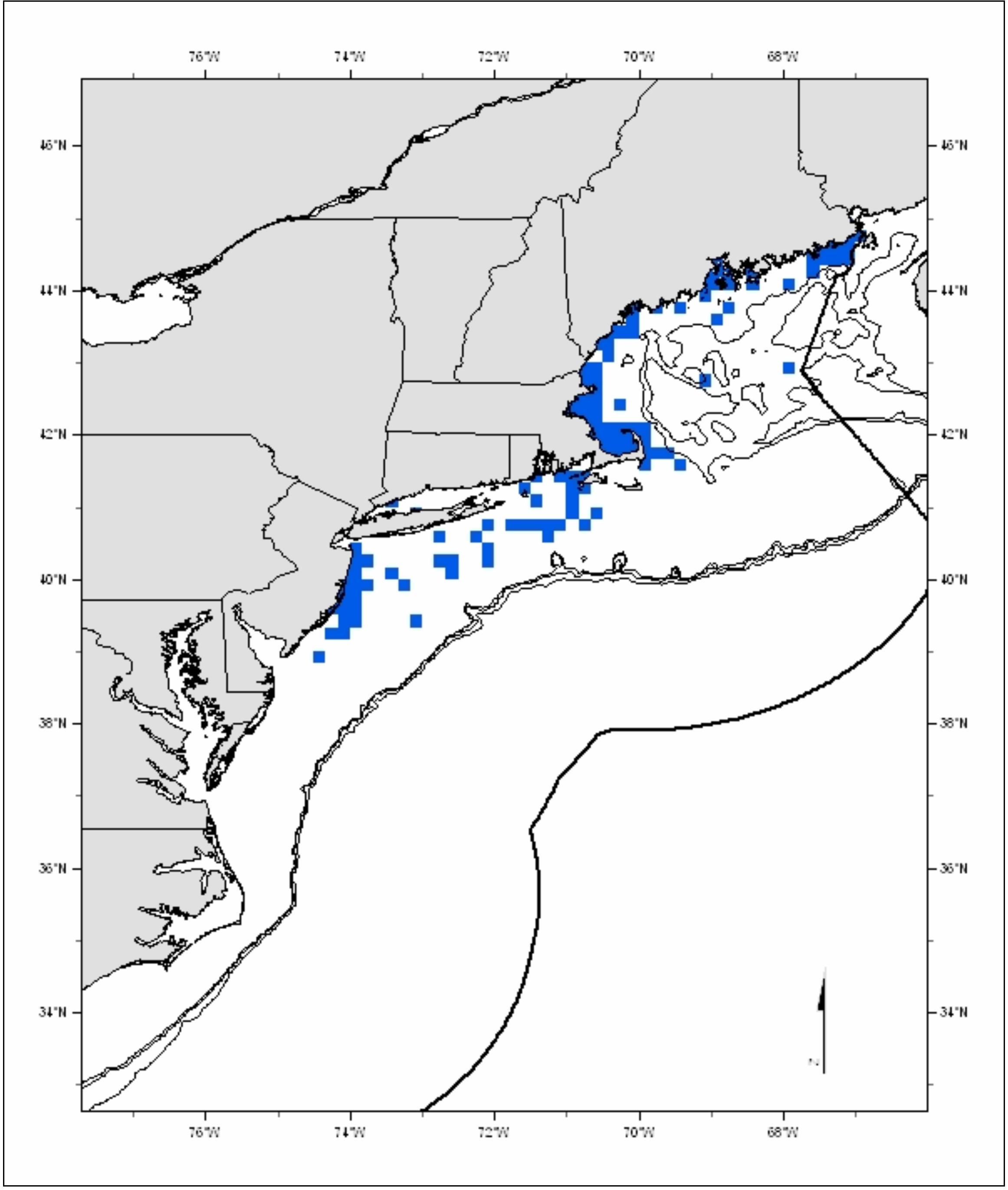
Eggs: Hard bottom benthic habitats in inshore and continental shelf waters as depicted on Map 165 - Map 168. The following conditions generally exist where EFH for ocean pout eggs is found: depths of less than 50 meters and bottom temperatures of 10ºC or less.
Preferred alternative

Larvae: No EFH designation (eliminate status quo designation). There is no true larval stage for this species.
Preferred alternative

Juveniles: Inshore and continental shelf benthic habitats in depths of 1 – 70 meters, including the intertidal zone, on a variety of substrates, as depicted on Map 169 - Map 172. EFH for juvenile ocean pout is generally found on a wide variety of substrates, including shells, rocks, algae, sand, mud, mud and sand, and/or gravel. Other conditions that generally exist where EFH is found are bottom temperatures of 2.5 – 11.5ºC and salinities of 31.5 – 33.5 ppt. Juvenile ocean pout feed primarily on brittle stars, amphipods, polychaetes, and bivalve mollusks.

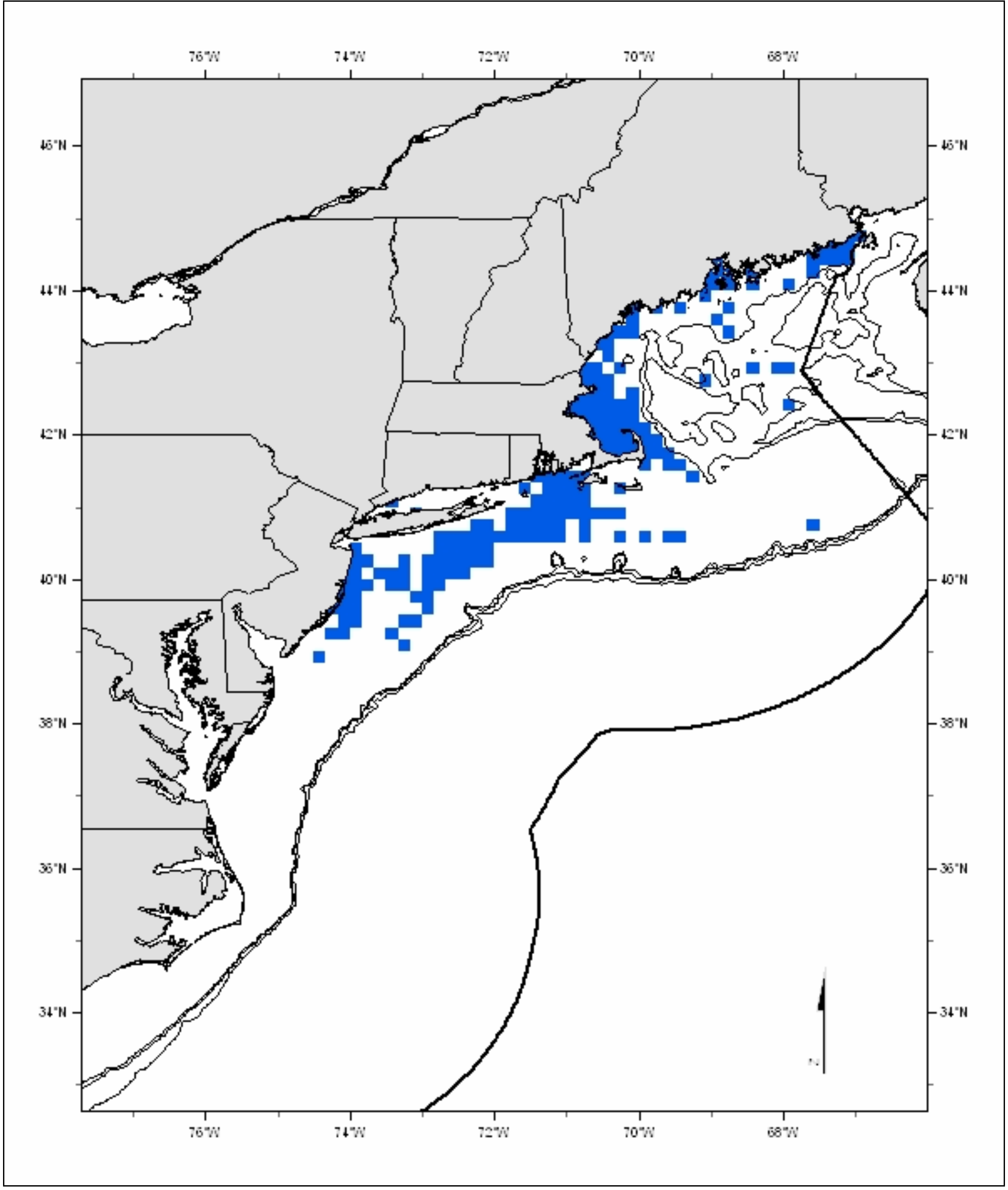
Adults: Inshore and continental shelf benthic habitats in depths of 25 – 100 meters on a variety of substrates, as depicted on Map 173 - Map 176. EFH for adult ocean pout is generally found on a wide variety of substrates, including shells, rocks, algae, sand, mud, mud and sand, and/or gravel. Other conditions that generally exist where EFH is found are bottom temperatures of 1.5 – 11.5ºC and salinities of 31.5 – 33.5 ppt. Ocean pout spawn on hard bottom in sheltered areas in depths less than 50 meters and bottom temperatures of 10ºC or less. Adults feed primarily on starfishes, crabs, bivalve mollusks, brittle stars, amphipods, and sand dollars.

Map 165. Ocean pout eggs, Alternative 2A



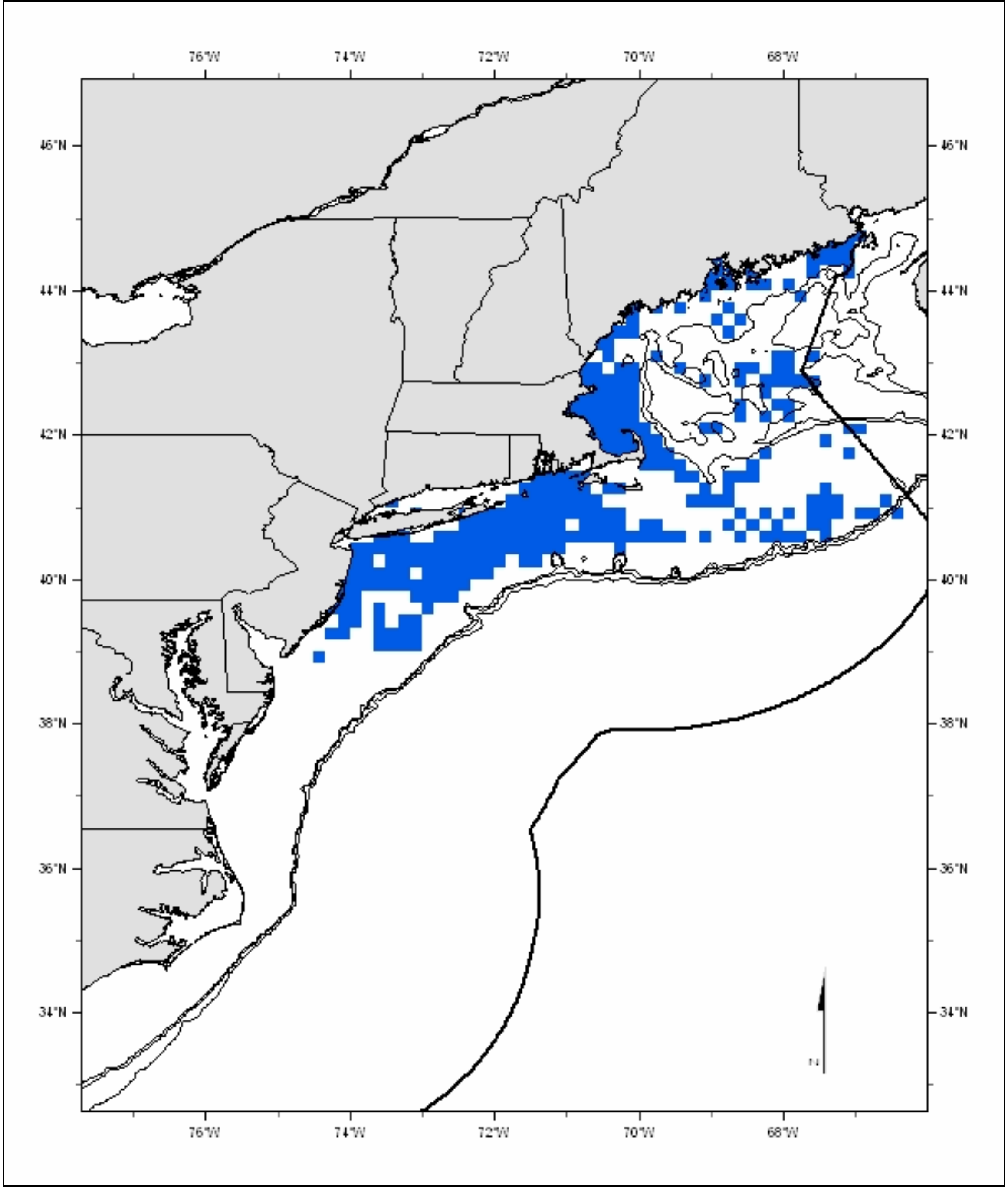
The Alternative 2A EFH designation for ocean pout eggs on the continental shelf is based upon the relative abundance of juveniles and adults during 1968-2005 in the fall and spring NMFS trawl survey at the 25% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where juvenile or adult ocean pout were caught in state trawl surveys in more than 10% of the tows, as well as those bays and estuaries identified by the NOAA ELMR program where ocean pout juveniles or adults were "common" or "abundant."

Map 166. Ocean pout eggs, Alternative 2B



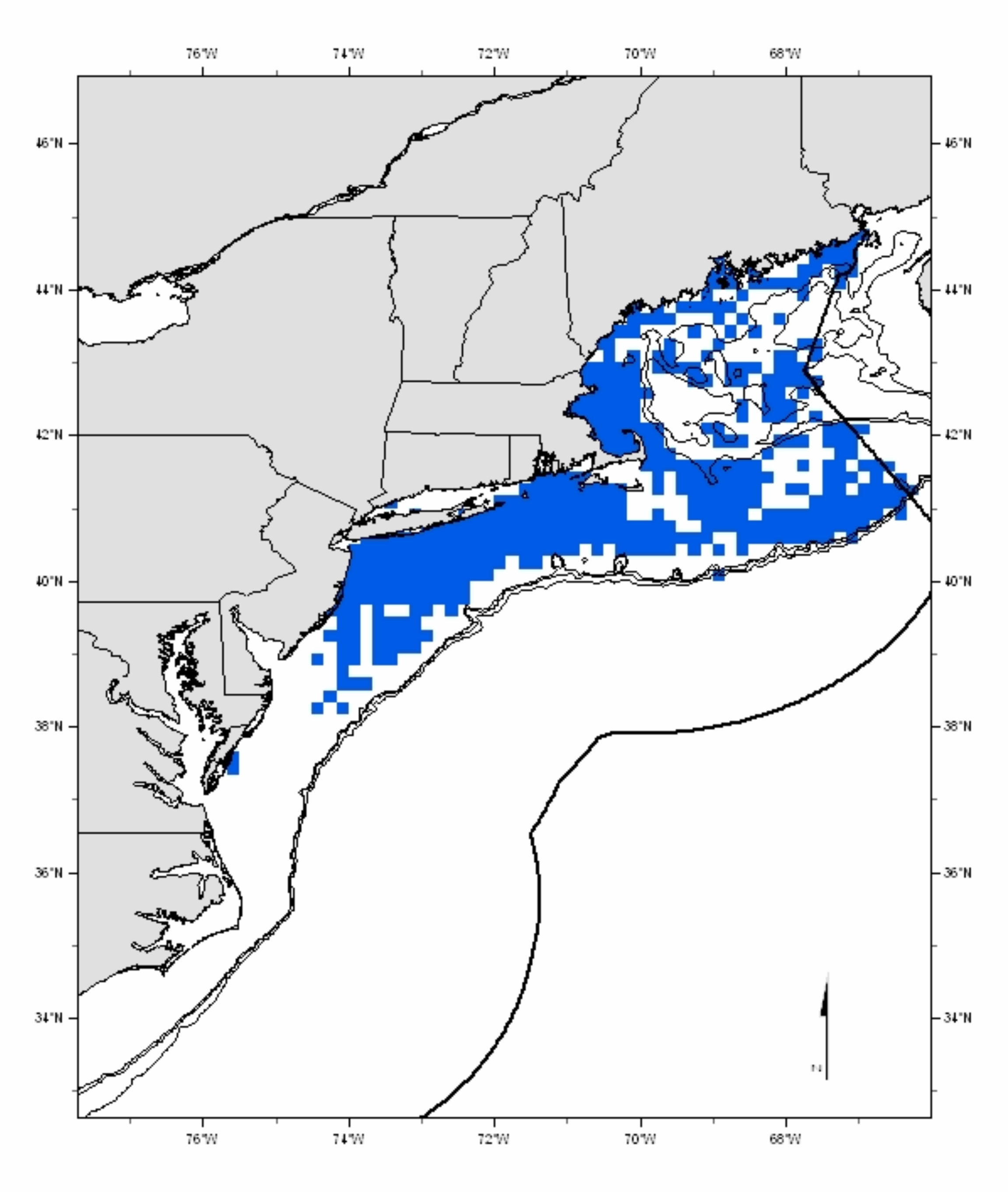
The Alternative 2B EFH designation for ocean pout eggs on the continental shelf is based upon the relative abundance of juveniles and adults during 1968-2005 in the fall and spring NMFS trawl survey at the 50% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where juvenile or adult ocean pout were caught in state trawl surveys in more than 10% of the tows, as well as those bays and estuaries identified by the NOAA ELMR program where ocean pout juveniles or adults were "common" or "abundant."

Map 167. Ocean pout eggs, Alternative 2C (*Preferred Alternative*)



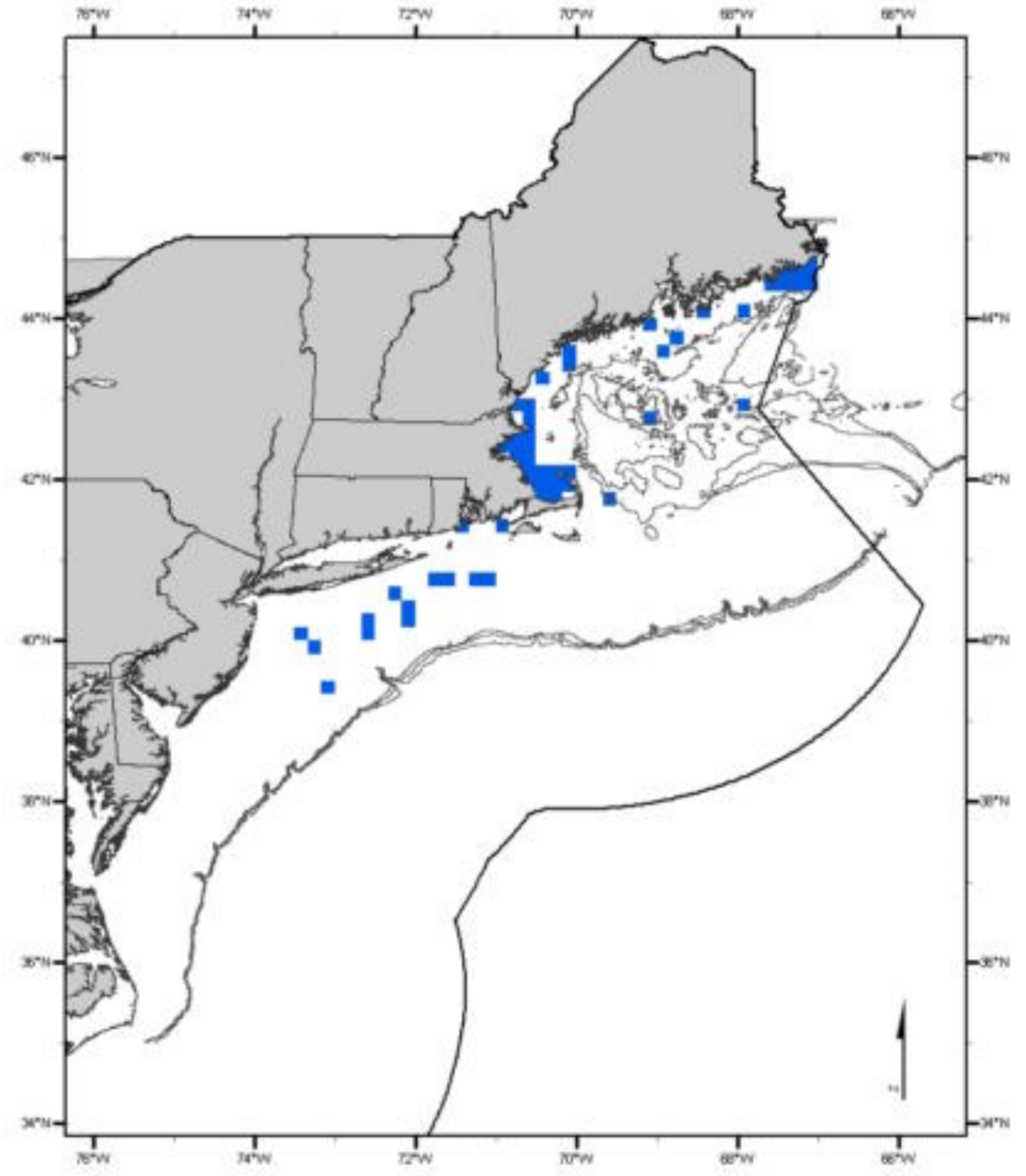
The Alternative 2C EFH designation for ocean pout eggs on the continental shelf is based upon the relative abundance of juveniles and adults during 1968-2005 in the fall and spring NMFS trawl survey at the 75% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where juvenile or adult ocean pout were caught in state trawl surveys in more than 10% of the tows, as well as those bays and estuaries identified by the NOAA ELMR program where ocean pout juveniles or adults were "common" or "abundant."

Map 168. Ocean pout eggs, Alternative 2D



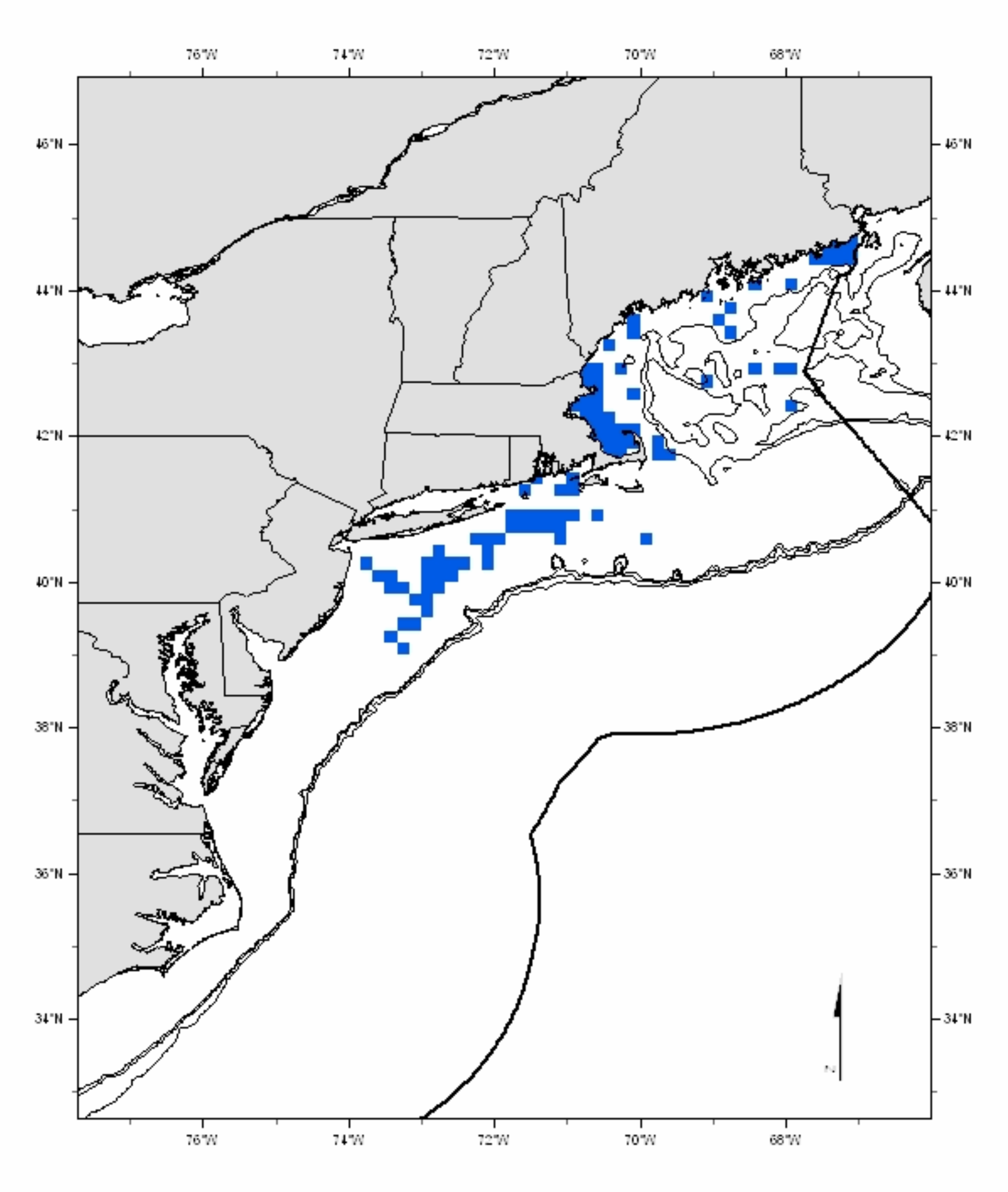
The Alternative 2D EFH designation for ocean pout eggs on the continental shelf is based upon the relative abundance of juveniles and adults during 1968-2005 in the fall and spring NMFS trawl survey at the 90% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where juvenile or adult ocean pout were caught in state trawl surveys in more than 10% of the tows, as well as those bays and estuaries identified by the NOAA ELMR program where ocean pout juveniles or adults were "common" or "abundant."

Map 169. Ocean pout juveniles, Alternative 2A



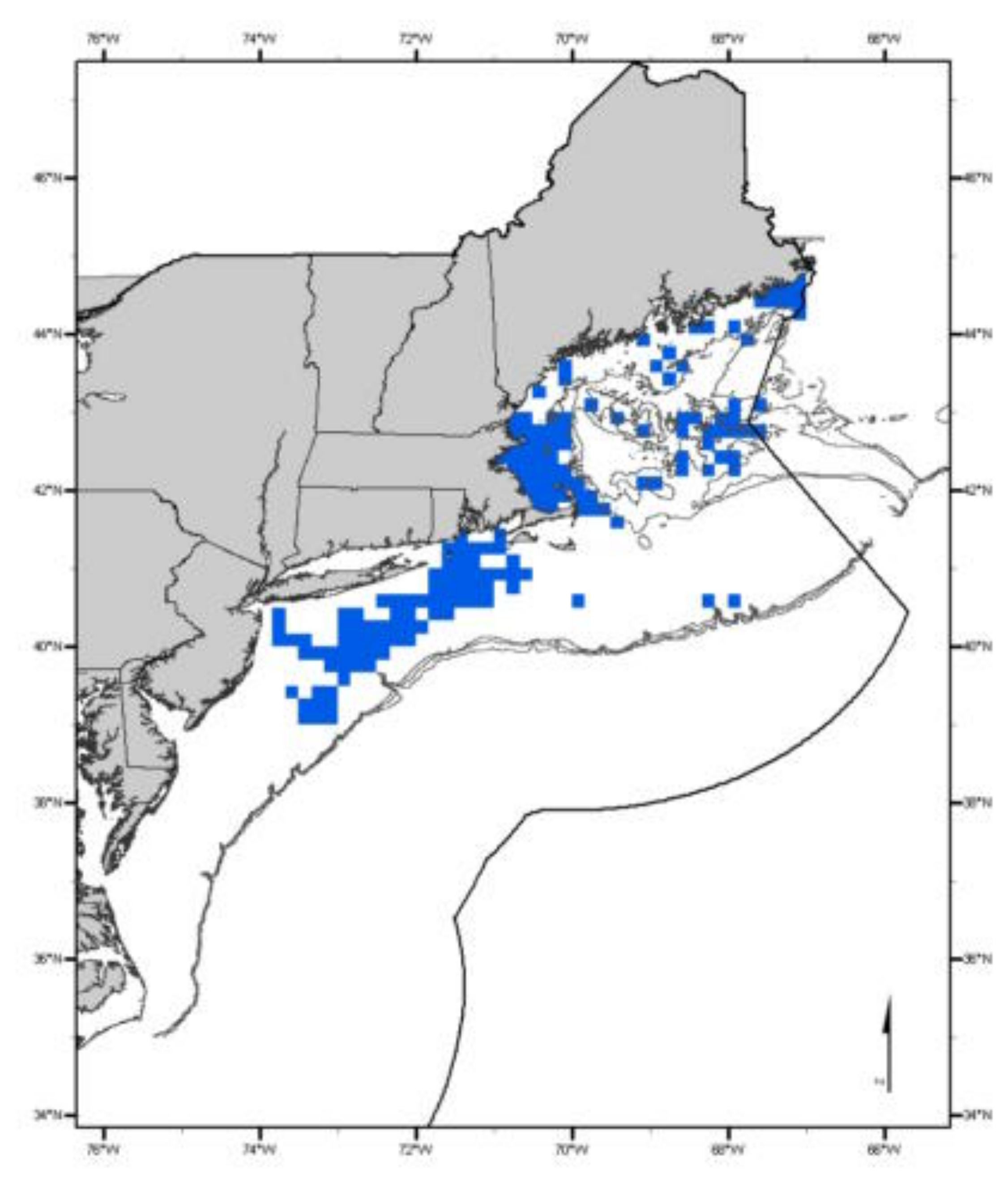
The Alternative 2A EFH designation for juvenile ocean pout on the continental shelf is based upon relative abundance during 1968-2005 in the fall and spring NMFS trawl survey at the 25% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where juvenile ocean pout were caught in state trawl surveys in more than 10% of the tows, as well as those bays and estuaries identified by the NOAA ELMR program where ocean pout juveniles were "common" or "abundant."

Map 170. Ocean pout juveniles, Alternative 2B



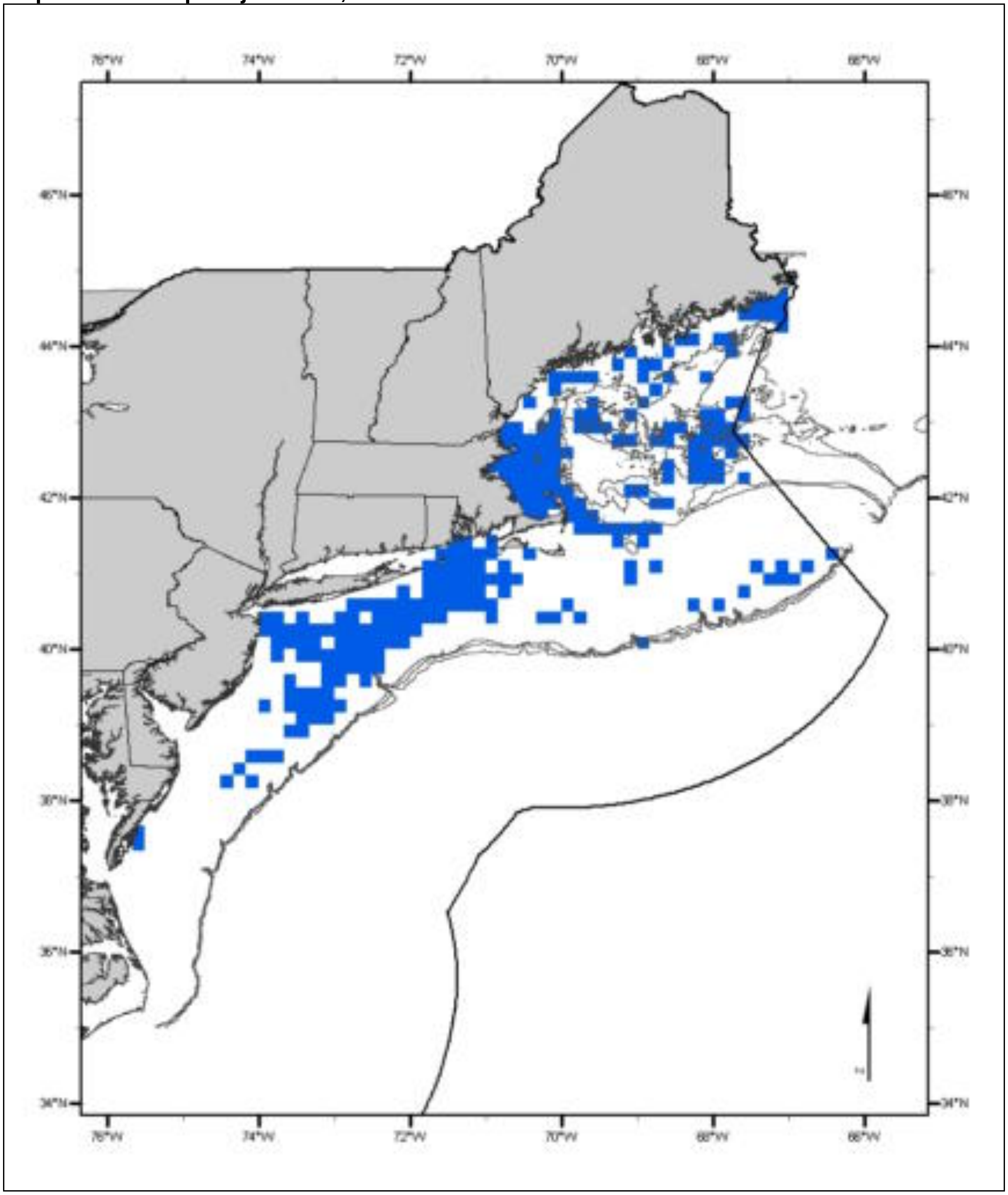
The Alternative 2B EFH designation for juvenile ocean pout on the continental shelf is based upon relative abundance during 1968-2005 in the fall and spring NMFS trawl survey at the 50% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where juvenile ocean pout were caught in state trawl surveys in more than 10% of the tows, as well as those bays and estuaries identified by the NOAA ELMR program where ocean pout juveniles were "common" or "abundant."

Map 171. Ocean pout juveniles, Alternative 2C



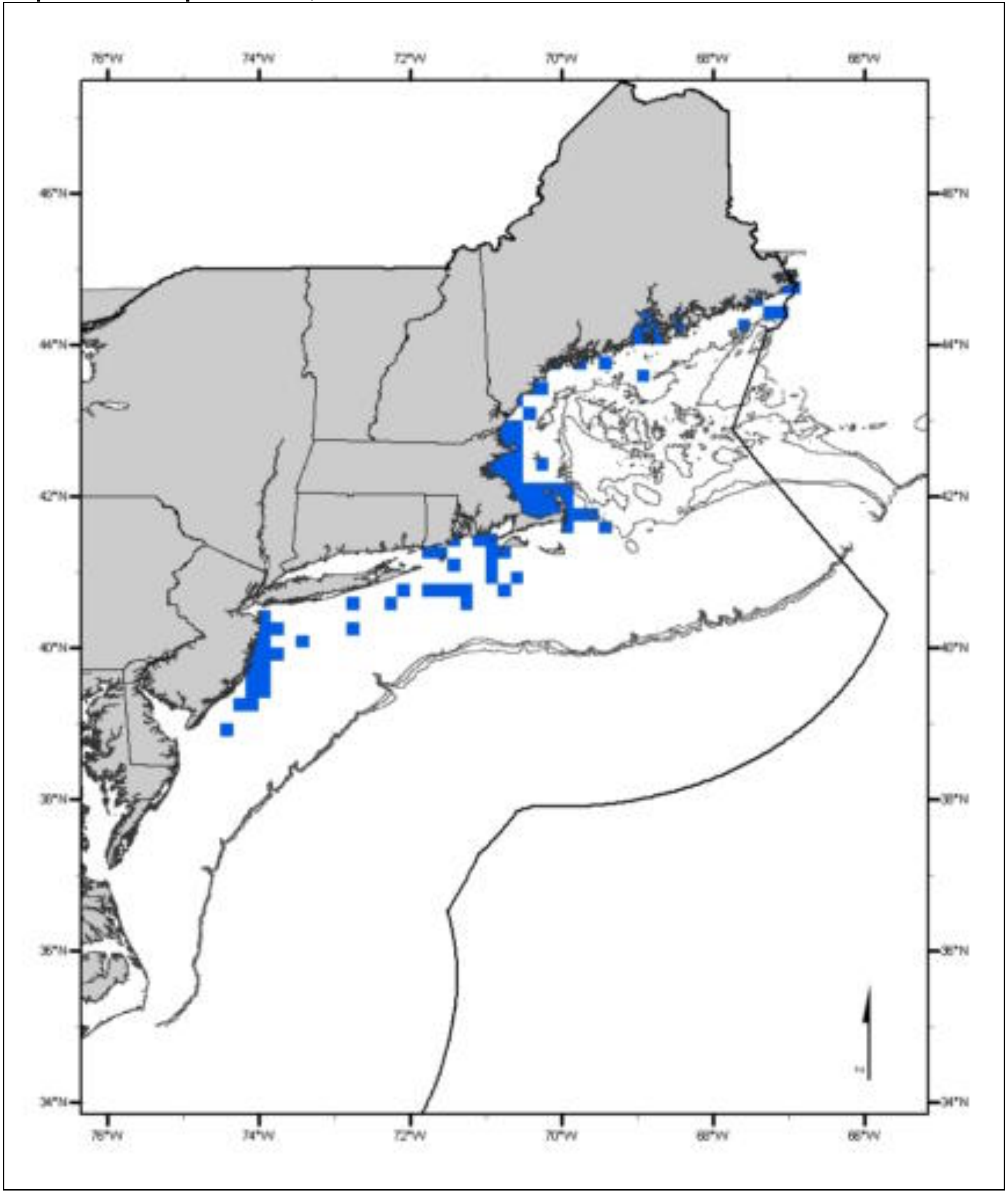
The Alternative 2C EFH designation for juvenile ocean pout on the continental shelf is based upon relative abundance during 1968-2005 in the fall and spring NMFS trawl survey at the 75% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where juvenile ocean pout were caught in state trawl surveys in more than 10% of the tows, as well as those bays and estuaries identified by the NOAA ELMR program where ocean pout juveniles were "common" or "abundant."

Map 172. Ocean pout juveniles, Alternative 2D



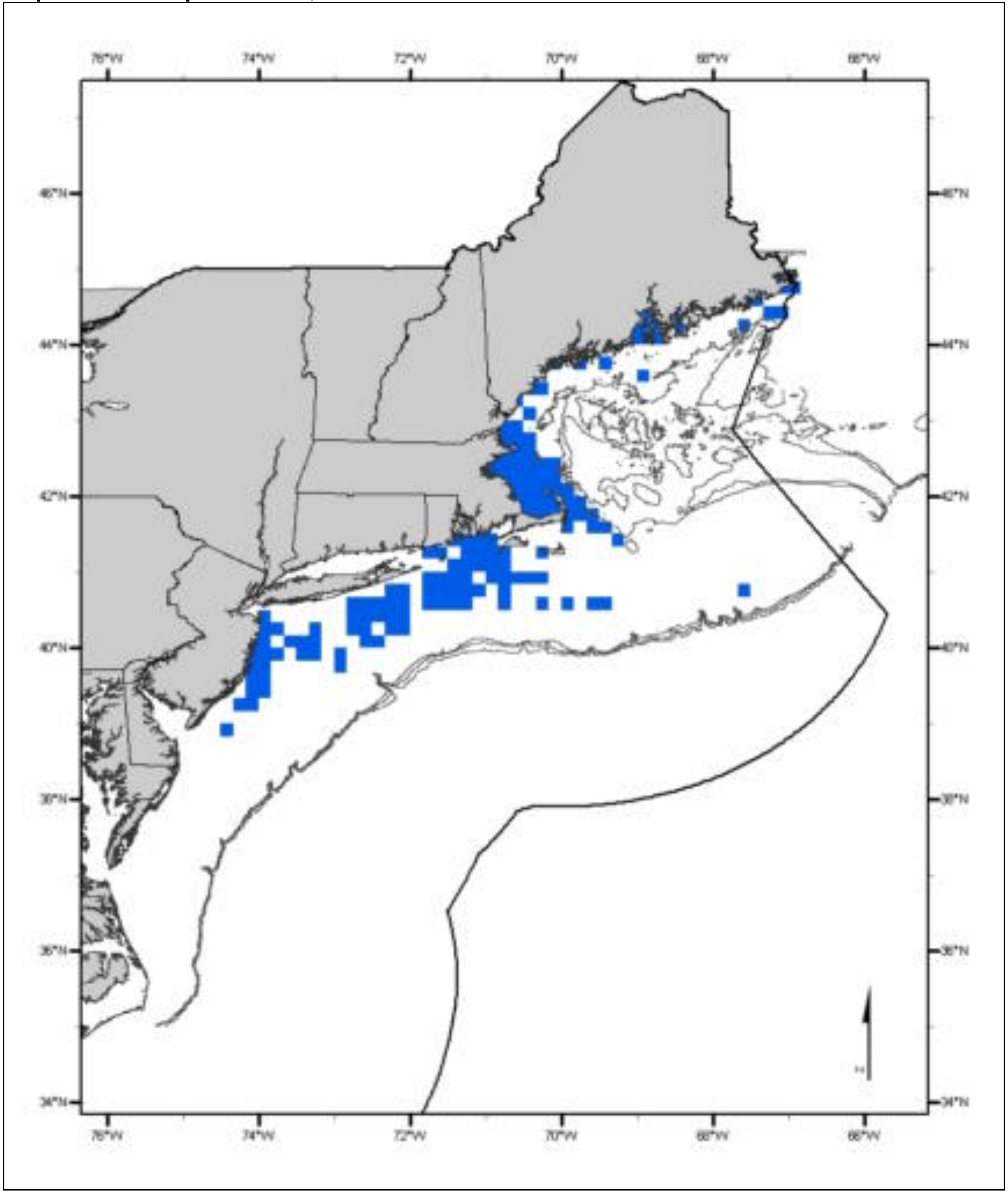
The Alternative 2D EFH designation for juvenile ocean pout on the continental shelf is based upon relative abundance during 1968-2005 in the fall and spring NMFS trawl survey at the 90% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where juvenile ocean pout were caught in state trawl surveys in more than 10% of the tows, as well as those bays and estuaries identified by the NOAA ELMR program where ocean pout juveniles were "common" or "abundant."

Map 173. Ocean pout adults, Alternative 2A



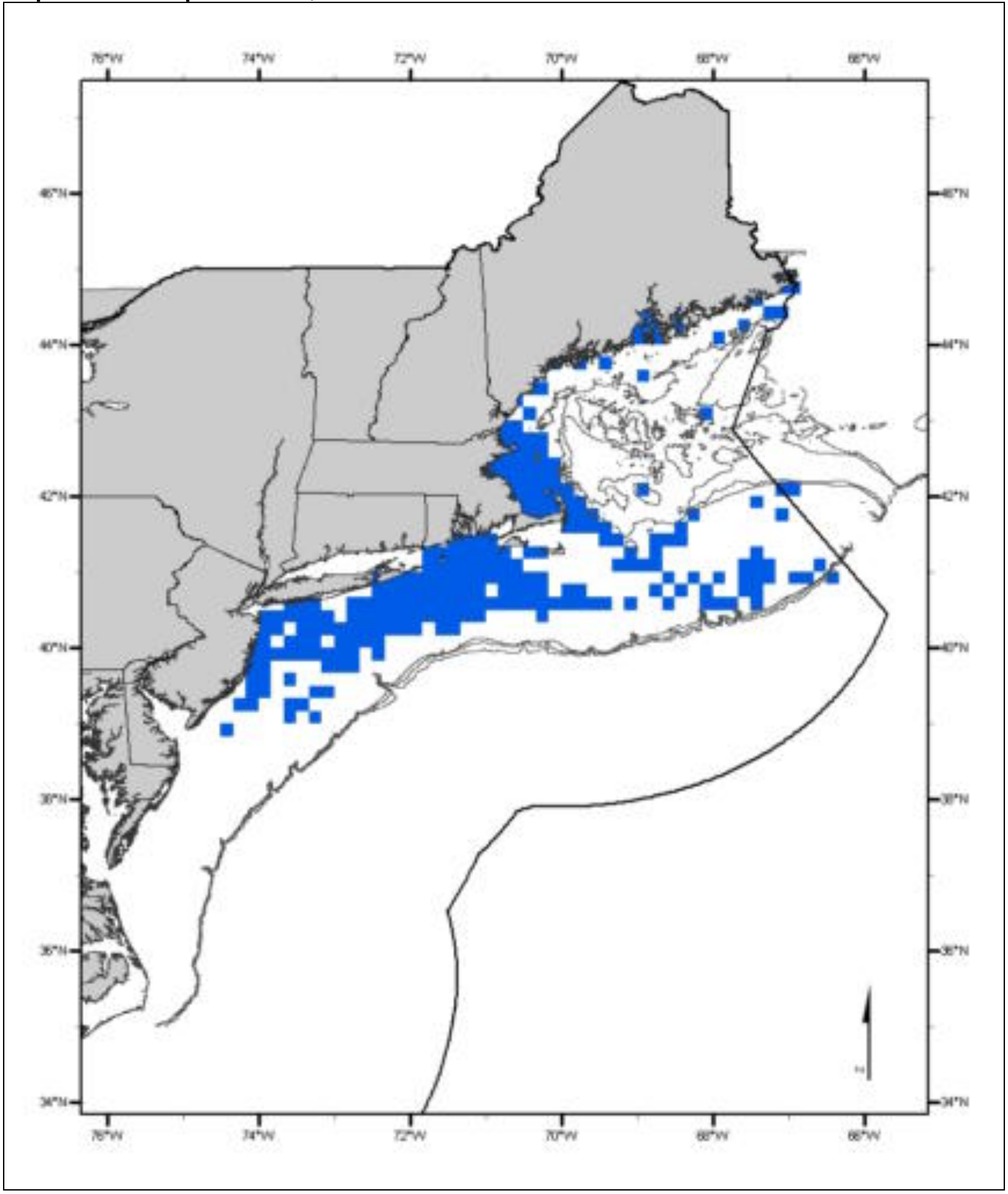
The Alternative 2A EFH designation for adult ocean pout on the continental shelf is based upon relative abundance during 1968-2005 in the fall and spring NMFS trawl survey at the 25% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where adult ocean pout were caught in state trawl surveys in more than 10% of the tows, as well as those bays and estuaries identified by the NOAA ELMR program where ocean pout adults were "common" or "abundant."

Map 174. Ocean pout adults, Alternative 2B



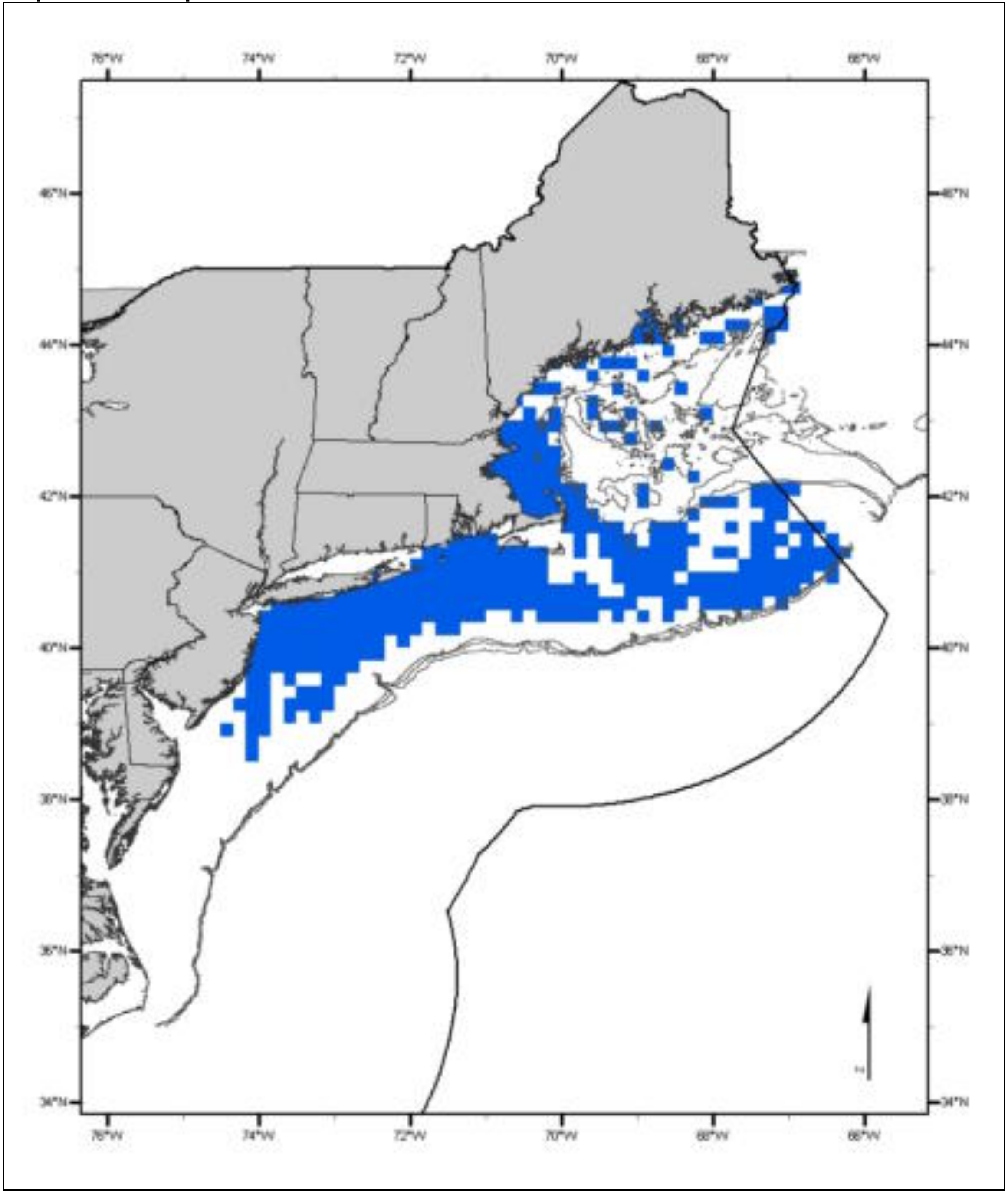
The Alternative 2B EFH designation for adult ocean pout on the continental shelf is based upon relative abundance during 1968-2005 in the fall and spring NMFS trawl survey at the 50% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where adult ocean pout were caught in state trawl surveys in more than 10% of the tows, as well as those bays and estuaries identified by the NOAA ELMR program where ocean pout adults were "common" or "abundant."

Map 175. Ocean pout adults, Alternative 2C



The Alternative 2C EFH designation for adult ocean pout on the continental shelf is based upon relative abundance during 1968-2005 in the fall and spring NMFS trawl survey at the 75% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where adult ocean pout were caught in state trawl surveys in more than 10% of the tows, as well as those bays and estuaries identified by the NOAA ELMR program where ocean pout adults were "common" or "abundant."

Map 176. Ocean pout adults, Alternative 2D



The Alternative 2D EFH designation for adult ocean pout on the continental shelf is based upon relative abundance during 1968-2005 in the fall and spring NMFS trawl survey at the 90% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where adult ocean pout were caught in state trawl surveys in more than 10% of the tows, as well as those bays and estuaries identified by the NOAA ELMR program where ocean pout adults were "common" or "abundant."

4.1.2.3.12 Offshore Hake

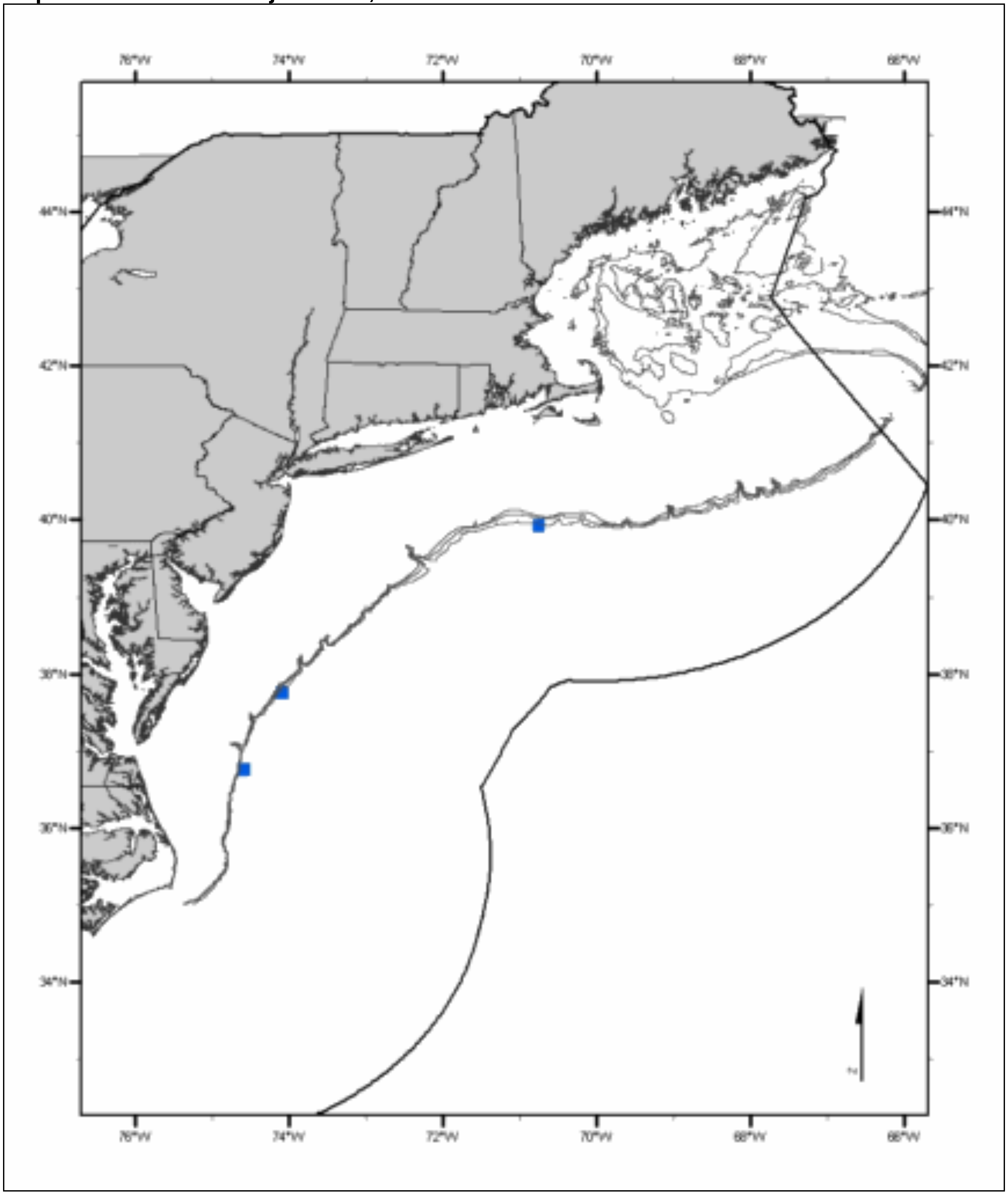
Eggs: No alternative EFH designation.

Larvae: No alternative EFH designation.

Juveniles: Pelagic and benthic habitats on the outer continental shelf in depths of 200 – 500 meters with mud and sand substrates, as depicted on Map 177 - Map 180. Other conditions that generally exist where benthic EFH for juvenile offshore hake is found are bottom water temperatures of 8.5 – 12.5°C and salinities of 34.5 – 36.5 ppt. Juvenile offshore hake migrate off the bottom at night and feed primarily on small fishes, euphausiids, and pandalid and pelagic shrimps.

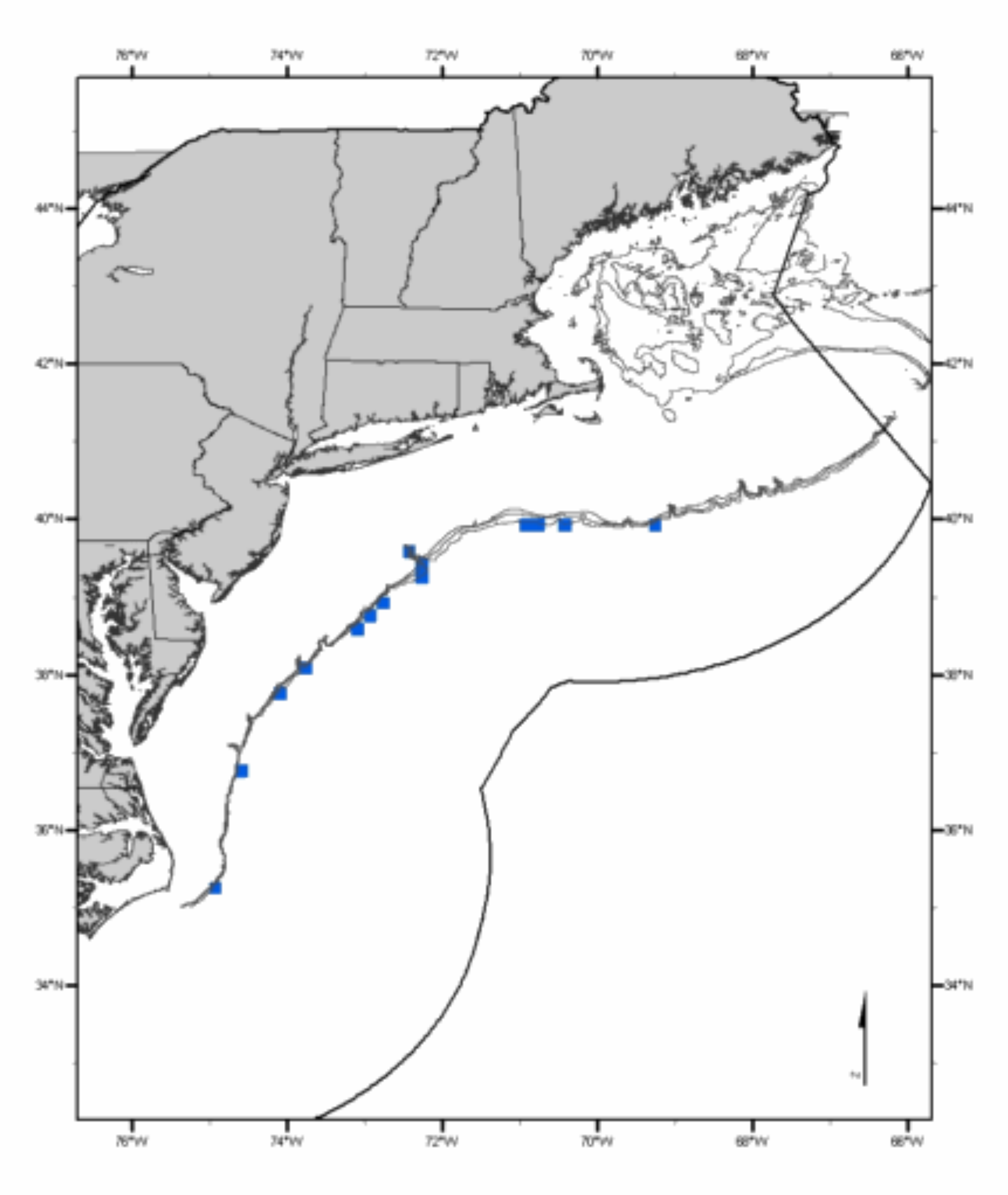
Adults: Pelagic and benthic habitats on the outer continental shelf in depths of 200 – 500 meters with mud and sand substrates, as depicted on Map 181- Map 184. The following conditions generally exist where benthic EFH for adult offshore hake is found: bottom water temperatures of 6.5 – 12.5°C and salinities of 34.5 – 36.5 ppt. Spawning generally occurs between 330 and 550 meters. Adult offshore hake migrate off the bottom at night and feed primarily on fishes such as gadids, hakes (especially silver hake) and other pelagic species, squids, and euphausiids.

Map 177. Offshore hake juveniles, Alternative 2A



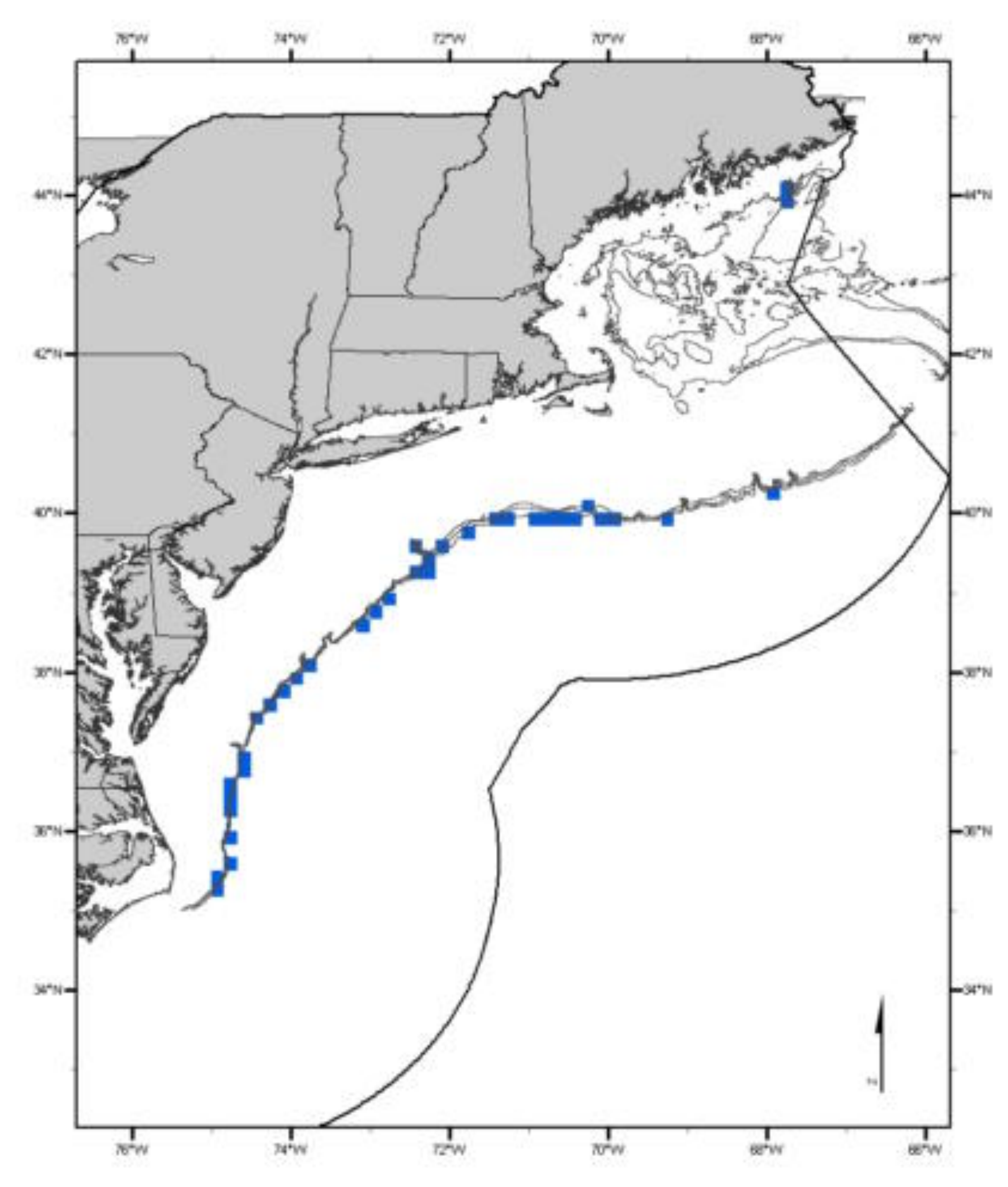
The Alternative 2A EFH designation for juvenile offshore hake on the continental shelf is based upon relative abundance during 1968-2005 in the fall and spring NMFS trawl survey at the 25% cumulative percentage level.

Map 178. Offshore hake juveniles, Alternative 2B



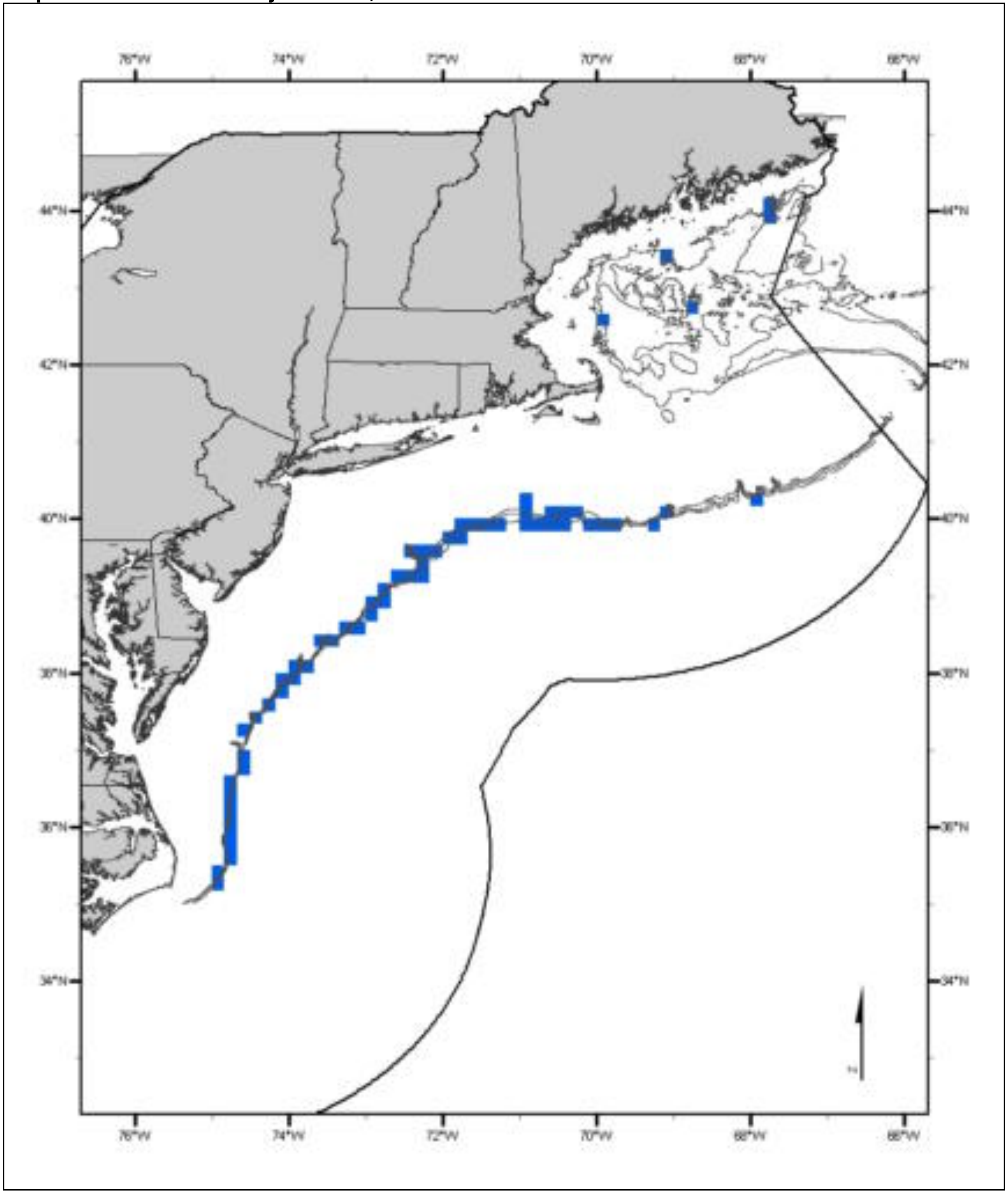
The Alternative 2B EFH designation for juvenile offshore hake on the continental shelf is based upon relative abundance during 1968-2005 in the fall and spring NMFS trawl survey at the 50 cumulative percentage level.

Map 179. Offshore hake juveniles, Alternative 2C



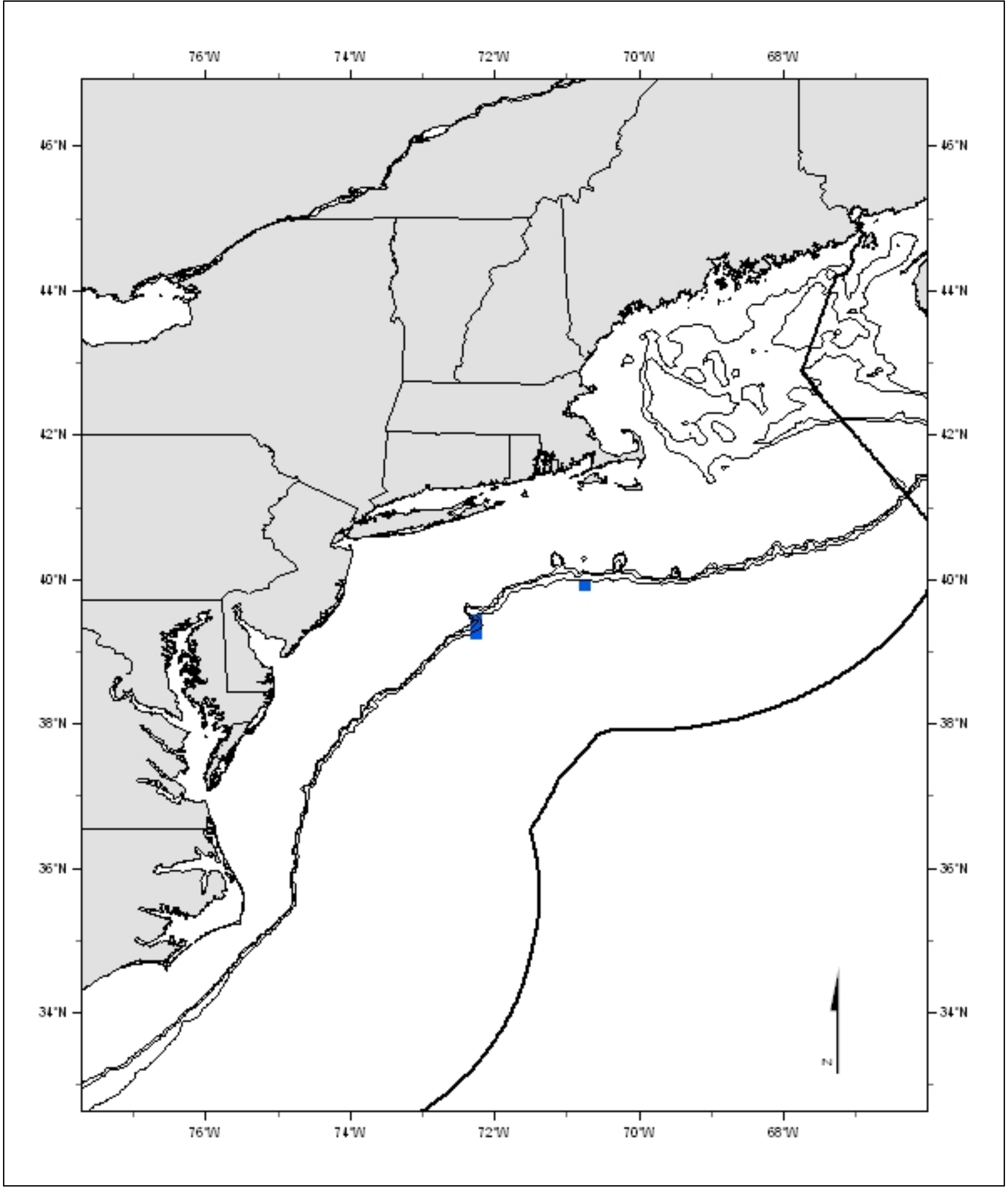
The Alternative 2C EFH designation for juvenile offshore hake on the continental shelf is based upon relative abundance during 1968-2005 in the fall and spring NMFS trawl survey at the 75% cumulative percentage level.

Map 180. Offshore hake juveniles, Alternative 2D



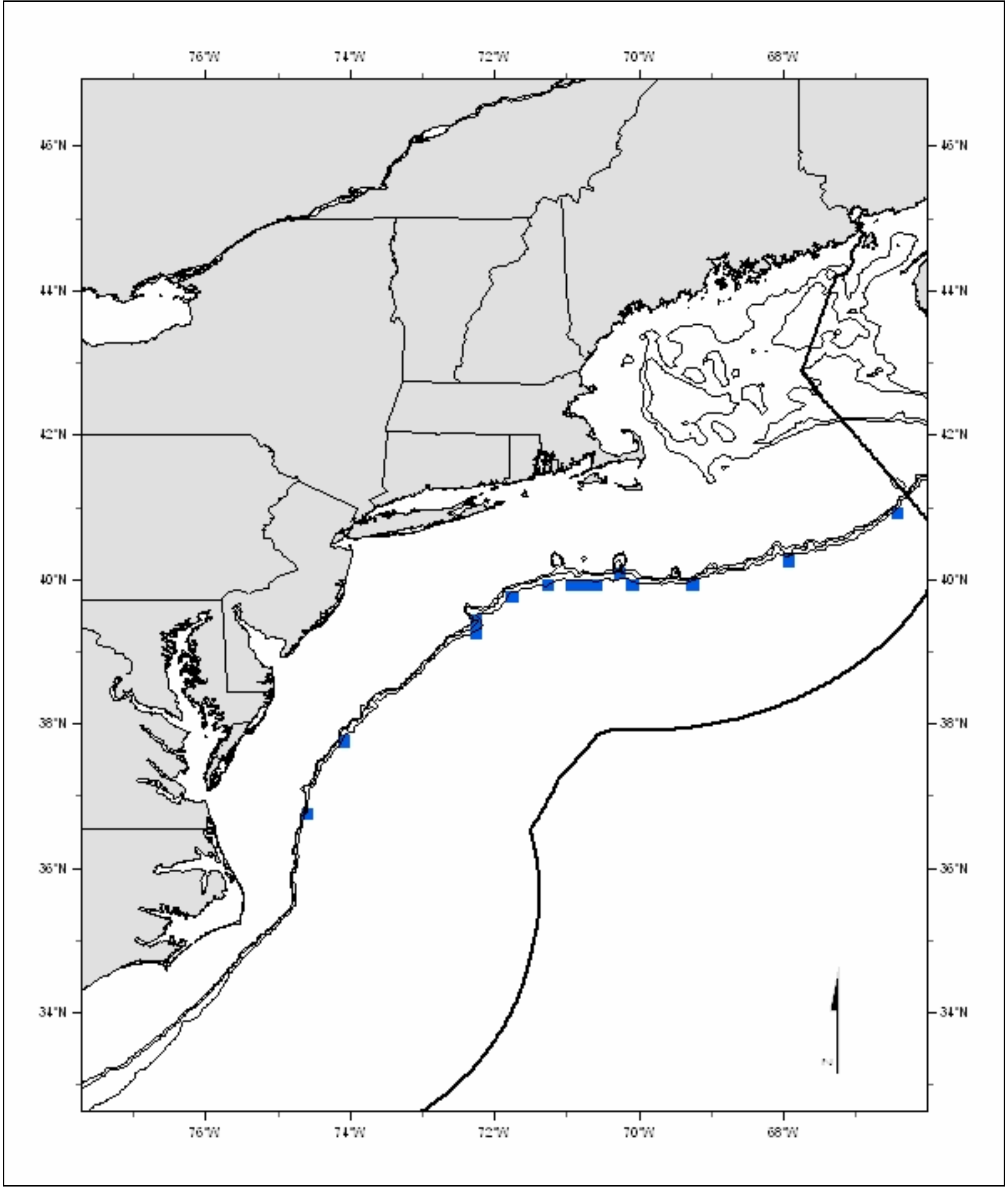
The Alternative 2D EFH designation for juvenile offshore hake on the continental shelf is based upon relative abundance during 1968-2005 in the fall and spring NMFS trawl survey at the 90% cumulative percentage level.

Map 181. Offshore hake adults, Alternative 2A



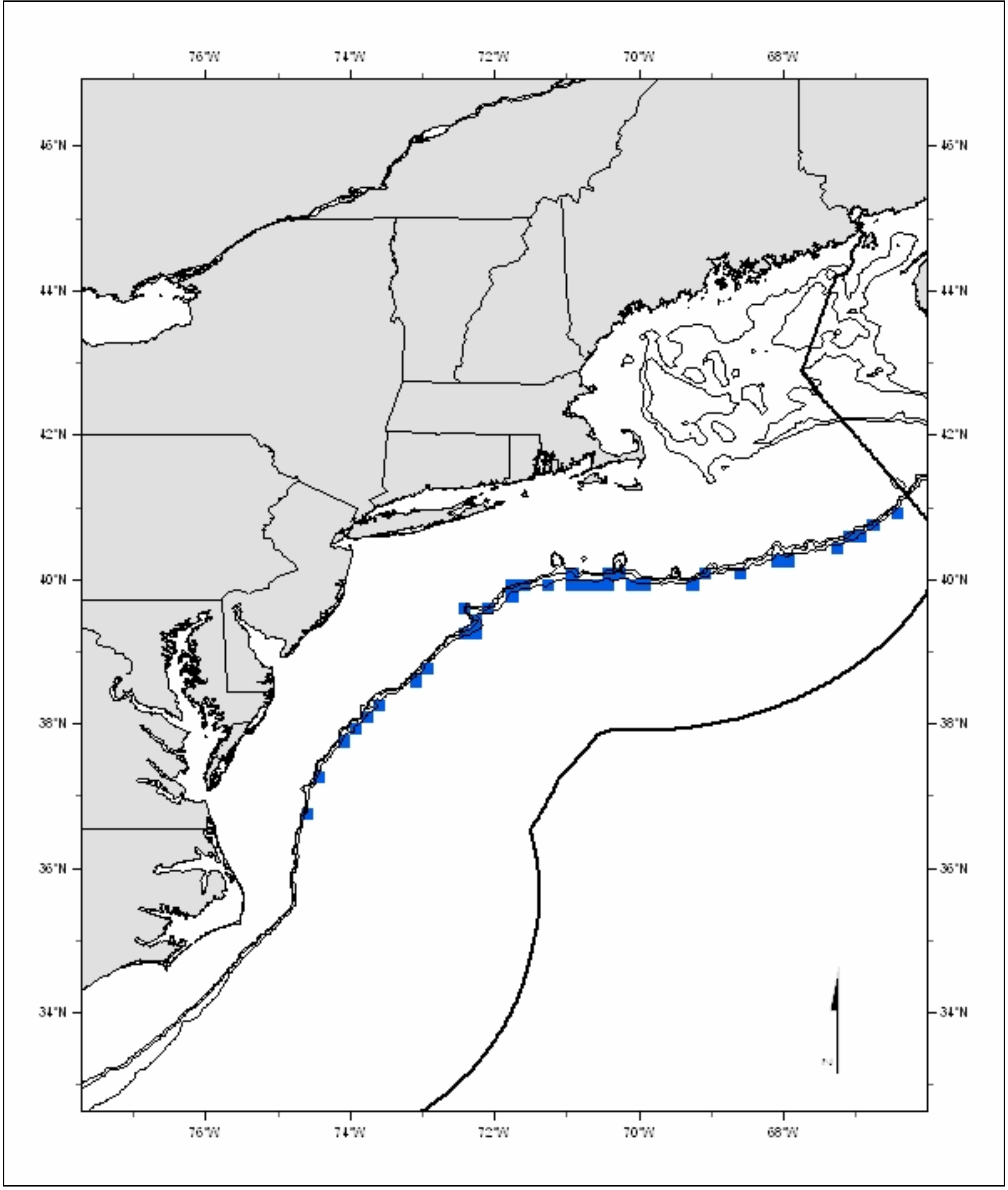
The Alternative 2A EFH designation for adult offshore hake on the continental shelf is based upon relative abundance during 1968-2005 in the fall and spring NMFS trawl survey at the 25% cumulative percentage level.

Map 182. Offshore hake adults, Alternative 2B



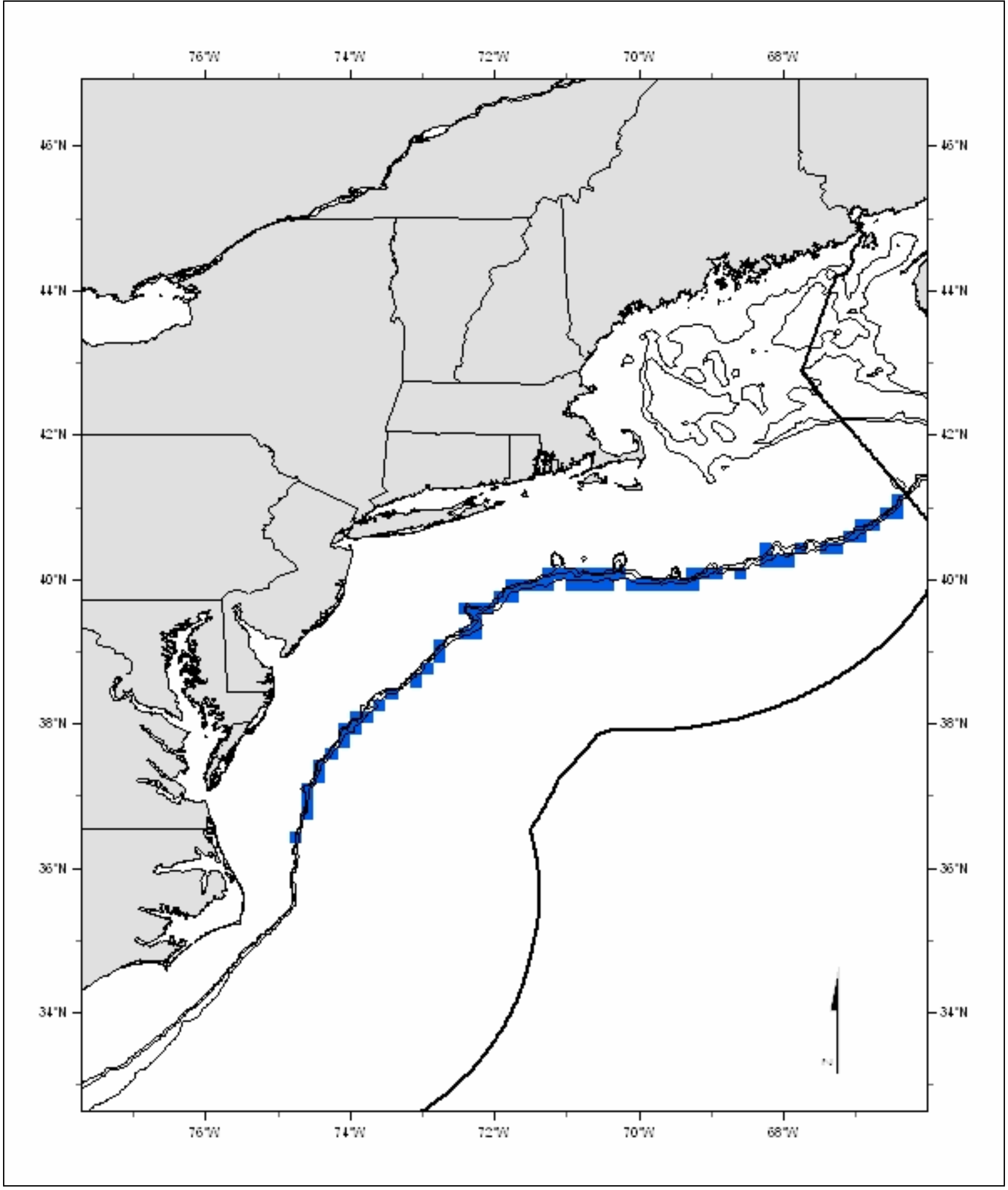
The Alternative 2B EFH designation for adult offshore hake on the continental shelf is based upon relative abundance during 1968-2005 in the fall and spring NMFS trawl survey at the 50 cumulative percentage level.

Map 183. Offshore hake adults, Alternative 2C



The Alternative 2CEFH designation for adult offshore hake on the continental shelf is based upon relative abundance during 1968-2005 in the fall and spring NMFS trawl survey at the 75% cumulative percentage level.

Map 184. Offshore hake adults, Alternative 2D



The Alternative 2DEFH designation for adult offshore hake on the continental shelf is based upon relative abundance during 1968-2005 in the fall and spring NMFS trawl survey at the 90% cumulative percentage level.

4.1.2.3.13 Pollock

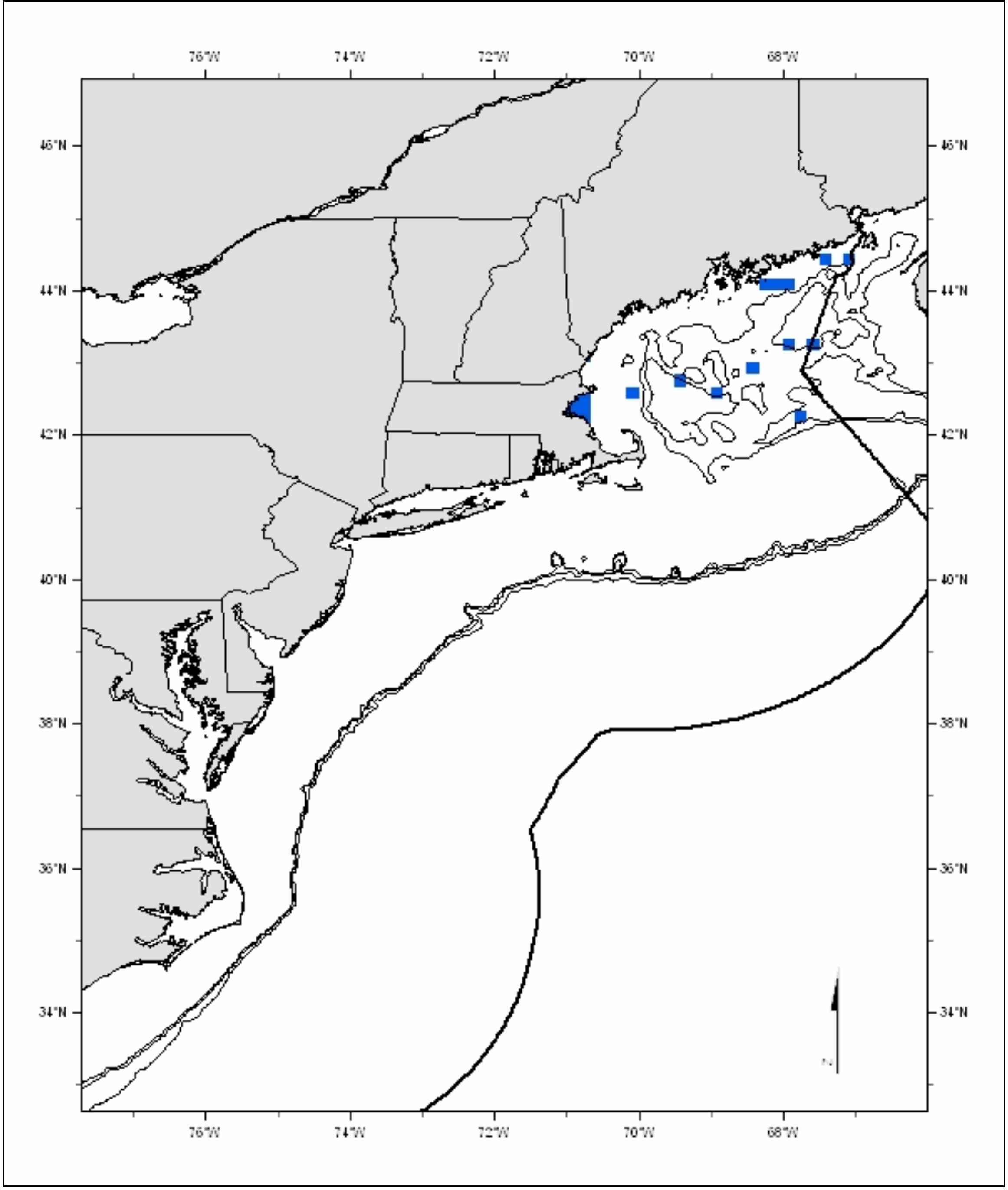
Eggs: Pelagic continental shelf habitats as depicted on Map 185 - Map 188. The following conditions generally exist where EFH for pollock eggs is found: bottom depths of 40 – 120 meters and water column temperatures of 2.5 – 13.5ºC.
Preferred Alternative

Larvae: Pelagic inshore and continental shelf habitats as depicted on Map 189 - Map 192. The following conditions generally exist where EFH for pollock larvae is found: bottom depths of 20 – 160 meters and water column temperatures of 3.5 – 11.5ºC. Larval pollock feed on copepods.
Preferred Alternative

Juveniles: Pelagic and benthic inshore and continental shelf habitats in depths of 1 – 180 meters with a wide variety of substrates as depicted on Map 193 - Map 196. Benthic EFH for juvenile pollock includes mud, sand, sand and mud, gravel, and rocky bottom with eelgrass and macroalgae. Other conditions that generally exist where benthic EFH is found are bottom temperatures of 2.5 – 12ºC, and, on the shelf, salinities between 31.5 and 34.5 ppt. EFH for juvenile pollock includes the intertidal zone. Juvenile pollock feed primarily on chaetognaths, amphipods, euphausiids, fishes (*e.g.*, herring), and squids.

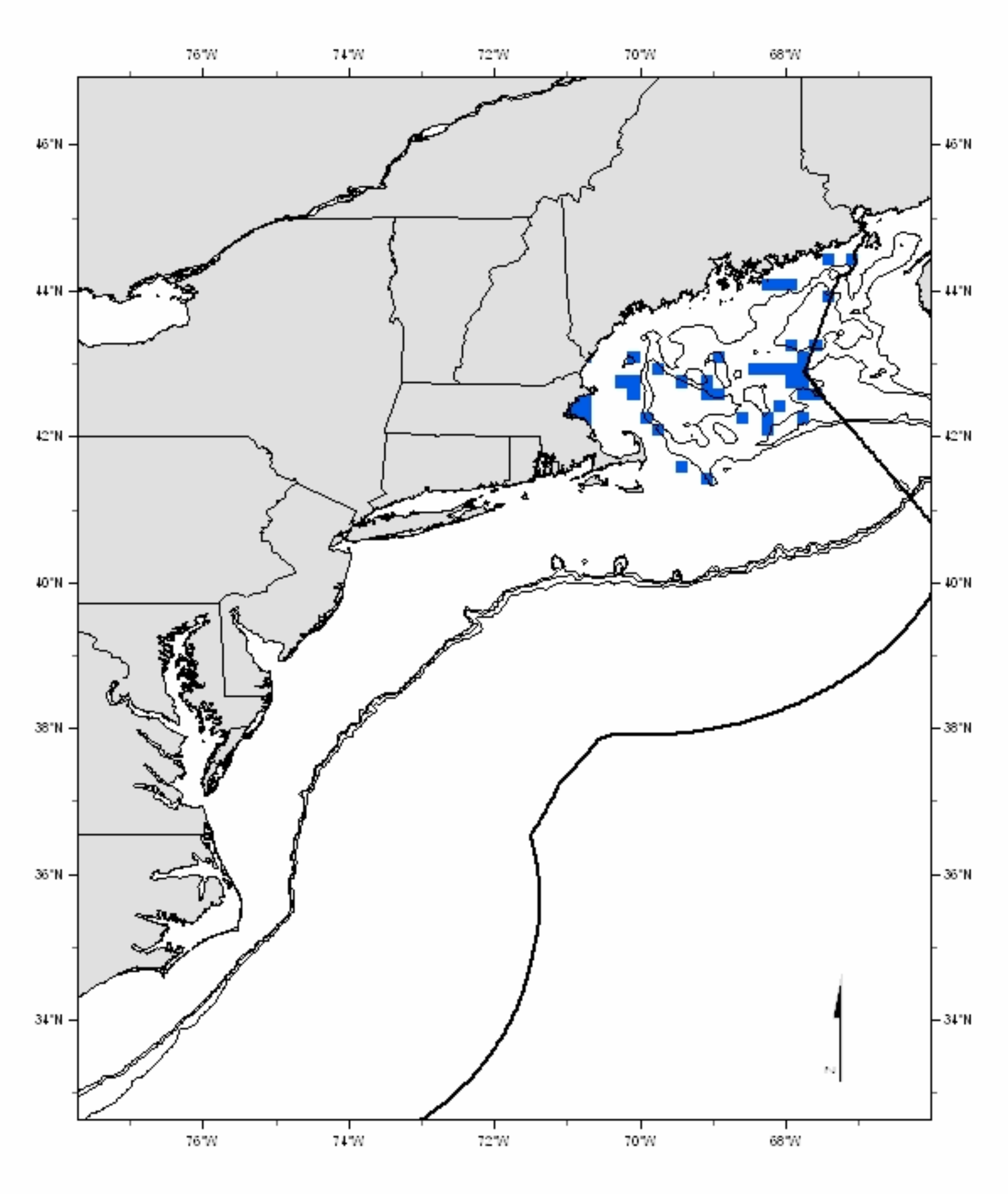
Adults: Pelagic and benthic continental shelf habitats in depths of 80 – 180 meters with a wide variety of substrates as depicted on Map 197 - Map 200. Benthic EFH for adult pollock includes mud, sand, sand and mud, gravel, mud and sand mixed with gravel, and rocky bottom. Other conditions that generally exist where benthic EFH is found are bottom water temperatures of 5.5 – 9.5ºC and salinities of 32.5 – 35.5 ppt. Pollock spawn over hard, stony or rocky bottom. Adult pollock feed primarily on euphausiids, fishes (e.g., herring, sand lance, and silver hake), and squids.

Map 185. Pollock eggs, Alternative 2A



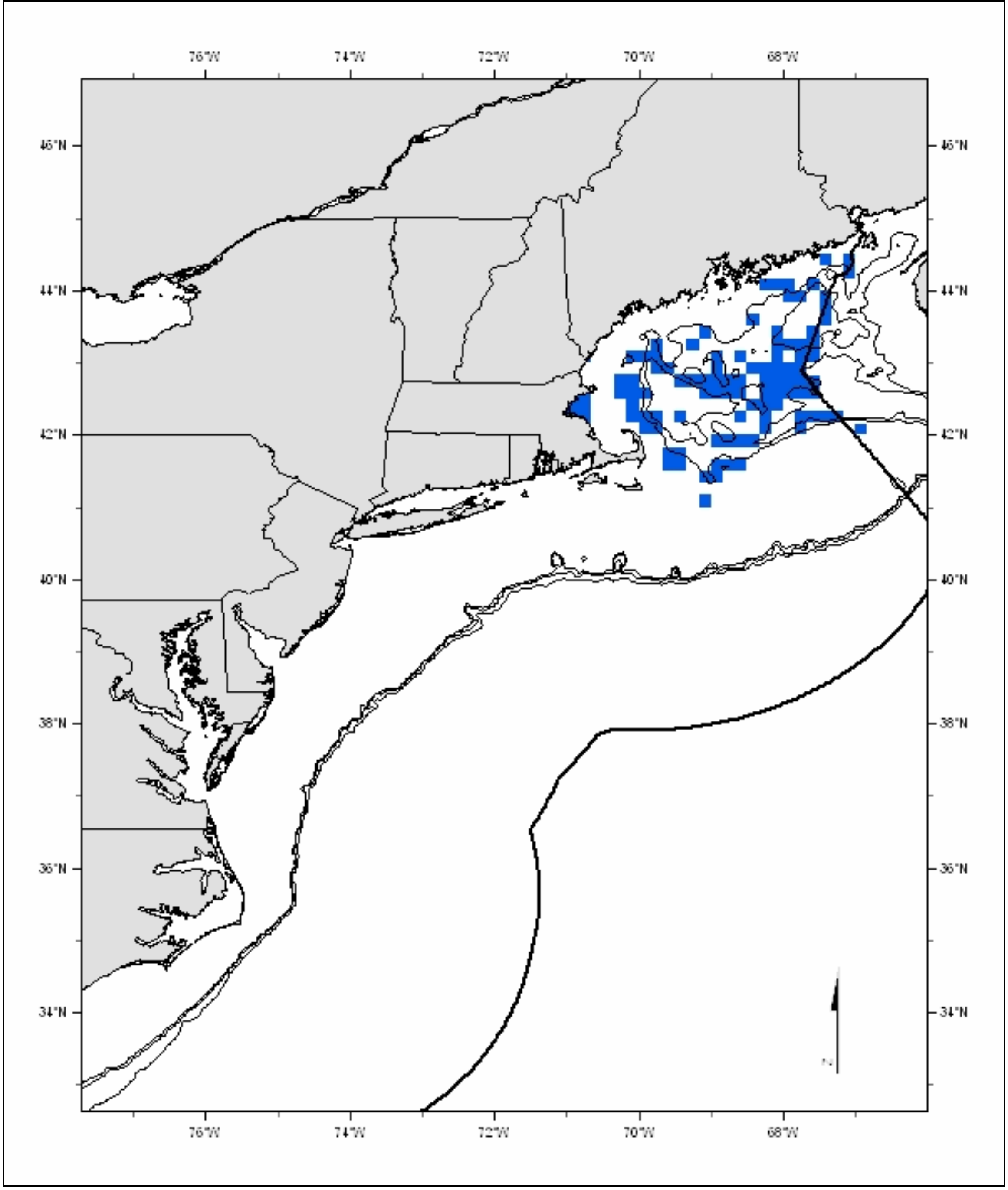
The Alternative 2A EFH designation for pollock eggs on the continental shelf is based upon the relative abundance of adult pollock during 1968-2005 in the fall and spring NMFS trawl survey at the 25% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where adult pollock were caught in state trawl surveys in more than 10% of the tows, as well as those bays and estuaries identified by the NOAA ELMR program where pollock eggs were "common" or "abundant."

Map 186. Pollock eggs, Alternative 2B



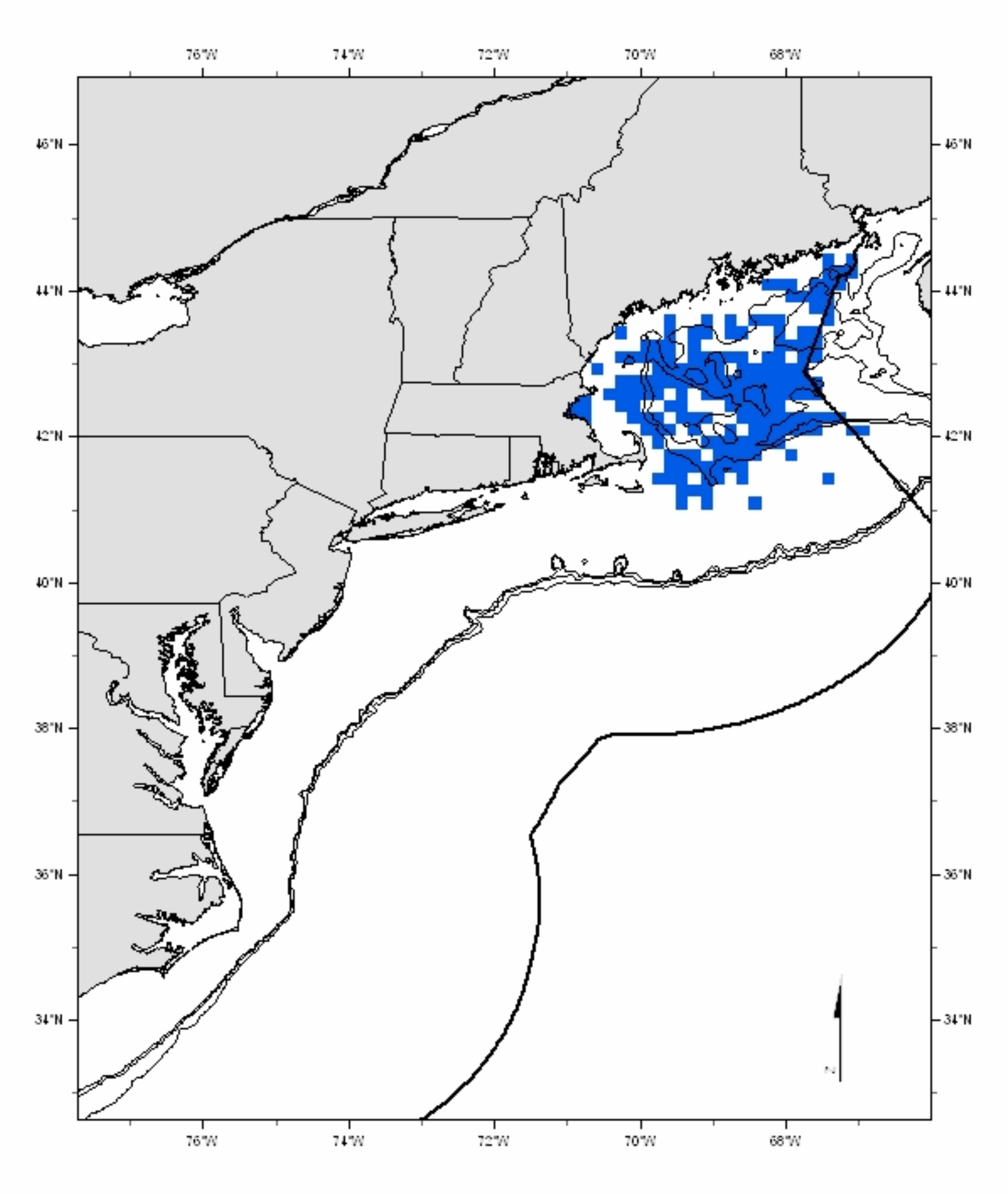
The Alternative 2B EFH designation for pollock eggs on the continental shelf is based upon the relative abundance of adult pollock during 1968-2005 in the fall and spring NMFS trawl survey at the 50% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where adult pollock were caught in state trawl surveys in more than 10% of the tows, as well as those bays and estuaries identified by the NOAA ELMR program where pollock eggs were "common" or "abundant."

Map 187. Pollock eggs, Alternative 2C



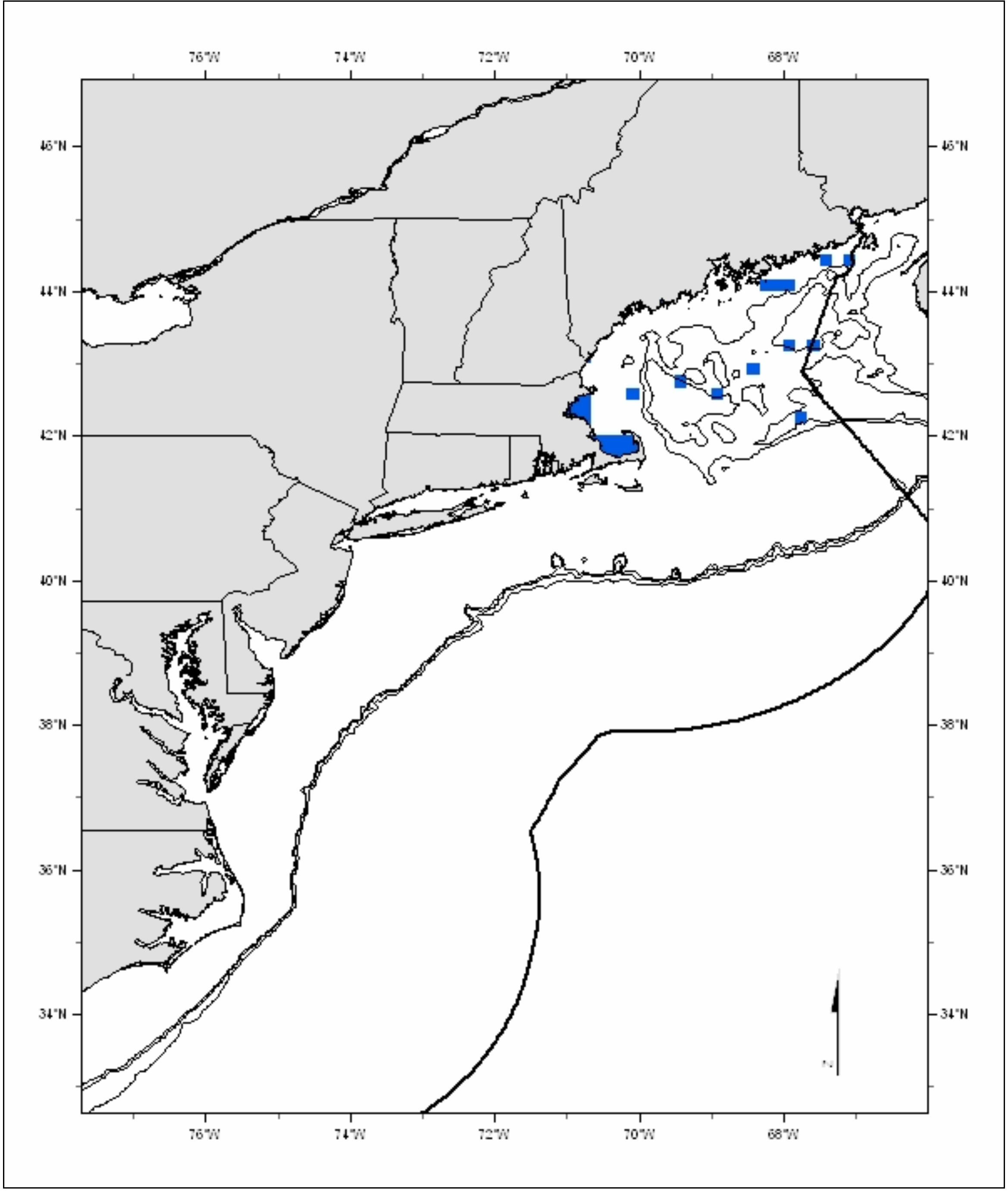
The Alternative 2C EFH designation for pollock eggs on the continental shelf is based upon the relative abundance of adult pollock during 1968-2005 in the fall and spring NMFS trawl survey at the 75% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where adult pollock were caught in state trawl surveys in more than 10% of the tows, as well as those bays and estuaries identified by the NOAA ELMR program where pollock eggs were "common" or "abundant."

Map 188. Pollock eggs, Alternative 2D (*Preferred Alternative*)



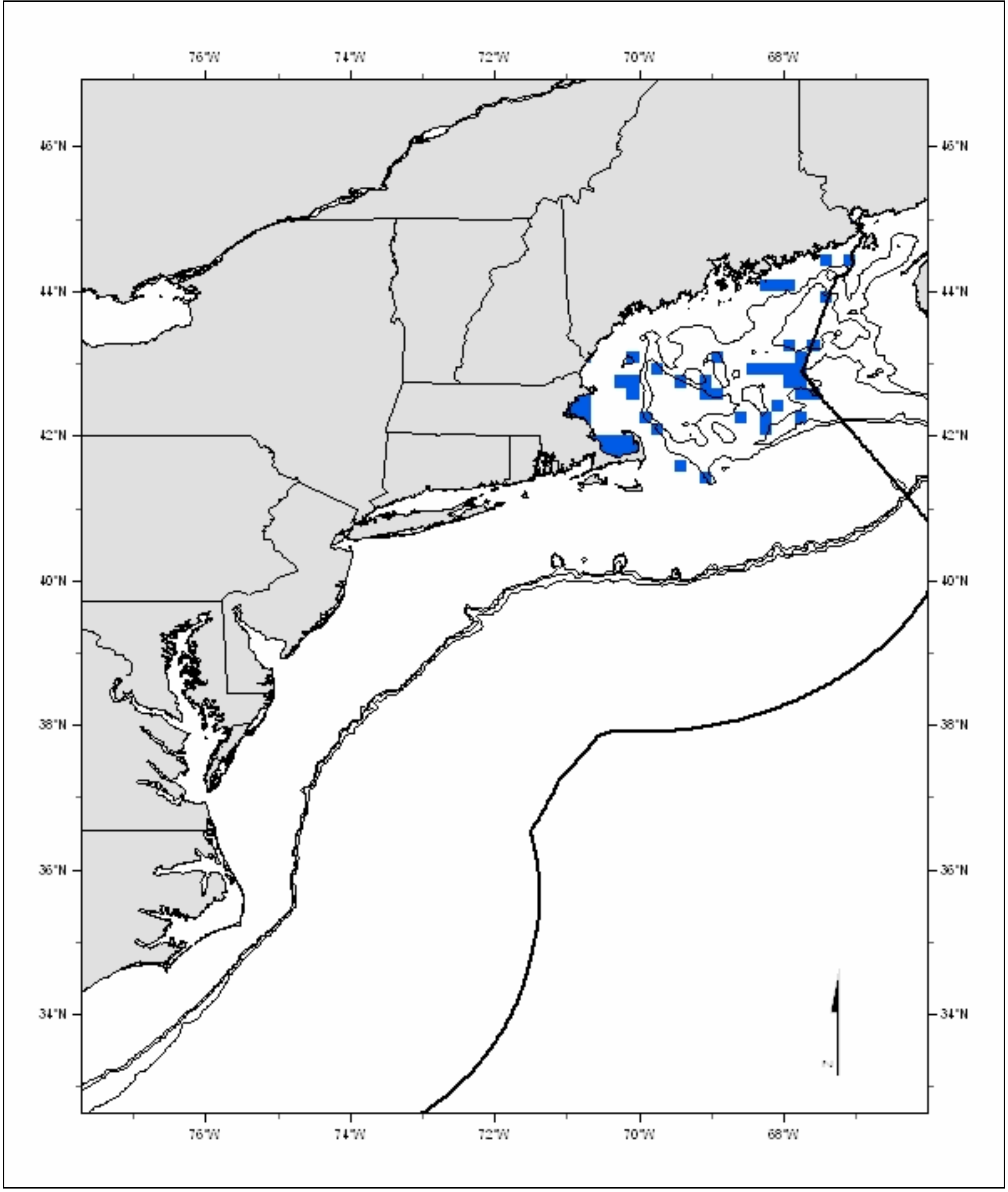
The Alternative 2D EFH designation for pollock eggs on the continental shelf is based upon the relative abundance of adult pollock during 1968-2005 in the fall and spring NMFS trawl survey at the 90% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where adult pollock were caught in state trawl surveys in more than 10% of the tows, as well as those bays and estuaries identified by the NOAA ELMR program where pollock eggs were "common" or "abundant."

Map 189. Pollock larvae, Alternative 2A



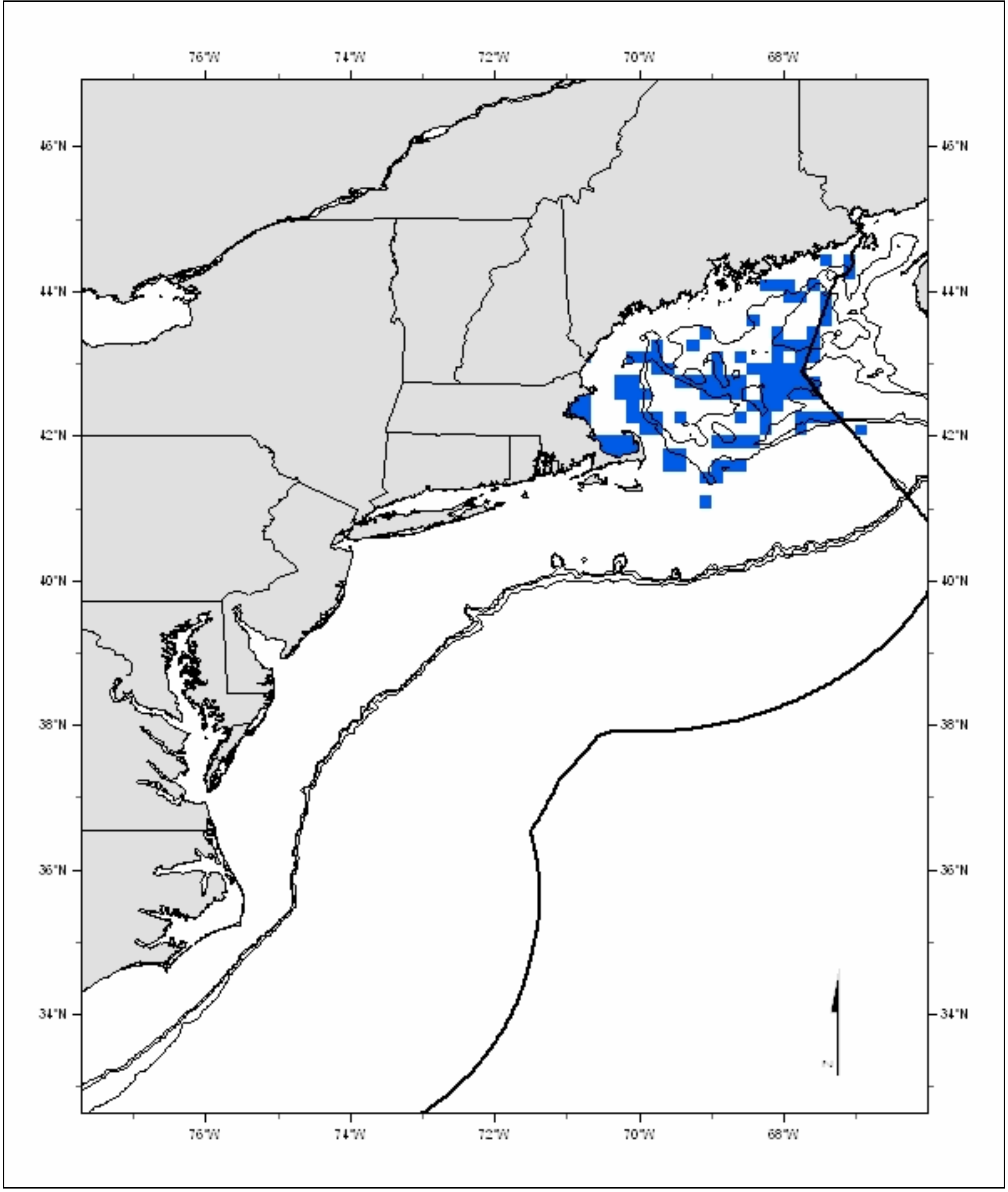
The Alternative 2A EFH designation for pollock larvae on the continental shelf is based upon the relative abundance of adult pollock during 1968-2005 in the fall and spring NMFS trawl survey at the 25% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where adult pollock were caught in state trawl surveys in more than 10% of the tows, as well as those bays and estuaries identified by the NOAA ELMR program where pollock larvae were "common" or "abundant."

Map 190. Pollock larvae, Alternative 2B



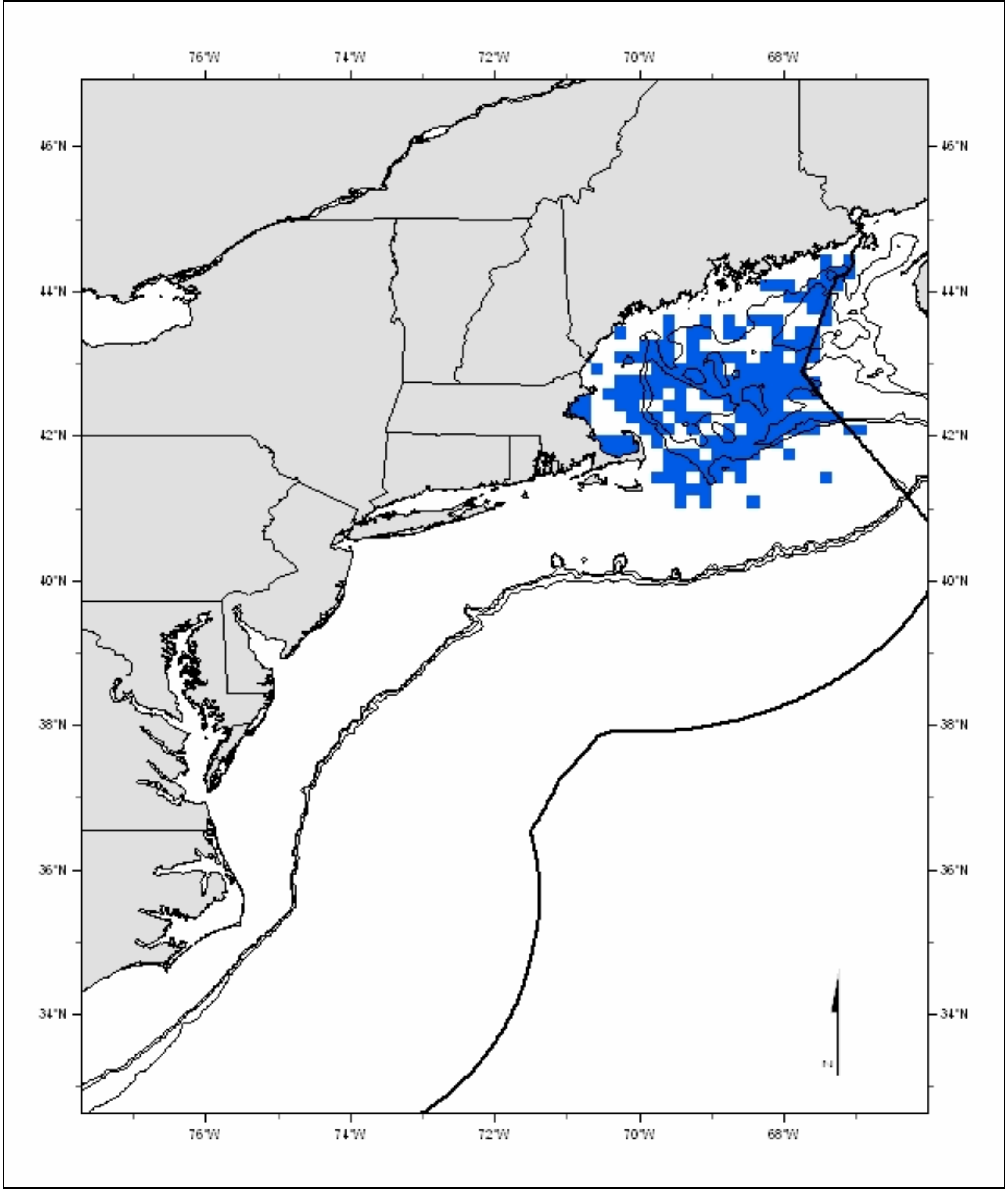
The Alternative 2B EFH designation for pollock larvae on the continental shelf is based upon the relative abundance of adult pollock during 1968-2005 in the fall and spring NMFS trawl survey at the 50% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where adult pollock were caught in state trawl surveys in more than 10% of the tows, as well as those bays and estuaries identified by the NOAA ELMR program where pollock larvae were "common" or "abundant."

Map 191. Pollock larvae, Alternative 2C



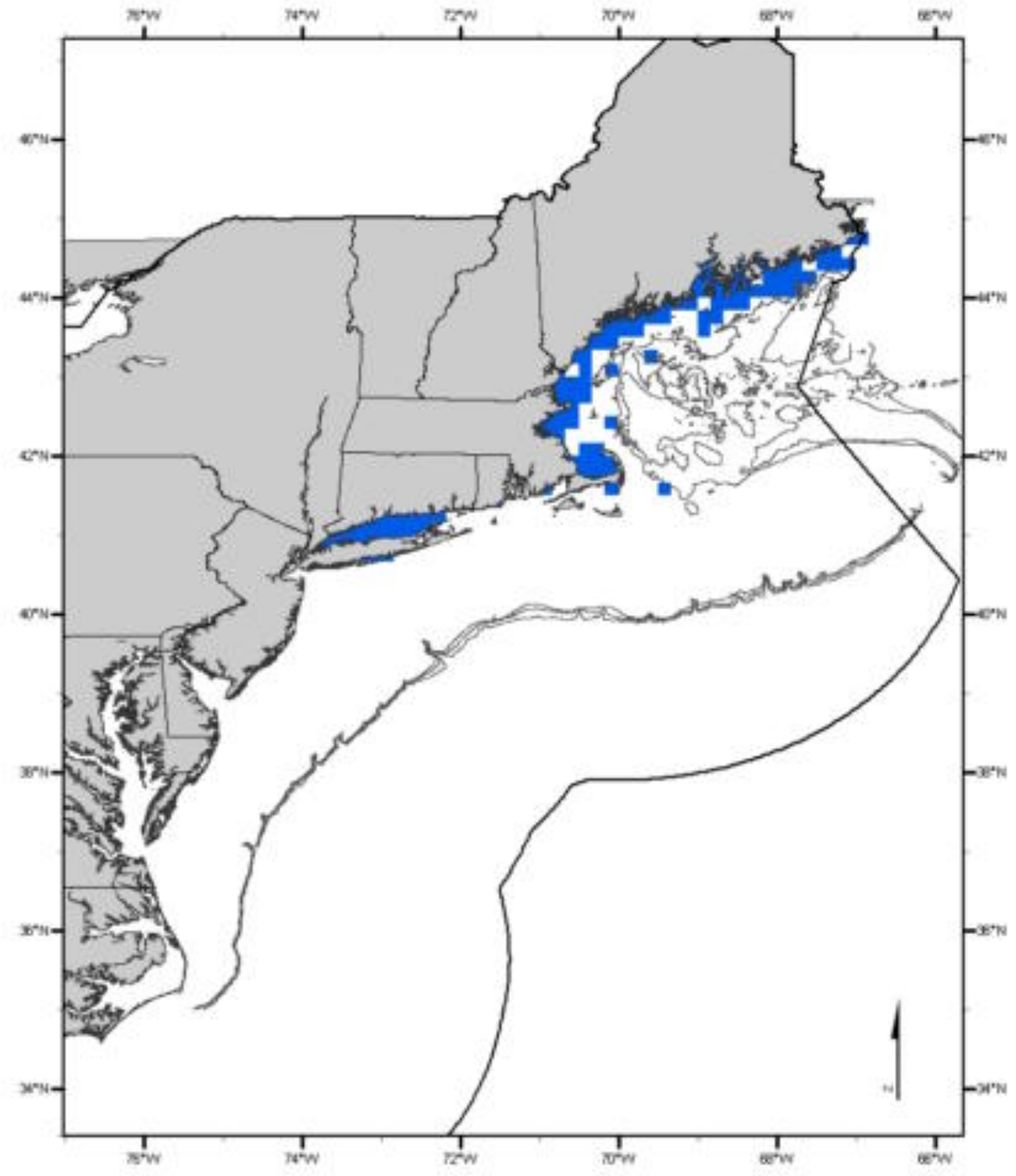
The Alternative 2C EFH designation for pollock larvae on the continental shelf is based upon the relative abundance of adult pollock during 1968-2005 in the fall and spring NMFS trawl survey at the 75% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where adult pollock were caught in state trawl surveys in more than 10% of the tows, as well as those bays and estuaries identified by the NOAA ELMR program where pollock larvae were "common" or "abundant."

Map 192. Pollock larvae, Alternative 2D (*Preferred Alternative*)



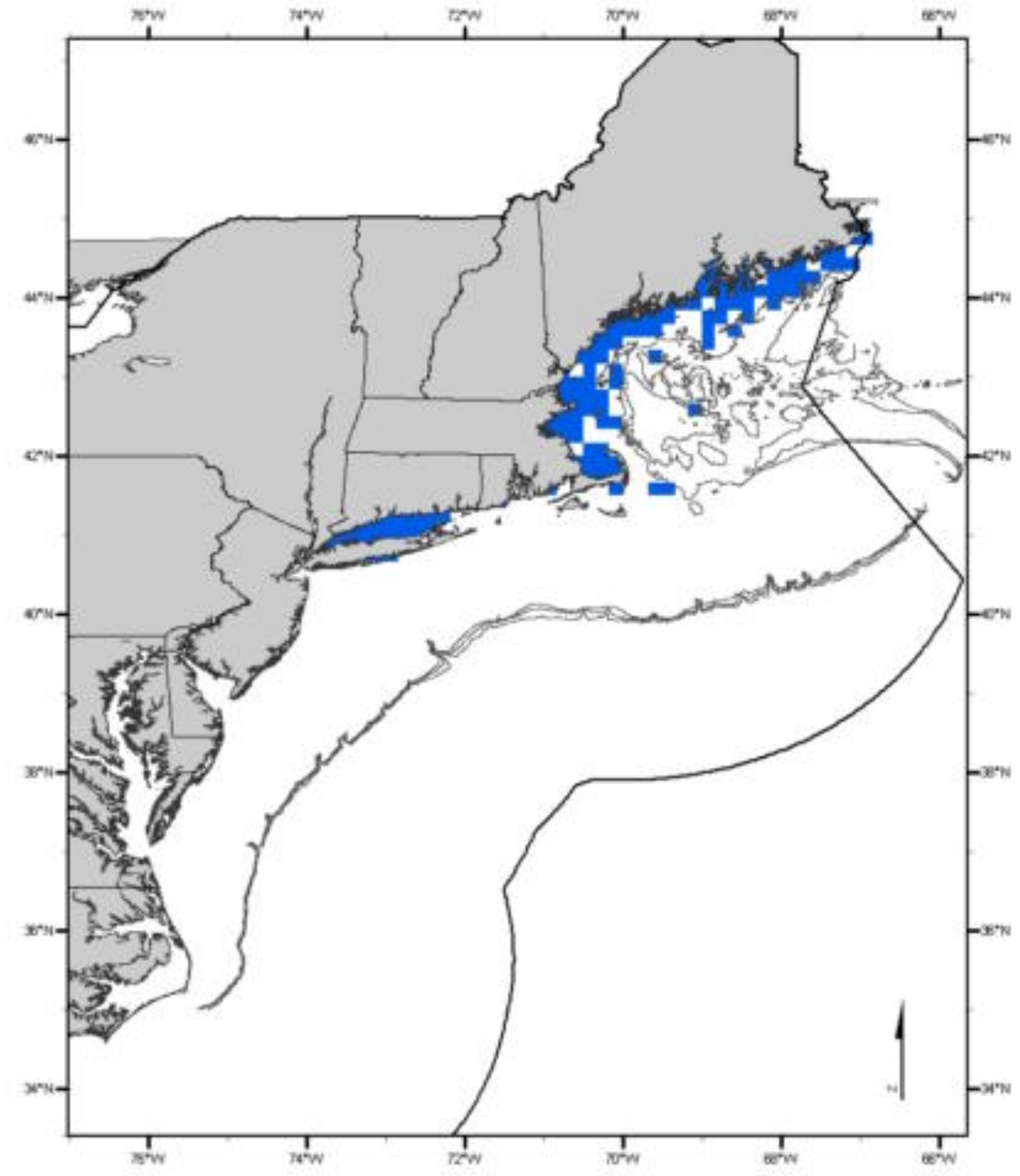
The Alternative 2D EFH designation for pollock larvae on the continental shelf is based upon the relative abundance of adult pollock during 1968-2005 in the fall and spring NMFS trawl survey at the 90% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where adult pollock were caught in state trawl surveys in more than 10% of the tows, as well as those bays and estuaries identified by the NOAA ELMR program where pollock larvae were "common" or "abundant."

Map 193. Pollock juveniles, Alternative 2A



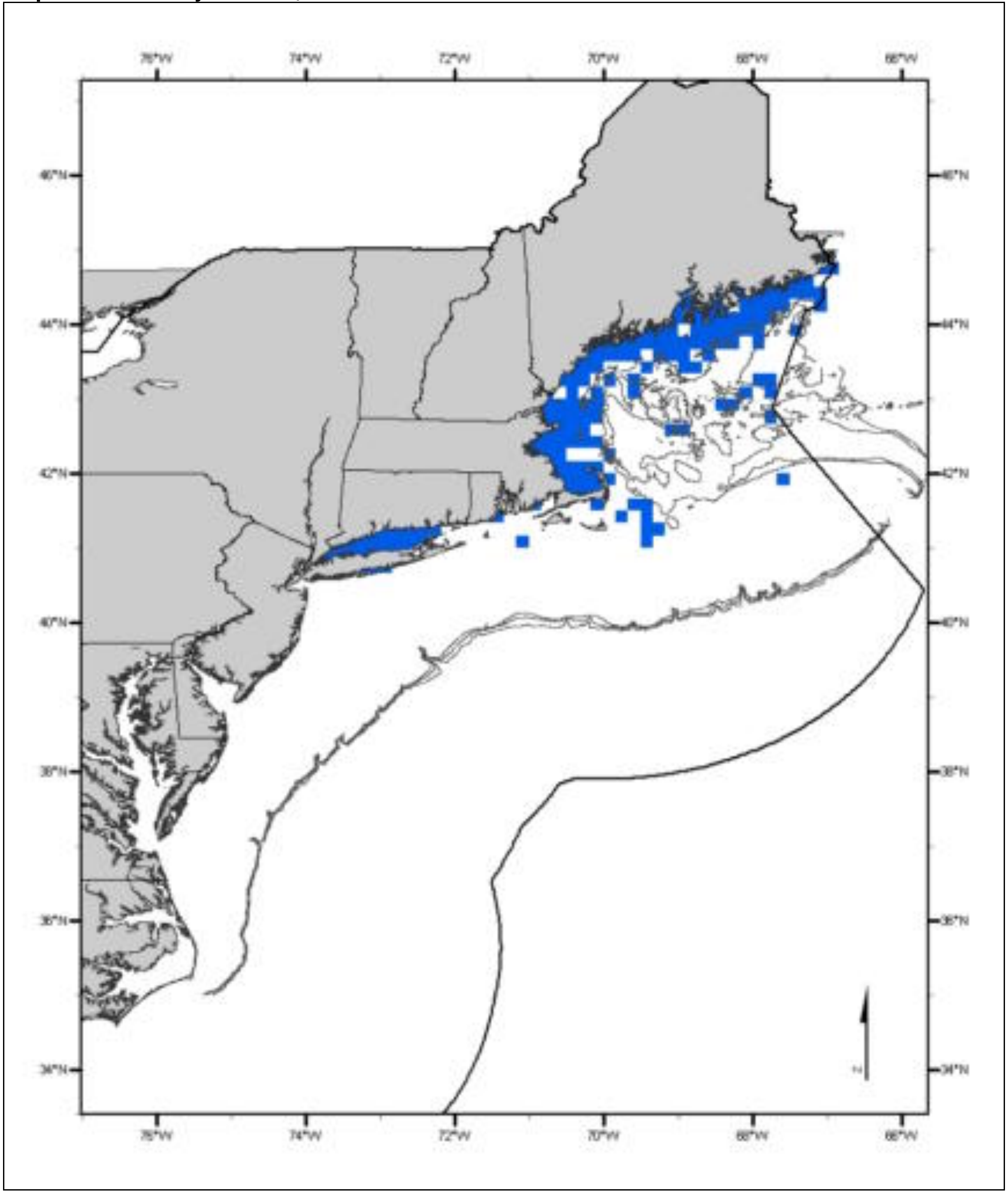
The Alternative 2A EFH designation for juvenile pollock on the continental shelf is based upon relative abundance during 1968-2005 in the fall and spring NMFS trawl survey at the 25% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where juvenile pollock were caught in state trawl surveys in more than 10% of the tows, as well as those bays and estuaries identified by the NOAA ELMR program where pollock juveniles were "common" or "abundant."

Map 194. Pollock juveniles, Alternative 2B



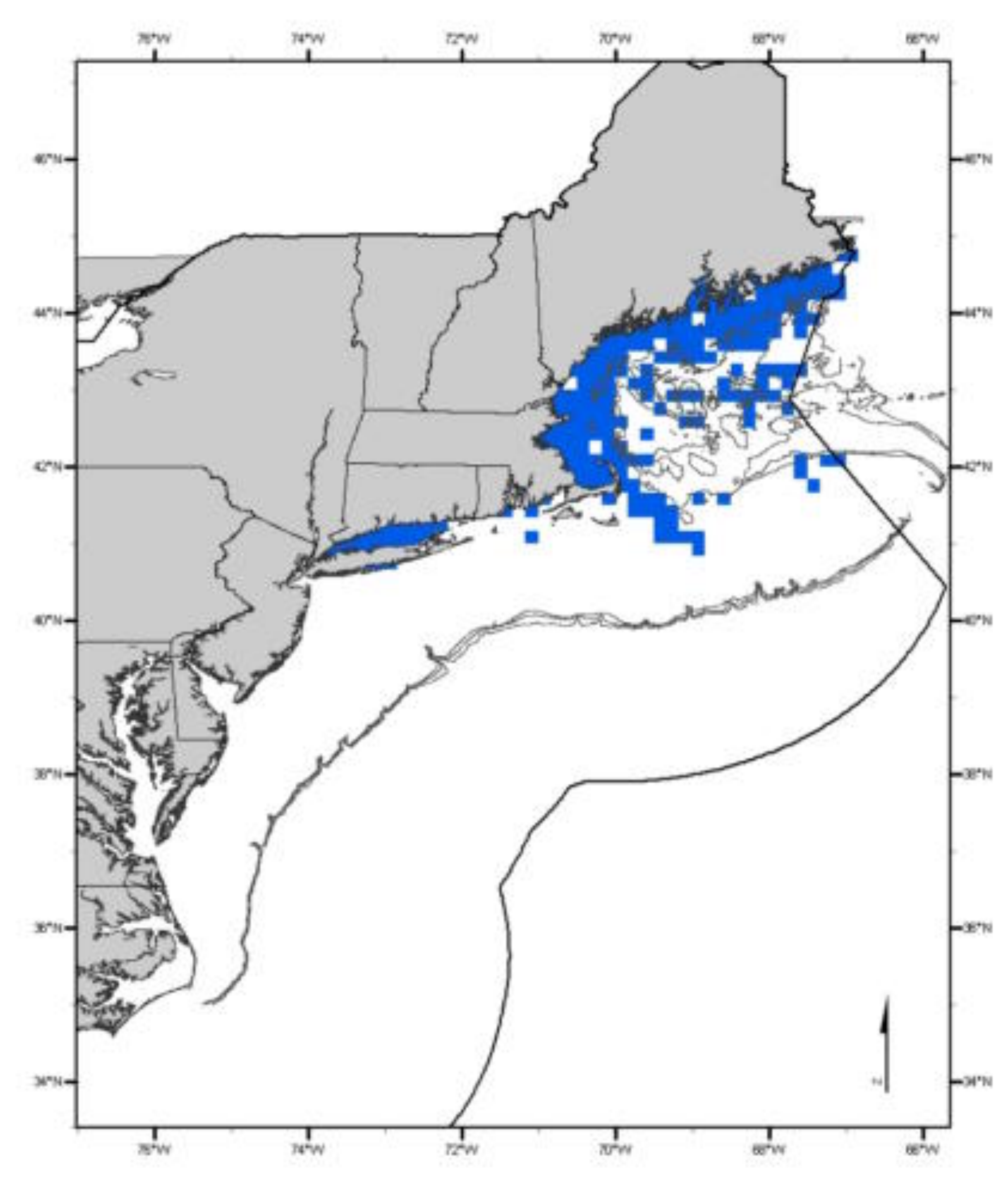
The Alternative 2B EFH designation for juvenile pollock on the continental shelf is based upon relative abundance during 1968-2005 in the fall and spring NMFS trawl survey at the 50% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where juvenile pollock were caught in state trawl surveys in more than 10% of the tows, as well as those bays and estuaries identified by the NOAA ELMR program where pollock juveniles were "common" or "abundant."

Map 195. Pollock juveniles, Alternative 2C



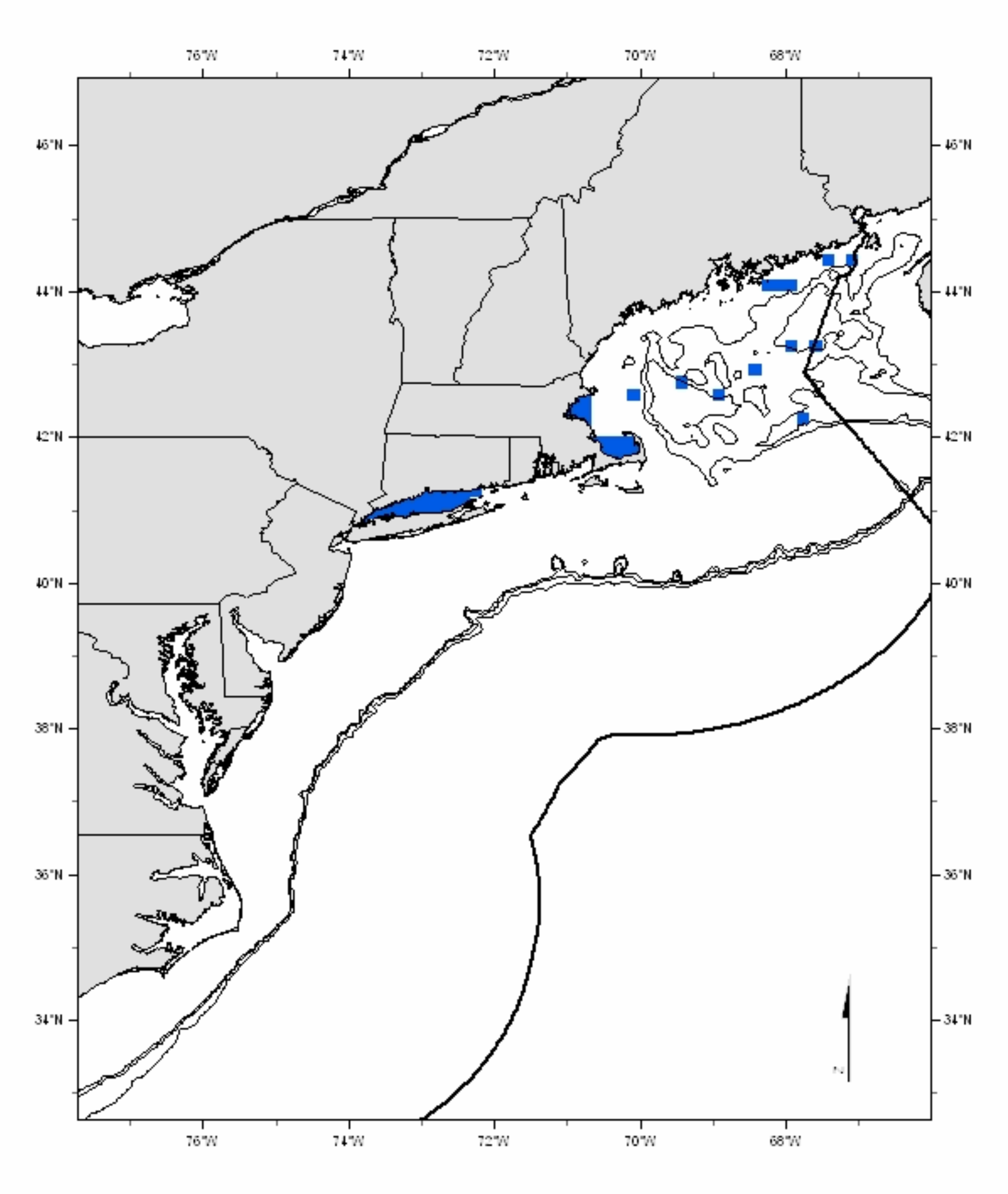
The Alternative 2C EFH designation for juvenile pollock on the continental shelf is based upon relative abundance during 1968-2005 in the fall and spring NMFS trawl survey at the 75% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where juvenile pollock were caught in state trawl surveys in more than 10% of the tows, as well as those bays and estuaries identified by the NOAA ELMR program where pollock juveniles were "common" or "abundant."

Map 196. Pollock juveniles, Alternative 2D



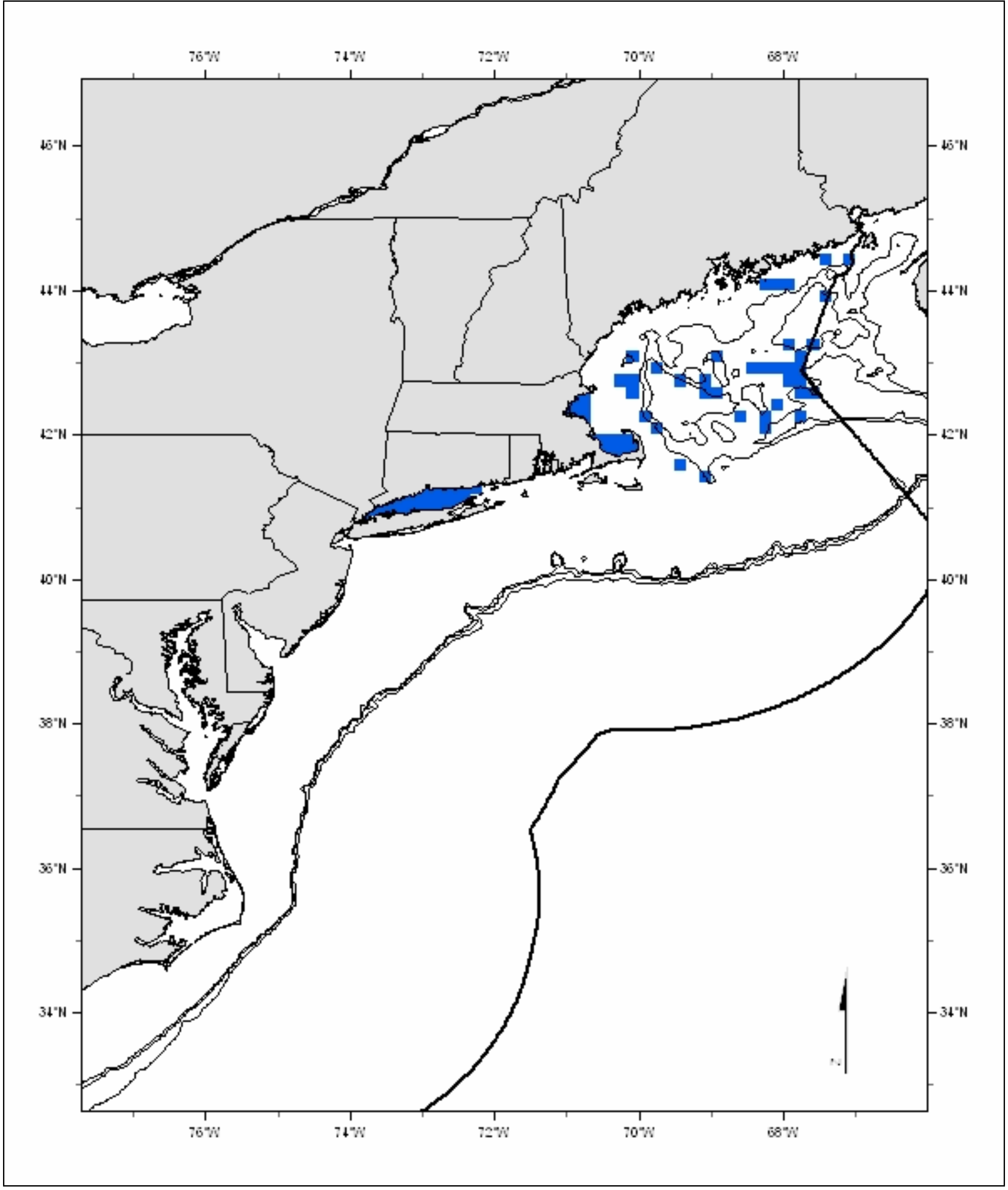
The Alternative 2D EFH designation for juvenile pollock on the continental shelf is based upon relative abundance during 1968-2005 in the fall and spring NMFS trawl survey at the 90% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where juvenile pollock were caught in state trawl surveys in more than 10% of the tows, as well as those bays and estuaries identified by the NOAA ELMR program where pollock juveniles were "common" or "abundant."

Map 197. Pollock adults, Alternative 2A



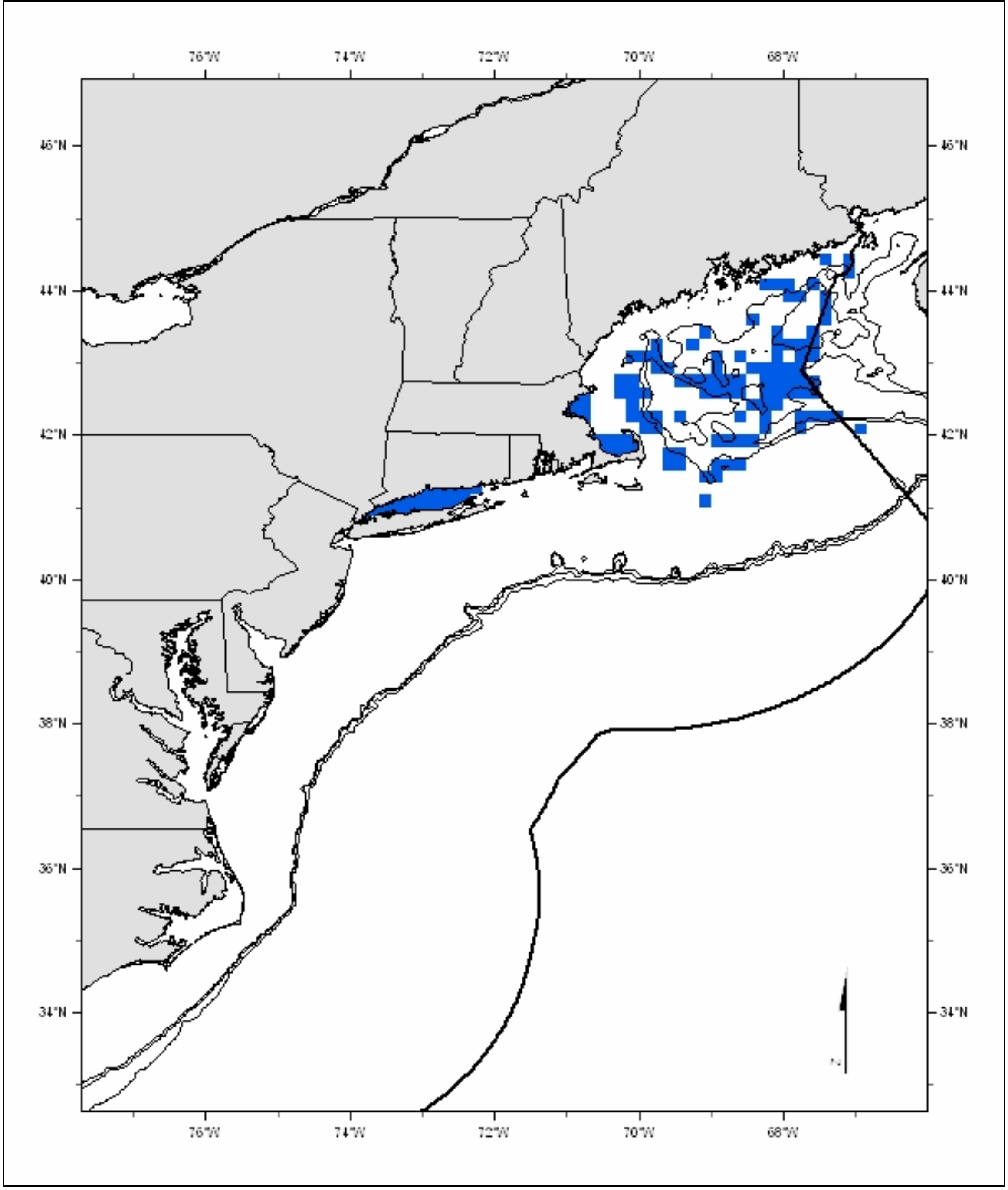
The Alternative 2A EFH designation for adult pollock on the continental shelf is based upon relative abundance during 1968-2005 in the fall and spring NMFS trawl survey at the 25% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where adult pollock were caught in state trawl surveys in more than 10% of the tows, as well as those bays and estuaries identified by the NOAA ELMR program where pollock adults were "common" or "abundant."

Map 198. Pollock adults, Alternative 2B



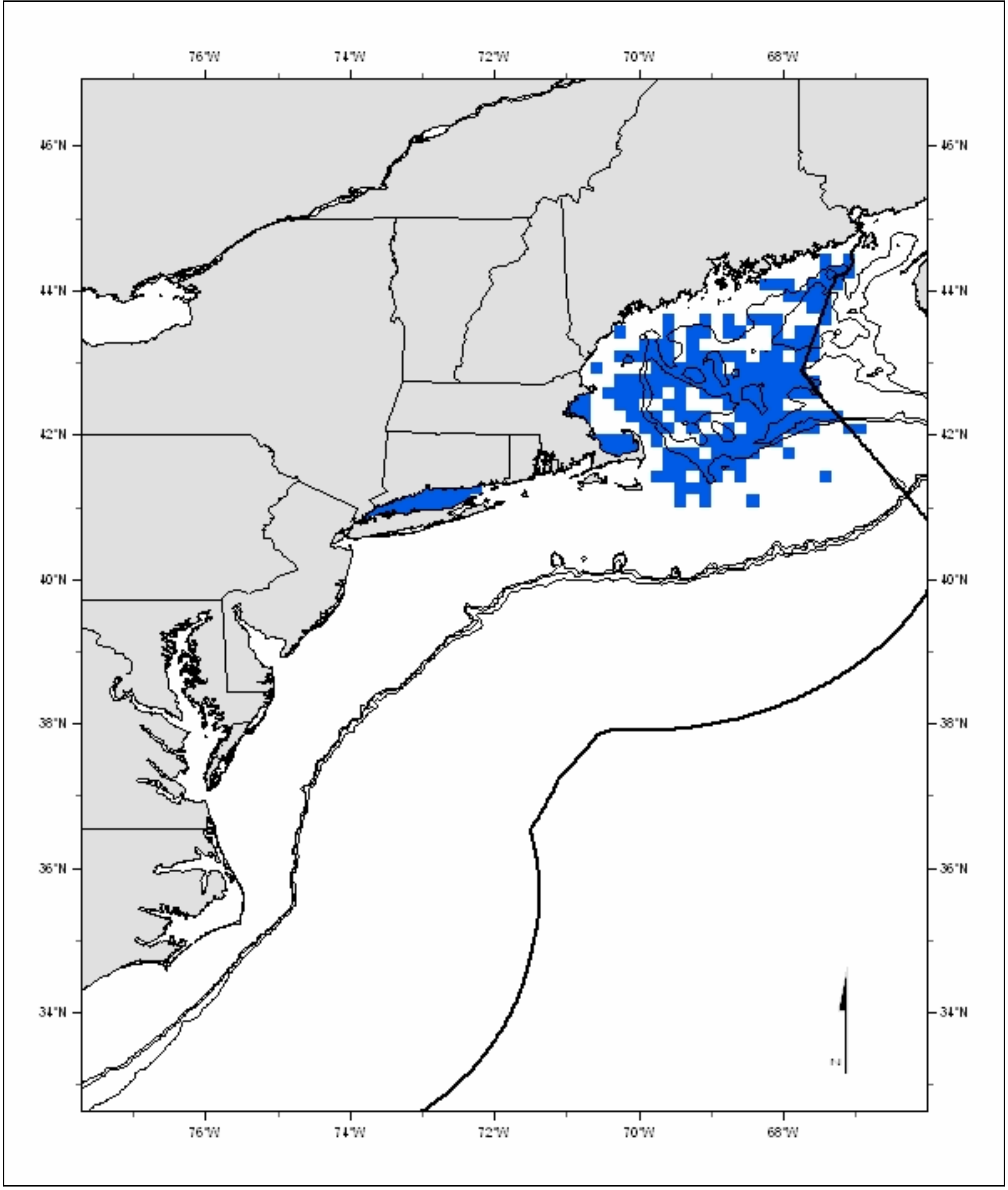
The Alternative 2B EFH designation for adult pollock on the continental shelf is based upon relative abundance during 1968-2005 in the fall and spring NMFS trawl survey at the 50% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where adult pollock were caught in state trawl surveys in more than 10% of the tows, as well as those bays and estuaries identified by the NOAA ELMR program where pollock adults were "common" or "abundant."

Map 199. Pollock adults, Alternative 2C



The Alternative 2C EFH designation for adult pollock on the continental shelf is based upon relative abundance during 1968-2005 in the fall and spring NMFS trawl survey at the 75% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where adult pollock were caught in state trawl surveys in more than 10% of the tows, as well as those bays and estuaries identified by the NOAA ELMR program where pollock adults were "common" or "abundant."

Map 200. Pollock adults, Alternative 2D



The Alternative 2D EFH designation for adult pollock on the continental shelf is based upon relative abundance during 1968-2005 in the fall and spring NMFS trawl survey at the 90% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where adult pollock were caught in state trawl surveys in more than 10% of the tows, as well as those bays and estuaries identified by the NOAA ELMR program where pollock adults were "common" or "abundant."

4.1.2.3.14 Red Hake

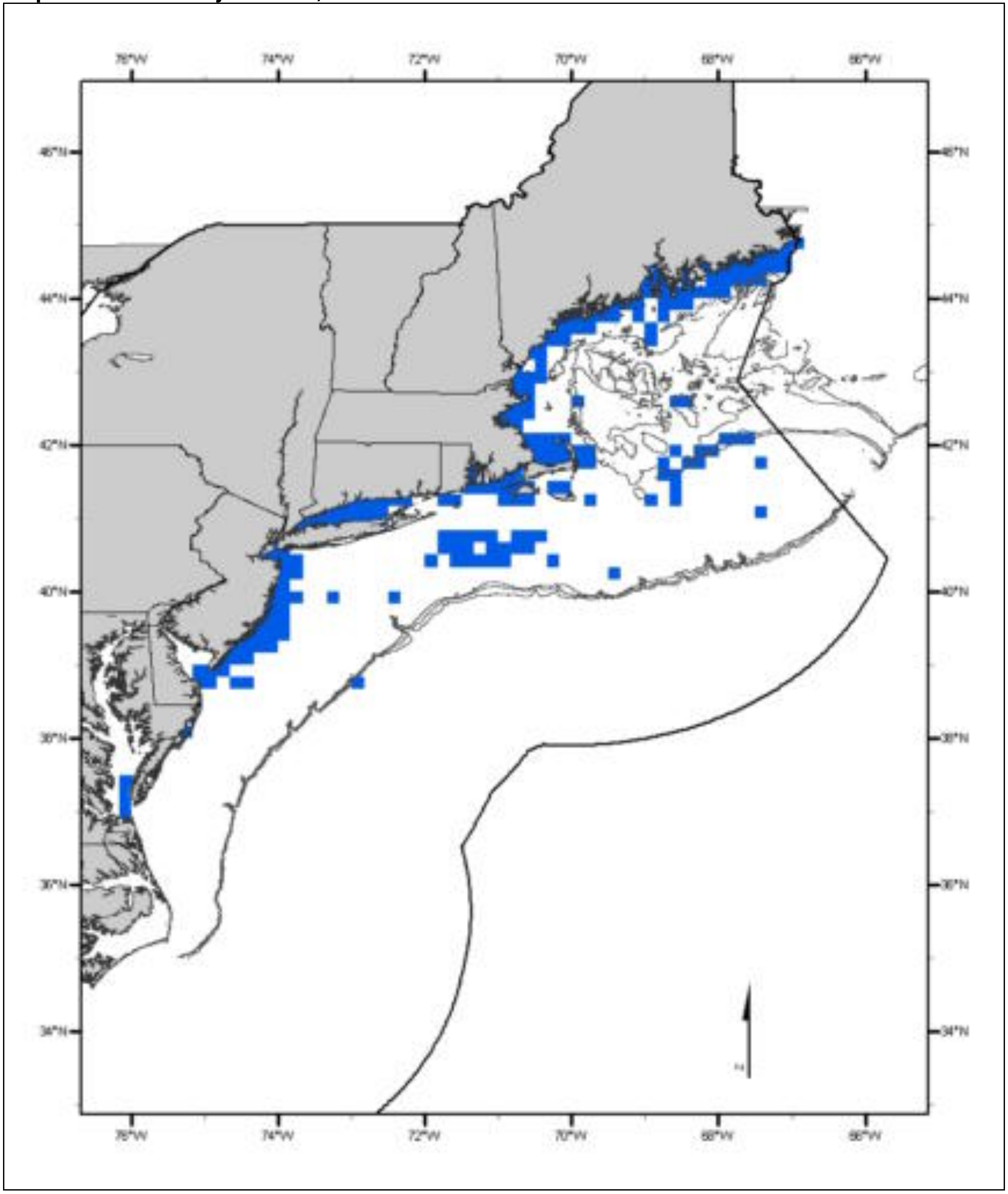
Eggs: No alternative EFH designation.

Larvae: No alternative EFH designation.

Juveniles: Estuarine, coastal marine, and continental shelf benthic habitats in depths of 1 – 80 meters, including the intertidal zone as depicted on Map 201 - Map 204. EFH for juvenile red hake includes mud, sand, and mud–sand substrates. EFH for YOY juveniles in coastal estuaries and embayments includes eelgrass and macroalgae. Shelter is critical for older juveniles (*e.g.*, shells, benthic epifauna, bottom depressions, and even inside live scallops). Other conditions that generally exist where EFH is found are bottom temperatures of 2.5 – 21.5ºC and salinities of 6.5 – 35.5 ppt. Once they settle to the bottom, juvenile red hake feed mostly on amphipods, a wide variety of decapods, fishes (*e.g.*, silver hake and sea robins), and polychaetes.

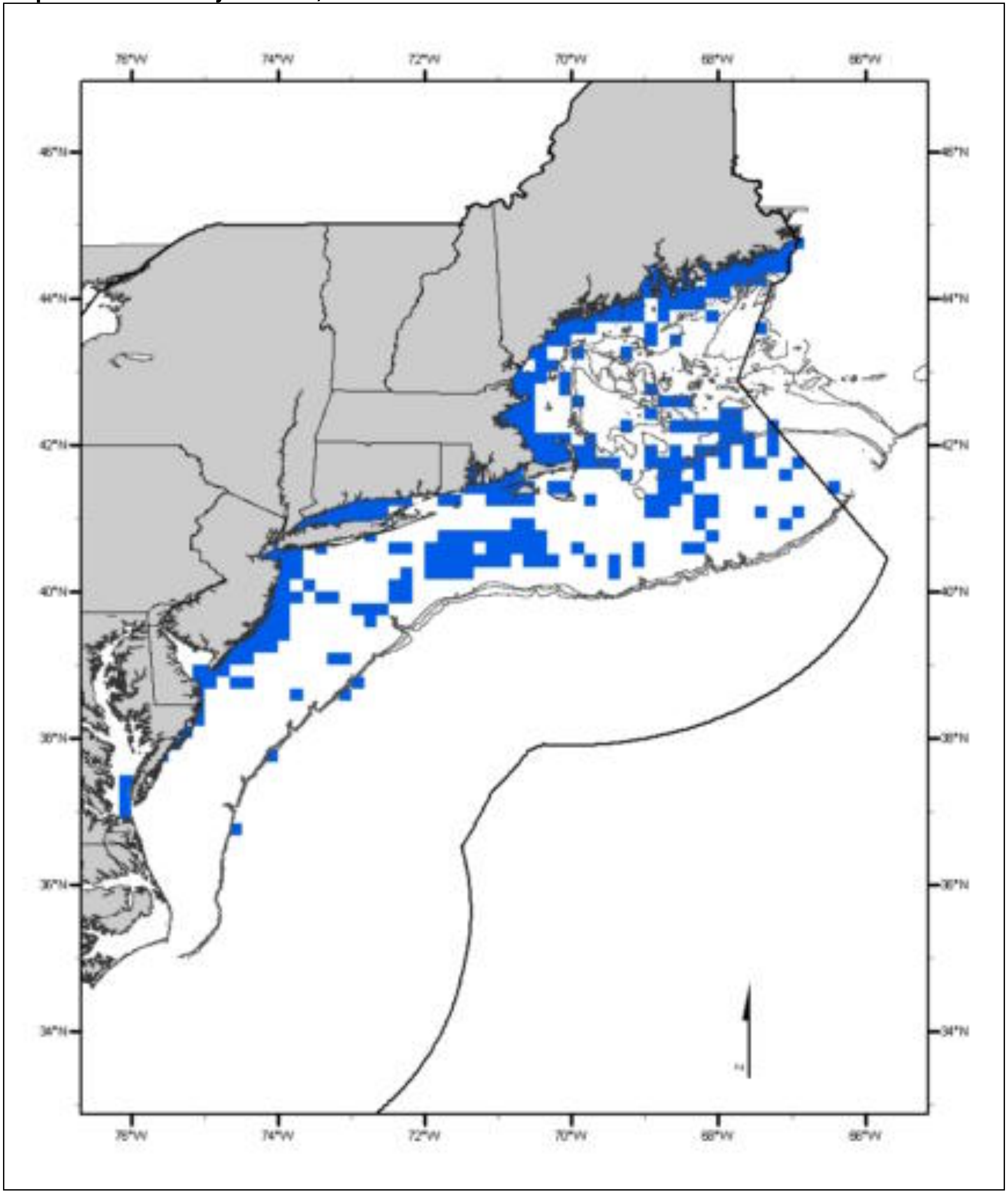
Adults: Coastal marine and continental shelf benthic habitats in depths of 20 – 300 meters as depicted on Map 205 - Map 208. EFH for adult red hake includes mud, sand, and mud–sand substrates, but they are most common on soft sediments or shell beds. Other conditions that generally exist where EFH is found are bottom temperatures of 4.5 – 12.5ºC and salinities of 23 – 34.5 ppt. Spawning generally occurs between temperatures of 5 and 10ºC. Adult red hake feed primarily on amphipods, bivalve mollusks, squids, and fishes (*e.g.*, sand lance, silver hake, clupeids, and gadids).

Map 201. Red hake juveniles, Alternative 2A



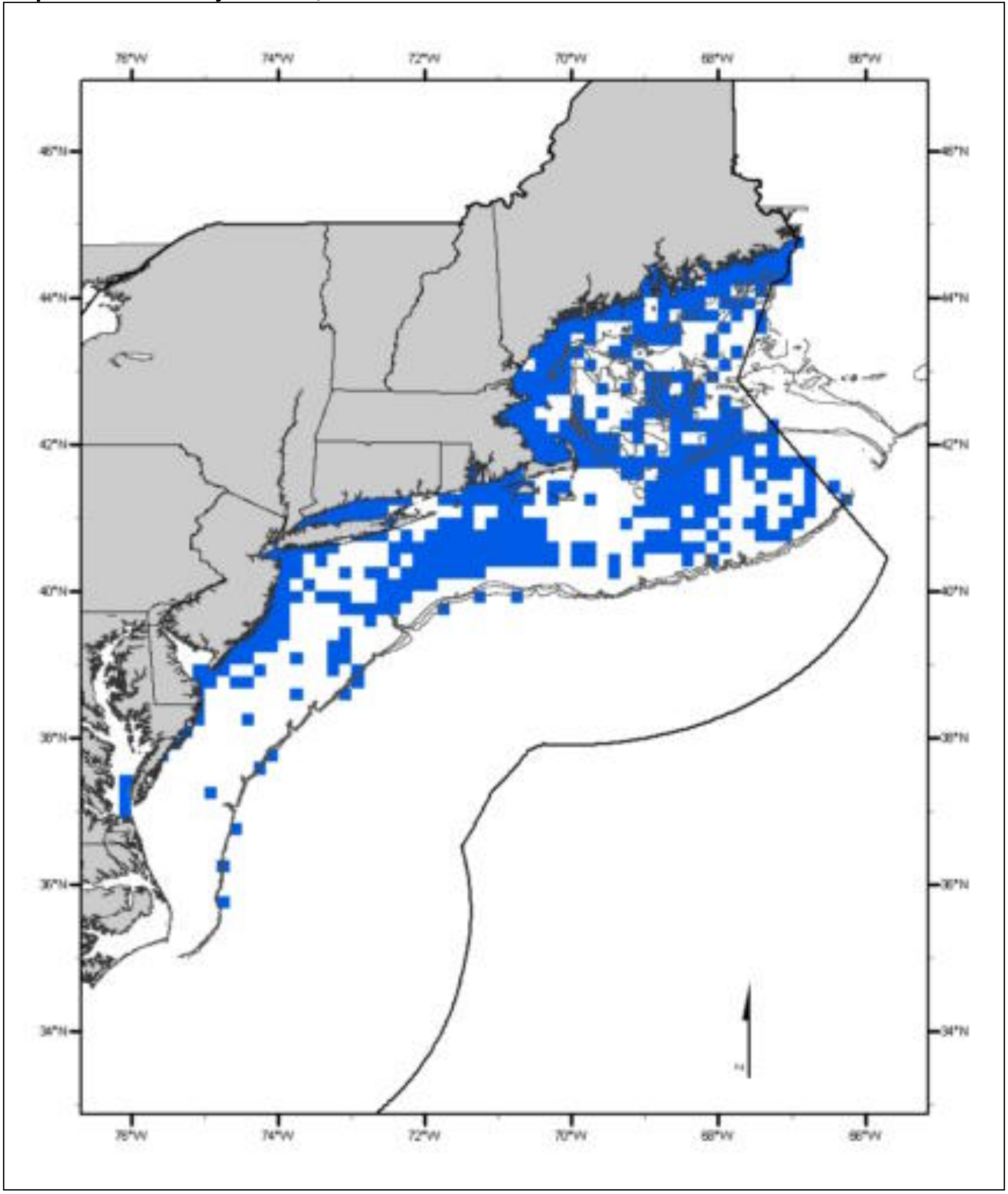
The Alternative 2A EFH designation for juvenile red hake on the continental shelf is based upon relative abundance during 1968-2005 in the fall and spring NMFS trawl survey at the 25% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where juvenile red hake were caught in state trawl surveys in more than 10% of the tows, as well as those bays and estuaries identified by the NOAA ELMR program where red hake juveniles were "common" or "abundant."

Map 202. Red hake juveniles, Alternative 2B



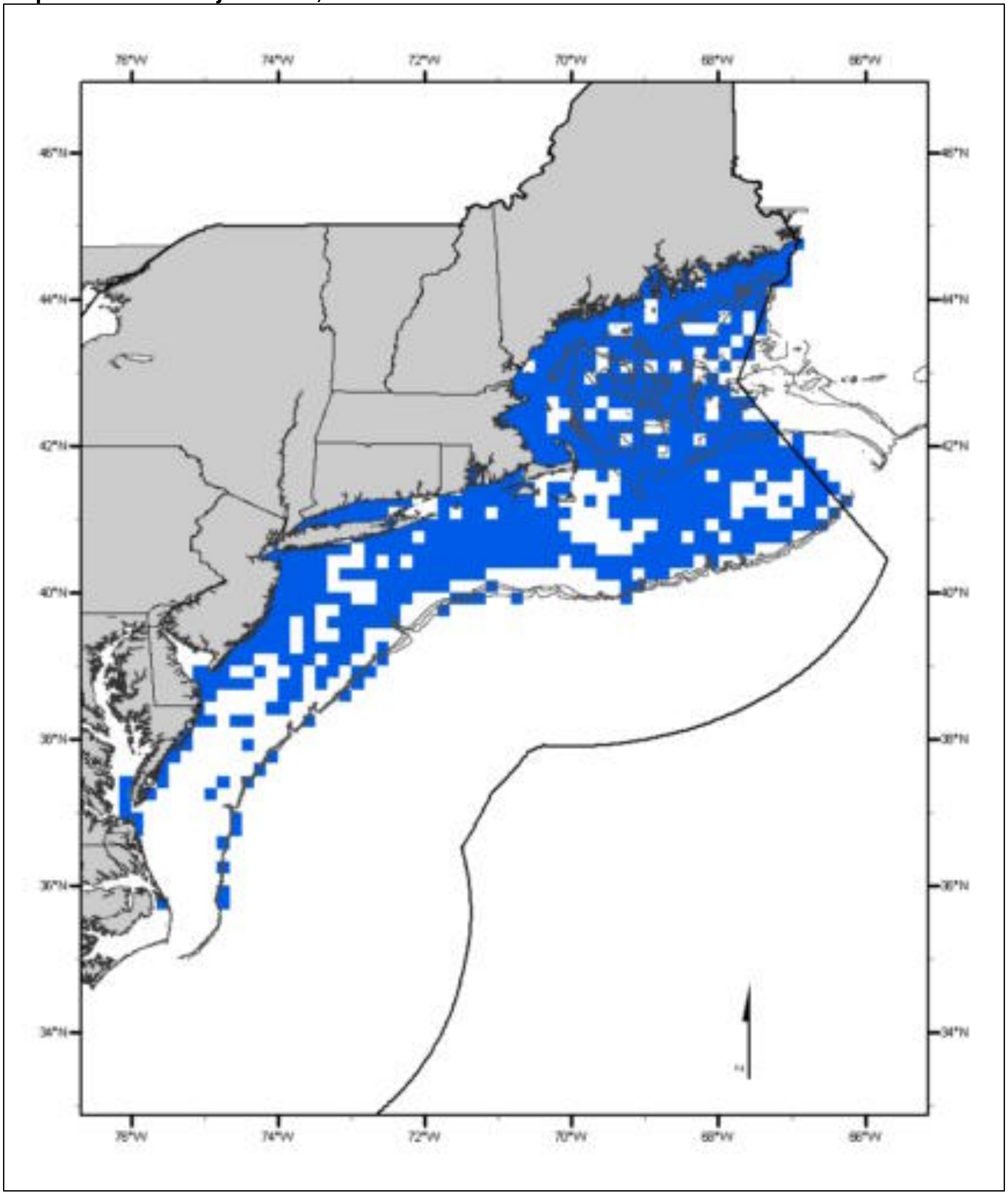
The Alternative 2B EFH designation for juvenile red hake on the continental shelf is based upon relative abundance during 1968-2005 in the fall and spring NMFS trawl survey at the 50% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where juvenile red hake were caught in state trawl surveys in more than 10% of the tows, as well as those bays and estuaries identified by the NOAA ELMR program where red hake juveniles were "common" or "abundant."

Map 203. Red hake juveniles, Alternative 2C



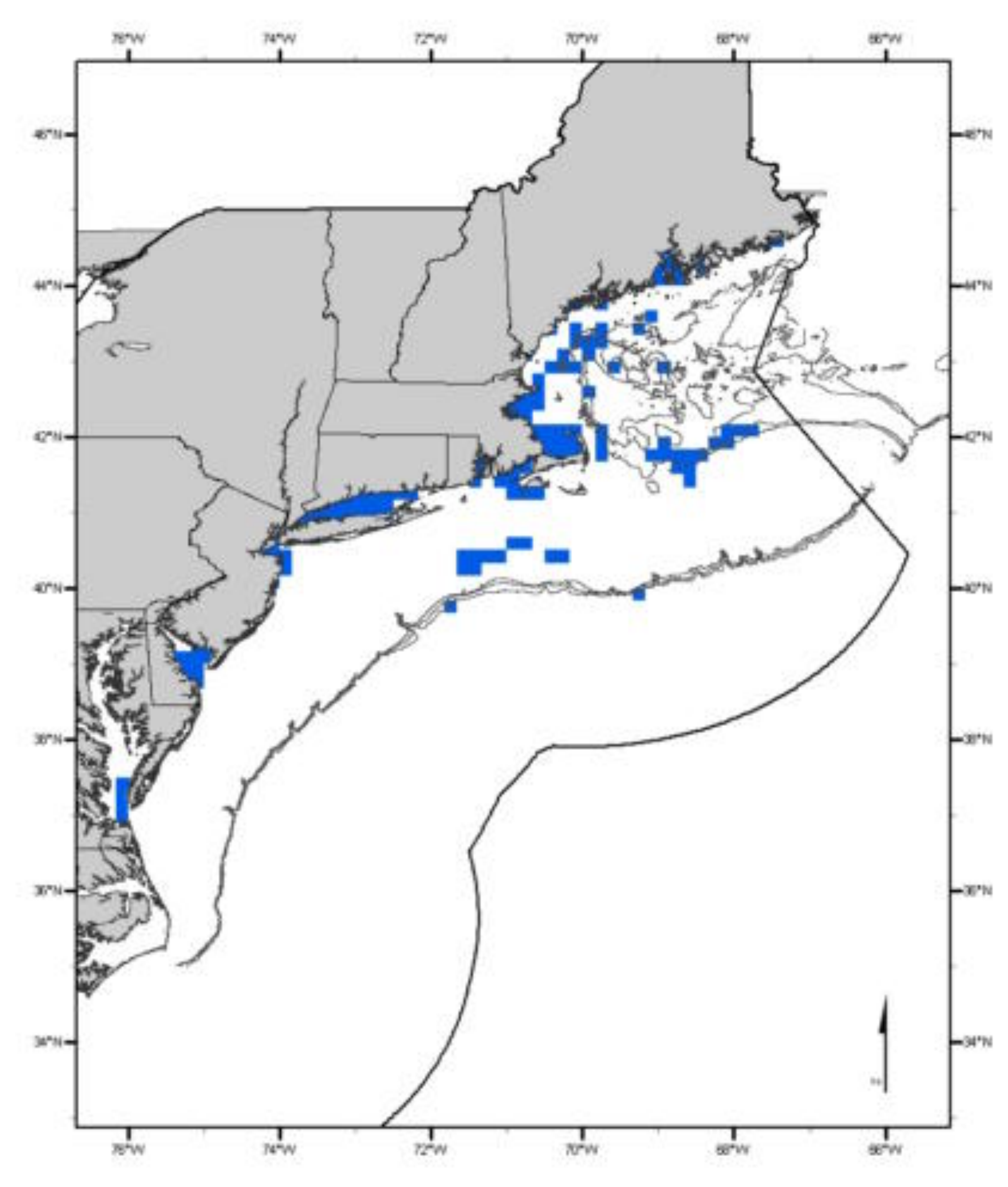
The Alternative 2C EFH designation for juvenile red hake on the continental shelf is based upon relative abundance during 1968-2005 in the fall and spring NMFS trawl survey at the 75% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where juvenile red hake were caught in state trawl surveys in more than 10% of the tows, as well as those bays and estuaries identified by the NOAA ELMR program where red hake juveniles were "common" or "abundant."

Map 204. Red hake juveniles, Alternative 2D



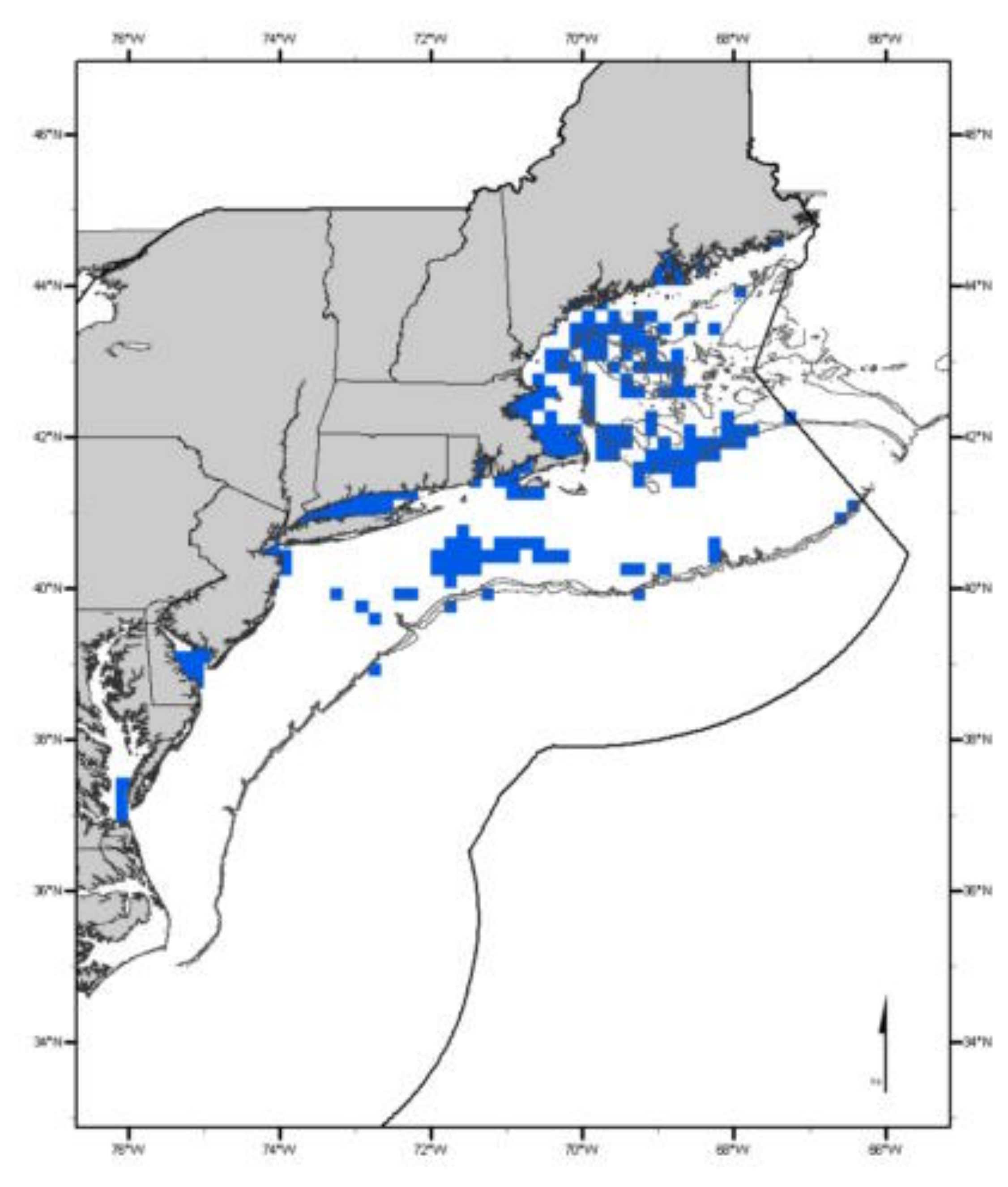
The Alternative 2D EFH designation for juvenile red hake on the continental shelf is based upon relative abundance during 1968-2005 in the fall and spring NMFS trawl survey at the 90% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where juvenile red hake were caught in state trawl surveys in more than 10% of the tows, as well as those bays and estuaries identified by the NOAA ELMR program where red hake juveniles were "common" or "abundant."

Map 205. Red hake adults, Alternative 2A



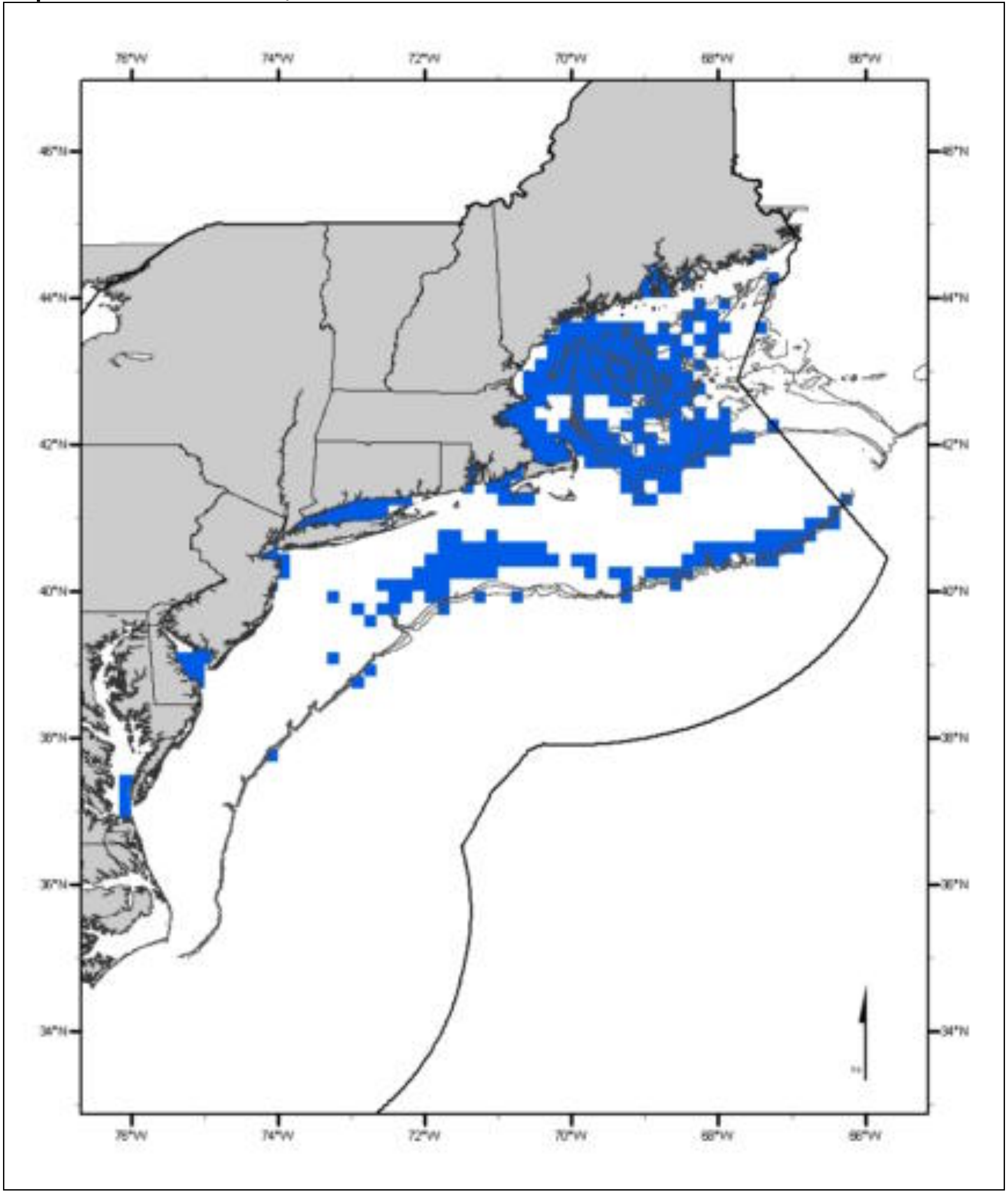
The Alternative 2A EFH designation for adult red hake on the continental shelf is based upon relative abundance during 1968-2005 in the fall and spring NMFS trawl survey at the 25% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where adult red hake were caught in state trawl surveys in more than 10% of the tows, as well as those bays and estuaries identified by the NOAA ELMR program where red hake adults were "common" or "abundant."

Map 206. Red hake adults, Alternative 2B



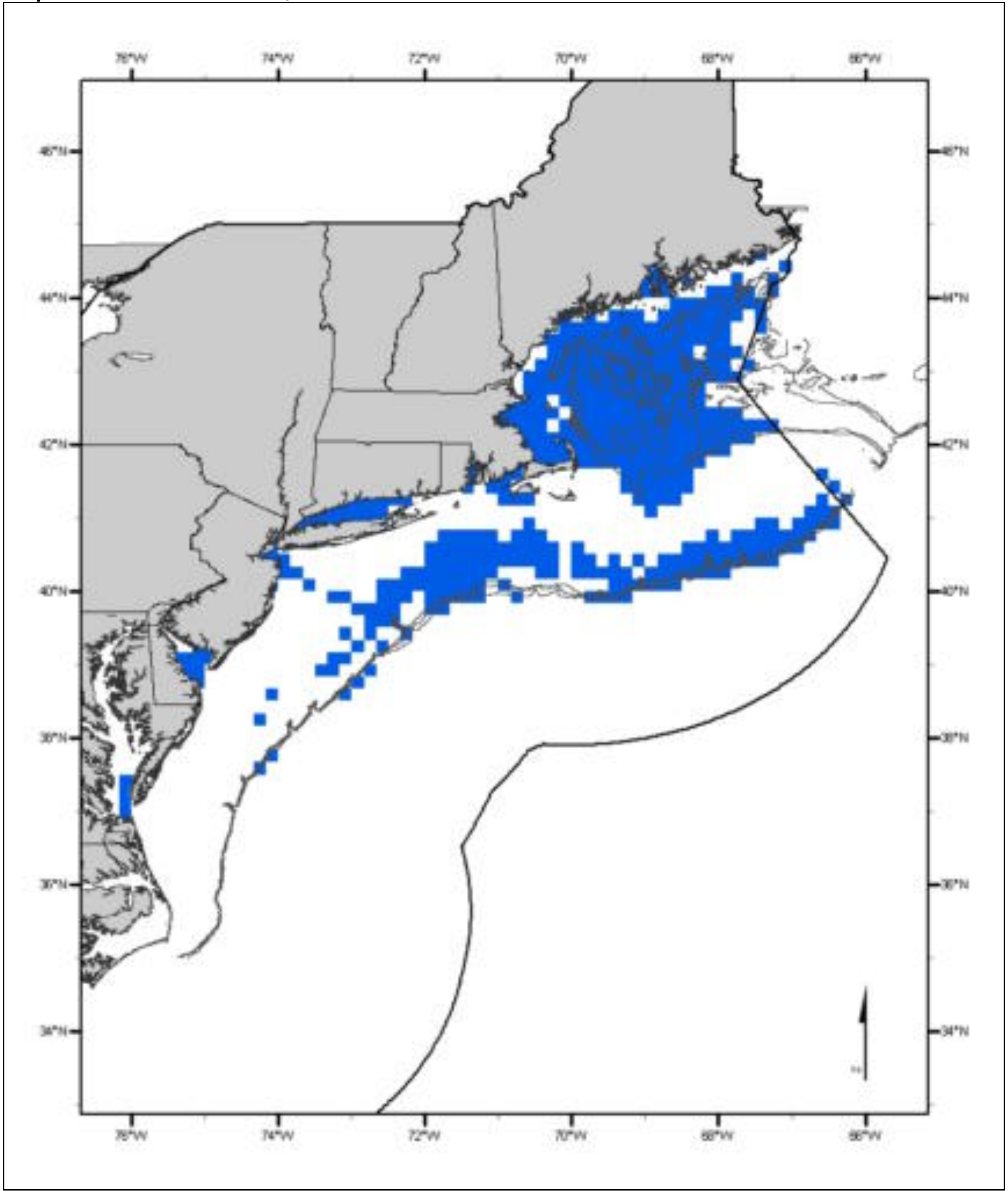
The Alternative 2B EFH designation for adult red hake on the continental shelf is based upon relative abundance during 1968-2005 in the fall and spring NMFS trawl survey at the 50% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where adult red hake were caught in state trawl surveys in more than 10% of the tows, as well as those bays and estuaries identified by the NOAA ELMR program where red hake adults were "common" or "abundant."

Map 207. Red hake adults, Alternative 2C



The Alternative 2C EFH designation for adult red hake on the continental shelf is based upon relative abundance during 1968-2005 in the fall and spring NMFS trawl survey at the 75% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where adult red hake were caught in state trawl surveys in more than 10% of the tows, as well as those bays and estuaries identified by the NOAA ELMR program where red hake adults were "common" or "abundant."

Map 208. Red hake adults, Alternative 2D



The Alternative 2D EFH designation for adult red hake on the continental shelf is based upon relative abundance during 1968-2005 in the fall and spring NMFS trawl survey at the 90% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where adult red hake were caught in state trawl surveys in more than 10% of the tows, as well as those bays and estuaries identified by the NOAA ELMR program where red hake adults were "common" or "abundant."

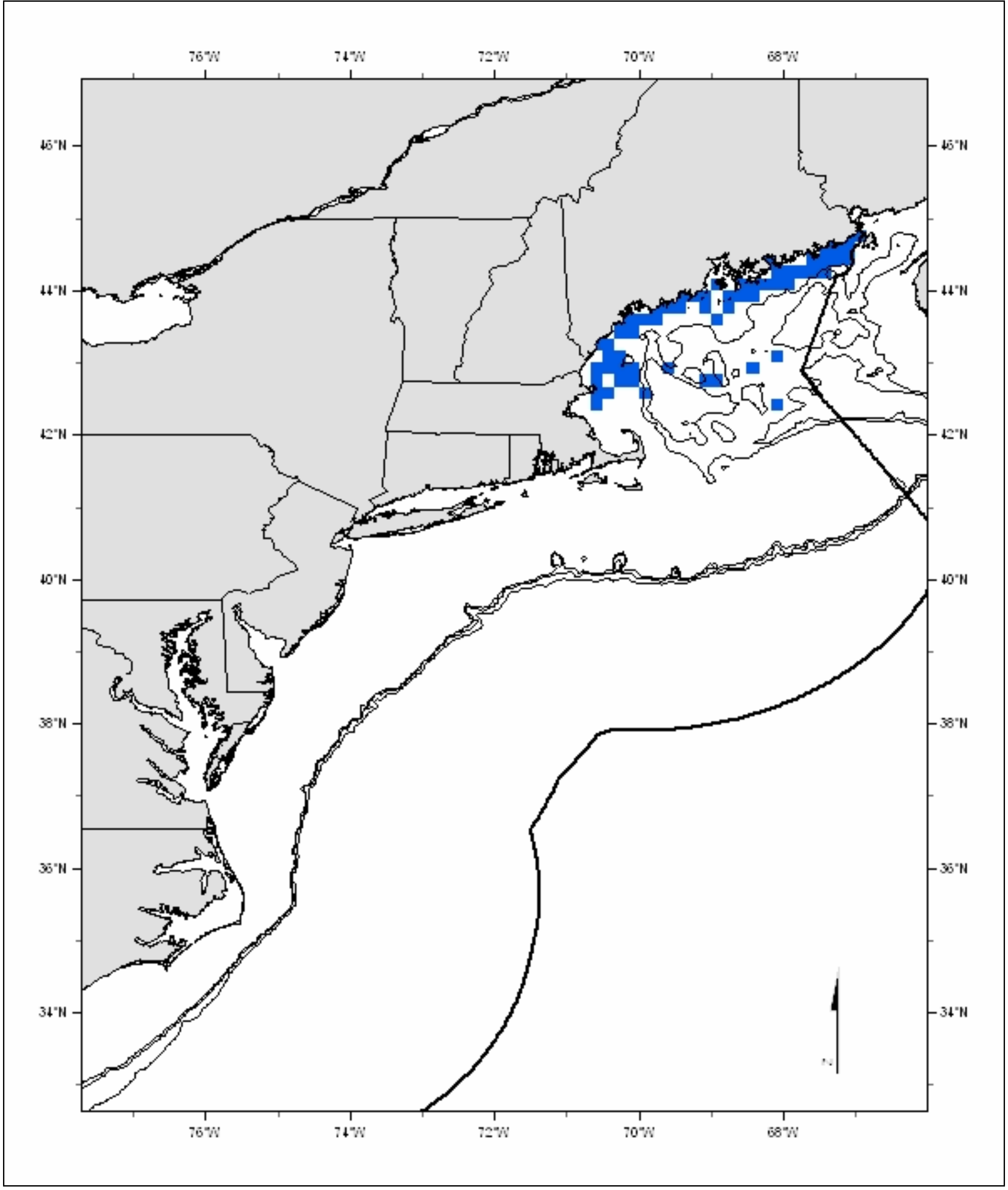
4.1.2.3.15 Redfish

Larvae: No alternative EFH designation.

Juveniles: No alternative EFH designation.

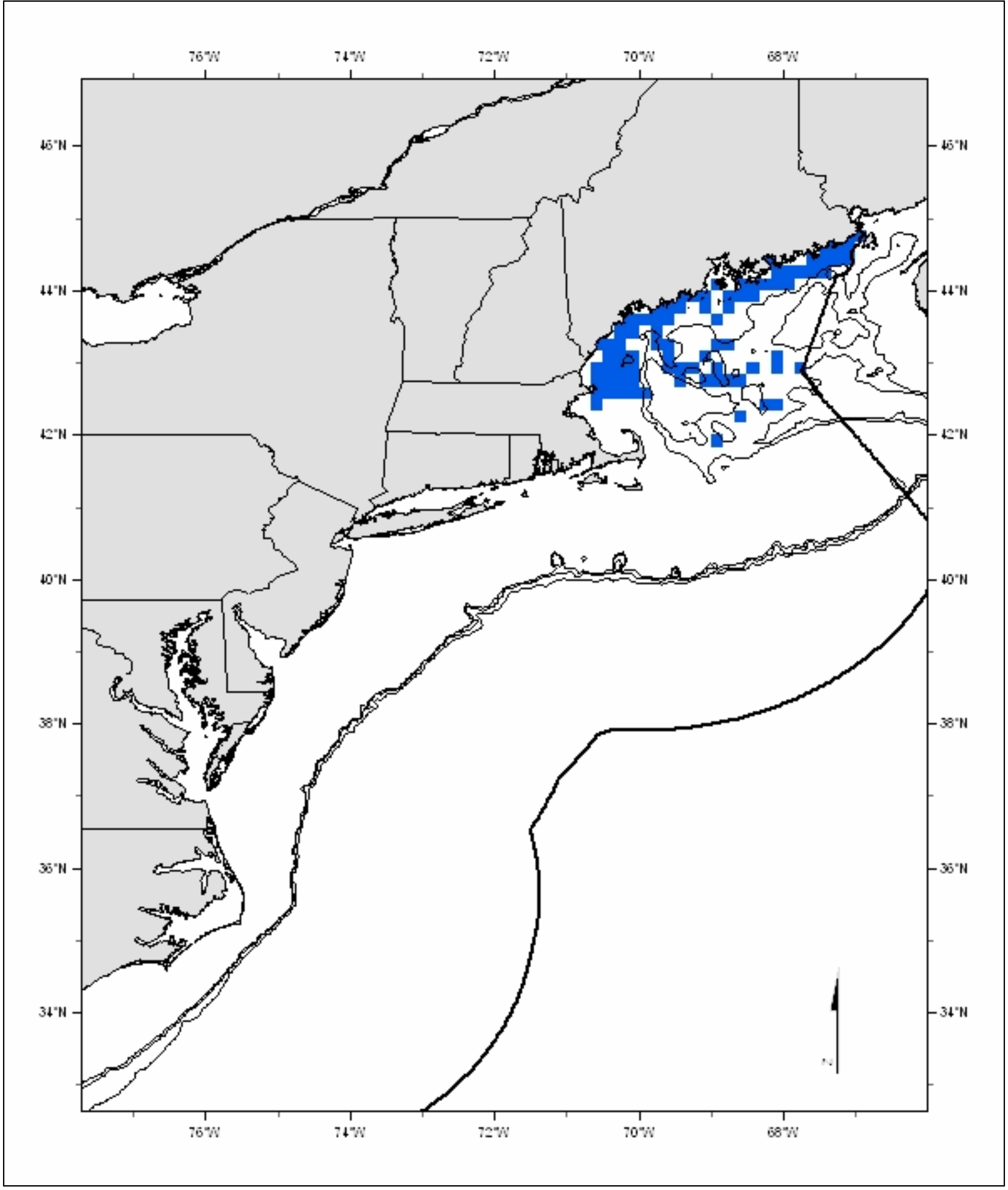
Adults: Benthic habitats on the continental shelf in depths of 140 – 200 meters as depicted on Map 213 - Map 216. EFH for adult redfish includes a wide variety of bottom types, but is primarily found on muddy, rocky substrates which support the growth of deep–water corals and other structure–forming sedentary epifauna such as sponges. Other conditions that generally exist where EFH is found are bottom temperatures of 3.5 – 9.5ºC and salinities of 32.5 – 34.5 ppt. Adult redfish feed primarily on euphausiids, amphipods, other crustaceans (*e.g.*, pandalid and sand shrimps), and fishes (*e.g.*, silver hake).

Map 209. Redfish juveniles, Alternative 2A



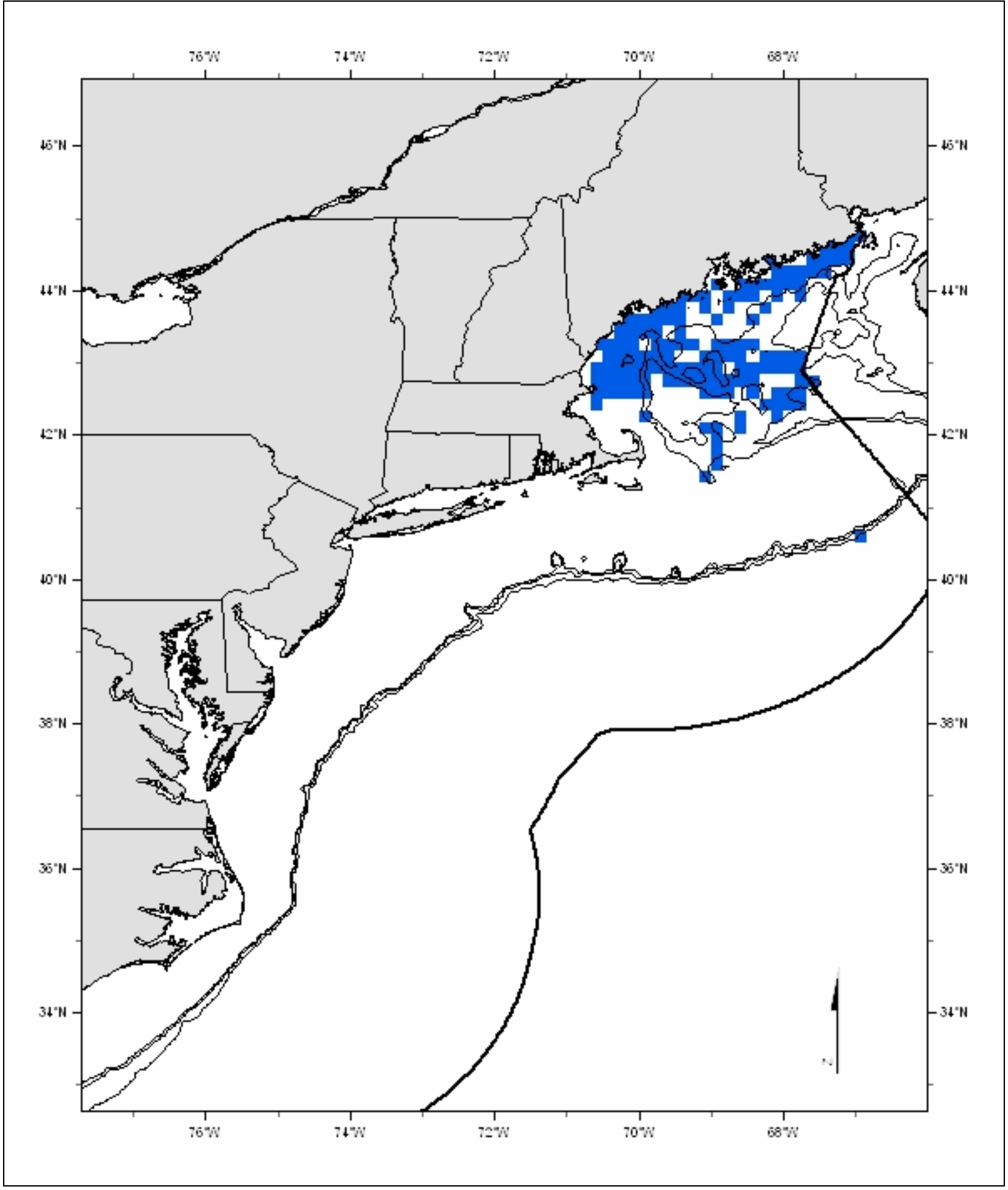
The Alternative 2A EFH designation for juvenile redfish on the continental shelf is based upon relative abundance during 1968-2005 in the fall and spring NMFS trawl survey at the 25% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where juvenile redfish were caught in state trawl surveys in more than 10% of the tows.

Map 210. Redfish juveniles, Alternative 2B



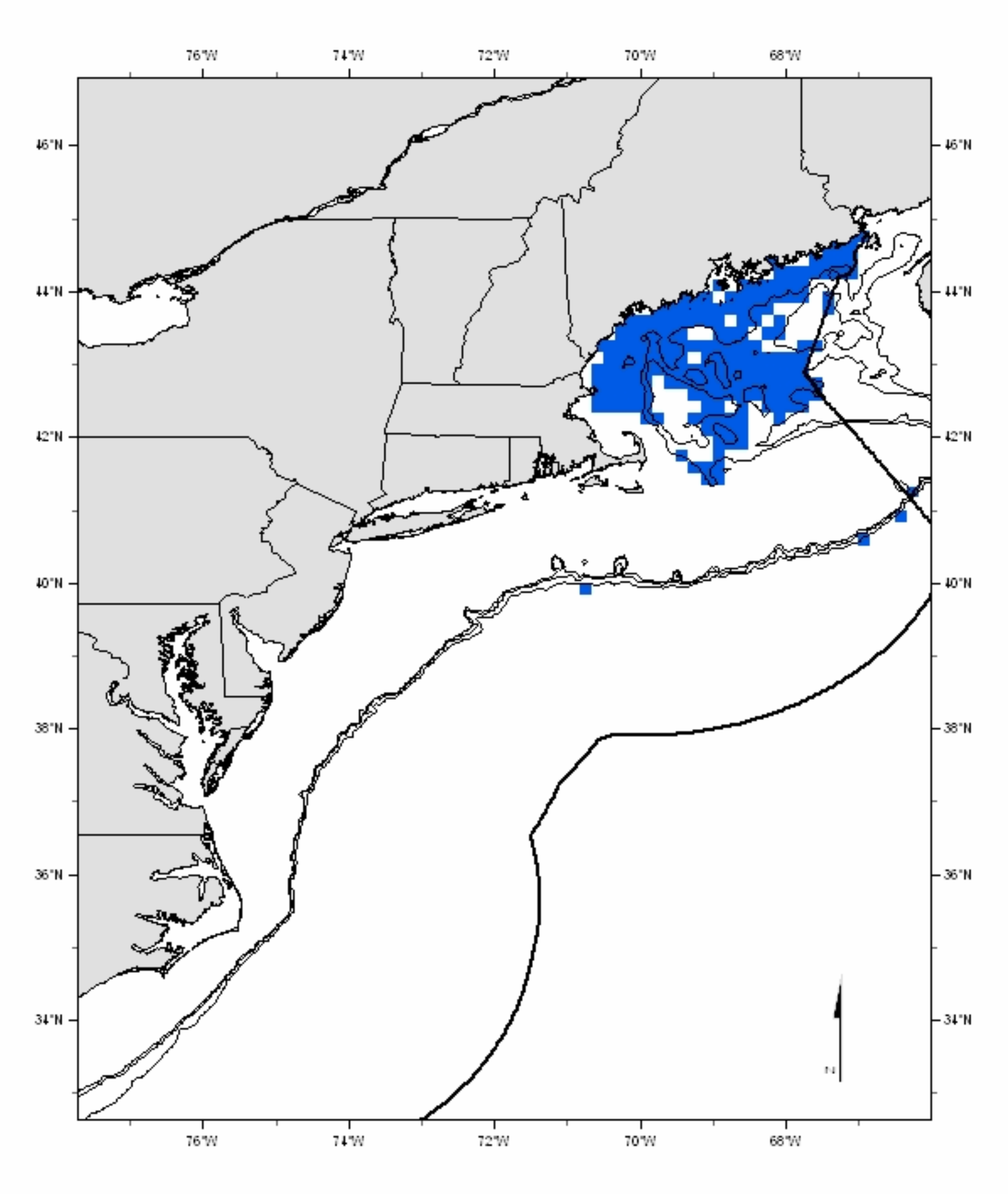
The Alternative 2B EFH designation for juvenile redfish on the continental shelf is based upon relative abundance during 1968-2005 in the fall and spring NMFS trawl survey at the 50% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where juvenile redfish were caught in state trawl surveys in more than 10% of the tows.

Map 211. Redfish juveniles, Alternative 2C



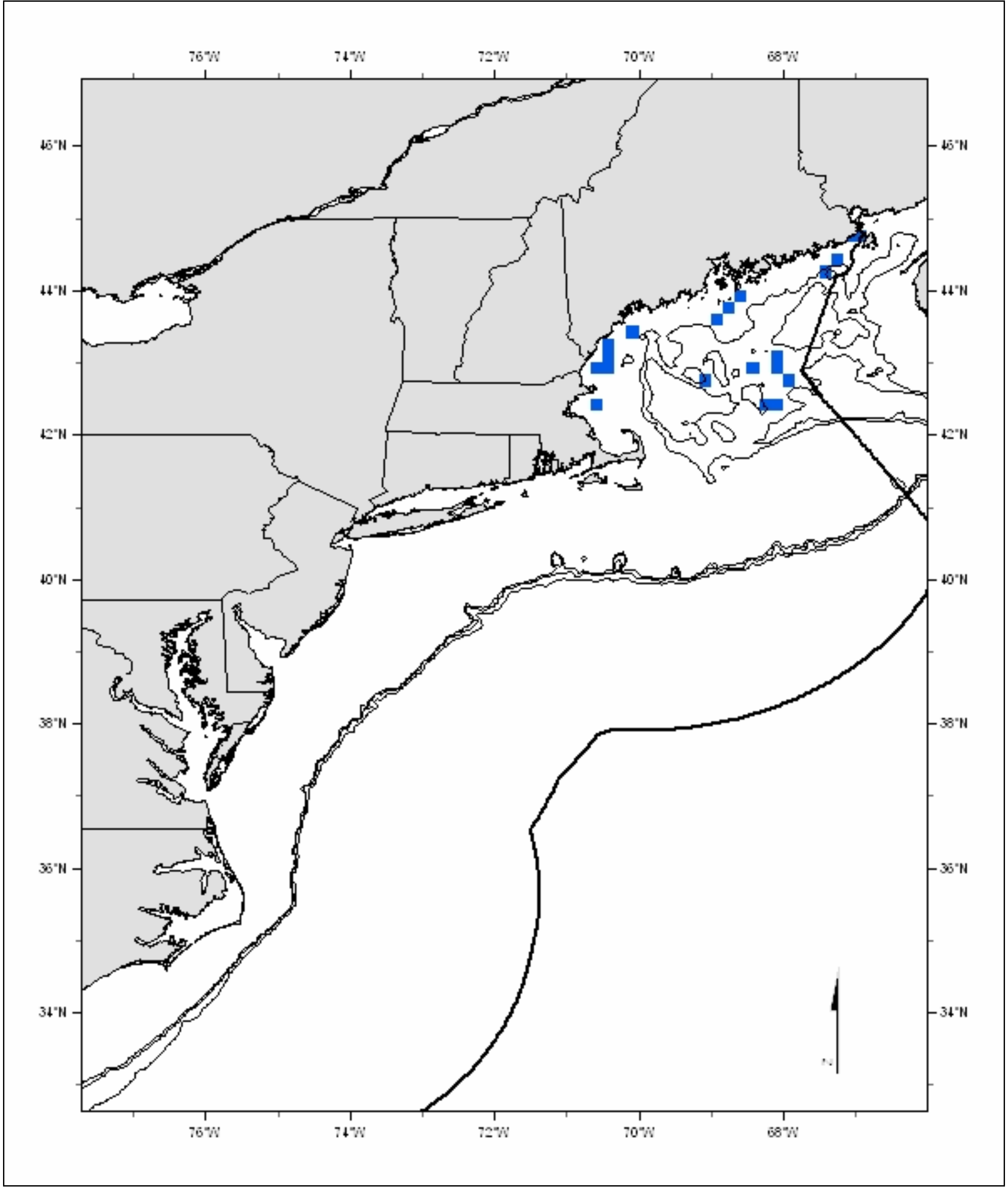
The Alternative 2C EFH designation for juvenile redfish on the continental shelf is based upon relative abundance during 1968-2005 in the fall and spring NMFS trawl survey at the 75% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where juvenile redfish were caught in state trawl surveys in more than 10% of the tows.

Map 212. Redfish juveniles, Alternative 2D



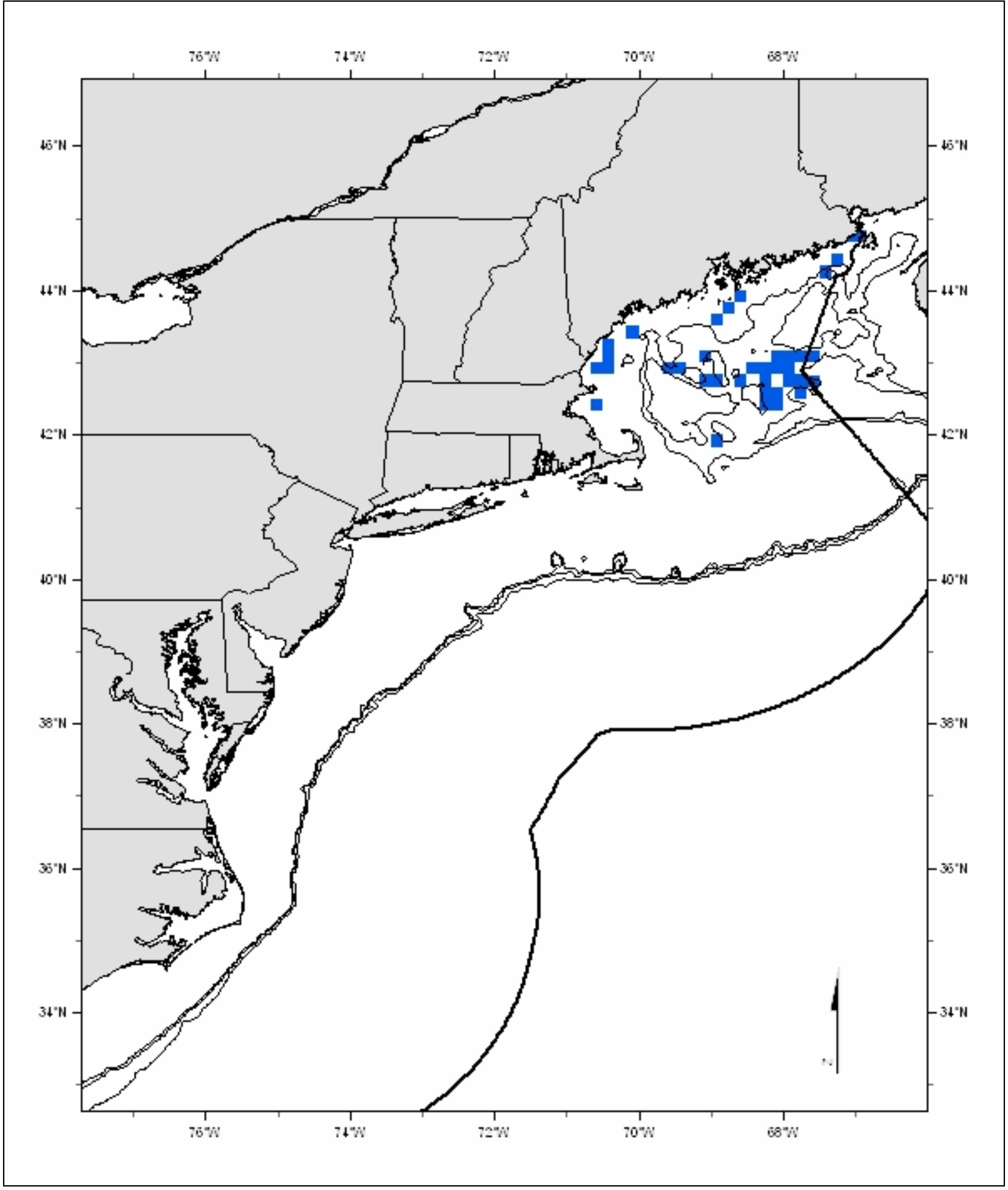
The Alternative 2D EFH designation for juvenile redfish on the continental shelf is based upon relative abundance during 1968-2005 in the fall and spring NMFS trawl survey at the 90% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where juvenile redfish were caught in state trawl surveys in more than 10% of the tows.

Map 213. Redfish adults, Alternative 2A



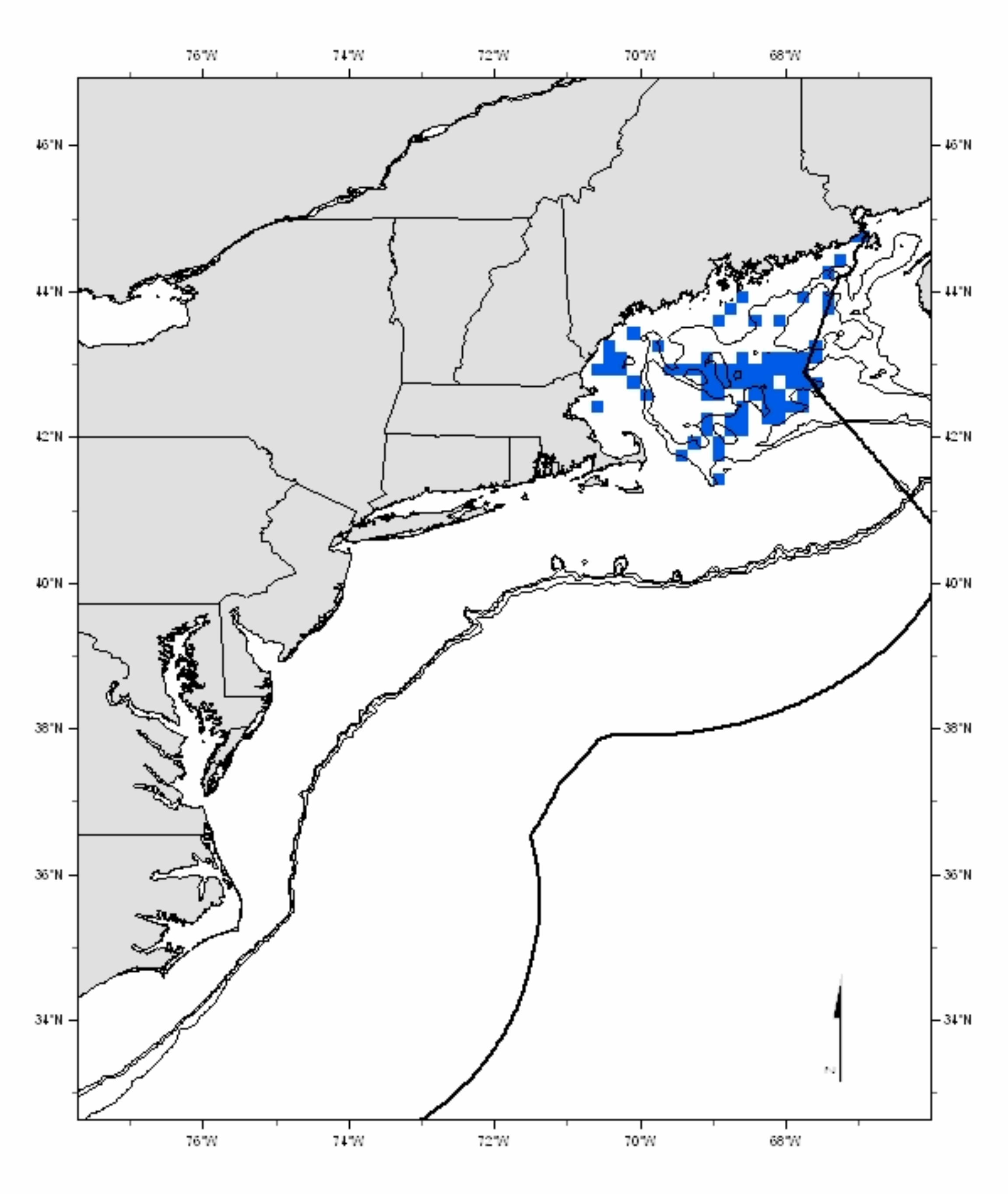
The Alternative 2A EFH designation for adult redfish on the continental shelf is based upon relative abundance during 1968-2005 in the fall and spring NMFS trawl survey at the 25% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where adult redfish were caught in state trawl surveys in more than 10% of the tows.

Map 214. Redfish adults, Alternative 2B



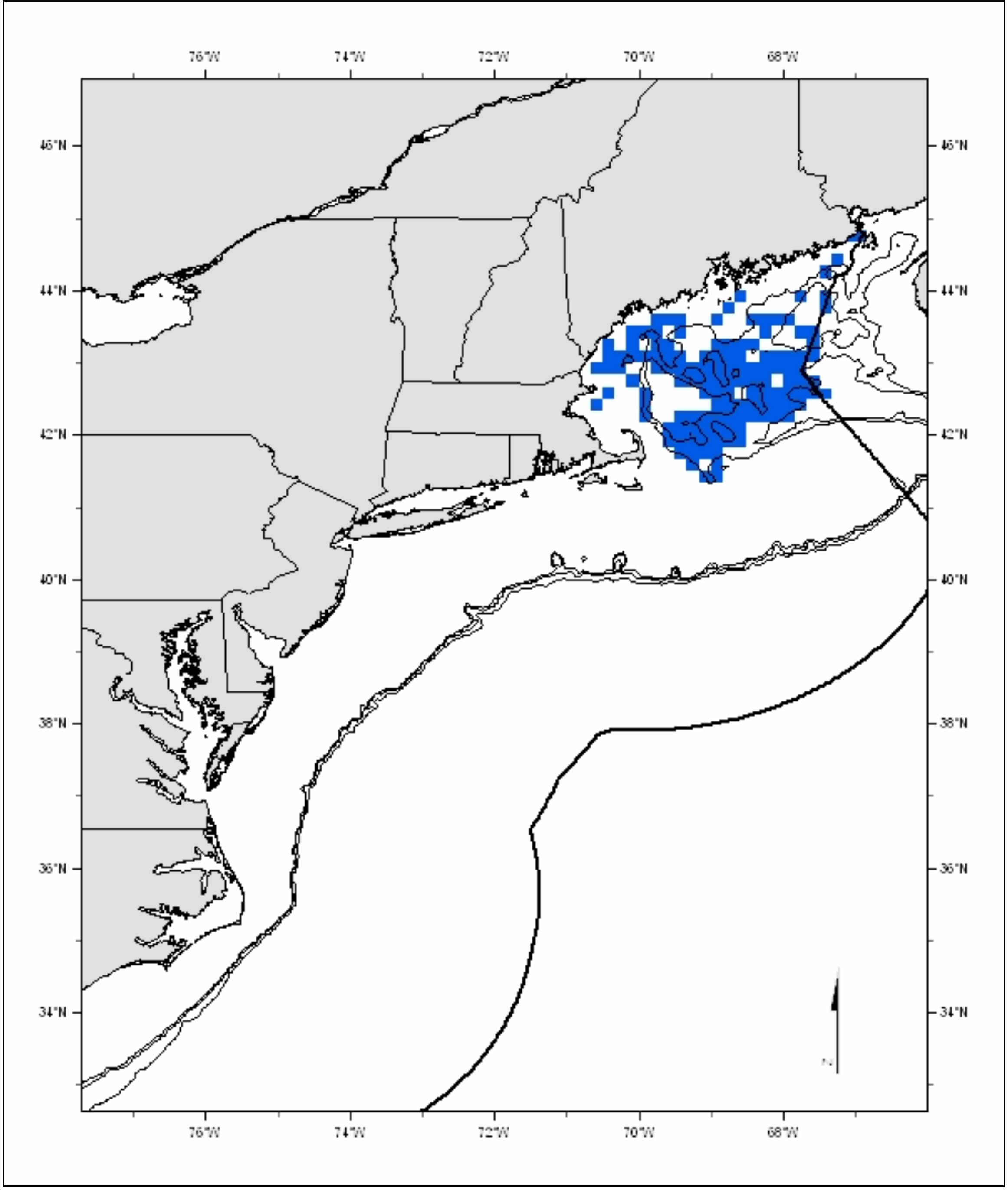
The Alternative 2B EFH designation for adult redfish on the continental shelf is based upon relative abundance during 1968-2005 in the fall and spring NMFS trawl survey at the 50% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where adult redfish were caught in state trawl surveys in more than 10% of the tows.

Map 215. Redfish adults, Alternative 2C



The Alternative 2C EFH designation for adult redfish on the continental shelf is based upon relative abundance during 1968-2005 in the fall and spring NMFS trawl survey at the 75% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where adult redfish were caught in state trawl surveys in more than 10% of the tows.

Map 216. Redfish adults, Alternative 2D



The Alternative 2D EFH designation for adult redfish on the continental shelf is based upon relative abundance during 1968-2005 in the fall and spring NMFS trawl survey at the 90% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where adult redfish were caught in state trawl surveys in more than 10% of the tows.

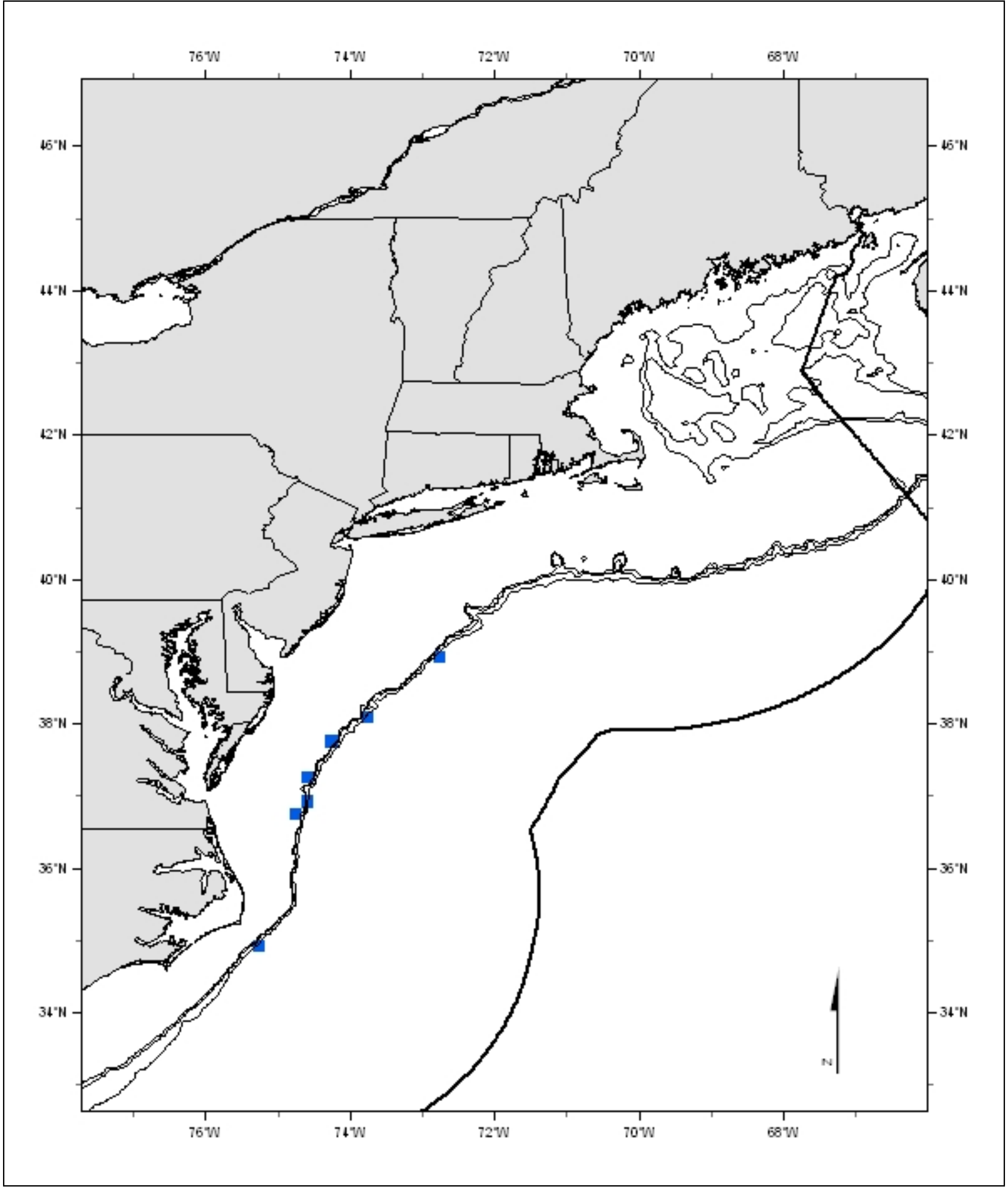
4.1.2.3.16 Rosette Skate

Eggs: There is no information available on the habitat associations or distribution of the egg stage for this species.

Larvae: No larval life stage exists for this species. Upon hatching, they are fully developed juveniles.

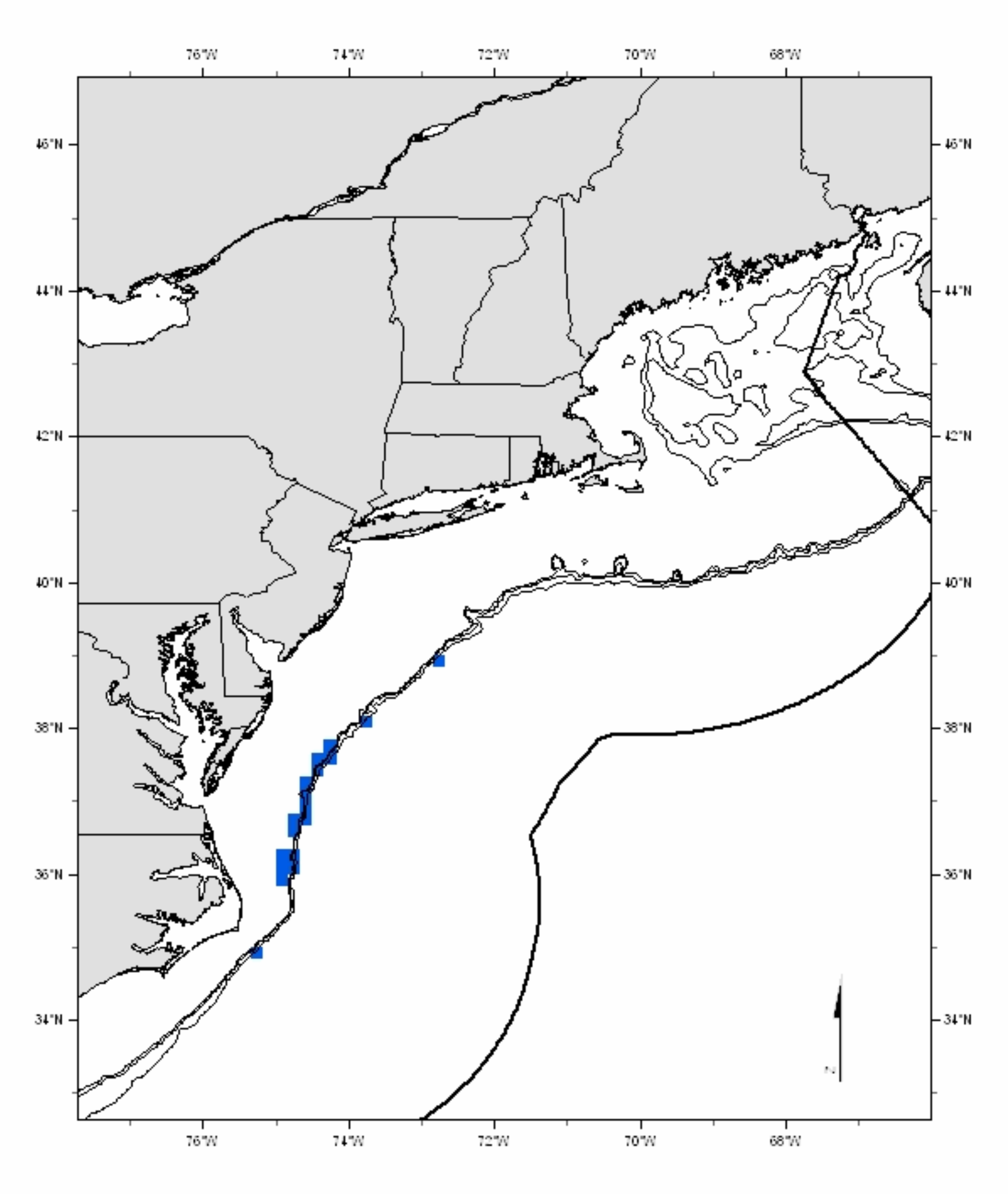
Juveniles and Adults: Continental shelf benthic habitats in depths of 70 – 300 meters with substrates composed of mud and sand, sometimes mixed with gravel as depicted on Map 217 - Map 220. Other conditions that generally exist where EFH for juvenile and adult rosette skate is found are bottom temperatures of 9.5 – 17.5ºC and salinities of 34.5 – 36.5 ppt. Primary prey organisms for juvenile and adult rosette skates are polychaetes and crustaceans (primarily amphipods).

Map 217. Rosette skate juveniles and adults, Alternative 2A



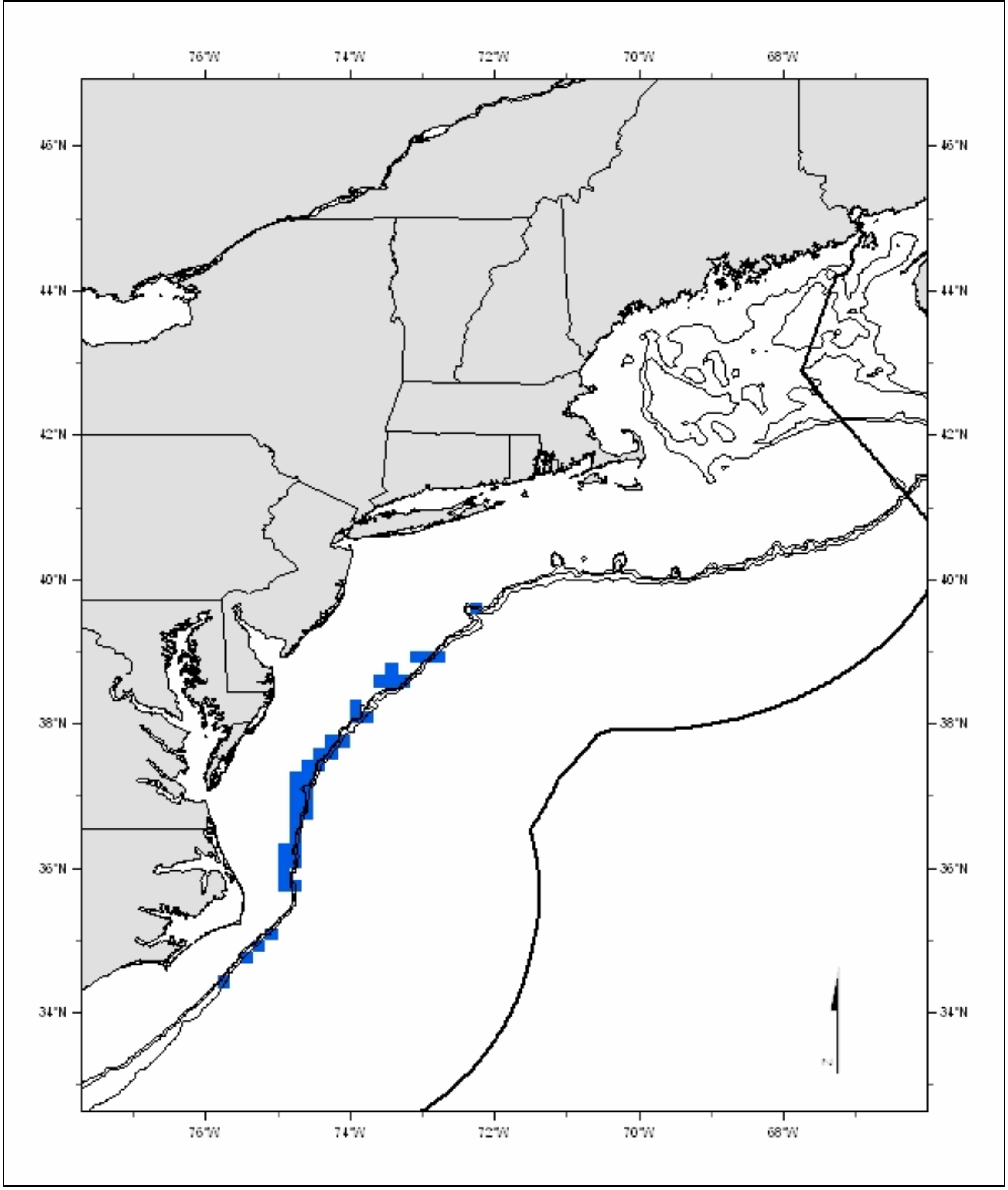
The Alternative 2A EFH designation for juvenile and adult rosette skate on the continental shelf is based upon the relative abundance of juveniles during 1968-2005 in the fall and spring NMFS trawl survey at the 25% cumulative percentage level.

Map 218. Rosette skate juveniles and adults, Alternative 2B



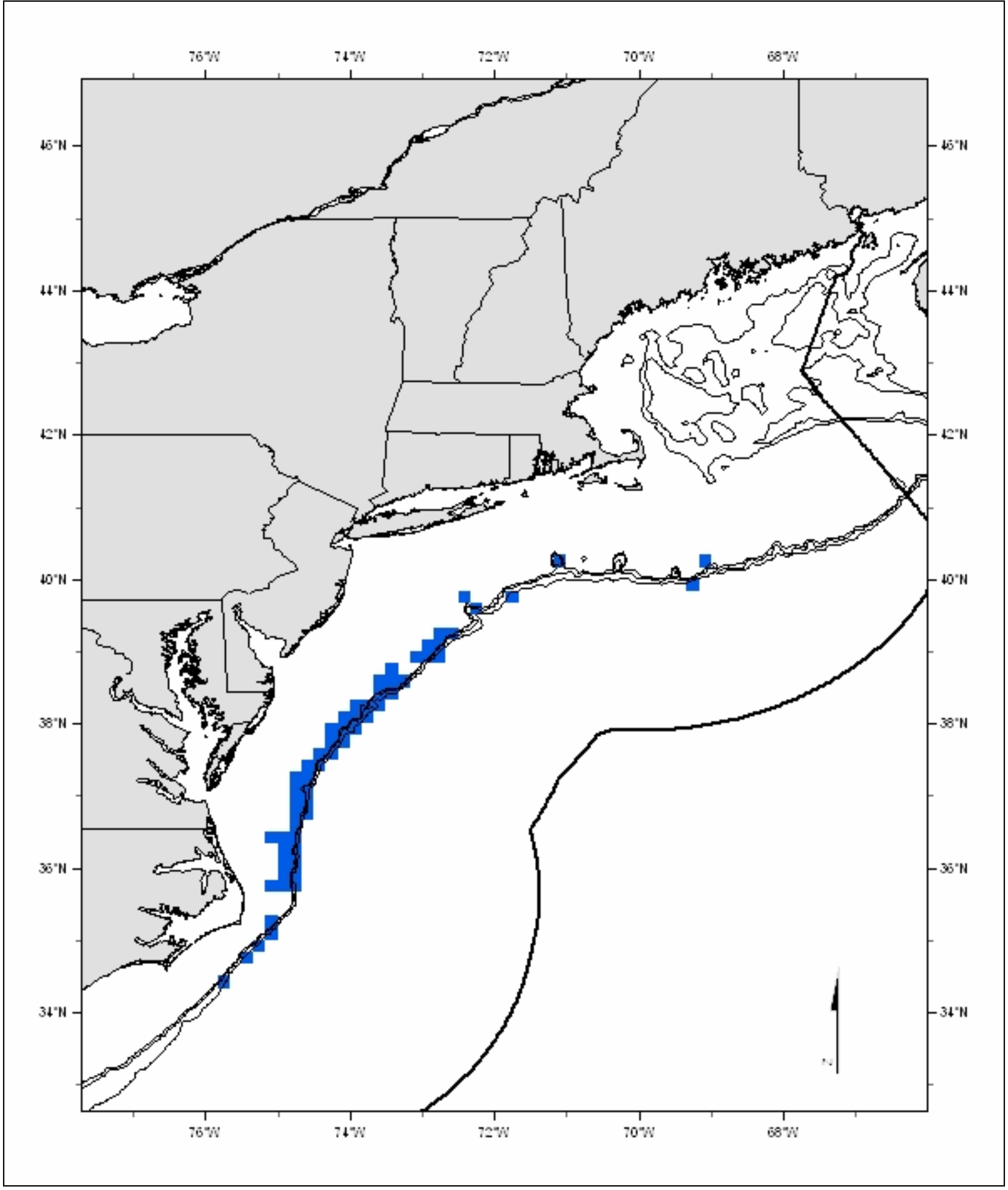
The Alternative 2B EFH designation for juvenile and adult rosette skate on the continental shelf is based upon the relative abundance of juveniles during 1968-2005 in the fall and spring NMFS trawl survey at the 50% cumulative percentage level.

Map 219. Rosette skate juveniles and adults, Alternative 2C



The Alternative 2C EFH designation for juvenile and adult rosette skate on the continental shelf is based upon the relative abundance of juveniles during 1968-2005 in the fall and spring NMFS trawl survey at the 75% cumulative percentage level.

Map 220. Rosette skate juveniles and adults, Alternative 2D



The Alternative 2D EFH designation for juvenile and adult rosette skate on the continental shelf is based upon the relative abundance of juveniles during 1968-2005 in the fall and spring NMFS trawl survey at the 90% cumulative percentage level.

4.1.2.3.17 Silver Hake

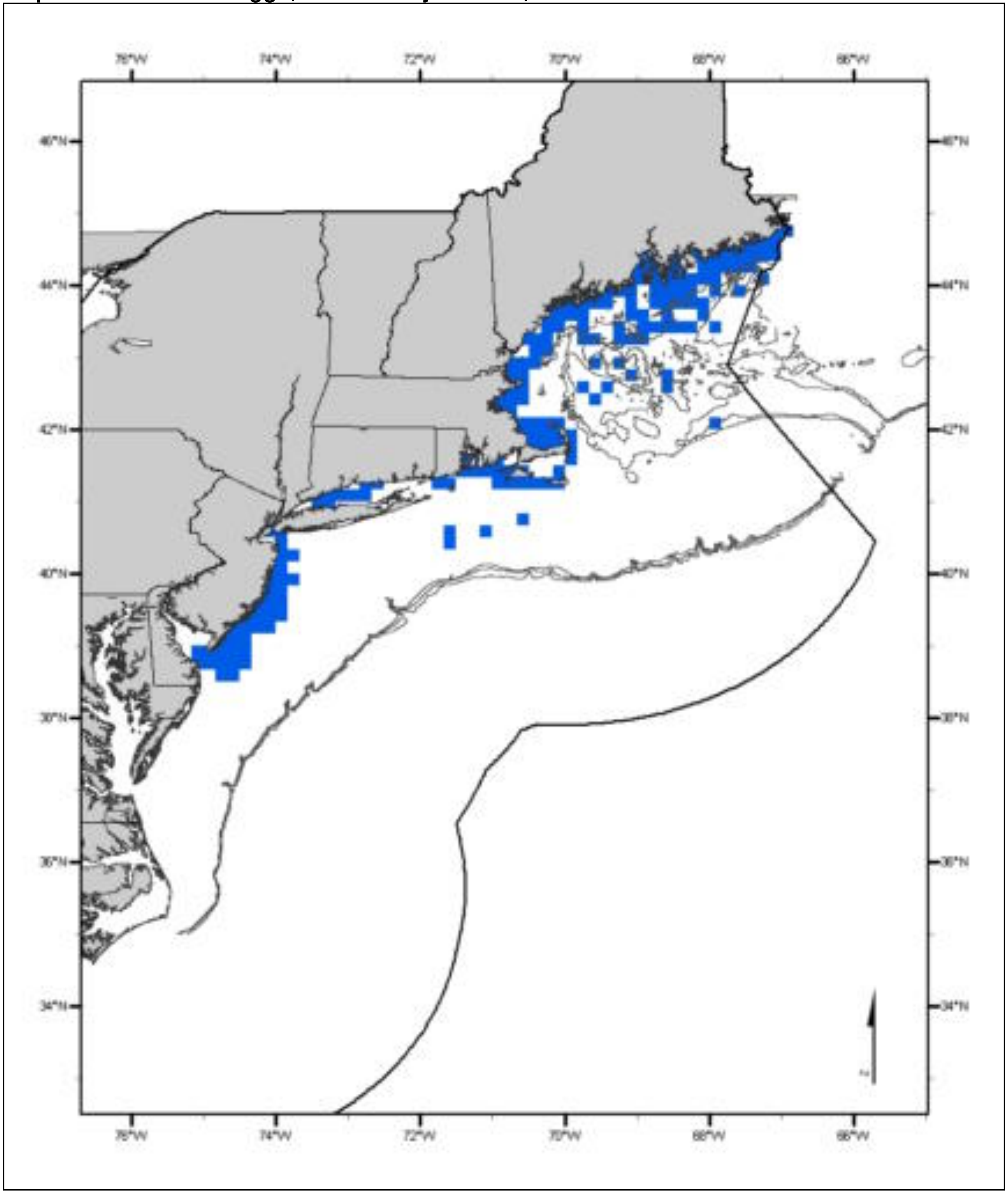
Eggs: Water column habitats on the continental shelf as depicted on Map 221 - Map 224. Conditions that generally exist where EFH for silver hake eggs is found are: bottom depths of 40 – 200 meters and water column temperatures of 7.5 – 23.5ºC.
Preferred alternative

Larvae: Water column habitats on the continental shelf as depicted on Map 221 - Map 224. Conditions that generally exist where EFH for silver hake larvae is found are: bottom depths of 40 – 140 meters and water column temperatures of 9.5 – 17.5ºC. Larval silver hake feed on copepods.
Preferred alternative

Juveniles: Pelagic and benthic habitats in inshore areas and on the continental shelf in depths of 10 – 400 meters as depicted on Map 221 - Map 224. Benthic EFH for juvenile silver hake includes substrates composed of mud, sand, mixtures of sand and mud, and/or shell fragments. They are sometimes found in bottom depressions or in association with amphipod tubes. Other conditions that generally exist where benthic EFH is found are bottom temperatures of 1.5 – 21.5ºC; and salinities of 26 – 34.5 ppt. Juvenile silver hake migrate off the bottom at night and feed primarily on euphausiids, decapod shrimps, and other crustaceans.

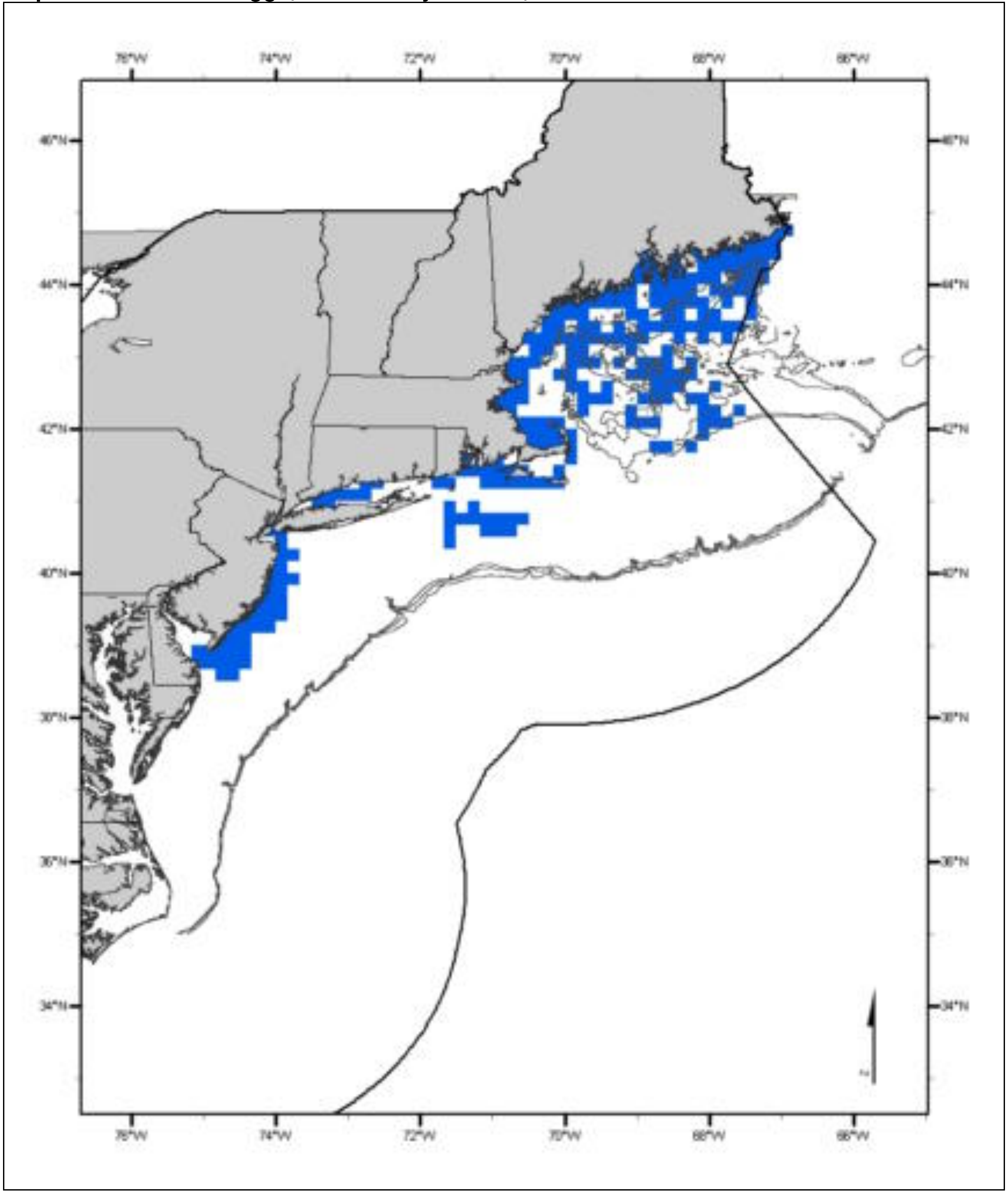
Adults: Pelagic and benthic habitats in inshore areas and on the continental shelf in depths of 10 – 500 meters as depicted on Map 225 - Map 228. Benthic EFH for adult silver hake includes substrates composed of mud, sand, mixtures of sand and mud, and/or shell fragments. They are sometimes found in bottom depressions. Other conditions that generally exist where benthic EFH for juvenile silver hake is found are bottom temperatures of 4.5 – 16ºC and salinities of 24 – 34.5 ppt. Adult silver hake migrate off the bottom at night and feed primarily on a variety of pelagic fish species, euphausiids, decapod shrimps, and other crustaceans.

Map 221. Silver hake eggs, larvae and juveniles, Alternative 2A



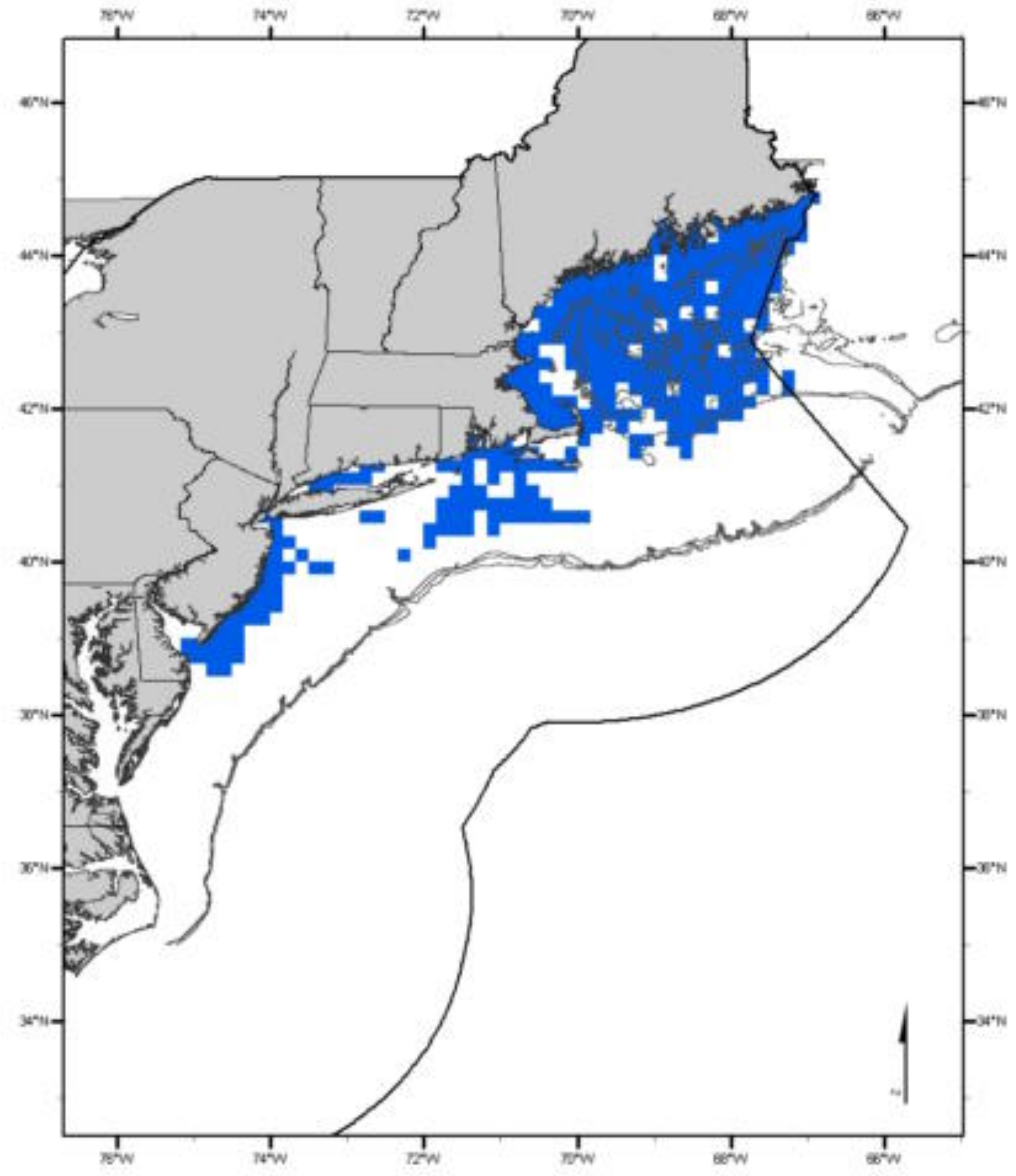
The Alternative 2A EFH designation for silver hake eggs, larvae, and juveniles on the continental shelf is based upon the relative abundance of juvenile silver hake during 1968-2005 in the fall and spring NMFS trawl survey at the 25% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where juvenile silver hake were caught in state trawl surveys in more than 10% of the tows and those bays and estuaries identified by the NOAA ELMR program where silver hake eggs or larvae were "common" or "abundant."

Map 222. Silver hake eggs, larvae and juveniles, Alternative 2B



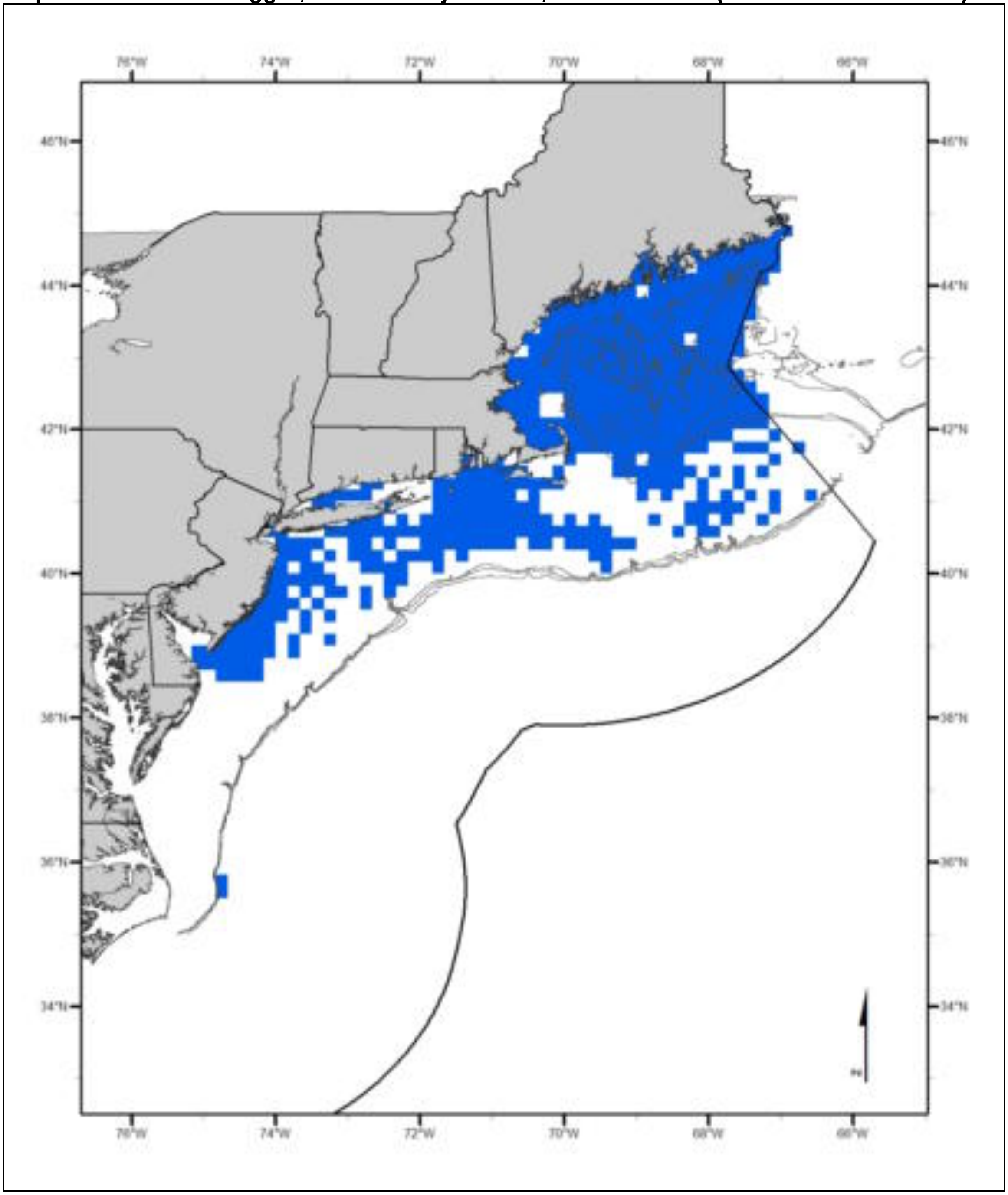
The Alternative 2B EFH designation for silver hake eggs, larvae, and juveniles on the continental shelf is based upon the relative abundance of juvenile silver hake during 1968-2005 in the fall and spring NMFS trawl survey at the 50% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where juvenile silver hake were caught in state trawl surveys in more than 10% of the tows and those bays and estuaries identified by the NOAA ELMR program where silver hake eggs or larvae were "common" or "abundant."

Map 223. Silver hake eggs, larvae and juveniles, Alternative 2C



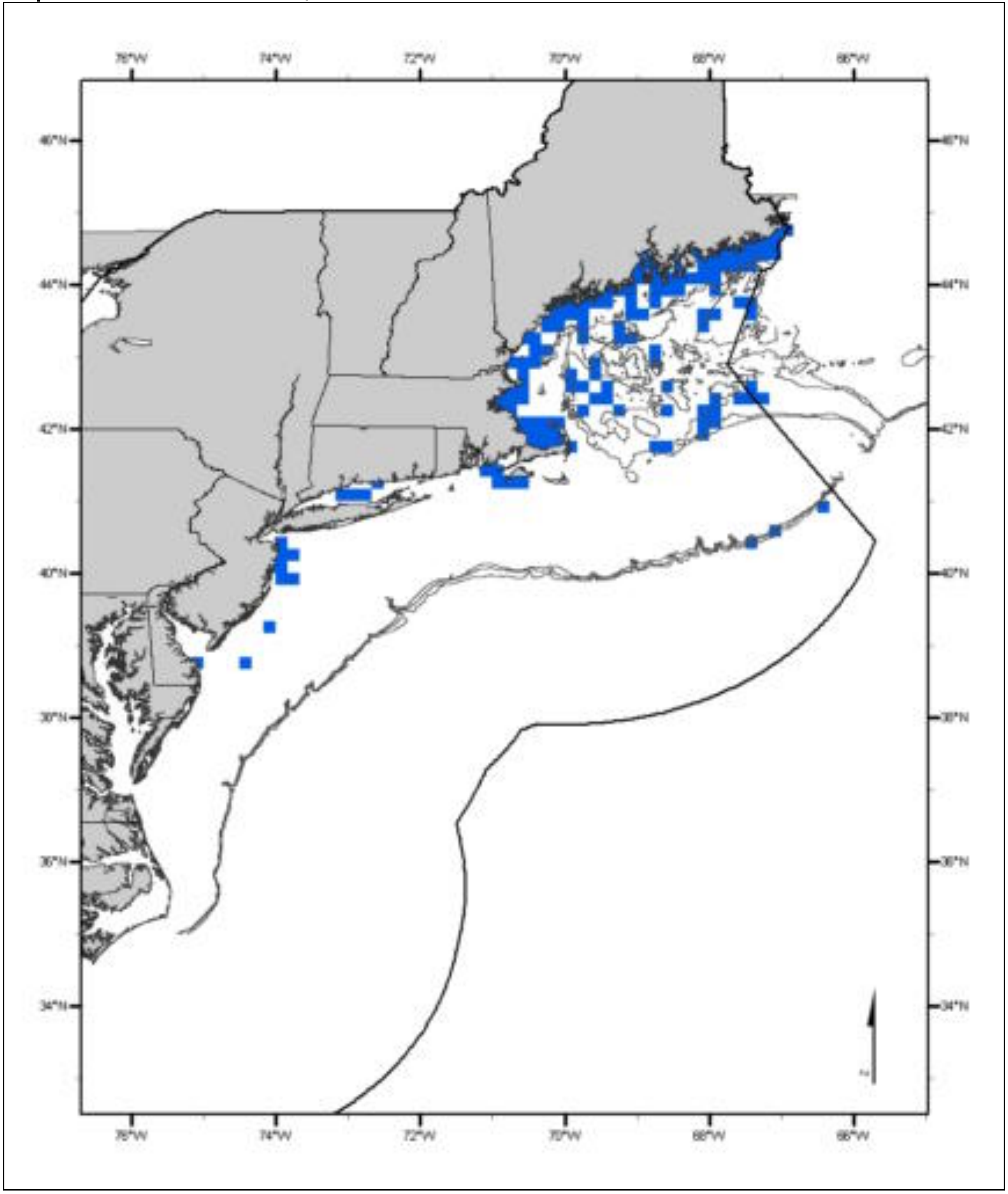
The Alternative 2C EFH designation for silver hake eggs, larvae, and juveniles on the continental shelf is based upon the relative abundance of juvenile silver hake during 1968-2005 in the fall and spring NMFS trawl survey at the 75% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where juvenile silver hake were caught in state trawl surveys in more than 10% of the tows and those bays and estuaries identified by the NOAA ELMR program where silver hake eggs or larvae were "common" or "abundant."

Map 224. Silver hake eggs*, larvae* and juveniles, Alternative 2D (**Preferred Alternative*)



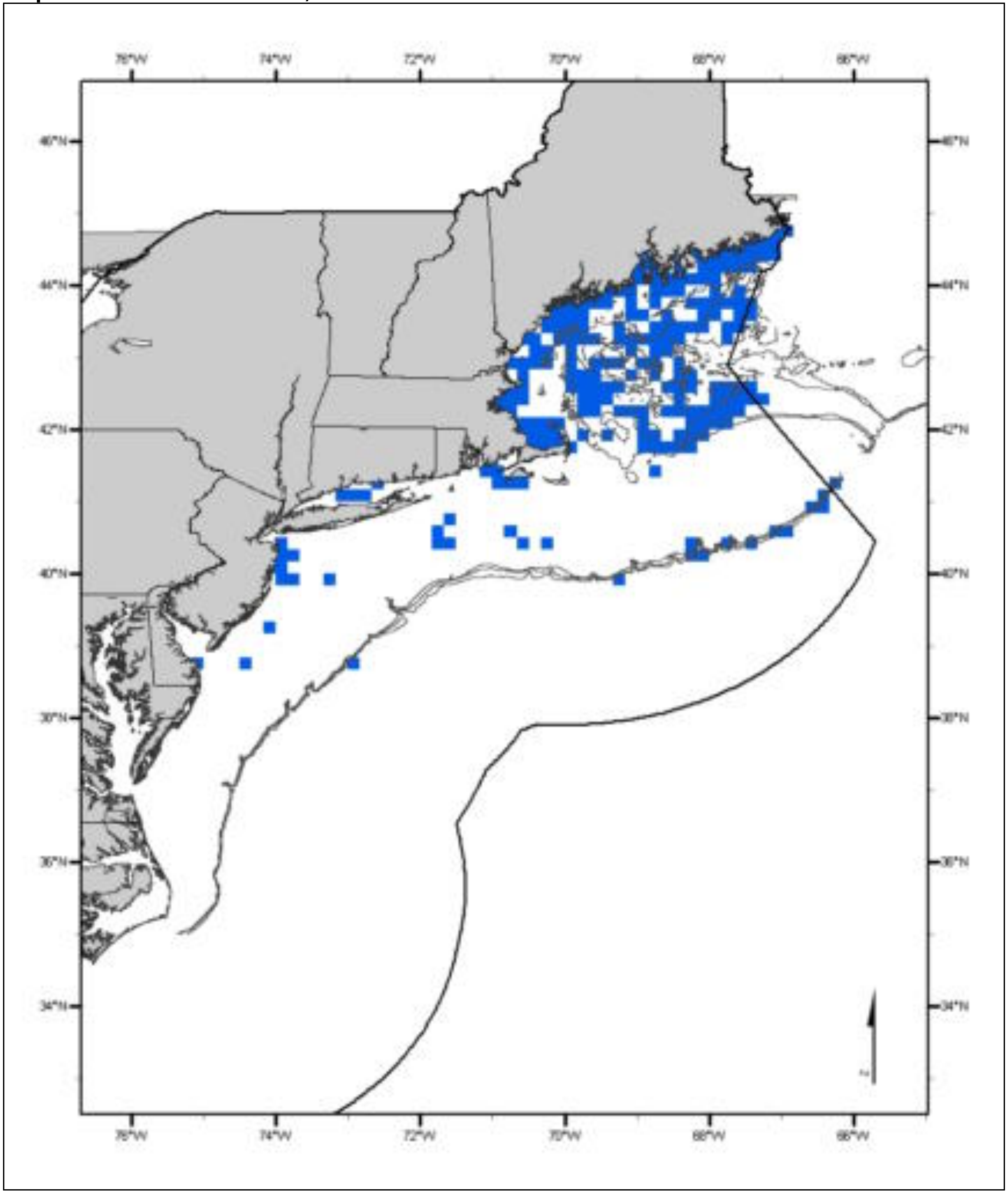
The Alternative 2D EFH designation for silver hake eggs, larvae, and juveniles on the continental shelf is based upon the relative abundance of juvenile silver hake during 1968-2005 in the fall and spring NMFS trawl survey at the 90% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where juvenile silver hake were caught in state trawl surveys in more than 10% of the tows and those bays and estuaries identified by the NOAA ELMR program where silver hake eggs and larvae were "common" or "abundant."

Map 225. Silver hake adults, Alternative 2A



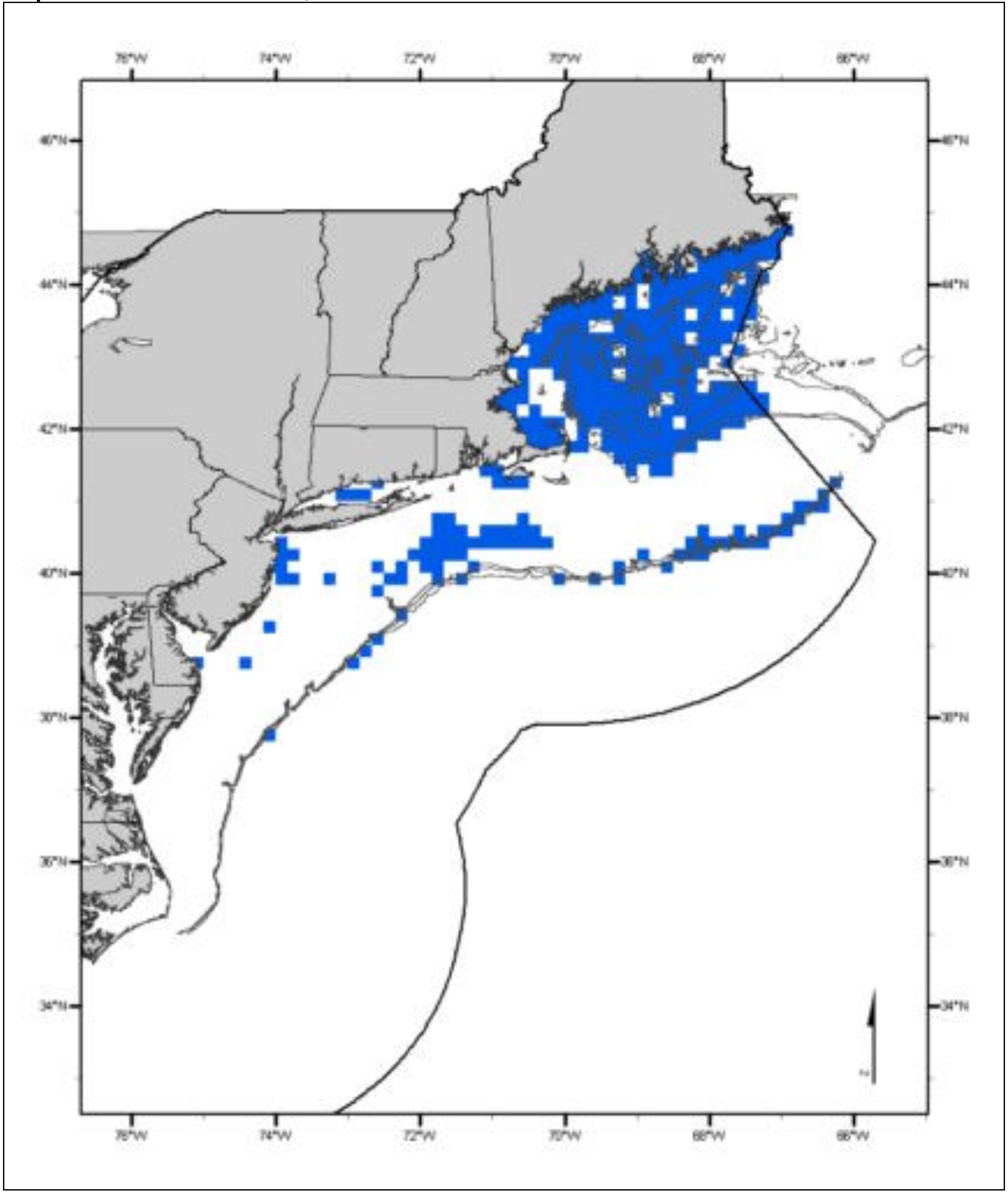
The Alternative 2A EFH designation for silver hake adults on the continental shelf is based upon the relative abundance of adults during 1968-2005 in the fall and spring NMFS trawl survey at the 25% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where adult silver hake were caught in state trawl surveys in more than 10% of the tows and those bays and estuaries identified by the NOAA ELMR program where adult silver hake were "common" or "abundant."

Map 226. Silver hake adults, Alternative 2B



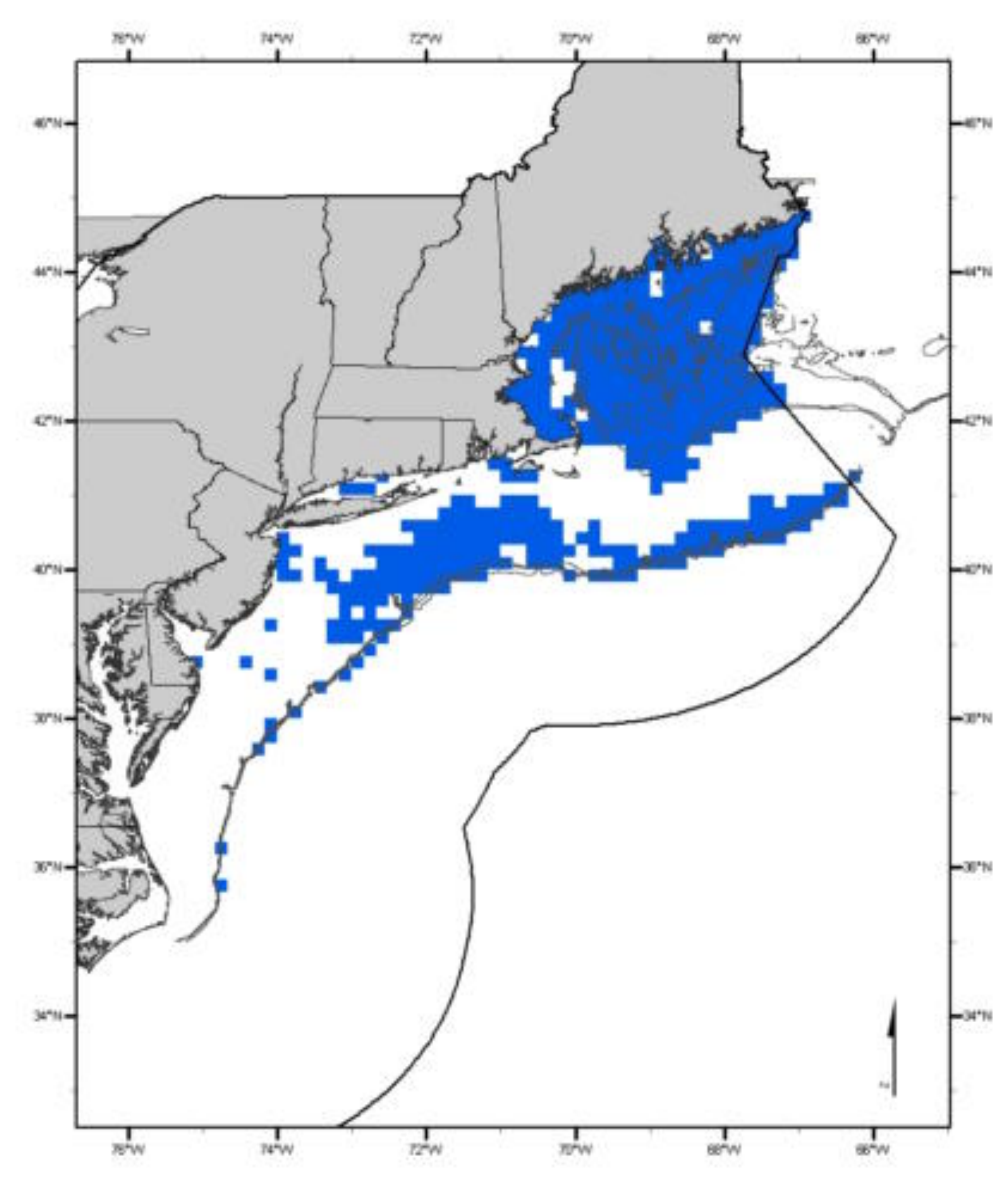
The Alternative 2B EFH designation for silver hake adults on the continental shelf is based upon the relative abundance of adults during 1968-2005 in the fall and spring NMFS trawl survey at the 50% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where adult silver hake were caught in state trawl surveys in more than 10% of the tows and those bays and estuaries identified by the NOAA ELMR program where adult silver hake were "common" or "abundant."

Map 227. Silver hake adults, Alternative 2C



The Alternative 2C EFH designation for silver hake adults on the continental shelf is based upon the relative abundance of adults during 1968-2005 in the fall and spring NMFS trawl survey at the 75% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where adult silver hake were caught in state trawl surveys in more than 10% of the tows and those bays and estuaries identified by the NOAA ELMR program where adult silver hake were "common" or "abundant."

Map 228. Silver hake adults, Alternative 2D



The Alternative 2D EFH designation for silver hake adults on the continental shelf is based upon the relative abundance of adults during 1968-2005 in the fall and spring NMFS trawl survey at the 90% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where adult silver hake were caught in state trawl surveys in more than 10% of the tows and those bays and estuaries identified by the NOAA ELMR program where adult silver hake were "common" or "abundant."

4.1.2.3.18 Smooth Skate

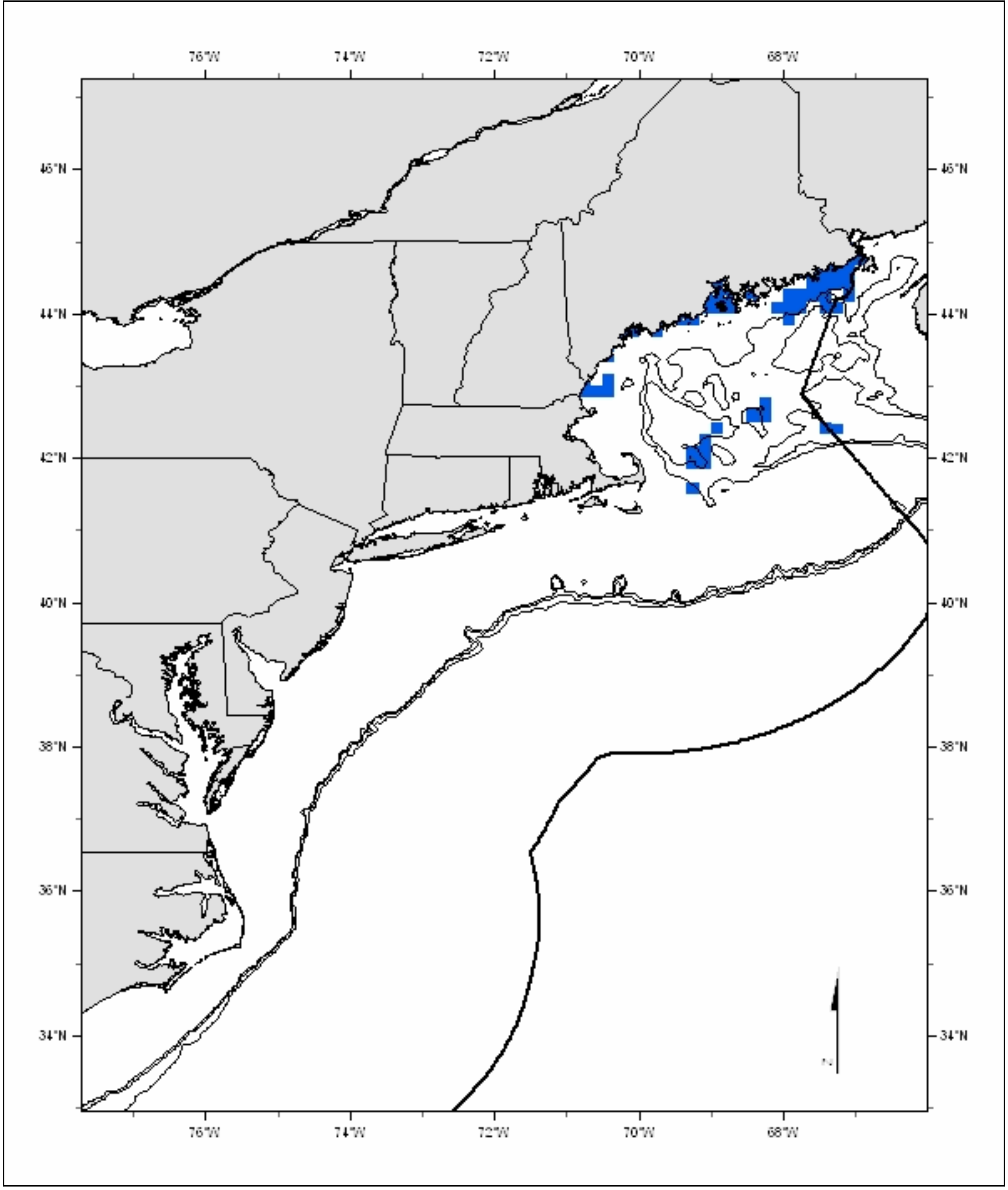
Eggs: There is no information available on the habitat associations or distribution of the egg stage for this species.

Larvae: No larval life stage exists for this species. Upon hatching, they are fully developed juveniles.

Juveniles: Benthic habitats on the continental shelf in depths of 120 – 400 meters as depicted on Map 229 - Map 232. EFH for juvenile smooth skates occurs mostly on soft mud in deeper areas, but also on sand, broken shells, gravel, and pebbles on offshore banks. Other conditions that generally exist where EFH is found are bottom temperatures of 3.5 – 9.5ºC and salinities of 32.5 – 35.5 ppt. Juvenile smooth skates feed on epifaunal crustaceans, primarily decapods (e.g., pandalid shrimp, hermit crabs, sand shrimp), and euphausiids, with some mysids, amphipods, and isopods.

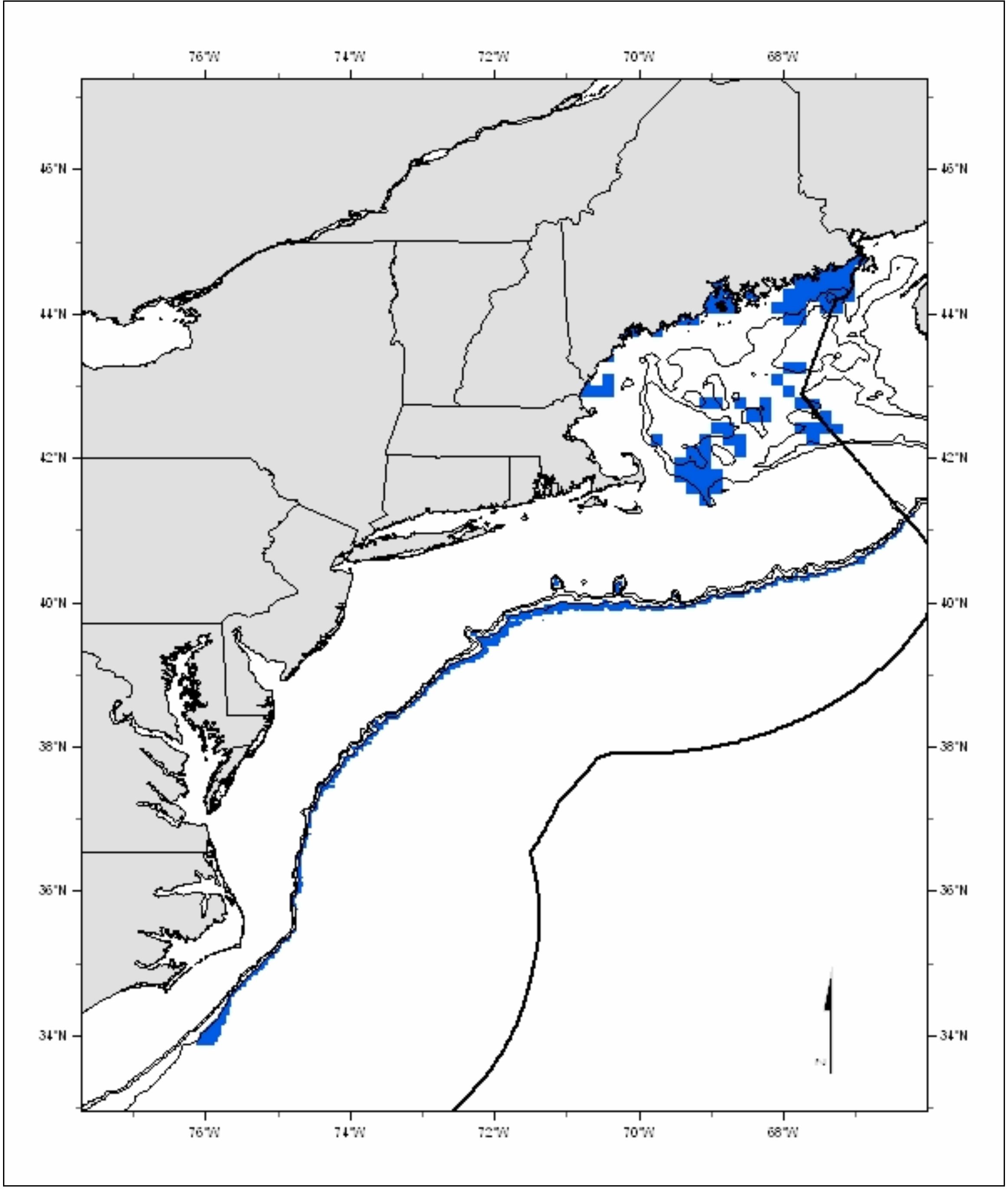
Adults: Benthic habitats on the continental shelf in depths of 120 – 400 meters as depicted on Map 233 - Map 236. EFH for adult smooth skates includes a wider variety of substrates than for juveniles, including mud, sand and mud, sand, and sand and mud mixed with shells, gravel and pebbles. Other conditions that generally exist where EFH is found are bottom temperatures of 3.5 – 8.5ºC and salinities of 32.5 – 35.5 ppt. Adult smooth skates have similar feeding habits as juveniles, but consume more decapods, euphausiids and fishes (*e.g.*, silver hake and sand lance), and fewer mysids and amphipods.

Map 229. Smooth skate juveniles, Alternative 2A



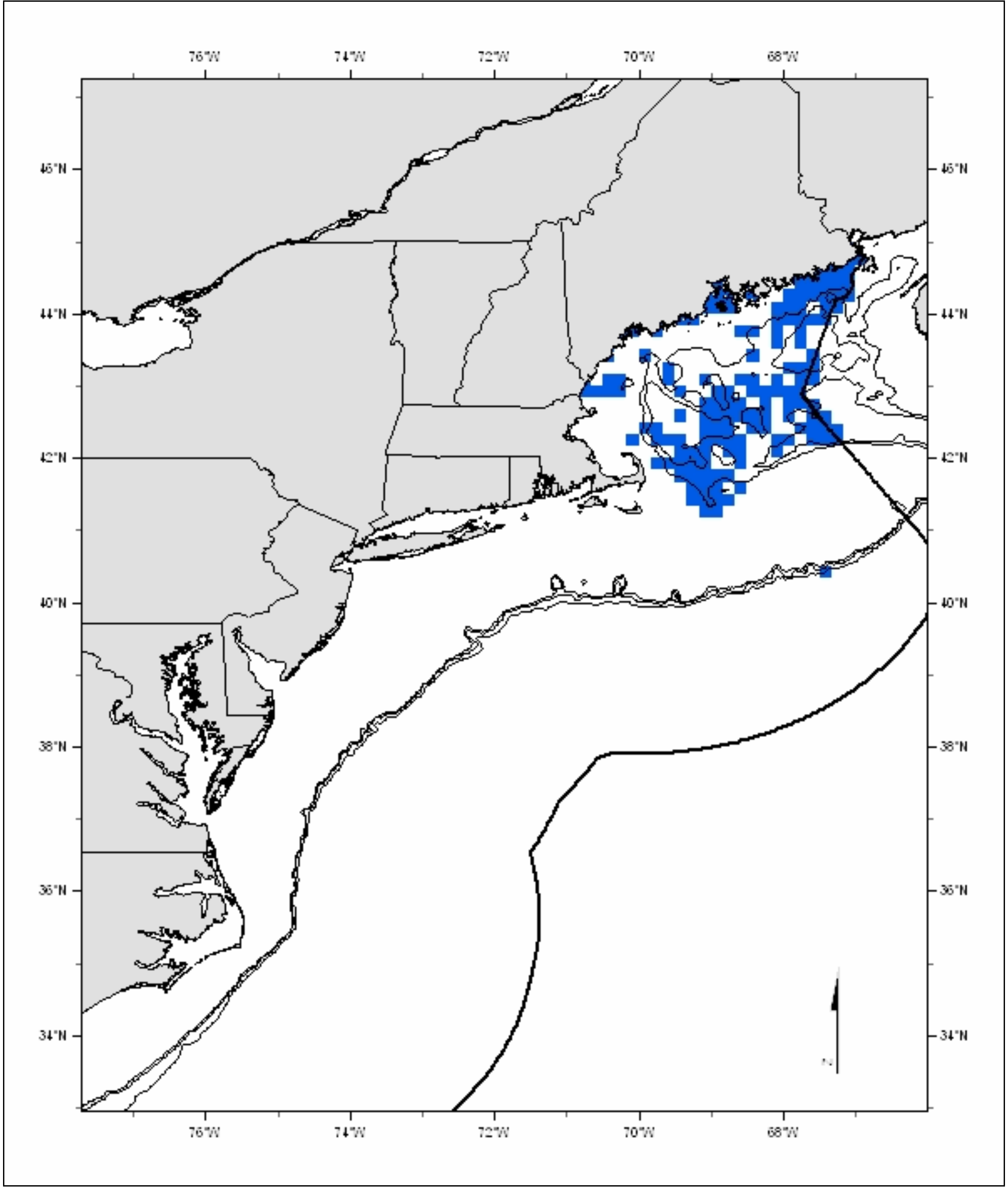
The Alternative 2A EFH designation for smooth skate juveniles on the continental shelf is based upon the relative abundance of juveniles during 1968-2005 in the fall and spring NMFS trawl survey at the 25% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where juvenile smooth skate were caught in state trawl surveys in more than 10% of the tows.

Map 230. Smooth skate juveniles, Alternative 2B



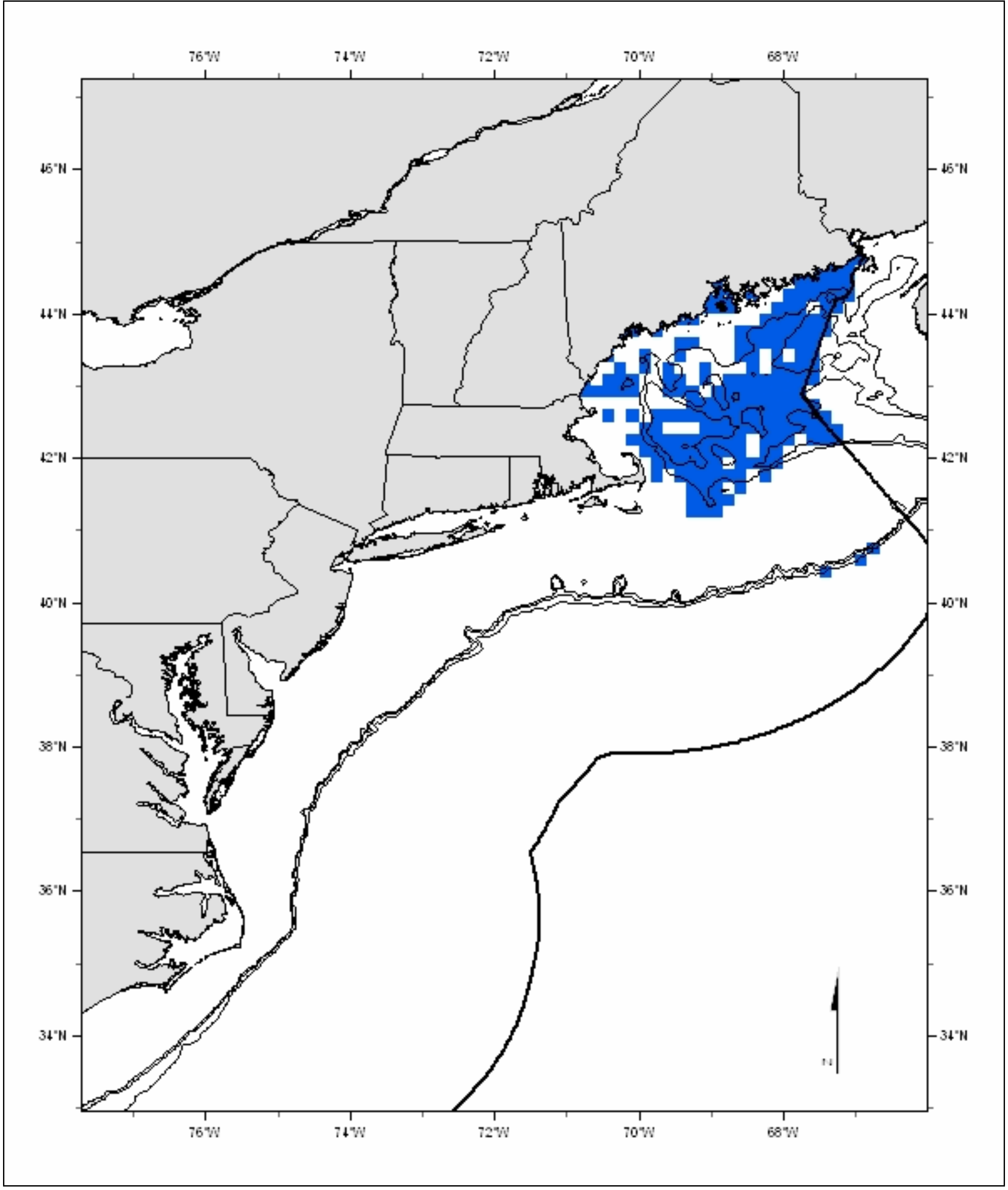
The Alternative 2B EFH designation for smooth skate juveniles on the continental shelf is based upon the relative abundance of juveniles during 1968-2005 in the fall and spring NMFS trawl survey at the 50% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where juvenile smooth skate were caught in state trawl surveys in more than 10% of the tows.

Map 231. Smooth skate juveniles, Alternative 2C



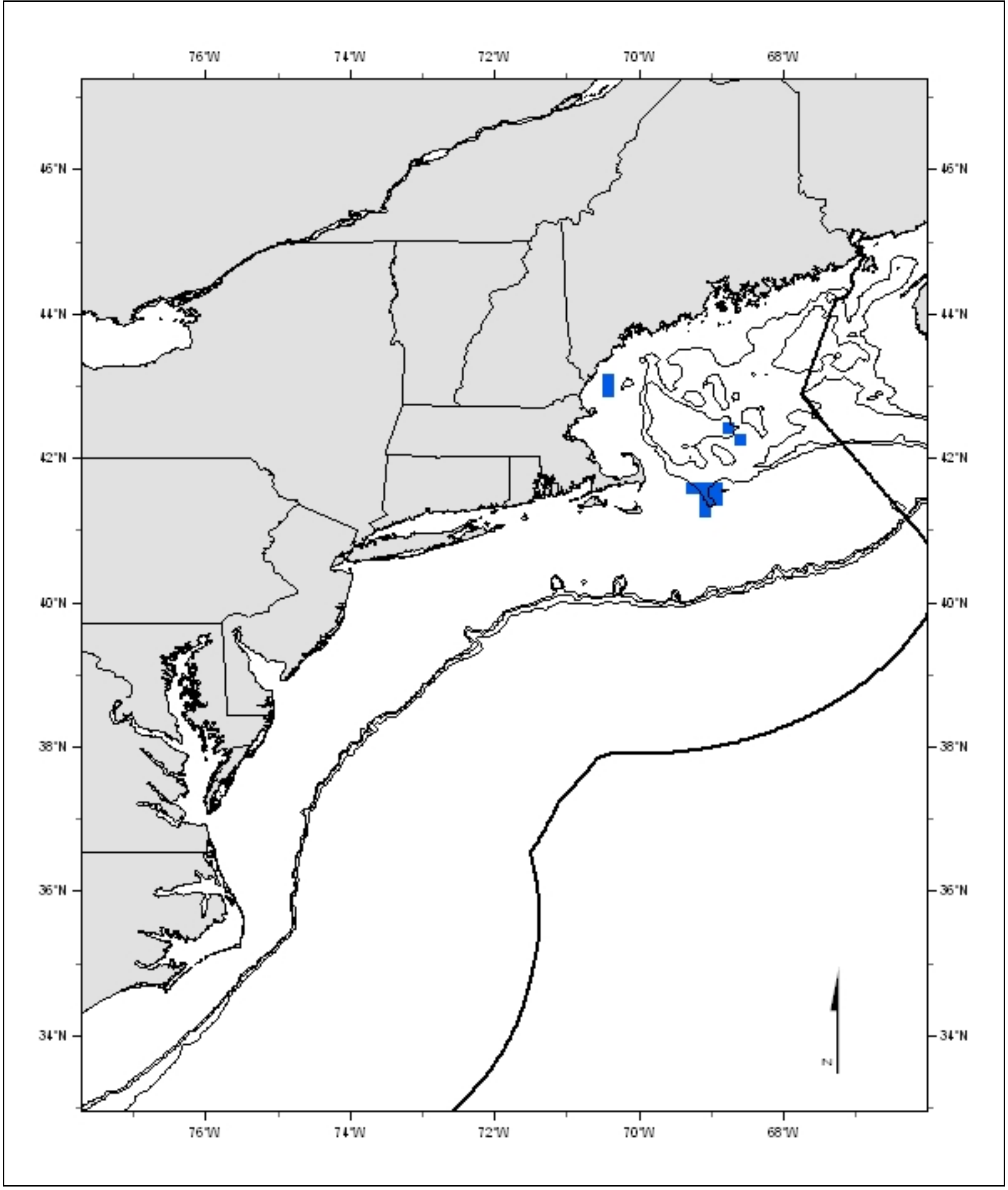
The Alternative 2C EFH designation for smooth skate juveniles on the continental shelf is based upon the relative abundance of juveniles during 1968-2005 in the fall and spring NMFS trawl survey at the 75% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where juvenile smooth skate were caught in state trawl surveys in more than 10% of the tows.

Map 232. Smooth skate juveniles, Alternative 2D



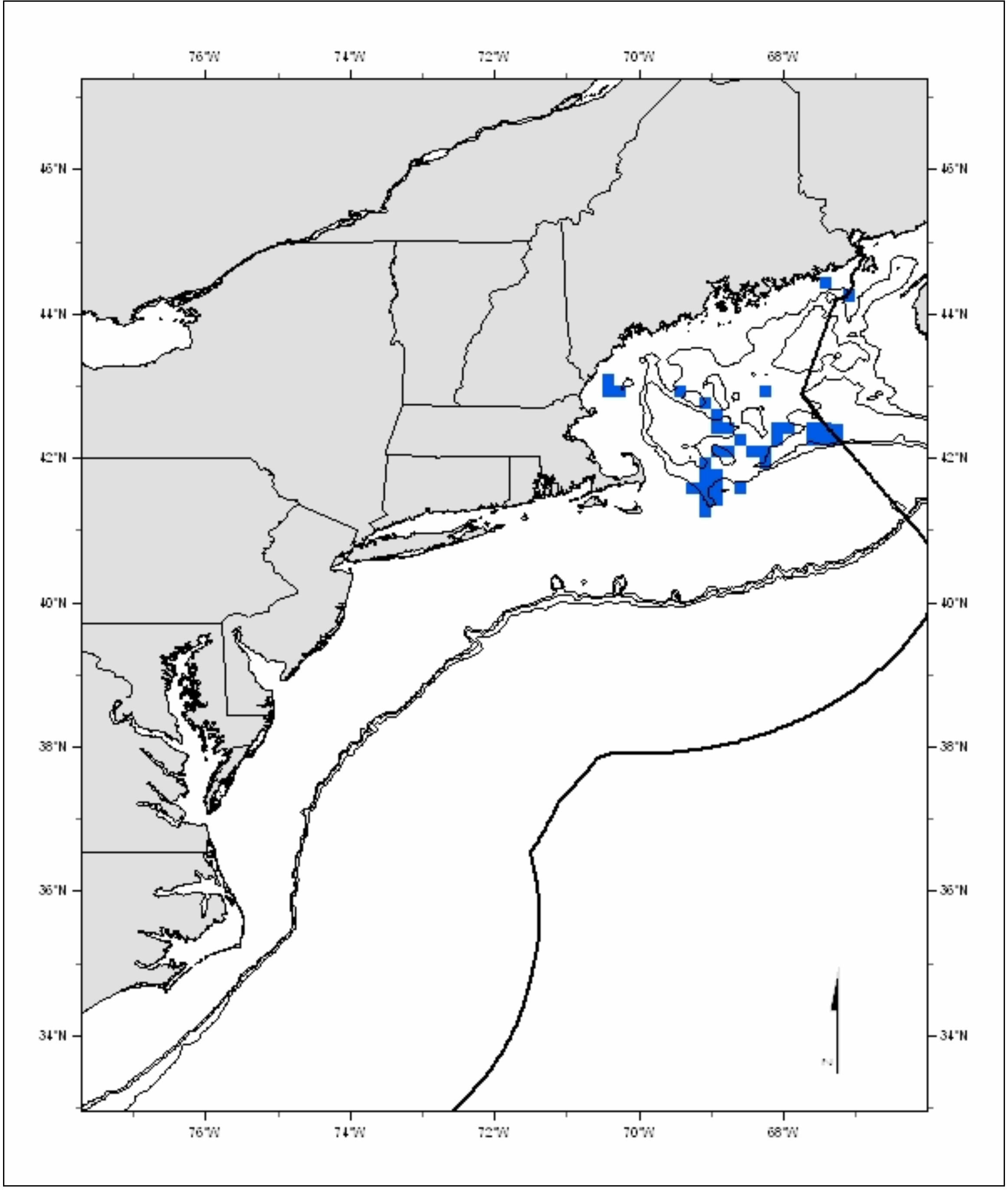
The Alternative 2D EFH designation for smooth skate juveniles on the continental shelf is based upon the relative abundance of juveniles during 1968-2005 in the fall and spring NMFS trawl survey at the 90% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where juvenile smooth skate were caught in state trawl surveys in more than 10% of the tows.

Map 233. Smooth skate adults, Alternative 2A



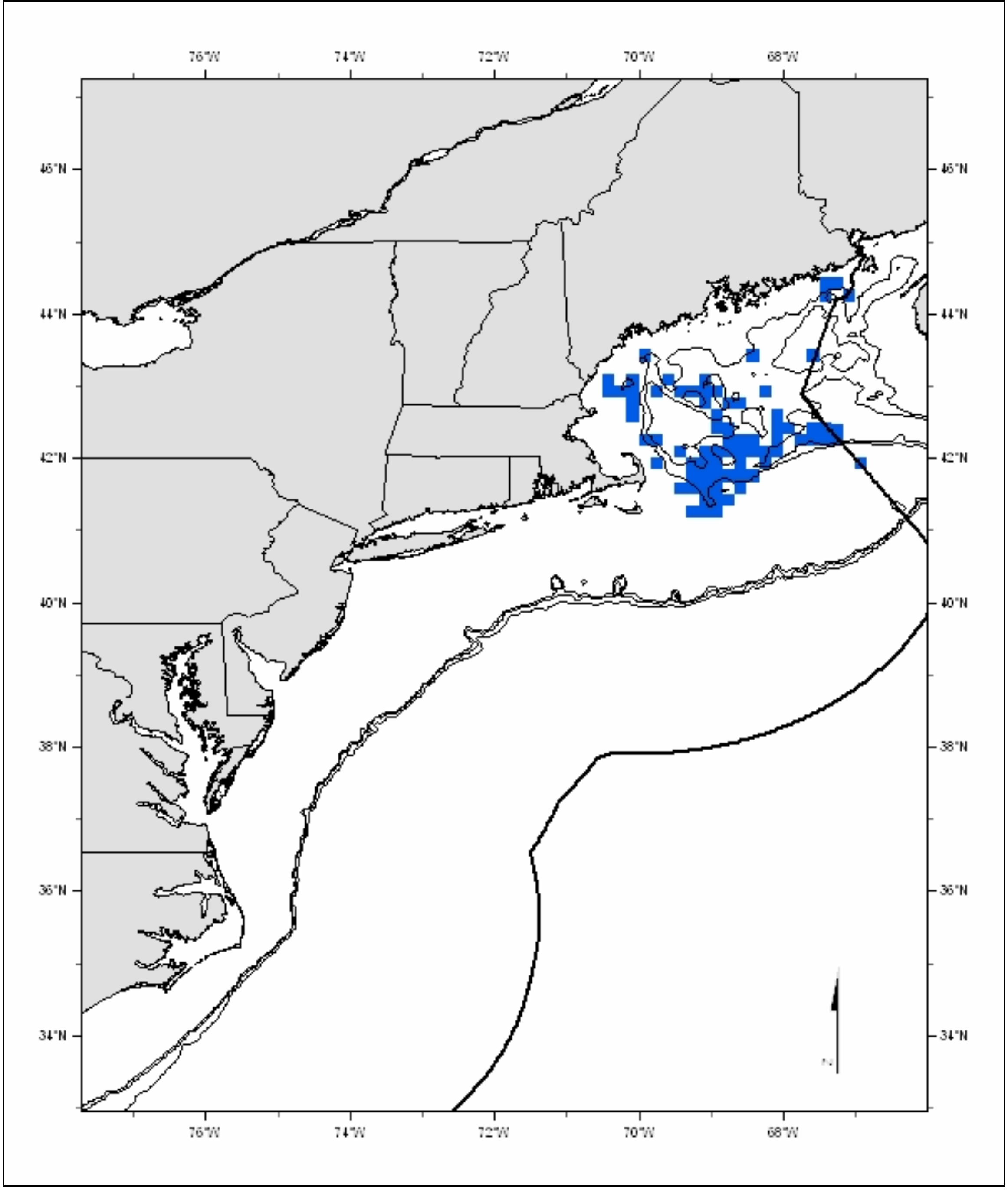
The Alternative 2A EFH designation for smooth skate adults on the continental shelf is based upon the relative abundance of adults during 1968-2005 in the fall and spring NMFS trawl survey at the 25% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where adult smooth skate were caught in state trawl surveys in more than 10% of the tows.

Map 234. Smooth skate adults, Alternative 2B



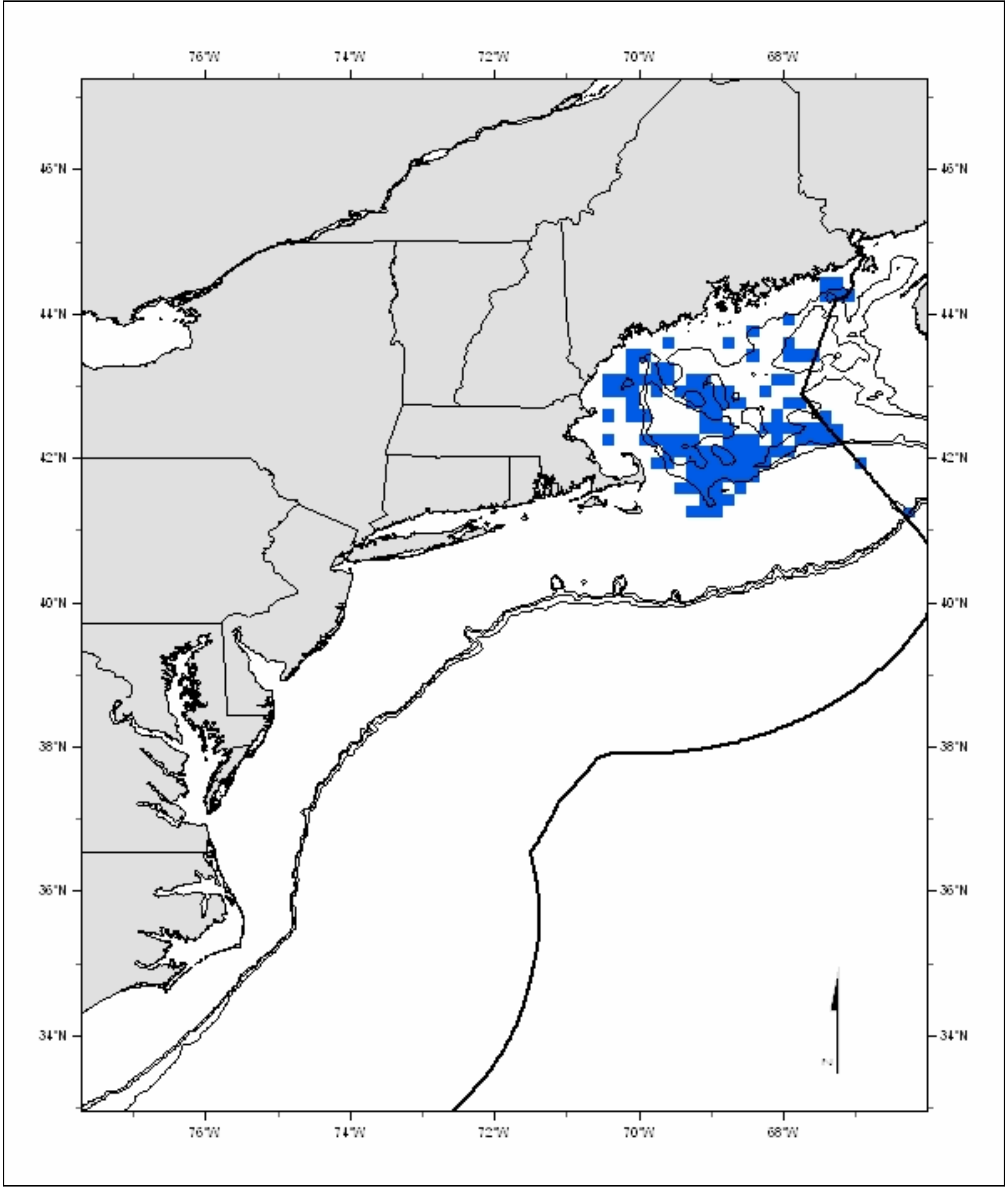
The Alternative 2B EFH designation for smooth skate adults on the continental shelf is based upon the relative abundance of adults during 1968-2005 in the fall and spring NMFS trawl survey at the 50% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where adult smooth skate were caught in state trawl surveys in more than 10% of the tows.

Map 235. Smooth skate adults, Alternative 2C



The Alternative 2C EFH designation for smooth skate adults on the continental shelf is based upon the relative abundance of adults during 1968-2005 in the fall and spring NMFS trawl survey at the 75% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where adult smooth skate were caught in state trawl surveys in more than 10% of the tows.

Map 236. Smooth skate adults, Alternative 2D



The Alternative 2D EFH designation for smooth skate adults on the continental shelf is based upon the relative abundance of adults during 1968-2005 in the fall and spring NMFS trawl survey at the 90% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where adult smooth skate were caught in state trawl surveys in more than 10% of the tows.

4.1.2.3.19 Thorny Skate

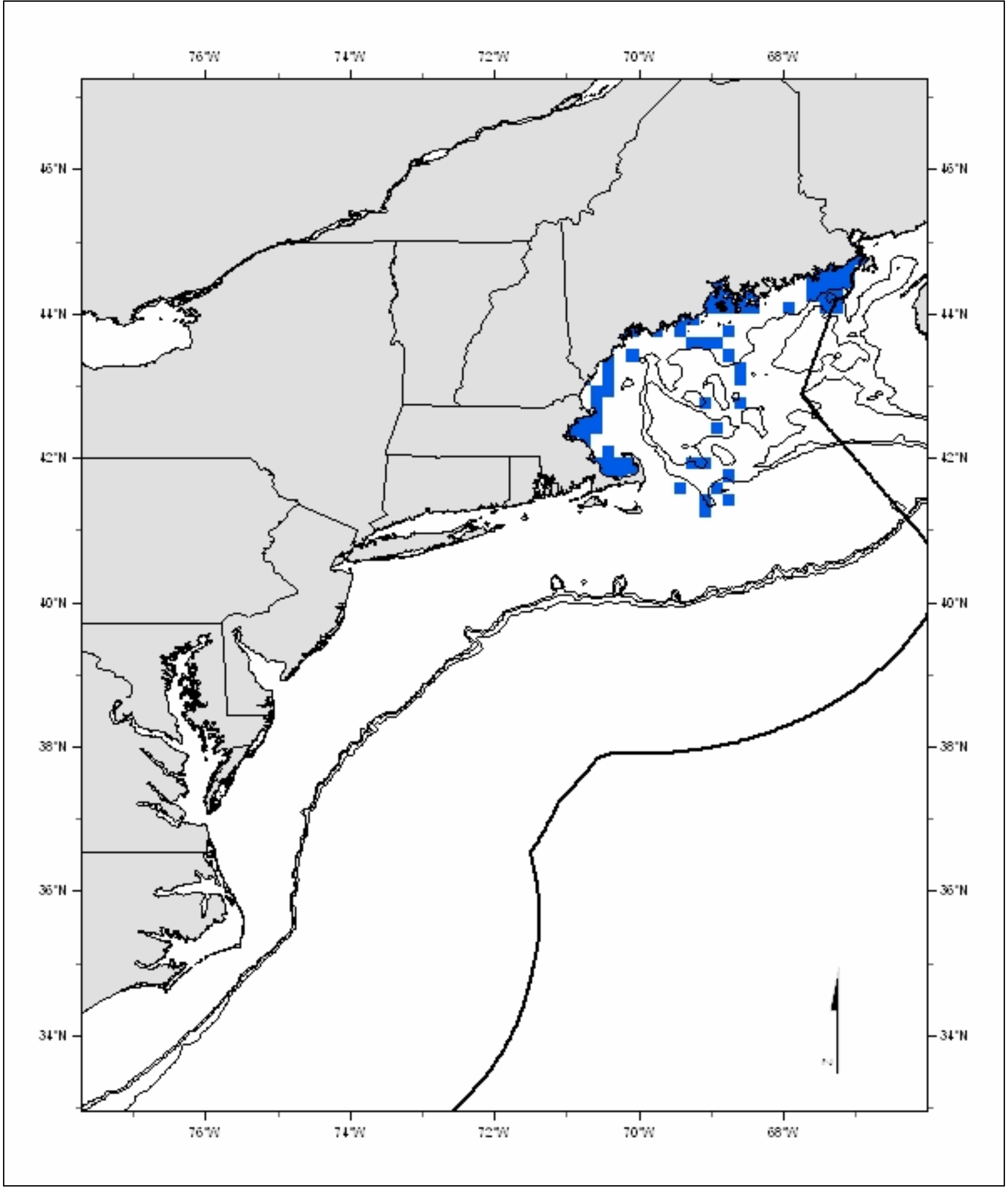
Eggs: There is no information available on the habitat associations or distribution of the egg stage for this species.

Larvae: No larval life stage exists for this species. Upon hatching, they are fully developed juveniles.

Juveniles: Benthic habitats on the continental shelf in depths of 35 – 400 meters as depicted on Map 237 - Map 240. EFH for juvenile thorny skate includes a wide range of bottom types from soft mud to gravel, broken shells, and pebbles. Other conditions that generally exist where EFH is found are bottom temperatures of 0.5 – 10.5ºC and salinities of 32.5 – 34.5 ppt. Juvenile thorny skates feed on polychaetes, a variety of crustaceans, and a variety of fishes (*e.g.*, sand lance, wrymouth, and silver hake).

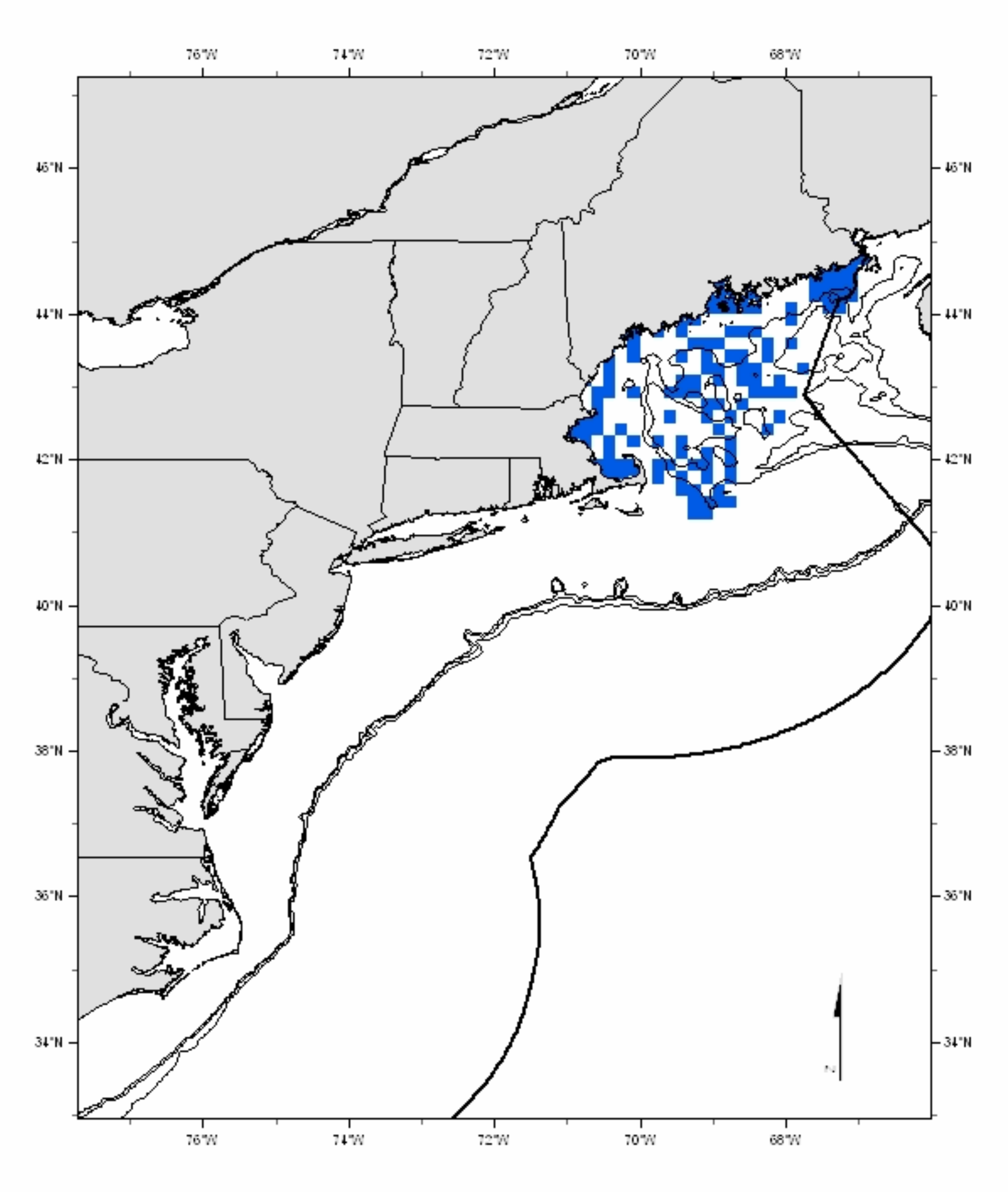
Adults: Benthic habitats on the continental shelf in depths of 120 – 400 meters as depicted on Map 241 - Map 244. EFH for adult thorny skate includes a wide range of bottom types from soft mud to gravel, broken shells, and pebbles, but they are found primarily on mud. Other conditions that generally exist where EFH is found are bottom temperatures of 2.5 – 7.5ºC and salinities of 32.5 – 34.5 ppt. Adult thorny skates feed on polychaetes, crustaceans (*e.g.*, pandalid shrimps, crabs, and euphausiids), fishes (*e.g.*, herring, wrymouth, and hagfish), and squids.

Map 237. Thorny skate juveniles, Alternative 2A



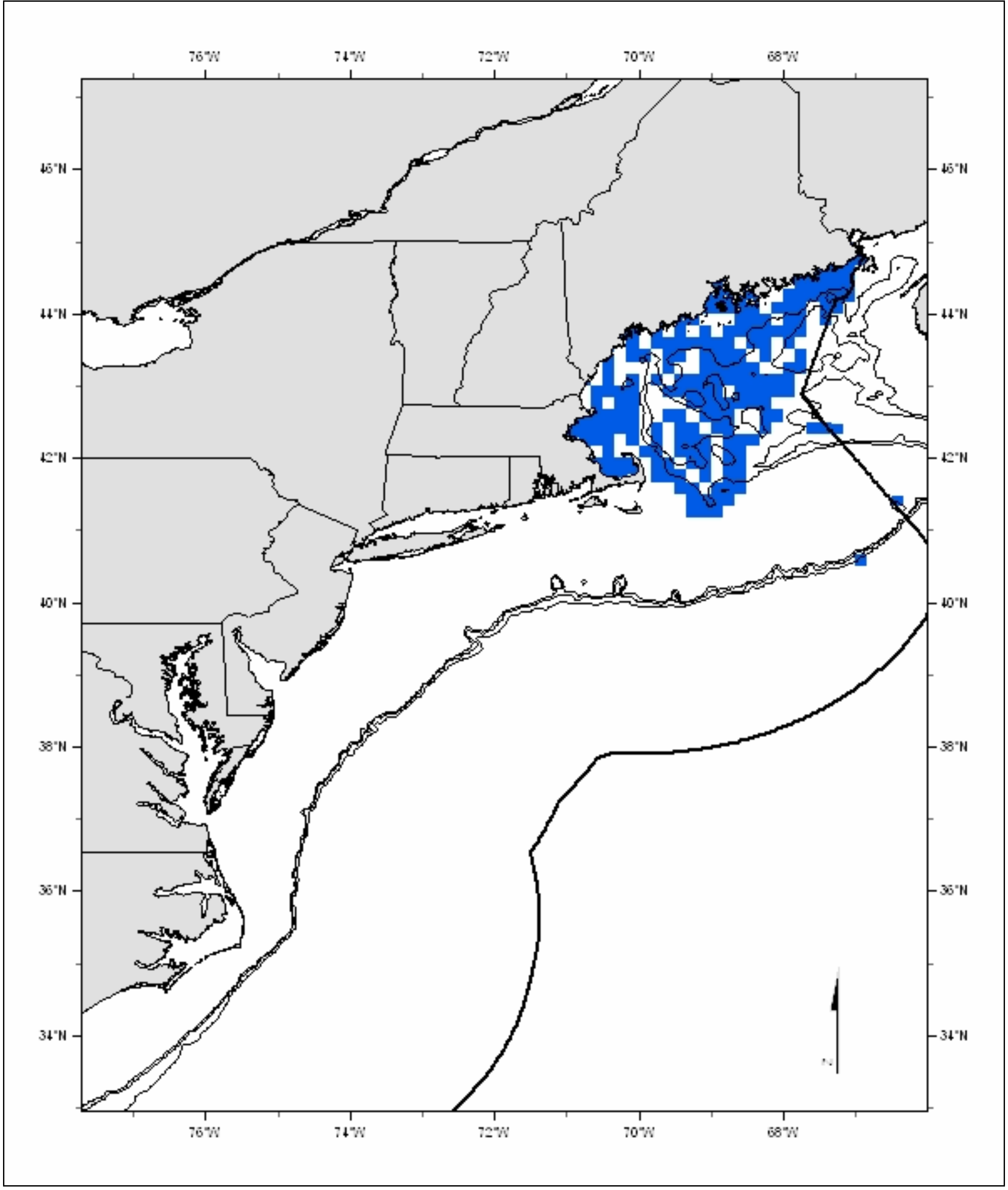
The Alternative 2A EFH designation for thorny skate juveniles on the continental shelf is based upon the relative abundance of juveniles during 1968-2005 in the fall and spring NMFS trawl survey at the 25% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where juvenile thorny skate were caught in state trawl surveys in more than 10% of the tows.

Map 238. Thorny skate juveniles, Alternative 2B



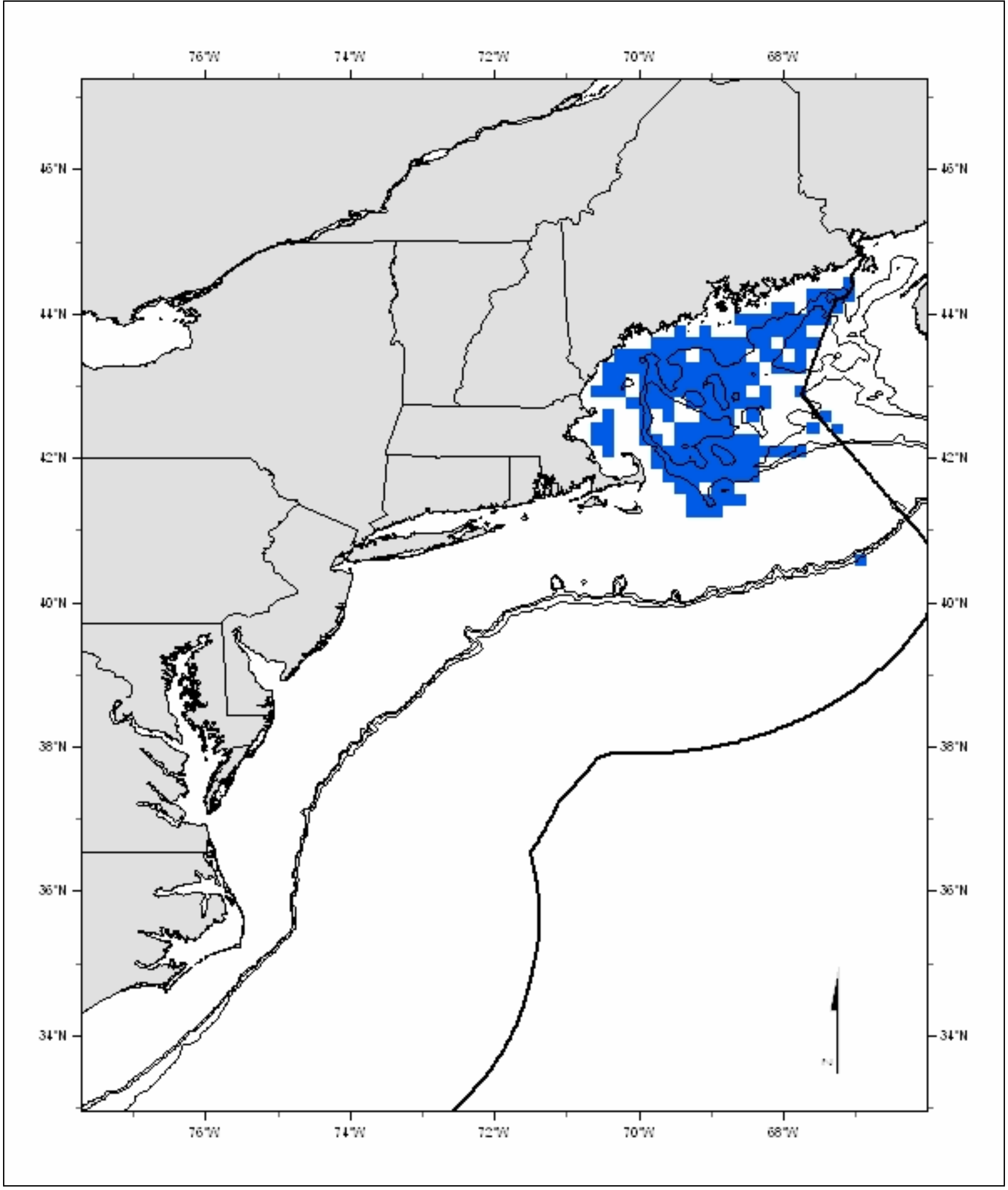
The Alternative 2B EFH designation for thorny skate juveniles on the continental shelf is based upon the relative abundance of juveniles during 1968-2005 in the fall and spring NMFS trawl survey at the 50% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where juvenile thorny skate were caught in state trawl surveys in more than 10% of the tows.

Map 239. Thorny skate juveniles, Alternative 2C



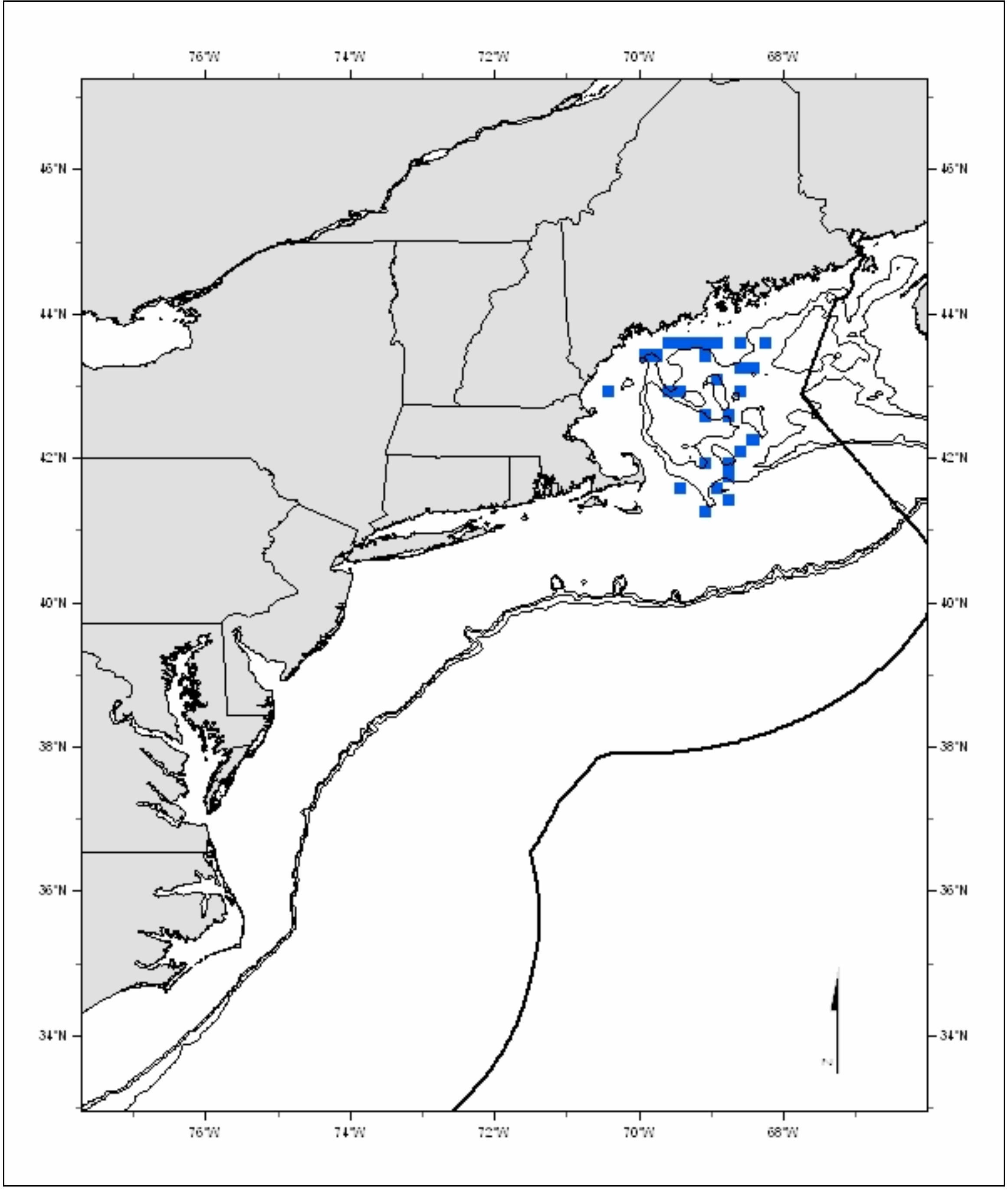
The Alternative 2C EFH designation for thorny skate juveniles on the continental shelf is based upon the relative abundance of juveniles during 1968-2005 in the fall and spring NMFS trawl survey at the 75% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where juvenile thorny skate were caught in state trawl surveys in more than 10% of the tows.

Map 240. Thorny skate juveniles, Alternative 2D



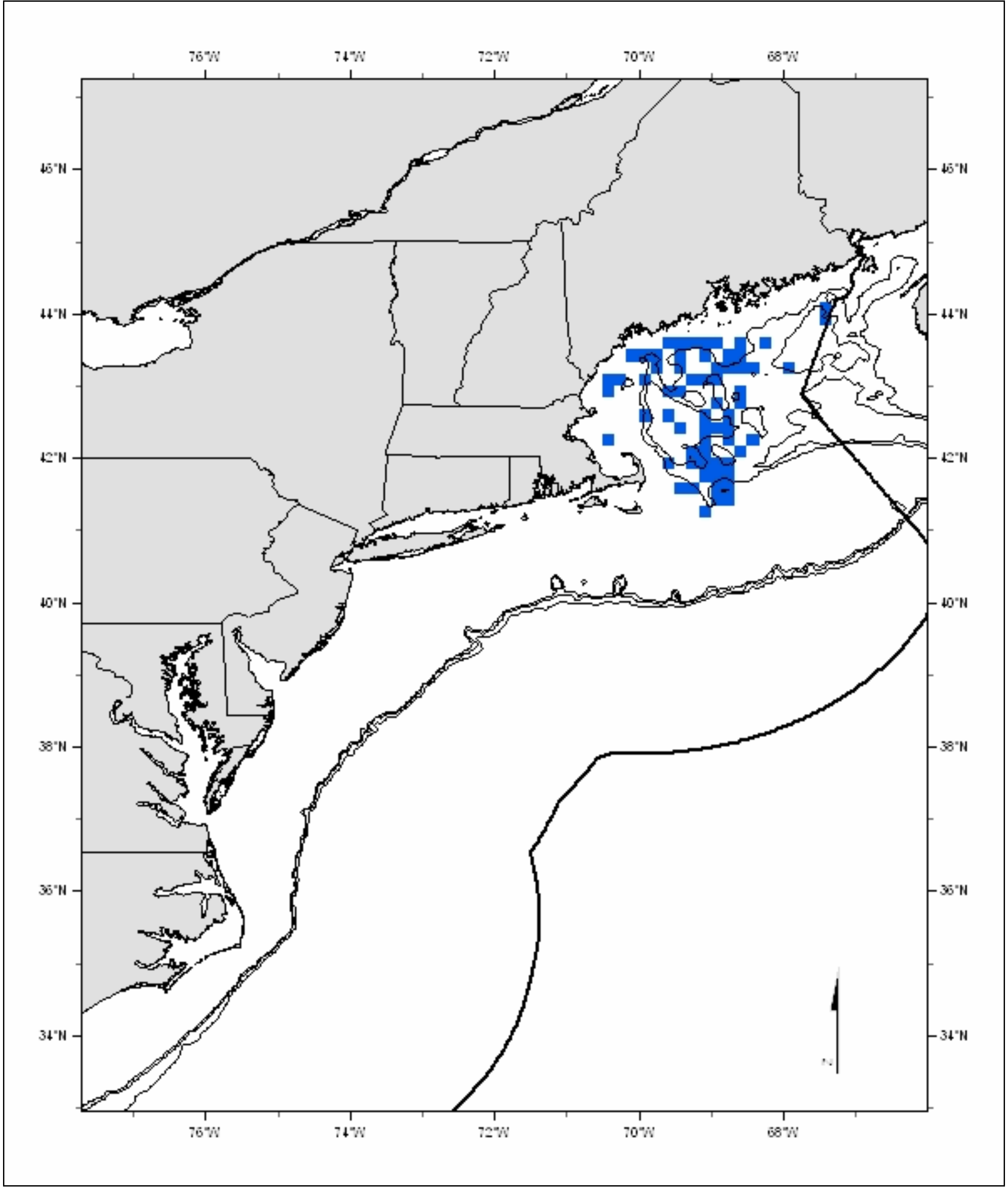
The Alternative 2D EFH designation for thorny skate juveniles on the continental shelf is based upon the relative abundance of juveniles during 1968-2005 in the fall and spring NMFS trawl survey at the 90% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where juvenile thorny skate were caught in state trawl surveys in more than 10% of the tows.

Map 241. Thorny skate adults, Alternative 2A



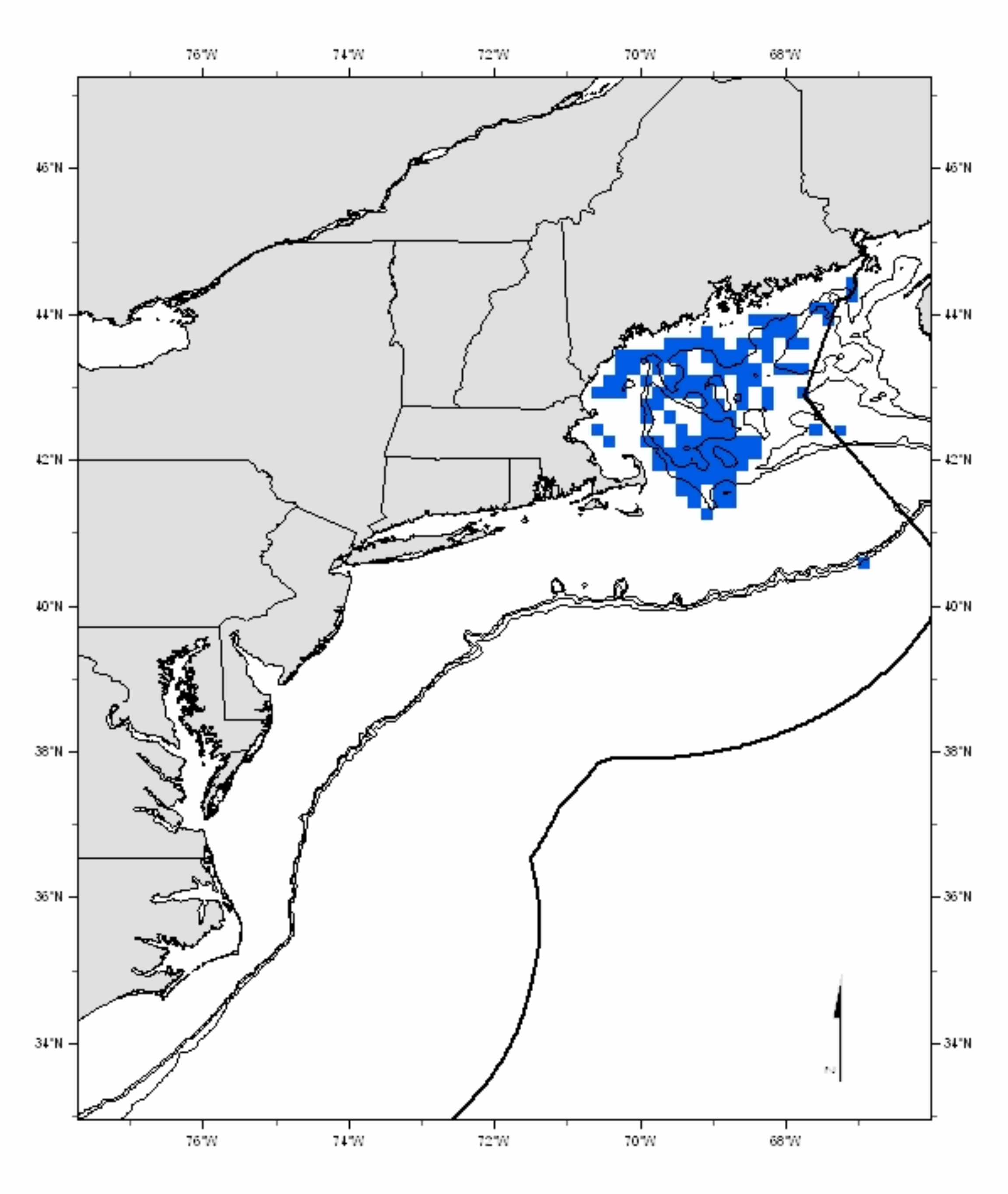
The Alternative 2A EFH designation for thorny skate adults on the continental shelf is based upon the relative abundance of adults during 1968-2005 in the fall and spring NMFS trawl survey at the 25% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where adult thorny skate were caught in state trawl surveys in more than 10% of the tows.

Map 242. Thorny skate adults, Alternative 2B



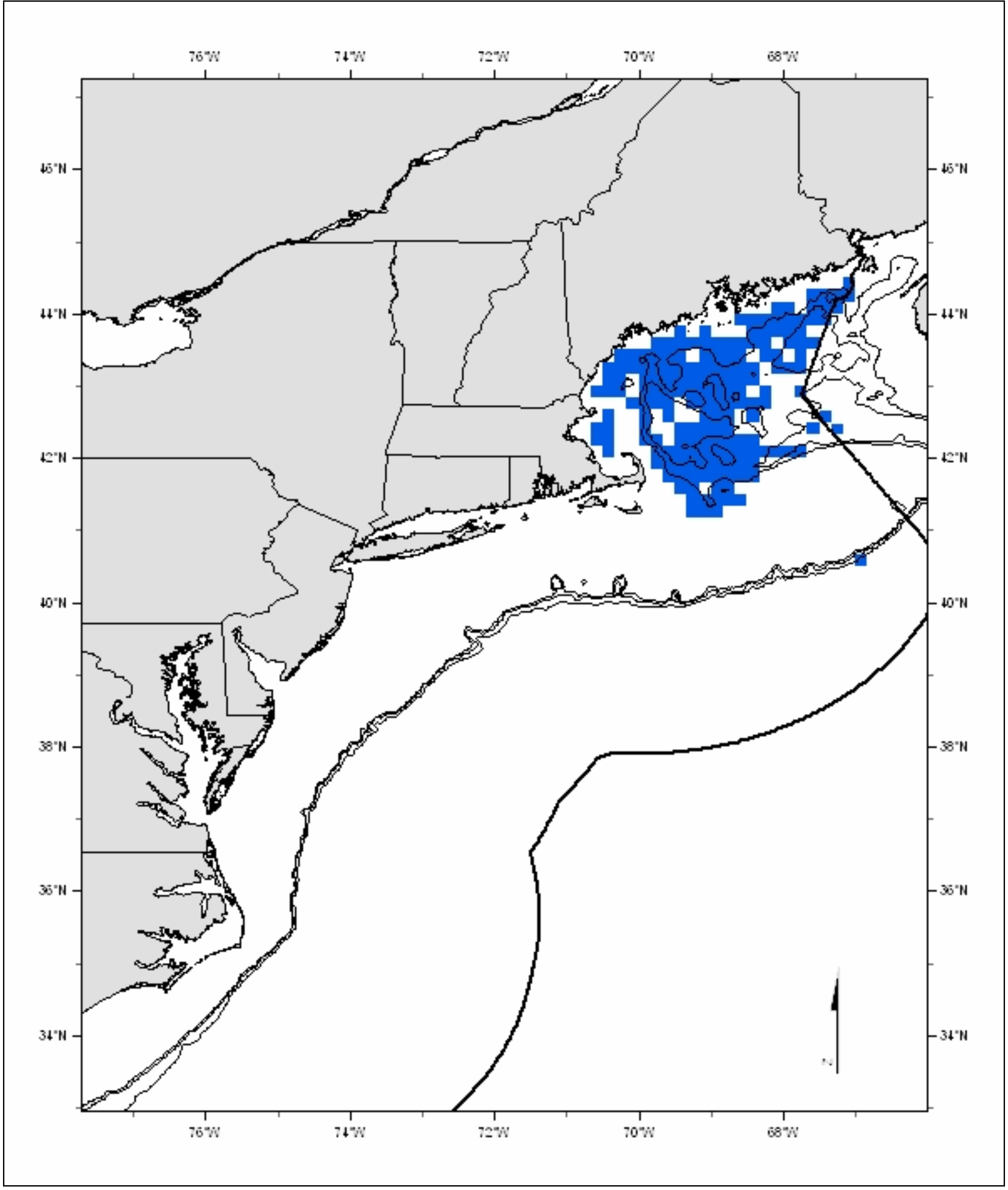
The Alternative 2B EFH designation for thorny skate adults on the continental shelf is based upon the relative abundance of adults during 1968-2005 in the fall and spring NMFS trawl survey at the 50% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where adult thorny skate were caught in state trawl surveys in more than 10% of the tows.

Map 243. Thorny skate adults, Alternative 2C



The Alternative 2C EFH designation for thorny skate adults on the continental shelf is based upon the relative abundance of adults during 1968-2005 in the fall and spring NMFS trawl survey at the 75% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where adult thorny skate were caught in state trawl surveys in more than 10% of the tows.

Map 244. Thorny skate adults, Alternative 2D



The Alternative 2D EFH designation for thorny skate adults on the continental shelf is based upon the relative abundance of adults during 1968-2005 in the fall and spring NMFS trawl survey at the 90% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where adult thorny skate were caught in state trawl surveys in more than 10% of the tows.

4.1.2.3.20 White Hake

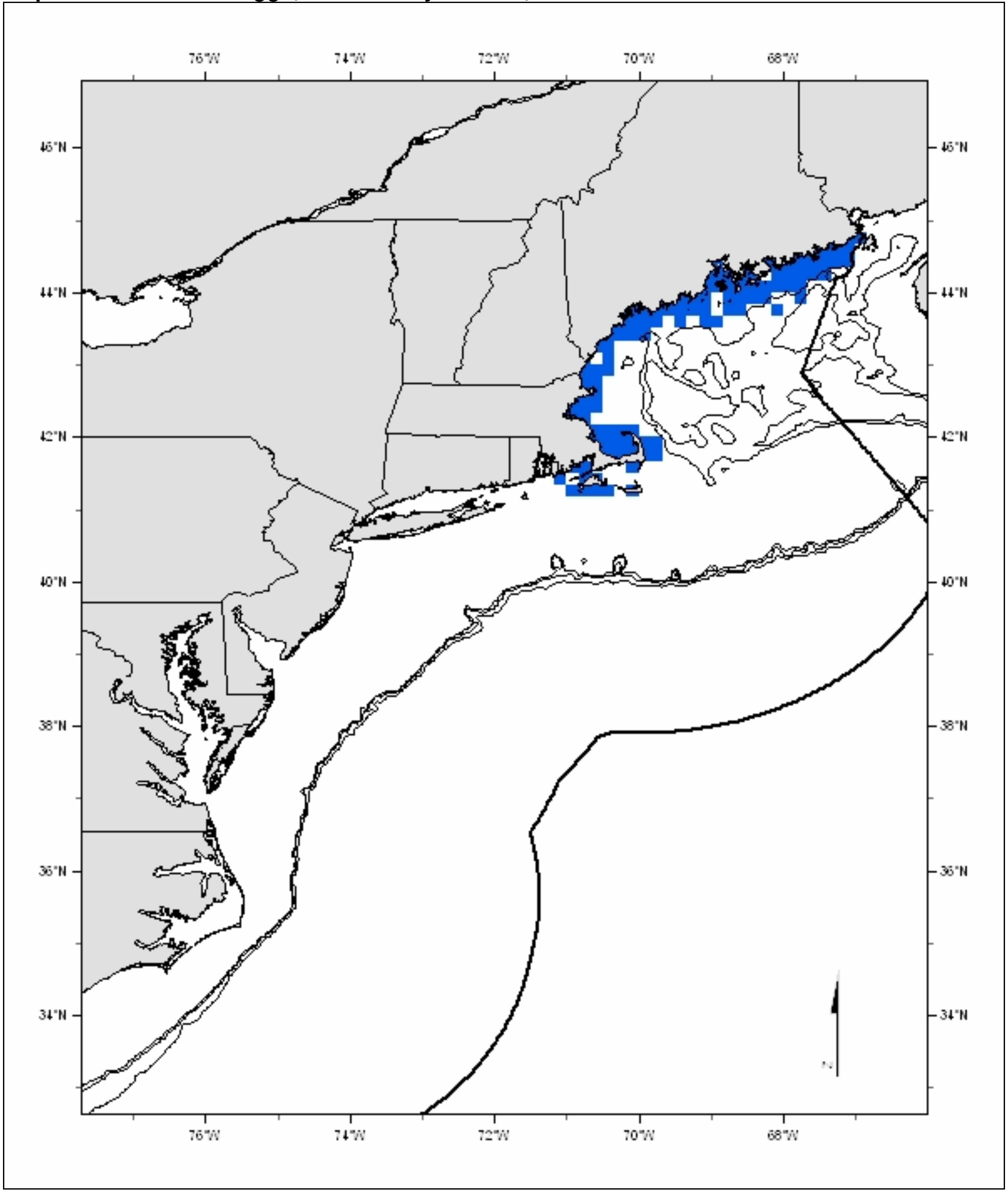
Eggs: Water column habitats on the continental shelf in depths of 100 – 400 meters as depicted in Map 245 - Map 248.
Preferred alternative

Larvae: Water column habitats on the continental shelf in depths of 100 – 400 meters as depicted in Map 245 - Map 248.
Preferred alternative

Juveniles: Estuarine, coastal marine, and continental shelf benthic habitats in depths of 1 – 300 meters with substrates composed of mud and/or eel grass as depicted on Map 245 - Map 248. Other conditions that generally exist where EFH for juvenile white hake is found are bottom temperatures of 2.5 – 15.5ºC and salinities of 13.4 – 34.5 ppt. EFH for juvenile white hake includes intertidal habitats. Once they settle to the bottom, juvenile white hakes feed primarily on euphausiids and pandalid, sand, and other shrimps, and also on amphipods, copepods, fishes (*e.g.*, silver hake, white hake, and gadids), and squids.

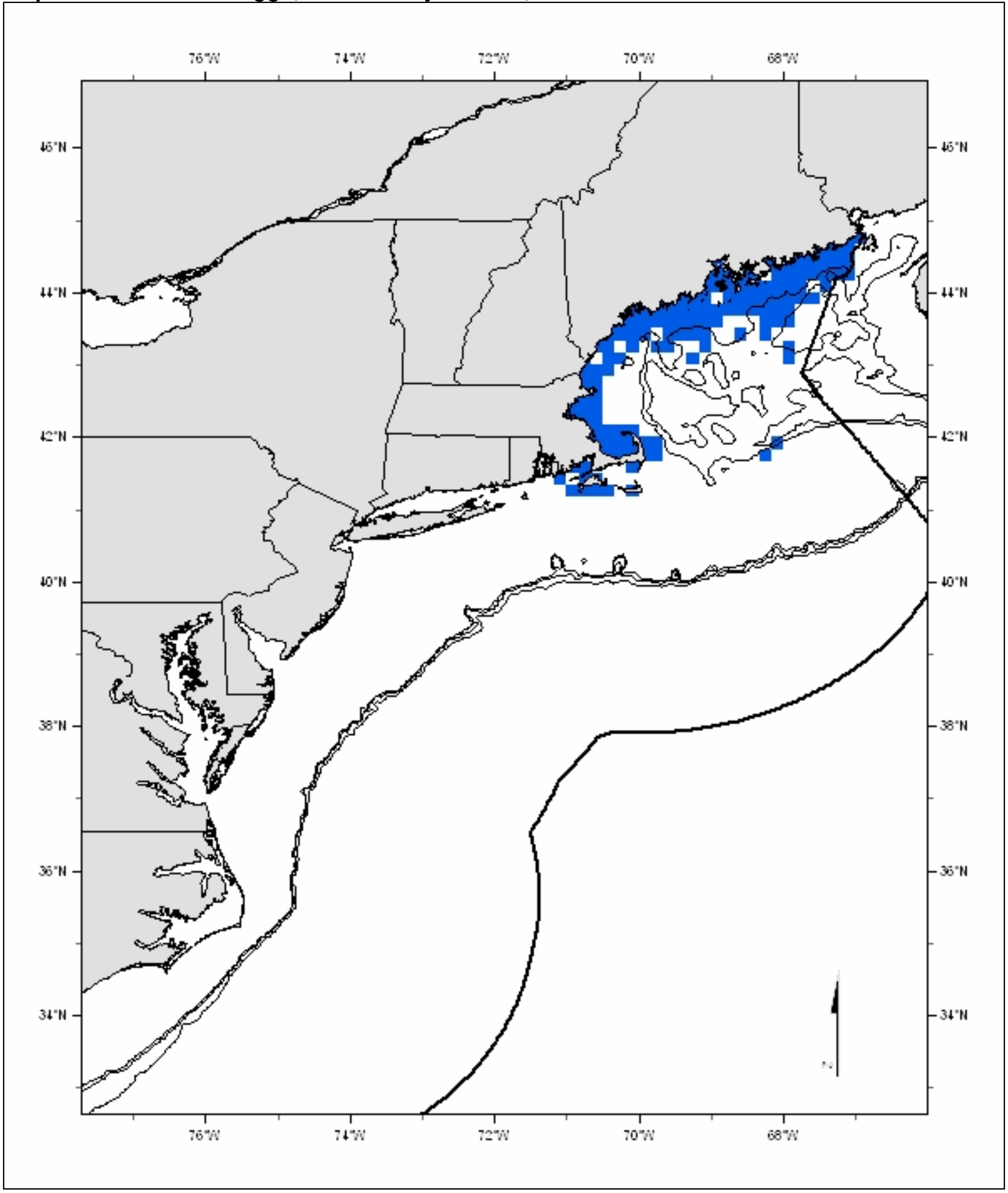
Adults: Benthic habitats on the continental shelf in depths of 100 – 400 meters with substrates composed of mud and/or sand–mud mixtures as depicted on Map 249- Map 252. Other conditions that generally exist where EFH for adult white hake is found are bottom temperatures of 4.5 – 10.5ºC and salinities of 32 – 35.5 ppt. Spawning takes place primarily in deep water on the continental slope. Adult white hakes feed primarily on fishes (*e.g.*, silver hake, other hakes, gadids, Atlantic herring and other clupeids, argentines), squid (*Illex* sp.), and also on squids, pandalid shrimps, and euphausiids.

Map 245. White hake eggs, larvae and juveniles, Alternative 2A



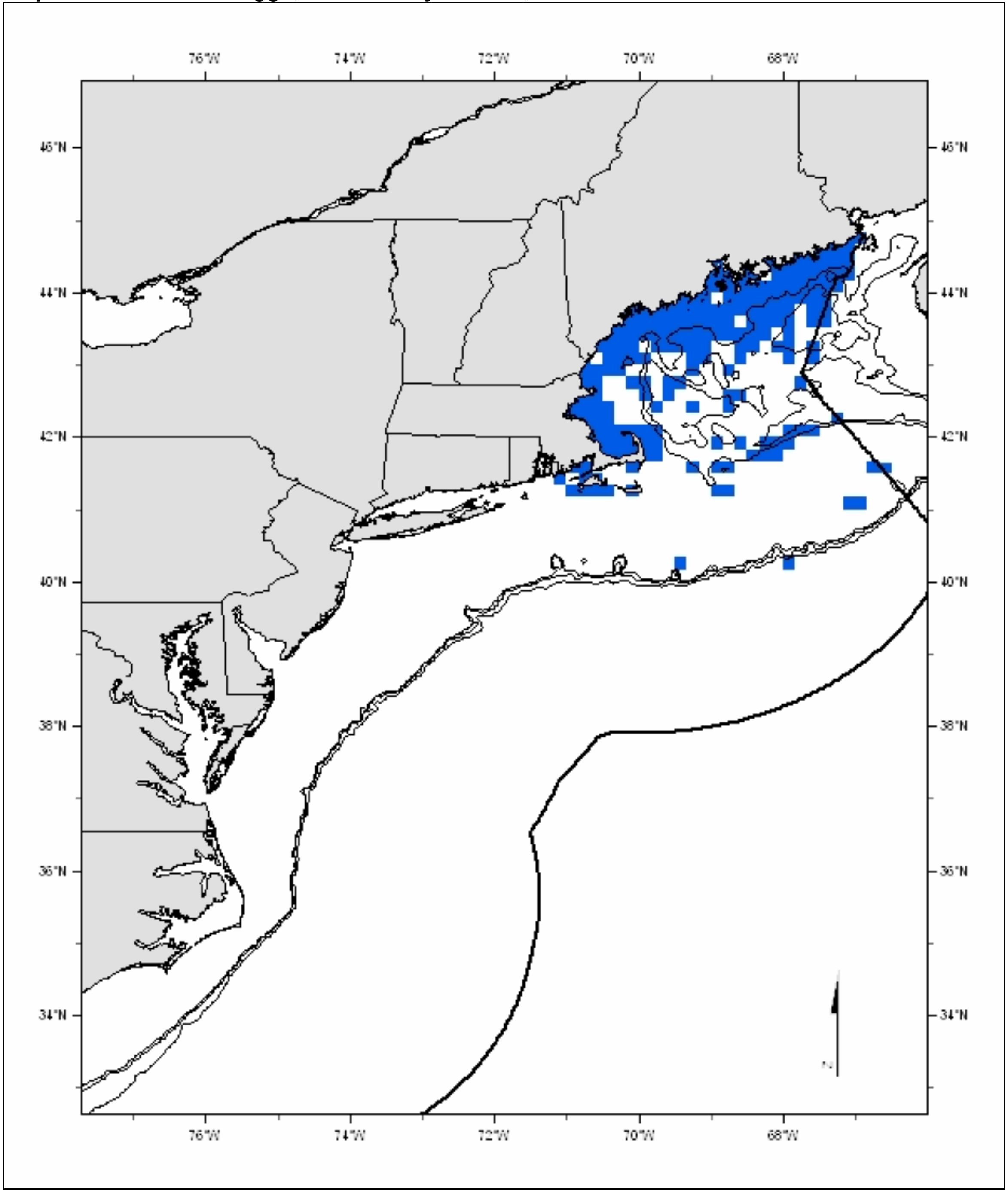
The Alternative 2A EFH designation for white hake eggs, larvae, and juveniles on the continental shelf is based upon the relative abundance of juveniles during 1968-2005 in the fall and spring NMFS trawl survey at the 25% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where juvenile white hake were caught in state trawl surveys in more than 10% of the tows and those bays and estuaries identified by the NOAA ELMR program where white hake eggs or larvae were "common" or "abundant."

Map 246. White hake eggs, larvae and juveniles, Alternative 2B



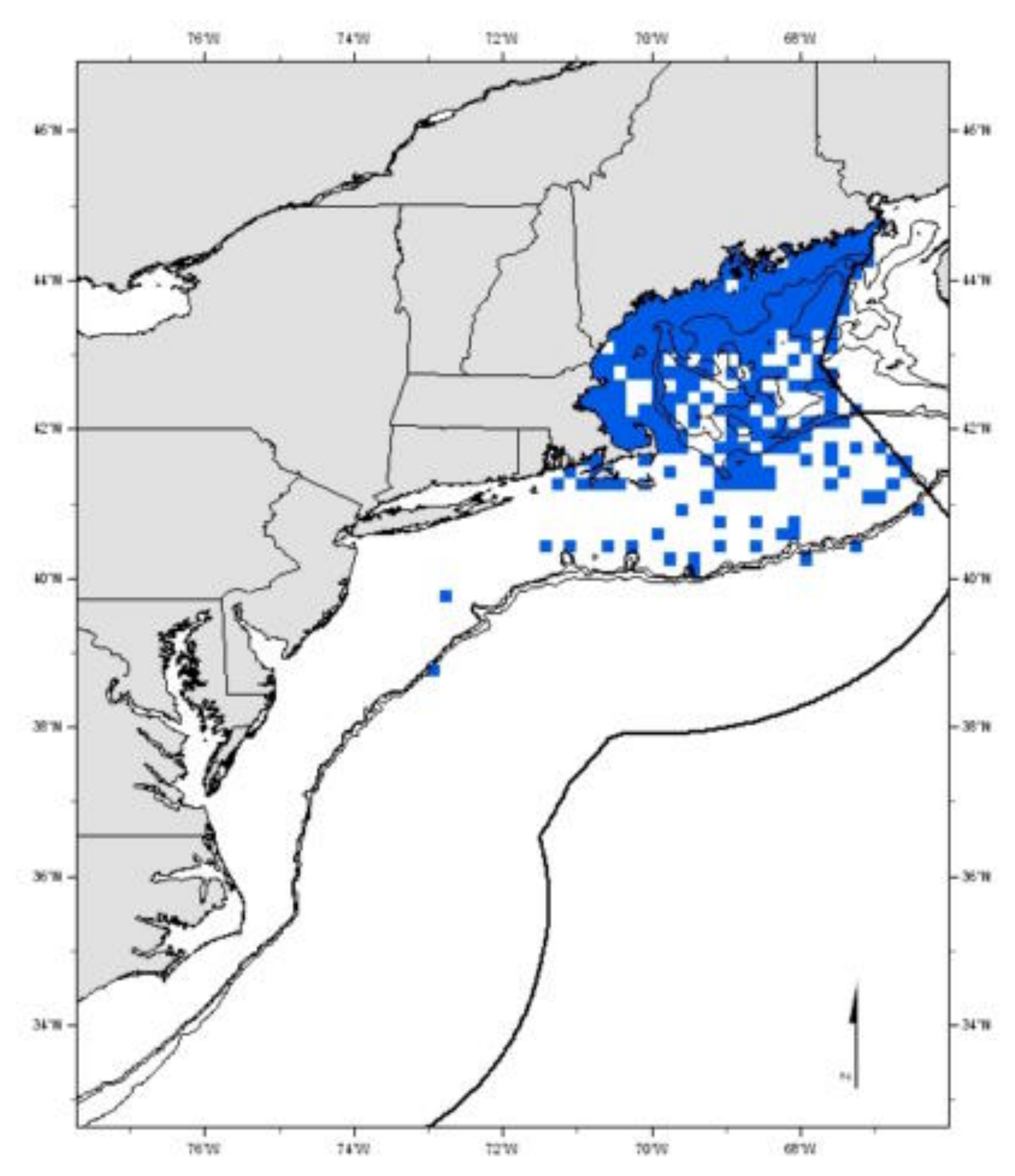
The Alternative 2B EFH designation for white hake eggs, larvae, and juveniles on the continental shelf is based upon the relative abundance of juveniles during 1968-2005 in the fall and spring NMFS trawl survey at the 50% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where juvenile white hake were caught in state trawl surveys in more than 10% of the tows and those bays and estuaries identified by the NOAA ELMR program where white hake eggs or larvae were "common" or "abundant."

Map 247. White hake eggs, larvae and juveniles, Alternative 2C



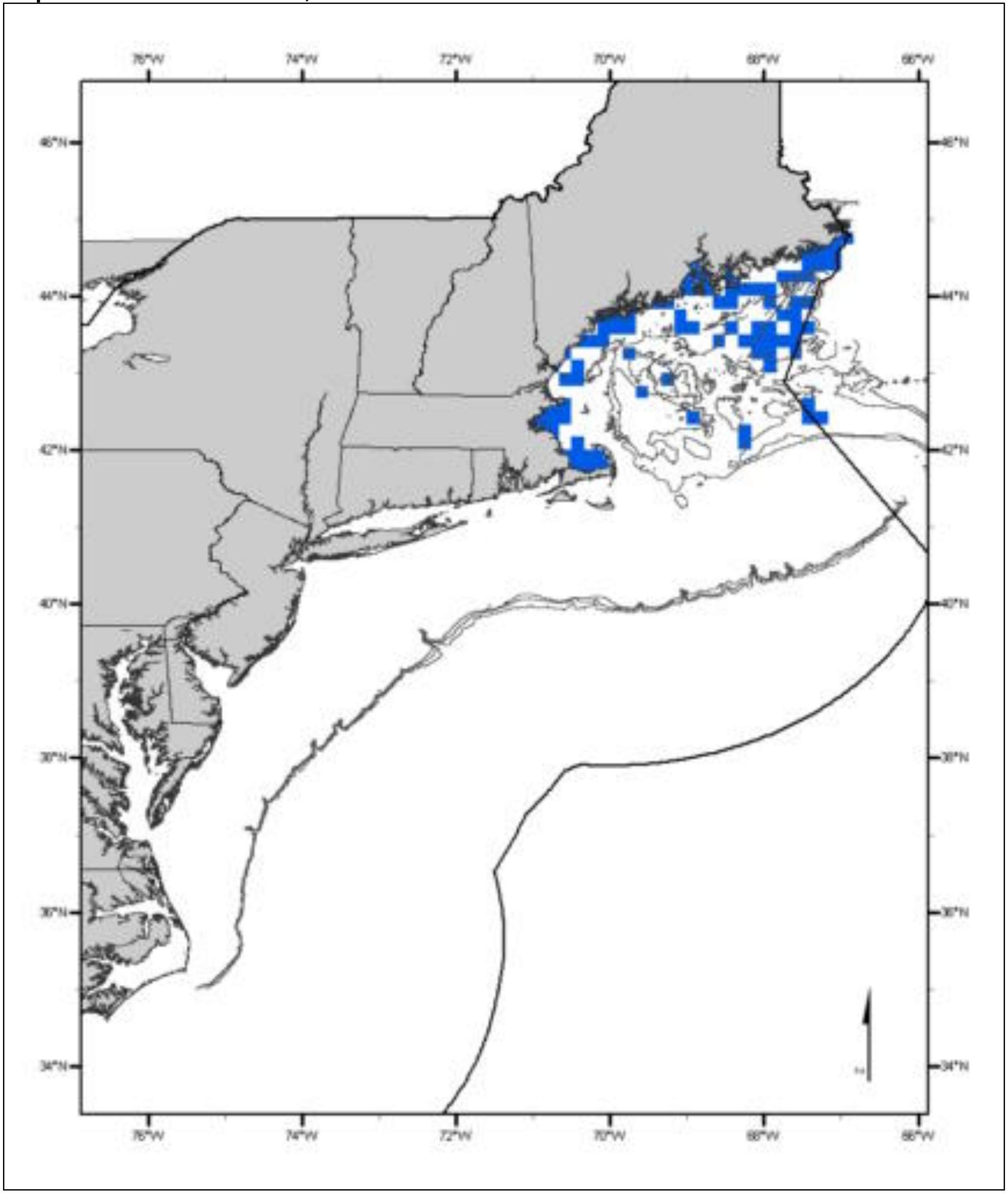
The Alternative 2C EFH designation for white hake eggs, larvae, and juveniles on the continental shelf is based upon the relative abundance of juveniles during 1968-2005 in the fall and spring NMFS trawl survey at the 75% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where juvenile white hake were caught in state trawl surveys in more than 10% of the tows and those bays and es

Map 248. White hake eggs*, larvae* and juveniles, Alternative 2D (*Preferred Alternative)**



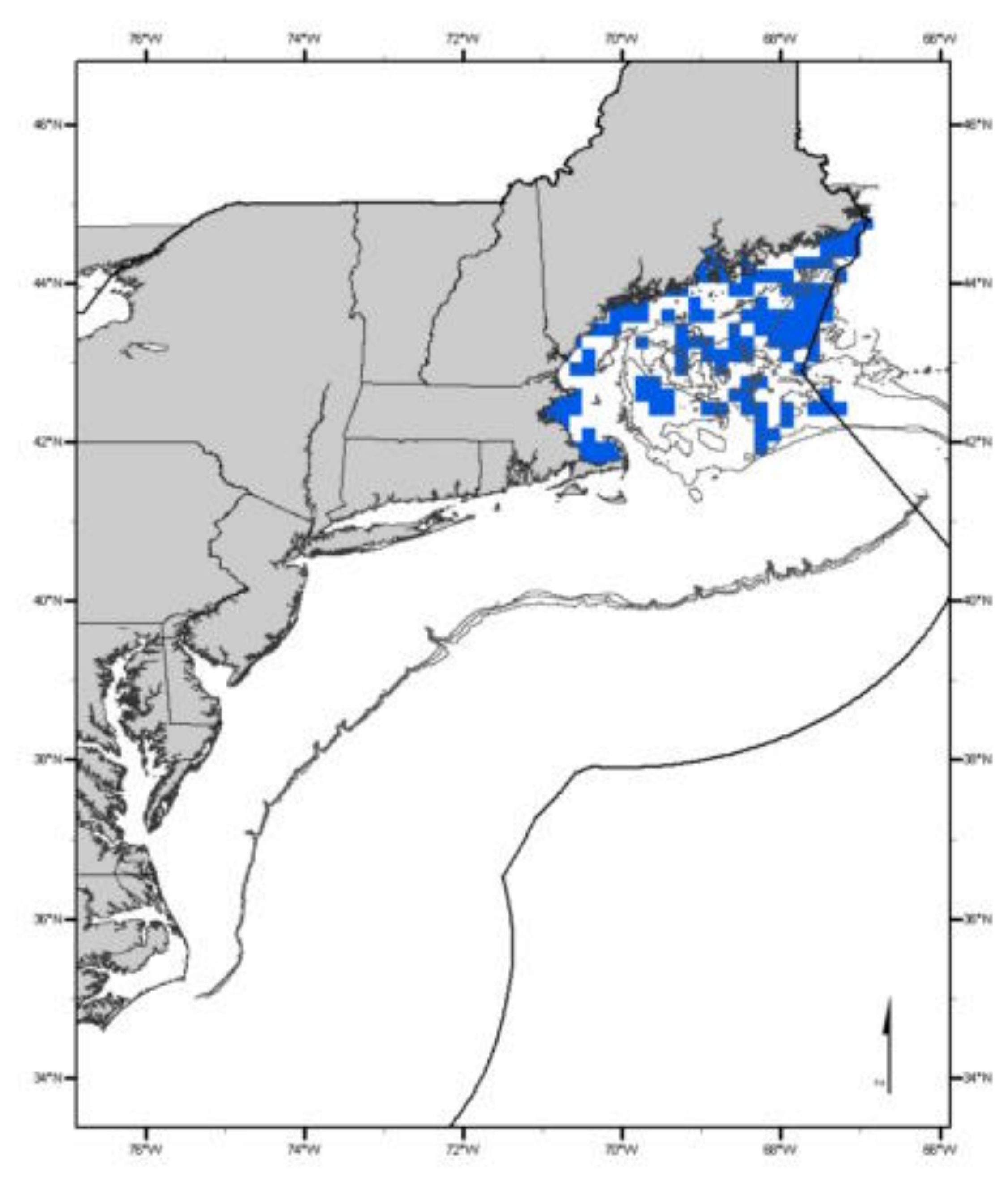
The Alternative 2D EFH designation for white hake eggs, larvae, and juveniles on the continental shelf is based upon the relative abundance of juveniles during 1968-2005 in the fall and spring NMFS trawl survey at the 90% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where juvenile white hake were caught in state trawl surveys in more than 10% of the tows and those bays and estuaries identified by the NOAA ELMR program where white hake eggs or larvae were "common" or "abundant."

Map 249. White hake adults, Alternative 2A



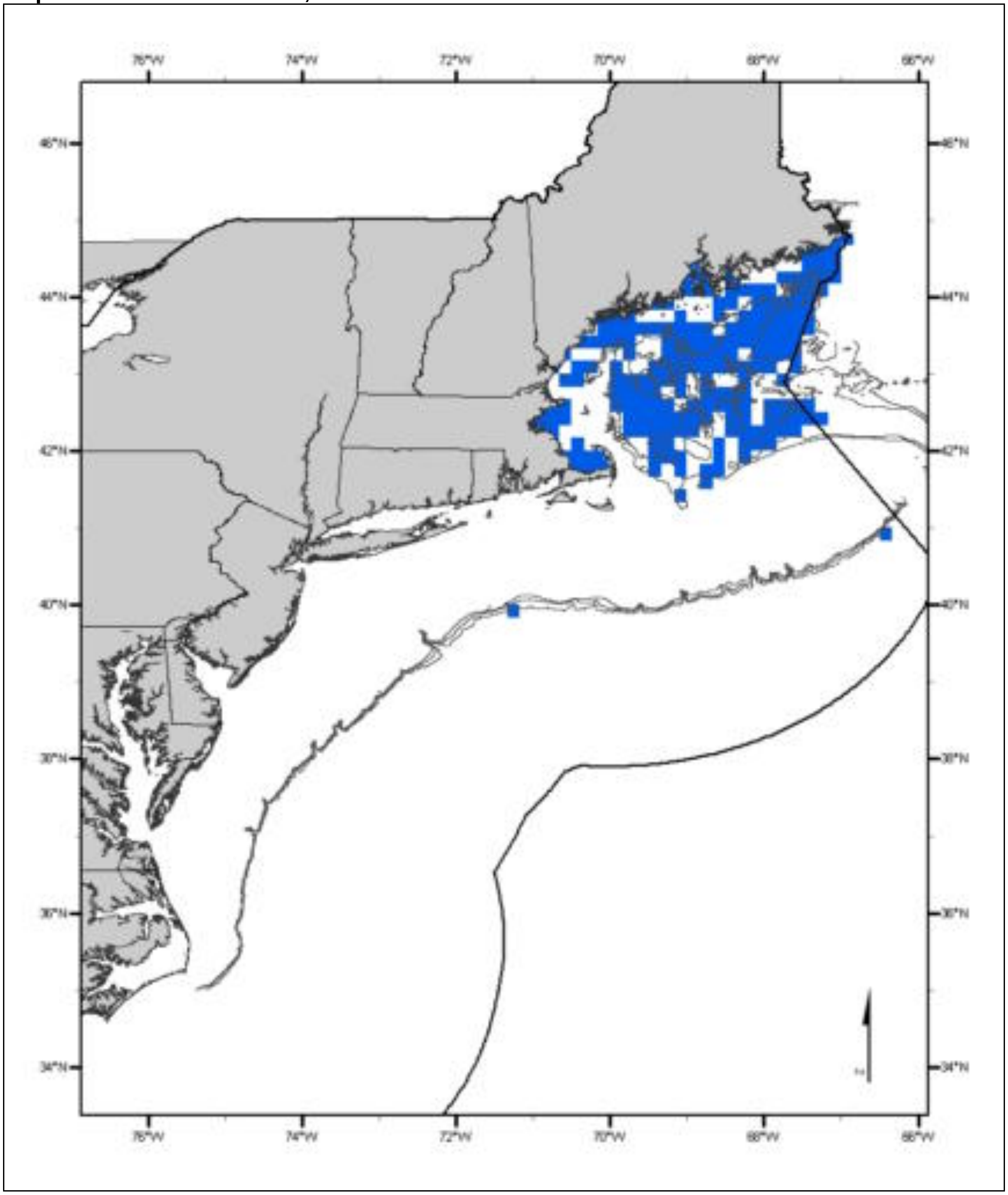
The Alternative 2A EFH designation for adult white hake on the continental shelf is based upon relative abundance during 1968-2005 in the fall and spring NMFS trawl survey at the 25% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where adult white hake were caught in state trawl surveys in more than 10% of the tows, as well as those bays and estuaries identified by the NOAA ELMR program where white hake adults were "common" or "abundant."

Map 250. White hake adults, Alternative 2B



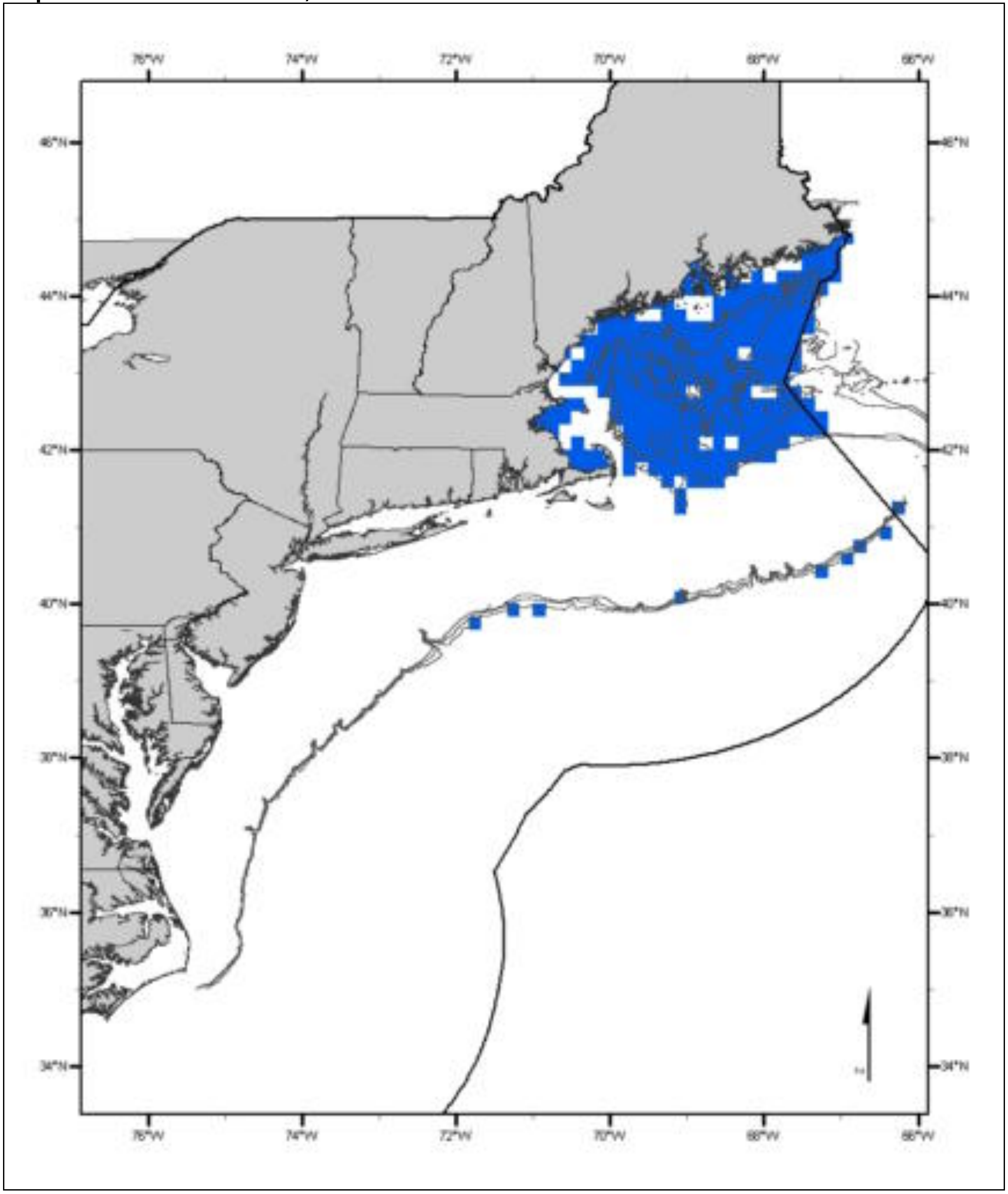
The Alternative 2B EFH designation for adult white hake on the continental shelf is based upon relative abundance during 1968-2005 in the fall and spring NMFS trawl survey at the 50% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where adult white hake were caught in state trawl surveys in more than 10% of the tows, as well as those bays and estuaries identified by the NOAA ELMR program where white hake adults were "common" or "abundant."

Map 251. White hake adults, Alternative 2C



The Alternative 2C EFH designation for adult white hake on the continental shelf is based upon relative abundance during 1968-2005 in the fall and spring NMFS trawl survey at the 75% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where adult white hake were caught in state trawl surveys in more than 10% of the tows, as well as those bays and estuaries identified by the NOAA ELMR program where white hake adults were "common" or "abundant."

Map 252. White hake adults, Alternative 2D



The Alternative 2D EFH designation for adult white hake on the continental shelf is based upon relative abundance during 1968-2005 in the fall and spring NMFS trawl survey at the 90% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where adult white hake were caught in state trawl surveys in more than 10% of the tows, as well as those bays and estuaries identified by the NOAA ELMR program where white hake adults were "common" or "abundant."

4.1.2.3.21 Windowpane Flounder

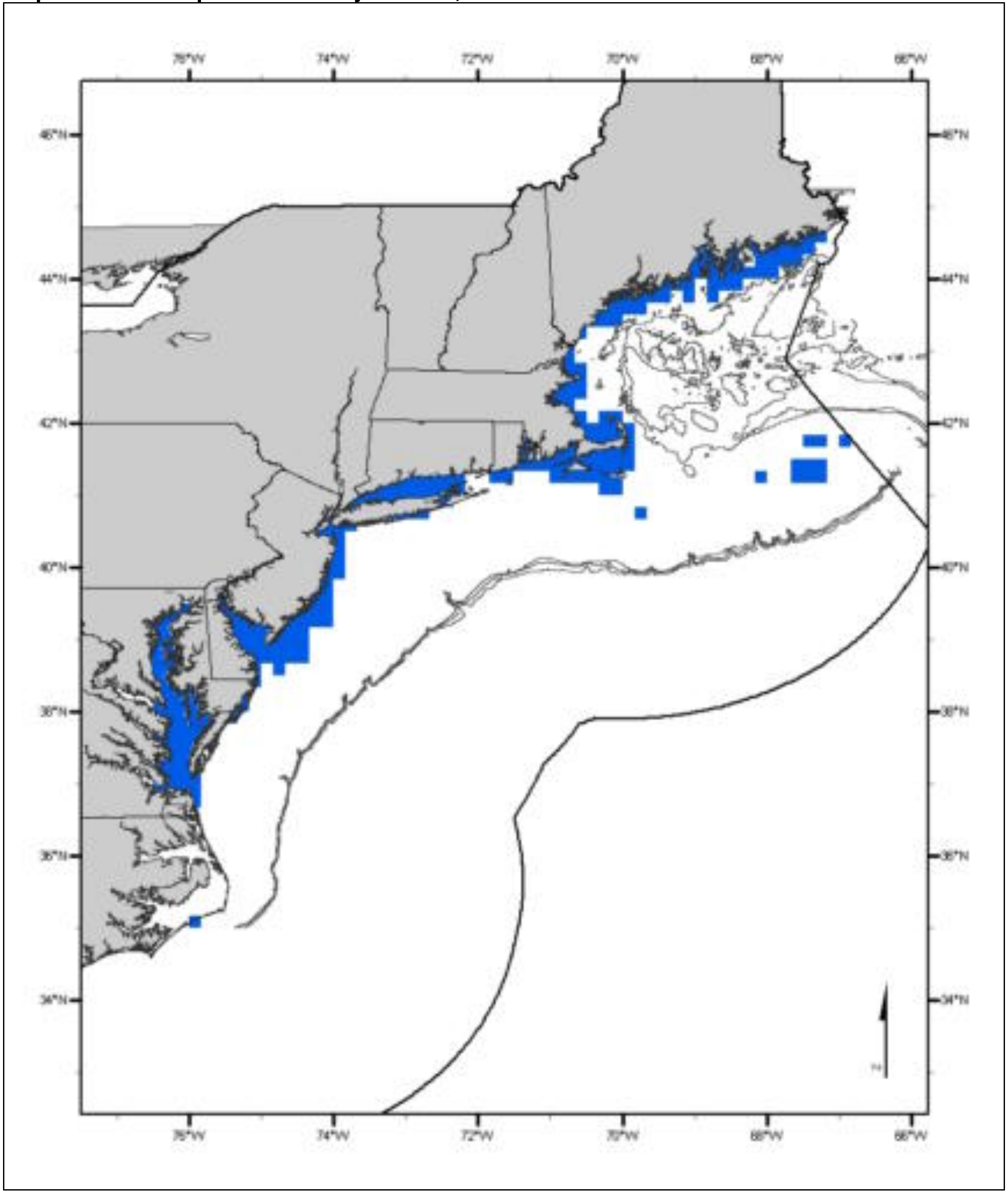
Eggs: No alternative EFH designation.

Larvae: No alternative EFH designation.

Juveniles: Sandy benthic habitats in estuarine, coastal marine, and continental shelf areas in depths of 1 – 60 meters, including the intertidal zone as depicted on Map 253 - Map 256. Other conditions that generally exist where EFH for juvenile windowpane is found are bottom temperatures of 2.5 – 26ºC and salinities of 14.5 – 33.5 ppt. Juvenile windowpane flounders feed primarily on mysids, but also on polychaetes, amphipods, decapod larvae, and small fishes (*e.g.*, sand lances).

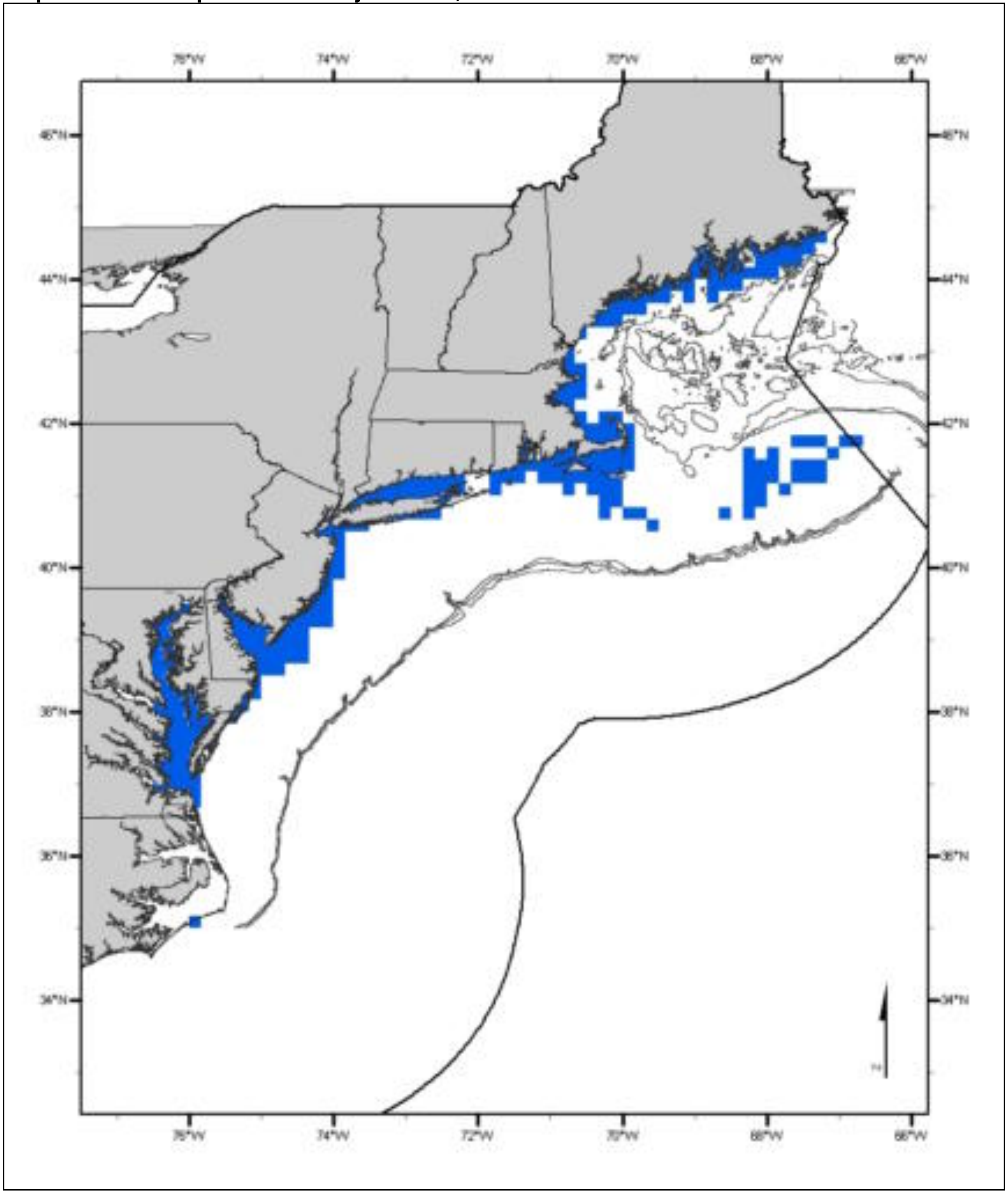
Adults: Sandy benthic habitats in estuarine, coastal marine, and continental shelf areas in depths of 1 – 70 meters, including the intertidal zone as depicted on Map 257 - Map 260. Other conditions that generally exist where EFH for adult windowpane is found are bottom temperatures of 2.5 – 20.5ºC and salinities of 23 – 33.5 ppt. Spawning occurs between 6 and 21ºC, and mostly between 8.5 and 13.5ºC. Adult windowpane flounders feed primarily on small crustaceans (amphipods, mysids, and sand shrimps) and fishes (*e.g.*, silver hakes, cusks, sand lances, gobies, and bay anchovies).

Map 253. Windowpane flounder juveniles, Alternative 2A



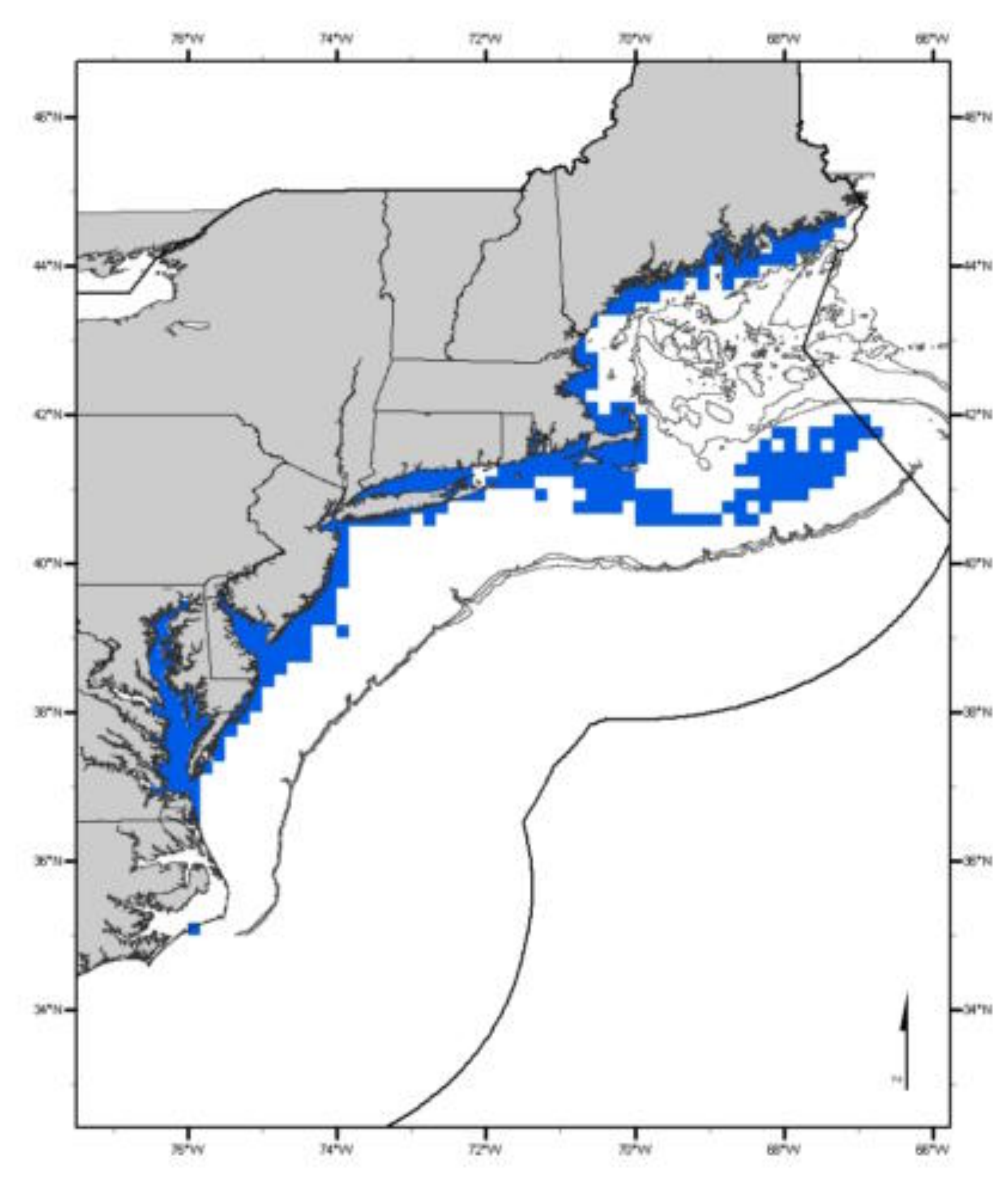
The Alternative 2A EFH designation for juvenile windowpane on the continental shelf is based upon relative abundance during 1968-2005 in the fall and spring NMFS trawl survey at the 25% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where juvenile windowpane were caught in state trawl surveys in more than 10% of the tows, as well as those bays and estuaries identified by the NOAA ELMR program where windowpane juveniles were "common" or "abundant."

Map 254. Windowpane flounder juveniles, Alternative 2B



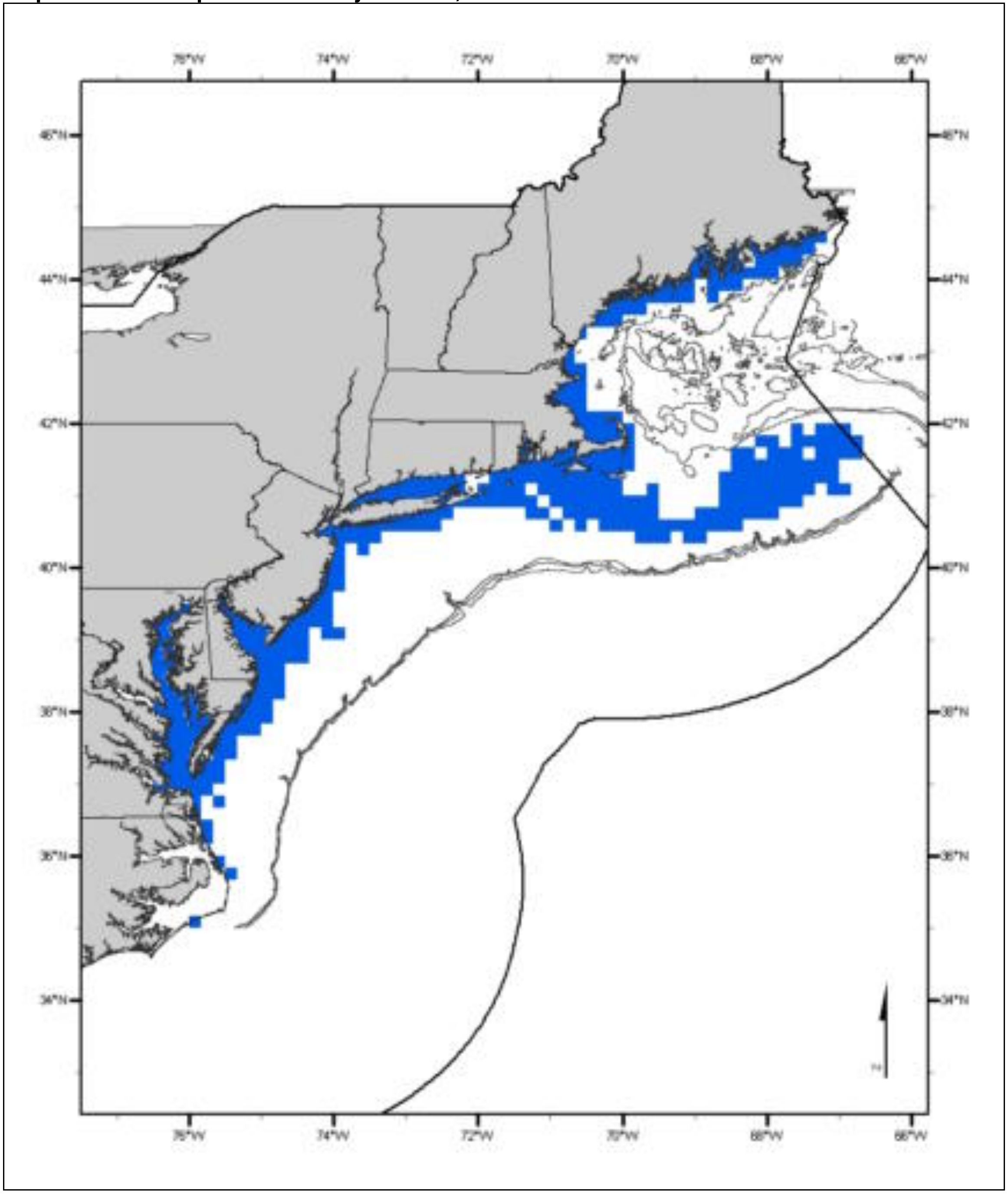
The Alternative 2B EFH designation for juvenile windowpane on the continental shelf is based upon relative abundance during 1968-2005 in the fall and spring NMFS trawl survey at the 50% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where juvenile windowpane were caught in state trawl surveys in more than 10% of the tows, as well as those bays and estuaries identified by the NOAA ELMR program where windowpane juveniles were "common" or "abundant."

Map 255. Windowpane flounder juveniles, Alternative 2C



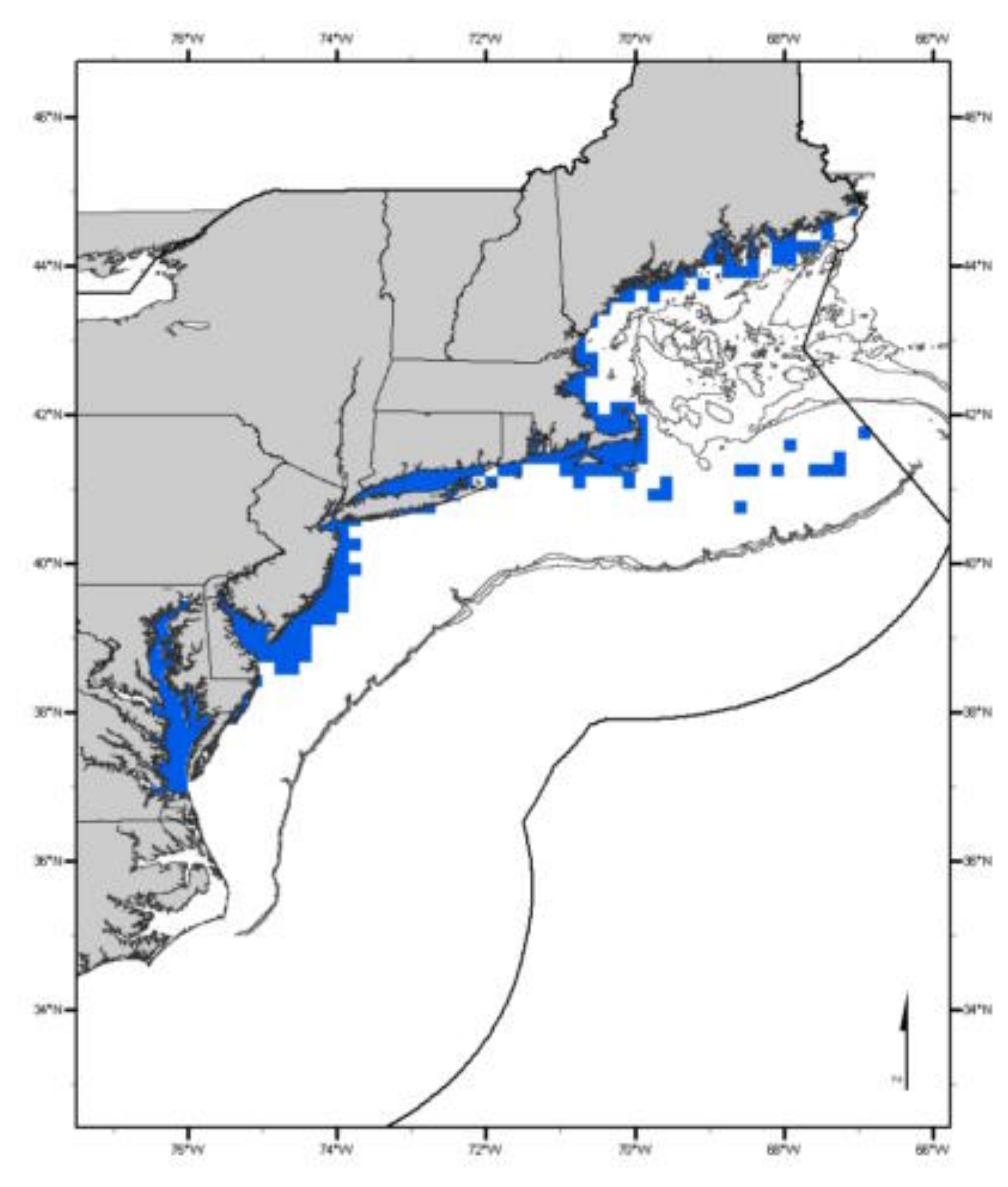
The Alternative 2C EFH designation for juvenile windowpane on the continental shelf is based upon relative abundance during 1968-2005 in the fall and spring NMFS trawl survey at the 75% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where juvenile windowpane were caught in state trawl surveys in more than 10% of the tows, as well as those bays and estuaries identified by the NOAA ELMR program where windowpane juveniles were "common" or "abundant."

Map 256. Windowpane flounder juveniles, Alternative 2D



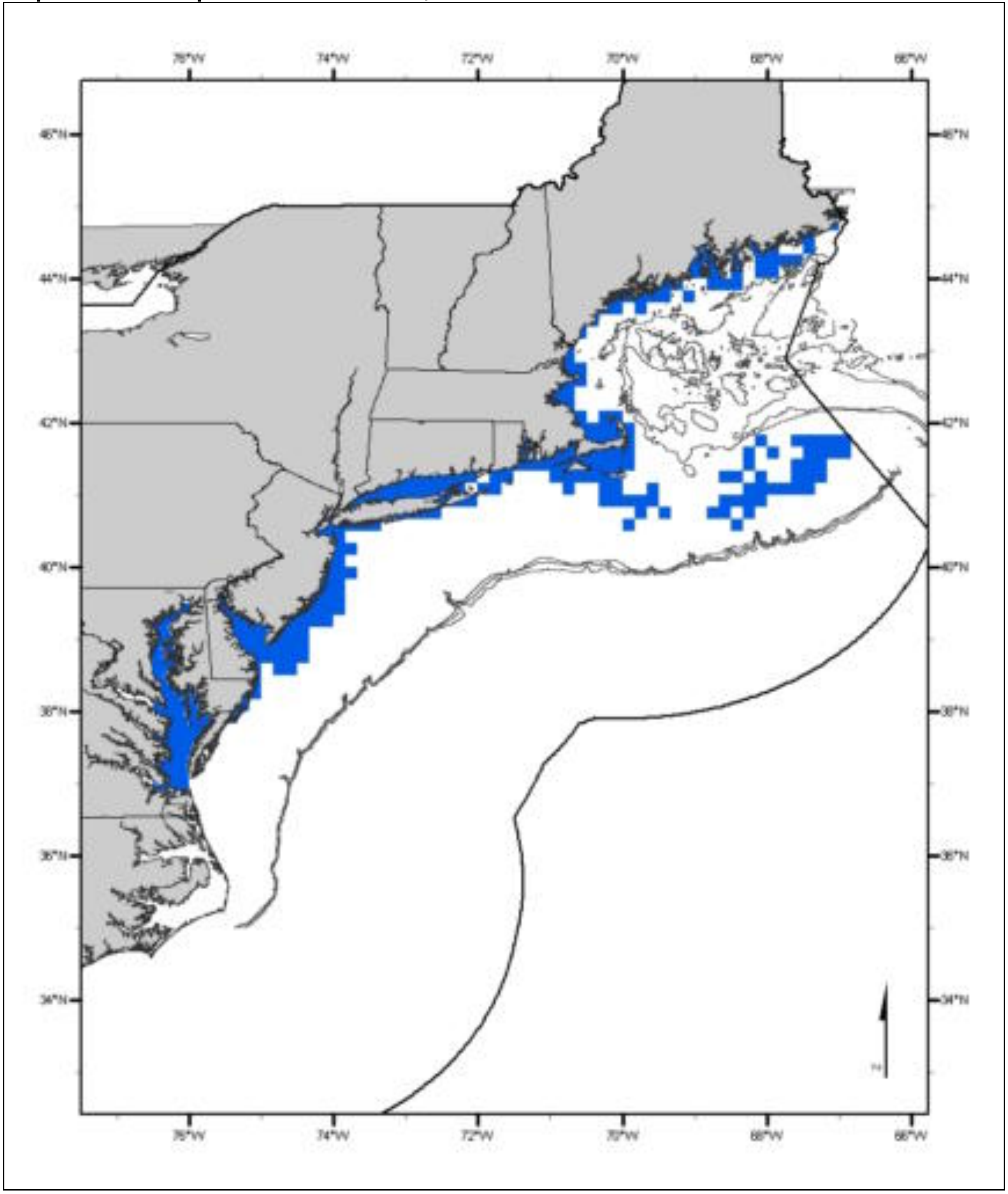
The Alternative 2D EFH designation for juvenile windowpane on the continental shelf is based upon relative abundance during 1968-2005 in the fall and spring NMFS trawl survey at the 90% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where juvenile windowpane were caught in state trawl surveys in more than 10% of the tows, as well as those bays and estuaries identified by the NOAA ELMR program where windowpane juveniles were "common" or "abundant."

Map 257. Windowpane flounder adults, Alternative 2A



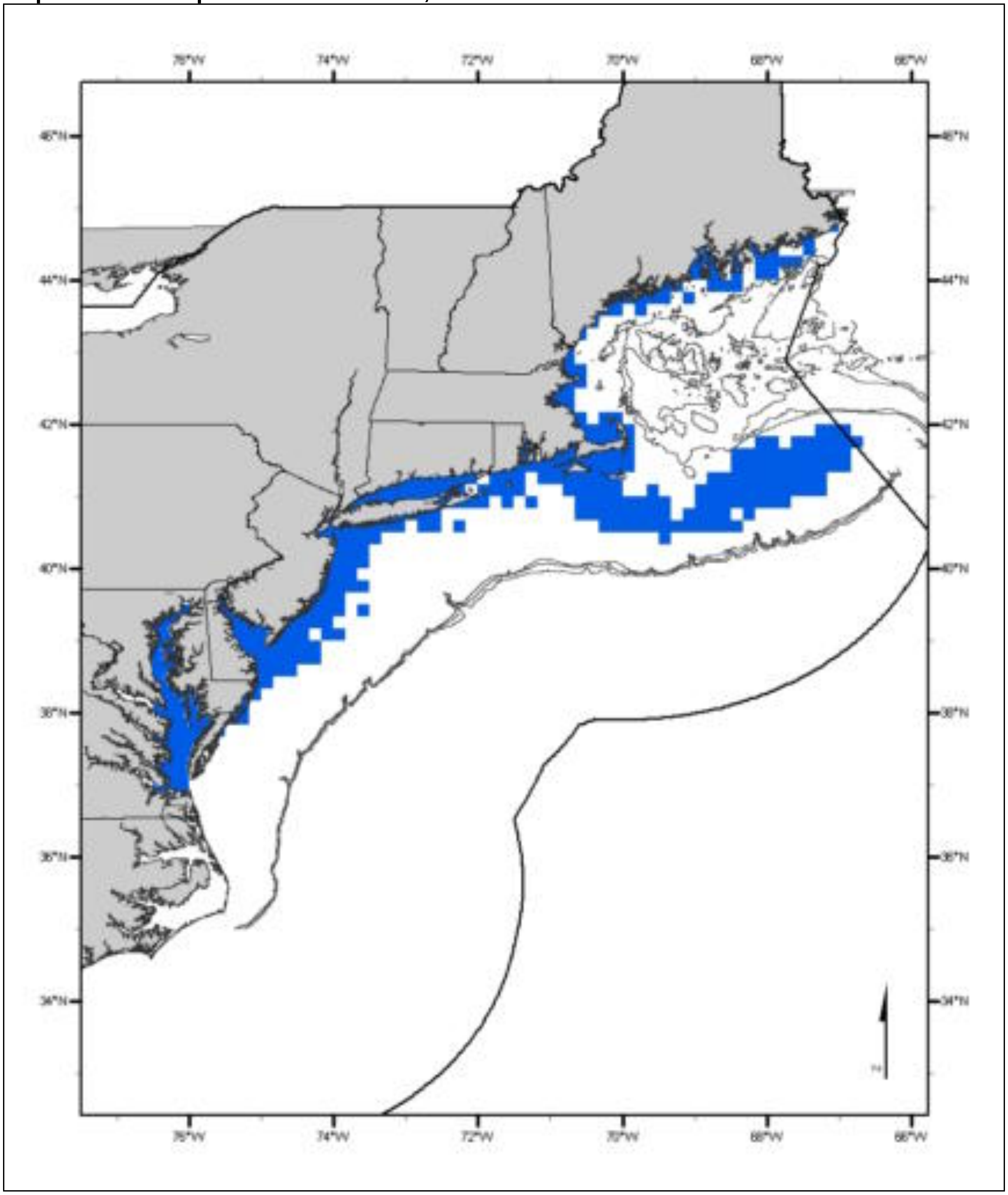
The Alternative 2A EFH designation for adult windowpane on the continental shelf is based upon relative abundance during 1968-2005 in the fall and spring NMFS trawl survey at the 25% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where adult windowpane were caught in state trawl surveys in more than 10% of the tows, as well as those bays and estuaries identified by the NOAA ELMR program where windowpane adults were "common" or "abundant."

Map 258. Windowpane flounder adults, Alternative 2B



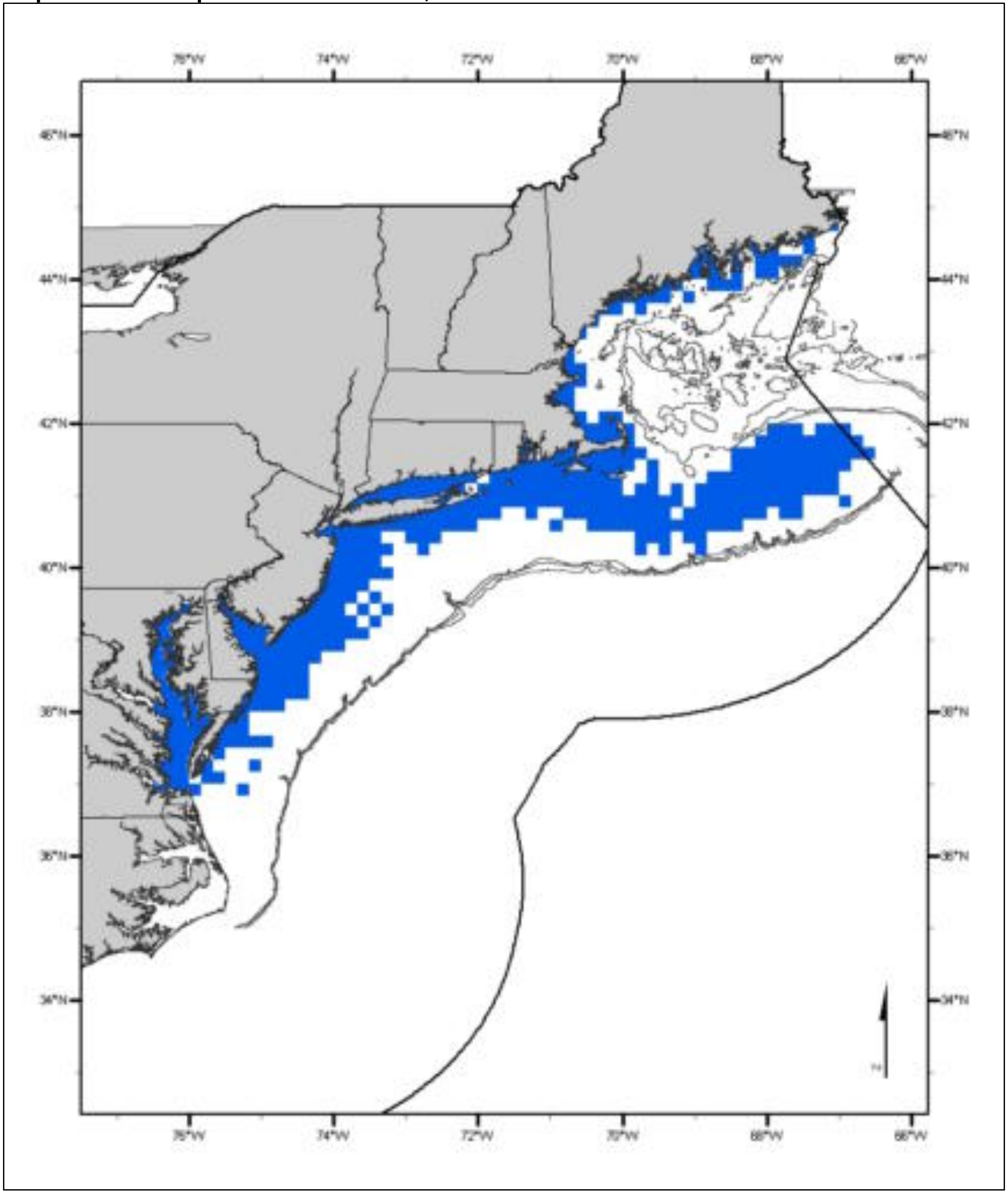
The Alternative 2B EFH designation for adult windowpane on the continental shelf is based upon relative abundance during 1968-2005 in the fall and spring NMFS trawl survey at the 50% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where adult windowpane were caught in state trawl surveys in more than 10% of the tows, as well as those bays and estuaries identified by the NOAA ELMR program where windowpane adults were "common" or "abundant."

Map 259. Windowpane flounder adults, Alternative 2C



The Alternative 2C EFH designation for adult windowpane on the continental shelf is based upon relative abundance during 1968-2005 in the fall and spring NMFS trawl survey at the 75% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where adult windowpane were caught in state trawl surveys in more than 10% of the tows, as well as those bays and estuaries identified by the NOAA ELMR program where windowpane adults were "common" or "abundant."

Map 260. Windowpane flounder adults, Alternative 2D



The Alternative 2D EFH designation for adult windowpane on the continental shelf is based upon relative abundance during 1968-2005 in the fall and spring NMFS trawl survey at the 90% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where adult windowpane were caught in state trawl surveys in more than 10% of the tows, as well as those bays and estuaries identified by the NOAA ELMR program where windowpane adults were "common" or "abundant."

4.1.2.3.22 Winter Flounder

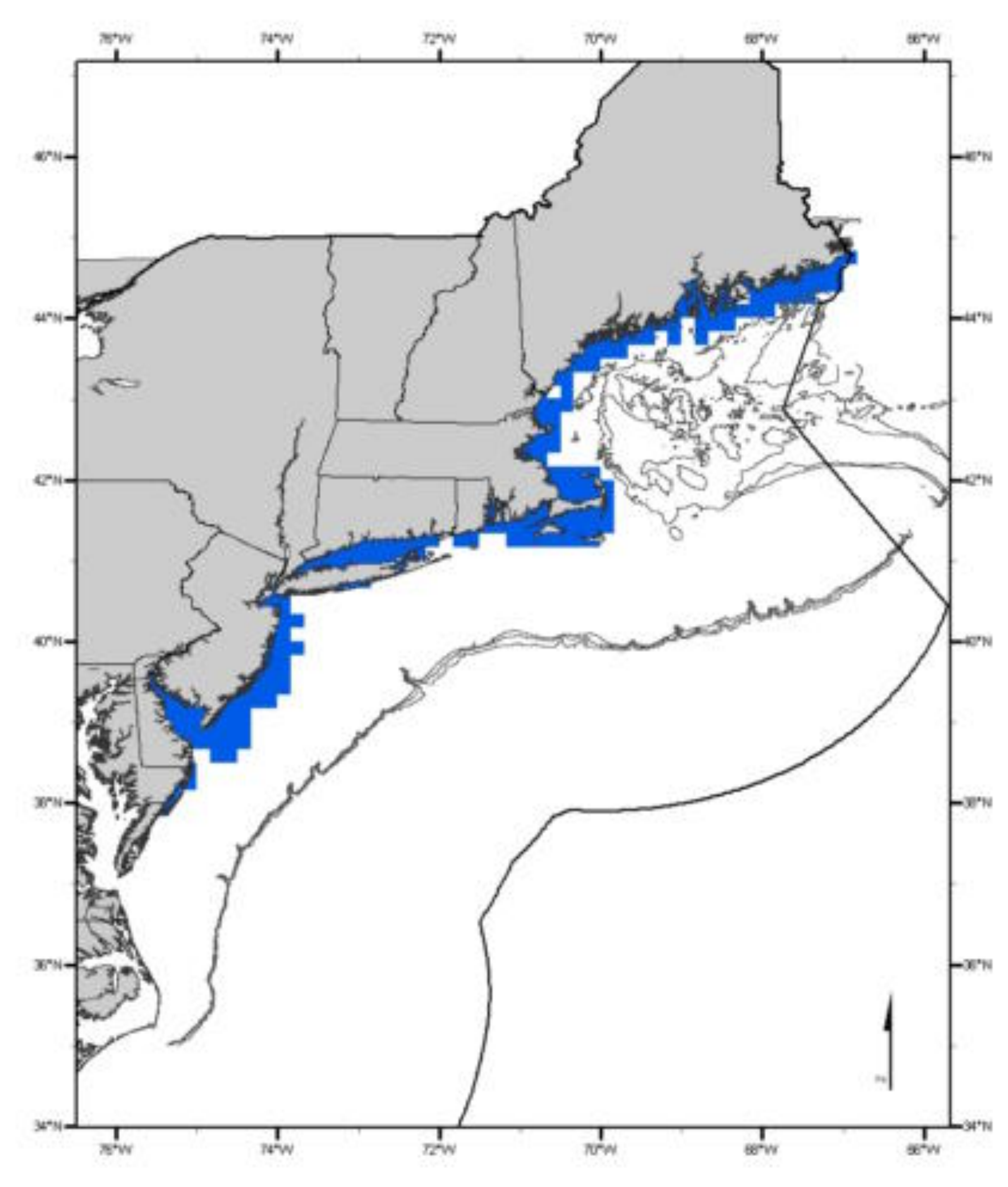
Eggs: No alternative EFH designation.

Larvae: No alternative EFH designation.

Juveniles: Estuarine, coastal marine, and continental shelf benthic habitats in depths of 0.5 – 50 meters with a variety of substrate types as depicted on Map 261 - Map 264. Juvenile winter flounder are found on vegetated and un-vegetated muddy and sandy sediments and in bottom debris; YOY juveniles inhabit eelgrass and macroalgae and are also found in marsh creeks. EFH includes intertidal and sub-tidal benthic habitats. Other conditions that generally exist where EFH for juvenile winter flounder is found are: bottom temperatures of 1 – 24.5ºC inshore and 1.5 – 16.5ºC on the shelf; and salinities of 9 – 33.5 ppt inshore and 31.5 – 33.5 ppt on the shelf. Primary prey organisms are polychaetes, amphipods, and other crustaceans. They also feed on small bivalves mollusks, including bivalve siphons.

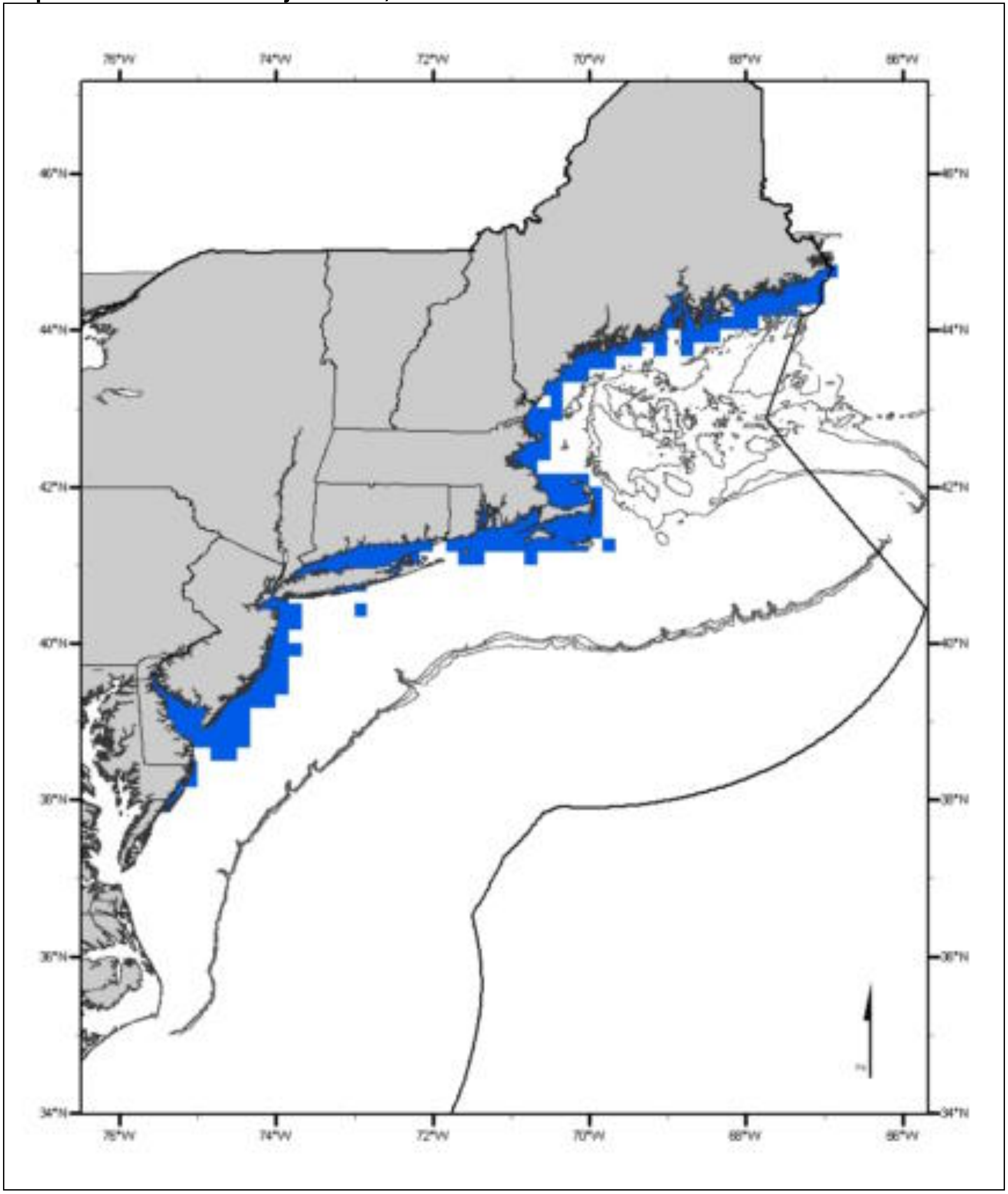
Adults: Estuarine, coastal marine, and continental shelf benthic habitats in depths of 2 – 60 meters as depicted on Map 265 - Map 268. EFH for adult winter flounder on the continental shelf occurs on sandy substrates. In inshore areas, EFH is composed of a variety of substrates (see eggs). Other conditions that generally exist where EFH for adult winter flounder is found are: bottom temperatures of 1 – 15.5ºC inshore and 1.5 – 12.5ºC on the shelf; and salinities of 9 – 33.5 ppt inshore and 31.5 – 33.5 ppt on the shelf. Spawning occurs inshore in depths as shallow as one meter or less and on Nantucket Shoals and Georges Bank in depths up to 72 meters; spawning may also occur on the shelf in southern New England and the Mid–Atlantic region. Primary prey organisms are polychaetes, amphipods and other crustaceans, planktonic hydroids, anemones (e.g., *Cerianthus* spp.), and bivalve mollusks.

Map 261. Winter flounder juveniles, Alternative 2A



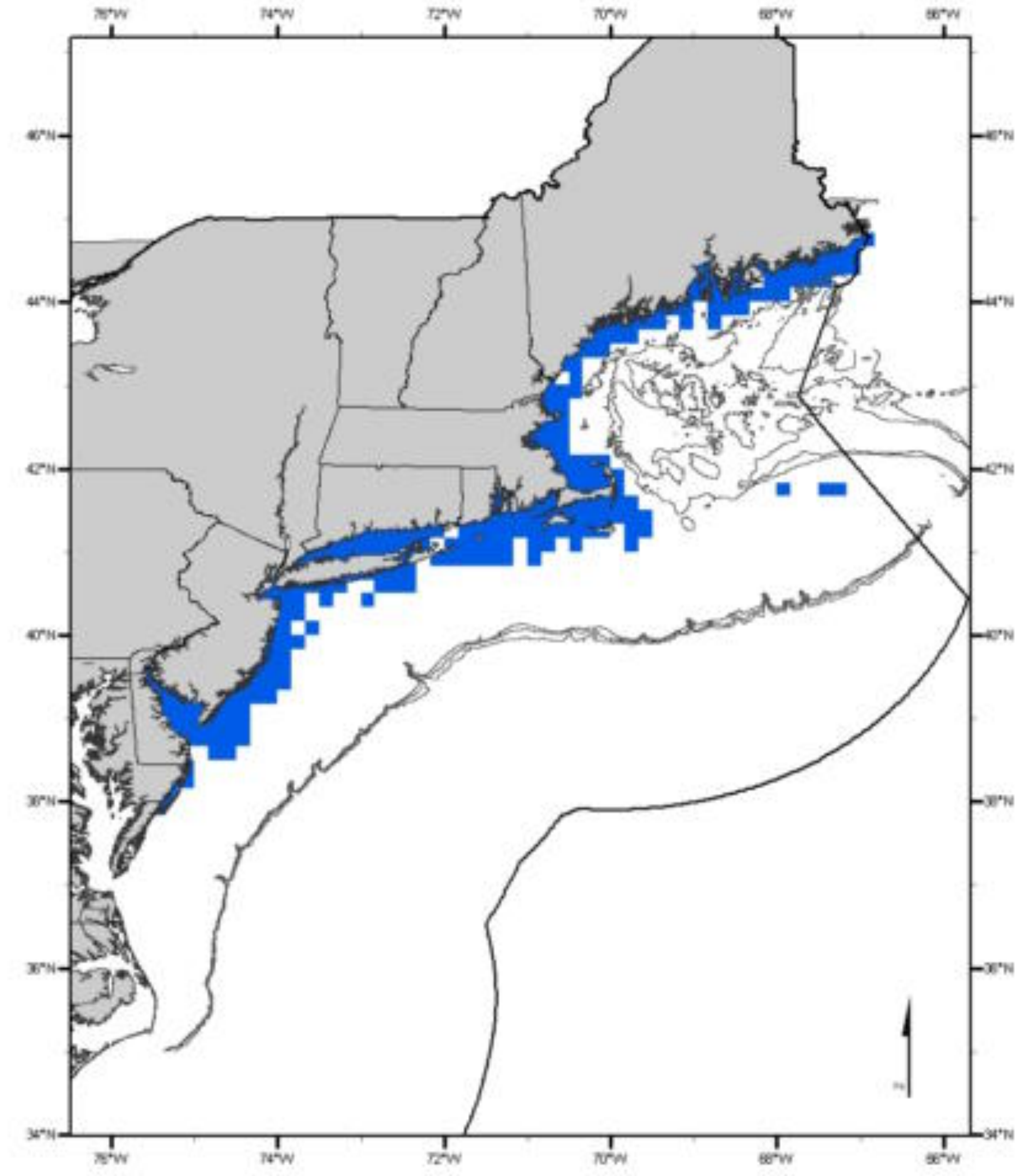
The Alternative 2A EFH designation for juvenile winter flounder on the continental shelf is based upon relative abundance during 1968-2005 in the fall and spring NMFS trawl survey at the 25% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where juvenile winter flounder were caught in state trawl surveys in more than 10% of the tows, as well as those bays and estuaries identified by the NOAA ELMR program where winter flounder juveniles were "common" or "abundant."

Map 262. Winter flounder juveniles, Alternative 2B



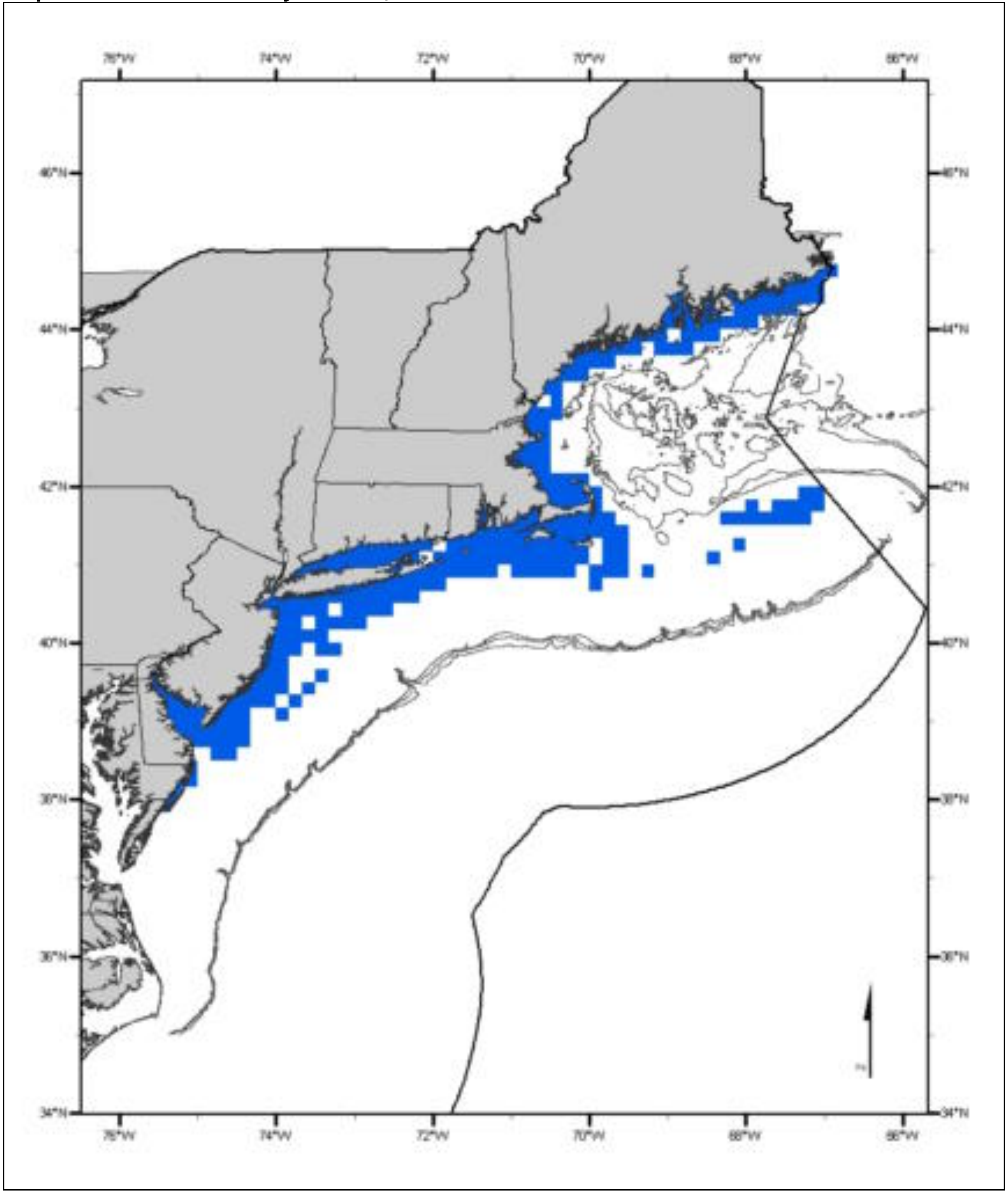
The Alternative 2B EFH designation for juvenile winter flounder on the continental shelf is based upon relative abundance during 1968-2005 in the fall and spring NMFS trawl survey at the 50% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where juvenile winter flounder were caught in state trawl surveys in more than 10% of the tows, as well as those bays and estuaries identified by the NOAA ELMR program where winter flounder juveniles were "common" or "abundant."

Map 263. Winter flounder juveniles, Alternative 2C



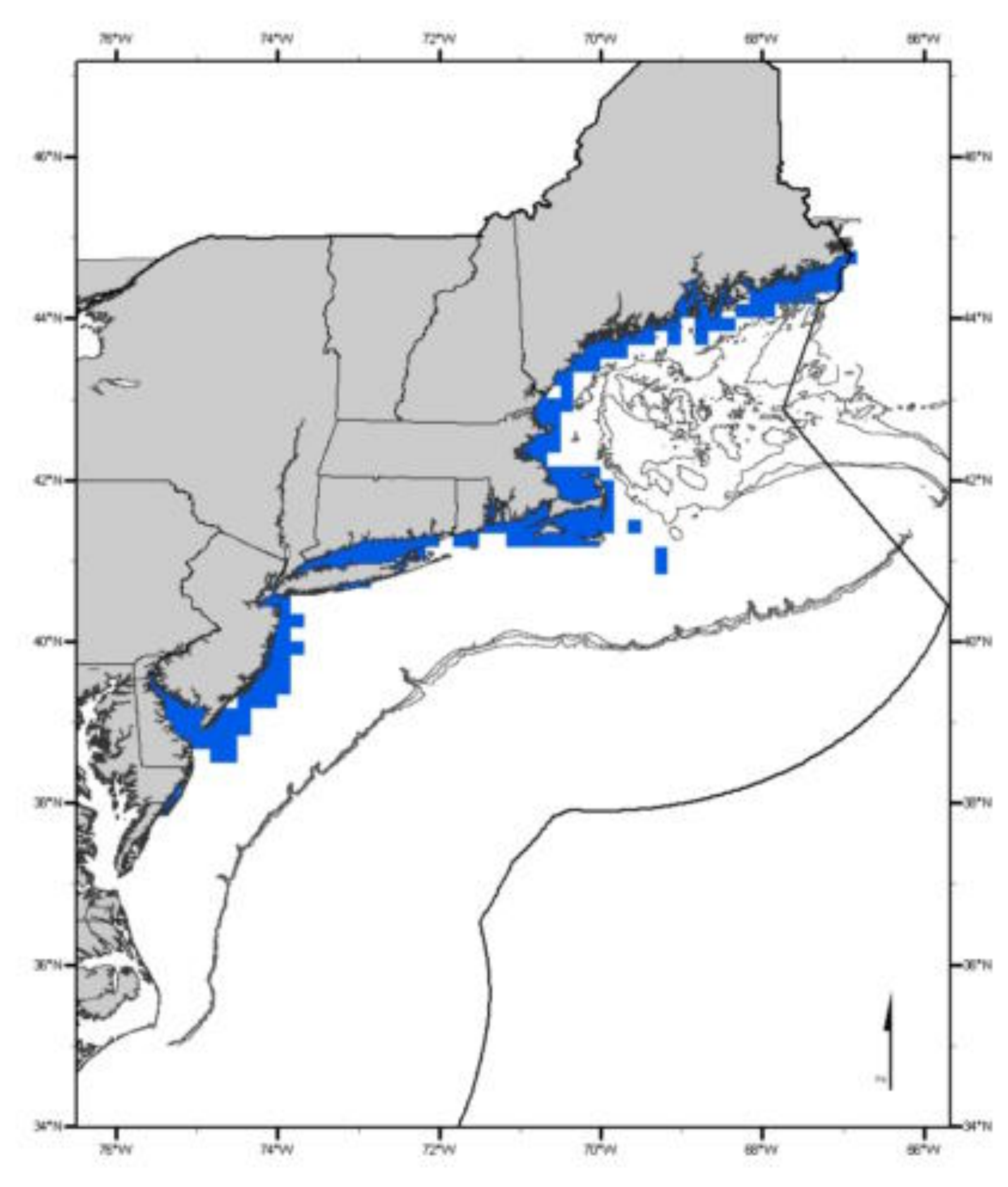
The Alternative 2C EFH designation for juvenile winter flounder on the continental shelf is based upon relative abundance during 1968-2005 in the fall and spring NMFS trawl survey at the 75% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where juvenile winter flounder were caught in state trawl surveys in more than 10% of the tows, as well as those bays and estuaries identified by the NOAA ELMR program where winter flounder juveniles were "common" or "abundant."

Map 264. Winter flounder juveniles, Alternative 2D



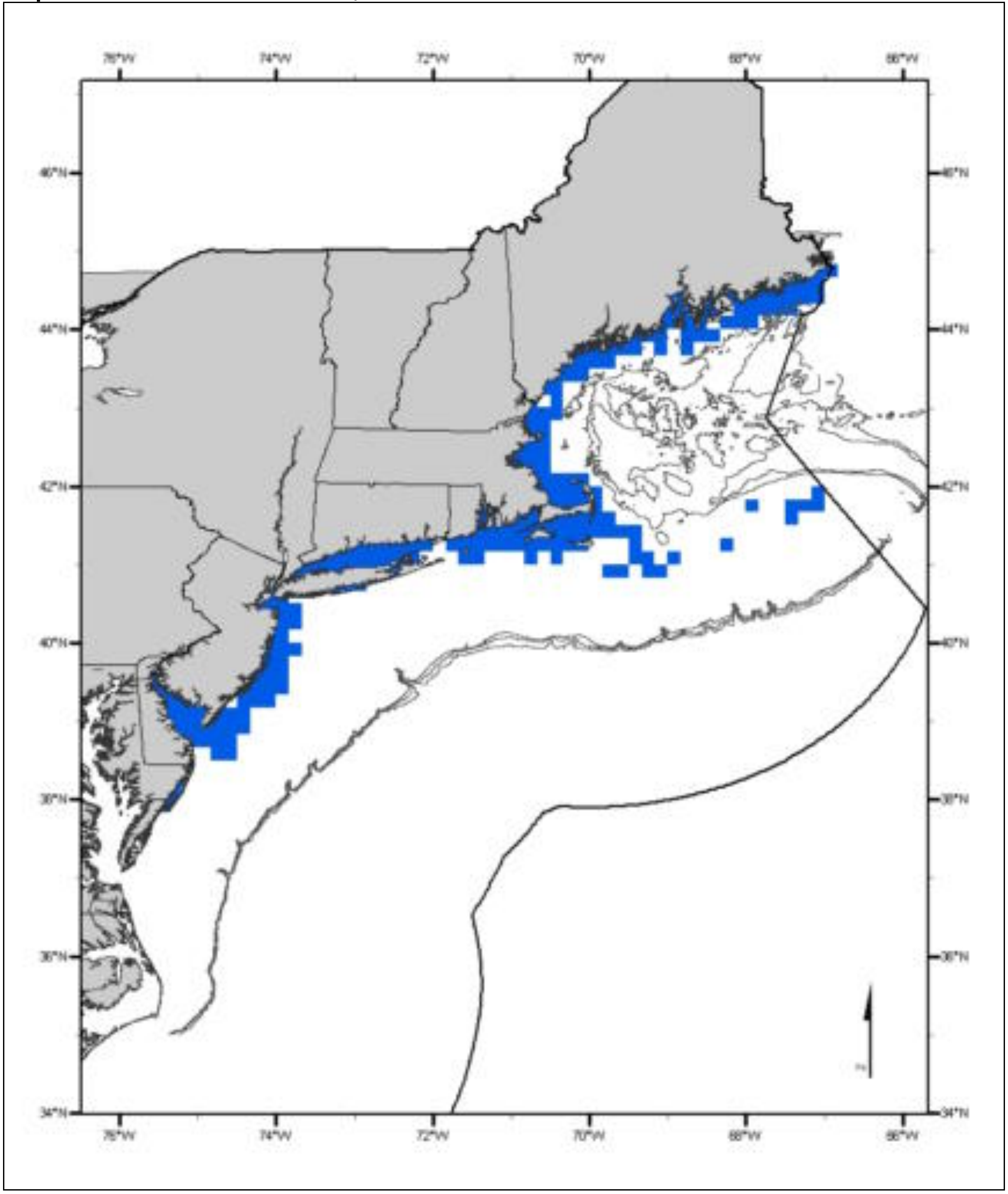
The Alternative 2D EFH designation for juvenile winter flounder on the continental shelf is based upon relative abundance during 1968-2005 in the fall and spring NMFS trawl survey at the 90% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where juvenile winter flounder were caught in state trawl surveys in more than 10% of the tows, as well as those bays and estuaries identified by the NOAA ELMR program where winter flounder juveniles were "common" or "abundant."

Map 265. Winter flounder adults Alternative 2A



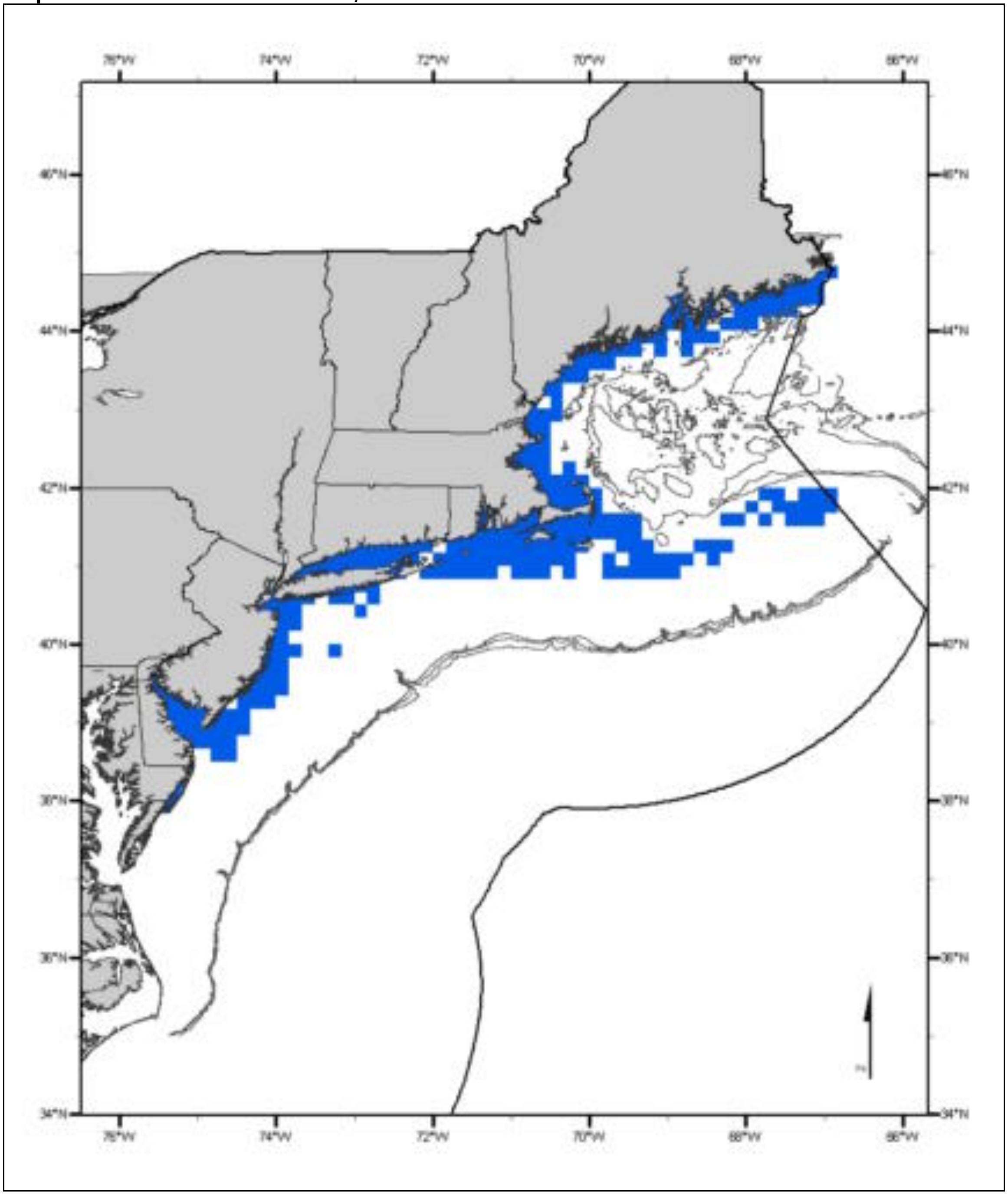
The Alternative 2A EFH designation for adult winter flounder on the continental shelf is based upon relative abundance during 1968-2005 in the fall and spring NMFS trawl survey at the 25% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where adult winter flounder were caught in state trawl surveys in more than 10% of the tows, as well as those bays and estuaries identified by the NOAA ELMR program where winter flounder adults were "common" or "abundant."

Map 266. Winter flounder adults, Alternative 2B



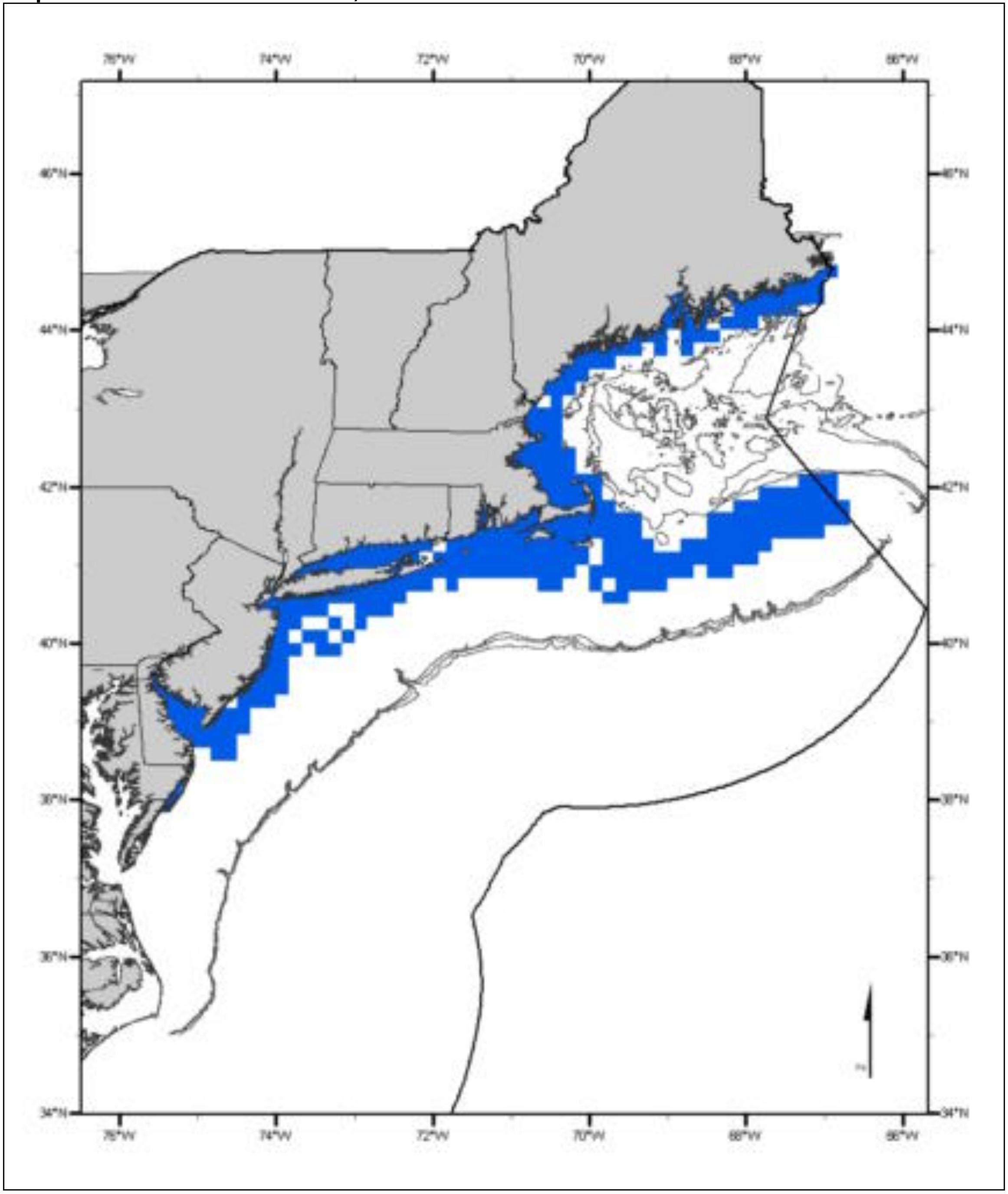
The Alternative 2B EFH designation for adult winter flounder on the continental shelf is based upon relative abundance during 1968-2005 in the fall and spring NMFS trawl survey at the 50% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where adult winter flounder were caught in state trawl surveys in more than 10% of the tows, as well as those bays and estuaries identified by the NOAA ELMR program where winter flounder adults were "common" or "abundant."

Map 267. Winter flounder adults, Alternative 2C



The Alternative 2C EFH designation for adult winter flounder on the continental shelf is based upon relative abundance during 1968-2005 in the fall and spring NMFS trawl survey at the 75% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where adult winter flounder were caught in state trawl surveys in more than 10% of the tows, as well as those bays and estuaries identified by the NOAA ELMR program where winter flounder adults were "common" or "abundant."

Map 268. Winter flounder adults, Alternative 2D



The Alternative 2D EFH designation for adult winter flounder on the continental shelf is based upon relative abundance during 1968-2005 in the fall and spring NMFS trawl survey at the 90% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where adult winter flounder were caught in state trawl surveys in more than 10% of the tows, as well as those bays and estuaries identified by the NOAA ELMR program where winter flounder adults were "common" or "abundant."

4.1.2.3.23 Winter Skate

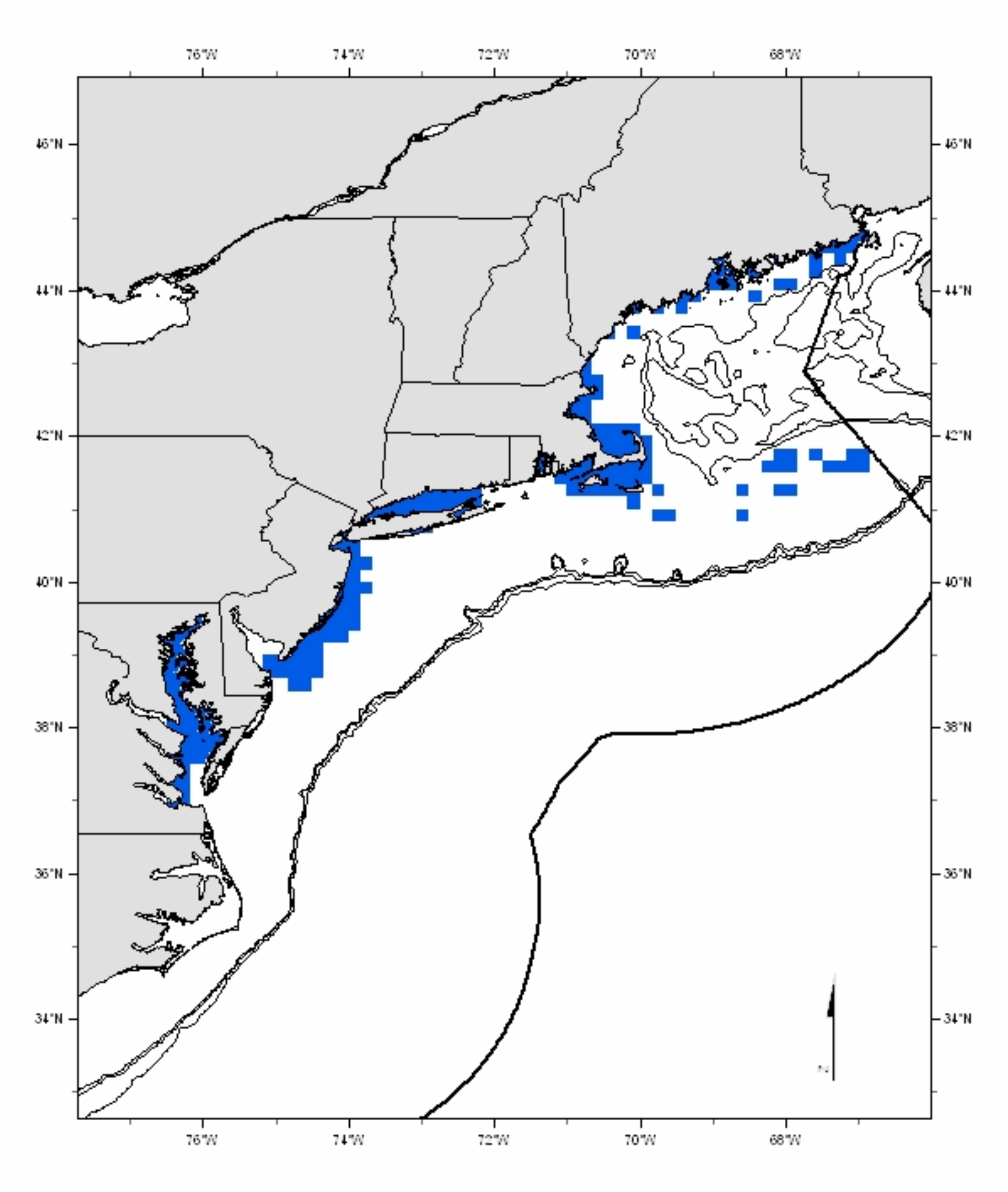
Eggs: There is no information available on the habitat associations or distribution of the egg stage for this species.

Larvae: No larval life stage exists for this species. Upon hatching, they are fully developed juveniles.

Juveniles: Estuarine, coastal marine, and continental shelf benthic habitats in depths of 5 – 80 meters on sand and gravel substrates as depicted on Map 269 - Map 272. Other conditions that generally exist where EFH for juvenile winter skates is found are bottom temperatures of 1.5 – 17.5ºC and salinities of 15.5 – 33.5 ppt. Juvenile winter skates feed on crustaceans (*e.g.*, amphipods, isopods, sand shrimps, crabs, pandalid shrimps), bivalve mollusks, a variety of fish species, and polychaetes.

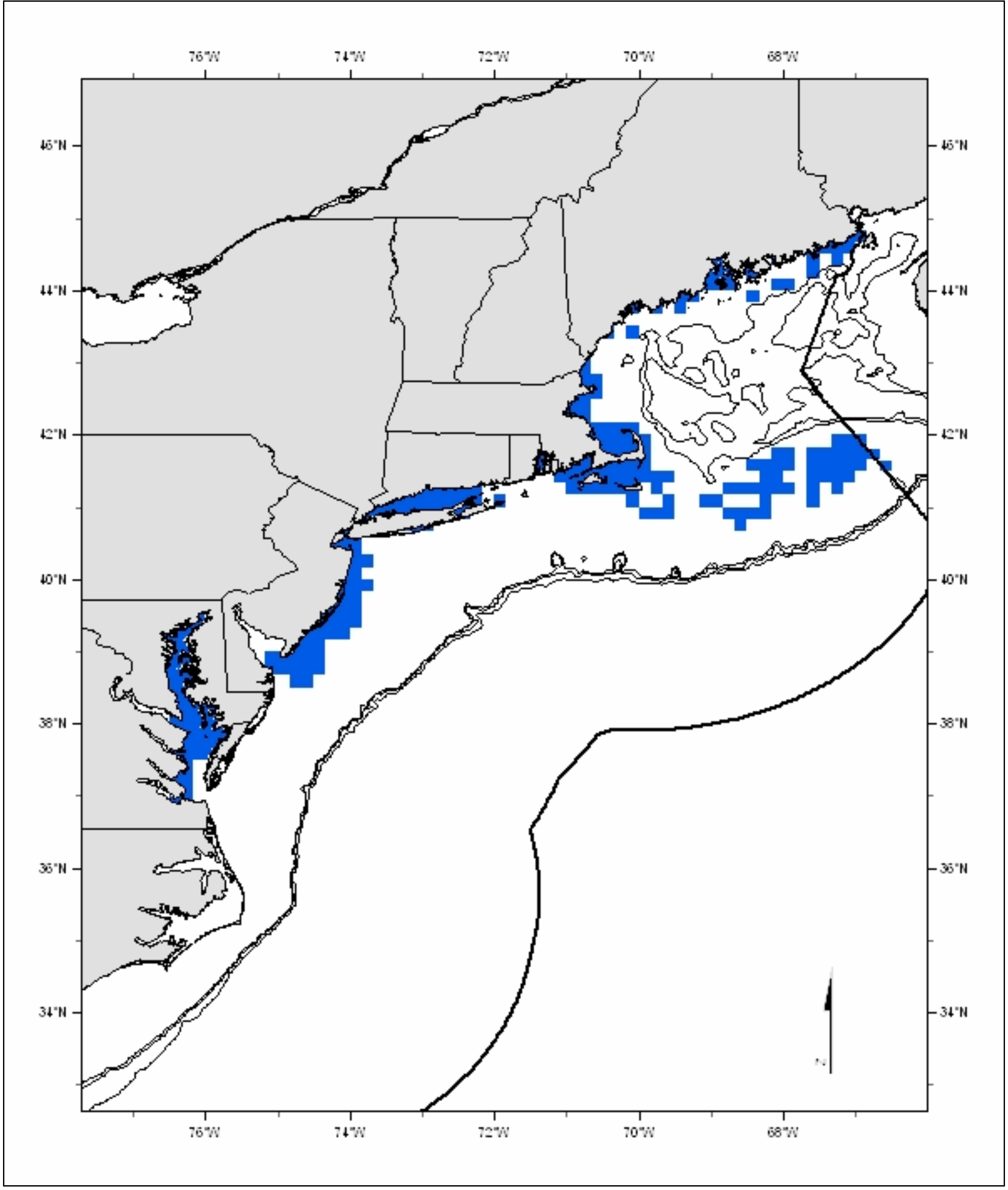
Adults: Estuarine, coastal marine, and continental shelf benthic habitats in depths of 5 – 60 meters on sand and gravel substrates as depicted on Map 273 - Map 276. Other conditions that generally exist where EFH for juvenile winter skates is found are bottom temperatures of 1.5 – 17.5ºC and salinities of 20.5 – 34.5 ppt. Adult winter skates feed on the same types of crustaceans, mollusks, polychaetes, and fishes as the juveniles, but their diets include more fishes and fewer crustaceans (especially amphipods and isopods).

Map 269. Winter skate juveniles, Alternative 2A



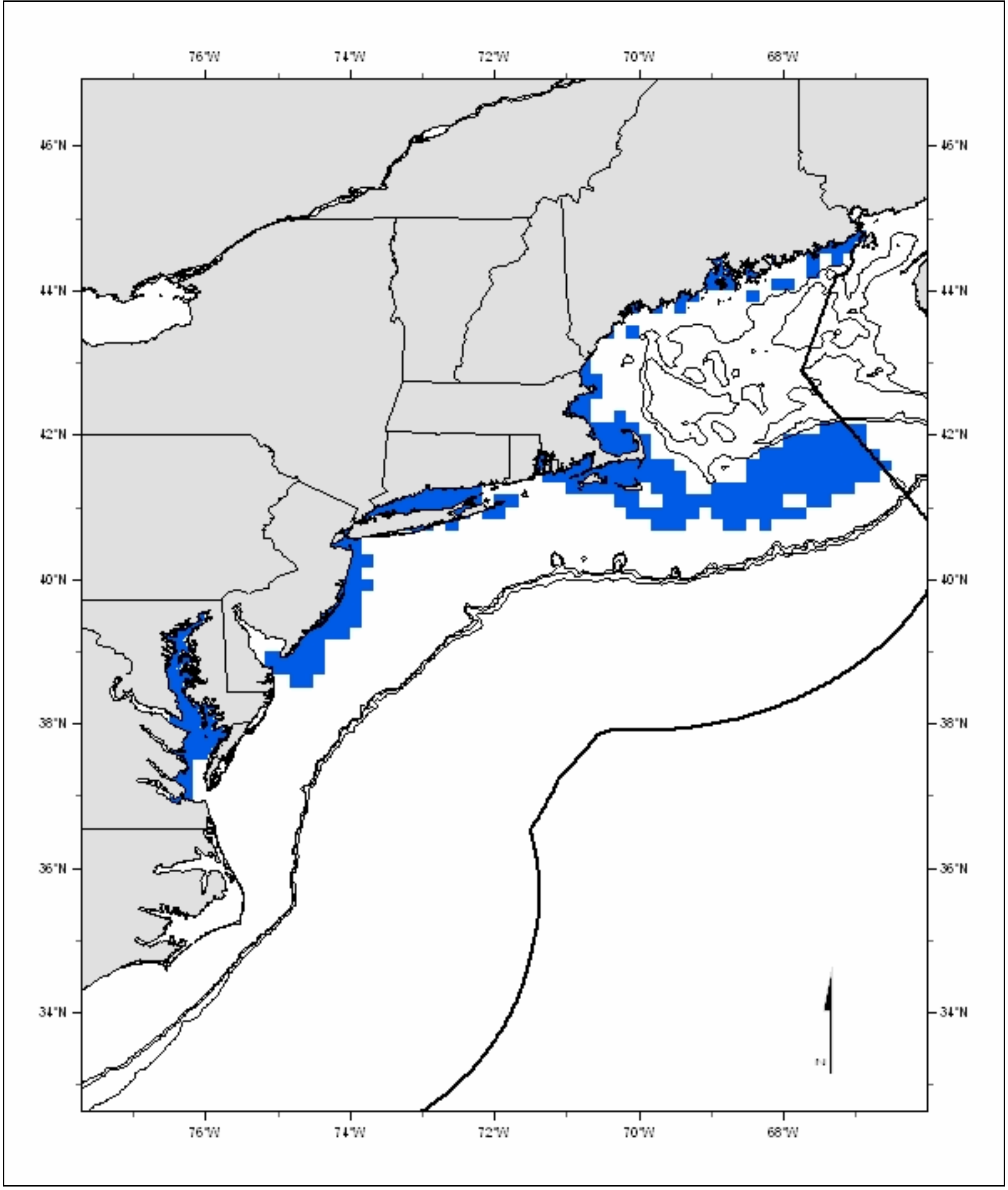
The Alternative 2A EFH designation for juvenile winter skate on the continental shelf is based upon relative abundance during 1968-2005 in the fall and spring NMFS trawl survey at the 25% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where juvenile winter skate were caught in state trawl surveys in more than 10% of the tows, as well as those bays and estuaries identified by the NOAA ELMR program where winter skate juveniles were determined to be "common" or abundant" (see Alternative 1).

Map 270. Winter skate juveniles, Alternative 2B



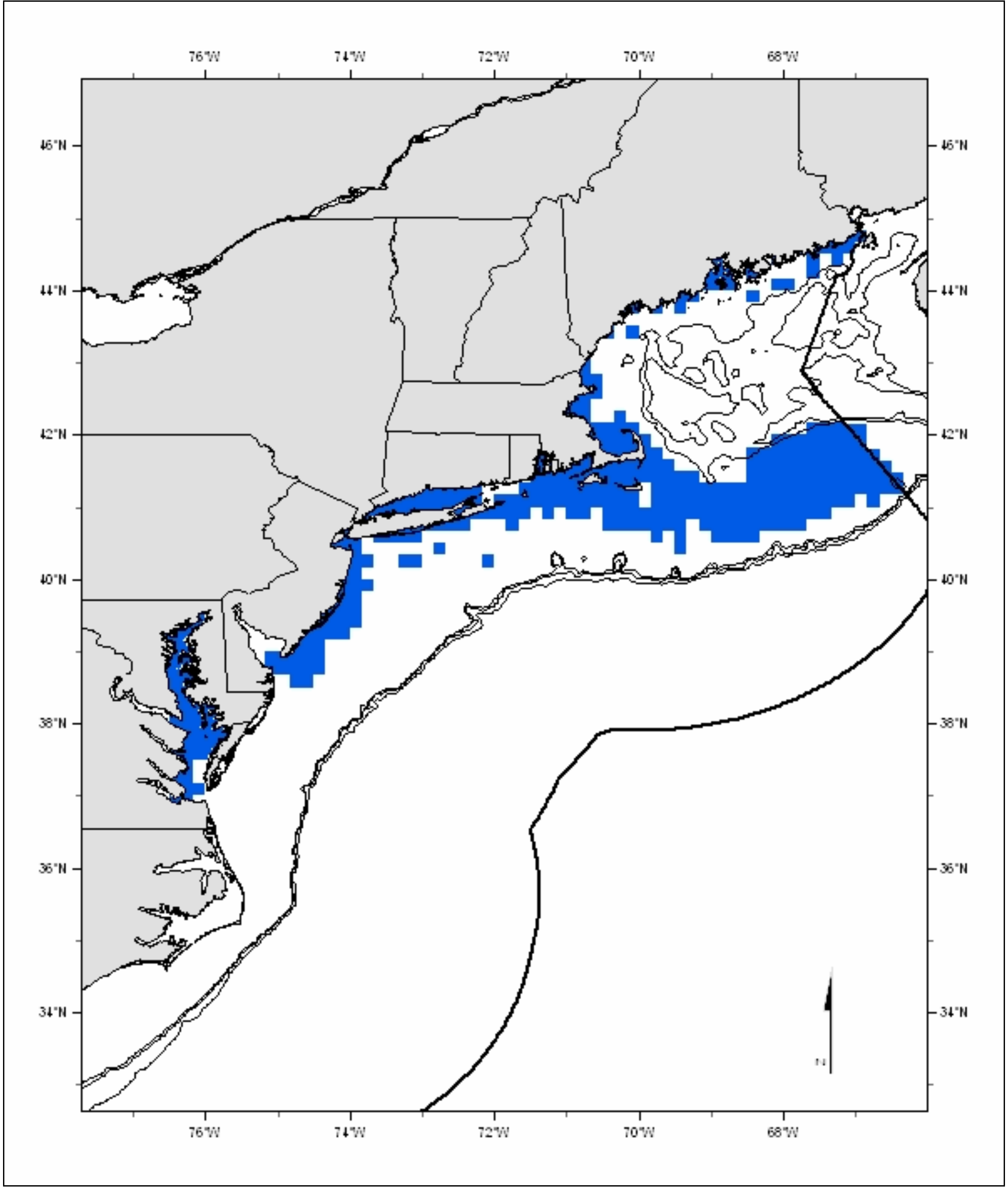
The Alternative 2B EFH designation for juvenile winter skate on the continental shelf is based upon relative abundance during 1968-2005 in the fall and spring NMFS trawl survey at the 50% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where juvenile winter skate were caught in state trawl surveys in more than 10% of the tows, as well as those bays and estuaries identified by the NOAA ELMR program where winter skate juveniles were determined to be "common" or abundant" (see Table 15, Alternative 1).

Map 271. Winter skate juveniles, Alternative 2C



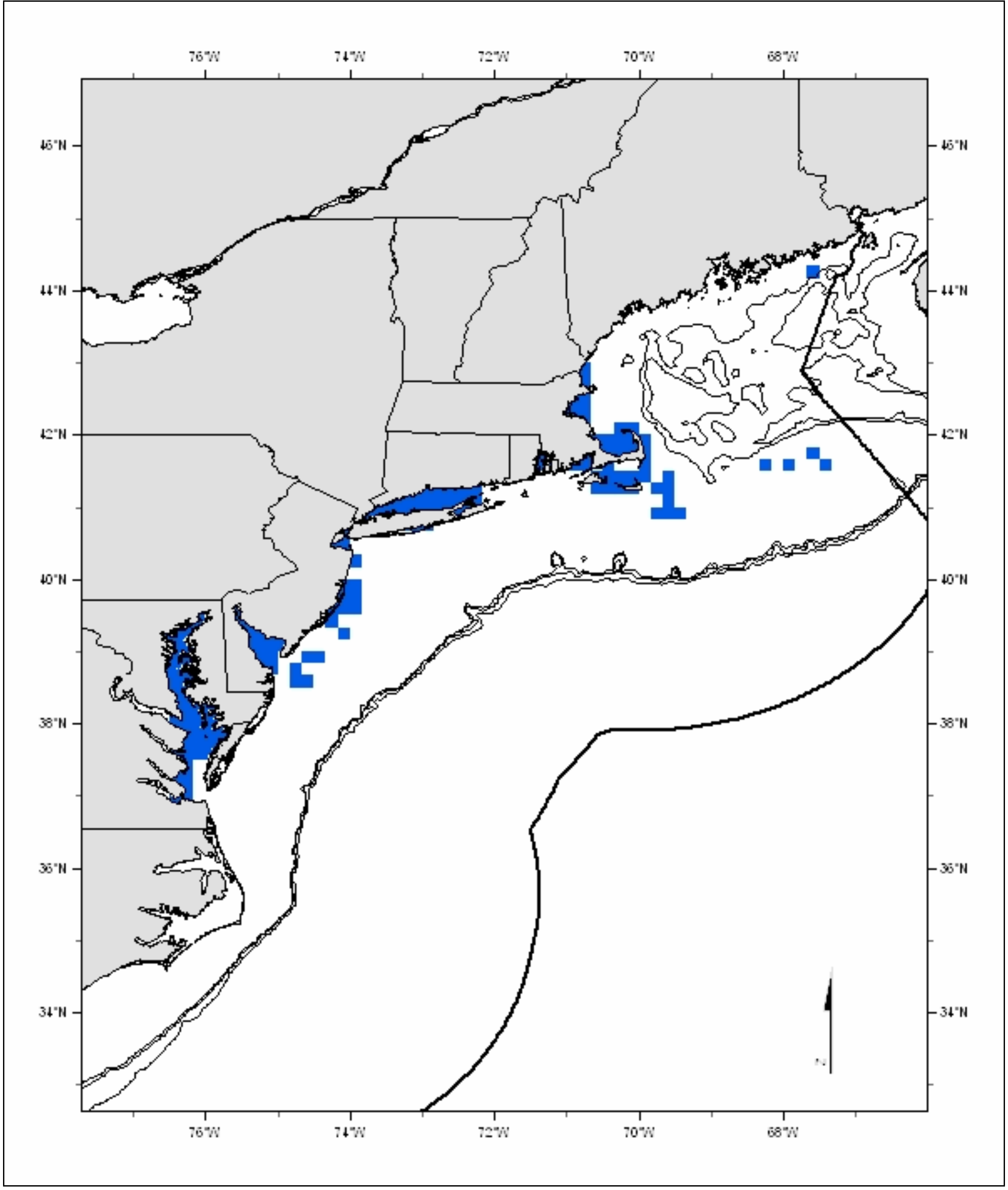
The Alternative 2C EFH designation for juvenile winter skate on the continental shelf is based upon relative abundance during 1968-2005 in the fall and spring NMFS trawl survey at the 75% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where juvenile winter skate were caught in state trawl surveys in more than 10% of the tows, as well as those bays and estuaries identified by the NOAA ELMR program where winter skate juveniles were determined to be "common" or abundant" (see Alternative 1).

Map 272. Winter skate juveniles, Alternative 2D



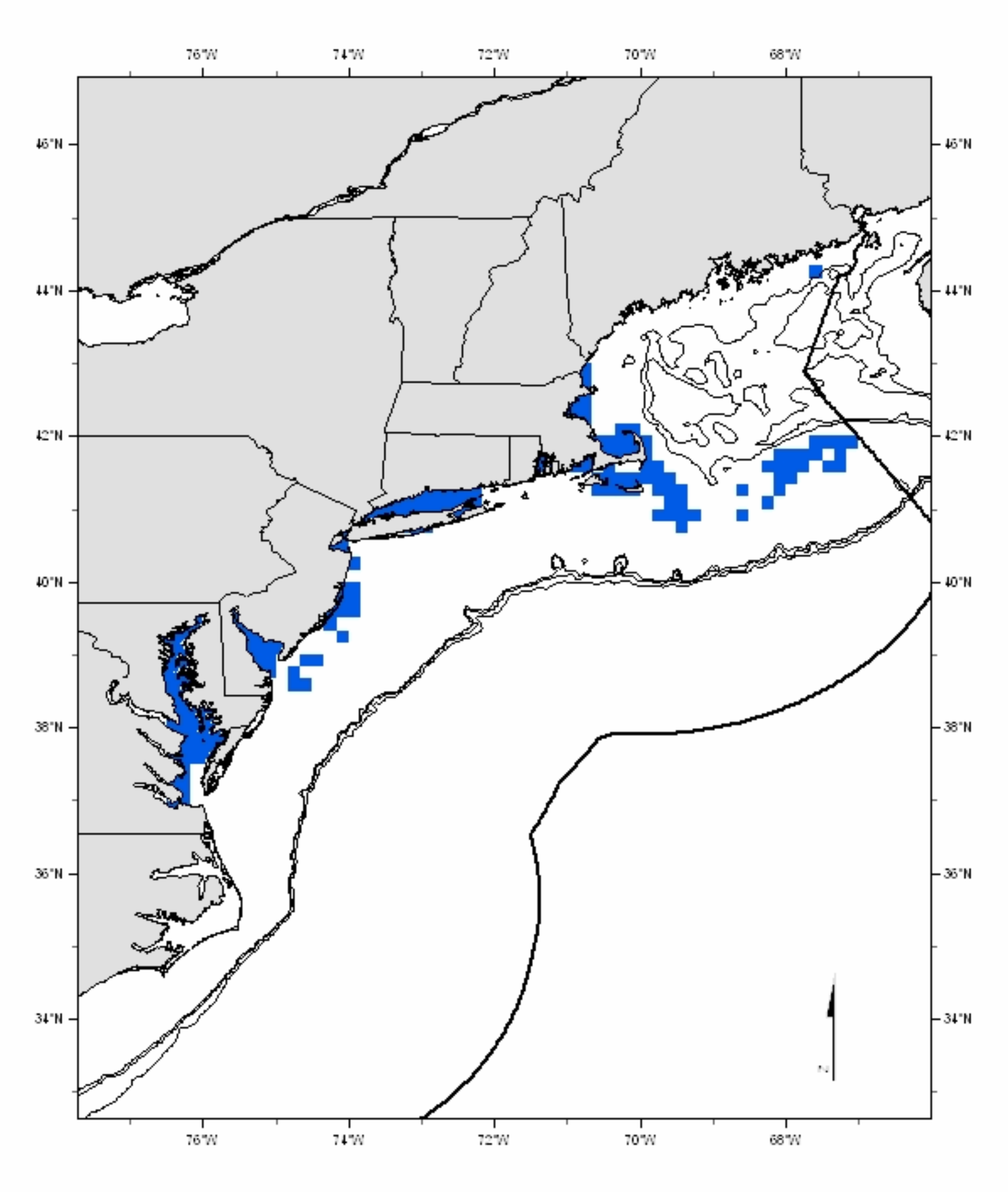
The Alternative 2D EFH designation for juvenile winter skate on the continental shelf is based upon relative abundance during 1968-2005 in the fall and spring NMFS trawl survey at the 90% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where juvenile winter skate were caught in state trawl surveys in more than 10% of the tows, as well as those bays and estuaries identified by the NOAA ELMR program where winter skate juveniles were determined to be "common" or abundant" (see Table 15, Alternative 1).

Map 273. Winter skate adults, Alternative 2A



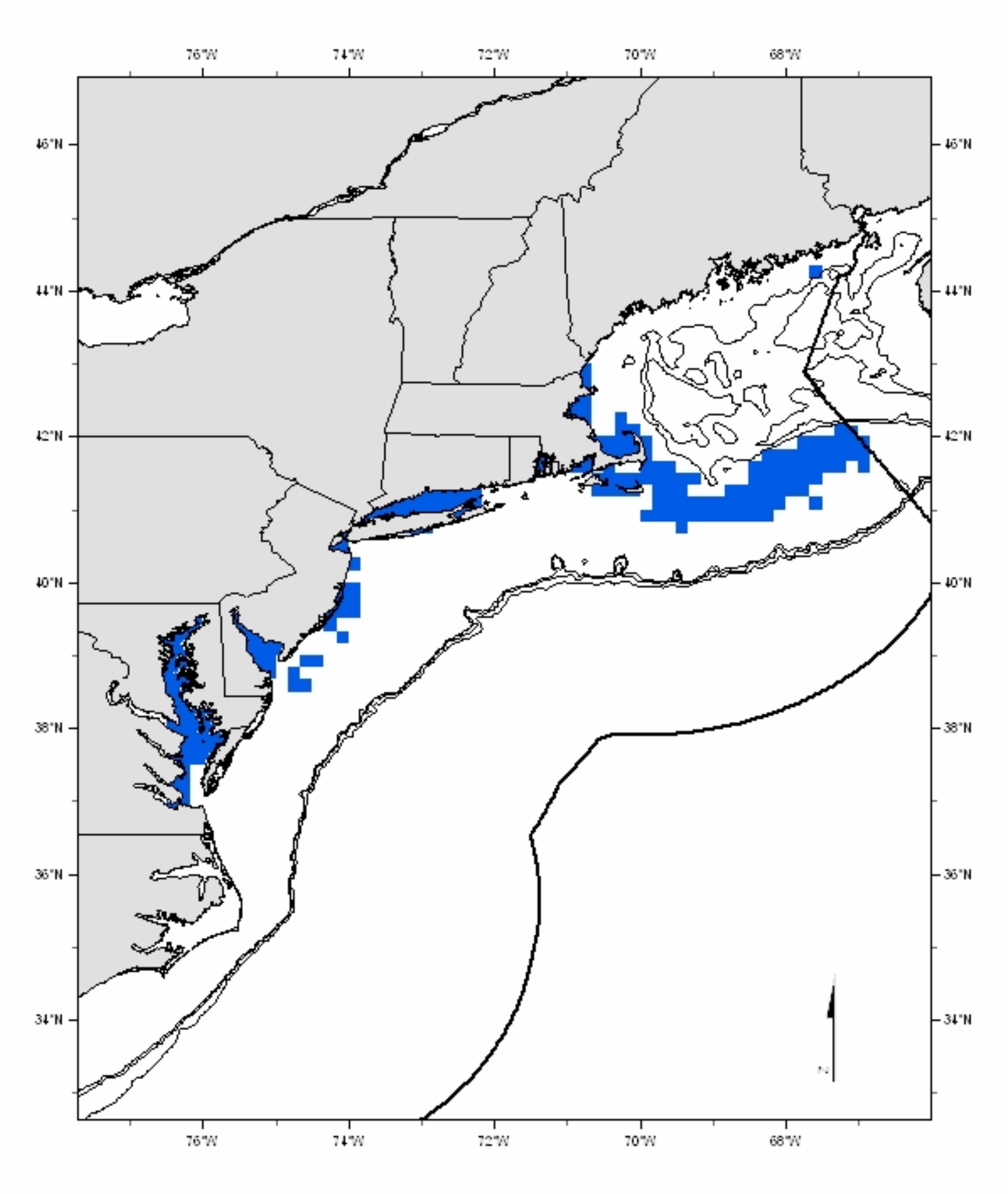
The Alternative 2A EFH designation for adult winter skate on the continental shelf is based upon relative abundance during 1968-2005 in the fall and spring NMFS trawl survey at the 25% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where adult winter skate were caught in state trawl surveys in more than 10% of the tows, as well as those bays and estuaries identified by the NOAA ELMR program where winter skate adults were determined to be "common" or abundant" (see Alternative 1).

Map 274. Winter skate adults, Alternative 2B



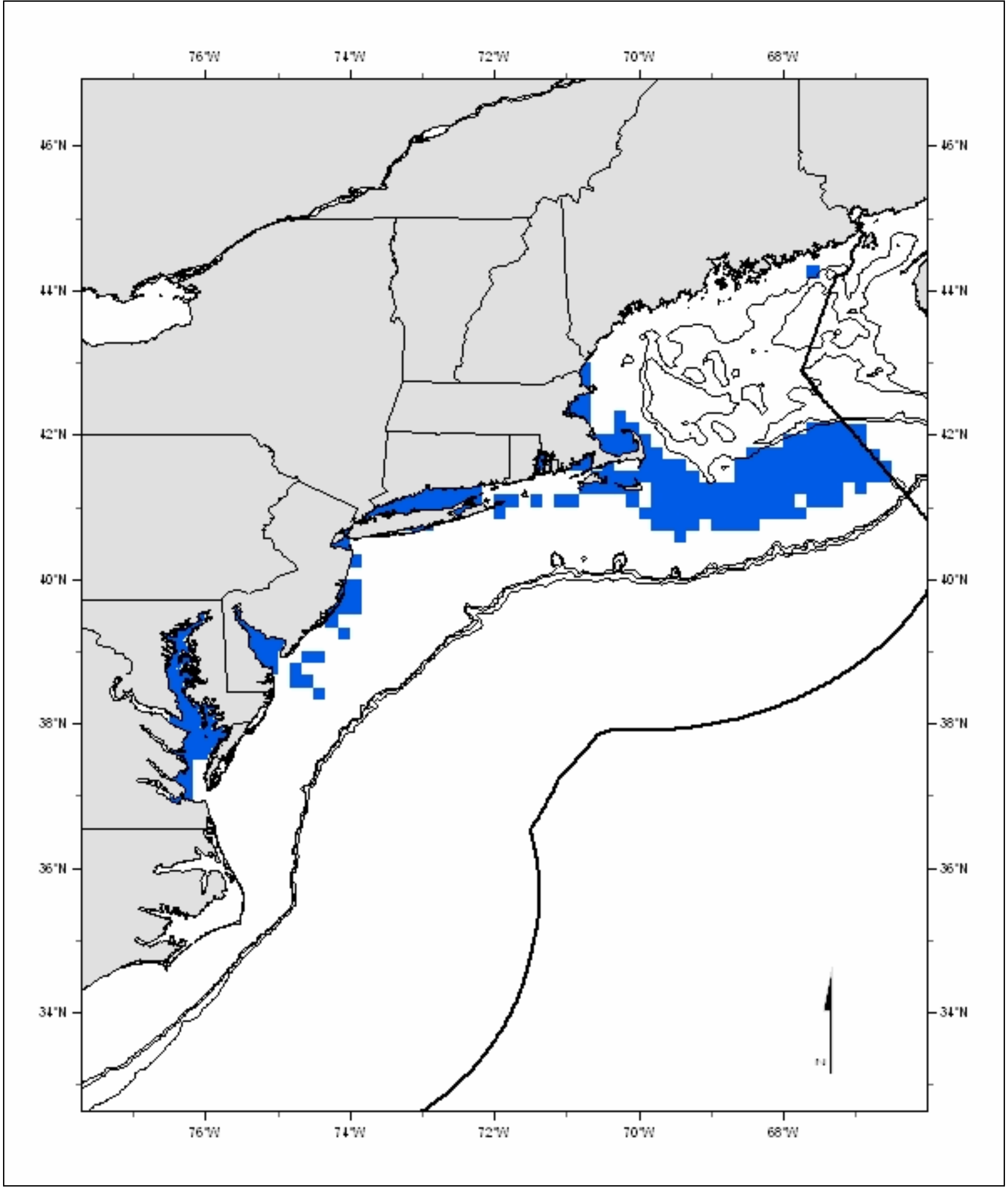
The Alternative 2B EFH designation for adult winter skate on the continental shelf is based upon relative abundance during 1968-2005 in the fall and spring NMFS trawl survey at the 50% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where adult winter skate were caught in state trawl surveys in more than 10% of the tows, as well as those bays and estuaries identified by the NOAA ELMR program where winter skate adults were determined to be "common" or abundant" (see Alternative 1).

Map 275. Winter skate adults, Alternative 2C



The Alternative 2C EFH designation for adult winter skate on the continental shelf is based upon relative abundance during 1968-2005 in the fall and spring NMFS trawl survey at the 75% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where adult winter skate were caught in state trawl surveys in more than 10% of the tows, as well as those bays and estuaries identified by the NOAA ELMR program where winter skate adults were determined to be "common" or abundant" (see Alternative 1).

Map 276. Winter skate adults, Alternative 2D



The Alternative 2D EFH designation for adult winter skate on the continental shelf is based upon relative abundance during 1968-2005 in the fall and spring NMFS trawl survey at the 90% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where adult winter skate were caught in state trawl surveys in more than 10% of the tows, as well as those bays and estuaries identified by the NOAA ELMR program where winter skate adults were determined to be "common" or abundant" (see Alternative 1).

4.1.2.3.24 Witch Flounder

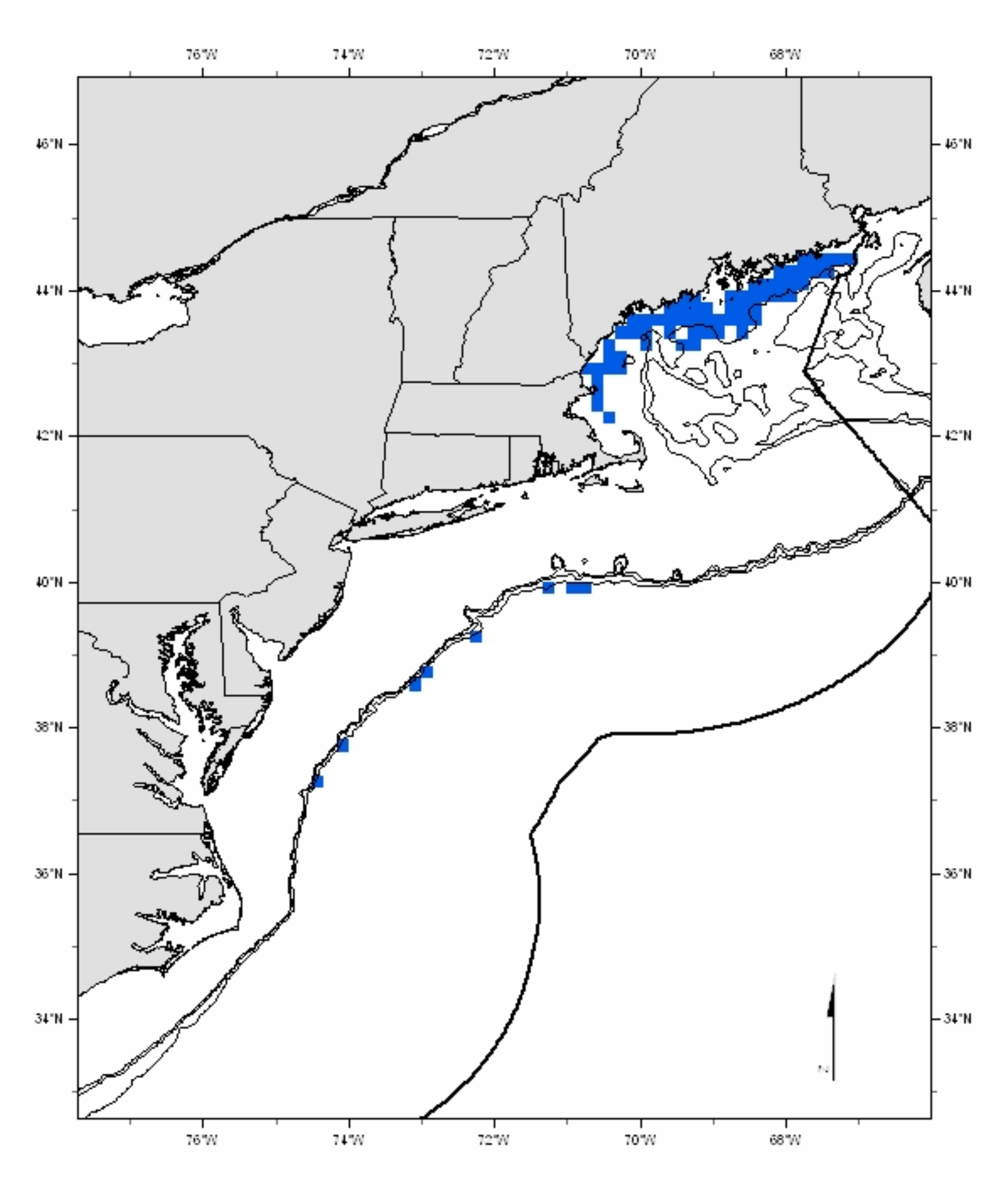
Eggs: No alternative EFH designation.

Larvae: No alternative EFH designation.

Juveniles: Benthic habitats on the continental shelf in depths of 50 – 400 meters with substrates of mud and/or mud and sand as depicted on Map 277 - Map 280. Other conditions that generally exist where EFH for juvenile witch flounder is found are: bottom temperatures of 3.5 – 13.5ºC and salinities of 32.5 – 34.5 ppt. Juvenile witch flounder feed primarily on polychaetes and crustaceans.

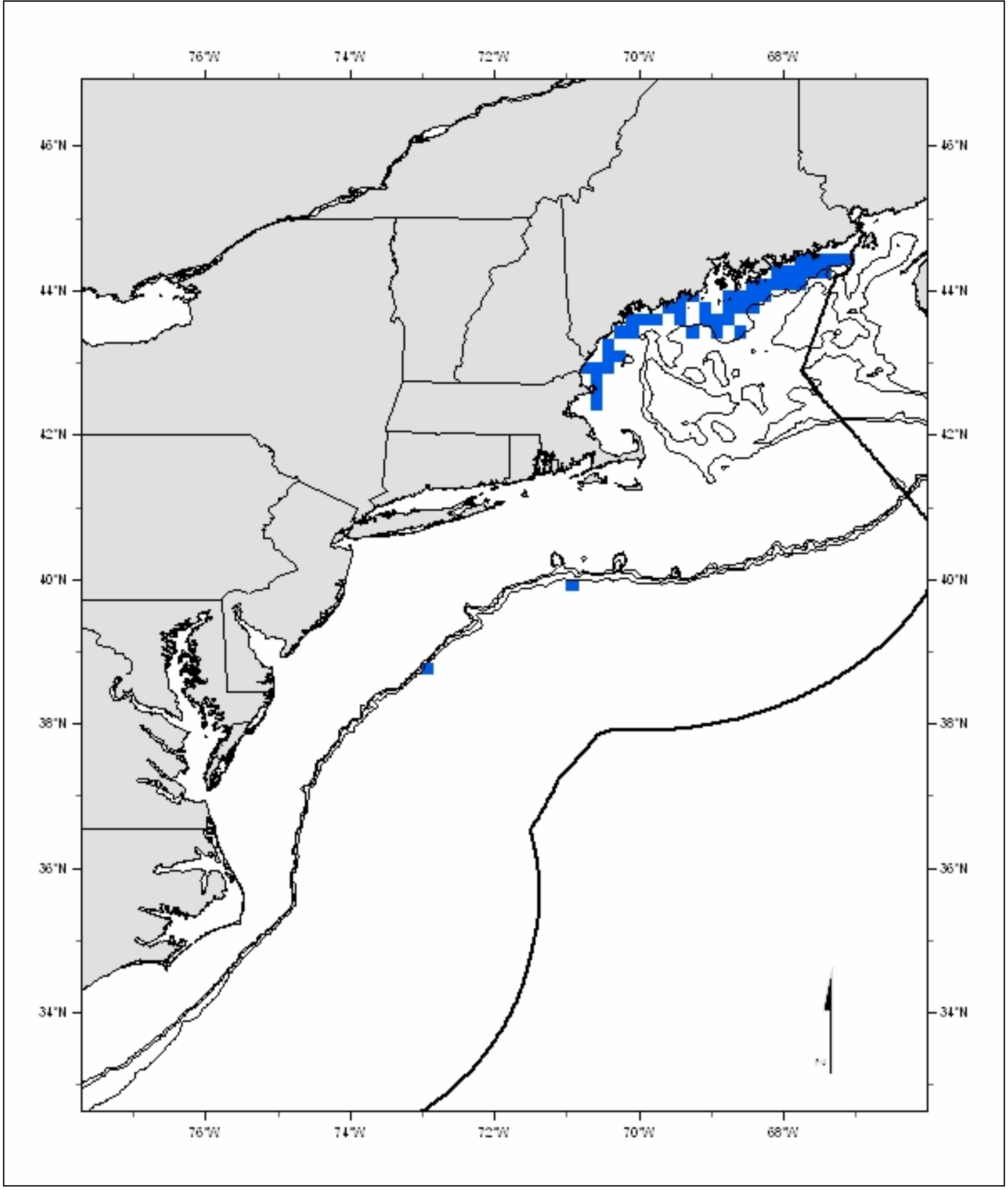
Adults: Benthic habitats on the continental shelf in depths of 35 – 400 meters with substrates of mud and/or mud and sand as depicted on Map 281 - Map 284. The following conditions generally exist where benthic EFH for adult witch flounder is found: bottom temperatures of 2.5 – 10.5ºC and salinities of 32.5 – 35.5 ppt. Spawning generally occurs at temperatures of 0 – 10ºC. Adult witch flounder feed primarily on polychaetes, mollusks, and echinoderms.

Map 277. Witch flounder juveniles, Alternative 2A



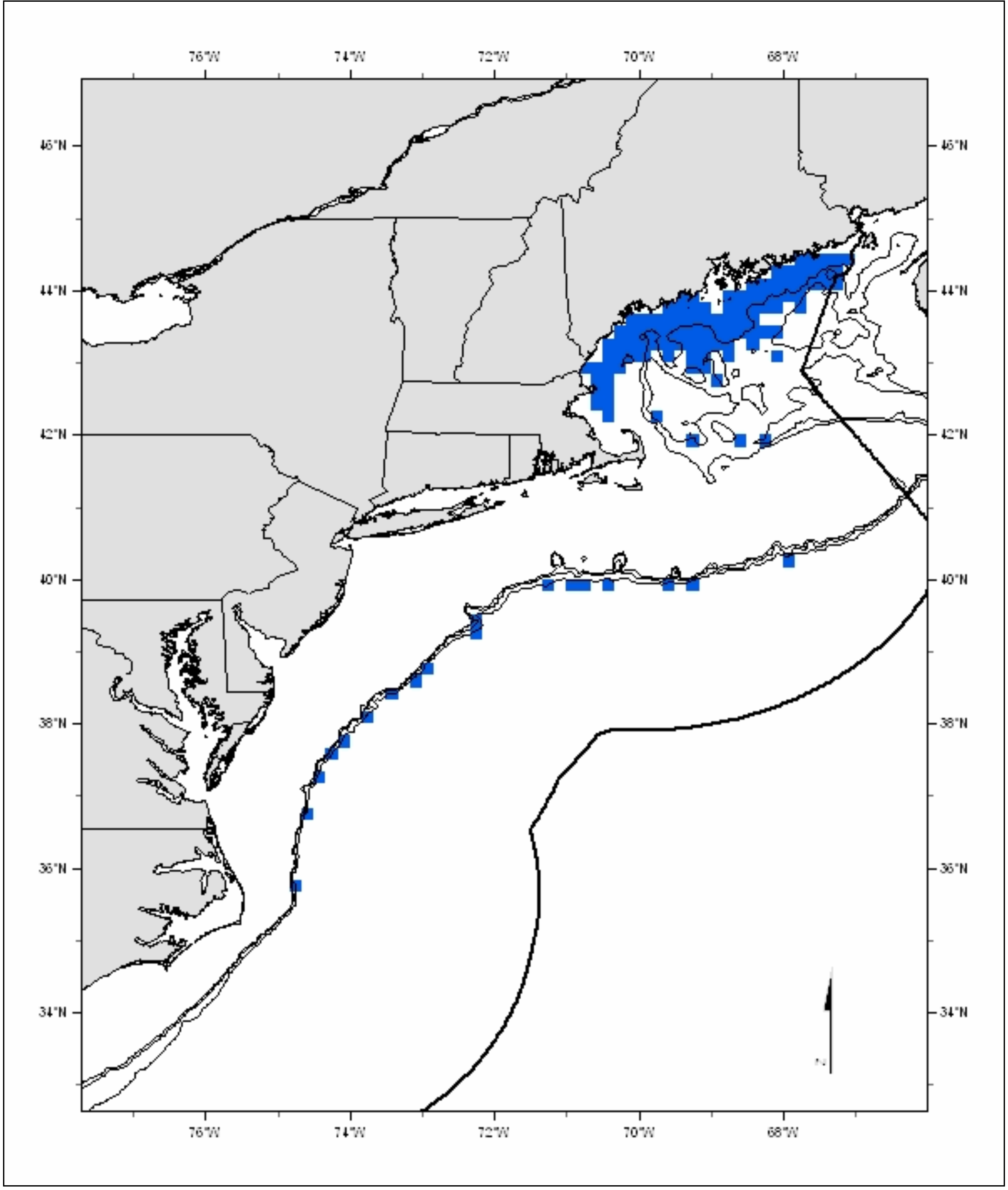
The Alternative 2A EFH designation for juvenile witch flounder on the continental shelf is based upon relative abundance during 1968-2005 in the fall and spring NMFS trawl survey at the 25% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where juvenile witch flounder were caught in state trawl surveys in more than 10% of the tows.

Map 278. Witch flounder juveniles, Alternative 2B



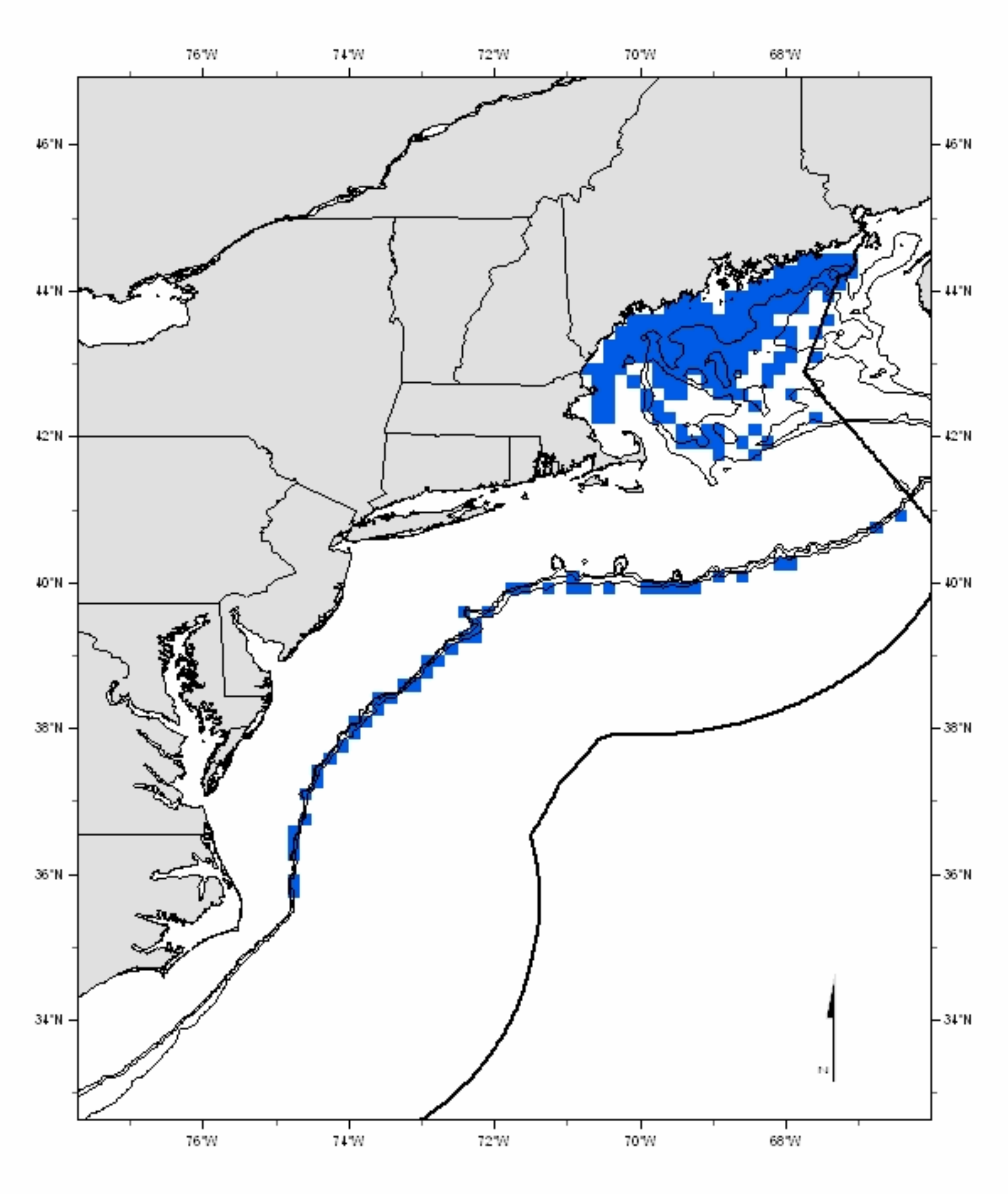
The Alternative 2B EFH designation for juvenile witch flounder on the continental shelf is based upon relative abundance during 1968-2005 in the fall and spring NMFS trawl survey at the 50% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where juvenile witch flounder were caught in state trawl surveys in more than 10% of the tows.

Map 279. Witch flounder juveniles, Alternative 2C



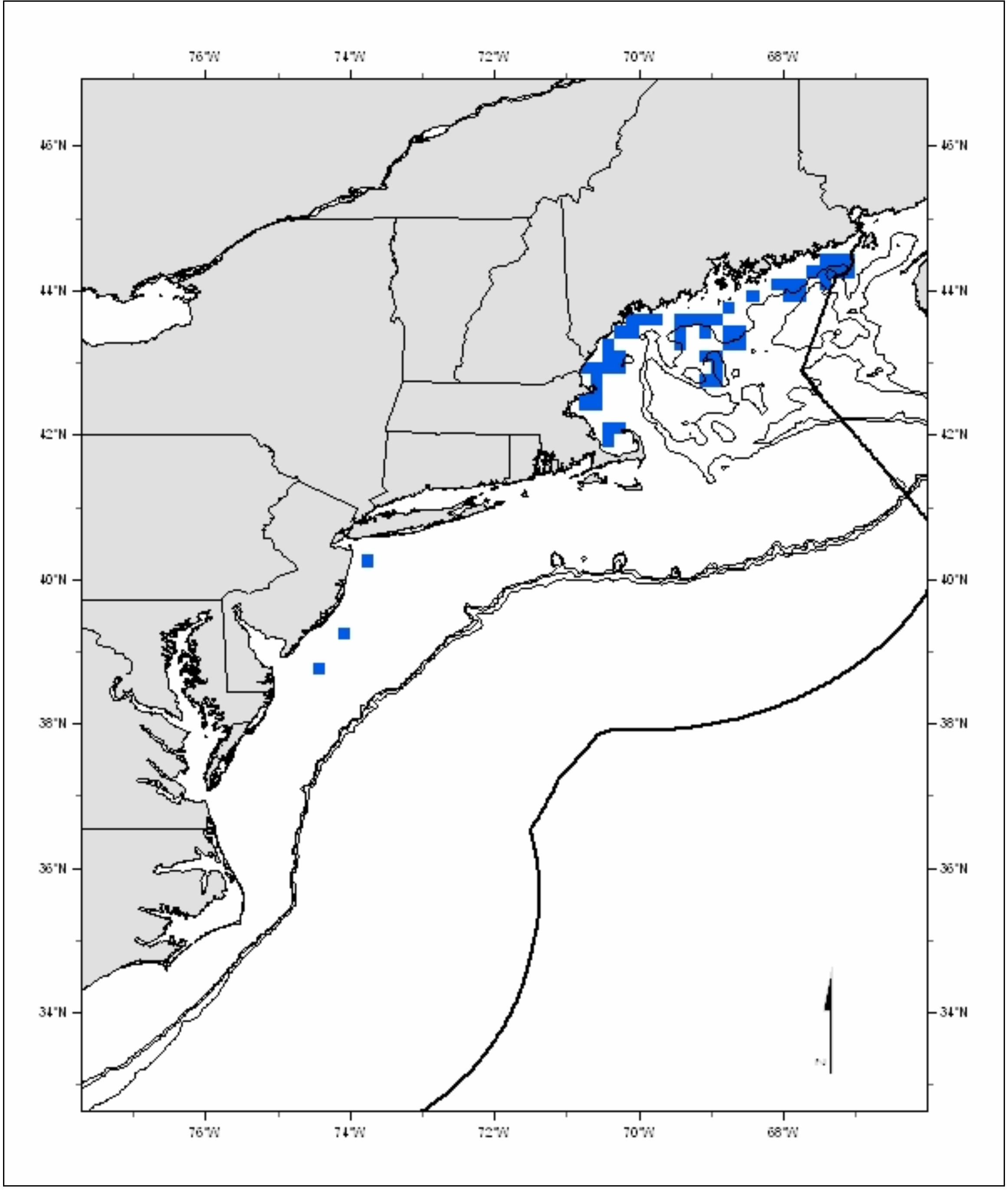
The Alternative 2C EFH designation for juvenile witch flounder on the continental shelf is based upon relative abundance during 1968-2005 in the fall and spring NMFS trawl survey at the 75% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where juvenile witch flounder were caught in state trawl surveys in more than 10% of the tows.

Map 280. Witch flounder juveniles, Alternative 2D



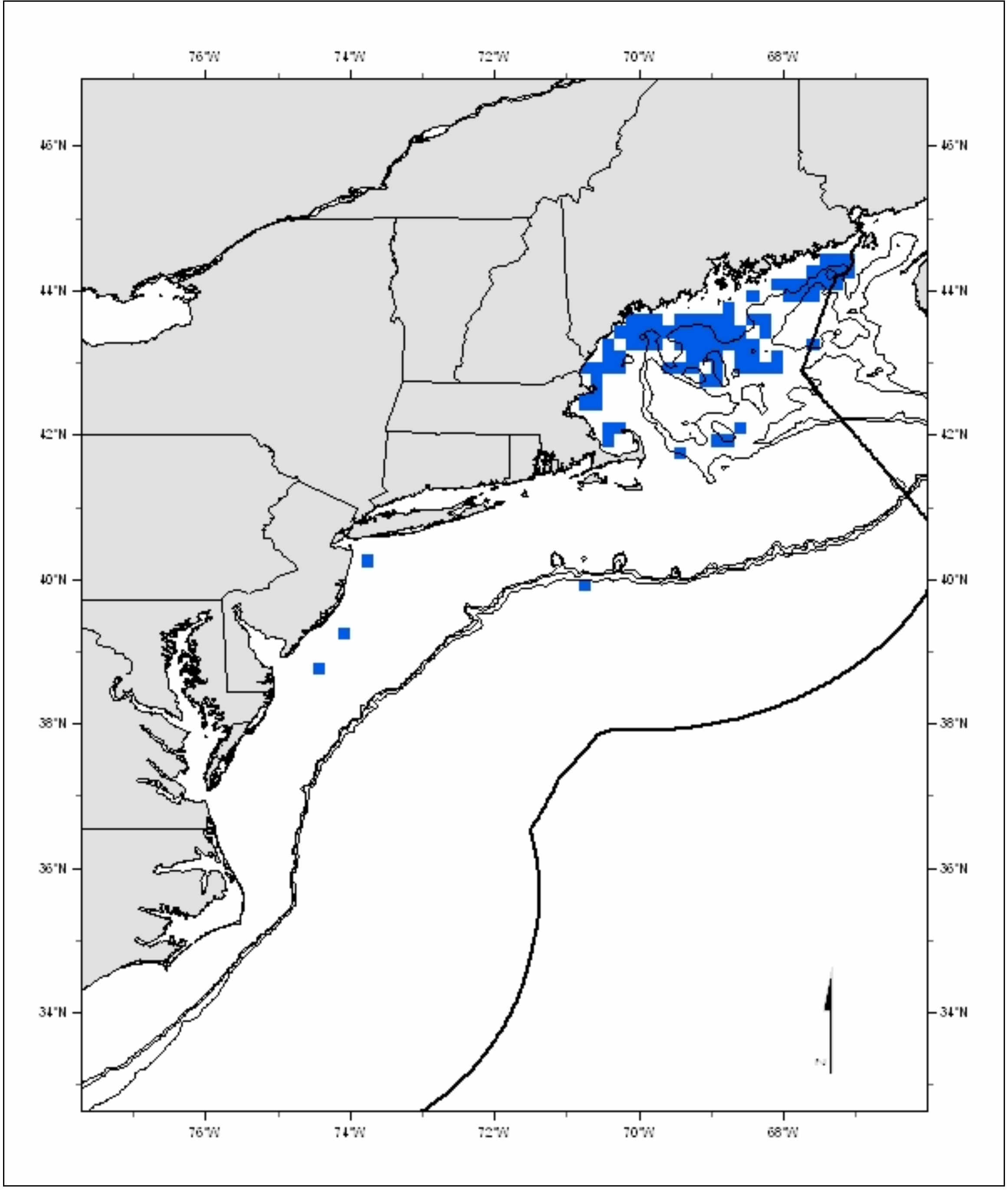
The Alternative 2D EFH designation for juvenile witch flounder on the continental shelf is based upon relative abundance during 1968-2005 in the fall and spring NMFS trawl survey at the 90% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where juvenile witch flounder were caught in state trawl surveys in more than 10% of the tows.

Map 281. Witch flounder adults, Alternative 2A



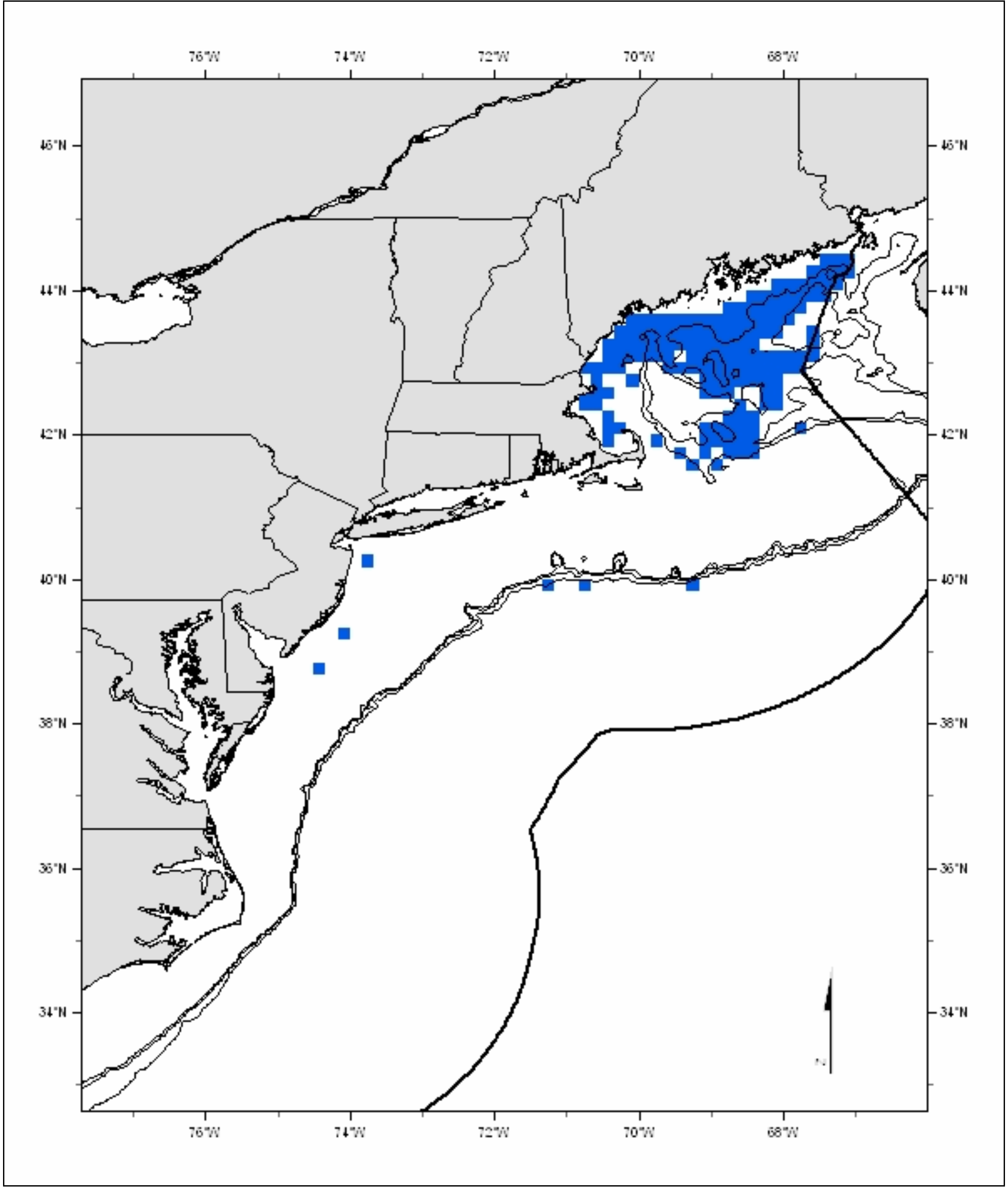
The Alternative 2A EFH designation for adult witch flounder on the continental shelf is based upon relative abundance during 1968-2005 in the fall and spring NMFS trawl survey at the 25% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where adult witch flounder were caught in state trawl surveys in more than 10% of the tows.

Map 282. Witch flounder adults, Alternative 2B



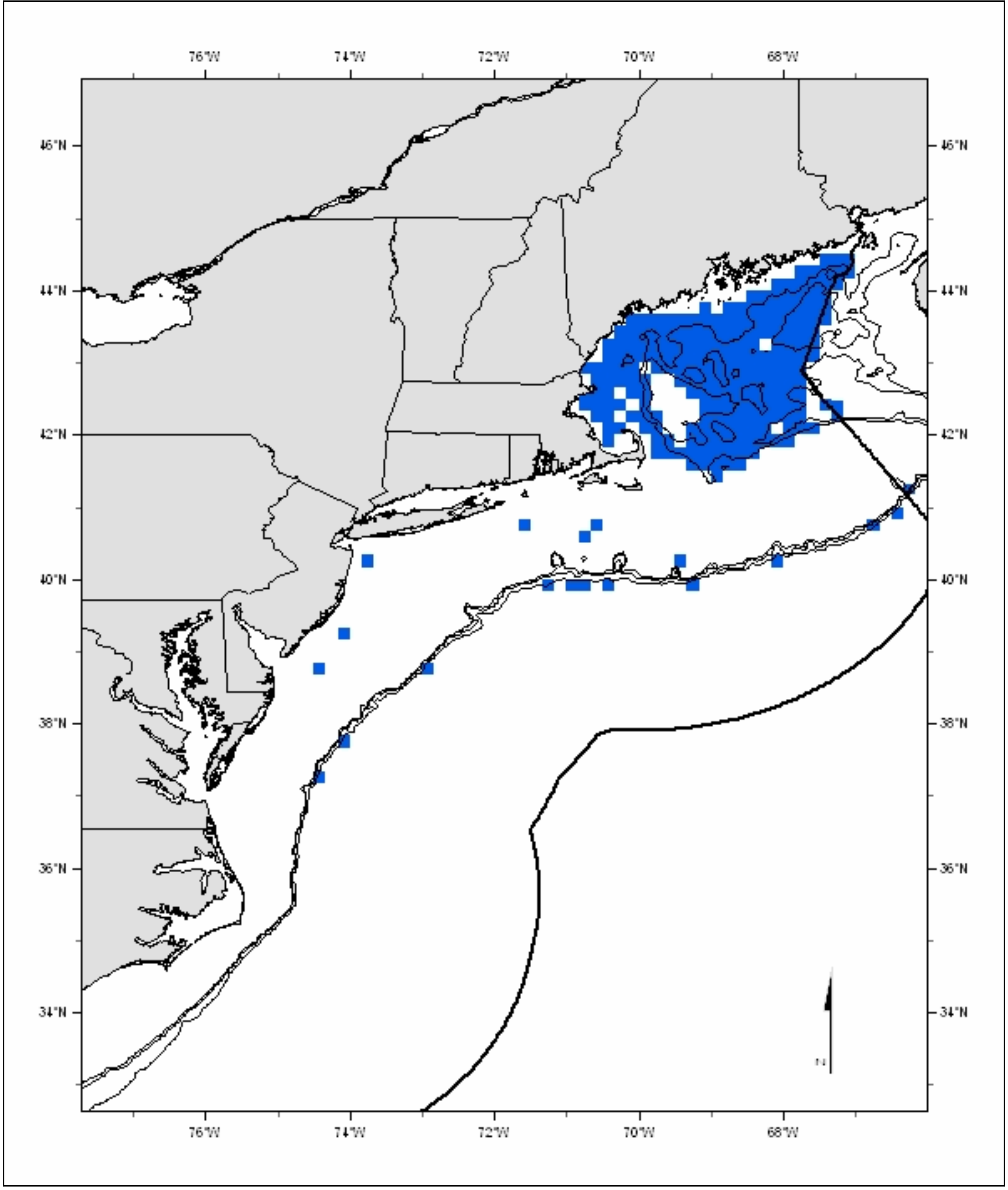
The Alternative 2B EFH designation for adult witch flounder on the continental shelf is based upon relative abundance during 1968-2005 in the fall and spring NMFS trawl survey at the 50% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where adult witch flounder were caught in state trawl surveys in more than 10% of the tows.

Map 283. Witch flounder adults, Alternative 2C



The Alternative 2C EFH designation for adult witch flounder on the continental shelf is based upon relative abundance during 1968-2005 in the fall and spring NMFS trawl survey at the 75% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where adult witch flounder were caught in state trawl surveys in more than 10% of the tows.

Map 284. Witch flounder adults, Alternative 2D



The Alternative 2D EFH designation for adult witch flounder on the continental shelf is based upon relative abundance during 1968-2005 in the fall and spring NMFS trawl survey at the 90% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where adult witch flounder were caught in state trawl surveys in more than 10% of the tows.

4.1.2.3.25 Yellowtail Flounder

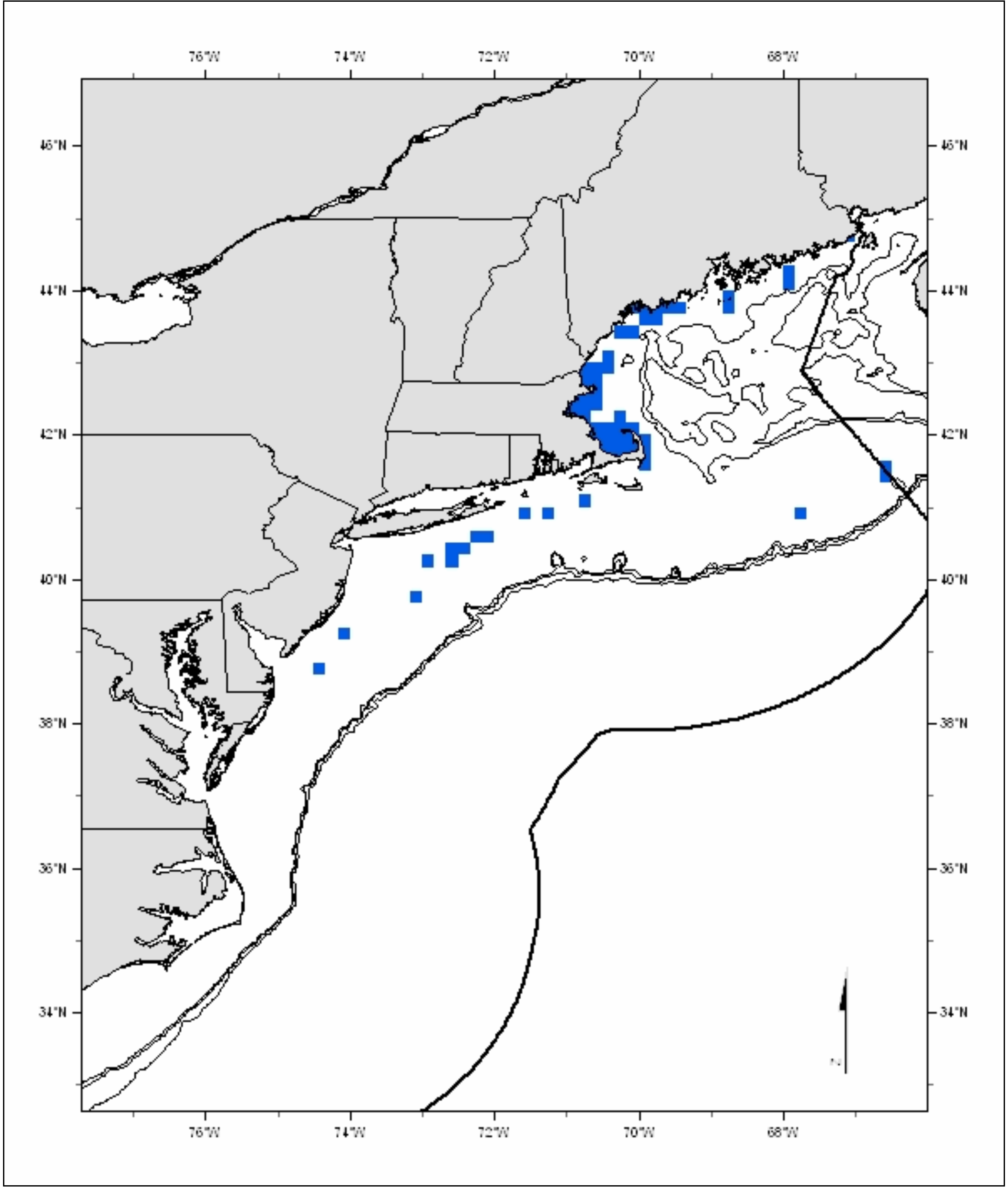
Eggs: No alternative EFH designation.

Larvae: No alternative EFH designation.

Juveniles: Sandy inshore and continental shelf benthic habitats in depths of 20 – 70 meters as depicted on Map 285 - Map 288. Other conditions that generally exist where EFH for juvenile yellowtail flounder is found are: bottom temperatures of 1.5 – 13.5ºC and salinities of 32.5 – 33.5 ppt. YOY juveniles prefer depths of 56 – 87 meters on the shelf. Primary prey organisms for juvenile yellowtail flounders are amphipods, polychaetes, and sand shrimps.

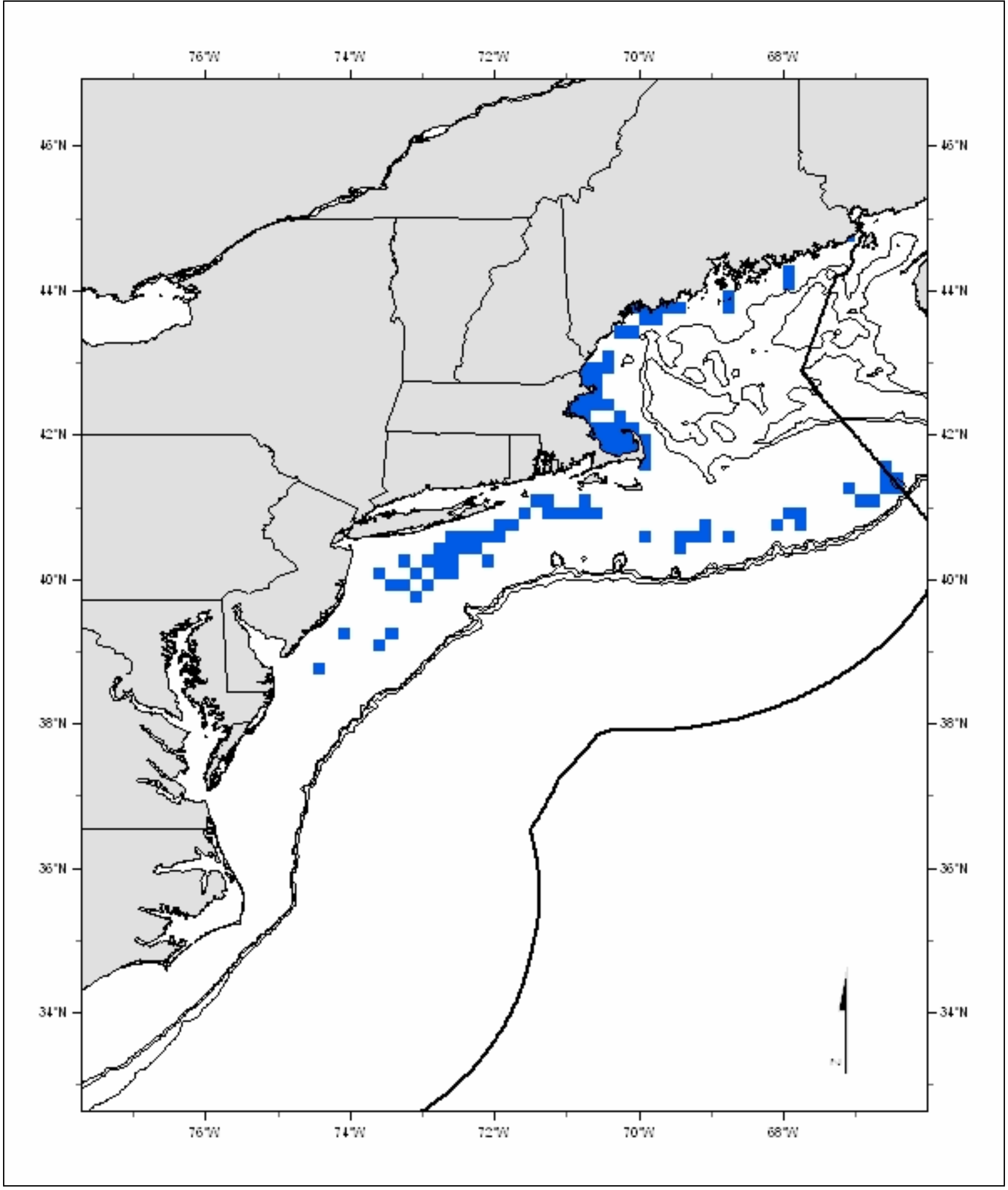
Adults: Sandy inshore and continental shelf benthic habitats in depths of 25 – 80 meters as depicted on Map 289 - Map 292. Substrate types that exist where EFH for adult yellowtail flounder is found consist of sand and mixtures of sand and mud. Other conditions that generally exist where EFH for adult yellowtail flounder is found are: bottom temperatures of 2.5 – 12.5ºC and salinities of 32.5 – 33.5 ppt. Spawning generally occurs at temperatures of 5 – 12ºC. Primary prey organisms for adult yellowtail flounders are amphipods, sand shrimps, polychaetes, nemerteans, and cerianthid anemones.

Map 285. Yellowtail flounder juveniles, Alternative 2A



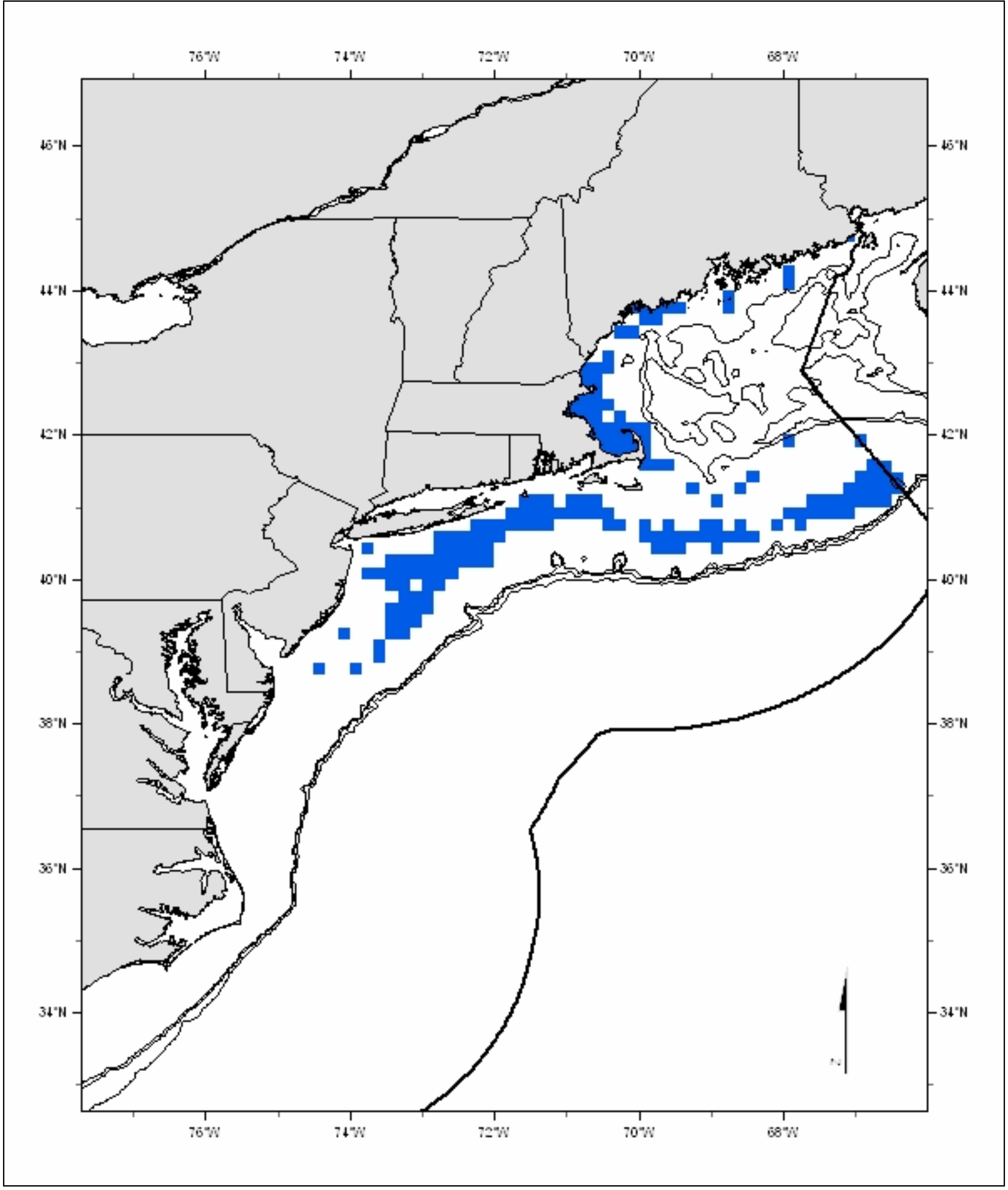
The Alternative 2A EFH designation for juvenile yellowtail flounder on the continental shelf is based upon relative abundance during 1968-2005 in the fall and spring NMFS trawl survey at the 25% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where juvenile yellowtail flounder were caught in state trawl surveys in more than 10% of the tows, as well as those bays and estuaries identified by the NOAA ELMR program where yellowtail flounder juveniles were "common" or "abundant."

Map 286. Yellowtail flounder juveniles, Alternative 2B



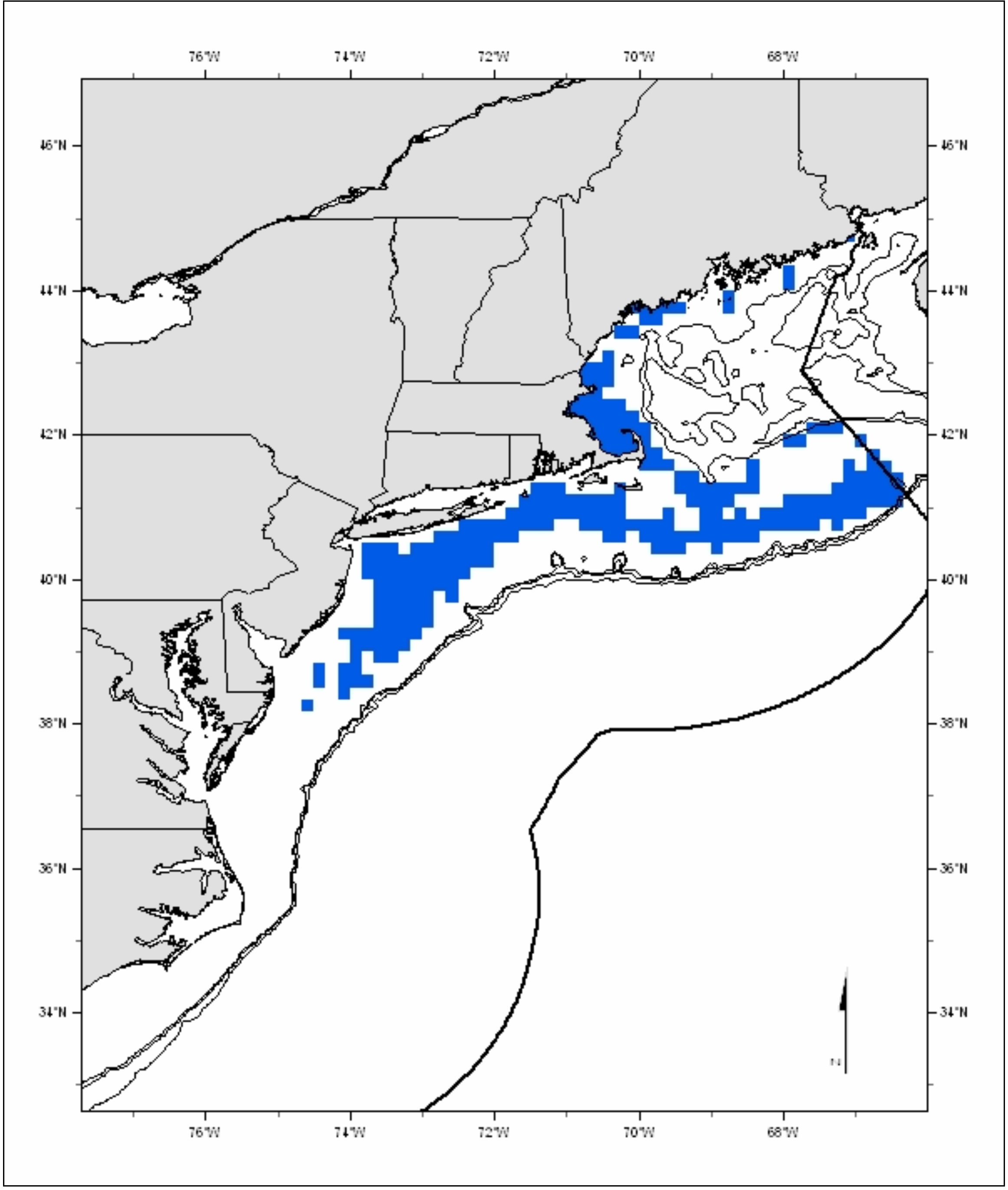
The Alternative 2B EFH designation for juvenile yellowtail flounder on the continental shelf is based upon relative abundance during 1968-2005 in the fall and spring NMFS trawl survey at the 50% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where juvenile yellowtail flounder were caught in state trawl surveys in more than 10% of the tows, as well as those bays and estuaries identified by the NOAA ELMR program where yellowtail flounder juveniles were "common" or "abundant."

Map 287. Yellowtail flounder juveniles, Alternative 2C



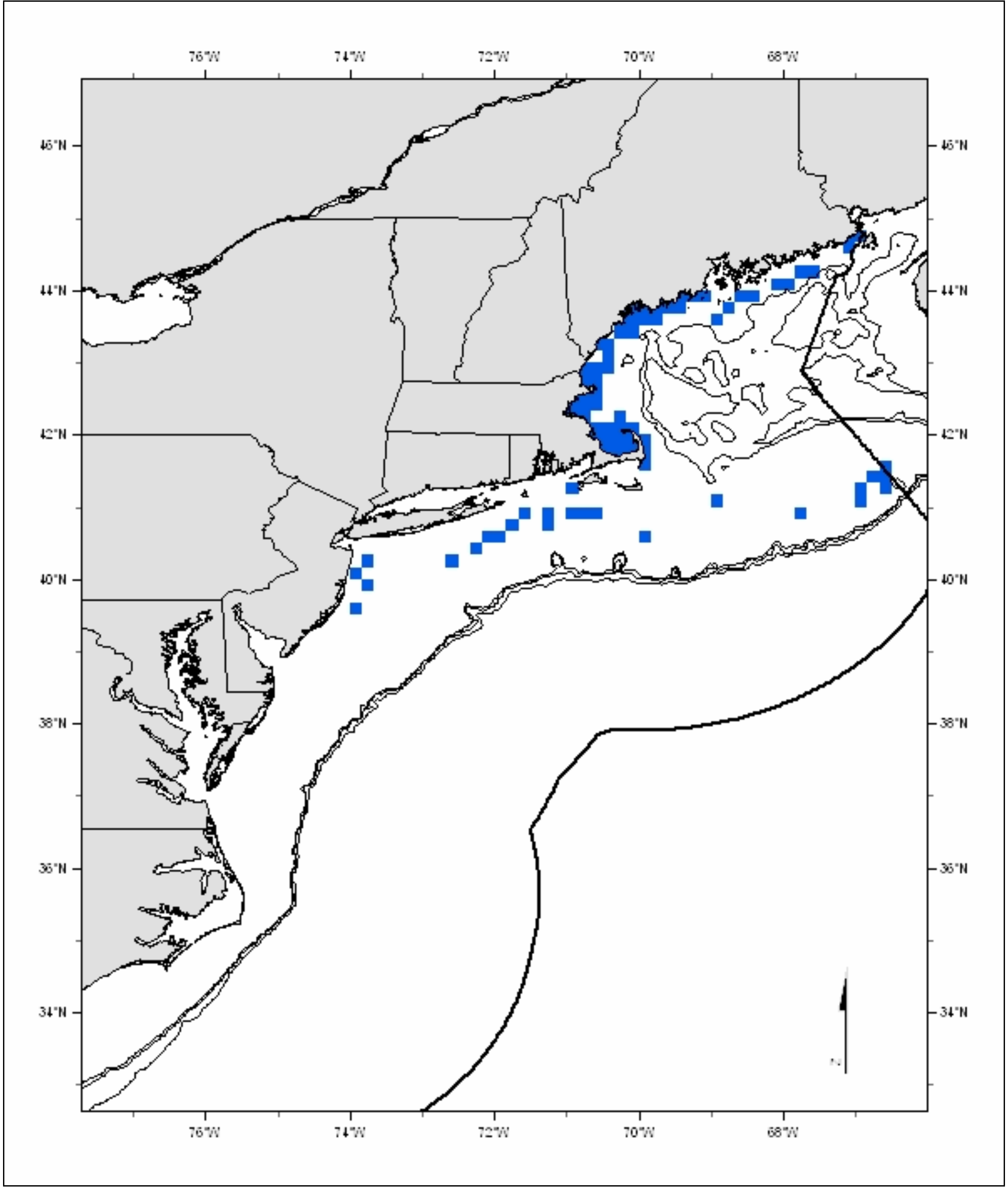
The Alternative 2C EFH designation for juvenile yellowtail flounder on the continental shelf is based upon relative abundance during 1968-2005 in the fall and spring NMFS trawl survey at the 75% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where juvenile yellowtail flounder were caught in state trawl surveys in more than 10% of the tows, as well as those bays and estuaries identified by the NOAA ELMR program where yellowtail flounder juveniles were "common" or "abundant."

Map 288. Yellowtail flounder juveniles, Alternative 2D



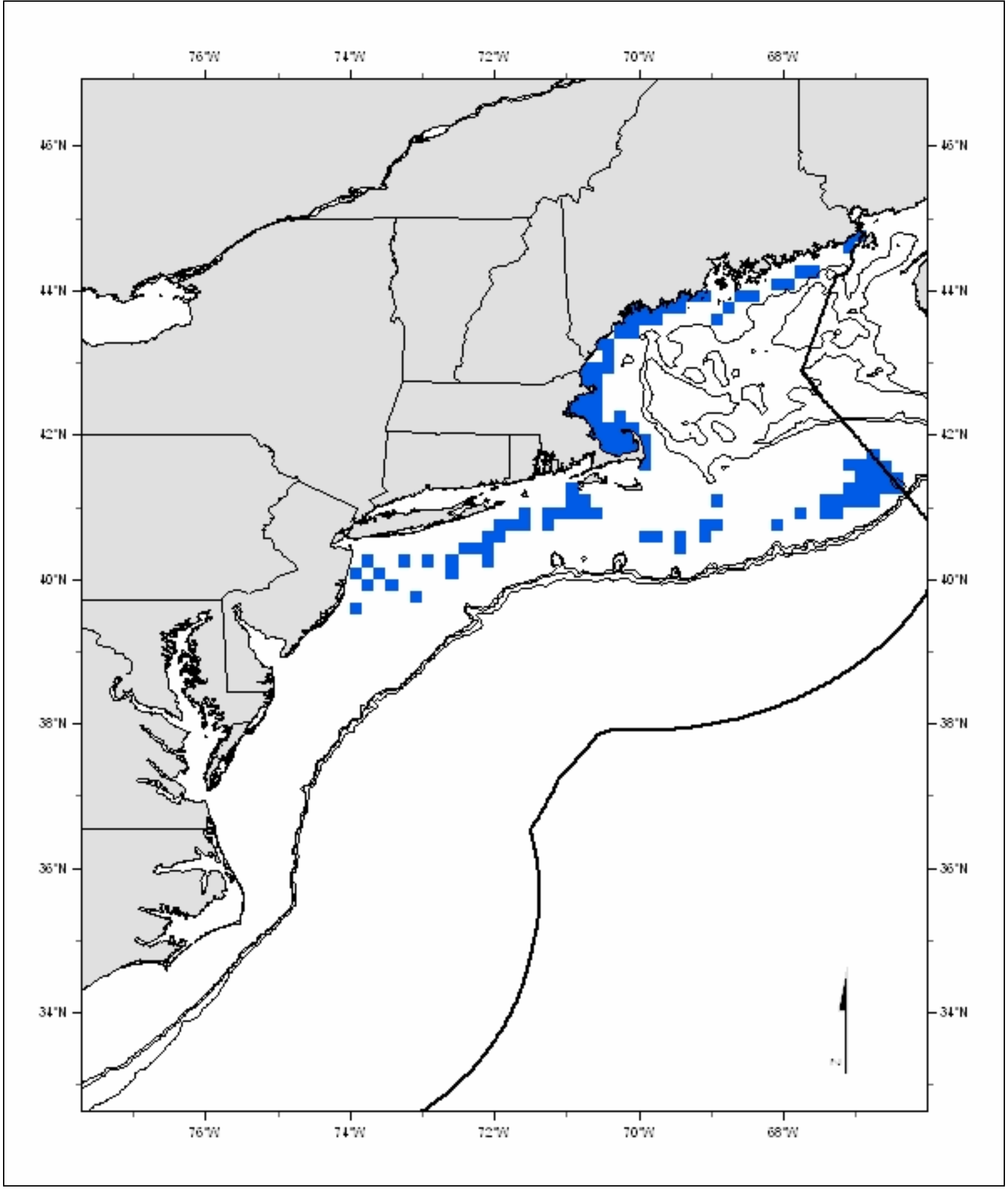
The Alternative 2D EFH designation for juvenile yellowtail flounder on the continental shelf is based upon relative abundance during 1968-2005 in the fall and spring NMFS trawl survey at the 90% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where juvenile yellowtail flounder were caught in state trawl surveys in more than 10% of the tows, as well as those bays and estuaries identified by the NOAA ELMR program where yellowtail flounder juveniles were "common" or "abundant."

Map 289. Yellowtail flounder adults, Alternative 2A



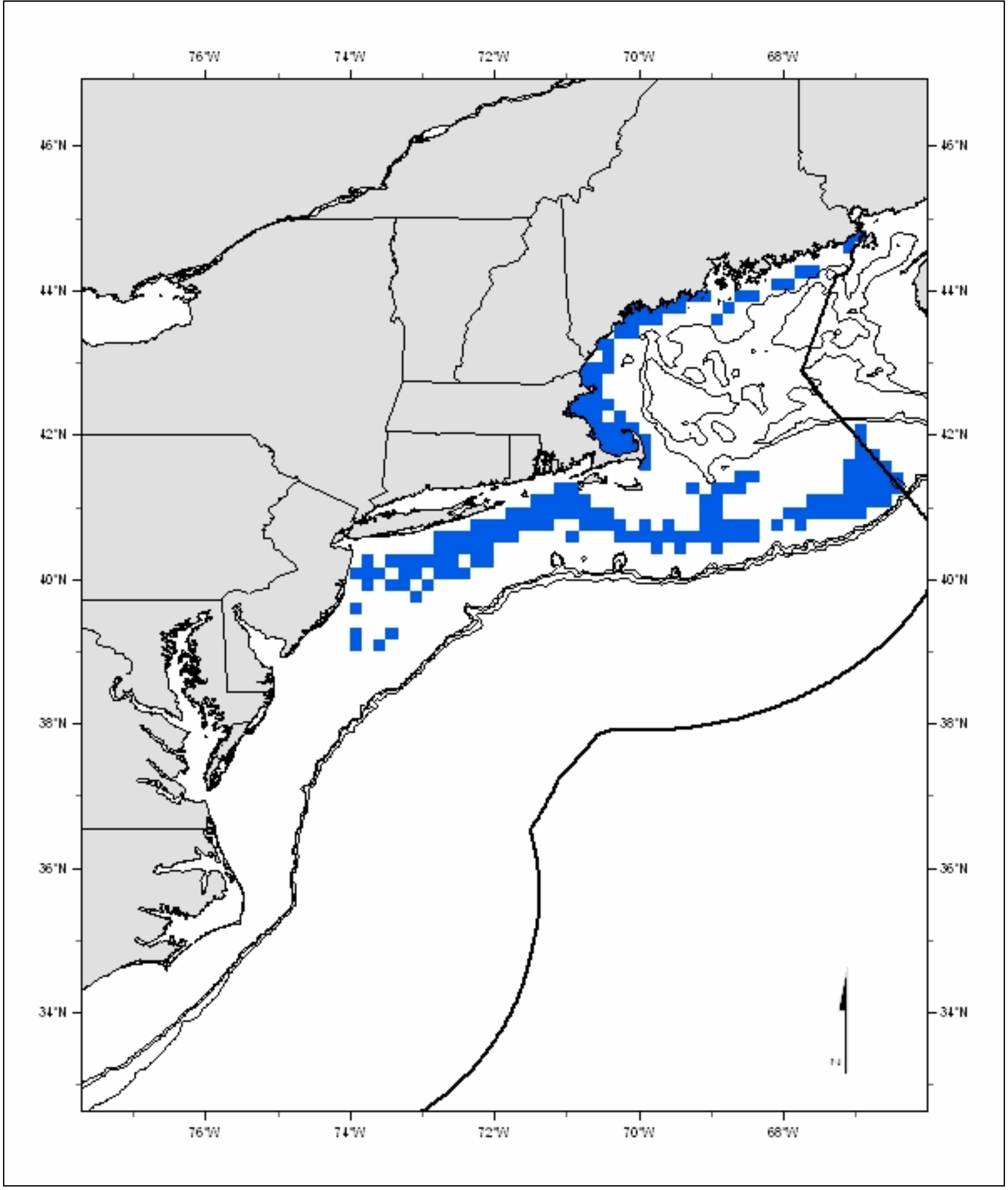
The Alternative 2A EFH designation for adult yellowtail flounder on the continental shelf is based upon relative abundance during 1968-2005 in the fall and spring NMFS trawl survey at the 25% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where adult yellowtail flounder were caught in state trawl surveys in more than 10% of the tows, as well as those bays and estuaries identified by the NOAA ELMR program where yellowtail flounder adults were "common" or "abundant."

Map 290. Yellowtail flounder adults, Alternative 2B



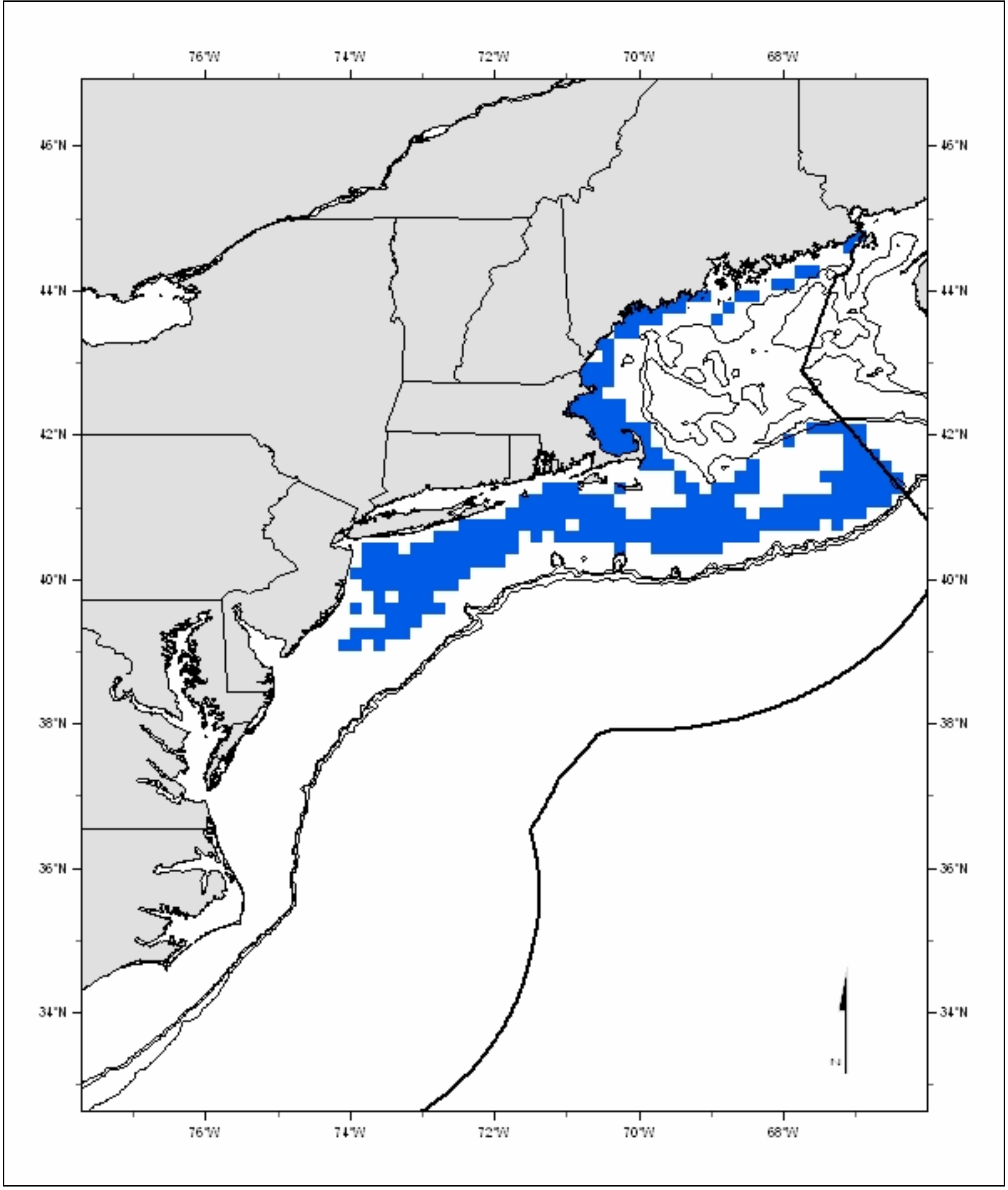
The Alternative 2B EFH designation for adult yellowtail flounder on the continental shelf is based upon relative abundance during 1968-2005 in the fall and spring NMFS trawl survey at the 50% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where adult yellowtail flounder were caught in state trawl surveys in more than 10% of the tows, as well as those bays and estuaries identified by the NOAA ELMR program where yellowtail flounder adults were "common" or "abundant."

Map 291. Yellowtail flounder adults, Alternative 2C



The Alternative 2C EFH designation for adult yellowtail flounder on the continental shelf is based upon relative abundance during 1968-2005 in the fall and spring NMFS trawl survey at the 75% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where adult yellowtail flounder were caught in state trawl surveys in more than 10% of the tows, as well as those bays and estuaries identified by the NOAA ELMR program where yellowtail flounder adults were "common" or "abundant."

Map 292. Yellowtail flounder adults, Alternative 2D



The Alternative 2D EFH designation for adult yellowtail flounder on the continental shelf is based upon relative abundance during 1968-2005 in the fall and spring NMFS trawl survey at the 90% cumulative percentage level. This alternative also includes ten minute squares in inshore areas where adult yellowtail flounder were caught in state trawl surveys in more than 10% of the tows, as well as those bays and estuaries identified by the NOAA ELMR program where yellowtail flounder adults were "common" or "abundant."

4.1.3 Alternative 3 – Abundance Plus Habitat Considerations

4.1.3.1 Methods

Based on the general advice provided in the short-term recommendations by the Habitat Evaluation Peer Review Committee, the PDT developed a GIS-based EFH designation methodology that combines the primary elements of Alternative 2 (updated fall and spring survey catch rate data for the continental shelf and ELMR information for inshore areas) with habitat features that are associated with high catch rates of benthic juvenile and adult life stages in order to more explicitly define and link the habitat characteristics of EFH in the text descriptions and the maps . "Preferred" depths, bottom temperatures, and substrate types were defined by analyzing tow-by-tow NMFS trawl survey data for the continental shelf, and information contained in up-dated EFH Source Documents and inshore state survey reports. Once preferred habitat features were defined for each benthic life stage of each species, they were "mapped" according to the spatial distribution of depths, fall and spring bottom temperatures, and substrate types that characterize the Northeast region. In addition, frequency of occurrence information (percentage of positive tows in individual ten minute squares) was extracted from a number of state survey datasets to provide more comprehensive EFH designations for the inshore area. For the off-shelf area (continental slope deeper than 500 meters and seamounts within the U.S. EEZ), EFH was defined according to information that indicates the presence of given species and life stage within defined depth and geographic ranges. Thus, the level of information used to develop this alternative varied from level 1 (presence-absence) in the off-shelf area to level 2 inshore and on the continental shelf. For a detailed explanation of the methods used in this alternative, refer to Appendix A.

4.1.3.2 Text Descriptions and Map Representations

4.1.3.2.1 American Plaice

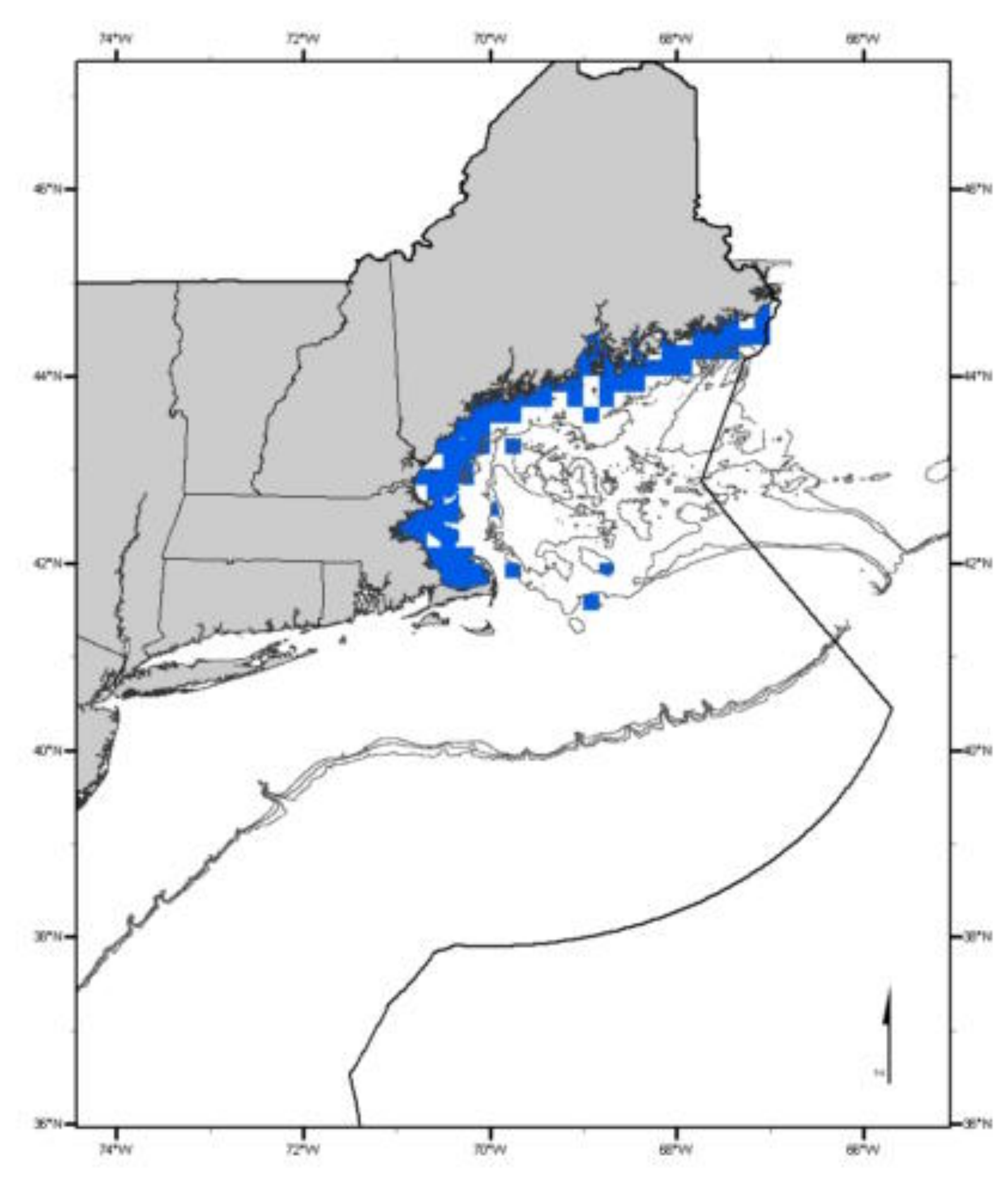
Eggs: No alternative EFH designation.

Larvae: No alternative EFH designation.

Juveniles: Continental shelf benthic habitats in depths of 40 – 180 meters with substrates of mud and/or mixtures of sand and mud, as depicted on Map 293 - Map 296. Other conditions that generally exist where EFH is found are bottom temperatures of 2.5 – 10.5ºC and salinities of 28 – 34.5 ppt. Primary benthic prey organisms for juvenile American plaice are nematodes, polychaetes, a variety of crustaceans, brittle stars, and bivalve mollusks. *(Preferred Alternative)*

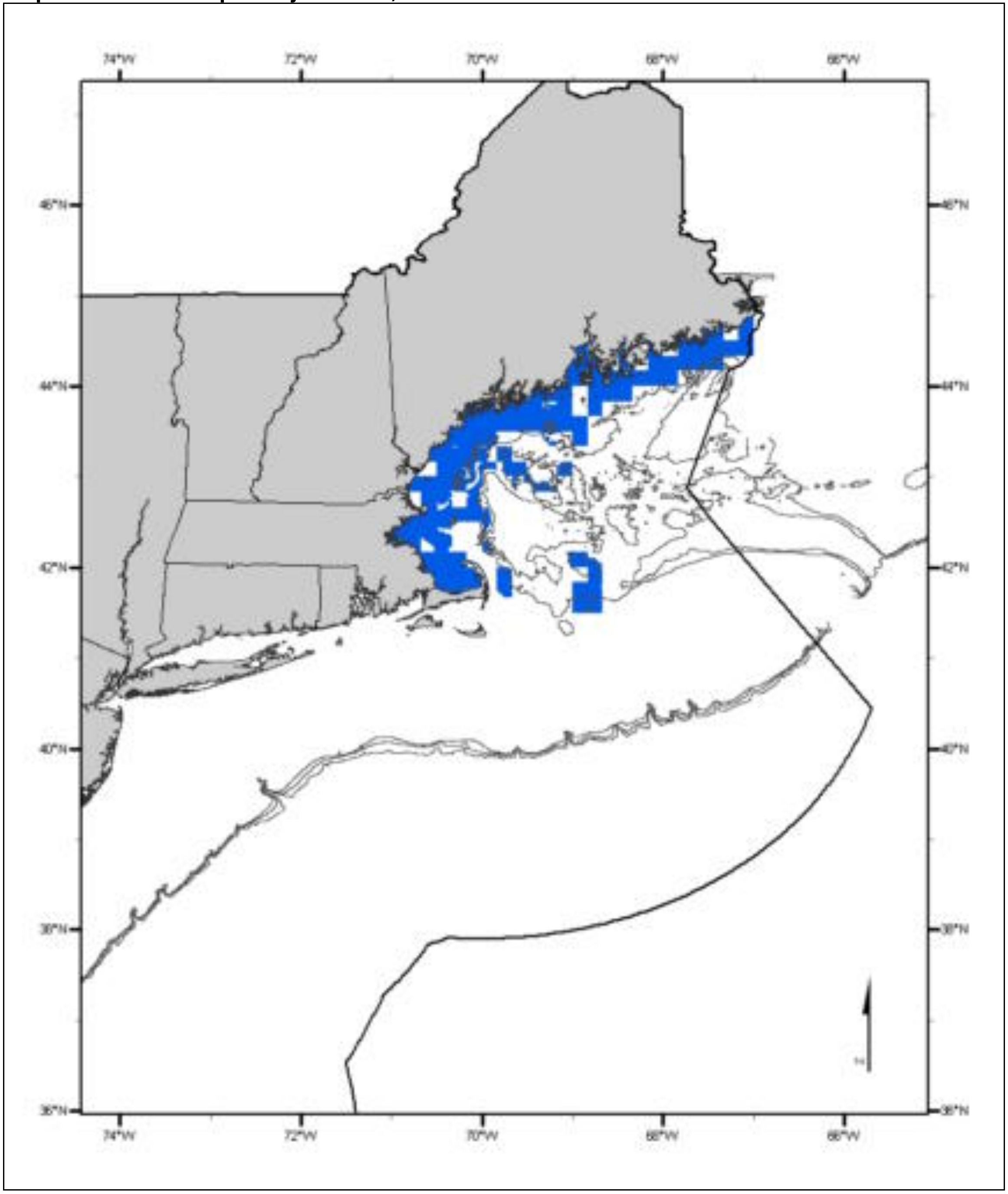
Adults: Continental shelf benthic habitats in depths of 40 – 200 meters with substrates of mud and/or mixtures of sand and mud, as depicted on Map 297 - Map 300. Other conditions that generally exist where EFH is found are bottom temperatures of 2.5 – 10.5ºC and salinities of 28 – 34.5 ppt. Spawning generally occurs in depths less than 90 meters and bottom temperatures of 3 – 6ºC. Primary prey organisms for adult American plaice are bivalve mollusks, a variety of crustaceans, brittle stars, starfishes, and sand dollars.
(Preferred Alternative).

Map 293. American plaice juveniles, Alternative 3A



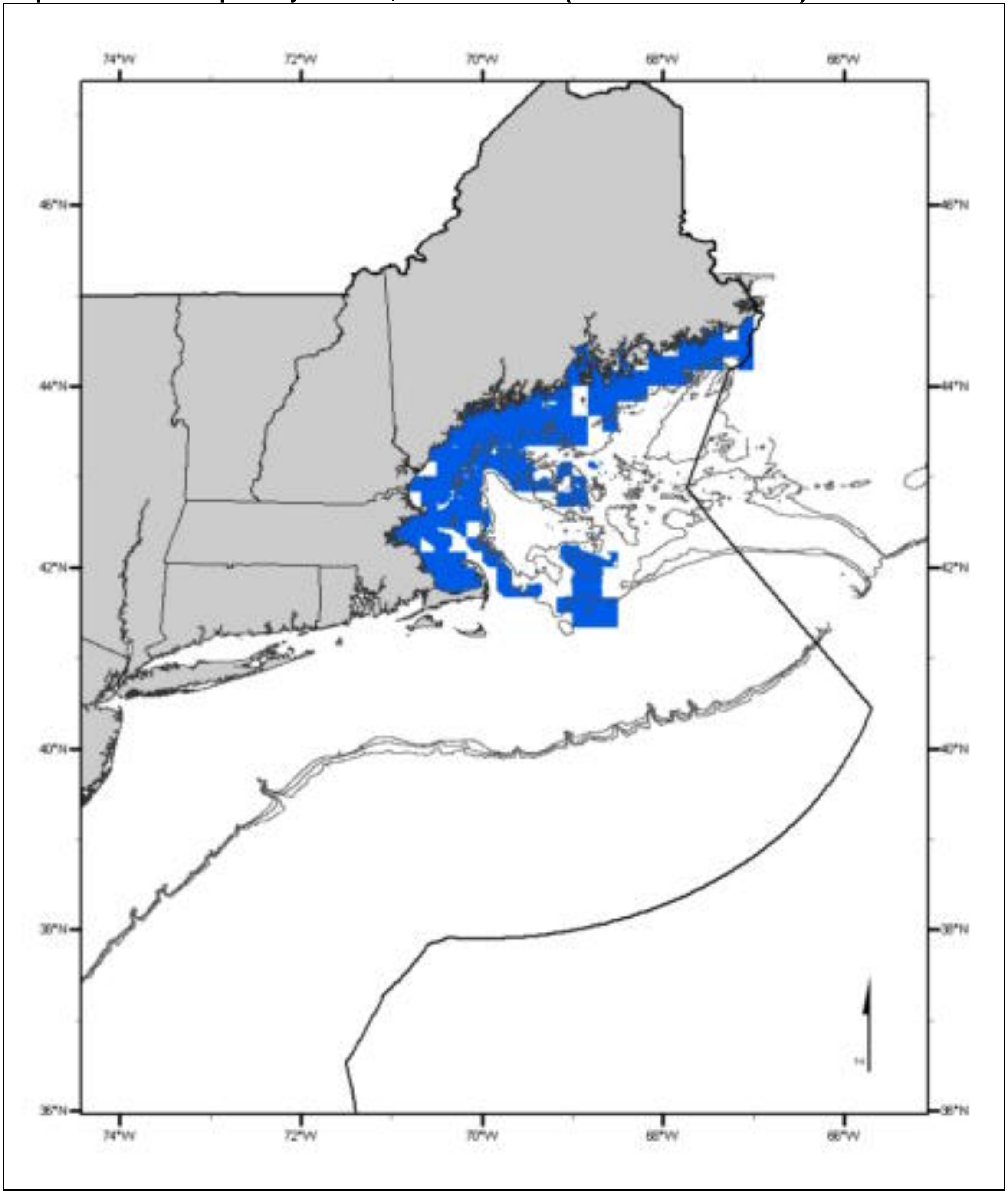
The Alternative 3A EFH designation for juvenile American plaice on the continental shelf is based on the distribution of substrate types, depths, and bottom temperatures that are associated with high catch rates of juveniles in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of juveniles in the 1968-2005 spring and fall NMFS trawl surveys at the 25% cumulative percentage of catch level and includes inshore areas where juvenile American plaice were determined to be present, based on 10% frequency of occurrence in state trawl surveys and ELMR information.

Map 294. American plaice juveniles, Alternative 3B



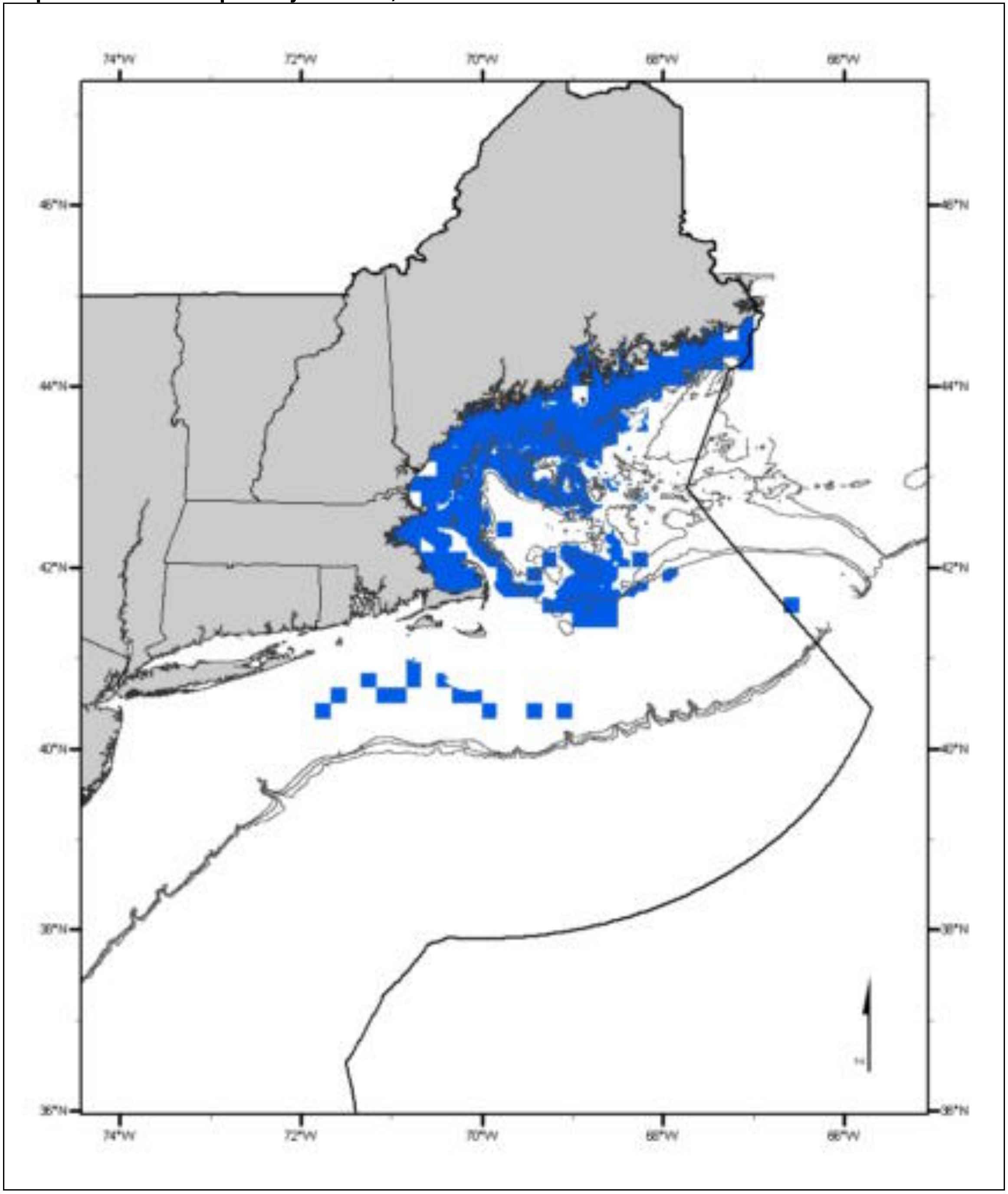
The Alternative 3B EFH designation for juvenile American plaice on the continental shelf is based on the distribution of substrate types, depths, and bottom temperatures that are associated with high catch rates of juveniles in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of juveniles in the 1968-2005 spring and fall NMFS trawl surveys at the 50% cumulative percentage of catch level and includes inshore areas where juvenile American plaice were determined to be present, based on 10% frequency of occurrence in state trawl surveys and ELMR information.

Map 295. American plaice juveniles, Alternative 3C *(Preferred Alternative)*



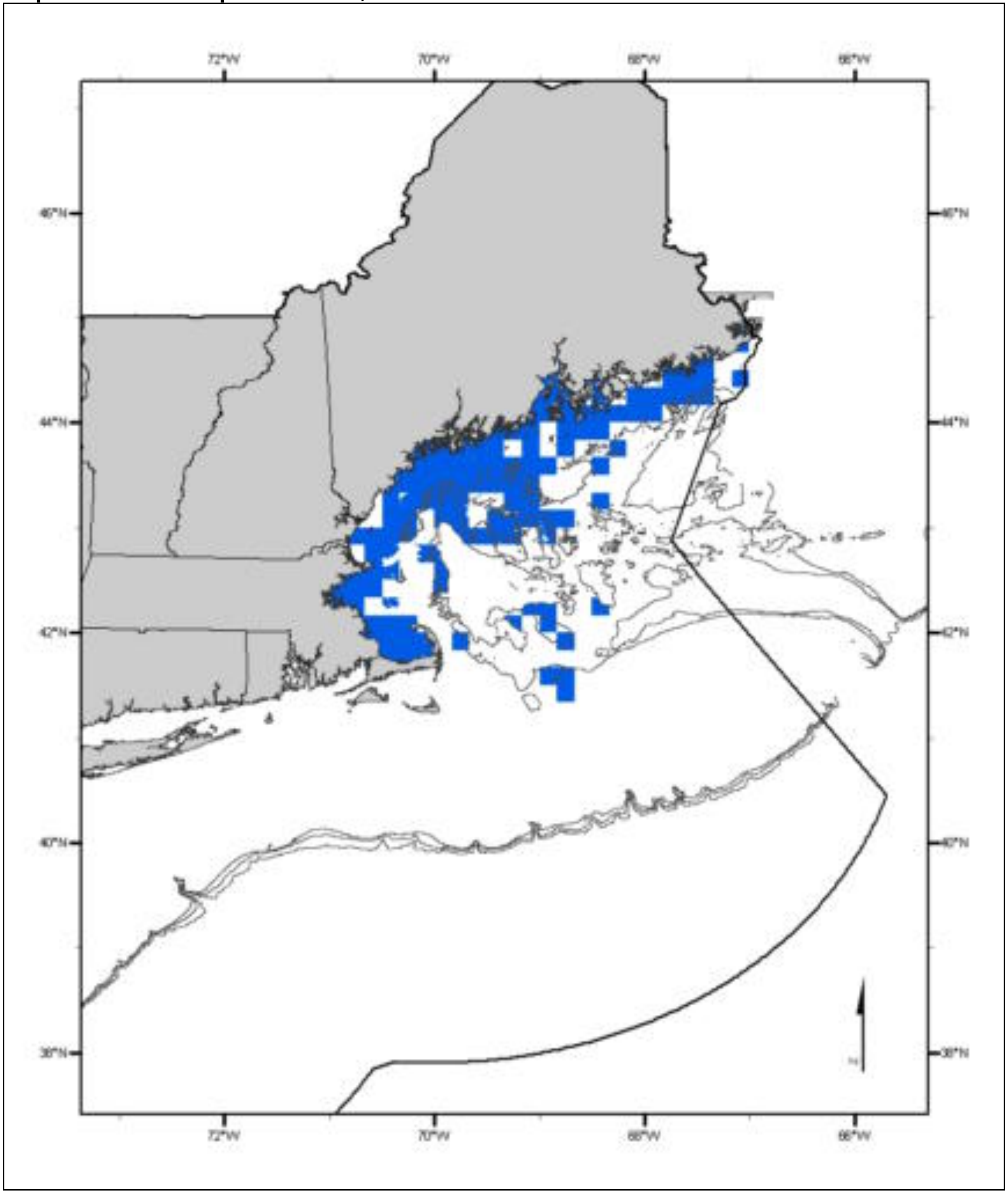
The Alternative 3C EFH designation for juvenile American plaice on the continental shelf is based on the distribution of substrate types, depths, and bottom temperatures that are associated with high catch rates of juveniles in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of juveniles in the 1968-2005 spring and fall NMFS trawl surveys at the 75% cumulative percentage of catch level and includes inshore areas where juvenile American plaice were determined to be present, based on 10% frequency of occurrence in state trawl surveys and ELMR information.

Map 296. American plaice juveniles, Alternative 3D



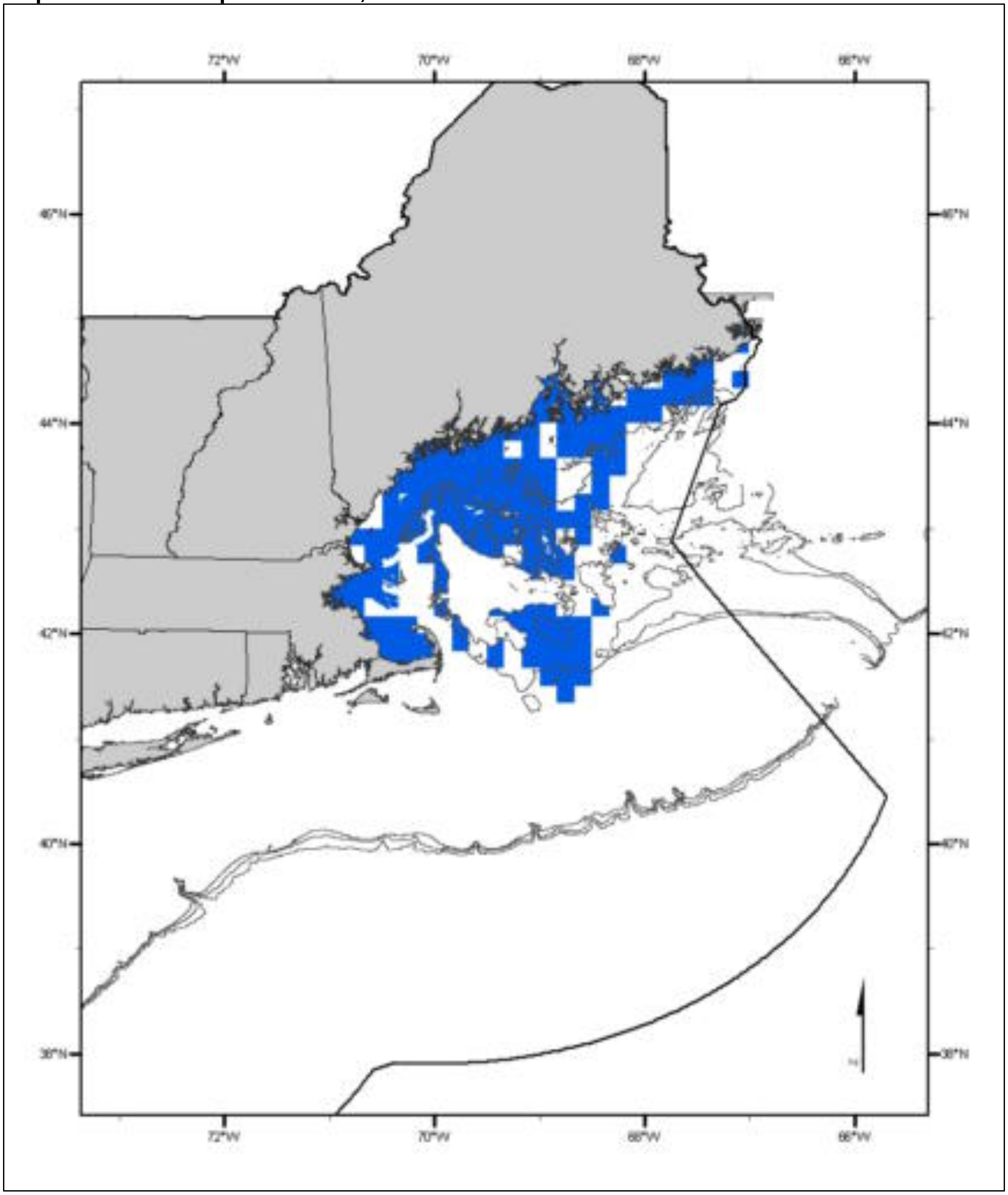
The Alternative 3D EFH designation for juvenile American plaice on the continental shelf is based on the distribution of substrate types, depths, and bottom temperatures that are associated with high catch rates of juveniles in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of juveniles in the 1968-2005 spring and fall NMFS trawl surveys at the 90% cumulative percentage of catch level and includes inshore areas where juvenile American plaice were determined to be present, based on 10% frequency of occurrence in state trawl surveys and ELMR information.

Map 297. American plaice adults, Alternative 3A



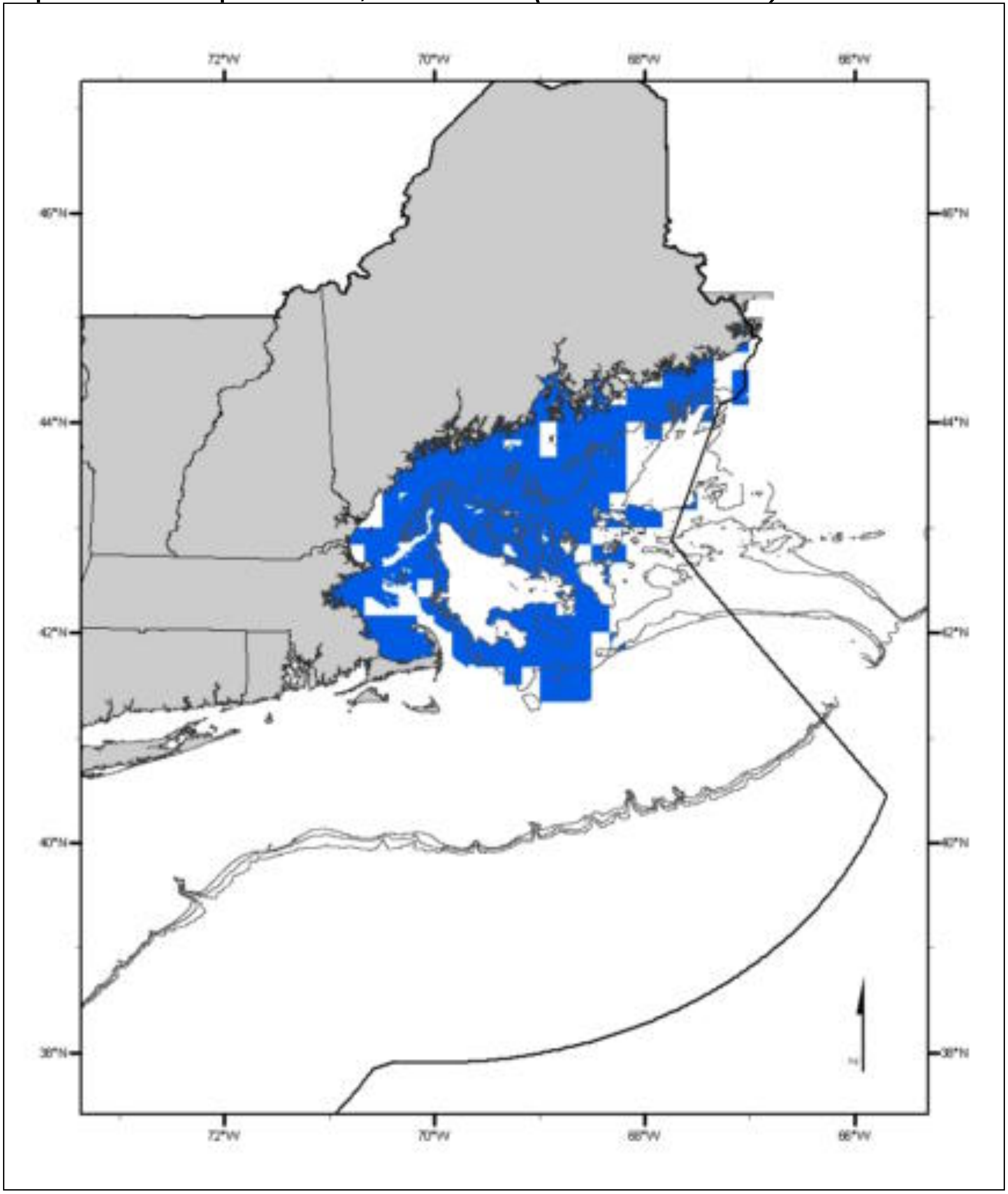
The Alternative 3A EFH designation for adult American plaice on the continental shelf is based on the distribution of substrate types, depths, and bottom temperatures that are associated with high catch rates of adults in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of adults in the 1968-2005 spring and fall NMFS trawl surveys at the 25% cumulative percentage of catch level and includes inshore areas where adult American plaice were determined to be present, based on 10% frequency of occurrence in state trawl surveys and ELMR information.

Map 298. American plaice adults, Alternative 3B



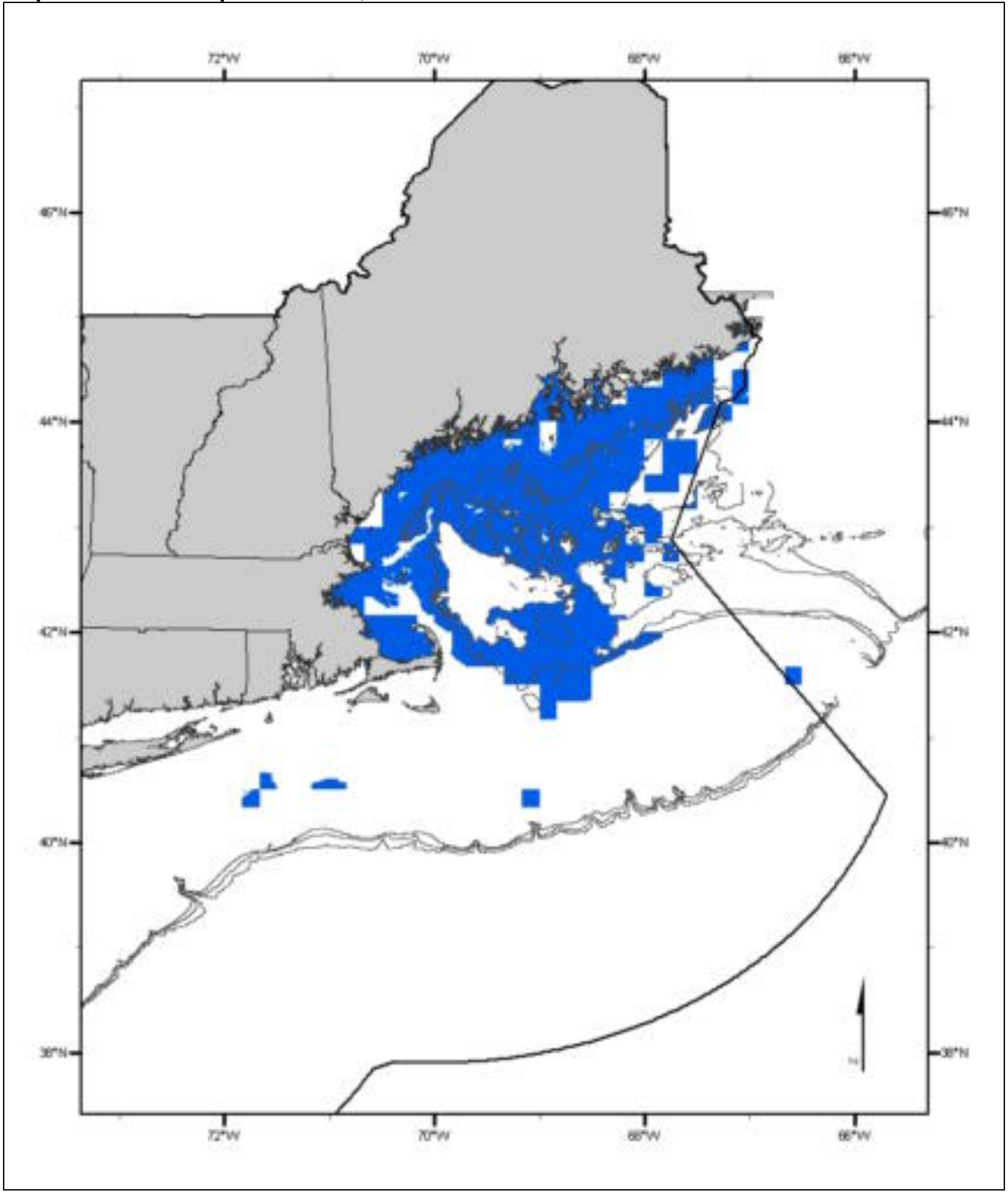
The Alternative 3B EFH designation for adult American plaice on the continental shelf is based on the distribution of substrate types, depths, and bottom temperatures that are associated with high catch rates of adults in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of adults in the 1968-2005 spring and fall NMFS trawl surveys at the 50% cumulative percentage of catch level and includes inshore areas where adult American plaice were determined to be present, based on 10% frequency of occurrence in state trawl surveys and ELMR information.

Map 299. American plaice adults, Alternative 3C *(Preferred Alternative)*



The Alternative 3C EFH designation for adult American plaice on the continental shelf is based on the distribution of substrate types, depths, and bottom temperatures that are associated with high catch rates of adults in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of adults in the 1968-2005 spring and fall NMFS trawl surveys at the 75% cumulative percentage of catch level and includes inshore areas where adult American plaice were determined to be present, based on 10% frequency of occurrence in state trawl surveys and ELMR information.

Map 300. American plaice adults, Alternative 3D



The Alternative 3D EFH designation for adult American plaice on the continental shelf is based on the distribution of substrate types, depths, and bottom temperatures that are associated with high catch rates of adults in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of adults in the 1968-2005 spring and fall NMFS trawl surveys at the 90% cumulative percentage of catch level and includes inshore areas where adult American plaice were determined to be present, based on 10% frequency of occurrence in state trawl surveys and ELMR information.

4.1.3.2.2 Atlantic Cod

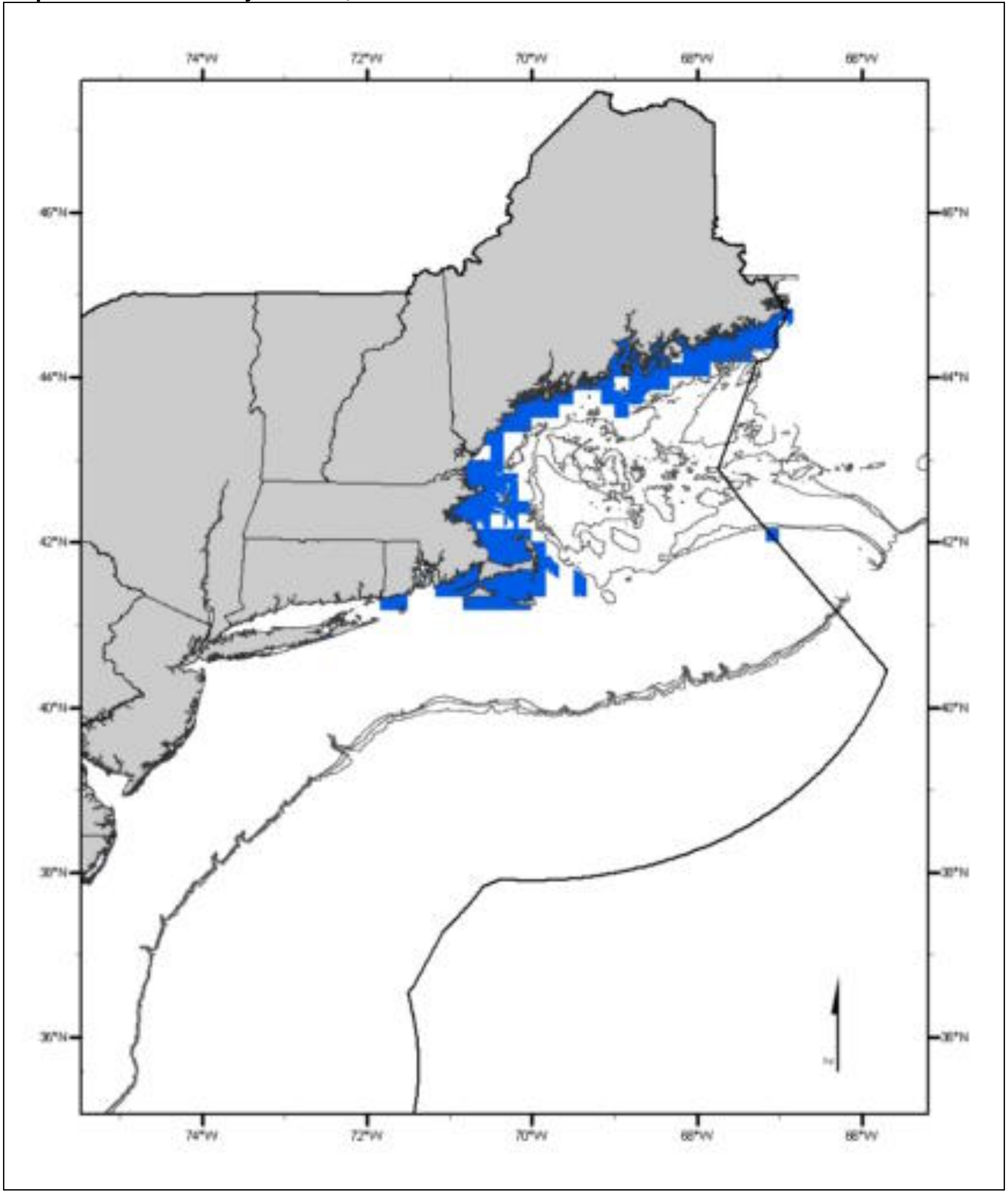
Eggs: No alternative EFH designation.

Larvae: No alternative EFH designation.

Juveniles: Inshore and continental shelf benthic habitats in depths of 1 – 120 meters (including the intertidal zone) with a wide variety of substrates, as depicted on Map 301 - Map 305. EFH for juvenile Atlantic cod includes boulders, cobbles, pebbles, gravel, sand, sand and mud, and/or sand and mud mixed with gravel, pebbles, and cobbles. Other conditions that generally exist where EFH is found are bottom temperatures of 2.5 – 12.5ºC and salinities of 28 – 34 ppt. YOY juveniles settle to the bottom in inshore and offshore waters, inhabiting seagrass and macroalgal beds and structurally–complex hard bottom substrates (*e.g.*, rock reef and cobble–pebble–gravel habitats with attached epifauna such as sponges). Recently–settled benthic juveniles feed primarily on mysids, while older juveniles feed on a variety of crustaceans. *(Preferred Alternative)*

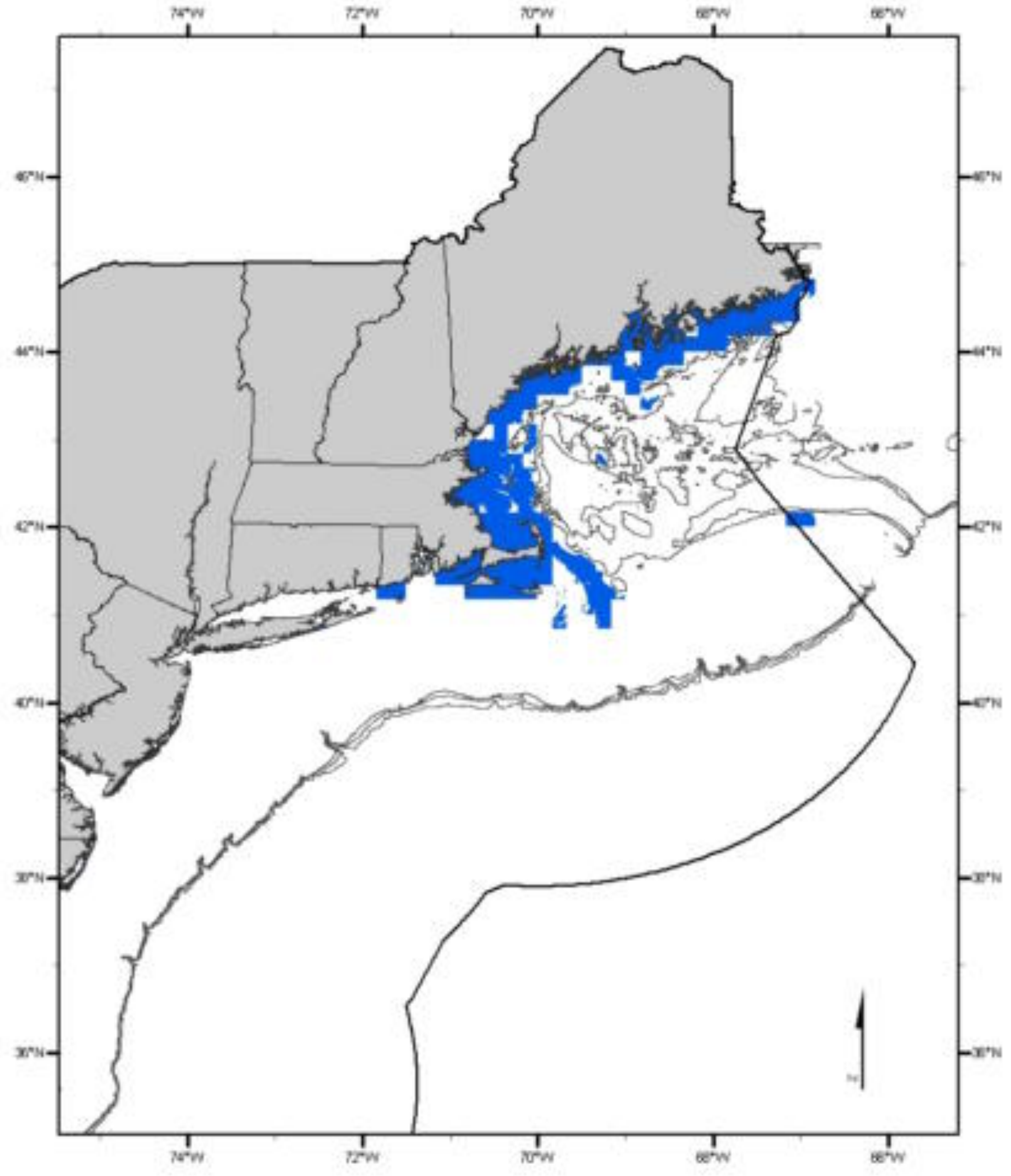
Adults: Inshore and continental shelf benthic habitats in depths of 20 – 140 meters with a wide variety of substrates, as depicted on Map 306 - Map 310. EFH for adult Atlantic cod includes rocky slopes and ledges, boulders, cobbles, pebbles, gravel, sand, and/or sand and mud mixed with gravel, pebbles, and cobbles. Other conditions that generally exist where EFH is found are bottom temperatures of 2.5 – 12.5ºC and salinities of 31 – 34 ppt. Spawning occurs in nearshore areas and on the continental shelf, usually in depths less than 73 meters. Adult Atlantic cod feed on squids and a variety of fishes and crustaceans. *(Preferred Alternative)*

Map 301. Atlantic cod juveniles, Alternative 3A



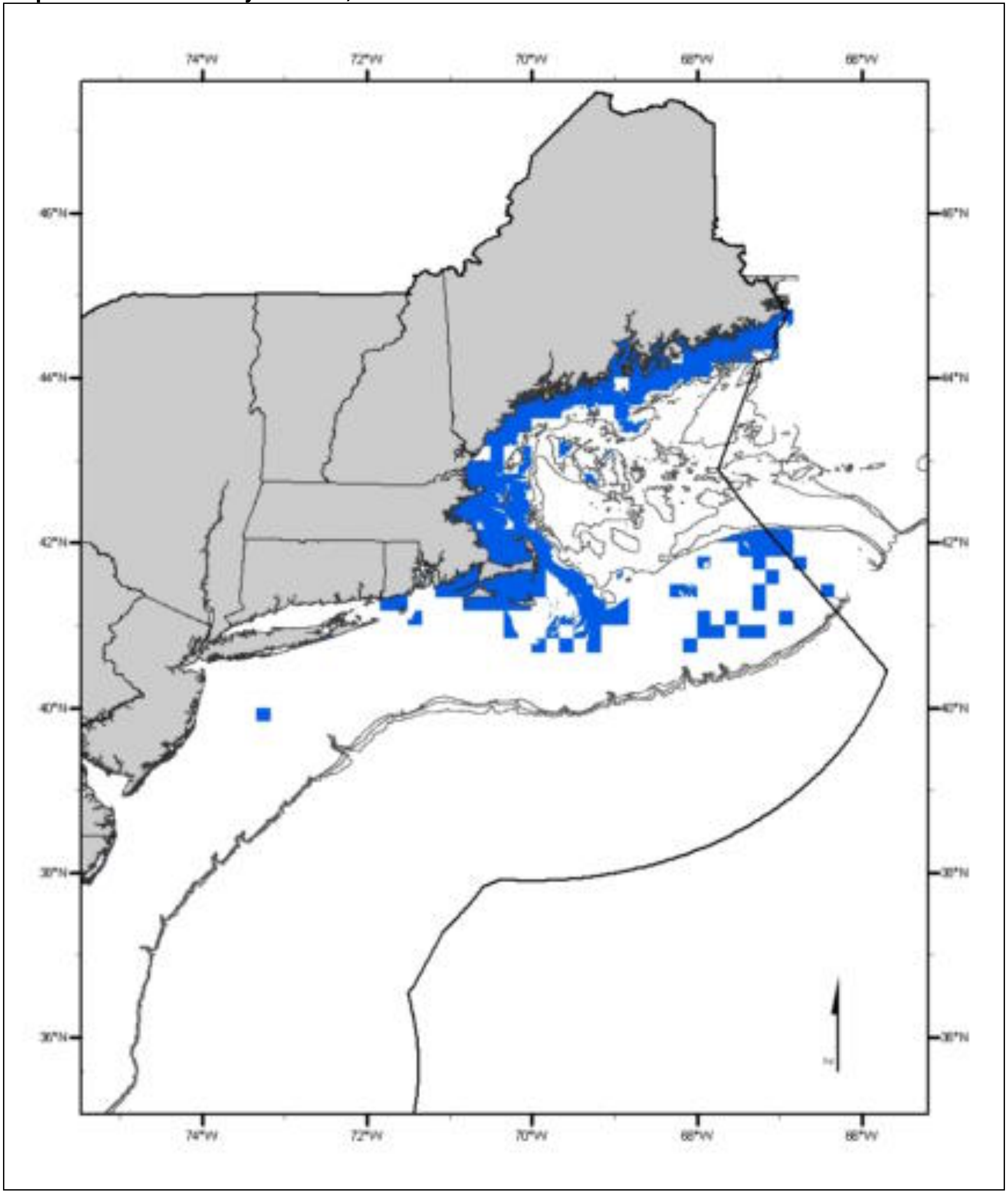
The Alternative 3A EFH designation for juvenile Atlantic cod on the continental shelf is based on the distribution of depths and bottom temperatures that are associated with high catch rates of juveniles in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of juveniles in the 1968-2005 spring and fall NMFS trawl surveys at the 25% cumulative percentage of catch level and includes inshore areas where juvenile Atlantic cod were determined to be present, based on 10% frequency of occurrence in state trawl surveys and ELMR information.

Map 302. Atlantic cod juveniles, Alternative 3B



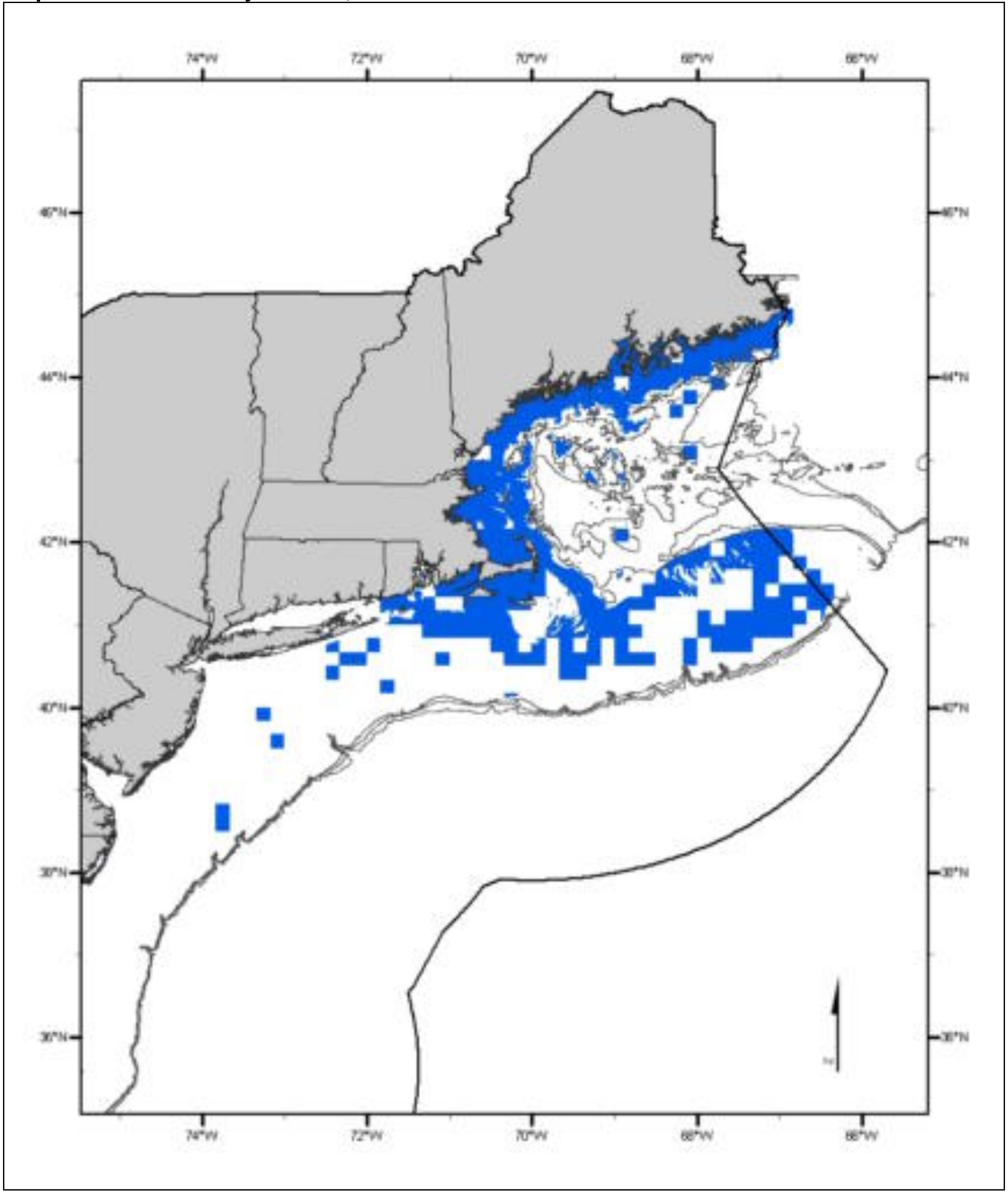
The Alternative 3B EFH designation for juvenile Atlantic cod on the continental shelf is based on the distribution of depths and bottom temperatures that are associated with high catch rates of juveniles in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of juveniles in the 1968-2005 spring and fall NMFS trawl surveys at the 50% cumulative percentage of catch level and includes inshore areas where juvenile Atlantic cod were determined to be present, based on 10% frequency of occurrence in state trawl surveys and ELMR information.

Map 303. Atlantic cod juveniles, Alternative 3C



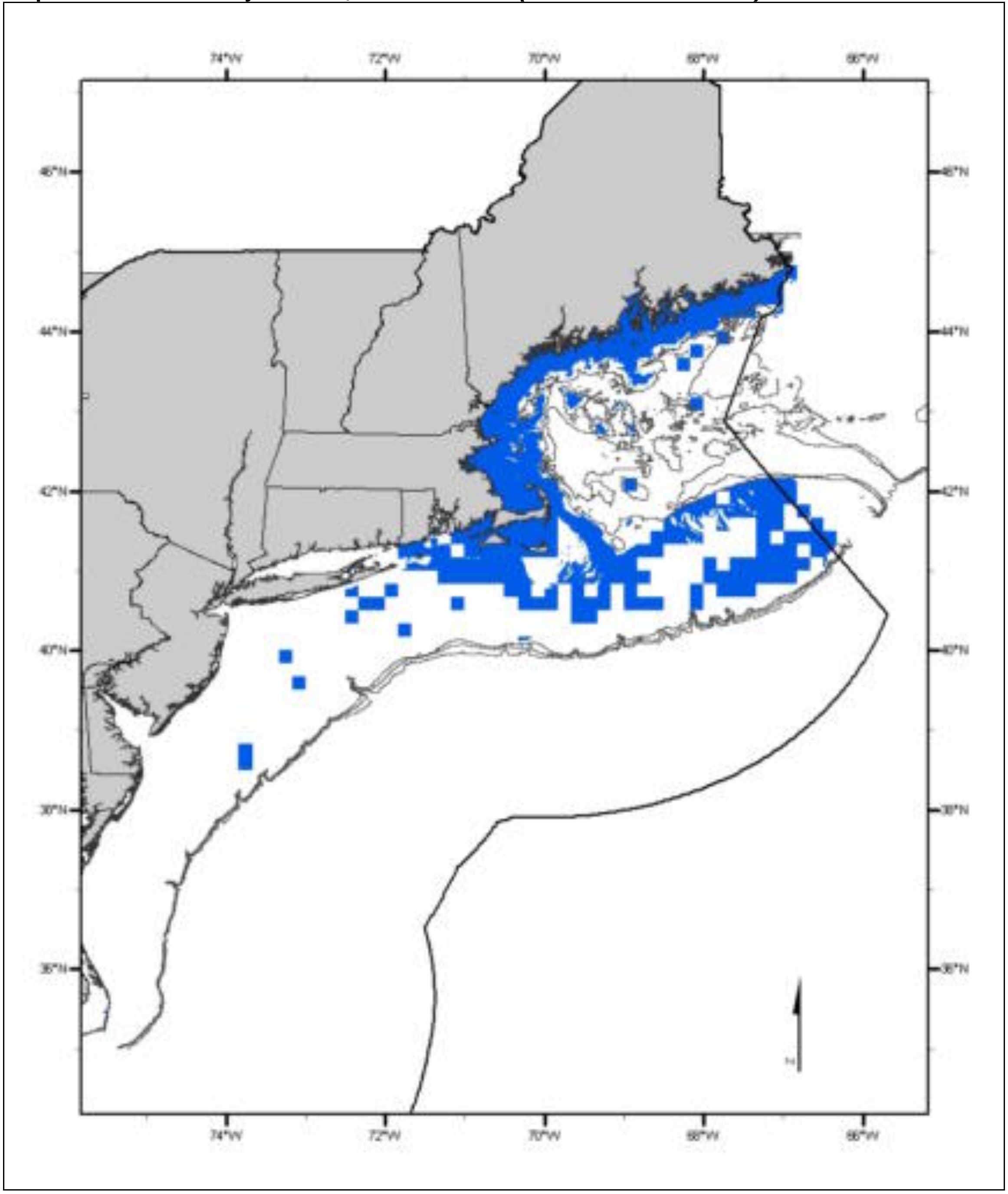
The Alternative 3C EFH designation for juvenile Atlantic cod on the continental shelf is based on the distribution of depths and bottom temperatures that are associated with high catch rates of juveniles in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of juveniles in the 1968-2005 spring and fall NMFS trawl surveys at the 75% cumulative percentage of catch level and includes inshore areas where juvenile Atlantic cod were determined to be present, based on 10% frequency of occurrence in state trawl surveys and ELMR information.

Map 304. Atlantic cod juveniles, Alternative 3D



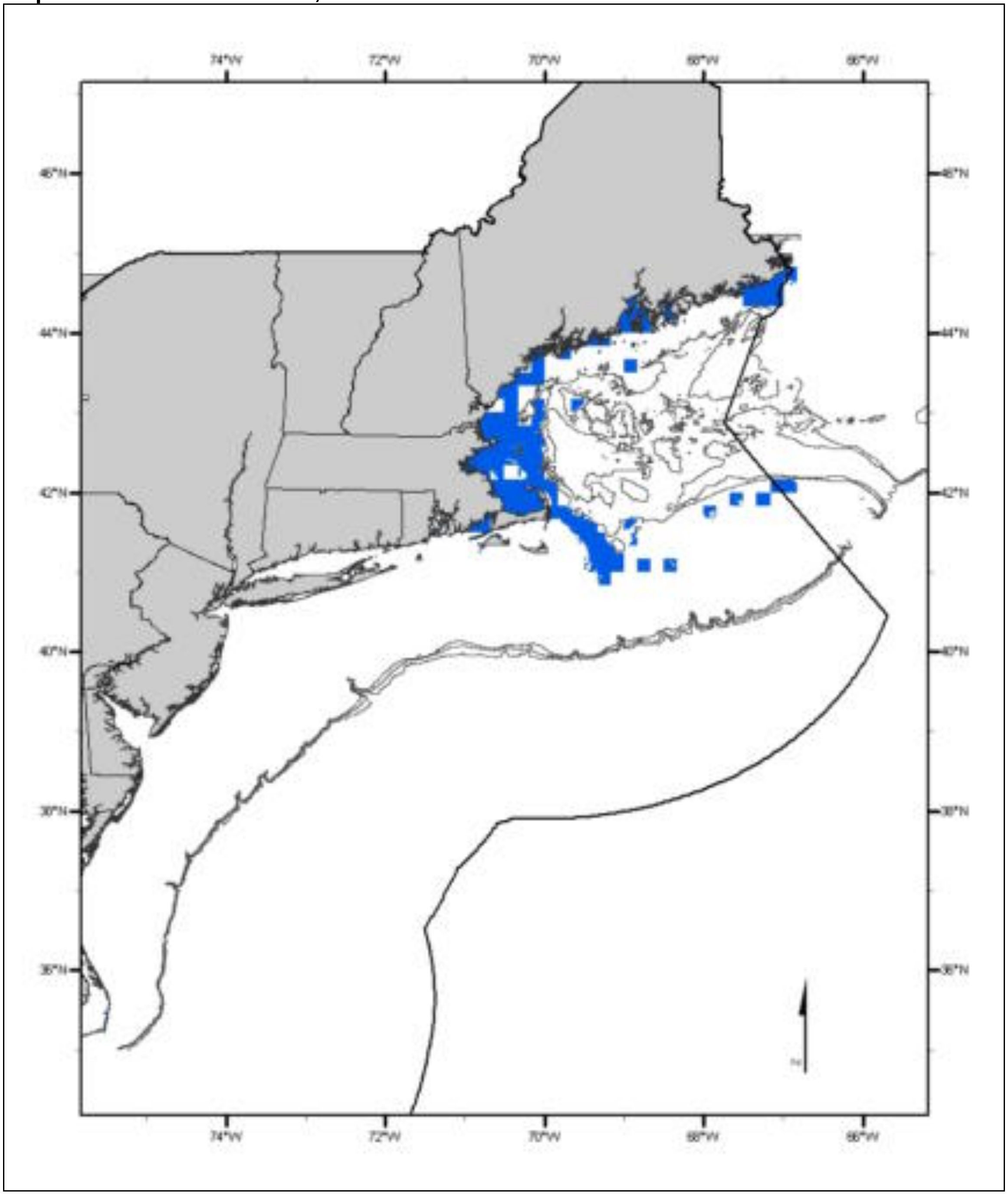
The Alternative 3D EFH designation for juvenile Atlantic cod on the continental shelf is based on the distribution of depths and bottom temperatures that are associated with high catch rates of juveniles in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of juveniles in the 1968-2005 spring and fall NMFS trawl surveys at the 90% cumulative percentage of catch level and includes inshore areas where juvenile Atlantic cod were determined to be present, based on 10% frequency of occurrence in state trawl surveys and ELMR information.

Map 305. Atlantic cod juveniles, Alternative 3E *(Preferred Alternative)*



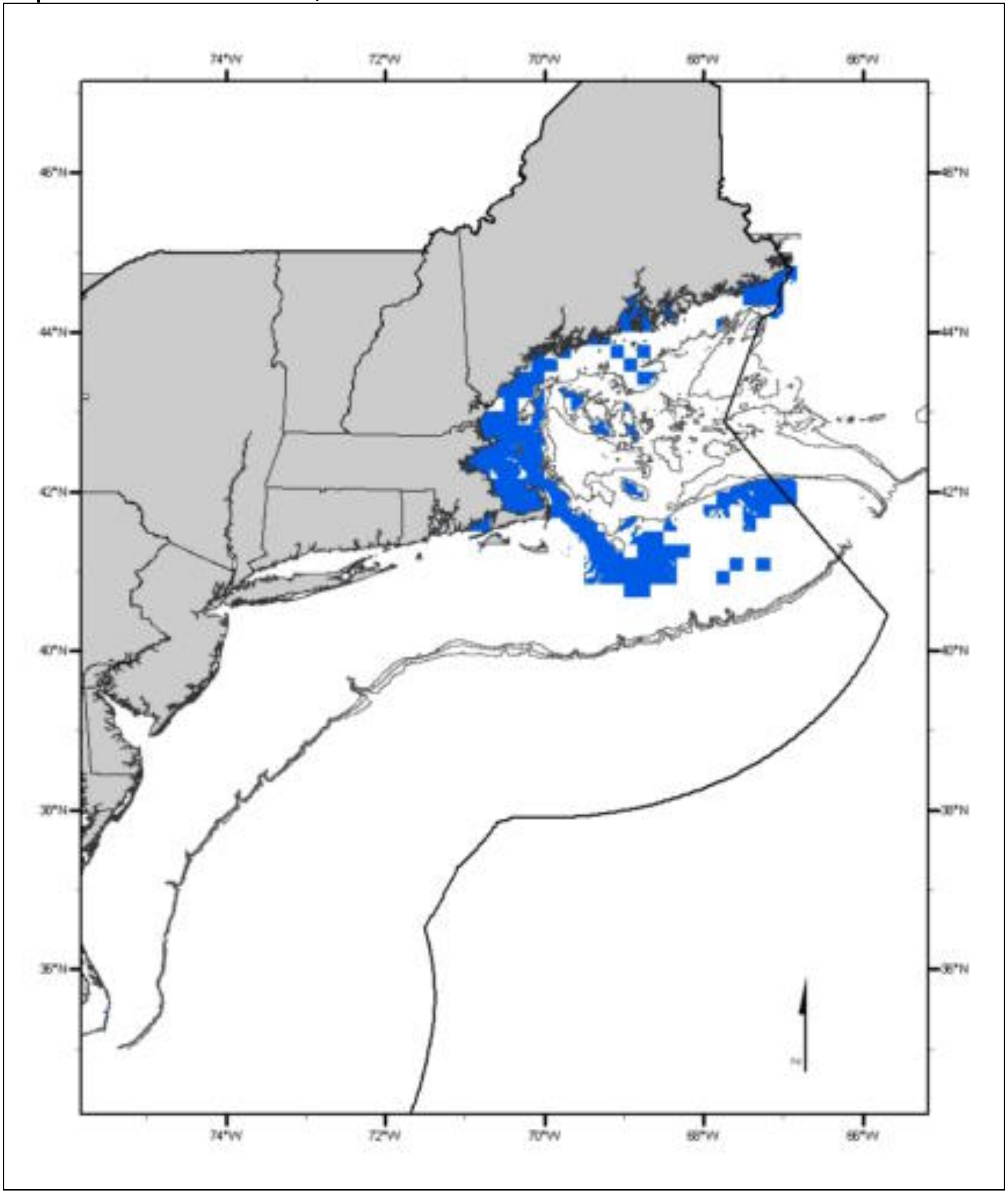
The Alternative 3E EFH designation for juvenile Atlantic cod on the continental shelf is based on the distribution of depths and bottom temperatures that are associated with high catch rates of juveniles in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of juveniles in the 1968-2005 spring and fall NMFS trawl surveys at the 90% cumulative percentage of catch level and includes inshore areas where juvenile Atlantic cod were determined to be present, based on 10% frequency of occurrence in state trawl surveys and ELMR information. In addition, 3E includes ten minute squares that were "filled in" along the MA, NH, and ME coasts, including the islands and portions of the Stellwagen Bank National Marine Sanctuary.

Map 306. Atlantic cod adults, Alternative 3A



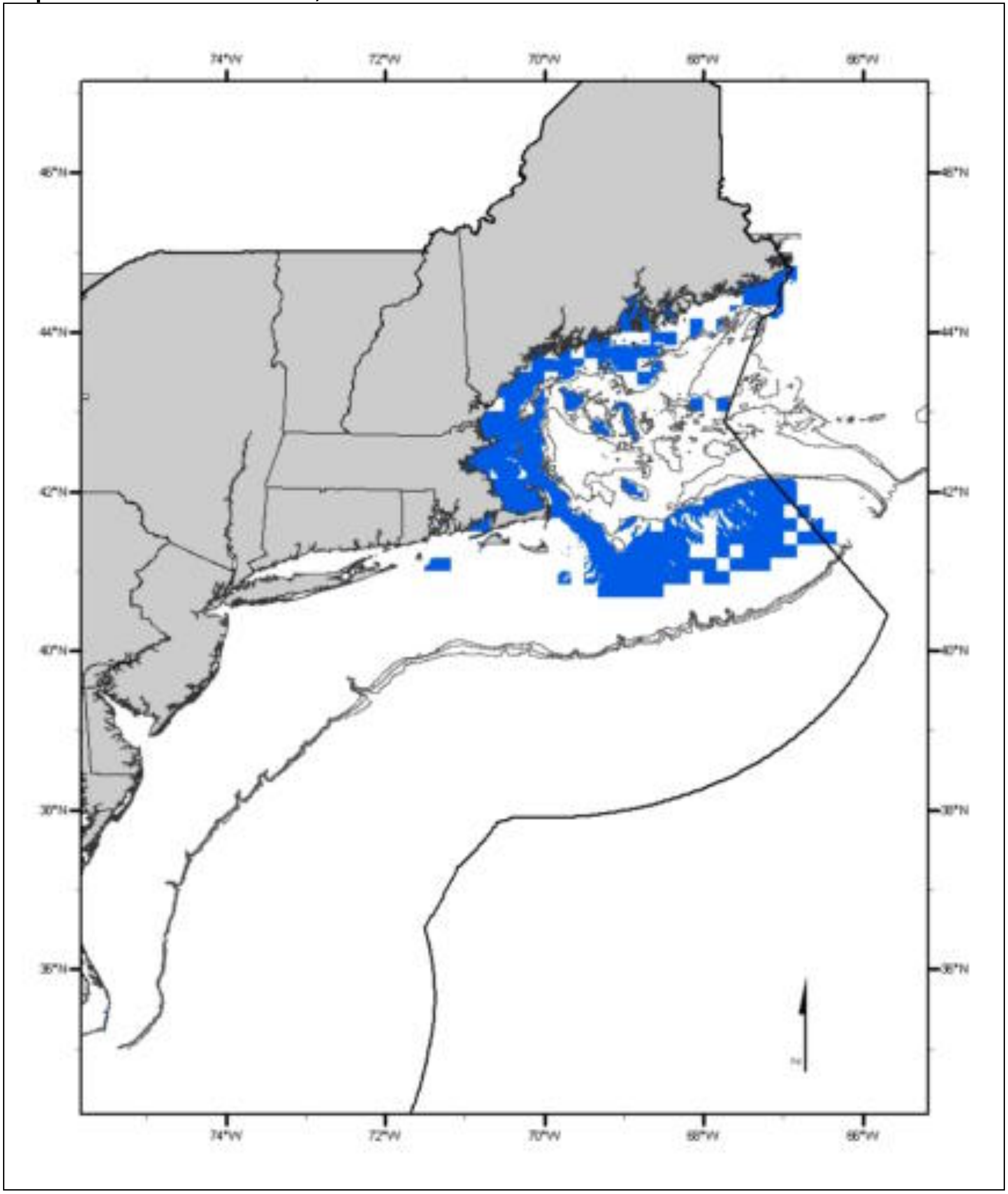
The Alternative 3A EFH designation for adult Atlantic cod on the continental shelf is based on the distribution of substrate types, depths, and bottom temperatures that are associated with high catch rates of adults in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of adults in the 1968-2005 spring and fall NMFS trawl surveys at the 25% cumulative percentage of catch level and includes inshore areas where adult Atlantic cod were determined to be present, based on 10% frequency of occurrence in state trawl surveys and ELMR information.

Map 307. Atlantic cod adults, Alternative 3B



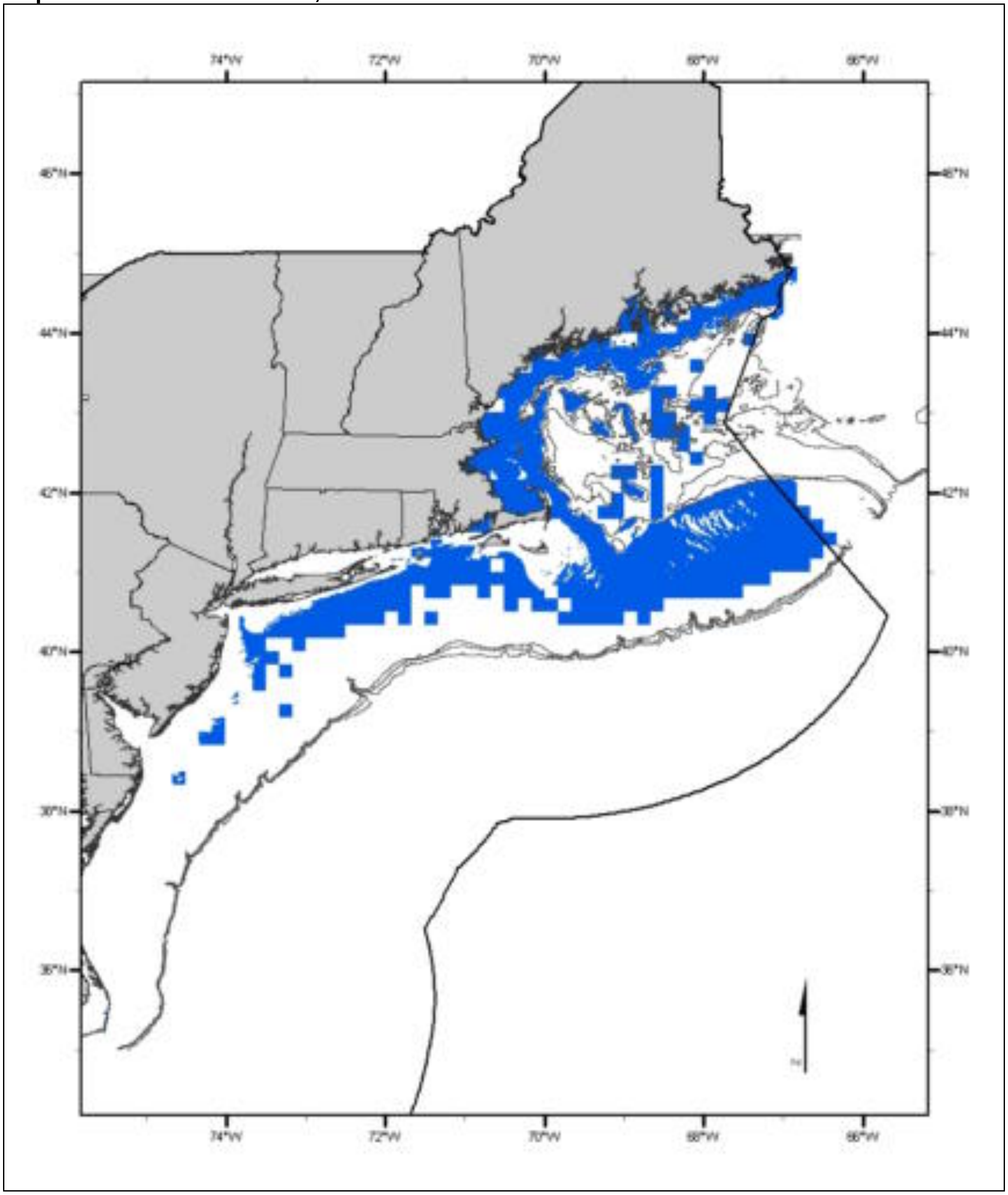
The Alternative 3B EFH designation for adult Atlantic cod on the continental shelf is based on the distribution of substrate types, depths, and bottom temperatures that are associated with high catch rates of adults in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of adults in the 1968-2005 spring and fall NMFS trawl surveys at the 50% cumulative percentage of catch level and includes inshore areas where adult Atlantic cod were determined to be present, based on 10% frequency of occurrence in state trawl surveys and ELMR information.

Map 308. Atlantic cod adults, Alternative 3C



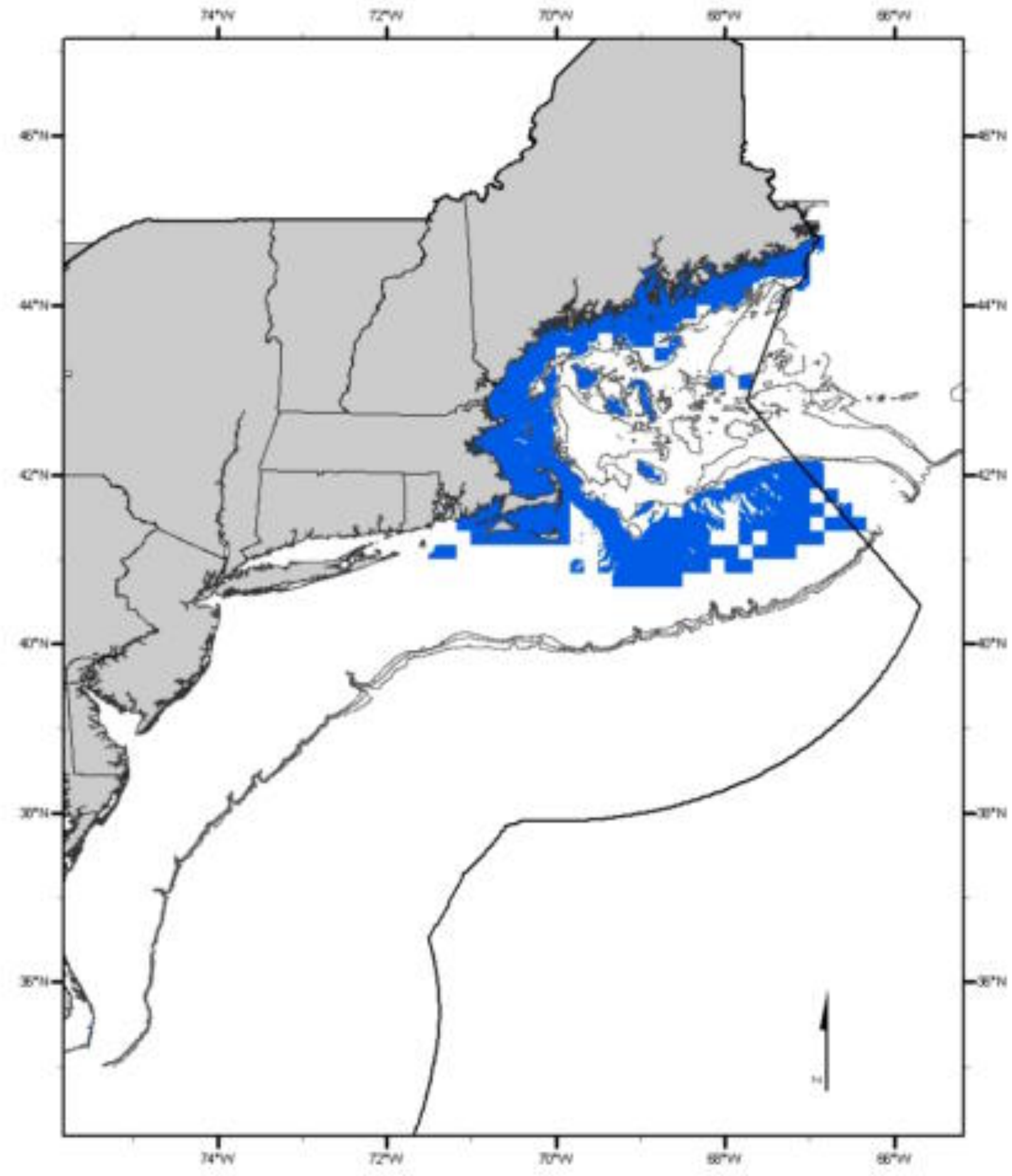
The Alternative 3C EFH designation for adult Atlantic cod on the continental shelf is based on the distribution of substrate types, depths, and bottom temperatures that are associated with high catch rates of adults in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of adults in the 1968-2005 spring and fall NMFS trawl surveys at the 75% cumulative percentage of catch level and includes inshore areas where adult Atlantic cod were determined to be present, based on 10% frequency of occurrence in state trawl surveys and ELMR information.

Map 309. Atlantic cod adults, Alternative 3D



The Alternative 3D EFH designation for adult Atlantic cod on the continental shelf is based on the distribution of substrate types, depths, and bottom temperatures that are associated with high catch rates of adults in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of adults in the 1968-2005 spring and fall NMFS trawl surveys at the 90% cumulative percentage of catch level and includes inshore areas where adult Atlantic cod were determined to be present, based on 10% frequency of occurrence in state trawl surveys and ELMR information.

Map 310. Atlantic cod adults, Alternative 3E *(Preferred Alternative)*



The Alternative 3E EFH designation for adult Atlantic cod on the continental shelf is based on the distribution of substrate types, depths, and bottom temperatures that are associated with high catch rates of adults in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of adults in the 1968-2005 spring and fall NMFS trawl surveys at the 90% cumulative percentage of catch level and includes inshore areas where adult Atlantic cod were determined to be present, based on 10% frequency of occurrence in state trawl surveys and ELMR information. In addition, 3E includes ten minute squares that were "filled in" along the MA, NH, and ME coasts, including the islands and portions of the Stellwagen Bank National Marine Sanctuary.

4.1.3.2.3 *Atlantic Halibut*

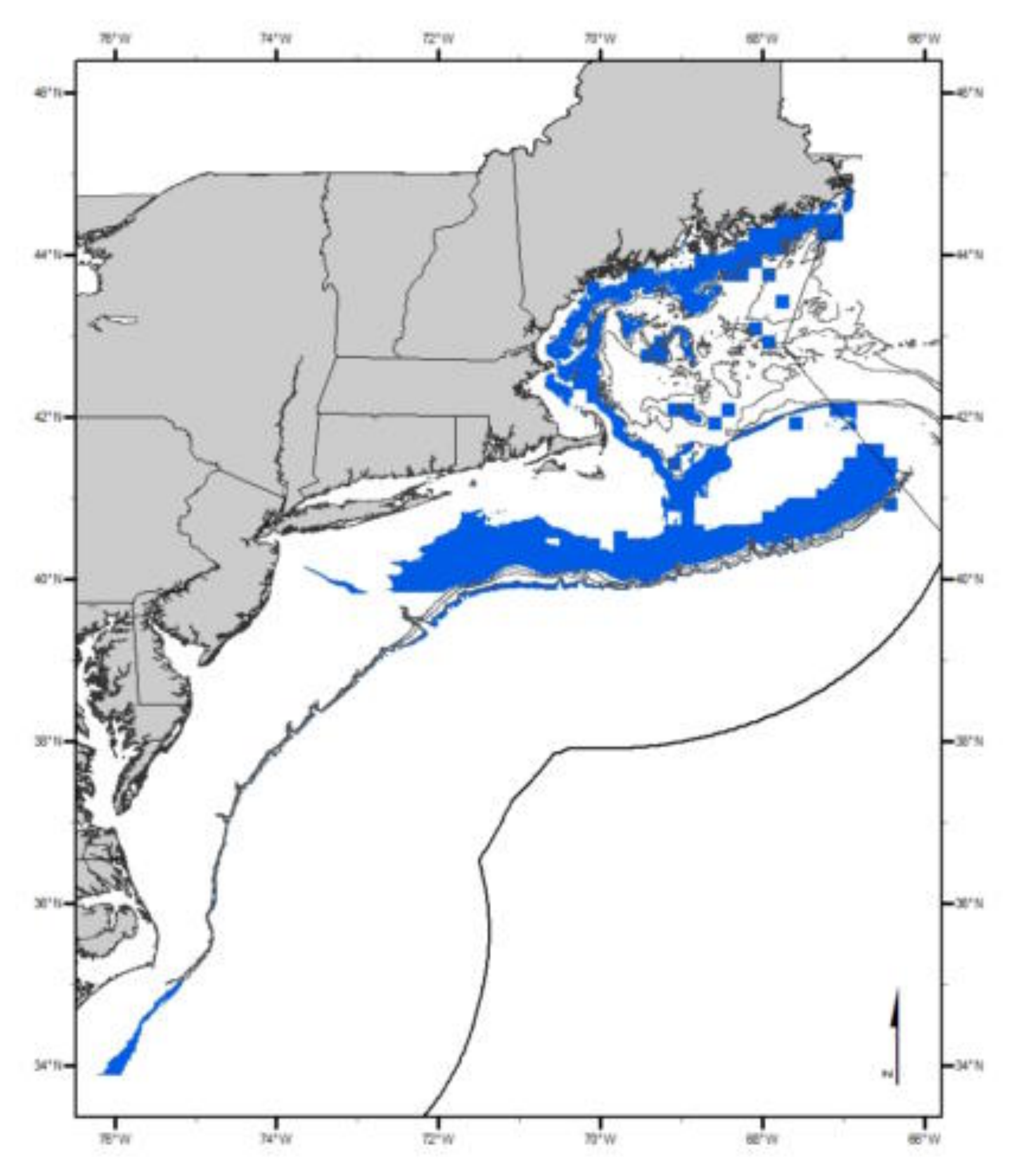
Eggs: No alternative EFH designation.

Larvae: No alternative EFH designation.

Juveniles: Benthic habitats on the continental shelf and slope in depths of 60 – 140 meters on the shelf and 400 – 700 meters on the slope, and with sand, gravel, and/or clay substrates, as depicted on Map 311. Other conditions that generally exist where EFH is found are bottom temperatures of 2.5 – 12.5ºC and salinities of 31.5 – 34.5 ppt. Primary prey organisms for juvenile Atlantic halibut are squids, crabs, a variety of fishes, pandalid shrimps, and sand shrimps. *(Preferred Alternative)*

Adults: Benthic habitats on the continental shelf and slope in depths of 60 – 140 meters on the shelf and 400 – 700 meters on the slope, with sand, gravel, and/or clay substrates, as depicted on Map 311. Other conditions that generally exist where EFH is found are bottom temperatures of 2.5 – 12.5ºC and salinities of 31.5 – 34.5 ppt. Spawning generally occurs over rough or rocky bottom on offshore banks in depths of at least 183 meters and on the continental slope as deep as 700 meters, at bottom temperatures of 4 – 7ºC, and salinities below 35 ppt. Primary prey organisms for adult Atlantic halibut are squids, crabs, a variety of fishes, pandalid shrimps, and sand shrimps. *(Preferred Alternative)*

Map 311. Atlantic halibut all life stages, Alternative 3 *(Preferred Alternative)*



The Alternative 3 EFH designation for juvenile and adult Atlantic halibut on the continental shelf is based on the distribution of depths and bottom temperatures that are associated with high catch rates of juveniles or adults in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of juveniles or adults in the 1968-2005 spring and fall NMFS trawl surveys at the 90% cumulative percentage of catch level and includes inshore and off-shelf areas where juvenile or adult Atlantic halibut were determined to be present, based on 10% frequency of occurrence in state trawl surveys, ELMR information, and off-shelf depth and geographic ranges.

4.1.3.2.4 Atlantic Herring

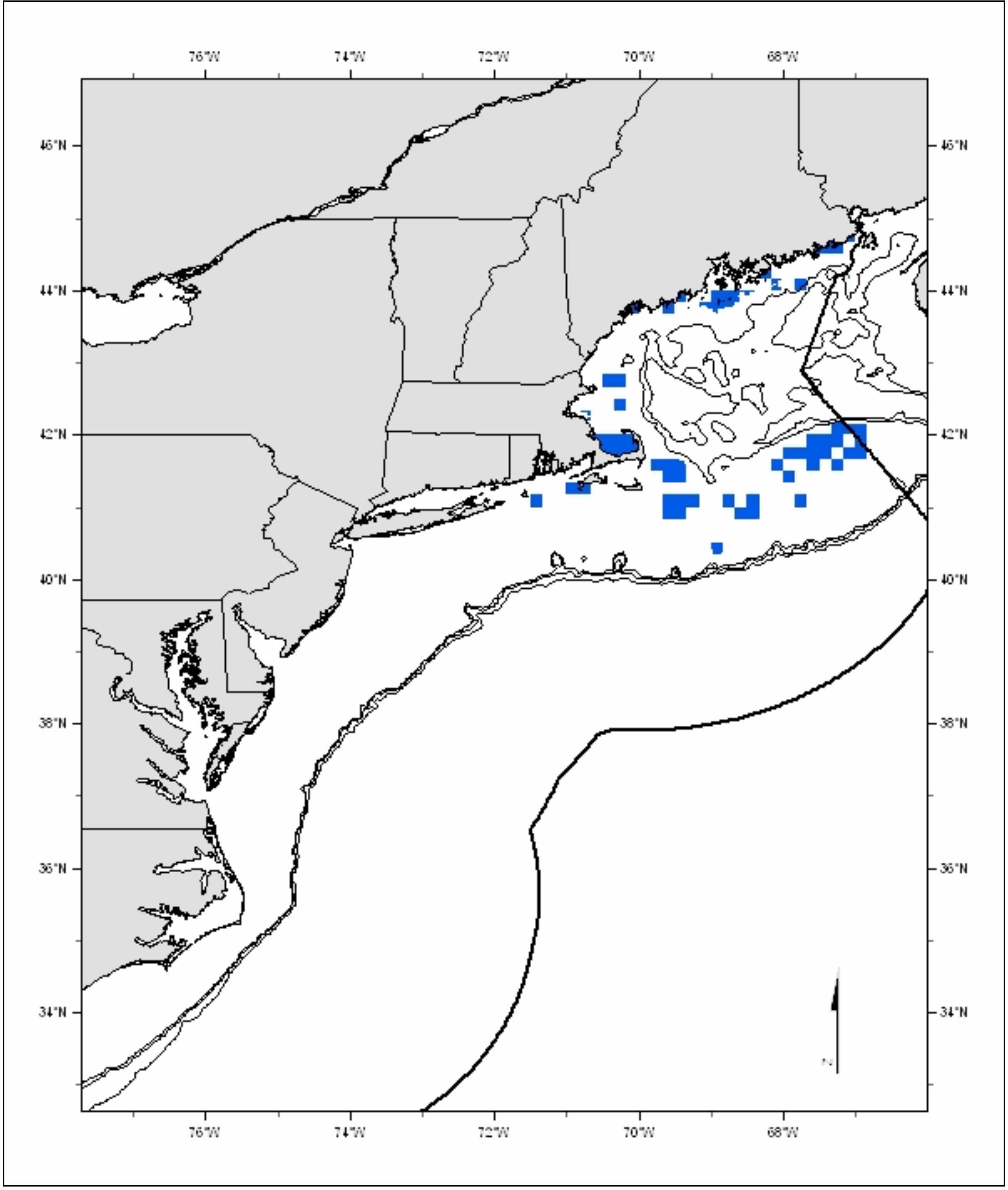
Eggs: Inshore and continental shelf benthic habitats with depths of 5 – 90 meters and substrates of boulders, cobble/pebble, gravel, coarse sand, and/or macroalgae, as depicted on Map 312. The following conditions generally exist where EFH for Atlantic herring eggs is found: bottom temperatures of 7 – 15ºC; salinities of 32 – 33 ppt; and strong bottom currents.

Larvae: No alternative EFH designation.

Juveniles: No alternative EFH designation.

Adults: No alternative EFH designation.

Map 312. Atlantic herring eggs, Alternative 3



The Alternative 3 EFH designation for Atlantic herring eggs on the continental shelf is based on the distribution of ten minute squares with substrate types and depth ranges where demersal eggs have been observed, plus any additional ten minute squares where eggs have been observed. Only portions of ten minute squares that correspond to the preferred depth range are designated and the spatial extent of the bottom habitat "layer" is limited to waters north of 40°N latitude. Inshore, this alternative also includes bays and estuaries identified by the NOAA ELMR program where Atlantic herring eggs were "rare," "common," or "abundant."

4.1.3.2.5 Atlantic Sea Scallop

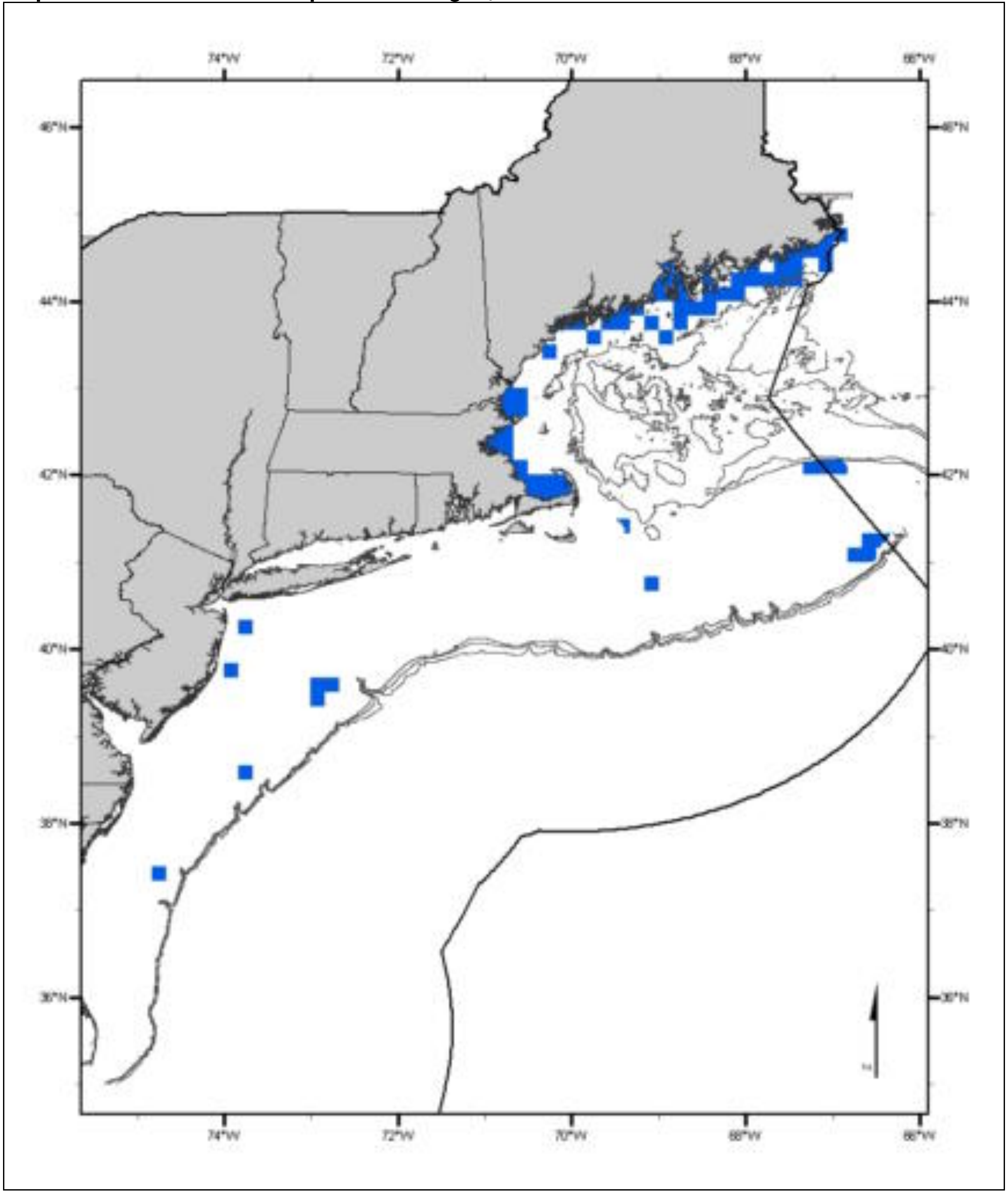
Eggs: No alternative EFH designation.

Larvae: No alternative EFH designation.

Juveniles: Inshore and continental shelf benthic habitats in depths of 18 – 120 meters with substrates of sand, gravel, and/or mixtures of gravel, mud, and sand , as depicted on Map 313 - Map 317. Other conditions that generally exist where EFH is found are bottom temperatures of 1 – 15ºC and salinities above 25 ppt. Juvenile sea scallops are filter–feeders, ingesting diatoms, detritus, microzooplankton, and bacteria.

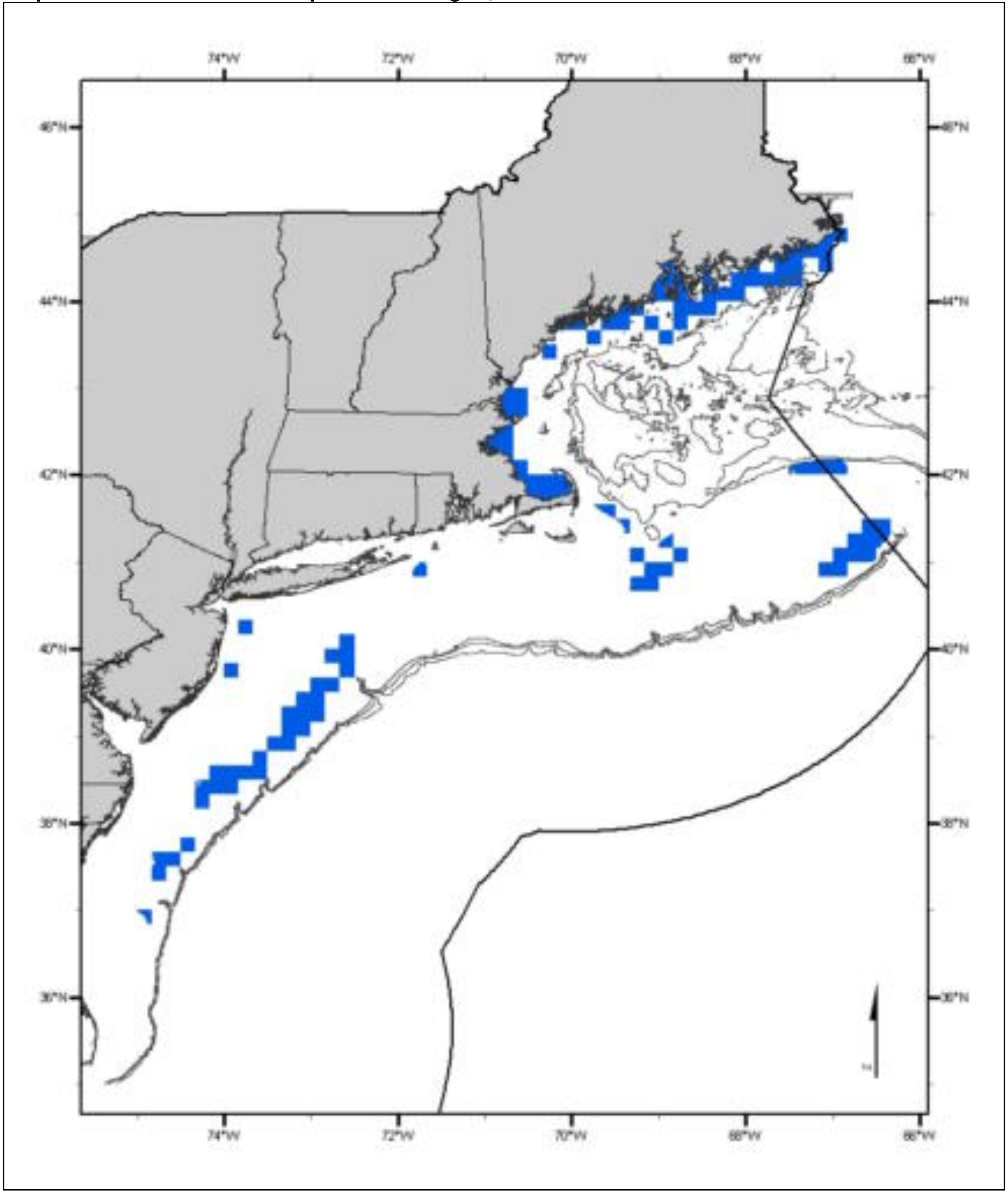
Adults: Inshore and continental shelf benthic habitats in depths of 18 – 120 meters with substrates of sand, gravel, and/or mixtures of gravel, mud, and sand , as depicted on Map Map 313 - Map 317. Other conditions that generally exist where EFH is found are bottom temperatures of 6.5 – 16ºC and salinities above 25 ppt. These same conditions generally prevail during spawning. Adult sea scallops are filter–feeders, ingesting diatoms, detritus, microzooplankton, and bacteria.

Map 313. Atlantic sea scallops all life stages, Alternative 3A



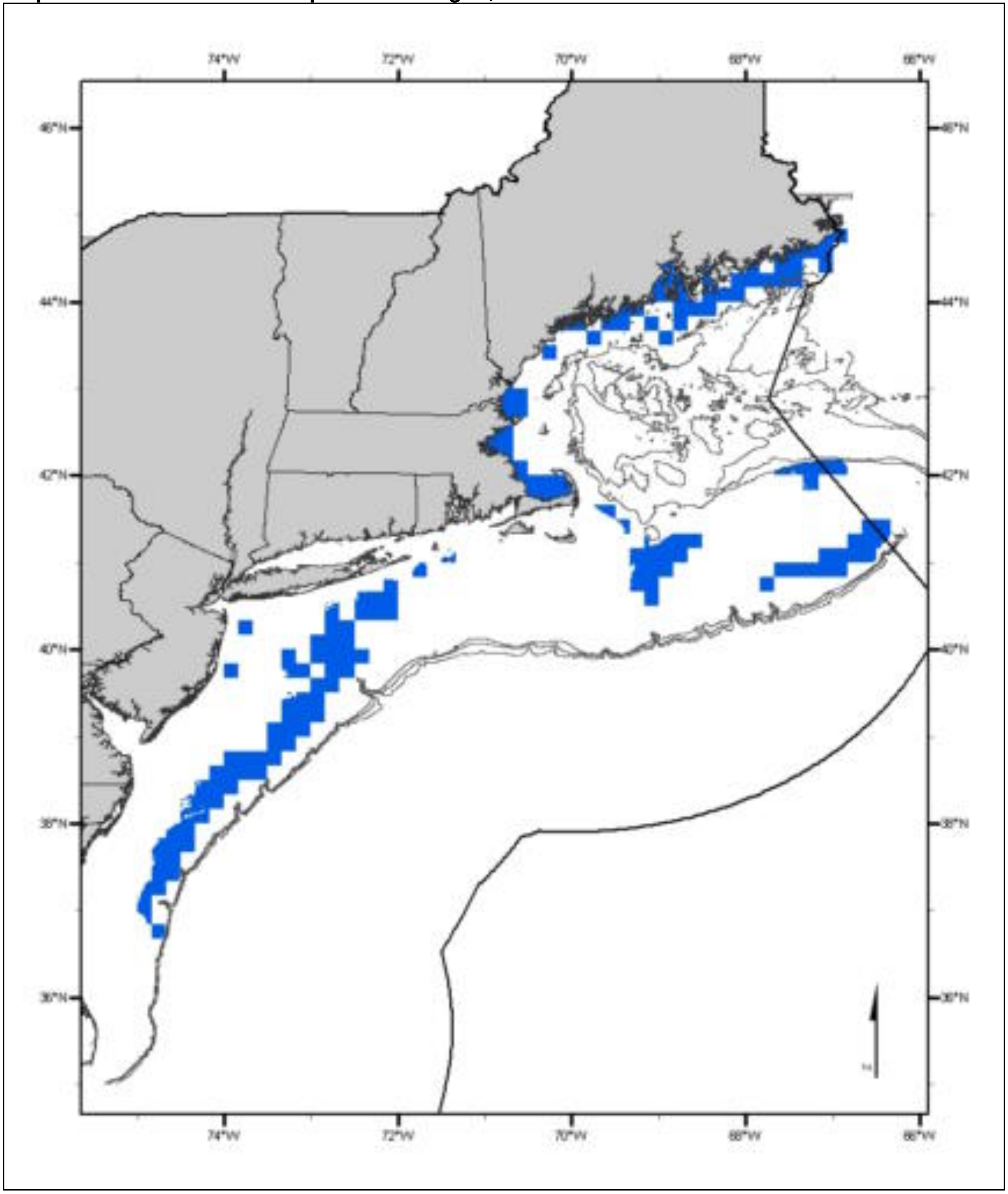
The Alternative 3A EFH designation for juvenile and adult Atlantic sea scallops on the continental shelf is based on the distribution of substrates, depths, and bottom temperatures that are associated with high catch rates of juveniles and adults in the summer 1975-2003 NMFS scallop dredge surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of juveniles and adults in the summer 1982-2005 NMFS scallop dredge surveys at the 25% cumulative percentage of catch level and includes inshore areas where juveniles and adults were determined to be present, based on 10% frequency of occurrence in state trawl surveys and ELMR information.

Map 314. Atlantic sea scallops all life stages, Alternative 3B



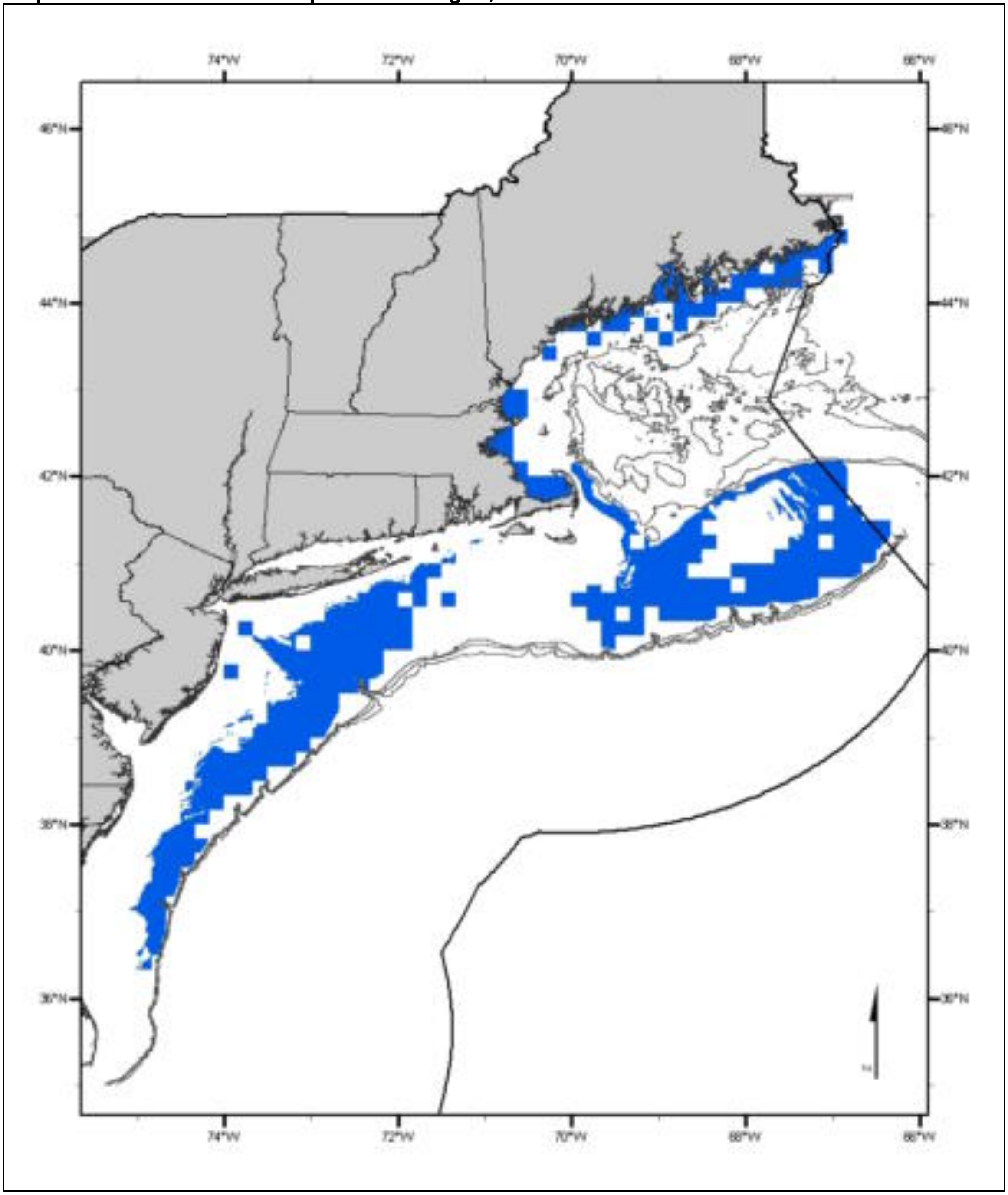
The Alternative 3B EFH designation for juvenile and adult Atlantic sea scallops on the continental shelf is based on the distribution of substrates, depths, and bottom temperatures that are associated with high catch rates of juveniles and adults in the summer 1975-2003 NMFS scallop dredge surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of juveniles and adults in the summer 1982-2005 NMFS scallop dredge surveys at the 50% cumulative percentage of catch level and includes inshore areas where juveniles and adults were determined to be present, based on 10% frequency of occurrence in state trawl surveys and ELMR information.

Map 315. Atlantic sea scallops all life stages, Alternative 3C



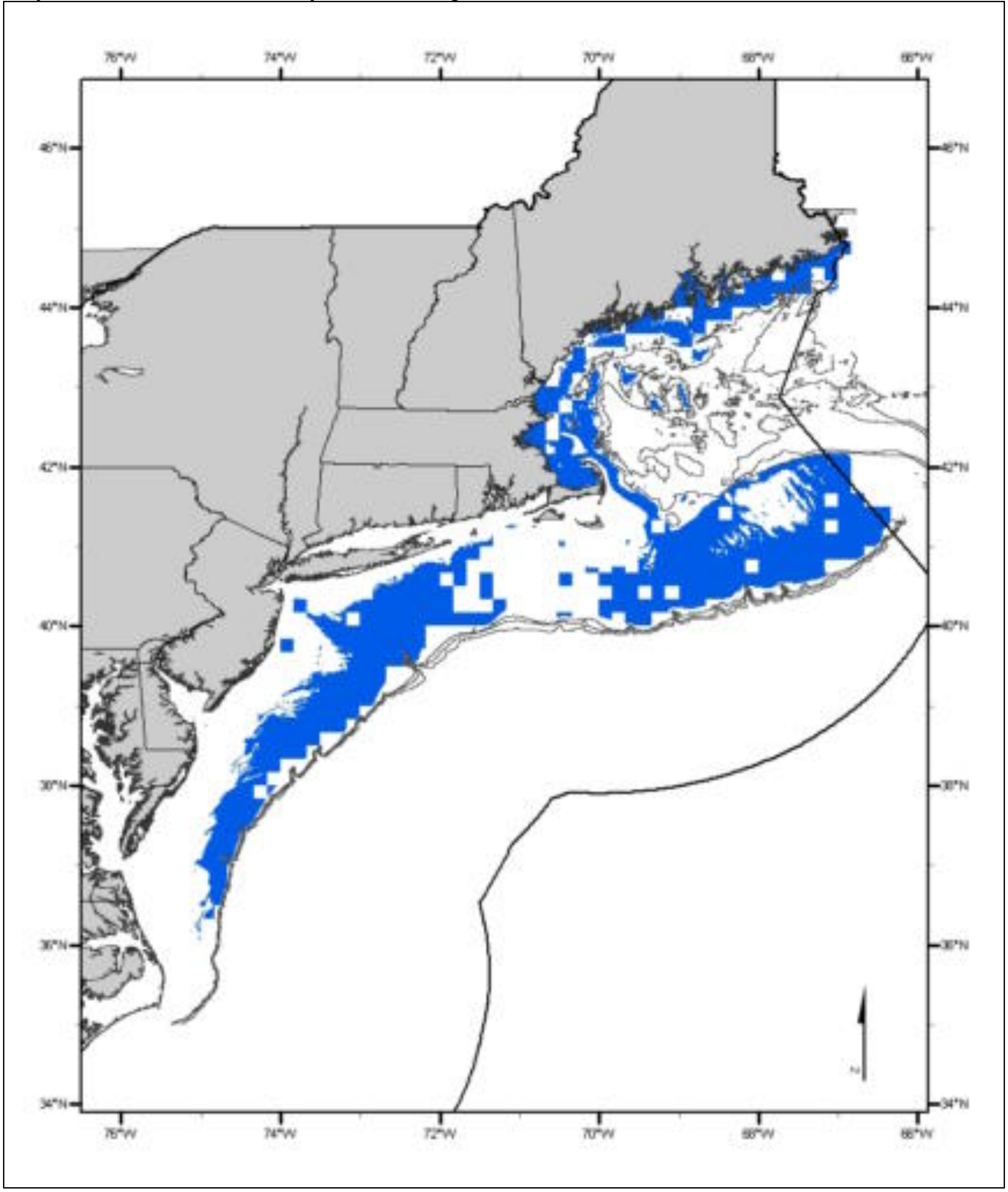
The Alternative 3C EFH designation for juvenile and adult Atlantic sea scallops on the continental shelf is based on the distribution of substrates, depths, and bottom temperatures that are associated with high catch rates of juveniles and adults in the summer 1975-2003 NMFS scallop dredge surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of juveniles and adults in the summer 1982-2005 NMFS scallop dredge surveys at the 75% cumulative percentage of catch level and includes inshore areas where juveniles and adults were determined to be present, based on 10% frequency of occurrence in state trawl surveys and ELMR information.

Map 316. Atlantic sea scallops all life stages, Alternative 3D



The Alternative 3D EFH designation for juvenile and adult Atlantic sea scallops on the continental shelf is based on the distribution of substrates, depths, and bottom temperatures that are associated with high catch rates of juveniles and adults in the summer 1975-2003 NMFS scallop dredge surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of juveniles and adults in the summer 1982-2005 NMFS scallop dredge surveys at the 90% cumulative percentage of catch level and includes inshore areas where juveniles and adults were determined to be present, based on 10% frequency of occurrence in state trawl surveys and ELMR information.

Map 317. Atlantic sea scallops all life stages, Alternative 3E



The Alternative 3E EFH designation for juvenile and adult Atlantic sea scallops is the same as the 3D Alternative with the addition of ten minute squares that were "filled in" along the eastern Maine coast.

4.1.3.2.6 Barndoor Skate

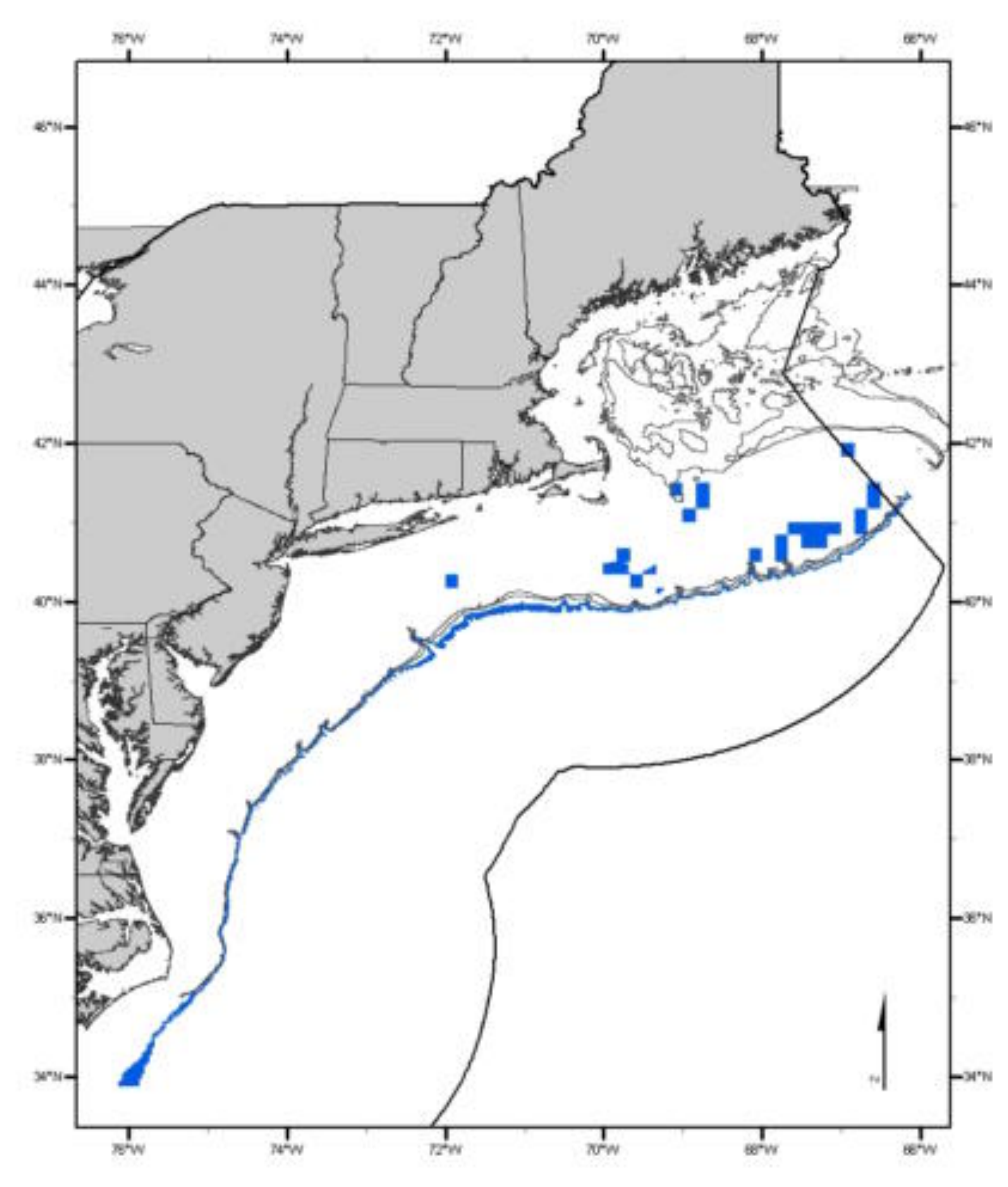
Eggs: No alternative EFH designation.

Larvae: No larval life stage exists for this species. Upon hatching, they are fully developed juveniles.

Juveniles: Benthic habitats on the continental shelf in depths of 50 – 160 meters, as depicted on Map 318 - Map 321. EFH for juvenile barndoor skates includes substrates composed primarily of sand, with some sand and mud, and/or sand and mud mixed with gravel, pebbles and cobbles. Other conditions that generally exist where EFH is found are bottom temperatures of 2.5 – 11.5ºC salinities of 20 – 34.5 ppt. Juvenile barndoor skates feed on benthic invertebrates such as polychaetes and a variety of crustaceans. *(Preferred Alternative)*

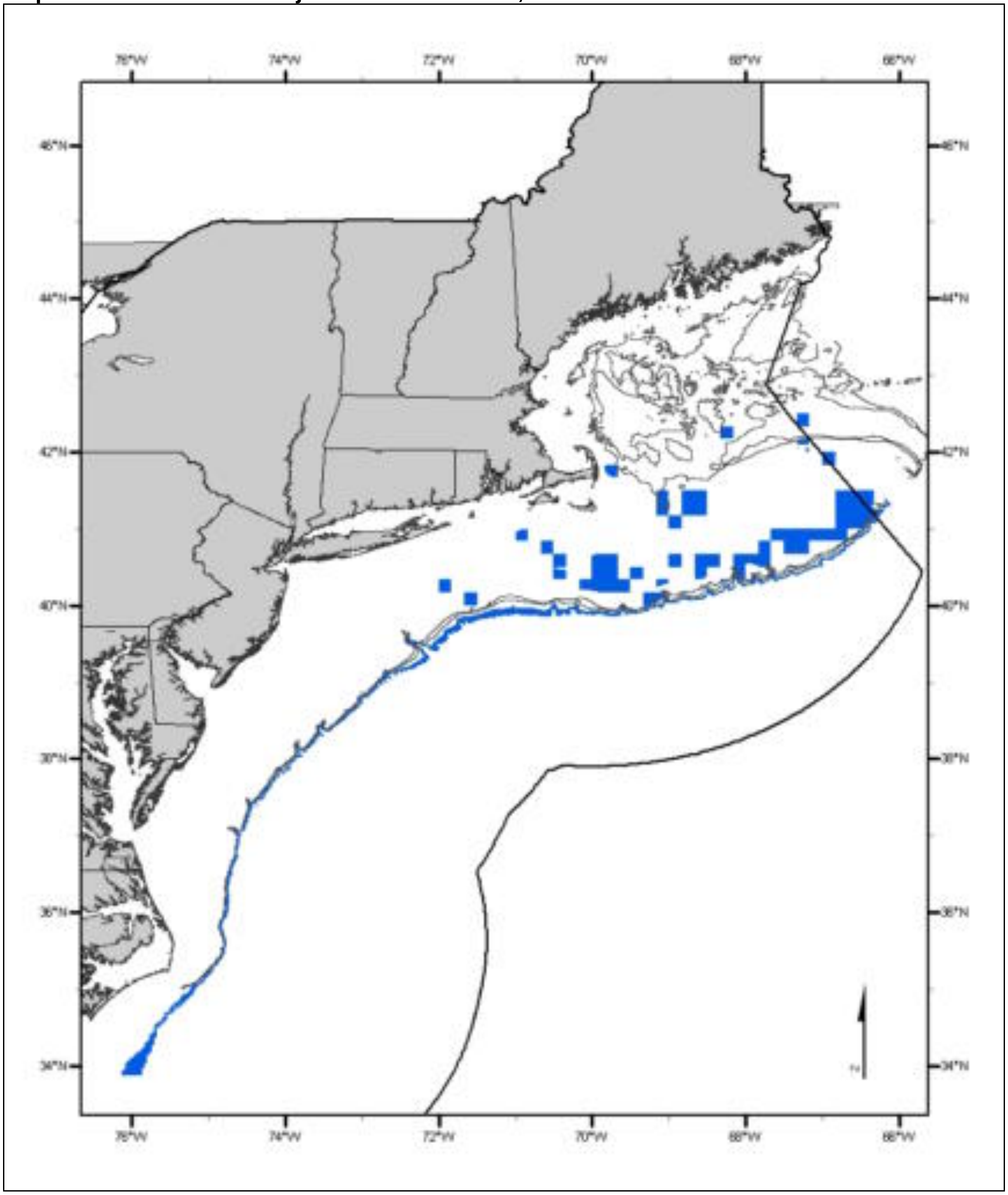
Adults: Benthic habitats on the continental shelf in depths of 60 – 750 meters, as depicted on Map 318 - Map 321. EFH for adult barndoor skates includes substrates composed primarily of sand, with some sand and mud, and/or sand and mud mixed with gravel, pebbles and cobbles. Other conditions that generally exist where EFH is found are bottom temperatures of 4.5 – 16.5ºC and salinities of 20 – 35.5 ppt. Adult barndoor skates feed on larger and more active prey than juveniles, including razor clams, large gastropods, squids, crabs, lobsters, and a variety of fishes. *(Preferred Alternative)*

Map 318. Barndoor skates juveniles and adults, Alternative 3A



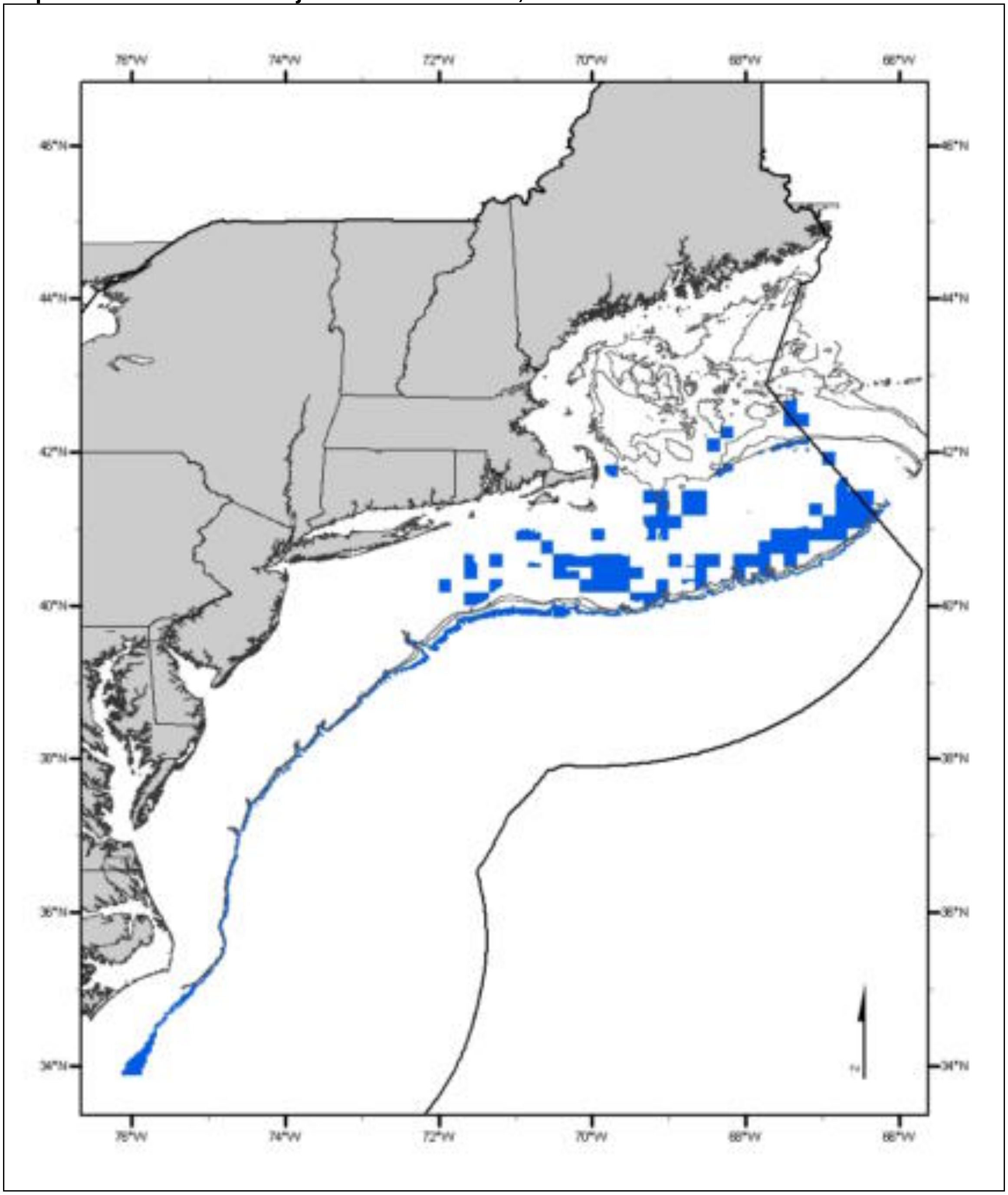
The Alternative 3A EFH designation for juvenile and adult barndoor skate on the continental shelf is based on the distribution of substrate types, depths, and bottom temperatures that are associated with high catch rates of juveniles in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of juveniles in the 1968-2005 spring and fall NMFS trawl surveys at the 25% cumulative percentage of catch level and includes off-shelf areas where juvenile and adult barndoor skate were determined to be present, based on depth and geographic ranges.

Map 319. Barndoor skates juveniles and adults, Alternative 3B



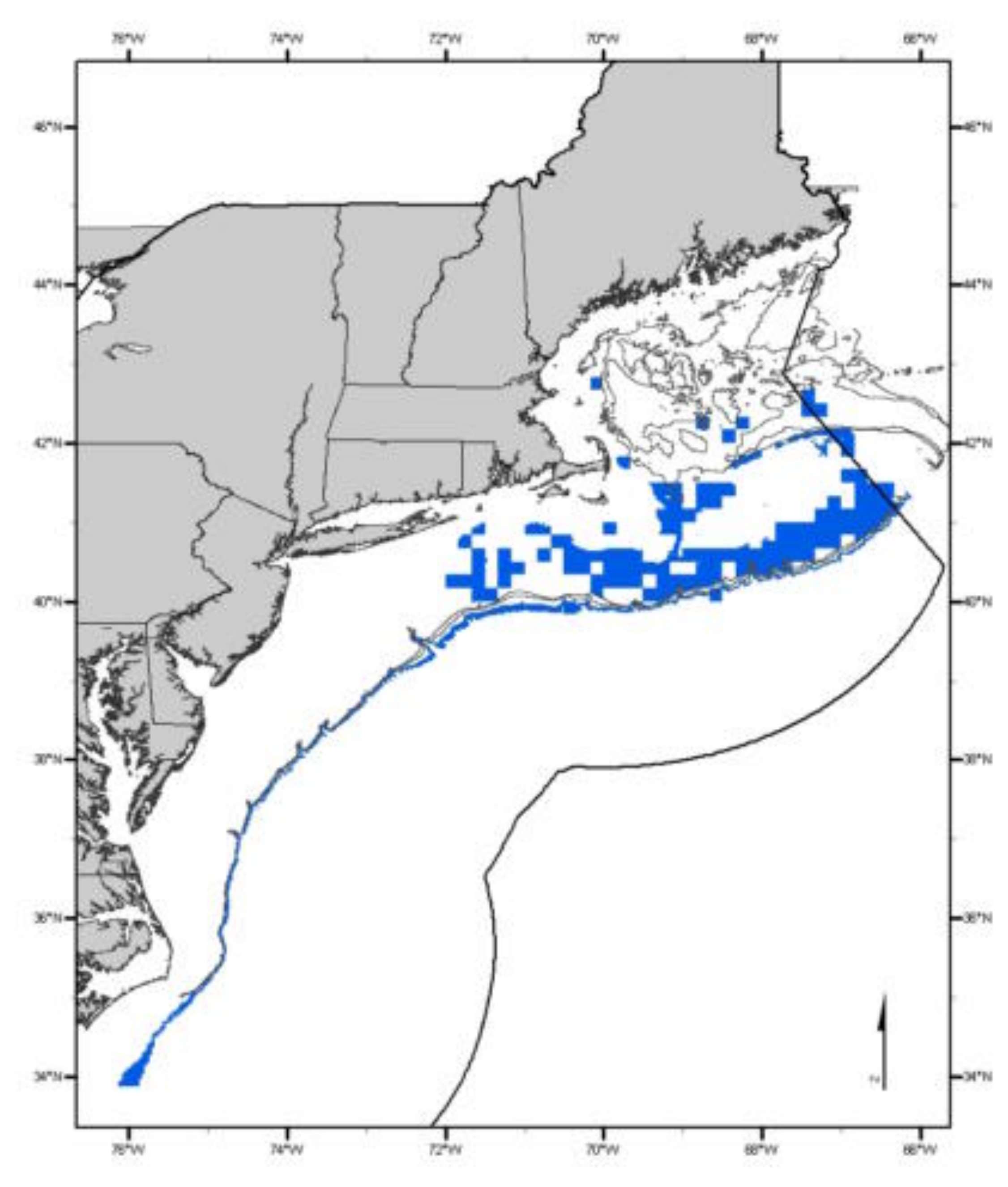
The Alternative 3B EFH designation for juvenile and adult barndoor skate on the continental shelf is based on the distribution of substrate types, depths, and bottom temperatures that are associated with high catch rates of juveniles in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of juveniles in the 1968-2005 spring and fall NMFS trawl surveys at the 50% cumulative percentage of catch level and includes off-shelf areas where juvenile and adult barndoor skate were determined to be present, based on depth and geographic ranges.

Map 320. Barndoor skates juveniles and adults, Alternative 3C



The Alternative 3C EFH designation for juvenile and adult barndoor skate on the continental shelf is based on the distribution of substrate types, depths, and bottom temperatures that are associated with high catch rates of juveniles in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of juveniles in the 1968-2005 spring and fall NMFS trawl surveys at the 75% cumulative percentage of catch level and includes off-shelf areas where juvenile and adult barndoor skate were determined to be present, based on depth and geographic ranges.

Map 321. Barndoor skates juveniles and adults, Alternative 3D *(Preferred Alternative)*



The Alternative 3D EFH designation for juvenile and adult barndoor skate on the continental shelf is based on the distribution of substrate types, depths, and bottom temperatures that are associated with high catch rates of juveniles in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of juveniles in the 1968-2005 spring and fall NMFS trawl surveys at the 90% cumulative percentage of catch level and includes off-shelf areas where juvenile and adult barndoor skate were determined to be present, based on off-shelf depth and geographic ranges.

4.1.3.2.7 Clearnose Skate

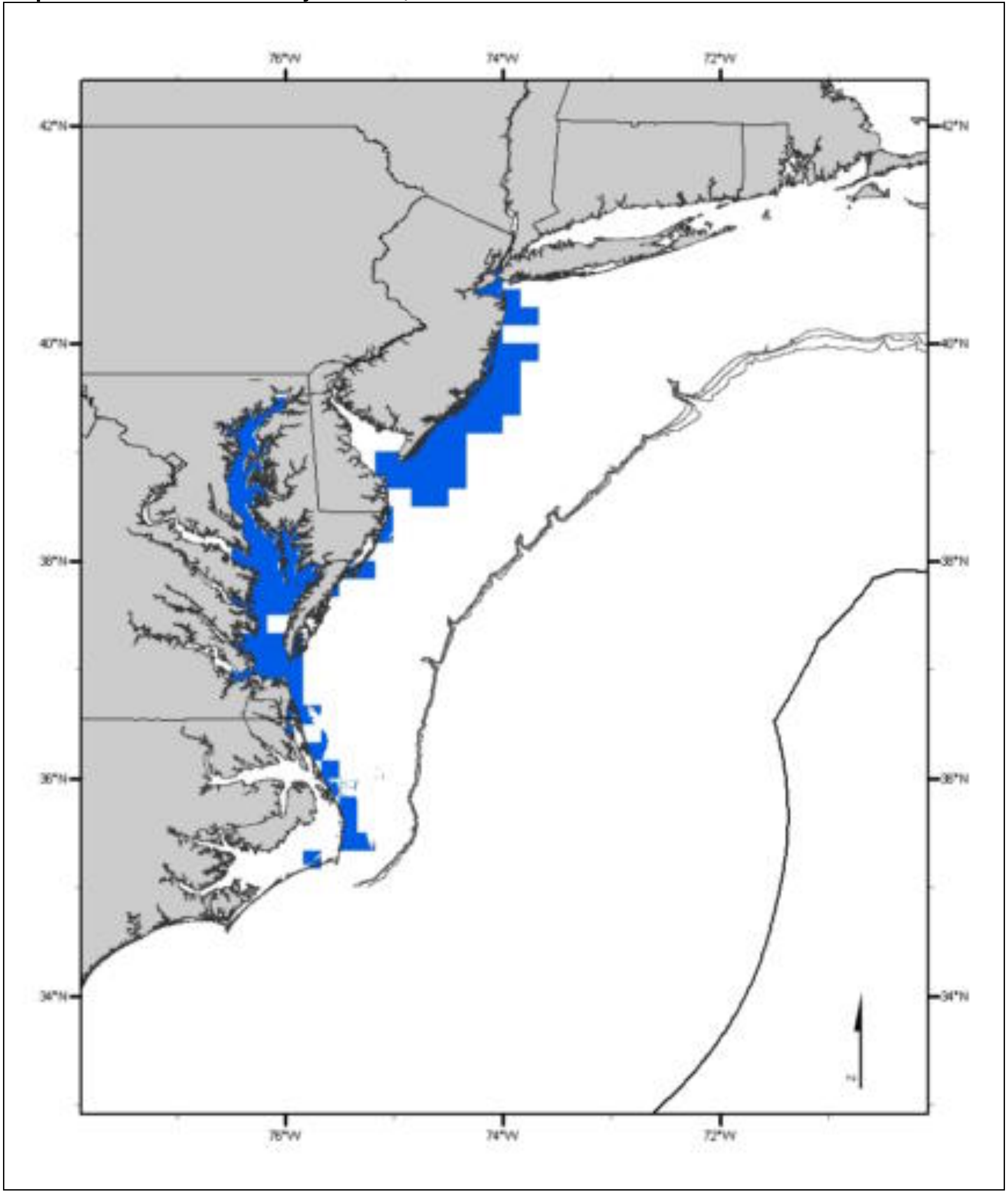
Eggs: No alternative EFH designation.

Larvae: No larval life stage exists for this species. Upon hatching, they are fully developed juveniles.

Juveniles: Estuarine, coastal marine, and continental shelf benthic habitats in depths of 1 – 30 meters, as depicted on Map 322 - Map 325. EFH for juvenile clearnose skates occurs primarily on sand, but also on mud and sand with and without gravel, and rocky bottom, and includes the intertidal zone. Other conditions that generally exist where EFH is found are bottom temperatures of 10 – 24ºC and salinities of 19.5 – 36.5 ppt. Juvenile clearnose skates feed on a variety of crustaceans and fishes, and, in inshore waters, on razor clams. *(Preferred Alternative)*

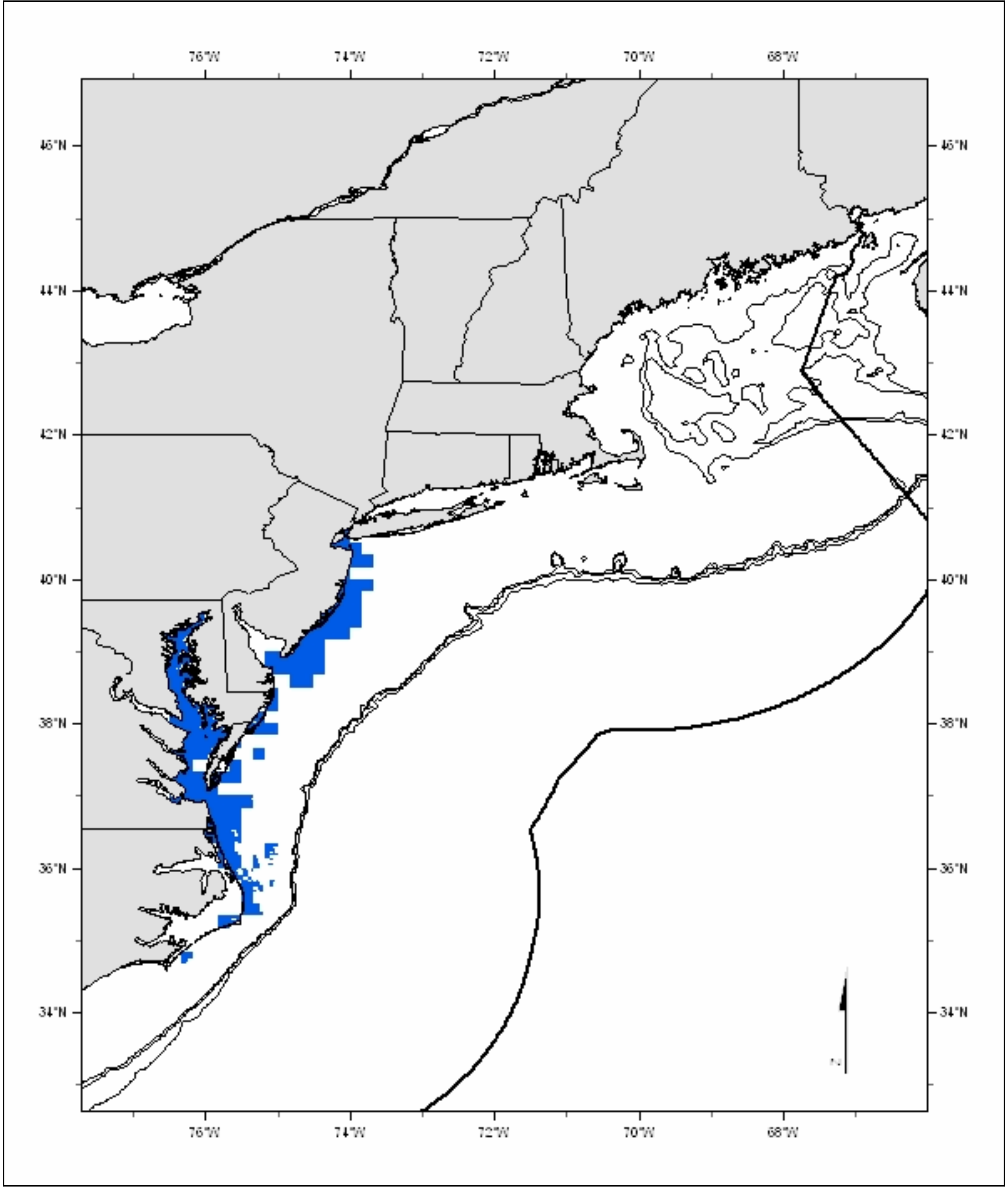
Adults: Estuarine, coastal marine, and continental shelf benthic habitats in depths of 1 – 30 meters, as depicted on Map 326 - Map 329. EFH for adult clearnose skates occurs primarily on sand, but also on mud and sand with and without gravel. Other conditions that generally exist where EFH is found are bottom temperatures of 10 – 24ºC salinities of 19.5 – 36.5 ppt. Adult clearnose skates feed on a variety of crustaceans and fishes, and, in inshore waters, on razor clams. *(Preferred Alternative)*

Map 322. Clearnose skates juveniles, Alternative 3A



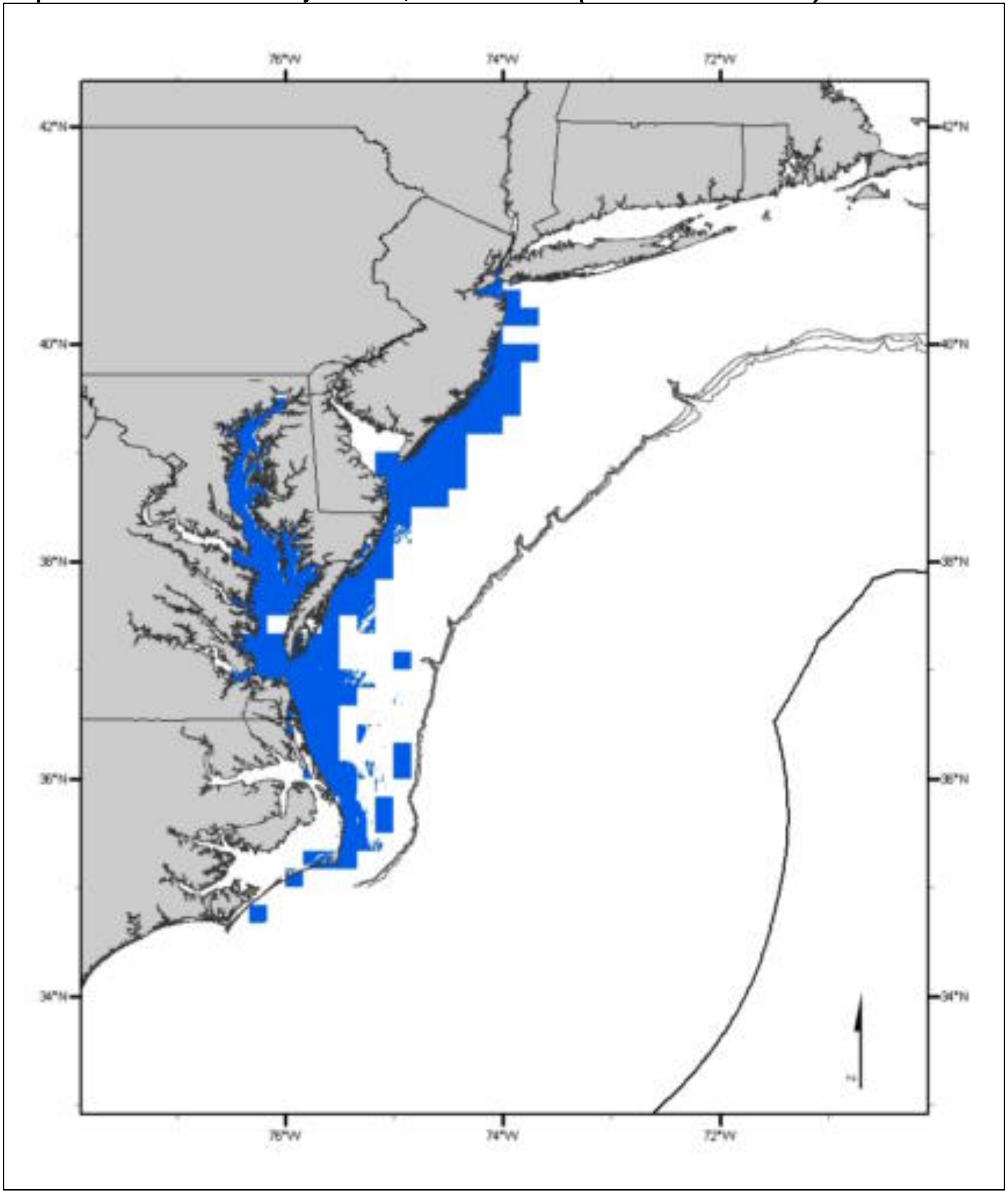
The Alternative 3A EFH designation for juvenile clearnose skate on the continental shelf is based on the distribution of substrate types, depths and bottom temperatures that are associated with high catch rates of juveniles in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of juveniles in the 1968-2005 spring and fall NMFS trawl surveys at the 25% cumulative percentage of catch level and includes inshore areas where juvenile clearnose skate were determined to be present, based on 10% frequency of occurrence in state trawl surveys and ELMR information.

Map 323. Clearnose skates juveniles, Alternative 3B



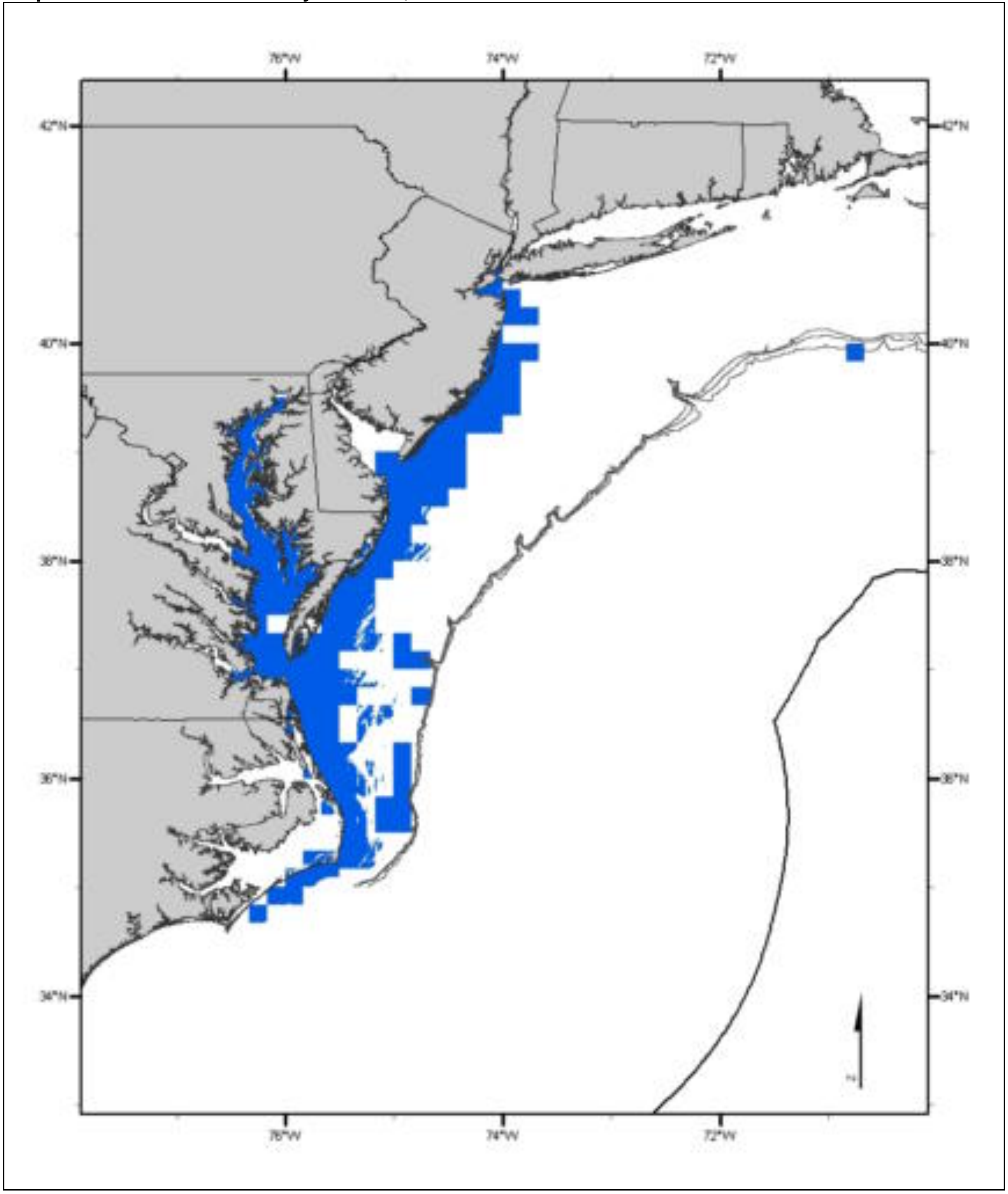
The Alternative 3B EFH designation for juvenile clearnose skate on the continental shelf is based on the distribution of substrate types, depths and bottom temperatures that are associated with high catch rates of juveniles in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of juveniles in the 1968-2005 spring and fall NMFS trawl surveys at the 50% cumulative percentage of catch level and includes inshore areas where juvenile clearnose skate were determined to be present, based on 10% frequency of occurrence in state trawl surveys and ELMR information.

Map 324. Clearnose skates juveniles, Alternative 3C *(Preferred Alternative)*



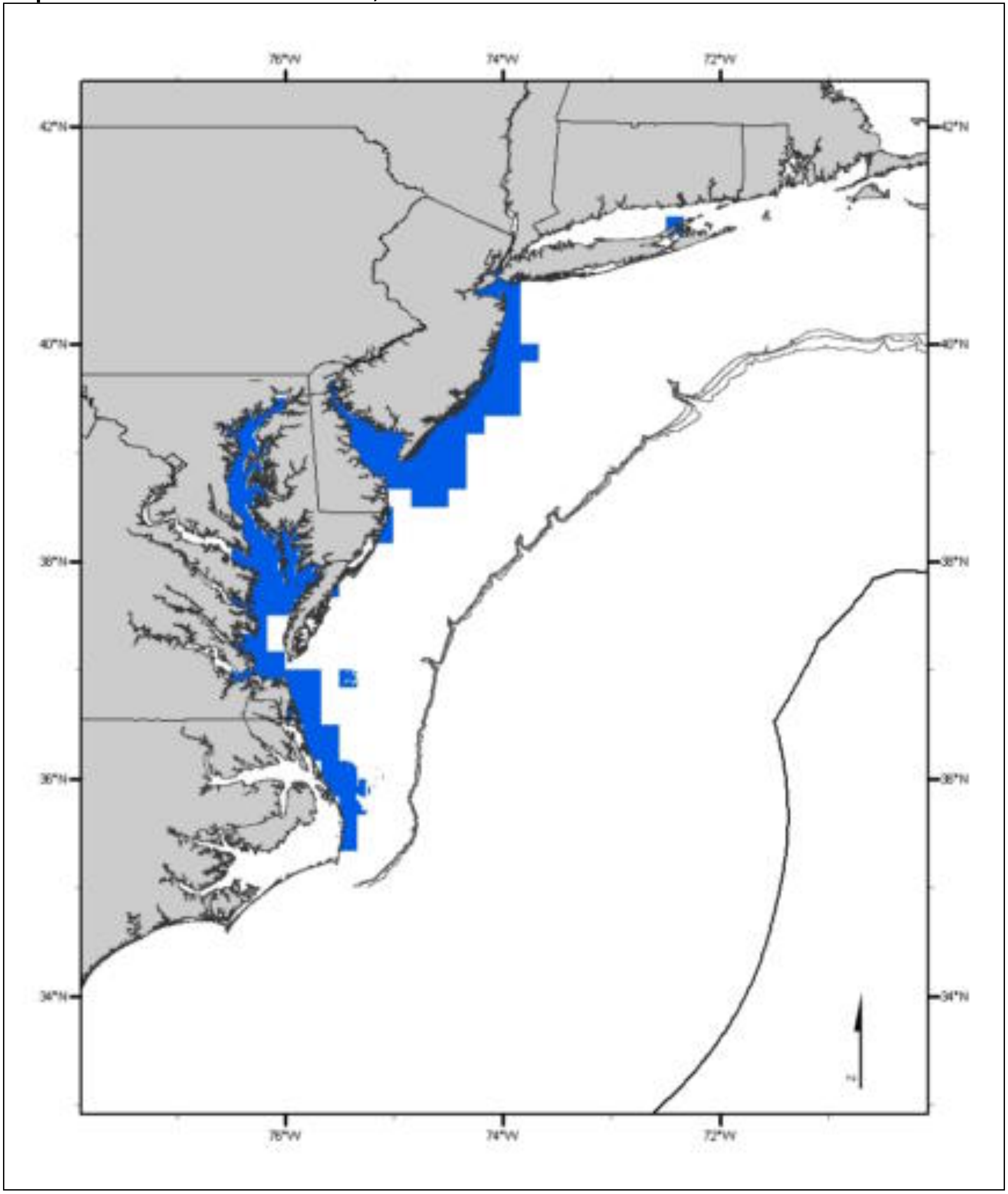
The Alternative 3C EFH designation for juvenile clearnose skate on the continental shelf is based on the distribution of substrate types, depths and bottom temperatures that are associated with high catch rates of juveniles in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of juveniles in the 1968-2005 spring and fall NMFS trawl surveys at the 75% cumulative percentage of catch level and includes inshore areas where juvenile clearnose skate were determined to be present, based on 10% frequency of occurrence in state trawl surveys and ELMR information.

Map 325. Clearnose skates juveniles, Alternative 3D



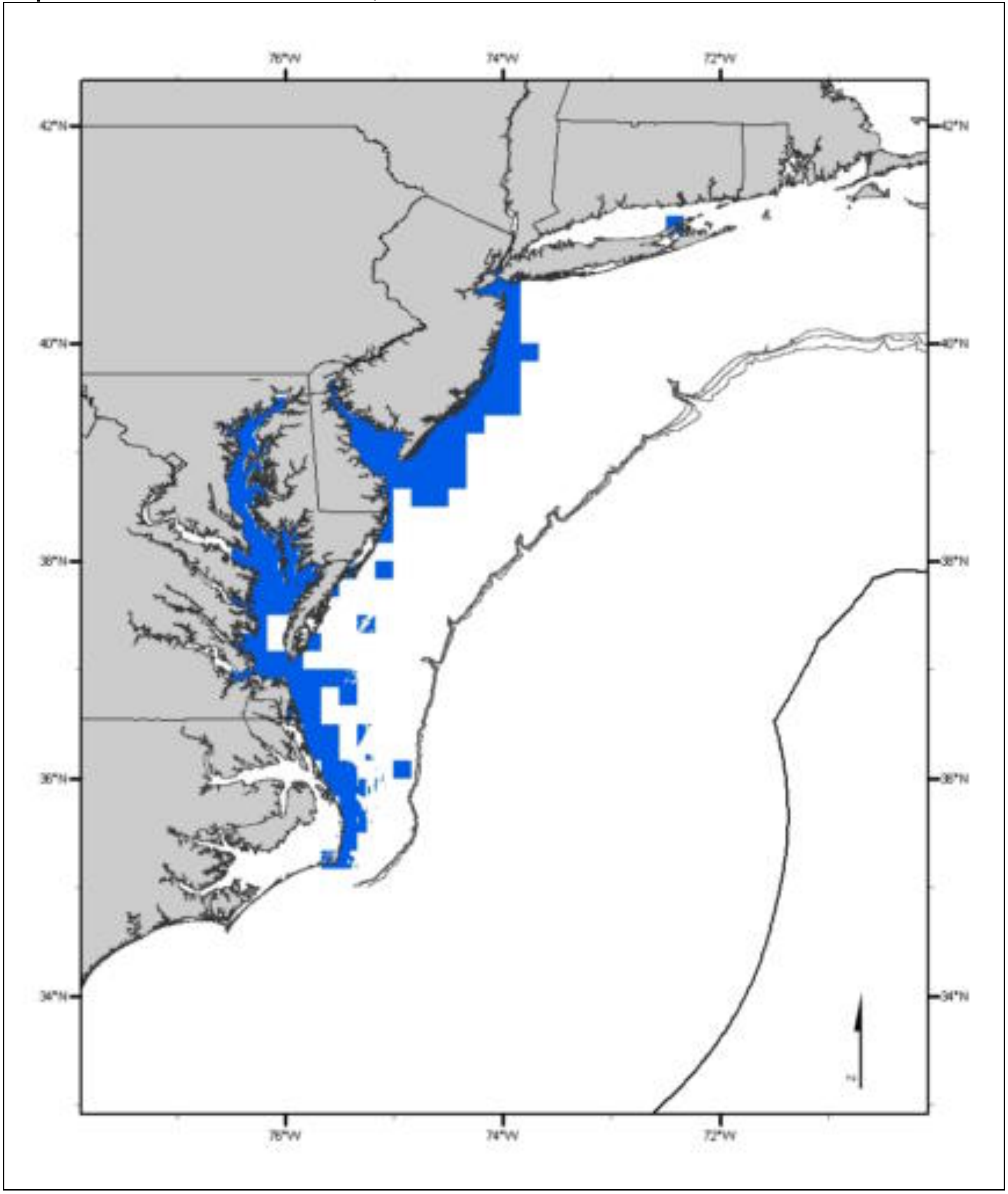
The Alternative 3D EFH designation for juvenile clearnose skate on the continental shelf is based on the distribution of substrate types, depths and bottom temperatures that are associated with high catch rates of juveniles in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of juveniles in the 1968-2005 spring and fall NMFS trawl surveys at the 90% cumulative percentage of catch level and includes inshore areas where juvenile clearnose skate were determined to be present, based on 10% frequency of occurrence in state trawl surveys and ELMR information.

Map 326. Clearnose skates adults, Alternative 3A



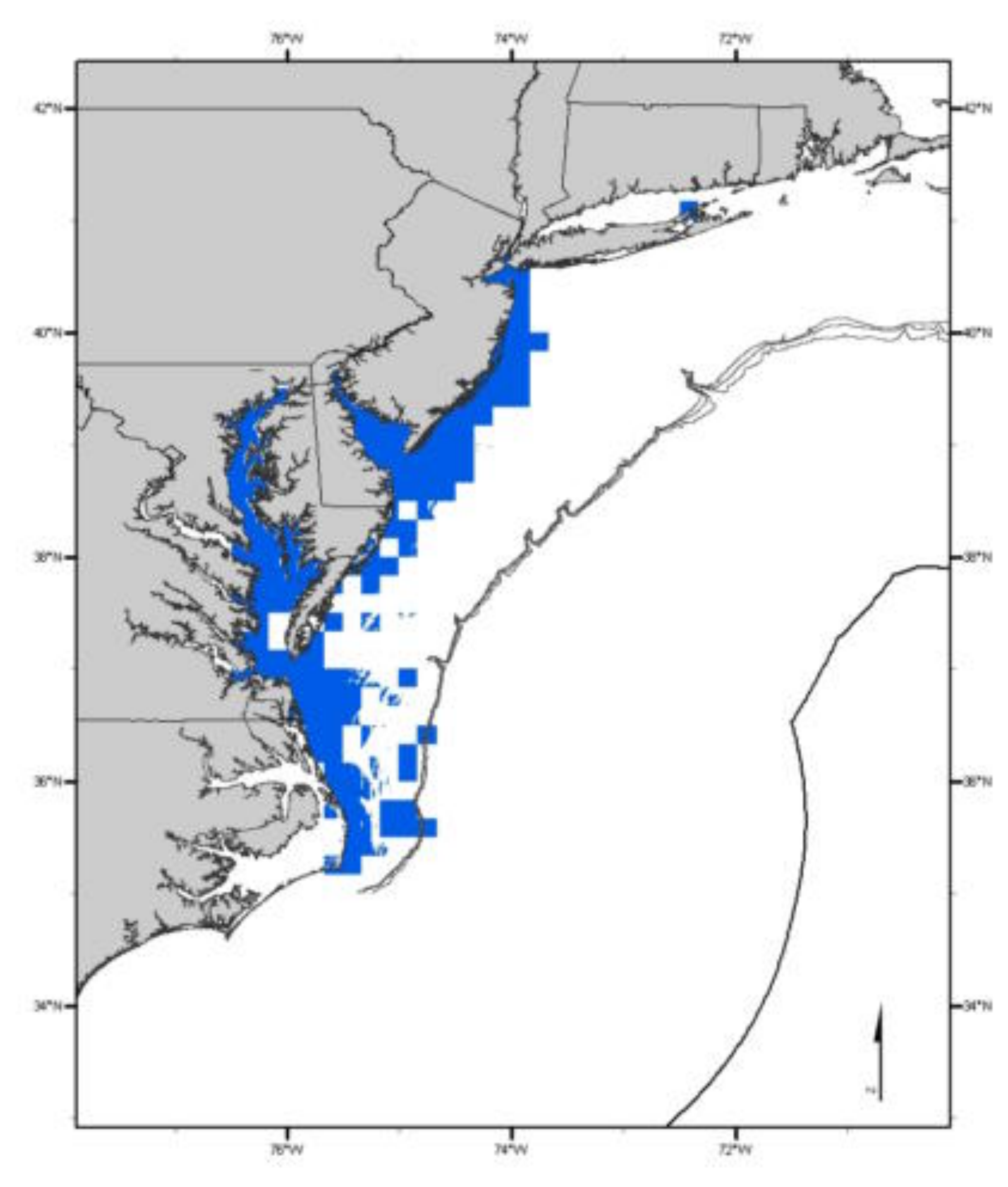
The Alternative 3A EFH designation for adult clearnose skate on the continental shelf is based on the distribution of substrate types, depths and bottom temperatures that are associated with high catch rates of adults in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of adults in the 1968-2005 spring and fall NMFS trawl surveys at the 25% cumulative percentage of catch level and includes inshore areas where adult clearnose skate were determined to be present, based on 10% frequency of occurrence in state trawl surveys and ELMR information.

Map 327. Clearnose skates adults, Alternative 3B



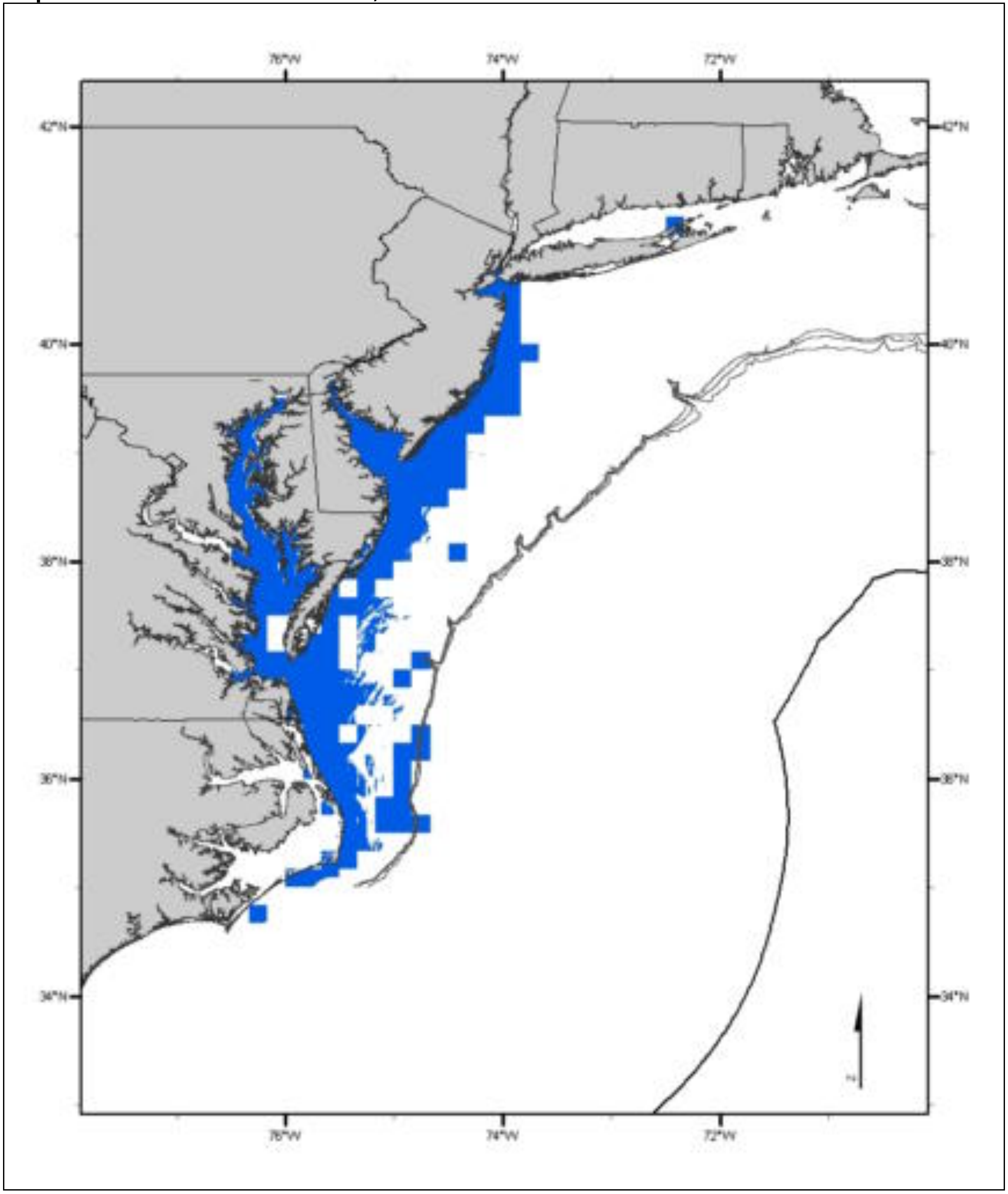
The Alternative 3B EFH designation for adult clearnose skate on the continental shelf is based on the distribution of substrate types, depths and bottom temperatures that are associated with high catch rates of adults in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of adults in the 1968-2005 spring and fall NMFS trawl surveys at the 50% cumulative percentage of catch level and includes inshore areas where adult clearnose skate were determined to be present, based on 10% frequency of occurrence in state trawl surveys and ELMR information.

Map 328. Clearnose skates adults, Alternative 3C *(Preferred Alternative)*



The Alternative 3C EFH designation for adult clearnose skate on the continental shelf is based on the distribution of substrate types, depths and bottom temperatures that are associated with high catch rates of adults in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of adults in the 1968-2005 spring and fall NMFS trawl surveys at the 75% cumulative percentage of catch level and includes inshore areas where adult clearnose skate were determined to be present, based on 10% frequency of occurrence in state trawl surveys and ELMR information.

Map 329. Clearnose skates adults, Alternative 3D



The Alternative 3D EFH designation for adult clearnose skate on the continental shelf is based on the distribution of substrate types, depths and bottom temperatures that are associated with high catch rates of adults in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of adults in the 1968-2005 spring and fall NMFS trawl surveys at the 90% cumulative percentage of catch level and includes inshore areas where adult clearnose skate were determined to be present, based on 10% frequency of occurrence in state trawl surveys and ELMR information.

4.1.3.2.8 Haddock

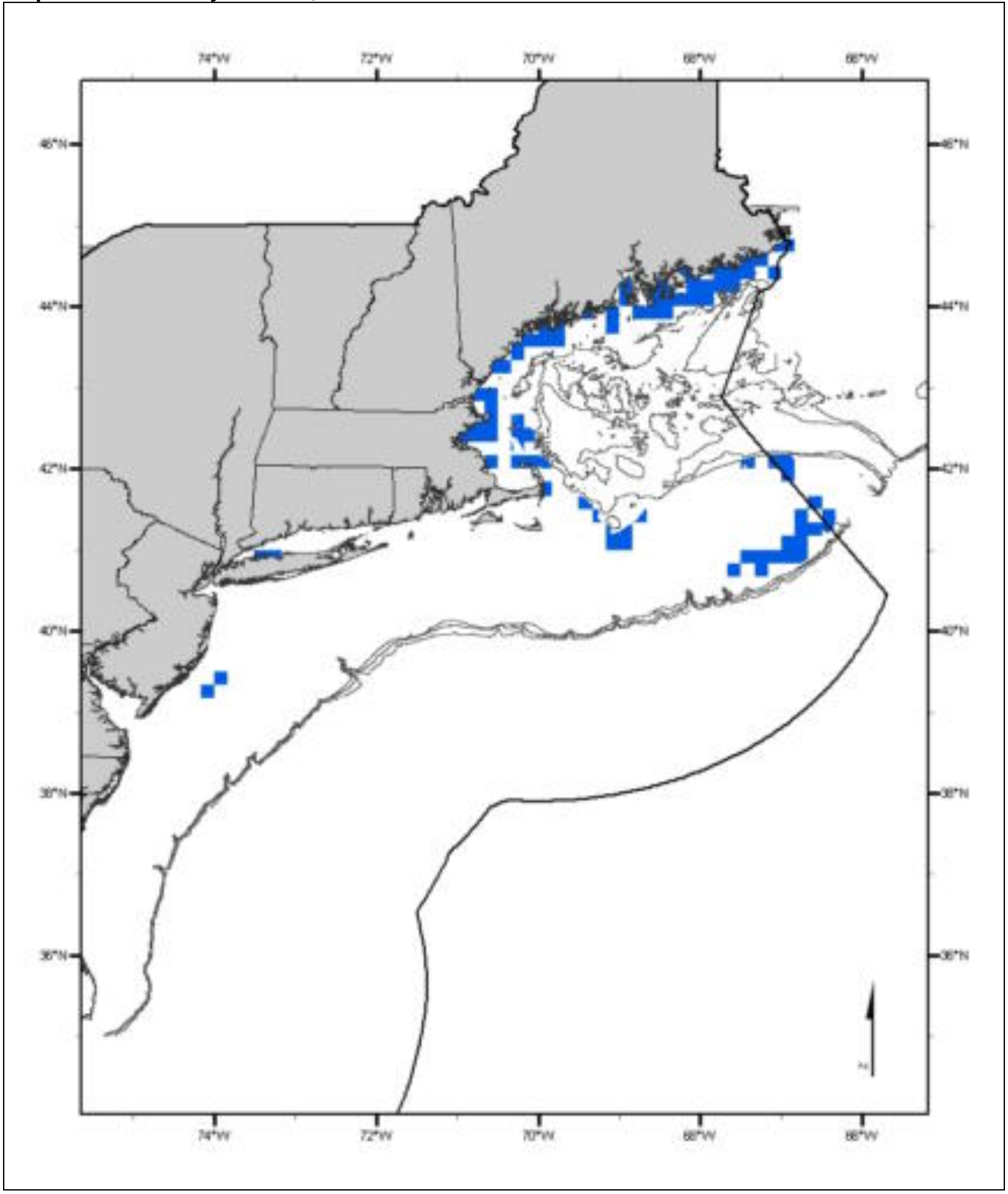
Eggs: No alternative EFH designation.

Larvae: No alternative EFH designation.

Juveniles: Inshore and continental shelf benthic habitats in depths of 30 – 120 meters with sandy–gravelly substrates as depicted on Map 330 - Map 333. EFH for juvenile haddock occurs on sandy bottom, on pebble–gravel bottom, and on sand and mud mixed with gravel. Other conditions that generally apply where EFH is found are bottom temperatures of 4.5 – 12.5ºC and salinities of 31.5 – 35.5 ppt. Benthic juvenile haddock feed on crustaceans, small bivalve mollusks, brittle stars, polychaetes, and fishes such as sand lance. *(Preferred Alternative)*

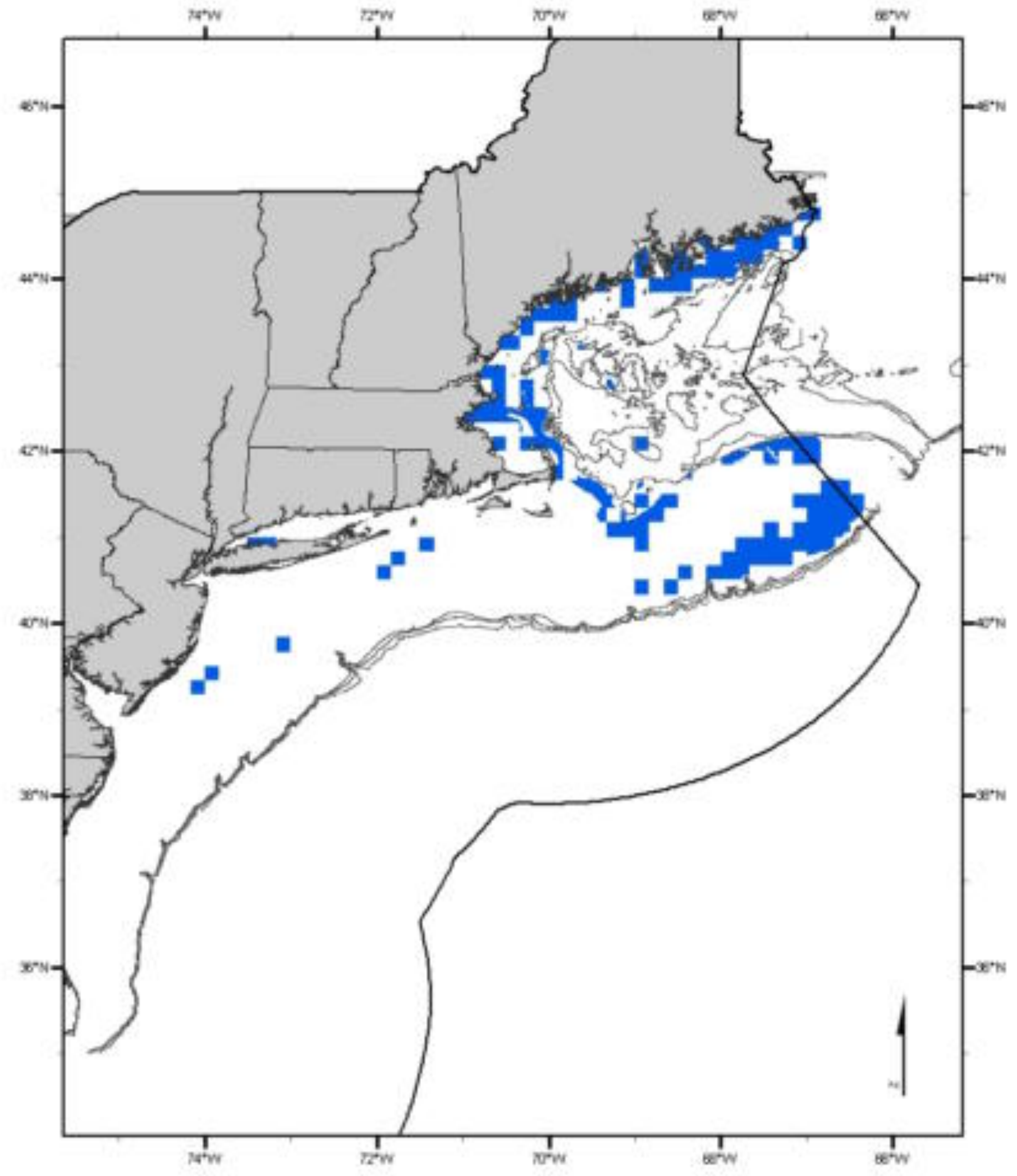
Adults: Continental shelf benthic habitats in depths of 60 – 140 meters with sandy–gravelly substrates as depicted on Map 334 - Map 338. EFH for adult haddock occurs on sandy bottom, on pebble–gravel bottom, and on sand and mud mixed with gravel. They prefer gravel, pebbles, clay, broken shells, and smooth, hard sand (especially between rocky patches), and are not common on rocks, ledges, kelp or soft mud. Other conditions that generally apply where EFH is found are bottom temperatures of 3.5 – 8.5ºC and salinities of 32.5 – 33.5 ppt. Spawning generally occurs at temperatures of 2 – 7ºC and salinities of 31.5 – 34 ppt. Primary prey organisms for adult haddock are fishes (*e.g.*, sand lance, mackerels, and herrings), amphipods, brittle stars, polychaetes, cnidarians, and euphausiids. *(Preferred Alternative)*

Map 330. Haddock juveniles, Alternative 3A



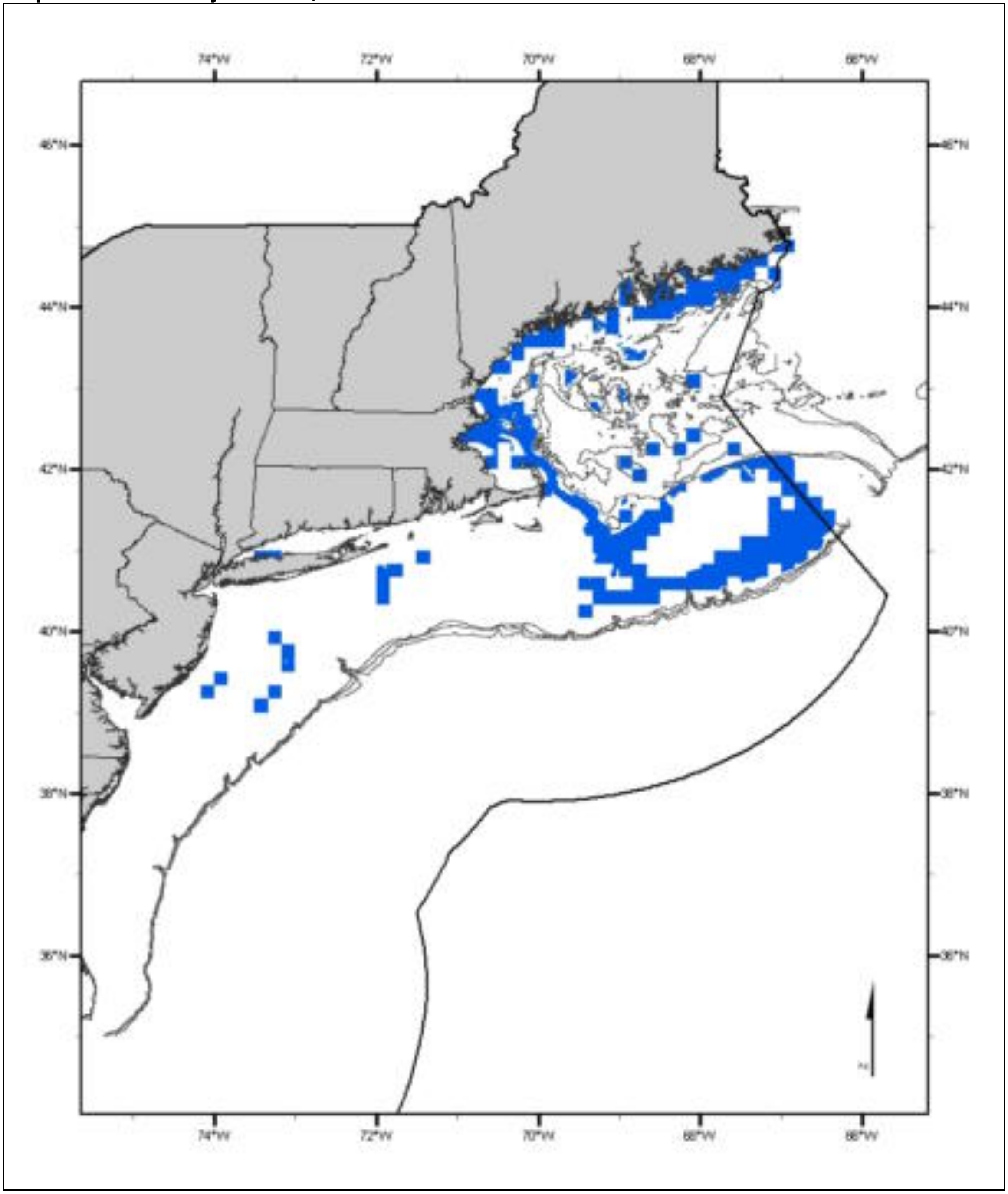
The Alternative 3A EFH designation for juvenile haddock on the continental shelf is based on the distribution of substrate types, depths and bottom temperatures that are associated with high catch rates of juveniles in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of juveniles in the 1968-2005 spring and fall NMFS trawl surveys at the 25% cumulative percentage of catch level and includes inshore areas where juvenile haddock were determined to be present, based on 10% frequency of occurrence in state trawl surveys and ELMR information.

Map 331. Haddock juveniles, Alternative 3B



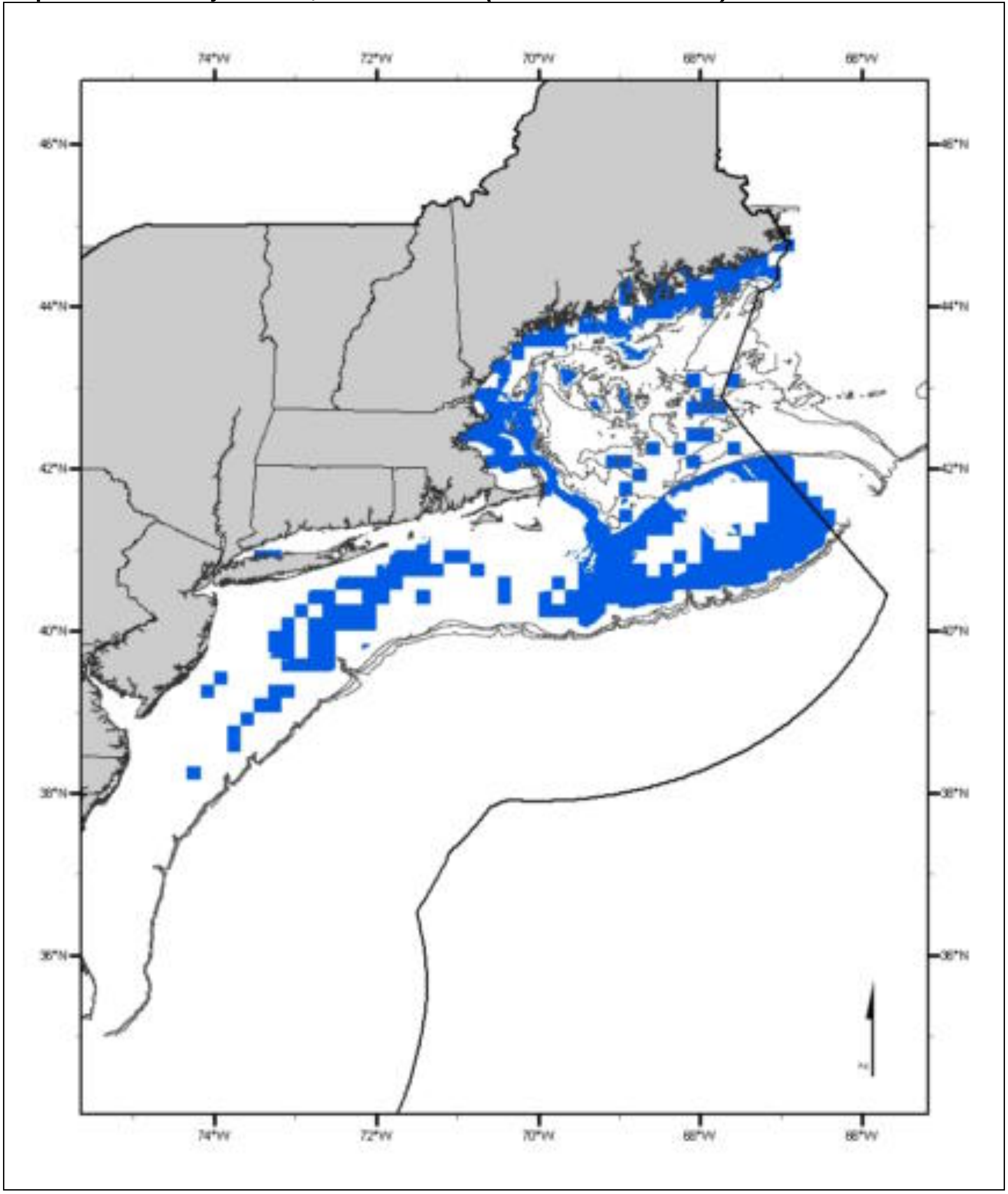
The Alternative 3B EFH designation for juvenile haddock on the continental shelf is based on the distribution of substrate types, depths and bottom temperatures that are associated with high catch rates of juveniles in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of juveniles in the 1968-2005 spring and fall NMFS trawl surveys at the 50% cumulative percentage of catch level and includes inshore areas where juvenile haddock were determined to be present, based on 10% frequency of occurrence in state trawl surveys and ELMR information.

Map 332. Haddock juveniles, Alternative 3C



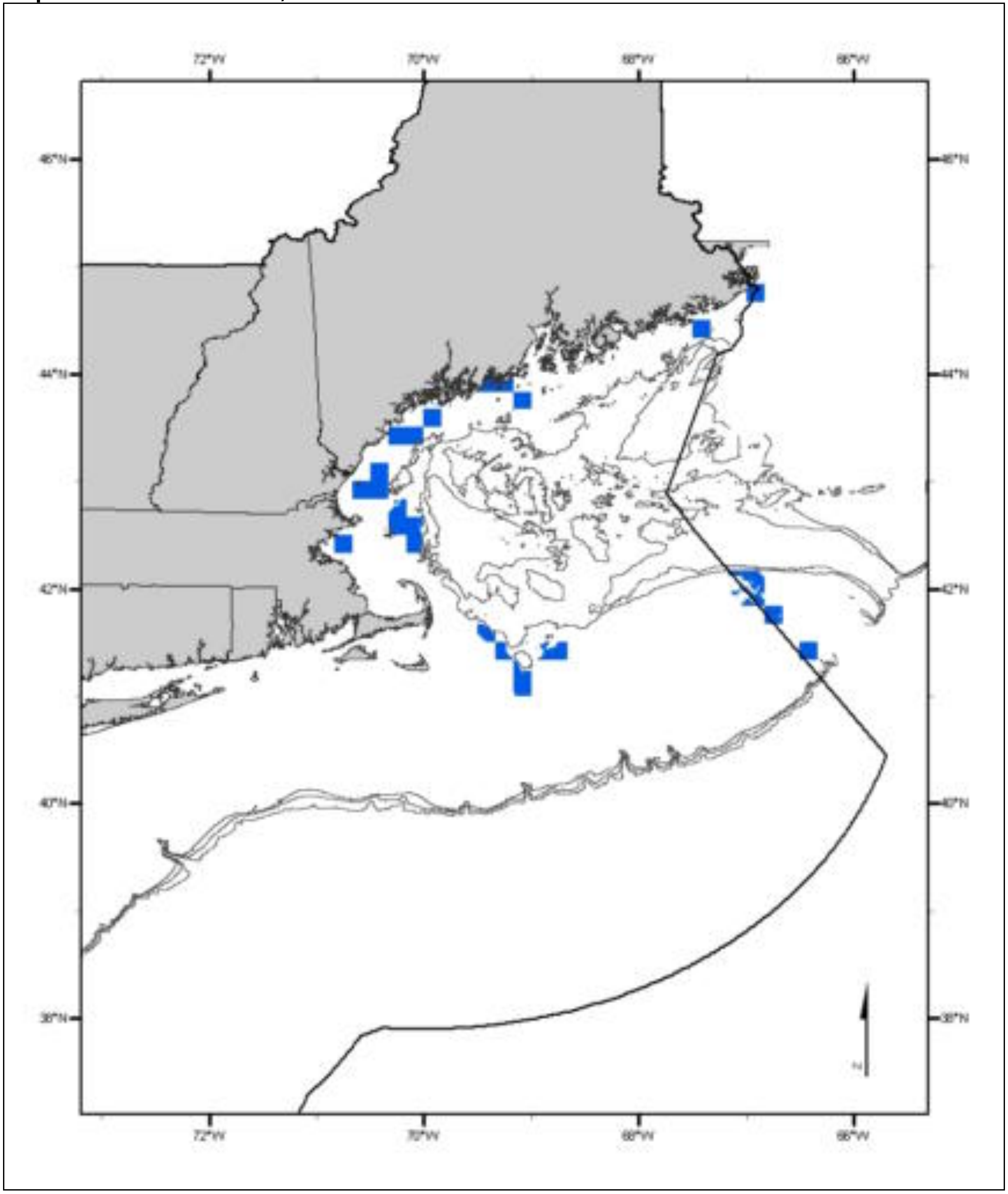
The Alternative 3C EFH designation for juvenile haddock on the continental shelf is based on the distribution of substrate types, depths and bottom temperatures that are associated with high catch rates of juveniles in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of juveniles in the 1968-2005 spring and fall NMFS trawl surveys at the 75% cumulative percentage of catch level and includes inshore areas where juvenile haddock were determined to be present, based on 10% frequency of occurrence in state trawl surveys and ELMR information.

Map 333. Haddock juveniles, Alternative 3D *(Preferred Alternative)*



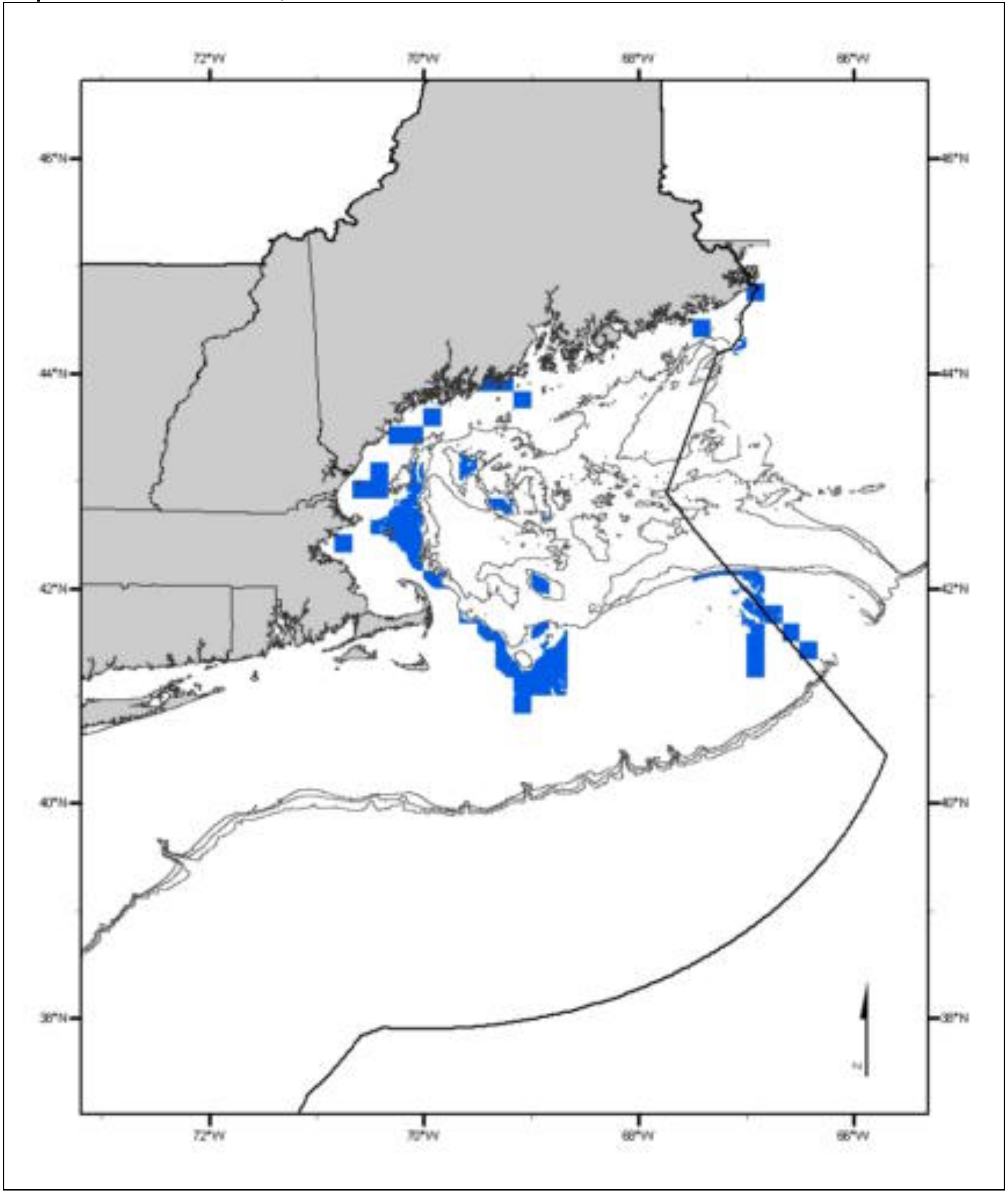
The Alternative 3D EFH designation for juvenile haddock on the continental shelf is based on the distribution of substrate types, depths and bottom temperatures that are associated with high catch rates of juveniles in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of juveniles in the 1968-2005 spring and fall NMFS trawl surveys at the 90% cumulative percentage of catch level and includes inshore areas where juvenile haddock were determined to be present, based on 10% frequency of occurrence in state trawl surveys and ELMR information.

Map 334. Haddock adults, Alternative 3A



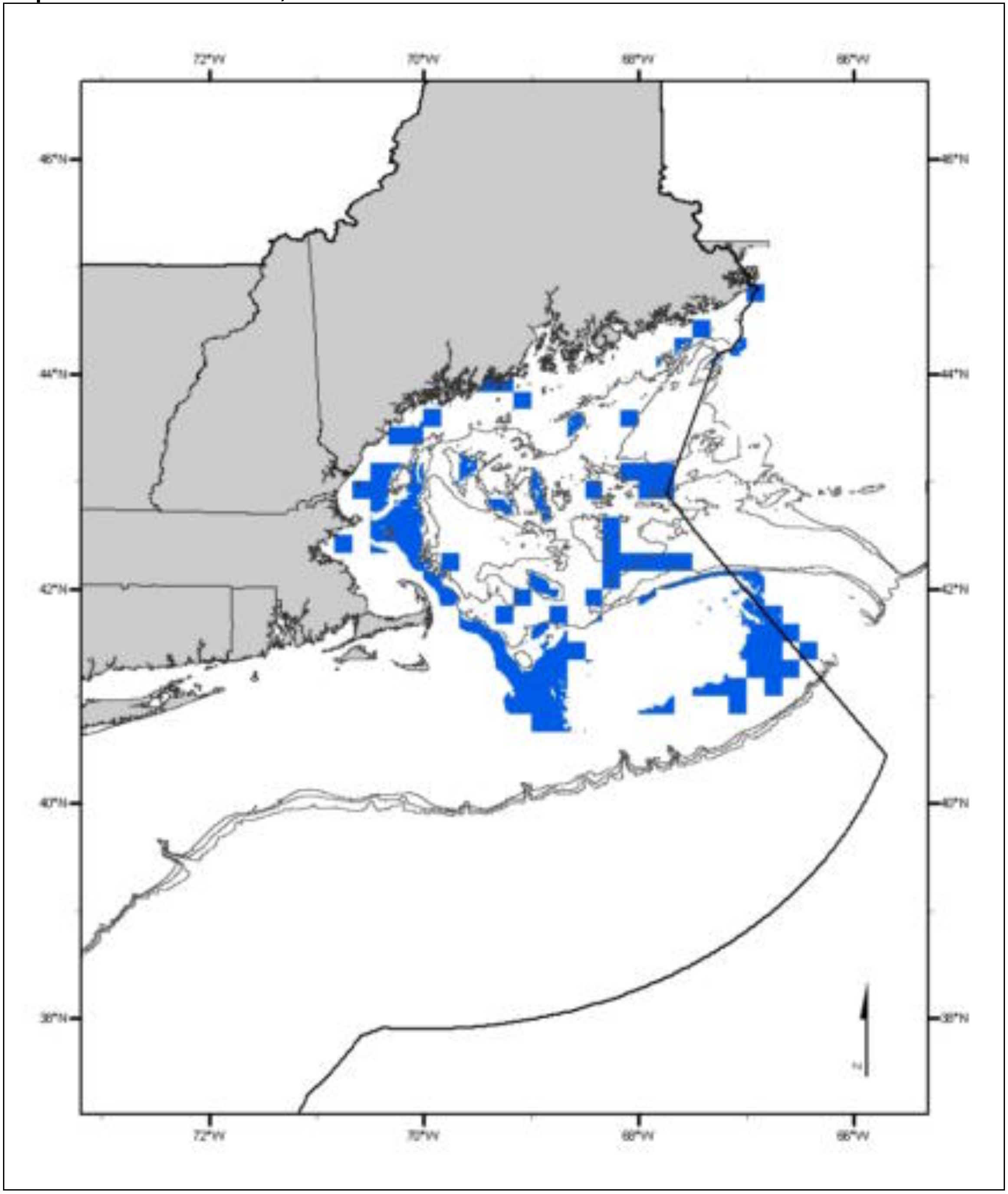
The Alternative 3A EFH designation for adult haddock on the continental shelf is based on the distribution of substrate types, depths and bottom temperatures that are associated with high catch rates of adults in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of adults in the 1968-2005 spring and fall NMFS trawl surveys at the 25% cumulative percentage of catch level and includes inshore areas where adult haddock were determined to be present, based on 10% frequency of occurrence in state trawl surveys and ELMR information.

Map 335. Haddock adults, Alternative 3B



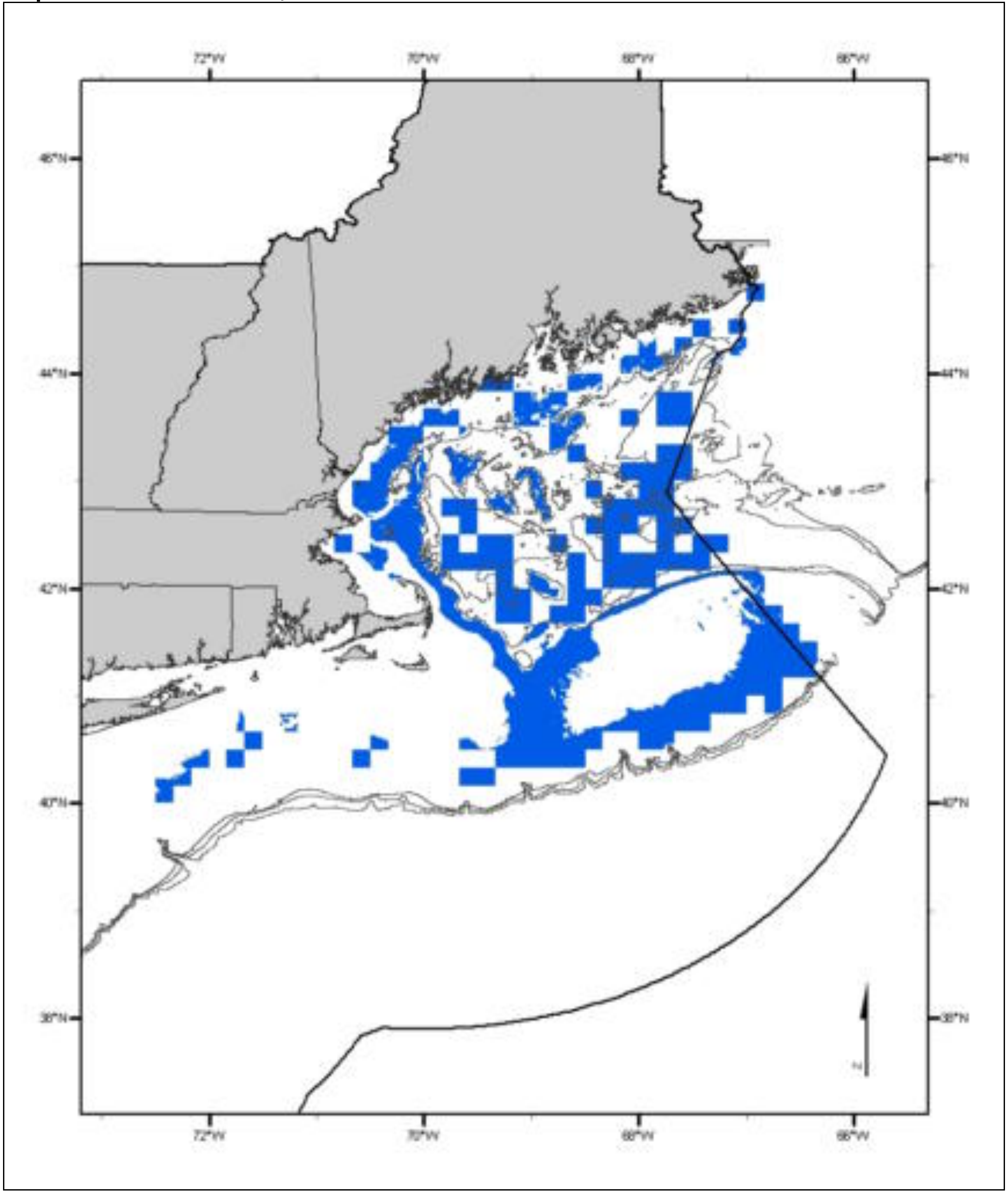
The Alternative 3B EFH designation for adult haddock on the continental shelf is based on the distribution of substrate types, depths and bottom temperatures that are associated with high catch rates of adults in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of adults in the 1968-2005 spring and fall NMFS trawl surveys at the 50% cumulative percentage of catch level and includes inshore areas where adult haddock were determined to be present, based on 10% frequency of occurrence in state trawl surveys and ELMR information.

Map 336. Haddock adults, Alternative 3C



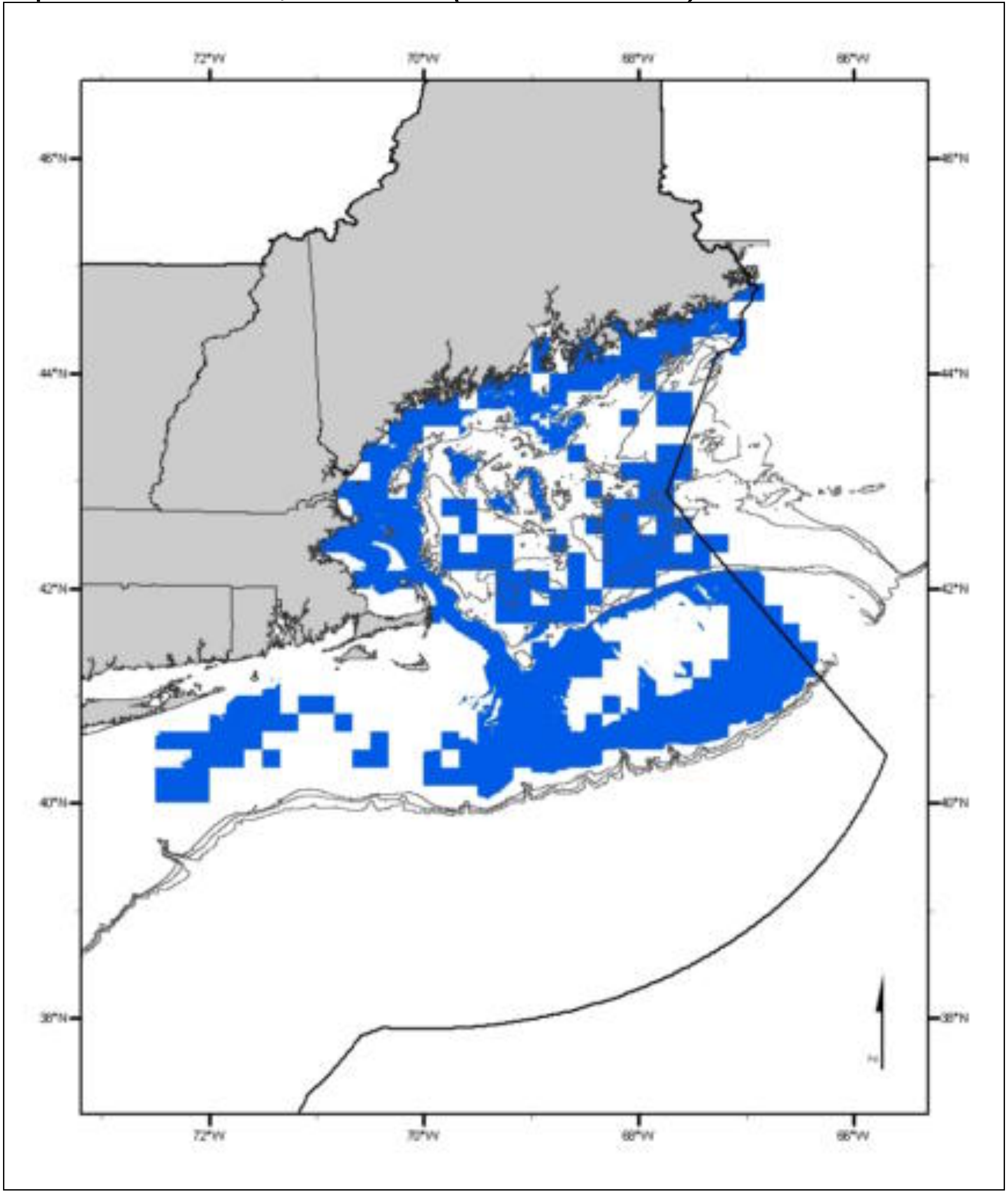
The Alternative 3C EFH designation for adult haddock on the continental shelf is based on the distribution of substrate types, depths and bottom temperatures that are associated with high catch rates of adults in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of adults in the 1968-2005 spring and fall NMFS trawl surveys at the 75% cumulative percentage of catch level and includes inshore areas where adult haddock were determined to be present, based on 10% frequency of occurrence in state trawl surveys and ELMR information.

Map 337. Haddock adults, Alternative 3D



The Alternative 3D EFH designation for adult haddock on the continental shelf is based on the distribution of substrate types, depths and bottom temperatures that are associated with high catch rates of adults in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of adults in the 1968-2005 spring and fall NMFS trawl surveys at the 90% cumulative percentage of catch level and includes inshore areas where adult haddock were determined to be present, based on 10% frequency of occurrence in state trawl surveys and ELMR information.

Map 338. Haddock adults, Alternative 3E *(Preferred Alternative)*



The Alternative 3E EFH designation for adult haddock is the union of the 3D designation for juvenile haddock and the 3D designation for adult haddock, bounded at the western and southern extent of the adult 3D map.

4.1.3.2.9 Little Skate

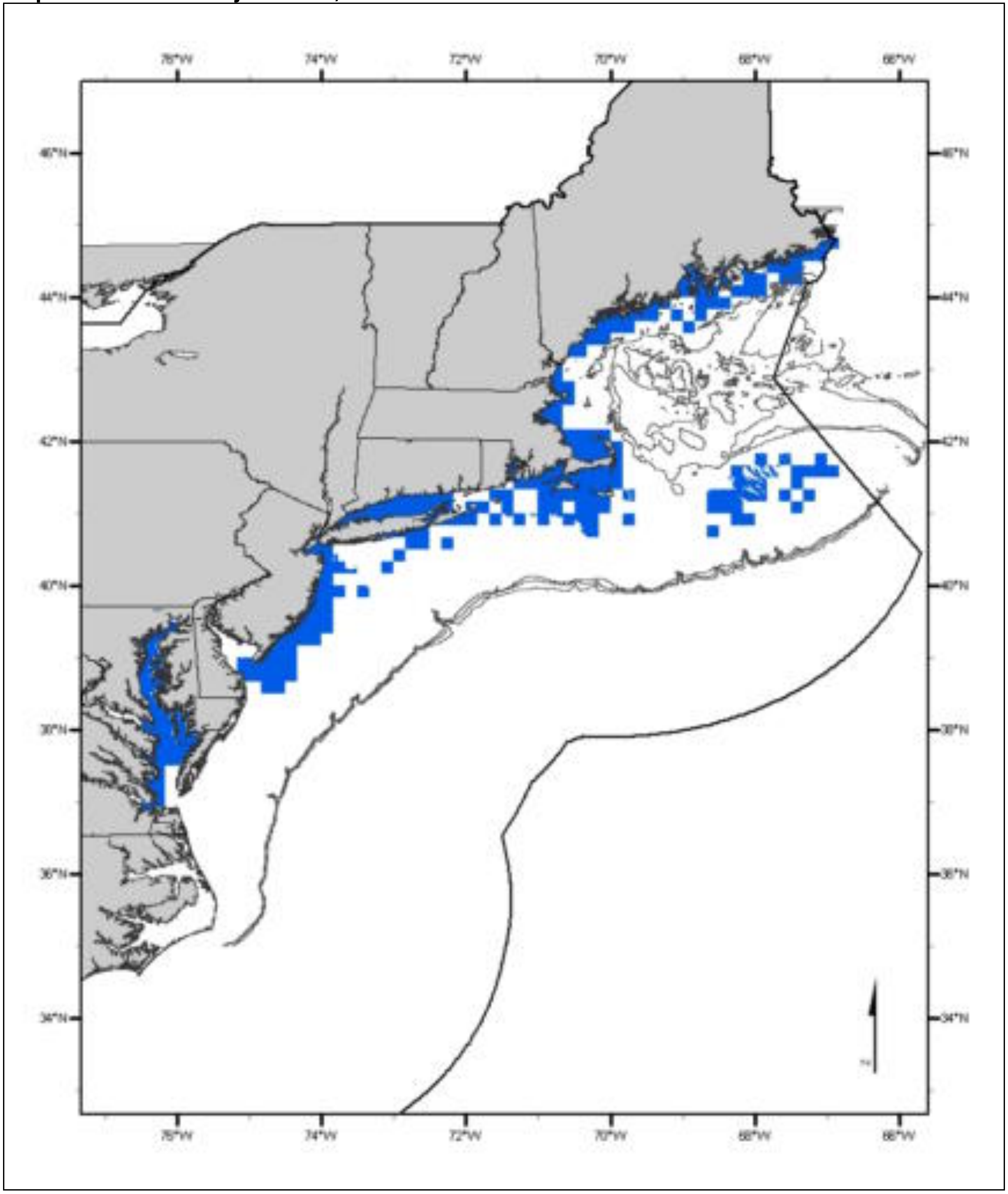
Eggs: No alternative EFH designation.

Larvae: No larval life stage exists for this species. Upon hatching, they are fully developed juveniles.

Juveniles: Sandy benthic habitats in coastal bays and estuaries and on the continental shelf in depths of 8 – 70 meters as depicted on Map 339 - Map 343. Other conditions that generally exist where EFH for juvenile little skate is found are bottom temperatures of 1.5 – 18.5ºC and salinities of 22.5 – 33.5 ppt. They feed on crustaceans (primarily amphipods and a variety of decapods). *(Preferred Alternative)*

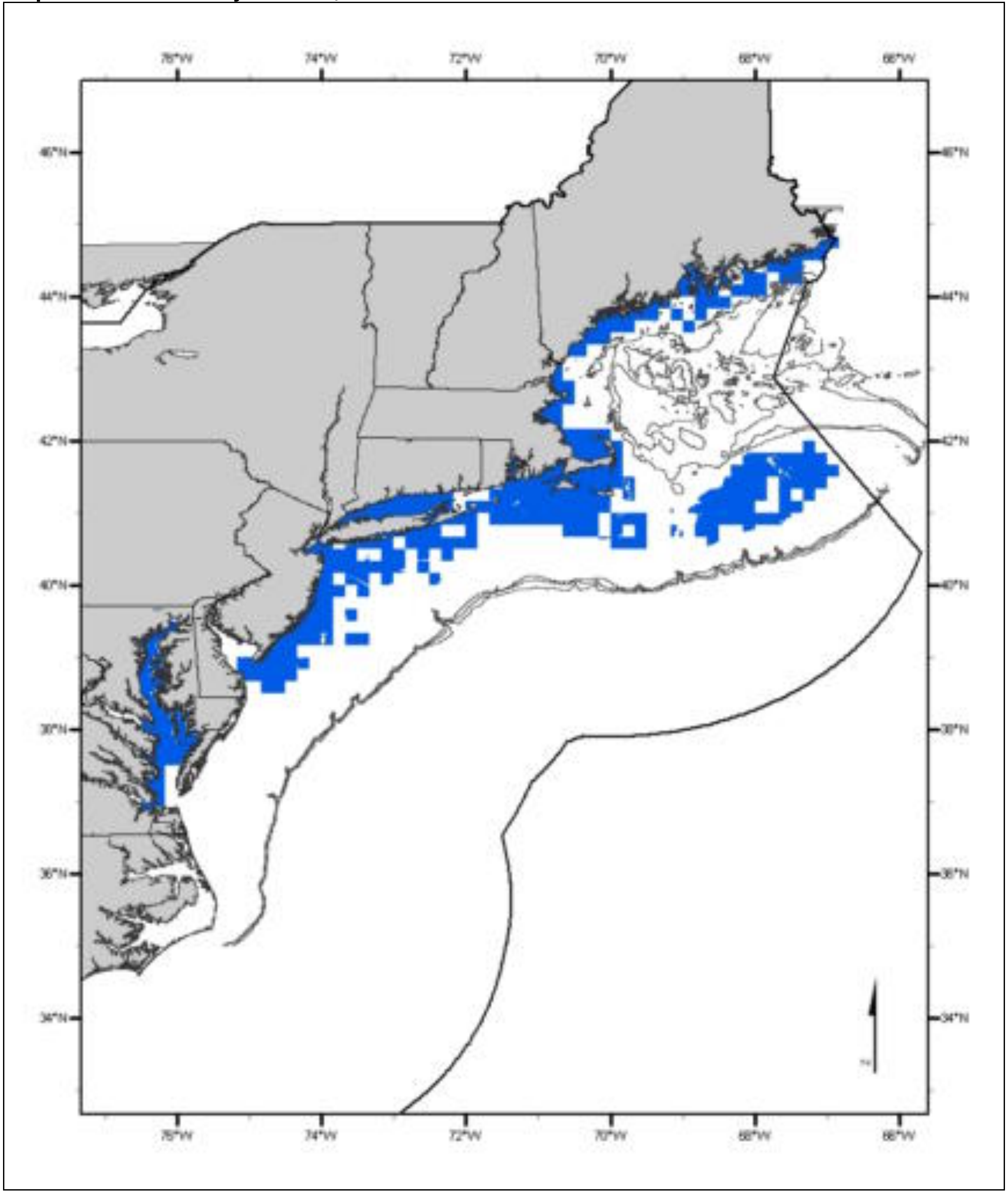
Adults: Sandy benthic habitats in coastal bays and estuaries and on the continental shelf in depths of 16 – 100 meters, as depicted on Map 344 - Map 348. Other conditions that generally exist where EFH for adult little skate is found are bottom temperatures of 1.5 – 22.5ºC and salinities of 24.5 – 34.5 ppt. Adult little skate have a similar diet to juveniles, but feed on more decapods (sand shrimps and crabs), polychaetes, and fishes (*e.g.*, Atlantic herring), and fewer amphipods. *(Preferred Alternative)*

Map 339. Little skate juveniles, Alternative 3A



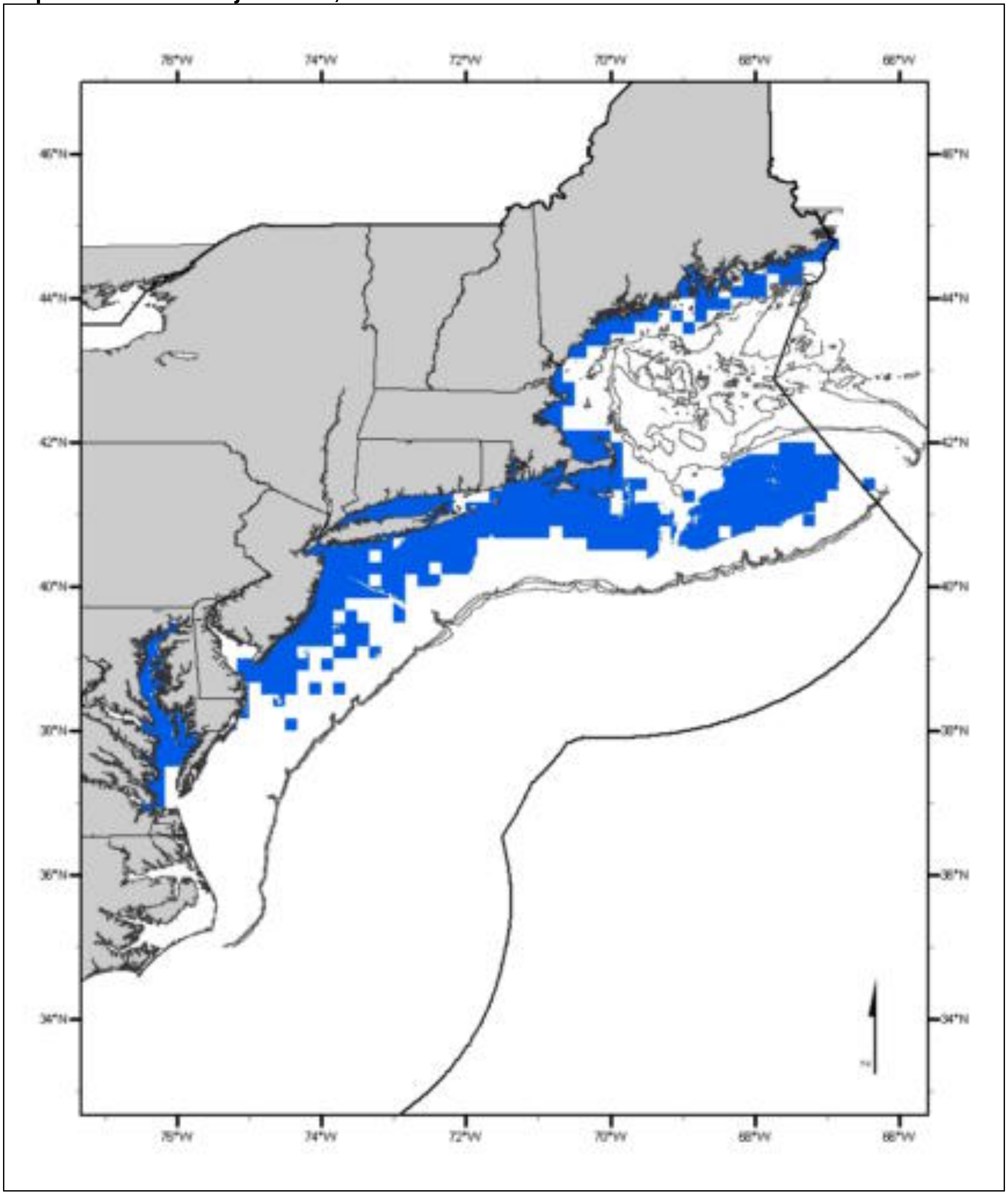
The Alternative 3A EFH designation for juvenile little skate on the continental shelf is based on the distribution of substrate types, depths and bottom temperatures that are associated with high catch rates of juveniles in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of juveniles in the 1968-2005 spring and fall NMFS trawl surveys at the 25% cumulative percentage of catch level and includes inshore areas where juvenile little skate were determined to be present, based on 10% frequency of occurrence in state trawl surveys and ELMR information.

Map 340. Little skate juveniles, Alternative 3B



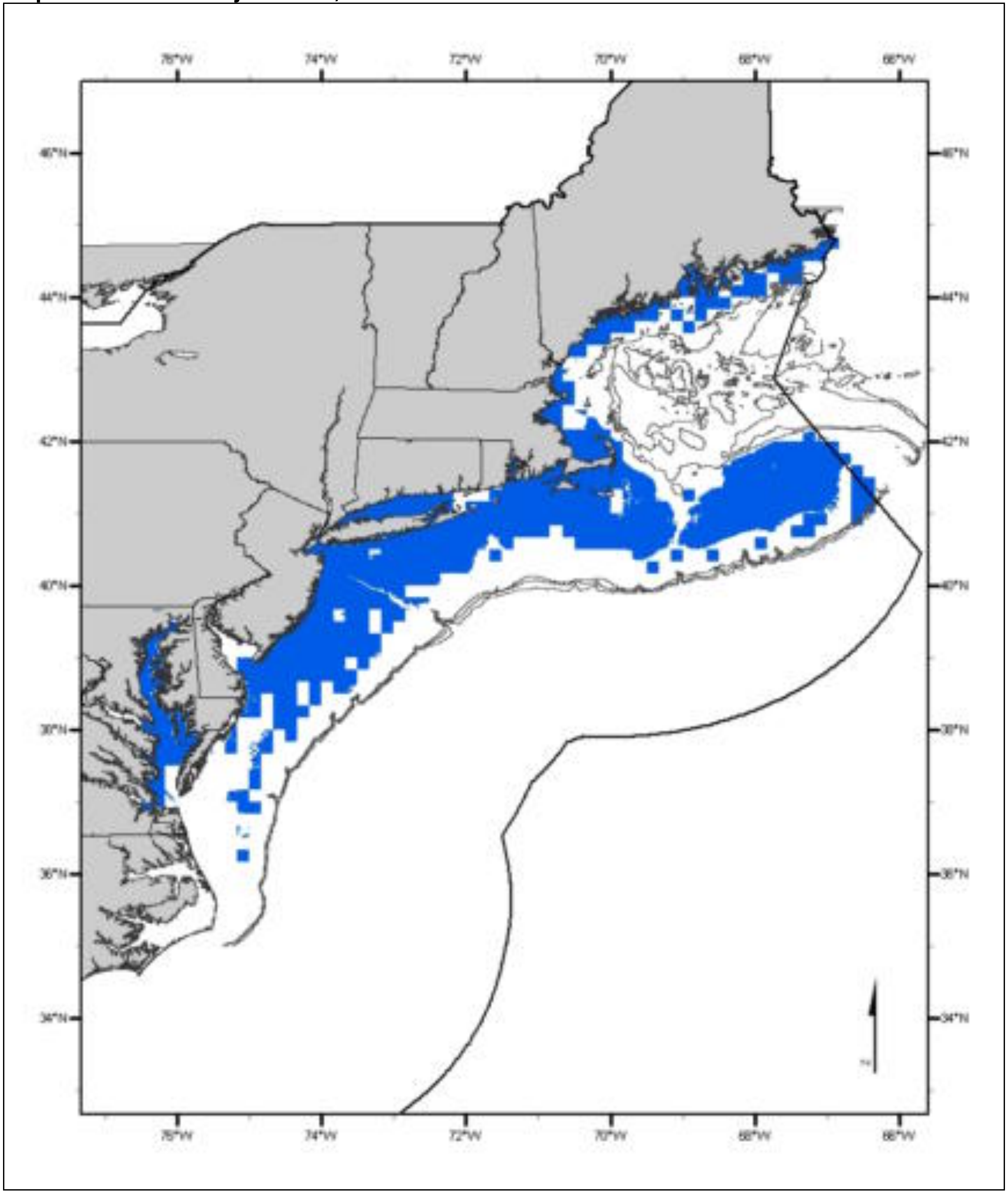
The Alternative 3B EFH designation for juvenile little skate on the continental shelf is based on the distribution of substrate types, depths and bottom temperatures that are associated with high catch rates of juveniles in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of juveniles in the 1968-2005 spring and fall NMFS trawl surveys at the 50% cumulative percentage of catch level and includes inshore areas where juvenile little skate were determined to be present, based on 10% frequency of occurrence in state trawl surveys and ELMR information.

Map 341. Little skate juveniles, Alternative 3C



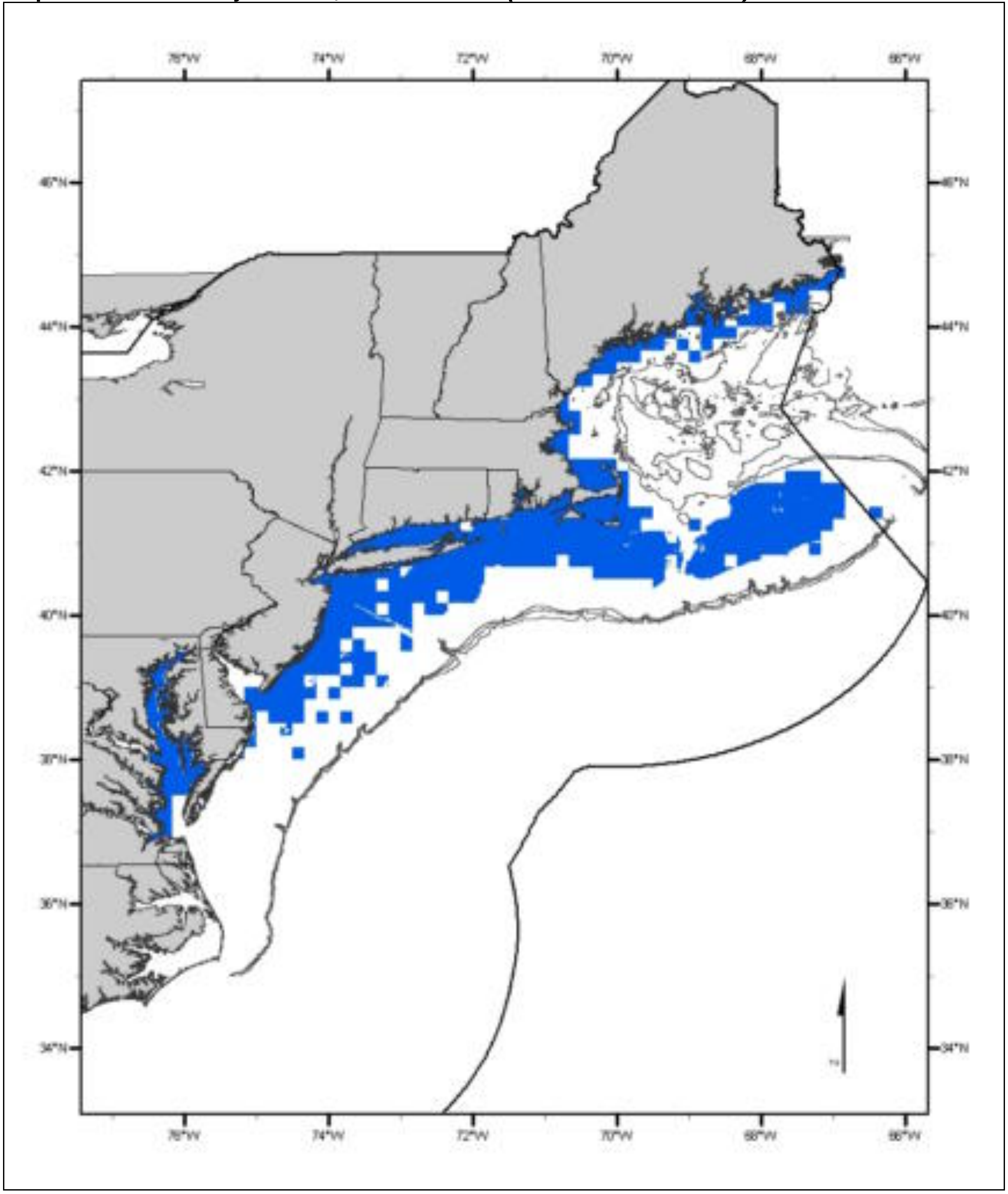
The Alternative 3C EFH designation for juvenile little skate on the continental shelf is based on the distribution of substrate types, depths and bottom temperatures that are associated with high catch rates of juveniles in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of juveniles in the 1968-2005 spring and fall NMFS trawl surveys at the 75% cumulative percentage of catch level and includes inshore areas where juvenile little skate were determined to be present, based on 10% frequency of occurrence in state trawl surveys and ELMR information.

Map 342. Little skate juveniles, Alternative 3D



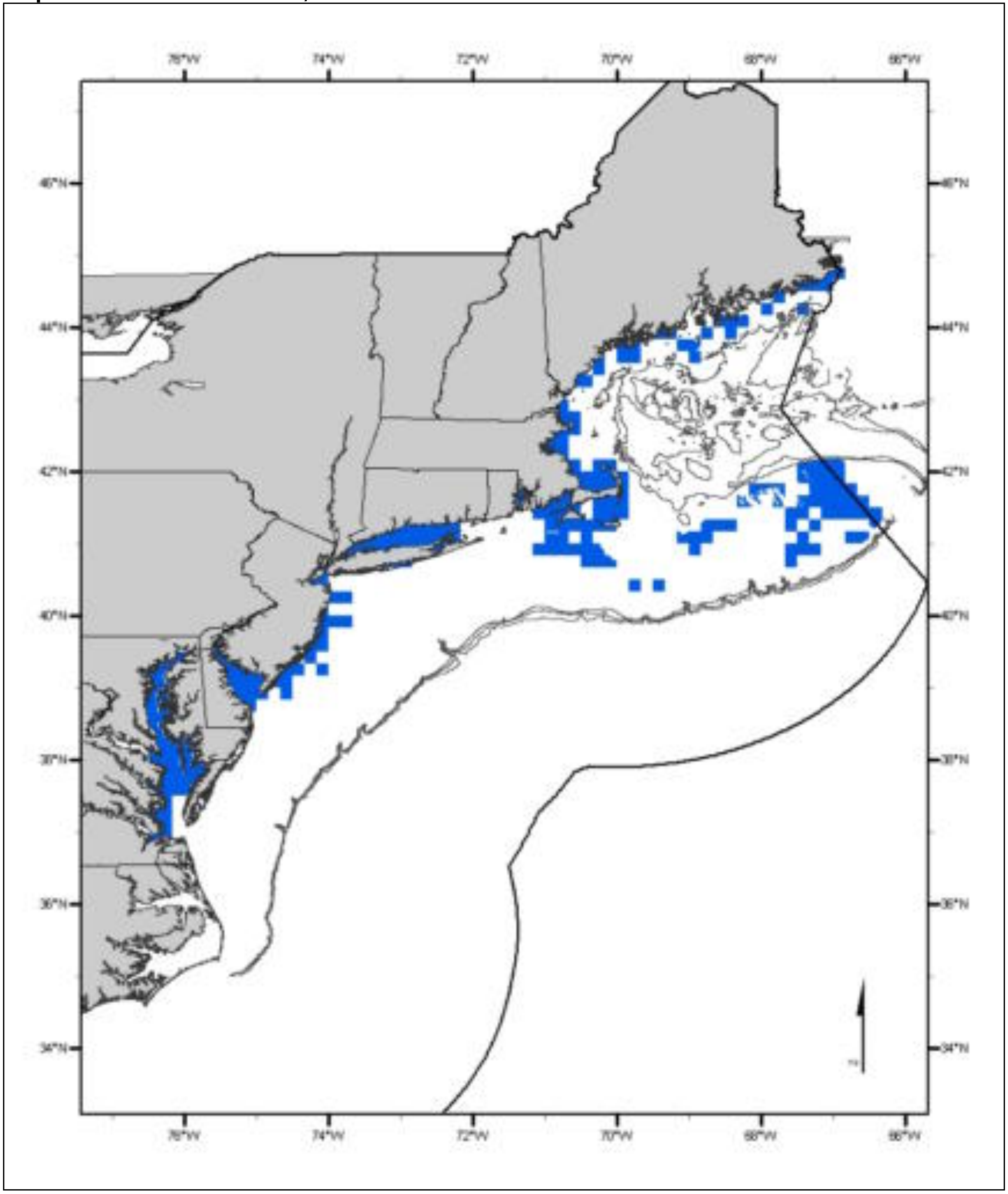
The Alternative 3D EFH designation for juvenile little skate on the continental shelf is based on the distribution of substrate types, depths and bottom temperatures that are associated with high catch rates of juveniles in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of juveniles in the 1968-2005 spring and fall NMFS trawl surveys at the 90% cumulative percentage of catch level and includes inshore areas where juvenile little skate were determined to be present, based on 10% frequency of occurrence in state trawl surveys and ELMR information.

Map 343. Little skate juveniles, Alternative 3E *(Preferred Alternative)*



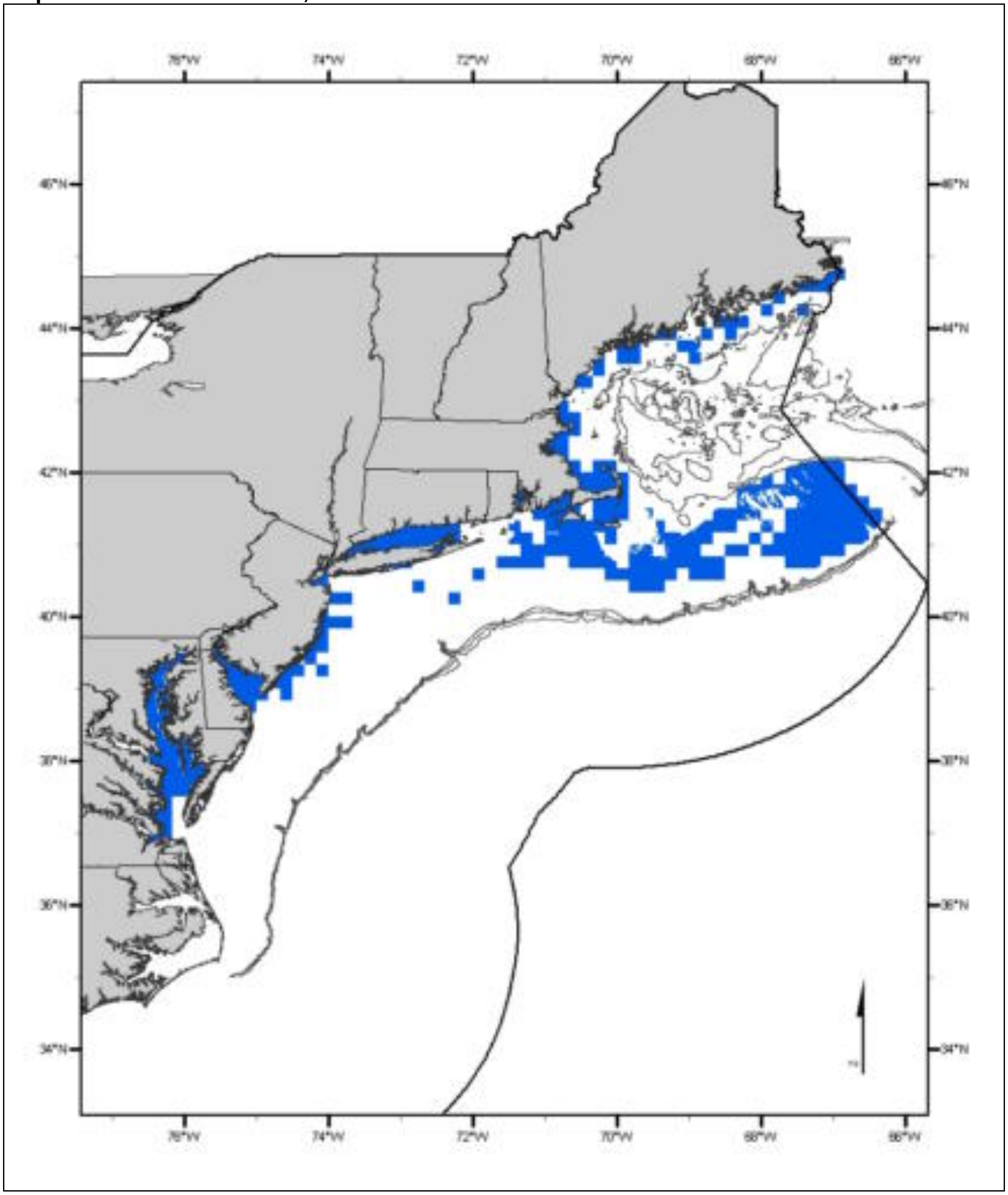
The Alternative 3E EFH designation for juvenile little skate is based on the 3C Alternative for juvenile little skate with the addition of ten minute squares along the RI and CT coasts and east of Nantucket Island where there are no survey data for this species.

Map 344. Little skate adults, Alternative 3A



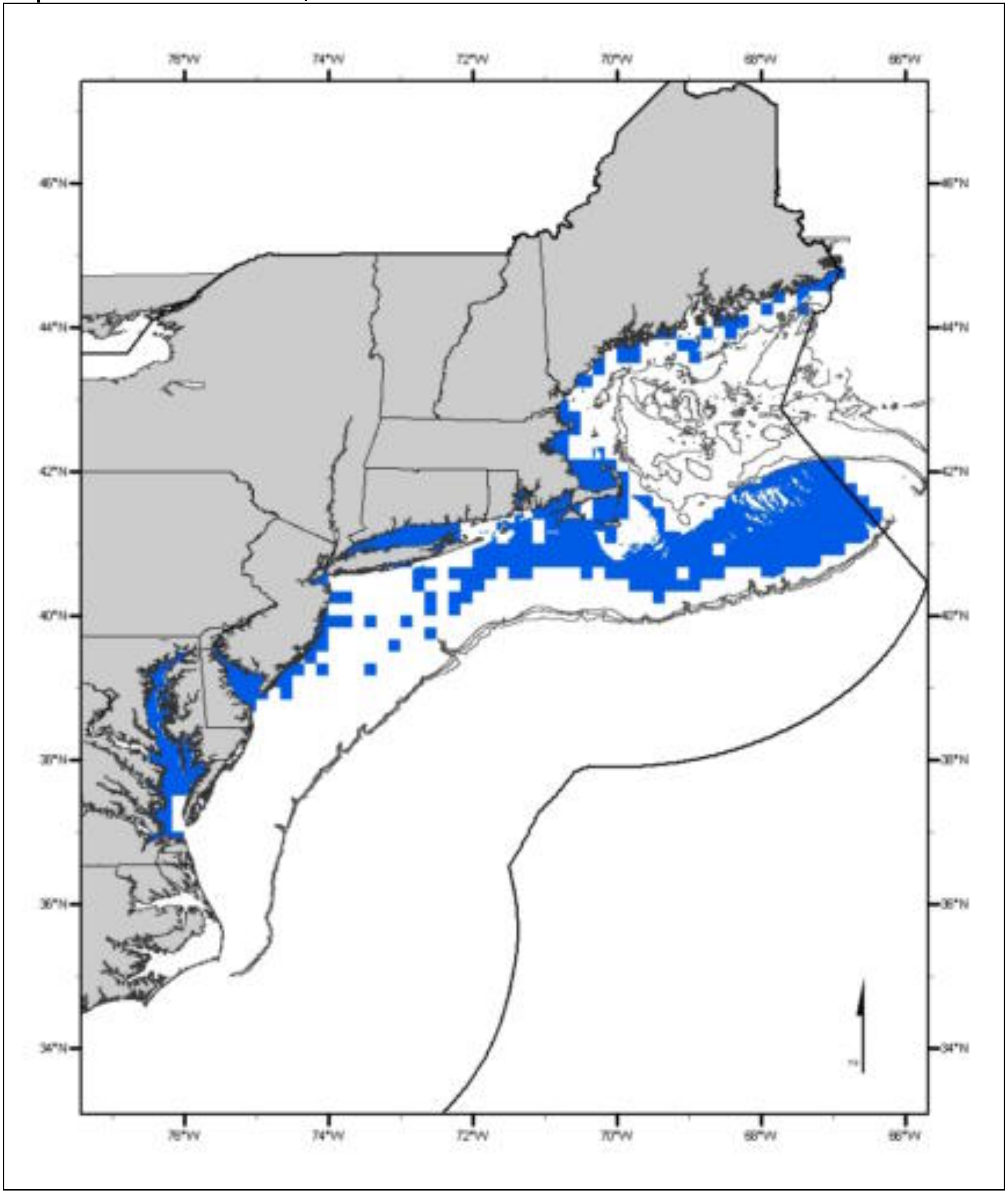
The Alternative 3A EFH designation for adult little skate on the continental shelf is based on the distribution of substrate types, depths and bottom temperatures that are associated with high catch rates of adults in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of adults in the 1968-2005 spring and fall NMFS trawl surveys at the 25% cumulative percentage of catch level and includes inshore areas where adult little skate were determined to be present, based on 10% frequency of occurrence in state trawl surveys and ELMR information.

Map 345. Little skate adults, Alternative 3B



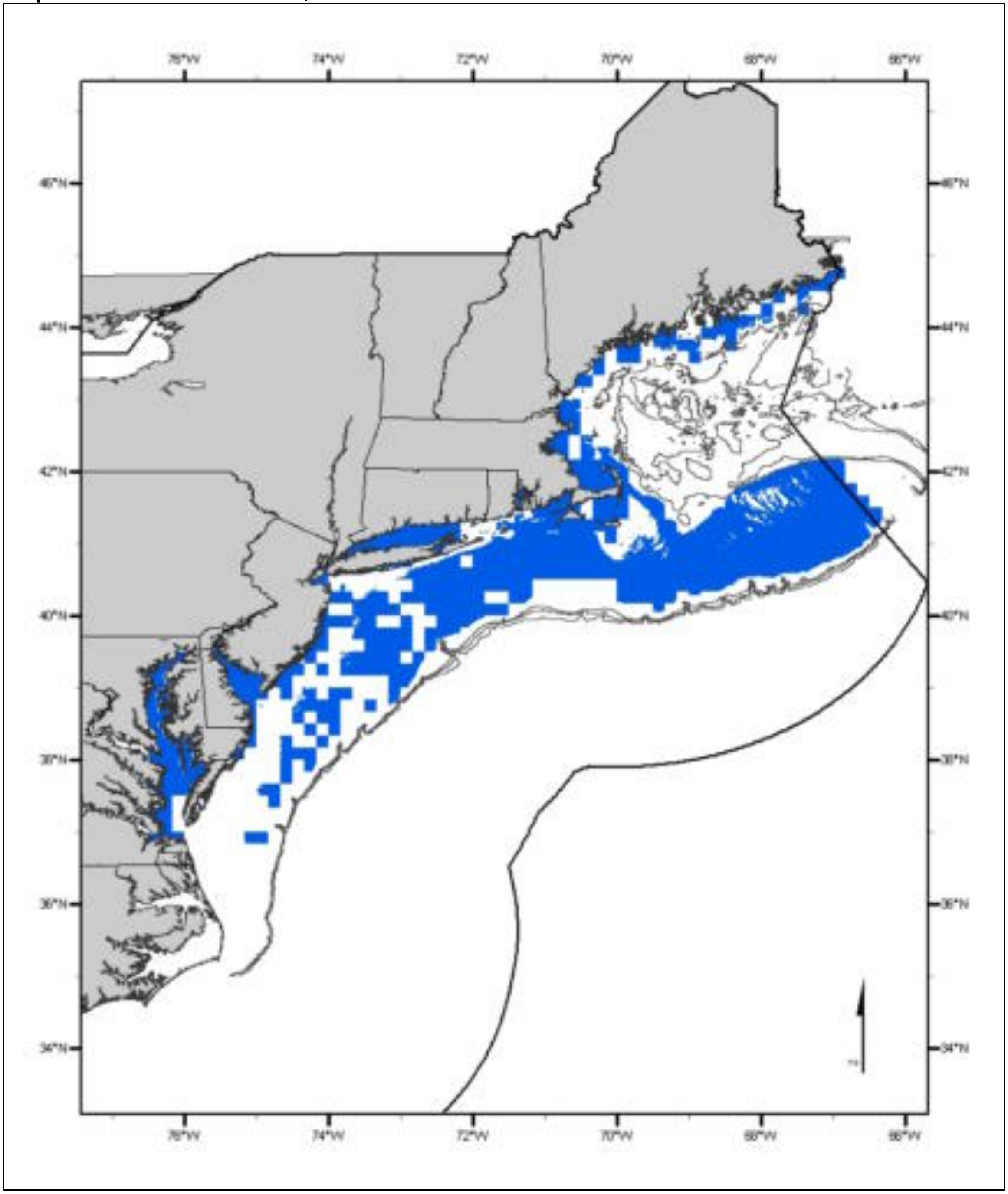
The Alternative 3B EFH designation for adult little skate on the continental shelf is based on the distribution of substrate types, depths and bottom temperatures that are associated with high catch rates of adults in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of adults in the 1968-2005 spring and fall NMFS trawl surveys at the 50% cumulative percentage of catch level and includes inshore areas where adult little skate were determined to be present, based on 10% frequency of occurrence in state trawl surveys and ELMR information.

Map 346. Little skate adults, Alternative 3C



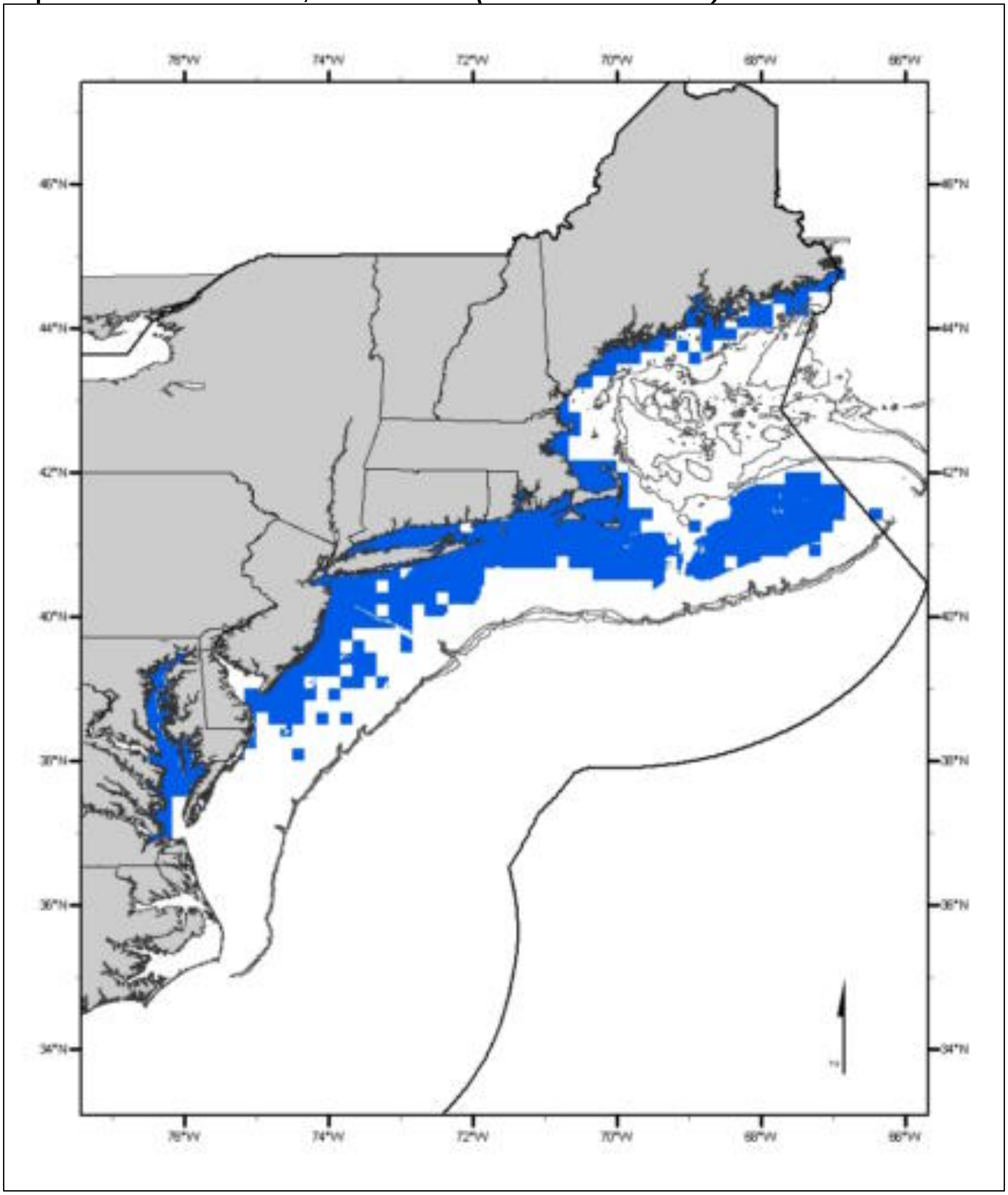
The Alternative 3C EFH designation for adult little skate on the continental shelf is based on the distribution of substrate types, depths and bottom temperatures that are associated with high catch rates of adults in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of adults in the 1968-2005 spring and fall NMFS trawl surveys at the 75% cumulative percentage of catch level and includes inshore areas where adult little skate were determined to be present, based on 10% frequency of occurrence in state trawl surveys and ELMR information.

Map 347. Little skate adults, Alternative 3D



The Alternative 3D EFH designation for adult little skate on the continental shelf is based on the distribution of substrate types, depths and bottom temperatures that are associated with high catch rates of adults in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of adults in the 1968-2005 spring and fall NMFS trawl surveys at the 90% cumulative percentage of catch level and includes inshore areas where adult little skate were determined to be present, based on 10% frequency of occurrence in state trawl surveys and ELMR information.

Map 348. Little skate adults, Alternative 3E *(Preferred Alternative)*



The Alternative 3E EFH designation for adult little skate is based on the 3C Alternative for adult little skate with the addition of ten minute squares along the RI and CT coasts and east of Nantucket Island where there are no survey data for this species.

4.1.3.2.10 Monkfish

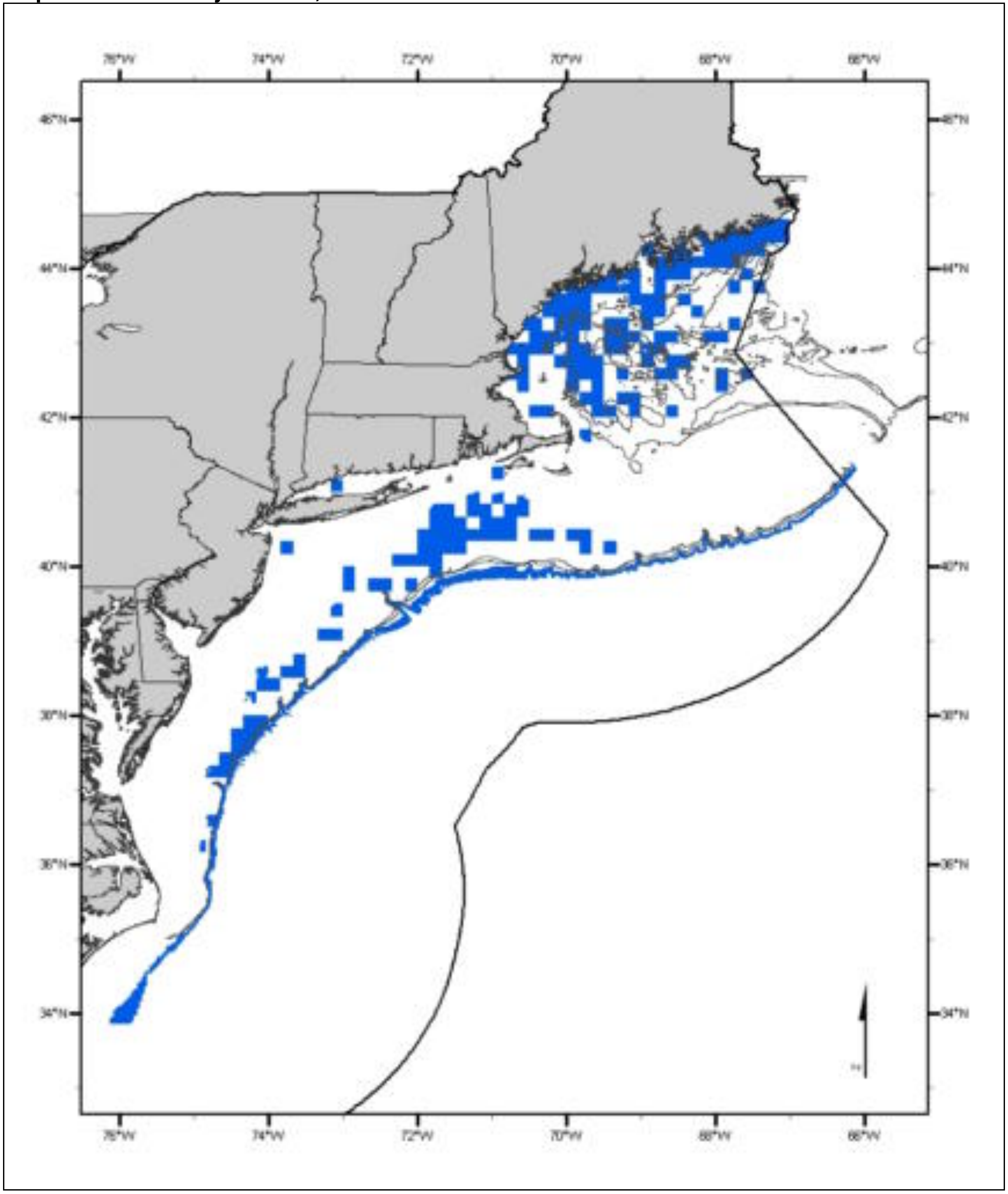
Eggs: No alternative EFH designation.

Larvae: No alternative EFH designation.

Juveniles: Benthic habitats in inshore areas and on the continental shelf and slope in depths of 30 – 1000 meters with mud, sand, and mud–sand substrates as depicted on Map 349 - Map 352. Other conditions that generally exist where EFH is found are bottom temperatures of 3.5 – 13.5ºC and salinities of 30.5 – 36.5 ppt. Juvenile monkfish are found on a variety of substrates, including mud, sand, gravel, broken shells, and pebbles, but are reported to prefer clay and mud over sand and gravel. YOY have been collected as deep as 900 meters on the continental slope. Primary prey for juvenile monkfish is other fishes (*e.g.*, sand lances, silver hakes, and flounders), pandalid shrimps, and squids. *(Preferred Alternative)*

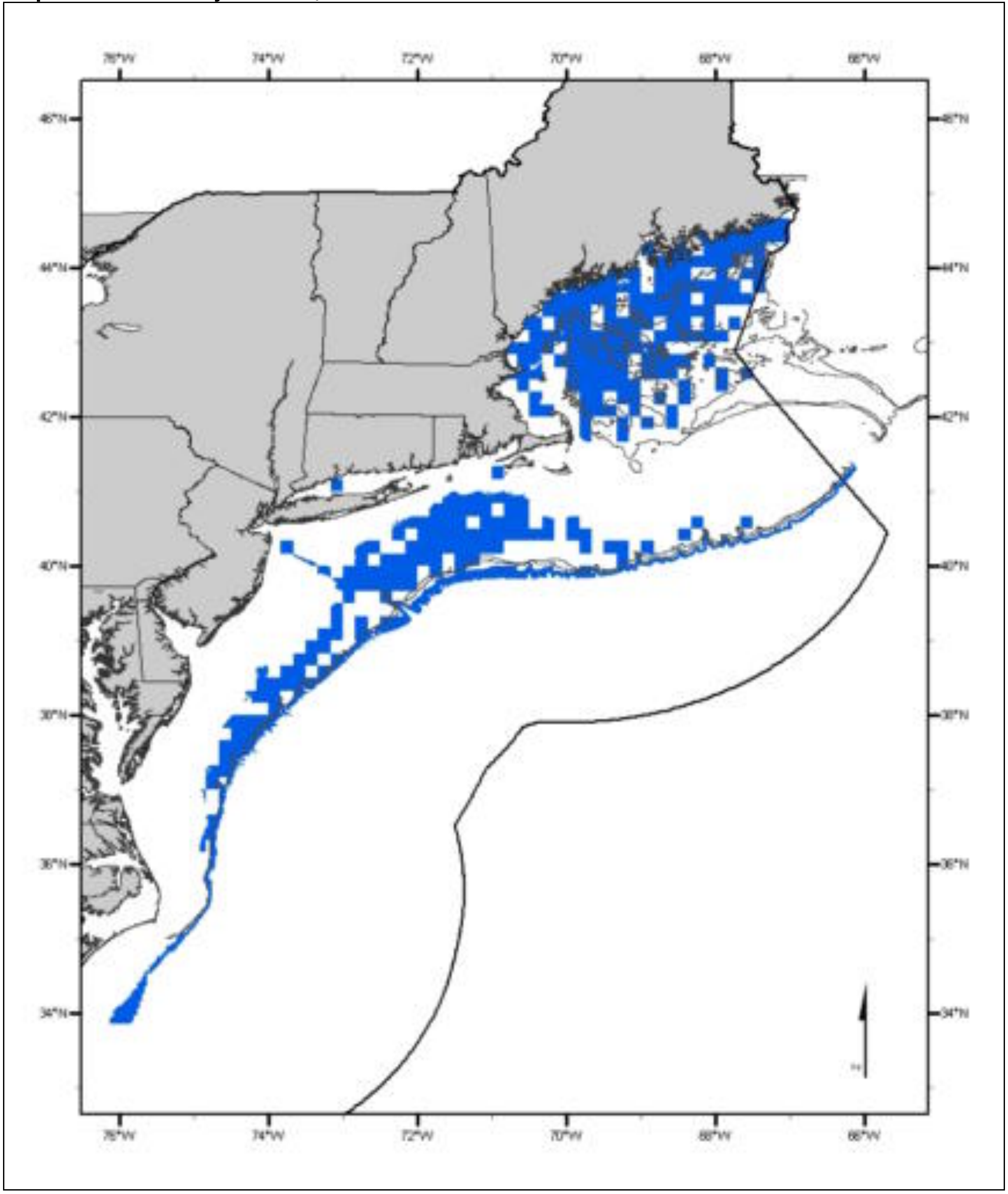
Adults: Benthic habitats in inshore areas and on the continental shelf and slope in depths of 20 – 1000 meters with mud, sand, and mud–sand substrates as depicted on Map 353 - Map 356. Other conditions that generally exist where EFH is found are bottom temperatures of 4.5 – 15.5ºC and salinities of 33.5 – 35.5 ppt. Adult monkfish are found on a variety of substrates, including mud, sand, gravel, broken shells, and pebbles, but are reported to prefer clay and mud over sand and gravel. They feed on a wide variety of other fishes and on squids. *(Preferred Alternative)*

Map 349. Monkfish juveniles, Alternative 3A



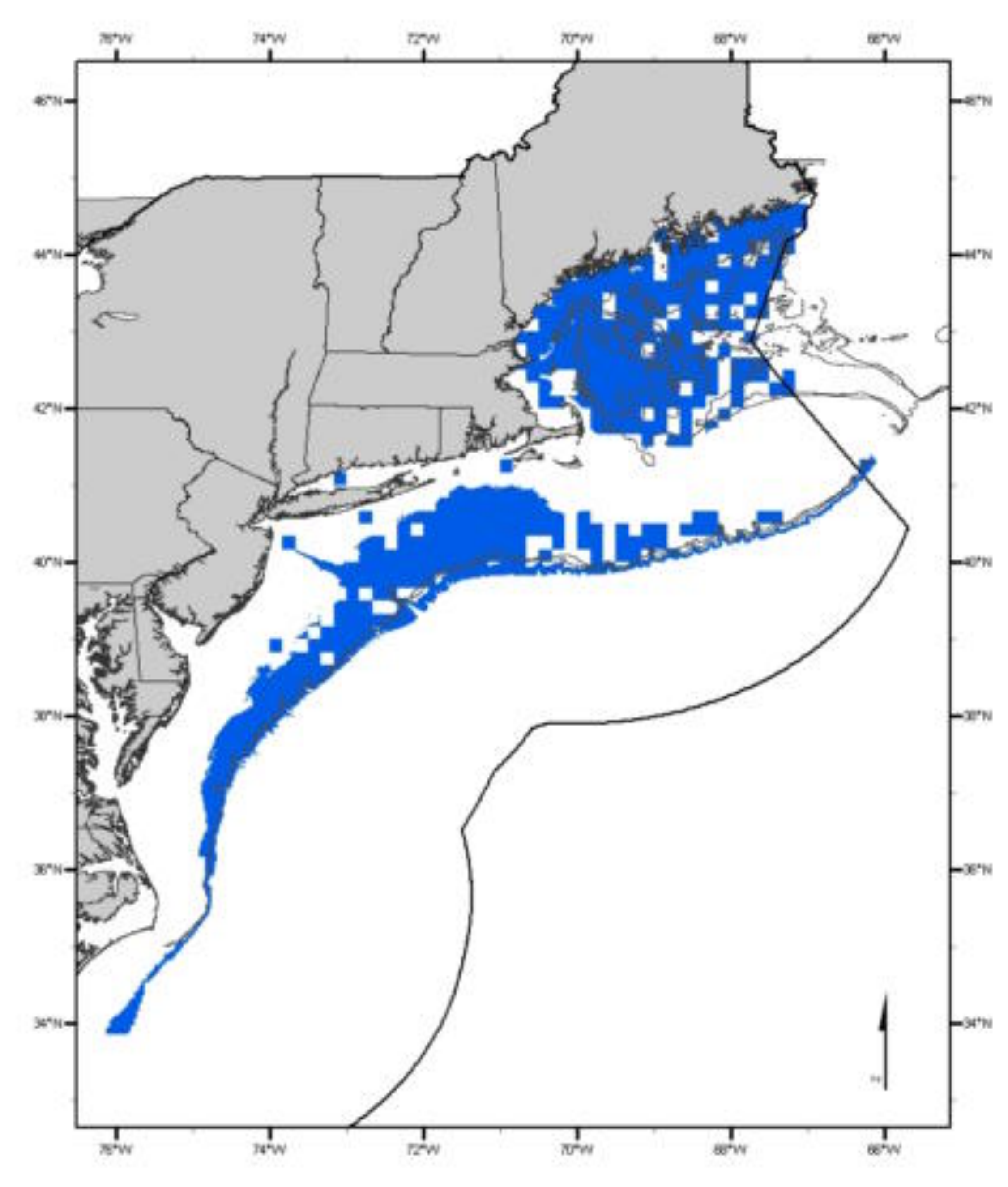
The Alternative 3A EFH designation for juvenile monkfish on the continental shelf is based on the distribution of depths and bottom temperatures that are associated with high catch rates of juveniles in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of juveniles in the 1968-2005 spring and fall NMFS trawl surveys at the 25% cumulative percentage of catch level and includes off-shelf areas where juvenile or adult monkfish were determined to be present, based on depth and geographic ranges.

Map 350. Monkfish juveniles, Alternative 3B



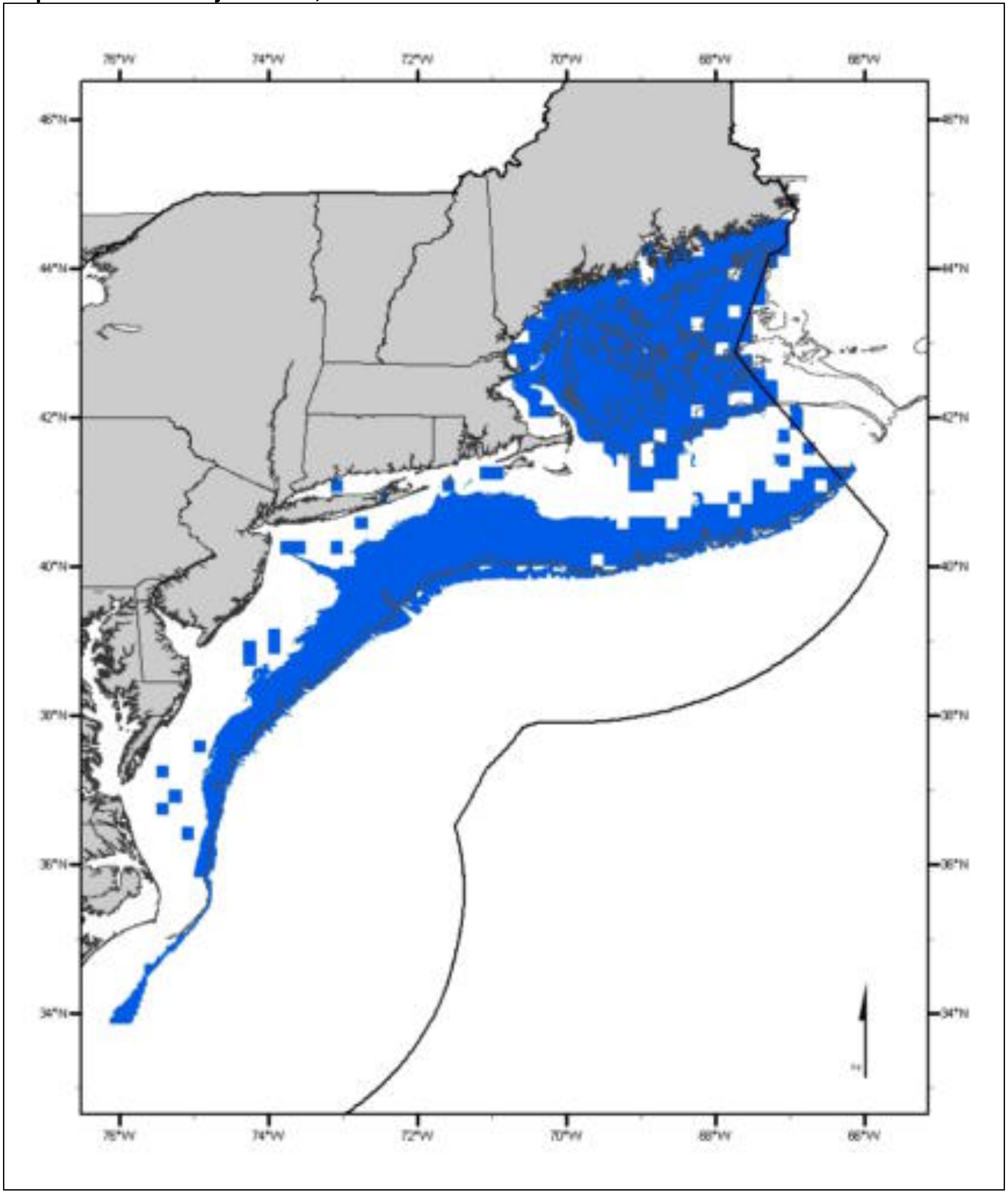
The Alternative 3B EFH designation for juvenile monkfish on the continental shelf is based on the distribution of depths and bottom temperatures that are associated with high catch rates of juveniles in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of juveniles in the 1968-2005 spring and fall NMFS trawl surveys at the 50% cumulative percentage of catch level and includes off-shelf areas where juvenile or adult monkfish were determined to be present, based on depth and geographic ranges.

Map 351. Monkfish juveniles, Alternative 3C *(Preferred Alternative)*



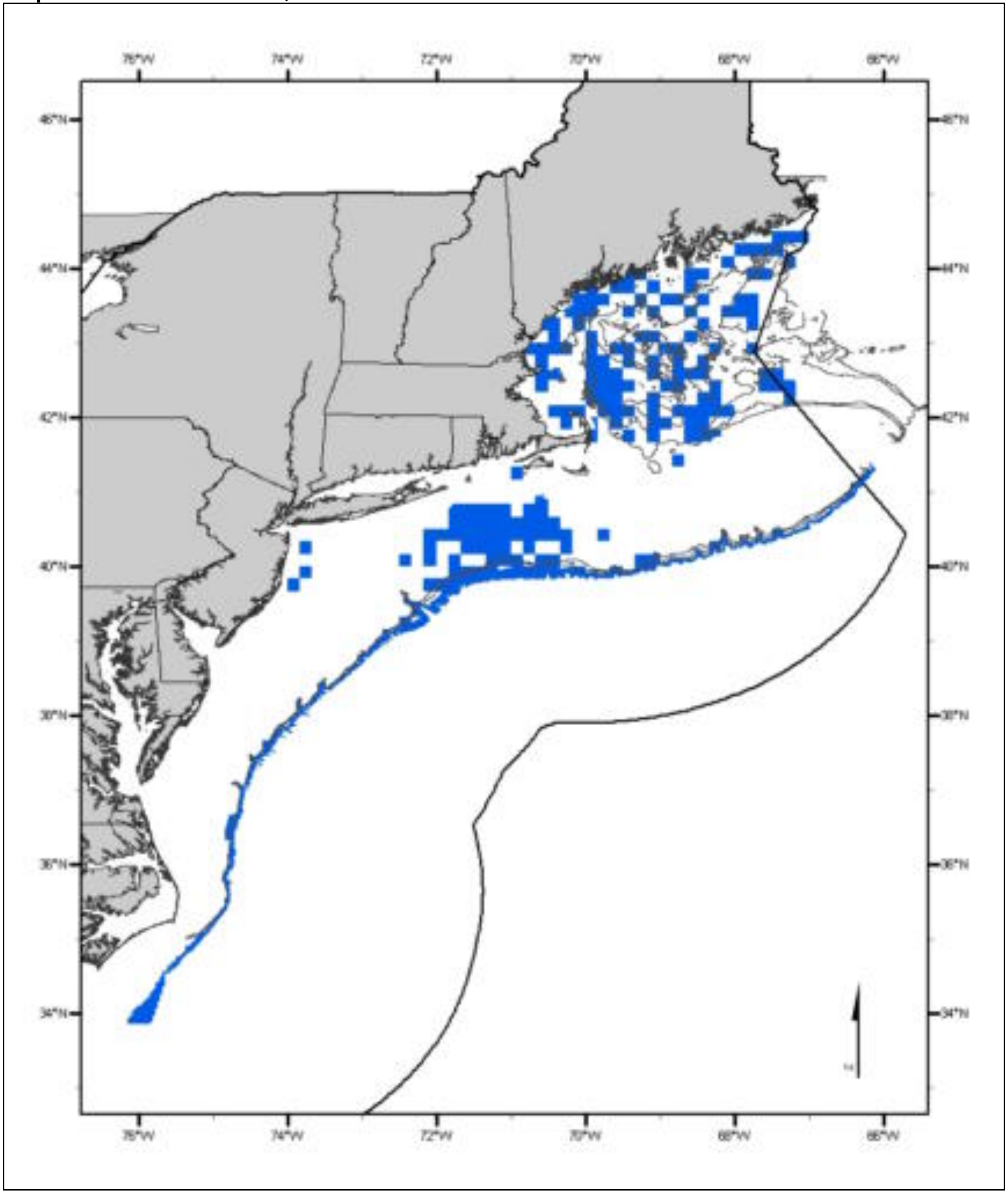
The Alternative 3C EFH designation for juvenile monkfish on the continental shelf is based on the distribution of depths and bottom temperatures that are associated with high catch rates of juveniles in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of juveniles in the 1968-2005 spring and fall NMFS trawl surveys at the 75% cumulative percentage of catch level and includes off-shelf areas where juvenile or adult monkfish were determined to be present, based on depth and geographic ranges.

Map 352. Monkfish juveniles, Alternative 3D



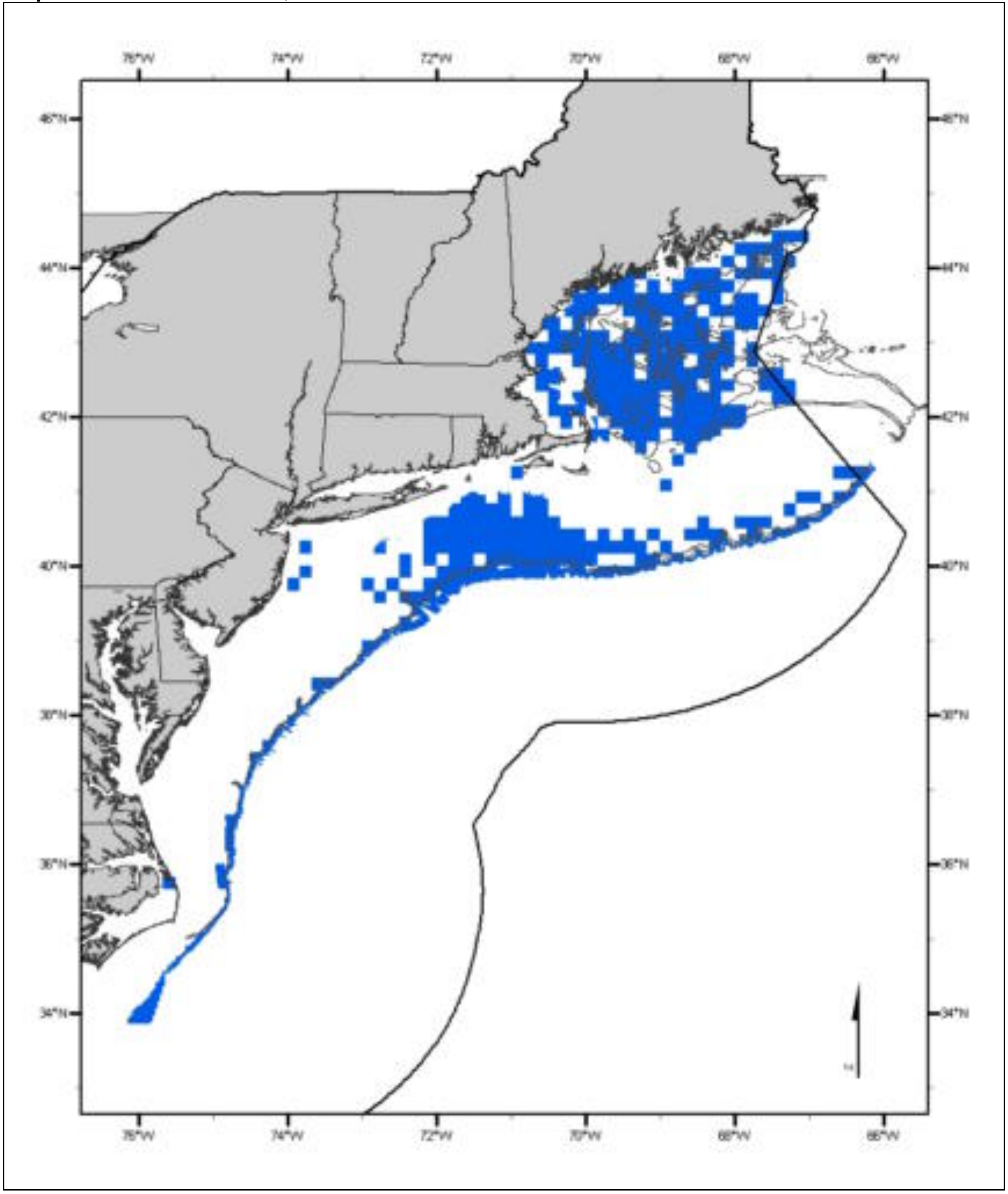
The Alternative 3D EFH designation for juvenile monkfish on the continental shelf is based on the distribution of depths and bottom temperatures that are associated with high catch rates of juveniles in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of juveniles in the 1968-2005 spring and fall NMFS trawl surveys at the 90% cumulative percentage of catch level and includes off-shelf areas where juvenile or adult monkfish were determined to be present, based on depth and geographic ranges.

Map 353. Monkfish adults, Alternative 3A



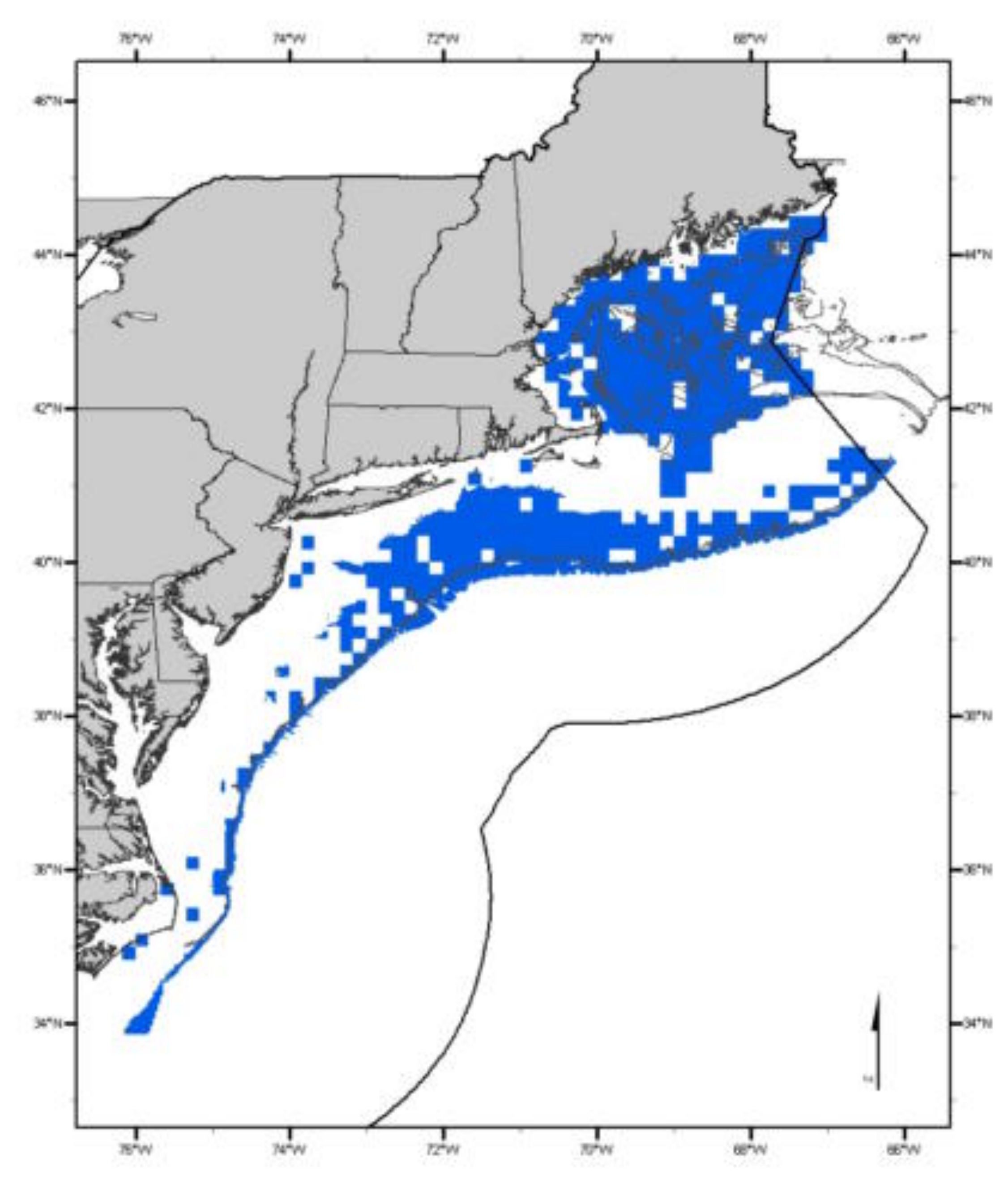
The Alternative 3A EFH designation for adult monkfish on the continental shelf is based on the distribution of depths and bottom temperatures that are associated with high catch rates of adults in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of adults in the 1968-2005 spring and fall NMFS trawl surveys at the 25% cumulative percentage of catch level and includes off-shelf areas where adult or adult monkfish were determined to be present, based on depth and geographic ranges.

Map 354. Monkfish adults, Alternative 3B



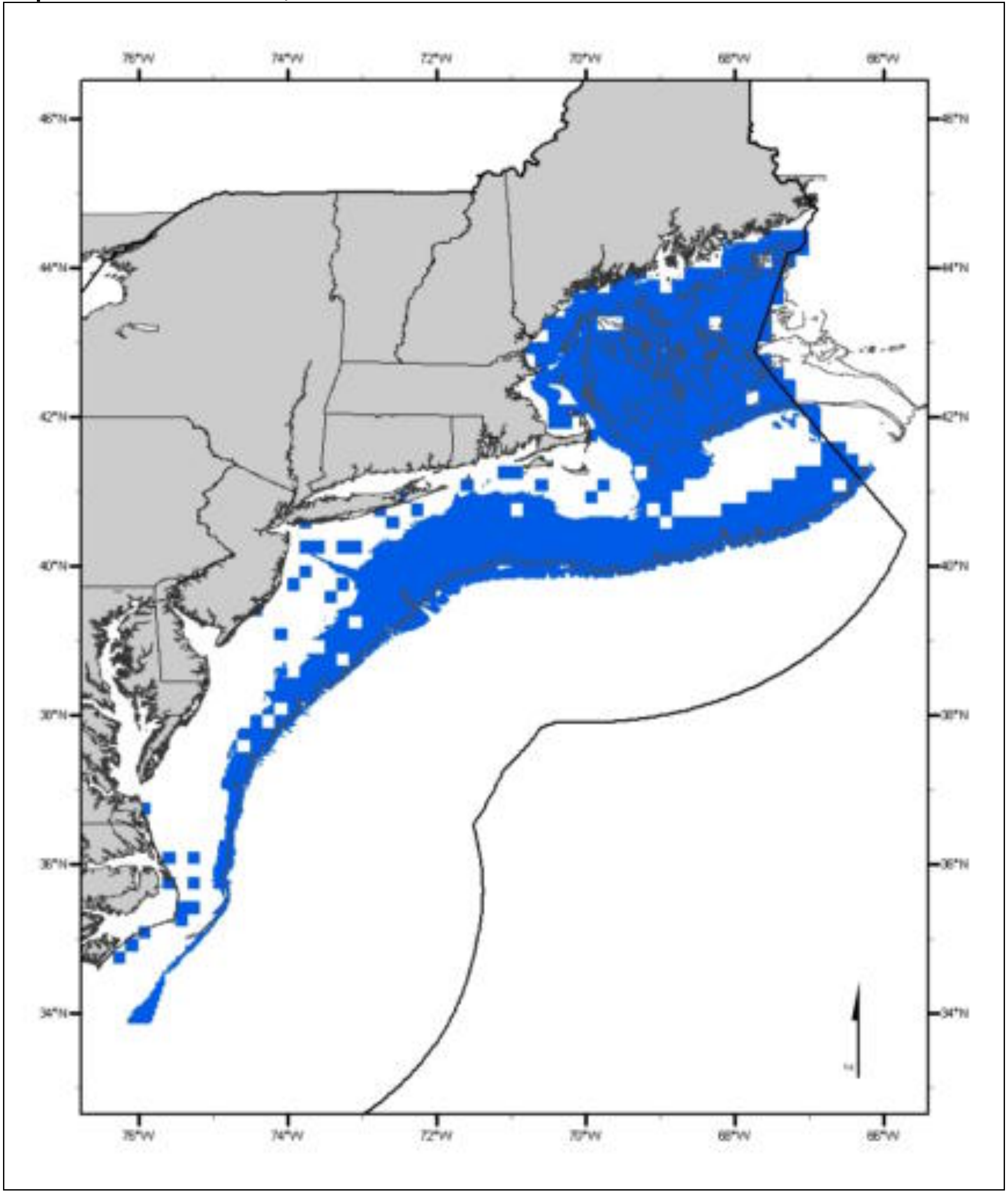
The Alternative 3B EFH designation for adult monkfish on the continental shelf is based on the distribution of depths and bottom temperatures that are associated with high catch rates of adults in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of adults in the 1968-2005 spring and fall NMFS trawl surveys at the 50% cumulative percentage of catch level and includes off-shelf areas where adult or adult monkfish were determined to be present, based on depth and geographic ranges.

Map 355. Monkfish adults, Alternative 3C *(Preferred Alternative)*



The Alternative 3C EFH designation for adult monkfish on the continental shelf is based on the distribution of depths and bottom temperatures that are associated with high catch rates of adults in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of adults in the 1968-2005 spring and fall NMFS trawl surveys at the 75% cumulative percentage of catch level and includes off-shelf areas where adult or adult monkfish were determined to be present, based on depth and geographic ranges.

Map 356. Monkfish adults, Alternative 3D



The Alternative 3D EFH designation for adult monkfish on the continental shelf is based on the distribution of depths and bottom temperatures that are associated with high catch rates of adults in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of adults in the 1968-2005 spring and fall NMFS trawl surveys at the 90% cumulative percentage of catch level and includes off-shelf areas where adult or adult monkfish were determined to be present, based on depth and geographic ranges.

4.1.3.2.11 Ocean Pout

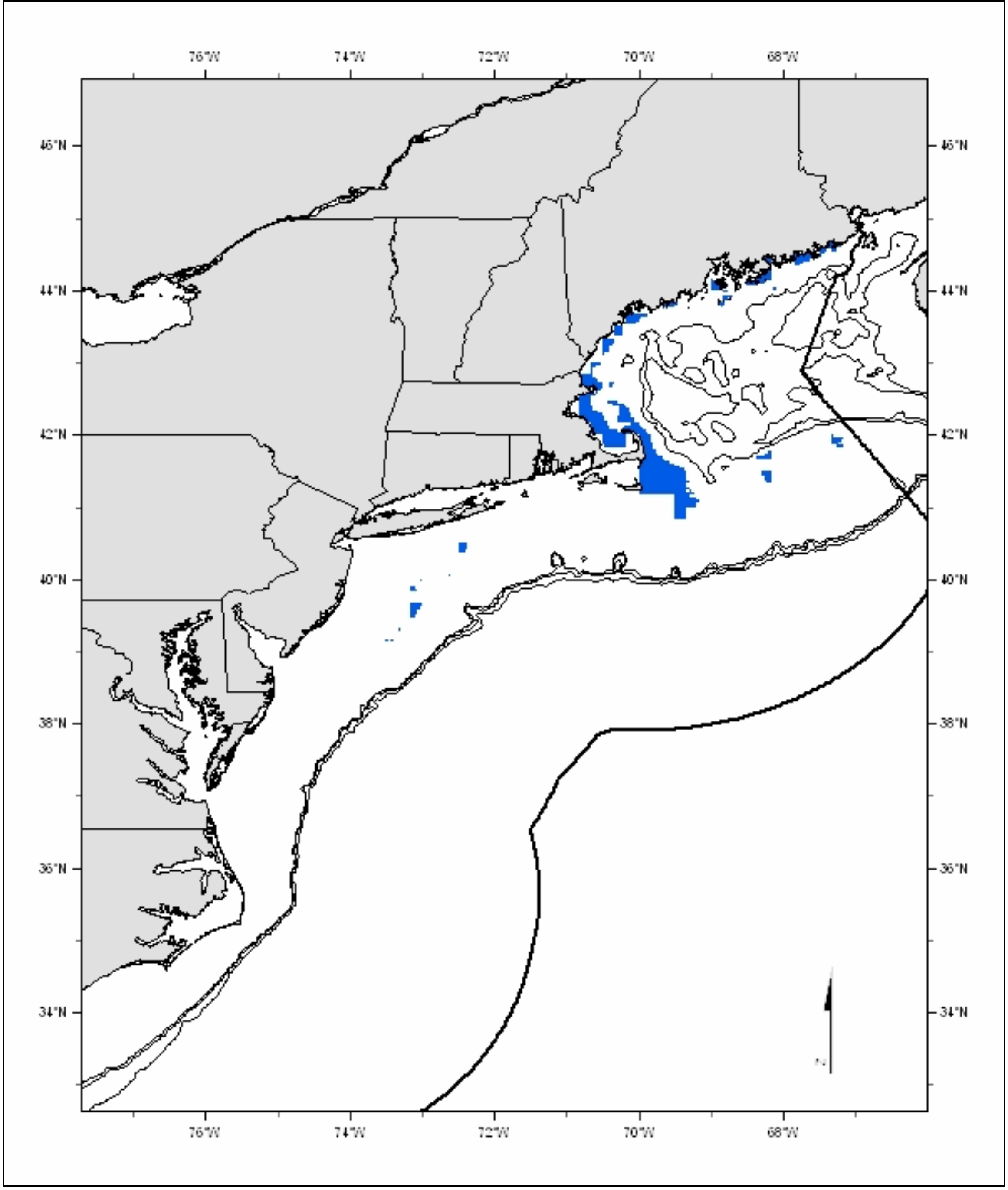
Eggs: Hard bottom benthic habitats in inshore and continental shelf waters as depicted on Map 357. The following conditions generally exist where EFH for ocean pout eggs is found: depths of less than 50 meters and bottom temperatures of 10ºC or less.

Larvae: No larval stage.

Juveniles: Inshore and continental shelf benthic habitats in depths of 1 – 70 meters, including the intertidal zone, on a variety of substrates, as depicted on Map 358 - Map 361. EFH for juvenile ocean pout is generally found on a wide variety of substrates, including shells, rocks, algae, sand, mud, mud and sand, and/or gravel. Other conditions that generally exist where EFH is found are bottom temperatures of 2.5 – 11.5ºC and salinities of 31.5 – 33.5 ppt. Juvenile ocean pout feed primarily on brittle stars, amphipods, polychaetes, and bivalve mollusks. *(Preferred Alternative)*

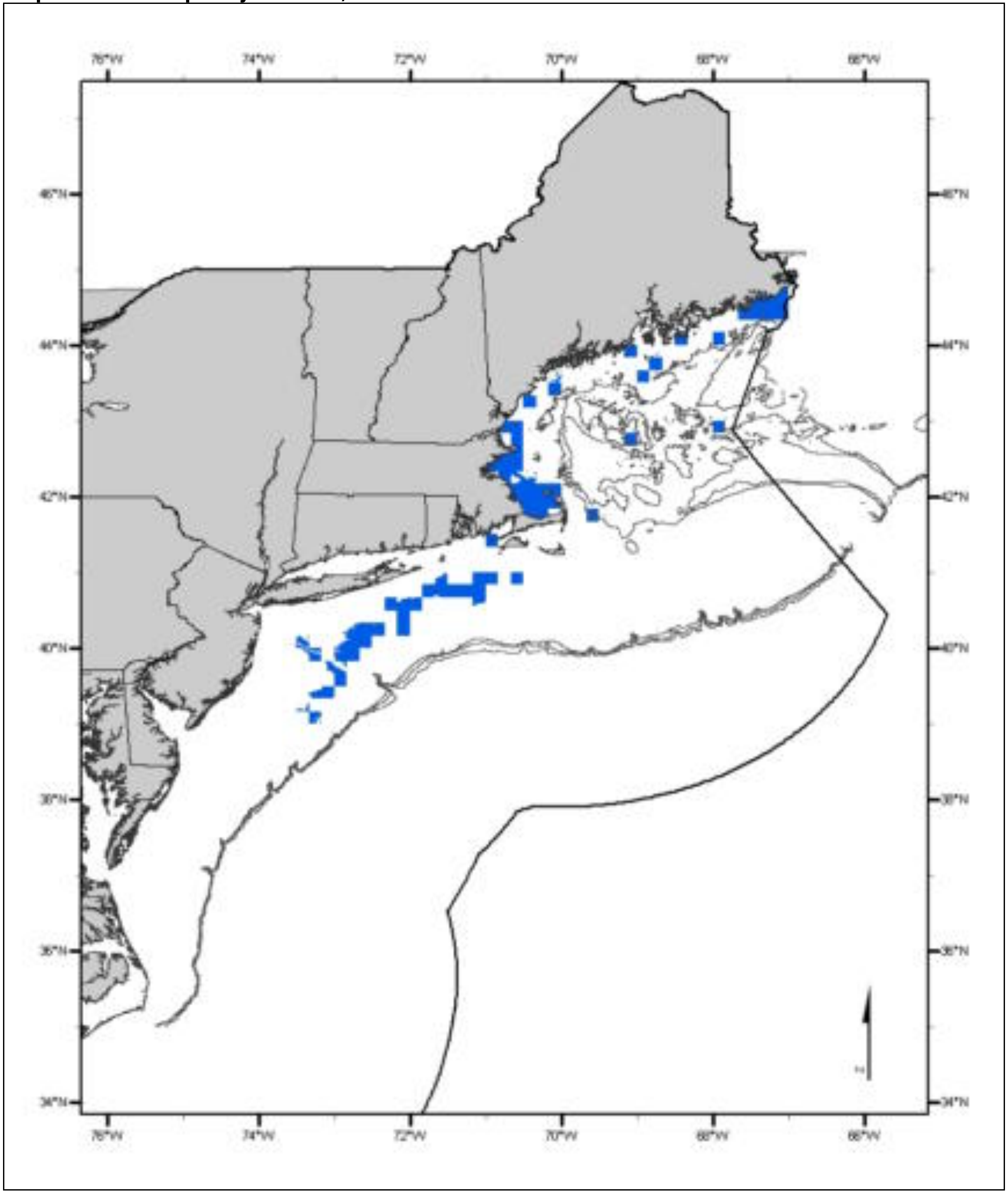
Adults: Inshore and continental shelf benthic habitats in depths of 25 – 100 meters on a variety of substrates, as depicted on Map 362 - Map 365. EFH for adult ocean pout is generally found on a wide variety of substrates, including shells, rocks, algae, sand, mud, mud and sand, and/or gravel. Other conditions that generally exist where EFH is found are bottom temperatures of 1.5 – 11.5ºC and salinities of 31.5 – 33.5 ppt. Ocean pout spawn on hard bottom in sheltered areas in depths less than 50 meters and bottom temperatures of 10ºC or less. Adults feed primarily on starfishes, crabs, bivalve mollusks, brittle stars, amphipods, and sand dollars. *(Preferred Alternative)*

Map 357. Ocean pout eggs, Alternative 3



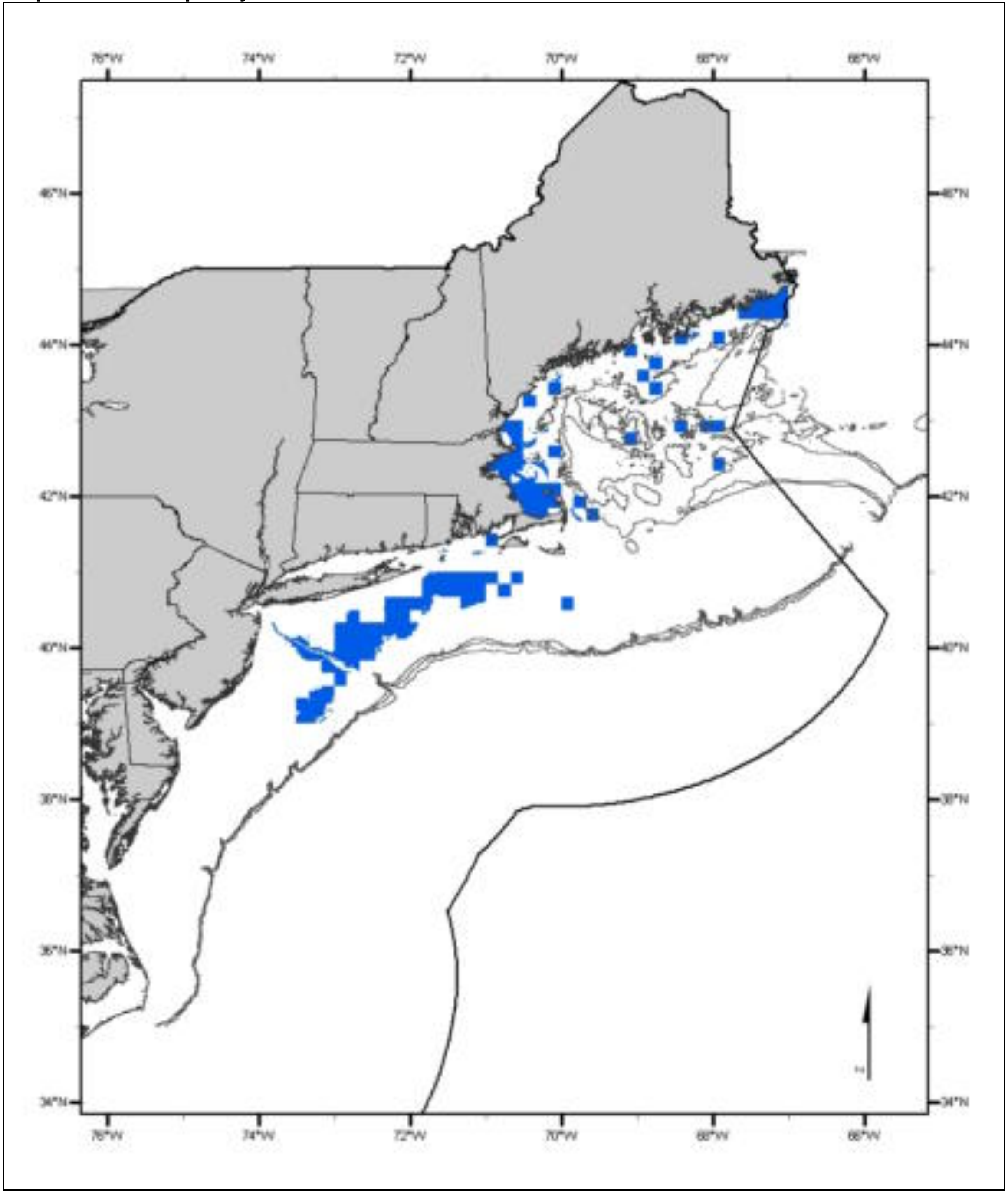
The Alternative 3 EFH designation for ocean pout eggs on the continental shelf is based on the depth and fall bottom temperature range for spawning adults that are reported in the EFH Source Document for this species.

Map 358. Ocean pout juveniles, Alternative 3A



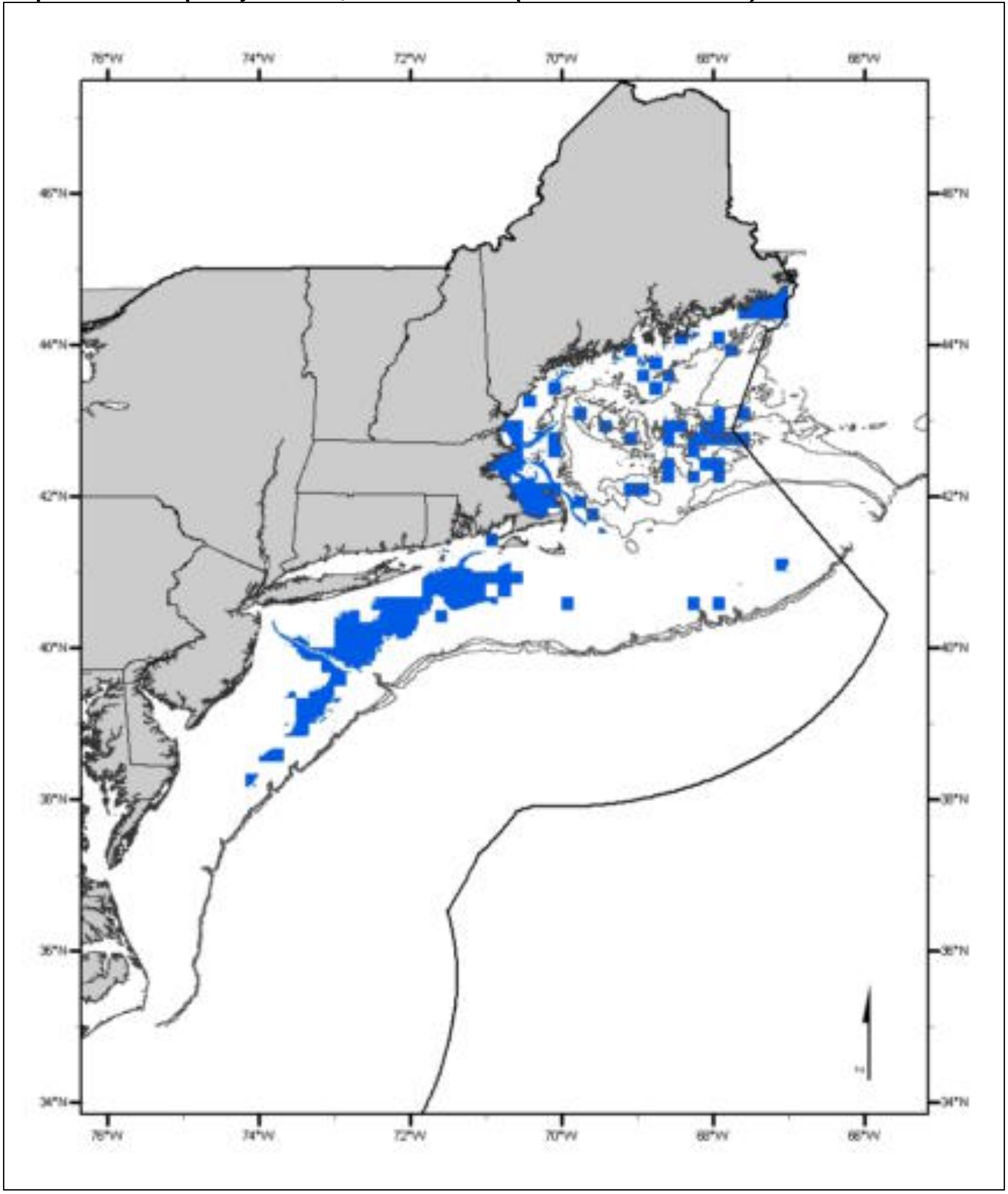
The Alternative 3A EFH designation for juvenile ocean pout on the continental shelf is based on the distribution of depths and bottom temperatures that are associated with high catch rates of juveniles in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of juveniles in the 1968-2005 spring and fall NMFS trawl surveys at the 25% cumulative percentage of catch level and includes inshore areas where juvenile ocean pout were determined to be present, based on 10% frequency of occurrence in state trawl surveys and ELMR information.

Map 359. Ocean pout juveniles, Alternative 3B



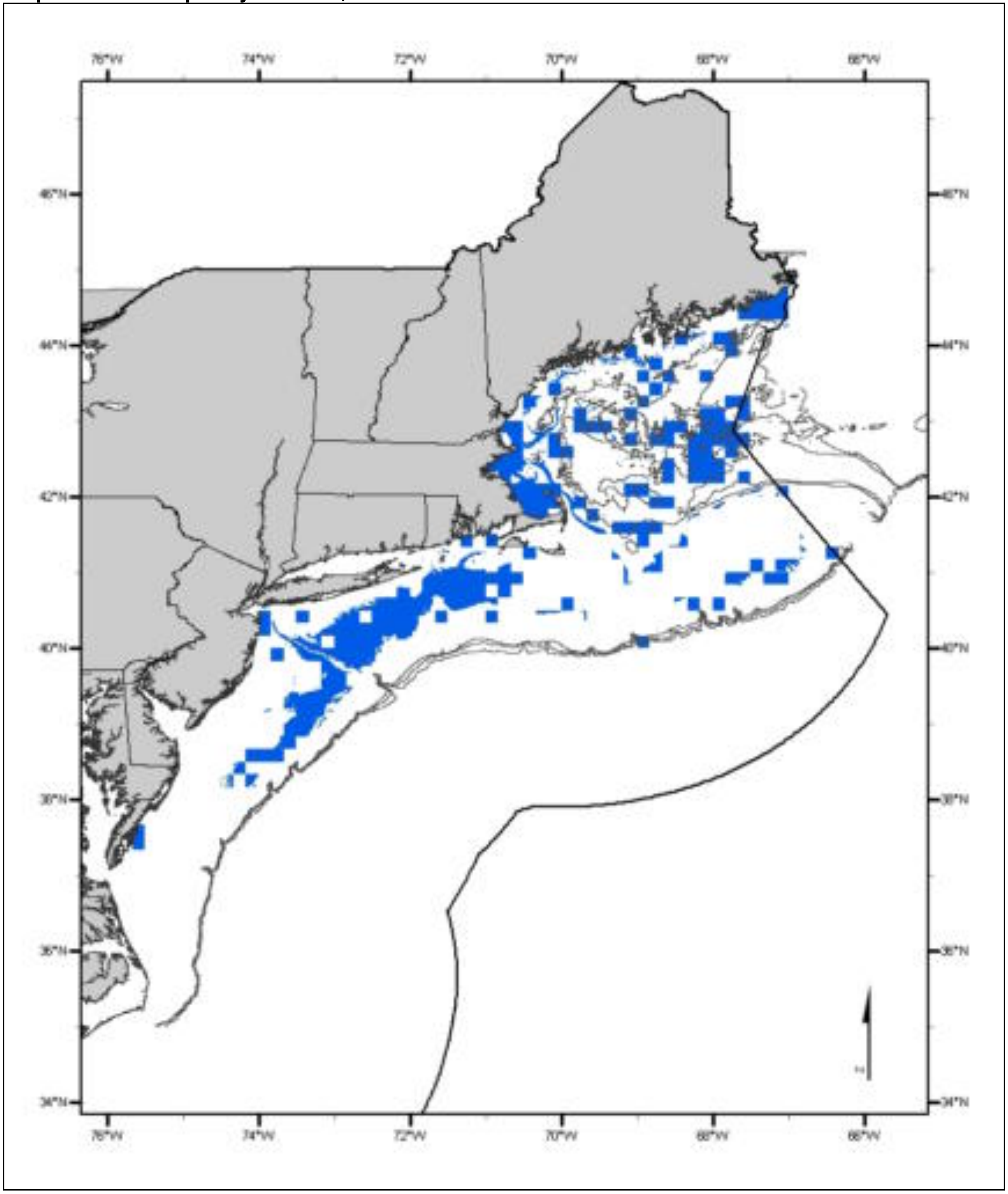
The Alternative 3B EFH designation for juvenile ocean pout on the continental shelf is based on the distribution of depths and bottom temperatures that are associated with high catch rates of juveniles in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of juveniles in the 1968-2005 spring and fall NMFS trawl surveys at the 50% cumulative percentage of catch level and includes inshore areas where juvenile ocean pout were determined to be present, based on 10% frequency of occurrence in state trawl surveys and ELMR information.

Map 360. Ocean pout juveniles, Alternative 3C *(Preferred Alternative)*



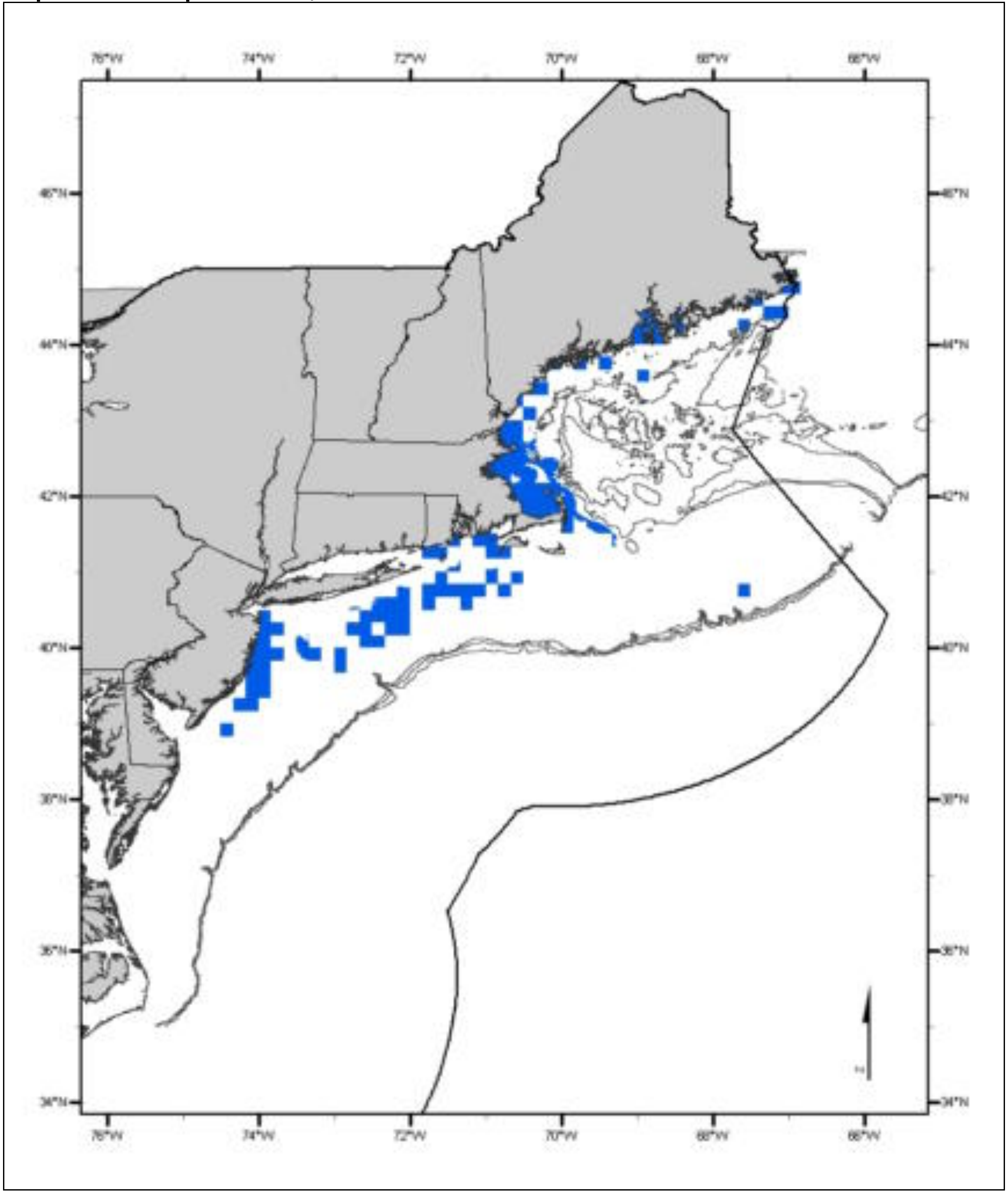
The Alternative 3C EFH designation for juvenile ocean pout on the continental shelf is based on the distribution of depths and bottom temperatures that are associated with high catch rates of juveniles in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of juveniles in the 1968-2005 spring and fall NMFS trawl surveys at the 75% cumulative percentage of catch level and includes inshore areas where juvenile ocean pout were determined to be present, based on 10% frequency of occurrence in state trawl surveys and ELMR information.

Map 361. Ocean pout juveniles, Alternative 3D



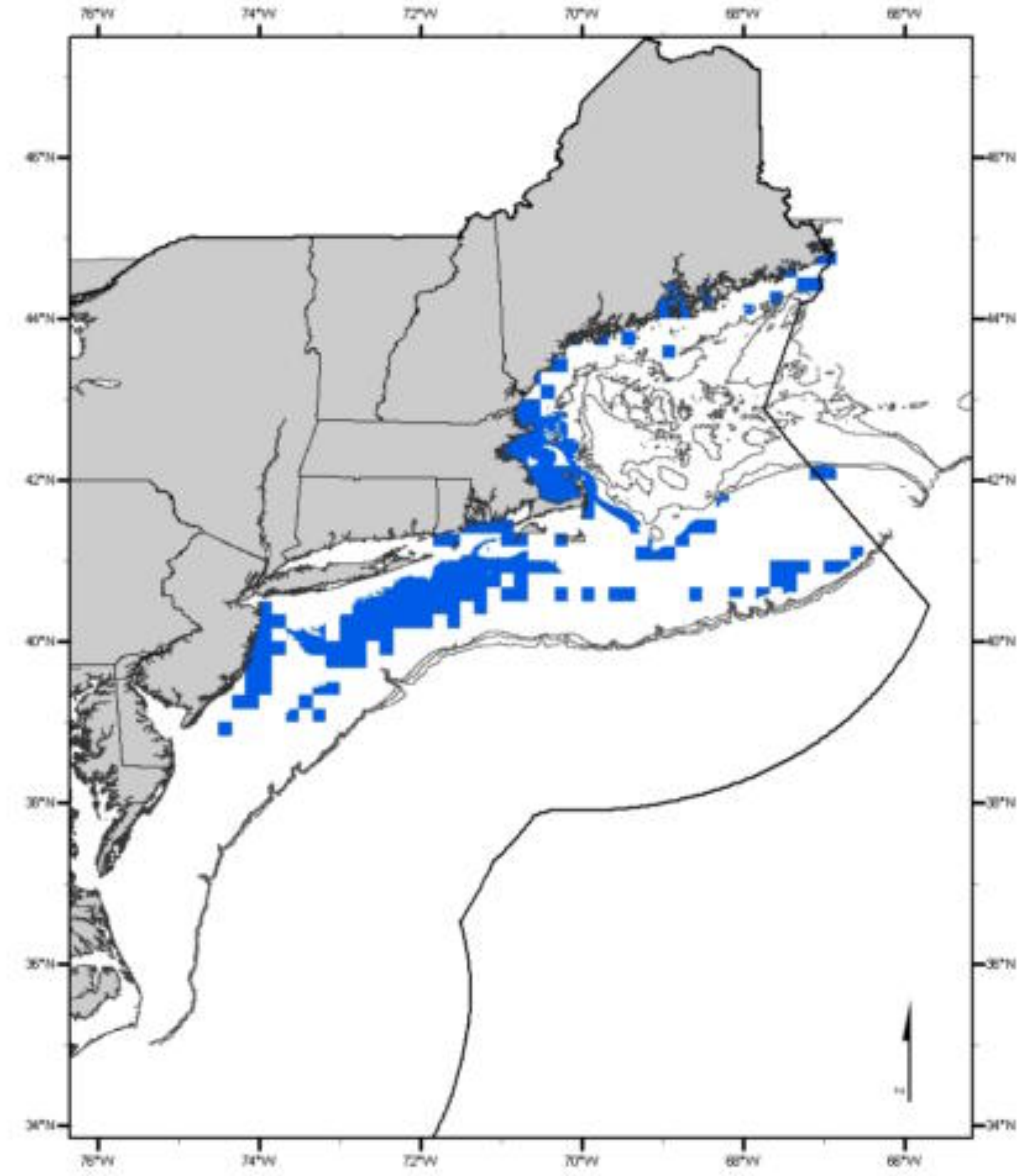
The Alternative 3D EFH designation for juvenile ocean pout on the continental shelf is based on the distribution of depths and bottom temperatures that are associated with high catch rates of juveniles in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of juveniles in the 1968-2005 spring and fall NMFS trawl surveys at the 90% cumulative percentage of catch level and includes inshore areas where juvenile ocean pout were determined to be present, based on 10% frequency of occurrence in state trawl surveys and ELMR information.

Map 362. Ocean pout adults, Alternative 3A



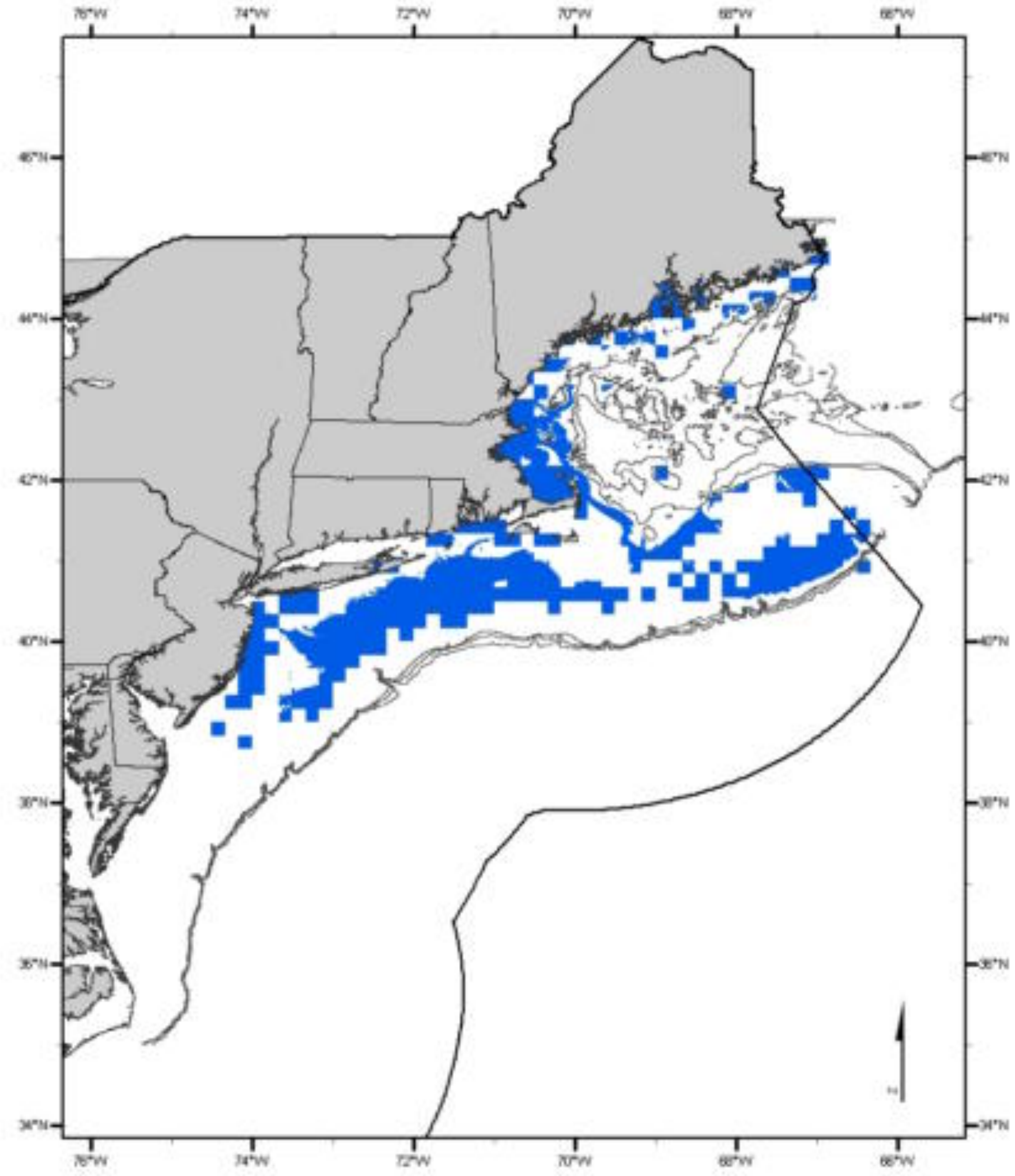
The Alternative 3A EFH designation for adult ocean pout on the continental shelf is based on the distribution of depths and bottom temperatures that are associated with high catch rates of adults in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of adults in the 1968-2005 spring and fall NMFS trawl surveys at the 25% cumulative percentage of catch level and includes inshore areas where adult ocean pout were determined to be present, based on 10% frequency of occurrence in state trawl surveys and ELMR information.

Map 363. Ocean pout adults, Alternative 3B



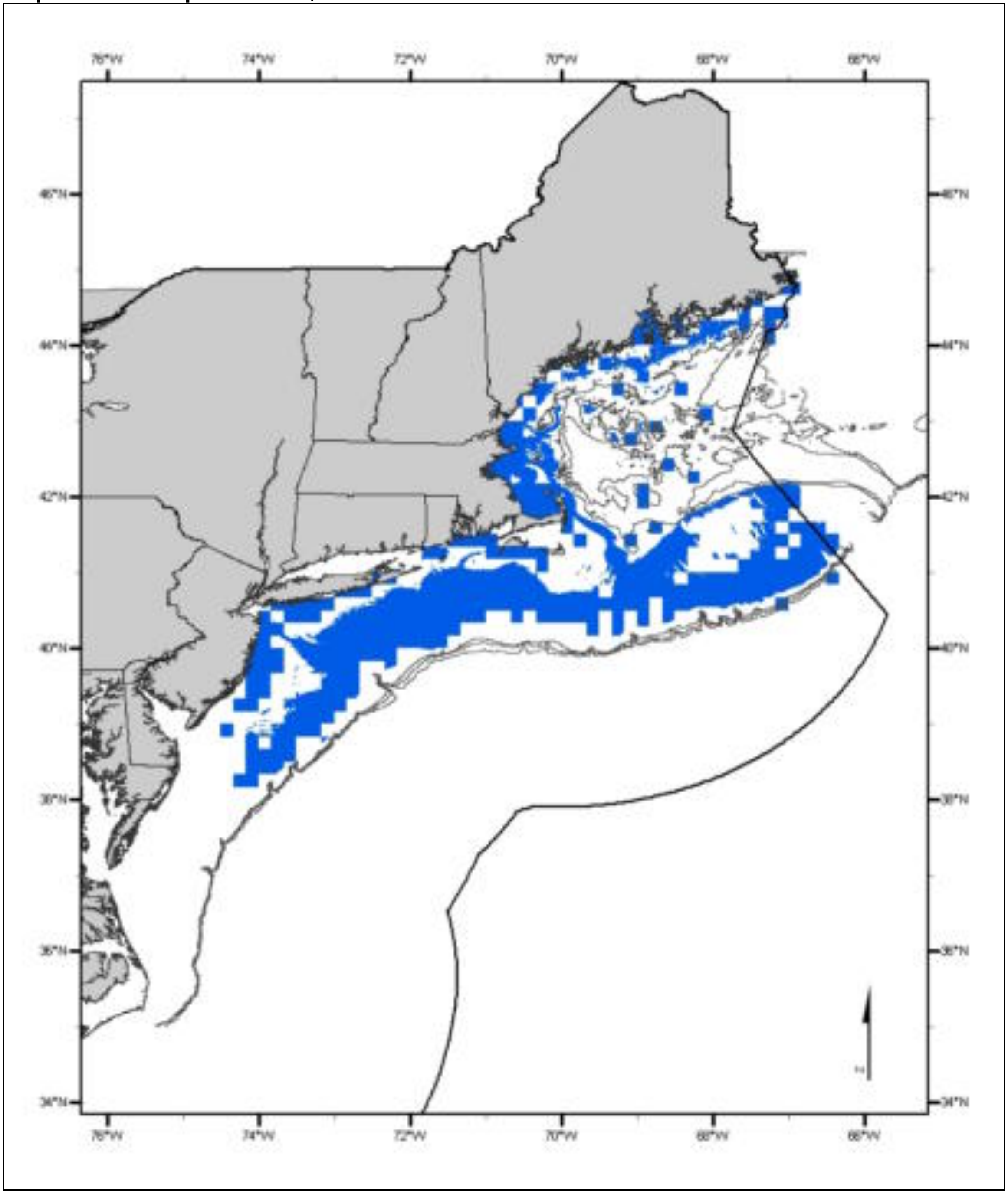
The Alternative 3B EFH designation for adult ocean pout on the continental shelf is based on the distribution of depths and bottom temperatures that are associated with high catch rates of adults in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of adults in the 1968-2005 spring and fall NMFS trawl surveys at the 50% cumulative percentage of catch level and includes inshore areas where adult ocean pout were determined to be present, based on 10% frequency of occurrence in state trawl surveys and ELMR information.

Map 364. Ocean pout adults, Alternative 3C *(Preferred Alternative)*



The Alternative 3C EFH designation for adult ocean pout on the continental shelf is based on the distribution of depths and bottom temperatures that are associated with high catch rates of adults in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of adults in the 1968-2005 spring and fall NMFS trawl surveys at the 75% cumulative percentage of catch level and includes inshore areas where adult ocean pout were determined to be present, based on 10% frequency of occurrence in state trawl surveys and ELMR information.

Map 365. Ocean pout adults, Alternative 3D



The Alternative 3D EFH designation for adult ocean pout on the continental shelf is based on the distribution of depths and bottom temperatures that are associated with high catch rates of adults in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of adults in the 1968-2005 spring and fall NMFS trawl surveys at the 90% cumulative percentage of catch level and includes inshore areas where adult ocean pout were determined to be present, based on 10% frequency of occurrence in state trawl surveys and ELMR information.

4.1.3.2.12 Offshore Hake

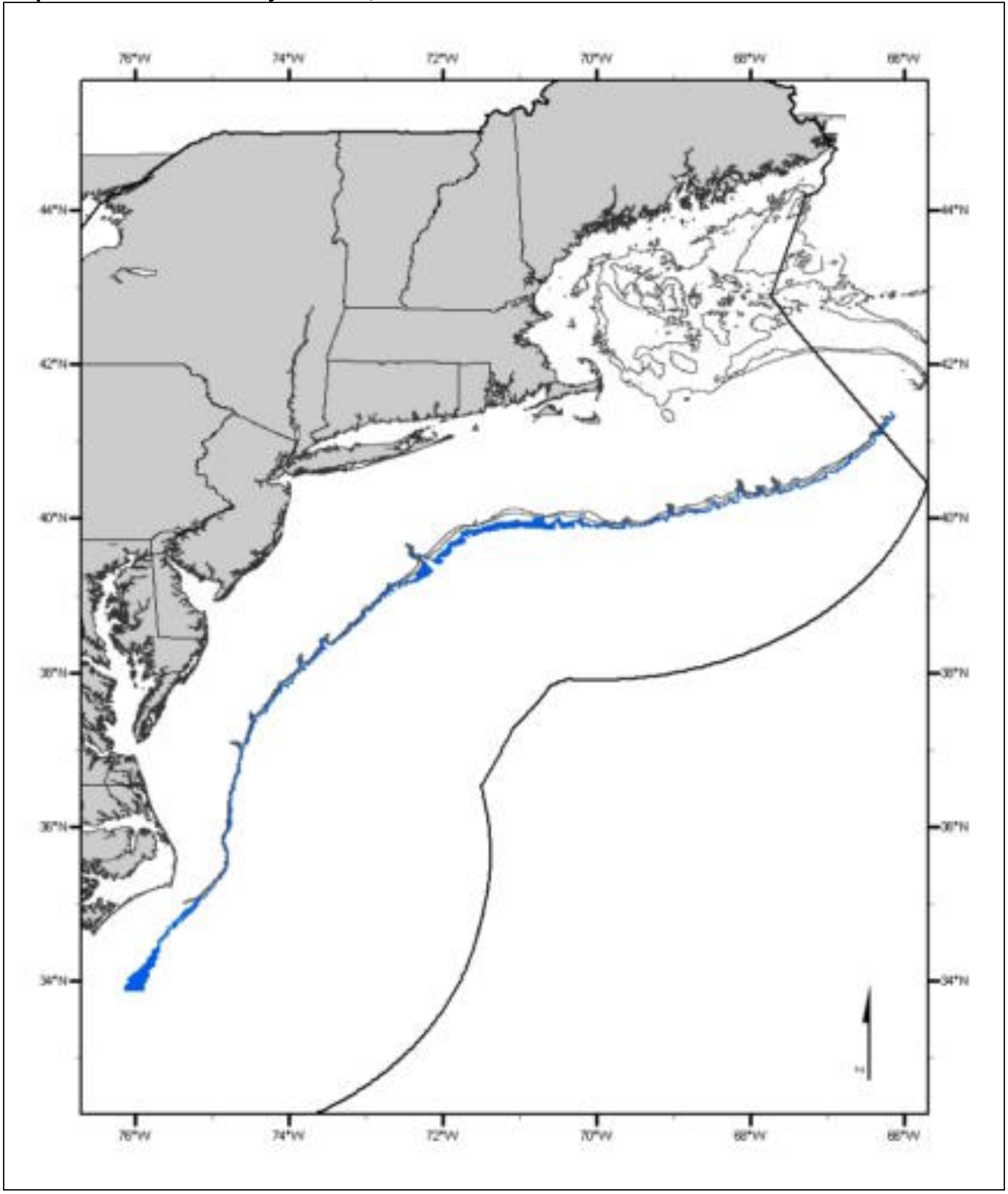
Eggs: No alternative EFH designation.

Larvae: No alternative EFH designation.

Juveniles: Pelagic and benthic habitats on the outer continental shelf and slope in depths of 200 – 750 meters with mud and sand substrates, as depicted on Map 366 - Map 369. Other conditions that generally exist where benthic EFH for juvenile offshore hake is found are bottom water temperatures of 8.5 – 12.5°C and salinities of 34.5 – 36.5 ppt. Juvenile offshore hake migrate off the bottom at night and feed primarily on small fishes, euphausiids, and pandalid and pelagic shrimps. *(Preferred Alternative)*

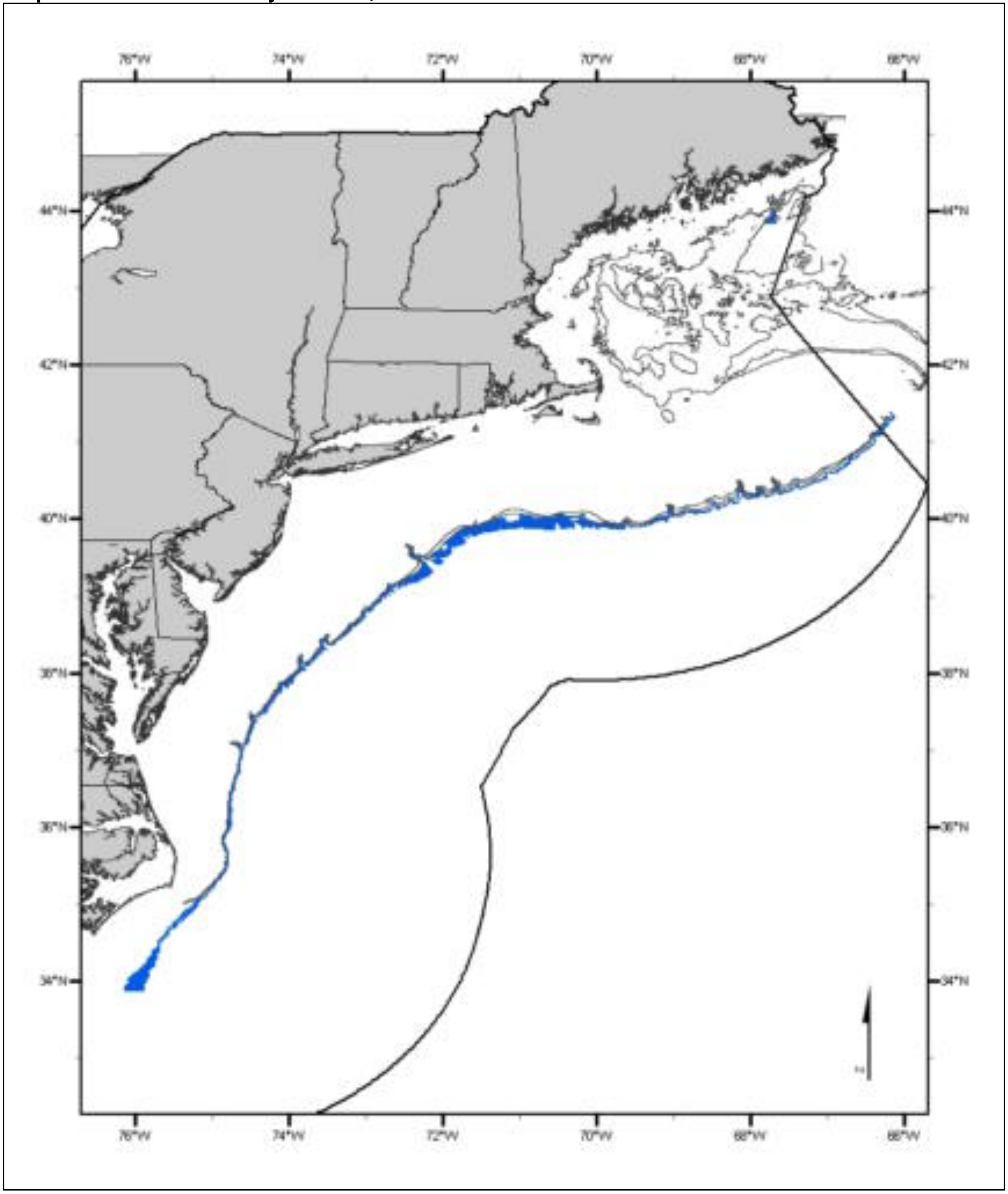
Adults: Pelagic and benthic habitats on the outer continental shelf and slope in depths of 200 – 750 meters with mud and sand substrates, as depicted on Map 370. The following conditions generally exist where benthic EFH for adult offshore hake is found: bottom water temperatures of 6.5 – 12.5°C and salinities of 34.5 – 36.5 ppt. Spawning generally occurs between 330 and 550 meters. Adult offshore hake migrate off the bottom at night and feed primarily on fishes such as gadids, hakes (especially silver hake) and other pelagic species, squids, and euphausiids. *(Preferred Alternative)*

Map 366. Offshore hake juveniles, Alternative 3A



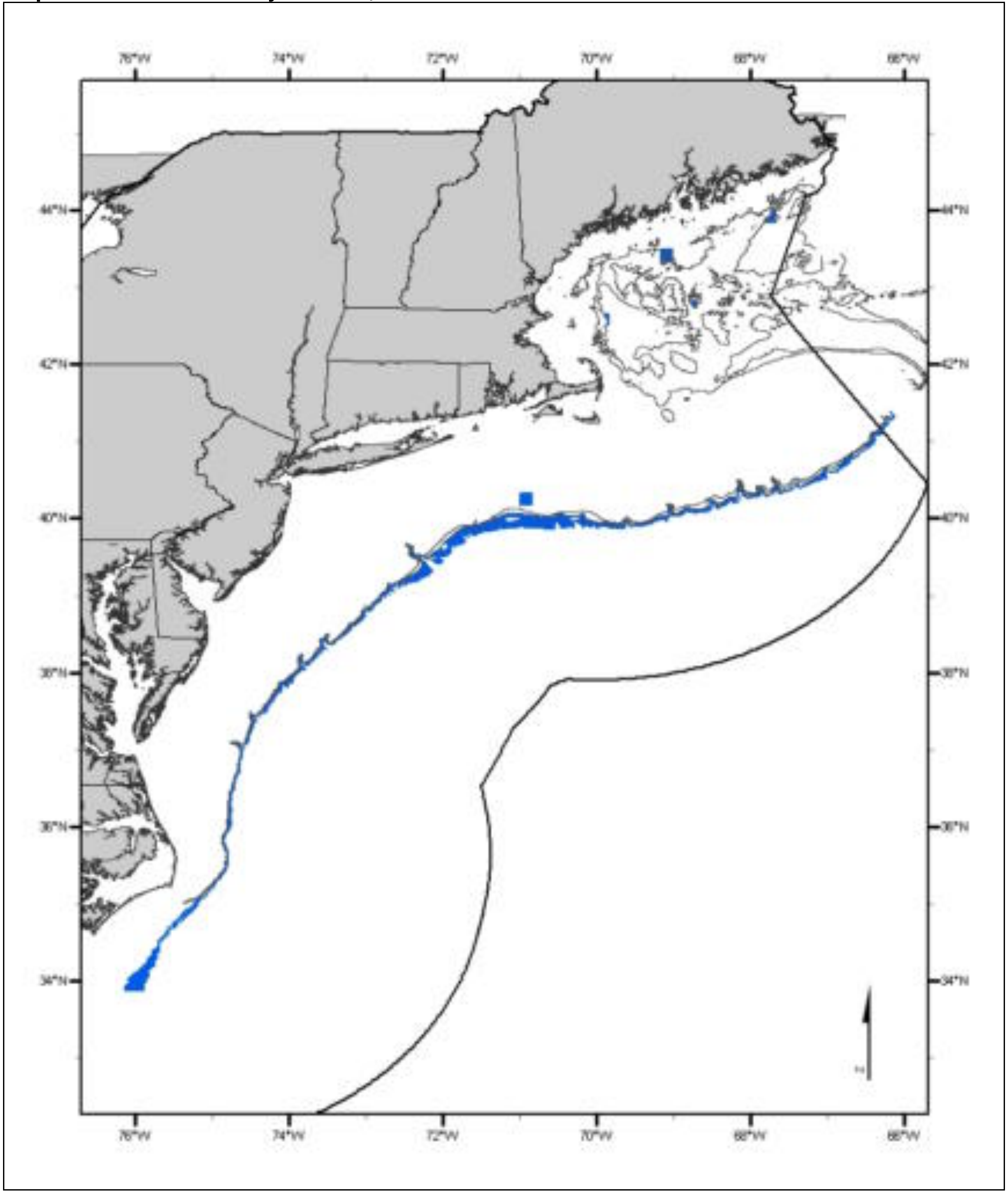
The Alternative 3A EFH designation for juvenile offshore hake on the continental shelf and slope is based on the distribution of depths and bottom temperatures that are associated with high catch rates of juveniles in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species.

Map 367. Offshore hake juveniles, Alternative 3B



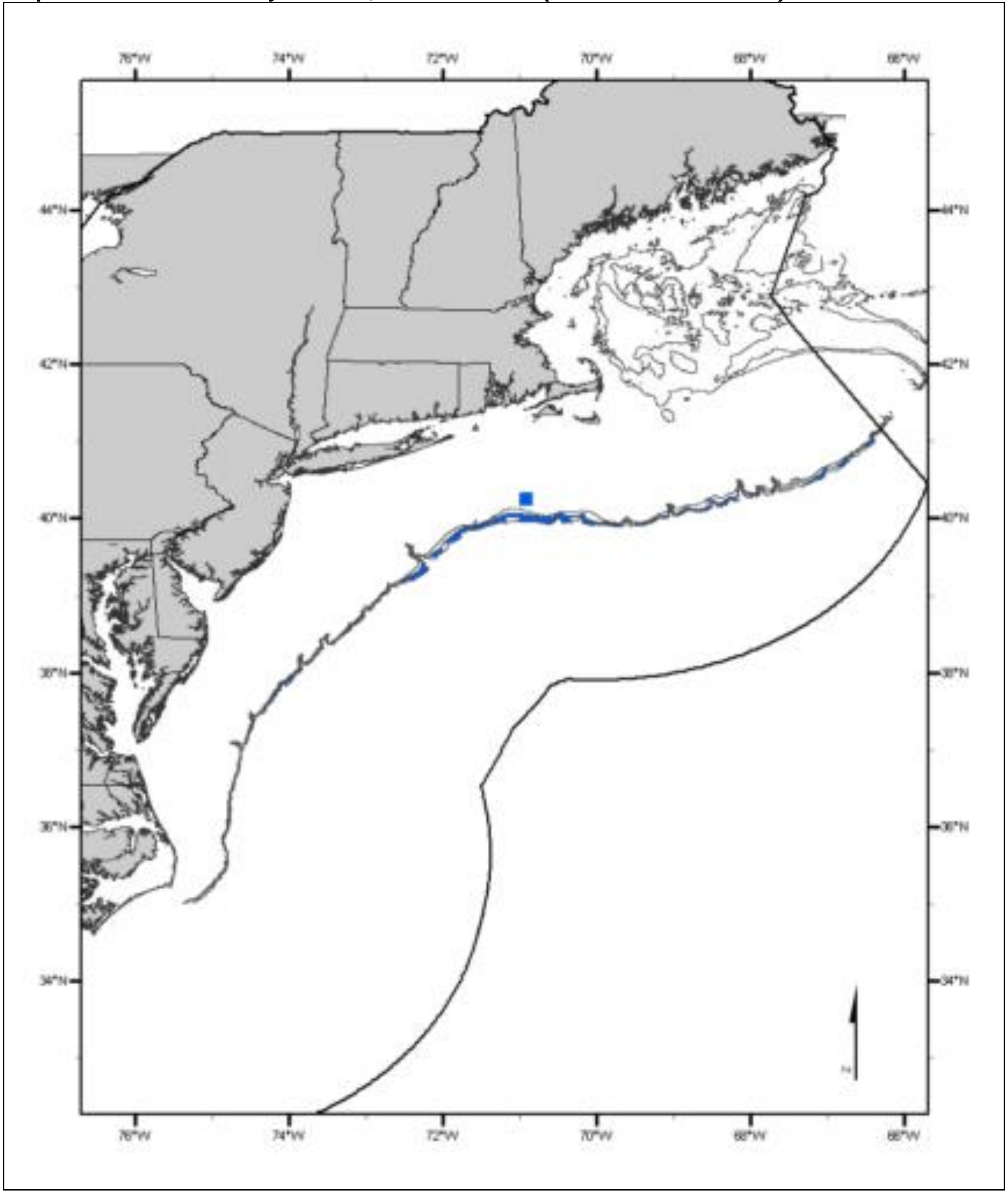
The Alternative 3B EFH designation for juvenile offshore hake on the continental shelf and slope is based on the distribution of depths and bottom temperatures that are associated with high catch rates of juveniles in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species. In addition, it includes a small area in the Gulf of Maine where the abundance of juveniles in the 1968-2005 spring and fall NMFS trawl surveys reached the *<u>75%</u>* *cumulative percentage of catch level and which falls within the designated depth range.*

Map 368. Offshore hake juveniles, Alternative 3C



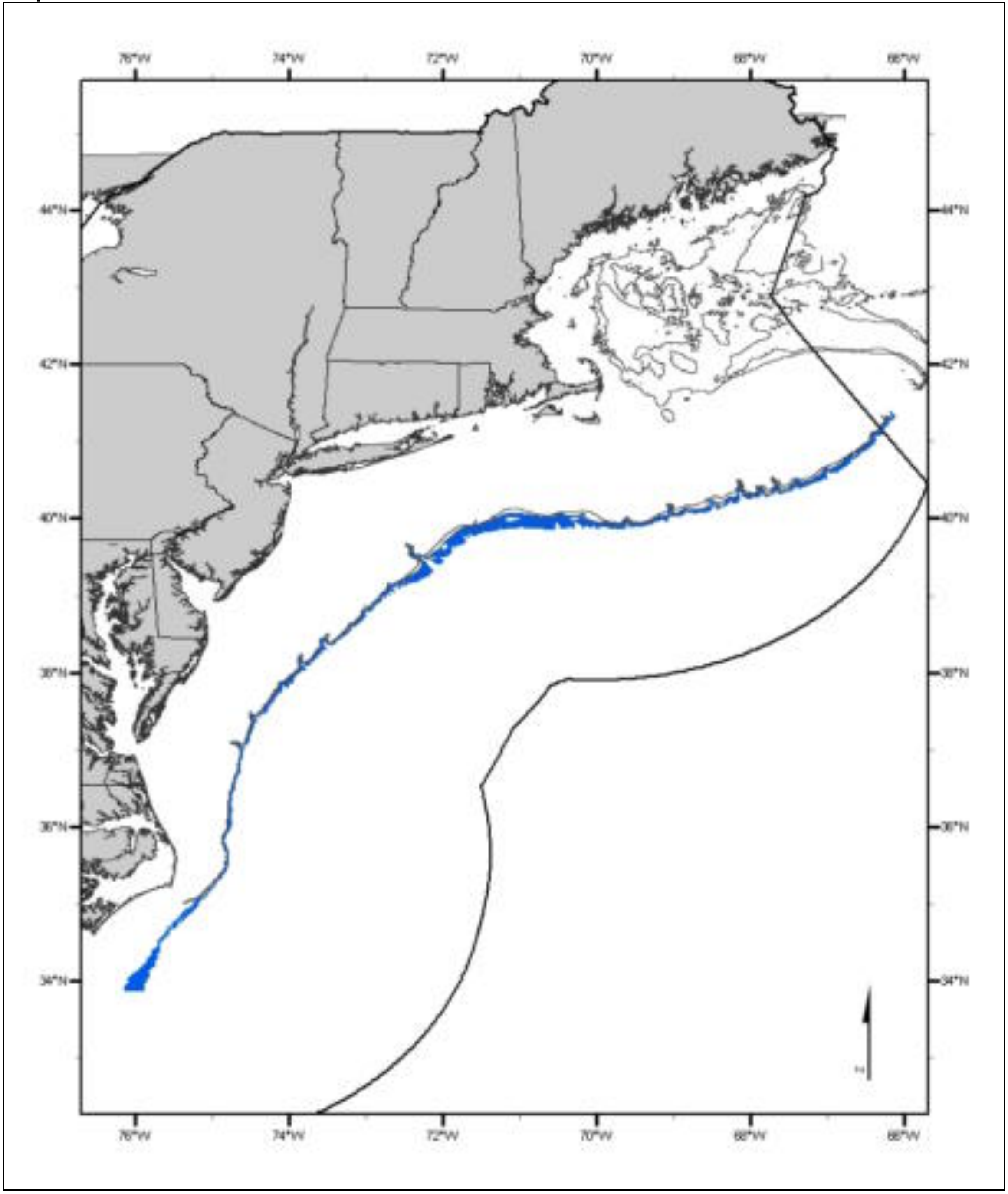
The Alternative 3C EFH designation for juvenile offshore hake on the continental shelf and slope is based on the distribution of depths and bottom temperatures that are associated with high catch rates of juveniles in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species. In addition, it includes a few areas in the Gulf of Maine and on the outer continental shelf where the abundance of juveniles in the 1968-2005 spring and fall NMFS trawl surveys reached the <u>*90%*</u> *cumulative percentage of catch level and which fall within the designated depth range.*

Map 369. Offshore hake juveniles, Alternative 3D *(Preferred Alternative)*



The Alternative 3D EFH designation for juvenile offshore hake on the continental shelf and slope is based on the distribution of depths and bottom temperatures that are associated with high catch rates of juveniles in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species. It is identical to the 3C juvenile offshore hake designation alternative, except that areas in the Gulf of Maine where the abundance of juveniles in the 1968-2005 spring and fall NMFS trawl surveys reached the 90% cumulative percentage of catch level and which fall within the designated depth range have been removed.

Map 370. Offshore hake adults, Alternative 3



The Alternative 3 EFH designation for juvenile offshore hake on the continental shelf and slope is based on the distribution of depths and bottom temperatures that are associated with high catch rates of juveniles in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species.

4.1.3.2.13 Pollock

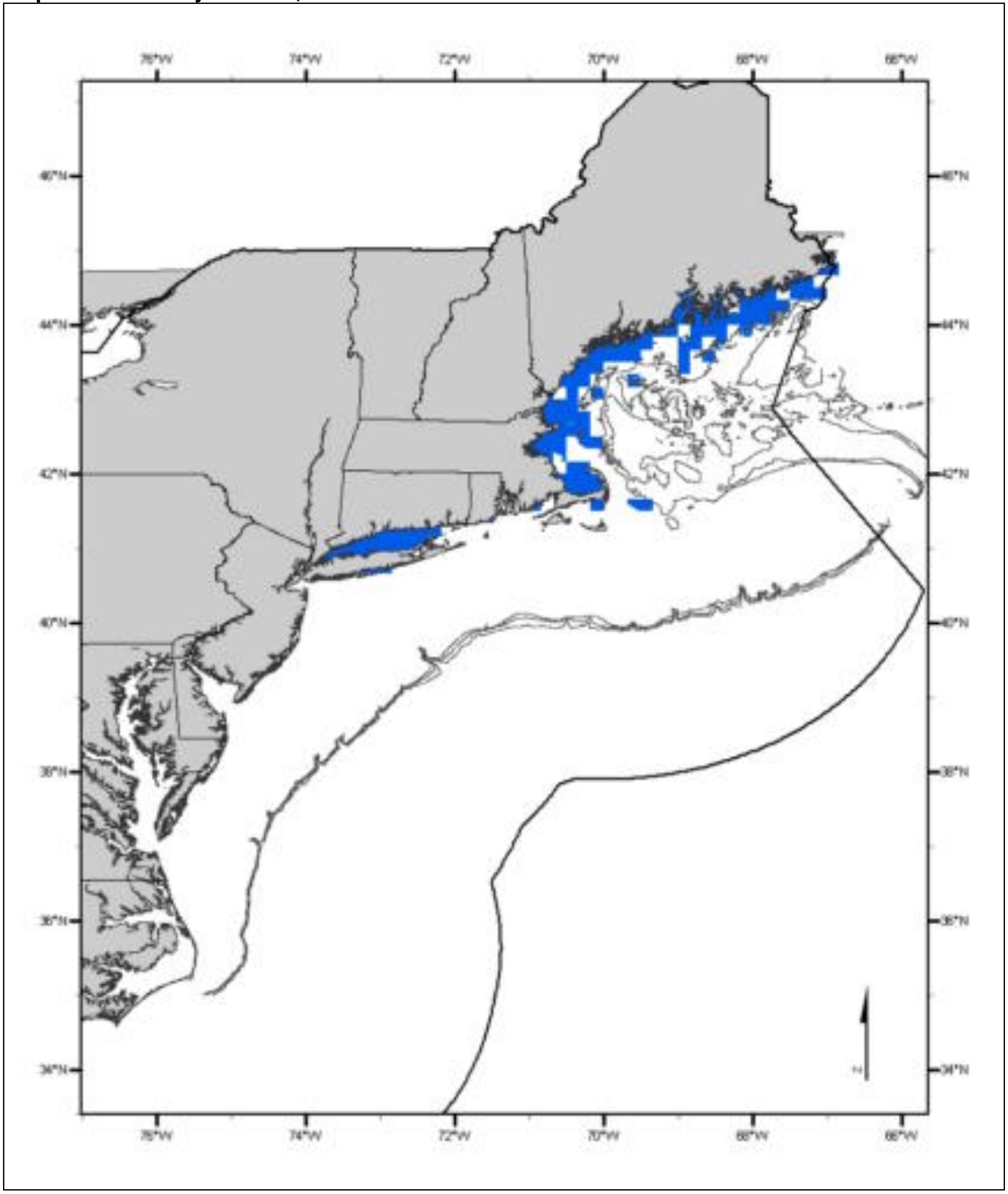
Eggs: No alternative EFH designation.

Larvae: No alternative EFH designation.

Juveniles: Pelagic and benthic inshore and continental shelf habitats in depths of 1 – 180 meters with a wide variety of substrates as depicted on Map 371 - Map 374. Benthic EFH for juvenile pollock includes mud, sand, sand and mud, gravel, and rocky bottom with eelgrass and macroalgae. Other conditions that generally exist where benthic EFH is found are bottom temperatures of 2.5 – 12ºC, and, on the shelf, salinities between 31.5 and 34.5 ppt. EFH for juvenile pollock includes the intertidal zone. Juvenile pollock feed primarily on chaetognaths, amphipods, euphausiids, fishes (*e.g.*, herring), and squids. *(Preferred Alternative)*

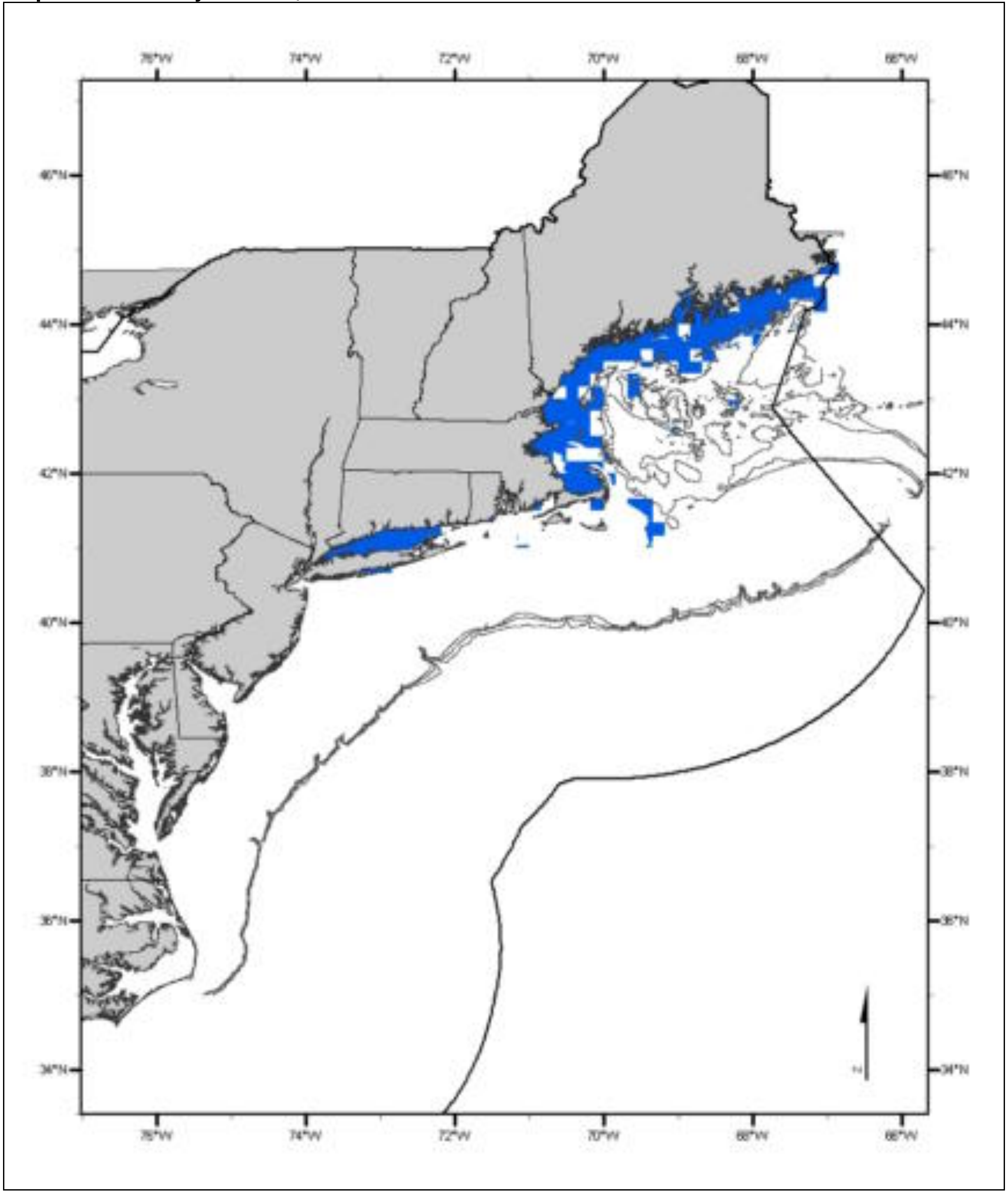
Adults: Pelagic and benthic continental shelf habitats in depths of 80 – 180 meters with a wide variety of substrates as depicted on Map 375 - Map 378. Benthic EFH for adult pollock includes mud, sand, sand and mud, gravel, mud and sand mixed with gravel, and rocky bottom. Other conditions that generally exist where benthic EFH is found are bottom water temperatures of 5.5 – 9.5ºC and salinities of 32.5 – 35.5 ppt. Pollock spawn over hard, stony or rocky bottom. Adult pollock feed primarily on euphausiids, fishes (e.g., herring, sand lance, and silver hake), and squids. *(Preferred Alternative)*

Map 371. Pollock juveniles, Alternative 3A



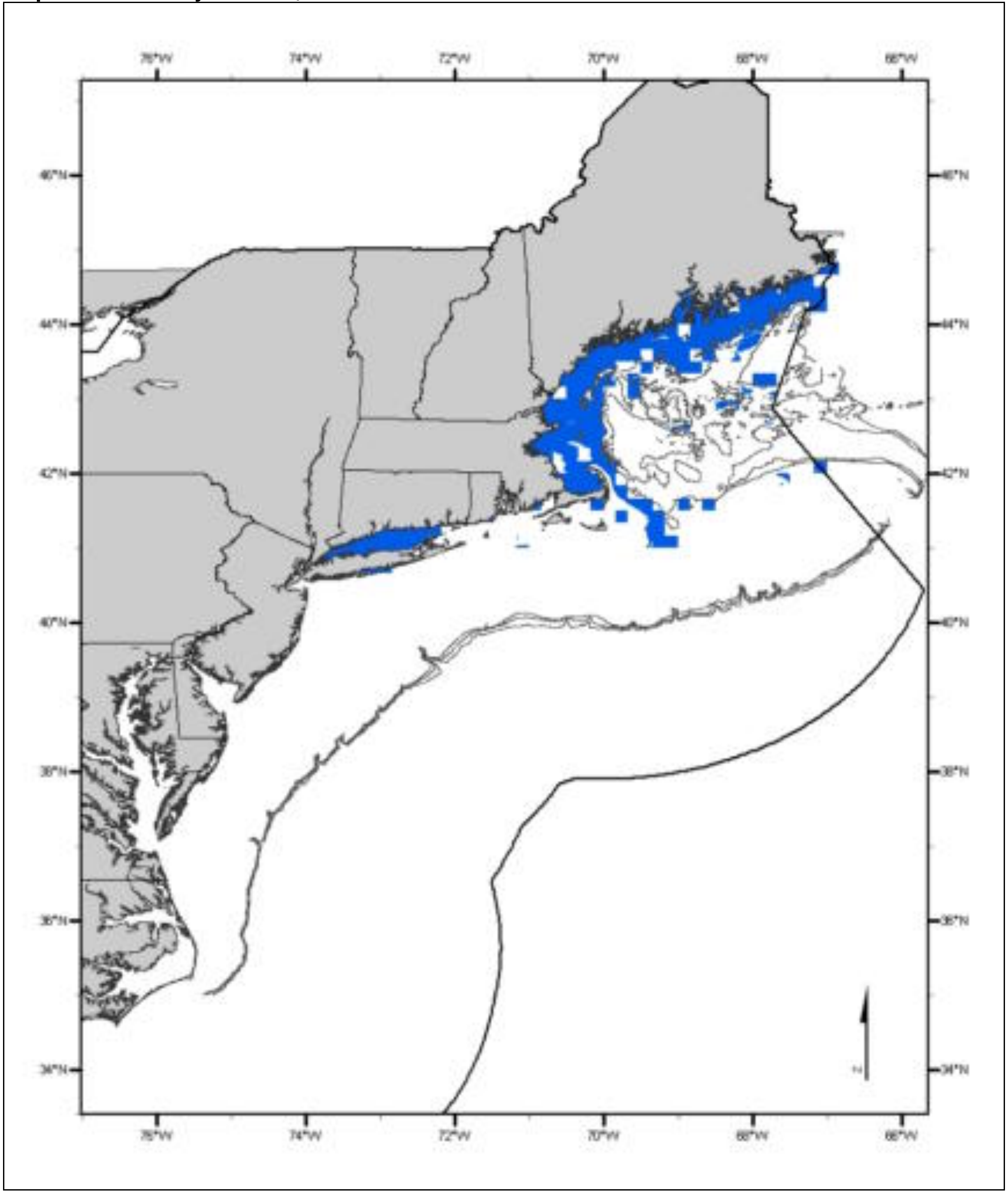
The Alternative 3A EFH designation for juvenile pollock on the continental shelf is based on the distribution of depths and bottom temperatures that are associated with high catch rates of juveniles in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of juveniles in the 1968-2005 spring and fall NMFS trawl surveys at the 25% cumulative percentage of catch level and includes inshore areas where juvenile pollock were determined to be present, based on 10% frequency of occurrence in state trawl surveys and ELMR information.

Map 372. Pollock juveniles, Alternative 3B



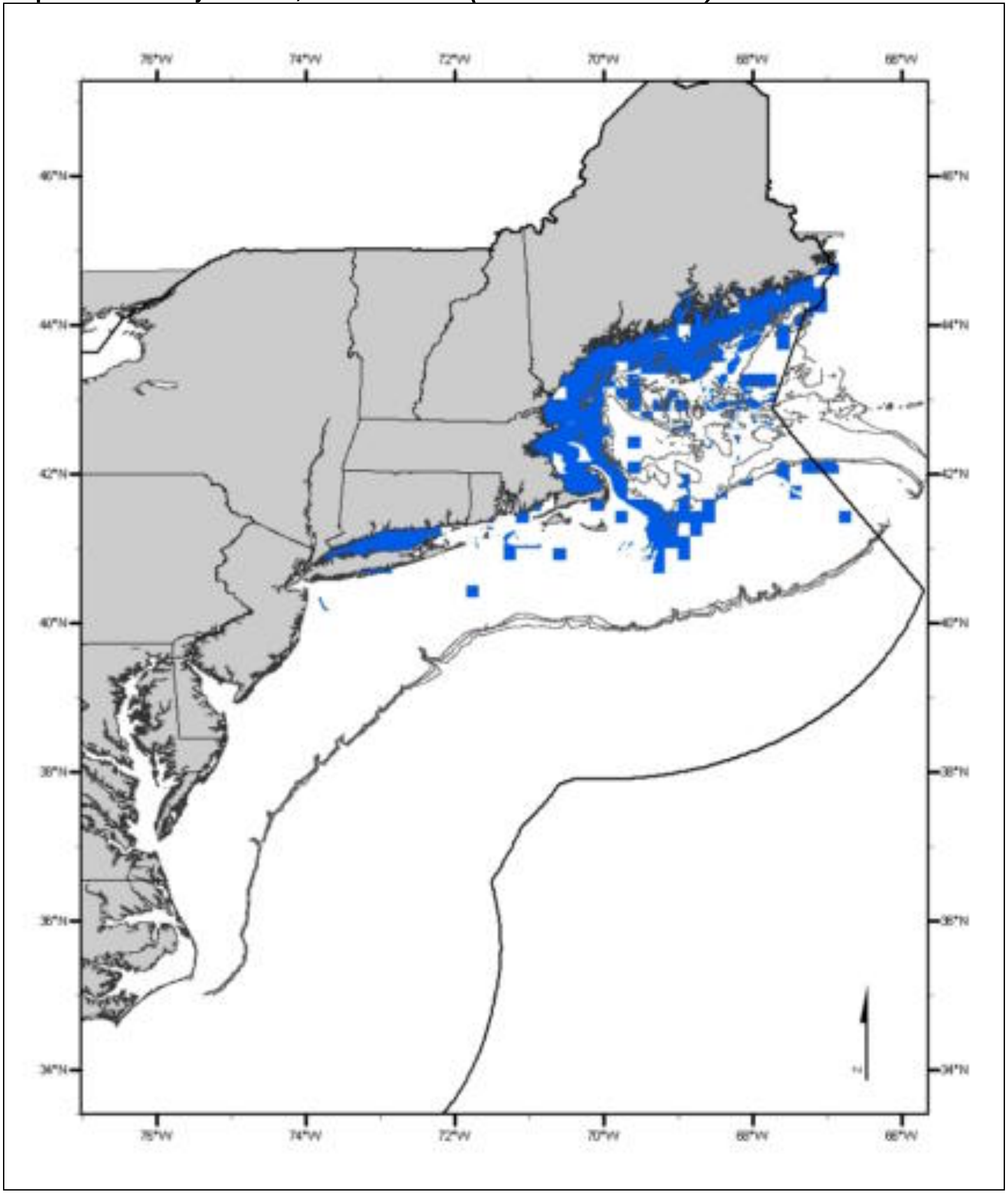
The Alternative 3B EFH designation for juvenile pollock on the continental shelf is based on the distribution of depths and bottom temperatures that are associated with high catch rates of juveniles in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of juveniles in the 1968-2005 spring and fall NMFS trawl surveys at the 50% cumulative percentage of catch level and includes inshore areas where juvenile pollock were determined to be present, based on 10% frequency of occurrence in state trawl surveys and ELMR information.

Map 373. Pollock juveniles, Alternative 3C



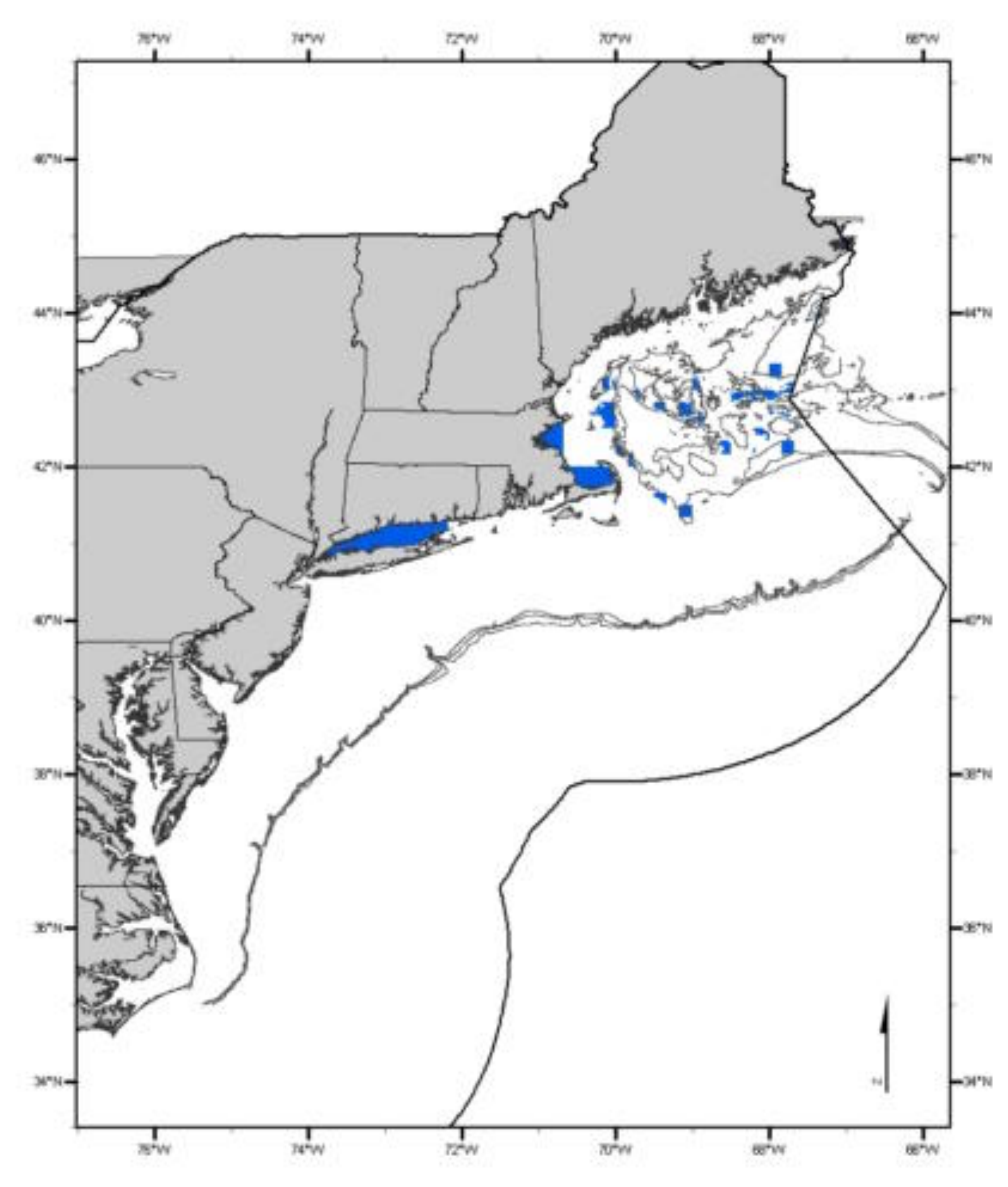
The Alternative 3C EFH designation for juvenile pollock on the continental shelf is based on the distribution of depths and bottom temperatures that are associated with high catch rates of juveniles in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of juveniles in the 1968-2005 spring and fall NMFS trawl surveys at the 75% cumulative percentage of catch level and includes inshore areas where juvenile pollock were determined to be present, based on 10% frequency of occurrence in state trawl surveys and ELMR information.

Map 374. Pollock juveniles, Alternative 3D *(Preferred Alternative)*



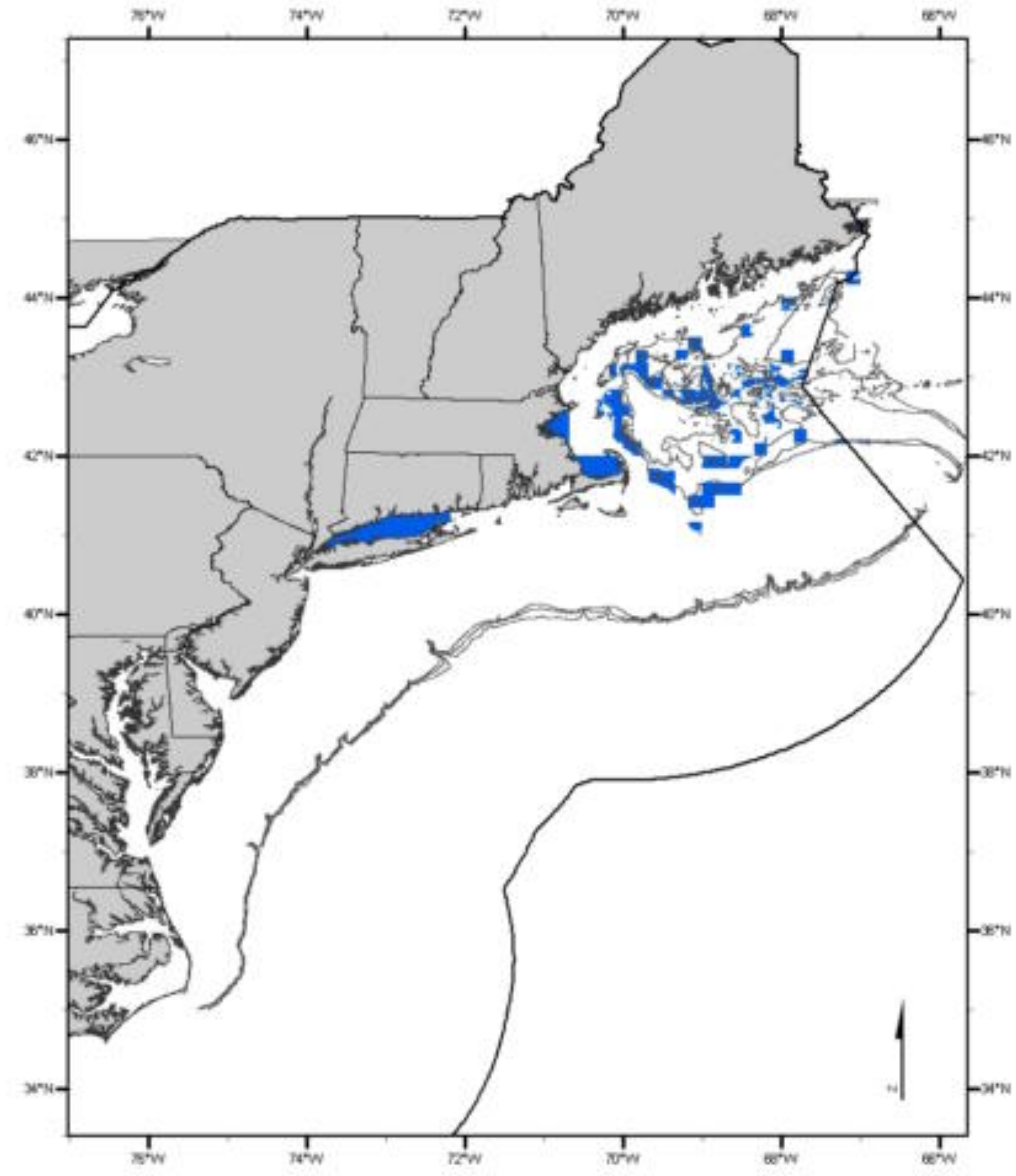
The Alternative 3D EFH designation for juvenile pollock on the continental shelf is based on the distribution of depths and bottom temperatures that are associated with high catch rates of juveniles in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of juveniles in the 1968-2005 spring and fall NMFS trawl surveys at the 90% cumulative percentage of catch level and includes inshore areas where juvenile pollock were determined to be present, based on 10% frequency of occurrence in state trawl surveys and ELMR information.

Map 375. Pollock adults, Alternative 3A



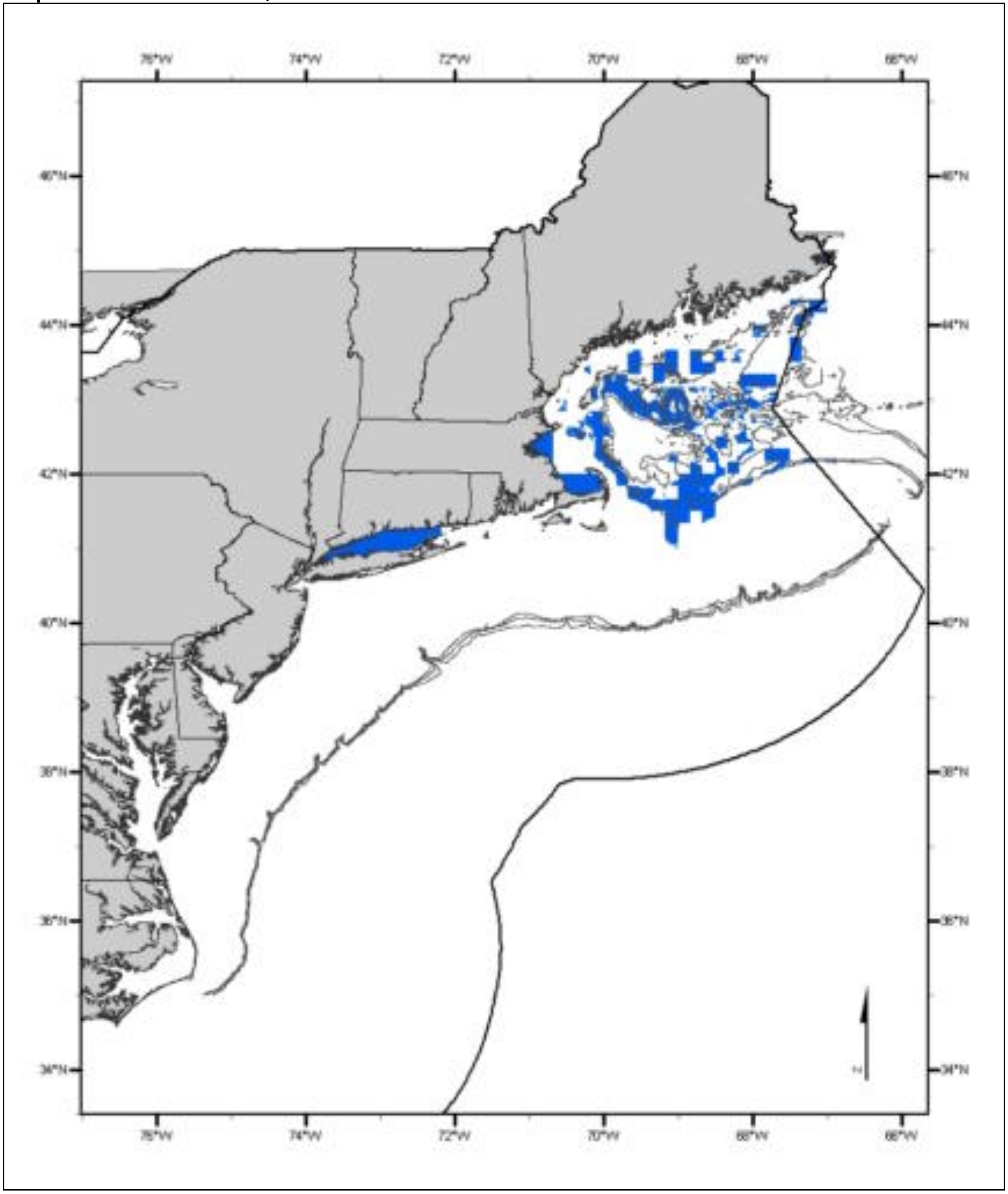
The Alternative 3A EFH designation for adult pollock on the continental shelf is based on the distribution of depths and bottom temperatures that are associated with high catch rates of adults in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of adults in the 1968-2005 spring and fall NMFS trawl surveys at the 25% cumulative percentage of catch level and includes inshore areas where adult pollock were determined to be present, based on 10% frequency of occurrence in state trawl surveys and ELMR information.

Map 376. Pollock adults, Alternative 3B



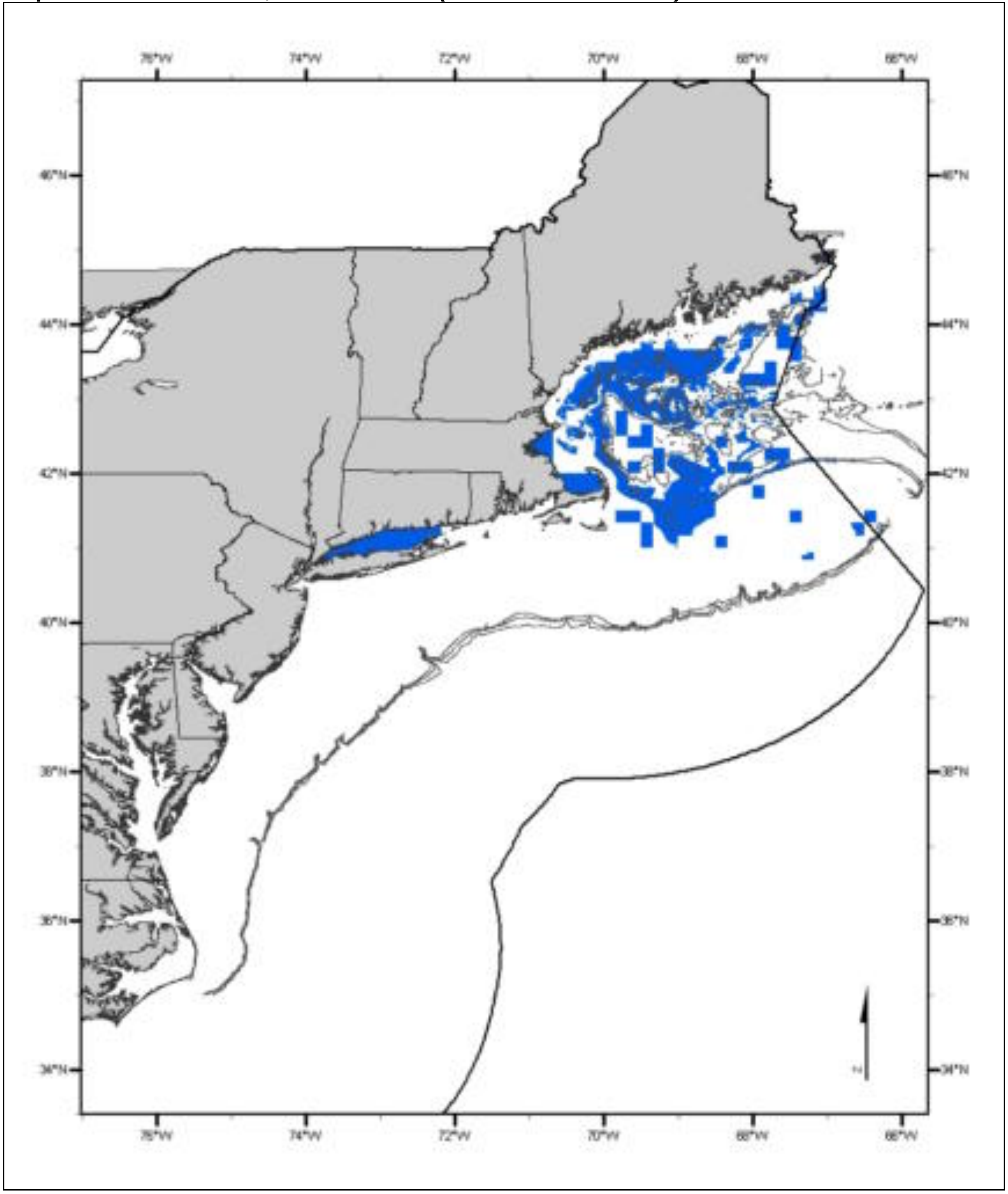
The Alternative 3B EFH designation for adult pollock on the continental shelf is based on the distribution of depths and bottom temperatures that are associated with high catch rates of adults in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of adults in the 1968-2005 spring and fall NMFS trawl surveys at the 50% cumulative percentage of catch level and includes inshore areas where adult pollock were determined to be present, based on 10% frequency of occurrence in state trawl surveys and ELMR information.

Map 377. Pollock adults, Alternative 3C



The Alternative 3C EFH designation for adult pollock on the continental shelf is based on the distribution of depths and bottom temperatures that are associated with high catch rates of adults in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of adults in the 1968-2005 spring and fall NMFS trawl surveys at the 75% cumulative percentage of catch level and includes inshore areas where adult pollock were determined to be present, based on 10% frequency of occurrence in state trawl surveys and ELMR information.

Map 378. Pollock adults, Alternative 3D *(Preferred Alternative)*



The Alternative 3D EFH designation for adult pollock on the continental shelf is based on the distribution of depths and bottom temperatures that are associated with high catch rates of adults in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of adults in the 1968-2005 spring and fall NMFS trawl surveys at the 90% cumulative percentage of catch level and includes inshore areas where adult pollock were determined to be present, based on 10% frequency of occurrence in state trawl surveys and ELMR information.

4.1.3.2.14 Red Hake

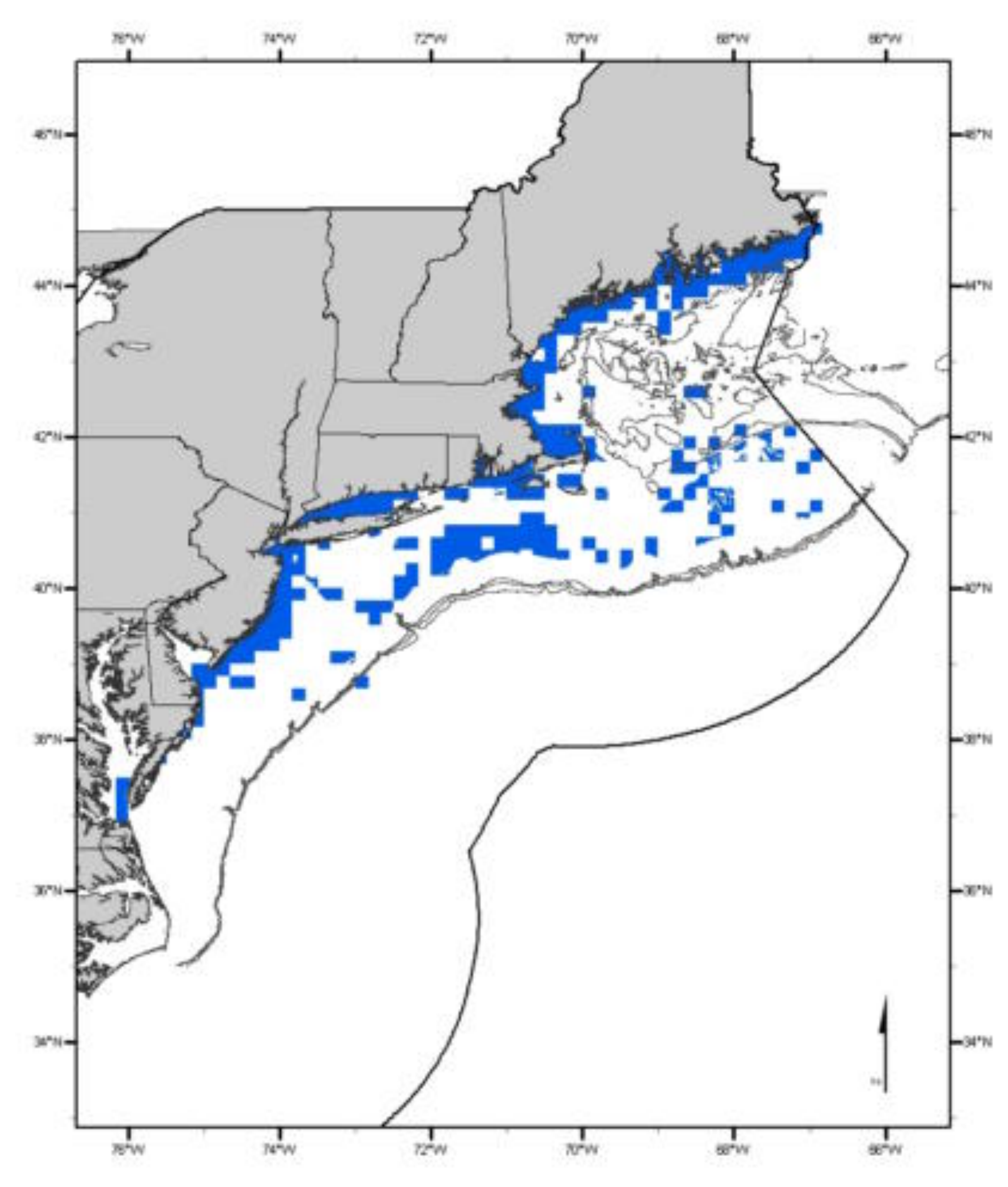
Eggs: Pelagic habitats in inshore areas, on the continental shelf and slope as depicted on Map 379 - Map 382. The following conditions generally exist where EFH for egg red hake is found: depths of 20-1500 meters and water column temperatures of 11.5 – 20.5ºC. *Preferred Alternative*

Larvae: Pelagic habitats in inshore areas, on the continental shelf and slope as depicted on Map 379 - Map 382. The following conditions generally exist where EFH for larval red hake is found: depths of 1- 1500 meters and water column of 11.5 – 20.5ºC. Larval red hake feed on copepods and other micro–crustaceans.
Preferred Alternative

Juveniles: Estuarine, coastal marine, and continental shelf benthic habitats in depths of 1 – 80 meters, including the intertidal zone as depicted on Map 379 - Map 382. EFH for juvenile red hake includes mud, sand, and mud–sand substrates. EFH for YOY juveniles in coastal estuaries and embayments includes eelgrass and macroalgae. Shelter is critical for older juveniles (*e.g.*, shells, benthic epifauna, bottom depressions, and even inside live scallops). Other conditions that generally exist where EFH is found are bottom temperatures of 2.5 – 21.5ºC and salinities of 6.5 – 35.5 ppt. Once they settle to the bottom, juvenile red hake feed mostly on amphipods, a wide variety of decapods, fishes (*e.g.*, silver hake and sea robins), and polychaetes. *(Preferred Alternative)*

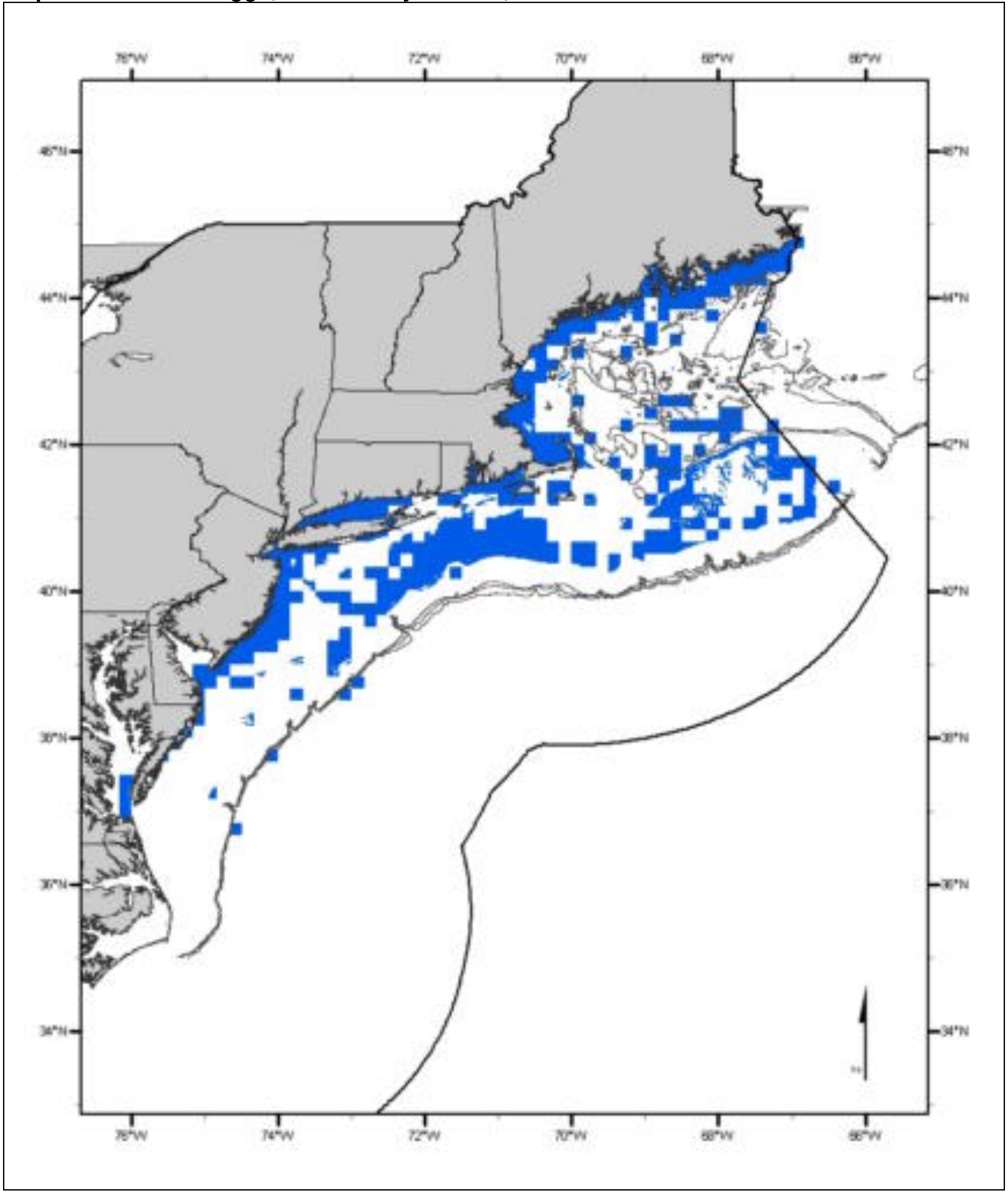
Adults: Coastal marine and continental shelf and slope benthic habitats in depths of 20 – 750 meters as depicted on Map 383 - Map 386. EFH for adult red hake includes mud, sand, and mud–sand substrates, but they are most common on soft sediments or shell beds. Other conditions that generally exist where EFH is found are bottom temperatures of 4.5 – 12.5ºC and salinities of 23 – 34.5 ppt. Spawning generally occurs between temperatures of 5 and 10ºC. Adult red hake feed primarily on amphipods, bivalve mollusks, squids, and fishes (*e.g.*, sand lance, silver hake, clupeids, and gadids). *(Preferred Alternative)*

Map 379. Red hake eggs, larvae and juveniles, Alternative 3A



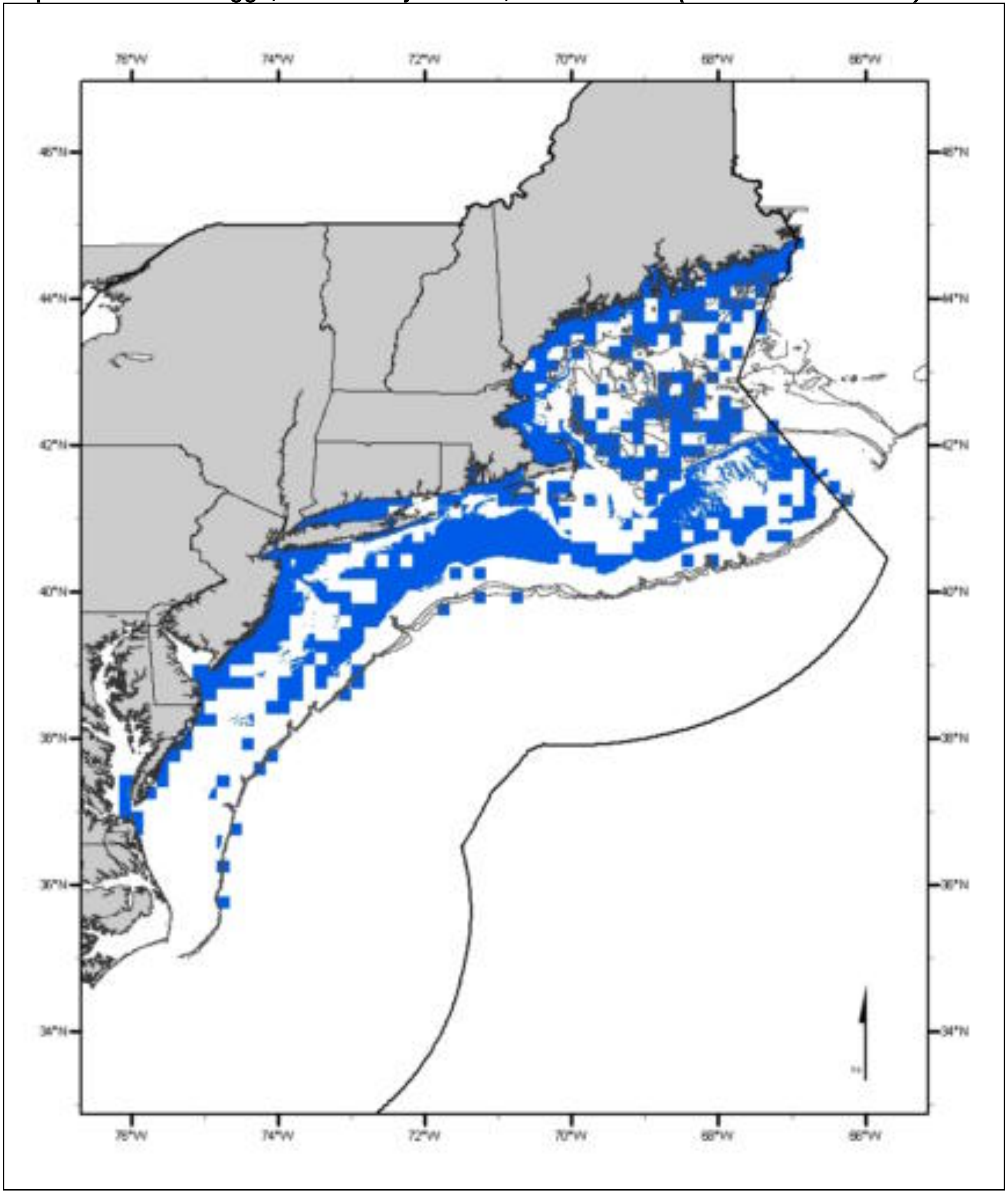
The Alternative 3A EFH designation for red hake eggs, larvae, and juveniles on the continental shelf is based on the distribution of depths and bottom temperatures that are associated with high catch rates of juveniles in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of juveniles in the 1968-2005 spring and fall NMFS trawl surveys at the 25% cumulative percentage of catch level and includes inshore areas where juvenile red hake were determined to be present, based on 10% frequency of occurrence in state trawl surveys and ELMR information.

Map 380. Red hake eggs, larvae and juveniles, Alternative 3B



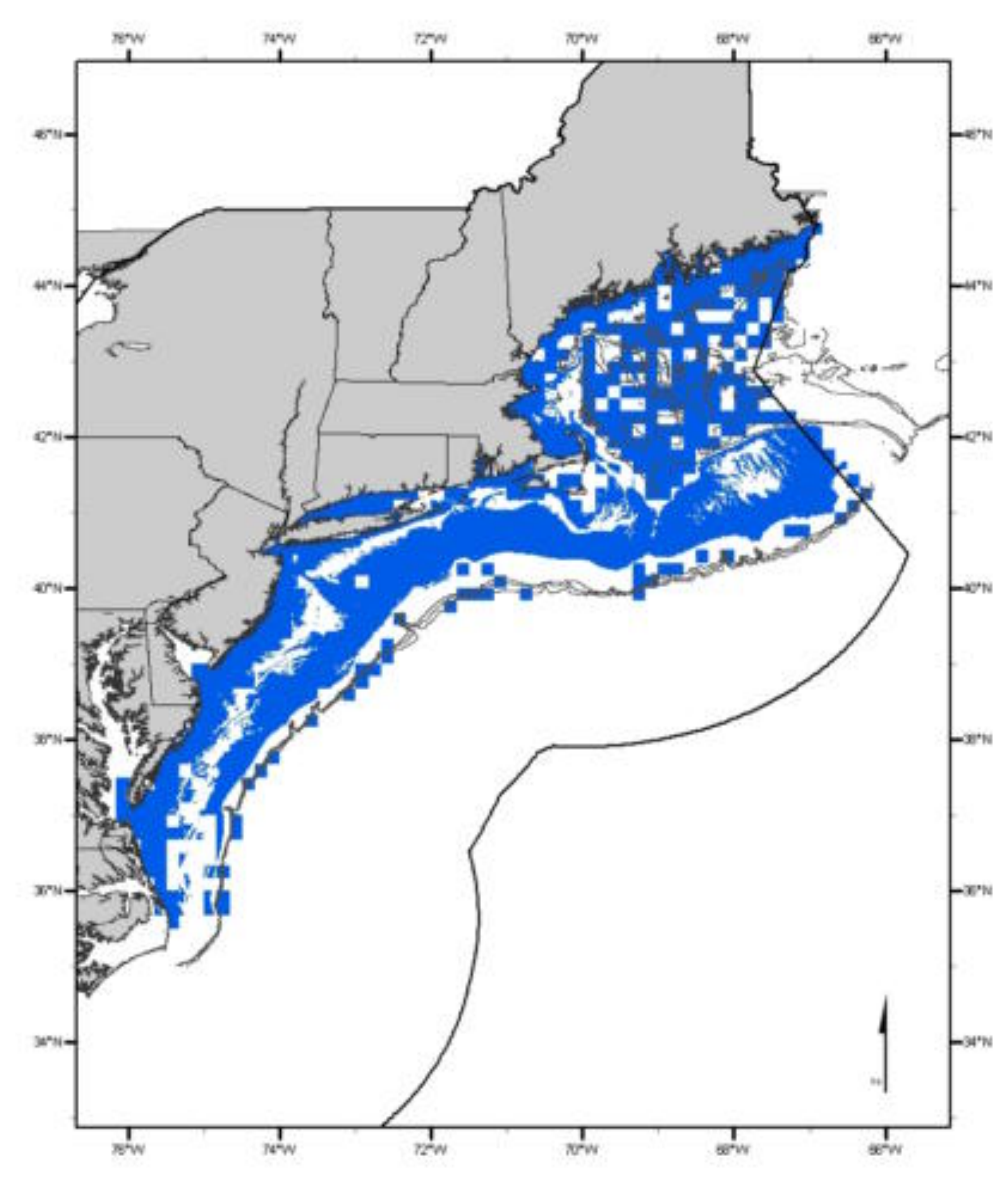
The Alternative 3B EFH designation for red hake eggs, larvae, and juveniles on the continental shelf is based on the distribution of depths and bottom temperatures that are associated with high catch rates of juveniles in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of juveniles in the 1968-2005 spring and fall NMFS trawl surveys at the 50% cumulative percentage of catch level and includes inshore areas where juvenile red hake were determined to be present, based on 10% frequency of occurrence in state trawl surveys and ELMR information.

Map 381. Red hake eggs, larvae and juveniles, Alternative 3C *(Preferred Alternative)*



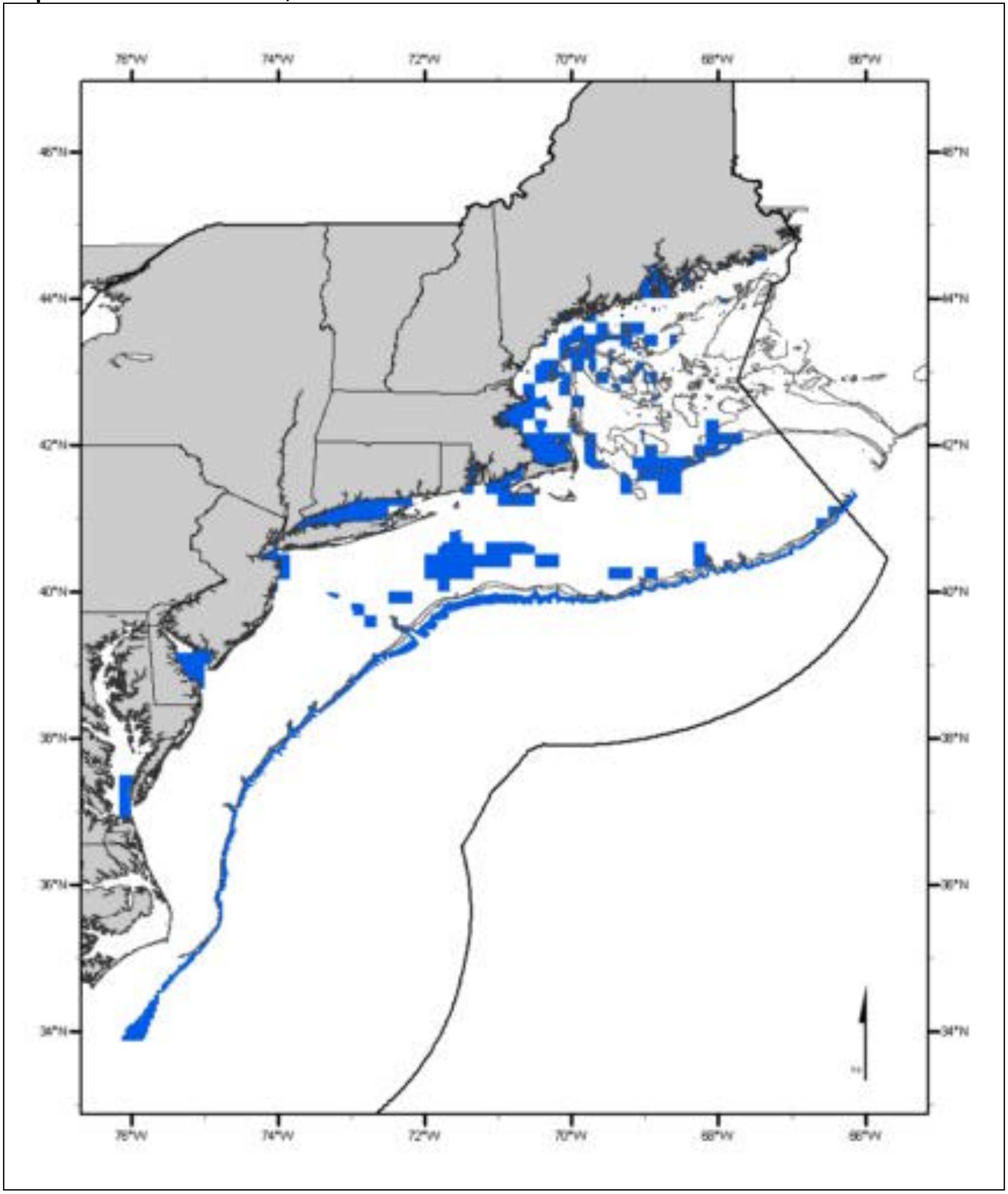
The Alternative 3C EFH designation for red hake eggs, larvae, and juveniles on the continental shelf is based on the distribution of depths and bottom temperatures that are associated with high catch rates of juveniles in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of juveniles in the 1968-2005 spring and fall NMFS trawl surveys at the 75% cumulative percentage of catch level and includes inshore areas where juvenile red hake were determined to be present, based on 10% frequency of occurrence in state trawl surveys and ELMR information.

Map 382. Red hake eggs, larvae and juveniles, Alternative 3D



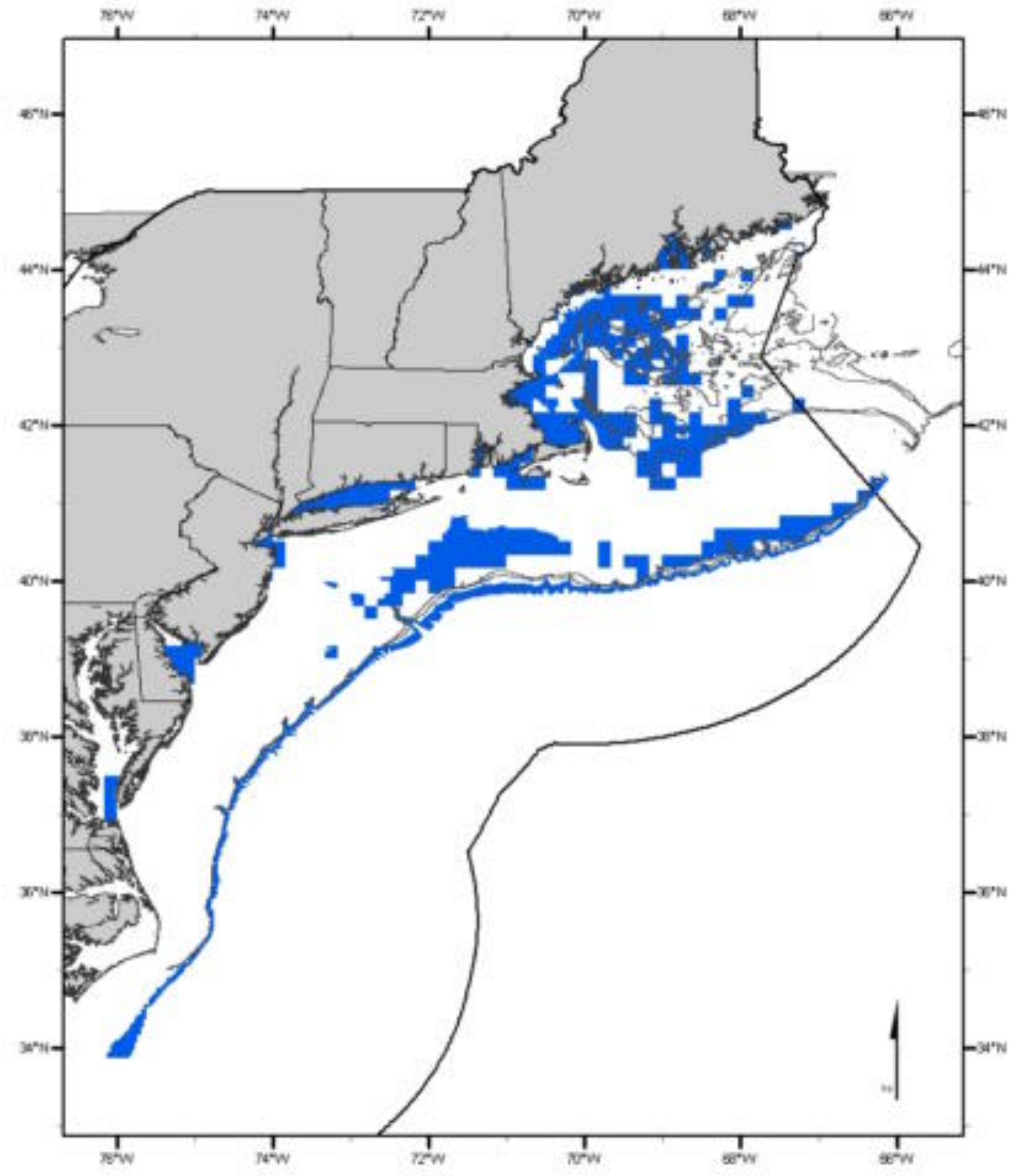
The Alternative 3D EFH designation for red hake eggs, larvae, and juveniles on the continental shelf is based on the distribution of depths and bottom temperatures that are associated with high catch rates of juveniles in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of juveniles in the 1968-2005 spring and fall NMFS trawl surveys at the 90% cumulative percentage of catch level and includes inshore areas where juvenile red hake were determined to be present, based on 10% frequency of occurrence in state trawl surveys and ELMR information.

Map 383. Red hake adults, Alternative 3A



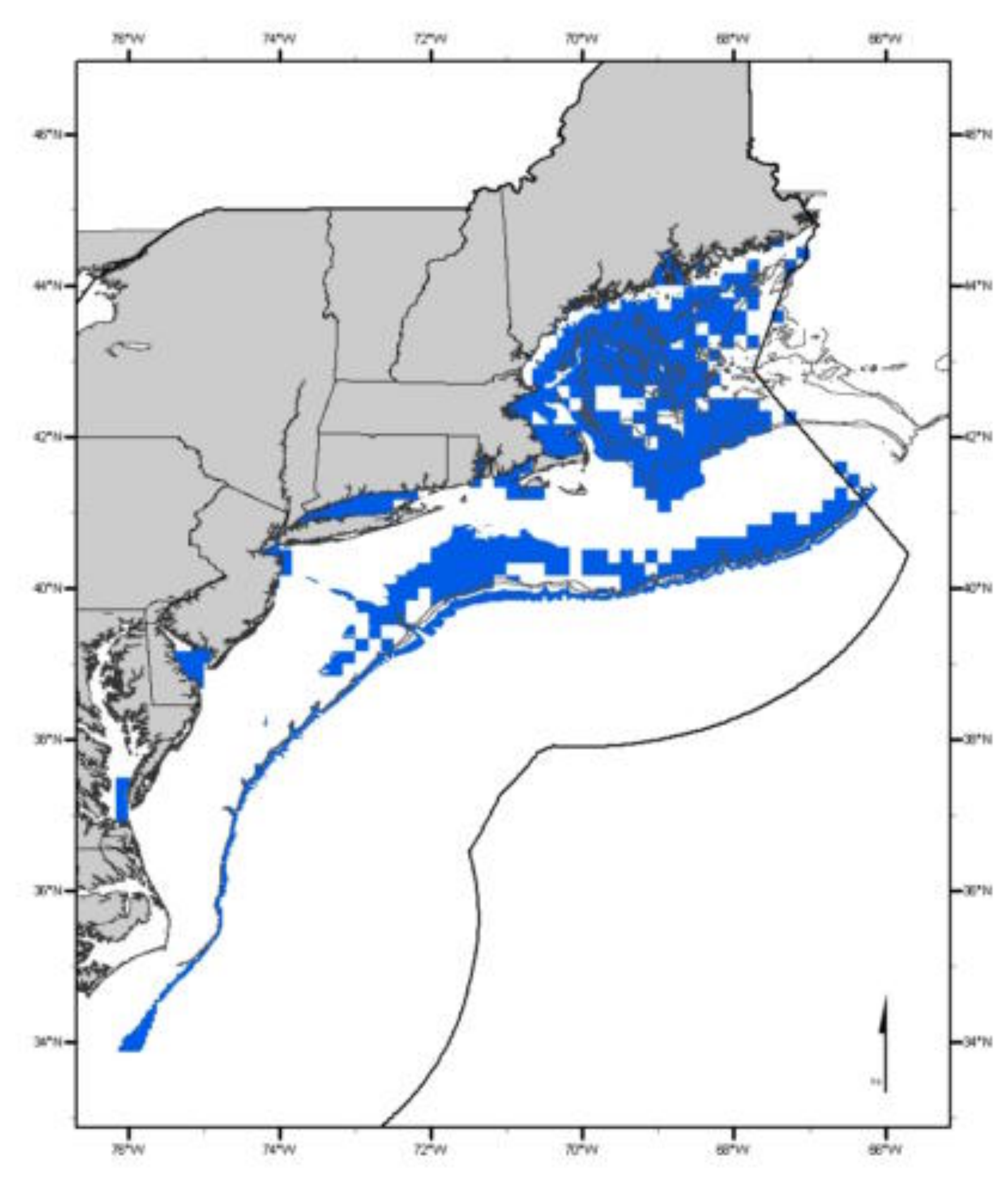
The Alternative 3A EFH designation for adult red hake on the continental shelf is based on the distribution of depths and bottom temperatures that are associated with high catch rates of adults in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of adults in the 1968-2005 spring and fall NMFS trawl surveys at the 25% cumulative percentage of catch level and includes inshore and off-shelf areas where adult red hake were determined to be present, based on 10% frequency of occurrence in state trawl surveys, ELMR information, and off-shelf depth and geographic ranges.

Map 384. Red hake adults, Alternative 3B



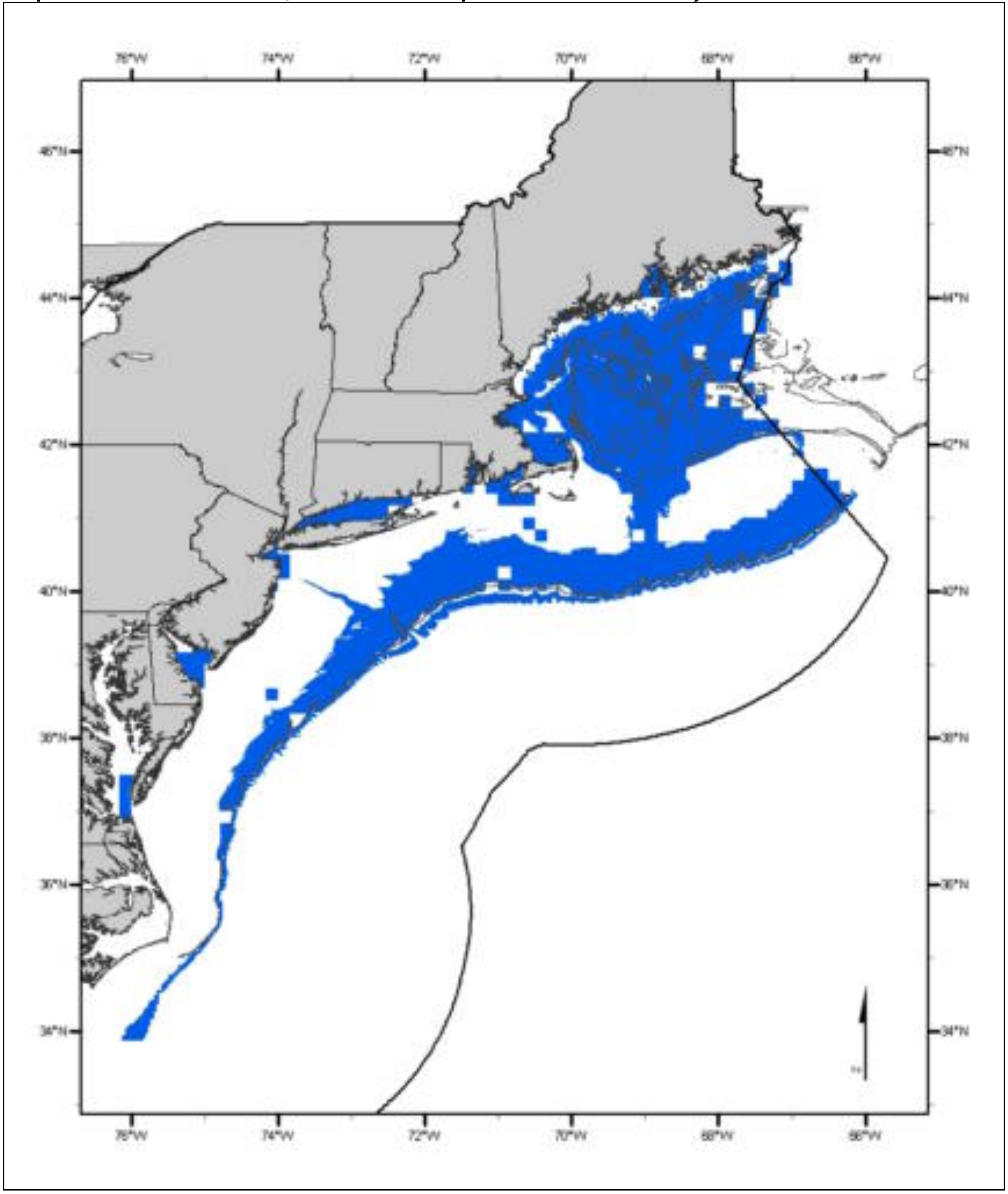
The Alternative 3B EFH designation for adult red hake on the continental shelf is based on the distribution of depths and bottom temperatures that are associated with high catch rates of adults in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of adults in the 1968-2005 spring and fall NMFS trawl surveys at the 50% cumulative percentage of catch level and includes inshore and off-shelf areas where adult red hake were determined to be present, based on 10% frequency of occurrence in state trawl surveys, ELMR information, and off-shelf depth and geographic ranges.

Map 385. Red hake adults, Alternative 3C



The Alternative 3C EFH designation for adult red hake on the continental shelf is based on the distribution of depths and bottom temperatures that are associated with high catch rates of adults in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of adults in the 1968-2005 spring and fall NMFS trawl surveys at the 75% cumulative percentage of catch level and includes inshore and off-shelf areas where adult red hake were determined to be present, based on 10% frequency of occurrence in state trawl surveys, ELMR information, and off-shelf depth and geographic ranges.

Map 386. Red hake adults, Alternative 3D *(Preferred Alternative)*



The Alternative 3D EFH designation for adult red hake on the continental shelf is based on the distribution of depths and bottom temperatures that are associated with high catch rates of adults in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of adults in the 1968-2005 spring and fall NMFS trawl surveys at the 90% cumulative percentage of catch level and includes inshore and off-shelf areas where adult red hake were determined to be present, based on 10% frequency of occurrence in state trawl surveys, ELMR information, and off-shelf depth and geographic ranges.

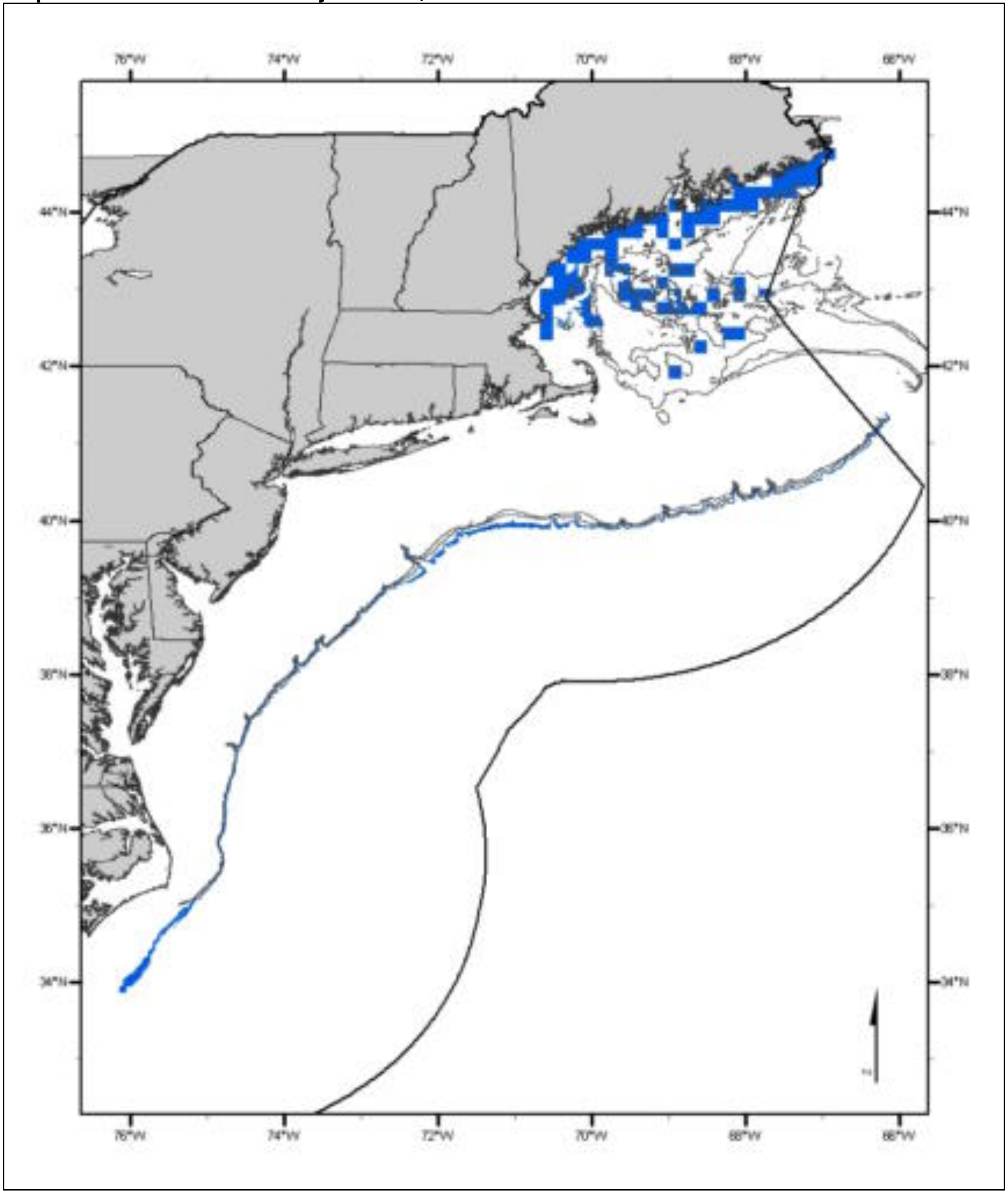
4.1.3.2.15 Redfish

Larvae: Water column habitats on the continental shelf and shelf as depicted on Map 387 - Map 390. The following conditions generally exist where EFH for larval redfish is found: bottom depths of 80-2000 meters and water column temperatures of 3.5-9.5ºC. Larval redfish feed on copepods, euphausiids, and fish and invertebrate eggs.
Preferred Alternative

Juveniles: Benthic habitats on the continental shelf in depths of 100 – 200 meters and on the continental slope in depths of 400 – 600 meters as depicted on Map 387 - Map 390. EFH for juvenile redfish includes a wide variety of bottom types, but is primarily found on muddy, rocky substrates. YOY are found on boulder reefs, while older juveniles are found in association with cerianthid anemones. Other conditions that generally exist where EFH is found are bottom temperatures of 2.5 – 9.5ºC and salinities of 32.5 – 34.5 ppt. Juvenile redfish feed primarily on larvaceans and crustaceans (copepods and euphausiids). *(Preferred Alternative)*

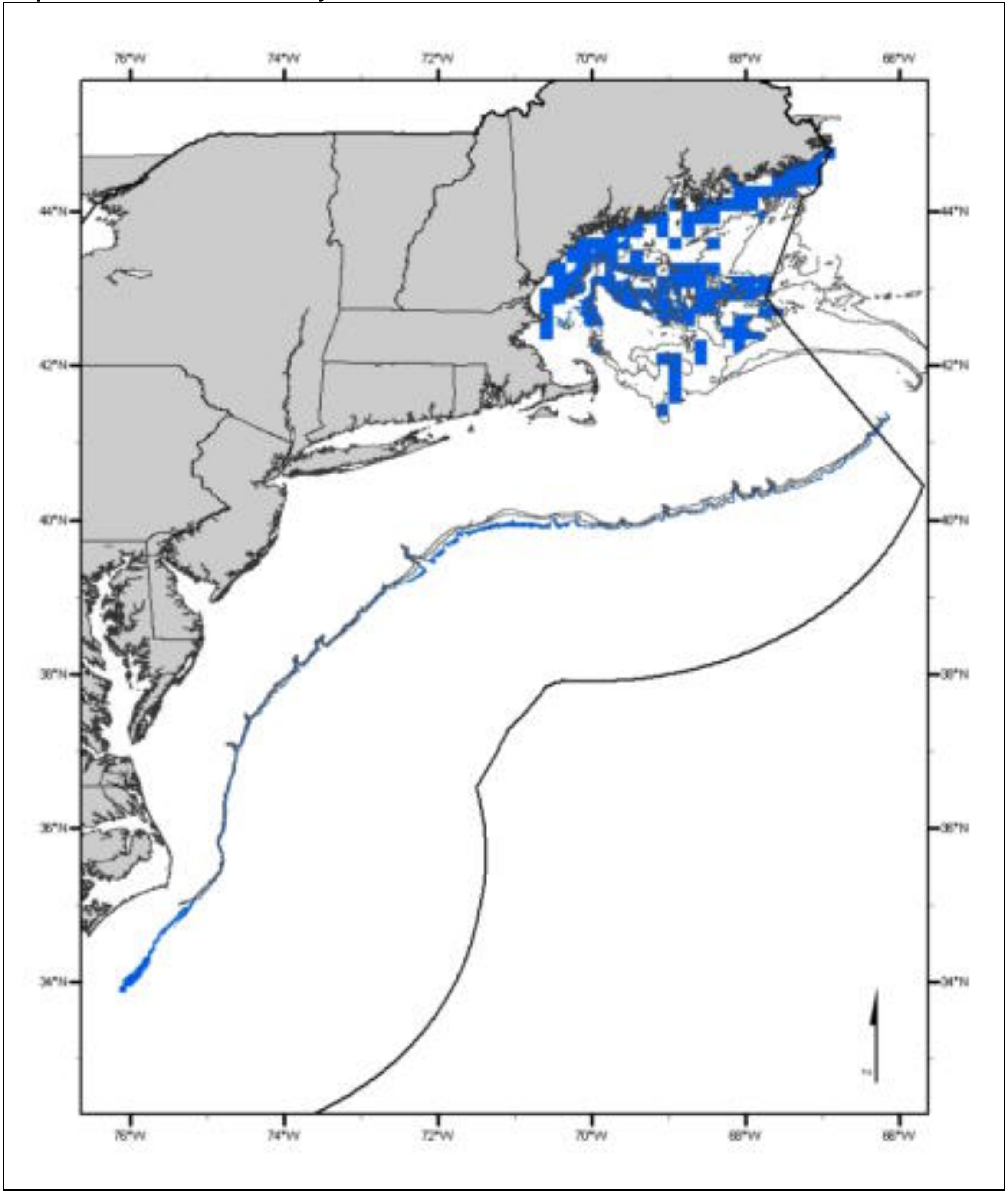
Adults: Benthic habitats on the continental shelf in depths of 140 – 200 meters and on the continental slope in depths of 400 – 600 meters as depicted on Map 391 - Map 394. EFH for adult redfish includes a wide variety of bottom types, but is primarily found on muddy, rocky substrates which support the growth of deep–water corals and other structure–forming sedentary epifauna such as sponges. Other conditions that generally exist where EFH is found are bottom temperatures of 3.5 – 9.5ºC and salinities of 32.5 – 34.5 ppt. Adult redfish feed primarily on euphausiids, amphipods, other crustaceans (*e.g.*, pandalid and sand shrimps), and fishes (*e.g.*, silver hake). *(Preferred Alternative)*

Map 387. Redfish larvae and juveniles, Alternative 3A



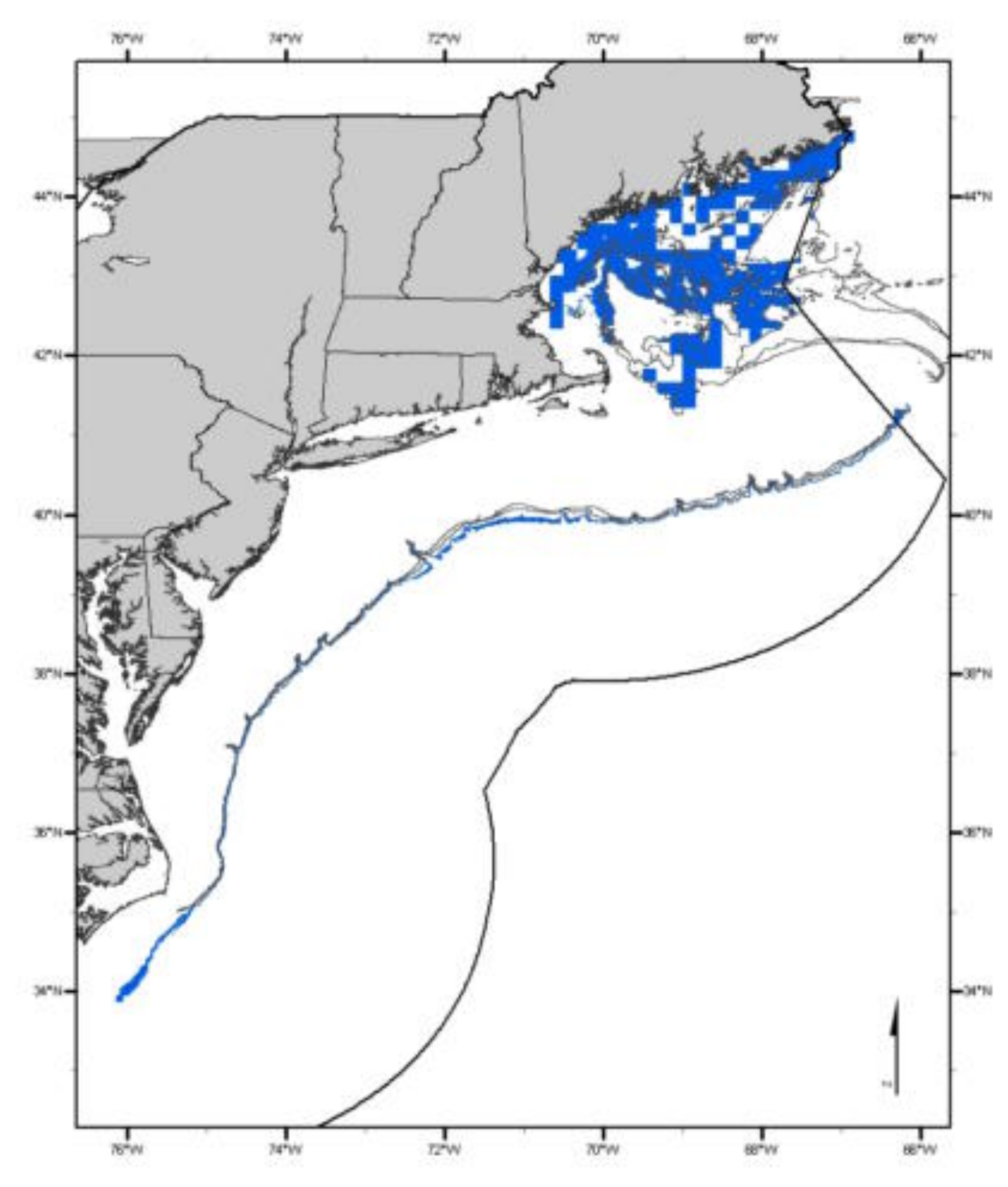
The Alternative 3A EFH designation for redfish larvae and juveniles on the continental shelf is based on the distribution of depths and bottom temperatures that are associated with high catch rates of juveniles in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of juveniles in the 1968-2005 spring and fall NMFS trawl surveys at the 25% cumulative percentage of catch level and includes inshore and off-shelf areas where juvenile redfish were determined to be present, based on 10% frequency of occurrence in state trawl surveys and off-shelf depth and geographic ranges.

Map 388. Redfish larvae and juveniles, Alternative 3B



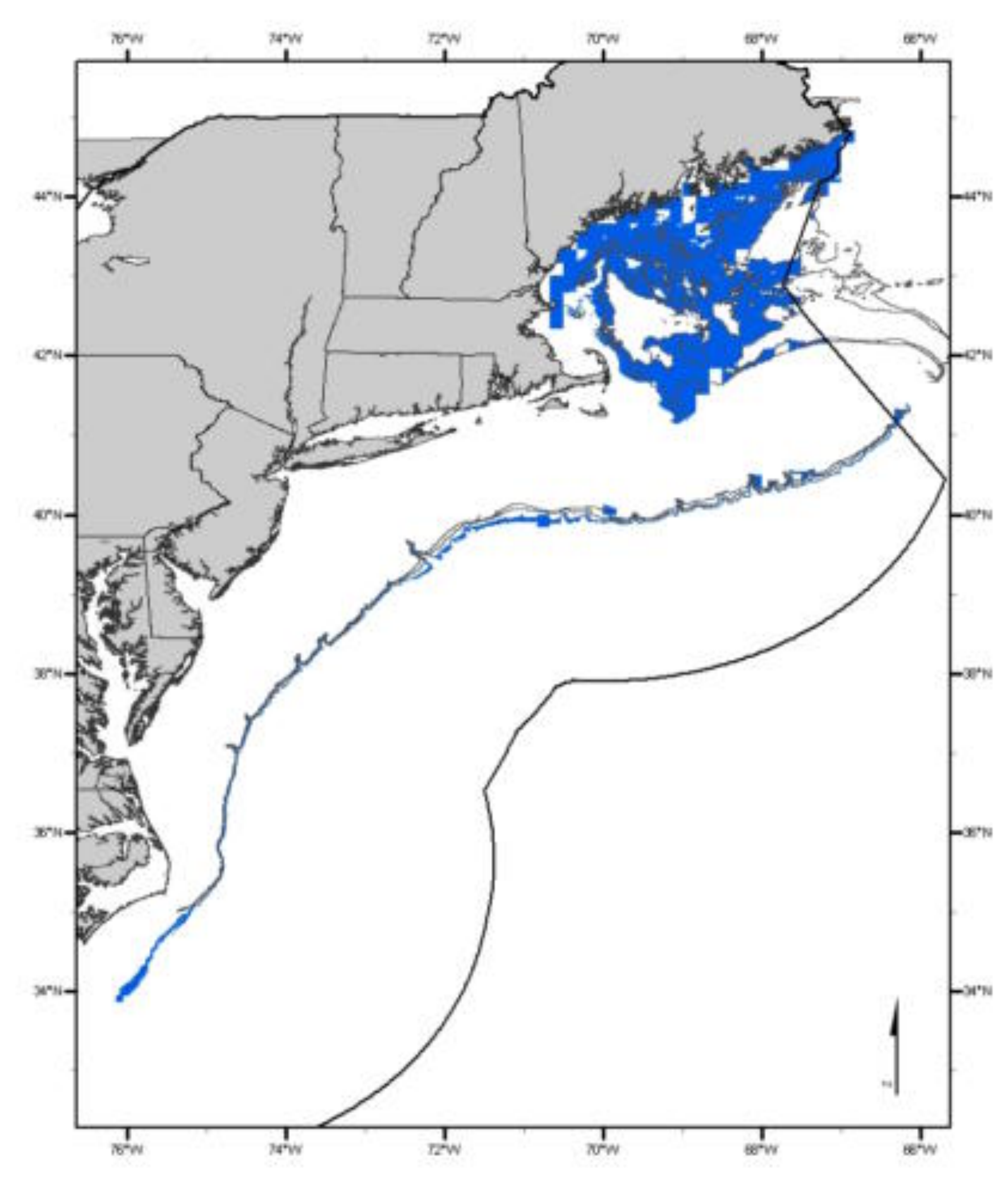
The Alternative 3B EFH designation for redfish larvae and juveniles on the continental shelf is based on the distribution of depths and bottom temperatures that are associated with high catch rates of juveniles in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of juveniles in the 1968-2005 spring and fall NMFS trawl surveys at the 50% cumulative percentage of catch level and includes inshore and off-shelf areas where juvenile redfish were determined to be present, based on 10% frequency of occurrence in state trawl surveys and off-shelf depth and geographic ranges.

Map 389. Redfish larvae and juveniles, Alternative 3C



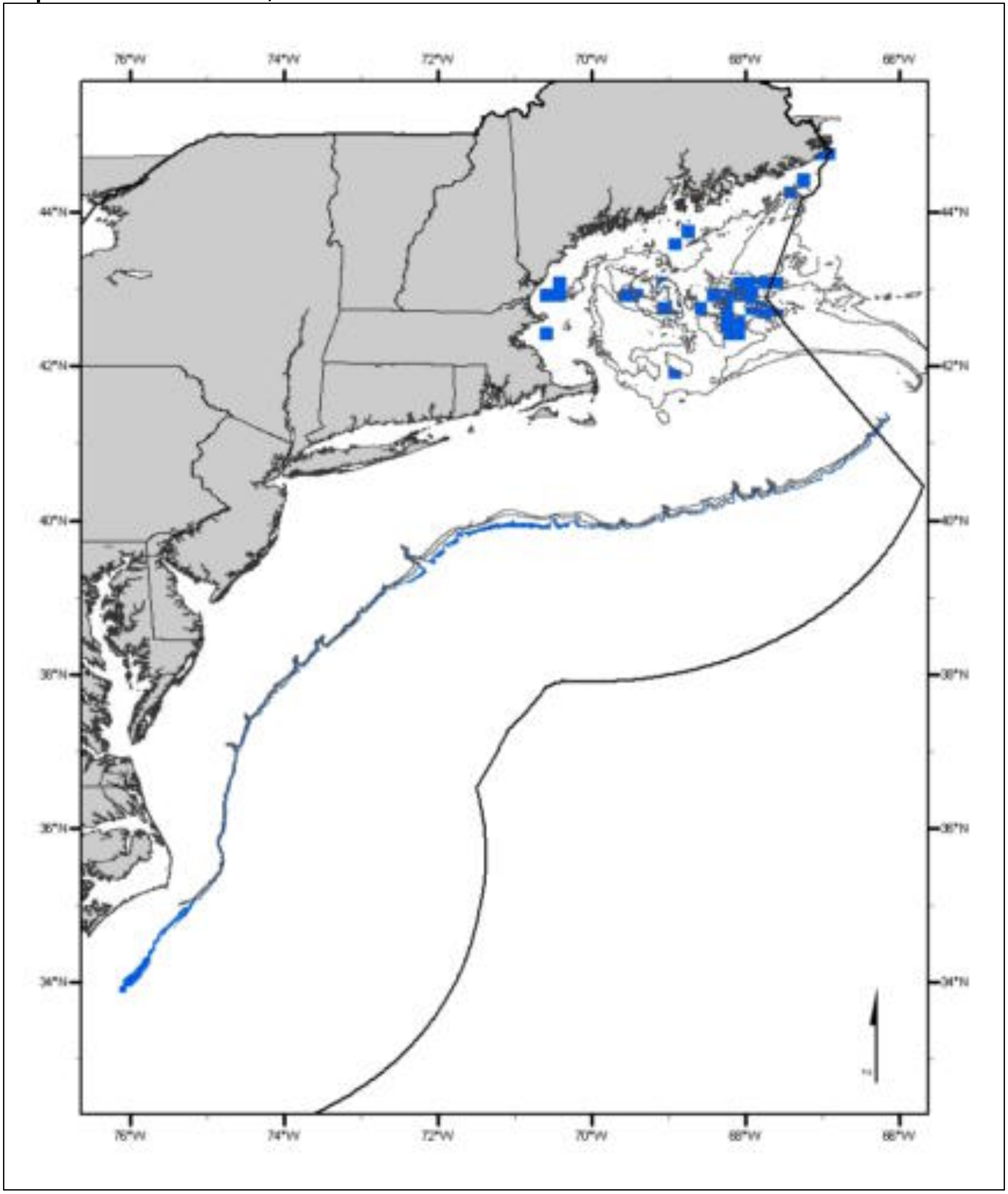
The Alternative 3C EFH designation for redfish larvae and juveniles on the continental shelf is based on the distribution of depths and bottom temperatures that are associated with high catch rates of juveniles in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of juveniles in the 1968-2005 spring and fall NMFS trawl surveys at the 75% cumulative percentage of catch level and includes inshore and off-shelf areas where juvenile redfish were determined to be present, based on 10% frequency of occurrence in state trawl surveys and off-shelf depth and geographic ranges.

Map 390. Redfish larvae and juveniles, Alternative 3D *(Preferred Alternative)*



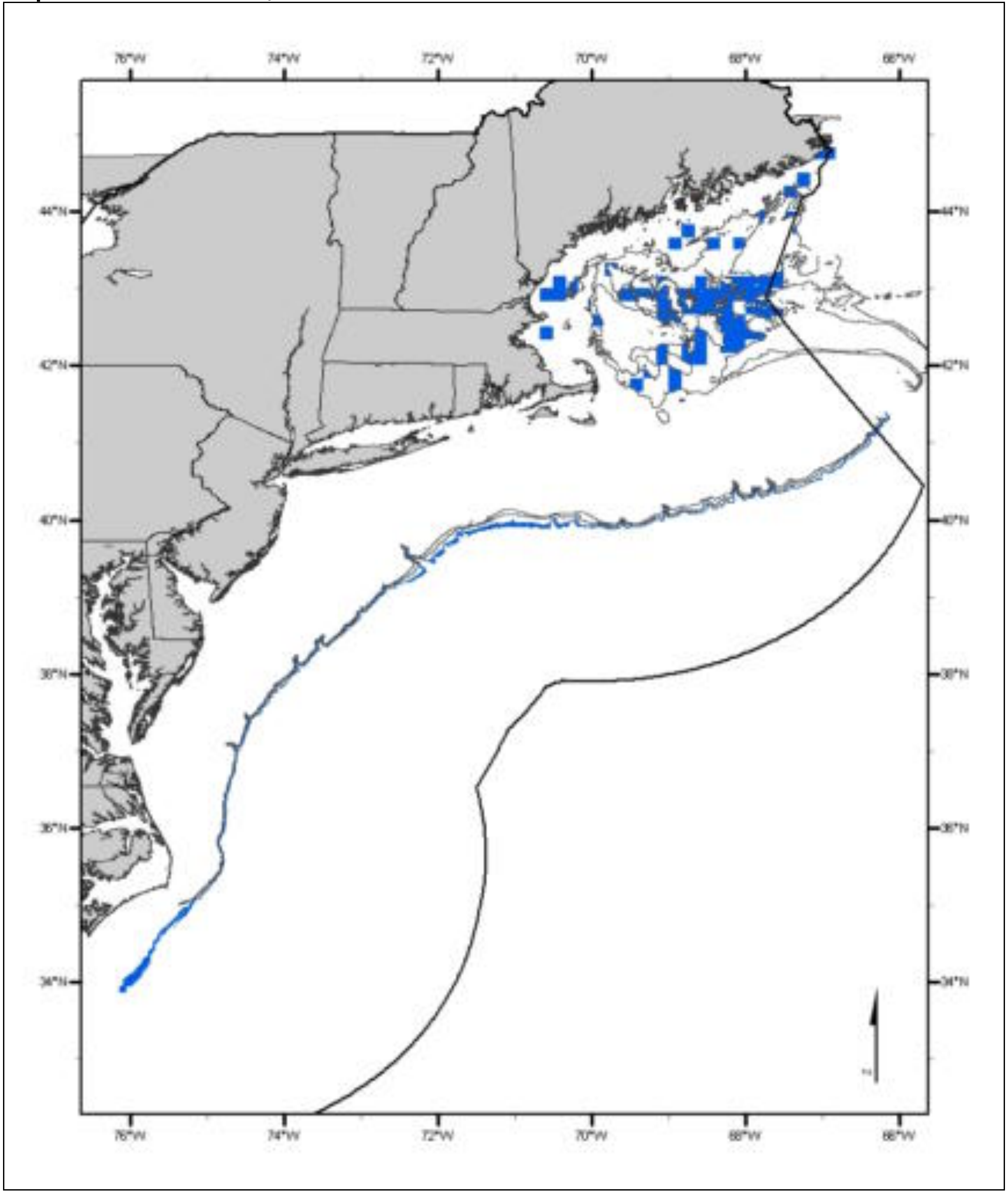
The Alternative 3D EFH designation for redfish larvae and juveniles on the continental shelf is based on the distribution of depths and bottom temperatures that are associated with high catch rates of juveniles in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of juveniles in the 1968-2005 spring and fall NMFS trawl surveys at the 90% cumulative percentage of catch level and includes inshore and off-shelf areas where juvenile redfish were determined to be present, based on 10% frequency of occurrence in state trawl surveys and off-shelf depth and geographic ranges.

Map 391. Redfish adults, Alternative 3A



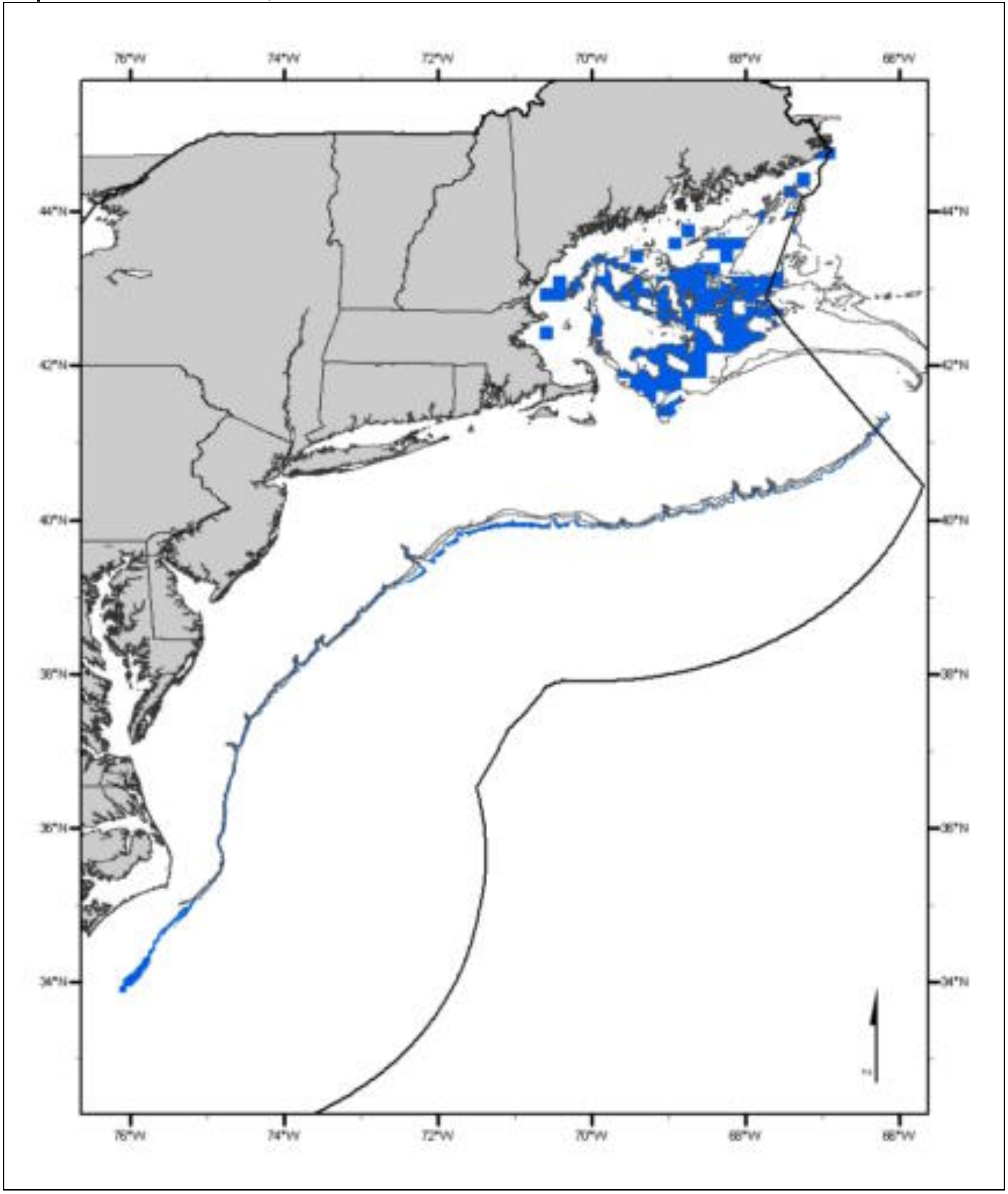
The Alternative 3A EFH designation for redfish adults on the continental shelf is based on the distribution of depths and bottom temperatures that are associated with high catch rates of adults in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of adults in the 1968-2005 spring and fall NMFS trawl surveys at the 25% cumulative percentage of catch level and includes inshore and off-shelf areas where adult redfish were determined to be present, based on 10% frequency of occurrence in state trawl surveys and off-shelf depth and geographic ranges.

Map 392. Redfish adults, Alternative 3B



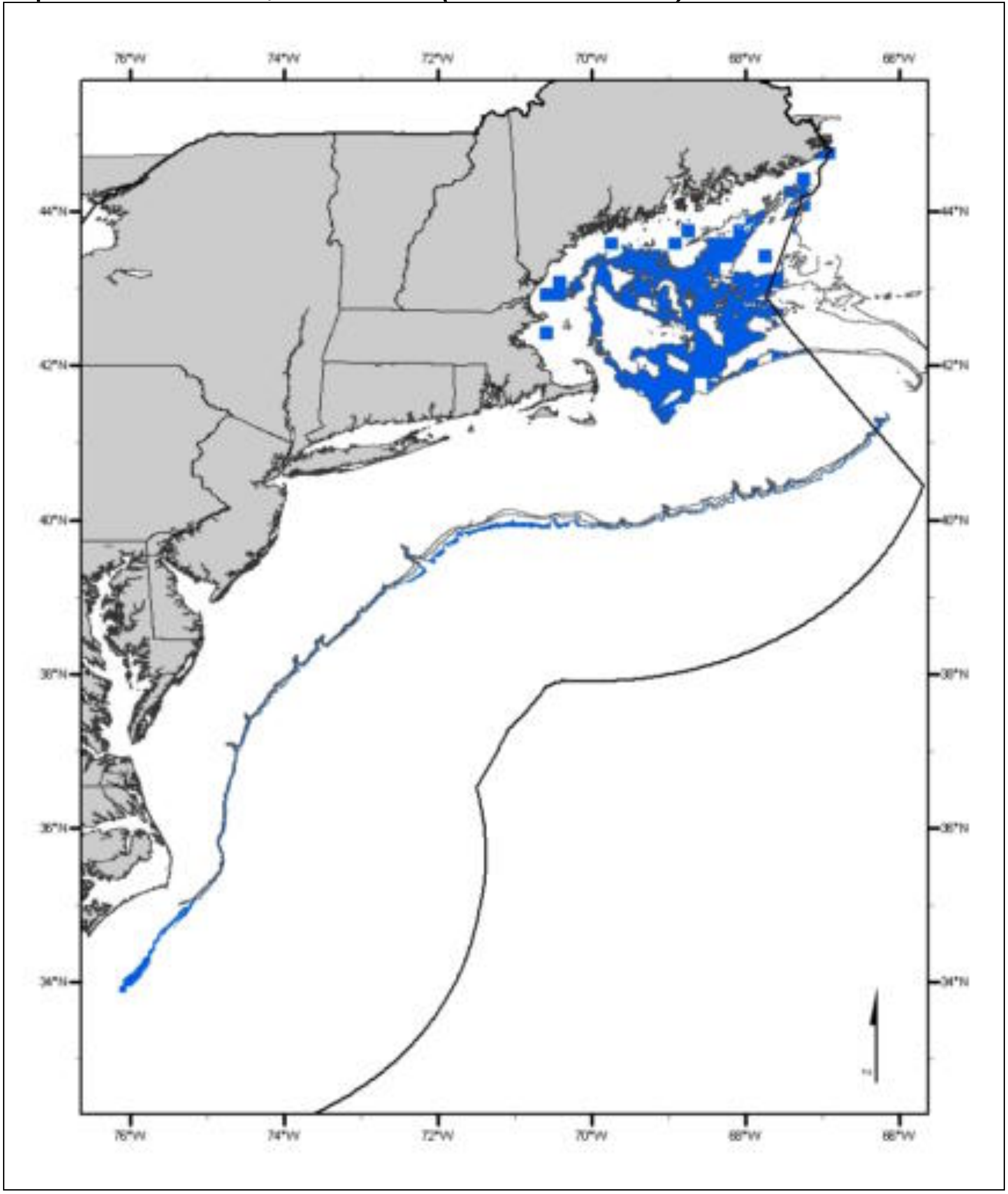
The Alternative 3B EFH designation for redfish adults on the continental shelf is based on the distribution of depths and bottom temperatures that are associated with high catch rates of adults in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of adults in the 1968-2005 spring and fall NMFS trawl surveys at the 50% cumulative percentage of catch level and includes inshore and off-shelf areas where adult redfish were determined to be present, based on 10% frequency of occurrence in state trawl surveys and off-shelf depth and geographic ranges.

Map 393. Redfish adults, Alternative 3C



The Alternative 3C EFH designation for redfish adults on the continental shelf is based on the distribution of depths and bottom temperatures that are associated with high catch rates of adults in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of adults in the 1968-2005 spring and fall NMFS trawl surveys at the 75% cumulative percentage of catch level and includes inshore and off-shelf areas where adult redfish were determined to be present, based on 10% frequency of occurrence in state trawl surveys and off-shelf depth and geographic ranges.

Map 394. Redfish adults, Alternative 3D *(Preferred Alternative)*



The Alternative 3D EFH designation for redfish adults on the continental shelf is based on the distribution of depths and bottom temperatures that are associated with high catch rates of adults in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of adults in the 1968-2005 spring and fall NMFS trawl surveys at the 90% cumulative percentage of catch level and includes inshore and off-shelf areas where adult redfish were determined to be present, based on 10% frequency of occurrence in state trawl surveys and off-shelf depth and geographic ranges.

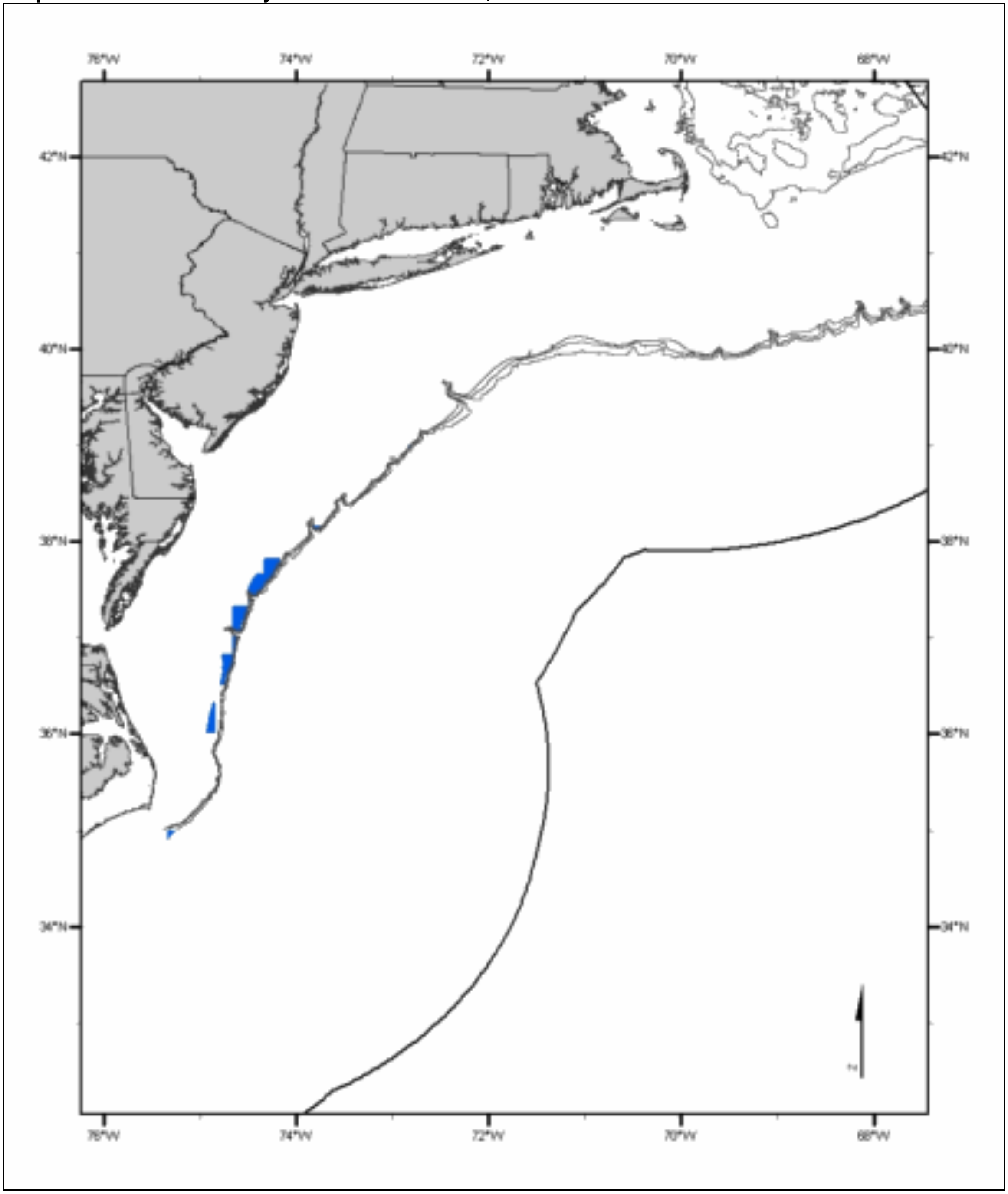
4.1.3.2.16 Rosette Skate

Eggs: No alternative EFH designation.

Larvae: No larval life stage exists for this species. Upon hatching, they are fully developed juveniles.

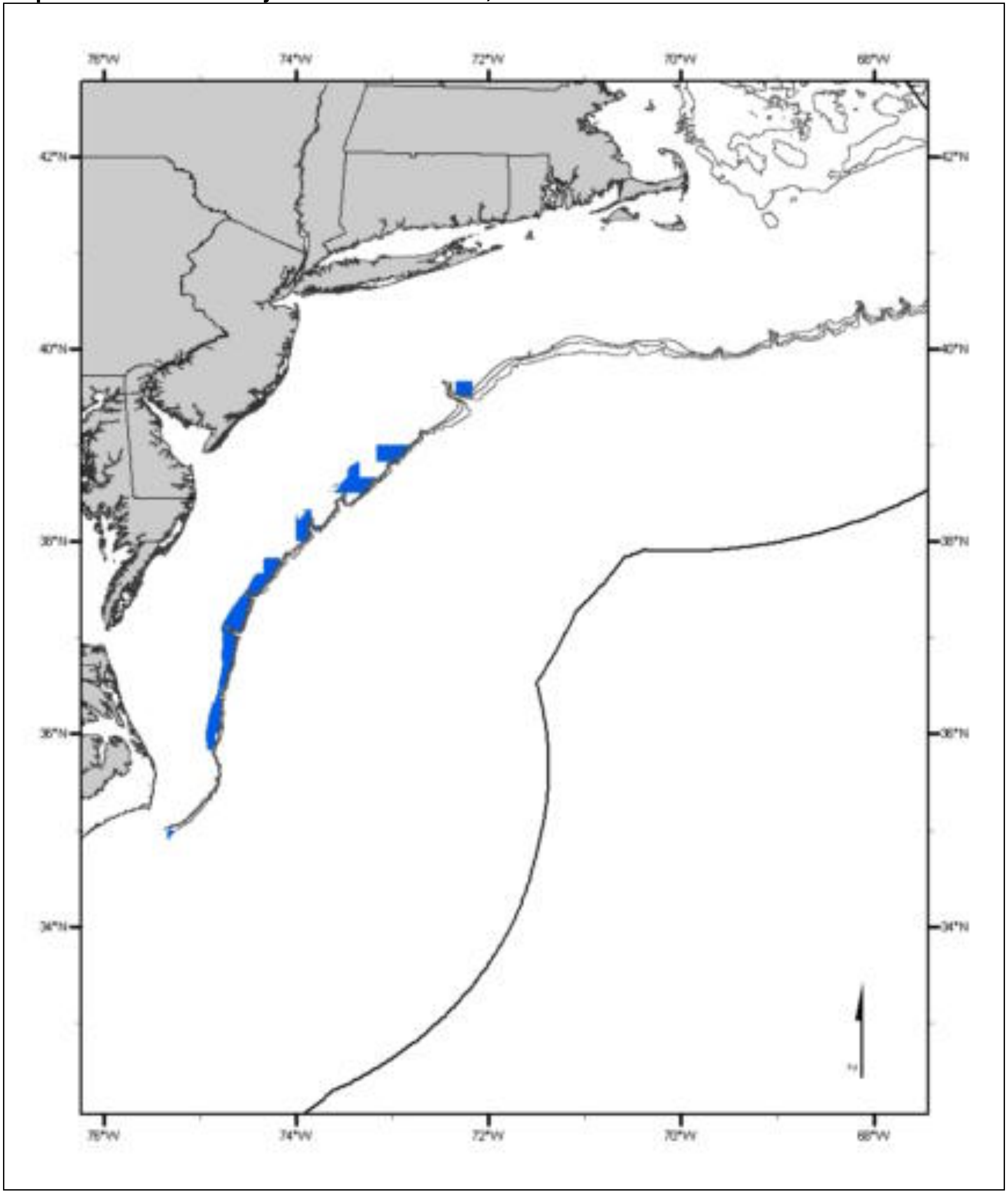
Juveniles and Adults: Continental shelf benthic habitats in depths of 70 – 300 meters with substrates composed of mud and sand, sometimes mixed with gravel as depicted on Map 395 - Map 398. Other conditions that generally exist where EFH for juvenile and adult rosette skate is found are bottom temperatures of 9.5 – 17.5ºC and salinities of 34.5 – 36.5 ppt. Primary prey organisms for juvenile and adult rosette skates are polychaetes and crustaceans (primarily amphipods). *(Preferred Alternative)*

Map 395. Rosette skate juveniles and adults, Alternative 3A



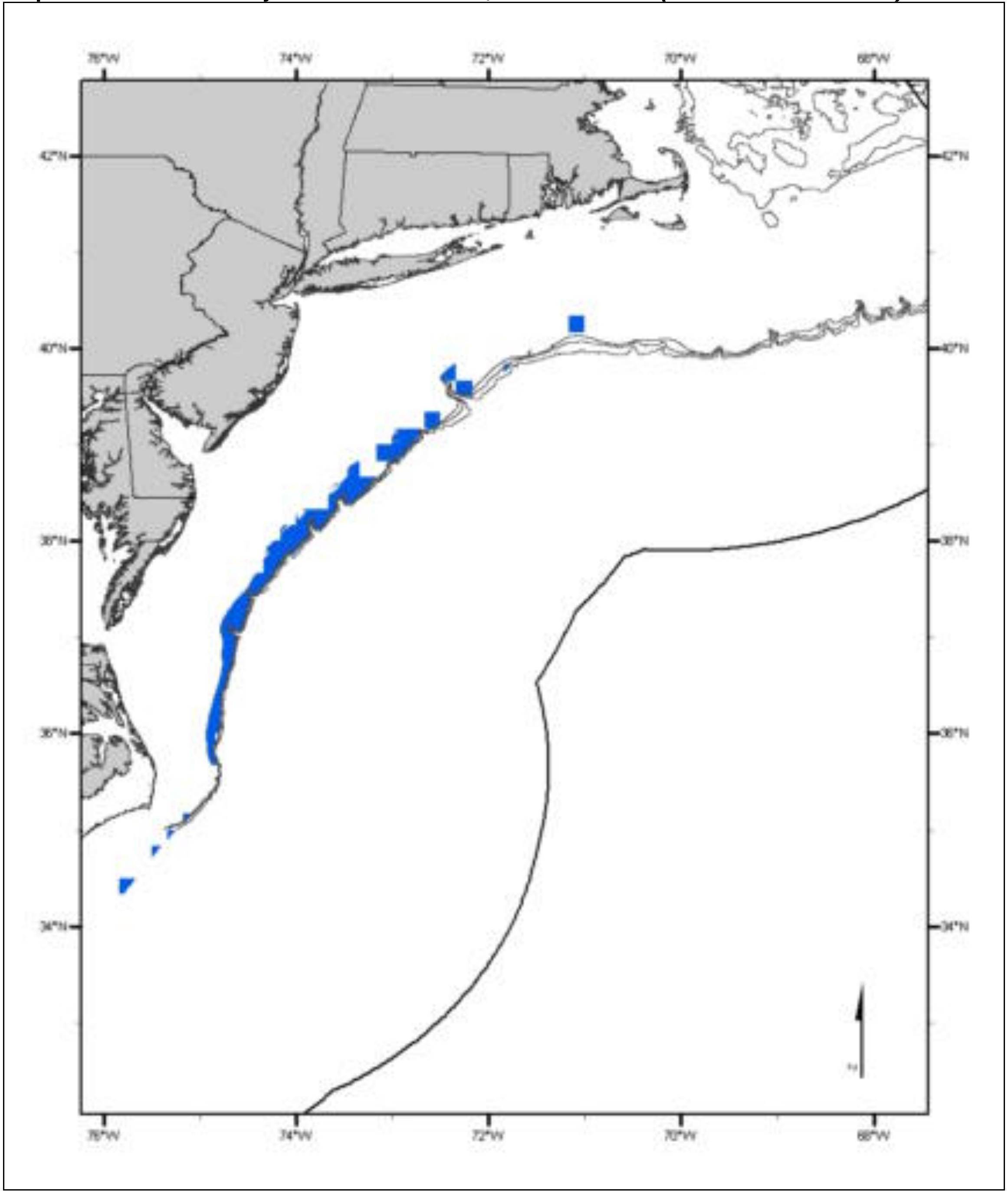
The Alternative 3A EFH designation for juvenile and adult rosette skate on the continental shelf is based on the distribution of depths and bottom temperatures that are associated with high catch rates of juveniles in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of juveniles in the 1968-2005 spring and fall NMFS trawl surveys at the 25% cumulative percentage of catch level.

Map 396. Rosette skate juveniles and adults, Alternative 3B



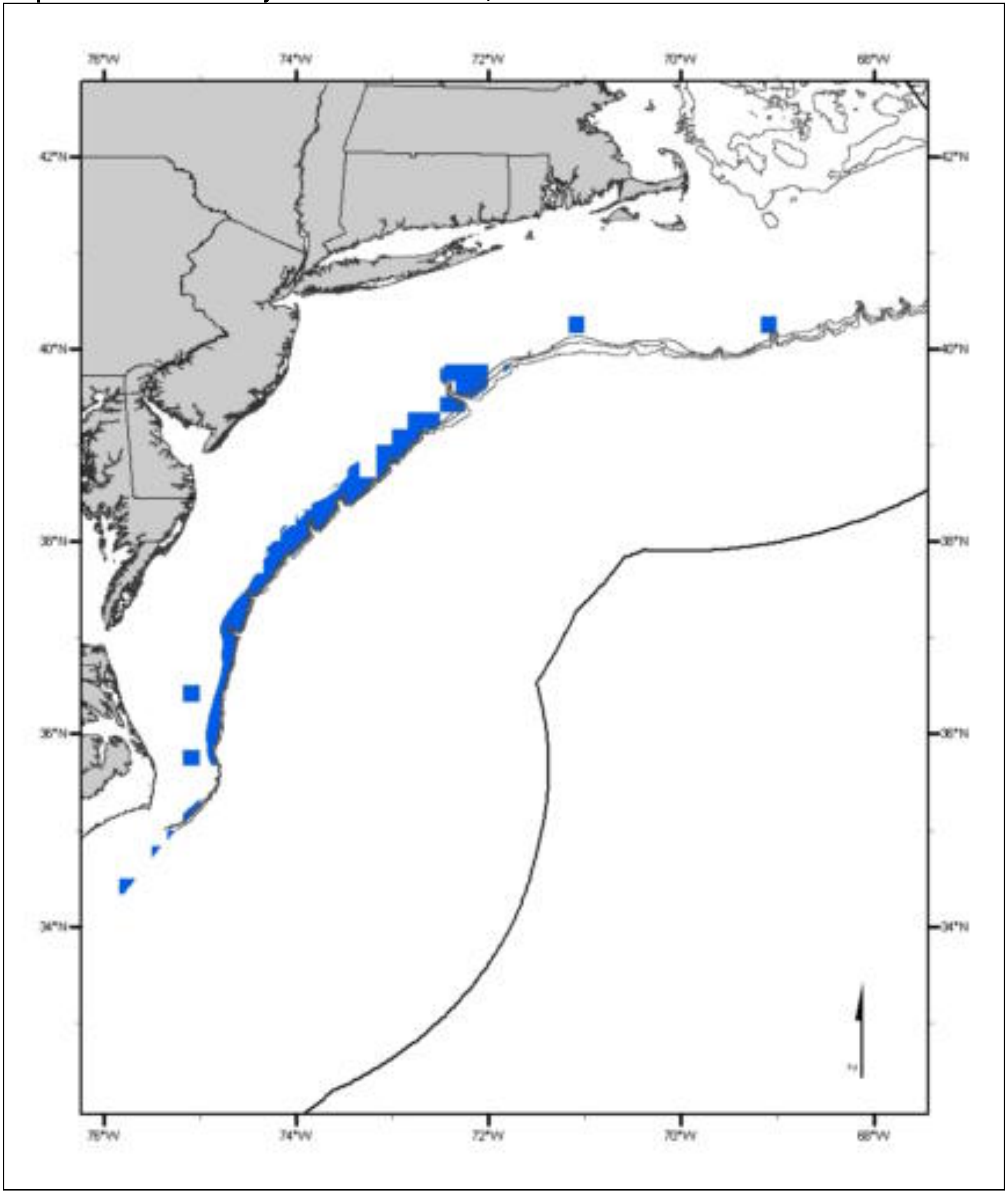
The Alternative 3B EFH designation for juvenile and adult rosette skate on the continental shelf is based on the distribution of depths and bottom temperatures that are associated with high catch rates of juveniles in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of juveniles in the 1968-2005 spring and fall NMFS trawl surveys at the 50% cumulative percentage of catch level.

Map 397. Rosette skate juveniles and adults, Alternative 3C *(Preferred Alternative)*



The Alternative 3C EFH designation for juvenile and adult rosette skate on the continental shelf is based on the distribution of depths and bottom temperatures that are associated with high catch rates of juveniles in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of juveniles in the 1968-2005 spring and fall NMFS trawl surveys at the 75% cumulative percentage of catch level.

Map 398. Rosette skate juveniles and adults, Alternative 3D



The Alternative 3D EFH designation for juvenile and adult rosette skate on the continental shelf is based on the distribution of depths and bottom temperatures that are associated with high catch rates of juveniles in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of juveniles in the 1968-2005 spring and fall NMFS trawl surveys at the 90% cumulative percentage of catch level.

4.1.3.2.17 Silver Hake

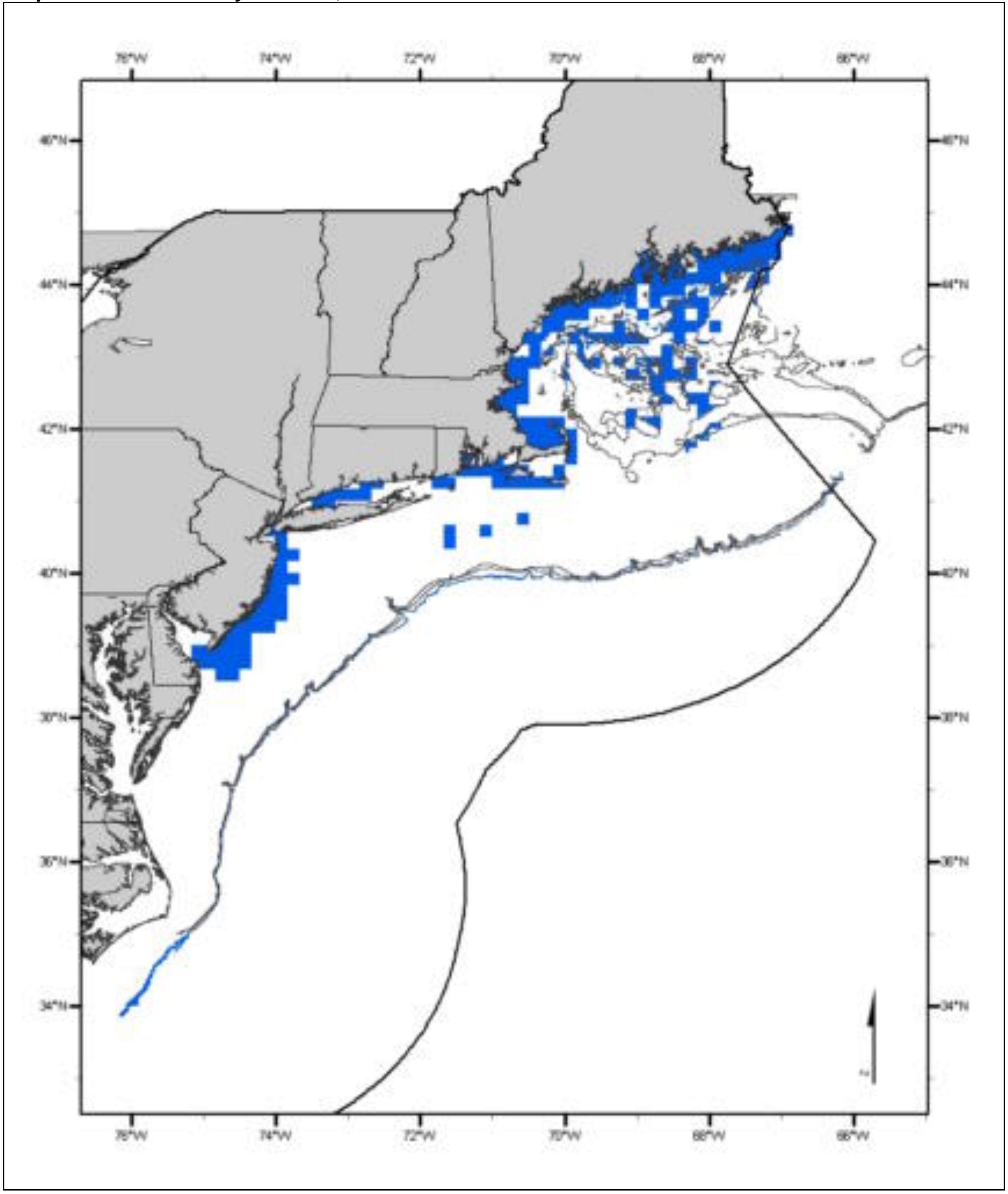
Eggs: No alternative EFH designation.

Larvae: No alternative EFH designation.

Juveniles: Pelagic and benthic habitats in inshore areas, and on the continental shelf and slope, in depths of 10 – 500 meters as depicted on Map 399 - Map 402. Benthic EFH for juvenile silver hake includes substrates composed of mud, sand, mixtures of sand and mud, and/or shell fragments. They are sometimes found in bottom depressions or in association with amphipod tubes. Other conditions that generally exist where benthic EFH is found are bottom temperatures of 1.5 – 21.5ºC; and salinities of 26 – 34.5 ppt. Juvenile silver hake migrate off the bottom at night and feed primarily on euphausiids, decapod shrimps, and other crustaceans. *(Preferred Alternative)*

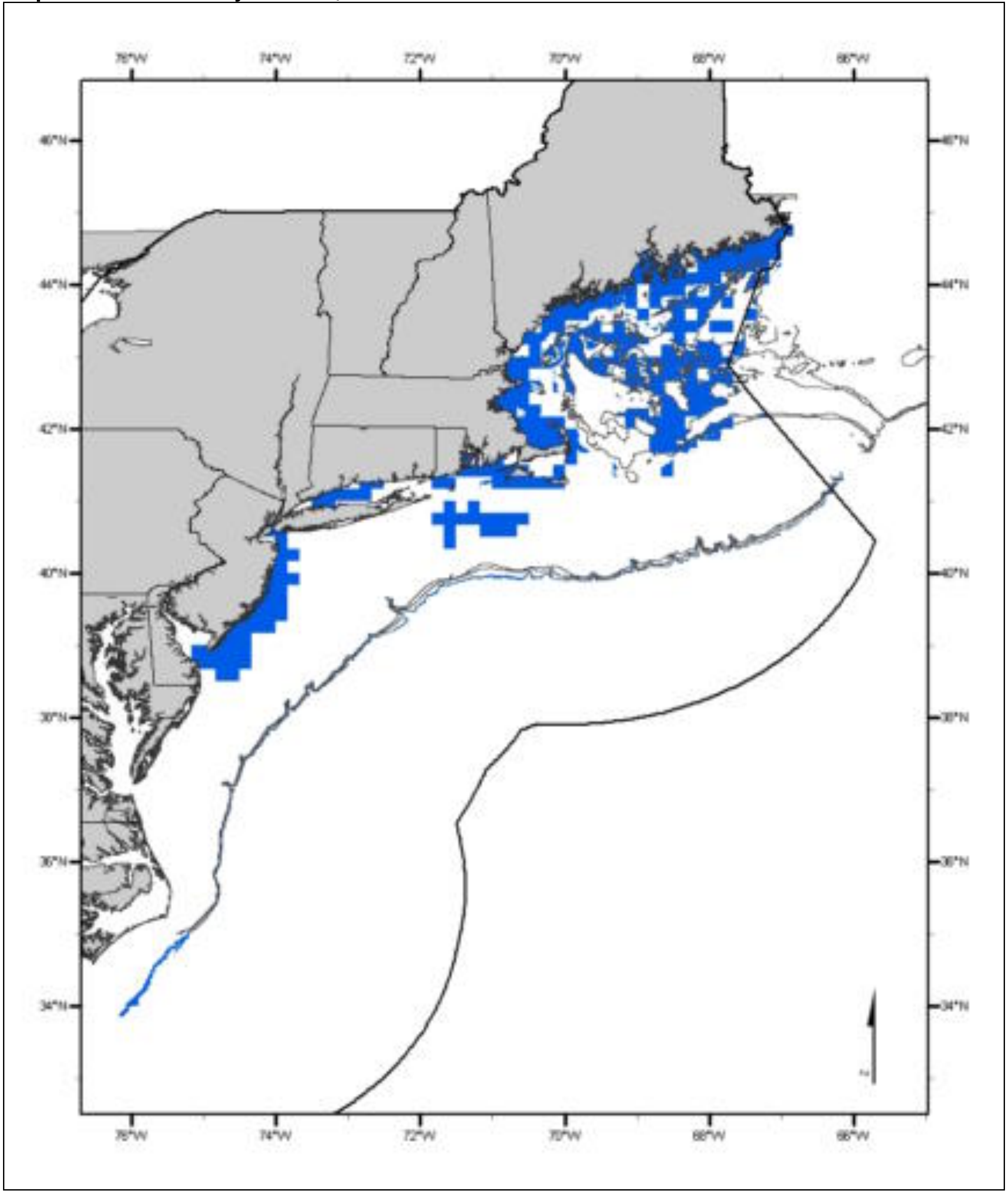
Adults: Pelagic and benthic habitats in inshore areas, and on the continental shelf and slope in depths of 10 – 500 meters as depicted on Map 403 - Map 406. Benthic EFH for adult silver hake includes substrates composed of mud, sand, mixtures of sand and mud, and/or shell fragments. They are sometimes found in bottom depressions. Other conditions that generally exist where benthic EFH for juvenile silver hake is found are bottom temperatures of 4.5 – 16ºC and salinities of 24 – 34.5 ppt. Adult silver hake migrate off the bottom at night and feed primarily on a variety of pelagic fish species, euphausiids, decapod shrimps, and other crustaceans. *(Preferred Alternative)*

Map 399. Silver hake juveniles, Alternative 3A



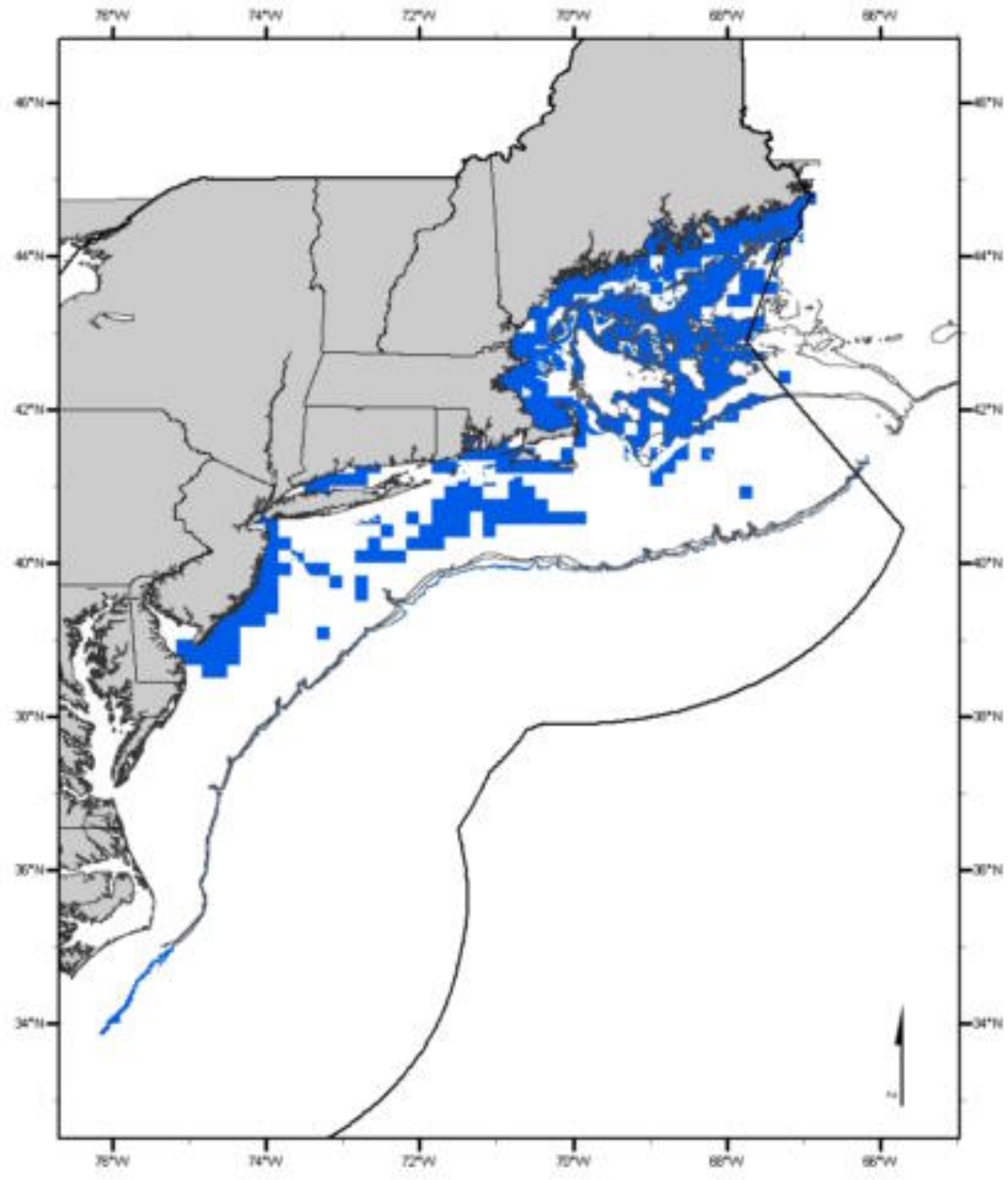
The Alternative 3A EFH designation for juvenile silver hake on the continental shelf is based on the distribution of depths and bottom temperatures that are associated with high catch rates of juveniles in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of juveniles in the 1968-2005 spring and fall NMFS trawl surveys at the 25% cumulative percentage of catch level and includes inshore areas where juvenile red hake were determined to be present, based on 10% frequency of occurrence in state trawl surveys and ELMR information.

Map 400. Silver hake juveniles, Alternative 3B



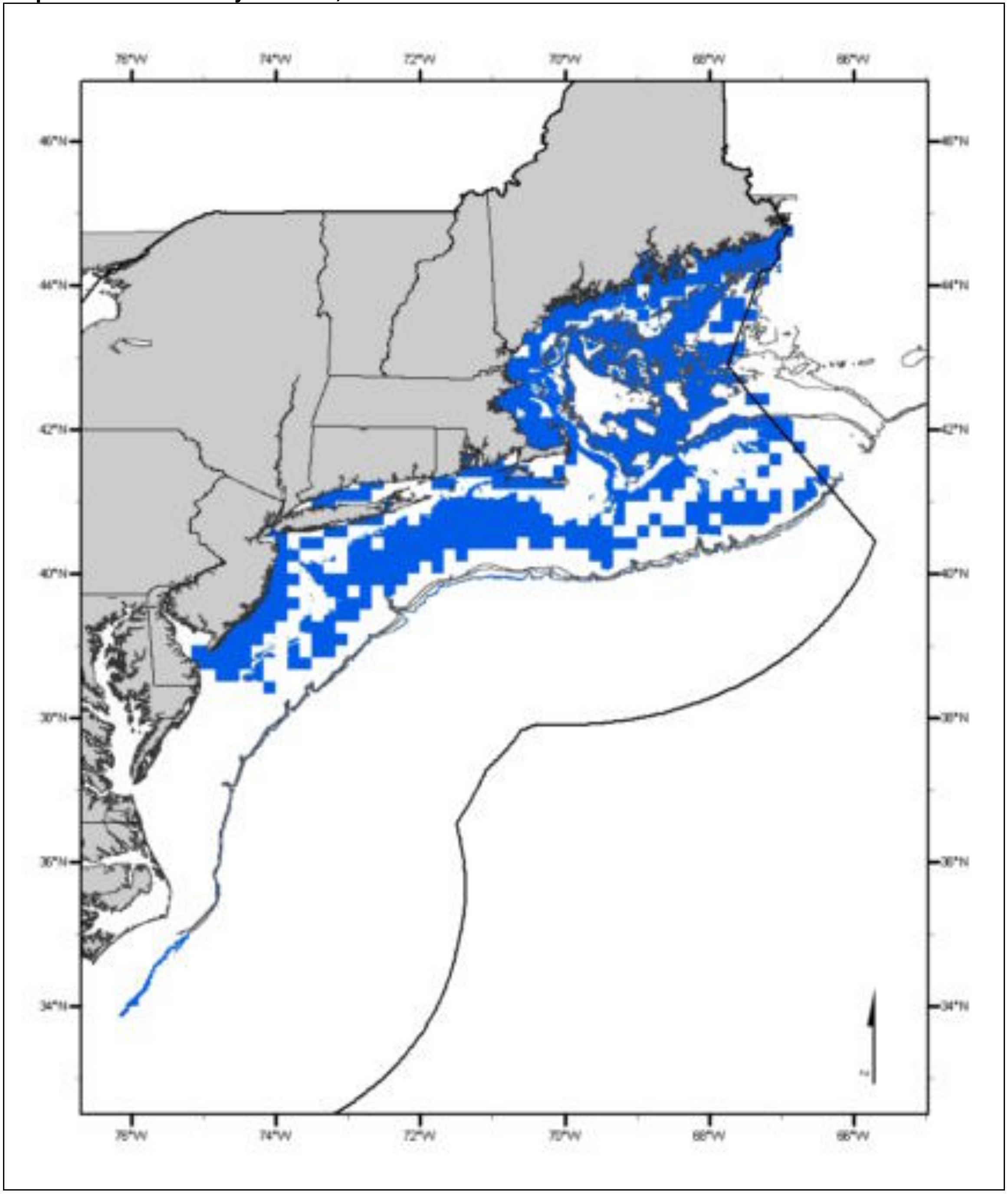
The Alternative 3B EFH designation for juvenile silver hake on the continental shelf is based on the distribution of depths and bottom temperatures that are associated with high catch rates of juveniles in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of juveniles in the 1968-2005 spring and fall NMFS trawl surveys at the 50% cumulative percentage of catch level and includes inshore areas where juvenile red hake were determined to be present, based on 10% frequency of occurrence in state trawl surveys and ELMR information.

Map 401. Silver hake juveniles, Alternative 3C *(Preferred Alternative)*



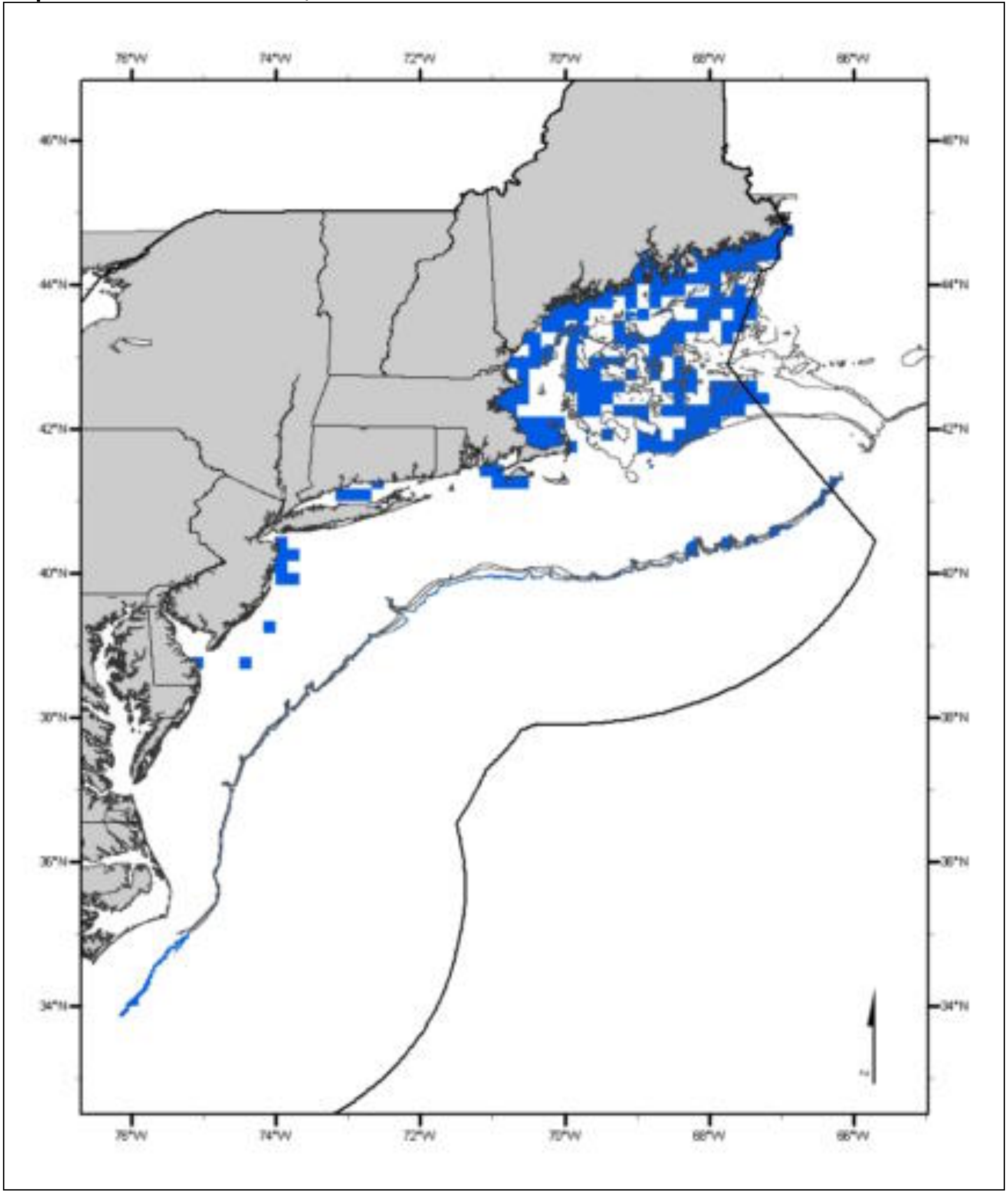
The Alternative 3C EFH designation for juvenile silver hake on the continental shelf is based on the distribution of depths and bottom temperatures that are associated with high catch rates of juveniles in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of juveniles in the 1968-2005 spring and fall NMFS trawl surveys at the 75% cumulative percentage of catch level and includes inshore areas where juvenile red hake were determined to be present, based on 10% frequency of occurrence in state trawl surveys and ELMR information.

Map 402. Silver hake juveniles, Alternative 3D



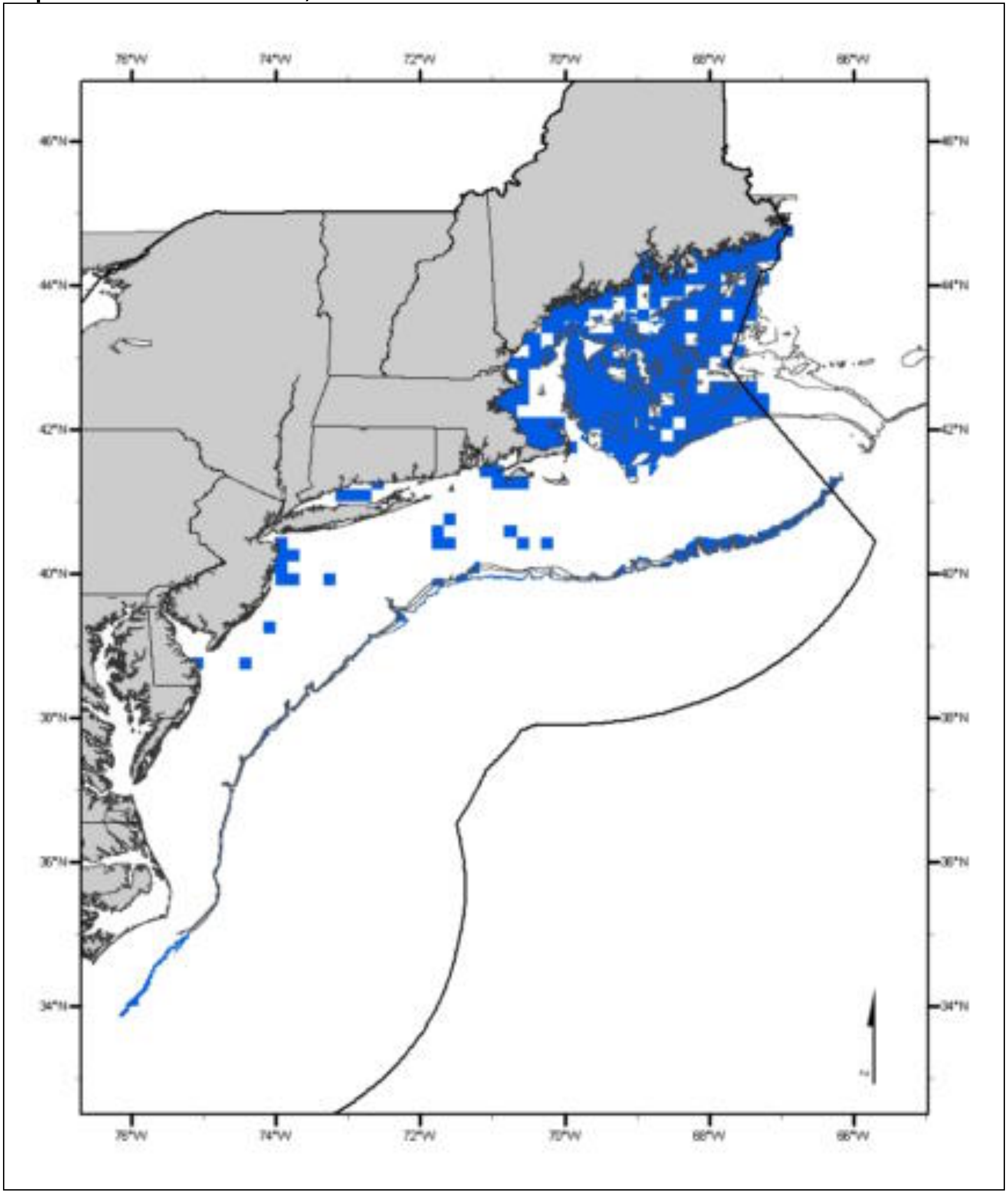
The Alternative 3D EFH designation for juvenile silver hake on the continental shelf is based on the distribution of depths and bottom temperatures that are associated with high catch rates of juveniles in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of juveniles in the 1968-2005 spring and fall NMFS trawl surveys at the 90% cumulative percentage of catch level and includes inshore areas where juvenile red hake were determined to be present, based on 10% frequency of occurrence in state trawl surveys and ELMR information.

Map 403. Silver hake adults, Alternative 3A



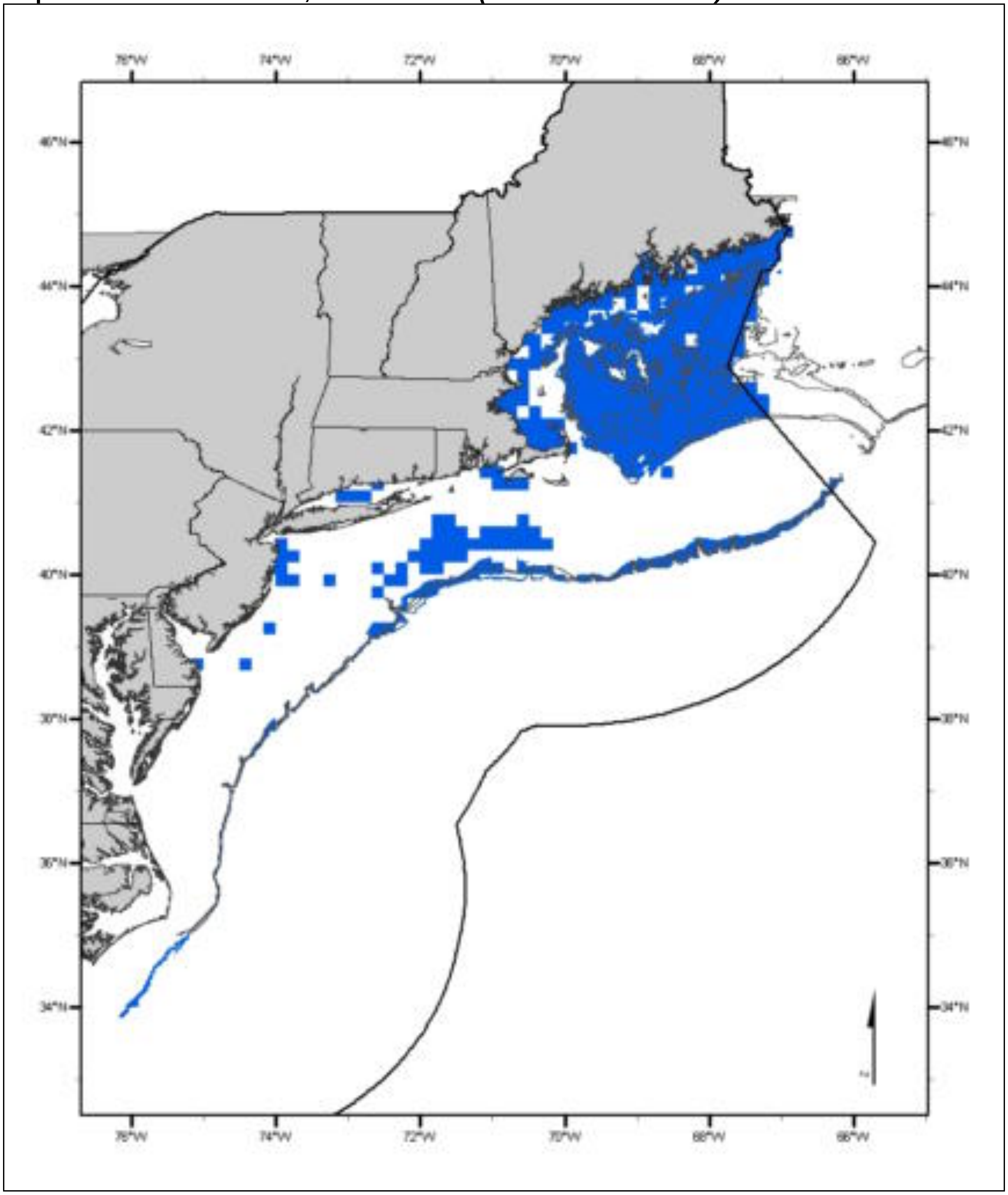
The Alternative 3A EFH designation for adult silver hake on the continental shelf is based on the distribution of depths and bottom temperatures that are associated with high catch rates of adults in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of adults in the 1968-2005 spring and fall NMFS trawl surveys at the 25% cumulative percentage of catch level and includes inshore and off-shelf areas where adult silver hake were determined to be present, based on 10% frequency of occurrence in state trawl surveys, ELMR information, and off-shelf depth and geographic ranges.

Map 404. Silver hake adults, Alternative 3B



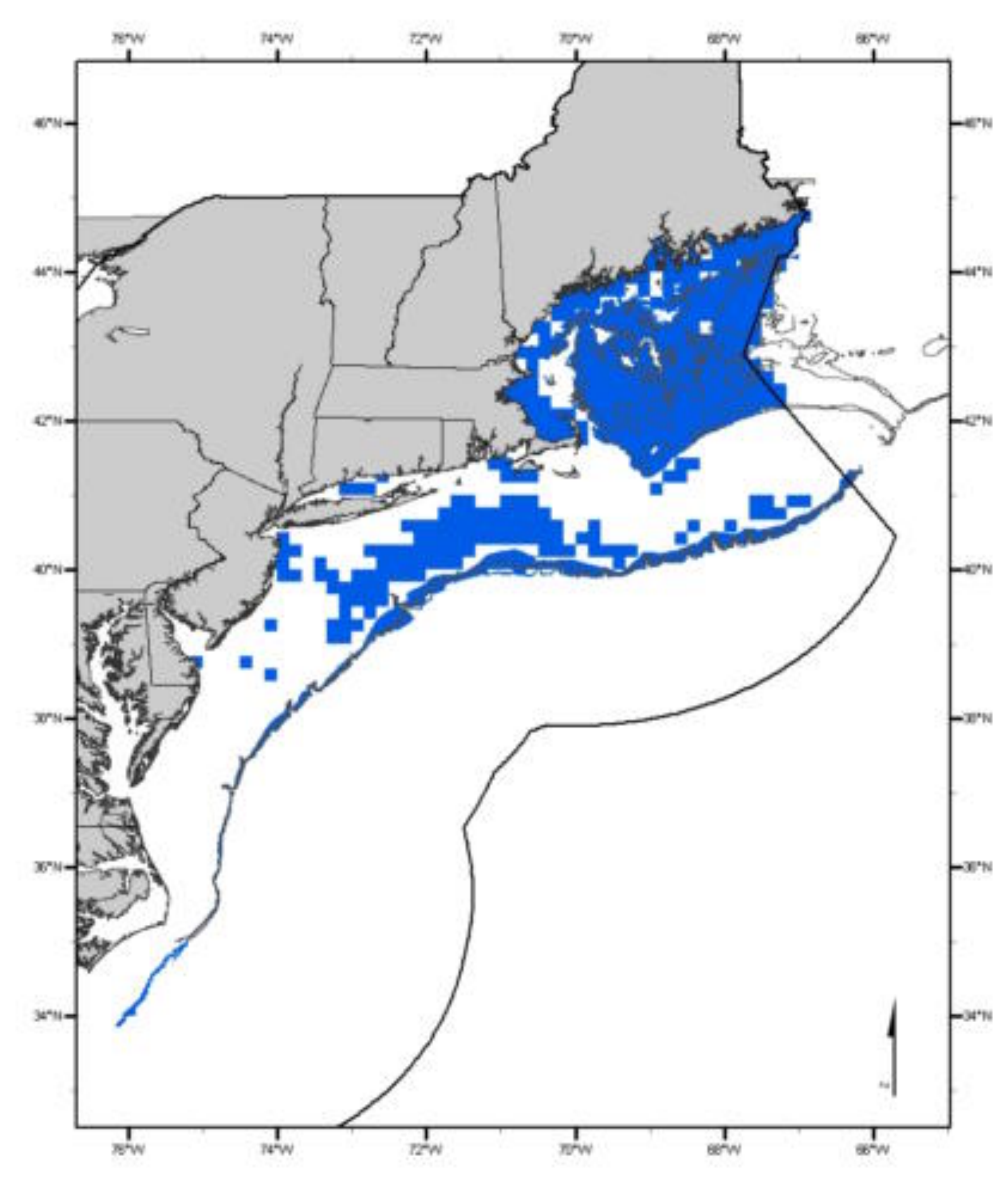
The Alternative 3B EFH designation for adult silver hake on the continental shelf is based on the distribution of depths and bottom temperatures that are associated with high catch rates of adults in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of adults in the 1968-2005 spring and fall NMFS trawl surveys at the 50% cumulative percentage of catch level and includes inshore and off-shelf areas where adult silver hake were determined to be present, based on 10% frequency of occurrence in state trawl surveys, ELMR information, and off-shelf depth and geographic ranges.

Map 405. Silver hake adults, Alternative 3C *(Preferred Alternative)*



The Alternative 3C EFH designation for adult silver hake on the continental shelf is based on the distribution of depths and bottom temperatures that are associated with high catch rates of adults in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of adults in the 1968-2005 spring and fall NMFS trawl surveys at the 75% cumulative percentage of catch level and includes inshore and off-shelf areas where adult silver hake were determined to be present, based on 10% frequency of occurrence in state trawl surveys, ELMR information, and off-shelf depth and geographic ranges.

Map 406. Silver hake adults, Alternative 3D



The Alternative 3D EFH designation for adult silver hake on the continental shelf is based on the distribution of depths and bottom temperatures that are associated with high catch rates of adults in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of adults in the 1968-2005 spring and fall NMFS trawl surveys at the 90% cumulative percentage of catch level and includes inshore and off-shelf areas where adult silver hake were determined to be present, based on 10% frequency of occurrence in state trawl surveys, ELMR information, and off-shelf depth and geographic ranges.

4.1.3.2.18 Smooth Skate

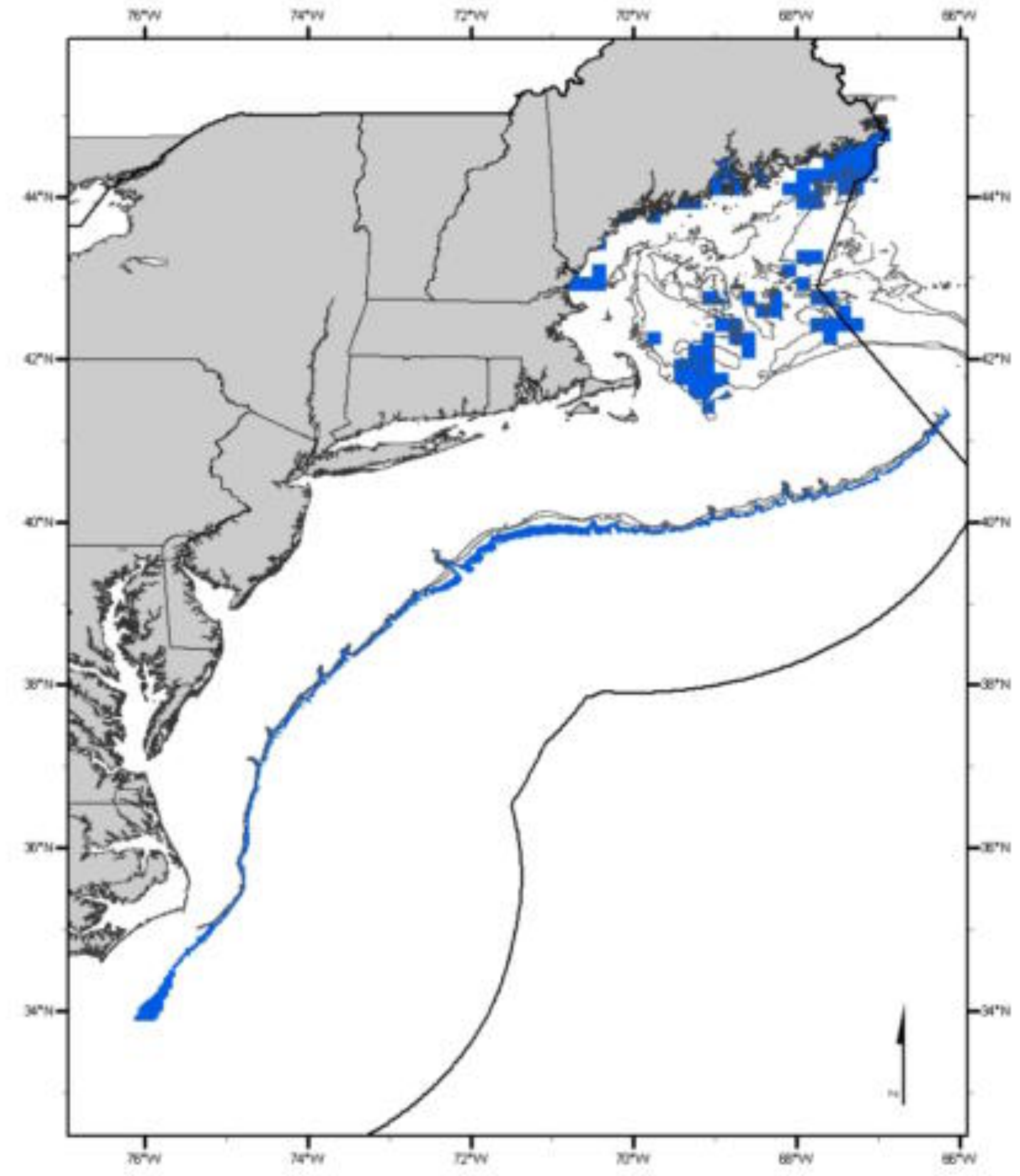
Eggs: No alternative EFH designation.

Larvae: No larval life stage exists for this species. Upon hatching, they are fully developed juveniles.

Juveniles: Benthic habitats on the continental shelf and slope in depths of 120 – 900 meters, as depicted on Map 407 - Map 410. EFH for juvenile smooth skates occurs mostly on soft mud in deeper areas, but also on sand, broken shells, gravel, and pebbles on offshore banks. Other conditions that generally exist where EFH is found are bottom temperatures of 3.5 – 9.5ºC and salinities of 32.5 – 35.5 ppt. Juvenile smooth skates feed on epifaunal crustaceans, primarily decapods (e.g., pandalid shrimp, hermit crabs, sand shrimp), and euphausiids, with some mysids, amphipods, and isopods. *(Preferred Alternative)*

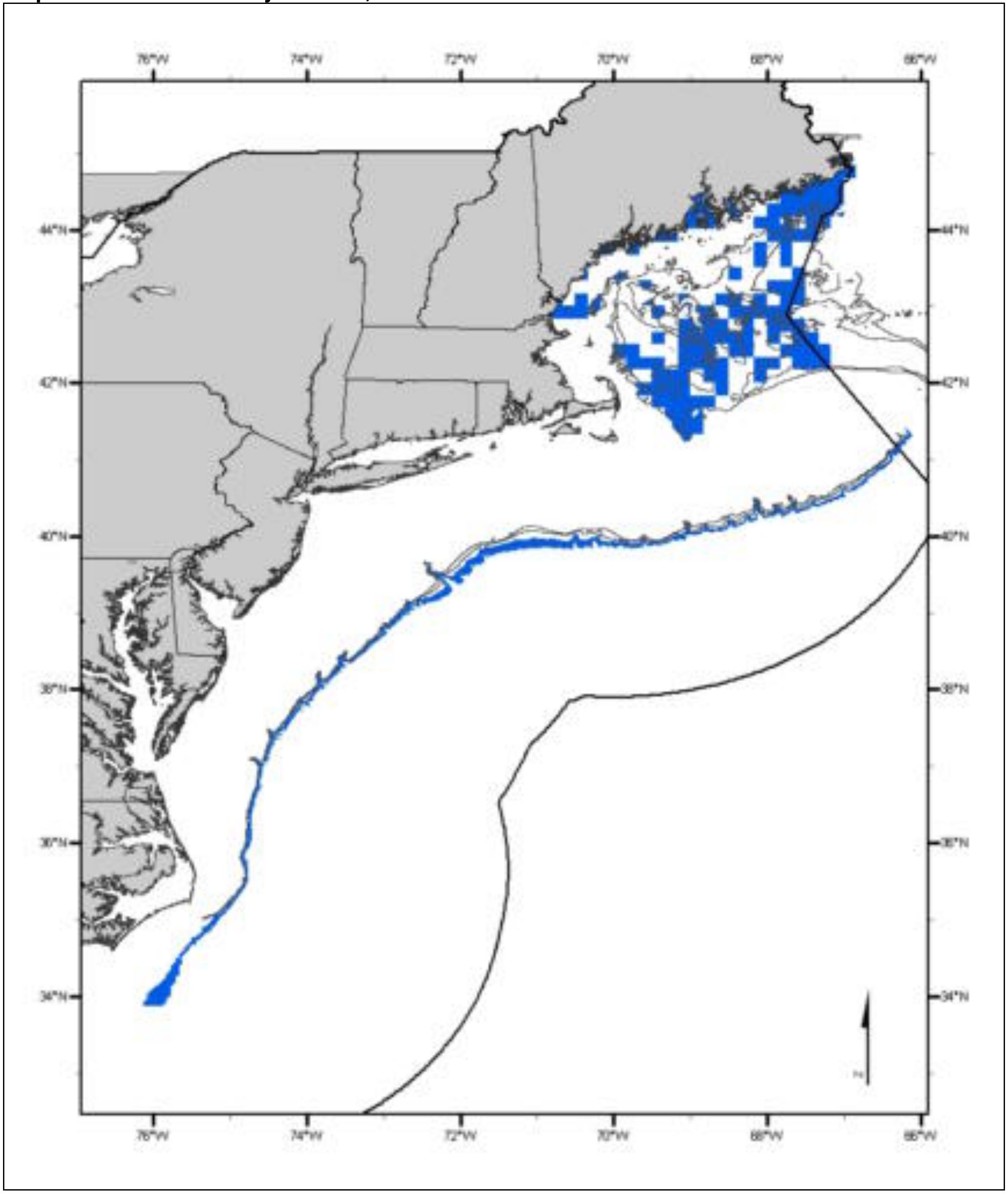
Adults: Benthic habitats on the continental shelf and slope in depths of 120 – 900 meters, as depicted on Map 411 - Map 414. EFH for adult smooth skates includes a wider variety of substrates than for juveniles, including mud, sand and mud, sand, and sand and mud mixed with shells, gravel and pebbles. Other conditions that generally exist where EFH is found are bottom temperatures of 3.5 – 8.5ºC and salinities of 32.5 – 35.5 ppt. Adult smooth skates have similar feeding habits as juveniles, but consume more decapods, euphausiids and fishes (*e.g.*, silver hake and sand lance), and fewer mysids and amphipods. *(Preferred Alternative)*

Map 407. Smooth skate juveniles, Alternative 3A



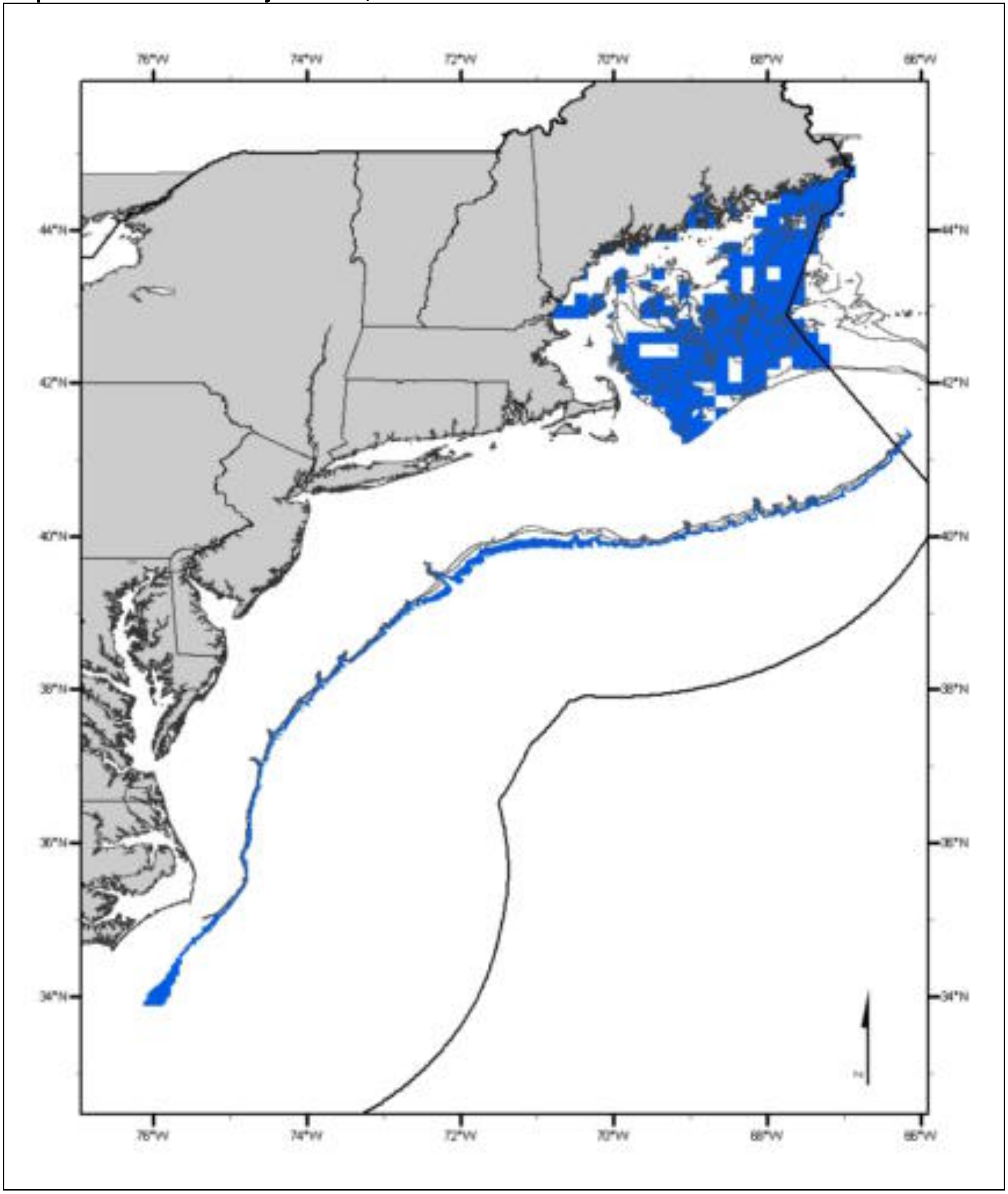
The Alternative 3A EFH designation for juvenile smooth skate on the continental shelf is based on the distribution of depths and bottom temperatures that are associated with high catch rates of juveniles in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of juveniles in the 1968-2005 spring and fall NMFS trawl surveys at the 25% cumulative percentage of catch level and includes inshore and off-shelf areas where juvenile smooth skate were determined to be present, based on 10% frequency of occurrence in state trawl surveys and off-shelf depth and geographic ranges.

Map 408. Smooth skate juveniles, Alternative 3B



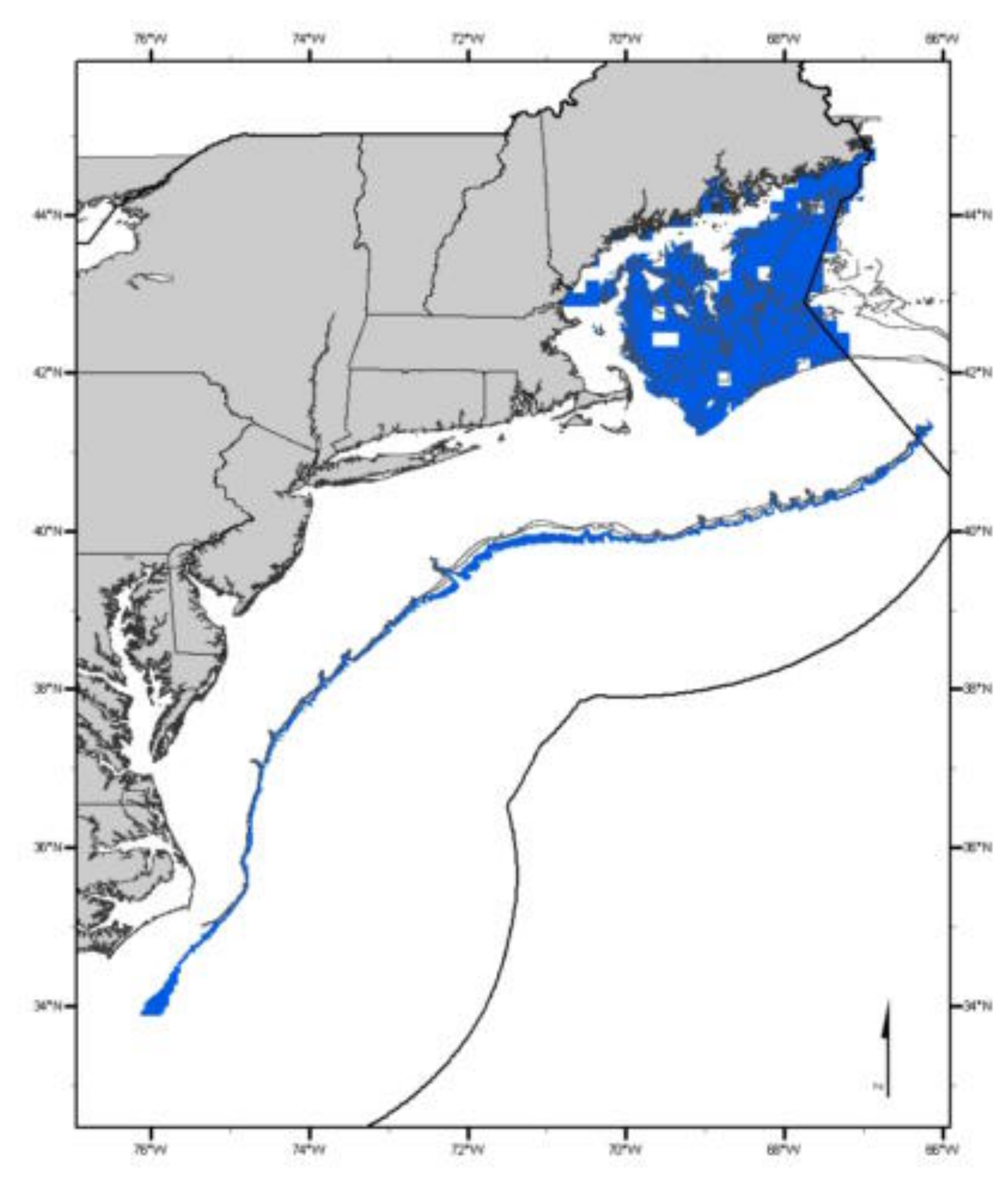
The Alternative 3B EFH designation for juvenile smooth skate on the continental shelf is based on the distribution of depths and bottom temperatures that are associated with high catch rates of juveniles in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of juveniles in the 1968-2005 spring and fall NMFS trawl surveys at the 50% cumulative percentage of catch level and includes inshore and off-shelf areas where juvenile smooth skate were determined to be present, based on 10% frequency of occurrence in state trawl surveys and off-shelf depth and geographic ranges.

Map 409. Smooth skate juveniles, Alternative 3C



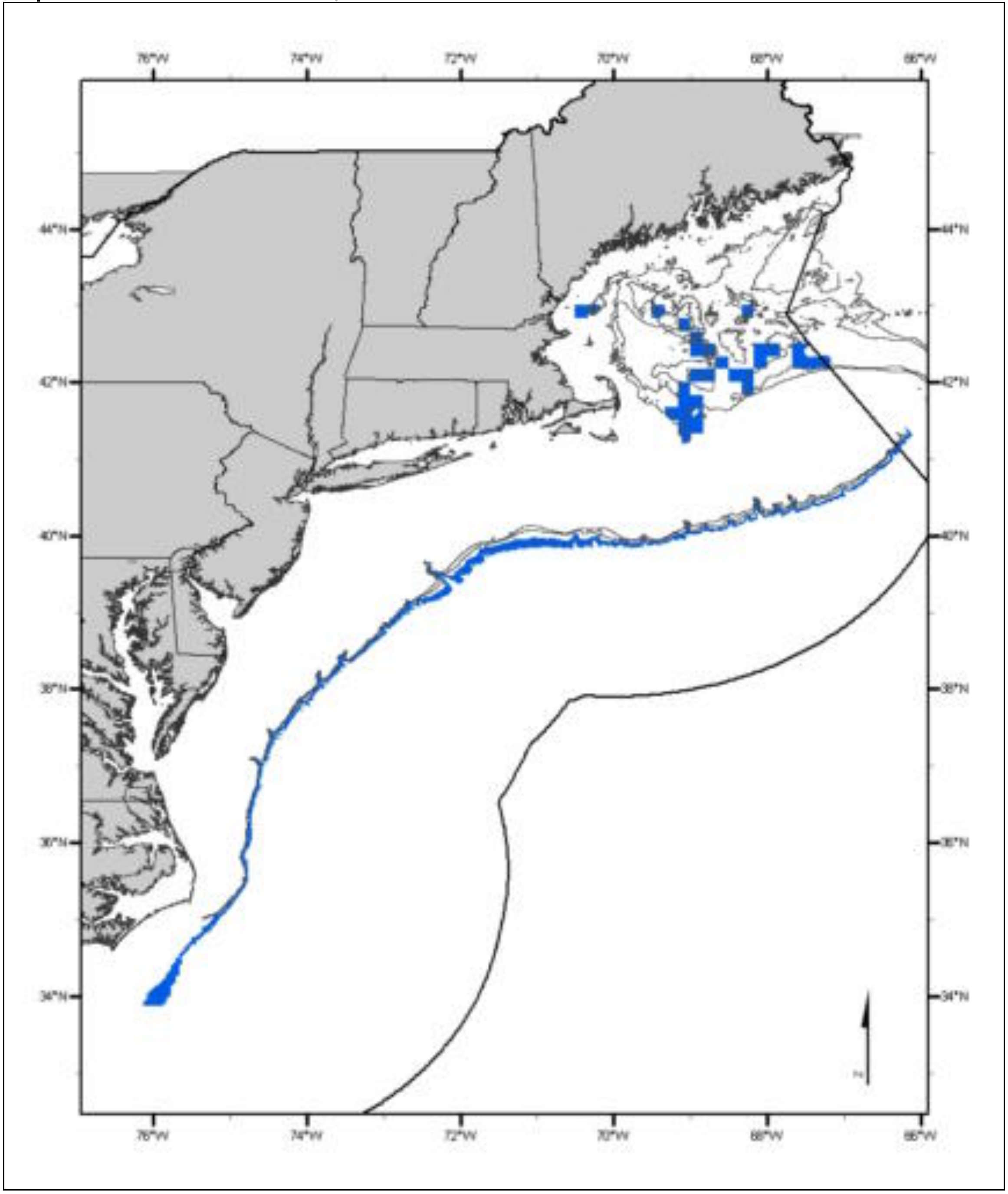
The Alternative 3C EFH designation for juvenile smooth skate on the continental shelf is based on the distribution of depths and bottom temperatures that are associated with high catch rates of juveniles in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of juveniles in the 1968-2005 spring and fall NMFS trawl surveys at the 75% cumulative percentage of catch level and includes inshore and off-shelf areas where juvenile smooth skate were determined to be present, based on 10% frequency of occurrence in state trawl surveys and off-shelf depth and geographic ranges.

Map 410. Smooth skate juveniles, Alternative 3D *(Preferred Alternative)*



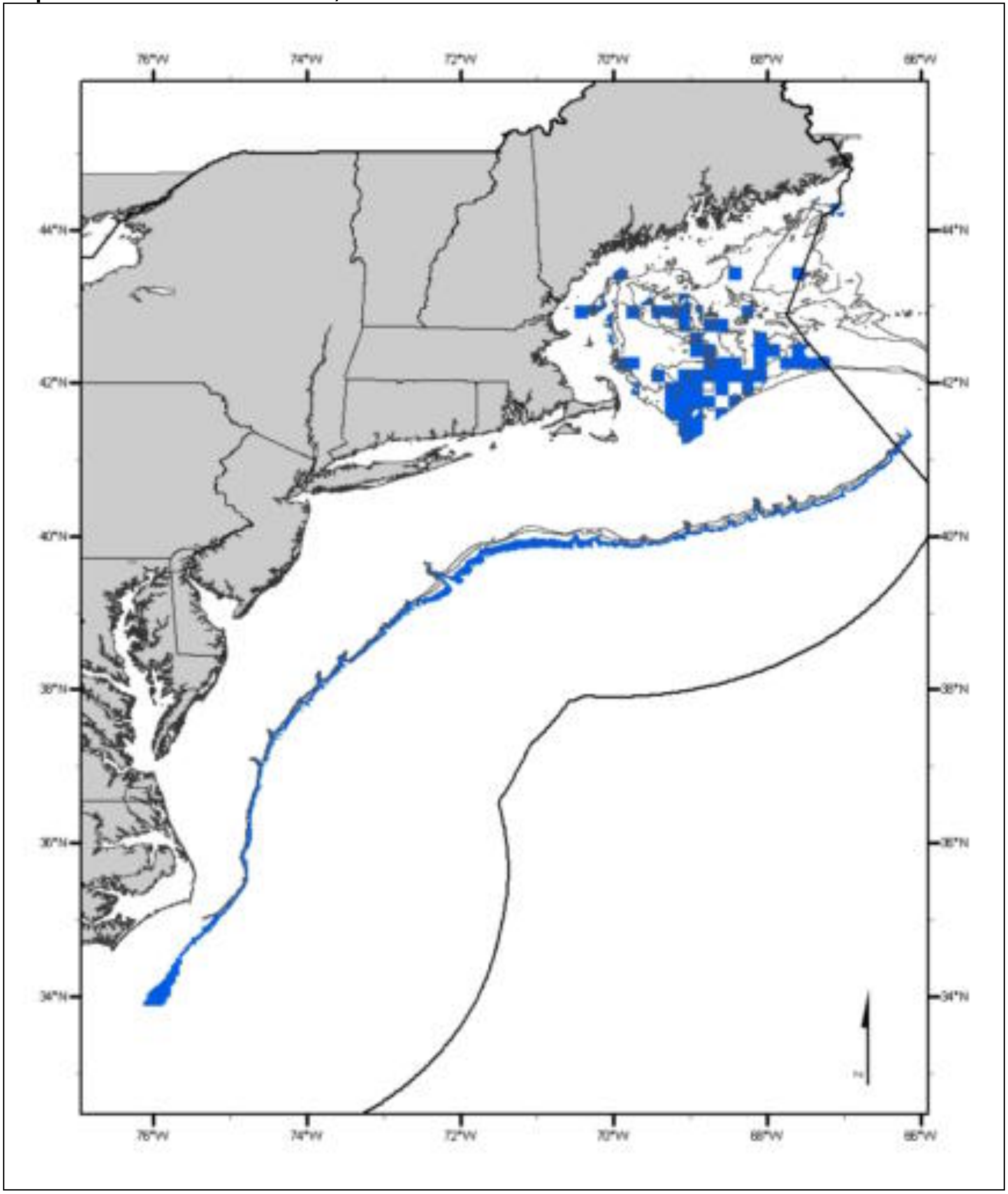
The Alternative 3D EFH designation for juvenile smooth skate on the continental shelf is based on the distribution of depths and bottom temperatures that are associated with high catch rates of juveniles in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of juveniles in the 1968-2005 spring and fall NMFS trawl surveys at the 90% cumulative percentage of catch level and includes inshore and off-shelf areas where juvenile smooth skate were determined to be present, based on 10% frequency of occurrence in state trawl surveys and off-shelf depth and geographic ranges.

Map 411. Smooth skate adults, Alternative 3A



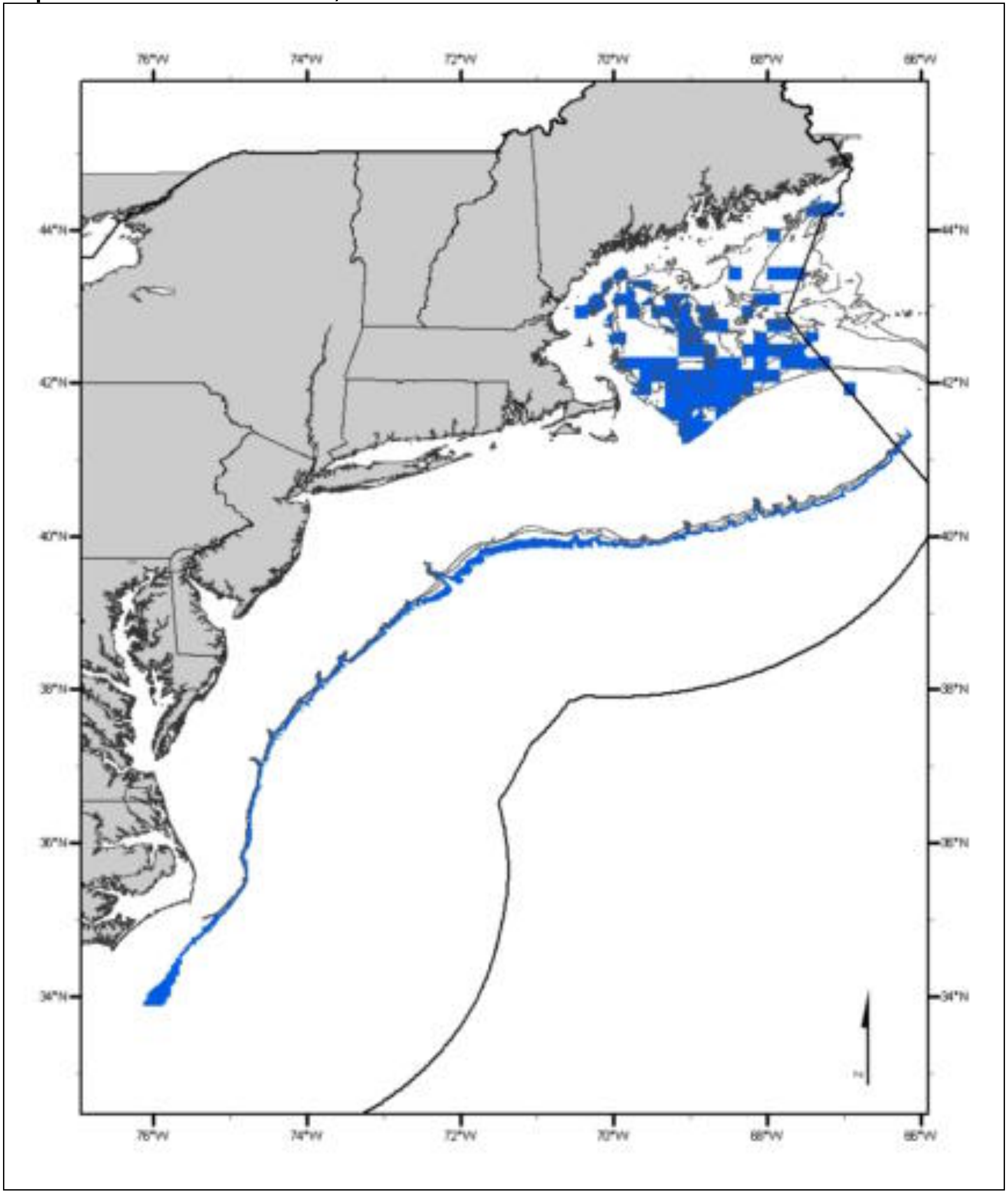
The Alternative 3A EFH designation for adult smooth skate on the continental shelf is based on the distribution of depths and bottom temperatures that are associated with high catch rates of adults in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of adults in the 1968-2005 spring and fall NMFS trawl surveys at the 25% cumulative percentage of catch level and includes inshore and off-shelf areas where adult smooth skate were determined to be present, based on 10% frequency of occurrence in state trawl surveys and off-shelf depth and geographic ranges.

Map 412. Smooth skate adults, Alternative 3B



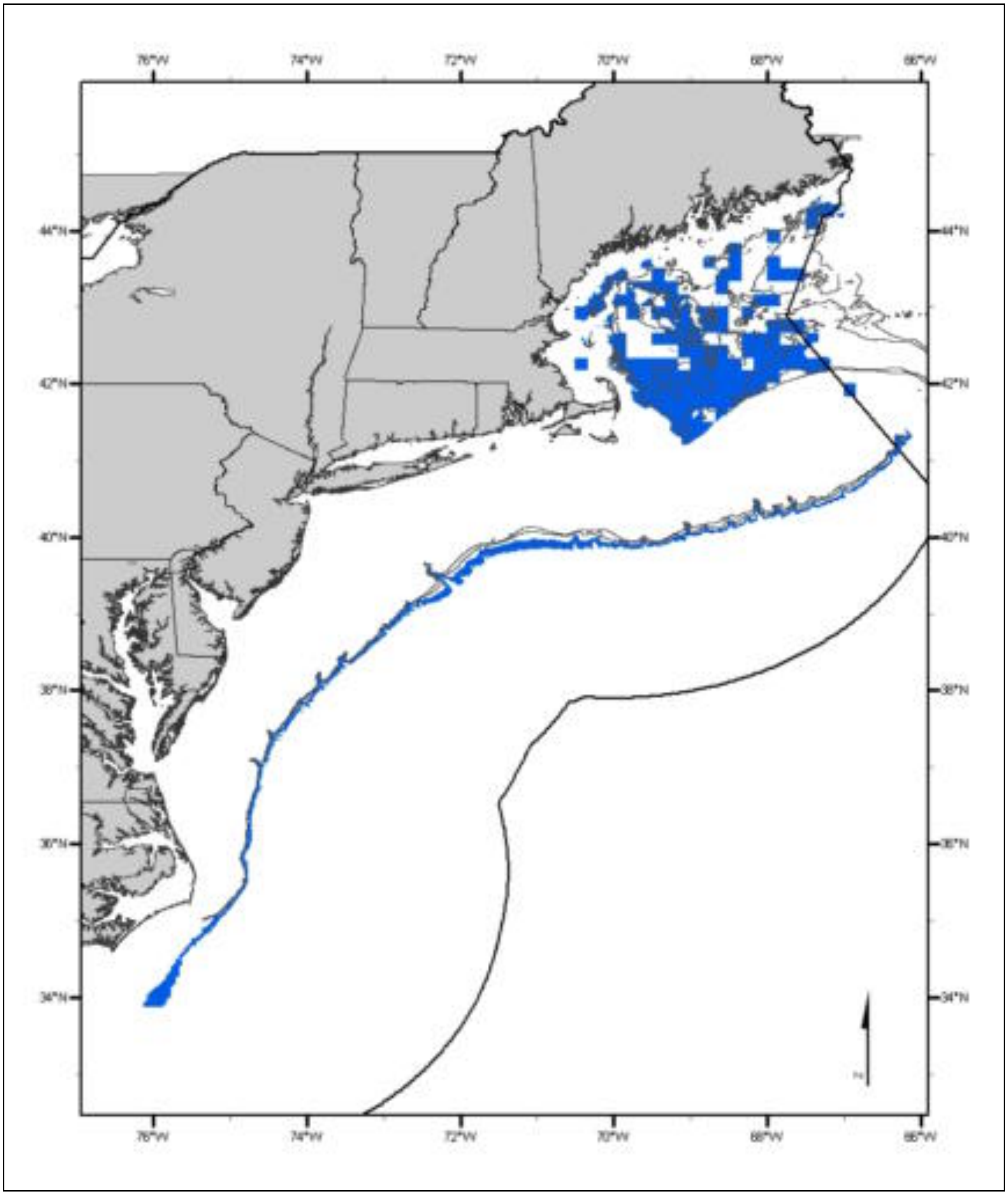
The Alternative 3B EFH designation for adult smooth skate on the continental shelf is based on the distribution of depths and bottom temperatures that are associated with high catch rates of adults in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of adults in the 1968-2005 spring and fall NMFS trawl surveys at the 50% cumulative percentage of catch level and includes inshore and off-shelf areas where adult smooth skate were determined to be present, based on 10% frequency of occurrence in state trawl surveys and off-shelf depth and geographic ranges.

Map 413. Smooth skate adults, Alternative 3C



The Alternative 3C EFH designation for adult smooth skate on the continental shelf is based on the distribution of depths and bottom temperatures that are associated with high catch rates of adults in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of adults in the 1968-2005 spring and fall NMFS trawl surveys at the 75% cumulative percentage of catch level and includes inshore and off-shelf areas where adult smooth skate were determined to be present, based on 10% frequency of occurrence in state trawl surveys and off-shelf depth and geographic ranges.

Map 414. Smooth skate adults, Alternative 3D *(Preferred Alternative)*



The Alternative 3D EFH designation for adult smooth skate on the continental shelf is based on the distribution of depths and bottom temperatures that are associated with high catch rates of adults in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of adults in the 1968-2005 spring and fall NMFS trawl surveys at the 90% cumulative percentage of catch level and includes inshore and off-shelf areas where adult smooth skate were determined to be present, based on 10% frequency of occurrence in state trawl surveys and off-shelf depth and geographic ranges.

4.1.3.2.19 Thorny Skate

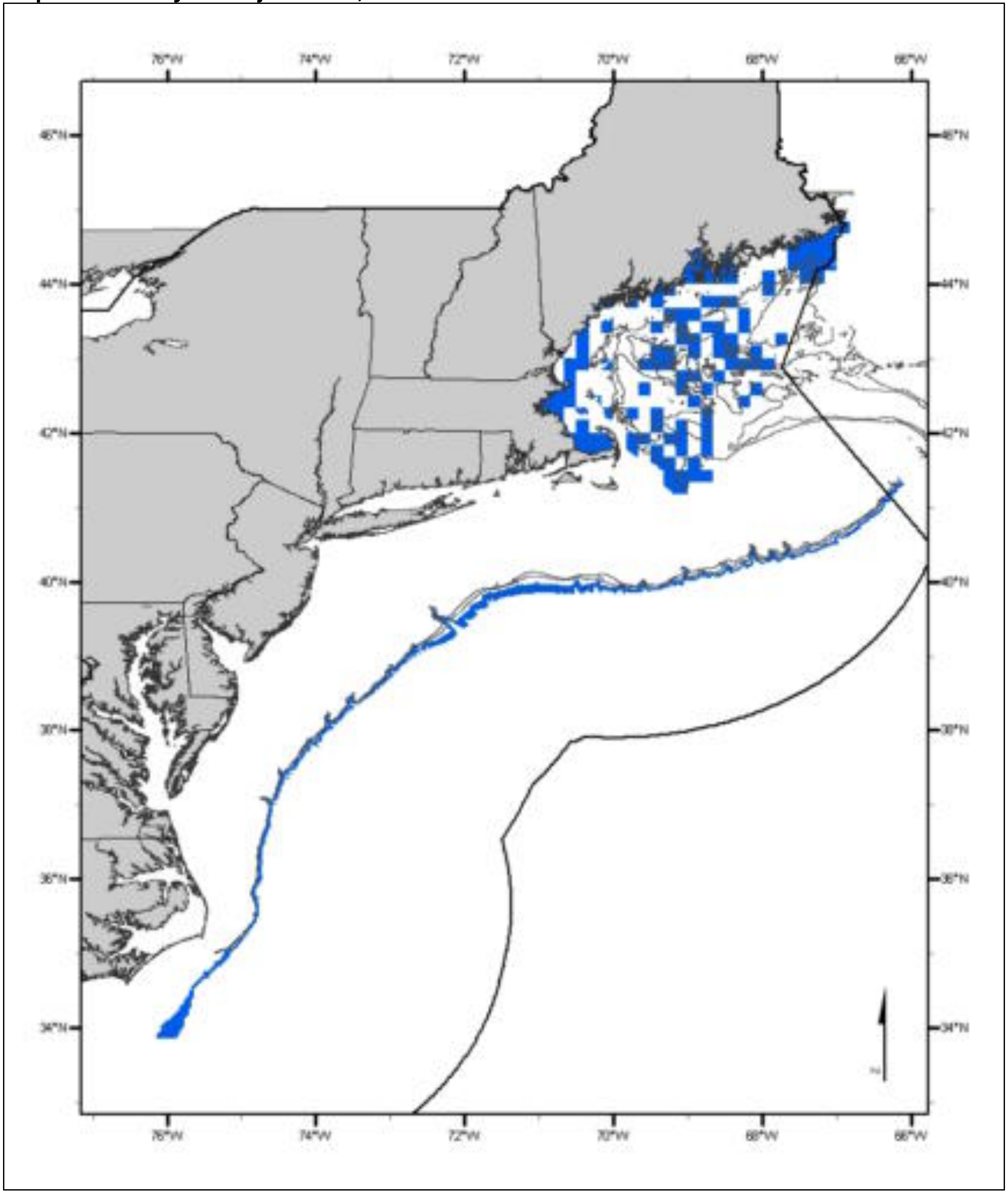
Eggs: No alternative EFH designation.

Larvae: No larval life stage exists for this species. Upon hatching, they are fully developed juveniles.

Juveniles: Benthic habitats on the continental shelf and slope in depths of 35 – 900 meters, as depicted on Map 415 - Map 418. EFH for juvenile thorny skate includes a wide range of bottom types from soft mud to gravel, broken shells, and pebbles. Other conditions that generally exist where EFH is found are bottom temperatures of 0.5 – 10.5ºC and salinities of 32.5 – 34.5 ppt. Juvenile thorny skates feed on polychaetes, a variety of crustaceans, and a variety of fishes (*e.g.*, sand lance, wrymouth, and silver hake). *(Preferred Alternative)*

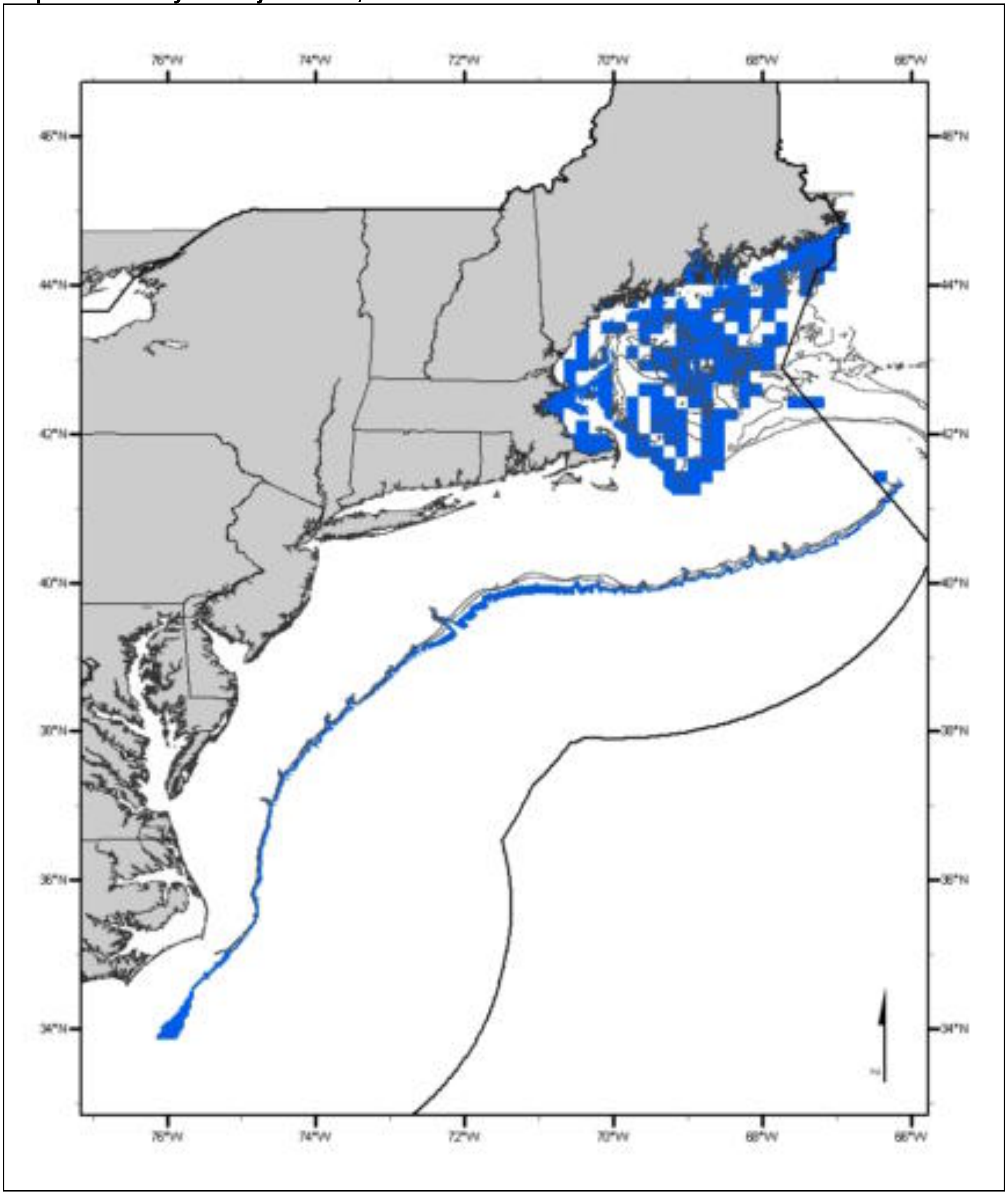
Adults: Benthic habitats on the continental shelf and slope in depths of 120 – 900 meters, as depicted on Map 419 - Map 422. EFH for adult thorny skate includes a wide range of bottom types from soft mud to gravel, broken shells, and pebbles, but they are found primarily on mud. Other conditions that generally exist where EFH is found are bottom temperatures of 2.5 – 7.5ºC and salinities of 32.5 – 34.5 ppt. Adult thorny skates feed on polychaetes, crustaceans (*e.g.*, pandalid shrimps, crabs, and euphausiids), fishes (*e.g.*, herring, wrymouth, and hagfish), and squids. *(Preferred Alternative)*

Map 415. Thorny skate juveniles, Alternative 3A



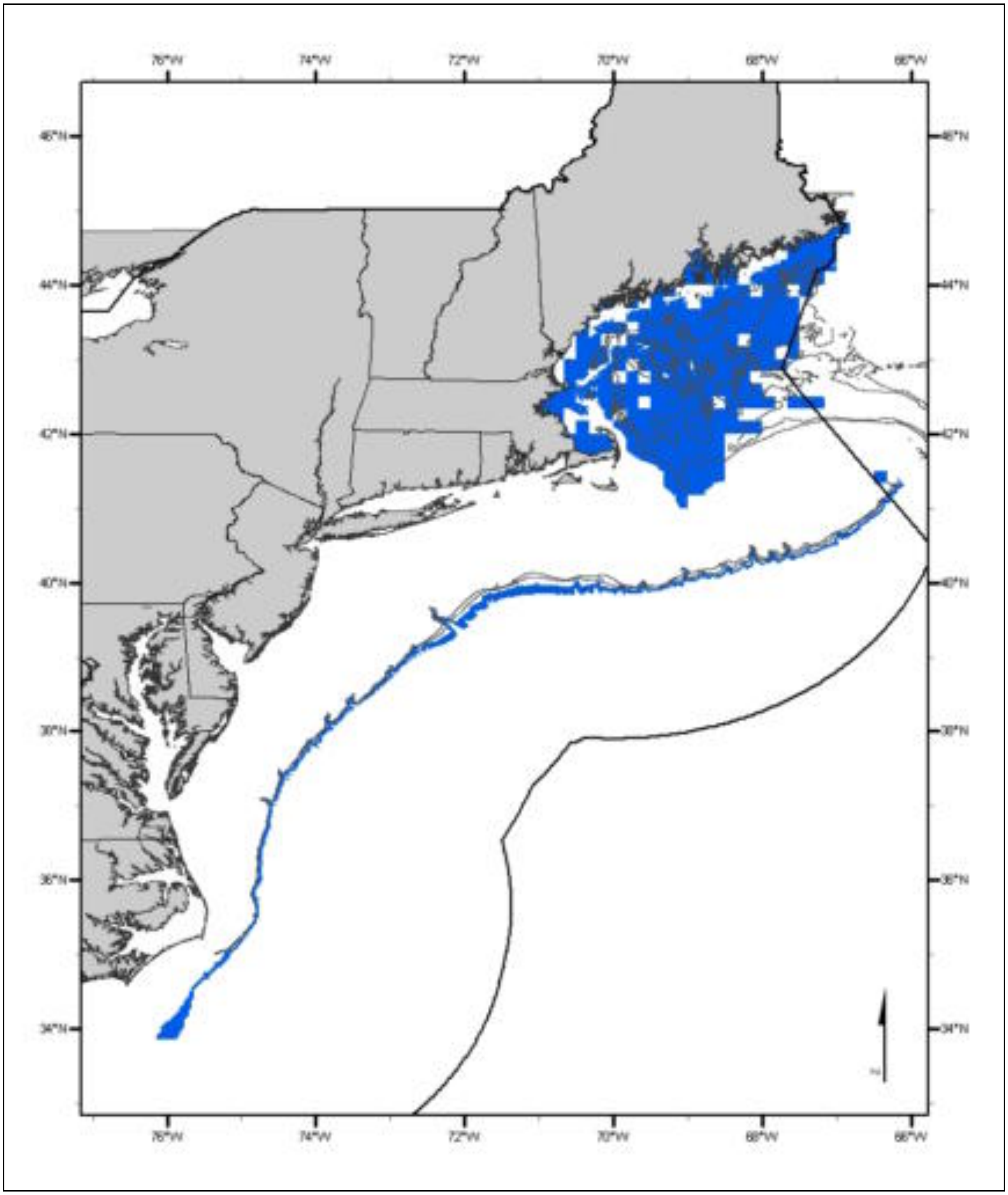
The Alternative 3A EFH designation for juvenile thorny skate on the continental shelf is based on the distribution of depths and bottom temperatures that are associated with high catch rates of juveniles in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of juveniles in the 1968-2005 spring and fall NMFS trawl surveys at the 25% cumulative percentage of catch level and includes inshore and off-shelf areas where juvenile thorny skate were determined to be present, based on 10% frequency of occurrence in state trawl surveys and off-shelf depth and geographic ranges.

Map 416. Thorny skate juveniles, Alternative 3B



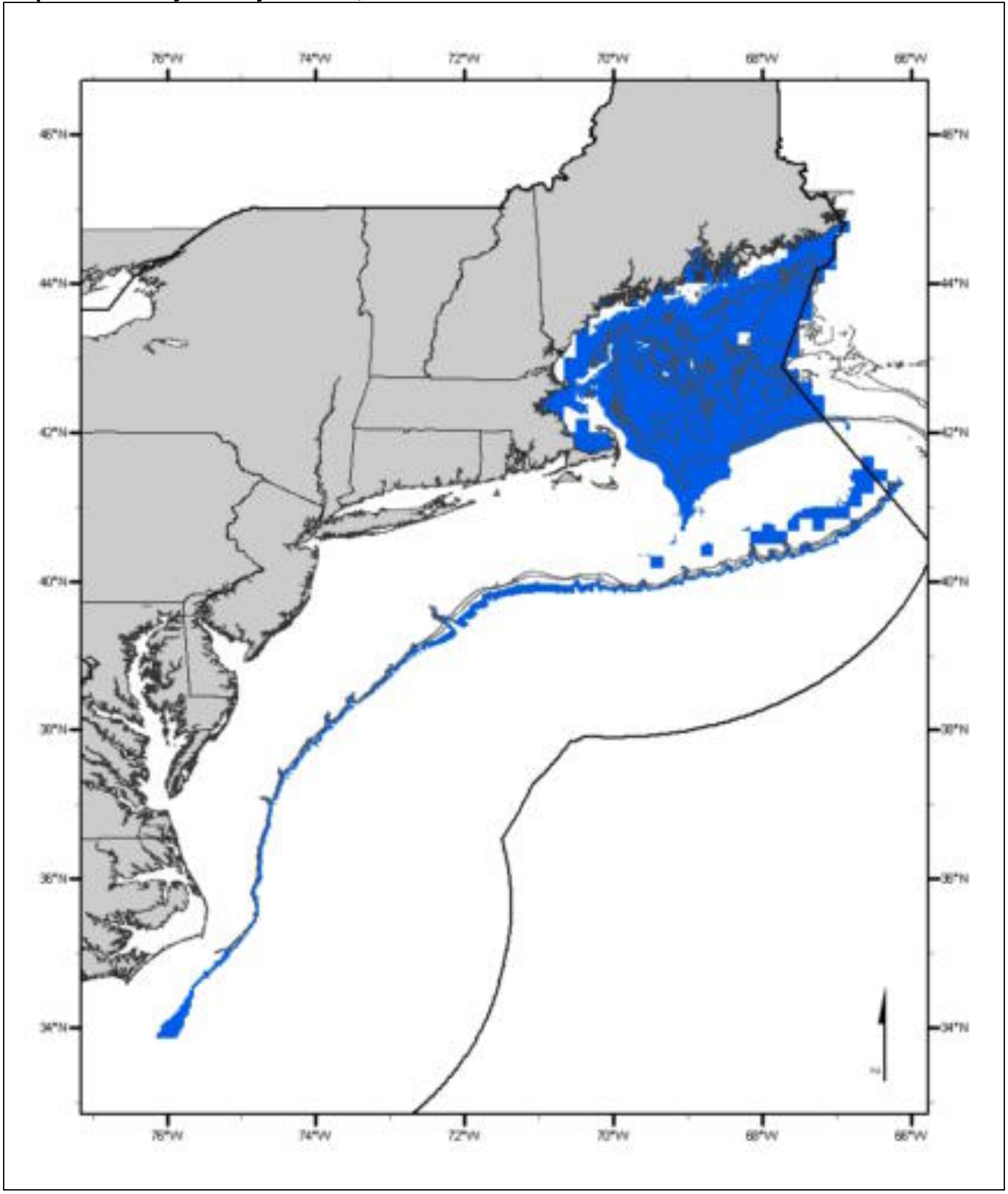
The Alternative 3B EFH designation for juvenile thorny skate on the continental shelf is based on the distribution of depths and bottom temperatures that are associated with high catch rates of juveniles in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of juveniles in the 1968-2005 spring and fall NMFS trawl surveys at the 50% cumulative percentage of catch level and includes inshore and off-shelf areas where juvenile thorny skate were determined to be present, based on 10% frequency of occurrence in state trawl surveys and off-shelf depth and geographic ranges.

Map 417. Thorny skate juveniles, Alternative 3C *(Preferred Alternative)*



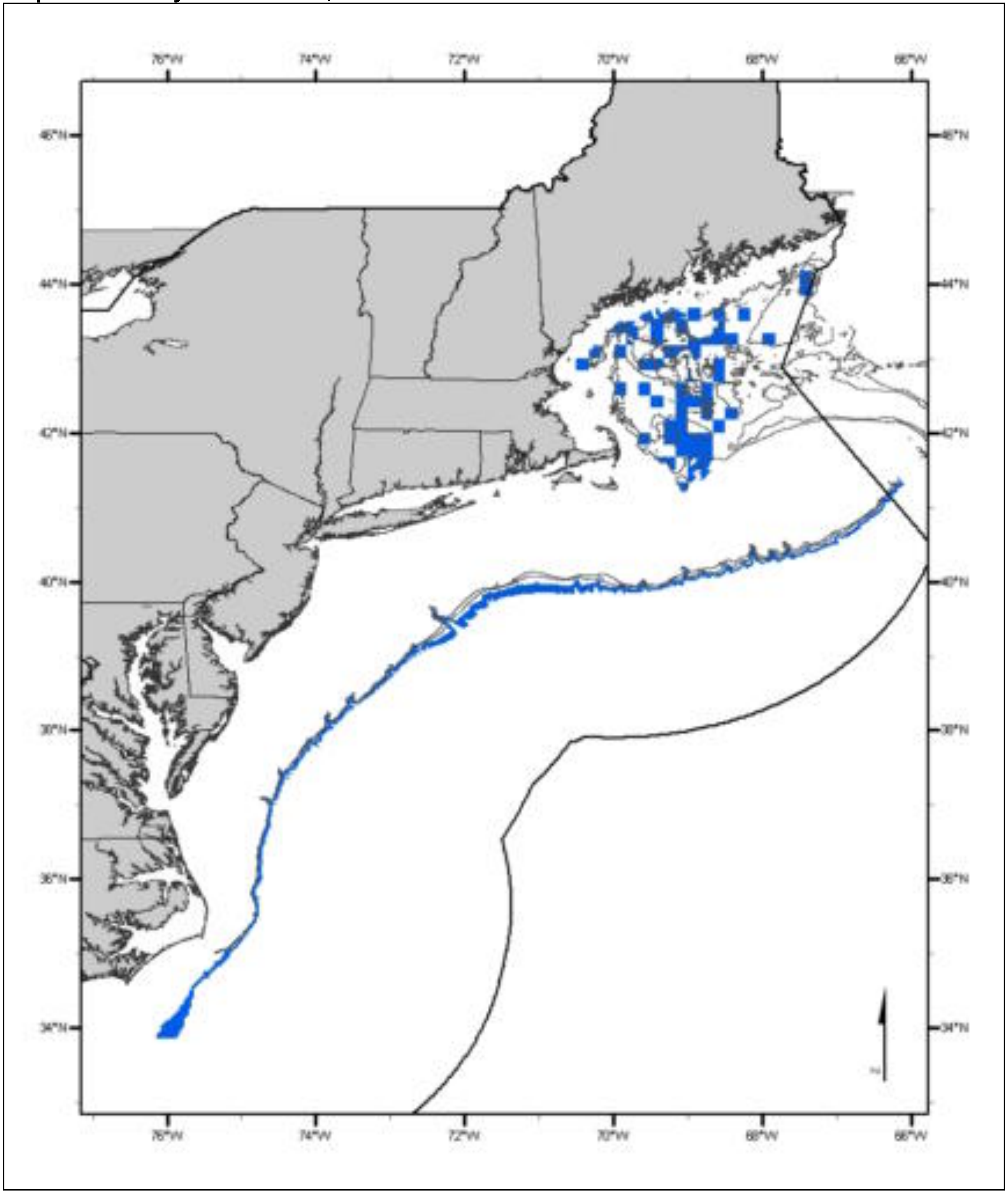
The Alternative 3C EFH designation for juvenile thorny skate on the continental shelf is based on the distribution of depths and bottom temperatures that are associated with high catch rates of juveniles in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of juveniles in the 1968-2005 spring and fall NMFS trawl surveys at the 75% cumulative percentage of catch level and includes inshore and off-shelf areas where juvenile thorny skate were determined to be present, based on 10% frequency of occurrence in state trawl surveys and off-shelf depth and geographic ranges.

Map 418. Thorny skate juveniles, Alternative 3D



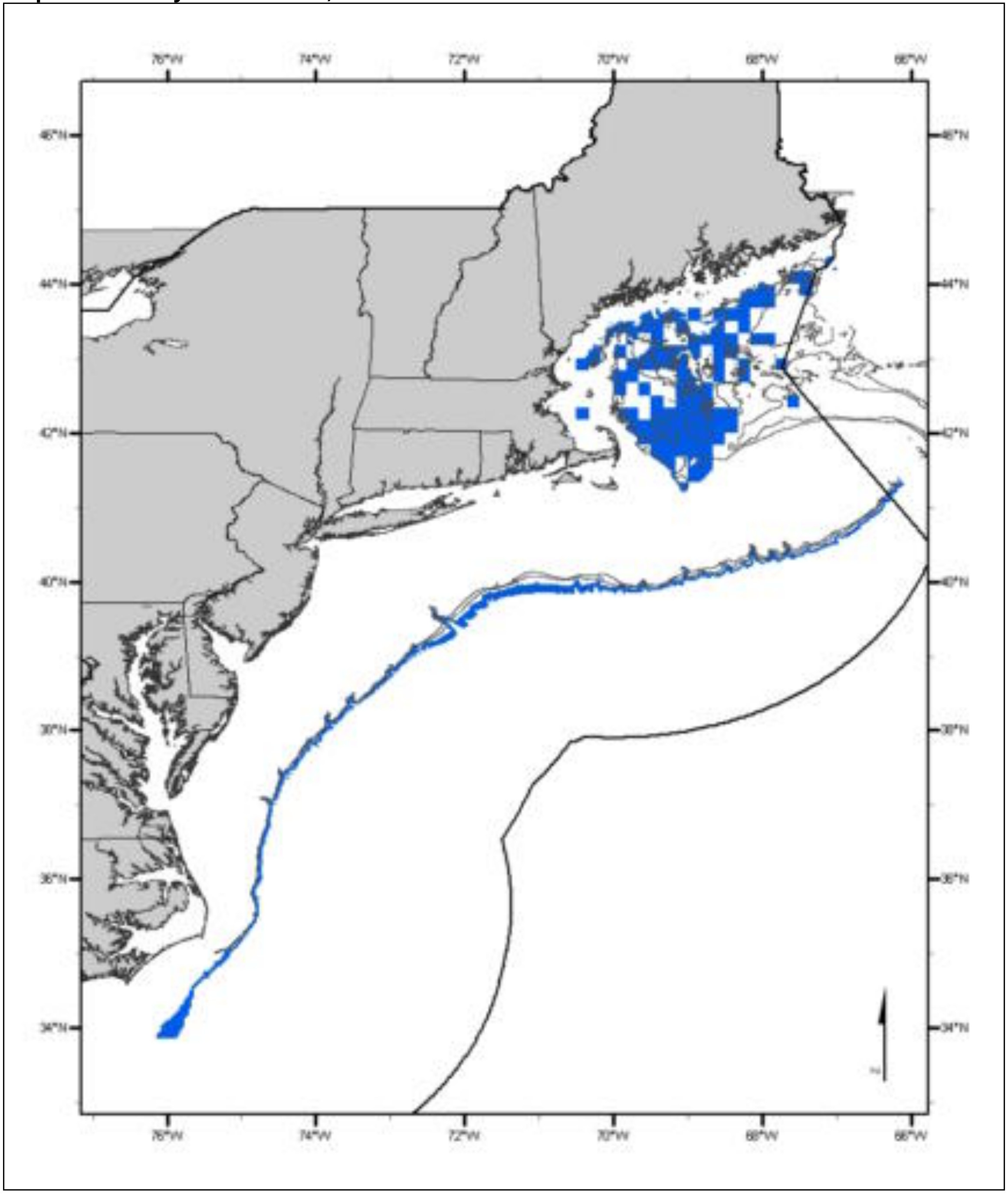
The Alternative 3D EFH designation for juvenile thorny skate on the continental shelf is based on the distribution of depths and bottom temperatures that are associated with high catch rates of juveniles in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of juveniles in the 1968-2005 spring and fall NMFS trawl surveys at the 90% cumulative percentage of catch level and includes inshore and off-shelf areas where juvenile thorny skate were determined to be present, based on 10% frequency of occurrence in state trawl surveys and off-shelf depth and geographic ranges.

Map 419. Thorny skate adults, Alternative 3A



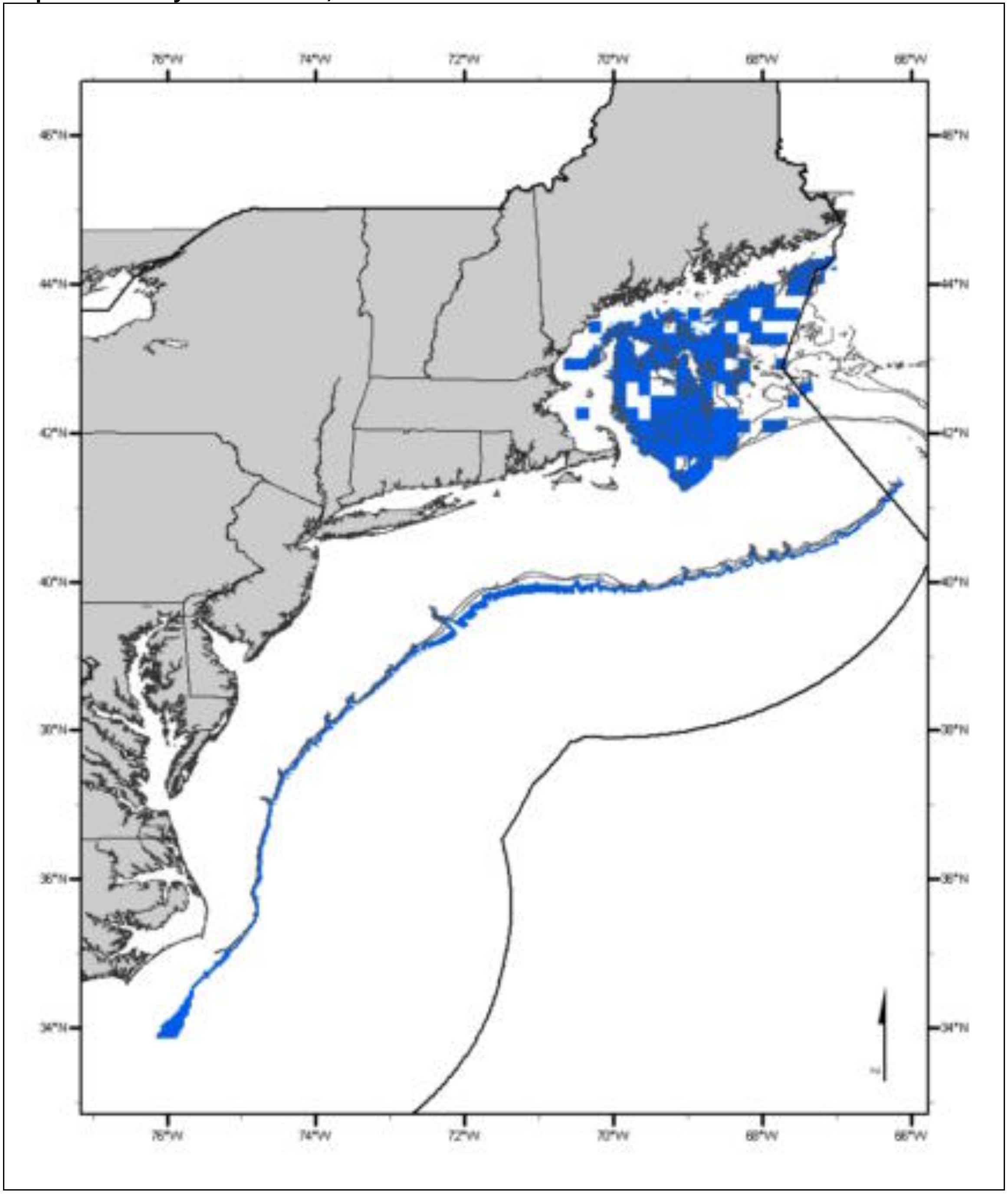
The Alternative 3A EFH designation for adult thorny skate on the continental shelf is based on the distribution of depths and bottom temperatures that are associated with high catch rates of adults in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of adults in the 1968-2005 spring and fall NMFS trawl surveys at the 25% cumulative percentage of catch level and includes inshore and off-shelf areas where adult thorny skate were determined to be present, based on 10% frequency of occurrence in state trawl surveys and off-shelf depth and geographic ranges.

Map 420. Thorny skate adults, Alternative 3B



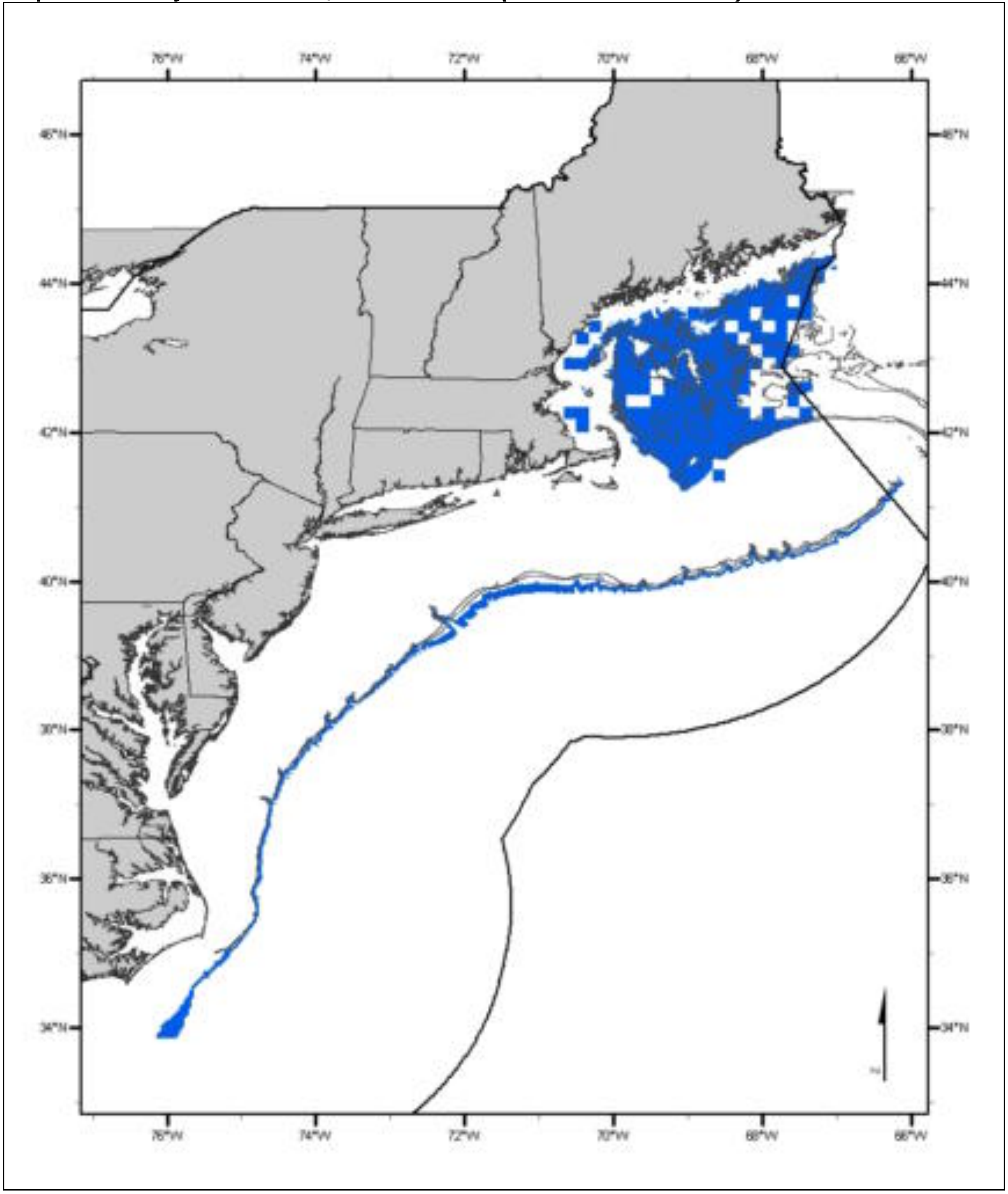
The Alternative 3B EFH designation for adult thorny skate on the continental shelf is based on the distribution of depths and bottom temperatures that are associated with high catch rates of adults in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of adults in the 1968-2005 spring and fall NMFS trawl surveys at the 50% cumulative percentage of catch level and includes inshore and off-shelf areas where adult thorny skate were determined to be present, based on 10% frequency of occurrence in state trawl surveys and off-shelf depth and geographic ranges.

Map 421. Thorny skate adults, Alternative 3C



The Alternative 3C EFH designation for adult thorny skate on the continental shelf is based on the distribution of depths and bottom temperatures that are associated with high catch rates of adults in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of adults in the 1968-2005 spring and fall NMFS trawl surveys at the 75% cumulative percentage of catch level and includes inshore and off-shelf areas where adult thorny skate were determined to be present, based on 10% frequency of occurrence in state trawl surveys and off-shelf depth and geographic ranges.

Map 422. Thorny skate adults, Alternative 3D *(Preferred Alternative)*



The Alternative 3D EFH designation for adult thorny skate on the continental shelf is based on the distribution of depths and bottom temperatures that are associated with high catch rates of adults in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of adults in the 1968-2005 spring and fall NMFS trawl surveys at the 90% cumulative percentage of catch level and includes inshore and off-shelf areas where adult thorny skate were determined to be present, based on 10% frequency of occurrence in state trawl surveys and off-shelf depth and geographic ranges.

4.1.3.2.20 White Hake

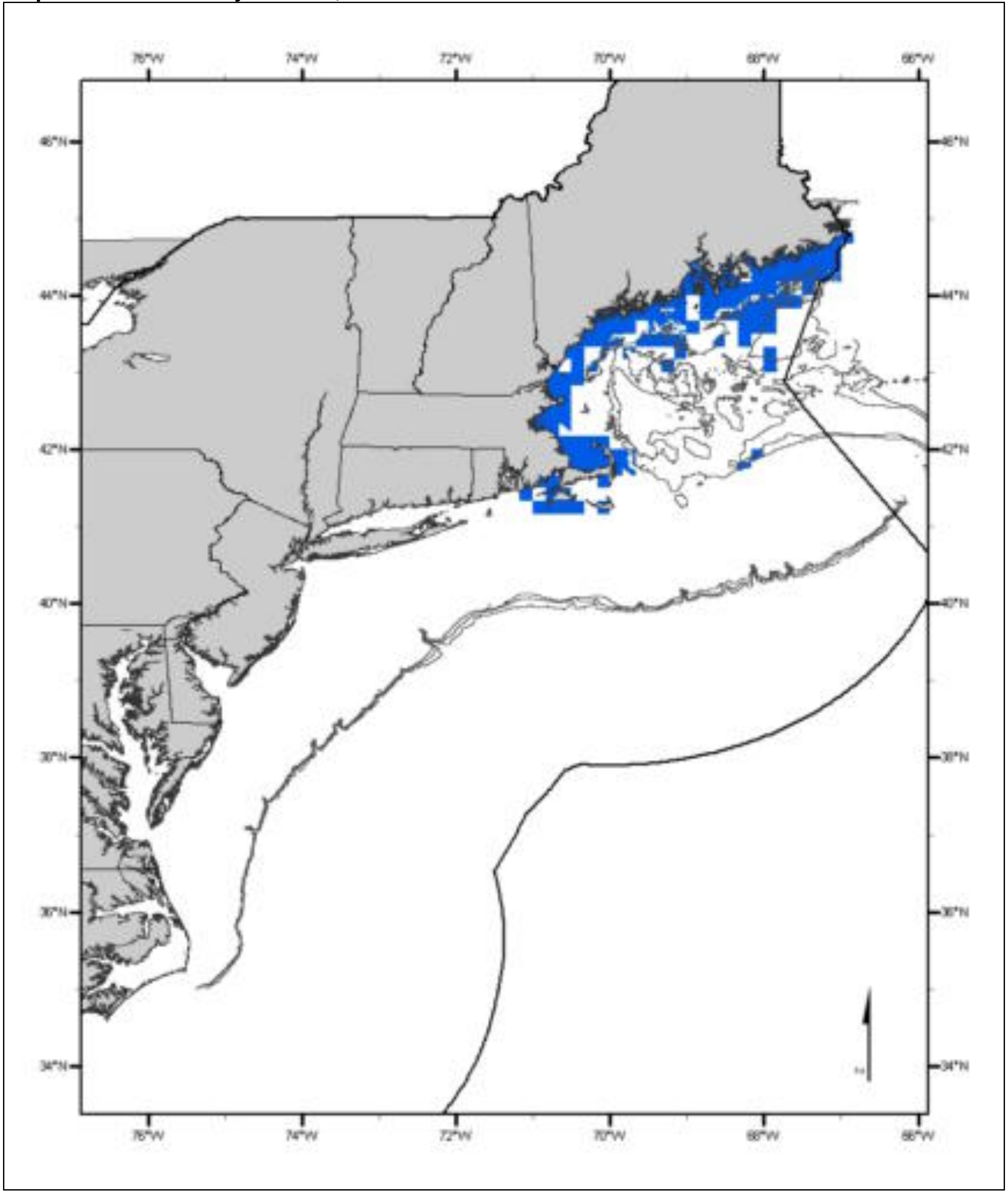
Eggs: No alternative EFH designation.

Larvae: No alternative EFH designation.

Juveniles: Estuarine, coastal marine, and continental shelf benthic habitats in depths of 1 – 300 meters with substrates composed of mud and/or eel grass as depicted on Map 423 - Map 426. Other conditions that generally exist where EFH for juvenile white hake is found are bottom temperatures of 2.5 – 15.5ºC and salinities of 13.4 – 34.5 ppt. EFH for juvenile white hake includes intertidal habitats. Once they settle to the bottom, juvenile white hakes feed primarily on euphausiids and pandalid, sand, and other shrimps, and also on amphipods, copepods, fishes (*e.g.*, silver hake, white hake, and gadids), and squids. *(Preferred Alternative)*

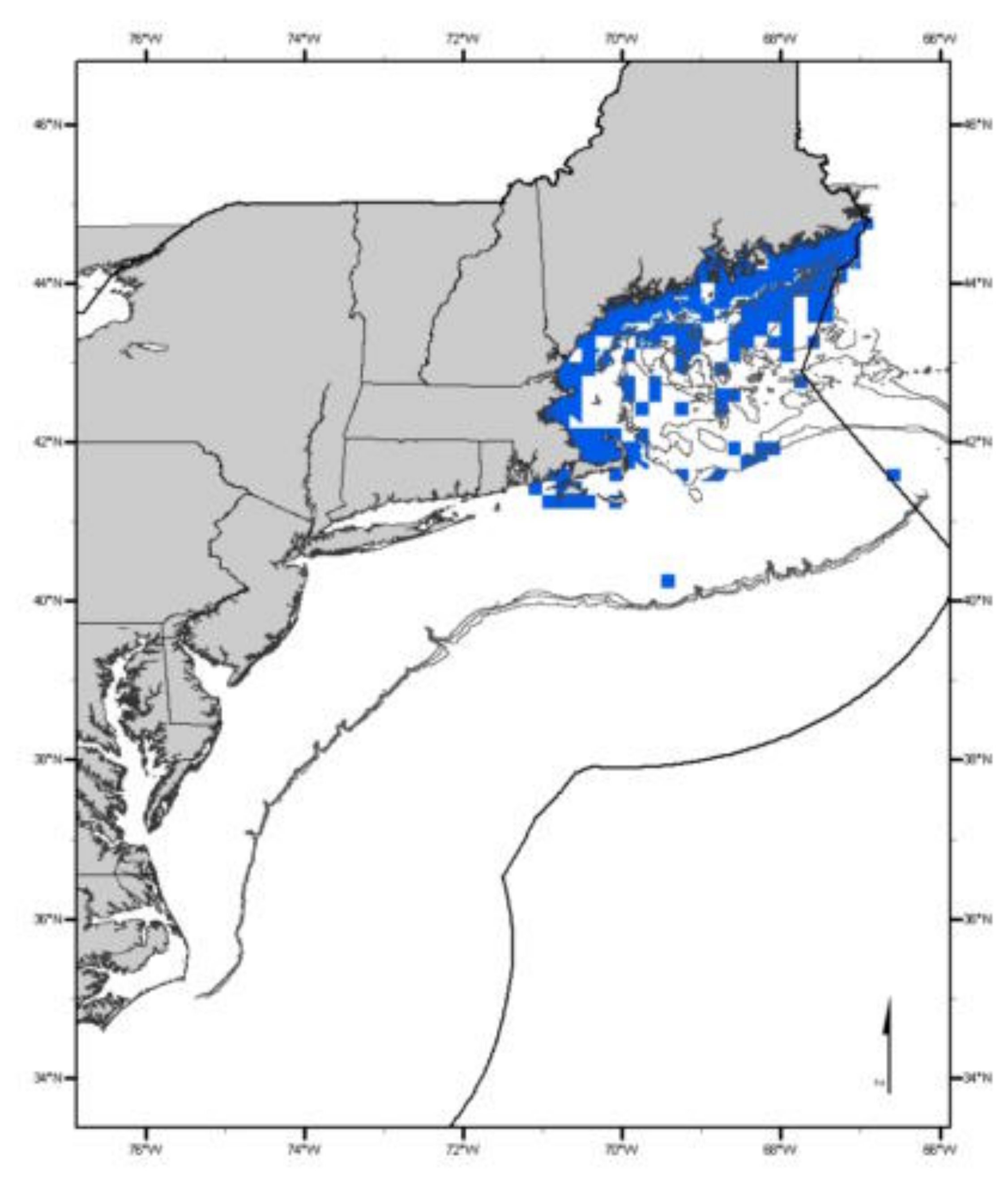
Adults: Benthic habitats in inshore areas and on the continental shelf and slope in depths of 100 – 2,250 meters with substrates composed of mud and/or sand–mud mixtures as depicted on Map 427 - Map 430. Other conditions that generally exist where EFH for adult white hake is found are bottom temperatures of 4.5 – 10.5ºC and salinities of 32 – 35.5 ppt. Spawning takes place primarily in deep water on the continental slope. Adult white hakes feed primarily on fishes (*e.g.*, silver hake, other hakes, gadids, Atlantic herring and other clupeids, argentines), squid (*Illex* sp.), and also on squids, pandalid shrimps, and euphausiids. *(Preferred Alternative)*

Map 423. White hake juveniles, Alternative 3A



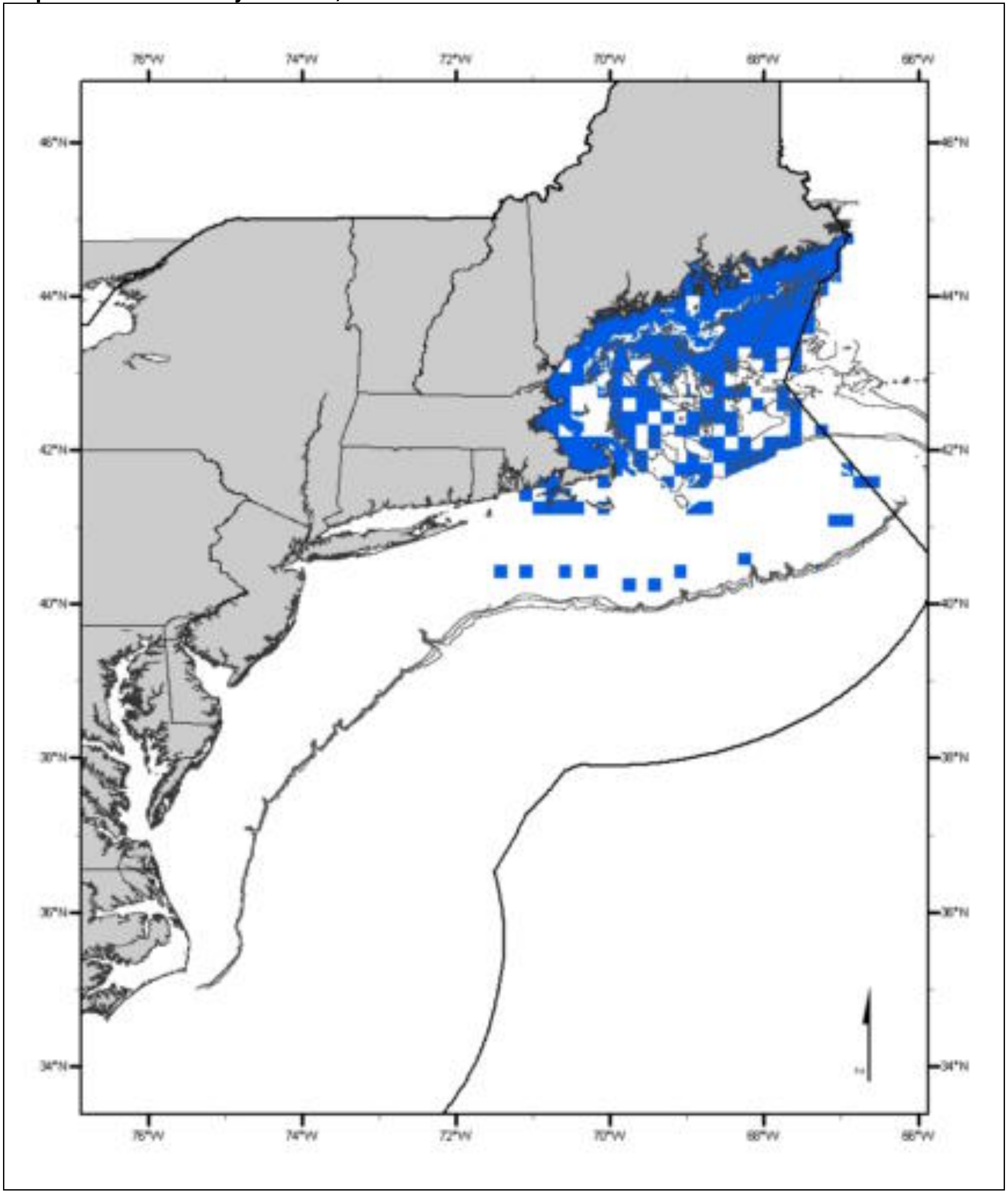
The Alternative 3A EFH designation for juvenile white hake on the continental shelf is based on the distribution of substrate types, depths, and bottom temperatures that are associated with high catch rates of juveniles in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of juveniles in the 1968-2005 spring and fall NMFS trawl surveys at the 25% cumulative percentage of catch level and includes inshore areas where juvenile white hake were determined to be present, based on 10% frequency of occurrence in state trawl surveys and ELMR information.

Map 424. White hake juveniles, Alternative 3B



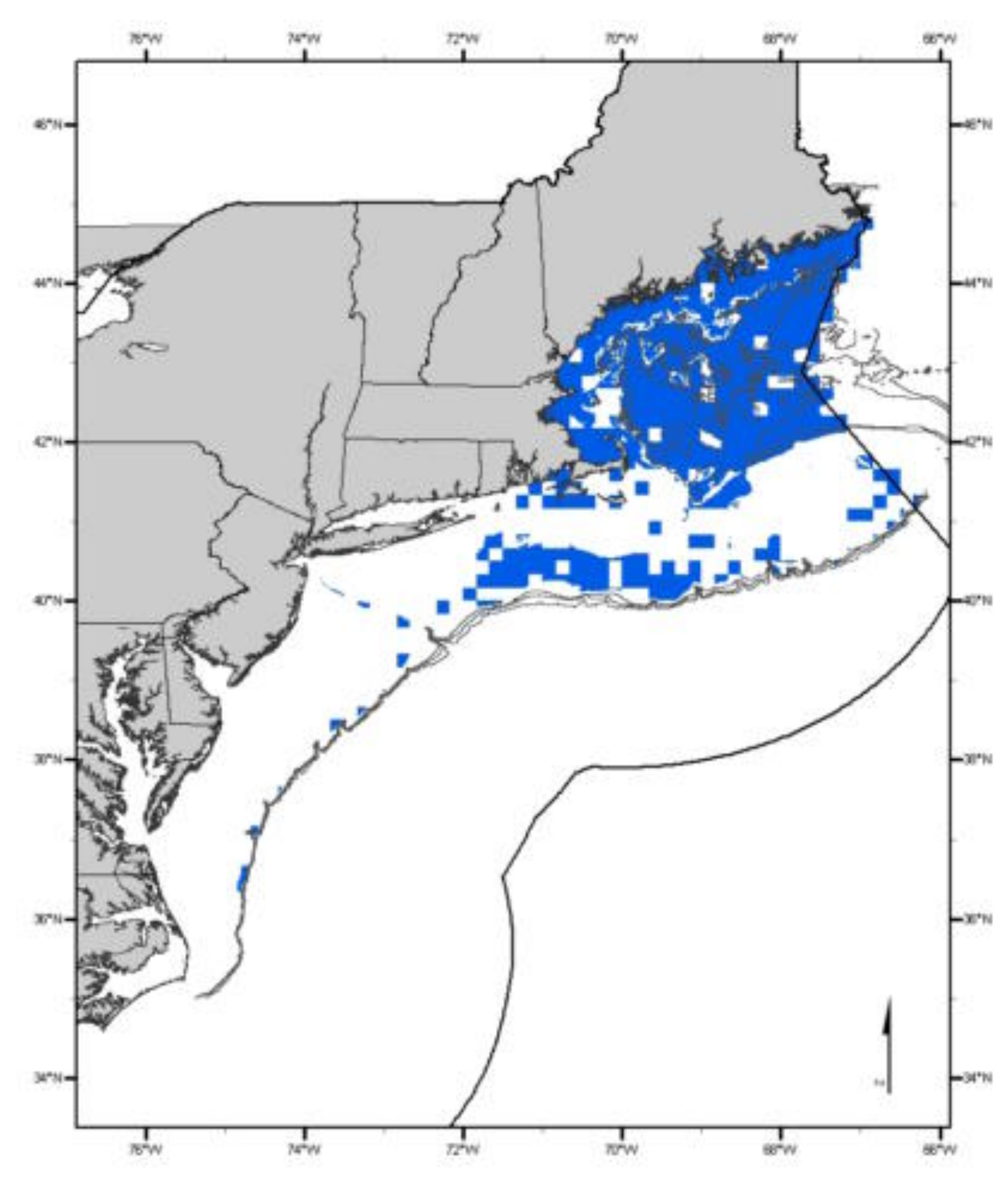
The Alternative 3B EFH designation for juvenile white hake on the continental shelf is based on the distribution of substrate types, depths, and bottom temperatures that are associated with high catch rates of juveniles in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of juveniles in the 1968-2005 spring and fall NMFS trawl surveys at the 50% cumulative percentage of catch level and includes inshore areas where juvenile white hake were determined to be present, based on 10% frequency of occurrence in state trawl surveys and ELMR information.

Map 425. White hake juveniles, Alternative 3C



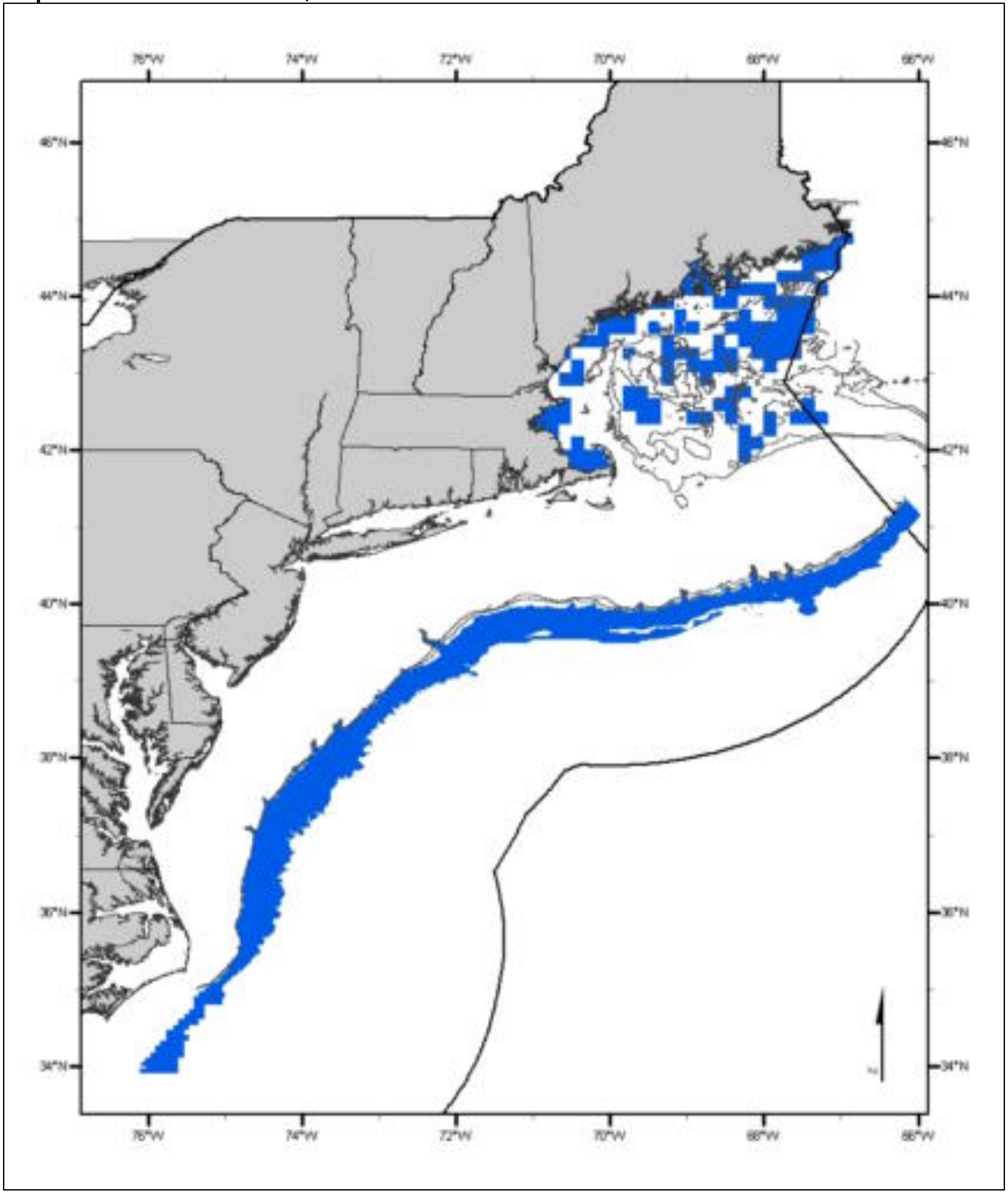
The Alternative 3C EFH designation for juvenile white hake on the continental shelf is based on the distribution of substrate types, depths, and bottom temperatures that are associated with high catch rates of juveniles in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of juveniles in the 1968-2005 spring and fall NMFS trawl surveys at the 75% cumulative percentage of catch level and includes inshore areas where juvenile white hake were determined to be present, based on 10% frequency of occurrence in state trawl surveys and ELMR information.

Map 426. White hake juveniles, Alternative 3D *(Preferred Alternative)*



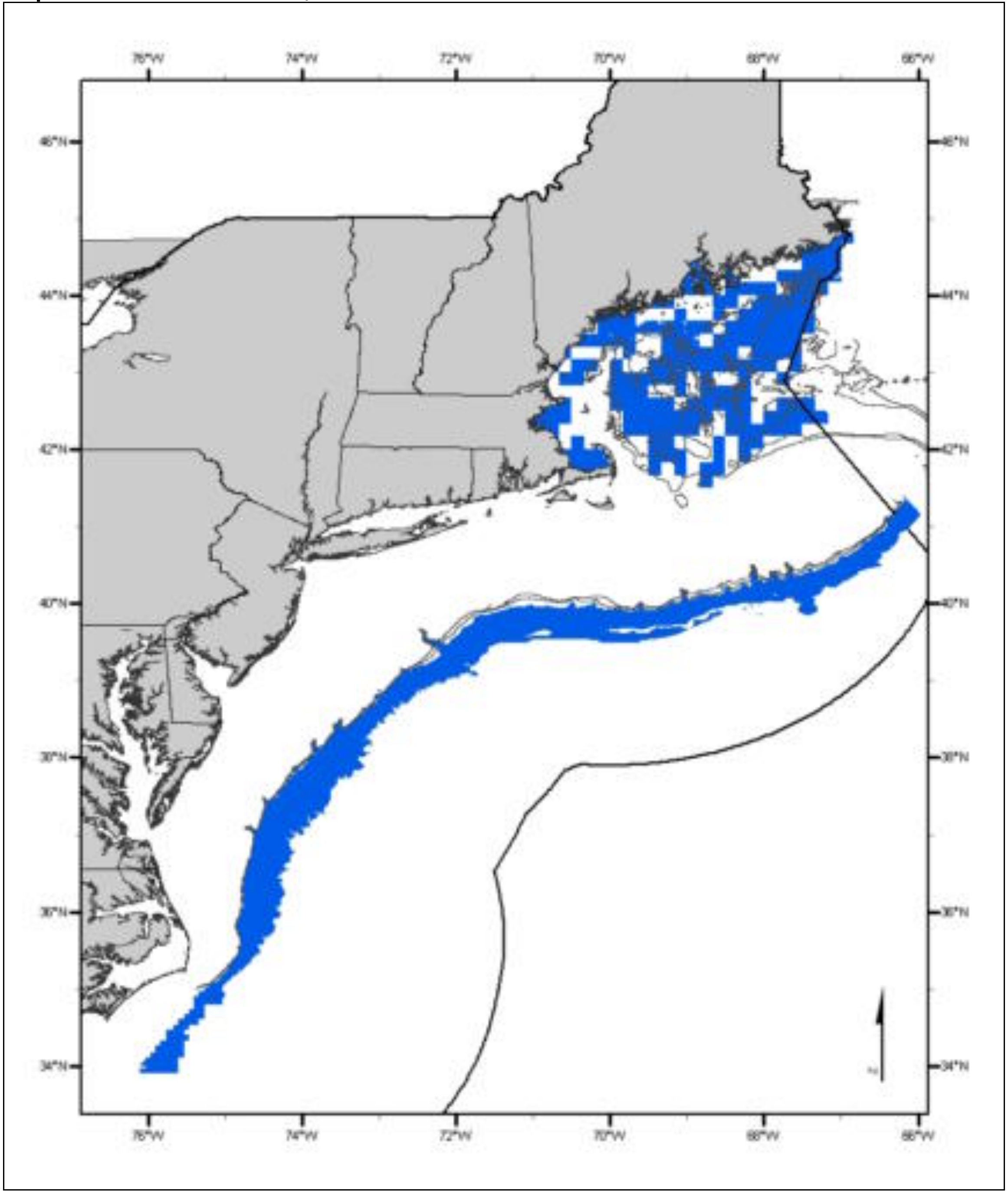
The Alternative 3D EFH designation for juvenile white hake on the continental shelf is based on the distribution of substrate types, depths, and bottom temperatures that are associated with high catch rates of juveniles in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of juveniles in the 1968-2005 spring and fall NMFS trawl surveys at the 90% cumulative percentage of catch level and includes inshore areas where juvenile white hake were determined to be present, based on 10% frequency of occurrence in state trawl surveys and ELMR information.

Map 427. White hake adults, Alternative 3A



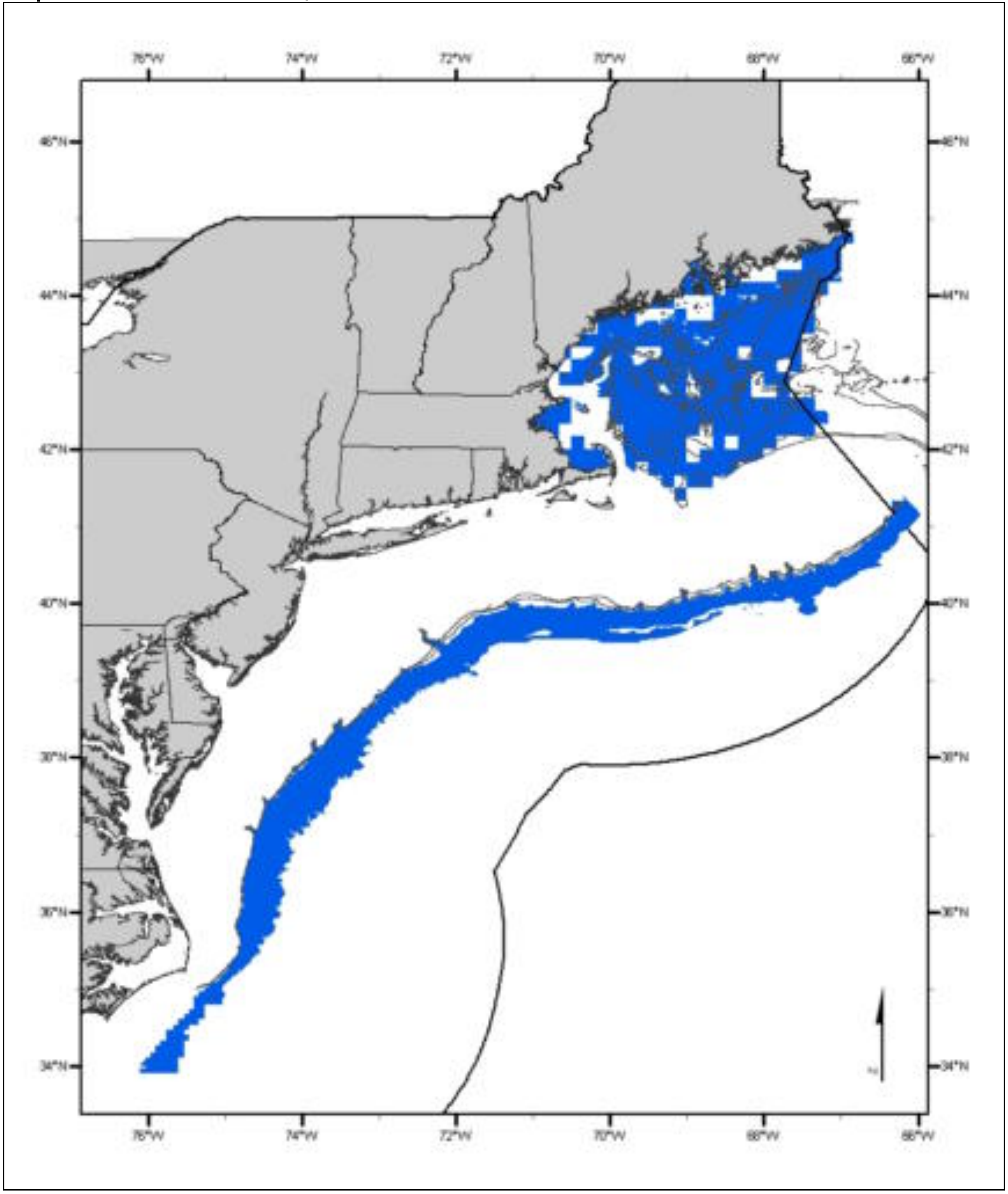
The Alternative 3A EFH designation for adult white hake on the continental shelf is based on the distribution of substrate types, depths, and bottom temperatures that are associated with high catch rates of adults in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of adults in the 1968-2005 spring and fall NMFS trawl surveys at the 25% cumulative percentage of catch level and includes inshore and off-shelf areas where adult white hake were determined to be present, based on 10% frequency of occurrence in state trawl surveys, ELMR information, and off-shelf depth and geographic ranges.

Map 428. White hake adults, Alternative 3B



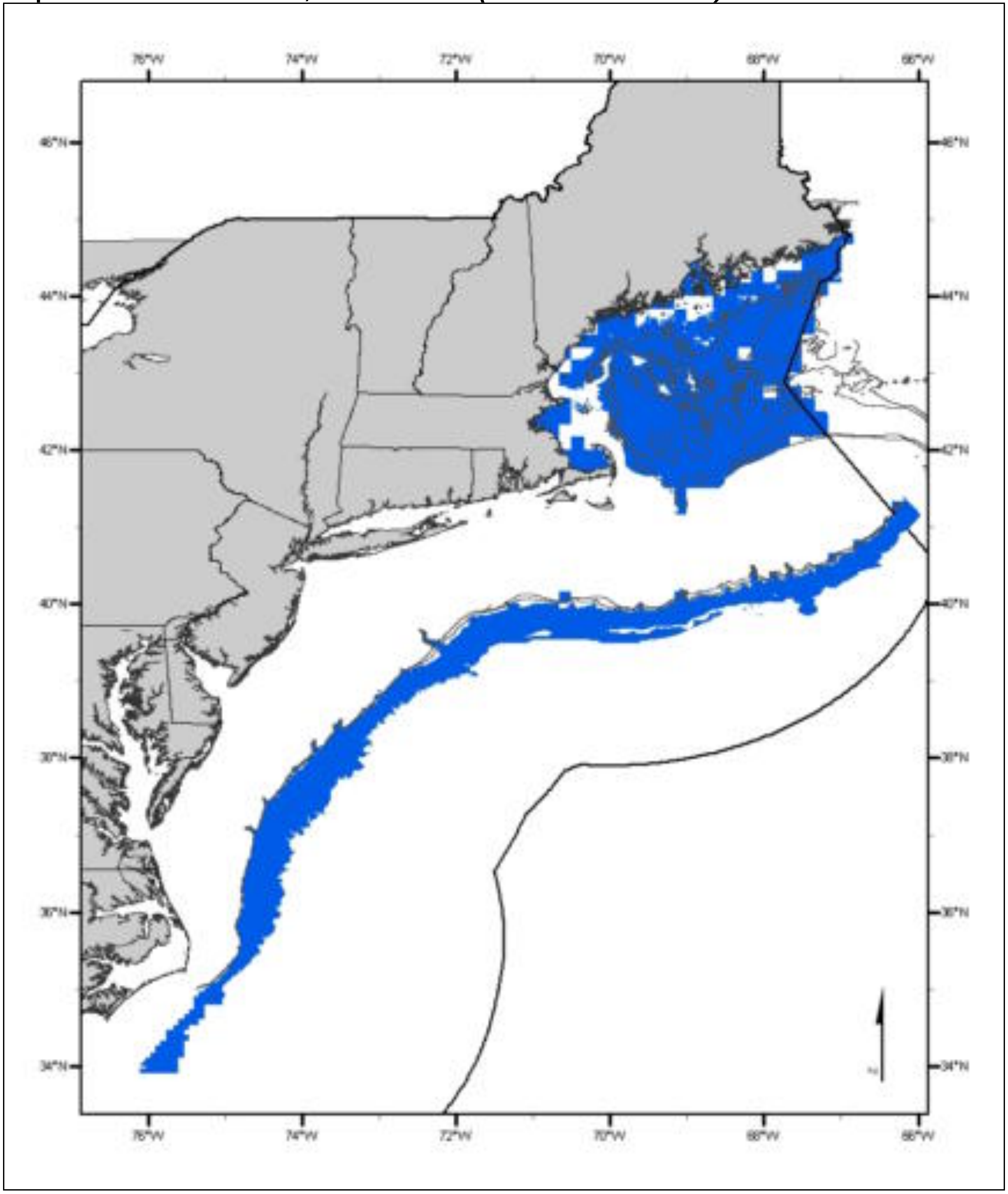
The Alternative 3B EFH designation for adult white hake on the continental shelf is based on the distribution of substrate types, depths, and bottom temperatures that are associated with high catch rates of adults in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of adults in the 1968-2005 spring and fall NMFS trawl surveys at the 50% cumulative percentage of catch level and includes inshore and off-shelf areas where adult white hake were determined to be present, based on 10% frequency of occurrence in state trawl surveys, ELMR information, and off-shelf depth and geographic ranges.

Map 429. White hake adults, Alternative 3C



The Alternative 3C EFH designation for adult white hake on the continental shelf is based on the distribution of substrate types, depths, and bottom temperatures that are associated with high catch rates of adults in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of adults in the 1968-2005 spring and fall NMFS trawl surveys at the 75% cumulative percentage of catch level and includes inshore and off-shelf areas where adult white hake were determined to be present, based on 10% frequency of occurrence in state trawl surveys, ELMR information, and off-shelf depth and geographic ranges.

Map 430. White hake adults, Alternative 3D *(Preferred Alternative)*



The Alternative 3D EFH designation for adult white hake on the continental shelf is based on the distribution of substrate types, depths, and bottom temperatures that are associated with high catch rates of adults in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of adults in the 1968-2005 spring and fall NMFS trawl surveys at the 90% cumulative percentage of catch level and includes inshore and off-shelf areas where adult white hake were determined to be present, based on 10% frequency of occurrence in state trawl surveys, ELMR information, and off-shelf depth and geographic ranges.

4.1.3.2.21 Windowpane Flounder

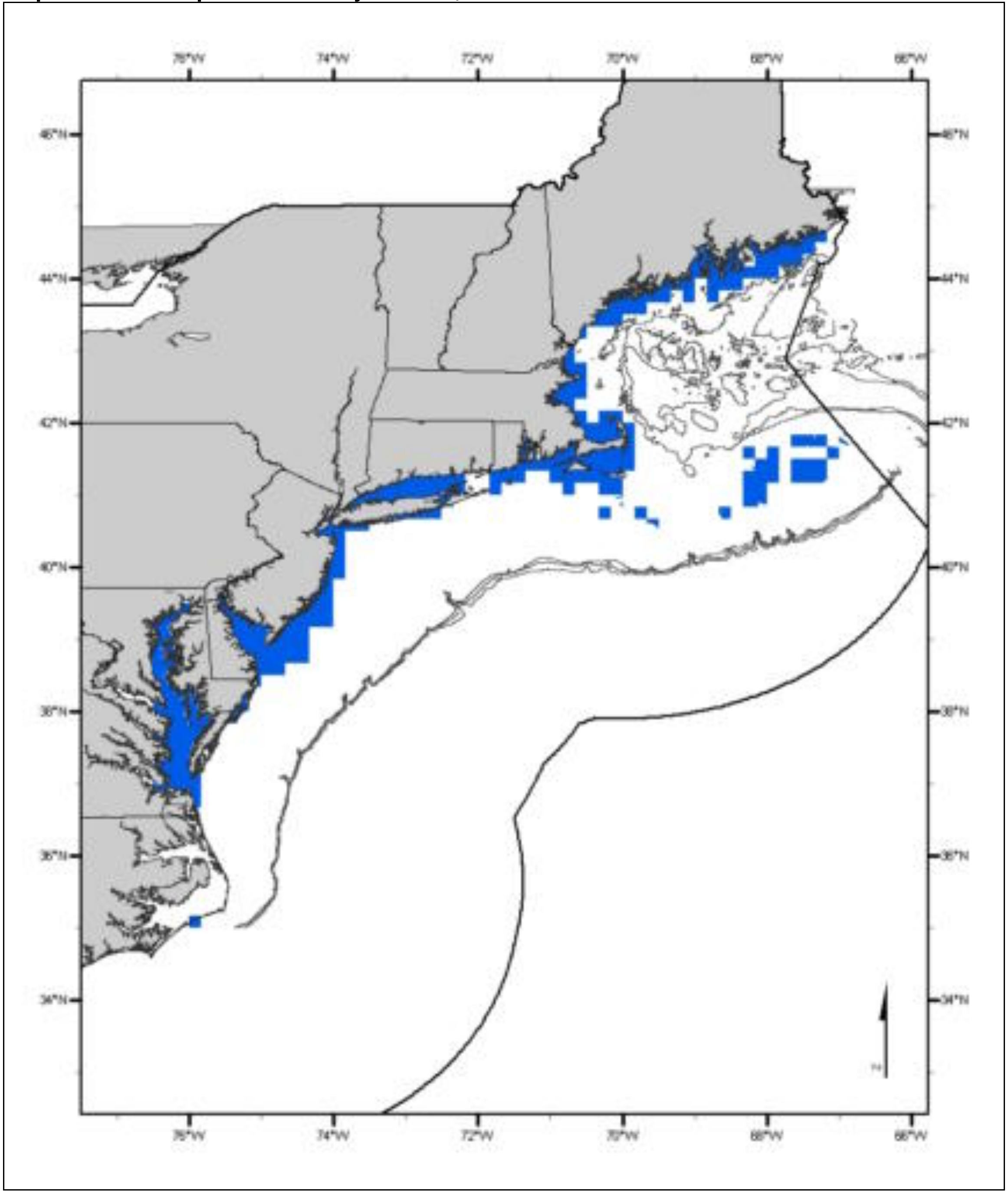
Eggs: No alternative EFH designation.

Larvae: No alternative EFH designation.

Juveniles: Sandy benthic habitats in estuarine, coastal marine, and continental shelf areas in depths of 1 – 60 meters, including the intertidal zone as depicted on Map 431 - Map 435. Other conditions that generally exist where EFH for juvenile windowpane is found are bottom temperatures of 2.5 – 26ºC and salinities of 14.5 – 33.5 ppt. Juvenile windowpane flounders feed primarily on mysids, but also on polychaetes, amphipods, decapod larvae, and small fishes (*e.g.*, sand lances). *(Preferred Alternative)*

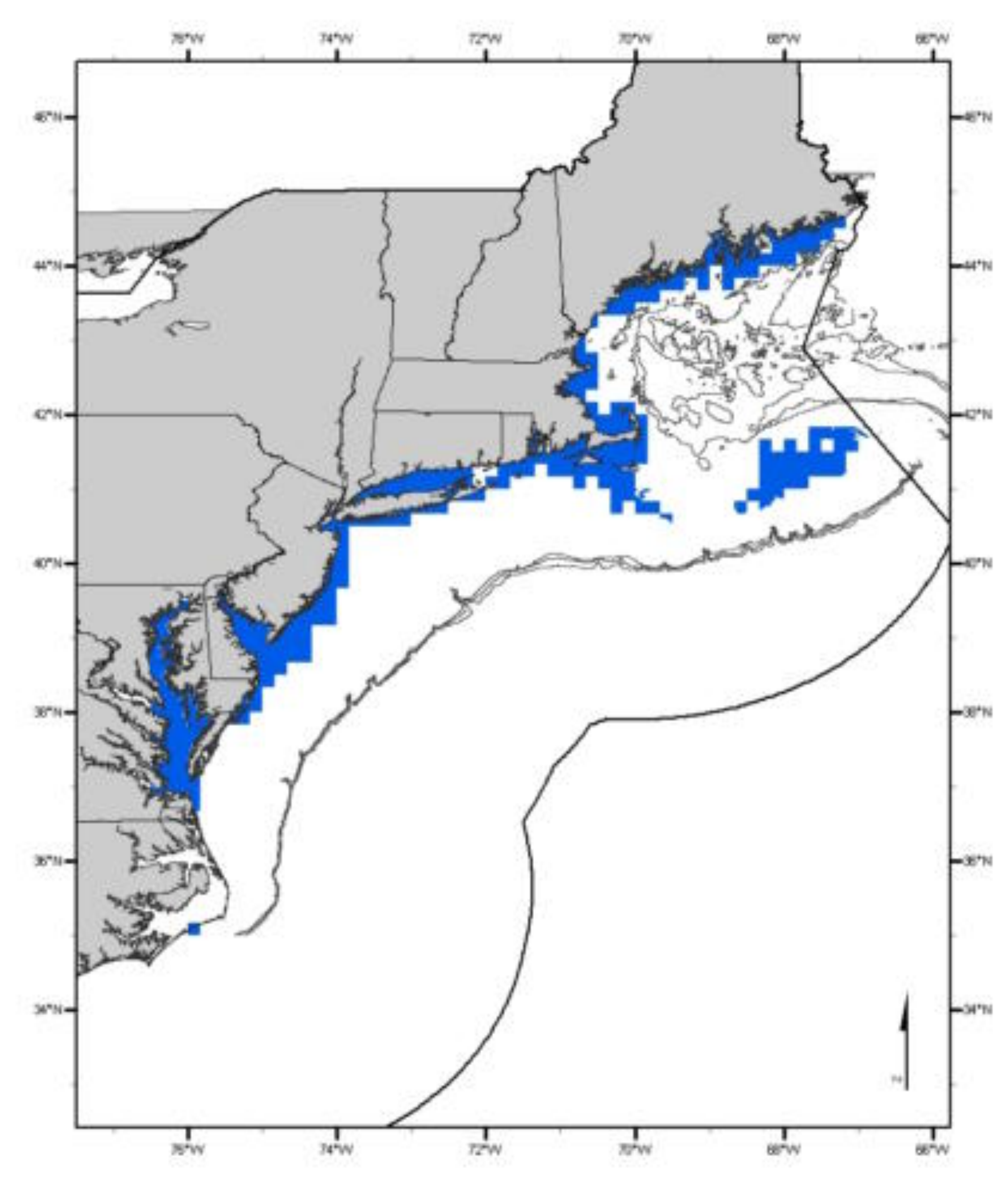
Adults: Sandy benthic habitats in estuarine, coastal marine, and continental shelf areas in depths of 1 – 70 meters, including the intertidal zone as depicted on Map 436 - Map 440. Other conditions that generally exist where EFH for adult windowpane is found are bottom temperatures of 2.5 – 20.5ºC and salinities of 23 – 33.5 ppt. Spawning occurs between 6 and 21ºC, and mostly between 8.5 and 13.5ºC. Adult windowpane flounders feed primarily on small crustaceans (amphipods, mysids, and sand shrimps) and fishes (*e.g.*, silver hakes, cusks, sand lances, gobies, and bay anchovies). *(Preferred Alternative)*

Map 431. Windowpane flounder juveniles, Alternative 3A



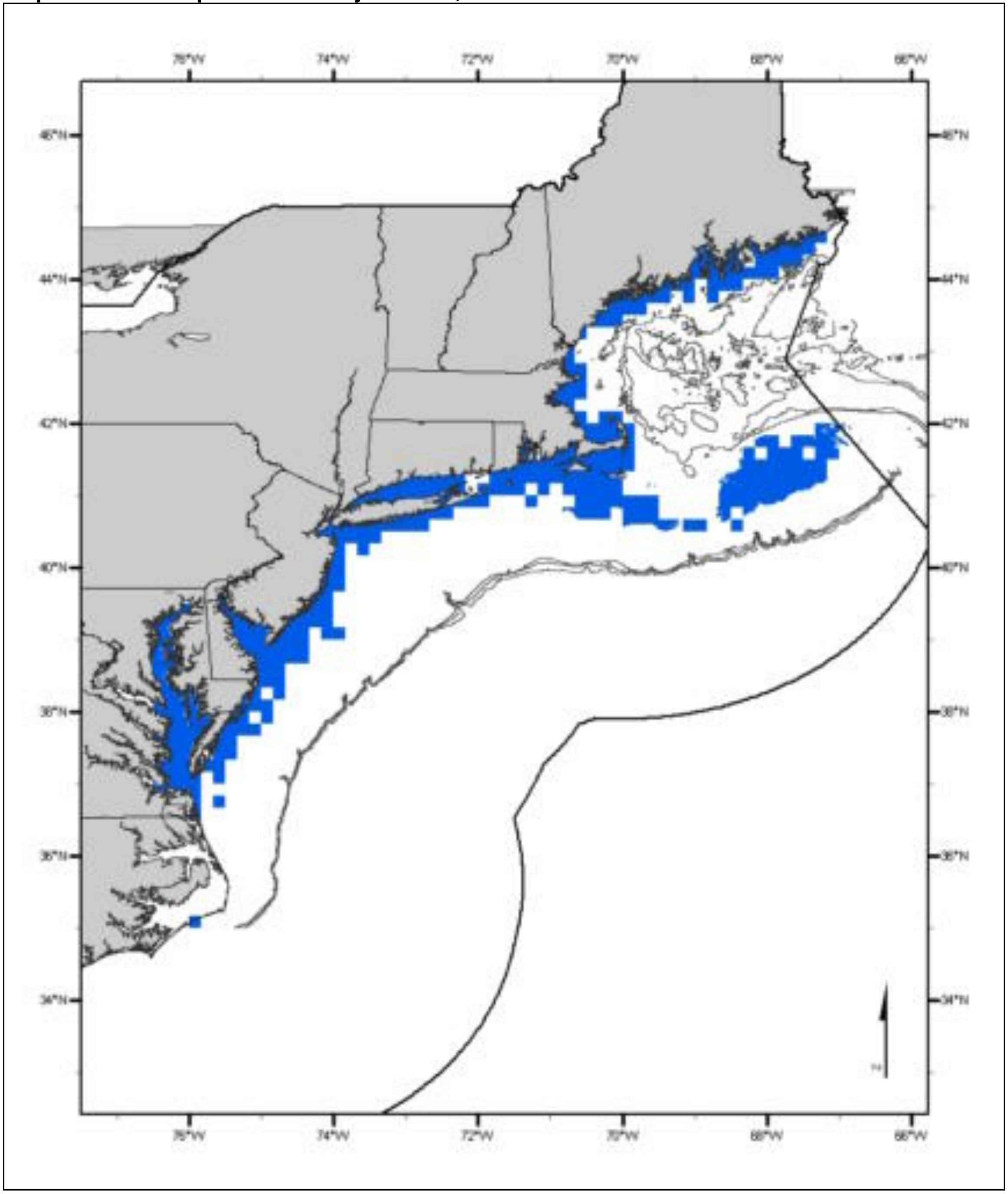
The Alternative 3A EFH designation for juvenile windowpane flounder on the continental shelf is based on the distribution of substrate types, depths, and bottom temperatures that are associated with high catch rates of juveniles in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of juveniles in the 1968-2005 spring and fall NMFS trawl surveys at the 25% cumulative percentage of catch level and includes inshore areas where juvenile red hake were determined to be present, based on 10% frequency of occurrence in state trawl surveys and ELMR information.

Map 432. Windowpane flounder juveniles, Alternative 3B



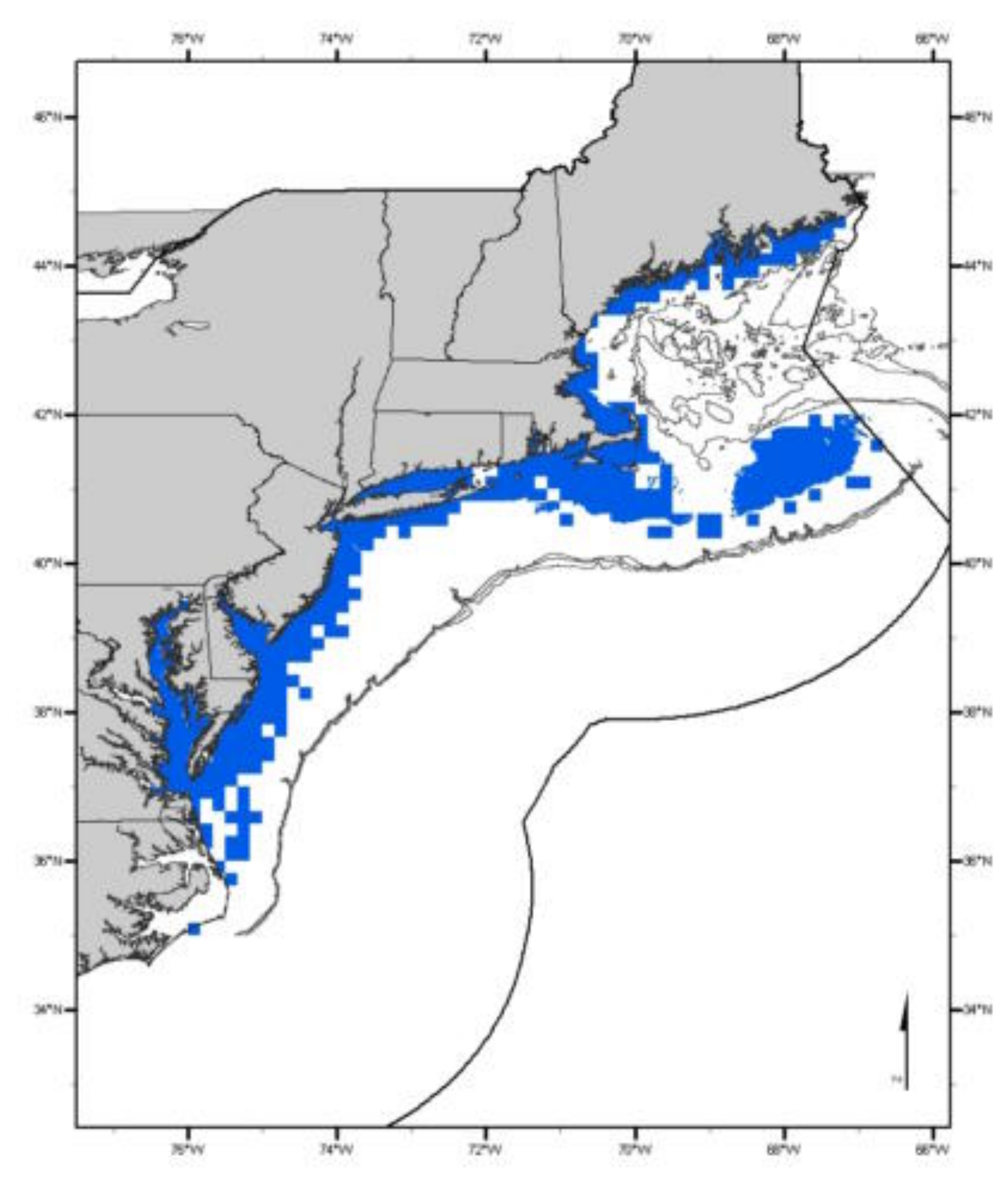
The Alternative 3B EFH designation for juvenile windowpane flounder on the continental shelf is based on the distribution of substrate types, depths, and bottom temperatures that are associated with high catch rates of juveniles in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of juveniles in the 1968-2005 spring and fall NMFS trawl surveys at the 50% cumulative percentage of catch level and includes inshore areas where juvenile red hake were determined to be present, based on 10% frequency of occurrence in state trawl surveys and ELMR information.

Map 433. Windowpane flounder juveniles, Alternative 3C



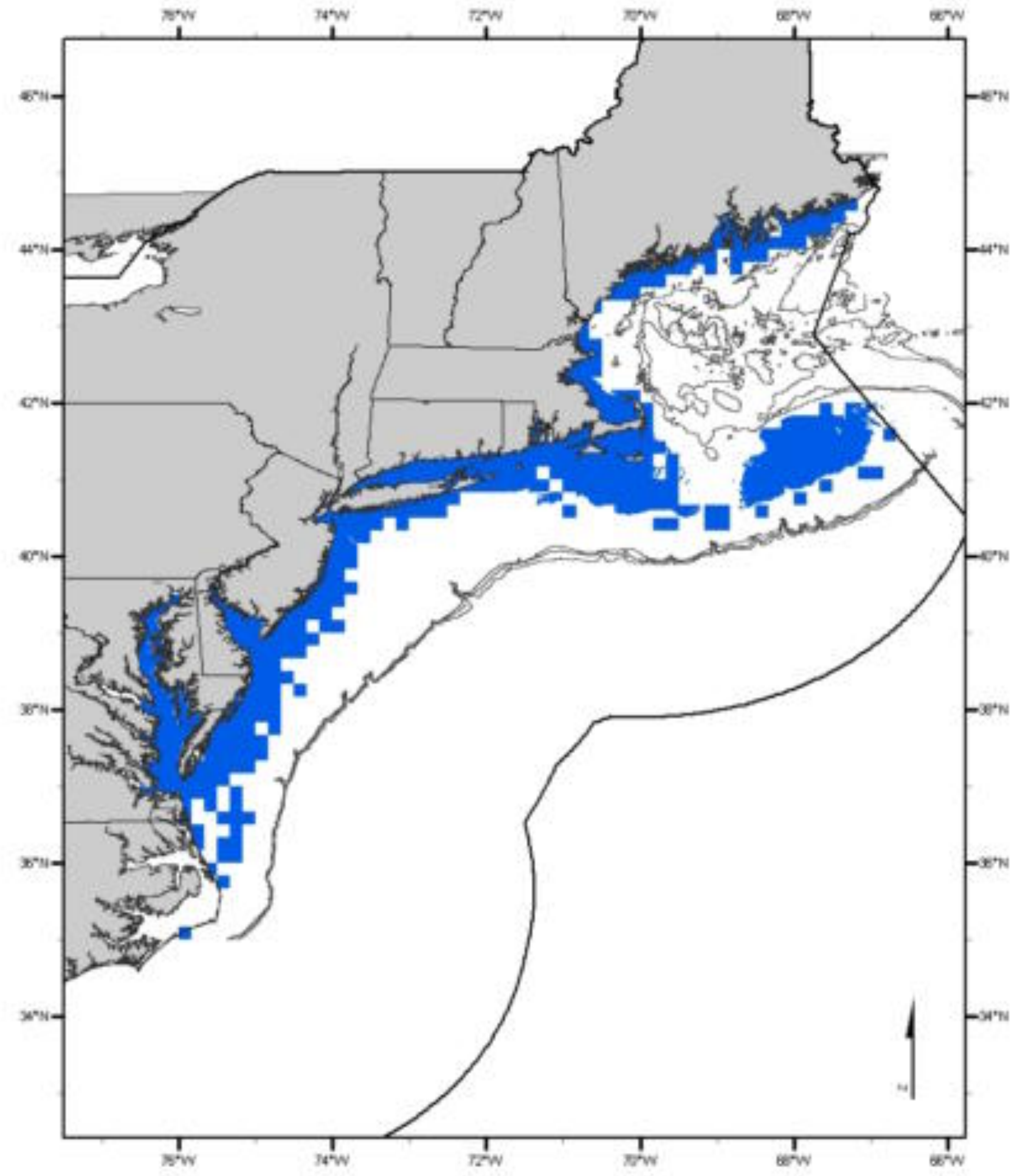
The Alternative 3C EFH designation for juvenile windowpane flounder on the continental shelf is based on the distribution of substrate types, depths, and bottom temperatures that are associated with high catch rates of juveniles in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of juveniles in the 1968-2005 spring and fall NMFS trawl surveys at the 75% cumulative percentage of catch level and includes inshore areas where juvenile red hake were determined to be present, based on 10% frequency of occurrence in state trawl surveys and ELMR information.

Map 434. Windowpane flounder juveniles, Alternative 3D



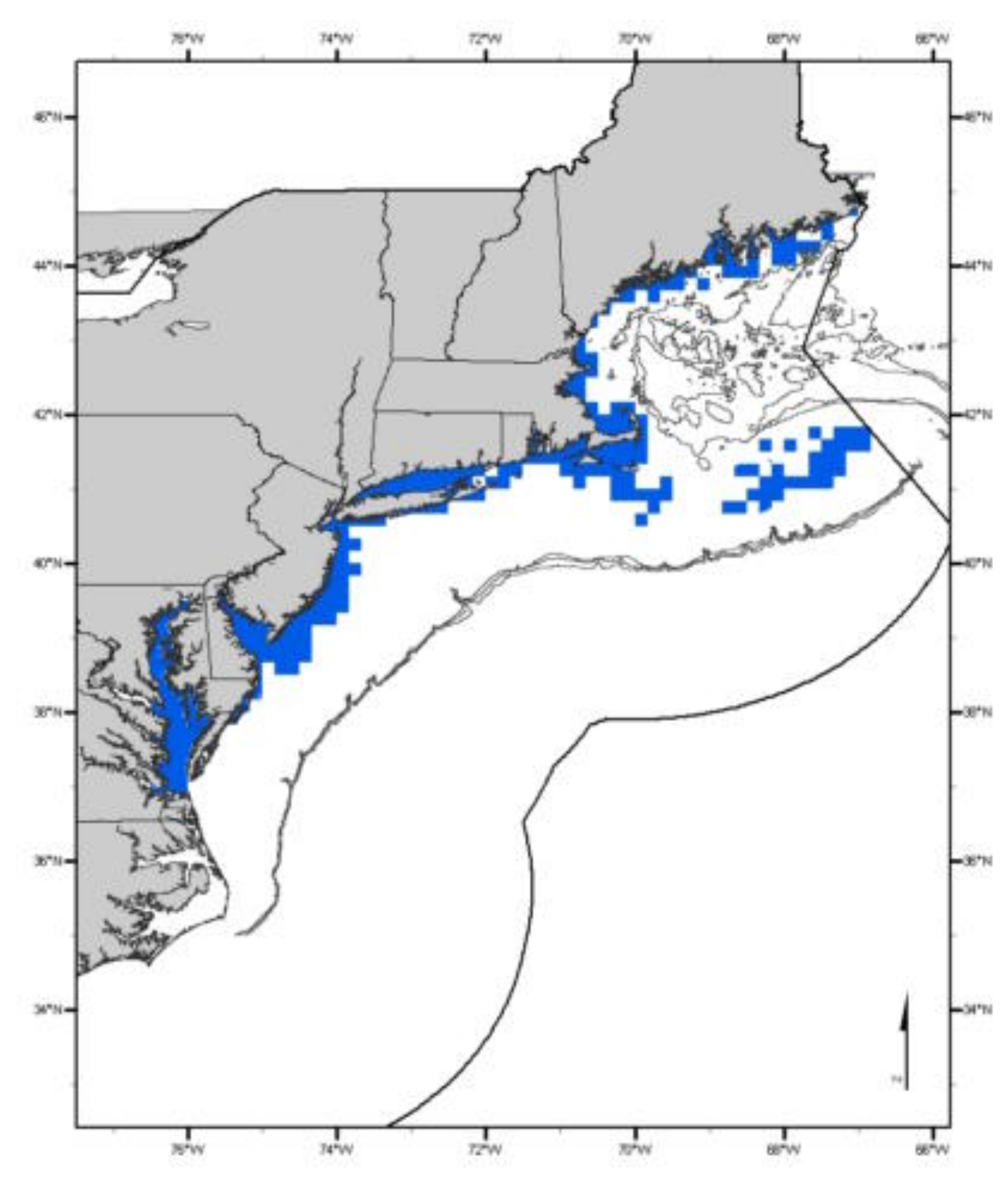
The Alternative 3D EFH designation for juvenile windowpane flounder on the continental shelf is based on the distribution of substrate types, depths, and bottom temperatures that are associated with high catch rates of juveniles in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of juveniles in the 1968-2005 spring and fall NMFS trawl surveys at the 90% cumulative percentage of catch level and includes inshore areas where juvenile red hake were determined to be present, based on 10% frequency of occurrence in state trawl surveys and ELMR information.

Map 435. Windowpane flounder juveniles, Alternative 3E *(Preferred Alternative)*



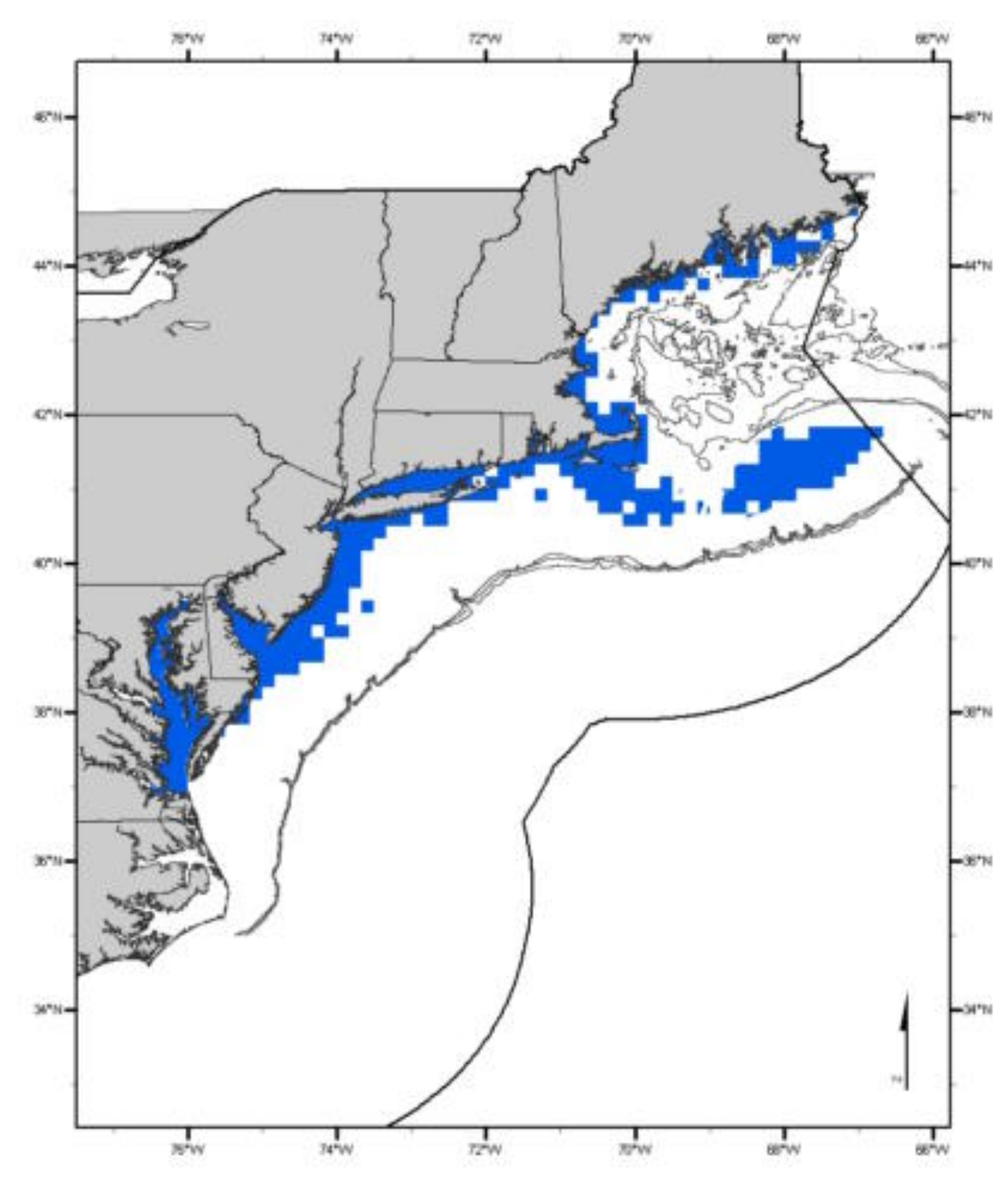
The Alternative 3E EFH designation for juvenile windowpane flounder flounder is the same as the 3D Alternative for juvenile windowpane flounder flounder with the addition of ten minute squares along the RI and CT coasts and southeast of Nantucket Island where there are no survey data.

Map 436. Windowpane flounder adults, Alternative 3A



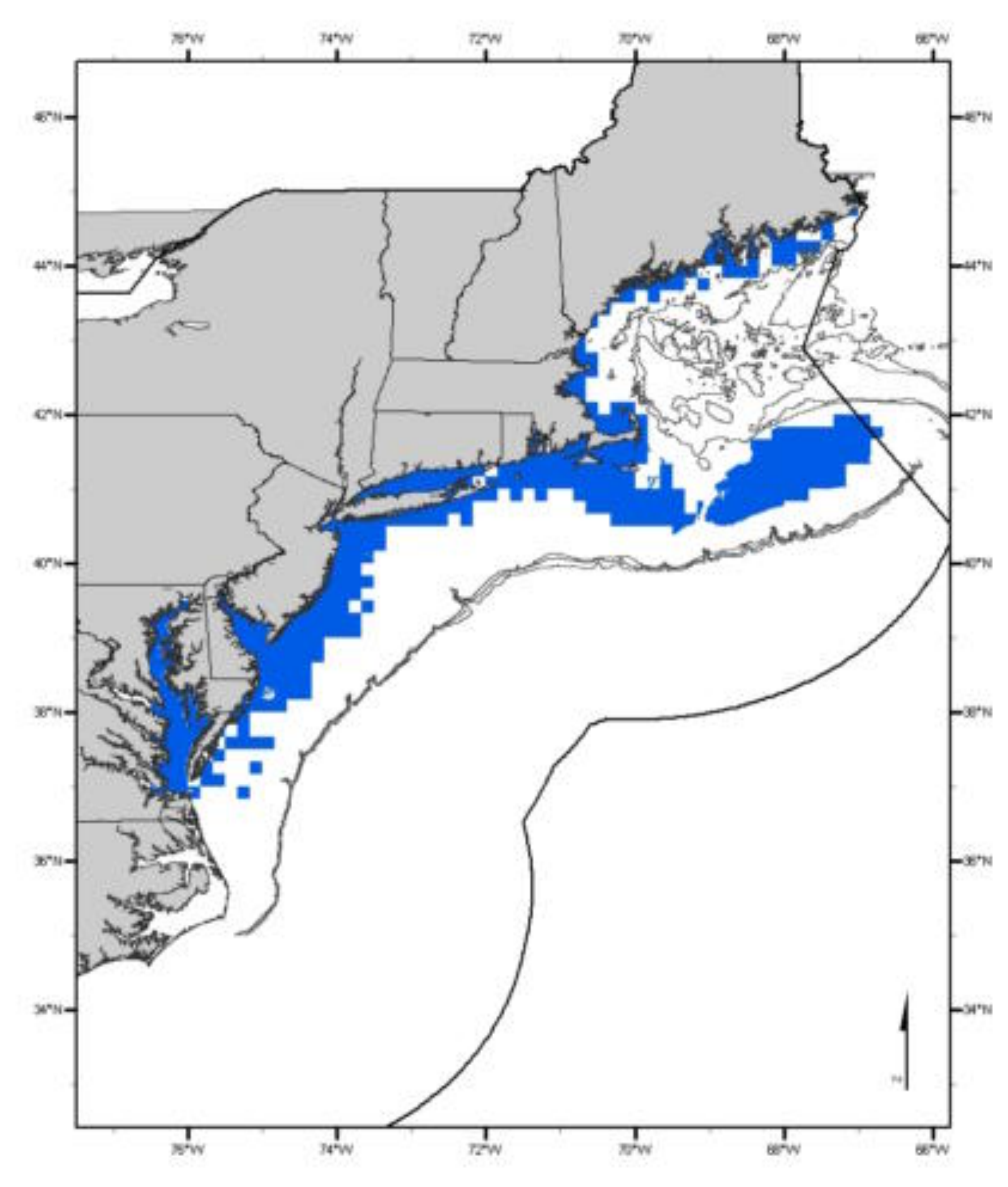
The Alternative 3A EFH designation for adult windowpane flounder on the continental shelf is based on the distribution of substrate types, depths, and bottom temperatures that are associated with high catch rates of adults in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of adults in the 1968-2005 spring and fall NMFS trawl surveys at the 25% cumulative percentage of catch level and includes inshore areas where adult red hake were determined to be present, based on 10% frequency of occurrence in state trawl surveys and ELMR information.

Map 437. Windowpane flounder adults, Alternative 3B



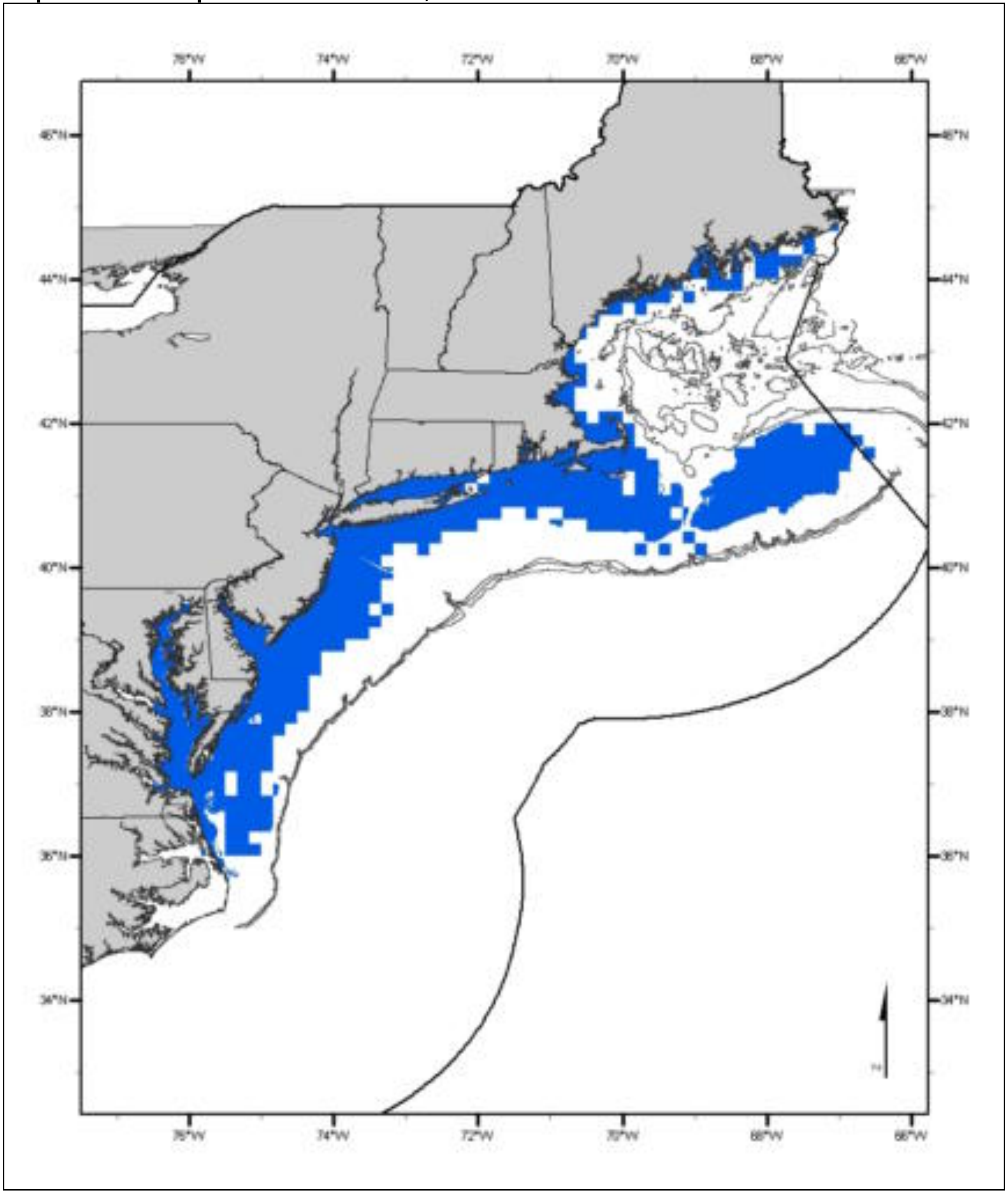
The Alternative 3B EFH designation for adult windowpane flounder on the continental shelf is based on the distribution of substrate types, depths, and bottom temperatures that are associated with high catch rates of adults in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of adults in the 1968-2005 spring and fall NMFS trawl surveys at the 50% cumulative percentage of catch level and includes inshore areas where adult red hake were determined to be present, based on 10% frequency of occurrence in state trawl surveys and ELMR information.

Map 438. Windowpane flounder adults, Alternative 3C



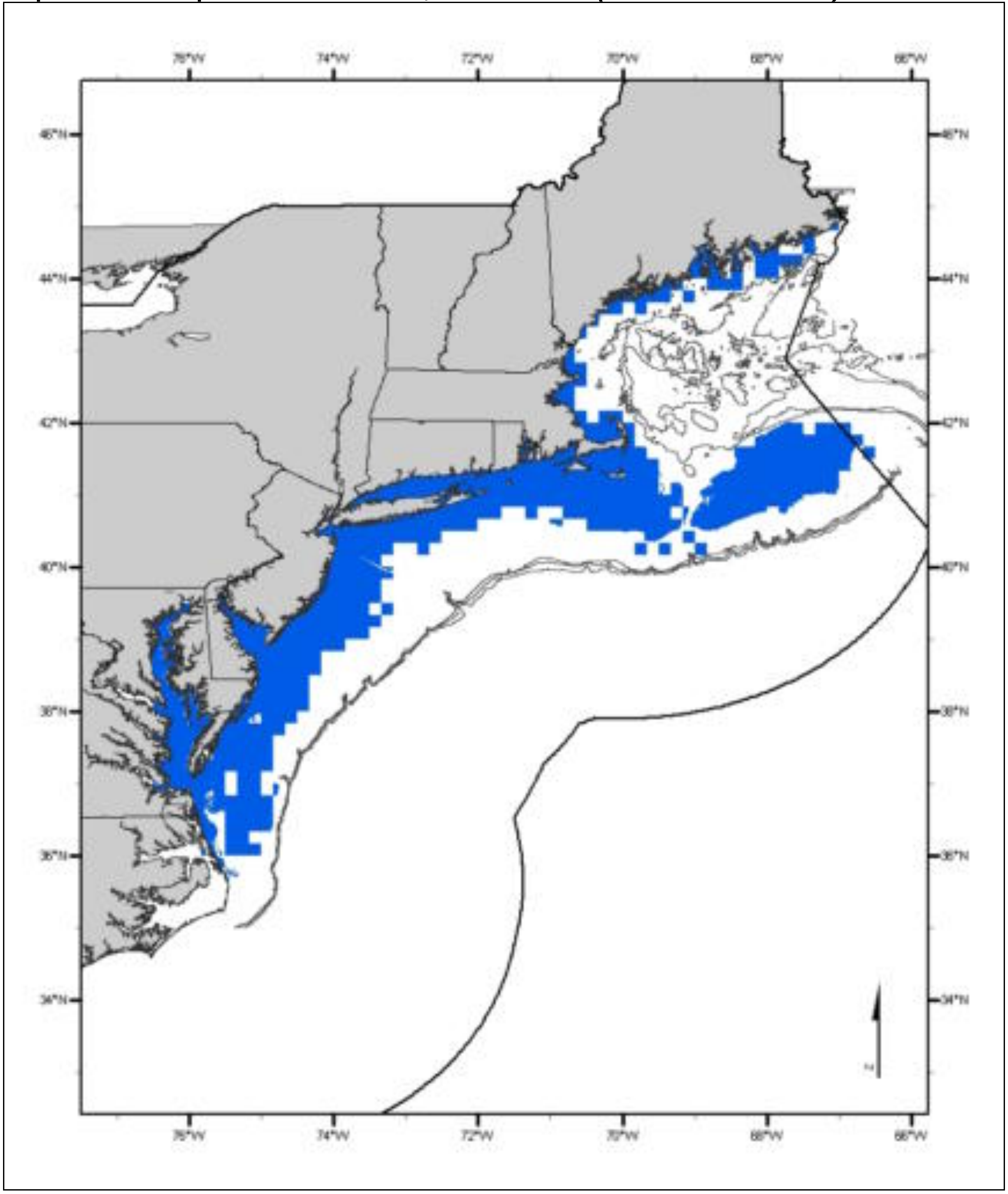
The Alternative 3C EFH designation for adult windowpane flounder on the continental shelf is based on the distribution of substrate types, depths, and bottom temperatures that are associated with high catch rates of adults in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of adults in the 1968-2005 spring and fall NMFS trawl surveys at the 75% cumulative percentage of catch level and includes inshore areas where adult red hake were determined to be present, based on 10% frequency of occurrence in state trawl surveys and ELMR information.

Map 439. Windowpane flounder adults, Alternative 3D



The Alternative 3D EFH designation for adult windowpane flounder on the continental shelf is based on the distribution of substrate types, depths, and bottom temperatures that are associated with high catch rates of adults in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of adults in the 1968-2005 spring and fall NMFS trawl surveys at the 90% cumulative percentage of catch level and includes inshore areas where adult red hake were determined to be present, based on 10% frequency of occurrence in state trawl surveys and ELMR information.

Map 440. Windowpane flounder adults, Alternative 3E *(Preferred Alternative)*



The Alternative 3E EFH designation for adult windowpane flounder flounder is the same as the 3D Alternative for adult windowpane flounder flounder with the addition of ten minute squares along the RI and CT coasts and southeast of Nantucket Island where there are no survey data for this species.

4.1.3.2.22 Winter Flounder

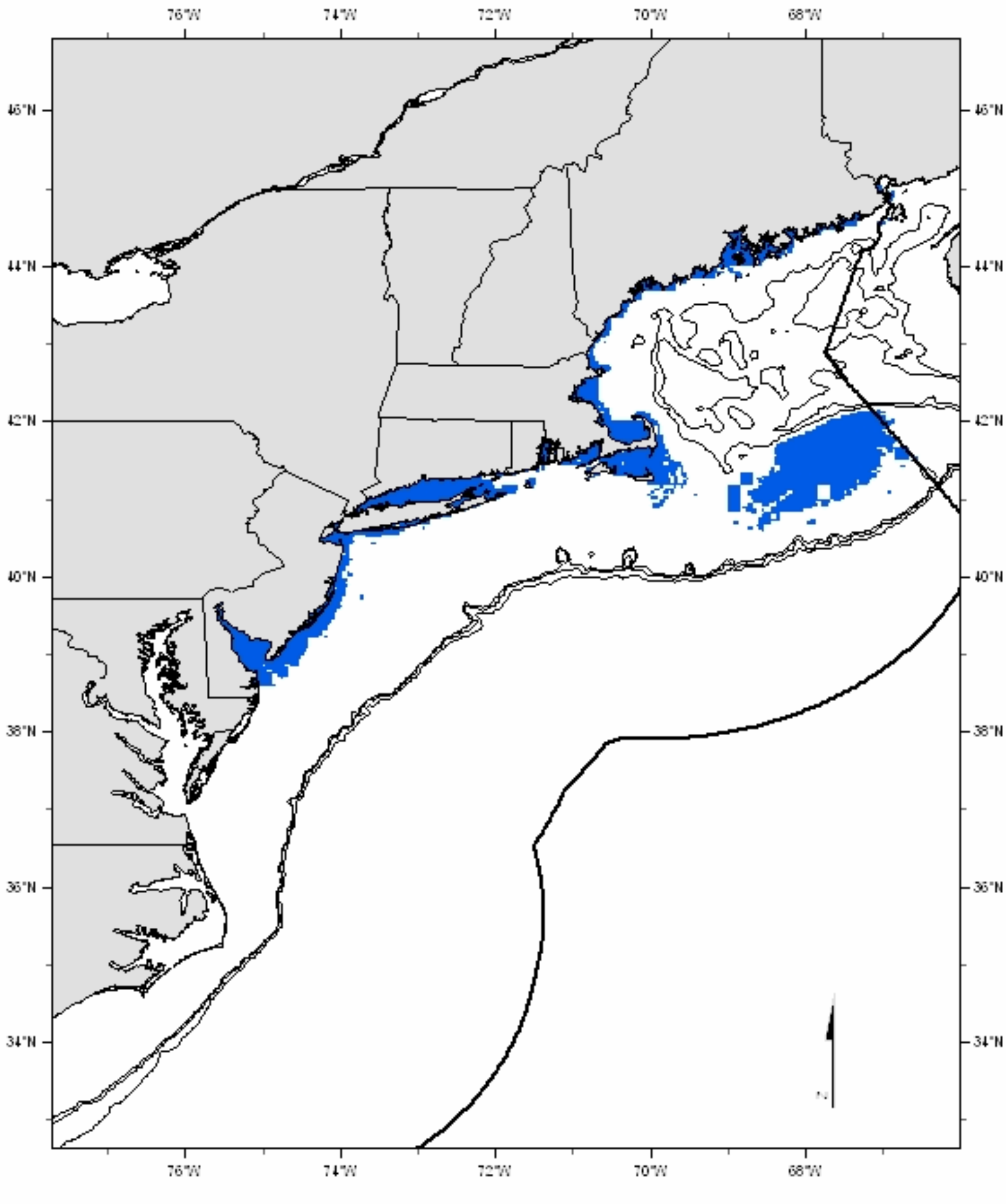
Eggs: Inshore estuarine and coastal marine benthic habitats in depths of 0.3–20 meters with substrates of mud, sand, muddy sand, gravel and/or submerged aquatic vegetation, extending from the Bay of Fundy to Delaware Bay, and benthic continental shelf habitats on Georges Bank and Nantucket Shoals in depths up to 72 meters with mud, sand, muddy sand, and/or gravel substrates as depicted on Map 441. In inshore waters, winter flounder eggs have been collected in depths between 0.3 and 8 meters and are believed to occur to at least 20 meters; spawning is reported at a maximum depth of 72 meters on Georges Bank. Other conditions that generally exist where EFH for winter flounder eggs is found include bottom water temperatures of 1 – 10ºC and salinities of 10 – 32 ppt.

Larvae: Estuarine, coastal marine, and continental shelf water column habitats as depicted on Map 441. The following conditions generally exist where EFH for winter flounder larvae is found: bottom depths of 2 – 72 meters; water column temperatures of 2 – 15ºC inshore and 5.5 – 10.5ºC on the shelf; and salinities of 4 – 30 inshore and up to 33 ppt on the shelf. Primary prey organisms are copepods, invertebrate eggs, and polychaetes.

Juveniles: Estuarine, coastal marine, and continental shelf benthic habitats in depths of 0.5 – 50 meters with a variety of substrate types as depicted on Map 442 - Map 445. Juvenile winter flounder are found on vegetated and un-vegetated muddy and sandy sediments and in bottom debris; YOY juveniles inhabit eelgrass and macroalgae and are also found in marsh creeks. EFH includes intertidal and sub-tidal benthic habitats. Other conditions that generally exist where EFH for juvenile winter flounder is found are: bottom temperatures of 1 – 24.5ºC inshore and 1.5 – 16.5ºC on the shelf; and salinities of 9 – 33.5 ppt inshore and 31.5 – 33.5 ppt on the shelf. Primary prey organisms are polychaetes, amphipods, and other crustaceans. They also feed on small bivalves mollusks, including bivalve siphons. *(Preferred Alternative)*

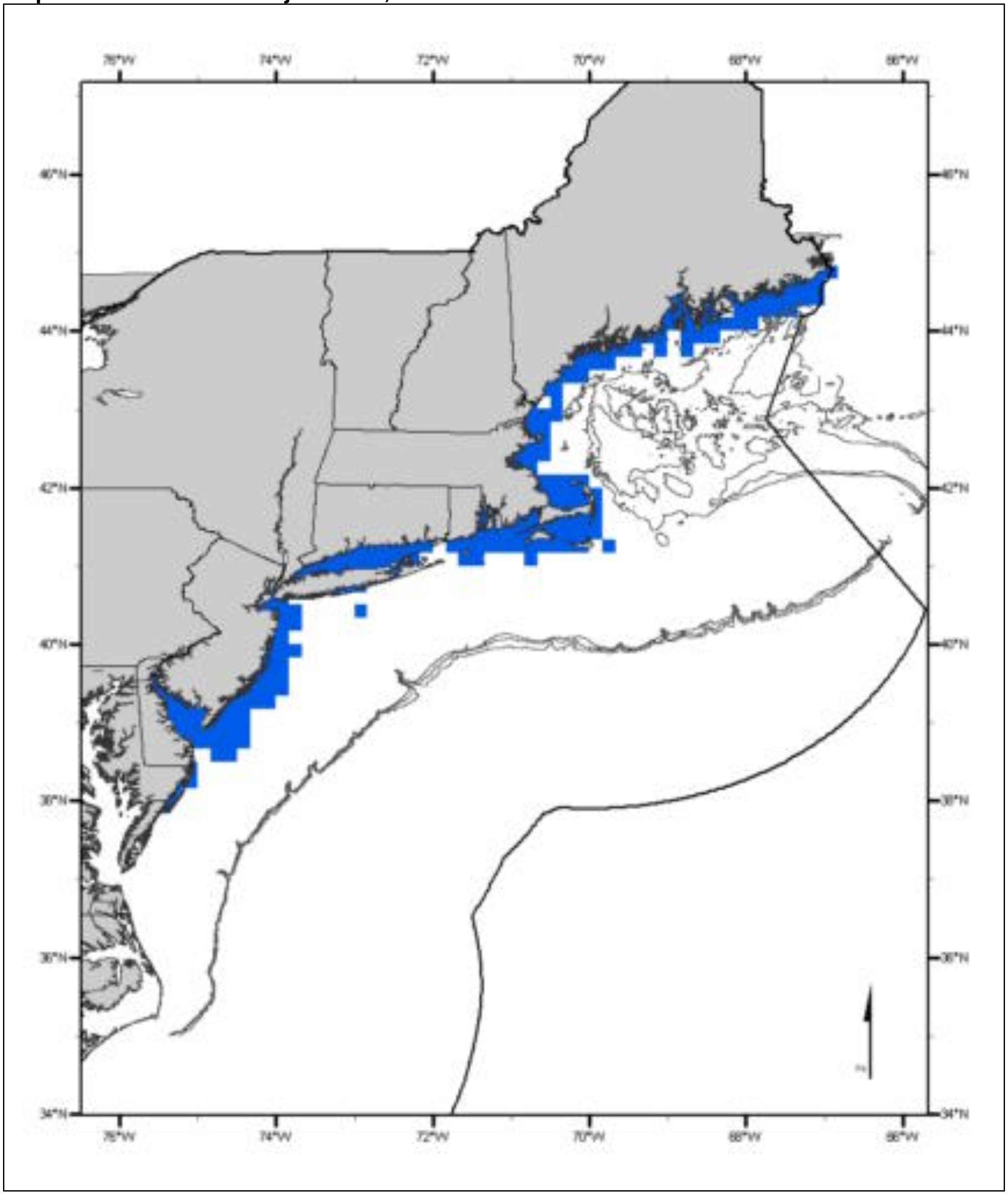
Adults: Estuarine, coastal marine, and continental shelf benthic habitats in depths of 2 – 60 meters as depicted on Map 447 - Map 450. EFH for adult winter flounder on the continental shelf occurs on sandy substrates. In inshore areas, EFH is composed of a variety of substrates (see eggs). Other conditions that generally exist where EFH for adult winter flounder is found are: bottom temperatures of 1 – 15.5ºC inshore and 1.5 – 12.5ºC on the shelf; and salinities of 9 – 33.5 ppt inshore and 31.5 – 33.5 ppt on the shelf. Spawning occurs inshore in depths as shallow as one meter or less and on Nantucket Shoals and Georges Bank in depths up to 72 meters; spawning may also occur on the shelf in southern New England and the Mid–Atlantic region. Primary prey organisms are polychaetes, amphipods and other crustaceans, planktonic hydroids, anemones (e.g., *Cerianthus* spp.), and bivalve mollusks. *(Preferred Alternative)*

Map 441. Winter flounder eggs and larvae, Alternative 3



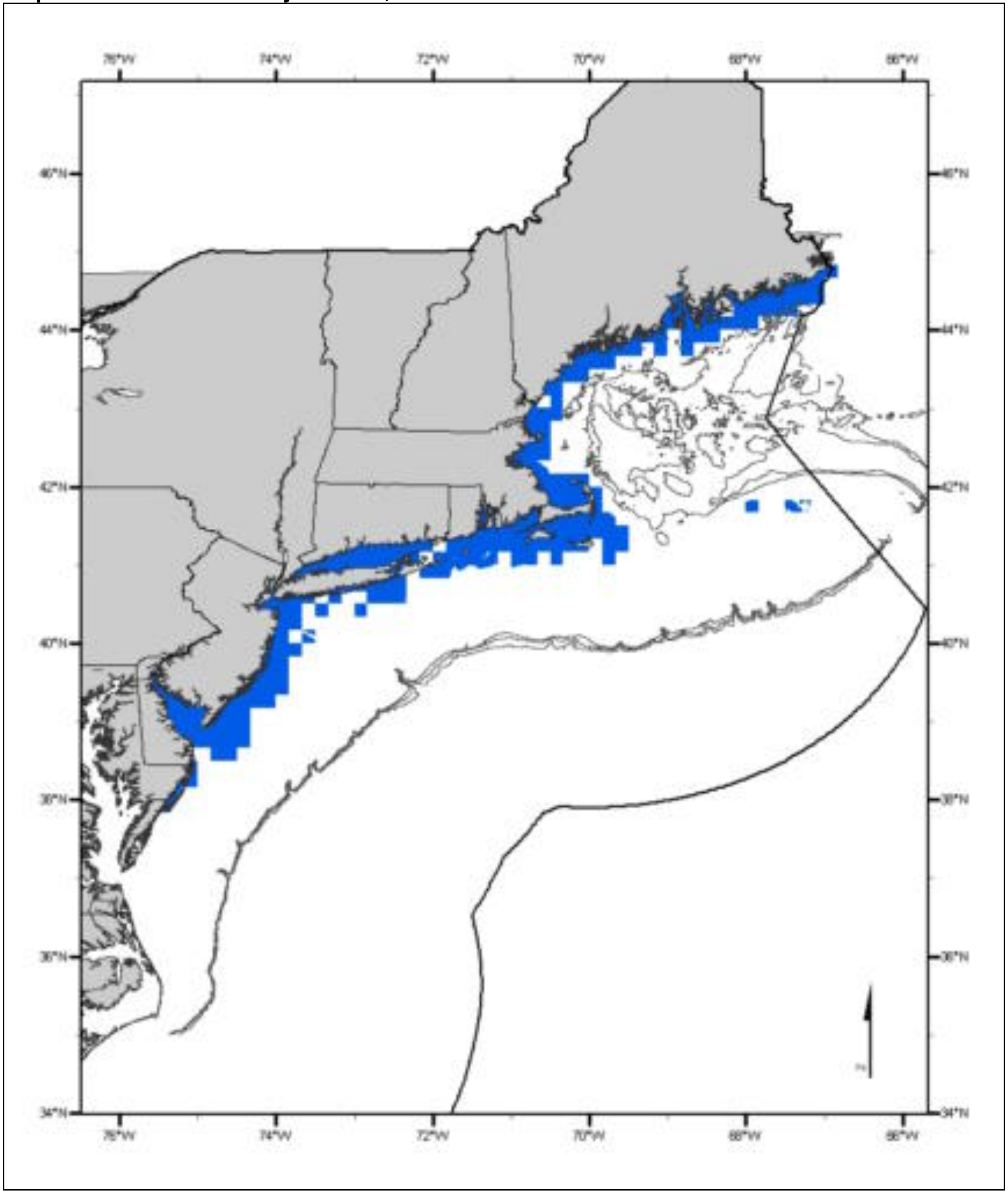
The Alternative 3 EFH designation for winter flounder eggs and larvae includes coastal waters out to a maximum depth of 20 meters within the range of spawning adults (eastern Maine to Delaware Bay) plus bays and estuaries identified in the NOAA ELMR program where winter flounder eggs and larvae are "common" or "abundant." It also includes spawning areas on Georges Bank to a maximum depth of 72 meters, as identified in the EFH Source Document.

Map 442. Winter flounder juveniles, Alternative 3A



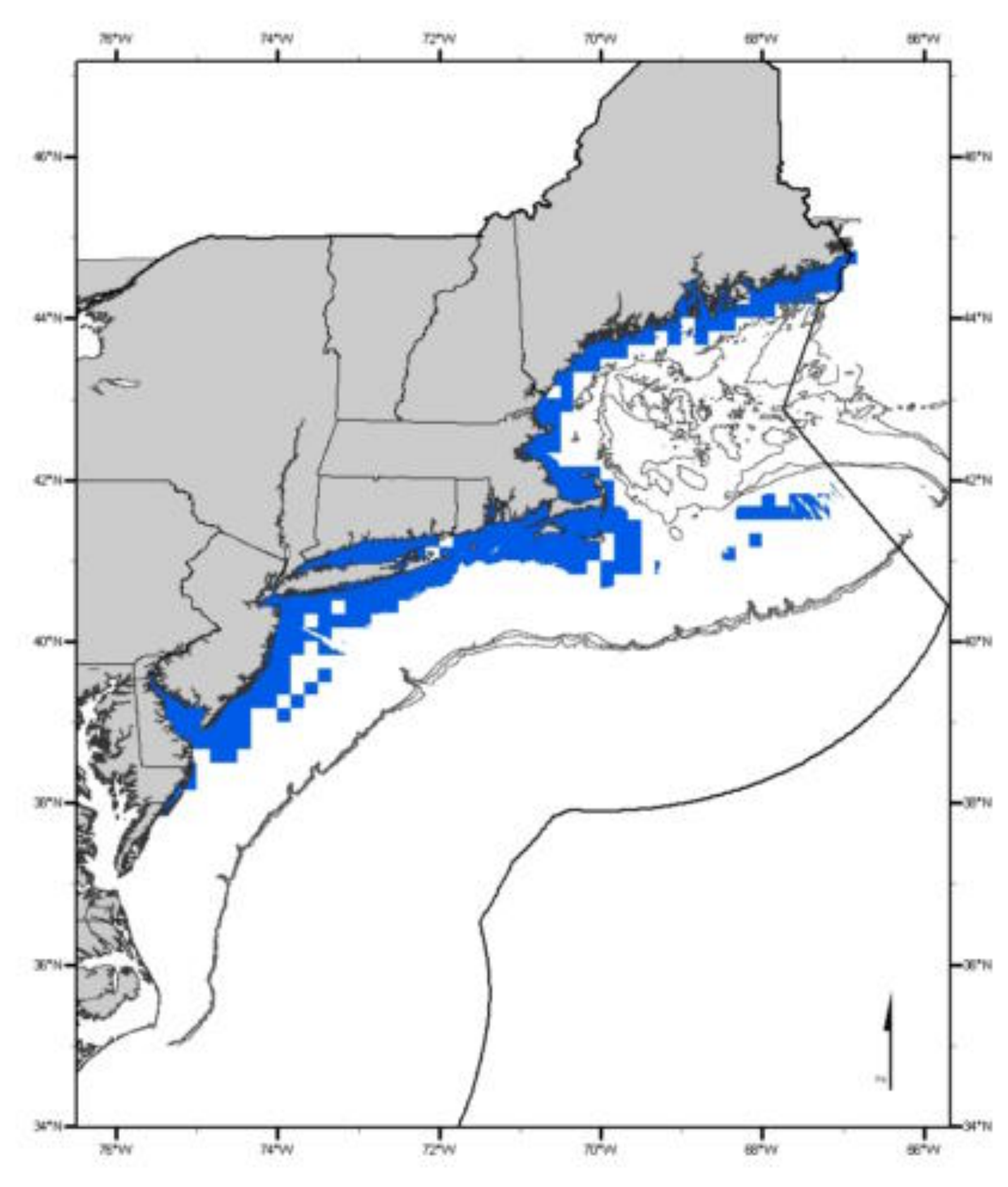
The Alternative 3A EFH designation for juvenile winter flounder on the continental shelf is based on the distribution of depths and bottom temperatures that are associated with high catch rates of juveniles in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of juveniles in the 1968-2005 spring and fall NMFS trawl surveys at the 25% cumulative percentage of catch level and includes inshore areas where juvenile winter flounder were determined to be present, based on 10% frequency of occurrence in state trawl surveys and ELMR information.

Map 443. Winter flounder juveniles, Alternative 3B



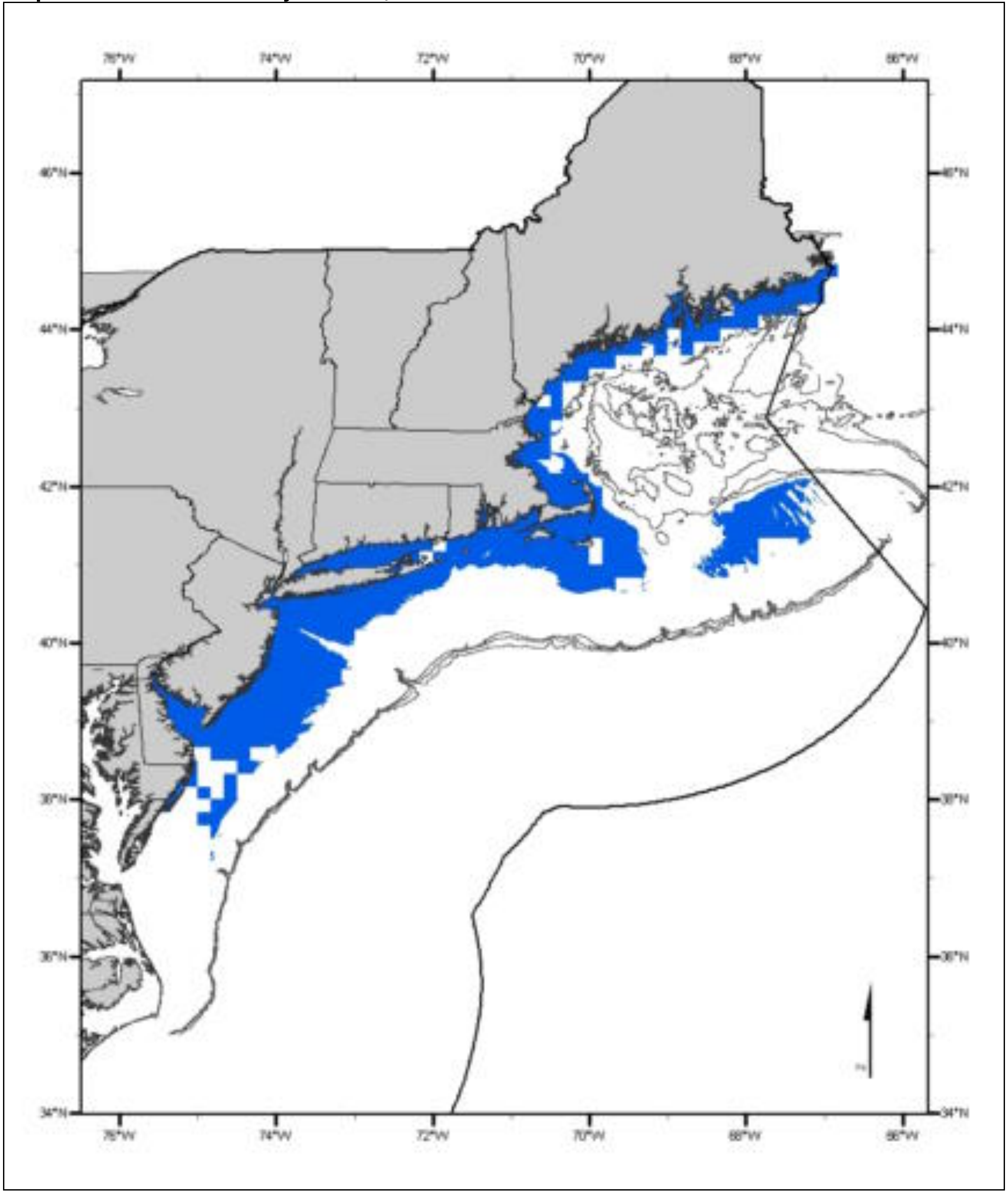
The Alternative 3B EFH designation for juvenile winter flounder on the continental shelf is based on the distribution of depths and bottom temperatures that are associated with high catch rates of juveniles in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of juveniles in the 1968-2005 spring and fall NMFS trawl surveys at the 50% cumulative percentage of catch level and includes inshore areas where juvenile winter flounder were determined to be present, based on 10% frequency of occurrence in state trawl surveys and ELMR information.

Map 444. Winter flounder juveniles, Alternative 3C



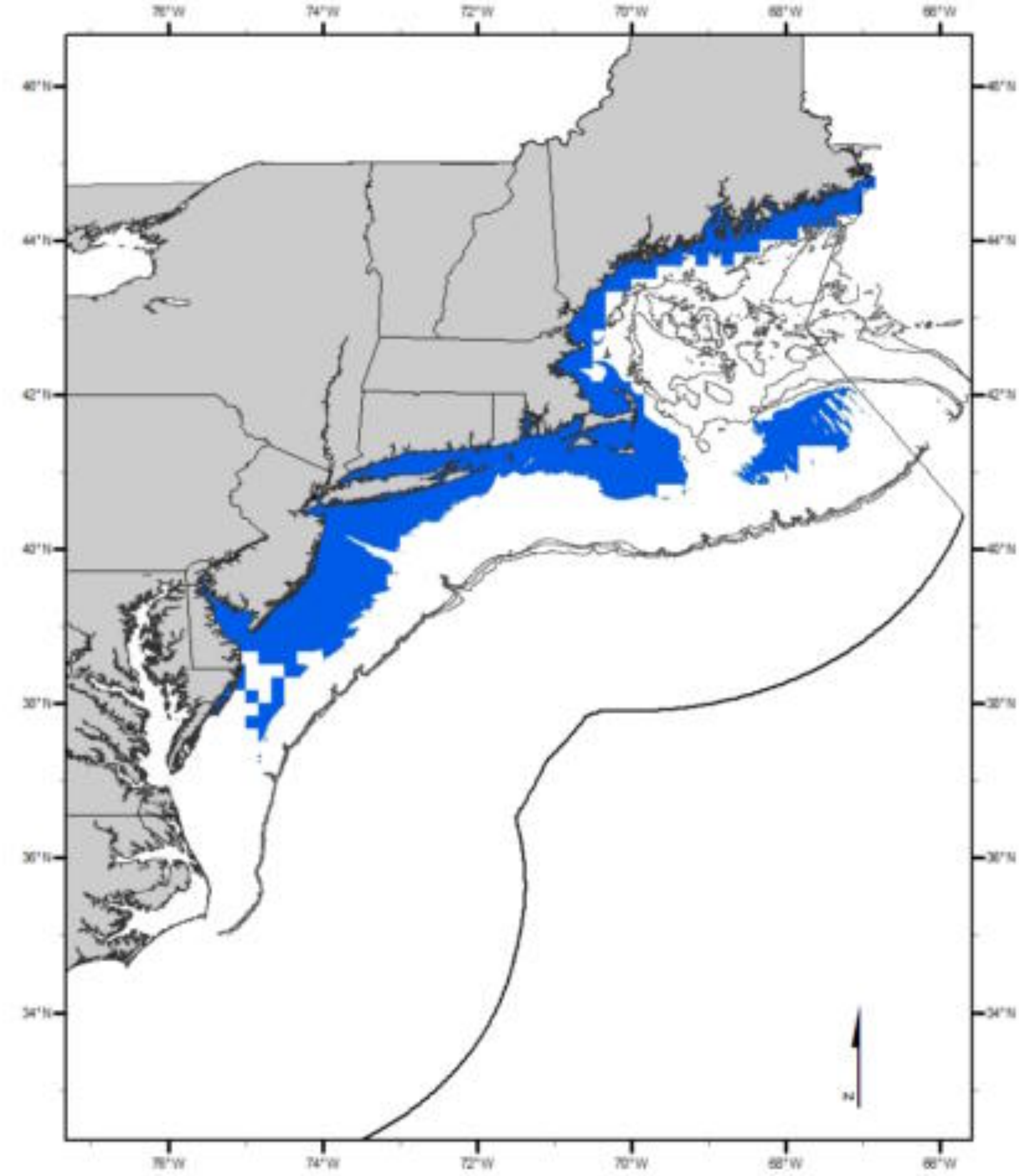
The Alternative 3C EFH designation for juvenile winter flounder on the continental shelf is based on the distribution of depths and bottom temperatures that are associated with high catch rates of juveniles in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of juveniles in the 1968-2005 spring and fall NMFS trawl surveys at the 75% cumulative percentage of catch level and includes inshore areas where juvenile winter flounder were determined to be present, based on 10% frequency of occurrence in state trawl surveys and ELMR information.

Map 445. Winter flounder juveniles, Alternative 3D



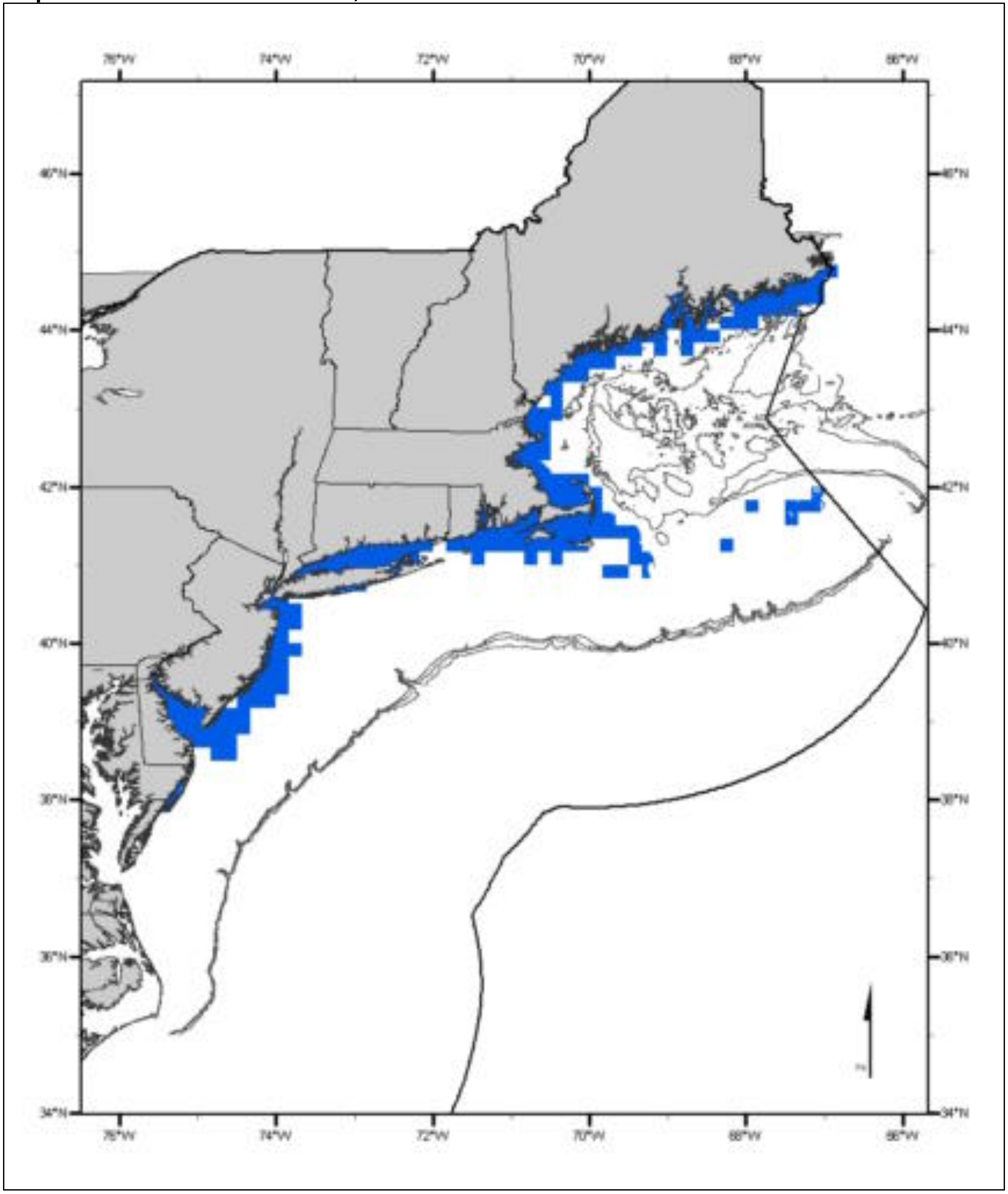
The Alternative 3D EFH designation for juvenile winter flounder on the continental shelf is based on the distribution of depths and bottom temperatures that are associated with high catch rates of juveniles in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of juveniles in the 1968-2005 spring and fall NMFS trawl surveys at the 90% cumulative percentage of catch level and includes inshore areas where juvenile winter flounder were determined to be present, based on 10% frequency of occurrence in state trawl surveys and ELMR information.

Map 446. Winter flounder juveniles, Alternative 3E *(Preferred Alternative)*



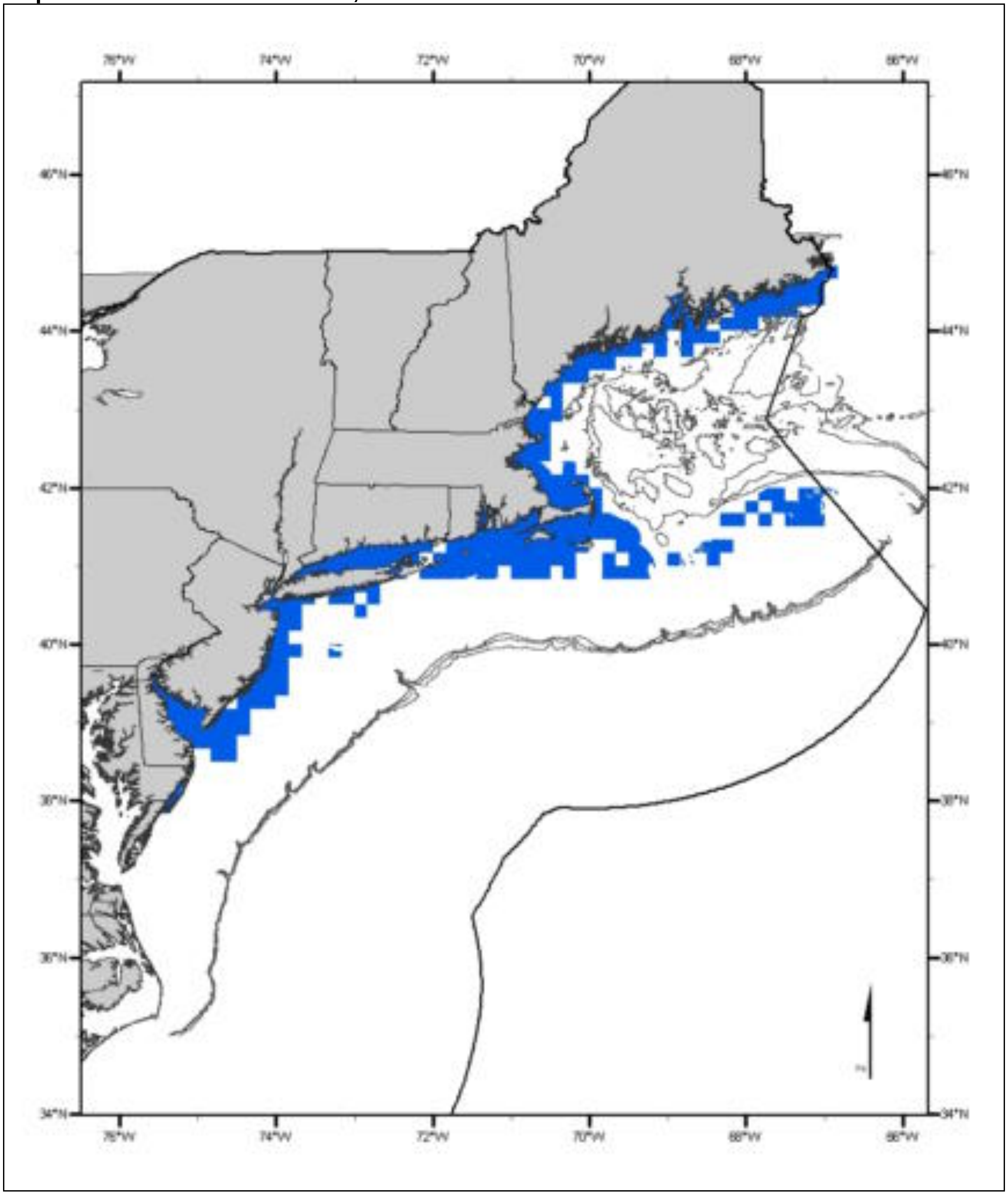
The Alternative 3E EFH designation for juvenile winter flounder is based on the Alternative 3D designation for juvenile winter flounder with "filled in" ten minute squares along the ME, NH, RI, and CT coasts and east and south of Nantucket Island.

Map 447. Winter flounder adults, Alternative 3A



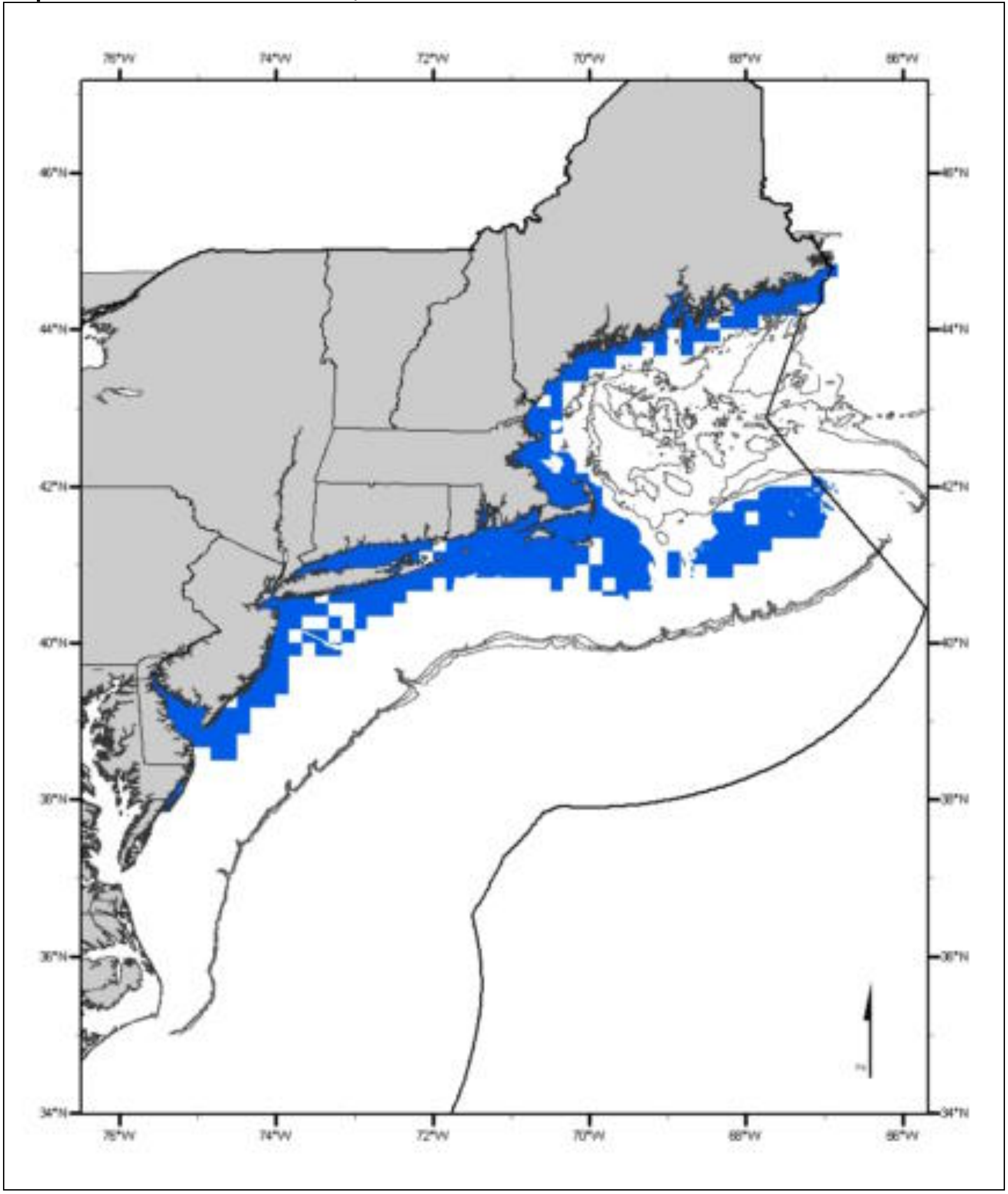
The Alternative 3A EFH designation for adult winter flounder on the continental shelf is based on the distribution of substrate types, depths, and bottom temperatures that are associated with high catch rates of adults in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of adults in the 1968-2005 spring and fall NMFS trawl surveys at the 25% cumulative percentage of catch level and includes inshore areas where adult winter flounder were determined to be present, based on 10% frequency of occurrence in state trawl surveys and ELMR information.

Map 448. Winter flounder adults, Alternative 3B



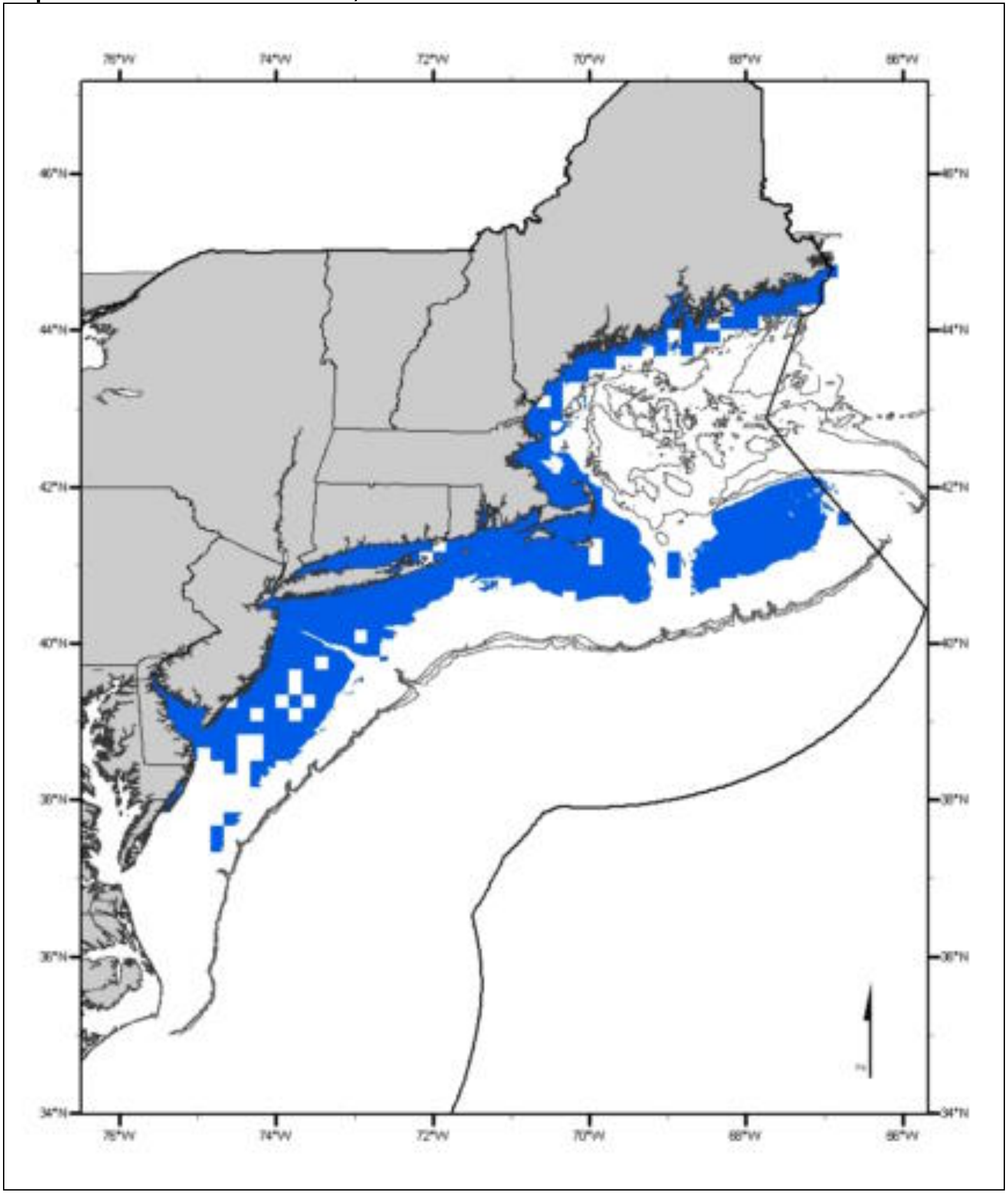
The Alternative 3B EFH designation for adult winter flounder on the continental shelf is based on the distribution of substrate types, depths and bottom temperatures that are associated with high catch rates of adults in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of adults in the 1968-2005 spring and fall NMFS trawl surveys at the 50% cumulative percentage of catch level and includes inshore areas where adult winter flounder were determined to be present, based on 10% frequency of occurrence in state trawl surveys and ELMR information.

Map 449. Winter flounder adults, Alternative 3C



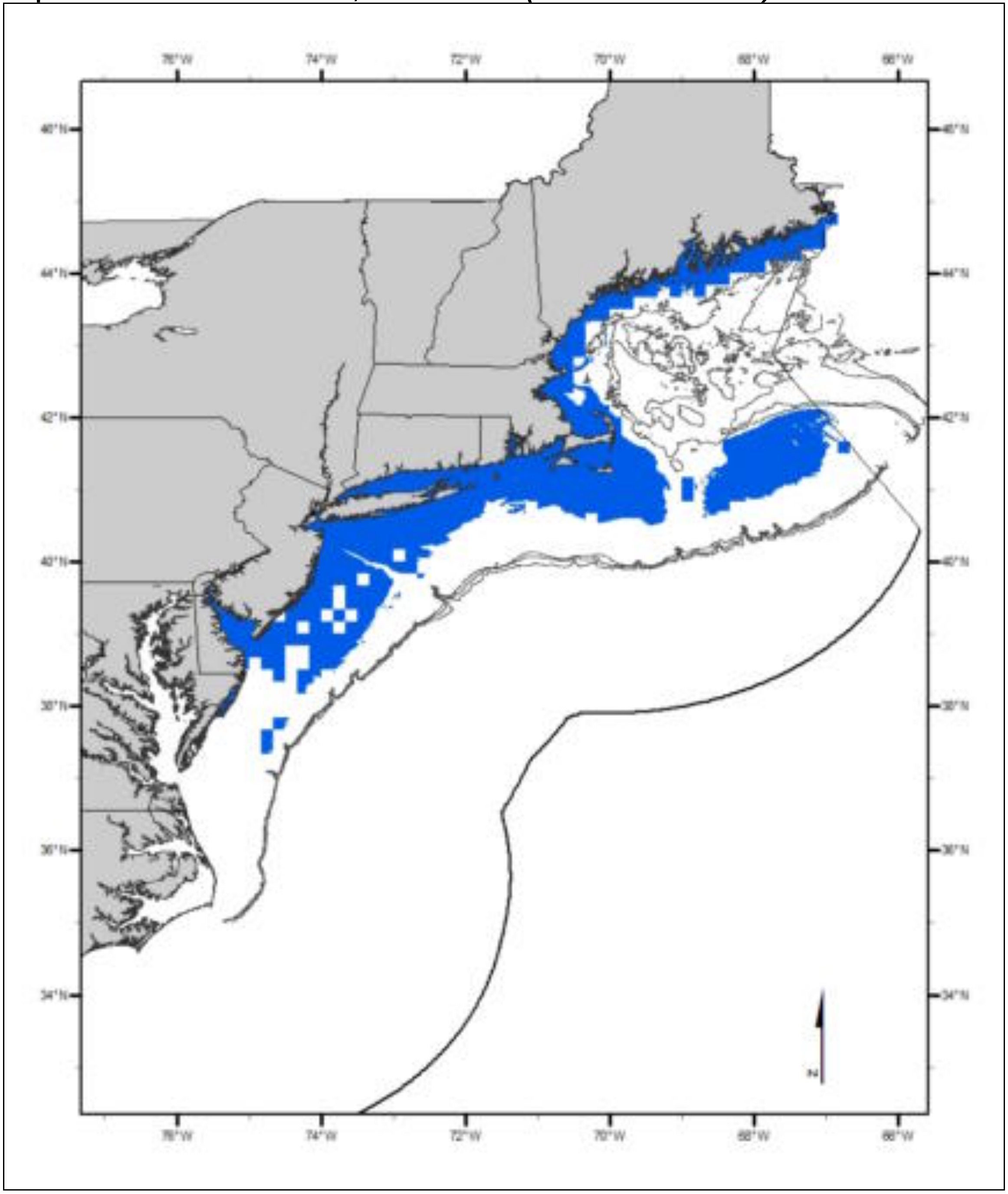
The Alternative 3C EFH designation for adult winter flounder on the continental shelf is based on the distribution of substrate types, depths and bottom temperatures that are associated with high catch rates of adults in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of adults in the 1968-2005 spring and fall NMFS trawl surveys at the 75% cumulative percentage of catch level and includes inshore areas where adult winter flounder were determined to be present, based on 10% frequency of occurrence in state trawl surveys and ELMR information.

Map 450. Winter flounder adults, Alternative 3D



The Alternative 3D EFH designation for adult winter flounder on the continental shelf is based on the distribution of substrate types, depths and bottom temperatures that are associated with high catch rates of adults in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of adults in the 1968-2005 spring and fall NMFS trawl surveys at the 90% cumulative percentage of catch level and includes inshore areas where adult winter flounder were determined to be present, based on 10% frequency of occurrence in state trawl surveys and ELMR information.

Map 451. Winter flounder adults, Alternative 3E *(Preferred Alternative)*



The Alternative 3E EFH designation for adult winter flounder is based on the Alternative 3D designation for adult winter flounder with "filled in" ten minute squares along the ME, NH, RI, and CT coasts and east and south of Nantucket Island.

4.1.3.2.23 Winter Skate

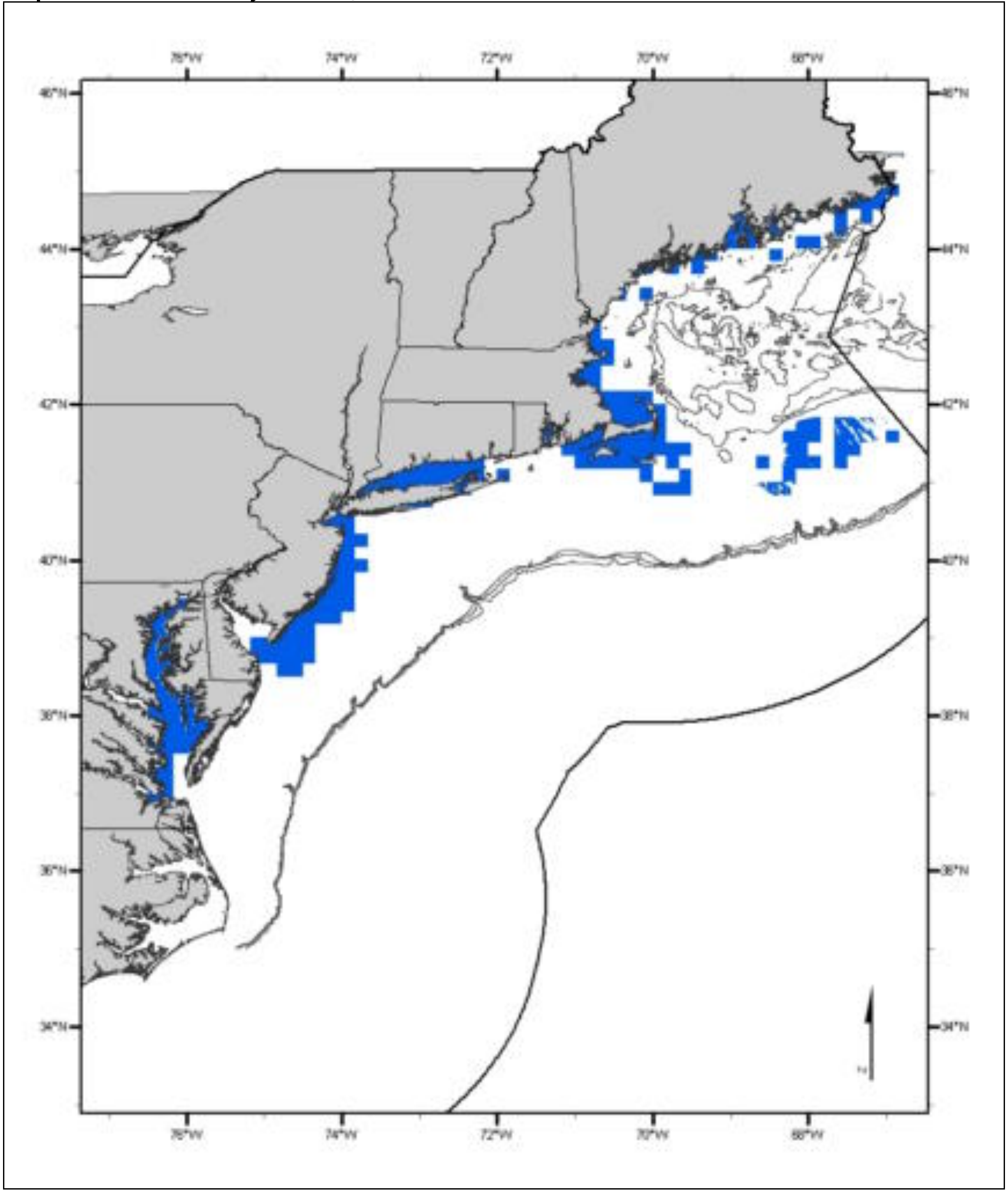
Eggs: No alternative EFH designation.

Larvae: No larval life stage exists for this species. Upon hatching, they are fully developed juveniles.

Juveniles: Estuarine, coastal marine, and continental shelf benthic habitats in depths of 5 – 80 meters on sand and gravel substrates, as depicted on Map 452 - Map 456. Other conditions that generally exist where EFH for juvenile winter skates is found are bottom temperatures of 1.5 – 17.5ºC and salinities of 15.5 – 33.5 ppt. Juvenile winter skates feed on crustaceans (*e.g.*, amphipods, isopods, sand shrimps, crabs, pandalid shrimps), bivalve mollusks, a variety of fish species, and polychaetes. *(Preferred Alternative)*

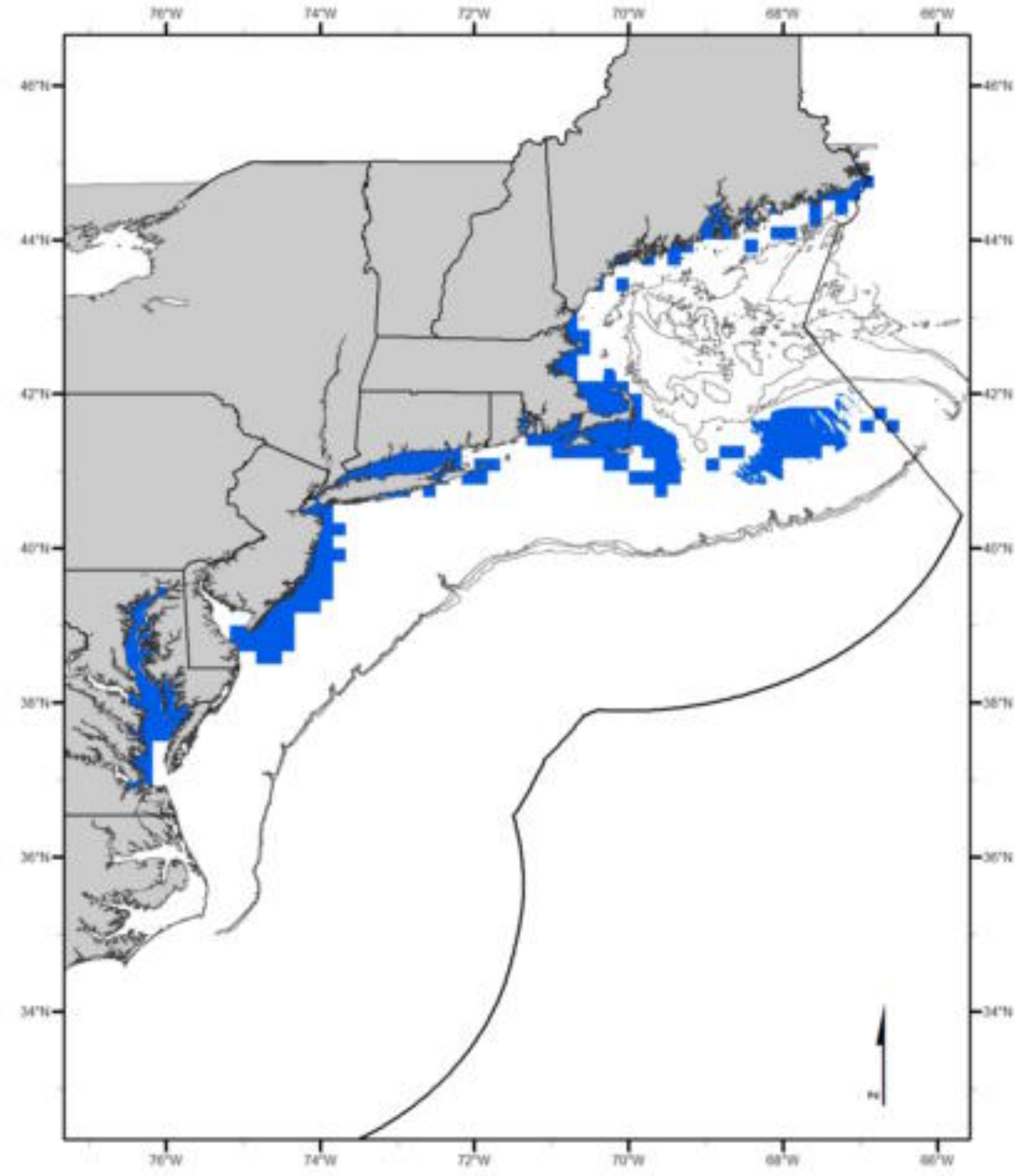
Adults: Estuarine, coastal marine, and continental shelf benthic habitats in depths of 5 – 60 meters on sand and gravel substrates, as depicted on Map 457 - Map 461. Other conditions that generally exist where EFH for juvenile winter skates is found are bottom temperatures of 1.5 – 17.5ºC and salinities of 20.5 – 34.5 ppt. Adult winter skates feed on the same types of crustaceans, mollusks, polychaetes, and fishes as the juveniles, but their diets include more fishes and fewer crustaceans (especially amphipods and isopods). *(Preferred Alternative)*

Map 452. Winter skate juveniles, Alternative 3A



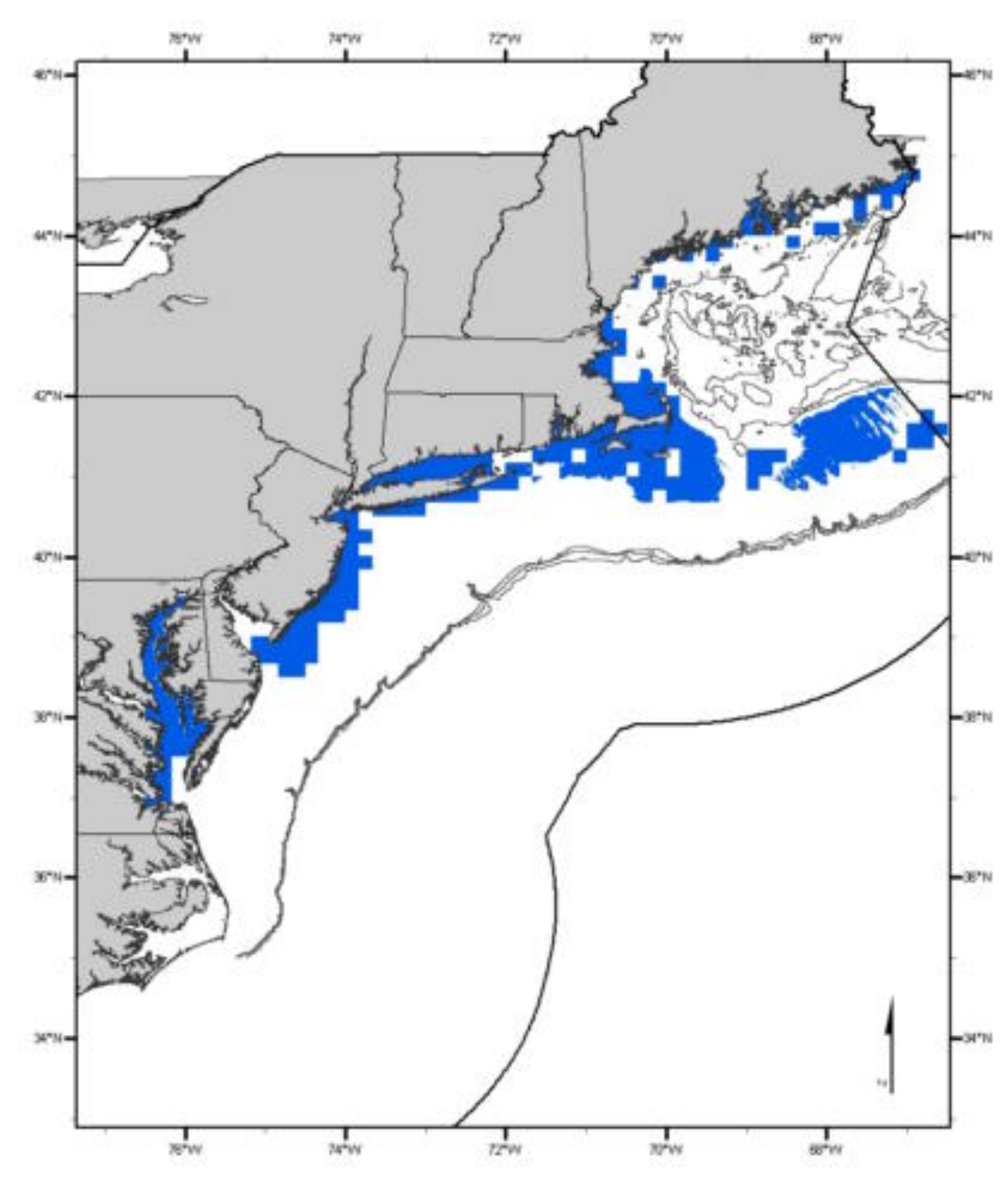
The Alternative 3A EFH designation for juvenile winter skate on the continental shelf is based on the distribution of substrate types, depths, and bottom temperatures that are associated with high catch rates of juveniles in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of juveniles in the 1968-2005 spring and fall NMFS trawl surveys at the 25% cumulative percentage of catch level and includes inshore areas where juvenile winter skate were determined to be present, based on 10% frequency of occurrence in state trawl surveys and ELMR information.

Map 453. Winter skate juveniles, Alternative 3B



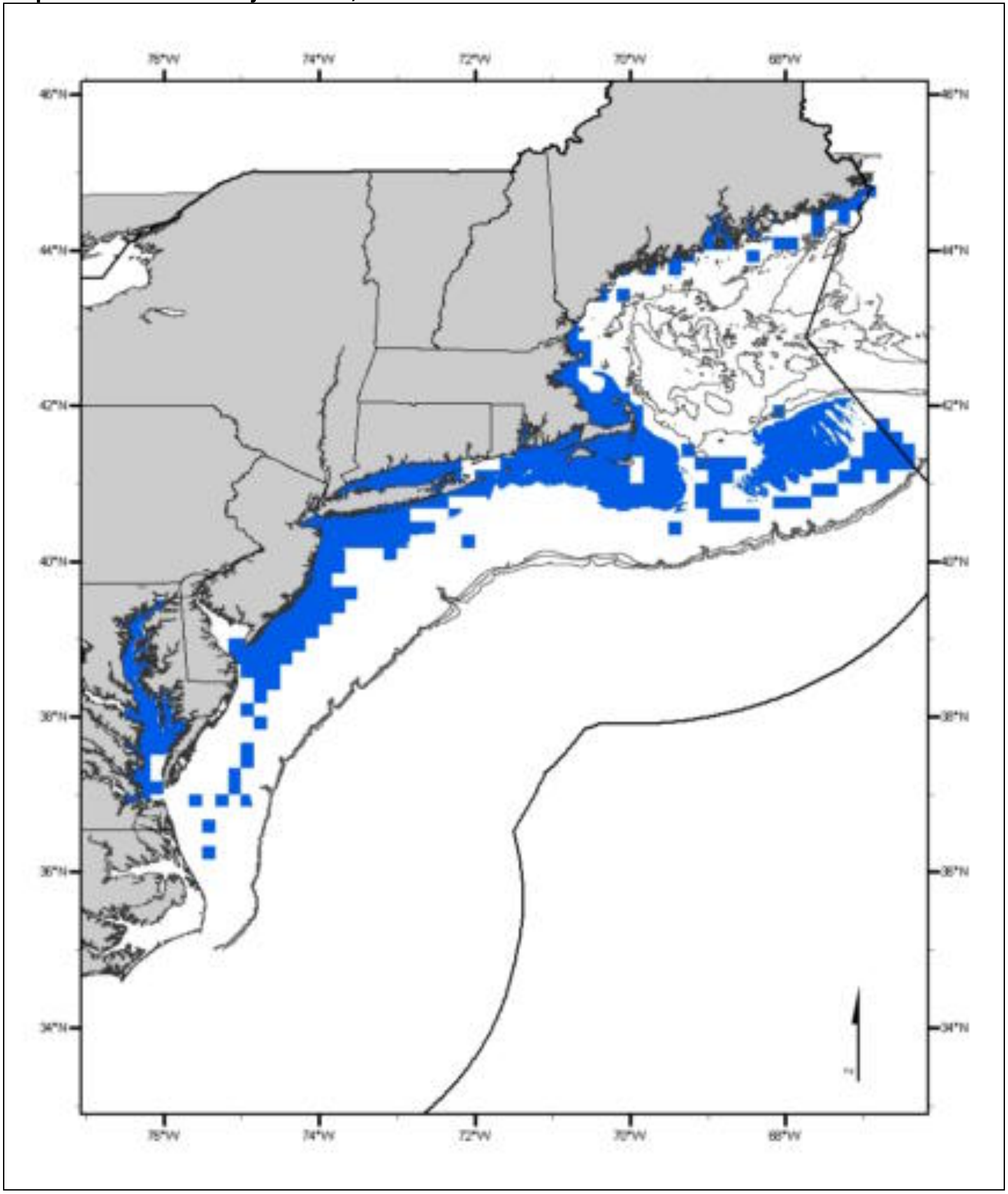
The Alternative 3B EFH designation for juvenile winter skate on the continental shelf is based on the distribution of substrate types, depths, and bottom temperatures that are associated with high catch rates of juveniles in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of juveniles in the 1968-2005 spring and fall NMFS trawl surveys at the 50% cumulative percentage of catch level and includes inshore areas where juvenile winter skate were determined to be present, based on 10% frequency of occurrence in state trawl surveys and ELMR information.

Map 454. Winter skate juveniles, Alternative 3C



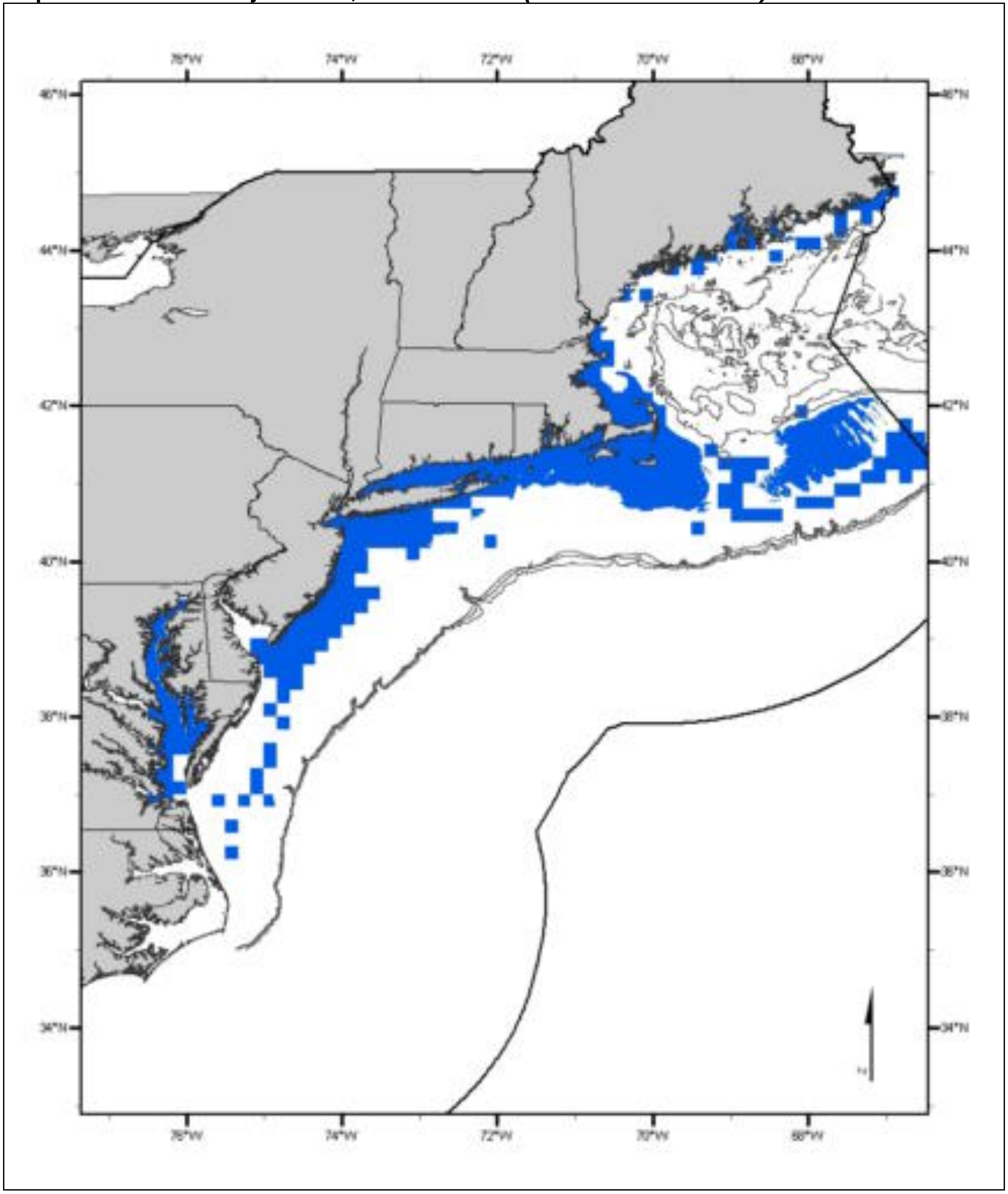
The Alternative 3C EFH designation for juvenile winter skate on the continental shelf is based on the distribution of substrate types, depths, and bottom temperatures that are associated with high catch rates of juveniles in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of juveniles in the 1968-2005 spring and fall NMFS trawl surveys at the 75% cumulative percentage of catch level and includes inshore areas where juvenile winter skate were determined to be present, based on 10% frequency of occurrence in state trawl surveys and ELMR information.

Map 455. Winter skate juveniles, Alternative 3D



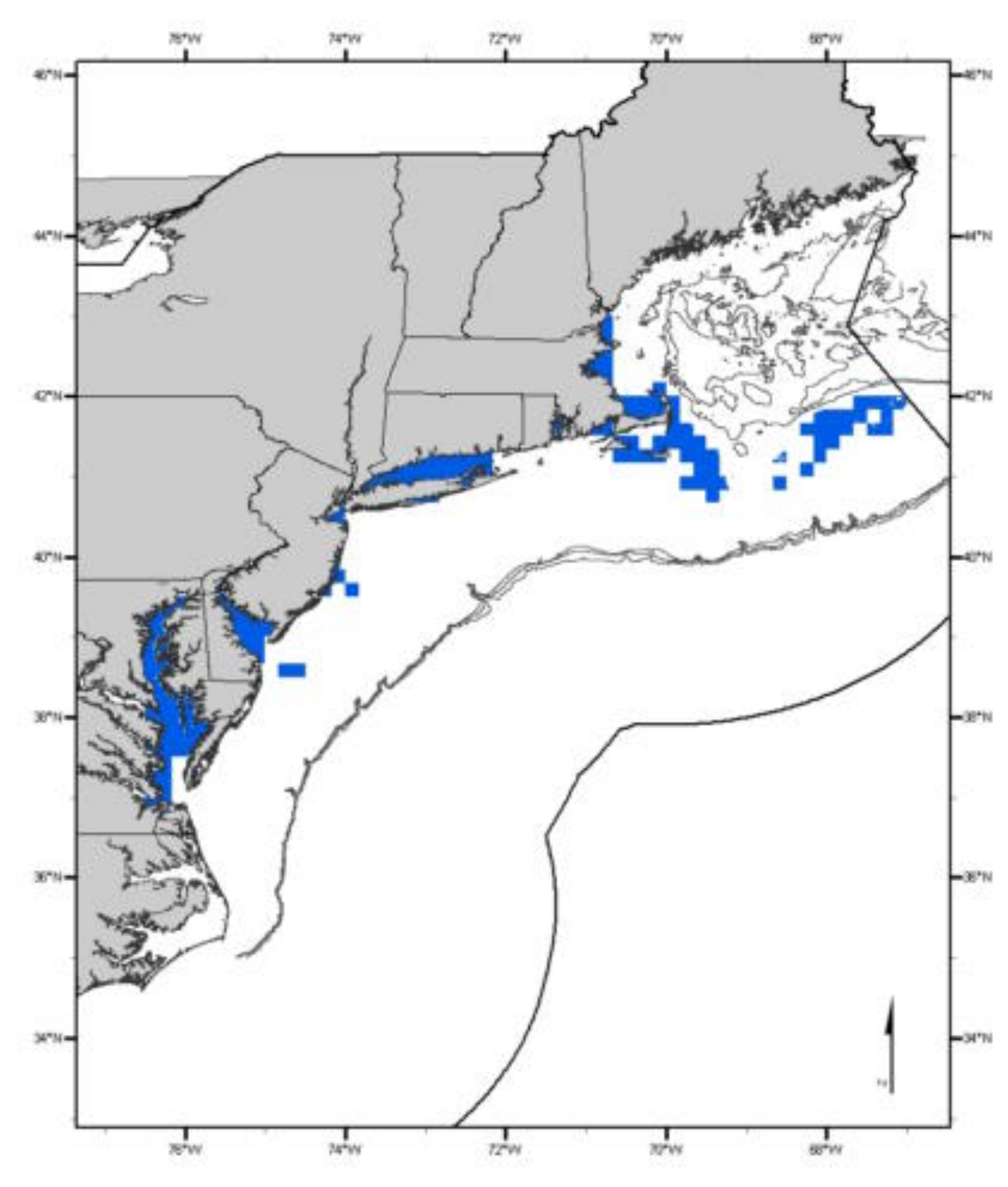
The Alternative 3D EFH designation for juvenile winter skate on the continental shelf is based on the distribution of substrate types, depths, and bottom temperatures that are associated with high catch rates of juveniles in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of juveniles in the 1968-2005 spring and fall NMFS trawl surveys at the 90% cumulative percentage of catch level and includes inshore areas where juvenile winter skate were determined to be present, based on 10% frequency of occurrence in state trawl surveys and ELMR information.

Map 456. Winter skate juveniles, Alternative 3E *(Preferred Alternative)*



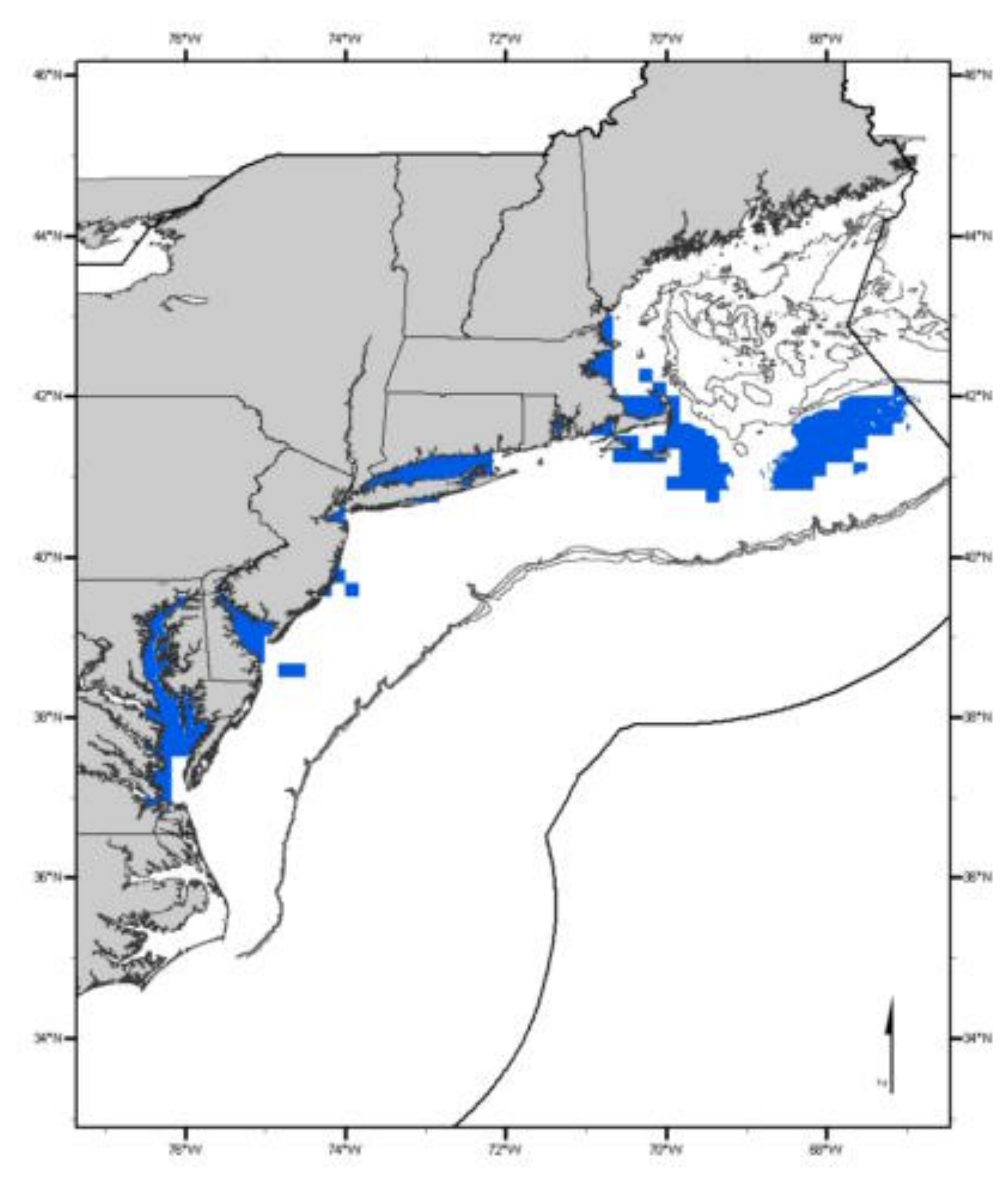
The Alternative 3E EFH designation for juvenile winter skate is based on the Alternative 3D designation for juvenile winter skate with the addition of ten minute squares along the RI and CT coasts and southeast of Nantucket Island where there are no survey data for this species.

Map 457. Winter skate adults, Alternative 3A



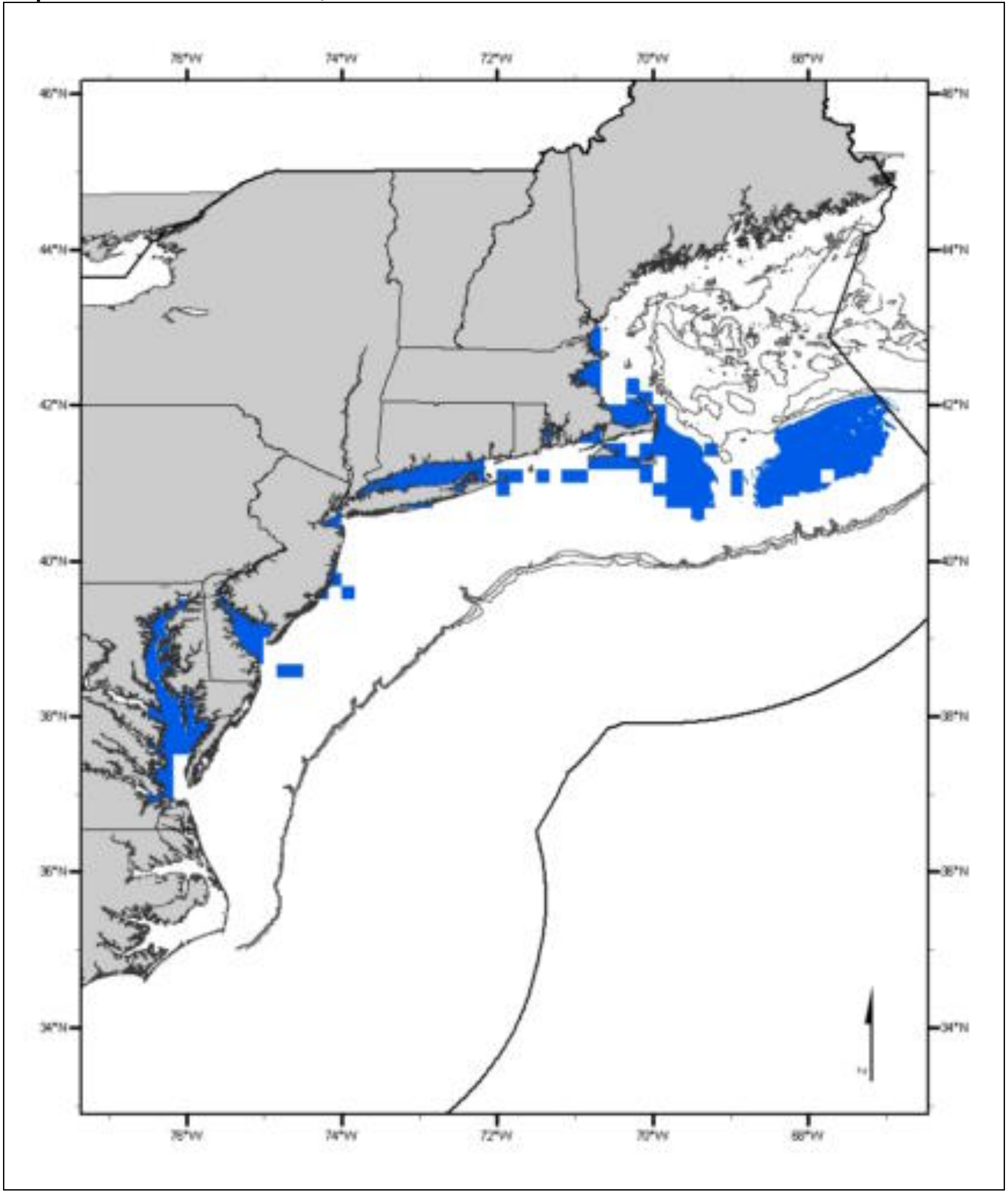
The Alternative 3A EFH designation for adult winter skate on the continental shelf is based on the distribution of substrate types, depths, and bottom temperatures that are associated with high catch rates of adults in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of adults in the 1968-2005 spring and fall NMFS trawl surveys at the 25% cumulative percentage of catch level and includes inshore areas where adult winter skate were determined to be present, based on 10% frequency of occurrence in state trawl surveys and ELMR information.

Map 458. Winter skate adults, Alternative 3B



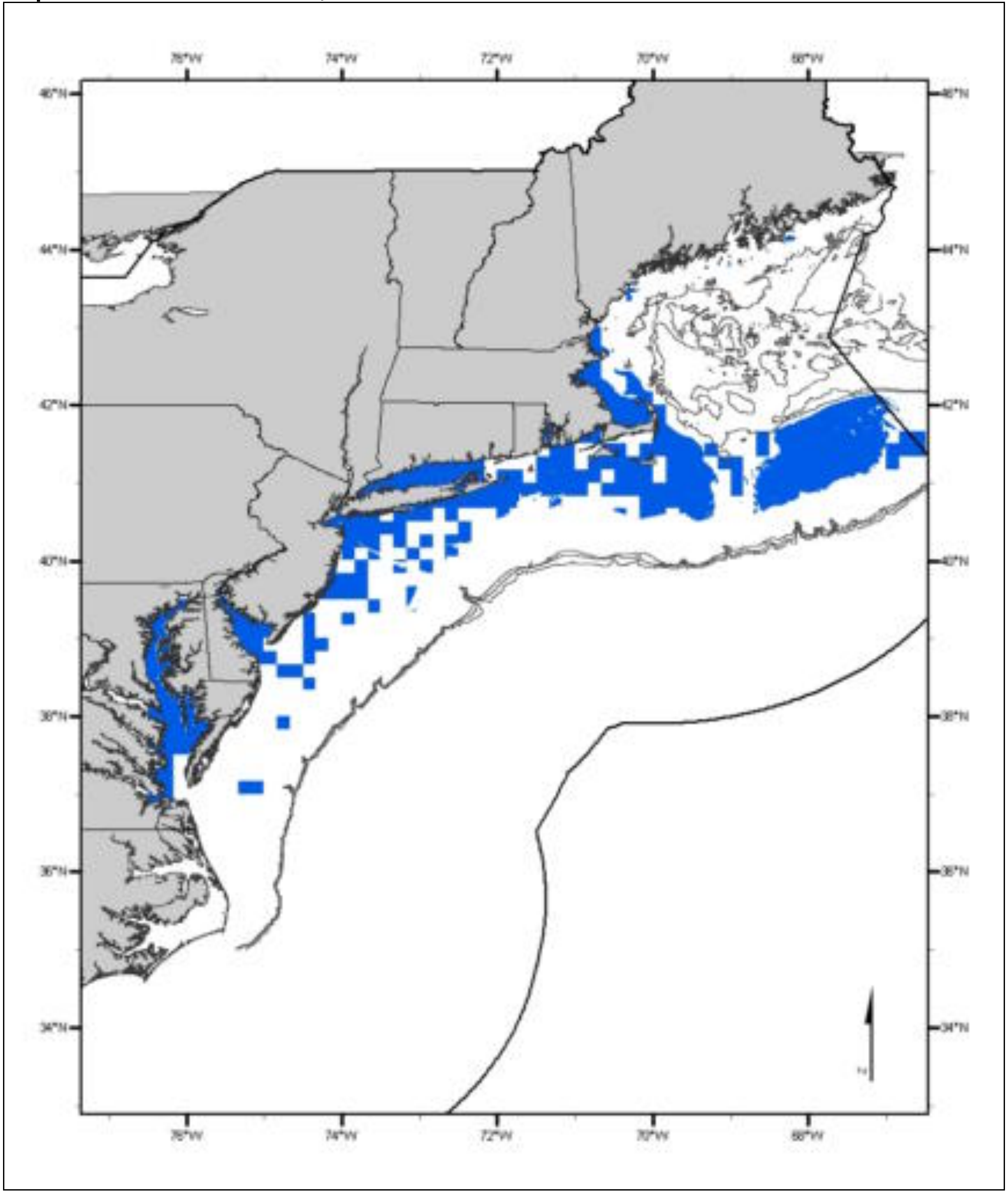
The Alternative 3B EFH designation for adult winter skate on the continental shelf is based on the distribution of substrate types, depths, and bottom temperatures that are associated with high catch rates of adults in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of adults in the 1968-2005 spring and fall NMFS trawl surveys at the 50% cumulative percentage of catch level and includes inshore areas where adult winter skate were determined to be present, based on 10% frequency of occurrence in state trawl surveys and ELMR information.

Map 459. Winter skate adults, Alternative 3C



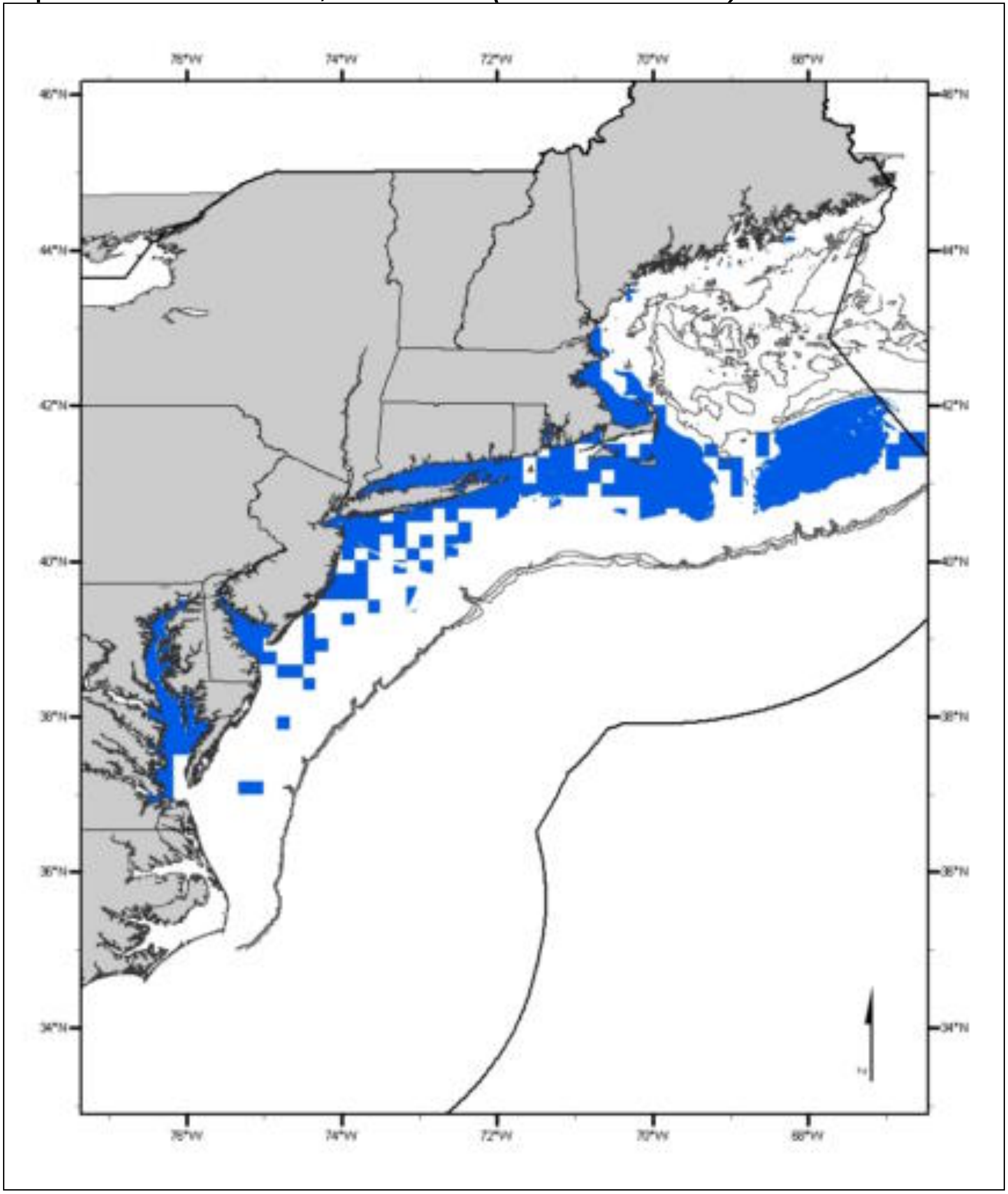
The Alternative 3C EFH designation for adult winter skate on the continental shelf is based on the distribution of substrate types, depths, and bottom temperatures that are associated with high catch rates of adults in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of adults in the 1968-2005 spring and fall NMFS trawl surveys at the 75% cumulative percentage of catch level and includes inshore areas where adult winter skate were determined to be present, based on 10% frequency of occurrence in state trawl surveys and ELMR information.

Map 460. Winter skate adults, Alternative 3D



The Alternative 3D EFH designation for adult winter skate on the continental shelf is based on the distribution of substrate types, depths, and bottom temperatures that are associated with high catch rates of adults in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of adults in the 1968-2005 spring and fall NMFS trawl surveys at the 90% cumulative percentage of catch level and includes inshore areas where adult winter skate were determined to be present, based on 10% frequency of occurrence in state trawl surveys and ELMR information.

Map 461. Winter skate adults, Alternative 3E *(Preferred Alternative)*



The Alternative 3E EFH designation for adult winter skate is based on the Alternative 3D designation for adult winter skate with the addition of ten minute squares along the RI and CT coasts and southeast of Nantucket Island where there are no survey data for this species.

4.1.3.2.24 Witch Flounder

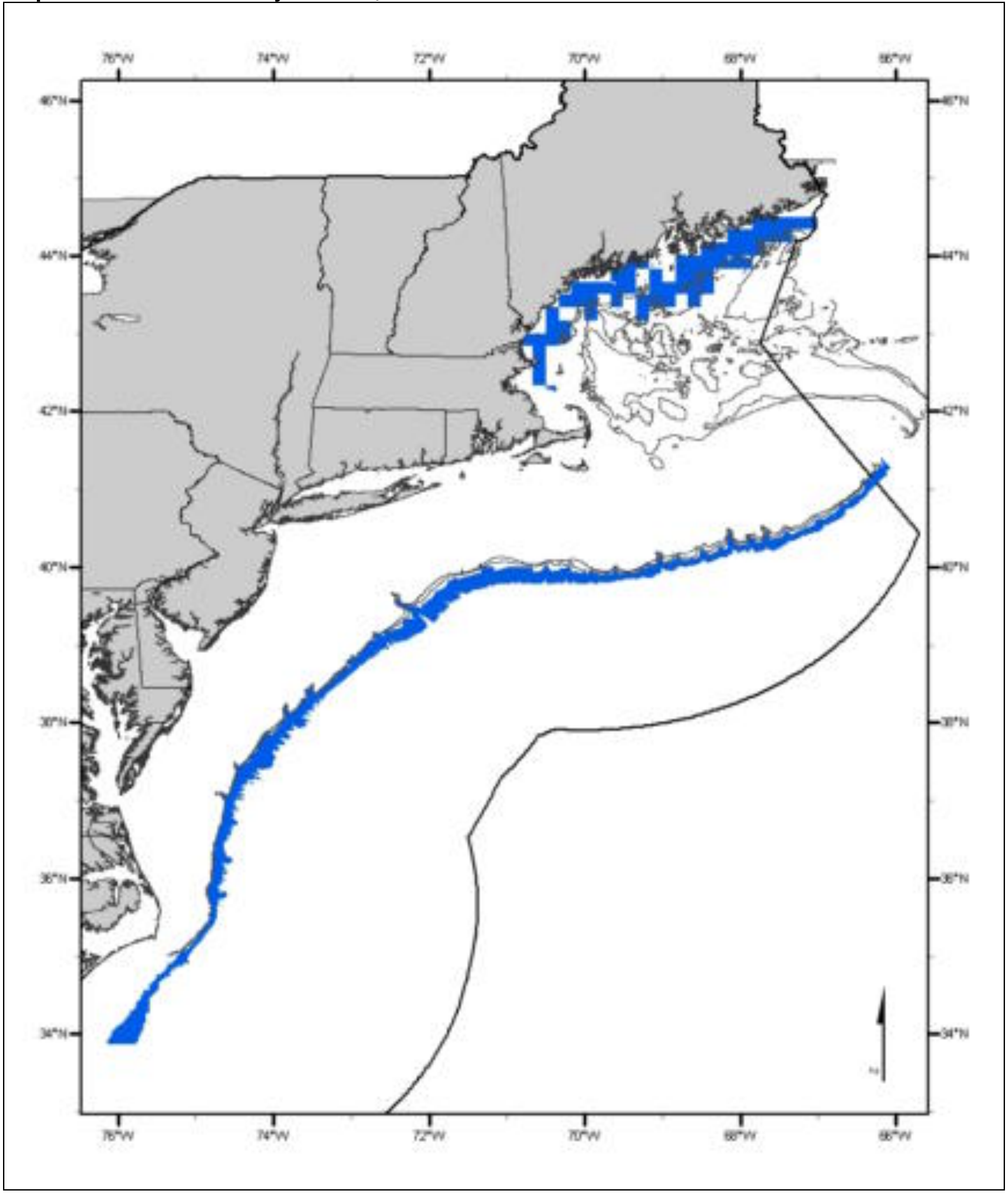
Eggs: No alternative EFH designation.

Larvae: No alternative EFH designation.

Juveniles: Benthic habitats on the continental shelf and slope in depths of 50 – 1500 meters with substrates of mud and/or mud and sand, as depicted on Map 462 - Map 465. Other conditions that generally exist where EFH for juvenile witch flounder is found are: bottom temperatures of 3.5 – 13.5ºC and salinities of 32.5 – 34.5 ppt. Juvenile witch flounder feed primarily on polychaetes and crustaceans. *(Preferred Alternative)*

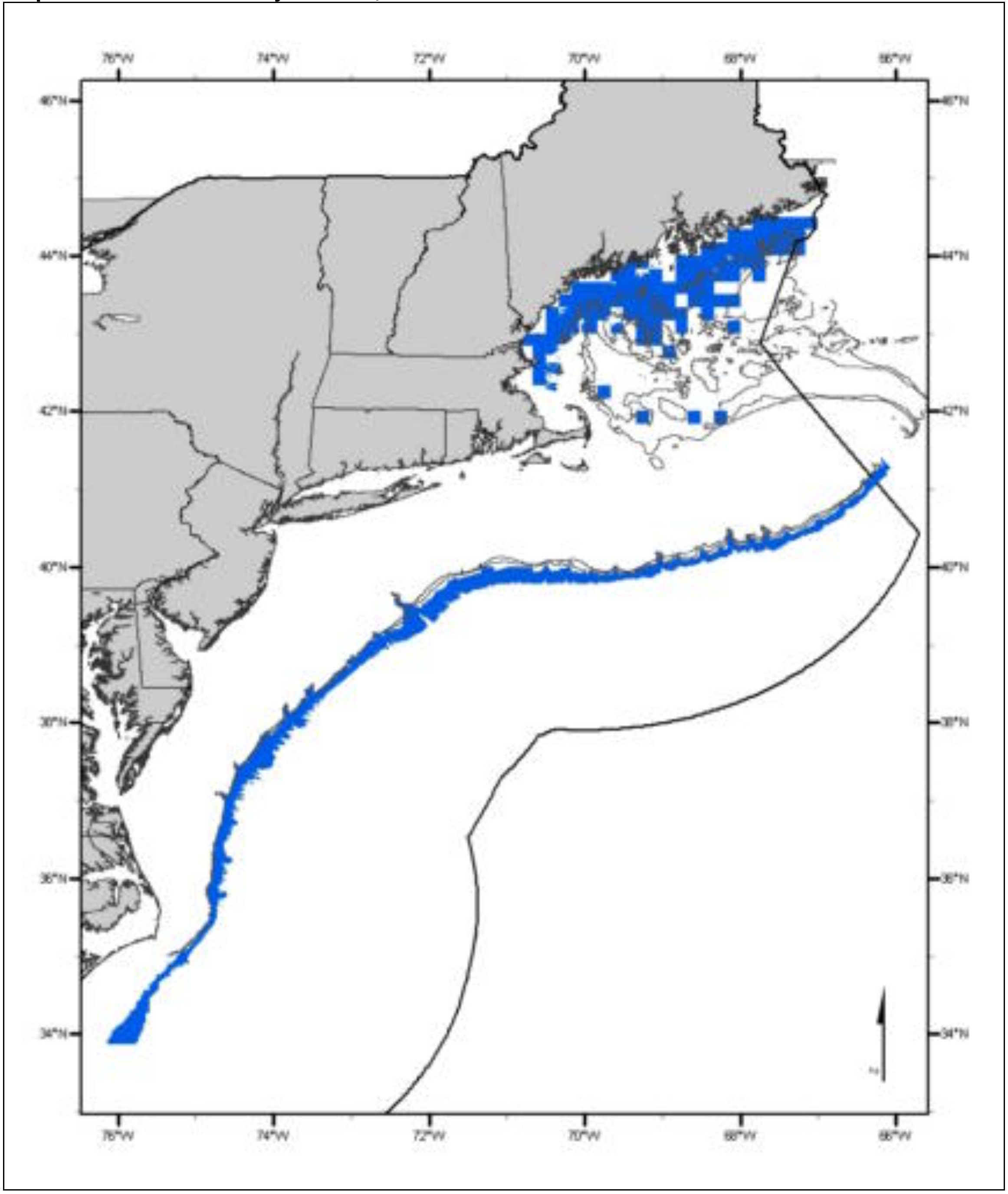
Adults: Benthic habitats on the continental shelf and slope in depths of 35 – 1500 meters with substrates of mud and/or mud and sand, as depicted on Map 466 - Map 470. The following conditions generally exist where benthic EFH for adult witch flounder is found: bottom temperatures of 2.5 – 10.5ºC and salinities of 32.5 – 35.5 ppt. Spawning generally occurs at temperatures of 0 – 10ºC. Adult witch flounder feed primarily on polychaetes, mollusks, and echinoderms. *(Preferred Alternative)*

Map 462. Witch flounder juveniles, Alternative 3A



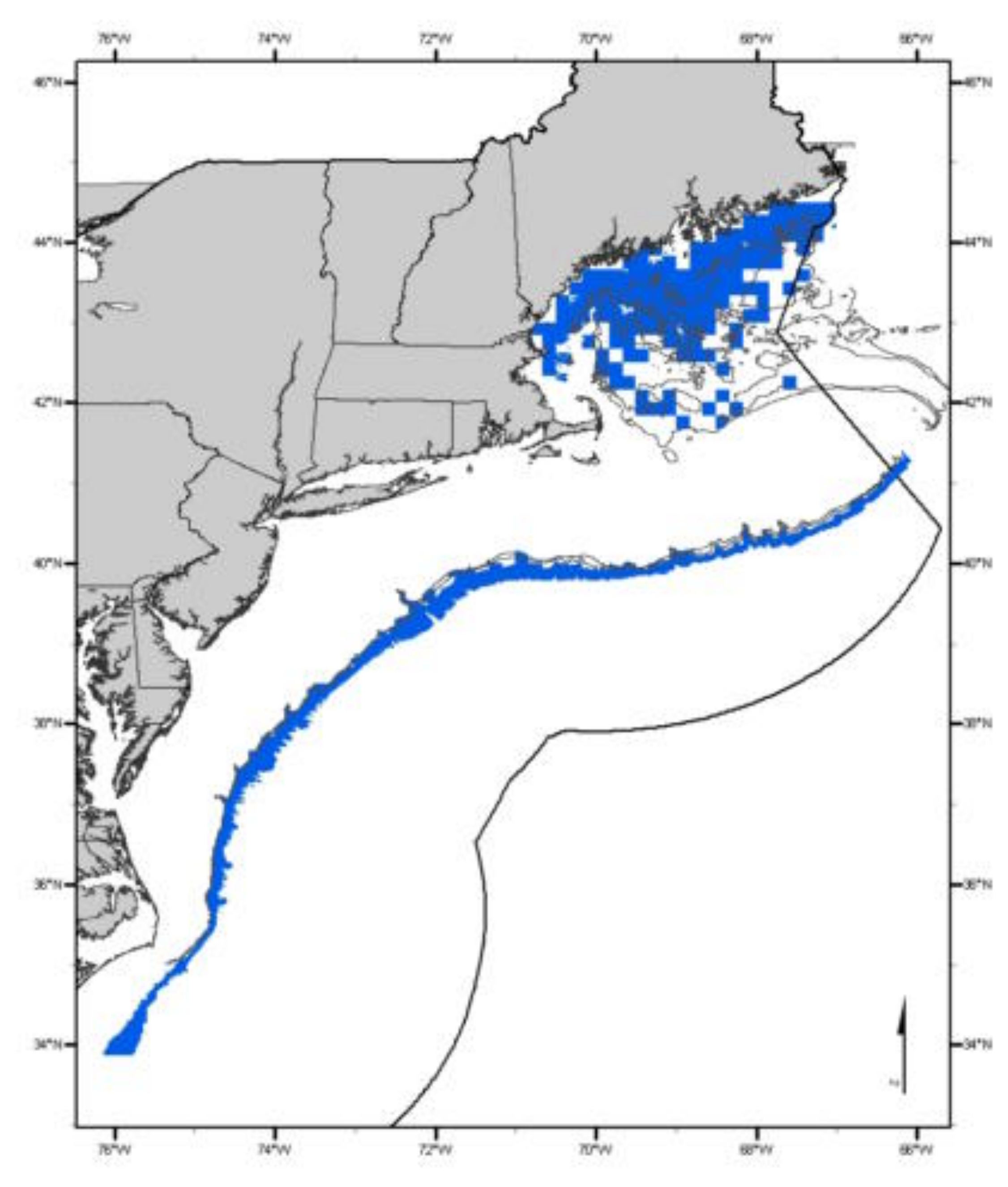
The Alternative 3A EFH designation for juvenile witch flounder on the continental shelf is based on the distribution of substrate types, depths, and bottom temperatures that are associated with high catch rates of juveniles in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of juveniles in the 1968-2005 spring and fall NMFS trawl surveys at the 25% cumulative percentage of catch level and includes inshore and off-shelf areas where juvenile thorny skate were determined to be present, based on 10% frequency of occurrence in state trawl surveys and off-shelf depth and geographic ranges.

Map 463. Witch flounder juveniles, Alternative 3B



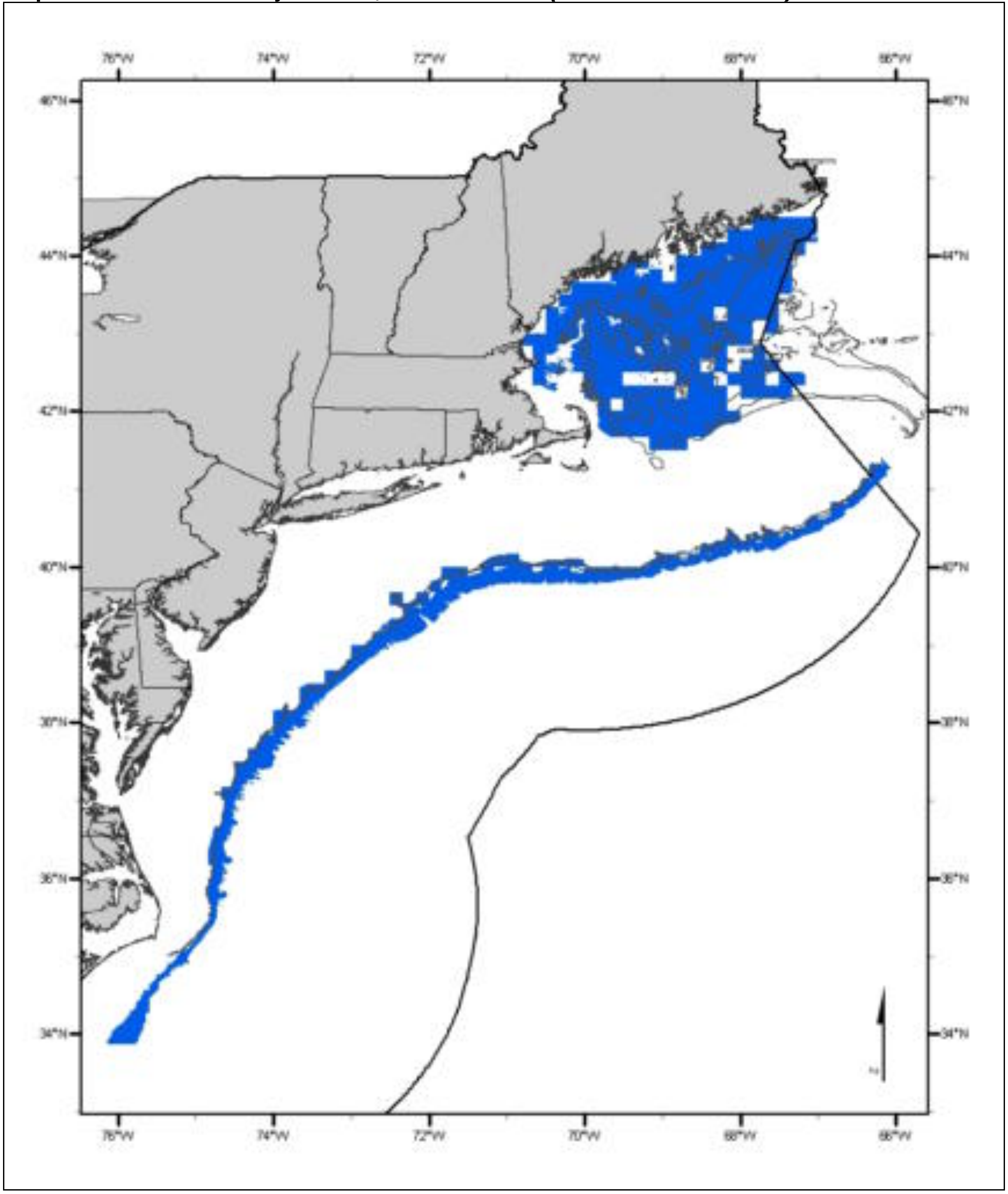
The Alternative 3B EFH designation for juvenile witch flounder on the continental shelf is based on the distribution of substrate types, depths, and bottom temperatures that are associated with high catch rates of juveniles in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of juveniles in the 1968-2005 spring and fall NMFS trawl surveys at the 50% cumulative percentage of catch level and includes inshore and off-shelf areas where juvenile thorny skate were determined to be present, based on 10% frequency of occurrence in state trawl surveys and off-shelf depth and geographic ranges.

Map 464. Witch flounder juveniles, Alternative 3C



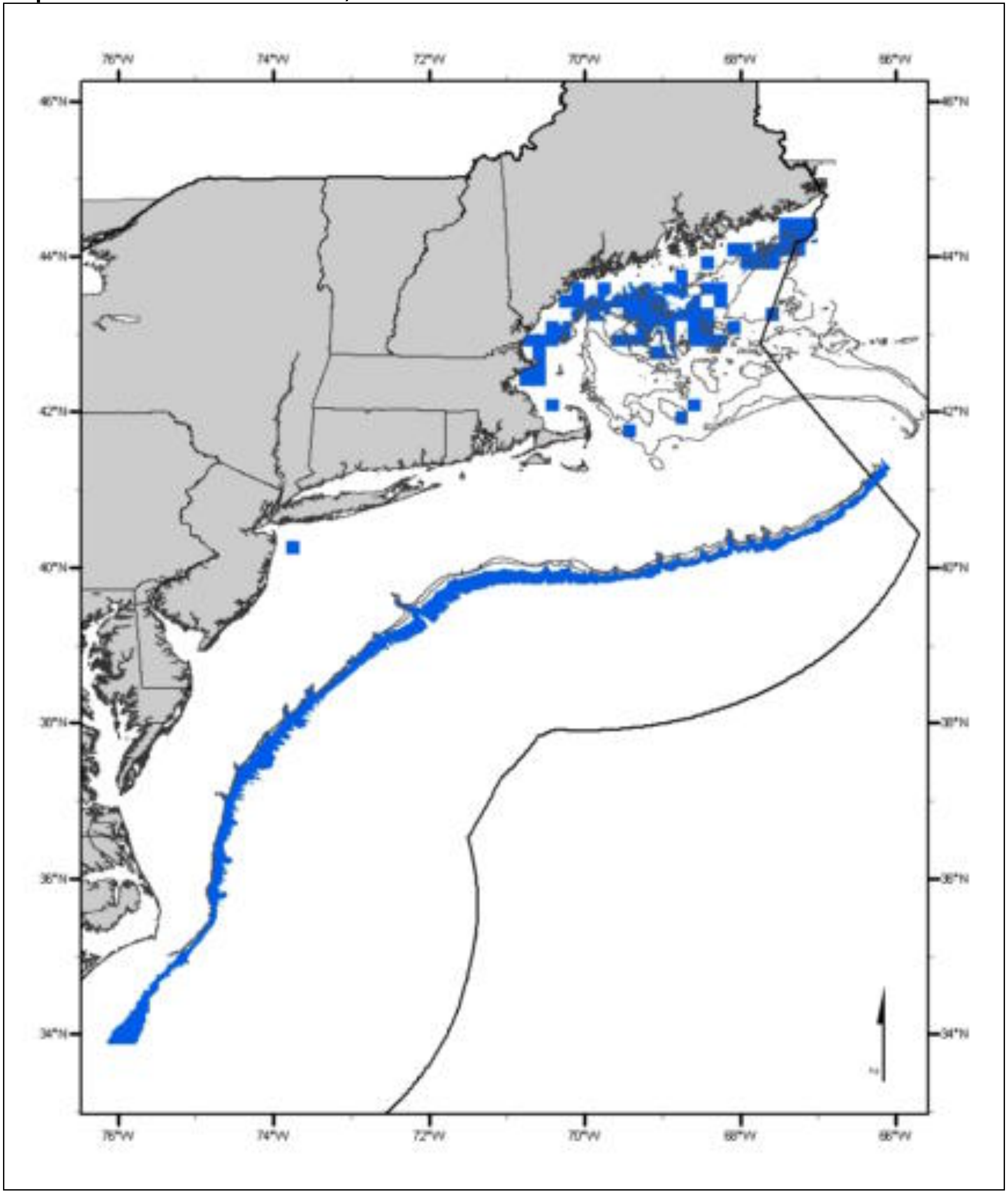
The Alternative 3C EFH designation for juvenile witch flounder on the continental shelf is based on the distribution of substrate types, depths, and bottom temperatures that are associated with high catch rates of juveniles in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of juveniles in the 1968-2005 spring and fall NMFS trawl surveys at the 75% cumulative percentage of catch level and includes inshore and off-shelf areas where juvenile thorny skate were determined to be present, based on 10% frequency of occurrence in state trawl surveys and off-shelf depth and geographic ranges.

Map 465. Witch flounder juveniles, Alternative 3D *(Preferred Alternative)*



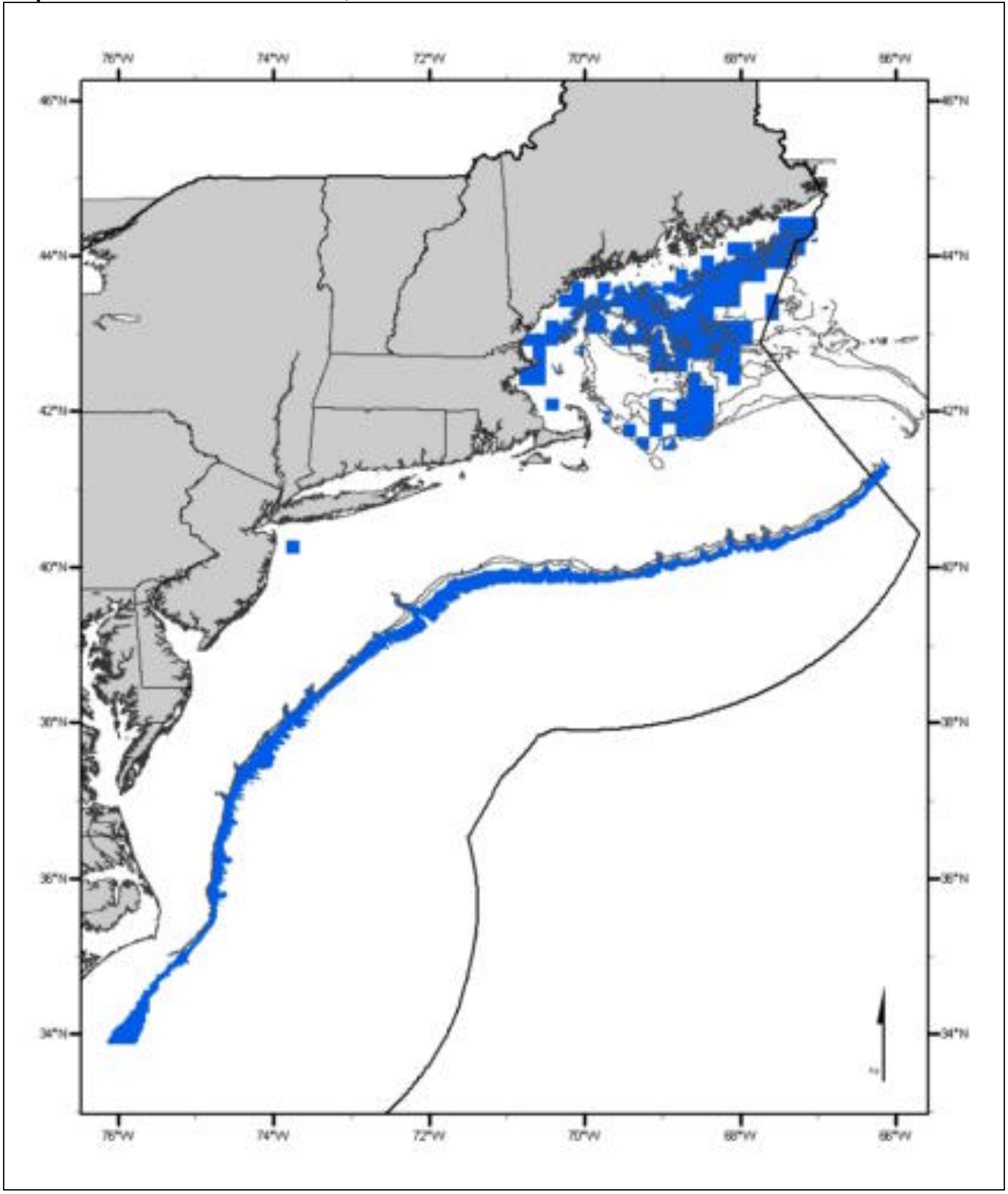
The Alternative 3D EFH designation for juvenile witch flounder on the continental shelf is based on the distribution of substrate types, depths, and bottom temperatures that are associated with high catch rates of juveniles in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of juveniles in the 1968-2005 spring and fall NMFS trawl surveys at the 90% cumulative percentage of catch level and includes inshore and off-shelf areas where juvenile thorny skate were determined to be present, based on 10% frequency of occurrence in state trawl surveys and off-shelf depth and geographic ranges.

Map 466. Witch flounder adults, Alternative 3A



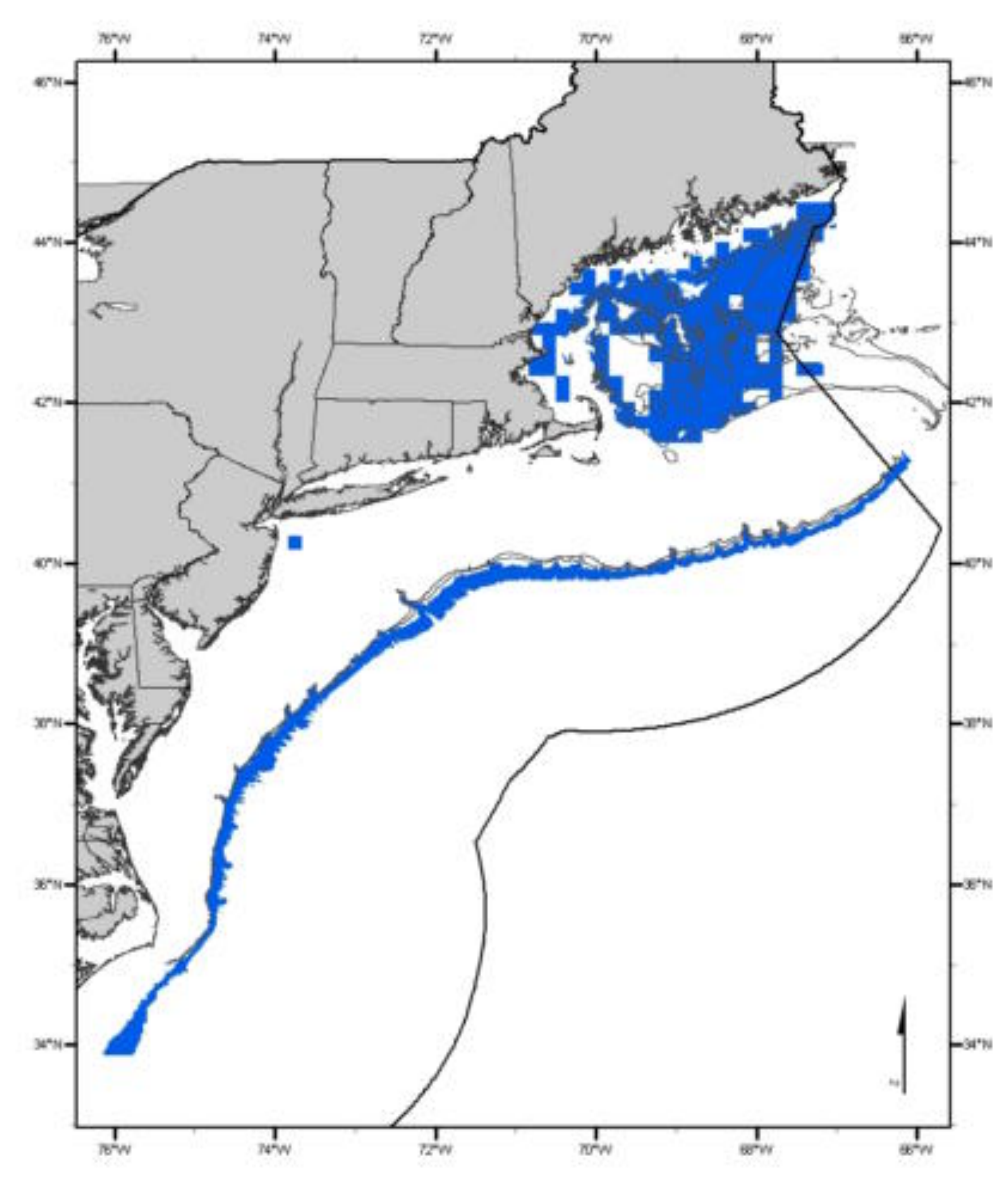
The Alternative 3A EFH designation for adult witch flounder on the continental shelf is based on the distribution of substrate types, depths, and bottom temperatures that are associated with high catch rates of adults in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of adults in the 1968-2005 spring and fall NMFS trawl surveys at the 25% cumulative percentage of catch level and includes inshore and off-shelf areas where adult thorny skate were determined to be present, based on 10% frequency of occurrence in state trawl surveys and off-shelf depth and geographic ranges.

Map 467. Witch flounder adults, Alternative 3B



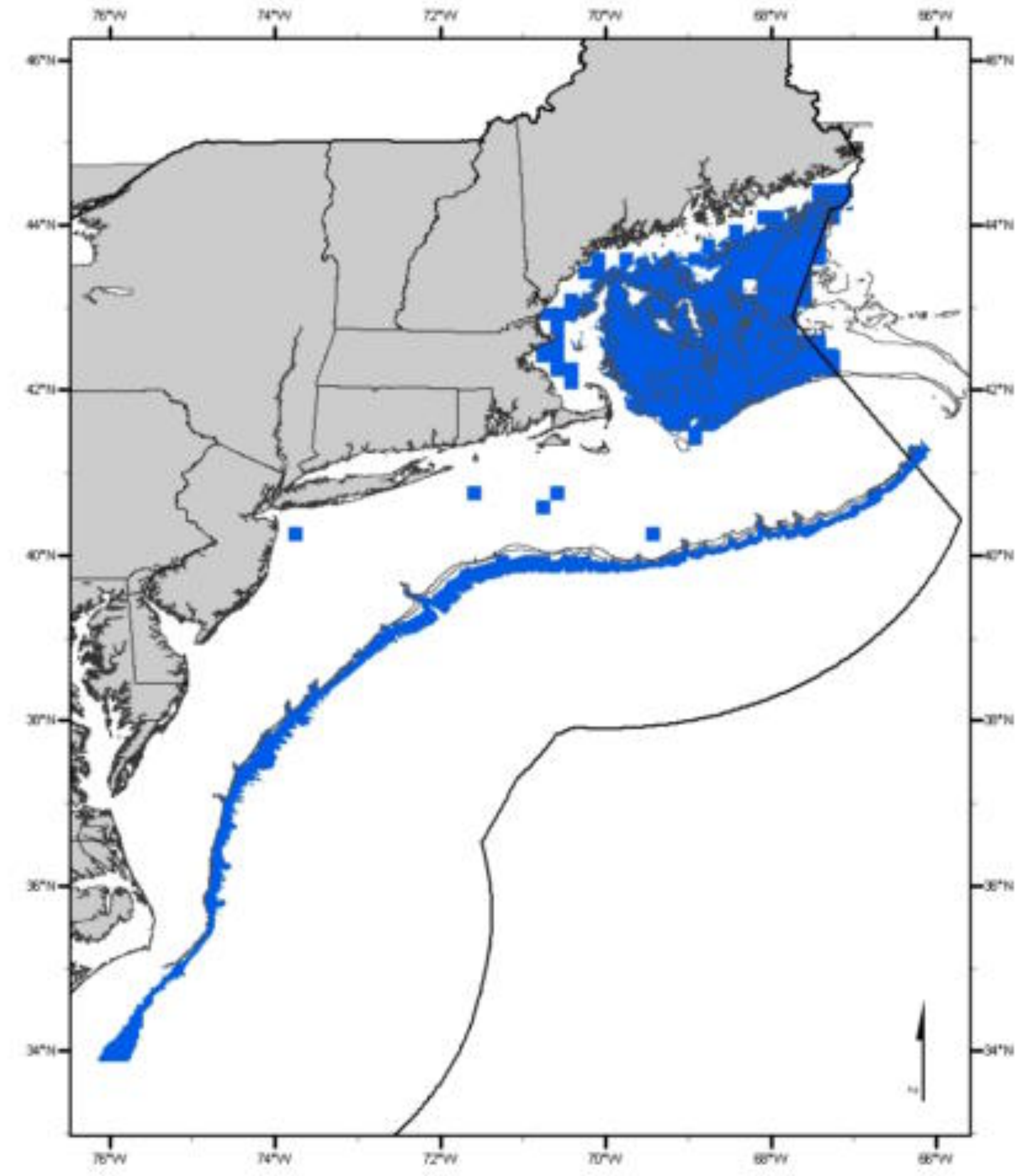
The Alternative 3B EFH designation for adult witch flounder on the continental shelf is based on the distribution of substrate types, depths, and bottom temperatures that are associated with high catch rates of adults in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of adults in the 1968-2005 spring and fall NMFS trawl surveys at the 50% cumulative percentage of catch level and includes inshore and off-shelf areas where adult thorny skate were determined to be present, based on 10% frequency of occurrence in state trawl surveys and off-shelf depth and geographic ranges.

Map 468. Witch flounder adults, Alternative 3C



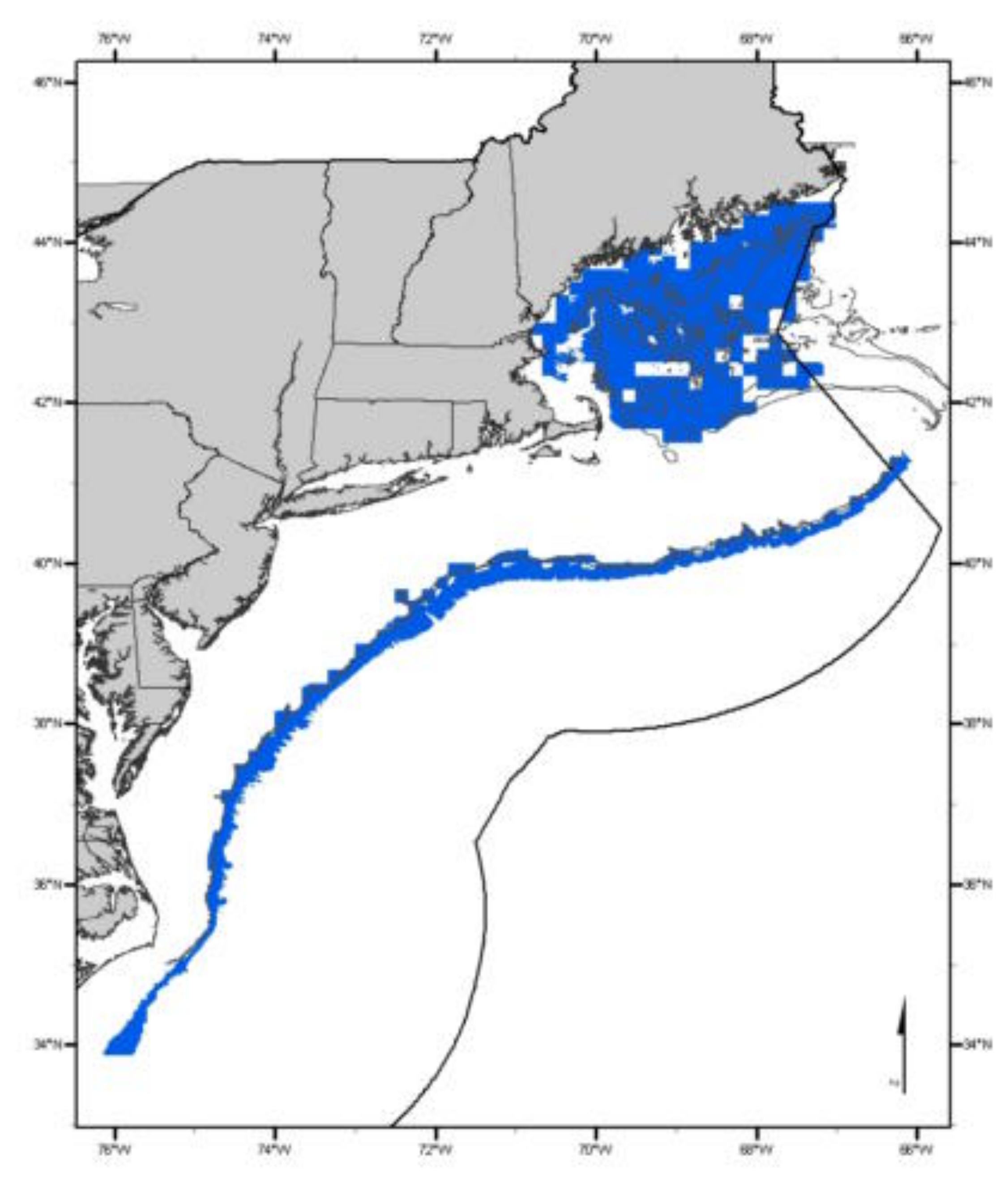
The Alternative 3C EFH designation for adult witch flounder on the continental shelf is based on the distribution of substrate types, depths, and bottom temperatures that are associated with high catch rates of adults in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of adults in the 1968-2005 spring and fall NMFS trawl surveys at the 75% cumulative percentage of catch level and includes inshore and off-shelf areas where adult thorny skate were determined to be present, based on 10% frequency of occurrence in state trawl surveys and off-shelf depth and geographic ranges.

Map 469. Witch flounder adults, Alternative 3D



The Alternative 3D EFH designation for adult witch flounder on the continental shelf is based on the distribution of substrate types, depths, and bottom temperatures that are associated with high catch rates of adults in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of adults in the 1968-2005 spring and fall NMFS trawl surveys at the 90% cumulative percentage of catch level and includes inshore and off-shelf areas where adult thorny skate were determined to be present, based on 10% frequency of occurrence in state trawl surveys and off-shelf depth and geographic ranges.

Map 470. Witch flounder adults, Alternative 3E *(Preferred Alternative)*



The Alternative 3E EFH designation for adult witch flounder on the continental shelf is the same as the Alternative 3D designation for juvenile witch flounder.

4.1.3.2.25 Yellowtail Flounder

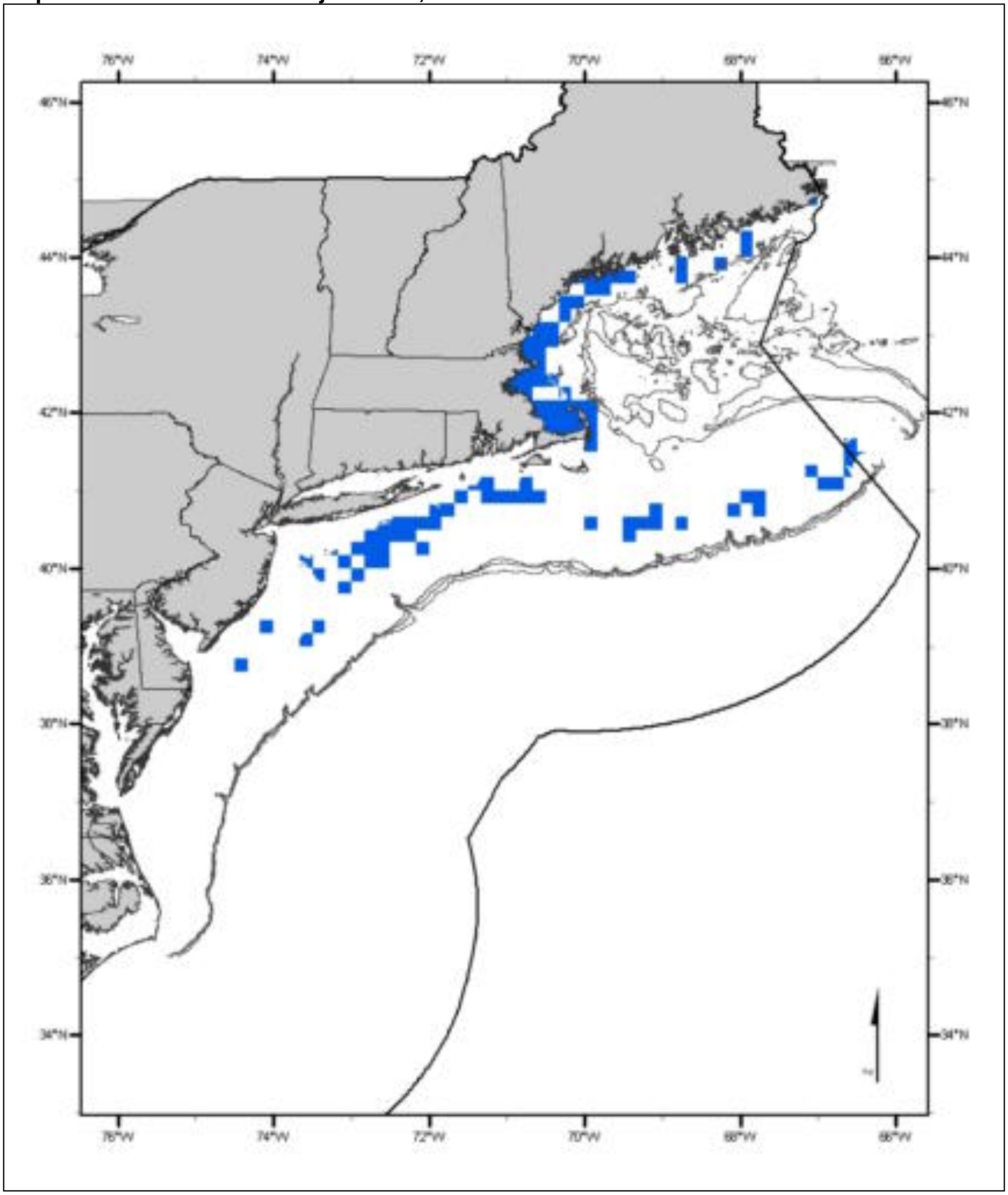
Eggs: No alternative EFH designation.

Larvae: No alternative EFH designation.

Juveniles: Sandy inshore and continental shelf benthic habitats in depths of 20-70 meters as depicted on Map 471 - Map 474. Other conditions that generally exist where EFH for juvenile yellowtail flounder is found are: bottom temperatures of 1.5 – 13.5ºC and salinities of 32.5 – 33.5 ppt. YOY juveniles prefer depths of 56 – 87 meters on the shelf. Primary prey organisms for juvenile yellowtail flounders are amphipods, polychaetes, and sand shrimps. *(Preferred Alternative)*

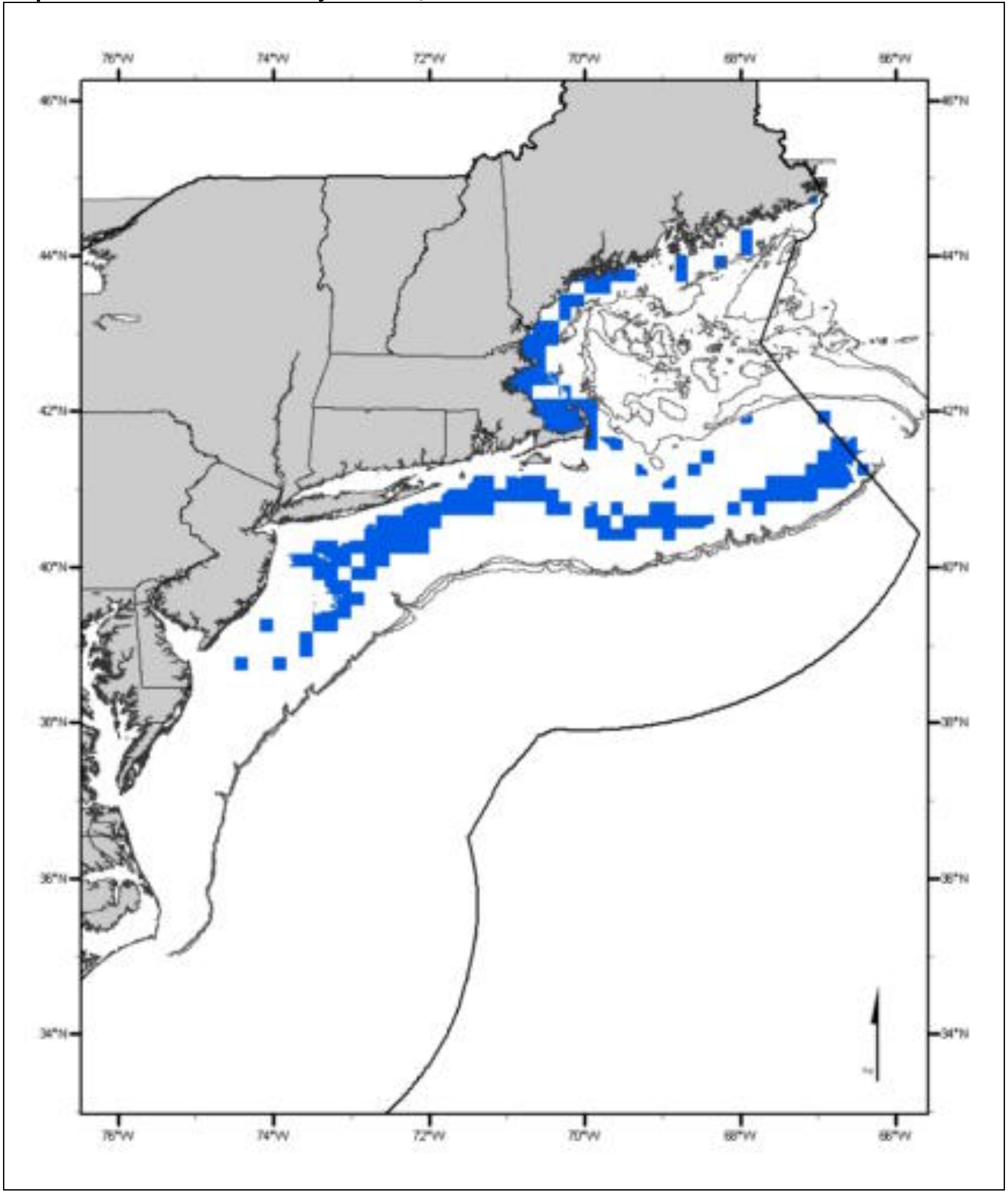
Adults: Sandy inshore and continental shelf benthic habitats in depths of 25 – 80 meters as depicted on Map 475 - Map 478. Substrate types that exist where EFH for adult yellowtail flounder is found consist of sand and mixtures of sand and mud. Other conditions that generally exist where EFH for adult yellowtail flounder is found are: bottom temperatures of 2.5 – 12.5ºC and salinities of 32.5 – 33.5 ppt. Spawning generally occurs at temperatures of 5 – 12ºC. Primary prey organisms for adult yellowtail flounders are amphipods, sand shrimps, polychaetes, nemerteans, and cerianthid anemones. *(Preferred Alternative)*

Map 471. Yellowtail flounder juveniles, Alternative 3A



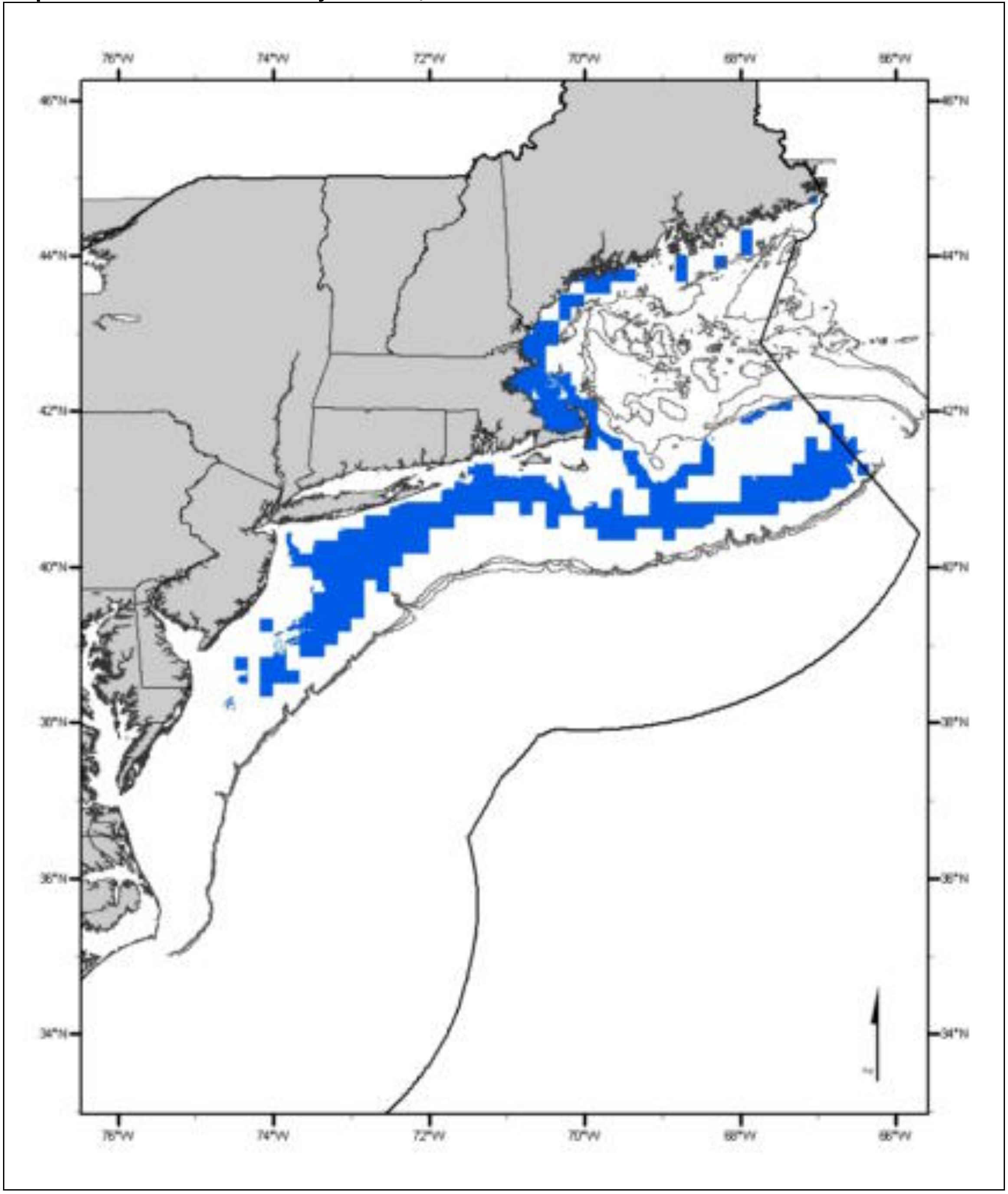
The Alternative 3A EFH designation for juvenile yellowtail flounder on the continental shelf is based on the distribution of substrate types, depths and bottom temperatures that are associated with high catch rates of juveniles in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of juveniles in the 1968-2005 spring and fall NMFS trawl surveys at the 25% cumulative percentage of catch level and includes inshore areas where juvenile yellowtail flounder were determined to be present, based on 10% frequency of occurrence in state trawl surveys and ELMR information.

Map 472. Yellowtail flounder juveniles, Alternative 3B



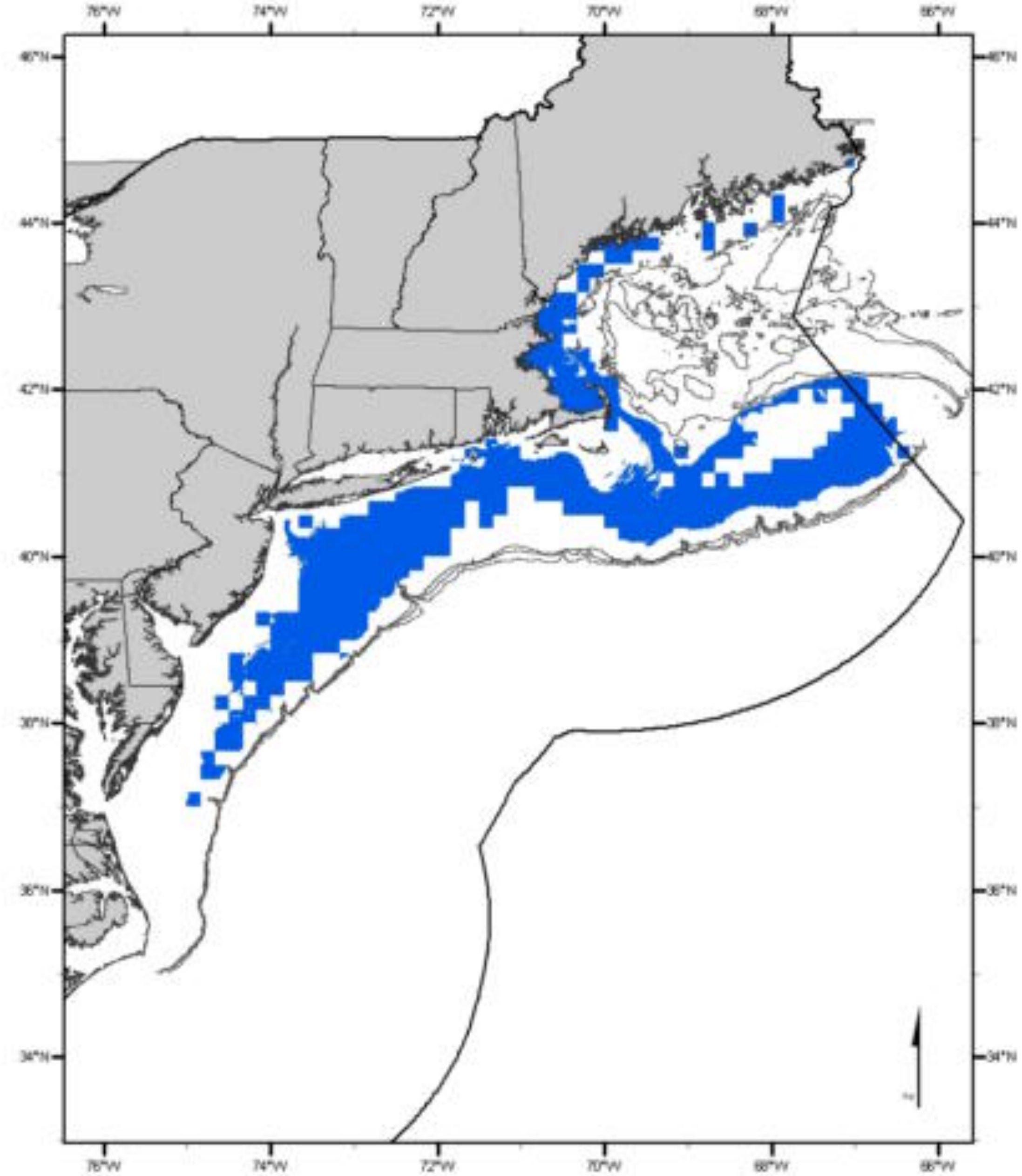
The Alternative 3B EFH designation for juvenile yellowtail flounder on the continental shelf is based on the distribution of substrate types, depths and bottom temperatures that are associated with high catch rates of juveniles in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of juveniles in the 1968-2005 spring and fall NMFS trawl surveys at the 50% cumulative percentage of catch level and includes inshore areas where juvenile yellowtail flounder were determined to be present, based on 10% frequency of occurrence in state trawl surveys and ELMR information.

Map 473. Yellowtail flounder juveniles, Alternative 3C



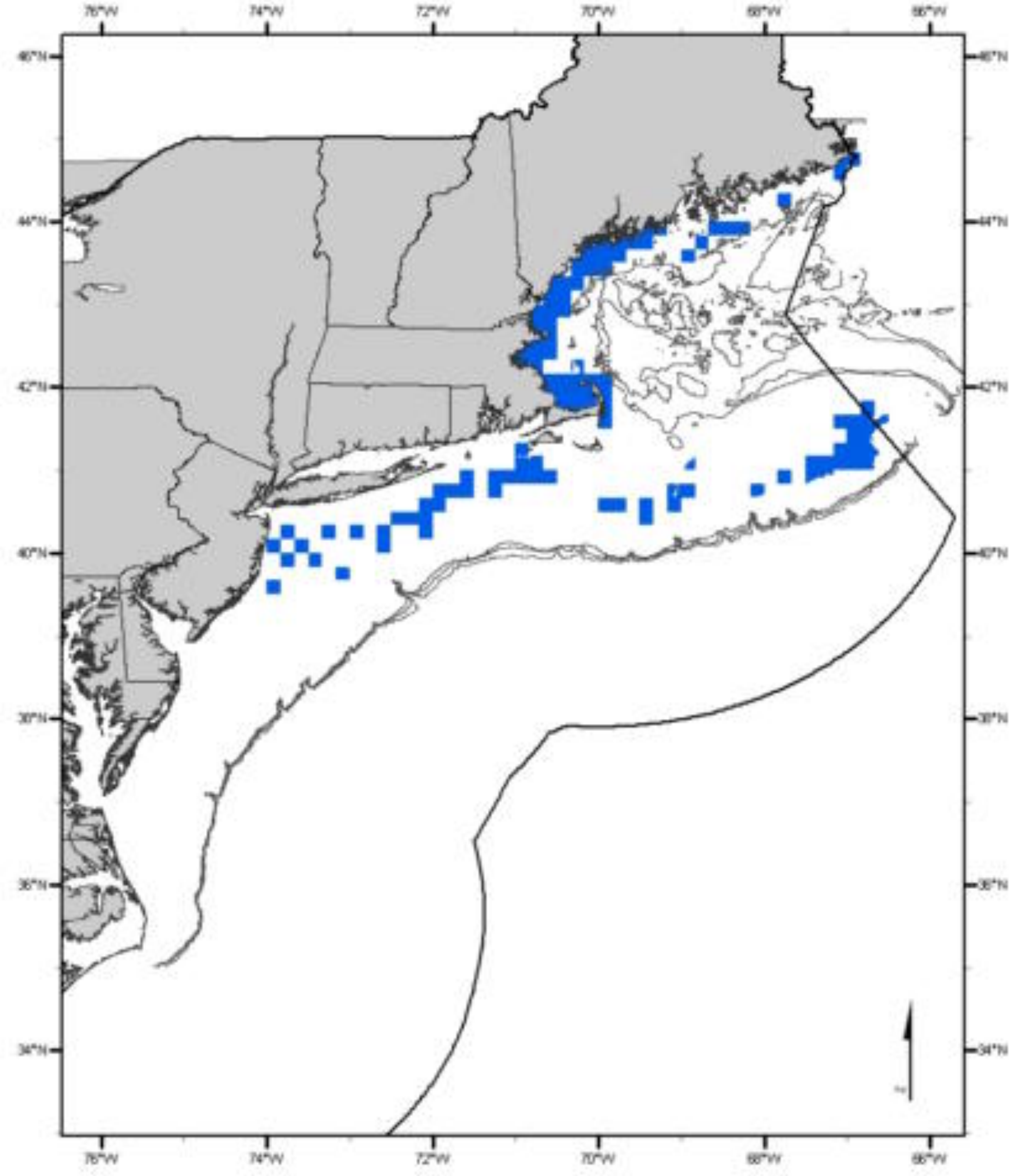
The Alternative 3C EFH designation for juvenile yellowtail flounder on the continental shelf is based on the distribution of substrate types, depths and bottom temperatures that are associated with high catch rates of juveniles in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of juveniles in the 1968-2005 spring and fall NMFS trawl surveys at the 75% cumulative percentage of catch level and includes inshore areas where juvenile yellowtail flounder were determined to be present, based on 10% frequency of occurrence in state trawl surveys and ELMR information.

Map 474. Yellowtail flounder juveniles, Alternative 3D *(Preferred Alternative)*



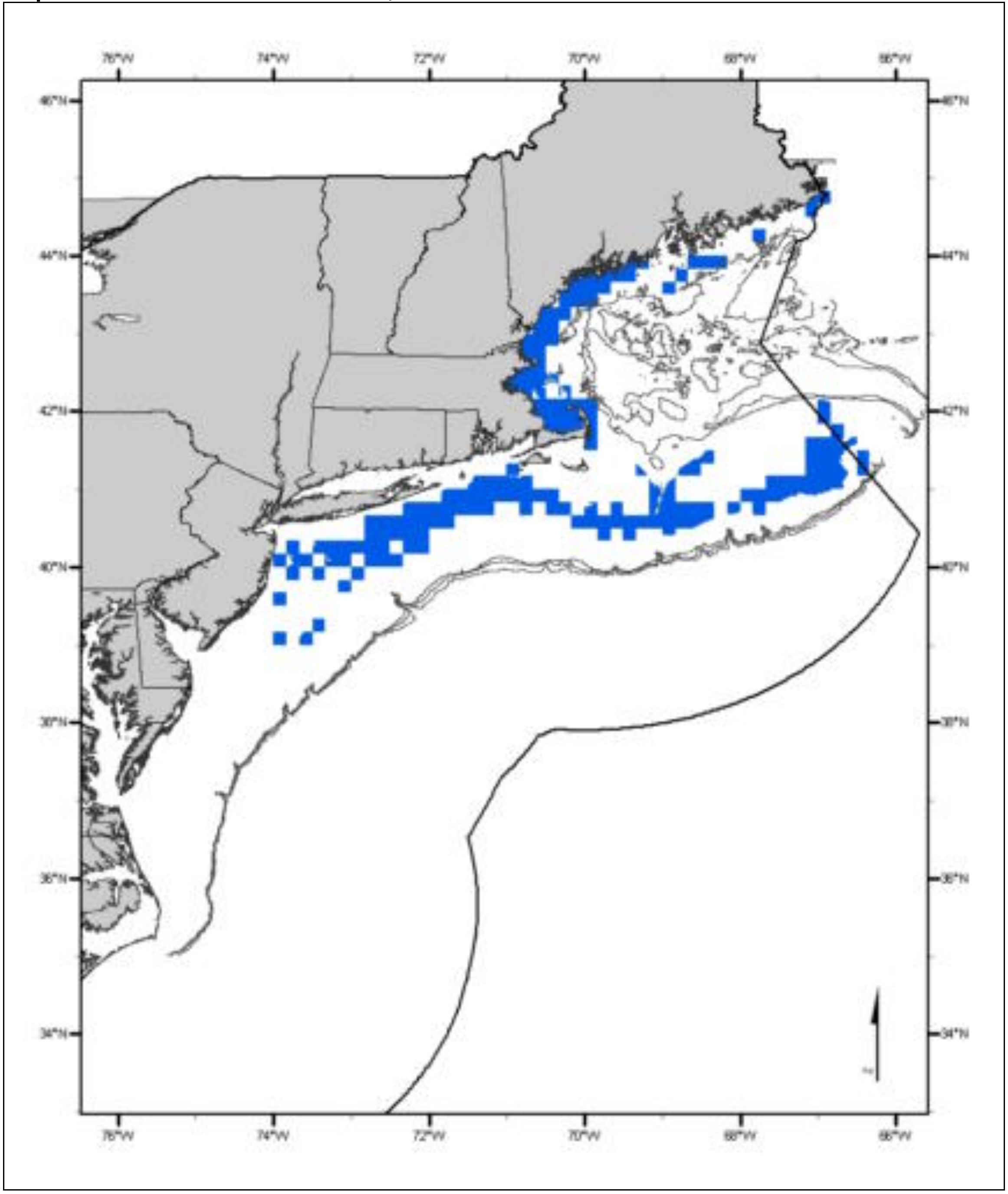
The Alternative 3D EFH designation for juvenile yellowtail flounder on the continental shelf is based on the distribution of substrate types, depths and bottom temperatures that are associated with high catch rates of juveniles in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of juveniles in the 1968-2005 spring and fall NMFS trawl surveys at the 90% cumulative percentage of catch level and includes inshore areas where juvenile yellowtail flounder were determined to be present, based on 10% frequency of occurrence in state trawl surveys and ELMR information.

Map 475. Yellowtail flounder adults, Alternative 3A



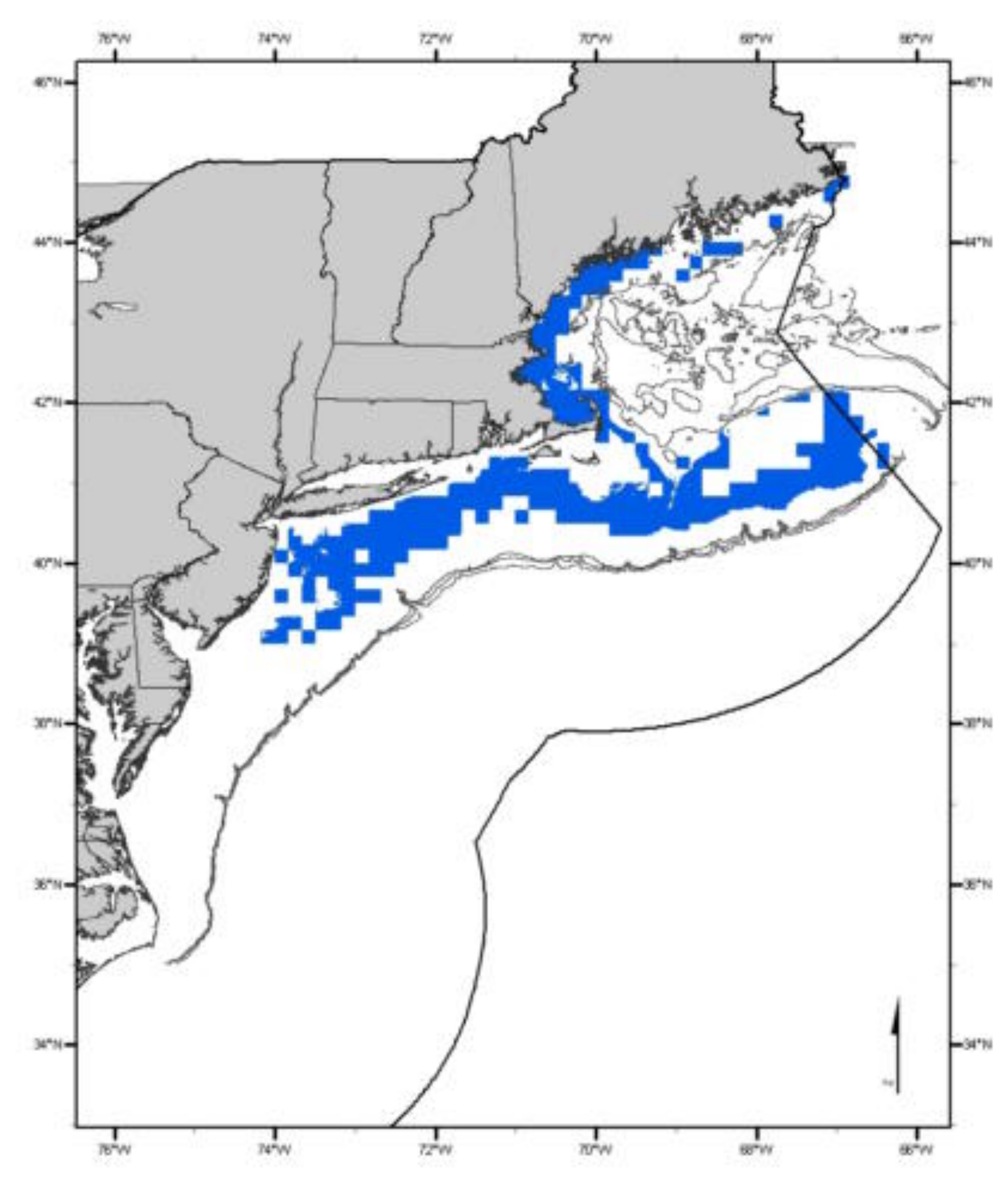
The Alternative 3A EFH designation for adult yellowtail flounder on the continental shelf is based on the distribution of substrate types, depths and bottom temperatures that are associated with high catch rates of adults in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of adults in the 1968-2005 spring and fall NMFS trawl surveys at the 25% cumulative percentage of catch level and includes inshore areas where adult yellowtail flounder were determined to be present, based on 10% frequency of occurrence in state trawl surveys and ELMR information.

Map 476. Yellowtail flounder adults, Alternative 3B



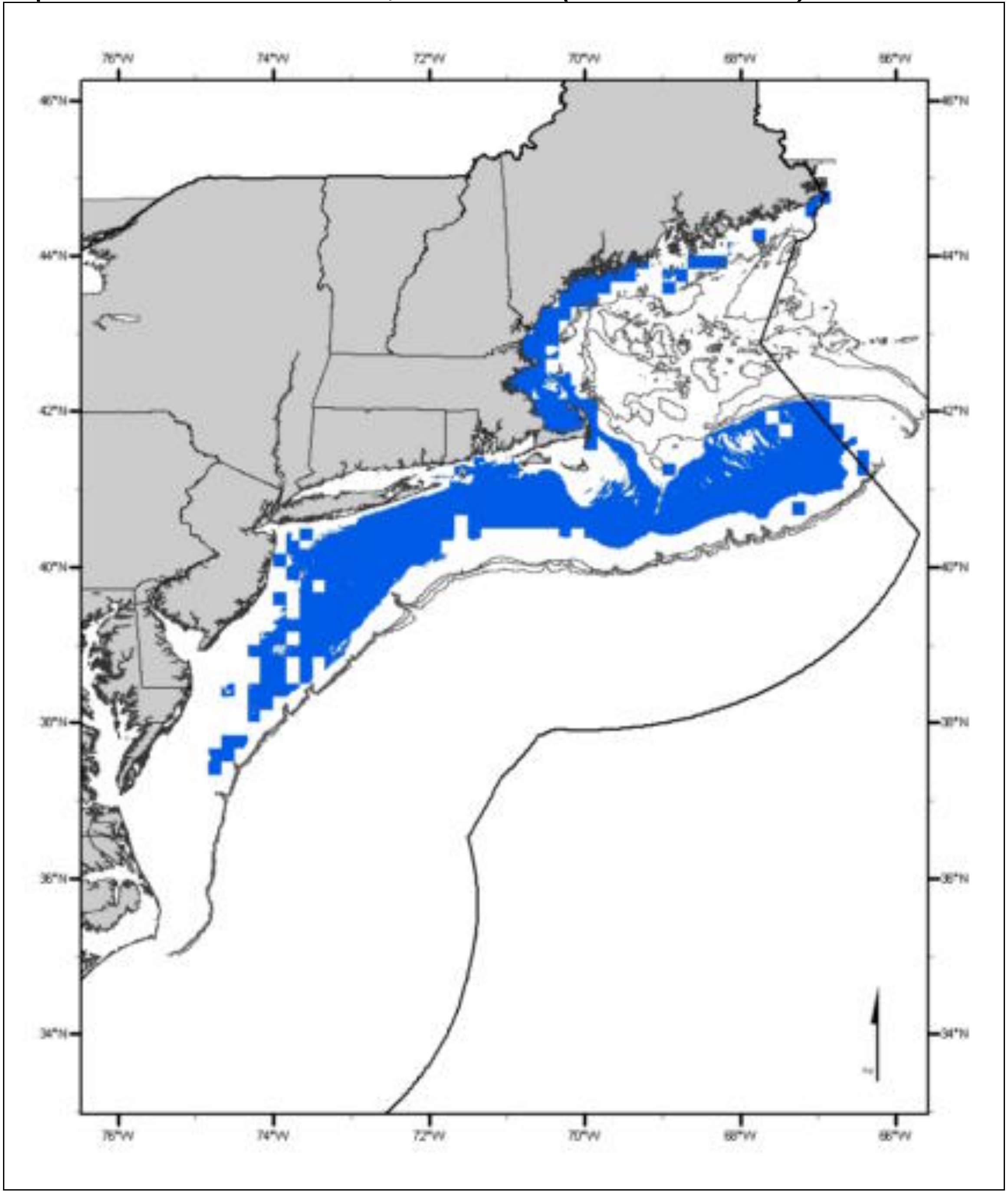
The Alternative 3B EFH designation for adult yellowtail flounder on the continental shelf is based on the distribution of substrate types, depths and bottom temperatures that are associated with high catch rates of adults in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of adults in the 1968-2005 spring and fall NMFS trawl surveys at the 50% cumulative percentage of catch level and includes inshore areas where adult yellowtail flounder were determined to be present, based on 10% frequency of occurrence in state trawl surveys and ELMR information.

Map 477. Yellowtail flounder adults, Alternative 3C



The Alternative 3C EFH designation for adult yellowtail flounder on the continental shelf is based on the distribution of substrate types, depths and bottom temperatures that are associated with high catch rates of adults in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of adults in the 1968-2005 spring and fall NMFS trawl surveys at the 75% cumulative percentage of catch level and includes inshore areas where adult yellowtail flounder were determined to be present, based on 10% frequency of occurrence in state trawl surveys and ELMR information.

Map 478. Yellowtail flounder adults, Alternative 3D *(Preferred Alternative)*



The Alternative 3D EFH designation for adult yellowtail flounder on the continental shelf is based on the distribution of substrate types, depths and bottom temperatures that are associated with high catch rates of adults in the 1963-2003 spring and fall NMFS trawl surveys or identified in the EFH Source Document for this species. This alternative is also based on the abundance of adults in the 1968-2005 spring and fall NMFS trawl surveys at the 90% cumulative percentage of catch level and includes inshore areas where adult yellowtail flounder were determined to be present, based on 10% frequency of occurrence in state trawl surveys and ELMR information.

4.1.4 Alternative 4 – Species Range

4.1.4.1 Methods

This alternative would designate the entire Exclusive Economic Zone (EEZ) that covers the composite spatial range or extent of the species under management by the NEFMC. EFH text descriptions and maps for this alternative were based on level 1 presence-only information. Thus, ranges of depth, temperature, and salinity in the text descriptions include the extremes within which any given species and life stage has been documented to be present in within the region (from inshore to the continental slope). The EFH maps for the continental shelf were based on 100% cumulative catch rates in the NMFS bottom trawl survey (i.e., any ten minute square where at least one fish was caught in a minimum of four tows during 1968-2005). Inshore and off-shelf distributions were mapped the same way as in alternatives 2 and 3. For a detailed explanation of the methods used to develop Alternative 4, please refer to Appendix A.

4.1.4.2 Text Descriptions and Map Representations

4.1.4.2.1 American Plaice

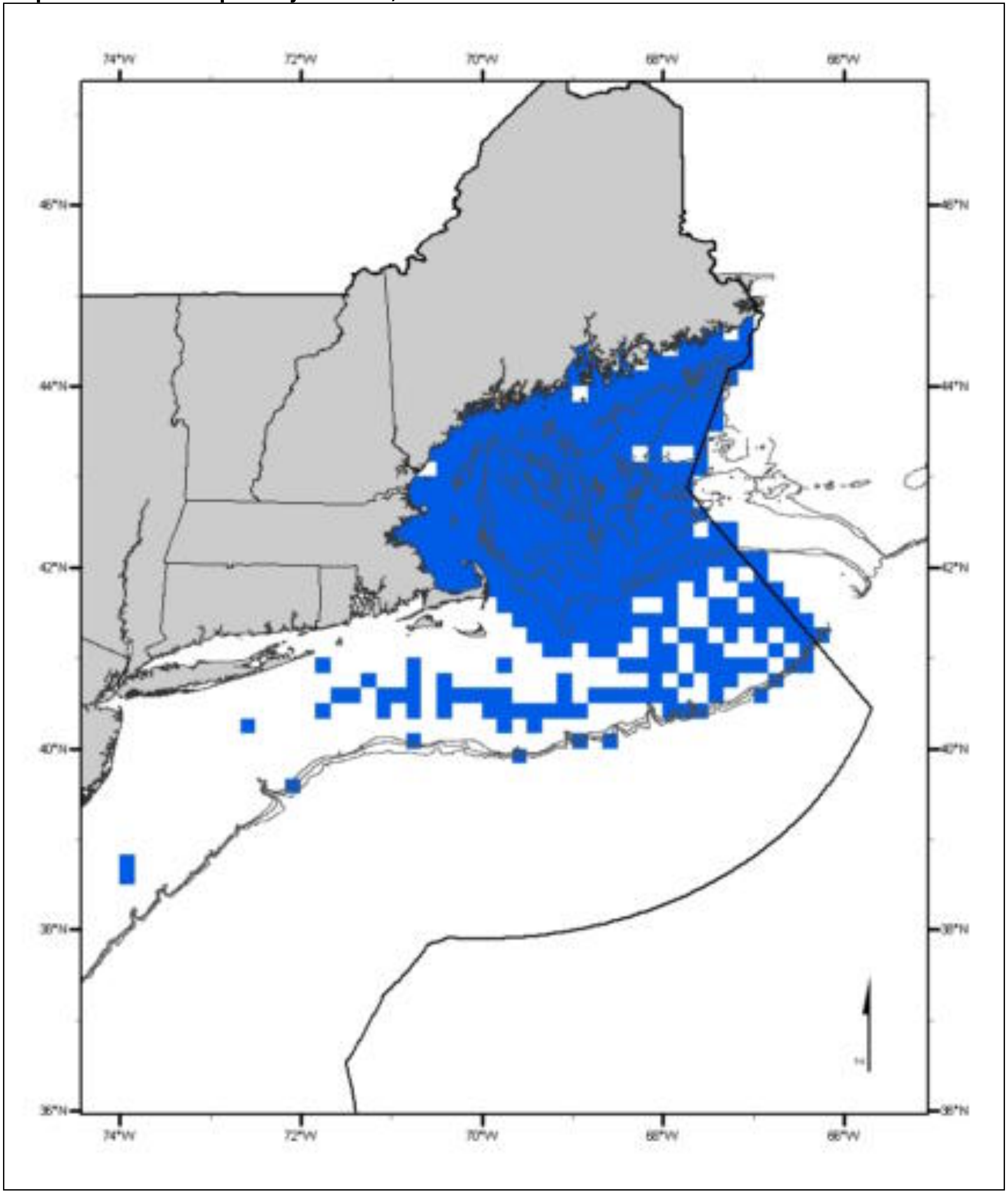
Eggs: No alternative EFH designation.

Larvae: No alternative EFH designation.

Juveniles: Inshore and continental shelf benthic habitats in depths of 1 – 500 meters with substrates of mud and/or mixtures of sand and mud, as depicted on Map 479. Other conditions that generally exist where EFH is found are bottom temperatures of 0.5 – 16.5ºC and salinities of 28 – 35.5 ppt. Primary benthic prey organisms for juvenile American plaice are nematodes, polychaetes, a variety of crustaceans, brittle stars, and bivalve mollusks.

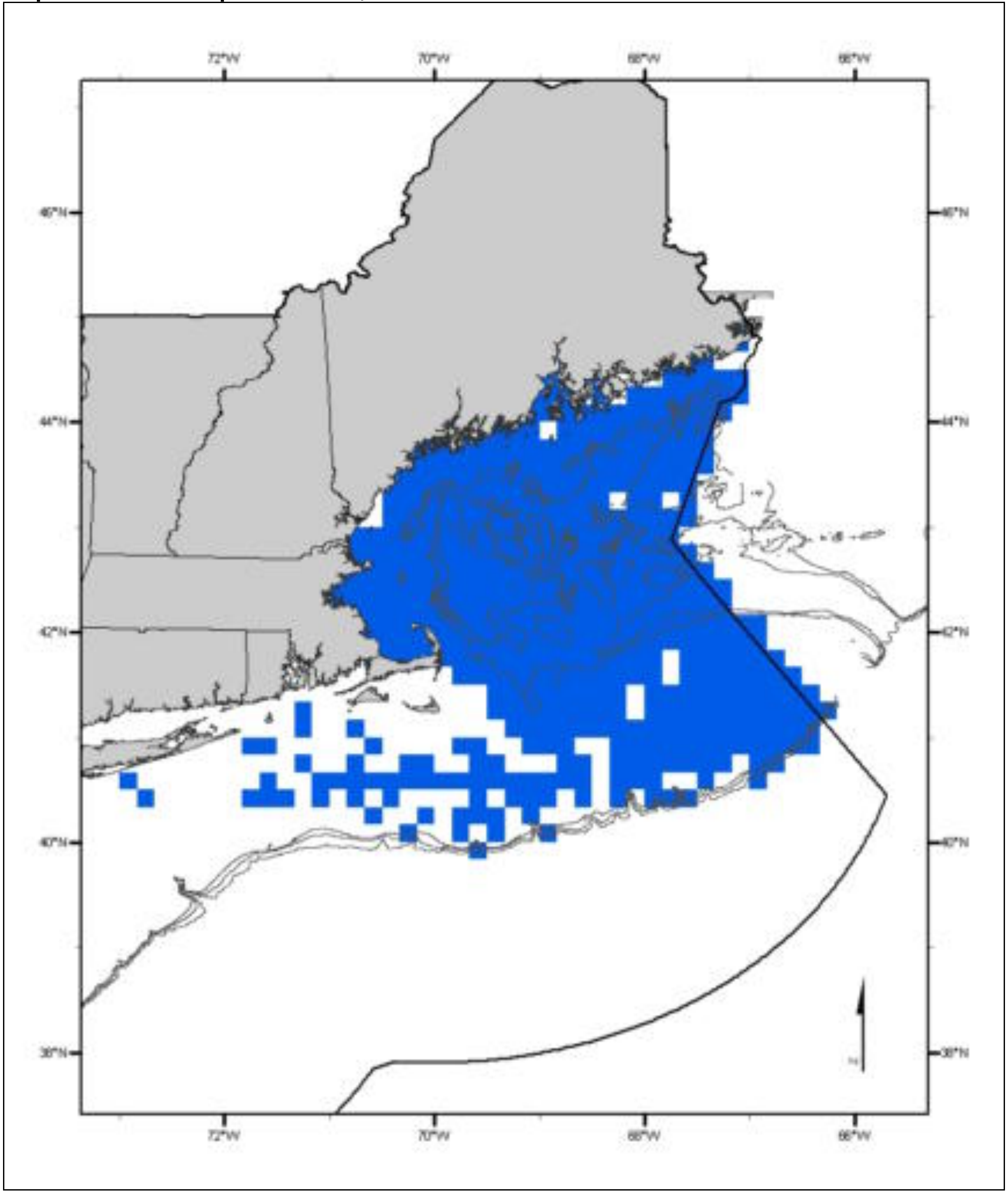
Adults: Inshore and continental shelf benthic habitats in depths of 1 – 500 meters with substrates of mud and/or mixtures of sand and mud, as depicted on Map 480. Other conditions that generally exist where EFH is found are bottom temperatures of 0.5 – 17.5ºC and salinities of 28 – 35.5 ppt. Spawning generally occurs in depths less than 90 meters and bottom temperatures of 3 – 6ºC. Primary prey organisms for adult American plaice are bivalve mollusks, a variety of crustaceans, brittle stars, starfishes, and sand dollars.

Map 479. American plaice juveniles, Alternative 4



The Alternative 4 EFH designation for juvenile American plaice on the continental shelf includes all the ten minute squares where juveniles were caught during 1968-2005 in the fall and spring NMFS trawl survey. Inshore, this alternative includes ten minute squares where juvenile American plaice were caught in state trawl surveys in more than 10% of the tows, as well as those bays and estuaries identified by the NOAA ELMR program where American plaice juveniles were "common" or "abundant."

Map 480. American plaice adults, Alternative 4



The Alternative 4 EFH designation for adult American plaice on the continental shelf includes all the ten minute squares where juveniles were caught during 1968-2005 in the fall and spring NMFS trawl survey. Inshore, this alternative includes ten minute squares where adult American plaice were caught in state trawl surveys in more than 10% of the tows, as well as those bays and estuaries identified by the NOAA ELMR program where American plaice adults were "common" or "abundant."

4.1.4.2.2 Atlantic Cod

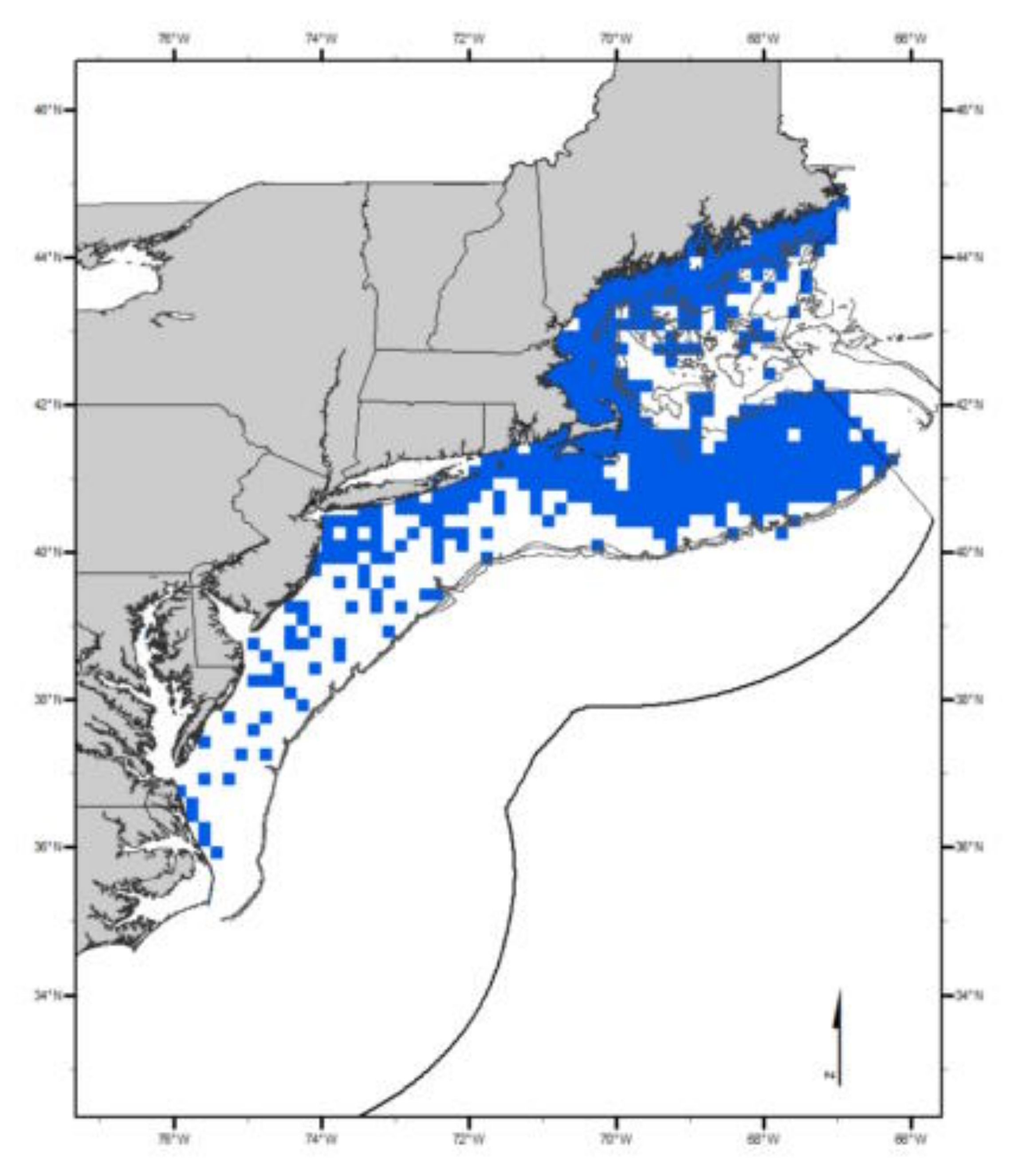
Eggs: Water column habitats in inshore waters, and on the continental shelf and slope, as depicted on Map 481. The following conditions generally exist where EFH for Atlantic cod eggs is found: bottom depths of 1 – 1000 meters; water column temperatures of 1.5–15.5ºC; and salinities of 32 – 33 ppt.

Larvae: Water column habitats in inshore waters, and on the continental shelf and slope, as depicted on Map 482. The following conditions generally exist where EFH for Atlantic cod larvae is found: bottom depths of 1 – 1000 meters; water column temperatures of 1.5 – 15.5ºC; and salinities of 32 – 33 ppt. Atlantic cod larvae feed on copepods.

Juveniles: Inshore and continental shelf benthic habitats in depths of 1 – 400 meters (including the intertidal zone) with a wide variety of substrates, as depicted on Map 483. EFH for juvenile Atlantic cod includes boulders, cobbles, pebbles, gravel, sand, sand and mud, and/or sand and mud mixed with gravel, pebbles, and cobbles. Other conditions that generally exist where EFH is found are bottom temperatures of 0.5 – 17.5ºC and salinities of 28 – 34 ppt. YOY juveniles settle to the bottom in inshore and offshore waters, inhabiting seagrass and macroalgal beds and structurally–complex hard bottom substrates (*e.g.*, rock reef and cobble–pebble–gravel habitats with attached epifauna such as sponges). Recently–settled benthic juveniles feed primarily on mysids, while older juveniles feed on a variety of crustaceans.

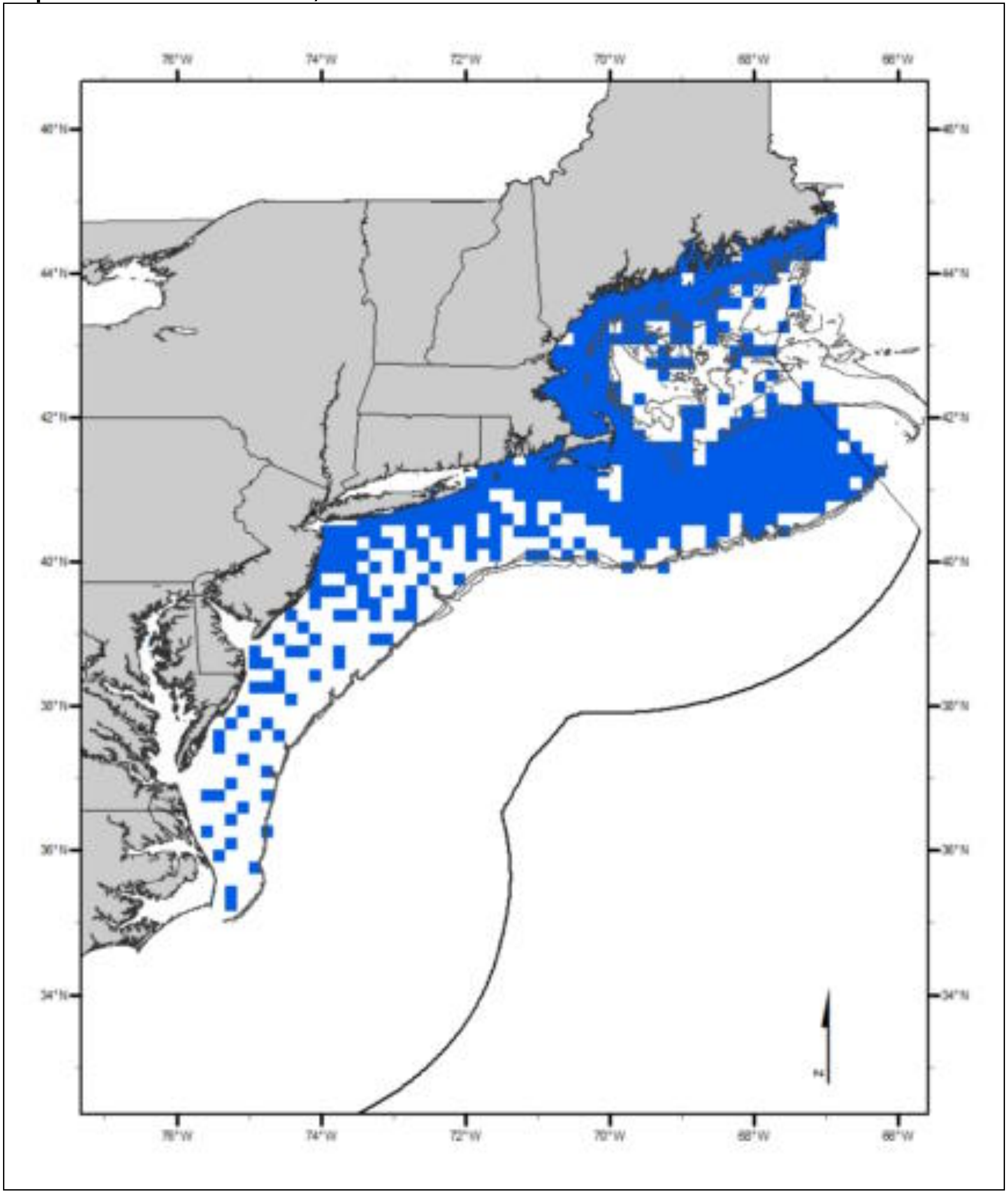
Adults: Inshore and continental shelf benthic habitats in depths of 1 – 500 meters with a wide variety of substrates, as depicted on Map 484. EFH for adult Atlantic cod includes rocky slopes and ledges, boulders, cobbles, pebbles, gravel, sand, and/or sand and mud mixed with gravel, pebbles, and cobbles. Other conditions that generally exist where EFH is found are bottom temperatures of 0.5 – 19.5ºC and salinities of 31 – 34 ppt. Spawning occurs in nearshore areas and on the continental shelf, usually in depths less than 73 meters. Adult Atlantic cod feed on squids and a variety of fishes and crustaceans.

Map 481. Atlantic cod eggs, Alternative 4



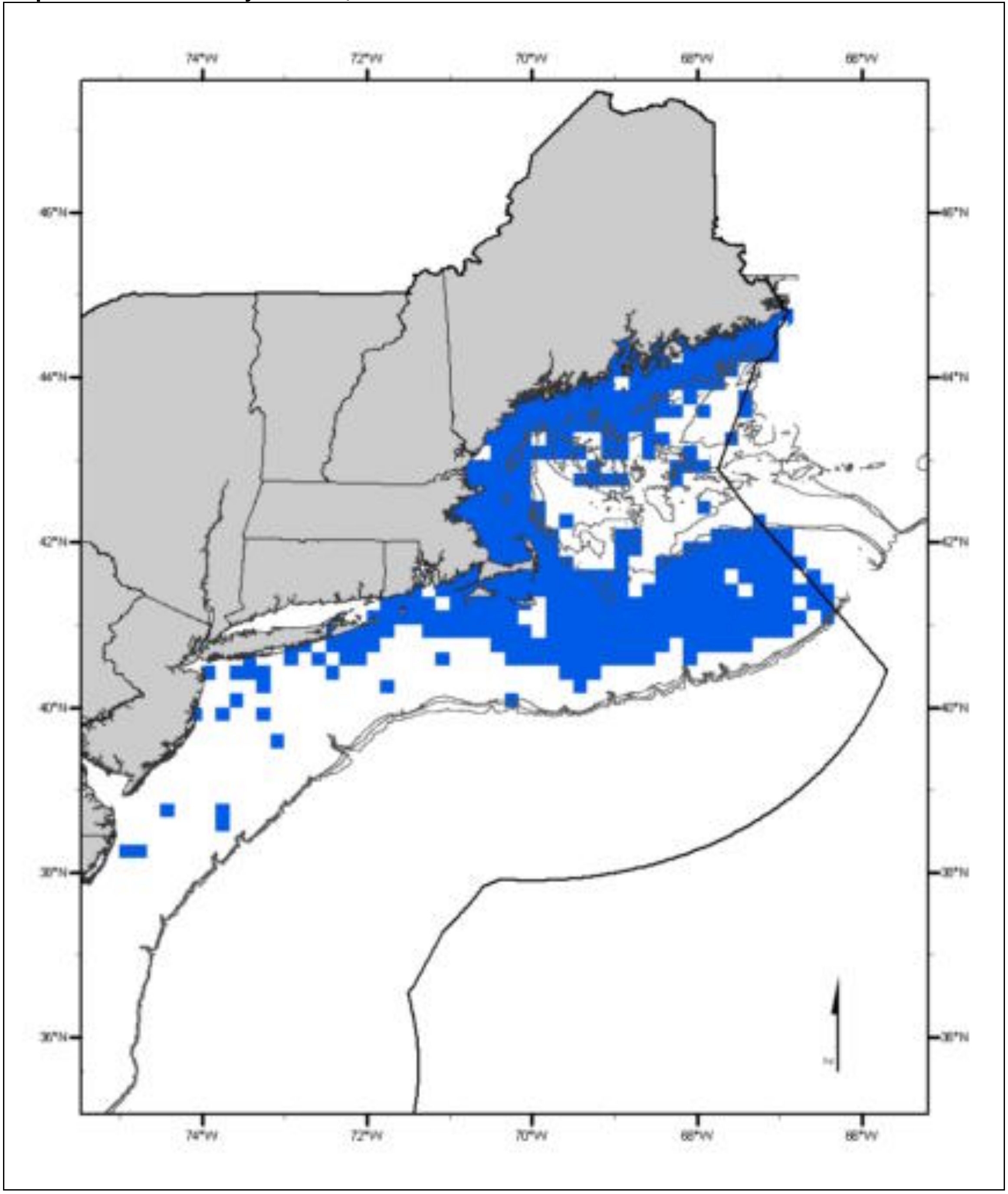
The Alternative 4 EFH designation for Atlantic cod eggs on the continental shelf includes all the ten minute squares where juvenile cod were caught during 1968-2005 in the fall and spring NMFS trawl survey. It also includes all the ten minute squares on the continental shelf and slope where eggs were collected during 1978-1987 in the NMFS MARMAP ichthyoplankton survey and inshore bays and estuaries identified by the NOAA ELMR program where Atlantic cod eggs were "common" or "abundant."

Map 482. Atlantic cod larvae, Alternative 4



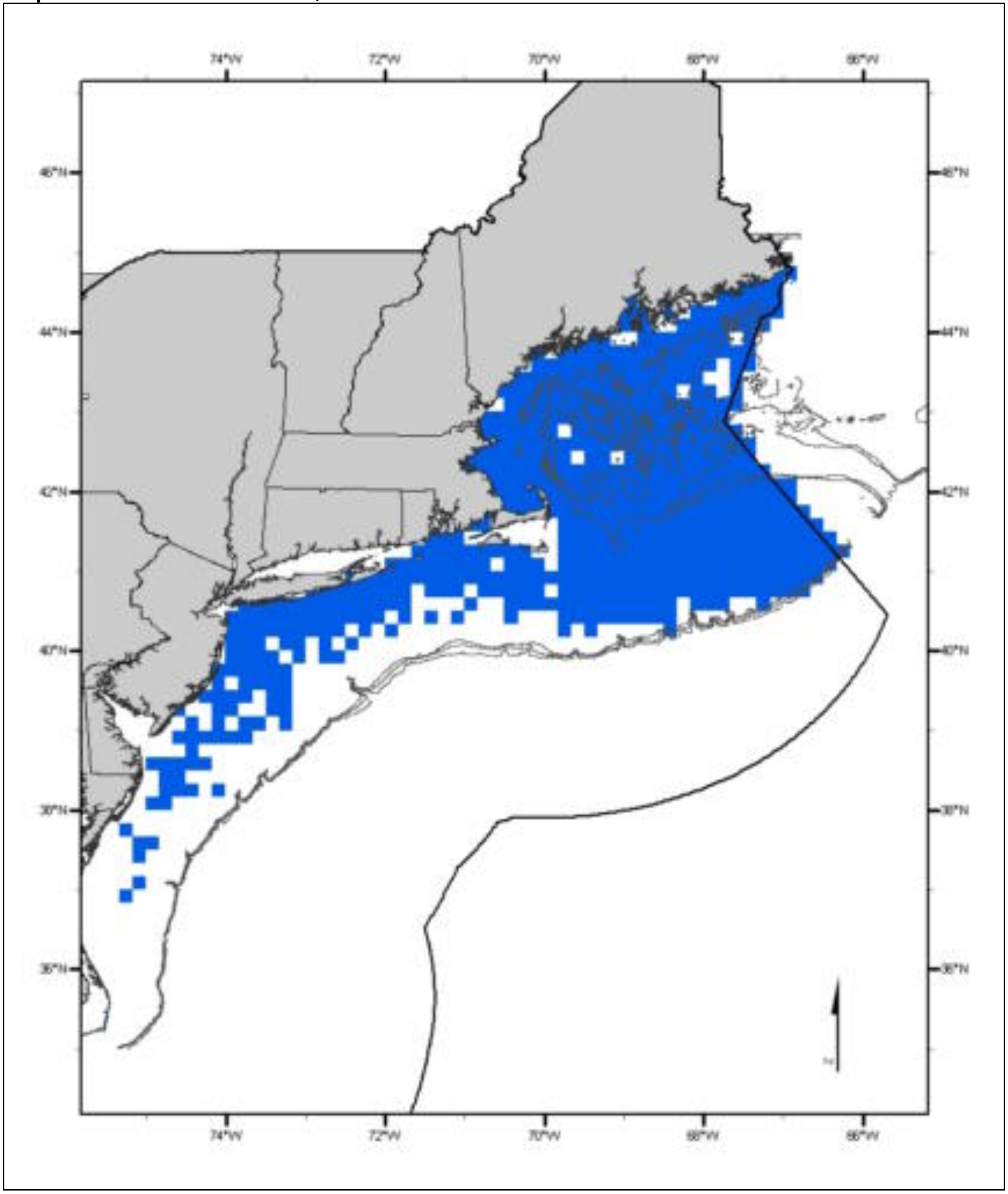
The Alternative 4 EFH designation for Atlantic cod larvae on the continental shelf includes all the ten minute squares where juvenile cod were caught during 1968-2005 in the fall and spring NMFS trawl survey. It also includes all the ten minute squares on the continental shelf and slope where larvae were collected during 1978-1987 in the NMFS MARMAP ichthyoplankton survey and inshore bays and estuaries identified by the NOAA ELMR program where Atlantic cod larvae were "common" or "abundant."

Map 483. Atlantic cod juveniles, Alternative 4



The Alternative 4 EFH designation for juvenile Atlantic cod on the continental shelf includes all the ten minute squares where juveniles were caught during 1968-2005 in the fall and spring NMFS trawl survey. Inshore, this alternative includes ten minute squares where juvenile Atlantic cod were caught in state trawl surveys in more than 10% of the tows, as well as those bays and estuaries identified by the NOAA ELMR program where Atlantic cod juveniles were "common" or "abundant."

Map 484. Atlantic cod adults, Alternative 4



The Alternative 4 EFH designation for adult Atlantic cod on the continental shelf includes all the ten minute squares where juveniles were caught during 1968-2005 in the fall and spring NMFS trawl survey. Inshore, this alternative includes ten minute squares where adult Atlantic cod were caught in state trawl surveys in more than 10% of the tows, as well as those bays and estuaries identified by the NOAA ELMR program where Atlantic cod adults were "common" or "abundant."

4.1.4.2.3 Atlantic Halibut

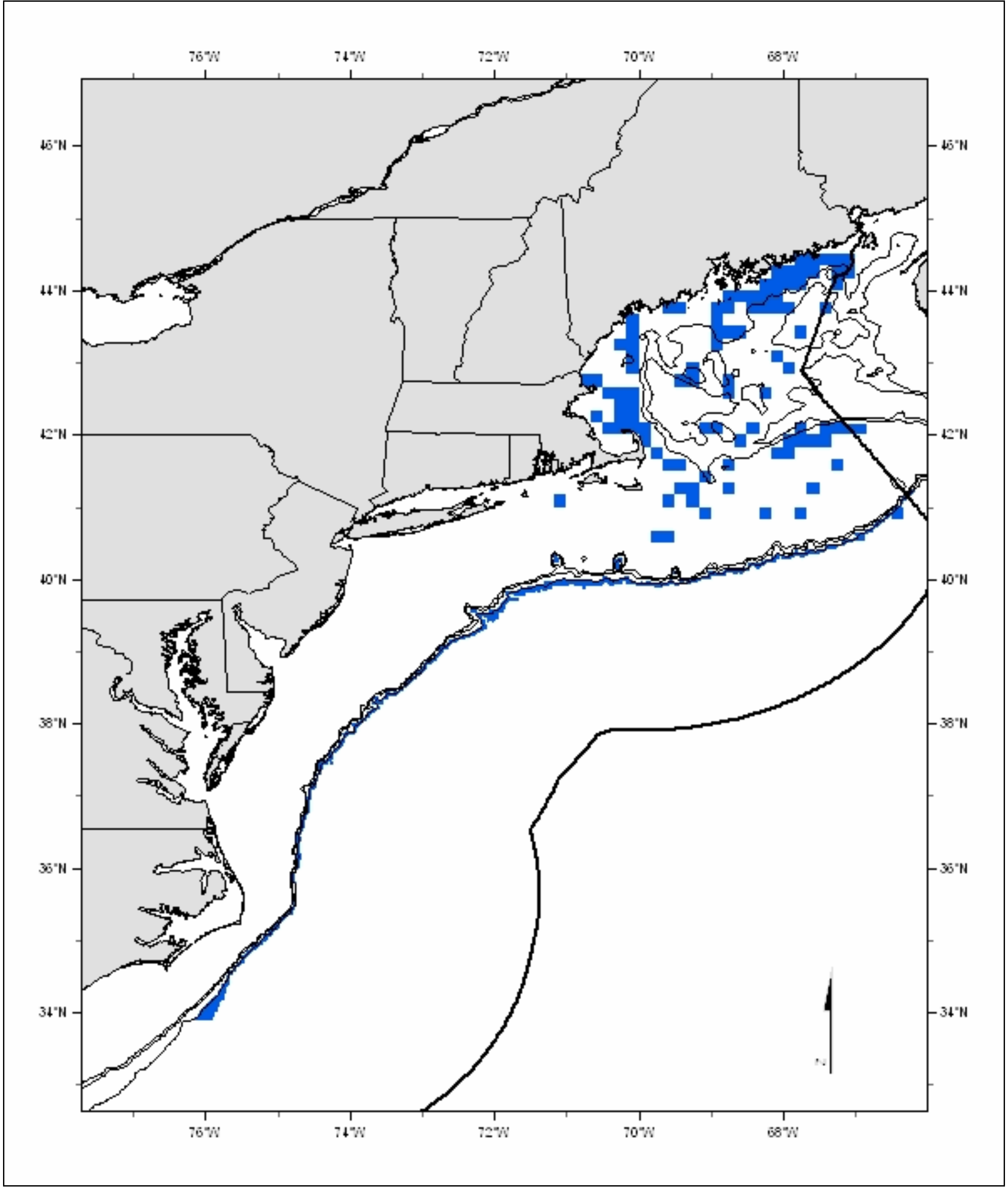
Eggs: No alternative EFH designation.

Larvae: No alternative EFH designation.

Juveniles: Benthic habitats on the continental shelf and slope in depths of 20 – 700 meters and with sand, gravel, and/or clay substrates, as depicted on Map 485. Other conditions that generally exist where EFH is found are bottom temperatures of 1.5 – 14.5ºC and salinities of 31.5 – 35.5 ppt. Primary prey organisms for juvenile Atlantic halibut are squids, crabs, a variety of fishes, pandalid shrimps, and sand shrimps.

Adults: Benthic habitats on the continental shelf and slope in depths of 20 – 700 meters with sand, gravel, and/or clay substrates, as depicted on Map 485. Other conditions that generally exist where EFH is found are bottom temperatures of 1.5 – 14.5ºC and salinities of 31.5 – 35.5 ppt. Spawning generally occurs over rough or rocky bottom on offshore banks in depths of at least 183 meters and on the continental slope as deep as 700 meters, at bottom temperatures of 4 – 7ºC, and salinities below 35 ppt. Primary prey organisms for adult Atlantic halibut are squids, crabs, a variety of fishes, pandalid shrimps, and sand shrimps.

Map 485. Atlantic halibut juveniles and adults, Alternative 4



The Alternative 4 EFH designation for juvenile and adult Atlantic halibut on the continental shelf includes all the ten minute squares where juveniles or adults were caught during 1968-2005 in the fall and spring NMFS trawl survey. Inshore, this alternative includes ten minute squares where juvenile Atlantic cod were caught in state trawl surveys in more than 10% of the tows. This alternative also includes the area beyond the continental shelf where juvenile or adult Atlantic halibut are known or presumed to be present, based on their maximum depth and geographic range.

4.1.4.2.4 Atlantic Herring

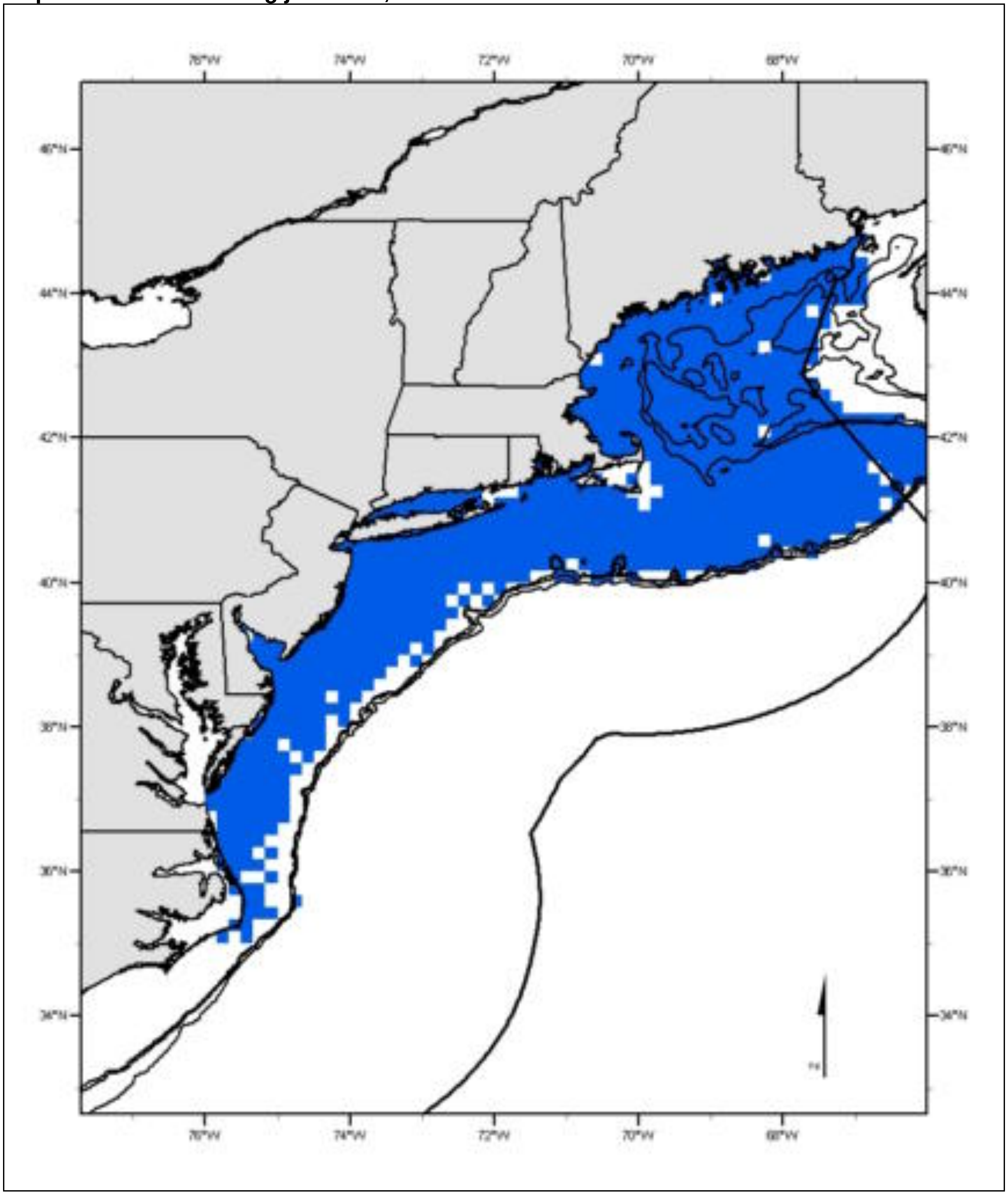
Eggs: No alternative EFH designations.

Larvae: No alternative EFH designations.

Juveniles: Coastal marine, estuarine, and continental shelf pelagic habitats with bottom depths of 1 – 400 meters, as depicted on Map 486. YOY juveniles utilize inshore marine and estuarine habitats, including intertidal waters, and can survive winter temperatures as low as -1.1ºC and salinities as low as 5 ppt. Older juveniles inhabit deeper water and prefer temperatures of 8 – 12ºC and salinities of 28 – 32 ppt. Juvenile Atlantic herring feed on zooplankton, primarily copepods, cladocerans, and invertebrate larvae.

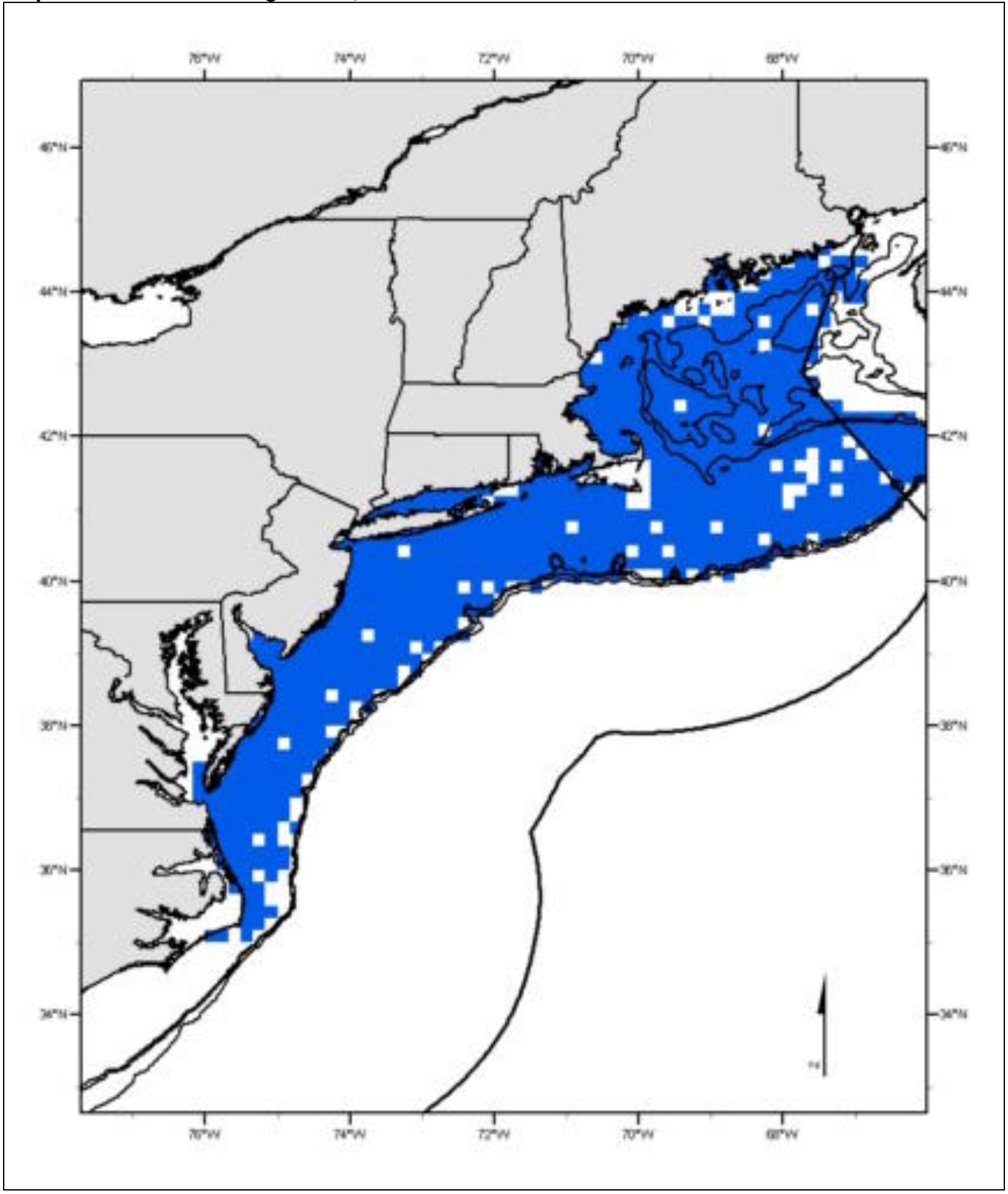
Adults: Inshore and continental shelf pelagic habitats with bottom depths of 1 – 400 meters, as depicted on Map 487. Spawning takes place on the bottom, generally in depths of 5 – 90 meters on a variety of substrates (see eggs). Adult Atlantic herring feed primarily on chaetognaths, pelagic crustaceans (euphausiids, amphipods, and copepods), and pelagic mollusks (pteropods).

Map 486. Atlantic herring juveniles, Alternative 4



The Alternative 4 EFH designation for juvenile Atlantic herring on the continental shelf includes all the ten minute squares where juveniles were caught during 1968-2005 in the fall and spring NMFS trawl survey. Inshore, this alternative includes ten minute squares where juvenile Atlantic herring were caught in state trawl surveys in more than 10% of the tows, as well as those bays and estuaries identified by the NOAA ELMR program where Atlantic herring juveniles were "common" or "abundant."

Map 487. Atlantic herring adults, Alternative 4



The Alternative 4 EFH designation for adult Atlantic herring on the continental shelf includes all the ten minute squares where juveniles were caught during 1968-2005 in the fall and spring NMFS trawl survey. Inshore, this alternative includes ten minute squares where adult Atlantic herring were caught in state trawl surveys in more than 10% of the tows, as well as those bays and estuaries identified by the NOAA ELMR program where Atlantic herring adults were "common" or "abundant."

4.1.4.2.5 Atlantic Sea Scallop

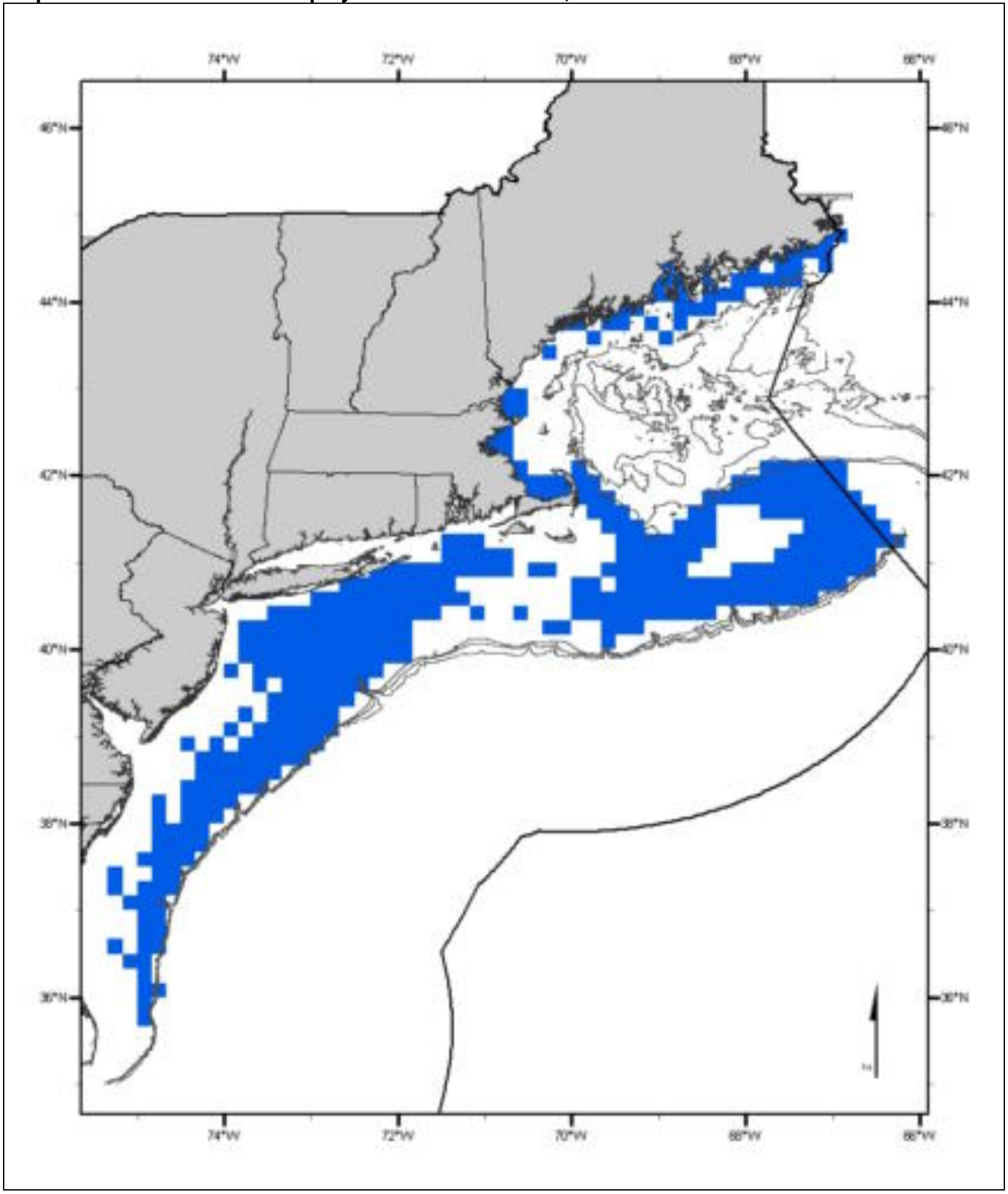
Eggs: No alternative EFH designation.

Larvae: No alternative EFH designation.

Juveniles: Inshore and continental shelf benthic habitats in depths of 2 – 180 meters with substrates of sand, gravel, and/or mixtures of gravel, mud, and sand , as depicted on Map 488. Other conditions that generally exist where EFH is found are bottom temperatures of 0.5 – 20.5ºC and salinities above 25 ppt. Juvenile sea scallops are filter–feeders, ingesting diatoms, detritus, microzooplankton, and bacteria.

Adults: Inshore and continental shelf benthic habitats in depths of 2 – 180 meters with substrates of sand, gravel, and/or mixtures of gravel, mud, and sand , as depicted on Map 488. Other conditions that generally exist where EFH is found are bottom temperatures of 0.5 – 20.5ºC and salinities above 25 ppt. These same conditions generally prevail during spawning. Adult sea scallops are filter–feeders, ingesting diatoms, detritus, microzooplankton, and bacteria.

Map 488. Atlantic sea scallops juveniles and adults, Alternative 4



The Alternative 4 EFH designation for juvenile and adult Atlantic sea scallops on the continental shelf includes all the ten minute squares where juveniles or adults were caught during 1982-2005 in the summer NMFS sea scallop dredge survey. Inshore, this alternative includes ten minute squares where juvenile or adult Atlantic sea scallops were caught in state trawl surveys in more than 10% of the tows, as well as those bays and estuaries identified by the NOAA ELMR program where juvenile or adult Atlantic sea scallops were "common" or "abundant."

4.1.4.2.6 Barndoor Skate

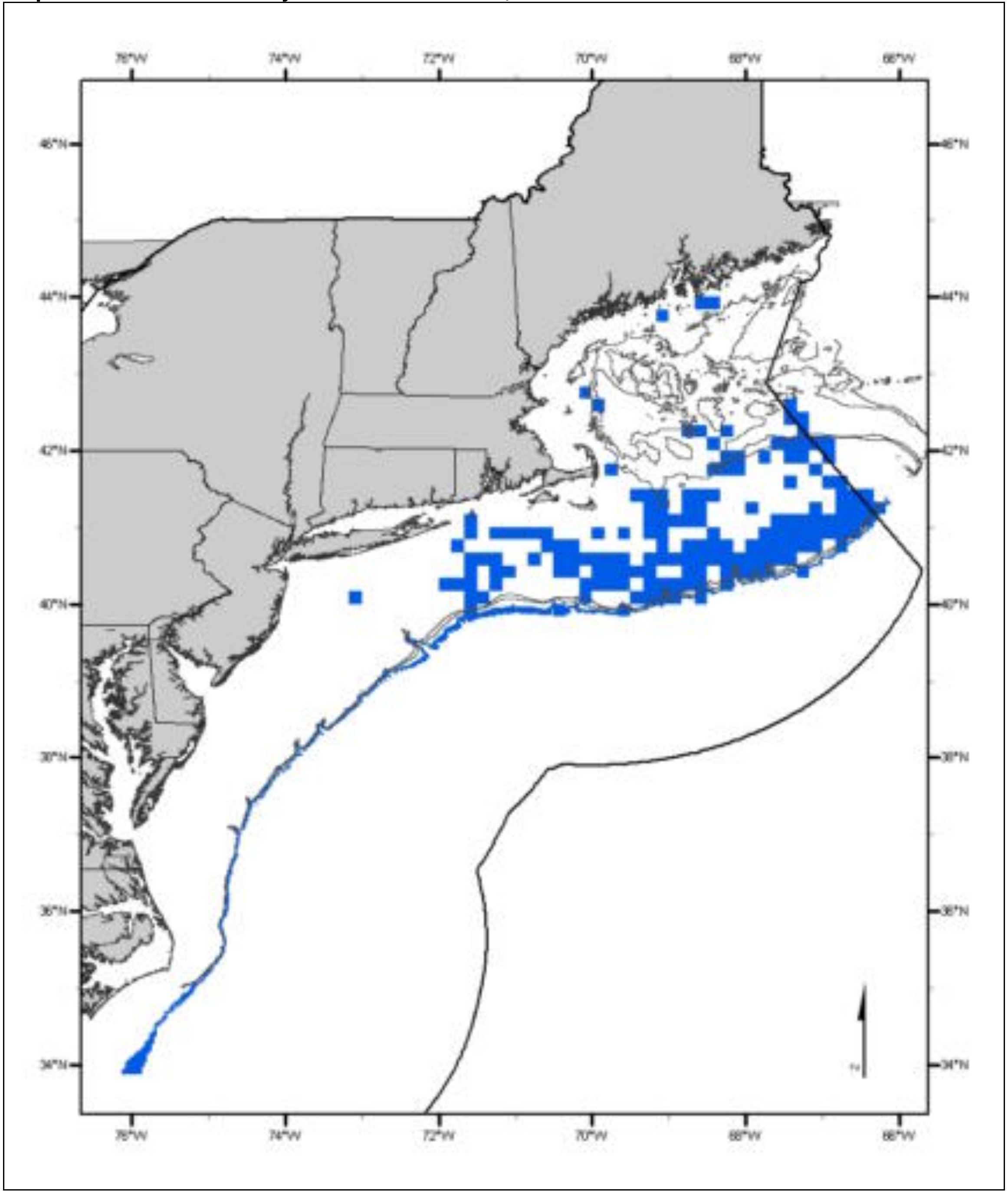
Eggs: There is no information available on the habitat requirements or distribution of the egg stage for this species.

Larvae: No larval life stage exists for this species. Upon hatching, they are fully developed juveniles.

Juveniles: Benthic habitats in inshore areas and on the continental shelf and slope in depths of 20 – 750 meters, as depicted on Map 489. EFH for juvenile barndoor skates includes substrates composed primarily of sand, with some sand and mud, and/or sand and mud mixed with gravel, pebbles and cobbles. Other conditions that generally exist where EFH is found are bottom temperatures of 2.5 – 18.5ºC salinities of 20 – 36.5 ppt. Juvenile barndoor skates feed on benthic invertebrates such as polychaetes and a variety of crustaceans.

Adults: Benthic habitats in inshore areas and on the continental shelf and slope in depths of 20 – 750 meters, as depicted on Map 489. EFH for adult barndoor skates includes substrates composed primarily of sand, with some sand and mud, and/or sand and mud mixed with gravel, pebbles and cobbles. Other conditions that generally exist where EFH is found are bottom temperatures of 3.5 – 16.5ºC and salinities of 20 – 36.5 ppt. Adult barndoor skates feed on larger and more active prey than juveniles, including razor clams, large gastropods, squids, crabs, lobsters, and a variety of fishes.

Map 489. Barndoor skate juveniles and adults, Alternative 4



The Alternative 4 EFH designation for juvenile and adult barndoor skate on the continental shelf includes all the ten minute squares where juveniles were caught during 1968-2005 in the fall and spring NMFS trawl survey. This alternative also includes the area beyond the continental shelf where juvenile or adult barndoor skate are known or presumed to be present, based on their maximum depth and geographic range.

4.1.4.2.7 Clearnose Skate

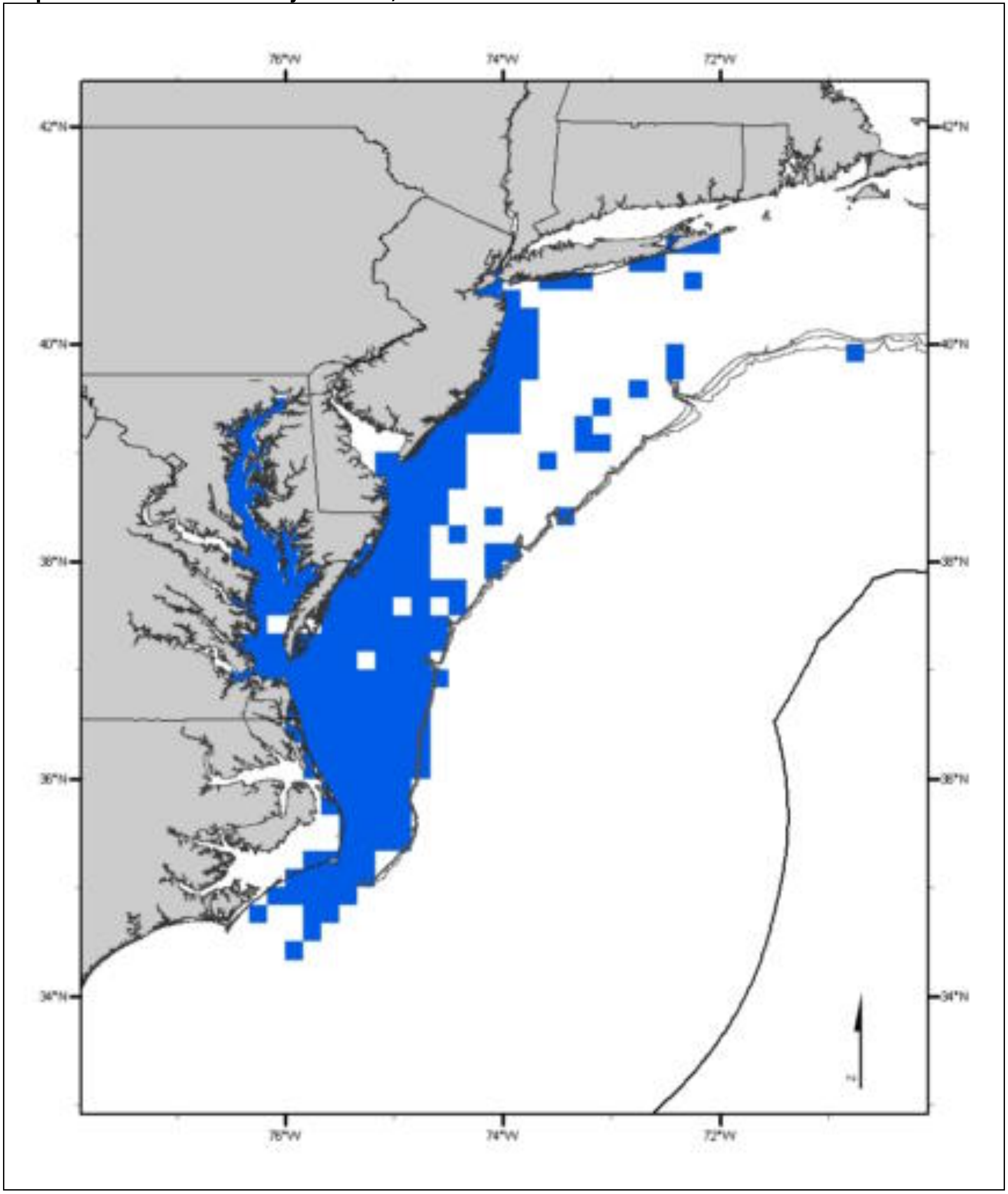
Eggs: There is no information available on the habitat requirements or distribution of the egg stage for this species.

Larvae: No larval life stage exists for this species. Upon hatching, they are fully developed juveniles.

Juveniles: Estuarine, coastal marine, and continental shelf benthic habitats in depths of 1 – 300 meters, as depicted on Map 490. EFH for juvenile clearnose skates occurs primarily on sand, but also on mud and sand with and without gravel, and rocky bottom, and includes the intertidal zone. Other conditions that generally exist where EFH is found are bottom temperatures of 3 – 27.5ºC and salinities of 19 – 36.5 ppt. Juvenile clearnose skates feed on a variety of crustaceans and fishes, and, in inshore waters, on razor clams.

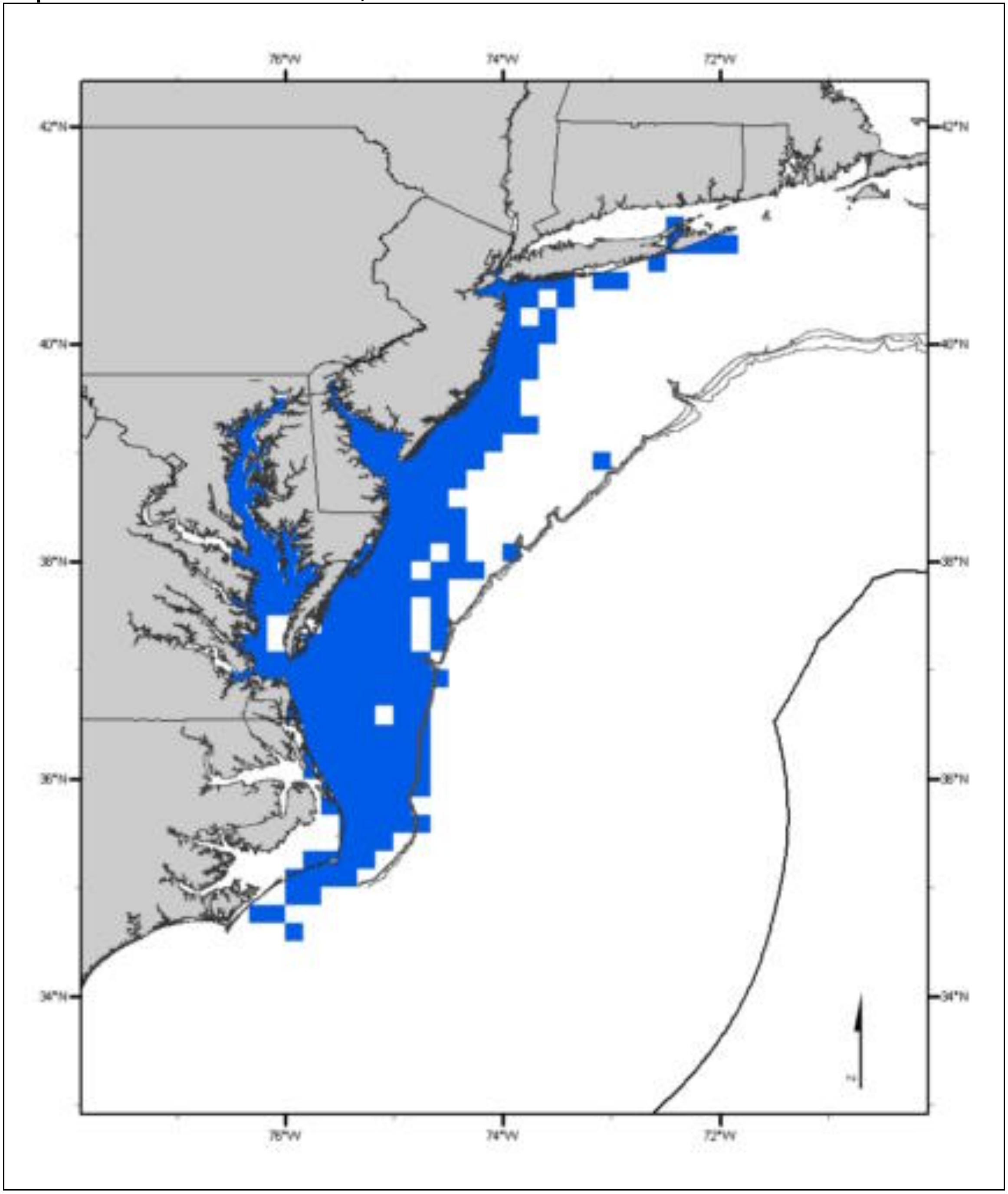
Adults: Estuarine, coastal marine, and continental shelf benthic habitats in depths of 1 – 300 meters, as depicted on Map 491. EFH for adult clearnose skates occurs primarily on sand, but also on mud and sand with and without gravel. Other conditions that generally exist where EFH is found are bottom temperatures of 3.5 – 25.5ºC salinities of 19.5 – 36.5 ppt. Adult clearnose skates feed on a variety of crustaceans and fishes, and, in inshore waters, on razor clams.

Map 490. Clearnose skate juveniles, Alternative 4



The Alternative 4 EFH designation for juvenile clearnose skate on the continental shelf includes all the ten minute squares where juveniles were caught during 1968-2005 in the fall and spring NMFS trawl survey. Inshore, this alternative includes ten minute squares where juvenile clearnose skate were caught in state trawl surveys in more than 10% of the tows, as well as those bays and estuaries identified by the NOAA ELMR program where clearnose skate juveniles were "common" or "abundant."

Map 491. Clearnose skate adults, Alternative 4



The Alternative 4 EFH designation for adult clearnose skate on the continental shelf includes all the ten minute squares where juveniles were caught during 1968-2005 in the fall and spring NMFS trawl survey. Inshore, this alternative includes ten minute squares where adult clearnose skate were caught in state trawl surveys in more than 10% of the tows, as well as those bays and estuaries identified by the NOAA ELMR program where clearnose skate adults were "common" or "abundant."

4.1.4.2.8 Haddock

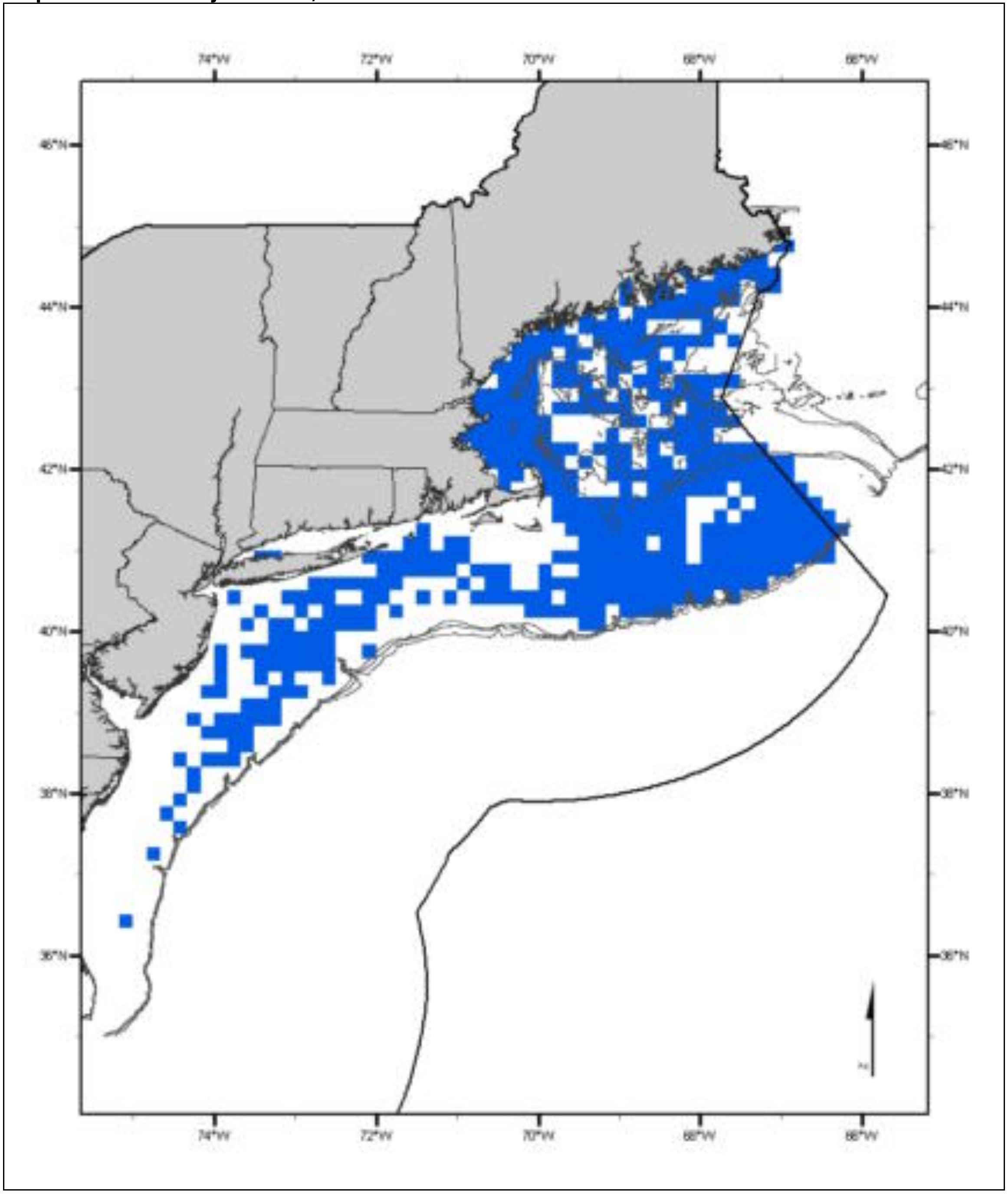
Eggs: No alternative EFH designation.

Larvae: No alternative EFH designation.

Juveniles: Inshore and continental shelf benthic habitats in depths of 7 – 400 meters with sandy–gravelly substrates, as depicted on Map 492. EFH for juvenile haddock occurs on sandy bottom, on pebble–gravel bottom, and on sand and mud mixed with gravel. Other conditions that generally exist where EFH is found are bottom temperatures of 0.5 – 15.5ºC and salinities of 30.5 – 35.5 ppt. Benthic juvenile haddock feed on crustaceans, small bivalve mollusks, brittle stars, polychaetes, and fishes such as sand lance.

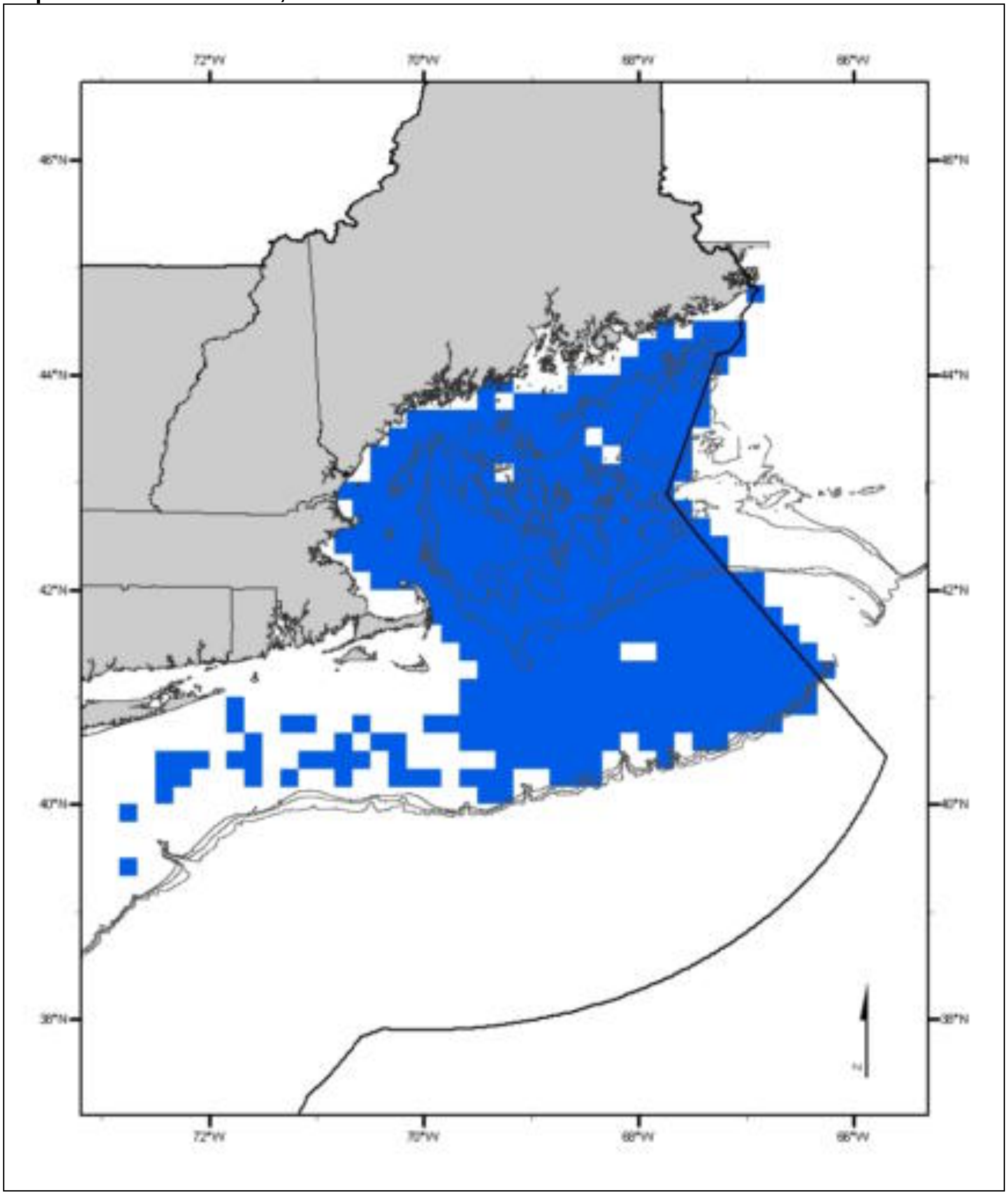
Adults: Inshore and continental shelf benthic habitats in depths of 20 – 400 meters with sandy–gravelly substrates, as depicted on Map 493. EFH for adult haddock occurs on sandy bottom, on pebble–gravel bottom, and on sand and mud mixed with gravel. They prefer gravel, pebbles, clay, broken shells, and smooth, hard sand (especially between rocky patches), and are not common on rocks, ledges, kelp or soft mud. Other conditions that generally exist where EFH is found are bottom temperatures of 0.5 – 15.5ºC and salinities of 32.5 – 33.5 ppt. Spawning generally occurs at temperatures of 2 – 7ºC and salinities of 31.5 – 35.5 ppt. Primary prey organisms for adult haddock are fishes (*e.g.*, sand lance, mackerels, and herrings), amphipods, brittle stars, polychaetes, cnidarians, and euphausiids.

Map 492. Haddock juveniles, Alternative 4



The Alternative 4 EFH designation for juvenile haddock on the continental shelf includes all the ten minute squares where juveniles were caught during 1968-2005 in the fall and spring NMFS trawl survey. Inshore, this alternative includes ten minute squares where juvenile haddock were caught in state trawl surveys in more than 10% of the tows, as well as those bays and estuaries identified by the NOAA ELMR program where haddock juveniles were "common" or "abundant."

Map 493. Haddock adults, Alternative 4



The Alternative 4 EFH designation for adult haddock on the continental shelf includes all the ten minute squares where adults were caught during 1968-2005 in the fall and spring NMFS trawl survey. Inshore, this alternative includes ten minute squares where adult haddock were caught in state trawl surveys in more than 10% of the tows, as well as those bays and estuaries identified by the NOAA ELMR program where haddock adults were "common" or "abundant."

4.1.4.2.9 Little Skate

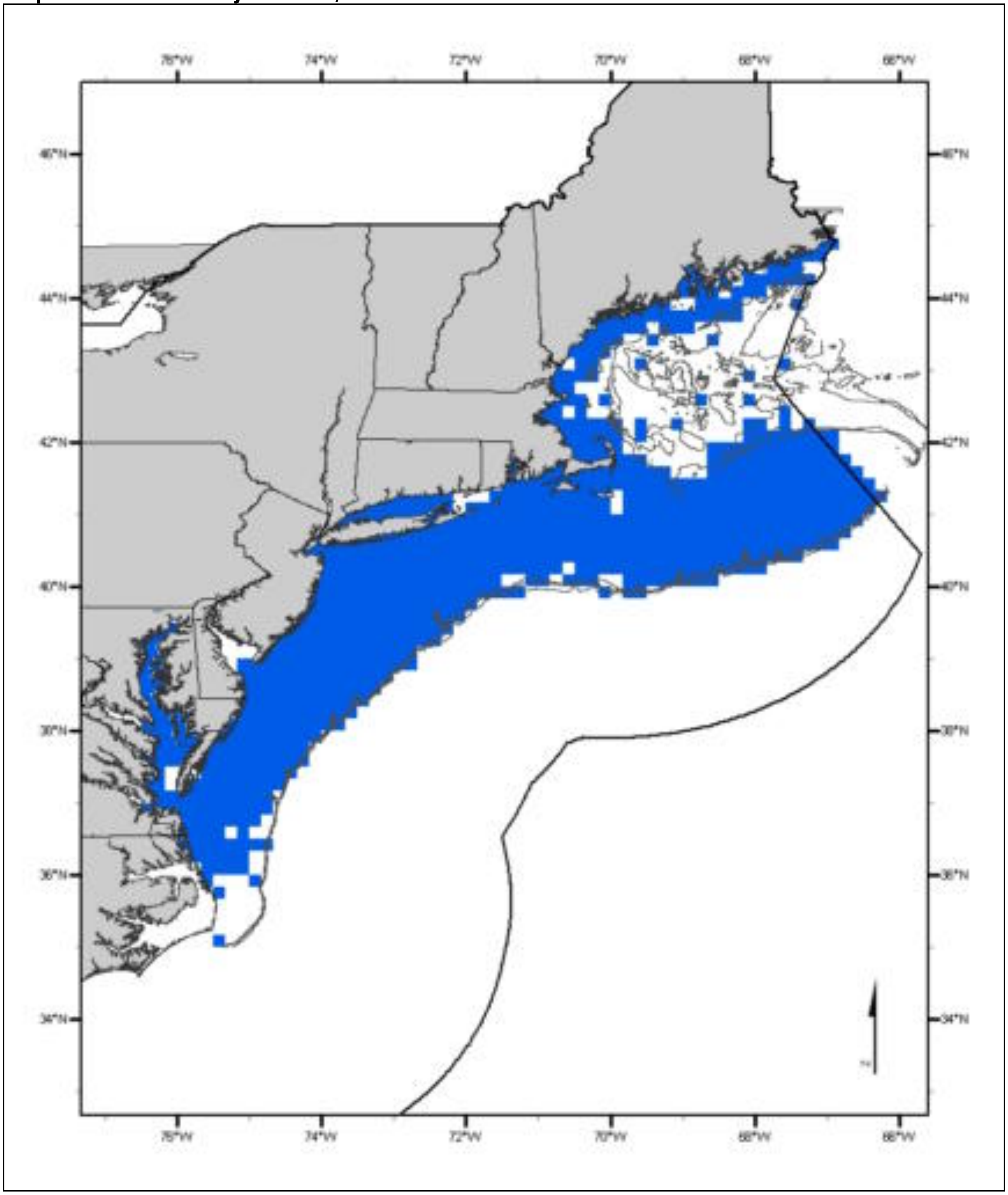
Eggs: There is no information available on the habitat requirements or distribution of the egg stage for this species.

Larvae: No larval life stage exists for this species. Upon hatching, they are fully developed juveniles.

Juveniles: Sandy benthic habitats in coastal bays and estuaries and on the continental shelf in depths of 1 – 400 meters, as depicted on Map 494. Other conditions that generally exist where EFH for juvenile little skate is found are bottom temperatures of 0 – 24.5ºC and salinities of 15 – 36.5 ppt. They feed on crustaceans (primarily amphipods and a variety of decapods).

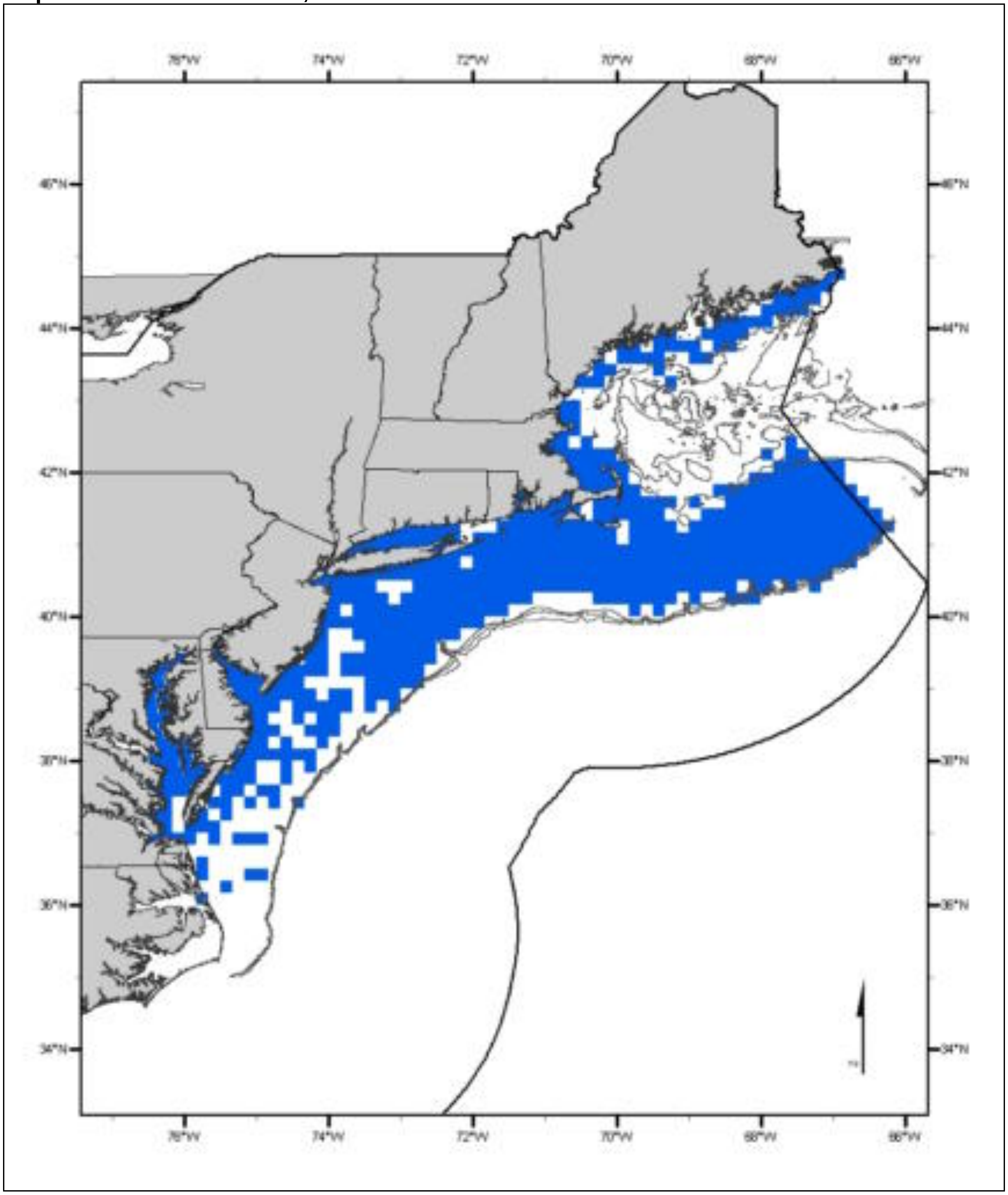
Adults: Sandy benthic habitats in coastal bays and estuaries and on the continental shelf in depths of 1 – 400 meters, as depicted on Map 495. Other conditions that generally exist where EFH for adult little skate is found are bottom temperatures of 1.5 – 22.5ºC and salinities of 13.5 – 36.5 ppt. Adult little skate have a similar diet to juveniles, but feed on more decapods (sand shrimps and crabs), polychaetes, and fishes (*e.g.*, Atlantic herring), and fewer amphipods.

Map 494. Little skate juveniles, Alternative 4



The Alternative 4 EFH designation for juvenile little skate on the continental shelf includes all the ten minute squares where juveniles were caught during 1968-2005 in the fall and spring NMFS trawl survey. Inshore, this alternative includes ten minute squares where juvenile little skate were caught in state trawl surveys in more than 10% of the tows, as well as those bays and estuaries identified by the NOAA ELMR program where little skate juveniles were "common" or "abundant.”

Map 495. Little skate adults, Alternative 4



The Alternative 4 EFH designation for adult little skate on the continental shelf includes all the ten minute squares where juveniles were caught during 1968-2005 in the fall and spring NMFS trawl survey. Inshore, this alternative includes ten minute squares where adult little skate were caught in state trawl surveys in more than 10% of the tows, as well as those bays and estuaries identified by the NOAA ELMR program where little skate adults were "common" or "abundant."

4.1.4.2.10 Monkfish

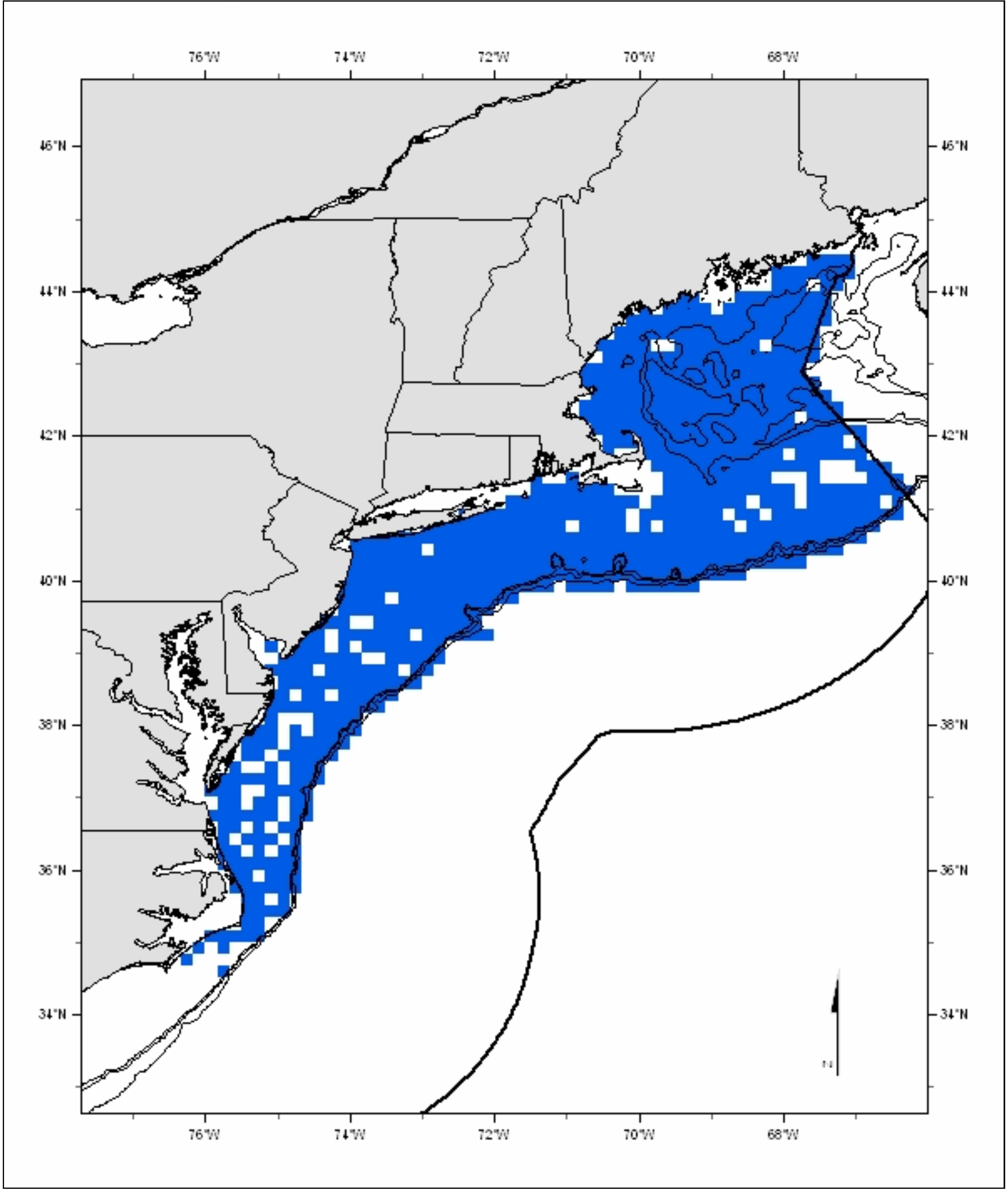
Eggs: Upper water column habitats in inshore areas, and on the continental shelf and slope, as depicted on Map 496. EFH for monkfish eggs generally occurs where bottom depths are 1 – 1500 meters and in water column temperatures of 10 – 20ºC.
Preferred alternative

Larvae: Inshore and continental shelf and slope water column habitats, as depicted on Map 496. EFH for monkfish larvae generally occurs where bottom depths are 1 – 1500 meters and in water column temperatures of 6.5 – 20.5ºC. Larval monkfish feed on zooplankton, including copepods, crustacean larvae, and chaetognaths.
Preferred alternative

Juveniles: Benthic habitats in inshore areas, and on the continental shelf and slope in depths of 1 – 1000 meters with mud, sand, and mud–sand substrates, as depicted on Map 497. Other conditions that generally exist where EFH is found are bottom temperatures of 1.5 – 24.5ºC and salinities of 29.5 – 36.5 ppt. Juvenile monkfish are found on a variety of substrates, including mud, sand, gravel, broken shells, and pebbles, but are reported to prefer clay and mud over sand and gravel. YOY have been collected as deep as 900 meters on the continental slope. Primary prey for juvenile monkfish is other fishes (*e.g.*, sand lances, silver hakes, and flounders), pandalid shrimps, and squids.

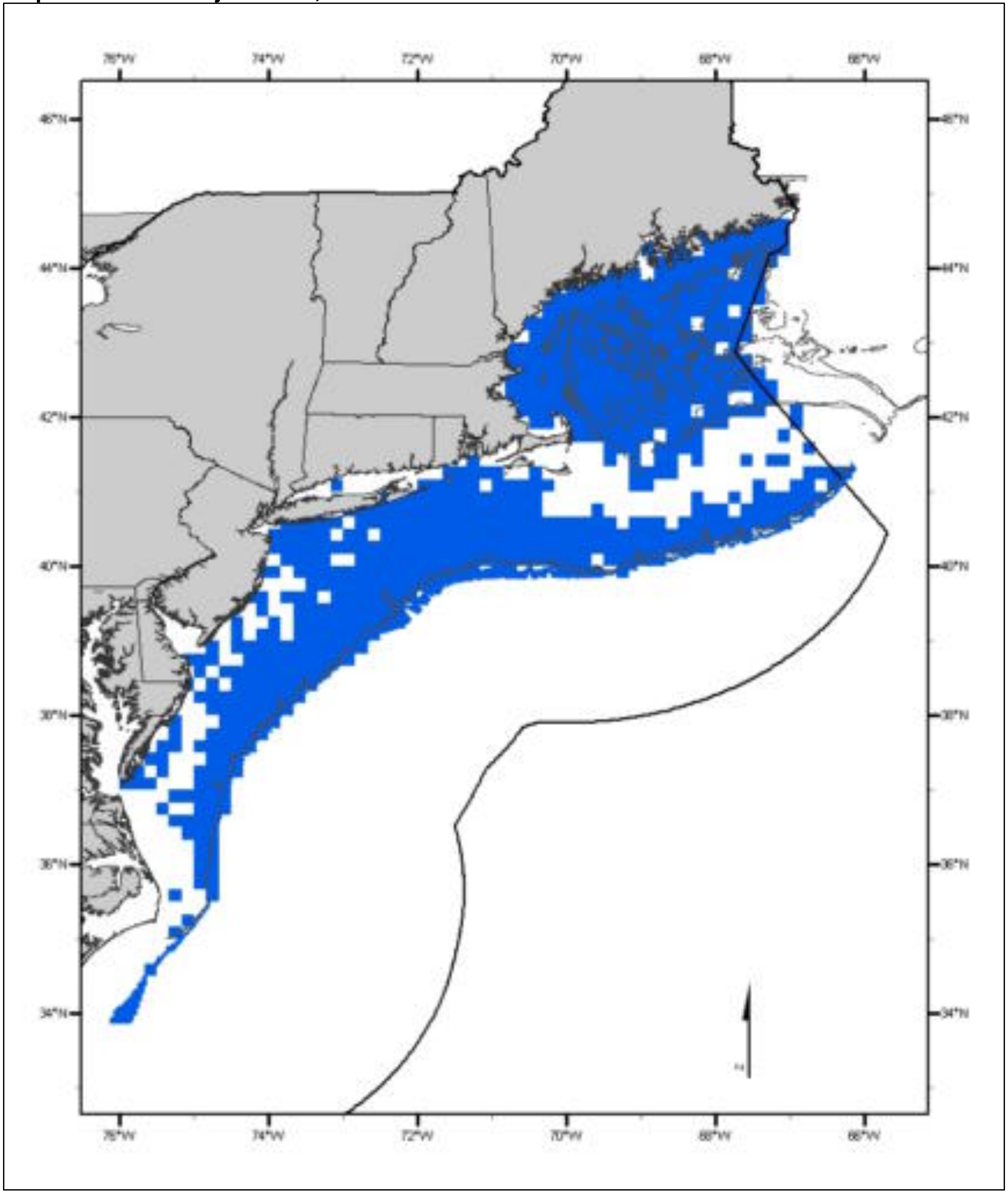
Adults: Benthic habitats in inshore areas, and on the continental shelf and slope in depths of 1 – 1000 meters with mud, sand, and mud–sand substrates, as depicted on Map 498. Other conditions that generally exist where EFH is found are bottom temperatures of 0.5 – 21.5ºC and salinities of 29.5 – 36.5 ppt. Adult monkfish are found on a variety of substrates, including mud, sand, gravel, broken shells, and pebbles, but are reported to prefer clay and mud over sand and gravel. They feed on a wide variety of other fishes and on squids.

Map 496. Monkfish egg and larvae, Alternative 4 (*Preferred Alternative*)



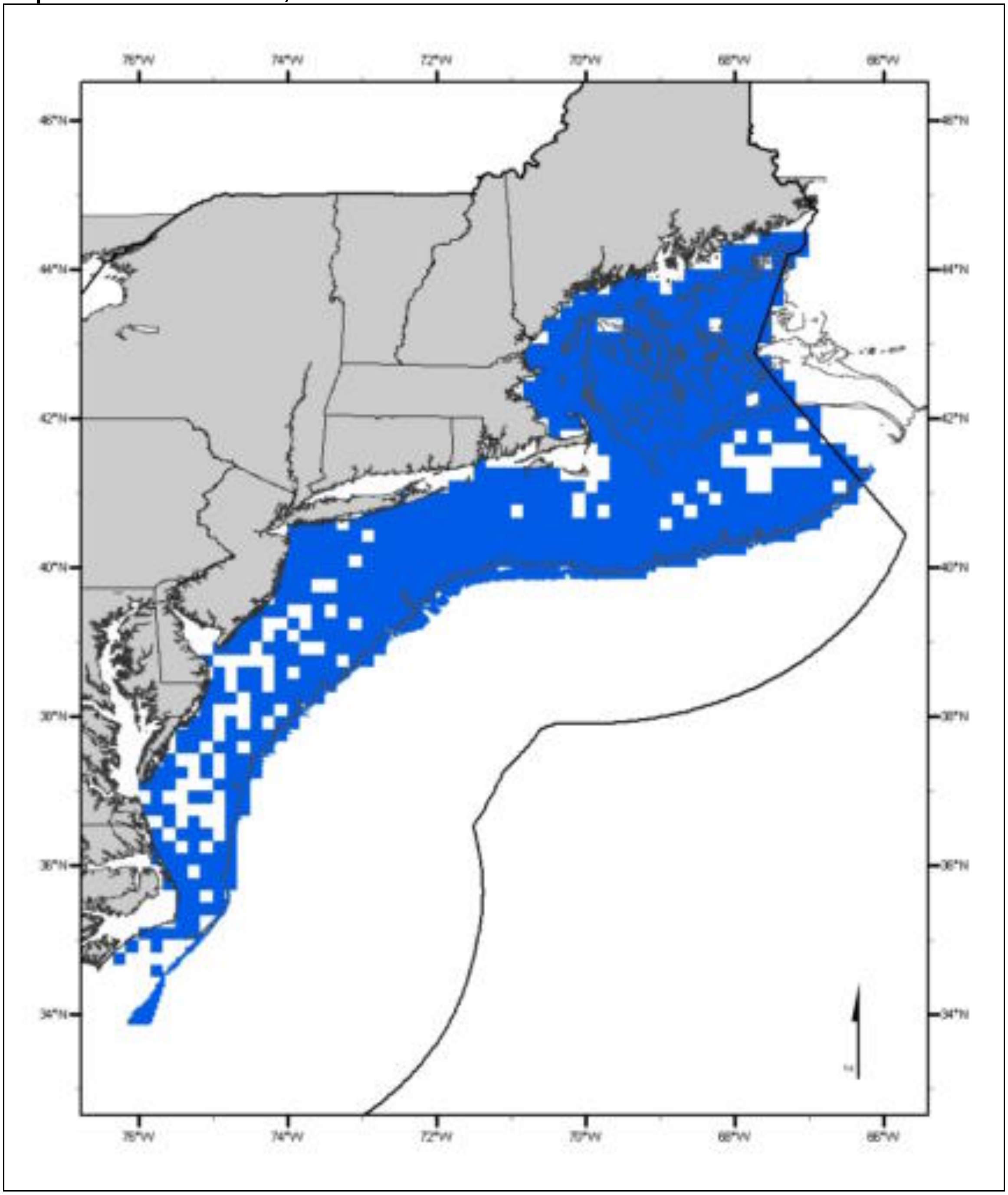
The Alternative 4 EFH designation for monkfish eggs and larvae on the continental shelf includes all the ten minute squares where adult monkfish were caught during 1968-2005 in the fall and spring NMFS trawl survey plus all the ten minute squares where monkfish larvae were collected during 1978-1987 in the NMFS MARMAP ichthyoplankton survey. Inshore, this alternative includes ten minute squares where adult monkfish were caught in state trawl surveys in more than 10% of the tows. This alternative also includes the area beyond the continental shelf where monkfish larvae are known or presumed to be present.

Map 497. Monkfish juveniles, Alternative 4



The Alternative 4 EFH designation for juvenile monkfish on the continental shelf includes all the ten minute squares where juveniles were caught during 1968-2005 in the fall and spring NMFS trawl survey. Inshore, this alternative includes ten minute squares where adult monkfish were caught in state trawl surveys in more than 10% of the tows. This alternative also includes the area beyond the continental shelf where juvenile or adult monkfish are known or presumed to be present, based on their maximum depth and geographic range.

Map 498. Monkfish adults, Alternative 4



The Alternative 4 EFH designation for adult monkfish on the continental shelf includes all the ten minute squares where adults were caught during 1968-2005 in the fall and spring NMFS trawl survey. Inshore, this alternative includes ten minute squares where adult monkfish were caught in state trawl surveys in more than 10% of the tows. This alternative also includes the area beyond the continental shelf where juvenile or adult monkfish are known or presumed to be present, based on their maximum depth and geographic range.

4.1.4.2.11 Ocean Pout

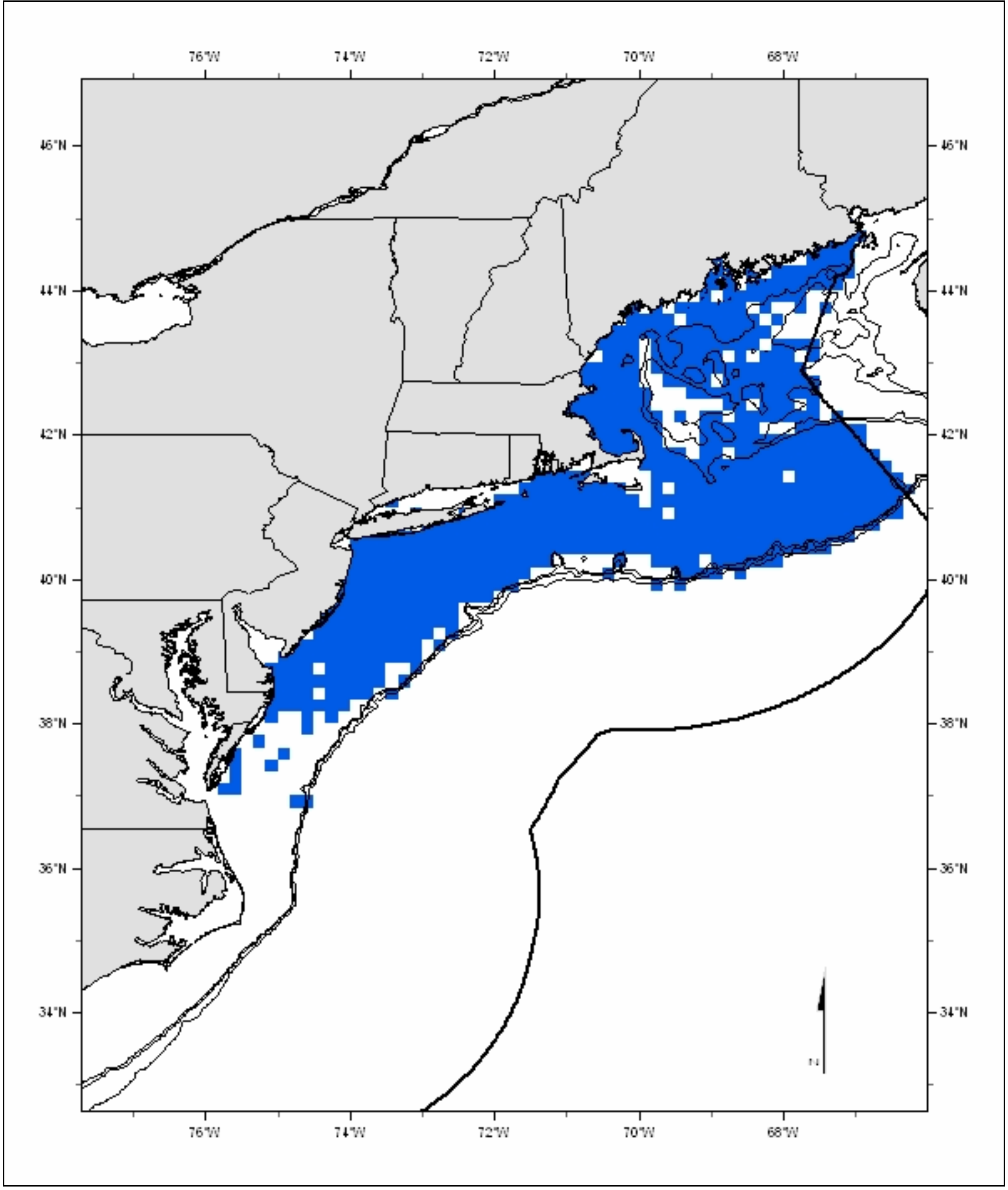
Eggs: Hard bottom benthic habitats in inshore and continental shelf waters, as depicted on Map 499. The following conditions generally exist where EFH for ocean pout eggs is found: depths of less than 50 meters and bottom temperatures of 10ºC or less.

Larvae: No alternative EFH designation.

Juveniles: Inshore and continental shelf benthic habitats in depths of 1 – 400 meters, including the intertidal zone, on a variety of substrates, as depicted on Map 500. EFH for juvenile ocean pout is generally found on a wide variety of substrates, including shells, rocks, algae, sand, mud, mud and sand, and/or gravel. Other conditions that generally exist where EFH is found are bottom temperatures of 1.5 – 18.5ºC and salinities of 30.5 – 36.5 ppt. Juvenile ocean pout feed primarily on brittle stars, amphipods, polychaetes, and bivalve mollusks.

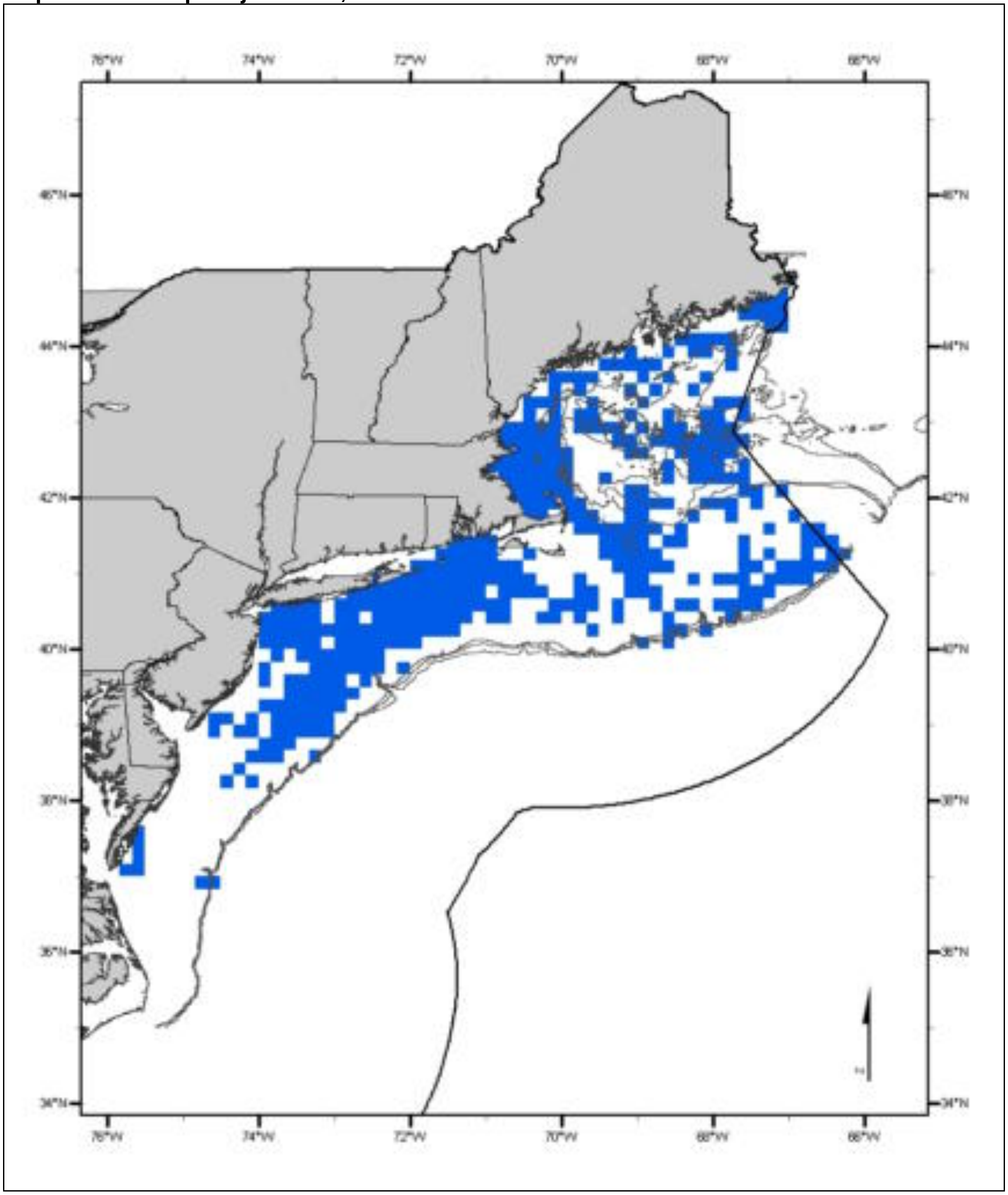
Adults: Inshore and continental shelf benthic habitats in depths of 1 – 400 meters on a variety of substrates, as depicted on Map 501. EFH for adult ocean pout is generally found on a wide variety of substrates, including shells, rocks, algae, sand, mud, mud and sand, and/or gravel. Other conditions that generally exist where EFH is found are bottom temperatures of 0.5 – 17.5ºC and salinities of 29.5 – 36.5 ppt. Ocean pout spawn on hard bottom in sheltered areas in depths less than 50 meters and bottom temperatures of 10ºC or less. Adults feed primarily on starfishes, crabs, bivalve mollusks, brittle stars, amphipods, and sand dollars.

Map 499. Ocean pout eggs, Alternative 4



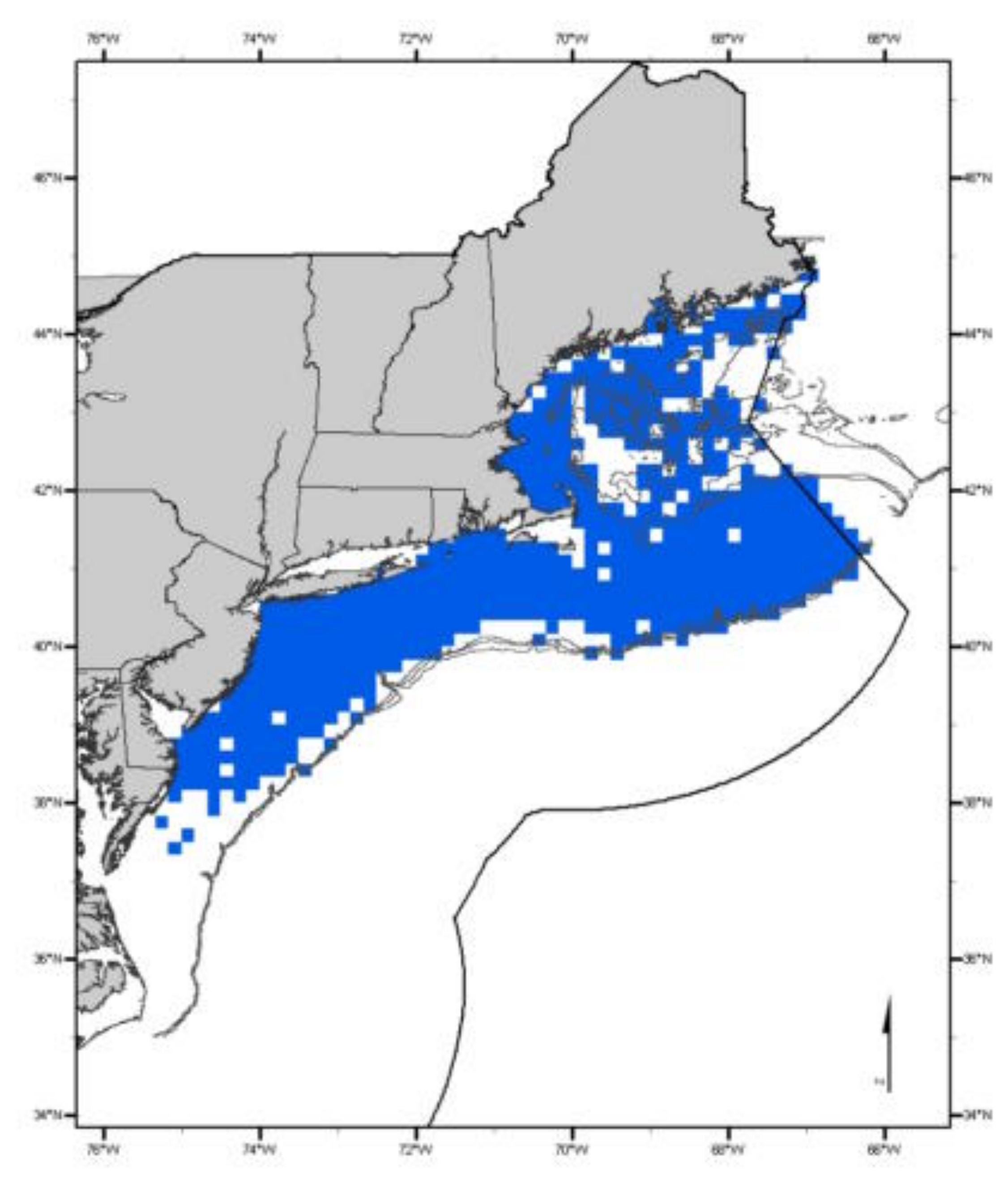
The Alternative 4 EFH designation for ocean pout eggs on the continental shelf includes all the ten minute squares where juvenile or adult ocean pout were caught during 1968-2005 in the fall and spring NMFS trawl survey. Inshore, this alternative includes ten minute squares where juvenile or adult ocean pout were caught in state trawl surveys in more than 10% of the tows, as well as those bays and estuaries identified by the NOAA ELMR program where juvenile or adult ocean pout were "common" or "abundant."

Map 500. Ocean pout juveniles, Alternative 4



The Alternative 4 EFH designation for juvenile ocean pout on the continental shelf includes all the ten minute squares where juveniles were caught during 1968-2005 in the fall and spring NMFS trawl survey. Inshore, this alternative includes ten minute squares where juvenile ocean pout were caught in state trawl surveys in more than 10% of the tows, as well as those bays and estuaries identified by the NOAA ELMR program where ocean pout juveniles were "common" or "abundant."

Map 501. Ocean pout adults, Alternative 4



The Alternative 4 EFH designation for adult ocean pout on the continental shelf includes all the ten minute squares where adults were caught during 1968-2005 in the fall and spring NMFS trawl survey. Inshore, this alternative includes ten minute squares where adult ocean pout were caught in state trawl surveys in more than 10% of the tows, as well as those bays and estuaries identified by the NOAA ELMR program where ocean pout adults were "common" or "abundant."

4.1.4.2.12 Offshore Hake

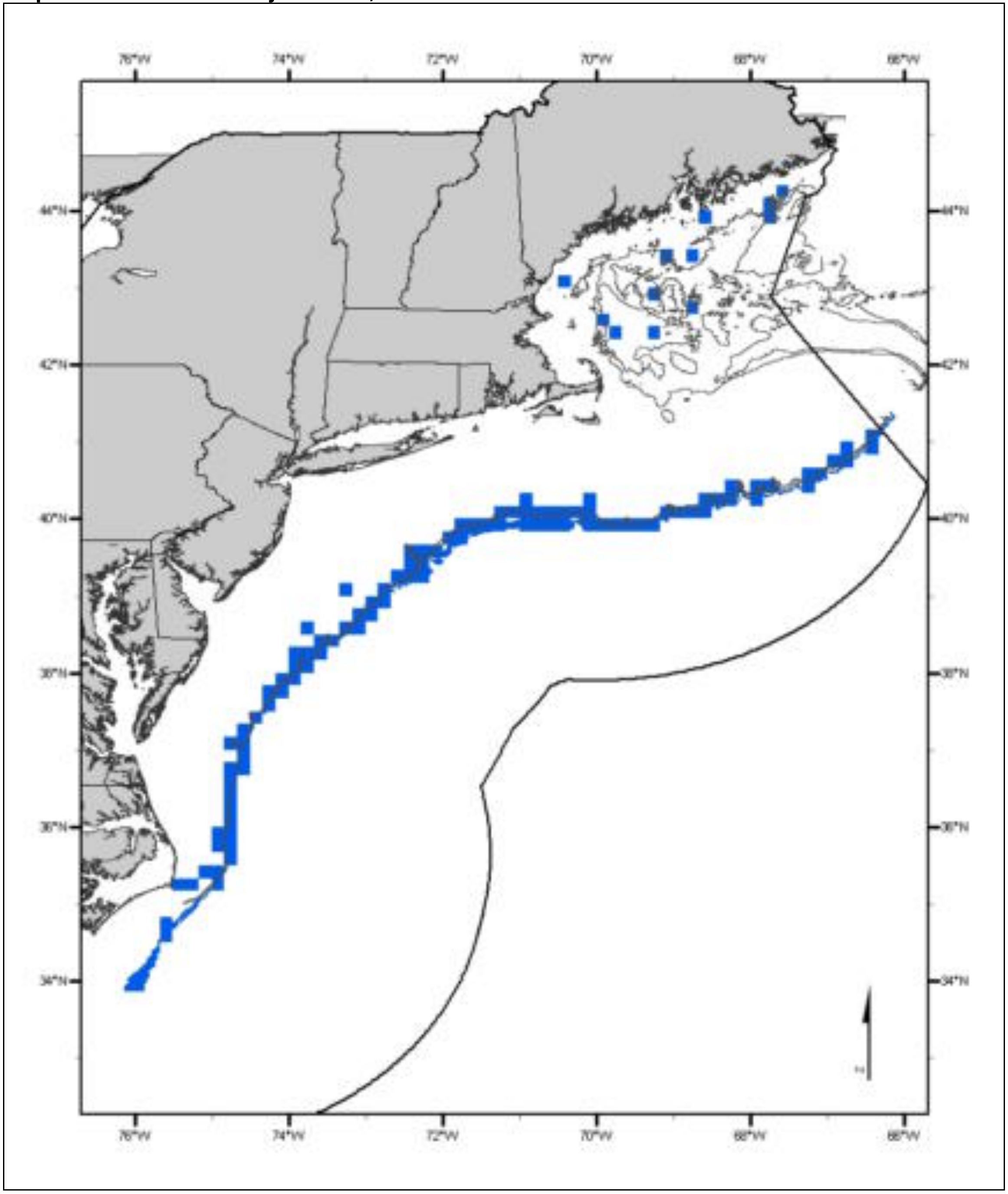
Eggs: No alternative EFH designation.

Larvae: No alternative EFH designation.

Juveniles: Pelagic and benthic habitats in inshore areas and on the outer continental shelf and slope in depths of 20 – 750 meters with mud and sand substrates, as depicted on Map 502. Other conditions that generally exist where benthic EFH for juvenile offshore hake is found are bottom water temperatures of 2.5 – 16.5°C and salinities of 31.5 – 36.5 ppt. Juvenile offshore hake migrate off the bottom at night and feed primarily on small fishes, euphausiids, and pandalid and pelagic shrimps.

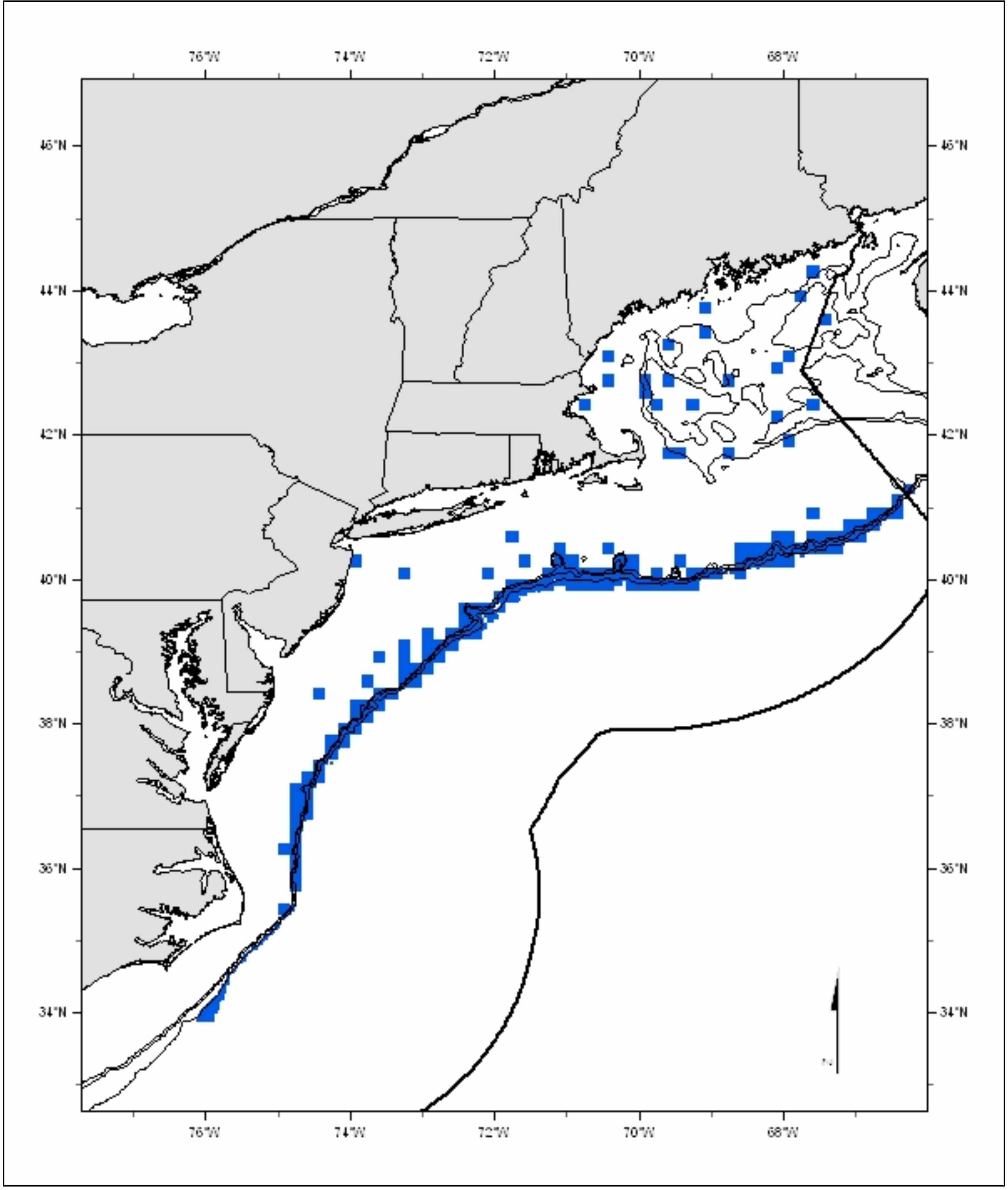
Adults: Pelagic and benthic habitats in inshore areas and on the outer continental shelf and slope in depths of 10 – 750 meters with mud and sand substrates, as depicted on Map 503. The following conditions generally exist where benthic EFH for adult offshore hake is found: bottom water temperatures of 3.5 – 12.5°C and salinities of 31.5 – 36.5 ppt. Spawning generally occurs between 330 and 550 meters. Adult offshore hake migrate off the bottom at night and feed primarily on fishes such as gadids, hakes (especially silver hake) and other pelagic species, squids, and euphausiids.

Map 502. Offshore hake juveniles, Alternative 4



The Alternative 4 EFH designation for juvenile offshore hake on the continental shelf includes all the ten minute squares where juveniles were caught during 1968-2005 in the fall and spring NMFS trawl survey. This alternative also includes the area beyond the continental shelf where juvenile or adult offshore hake are known or presumed to be present, based on their maximum depth and geographic range.

Map 503. Offshore hake adults, Alternative 4



The Alternative 4 EFH designation for adult offshore hake on the continental shelf includes all the ten minute squares where adults were caught during 1968-2005 in the fall and spring NMFS trawl survey. This alternative also includes the area beyond the continental shelf where juvenile or adult offshore hake are known or presumed to be present, based on their maximum depth and geographic range.

4.1.4.2.13 Pollock

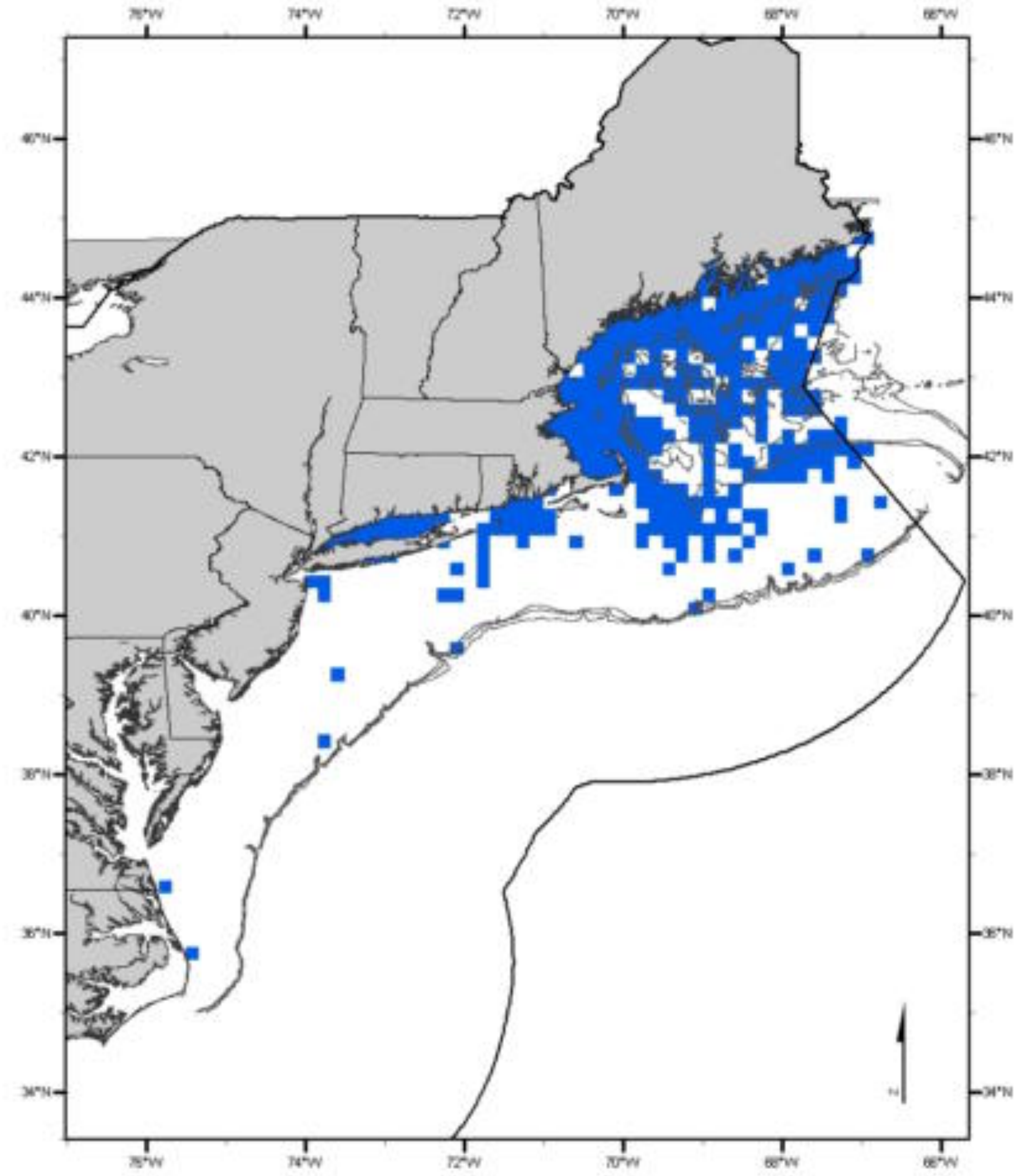
Eggs: Pelagic inshore and continental shelf habitats as depicted on Map 505. The following conditions generally exist where EFH for pollock eggs is found: bottom depths of 1 – 280 meters and water column temperatures of 2.5 – 17.5ºC.

Larvae: Pelagic inshore and continental shelf habitats as depicted on Map 505. The following conditions generally exist where EFH for pollock larvae is found: bottom depths of 1 – 280 meters and water column temperatures of 1.5 – 17.5ºC. Larval pollock feed on copepods.

Juveniles: Pelagic and benthic inshore and continental shelf habitats in depths of 1 – 400 meters with a wide variety of substrates as depicted on Map 504. Benthic EFH for juvenile pollock includes mud, sand, sand and mud, gravel, and rocky bottom with eelgrass and macroalgae. Other conditions that generally exist where benthic EFH is found are bottom temperatures of 0.5 – 17.5ºC, and, on the shelf, salinities between 28 and 35.5 ppt. EFH for juvenile pollock includes the intertidal zone. Juvenile pollock feed primarily on chaetognaths, amphipods, euphausiids, fishes (*e.g.*, herring), and squids.

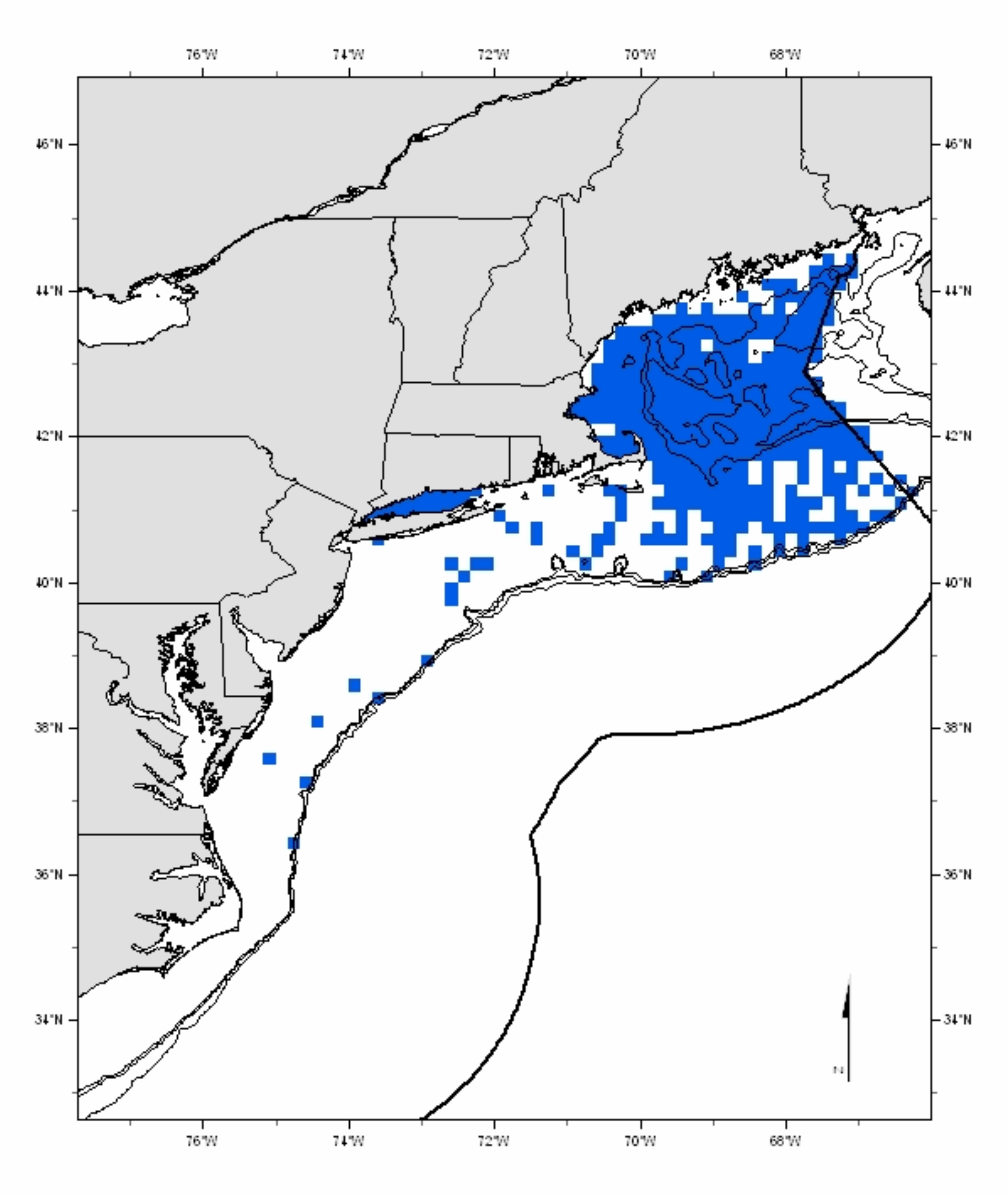
Adults: Pelagic and benthic inshore and continental shelf habitats in depths of 1 – 400 meters with a wide variety of substrates as depicted on Map 505. Benthic EFH for adult pollock includes mud, sand, sand and mud, gravel, mud and sand mixed with gravel, and rocky bottom. Other conditions that generally exist where benthic EFH is found are bottom water temperatures of 1.5 – 16.5ºC and salinities of 31.5 – 35.5 ppt. Pollock spawn over hard, stony or rocky bottom. Adult pollock feed primarily on euphausiids, fishes (e.g., herring, sand lance, and silver hake), and squids.

Map 504. Pollock juveniles, Alternative 4



The Alternative 4 EFH designation for pollock eggs on the continental shelf includes all the ten minute squares where adult pollock were caught during 1968-2005 in the fall and spring NMFS trawl survey. Inshore, this alternative includes ten minute squares where adult pollock were caught in state trawl surveys in more than 10% of the tows, as well as those bays and estuaries identified by the NOAA ELMR program where pollock eggs were "common" or "abundant."

Map 505. Pollock eggs, larvae and adults, Alternative 4



The Alternative 4 EFH designation for pollock eggs, larvae, and adults on the continental shelf includes all the ten minute squares where adult pollock were caught during 1968-2005 in the fall and spring NMFS trawl survey. Inshore, this alternative includes ten minute squares where adult pollock were caught in state trawl surveys in more than 10% of the tows, as well as those bays and estuaries identified by the NOAA ELMR program where pollock eggs, larvae, or adults were "common" or "abundant."

4.1.4.2.14 Red Hake

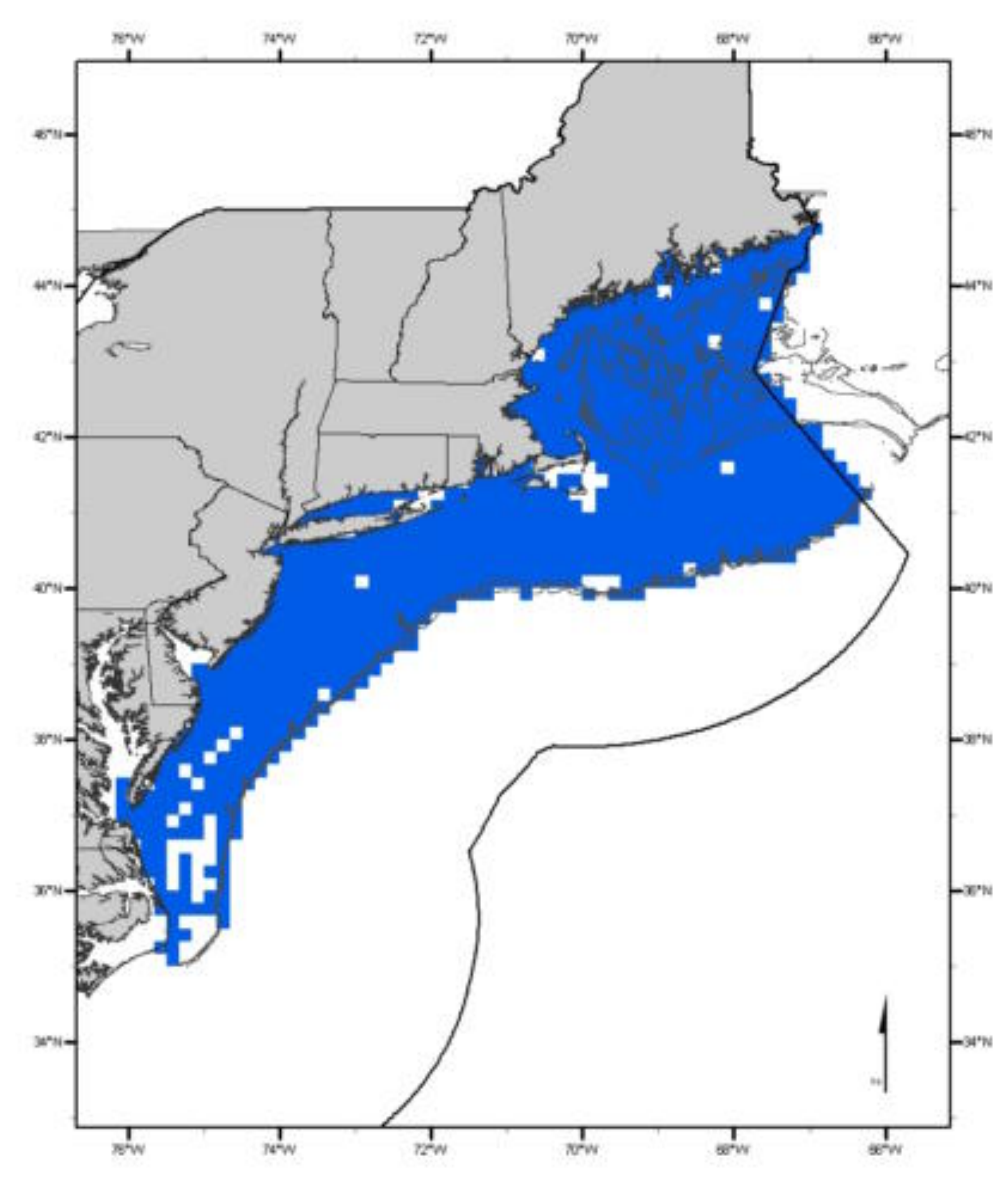
Eggs: Water column habitats in inshore areas and on the continental shelf and slope as depicted on Map 506. The following conditions generally exist where EFH for larval red hake is found: bottom depths of 1 – 1500 meters and water column temperatures of 7.5 – 23.5ºC.

Larvae: Water column habitats in inshore areas and on the continental shelf and slope as depicted on Map 506. The following conditions generally exist where EFH for larval red hake is found: bottom depths of 1 – 1500 meters and water column temperatures of 7.5 – 23.5ºC. Larval red hake feed on copepods and other micro–crustaceans.

Juveniles: Estuarine, coastal marine, and continental shelf and slope benthic habitats in depths of 1 – 500 meters, including the intertidal zone as depicted on Map 506. EFH for juvenile red hake includes mud, sand, and mud–sand substrates. EFH for YOY juveniles in coastal estuaries and embayments includes eelgrass and macroalgae. Shelter is critical for older juveniles (*e.g.*, shells, benthic epifauna, bottom depressions, and even inside live scallops). Other conditions that generally exist where EFH is found are bottom temperatures of 1.5 – 22.5ºC and salinities of 6.5 – 36.5 ppt. Once they settle to the bottom, juvenile red hake feed mostly on amphipods, a wide variety of decapods, fishes (*e.g.*, silver hake and sea robins), and polychaetes.

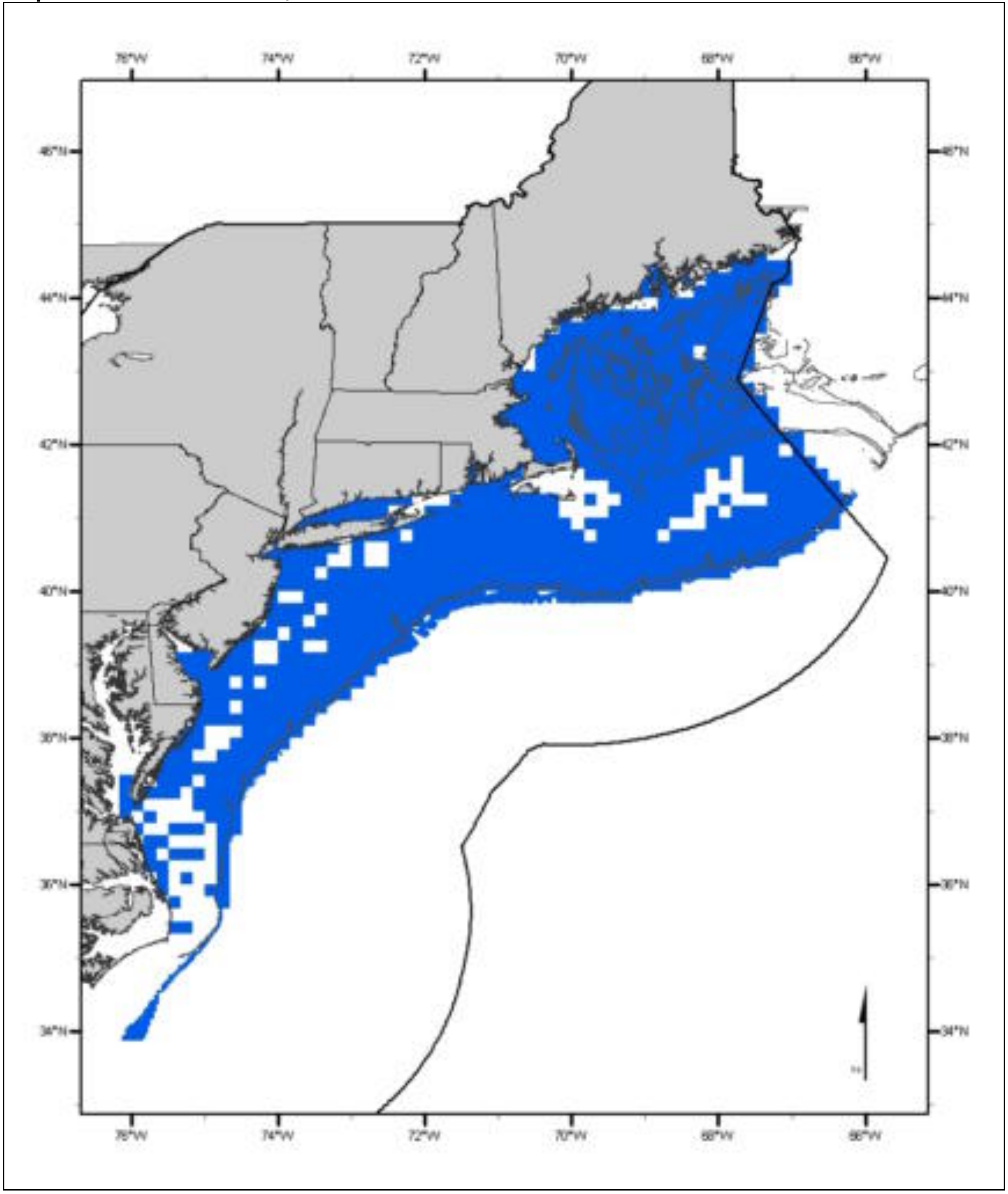
Adults: Coastal marine and continental shelf and slope benthic habitats in depths of 1 – 750 meters as depicted on Map 507. EFH for adult red hake includes mud, sand, and mud–sand substrates, but they are most common on soft sediments or shell beds. Other conditions that generally exist where EFH is found are bottom temperatures of 1.5 – 21.5ºC and salinities of 23 – 36.5 ppt. Spawning generally occurs between temperatures of 5 and 10ºC. Adult red hake feed primarily on amphipods, bivalve mollusks, squids, and fishes (*e.g.*, sand lance, silver hake, clupeids, and gadids).

Map 506. Red hake egg, larvae and juveniles, Alternative 4



The Alternative 4 EFH designation for red hake eggs, larvae, and juveniles on the continental shelf includes all the ten minute squares where juvenile monkfish were caught during 1968-2005 in the fall and spring NMFS trawl survey. Inshore, this alternative includes ten minute squares where juvenile red hake were caught in state trawl surveys in more than 10% of the tows, as well as those bays and estuaries identified by the NOAA ELMR program where red hake juveniles were "common" or "abundant."

Map 507. Red hake adults, Alternative 4



The Alternative 4 EFH designation for adult red hake on the continental shelf includes all the ten minute squares where adults were caught during 1968-2005 in the fall and spring NMFS trawl survey. Inshore, this alternative includes ten minute squares where adult red hake were caught in state trawl surveys in more than 10% of the tows, as well as those bays and estuaries identified by the NOAA ELMR program where red hake adults were "common" or "abundant." This alternative also includes the area beyond the continental shelf where adult red hake are known or presumed to be present, based on their maximum depth and geographic range.

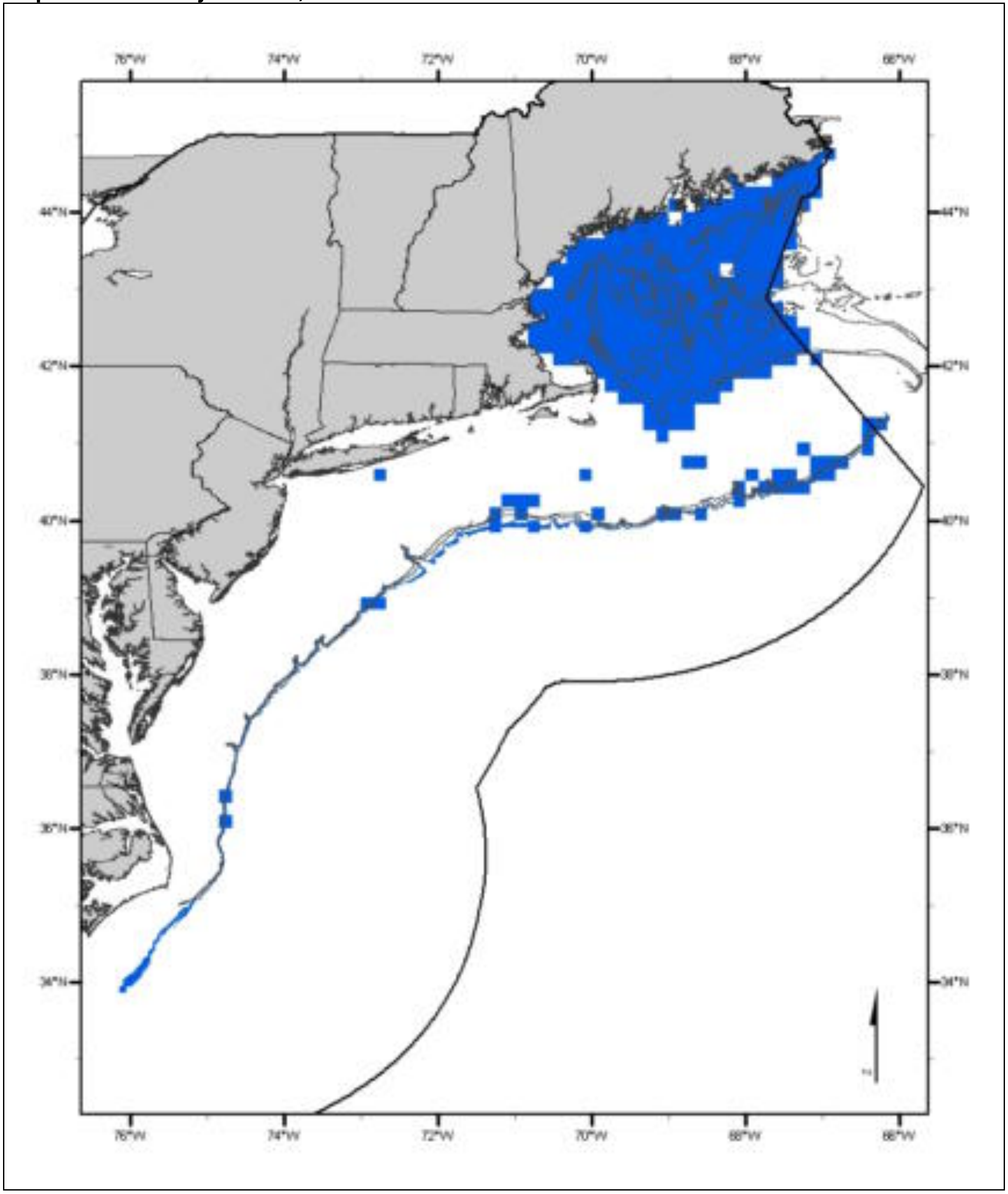
4.1.4.2.15 Redfish

Larvae: Water column habitats on the continental shelf and slope as depicted on Map 509. Conditions that generally exist where EFH for redfish larvae is found are: bottom depths of 40 – 2000 meters and water column temperatures of 2.5 – 9.5ºC. Larval redfish feed on copepods, euphausiids, and fish and invertebrate eggs.

Juveniles: Benthic habitats in inshore areas and on the continental shelf and slope in depths of 15 – 600 meters as depicted on Map 508. EFH for juvenile redfish includes a wide variety of bottom types, but is primarily found on muddy, rocky substrates. YOY are found on boulder reefs, while older juveniles are found in association with cerianthid anemones. Other conditions that generally exist where EFH is found are bottom temperatures of 1.5 – 19.5ºC and salinities of 30.5 – 36.5 ppt. Juvenile redfish feed primarily on larvaceans and crustaceans (copepods and euphausiids).

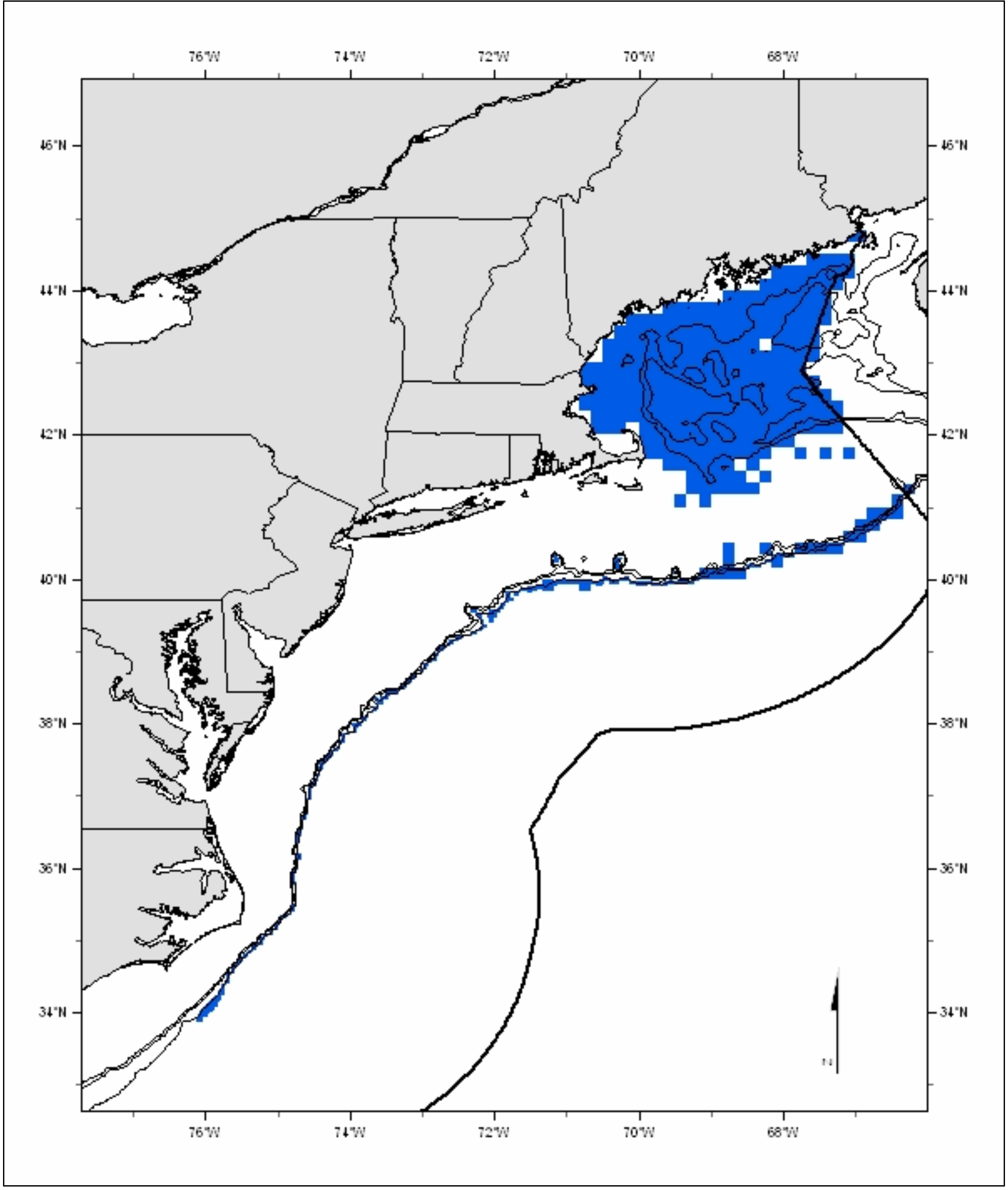
Adults: Benthic habitats in inshore areas and on the continental shelf and slope in depths of 20 – 600 meters as depicted on Map 509. EFH for adult redfish includes a wide variety of bottom types, but is primarily found on muddy, rocky substrates which support the growth of deep-water corals and other structure–forming sedentary epifauna such as sponges. Other conditions that generally exist where EFH is found are bottom temperatures of 0.5 – 21.5ºC and salinities of 31.5 – 35.5 ppt. Adult redfish feed primarily on euphausiids, amphipods, other crustaceans (*e.g.*, pandalid and sand shrimps), and fishes (*e.g.*, silver hake).

Map 508. Redfish juveniles, Alternative 4



The Alternative 4 EFH designation for juvenile redfish on the continental shelf includes all the ten minute squares where juveniles were caught during 1968-2005 in the fall and spring NMFS trawl survey. Inshore, this alternative includes ten minute squares where juvenile redfish were caught in state trawl surveys in more than 10% of the tows. This alternative also includes the area beyond the continental shelf where juvenile or adult redfish are known or presumed to be present, based on their maximum depth and geographic range.

Map 509. Redfish larvae and adults, Alternative 4



The Alternative 4 EFH designation for redfish larvae and adults on the continental shelf includes all the ten minute squares where adult redfish were caught during 1968-2005 in the fall and spring NMFS trawl survey. Inshore, this alternative includes ten minute squares where adult redfish were caught in state trawl surveys in more than 10% of the tows. This alternative also includes the area beyond the continental shelf where juvenile or adult redfish adults are known or presumed to be present, based on their maximum depth and geographic range.

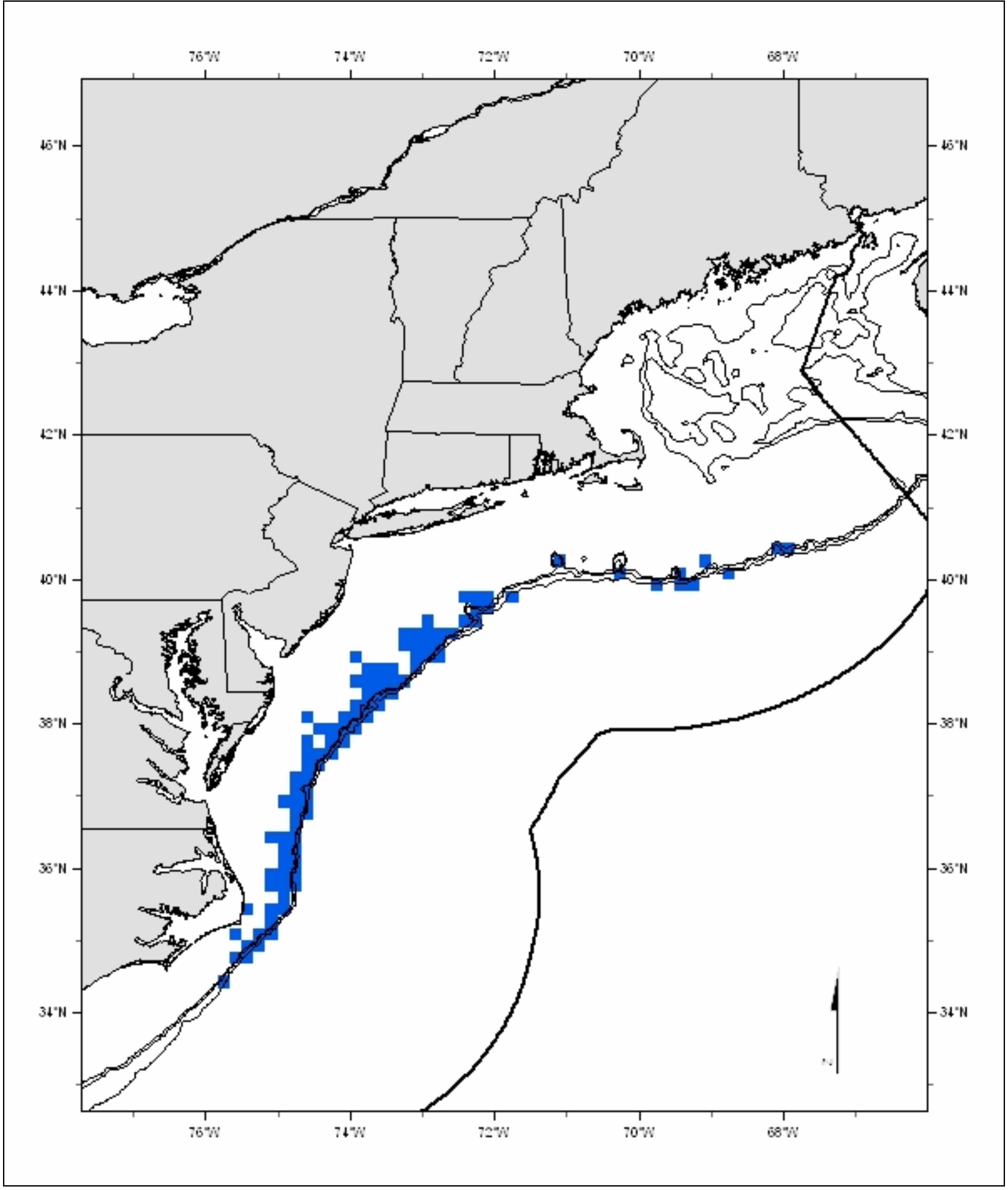
4.1.4.2.16 Rosette Skate

Eggs: There is no information available on the habitat associations or distribution of the egg stage for this species.

Larvae: No larval life stage exists for this species. Upon hatching, they are fully developed juveniles.

Juveniles and Adults: Continental shelf benthic habitats in depths of 10-500 meters with substrates composed of mud and sand, sometimes mixed with gravel as depicted on Map 510. Other conditions that generally exist where EFH for juvenile and adult rosette skate is found are bottom temperatures of 4.5 – 25.5ºC and salinities of 30.5 – 36.5 ppt. Primary prey organisms for juvenile and adult rosette skates are polychaetes and crustaceans (primarily amphipods).

Map 510. Rosette skate juveniles and adults, Alternative 4



The Alternative 4 EFH designation for juvenile and adult rosette skate on the continental shelf includes all the ten minute squares where juveniles were caught during 1968-2005 in the fall and spring NMFS trawl survey. This alternative also includes the area beyond the continental shelf where juveniles or adults are known or presumed to be present, based on their maximum depth and geographic range.

4.1.4.2.17 Silver Hake

Eggs: Water column habitats in inshore areas and on the continental shelf and slope as depicted on Map 511. Conditions that generally exist where EFH for silver hake eggs is found are: bottom depths of 1 – 1500 meters and water column temperatures of 4.5 – 26.5ºC.

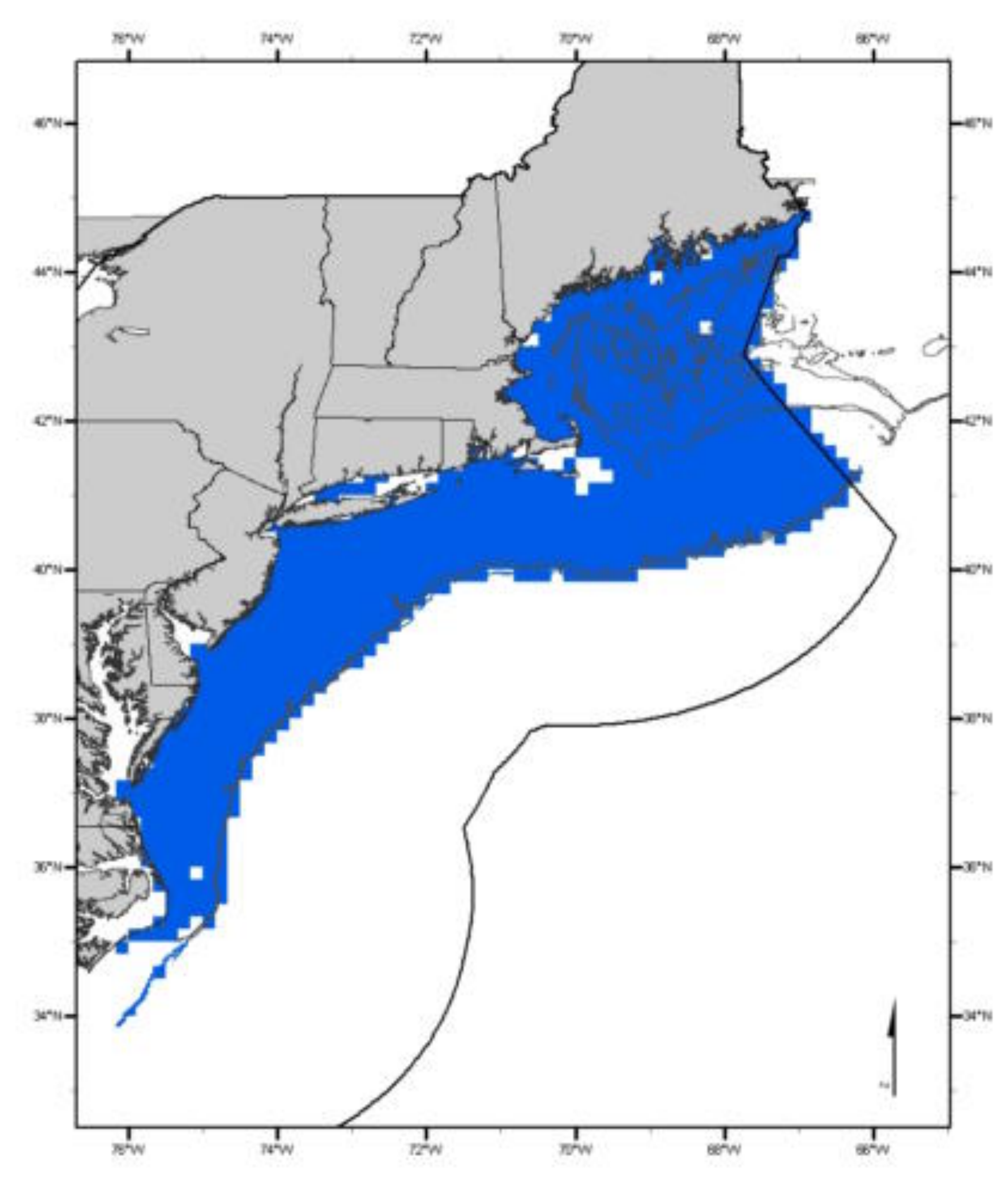
Larvae: Water column habitats in inshore areas and on the continental shelf and slope as depicted on Map 511. Conditions that generally exist where EFH for silver hake larvae is found are: bottom depths of 1 – 1500 meters and water column temperatures of 4.5 – 26.5ºC. Larval silver hake feed on copepods.

Juveniles: Pelagic and benthic habitats in inshore areas and on the continental shelf and slope in depths of 5 – 400 meters as depicted on Map 511. Benthic EFH for juvenile silver hake includes substrates composed of mud, sand, mixtures of sand and mud, and/or shell fragments. They are sometimes found in bottom depressions or in association with amphipod tubes. Other conditions that generally exist where benthic EFH is found are bottom temperatures of 0 – 22.5ºC; and salinities of 13.5 – 36 ppt. Juvenile silver hake migrate off the bottom at night and feed primarily on euphausiids, decapod shrimps, and other crustaceans.

Adults: Pelagic and benthic habitats in inshore areas and on the continental shelf and slope in depths of 5 – 500 meters as depicted on Map 512. Benthic EFH for adult silver hake includes substrates composed of mud, sand, mixtures of sand and mud, and/or shell fragments. They are sometimes found in bottom depressions. Other conditions that generally exist where benthic EFH for juvenile silver hake is found are bottom temperatures of 1 – 18ºC and salinities of 24 – 36.5 ppt. Adult silver hake migrate off the bottom at night and feed primarily on a variety of pelagic fish species, euphausiids, decapod shrimps, and other crustaceans.

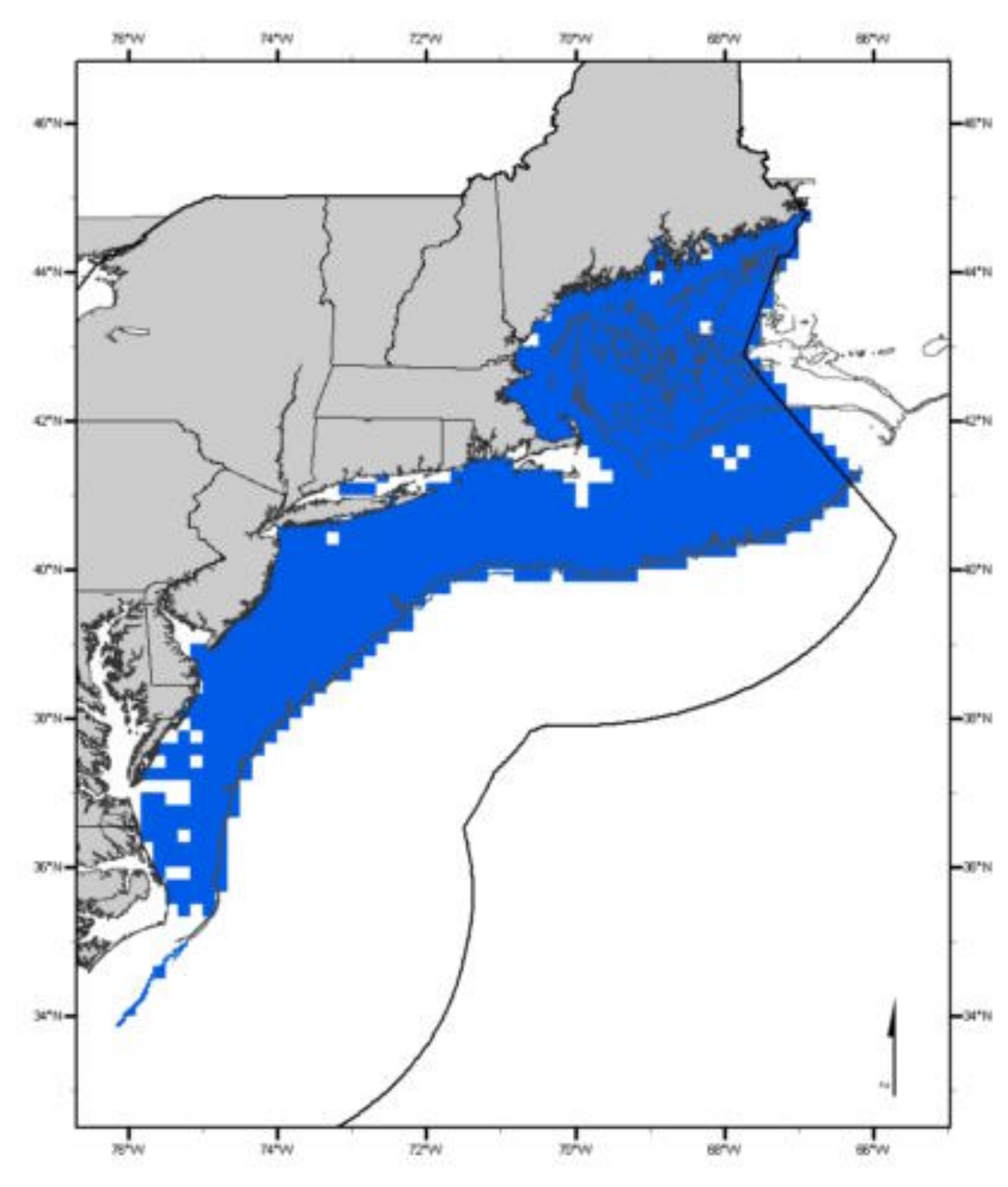
** Subject to Council approval.*

Map 511. Silver hake eggs, larvae and juveniles, Alternative 4



The Alternative 4 EFH designation for silver hake eggs, larvae, and juveniles on the continental shelf includes all the ten minute squares where juvenile silver hake were caught during 1968-2005 in the fall and spring NMFS trawl survey. Inshore, this alternative includes ten minute squares where juvenile silver hake were caught in state trawl surveys in more than 10% of the tows, as well as those bays and estuaries identified by the NOAA ELMR program where silver hake eggs or larvae were "common" or "abundant."

Map 512. Silver hake adults, Alternative 4



The Alternative 4 EFH designation for adult silver hake on the continental shelf includes all the ten minute squares where adults were caught during 1968-2005 in the fall and spring NMFS trawl survey. Inshore, this alternative includes ten minute squares where adult silver hake were caught in state trawl surveys in more than 10% of the tows, as well as those bays and estuaries identified by the NOAA ELMR program where silver hake adults were "common" or "abundant." This alternative also includes the area beyond the continental shelf where adult silver hake are known or presumed to be present, based on their maximum depth and geographic range.

4.1.4.2.18 Smooth Skate

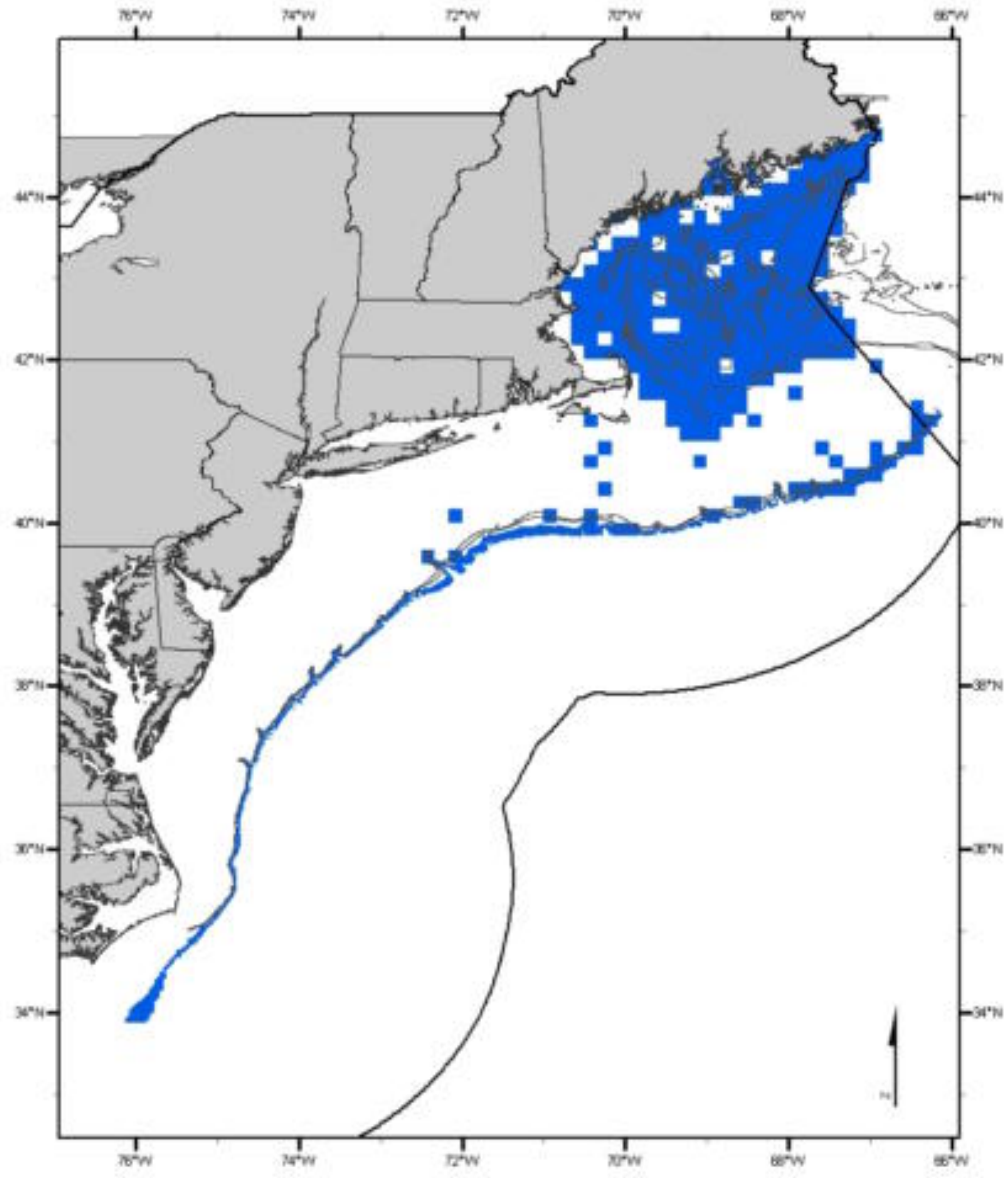
Eggs: There is no information available on the habitat associations or distribution of the egg stage for this species.

Larvae: No larval life stage exists for this species. Upon hatching, they are fully developed juveniles.

Juveniles: Benthic habitats in inshore areas and on the continental shelf and slope in depths of 12 – 900 meters as depicted on Map 513. EFH for juvenile smooth skates occurs mostly on soft mud in deeper areas, but also on sand, broken shells, gravel, and pebbles on offshore banks. Other conditions that generally exist where EFH is found are bottom temperatures of 1.5 – 16.5ºC and salinities of 31.5 – 35.5 ppt. Juvenile smooth skates feed on epifaunal crustaceans, primarily decapods (e.g., pandalid shrimp, hermit crabs, sand shrimp), and euphausiids, with some mysids, amphipods, and isopods.

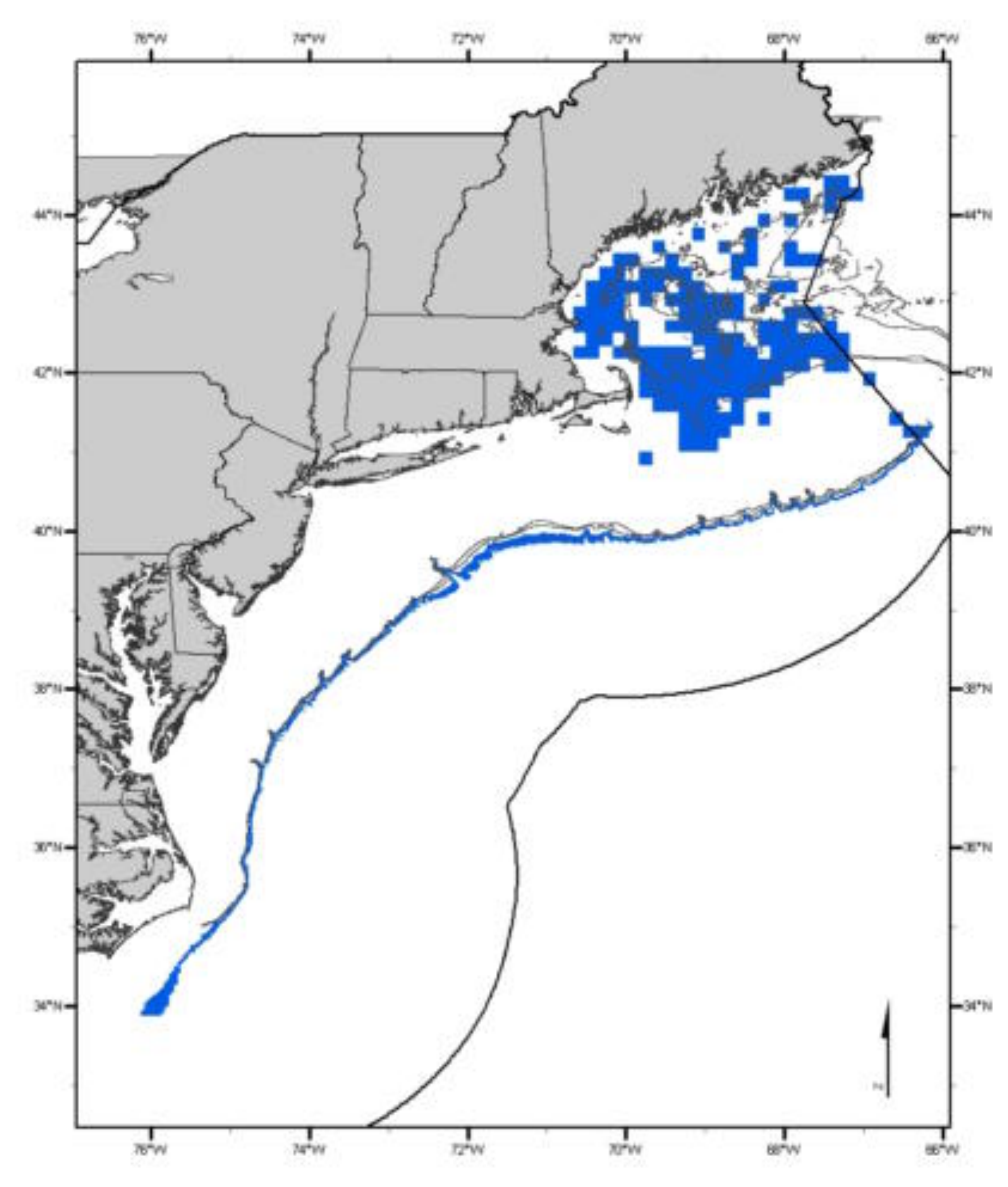
Adults: Benthic habitats in inshore areas and on the outer continental shelf and slope in depths of 12 – 900 meters as depicted on Map 514. EFH for adult smooth skates includes a wider variety of substrates than for juveniles, including mud, sand and mud, sand, and sand and mud mixed with shells, gravel and pebbles. Other conditions that generally exist where EFH is found are bottom temperatures of 2.5 – 21.5ºC and salinities of 31.5 – 35.5 ppt. Adult smooth skates have similar feeding habits as juveniles, but consume more decapods, euphausiids and fishes (*e.g.*, silver hake and sand lance), and fewer mysids and amphipods.

Map 513. Smooth skate juveniles, Alternative 4



The Alternative 4 EFH designation for juvenile smooth skate on the continental shelf includes all the ten minute squares where juveniles were caught during 1968-2005 in the fall and spring NMFS trawl survey. Inshore, this alternative includes ten minute squares where juvenile smooth skate were caught in state trawl surveys in more than 10% of the tows. This alternative also includes the area beyond the continental shelf where juvenile smooth skate are known or presumed to be present, based on their maximum depth and geographic range.

Map 514. Smooth skate adults, Alternative 4



The Alternative 4 EFH designation for adult smooth skate on the continental shelf includes all the ten minute squares where adults were caught during 1968-2005 in the fall and spring NMFS trawl survey. Inshore, this alternative includes ten minute squares where adult smooth skate were caught in state trawl surveys in more than 10% of the tows. This alternative also includes the area beyond the continental shelf where adult smooth skate are known or presumed to be present, based on their maximum depth and geographic range.

4.1.4.2.19 Thorny Skate

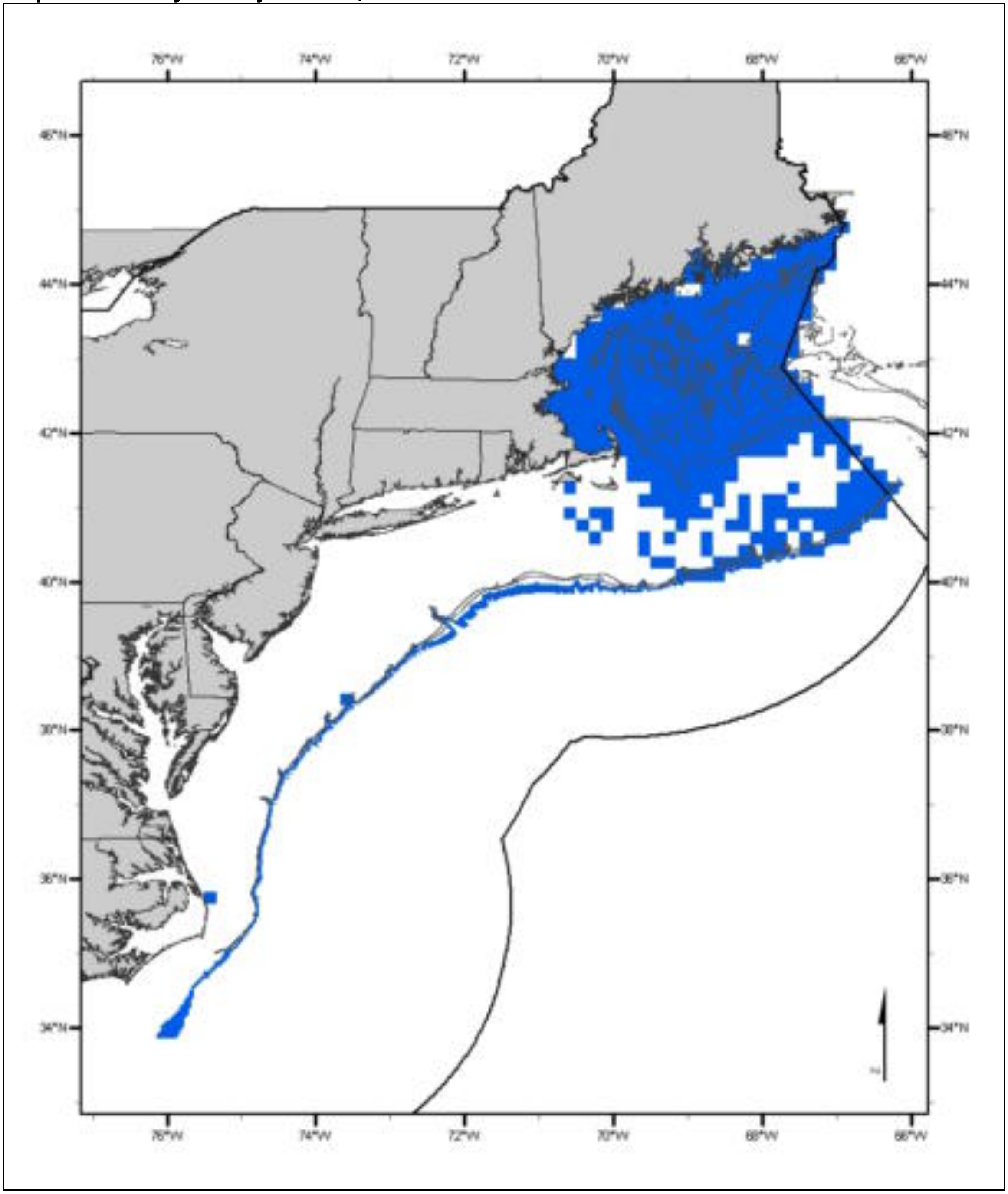
Eggs: There is no information available on the habitat associations or distribution of the egg stage for this species.

Larvae: No larval life stage exists for this species. Upon hatching, they are fully developed juveniles.

Juveniles: Benthic habitats in inshore areas and on the continental shelf and slope in depths of 10 – 900 meters as depicted on Map 515. EFH for juvenile thorny skate includes a wide range of bottom types from soft mud to gravel, broken shells, and pebbles. Other conditions that generally exist where EFH is found are bottom temperatures of 0.5 – 25.5ºC and salinities of 30.5 – 36.5 ppt. Juvenile thorny skates feed on polychaetes, a variety of crustaceans, and a variety of fishes (*e.g.*, sand lance, wrymouth, and silver hake).

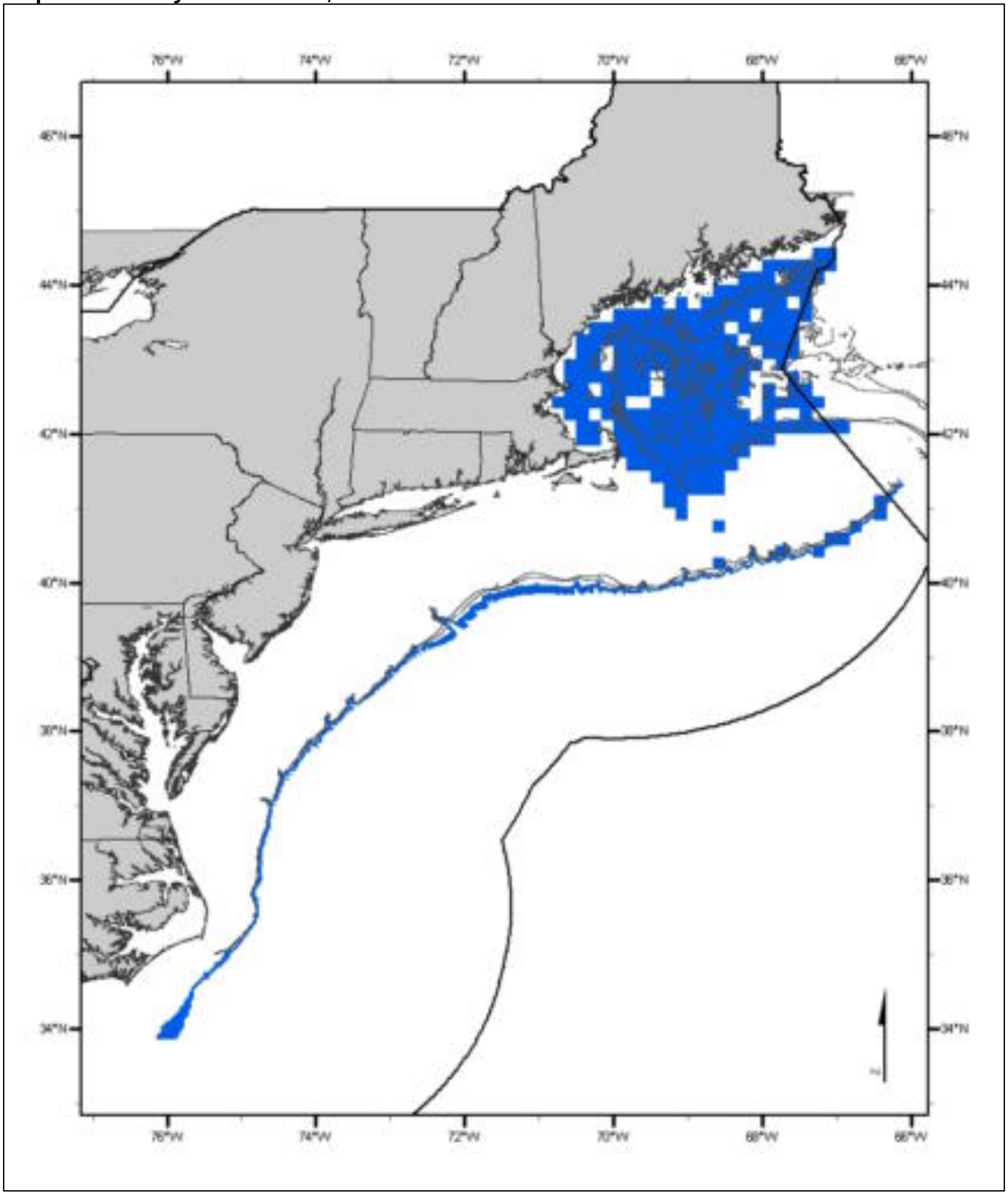
Adults: Benthic habitats in inshore areas and on the continental shelf and slope in depths of 30 – 900 meters as depicted on Map 516. EFH for adult thorny skate includes a wide range of bottom types from soft mud to gravel, broken shells, and pebbles, but they are found primarily on mud. Other conditions that generally exist where EFH is found are bottom temperatures of 1.5 – 14.5ºC and salinities of 31.5 – 35.5 ppt. Adult thorny skates feed on polychaetes, crustaceans (*e.g.*, pandalid shrimps, crabs, and euphausiids), fishes (*e.g.*, herring, wrymouth, and hagfish), and squids.

Map 515. Thorny skate juveniles, Alternative 4



The Alternative 4 EFH designation for juvenile thorny skate on the continental shelf includes all the ten minute squares where juveniles were caught during 1968-2005 in the fall and spring NMFS trawl survey. Inshore, this alternative includes ten minute squares where juvenile thorny skate were caught in state trawl surveys in more than 10% of the tows. This alternative also includes the area beyond the continental shelf where juvenile thorny skate are known or presumed to be present, based on their maximum depth and geographic range.

Map 516. Thorny skate adults, Alternative 4



The Alternative 4 EFH designation for adult thorny skate on the continental shelf includes all the ten minute squares where adults were caught during 1968-2005 in the fall and spring NMFS trawl survey. Inshore, this alternative includes ten minute squares where adult thorny skate were caught in state trawl surveys in more than 10% of the tows. This alternative also includes the area beyond the continental shelf where adult thorny skate are known or presumed to be present, based on their maximum depth and geographic range.

4.1.4.2.20 White Hake

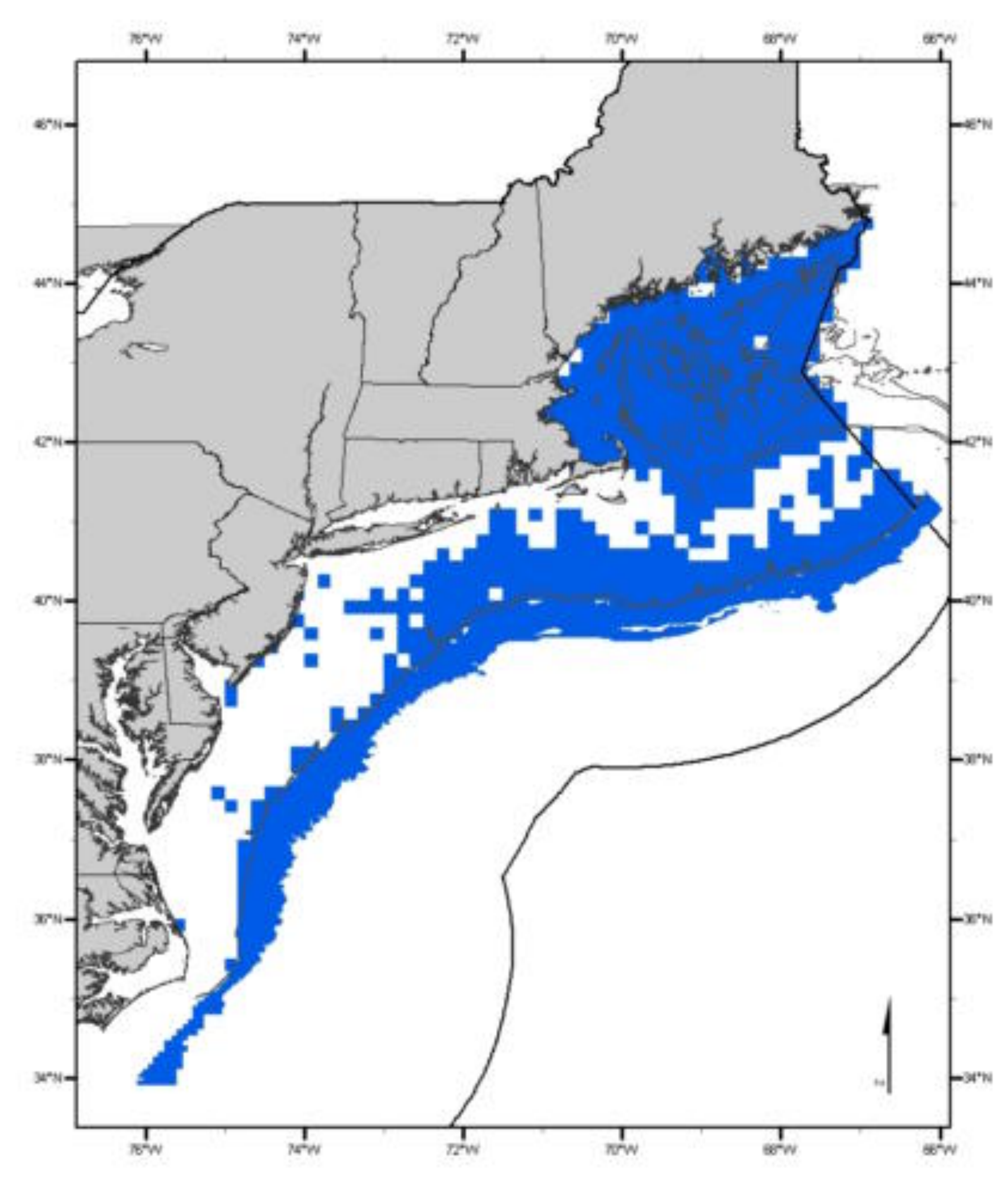
Eggs: Water column habitats on the continental shelf and slope in depths of 100 – 2,250 meters as depicted on Map 517.

Larvae: Water column habitats on the continental shelf and slope in depths of 100 – 2,250 meters as depicted on Map 517.

Juveniles: Estuarine, coastal marine, and continental shelf benthic habitats in depths of 1 – 500 meters with substrates composed of mud and/or eel grass, as depicted on Map 517. Other conditions that generally exist where EFH for juvenile white hake is found are bottom temperatures of 0.5 – 21ºC and salinities of 13.4 – 35.5 ppt. EFH for juvenile white hake includes intertidal habitats. Once they settle to the bottom, juvenile white hakes feed primarily on euphausiids and pandalid, sand, and other shrimps, and also on amphipods, copepods, fishes (*e.g.*, silver hake, white hake, and gadids), and squids.

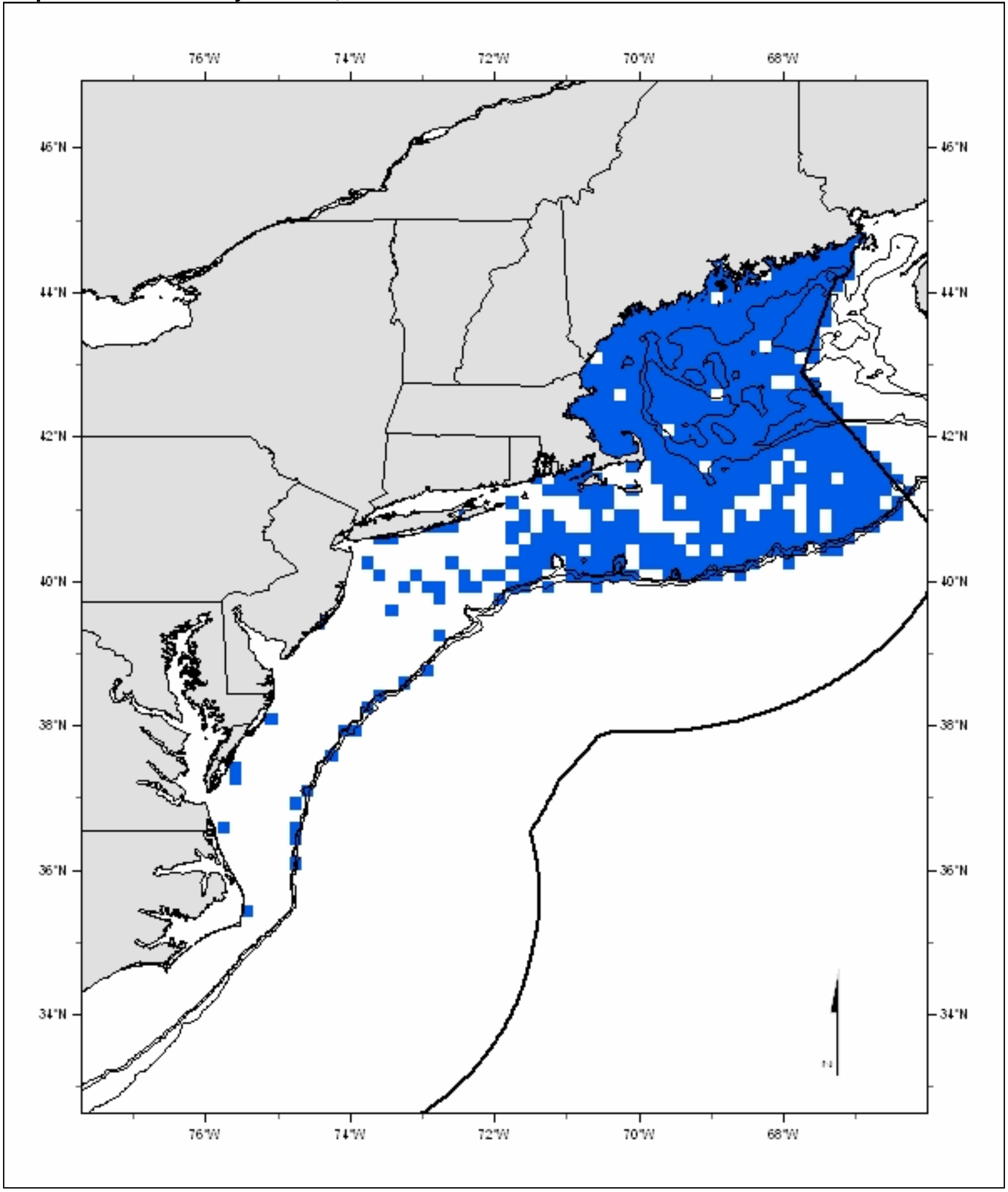
Adults: Benthic habitats on the continental shelf and slope in depths of 100 – 2,250 meters with substrates composed of mud and/or sand–mud mixtures, as depicted on Map 517. Other conditions that generally exist where EFH for adult white hake is found are bottom temperatures of 1.5 – 21.5ºC and salinities of 28.5 – 36.5 ppt. Spawning takes place primarily in deep water on the continental slope. Adult white hakes feed primarily on fishes (*e.g.*, silver hake, other hakes, gadids, Atlantic herring and other clupeids, argentines), squid (*Illex* sp.), and also on squids, pandalid shrimps, and euphausiids.

Map 517. White hake egg, larvae and adults, Alternative 4



The Alternative 4 EFH designation for white hake eggs, larvae, and adults on the continental shelf includes all the ten minute squares where adult white hake were caught during 1968-2005 in the fall and spring NMFS trawl survey. Inshore, this alternative includes ten minute squares where adult white hake were caught in state trawl surveys in more than 10% of the tows, as well as those bays and estuaries identified by the NOAA ELMR program where white hake eggs or larvae were "common" or "abundant." This alternative also includes the area beyond the continental shelf where adult white hake are known or presumed to be present, based on their maximum depth and geographic range.

Map 518. White hake juveniles, Alternative 4



The Alternative 4 EFH designation for white hake juveniles on the continental shelf includes all the ten minute squares where juvenile white hake were caught during 1968-2005 in the fall and spring NMFS trawl survey. Inshore, this alternative includes ten minute squares where juvenile white hake were caught in state trawl surveys in more than 10% of the tows, as well as those bays and estuaries identified by the NOAA ELMR program where white hake juveniles were "common" or "abundant."

4.1.4.2.21 Windowpane Flounder

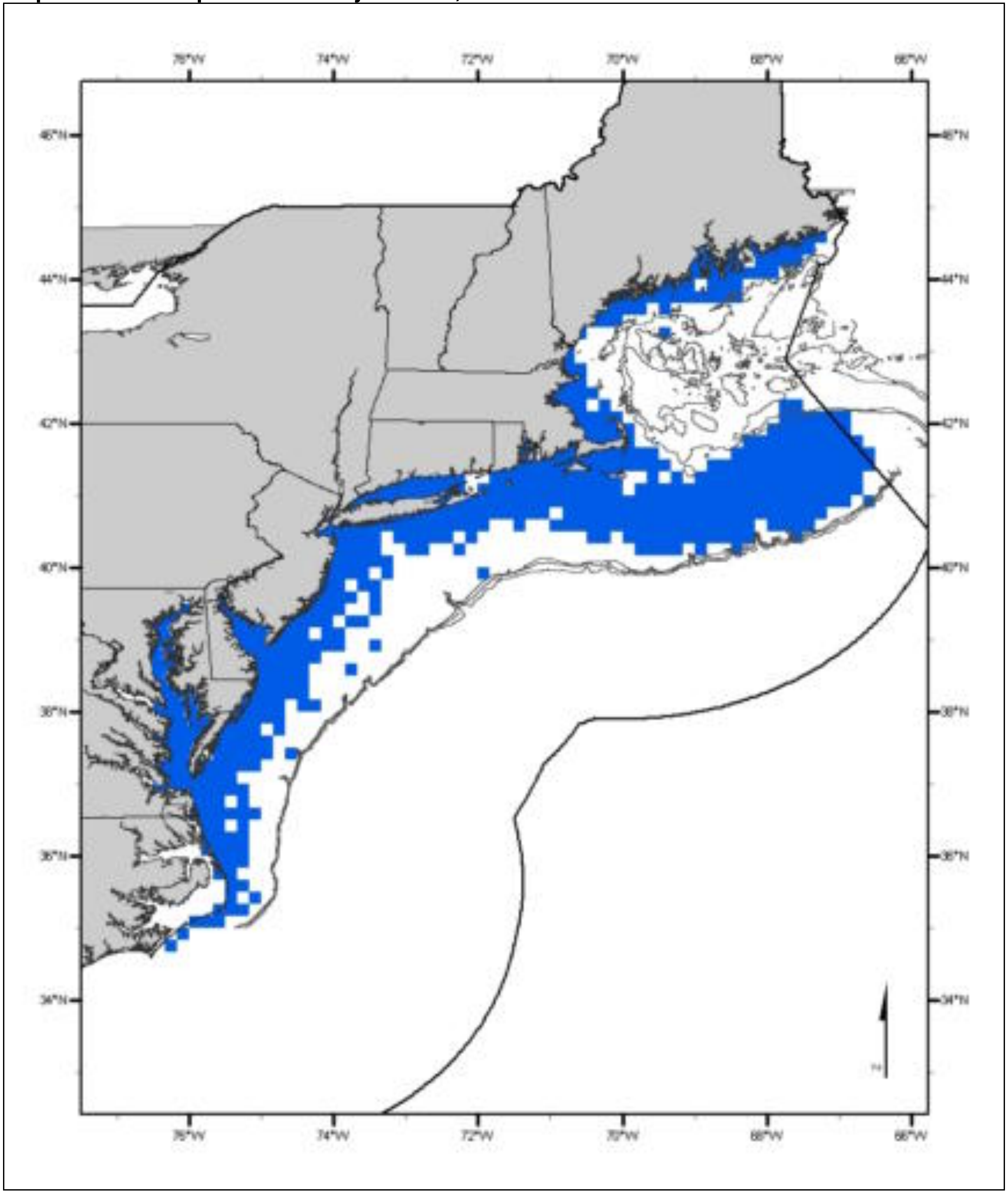
Eggs: No alternative EFH designation.

Larvae: No alternative EFH designation.

Juveniles: Sandy benthic habitats in estuarine, coastal marine, and continental shelf areas in depths of 1 – 300 meters, including the intertidal zone as depicted on Map 519. Other conditions that generally exist where EFH for juvenile windowpane is found are bottom temperatures of 0 – 30ºC and salinities of 1 – 36 ppt. Juvenile windowpane flounders feed primarily on mysids, but also on polychaetes, amphipods, decapod larvae, and small fishes (*e.g.*, sand lances).

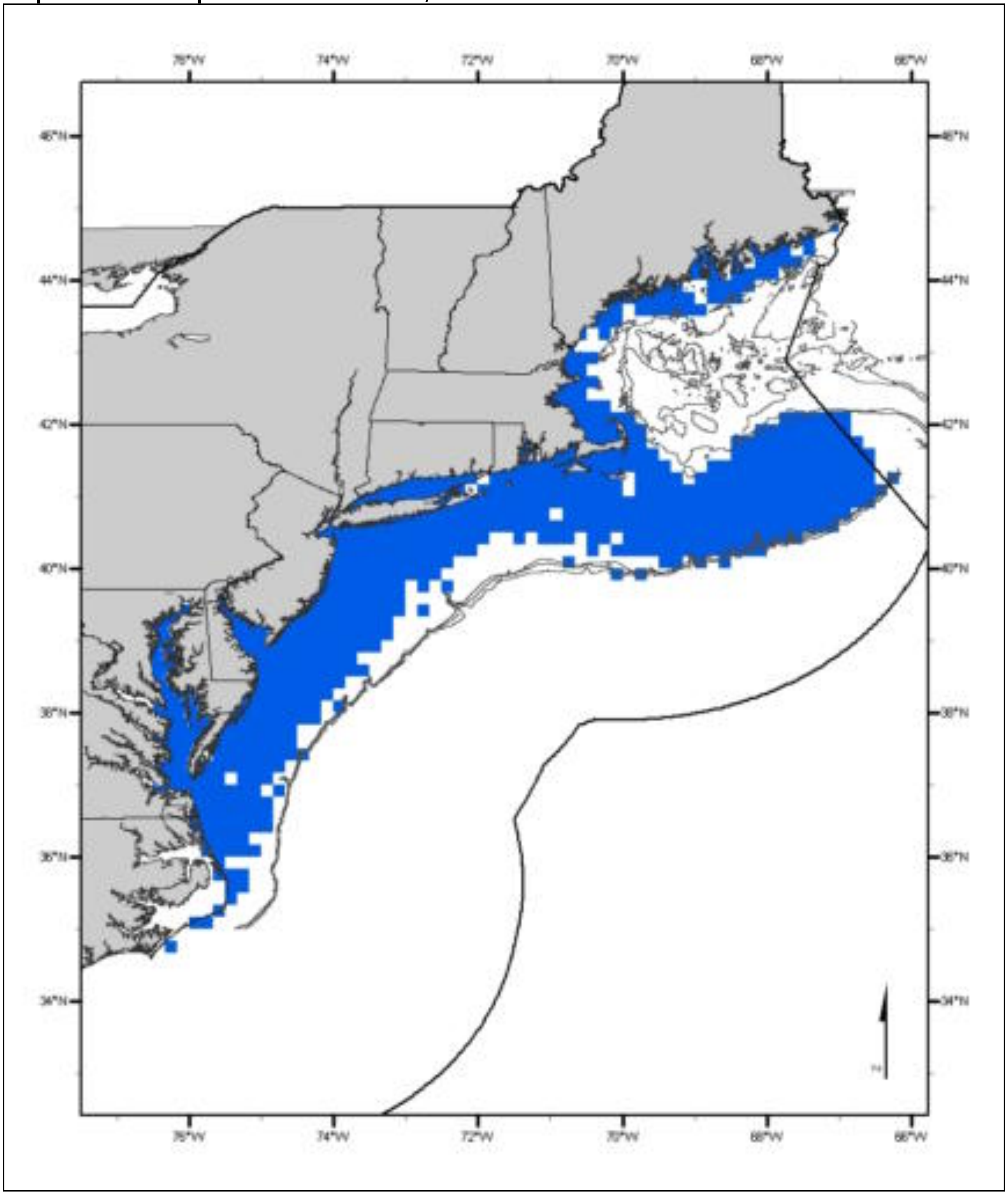
Adults: Sandy benthic habitats in estuarine, coastal marine, and continental shelf areas in depths of 1 – 400 meters, including the intertidal zone as depicted on Map 520. Other conditions that generally exist where EFH for adult windowpane is found are bottom temperatures of 0 – 25ºC and salinities of 1 – 36 ppt. Spawning occurs between 6 and 21ºC, and mostly between 8.5 and 13.5ºC. Adult windowpane flounders feed primarily on small crustaceans (amphipods, mysids, and sand shrimps) and fishes (*e.g.*, silver hakes, cusks, sand lances, gobies, and bay anchovies).

Map 519. Windowpane flounder juveniles, Alternative 4



The Alternative 4 EFH designation for windowpane juveniles on the continental shelf includes all the ten minute squares where juvenile windowpane were caught during 1968-2005 in the fall and spring NMFS trawl survey. Inshore, this alternative includes ten minute squares where juvenile windowpane were caught in state trawl surveys in more than 10% of the tows, as well as those bays and estuaries identified by the NOAA ELMR program where windowpane juveniles were "common" or "abundant."

Map 520. Windowpane flounder adults, Alternative 4



The Alternative 4 EFH designation for windowpane adults on the continental shelf includes all the ten minute squares where adult windowpane were caught during 1968-2005 in the fall and spring NMFS trawl survey. Inshore, this alternative includes ten minute squares where adult windowpane were caught in state trawl surveys in more than 10% of the tows, as well as those bays and estuaries identified by the NOAA ELMR program where windowpane adults were "common" or "abundant."

4.1.4.2.22 Winter Flounder

Eggs: Inshore estuarine and coastal marine benthic habitats in depths of 0.3 to 20 meters with substrates of mud, sand, muddy sand, gravel and/or submerged aquatic vegetation, extending from the Bay of Fundy to Delaware Bay, and benthic continental shelf habitats on Georges Bank and Nantucket Shoals in depths up to 72 meters with mud, sand, muddy sand, and/or gravel substrates, as depicted on Map 522. In inshore waters, winter flounder eggs have been collected in depths between 0.3 and 8 meters and are believed to occur to at least 20 meters; spawning is reported at a maximum depth of 72 meters on Georges Bank. Other conditions that generally exist where EFH for winter flounder eggs is found include bottom water temperatures of 1 – 10ºC and salinities of 10 – 32 ppt.

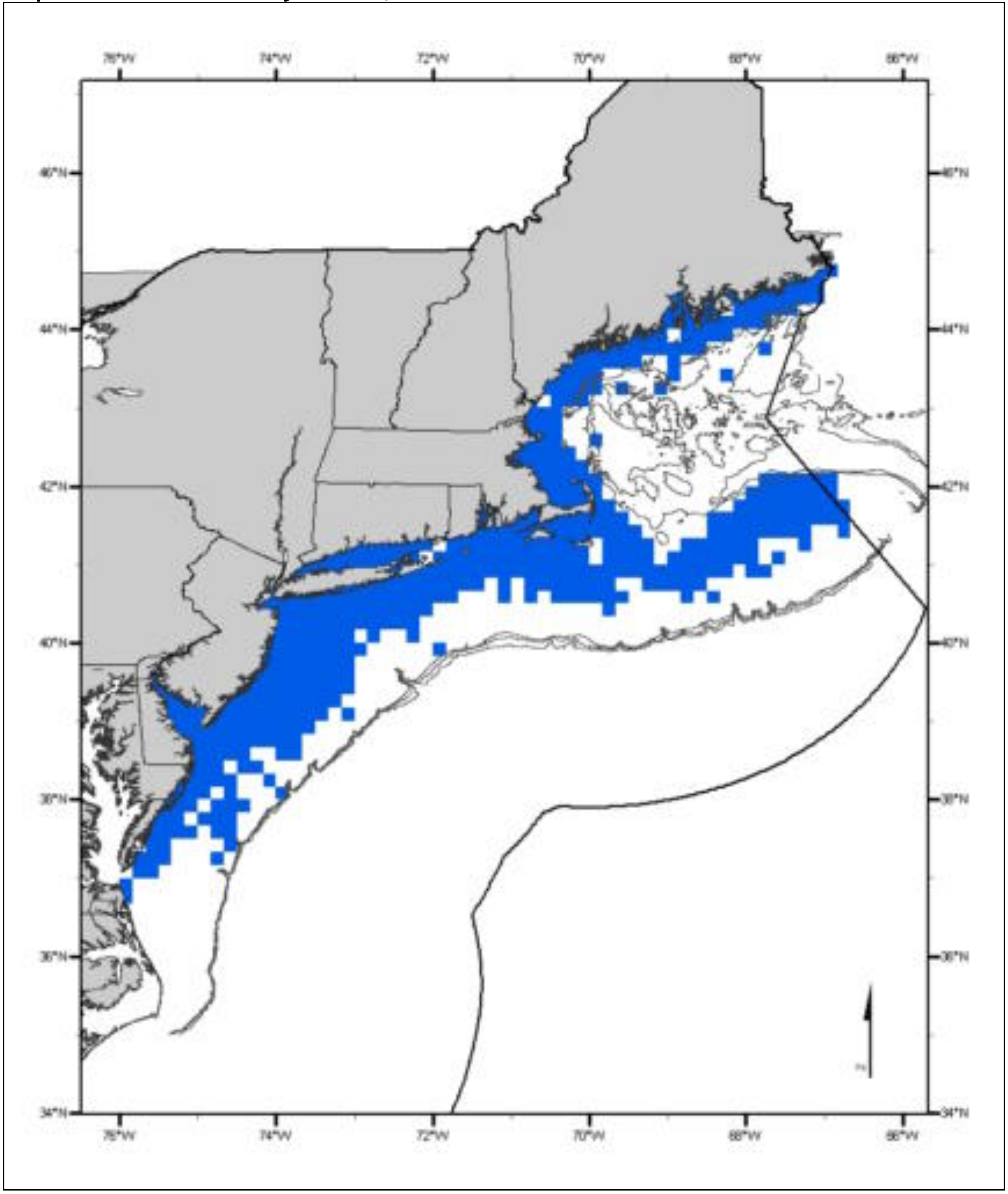
Larvae: Estuarine, coastal marine, and continental shelf water column habitats as depicted on Map 522. The following conditions generally exist where EFH for winter flounder larvae is found: bottom depths of 2-72 meters; water column temperatures of 2 – 15ºC inshore and 5.5 – 10.5ºC on the shelf; and salinities of 4 – 30 inshore and up to 33 ppt on the shelf. Primary prey organisms are copepods, invertebrate eggs, and polychaetes.

Juveniles: Estuarine, coastal marine, and continental shelf benthic habitats in depths of 0.5 – 300 meters with a variety of substrate types, as depicted on

Map 521. Juvenile winter flounder are found on vegetated and un-vegetated muddy and sandy sediments and in bottom debris; YOY juveniles inhabit eelgrass and macroalgae and are also found in marsh creeks. EFH includes intertidal and sub-tidal benthic habitats. Other conditions that generally exist where EFH for juvenile winter flounder is found are: bottom temperatures of 0 – 32ºC inshore and 0.5 – 22.5ºC on the shelf; and salinities of 3 – 40 ppt inshore and 28.5 – 34.5 on the shelf. Primary prey organisms are polychaetes, amphipods, and other crustaceans. They also feed on small bivalves mollusks, including bivalve siphons.

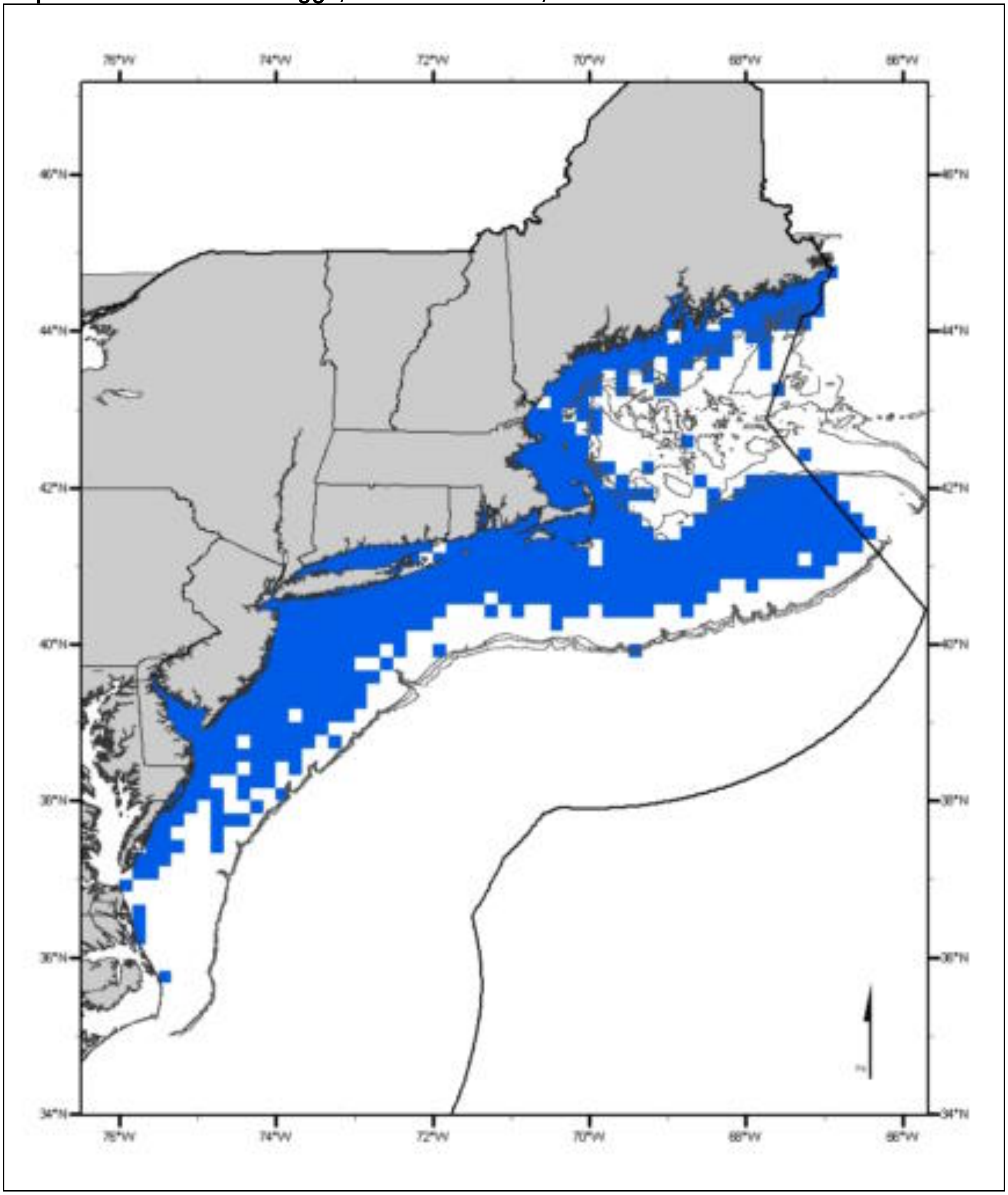
Adults: Estuarine, coastal marine, and continental shelf and slope benthic habitats in depths of 2-500 meters, as depicted on Map 522. EFH for adult winter flounder on the continental shelf occurs on sandy substrates. In inshore areas, EFH is composed of a variety of substrates (see eggs). Other conditions that generally exist where EFH for adult winter flounder is found are: bottom temperatures of 0 – 24ºC inshore and on the shelf; and salinities of 8 – 36 ppt inshore and 15 – 34.5 on the shelf. Spawning occurs inshore in depths as shallow as one meter or less and on Nantucket Shoals and Georges Bank in depths up to 72 meters; spawning may also occur on the shelf in southern New England and the Mid–Atlantic region. Primary prey organisms are polychaetes, amphipods and other crustaceans, planktonic hydroids, anemones (e.g., *Cerianthus* spp.), and bivalve mollusks.

Map 521. Winter flounder juveniles, Alternative 4



The Alternative 4 EFH designation for winter flounder juveniles on the continental shelf includes all the ten minute squares where adult winter flounder were caught during 1968-2005 in the fall and spring NMFS trawl survey. Inshore, this alternative includes ten minute squares where adult winter flounder were caught in state trawl surveys in more than 10% of the tows, as well as those bays and estuaries identified by the NOAA ELMR program where winter flounder adults were "common" or "abundant."

Map 522. Winter flounder eggs, larvae and adults, Alternative 4



The Alternative 4 EFH designation for winter flounder eggs, larvae, and adults on the continental shelf includes all the ten minute squares where adult winter flounder were caught during 1968-2005 in the fall and spring NMFS trawl survey. Inshore, this alternative includes ten minute squares where adult winter flounder were caught in state trawl surveys in more than 10% of the tows, as well as those bays and estuaries identified by the NOAA ELMR program where winter flounder eggs or larvae were "common" or "abundant."

4.1.4.2.23 Winter Skate

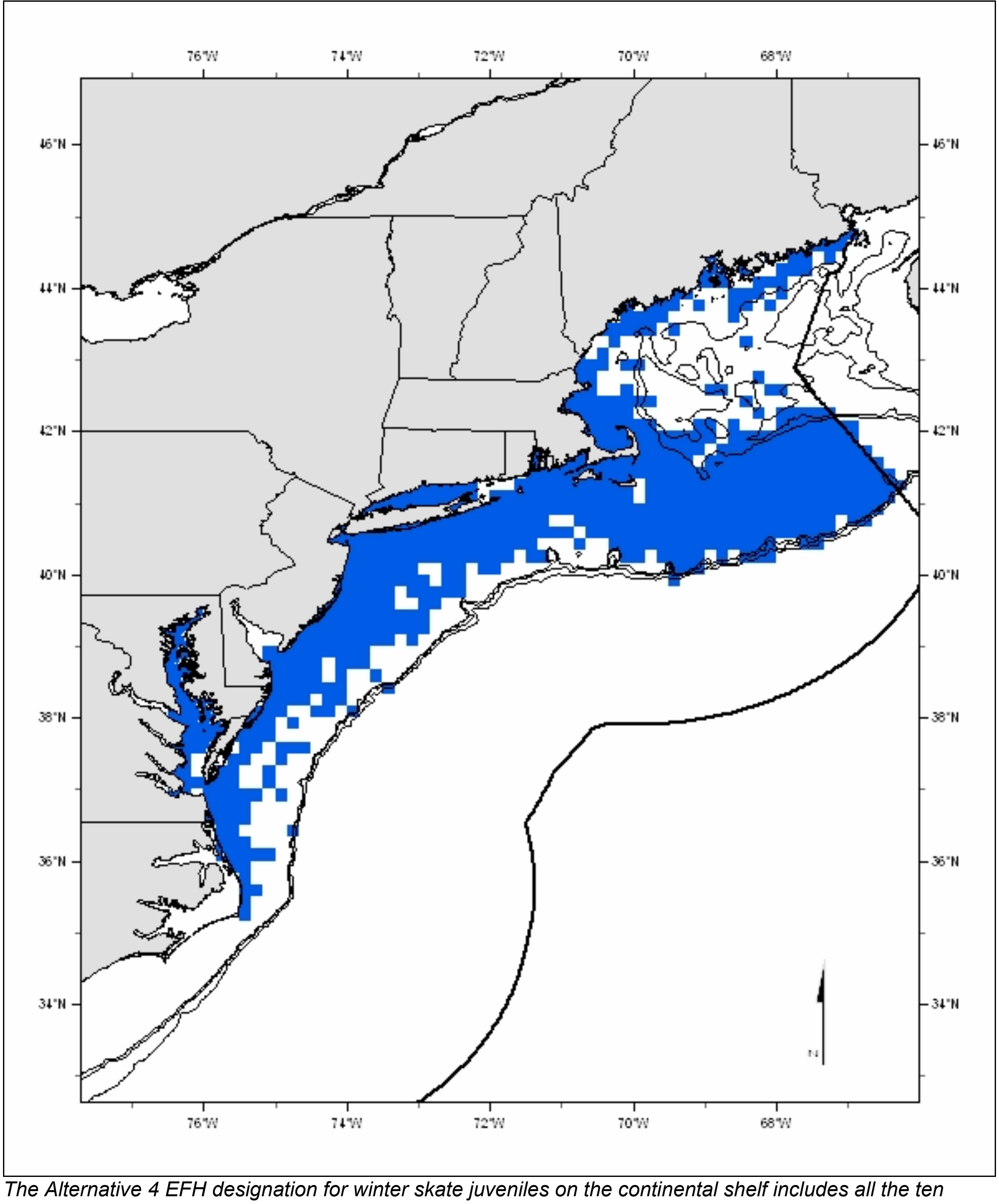
Eggs: There is no information available on the habitat associations or distribution of the egg stage for this species.

Larvae: No larval life stage exists for this species. Upon hatching, they are fully developed juveniles.

Juveniles: Estuarine, coastal marine, and continental shelf benthic habitats in depths of 1 – 400 meters on sand and gravel substrates as depicted on Map 523. Other conditions that generally exist where EFH for juvenile winter skates is found are bottom temperatures of 0 – 22ºC and salinities of 15 – 36 ppt. Juvenile winter skates feed on crustaceans (*e.g.*, amphipods, isopods, sand shrimps, crabs, pandalid shrimps), bivalve mollusks, a variety of fish species, and polychaetes.

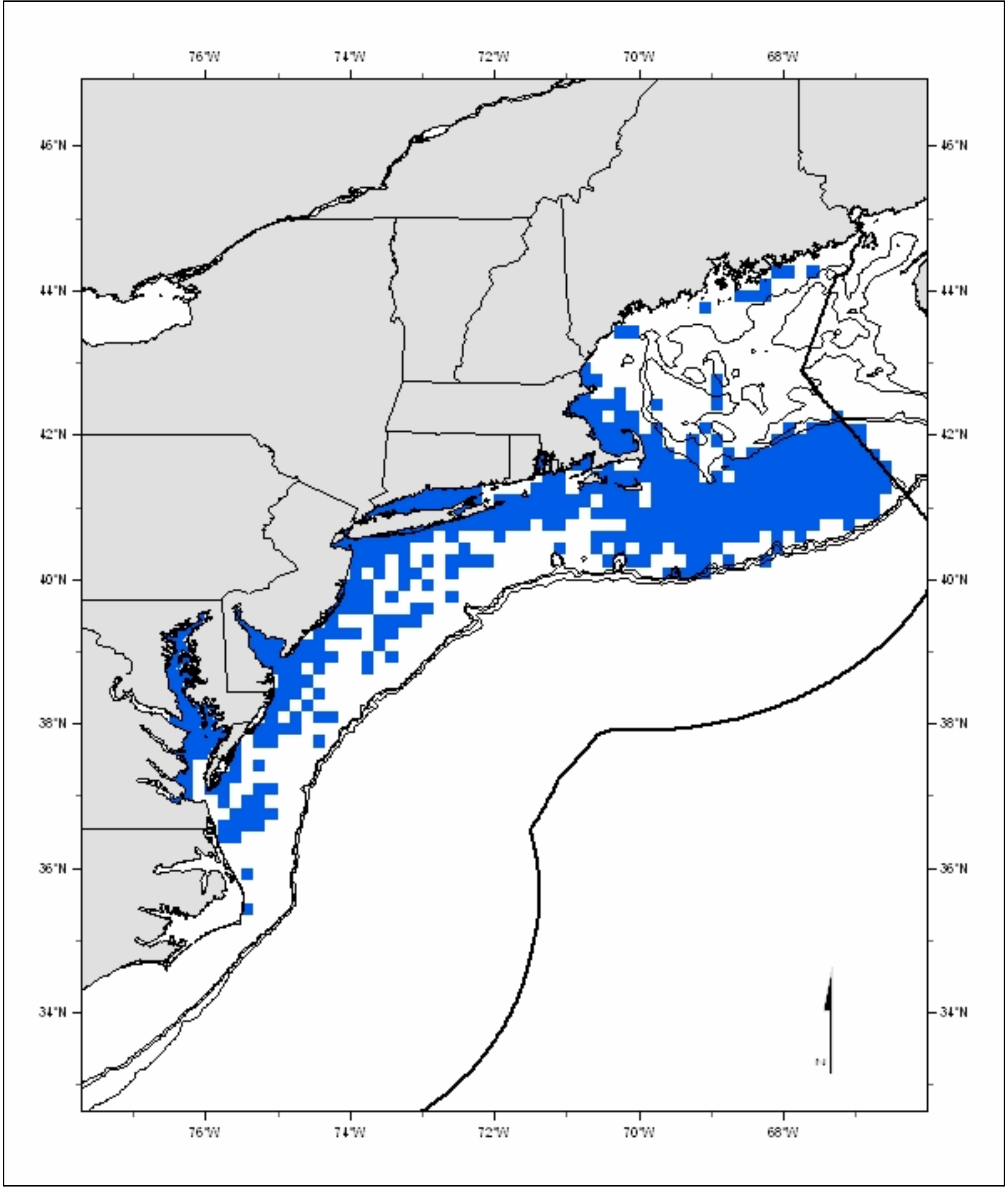
Adults: Estuarine, coastal marine, and continental shelf benthic habitats in depths of 1 – 400 meters on sand and gravel substrates as depicted on Map 524. Other conditions that generally exist where EFH for juvenile winter skates is found are bottom temperatures of 0.5 – 20.5ºC and salinities of 27 – 36.5 ppt. Adult winter skates feed on the same types of crustaceans, mollusks, polychaetes, and fishes as the juveniles, but their diets include more fishes and fewer crustaceans (especially amphipods and isopods).

Map 523. Winter skate juveniles, Alternative 4



The Alternative 4 EFH designation for winter skate juveniles on the continental shelf includes all the ten minute squares where juvenile winter skate were caught during 1968-2005 in the fall and spring NMFS trawl survey. Inshore, this alternative includes ten minute squares where juvenile winter skate were caught in state trawl surveys in more than 10% of the tows, as well as those bays and estuaries identified by the NOAA ELMR program where winter skate juveniles were "common" or "abundant."

Map 524. Winter skates adults, Alternative 4



The Alternative 4 EFH designation for winter skate adults on the continental shelf includes all the ten minute squares where adult winter skate were caught during 1968-2005 in the fall and spring NMFS trawl survey. Inshore, this alternative includes ten minute squares where adult winter skate were caught in state trawl surveys in more than 10% of the tows, as well as those bays and estuaries identified by the NOAA ELMR program where winter skate adults were "common" or "abundant."

4.1.4.2.24 Witch Flounder

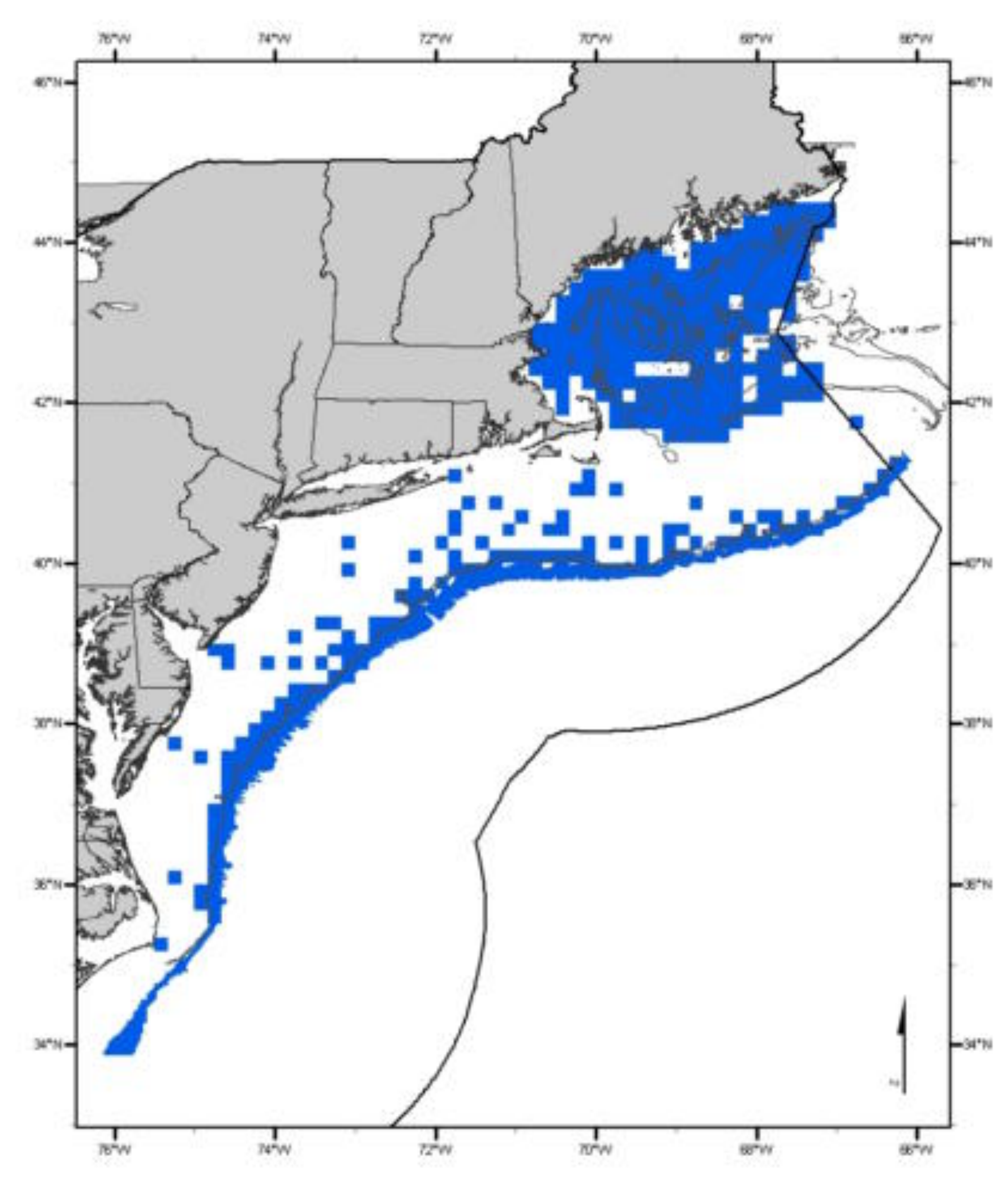
Eggs: No alternative EFH designation.

Larvae: No alternative EFH designation.

Juveniles: Benthic habitats on the continental shelf and slope in depths of 50 – 1500 meters with substrates of mud and/or mud and sand as depicted on Map 525. Other conditions that generally exist where EFH for juvenile witch flounder is found are: bottom temperatures of 0.5 – 19.5ºC and salinities of 30.5 – 36.5 ppt. Juvenile witch flounder feed primarily on polychaetes and crustaceans.

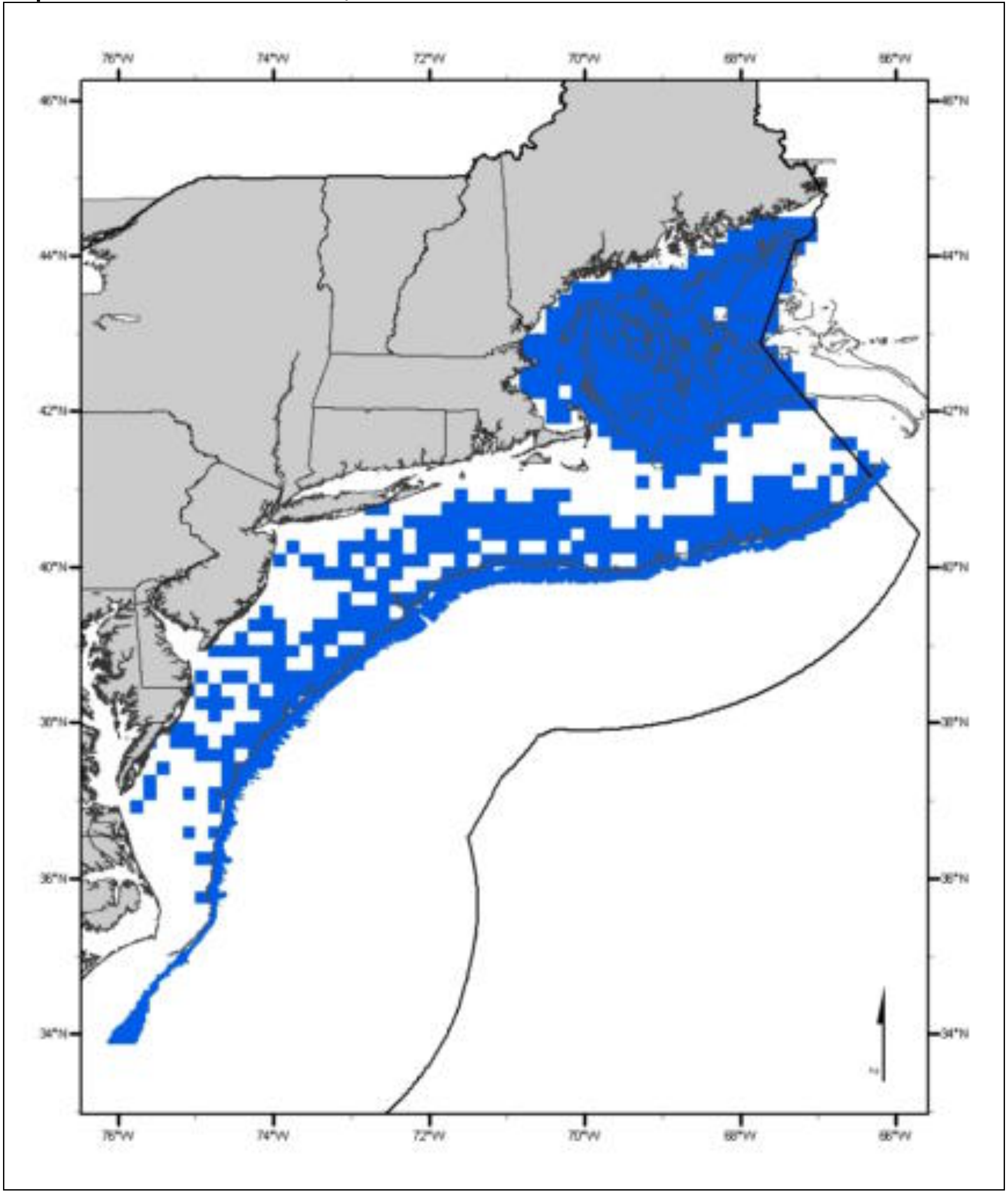
Adults: Benthic habitats on the continental shelf and slope in depths of 35 – 1500 meters with substrates of mud and/or mud and sand, as depicted on Map 526. The following conditions generally exist where benthic EFH for adult witch flounder is found: bottom temperatures of 0 – 21.5ºC and salinities of 30.5 – 36.5 ppt. Spawning generally occurs at temperatures of 0 – 10ºC. Adult witch flounder feed primarily on polychaetes, mollusks, and echinoderms.

Map 525. Witch flounder juveniles, Alternative 4



The Alternative 4 EFH designation for witch flounder juveniles on the continental shelf includes all the ten minute squares where juvenile witch flounder were caught during 1968-2005 in the fall and spring NMFS trawl survey. Inshore, this alternative includes ten minute squares where juvenile witch flounder were caught in state trawl surveys in more than 10% of the tows. This alternative also includes the area beyond the continental shelf where juvenile or adult witch flounder are known or presumed to be present, based on their maximum depth and geographic range.

Map 526. Witch flounder adults, Alternative 4



The Alternative 4 EFH designation for witch flounder adults on the continental shelf includes all the ten minute squares where adult witch flounder were caught during 1968-2005 in the fall and spring NMFS trawl survey. Inshore, this alternative includes ten minute squares where adult witch flounder were caught in state trawl surveys in more than 10% of the tows. This alternative also includes the area beyond the continental shelf where juvenile or adult witch flounder are known or presumed to be present, based on their maximum depth and geographic range.

4.1.4.2.25 Yellowtail Flounder

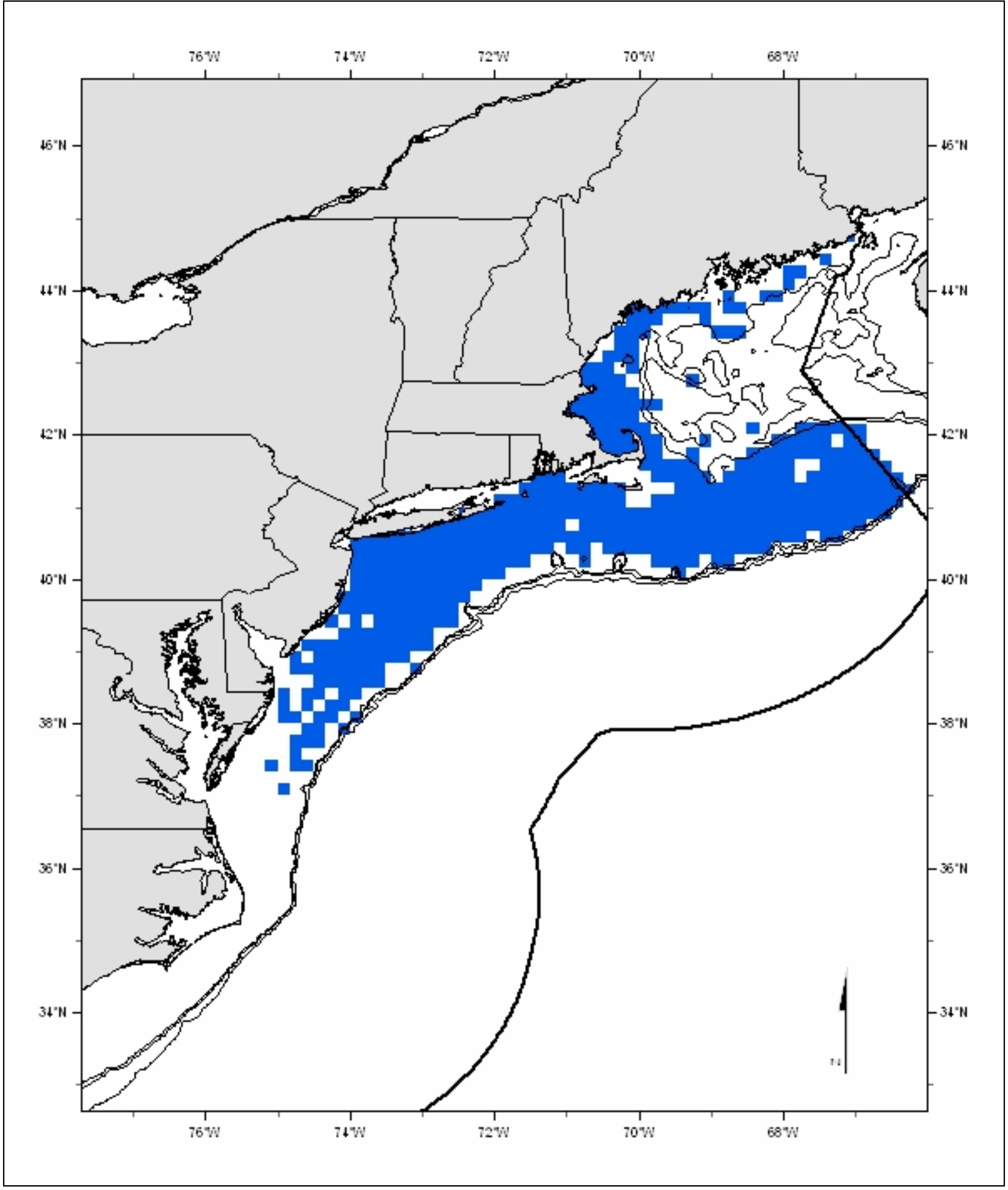
Eggs: No alternative EFH designation.

Larvae: No alternative EFH designation.

Juveniles: Sandy inshore and continental shelf benthic habitats in depths of 4 – 400 meters as depicted on Map 527. Other conditions that generally exist where EFH for juvenile yellowtail flounder is found are bottom temperatures of 0.5 – 18.5ºC and salinities of 28 – 35.5 ppt. YOY juveniles prefer depths of 56 – 87 on the shelf. Primary prey organisms for juvenile yellowtail flounders are amphipods, polychaetes, and sand shrimps.

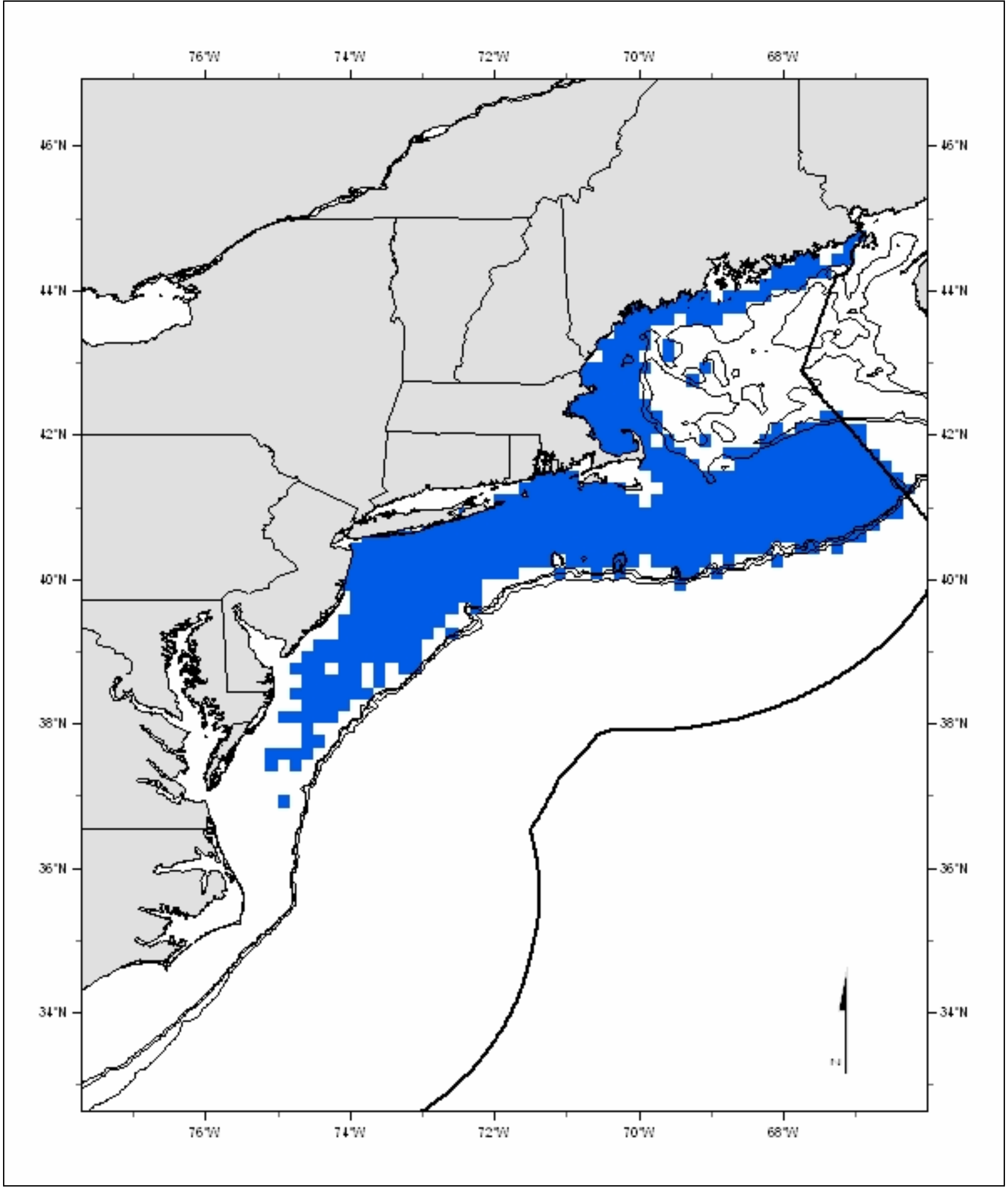
Adults: Inshore and continental shelf benthic habitats in depths of 4 – 400 meters as depicted on Map 528. Substrate types that exist where EFH for adult yellowtail flounder is found consist of sand and mixtures of sand and mud. Other conditions that generally exist where EFH for adult yellowtail flounder is found are bottom temperatures of 0.5 – 19.5ºC and salinities of 28 – 36.5 ppt. Spawning generally occurs at temperatures of 5 – 12ºC. Primary prey organisms for adult yellowtail flounders are amphipods, sand shrimps, polychaetes, nemerteans, and cerianthid anemones.

Map 527. Yellowtail flounder juveniles, Alternative 4



The Alternative 4 EFH designation for yellowtail juveniles on the continental shelf includes all the ten minute squares where juvenile yellowtail were caught during 1968-2005 in the fall and spring NMFS trawl survey. Inshore, this alternative includes ten minute squares where juvenile yellowtail were caught in state trawl surveys in more than 10% of the tows, as well as those bays and estuaries identified by the NOAA ELMR program where yellowtail juveniles were "common" or "abundant."

Map 528. Yellowtail flounder adults, Alternative 4



The Alternative 4 EFH designation for yellowtail adults on the continental shelf includes all the ten minute squares where adult yellowtail were caught during 1968-2005 in the fall and spring NMFS trawl survey. Inshore, this alternative includes ten minute squares where adult yellowtail were caught in state trawl surveys in more than 10% of the tows, as well as those bays and estuaries identified by the NOAA ELMR program where yellowtail adults were "common" or "abundant."

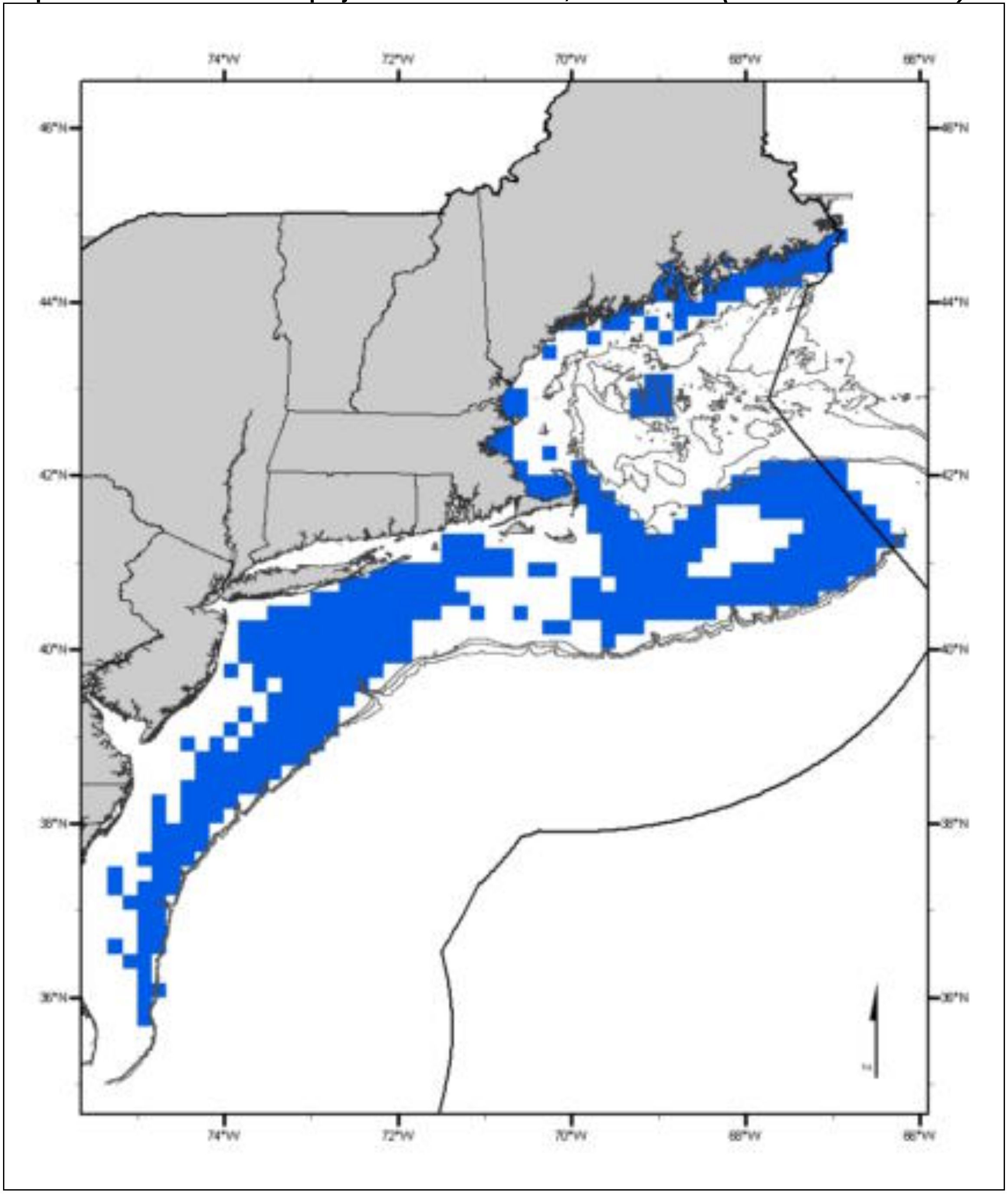
4.1.5 Alternative 5

4.1.5.1 Atlantic Sea Scallop

Juveniles: Inshore and continental shelf benthic habitats in depths of 2 – 180 meters with substrates of sand, gravel, and/or mixtures of gravel, mud, and sand, as depicted on Map 529. Other conditions that generally exist where EFH is found are bottom temperatures of 0.5 – 20.5ºC and salinities above 25 ppt. Juvenile sea scallops are filter–feeders, ingesting diatoms, detritus, microzooplankton, and bacteria. *(Preferred Alternative)*

Adults: Inshore and continental shelf benthic habitats in depths of 2 – 180 meters with substrates of sand, gravel, and/or mixtures of gravel, mud, and sand, as depicted on Map 529. Other conditions that generally exist where EFH is found are bottom temperatures of 0.5 – 20.5ºC and salinities above 25 ppt. These same conditions generally prevail during spawning. Adult sea scallops are filter–feeders, ingesting diatoms, detritus, microzooplankton, and bacteria. *(Preferred Alternative)*

Map 529. Atlantic sea scallops juveniles and adults, Alternative 5 *(Preferred Alternative)*



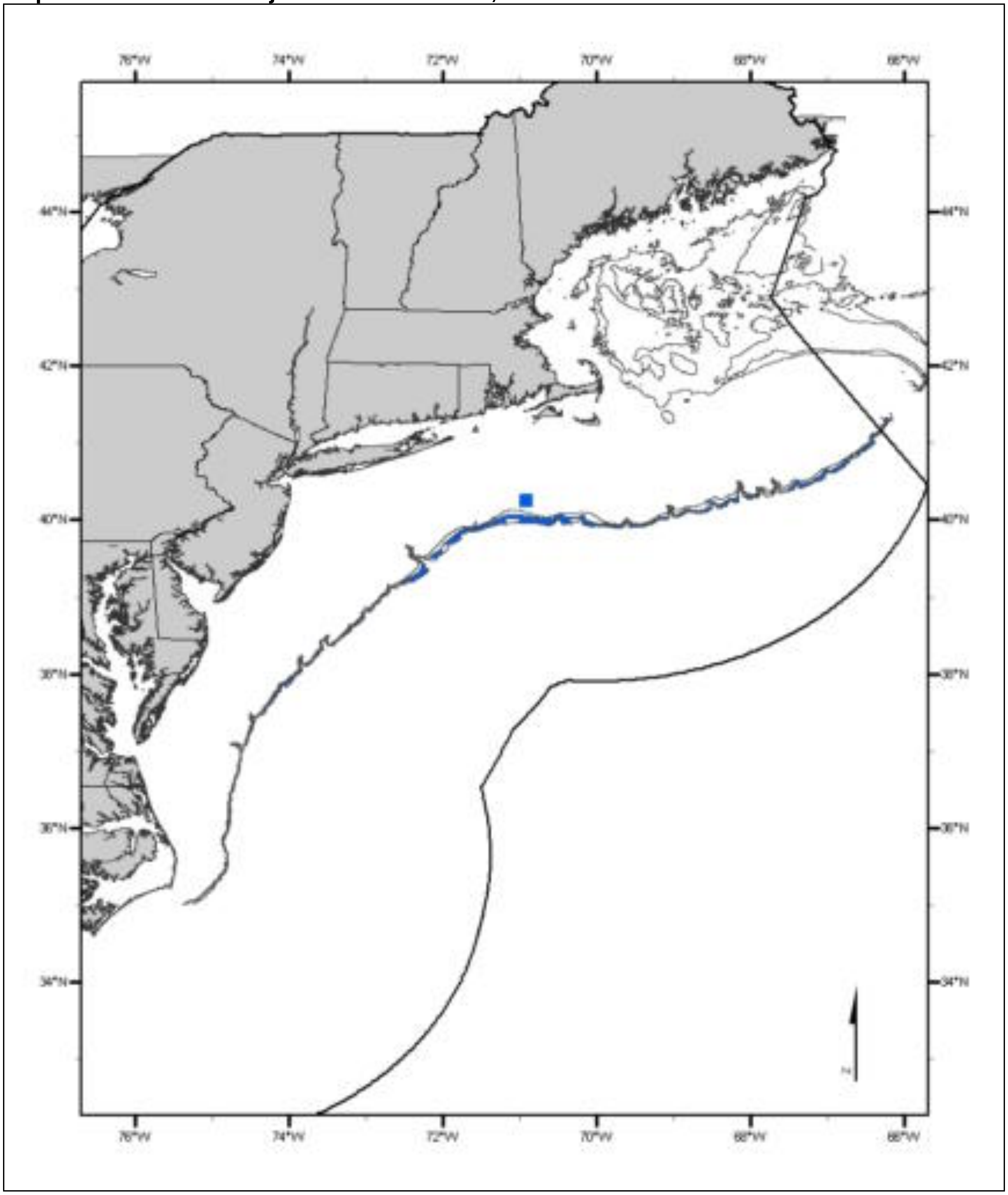
The Alternative 5 EFH designation for juvenile and adult Atlantic sea scallops is the same as the Alternative 4 designation, with the addition of ten minute squares on Fipennies Ledge and in eastern Maine that are not well represented in state surveys of the Gulf of Maine. The Alternative 4 EFH designation includes all the ten minute squares where juveniles or adults were caught during 1982-2005 in the summer NMFS sea scallop dredge survey and ten minute squares in the Gulf of Maine where juveniles or adults were caught in state trawl surveys in more than 10% of the tows, as well as those bays and estuaries identified by the NOAA ELMR program where juvenile or adult Atlantic sea scallops were "common" or "abundant."

4.1.5.2 Offshore Hake

Juveniles: Pelagic and benthic habitats on the outer continental shelf and slope in depths of 200 – 750 meters with mud and sand substrates, as depicted on Map 530. Other conditions that generally exist where benthic EFH for juvenile offshore hake is found are bottom water temperatures of 8.5 – 12.5°C and salinities of 34.5 – 36.5 ppt. Juvenile offshore hake migrate off the bottom at night and feed primarily on small fishes, euphausiids, and pandalid and pelagic shrimps.

Adults: Pelagic and benthic habitats on the outer continental shelf and slope in depths of 200 – 750 meters with mud and sand substrates, as depicted on Map 530. The following conditions generally exist where benthic EFH for adult offshore hake is found: bottom water temperatures of 6.5 – 12.5°C and salinities of 34.5 – 36.5 ppt. Spawning generally occurs between 330 and 550 meters. Adult offshore hake migrate off the bottom at night and feed primarily on fishes such as gadids, hakes (especially silver hake) and other pelagic species, squids, and euphausiids.

Map 530. Offshore hake juveniles and adults, Alternative 5



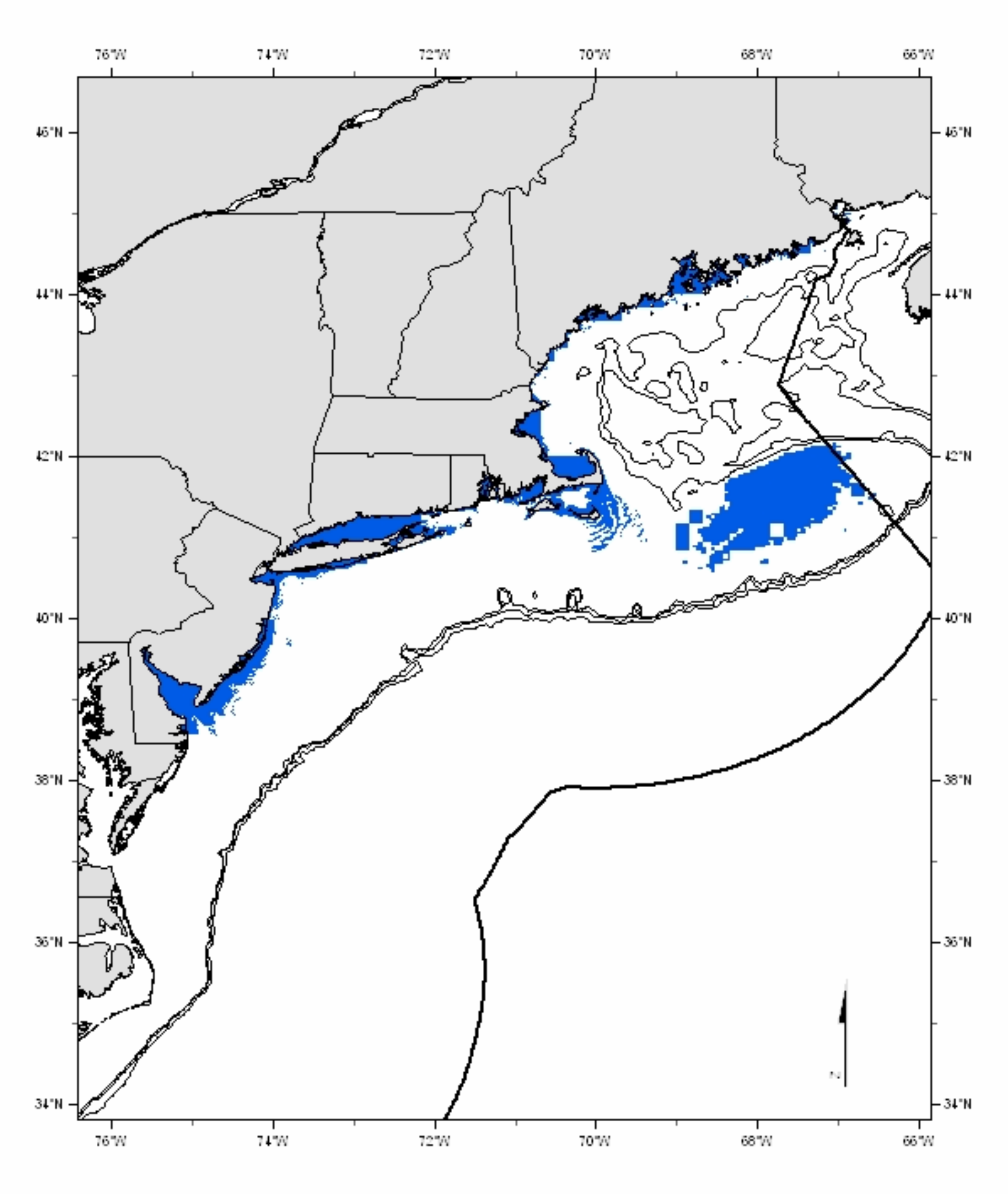
The Alternative 5 EFH designation for juvenile and adult offshore hake combines Alternative 3E for juveniles and 3D for adults. This alternative is based on off-shelf areas where juvenile and adult offshore hake were determined to be present, based on depth and geographic ranges, and also includes one ten minute square where the abundance of juveniles in the 1968-2005 spring and fall NMFS trawl surveys reached the 90% cumulative percentage of catch level.

4.1.5.3 Winter Flounder

Eggs: Inshore estuarine and coastal marine benthic habitats in depths of 0.3–20 meters with substrates of mud, sand, muddy sand, gravel and/or submerged aquatic vegetation, extending from the Bay of Fundy to Delaware Bay, and benthic continental shelf habitats on Georges Bank and Nantucket Shoals in depths up to 72 meters with mud, sand, muddy sand, and/or gravel substrates, as depicted on Map 531 - Map 532. In inshore waters, winter flounder eggs have been collected in depths between 0.3 and 8 meters and are believed to occur to at least 20 meters; spawning is reported at a maximum depth of 72 meters on Georges Bank. Other conditions that generally exist where EFH for winter flounder eggs is found include bottom water temperatures of 1 – 10ºC and salinities of 10 – 32 ppt. *(Preferred Alternative)*

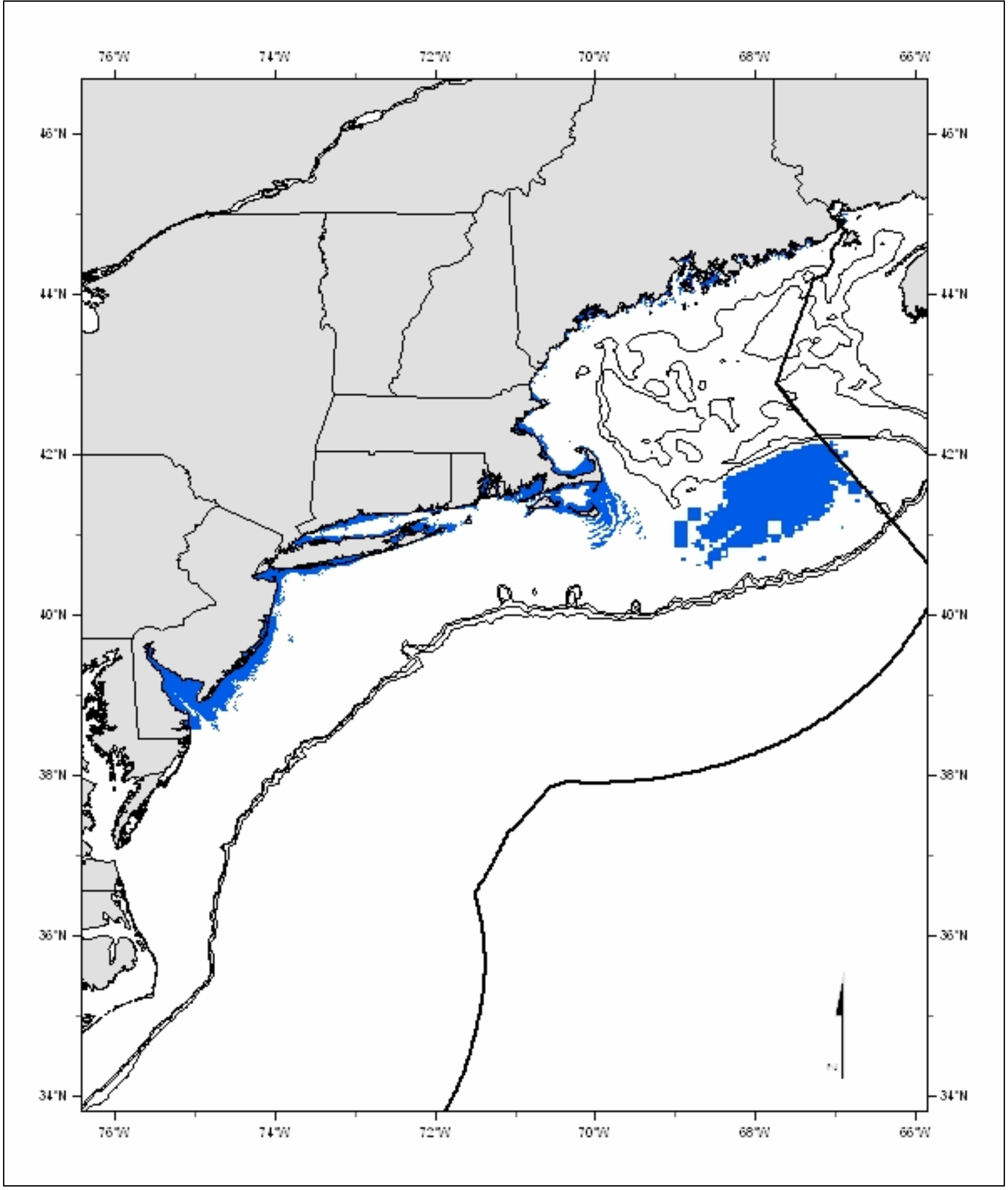
Larvae: Estuarine, coastal marine, and continental shelf water column habitats, as depicted on Map 531 - Map 532. The following conditions generally exist where EFH for winter flounder larvae is found: bottom depths of 0-72 meters; water column temperatures of 2 – 15ºC inshore and 5.5 – 10.5ºC on the shelf; and salinities of 4 – 30 inshore and up to 33 ppt on the shelf. Primary prey organisms are copepods, invertebrate eggs, and polychaetes. *(Preferred Alternative)*

Map 531. Winter flounder eggs and larvae, Alternative 5A *(Preferred Alternative)*



The Alternative 5A EFH designation for winter flounder eggs and larvae is the same as the Alternative 3 designation for eggs and larvae, except that areas in Nantucket Sound deeper than 20 meters have been removed. The Alternative 3 designation includes coastal waters out to a maximum depth of 20 meters within the range of spawning adults (eastern Maine to Delaware Bay) plus bays and estuaries identified in the NOAA ELMR program where winter flounder eggs and larvae are "common" or "abundant." It also includes spawning areas on Georges Bank to a maximum depth of 72 meters, as identified in the EFH Source Document.

Map 532. Winter flounder eggs and larvae, Alternative 5B



The Alternative 5B EFH designation for winter flounder eggs and larvae is the same as the Alternative 5A designation for eggs and larvae, except that areas identified in the NOAA ELMR program where winter flounder eggs and larvae are "common" or "abundant" are not included. This alternative includes coastal waters out to a maximum depth of 20 meters within the range of spawning adults (eastern Maine to Delaware Bay), not including waters deeper than 20 meters in Nantucket Sound. It also includes spawning areas on Georges Bank to a maximum depth of 72 meters, as identified in the EFH Source Document.

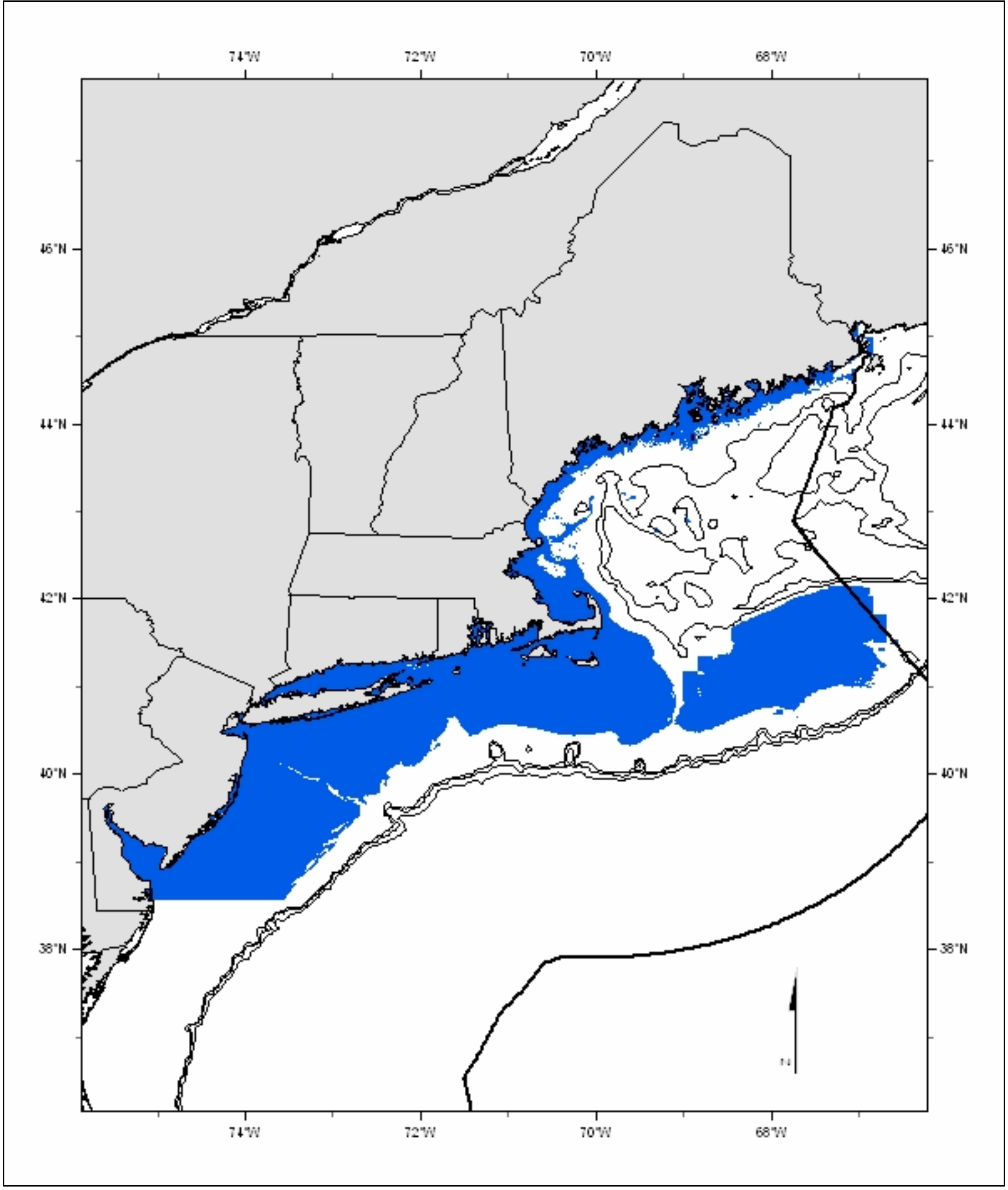
4.1.6 Alternative 6

4.1.6.1 Winter Flounder

Eggs: Inshore estuarine and coastal marine benthic habitats in depths of 0.3–20 meters with substrates of mud, sand, muddy sand, gravel and/or submerged aquatic vegetation, extending from the Bay of Fundy to Delaware Bay, and benthic continental shelf habitats on Georges Bank and Nantucket Shoals in depths up to 72 meters with mud, sand, muddy sand, and/or gravel substrates, as depicted on Map 533. In inshore waters, winter flounder eggs have been collected in depths between 0.3 and 8 meters and are believed to occur to at least 20 meters; spawning is reported at a maximum depth of 72 meters on Georges Bank. Other conditions that generally exist where EFH for winter flounder eggs is found include bottom water temperatures of 1 – 10ºC and salinities of 10 – 32 ppt.

Larvae: Estuarine, coastal marine, and continental shelf water column habitats (add geographic distribution), as depicted on Map 533. The following conditions generally exist where EFH for winter flounder larvae is found: bottom depths of 2 – 72m; water column temperatures of 2 – 15ºC inshore and 5.5 – 10.5ºC on the shelf; and salinities of 4 – 30 inshore and up to 33 ppt on the shelf. Primary prey organisms are copepods, invertebrate eggs, and polychaetes.

Map 533. Winter flounder eggs and larvae, Alternative 6



The Alternative 6 EFH designation for winter flounder eggs and larvae includes coastal and continental shelf waters out to a maximum depth of 72 meters within the range of spawning adults (eastern Maine to Delaware Bay) plus bays and estuaries identified in the NOAA ELMR program where winter flounder eggs and larvae are "common" or "abundant."

4.1.7 Atlantic Salmon and Deep-Sea Red Crab EFH Alternatives

4.1.7.1 Atlantic Salmon

4.1.7.1.1 Alternative 1 – Status Quo

In its *Report to Congress: Status of the Fisheries of the United States* (September 1997), NMFS determined Atlantic salmon is considered overfished, based upon an assessment of stock level. Essential fish habitat for Atlantic salmon is described as all waters currently or historically accessible to Atlantic salmon within the streams, rivers, lakes, ponds, wetlands, and other water bodies of Maine, New Hampshire, Vermont, Massachusetts, Rhode Island and Connecticut identified as EFH in Map 534 - Map 536 and in the accompanying table and that meet the following conditions:

Eggs: Bottom habitats with a gravel or cobble riffle (redd) above or below a pool of rivers as depicted in Map 534. Generally, the following conditions exist in the egg pits (redds): water temperatures below 10° C, and clean, well-oxygenated fresh water. Atlantic salmon eggs are most frequently observed between October and April.

Larvae: Bottom habitats with a gravel or cobble riffle (redd) above or below a pool of rivers as depicted in Map 534. Generally, the following conditions exist where Atlantic salmon larvae, or alevins/fry, are found: water temperatures below 10° C, and clean, well-oxygenated fresh water. Atlantic salmon alevins/fry are most frequently observed between March and June.

Juveniles: Bottom habitats of shallow gravel / cobble riffles interspersed with deeper riffles and pools in rivers and estuaries as depicted in Map 535. Generally, the following conditions exist where Atlantic salmon parr are found: clean, well-oxygenated fresh water, water temperatures below 25° C, water depths between 10 cm and 61 cm, and water velocities between 30 and 92 cm per second. As they grow, parr transform into smolts. Atlantic salmon smolts require access downstream to make their way to the ocean. Upon entering the sea, "post-smolts" become pelagic and range from Long Island Sound north to the Labrador Sea.

Adults: For adult Atlantic salmon returning to spawn, habitats with resting and holding pools in rivers and estuaries as depicted in Map 536. Returning Atlantic salmon require access to their natal streams and access to the spawning grounds. Generally, the following conditions exist where returning Atlantic salmon adults are found migrating to the spawning grounds: water temperatures below 22.8° C, and dissolved oxygen above 5 ppm. Oceanic adult Atlantic salmon are primarily pelagic and range from the waters of the continental shelf off southern New England north throughout the Gulf of Maine.

Spawning Adults: Bottom habitats with a gravel or cobble riffle (redd) above or below a pool of rivers as depicted in Map 536. Generally, the following conditions exist where spawning Atlantic salmon adults are found: water temperatures below 10° C, water depths between 30 cm and 61 cm, water velocities around 61 cm per second, and clean, well-oxygenated fresh water. Spawning Atlantic salmon adults are most frequently observed during October and November.

Atlantic salmon EFH includes all aquatic habitats in the watersheds of the identified rivers, including all tributaries, to the extent that they are currently or were historically accessible for salmon migration. Atlantic salmon EFH excludes areas upstream of longstanding naturally impassable barriers (i.e., natural waterfalls in existence for at least several hundred years). All of the above EFH descriptions include those bays and estuaries listed on the following table.

Table 23. EFH Designation of Estuaries and Embayments, Atlantic salmon (*Salmo salar*)

Estuaries and Embayments	Eggs	Larvae	Juveniles	Adults	Spawning Adults
Passamaquoddy Bay			f,m,s	f,m,s	
Englishman/Machias Bay			f,m,s	f,m,s	
Narraguagus Bay			f,m,s	f,m,s	
Blue Hill Bay			f,m,s	f,m,s	
Penobscot Bay	f	f	f,m,s	f,m,s	f
Muscongus Bay			f,m,s	f,m,s	
Damariscotta River					
Sheepscot River	f	f	f,m,s	f,m,s	f
Kennebec / Androscoggin Rivers	f	f	f,m,s	f,m,s	f
Casco Bay			f,m,s	f,m,s	
Saco Bay			f,m,s	f,m,s	
Wells Harbor					
Great Bay			f,m		
Merrimack River			f,m	f,m	
Massachusetts Bay					
Boston Harbor					
Cape Cod Bay					
Waquoit Bay					
Buzzards Bay					
Narragansett Bay					
Long Island Sound			f,m	f,m,s	
Connecticut River			f,m	f,m	
Gardiners Bay			m,s	m,s	
Great South Bay				s	
Hudson River / Raritan Bay					
Barnegat Bay					
Delaware Bay					
Chincoteague Bay					
Chesapeake Bay					

S ≡ The EFH designation for this species includes the seawater salinity zone of this bay or estuary (salinity > 25.0‰).
M ≡ The EFH designation for this species includes the mixing water / brackish salinity zone of this bay or estuary (0.5 < salinity < 25.0‰).
F ≡ The EFH designation for this species includes the tidal freshwater salinity zone of this bay or estuary (0.0 < salinity < 0.5‰).

These EFH designations of estuaries and embayments are based on the NOAA Estuarine Living Marine Resources (ELMR) program (Jury et al. 1994; Stone et al. 1994). For a detailed view of the salinity zone boundaries, as described in the ELMR reports, please see Appendix B of the 1998 EFH Omnibus Amendment. The Council recognizes the spatial and temporal variability of estuarine and embayment *environmental conditions generally associated with this species.*

Map 534. Atlantic salmon eggs and larvae, Alternative 1 (No Action)

The EFH designation for Atlantic salmon eggs and larvae represents all rivers where Atlantic salmon are currently present [26 rivers]. This designation also includes those bays and estuaries identified by the NOAA ELMR program as supporting Atlantic salmon eggs and larvae at the "abundant", "common" or "rare" level. This alternative was selected to ensure that all rivers currently capable of supporting Atlantic salmon are included in the EFH designation. The guidance in the Interim Final Rule (in place during the 1998 EFH Omnibus Amendment) directed that for overfished species where habitat loss or degradation may be contributing to the overfished condition, all habitats currently used by the species should be considered essential. The rivers from which Atlantic salmon have been extirpated were not selected as EFH on the presumption that it would be extremely unlikely that these rivers will again support Atlantic salmon without artificial supplementation or stocking.

Map 535. Atlantic salmon juveniles, Alternative 1 (No Action)

The EFH designation for Atlantic salmon juveniles represents all rivers where Atlantic salmon are currently present [26 rivers]. This designation also includes those bays and estuaries identified by the NOAA ELMR program as supporting Atlantic salmon juveniles at the "abundant", "common" or "rare" level. This alternative was selected to ensure that all rivers currently capable of supporting Atlantic salmon are included in the EFH designation. The guidance in the Interim Final Rule (in place during the 1998 EFH Omnibus Amendment) directed that for overfished species where habitat loss or degradation may be contributing to the overfished condition, all habitats currently used by the species should be considered essential. The rivers from which Atlantic salmon have been extirpated were not selected as EFH on the presumption that it would be extremely unlikely that these rivers will again support Atlantic salmon without artificial supplementation or stocking.

Map *536*. Atlantic salmon adults, Alternative 1 (No Action)

The EFH designation for Atlantic salmon adults represents all rivers where Atlantic salmon are currently present [26 rivers]. This designation also includes those bays and estuaries identified by the NOAA ELMR program as supporting Atlantic salmon adults at the "abundant", "common" or "rare" level. This alternative was selected to ensure that all rivers currently capable of supporting Atlantic salmon are included in the EFH designation. The guidance in the Interim Final Rule (in place during the 1998 EFH Omnibus Amendment) directed that for overfished species where habitat loss or degradation may be contributing to the overfished condition, all habitats currently used by the species should be considered essential. The rivers from which Atlantic salmon have been extirpated were not selected as EFH on the presumption that it would be extremely unlikely that these rivers will again support Atlantic salmon without artificial supplementation or stocking.

4.1.7.1.2 Alternative 2 – Ten (10) Year Presence

The list of rivers and estuaries that are applicable in Alternative 2 are listed in Table 24 as "Current" or "Recent" which means that Atlantic salmon have been documented in the system in the last ten (10) years (1996-2005). The designated rivers and streams are listed according to the rivers and coastal bays that form a direct connection to the sea. Subregion names and hydrologic unit codes (HUC) used by the U.S. Geological Survey, and index numbers for each river, correspond to what is shown in Map 537 - Map 539. EFH for the freshwater life history stages of Atlantic salmon includes all rivers and streams in each designated drainage system that exhibit the environmental conditions identified in the EFH text descriptions.

Table 24. Alternative 2 – 10 year presence: New England rivers, streams, and estuaries (bays) designated as essential fish habitat for Atlantic salmon, based on documented presence of juveniles or adults.

Locations labeled as "current" or "recent" have had a documented presence in the last 10 years (1996-2005) and those labeled as "current" have had a documented presence in the last three (3) years (2003-2005).

Subregion (HUC4)	HUC	Drainage	River Status	Bay Designation	Estuary Status	River Name	Index
St John	0101	St John	Current	Bay of Fundy	Current	Aroostook River	1
						Little Madawaska River	2
						Big Machias River	3
						Mooseleuk Stream	4
						Presque Isle Stream	5
						St Croix Stream	6
						Meduxnekeag River	7
						N Branch Meduxnekeag R	8
Maine Coastal	0105	St Croix	Current	Passamaquoddy Bay	Current	St Croix River	9
						Tomah Stream	10
		Boyden	Recent	Cobscook Bay	Current	Boyden Stream	11
		Dennys	Current			Dennys River	13
						Cathance Stream	14
		Hobart	Recent			Hobart Stream	15
		East Machias	Current	Machias Bay	Current	East Machias River	17
		Machias	Current			Machias River	18
						Mopang Stream	19
						Old Stream	20
		Chandler	Recent	Chandler/Englishman Bay	Recent	Chandler River	21
		Indian	Recent	Western Bay	Recent	Indian River	22
		Pleasant	Current	Pleasant/Narraguagus Bay	Current	Pleasant River	23
		Narraguagus	Current			Narraguagus River	24
						West Branch Narraguagus R	25

Subregion (HUC4)	HUC	Drainage	River Status	Bay Designation	Estuary Status	River Name	Index
		Tunk	Recent	Gouldsboro Bay	Recent	Tunk Stream	26
		Union	Current	Blue Hill Bay	Current	Union River	27
						West Branch Union R	28
Penobscot	0102	Orland	Recent	Penobscot Bay	Current	Orland River	29
		Penobscot	Current			Penobscot River	30
						Cove Brook	31
						East Branch Mattawamkeag River	32
						East Branch Penobscot R	33
						East Branch Pleasant R	34
						Eaton Brook	35
						Felts Brook	36
						Kenduskeag Stream	37
						Marsh Stream	38
						Mattawamkeag River	39
						Millinocket Stream	40
						Molunkus Stream	41
						Nesowadnehunk Stream	42
						North Branch Marsh Stream	43
						North Branch Penobscot R	44
						Passadumkeag River	45
						Pine Stream	46
						Piscataquis River	47
						Pleasant River	48
						Russell Stream	49
						Salmon Stream	50
						Seboeis River	51
						Souadabscook Stream	52

Subregion (HUC4)	HUC	Drainage	River Status	Bay Designation	Estuary Status	River Name	Index
						South Branch Penobscot R	53
						Sunkhaze Stream	54
						Wassataquoik Stream	55
						West Branch Mattawamkeag R	56
						West Branch Penobscot R	57
						West Branch Pleasant R	58
						West Branch Souadabscook Stream	59
Maine Coastal	0105	Passagassawakeag	Current			Passagassawakeag River	60
		Ducktrap	Current			Ducktrap River	62
		St George	Current	Muscongus Bay	Current	St George River	63
		Medomak	Recent			Medomack River	64
		Pemaquid	Recent	Johns Bay	Recent	Pemaquid River	65
		Sheepscot	Current	Sheepscot Bay	Current	Sheepscot River	66
						West Branch Sheepscot R	67
Kennebec	0103	Kennebec	Current	Local Estuary	Current	Kennebec River	68
						Carrabassett River	69
						Carrabassett Stream	70
						Craigin Brook	71
						Eastern River	72
						Messalonskee Stream	73
						Sandy River	74
						Sebasticook River	75
						Togus Stream	76
						Wesserunsett Stream	77
Androscoggin	0104	Androscoggin		Local Estuary	Current	Androscoggin River	78
						Little Androscoggin	79

Subregion (HUC4)	HUC	Drainage	River Status	Bay Designation	Estuary Status	River Name	Index
						River	
						Nezinscot River	80
						Webb River	81
Saco	0106	Royal River	Recent	Casco Bay	Recent	Royal River	82
		Presumpscot	Recent			Presumpscot River	83
						Mill Brook	84
						Piscataqua River	85
Saco	0106	Saco	Current	Saco Bay	Current	Saco River	86
						Breakneck Brook	87
						Ellis River	88
						Hancock Brook	89
						Josies Brook	90
						Little Ossipee River	91
						Ossipee River	92
						Shepards River	93
						Swan Pond Brook	94
		Kennebunk	Recent	Local Estuary	Recent	Kennebunk River	95
		Mousam	Recent			Mousam River	96
		Cocheco	Current	Great Bay	Current	Cocheco River	97
		Lamprey	Current	Great Bay	Current	Lamprey River	98
Merrimack	0107	Merrimack	Current	Ipswich Bay	Current	Merrimack River	99
						Amey Brook	100
						Assabet River	101
						Baboosic Brook	102
						Baker River	103
						Beaver Brook	104
						Blackwater River	105
						Bog Brook	106
						Cockermouth River	107
						Cohas Brook	108
						Concord River	109

Subregion (HUC4)	HUC	Drainage	River Status	Bay Designation	Estuary Status	River Name	Index
						Contoocook River	110
						E Branch Pemigewasset R	111
						Eastman Brook	112
						Glover Brook	113
						Golden Brook	197
						Hubbard Brook	114
						Mad River	116
						Mill Brook	117
						Moosilauke Brook	118
						Nashua River	119
						Nissitissit River	120
						Pemigewasset River	121
						Pennichuck Brook	122
						Piscataquog River	123
						Powwow River	124
						Pulpit Brook	125
						Shawseen River	126
						Smith River	127
						Souhegan River	128
						South Branch Baker River	198
						S Branch Piscataquog R	129
						Spicket River	130
						Squannacook River	131
						Stony Brook	132
						Sudbury River	133
						Suncook River	134
						Warner River	135
						West Branch Brook	136
						Witches Brook	199

Subregion (HUC4)	HUC	Drainage	River Status	Bay Designation	Estuary Status	River Name	Index
MA-RI Coastal	0109	Pawcatuck	Current	Long Island Sound	Current	Pawcatuck River	139
						Beaver River	140
						Wood River	141
Connecticut	0108	Connecticut	Current	Long Island Sound	Current	Connecticut River	145
						Ammonoosuc River	146
						Ashuelot River	147
						Black River	148
						Blackledge River	149
						Bloods Brook	150
						Chicopee River	151
						Cold River	152
						Deerfield River	153
						East Branch Farmington R	154
						East Branch Salmon Brook	155
						Eight Mile River	156
						Fall River	157
						Farmington River	158
						Fort River	159
						Four Mile Brook	160
						Green River	161
						Israel River	162
						Johns River	163
						Little Sugar River	164
						Manhan River	165
						Mascoma River	166
						Mill Brook	167
						Mill River (Hatfield)	168
						Mill River (Northampton)	169
						Millers River	170

Subregion (HUC4)	HUC	Drainage	River Status	Bay Designation	Estuary Status	River Name	Index
						Mohawk River	171
						Nepaug River	172
						Nulhegan River	173
						Ompompanoosuc River	174
						Ottauquechee River	175
						Passumpsic River	176
						Paul Stream	177
						Pequabuck River	178
						Salmon Brook	179
						Salmon River	180
						Sawmill River	181
						Saxtons River	182
						Stevens River	183
						Sugar River	184
						Upper Ammonoosuc River	185
						Waits River	186
						Wells River	187
						West Branch Farmington R	188
						West River	189
						Westfield River	190
						White River	191
						Williams River	192

Two options are under consideration for the **text descriptions**:

Alternative 2A: Text descriptions by habitat type

Alternative 2B: Text descriptions by life stage

Additionally, three options are under consideration for **map representations** as sub-alternatives for each text description method (e.g. Alternative 2A, Option 1). *Depending on which option is selected by the Council, the text description will be modified accordingly.*

Option 1: No oceanic component (only include the ELMR areas for the rivers and the bays and estuaries shown on the map are defined by the 25 ppt salinity boundary if applicable)

Option 2: Oceanic component bounded by the three-mile state limit as a buffer for the rivers with an EFH designation

Option 3: Oceanic component that includes the area from the coast to the Hague Line (EEZ) and south to 41 degrees of latitude.

4.1.7.1.2.1 Alternative 2A – Designation by Habitat Type

Fresh Water Spawning and Rearing Habitats - Riffle and run habitats in shallow, well-oxygenated, fresh water streams with gravel/rocky substrates, as well as pools and vegetated riverine areas of lower velocity. These habitats occur in a range from 1st order streams (headwaters) to some 3rd or 4th order streams with low temperatures within the watersheds of the rivers listed in Table 24 and depicted in Map 537-Map 539. Five life stages of Atlantic salmon utilize these habitats – eggs, larvae (alevins), recently-hatched juveniles (fry), older juveniles (parr), and spawning adults. Intra-gravel habitat in the stream bed is essential for Atlantic salmon eggs and alevins, whereas EFH for the juveniles and spawning adults is the stream itself. Only parr utilize non-riffle and run habitats. The following conditions generally apply where EFH for these five life stages is found:

Eggs: Grain size diameters of 2-64 mm, water depths of 17-76 cm, water temperatures of 0-16°C (6-7 optimal), intra-gravel water velocities above 20 cm/sec (53 optimal), dissolved oxygen concentrations above 3 mg/l (7 optimal), and ph above 4.0 (5.5 optimal). Eggs are deposited in nests (redds) in late October-November and are buried in the substrate to depths of 10-25 cm where they remain for 175-195 days before hatching.

Larvae: Grain size diameters of 2-64 mm, water depths of 17-76 cm, water temperatures of 0-16°C, intra-gravel water velocities above 20 cm/sec (53 optimal), and dissolved oxygen concentrations above 3 mg/l (7 optimal). Larvae remain in the substrate for about six weeks before emerging as fry in the spring.

Juveniles (fry, <5 cm TL): Grain size diameters of 15-64 mm and, for emerging fry, stream flow velocities below 20 cm/sec. EFH conditions of depth and temperature for small, emerging fry are generally the same as for eggs and larvae, but larger fry disperse up to 5 km from redd sites and may be exposed to a wider range of habitat conditions. Atlantic salmon fry feed on plankton and small invertebrates.

Juveniles (parr, 5-10 cm TL): Water depths of 10-15 cm for parr <7 cm TL and 30-60 cm for larger parr, temperatures of 7-25°C, dissolved oxygen concentrations above 5 mg/l, and water velocities of 30-92 cm/sec. Atlantic salmon parr feed on a variety of terrestrial and freshwater invertebrates (e.g., insects, aquatic annelids, and mollusks).

Spawning adults: Grain size diameters of 2-64 mm, water depths of 17-76 cm, and temperatures of 4-14°C. Spawning in U.S. waters generally occurs during late October through November. EFH for spawning adult salmon also includes coastal marine, estuarine, lacustrine, and riverine habitats used during upstream migration (see below). Adult Atlantic salmon do not feed while spawning. (Note: All spawning females are sea-run salmon, but spawning males include some sea-run salmon and some juveniles that mature in fresh water before ever migrating to the ocean).

Emigration-Immigration Habitats - Variety of riverine, lacustrine, estuarine, and coastal marine habitats used by older juvenile Atlantic salmon (smolts, >10 cm TL) during their downstream migration to the sea, by mature adult salmon during their upstream spawning migration, and by spent adults (kelts) following spawning, before they return to the ocean. EFH for migrating smolts and kelts includes streams, rivers, and estuaries from 1st to 5th order, as well as lakes, ponds, and impoundments, within the watersheds of the rivers listed in Table 24 and depicted in Map 537 - Map 539. EFH for all three life stages is generally characterized by salinities below 25 ppt. Transit habitats utilized during upstream migration include streams, rivers, and estuaries from 1st to 5th order, as well as coastal and open ocean marine areas and is generally characterized by temperatures less than 23°C and dissolved oxygen concentrations greater than 5 mg/l. Atlantic salmon smolts feed on a variety of terrestrial and freshwater invertebrates (e.g., insect larvae and nymphs, aquatic annelids, and mollusks). Adult salmon do not feed during their upstream spawning runs. Spent adults feed on fish and aquatic insects.

Marine Habitats - Coastal and open ocean pelagic marine habitats. These habitats are utilized by older juveniles (post-smolts) during the oceanic phase of their life cycle as they are migrating north to feeding grounds in the North Atlantic, by adults during their landward spawning migration from the marine environment, and by adults that return to the sea after spawning. Marine EFH for Atlantic salmon includes potentially all oceanic waters north of 41° N latitude to the seaward boundary of the EEZ and the U.S.-Canada border, as depicted in Map 537 - Map 539. Marine EFH for Atlantic salmon is generally defined by spring (April-May) sea-surface temperatures between 4 and 10°C and salinities above 25 ppt. When post-smolts first enter the marine environment, they feed mainly on insects and marine invertebrates and then switch to larval and small juvenile fish (e.g., Atlantic herring and sand lance), pelagic amphipods, and euphausiids. While in the marine environment, non-spawning adults feed on a variety of fish (e.g., herring, haddock, sculpins, sand lance, mackerel, and flatfishes).

4.1.7.1.2.2 Alternative 2B – Designation by Life Stage

Eggs – In nests (redds), in intra-gravel riffle and run habitats in shallow, fresh water, well-oxygenated, gravel/rocky stream beds. The following conditions generally apply where EFH for Atlantic salmon eggs is found: substrate grain sizes of 2-64 mm (diameter), water depths of 17-76 cm, water temperatures of 0-16°C (6-7 optimal), intra-gravel water velocities above 20 cm/sec (53 optimal), dissolved oxygen concentrations above 3 mg/l (7 optimal), and pH above 4.0 (>5.5 optimal). EFH for Atlantic salmon egg occurs to a substrate depth of 10-25 cm in streams that range from 1st order (headwaters) to some 3rd or 4th order streams with low temperatures within the watersheds of the rivers listed in Table 24 and depicted in Map 537 - Map 539.

Larvae (alevins) – Intra-gravel riffle and run habitats, in shallow, fresh water, well-oxygenated, gravel/rocky stream beds. The following conditions generally apply where EFH for Atlantic salmon larvae is found: substrate grain sizes of 2-64 mm (diameter), depths of 17-76 cm, water temperatures of 0-16°C, intra-gravel water velocities above 20 cm/sec (53 optimal), and dissolved oxygen concentrations above 3 mg/l (7 optimal). EFH for Atlantic salmon alevins occurs in a range from 1st to some 3rd or 4th order streams with low temperatures within the watersheds of the rivers listed in Table 24 and depicted in Map 537 - Map 539.

Juveniles (fry, <5 cm TL) – Riffle and run habitats, in shallow, fresh water, gravel/rocky streams. EFH conditions of depth and temperature for small Atlantic salmon fry just after they emerge from the substrate are generally the same as for the eggs and larvae, but larger fry disperse up to 5 km from redd sites and may be exposed to a wider range of habitat conditions. EFH for small Atlantic salmon fry is generally found where substrate grain size diameter is 15-64 mm and stream flow velocities are no more than 20 cm/sec, whereas larger fry can withstand velocities >50 cm/sec. EFH for Atlantic salmon fry occurs in a range from 1st to some 3rd or 4th order streams with low temperatures within the watersheds of the rivers listed in Table 24 and depicted in Map 537 - Map 539. Atlantic salmon fry feed on plankton and small invertebrates.

Juveniles (parr, 5-10 cm TL) – Riffle and run habitats, in shallow, fresh water, gravel/rocky streams, as well as pools and vegetated riverine areas of lower velocity. The following conditions generally apply where EFH for Atlantic salmon parr is found: depths of 10-15 cm for parr <7 cm TL and 30-60 cm for larger parr, temperatures of 7-25°C, dissolved oxygen concentrations above 5 mg/l, and water velocities of 30-92 cm/sec. EFH for Atlantic salmon parr occurs in a range from 1st to some 3rd or 4th order streams with low temperatures within the watersheds of the rivers listed in Table 24 and depicted in Map 537 - Map 539. Atlantic salmon parr feed on a variety of terrestrial and freshwater invertebrates (e.g., insects, aquatic annelids, and mollusks).

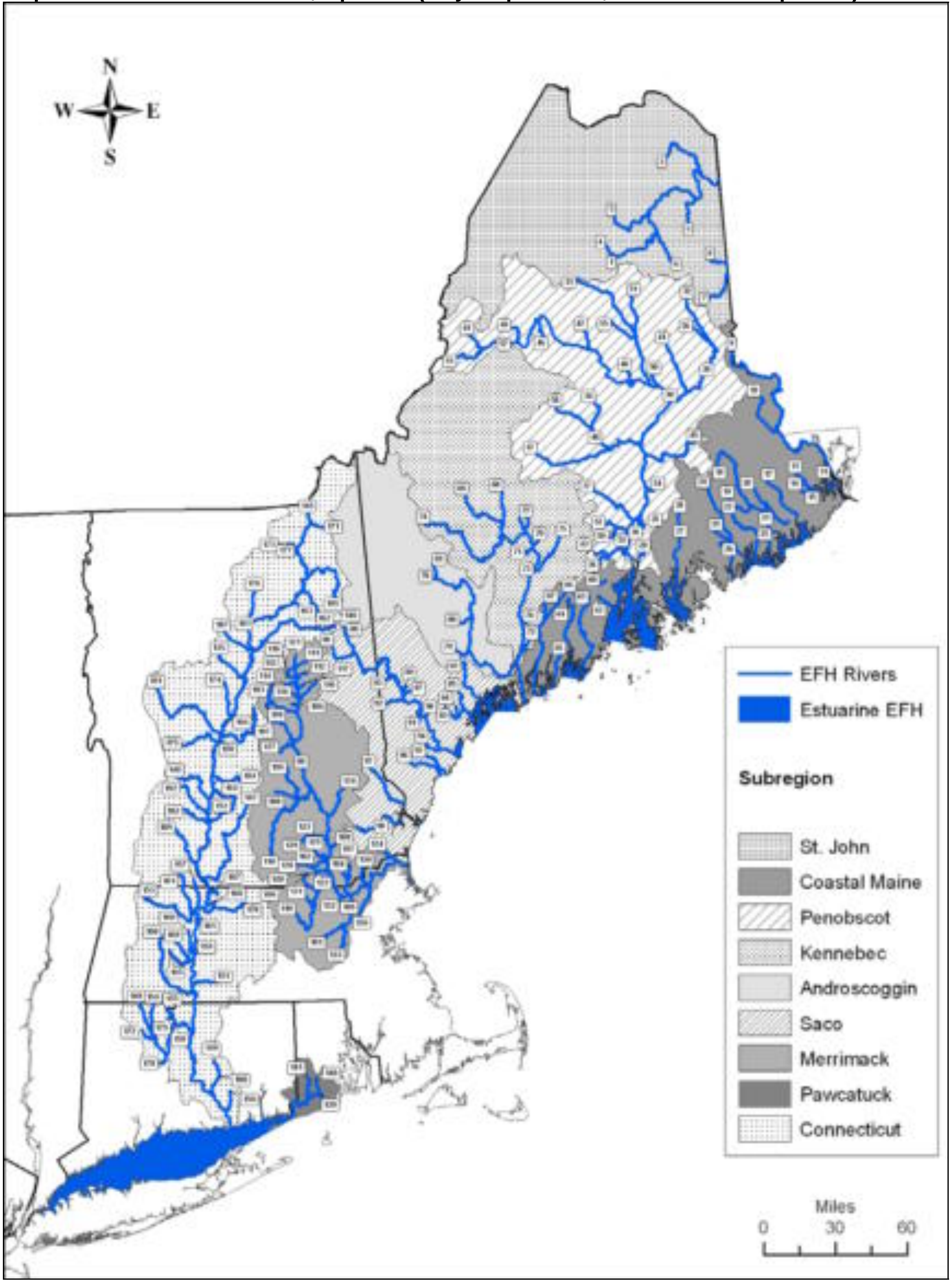
Juveniles (smolts, >10 cm TL) – Variety of riverine, lacustrine, and estuarine habitats. EFH for Atlantic salmon smolts is utilized during their downstream migration and includes streams, rivers, and estuaries from 1st to 5th order, as well as lakes and ponds, and impoundments, within the watersheds of the rivers listed in Table 24 and depicted in Map 537 - Map 539. EFH for this life stage is generally characterized by salinities below 25 ppt. Atlantic salmon smolts feed on a variety of terrestrial and freshwater invertebrates (e.g., insects, aquatic annelids, and mollusks).

Juveniles (post-smolts) – Coastal and open ocean pelagic marine habitats utilized during the oceanic phase of the juvenile lifestage, when they enter the marine environment and before they mature and return to fresh water to spawn, as depicted in Map 537 - Map 539. EFH for Atlantic salmon post-smolts is generally characterized by spring (April-May) sea-surface temperatures between 4 and 10°C and salinities above 25 ppt. They migrate north out of the U.S. EEZ as surface water temperatures increase. EFH for this life stage includes potentially all pelagic marine habitats within the EEZ north of 41° N latitude. When post-smolts first enter the marine environment, they feed mainly on terrestrial insects and marine invertebrates. Later, they switch to larval and small juvenile fish (e.g., Atlantic herring and sand lance), pelagic amphipods, and euphausiids.

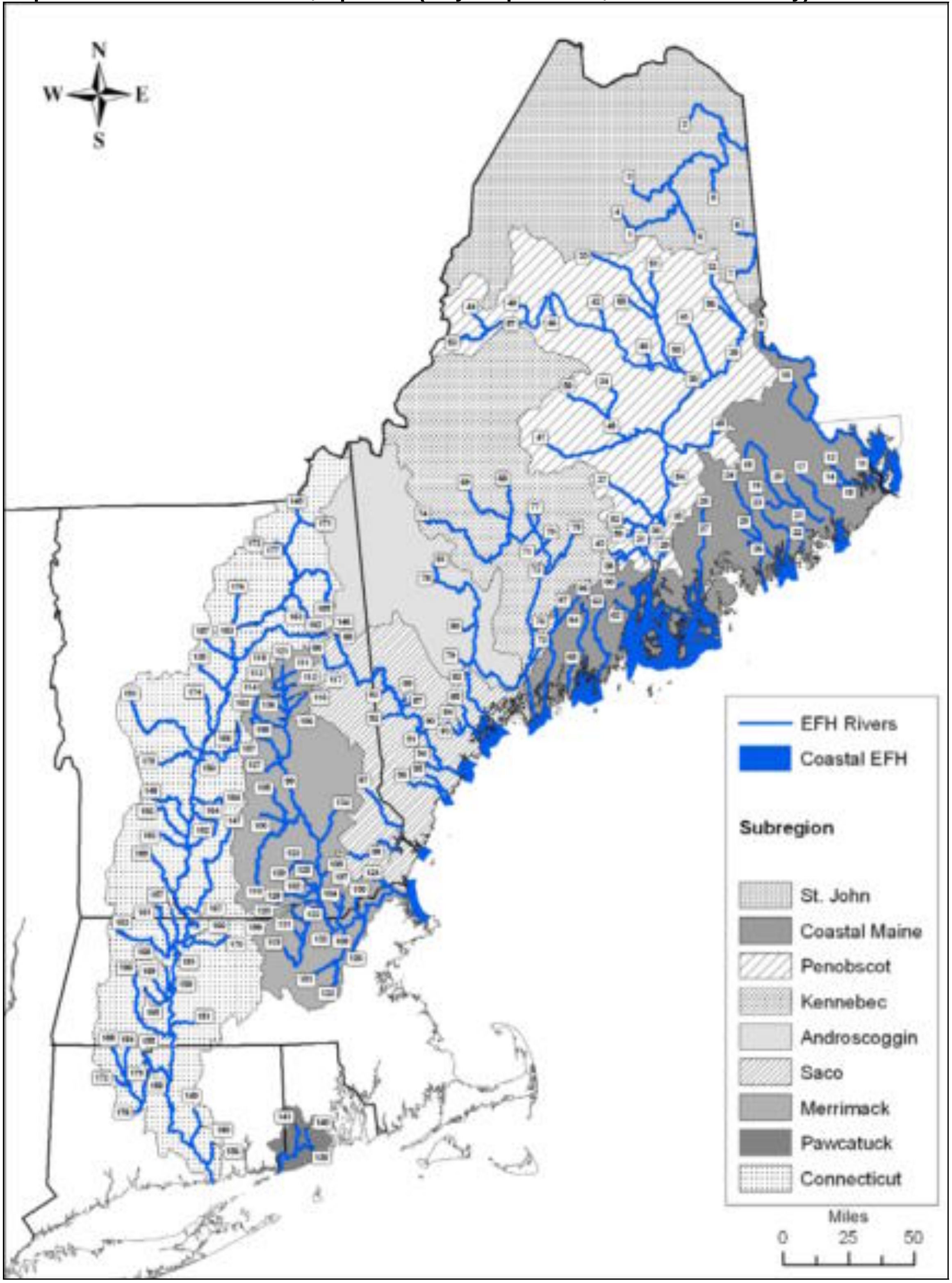
Adults (spawning) – Shallow, fresh water, riffle and run spawning habitats with gravel/rocky substrate, as well as lacustrine, riverine, and estuarine habitats used during upstream migration from the marine environment. EFH for spawning Atlantic salmon includes 1st order to some 3rd or 4th order streams with low temperatures within the watersheds of the rivers listed in Table 24 and depicted in Map 537 - Map 539. Transit habitats utilized during upstream migration include streams, rivers, and estuaries from 1st to 5th order, as well as coastal bays and estuaries listed in Table 24 and shown in Map 537 - Map 539. The following conditions generally describe EFH in fresh water spawning locations: water depths of 17-76 cm, temperatures of 4-14°C, and substrate 2-64 mm in diameter. EFH during upstream migration is generally characterized by a wide range of salinities (0 to 25 ppt), temperatures less than 23°C, and dissolved oxygen concentrations greater than 5 mg/l. Adult salmon do not feed during their upstream spawning runs.

Adults (non-spawning) – Variety of riverine, lacustrine, and estuarine habitats utilized by adult Atlantic salmon following spawning, before they return to the ocean, and pelagic marine habitats utilized by spent fish after they reach the ocean and by adults during their landward spawning migration. EFH for non-spawning adult Atlantic salmon includes 1st to 5th order streams, rivers, and estuaries listed in Table 24 and shown in Map 537- Map 539, as well as potentially oceanic waters north of 41° N latitude within the U.S. EEZ, as depicted in Map 537 - Map 539. During their spawning migration, adult Atlantic salmon generally arrive in U.S. waters in the spring (April-May) when sea surface temperatures are between 4 and 10°C. Spent adults that survive spawning may remain in fresh water and estuarine habitats for up to six months before returning to the sea. Non-spawning adults feed on a variety of marine and fresh water fish (e.g., herring, alewives, smelt, capelin, mummichogs, haddock, sculpins, sand lance, mackerel, and flatfishes).

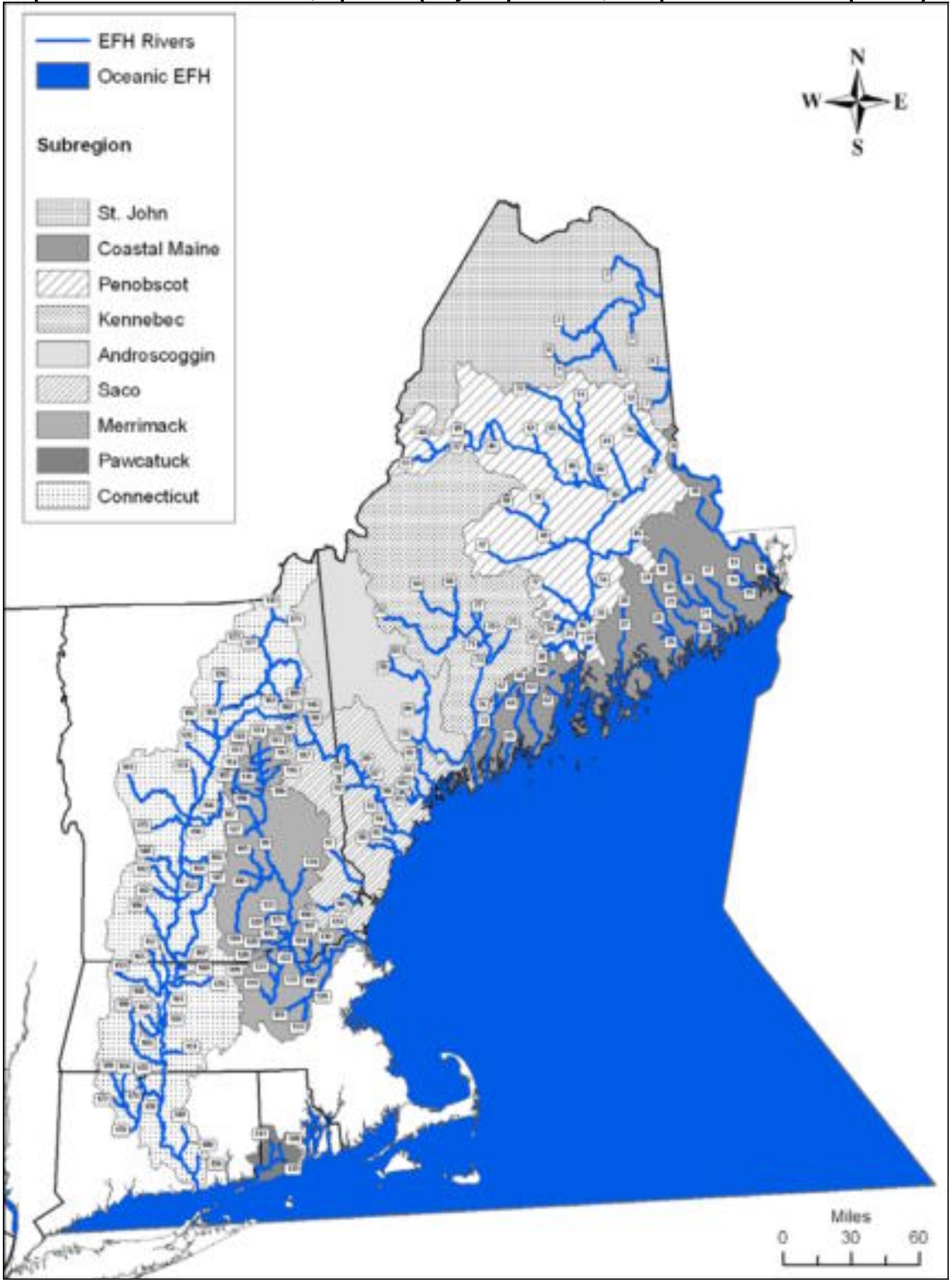
Map 537. Alternative 2A or 2B, Option 1 (10 year presence, no oceanic component)



Map 538. Alternative 2A or 2B, Option 2 (10 year presence, coastal areas only)



Map 539. Alternative 2A or 2B, Option 3 (10 year presence, complete oceanic component)



4.1.7.1.3 Alternative 3 – Three (3) Year Presence (Current)

The list of rivers and estuaries that are applicable in Alternative 3 are listed in Table 25 as "Current" which means that Atlantic salmon have been documented in the system in the last three years (2003-2005). The designated rivers and streams are listed according to the rivers and coastal bays that form a direct connection to the sea. Subregion names and hydrologic unit codes (HUC) used by the U.S. Geological Survey, and index numbers for each river, correspond to what is shown in Map 540 - Map 542. EFH for the freshwater life history stages of Atlantic salmon includes all rivers and streams in each designated drainage system that exhibit the environmental conditions identified in the EFH text descriptions.

Table 25. Alternative 3 – Three year presence: New England rivers, streams, and estuaries (bays) designated as essential fish habitat for Atlantic salmon, based on documented presence of juveniles or adults.

Locations labeled as labeled as "current" have had a documented presence in the last three (3) years (2003-2005).

Subregion (HUC4)	HUC4	Drainage	River Status	Bay Designation	Estuary Status	River Name	Index
St John	0101	St John	Current	Bay of Fundy	Current	Aroostook River	1
						Little Madawaska River	2
						Big Machias River	3
						Mooseleuk Stream	4
						Presque Isle Stream	5
						St Croix Stream	6
						Meduxnekeag River	7
						N Branch Meduxnekeag R	8
Maine Coastal	0105	St Croix	Current	Passamaquoddy Bay	Current	St Croix River	9
						Tomah Stream	10
		Dennys	Current			Dennys River	13
						Cathance Stream	14
		East Machias	Current	Machias Bay	Current	East Machias River	17
		Machias	Current			Machias River	18
						Mopang Stream	19
						Old Stream	20
		Pleasant	Current	Pleasant/Narraguagus Bay	Current	Pleasant River	23
		Narraguagus	Current			Narraguagus River	24
						West Branch Narraguagus R	25
		Union	Current	Blue Hill Bay	Current	Union River	27
						West Branch Union R	28
Penobscot	0102	Penobscot	Current	Penobscot Bay	Current	Penobscot River	30
						Cove Brook	31
						East Branch Mattawamkeag River	32
						East Branch Penobscot R	33

Subregion (HUC4)	HUC4	Drainage	River Status	Bay Designation	Estuary Status	River Name	Index
						East Branch Pleasant R	34
						Eaton Brook	35
						Felts Brook	36
						Kenduskeag Stream	37
						Marsh Stream	38
						Mattawamkeag River	39
						Millinocket Stream	40
						Molunkus Stream	41
						Nesowadnehunk Stream	42
						North Branch Marsh Stream	43
						North Branch Penobscot R	44
						Passadumkeag River	45
						Pine Stream	46
						Piscataquis River	47
						Pleasant River	48
						Russell Stream	49
						Salmon Stream	50
						Seboeis River	51
						Souadabscook Stream	52
						South Branch Penobscot R	53
						Sunkhaze Stream	54
						Wassataquoik Stream	55
						West Branch Mattawamkeag R	56
						West Branch Penobscot R	57
						West Branch Pleasant R	58
						West Branch Souadabscook Stream	59
Maine Coastal	0105	Passagassawakeag	Current			Passagassawakeag	60

Subregion (HUC4)	HUC4	Drainage	River Status	Bay Designation	Estuary Status	River Name	Index
						River	
		Ducktrap	Current			Ducktrap River	62
		St George	Current	Muscongus Bay	Current	St George River	63
		Sheepscot	Current	Sheepscot Bay	Current	Sheepscot River	66
						West Branch Sheepscot R	67
Kennebec	0103	Kennebec	Current	Local Estuary	Current	Kennebec River	68
						Carrabassett River	69
						Carrabassett Stream	70
						Craigin Brook	71
						Eastern River	72
						Messalonskee Stream	73
						Sandy River	74
						Sebasticook River	75
						Togus Stream	76
						Wesserunsett Stream	77
Androscoggin	0104	Androscoggin		Local Estuary	Current	Androscoggin River	78
						Little Androscoggin River	79
						Nezinscot River	80
						Webb River	81
Saco	0106	Saco	Current	Saco Bay	Current	Saco River	86
						Breakneck Brook	87
						Ellis River	88
						Hancock Brook	89
						Josies Brook	90
						Little Ossipee River	91
						Ossipee River	92
						Shepards River	93
						Swan Pond Brook	94
		Cocheco	Current	Great Bay	Current	Cocheco River	97
		Lamprey	Current	Great Bay	Current	Lamprey River	98

Subregion (HUC4)	HUC4	Drainage	River Status	Bay Designation	Estuary Status	River Name	Index
Merrimack	0107	Merrimack	Current	Ipswich Bay	Current	Merrimack River	99
						Amey Brook	100
						Assabet River	101
						Baboosic Brook	102
						Baker River	103
						Beaver Brook	104
						Blackwater River	105
						Bog Brook	106
						Cockermouth River	107
						Cohas Brook	108
						Concord River	109
						Contoocook River	110
						E Branch Pemigewasset R	111
						Eastman Brook	112
						Glover Brook	113
						Golden Brook	197
						Hubbard Brook	114
						Mad River	116
						Mill Brook	117
						Moosilauke Brook	118
						Nashua River	119
						Nissitissit River	120
						Pemigewasset River	121
						Pennichuck Brook	122
						Piscataquog River	123
						Powwow River	124
						Pulpit Brook	125
						Shawseen River	126
						Smith River	127
						Souhegan River	128

Subregion (HUC4)	HUC4	Drainage	River Status	Bay Designation	Estuary Status	River Name	Index
						South Branch Baker River	198
						S Branch Piscataquog R	129
						Spicket River	130
						Squannacook River	131
						Stony Brook	132
						Sudbury River	133
						Suncook River	134
						Warner River	135
						West Branch Brook	136
						Witches Brook	199
MA-RI Coastal	0109	Pawcatuck	Current	Long Island Sound	Current	Pawcatuck River	139
						Beaver River	140
						Wood River	141
Connecticut	0108	Connecticut	Current	Long Island Sound	Current	Connecticut River	145
						Ammonoosuc River	146
						Ashuelot River	147
						Black River	148
						Blackledge River	149
						Bloods Brook	150
						Chicopee River	151
						Cold River	152
						Deerfield River	153
						East Branch Farmington R	154
						East Branch Salmon Brook	155
						Eightmile River	156
						Fall River	157
						Farmington River	158
						Fort River	159
						Fourmile Brook	160

Subregion (HUC4)	HUC4	Drainage	River Status	Bay Designation	Estuary Status	River Name	Index
						Green River	161
						Israel River	162
						Johns River	163
						Little Sugar River	164
						Manhan River	165
						Mascoma River	166
						Mill Brook	167
						Mill River (Hatfield)	168
						Mill River (Northampton)	169
						Millers River	170
						Mohawk River	171
						Nepaug River	172
						Nulhegan River	173
						Ompompanoosuc River	174
						Ottauquechee River	175
						Passumpsic River	176
						Paul Stream	177
						Pequabuck River	178
						Salmon Brook	179
						Salmon River	180
						Sawmill River	181
						Saxtons River	182
						Stevens River	183
						Sugar River	184
						Upper Ammonoosuc River	185
						Waits River	186
						Wells River	187
						West Branch Farmington R	188
						West River	189
						Westfield River	190

Subregion (HUC4)	HUC4	Drainage	River Status	Bay Designation	Estuary Status	River Name	Index
						White River	191
						Williams River	192

Two options are under consideration for the **text descriptions**:

Alternative 3A: Text descriptions by habitat type

Alternative 3B: Text descriptions by life stage

Additionally, three options are under consideration for **map representations** as sub-alternatives for each text description method (e.g. Alternative 3A, Option 1). *Depending on which option is selected by the Council, the text description will be modified accordingly.*

Option 1: No oceanic component (only include the ELMR areas for the rivers and the bays and estuaries shown on the map are defined by the 25 ppt salinity boundary if applicable)

Option 2: Oceanic component bounded by the three-mile state limit as a buffer for the rivers with an EFH designation

Option 3: Oceanic component that includes the area from the coast to the Hague Line (EEZ) and south to 41 degrees of latitude.

4.1.7.1.3.1 Alternative 3A – Designation by Habitat Type

Fresh Water Spawning and Rearing Habitats - Riffle and run habitats in shallow, well-oxygenated, fresh water streams with gravel/rocky substrates, as well as pools and vegetated riverine areas of lower velocity. These habitats occur in a range from 1st order streams (headwaters) to some 3rd or 4th order streams with low temperatures within the watersheds of the rivers listed in Table 25 and depicted in Map 540 –Map 542. Five life stages of Atlantic salmon utilize these habitats – eggs, larvae (alevins), recently-hatched juveniles (fry), older juveniles (parr), and spawning adults. Intra-gravel habitat in the stream bed is essential for Atlantic salmon eggs and alevins, whereas EFH for the juveniles and spawning adults is the stream itself. Only parr utilize non-riffle and run habitats. The following conditions generally apply where EFH for these five life stages is found:

Eggs: Grain size diameters of 2-64 mm, water depths of 17-76 cm, water temperatures of 0-16°C (6-7 optimal), intra-gravel water velocities above 20 cm/sec (53 optimal), dissolved oxygen concentrations above 3 mg/l (7 optimal), and ph above 4.0 (5.5 optimal). Eggs are deposited in nests (redds) in late October-November and are buried in the substrate to depths of 10-25 cm where they remain for 175-195 days before hatching.

Larvae: Grain size diameters of 2-64 mm, water depths of 17-76 cm, water temperatures of 0-16°C, intra-gravel water velocities above 20 cm/sec (53 optimal), and dissolved oxygen concentrations above 3 mg/l (7 optimal). Larvae remain in the substrate for about six weeks before emerging as fry in the spring.

Juveniles (fry, <5 cm TL): Grain size diameters of 15-64 mm and, for emerging fry, stream flow velocities below 20 cm/sec. EFH conditions of depth and temperature for small, emerging fry are generally the same as for eggs and larvae, but larger fry disperse up to 5 km from redd sites and may be exposed to a wider range of habitat conditions. Atlantic salmon fry feed on plankton and small invertebrates.

Juveniles (parr, 5-10 cm TL): Water depths of 10-15 cm for parr <7 cm TL and 30-60 cm for larger parr, temperatures of 7-25°C, dissolved oxygen concentrations above 5 mg/l, and water velocities of 30-92 cm/sec. Atlantic salmon parr feed on a variety of terrestrial and freshwater invertebrates (e.g., insects, aquatic annelids, and mollusks).

Spawning adults: Grain size diameters of 2-64 mm, water depths of 17-76 cm, and temperatures of 4-14°C. Spawning in U.S. waters generally occurs during late October through November. EFH for spawning adult salmon also includes coastal marine, estuarine, lacustrine, and riverine habitats used during upstream migration (see below). Adult Atlantic salmon do not feed while spawning. (Note: All spawning females are sea-run salmon, but spawning males include some sea-run salmon and some juveniles that mature in fresh water before ever migrating to the ocean).

Emigration-Immigration Habitats - Variety of riverine, lacustrine, estuarine, and coastal marine habitats used by older juvenile Atlantic salmon (smolts, >10 cm TL) during their downstream migration to the sea, by mature adult salmon during their upstream spawning migration, and by spent adults (kelts) following spawning, before they return to the ocean. EFH for migrating smolts and kelts includes streams, rivers, and estuaries from 1st to 5th order, as well as lakes, ponds, and impoundments, within the watersheds of the rivers listed in Table 25 and depicted in Map 540 -Map 542. EFH for all three life stages is generally characterized by salinities below 25 ppt. Transit habitats utilized during upstream migration include streams, rivers, and estuaries from 1st to 5th order, as well as coastal and open ocean marine areas and is generally characterized by temperatures less than 23°C and dissolved oxygen concentrations greater than 5 mg/l. Atlantic salmon smolts feed on a variety of terrestrial and freshwater invertebrates (e.g., insect larvae and nymphs, aquatic annelids, and mollusks). Adult salmon do not feed during their upstream spawning runs. Spent adults feed on fish and aquatic insects.

Marine Habitats - Coastal and open ocean pelagic marine habitats. These habitats are utilized by older juveniles (post-smolts) during the oceanic phase of their life cycle as they are migrating north to feeding grounds in the North Atlantic, by adults during their landward spawning migration from the marine environment, and by adults that return to the sea after spawning. Marine EFH for Atlantic salmon includes potentially all oceanic waters north of 41° N latitude to the seaward boundary of the EEZ and the U.S.-Canada border, as depicted in Map 540 -Map 542. Marine EFH for Atlantic salmon is generally defined by spring (April-May) sea-surface temperatures between 4 and 10°C and salinities above 25 ppt. When post-smolts first enter the marine environment, they feed mainly on insects and marine invertebrates and then switch to larval and small juvenile fish (e.g., Atlantic herring and sand lance), pelagic amphipods, and euphausiids. While in the marine environment, non-spawning adults feed on a variety of fish (e.g., herring, haddock, sculpins, sand lance, mackerel, and flatfishes).

4.1.7.1.3.2 Alternative 3B – Designation by Life Stage

Eggs – In nests (redds), in intra-gravel riffle and run habitats in shallow, fresh water, well-oxygenated, gravel/rocky stream beds. The following conditions generally apply where EFH for Atlantic salmon eggs is found: substrate grain sizes of 2-64 mm (diameter), water depths of 17-76 cm, water temperatures of 0-16°C (6-7 optimal), intra-gravel water velocities above 20 cm/sec (53 optimal), dissolved oxygen concentrations above 3 mg/l (7 optimal), and pH above 4.0 (>5.5 optimal). EFH for Atlantic salmon egg occurs to a substrate depth of 10-25 cm in streams that range from 1st order (headwaters) to some 3rd or 4th order streams with low temperatures within the watersheds of the rivers listed in Table 25 and depicted in Map 540 - Map 542.

Larvae (alevins) – Intra-gravel riffle and run habitats, in shallow, fresh water, well-oxygenated, gravel/rocky stream beds. The following conditions generally apply where EFH for Atlantic salmon larvae is found: substrate grain sizes of 2-64 mm (diameter), depths of 17-76 cm, water temperatures of 0-16°C, intra-gravel water velocities above 20 cm/sec (53 optimal), and dissolved oxygen concentrations above 3 mg/l (7 optimal). EFH for Atlantic salmon alevins occurs in a range from 1st to some 3rd or 4th order streams with low temperatures within the watersheds of the rivers listed in Table 25 and depicted in Map 540 - Map 542.

Juveniles (fry, <5 cm TL) – Riffle and run habitats, in shallow, fresh water, gravel/rocky streams. EFH conditions of depth and temperature for small Atlantic salmon fry just after they emerge from the substrate are generally the same as for the eggs and larvae, but larger fry disperse up to 5 km from redd sites and may be exposed to a wider range of habitat conditions. EFH for small Atlantic salmon fry is generally found where substrate grain size diameter is 15-64 mm and stream flow velocities are no more than 20 cm/sec, whereas larger fry can withstand velocities >50 cm/sec. EFH for Atlantic salmon fry occurs in a range from 1st to some 3rd or 4th order streams with low temperatures within the watersheds of the rivers listed in Table 25 and depicted in Map 540 - Map 542. Atlantic salmon fry feed on plankton and small invertebrates.

Juveniles (parr, 5-10 cm TL) – Riffle and run habitats, in shallow, fresh water, gravel/rocky streams, as well as pools and vegetated riverine areas of lower velocity. The following conditions generally apply where EFH for Atlantic salmon parr is found: depths of 10-15 cm for parr <7 cm TL and 30-60 cm for larger parr, temperatures of 7-25°C, dissolved oxygen concentrations above 5 mg/l, and water velocities of 30-92 cm/sec. EFH for Atlantic salmon parr occurs in a range from 1st to some 3rd or 4th order streams with low temperatures within the watersheds of the rivers listed in Table 25 and depicted in Map 540 - Map 542. Atlantic salmon parr feed on a variety of terrestrial and freshwater invertebrates (e.g., insects, aquatic annelids, and mollusks).

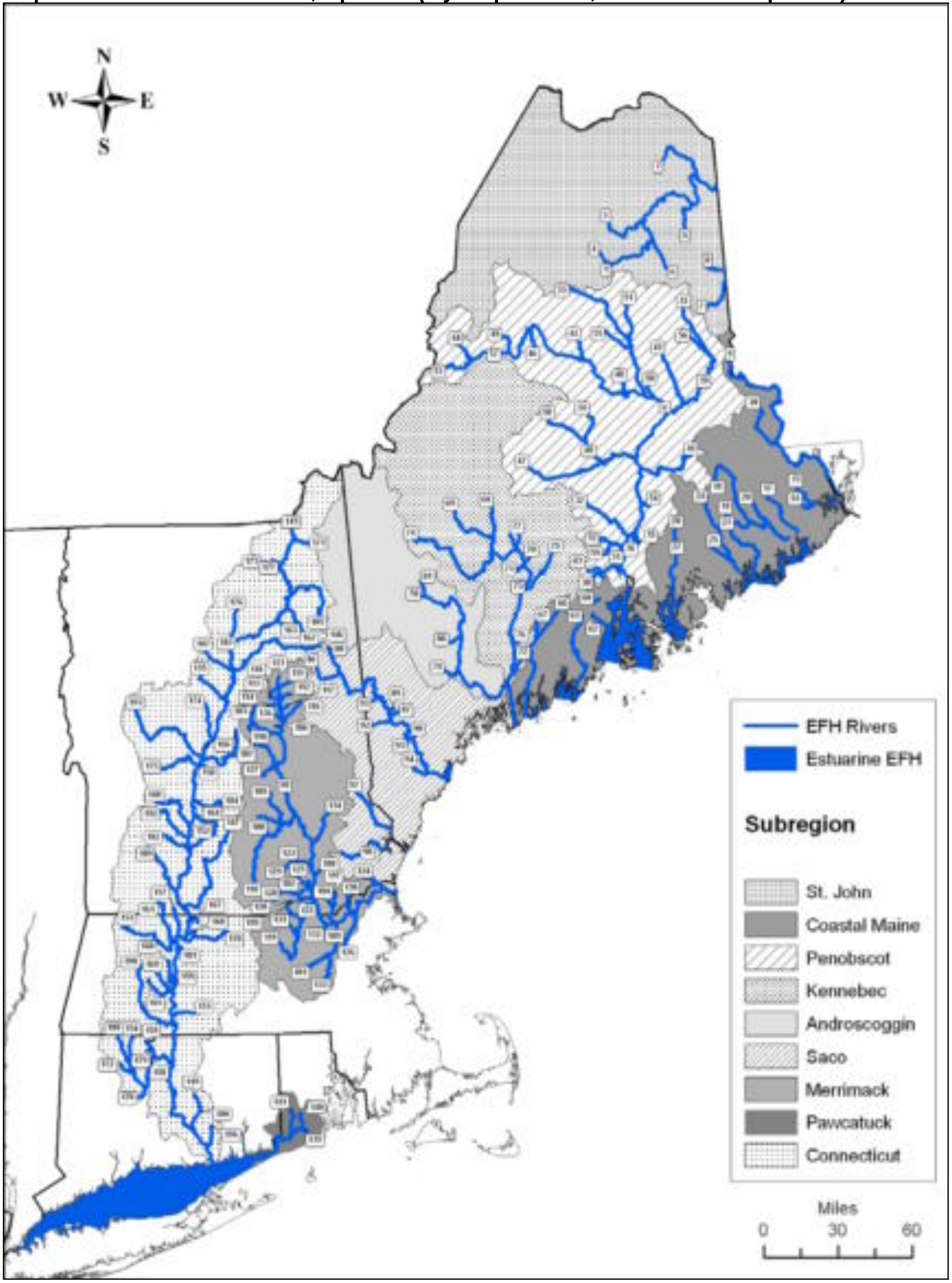
Juveniles (smolts, >10 cm TL) – Variety of riverine, lacustrine, and estuarine habitats. EFH for Atlantic salmon smolts is utilized during their downstream migration and includes streams, rivers, and estuaries from 1st to 5th order, as well as lakes and ponds, and impoundments, within the watersheds of the rivers listed in Table 25 and depicted in Map 540 - Map 542**Error! Reference source not found.**. EFH for this life stage is generally characterized by salinities below 25 ppt. Atlantic salmon smolts feed on a variety of terrestrial and freshwater invertebrates (e.g., insects, aquatic annelids, and mollusks).

Juveniles (post-smolts) – Coastal and open ocean pelagic marine habitats utilized during the oceanic phase of the juvenile lifestage, when they enter the marine environment and before they mature and return to fresh water to spawn, as depicted in Map 540 - Map 542. EFH for Atlantic salmon post-smolts is generally characterized by spring (April-May) sea-surface temperatures between 4 and 10°C and salinities above 25 ppt. They migrate north out of the U.S. EEZ as surface water temperatures increase. EFH for this life stage includes potentially all pelagic marine habitats within the EEZ north of 41° N latitude. When post-smolts first enter the marine environment, they feed mainly on terrestrial insects and marine invertebrates. Later, they switch to larval and small juvenile fish (e.g., Atlantic herring and sand lance), pelagic amphipods, and euphausiids.

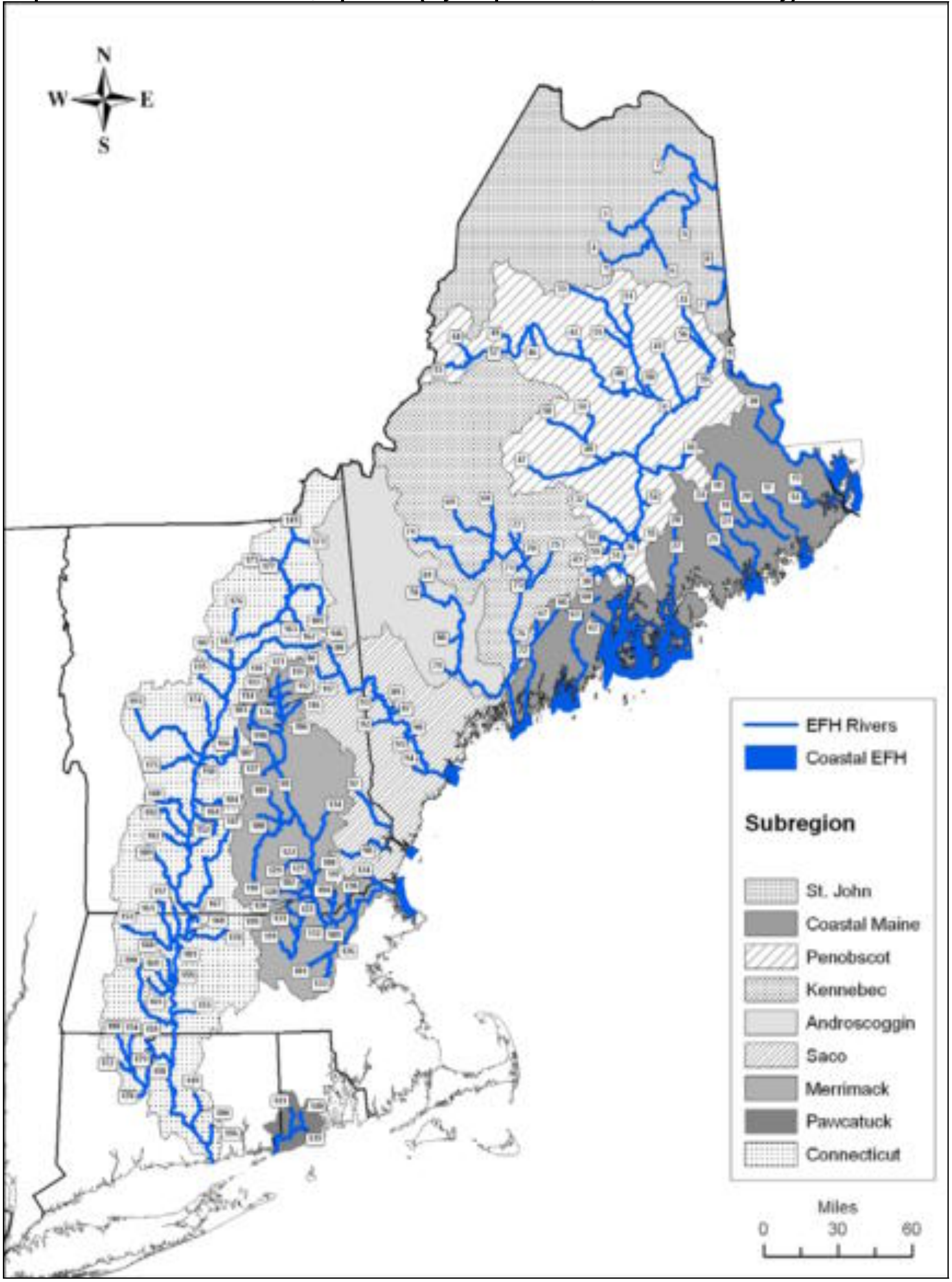
Adults (spawning) – Shallow, fresh water, riffle and run spawning habitats with gravel/rocky substrate, as well as lacustrine, riverine, and estuarine habitats used during upstream migration from the marine environment. EFH for spawning Atlantic salmon includes 1st order to some 3rd or 4th order streams with low temperatures within the watersheds of the rivers listed in Table 25 and depicted in Map 540 - Map 542. Transit habitats utilized during upstream migration include streams, rivers, and estuaries from 1st to 5th order, as well as coastal bays and estuaries listed in Table 25 and shown in Map 540 - Map 542. The following conditions generally describe EFH in fresh water spawning locations: water depths of 17-76 cm, temperatures of 4-14°C, and substrate 2-64 mm in diameter. EFH during upstream migration is generally characterized by a wide range of salinities (0 to 25 ppt), temperatures less than 23°C, and dissolved oxygen concentrations greater than 5 mg/l. Adult salmon do not feed during their upstream spawning runs.

Adults (non-spawning) – Variety of riverine, lacustrine, and estuarine habitats utilized by adult Atlantic salmon following spawning, before they return to the ocean, and pelagic marine habitats utilized by spent fish after they reach the ocean and by adults during their landward spawning migration. EFH for non-spawning adult Atlantic salmon includes 1st to 5th order streams, rivers, and estuaries listed in Table 25 and shown in Map 540 - Map 542, as well as potentially oceanic waters north of 41° N latitude within the U.S. EEZ, as depicted in Map 540 - Map 542. During their spawning migration, adult Atlantic salmon generally arrive in U.S. waters in the spring (April-May) when sea surface temperatures are between 4 and 10°C. Spent adults that survive spawning may remain in fresh water and estuarine habitats for up to six months before returning to the sea. Non-spawning adults feed on a variety of marine and fresh water fish (e.g., herring, alewives, smelt, capelin, mummichogs, haddock, sculpins, sand lance, mackerel, and flatfishes).

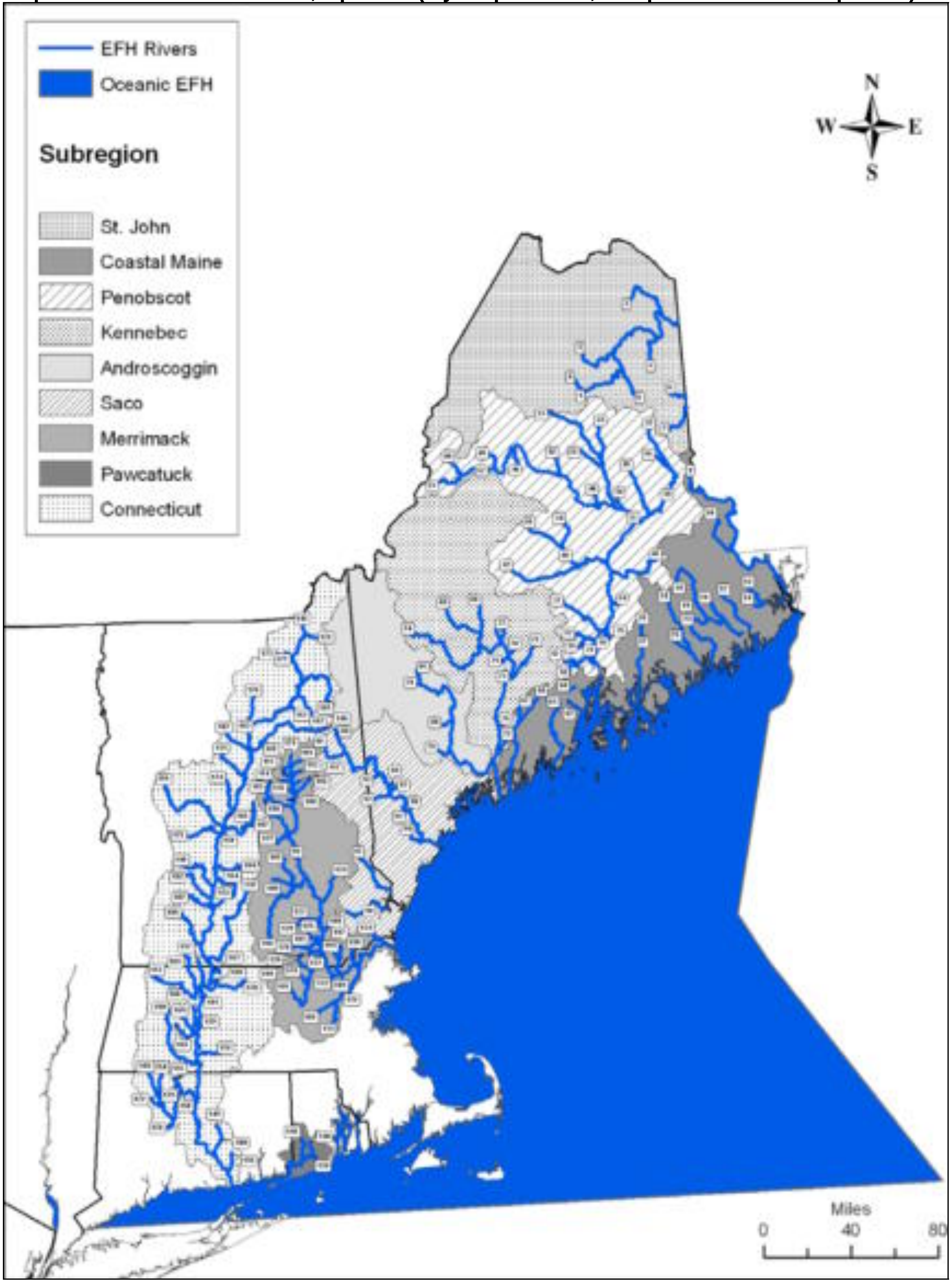
Map 540. Alternative 3A or 3B, Option 1 (3 year presence, no oceanic component)



Map 541. Alternative 3A or 3B, Option 2 (3 year presence, coastal areas only)



Map 542. Alternative 3A or 3B, Option 3 (3 year presence, complete oceanic component)



4.1.7.2 Deep-Sea Red Crab

Summary of Alternatives

Table 26. Summary of Deep-Sea Red Crab EFH Designation Alternatives

Alternative	Spatial Realm →	→	→	→	→
↓	Shelf (GOM)	Off-Shelf/Slope	Observed Seamounts (depth-defined)	Observed Seamounts (feature-defined)	All EEZ Seamounts
1		X			
2		X			
3A		X	X		
3B		X		X	
4	X	X			
5A	X	X	X		
5B	X	X		X	
6	X	X			X

4.1.7.2.1 Alternative 1 (No Action)

Under this alternative, the existing EFH designations implemented for deep-sea red crab in the 2002 Red Crab FMP would remain in place. Text and map descriptions for this alternative were based on depths, substrates, and bottom temperatures where juvenile and adult red crab are found on the continental slope, as described in the EFH Source Document for this species.

In its *Report to Congress: Status of the Fisheries of the United States* (January 2001), NMFS reported that the status of the resource is currently unknown. EFH for red crab includes those areas of the offshore waters (out to the offshore U.S. boundary of the exclusive economic zone) that are identified on **Map 543** - **Map 546** and described by the following conditions. The text description refers to the maps of the preferred options for EFH designation for each life history stage. If the Council's preferred options change, the EFH text description will be modified to reflect these changes.

Eggs: Red crab eggs are brooded attached to the underside of the female crab until they hatch into larvae and are released into the water column. Egg-bearing females are most commonly found on the shallow continental slope between 200 and 400 meters, where temperatures are typically between 4 - 10° C. The EFH designation for red crab eggs will be the same as the known distribution of egg-bearing females (200 - 400 meters) along the southern flank of Georges Bank and south to Cape Hatteras, North Carolina, as depicted on **Map 543**.

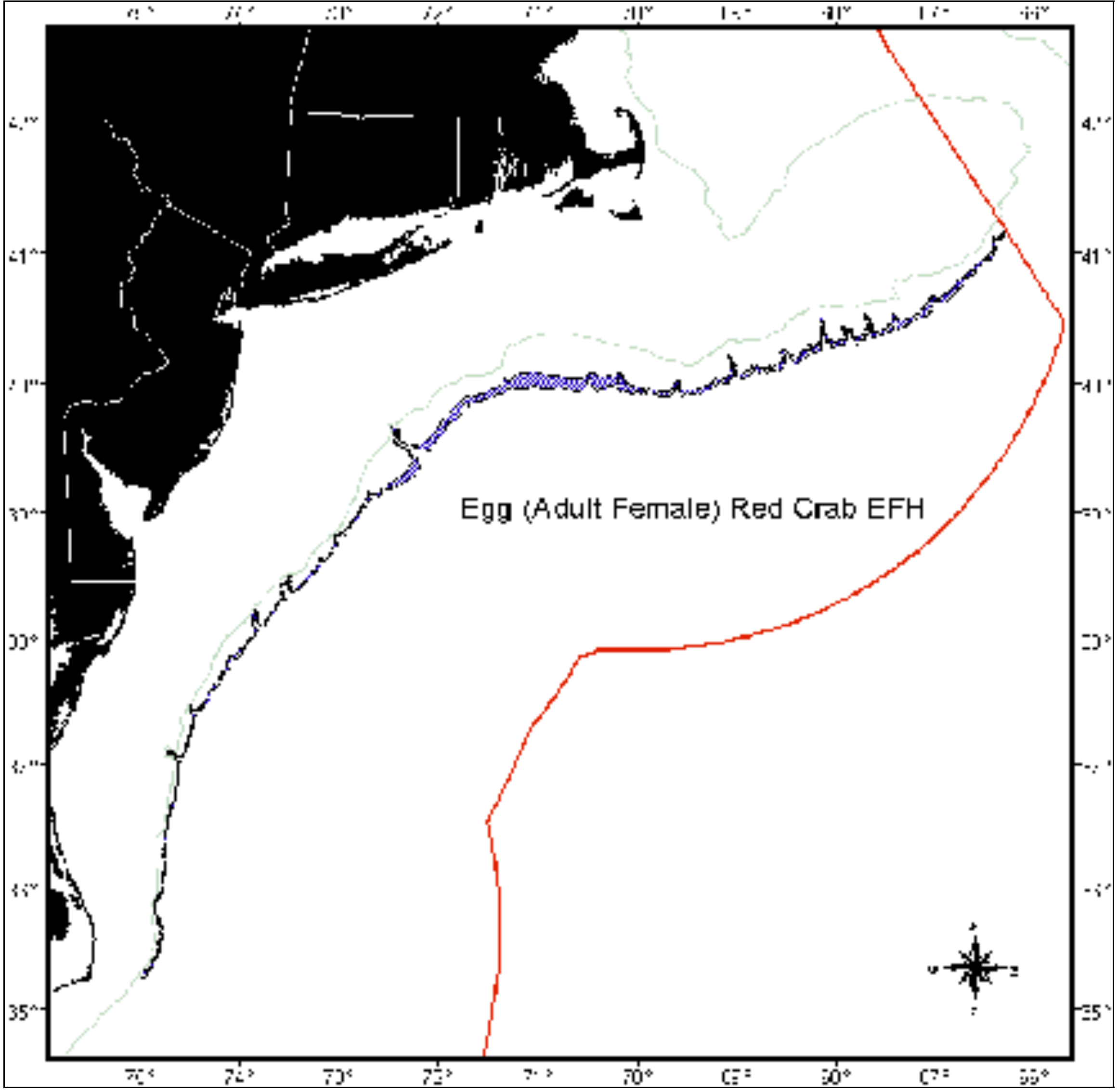
Larvae: Essential fish habitat for red crab larvae is described as the water column from the surface to the seafloor across the entire depth range identified for the species, 200 - 1800 meters along the southern flank of Georges Bank and south to Cape Hatteras, North Carolina, as depicted on **Map 544**. Generally, the following conditions exist where red crab larvae are most commonly observed: water temperatures between 4 and 25° C, salinities between 29 and 36‰, and dissolved oxygen between 5 and 8 ml/l. Red crab larvae appear to be most common during January through June.

Juveniles: Bottom habitats of the continental slope with a substrate of silts, clays, and all silt-clay-sand composites within the depths of 700 to 1800 meters along the southern flank of Georges Bank and south to Cape Hatteras, North Carolina, as depicted on **Map 545**. Generally, the following conditions exist where red crab juveniles are most commonly observed: water temperatures between 4 and 10° C, salinities of approximately 35‰, and dissolved oxygen between 3 and 7 ml/l.

Adults: Bottom habitats of the continental slope with a substrate of silts, clays, and all silt-clay-sand composites within the depths of 200 to 1300 meters along the southern flank of Georges Bank and south to Cape Hatteras, North Carolina, as depicted on **Map 546**. Generally, the following conditions exist where red crab adults are most commonly observed: water temperatures between 5 and 14° C, salinities of approximately 35‰, and dissolved oxygen between 3 and 8 ml/l.

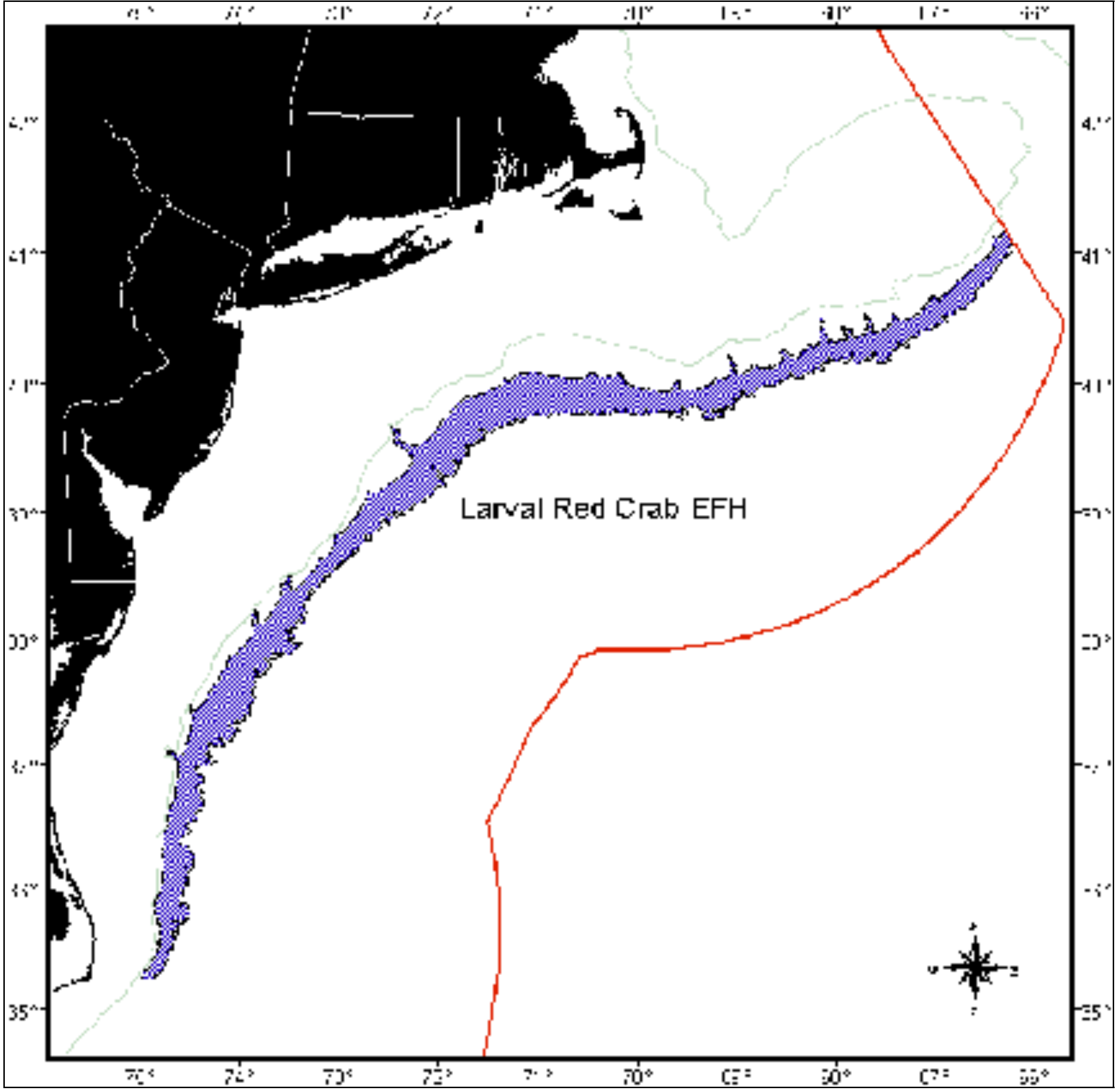
Spawning Adults: Bottom habitats of the continental slope with a substrate of silts, clays, and all silt-clay-sand composites within the depths of 200 to 1300 meters along the southern flank of Georges Bank and south to Cape Hatteras, North Carolina, as depicted on **Map 546**. Generally, the following conditions exist where red crab adults are most commonly observed: water temperatures between 4 and 12° C, salinities of approximately 35‰, and dissolved oxygen between 3 and 8 ml/l.

Map 543. Deep-sea red crab eggs, Alternative 1 (No Action)



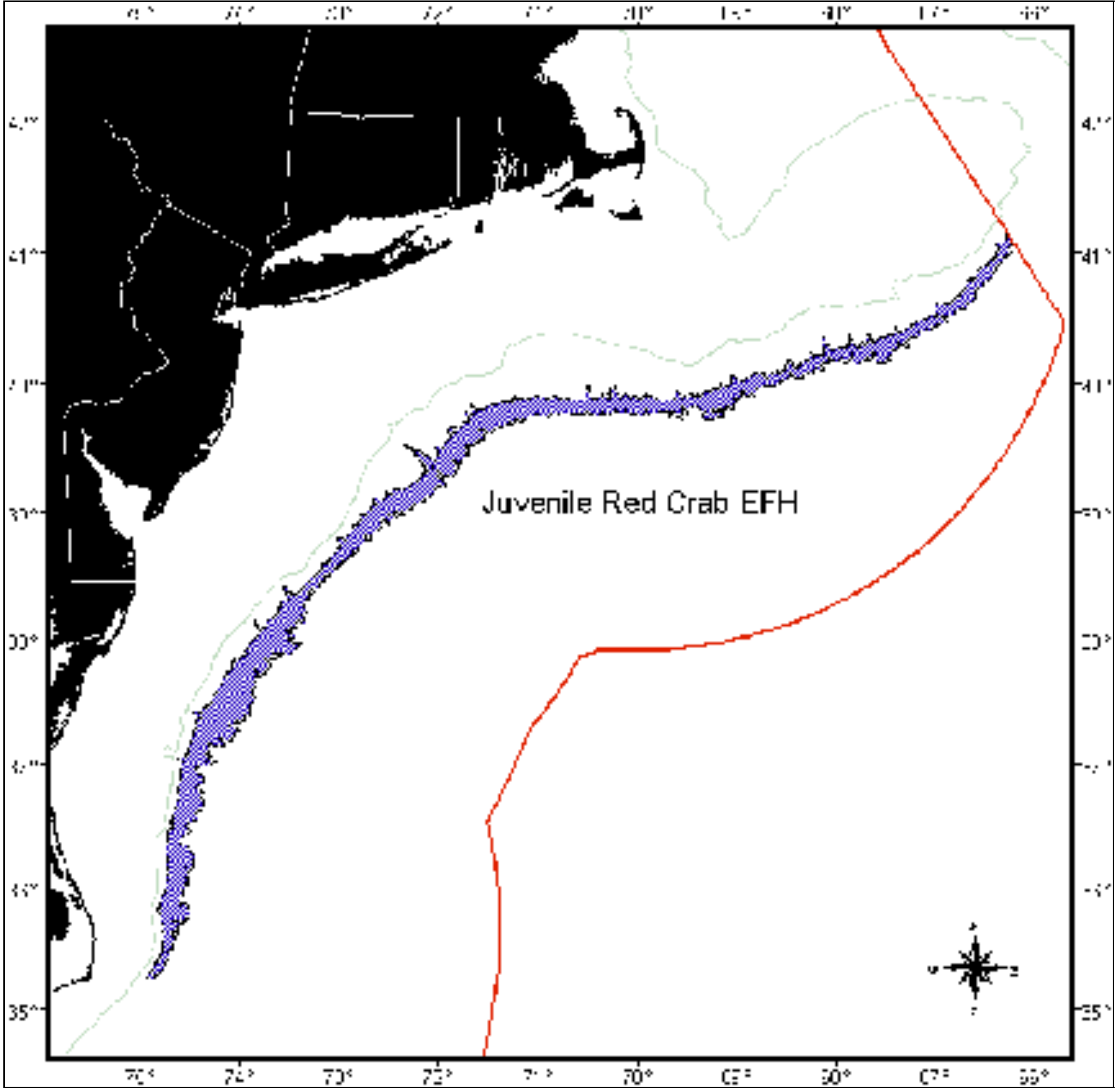
This map represents the designation of EFH for this life history stage based on known depth zone affinities. This delineates the potential EFH for red crab eggs based on the preferred depth range of adult females (Steimle et al. 2001). This is distinct from the EFH designation for red crab adults, which is much broader to reflect the inclusion of adult males.

Map 544. Deep-sea red crab larvae, Alternative 1 (No Action)



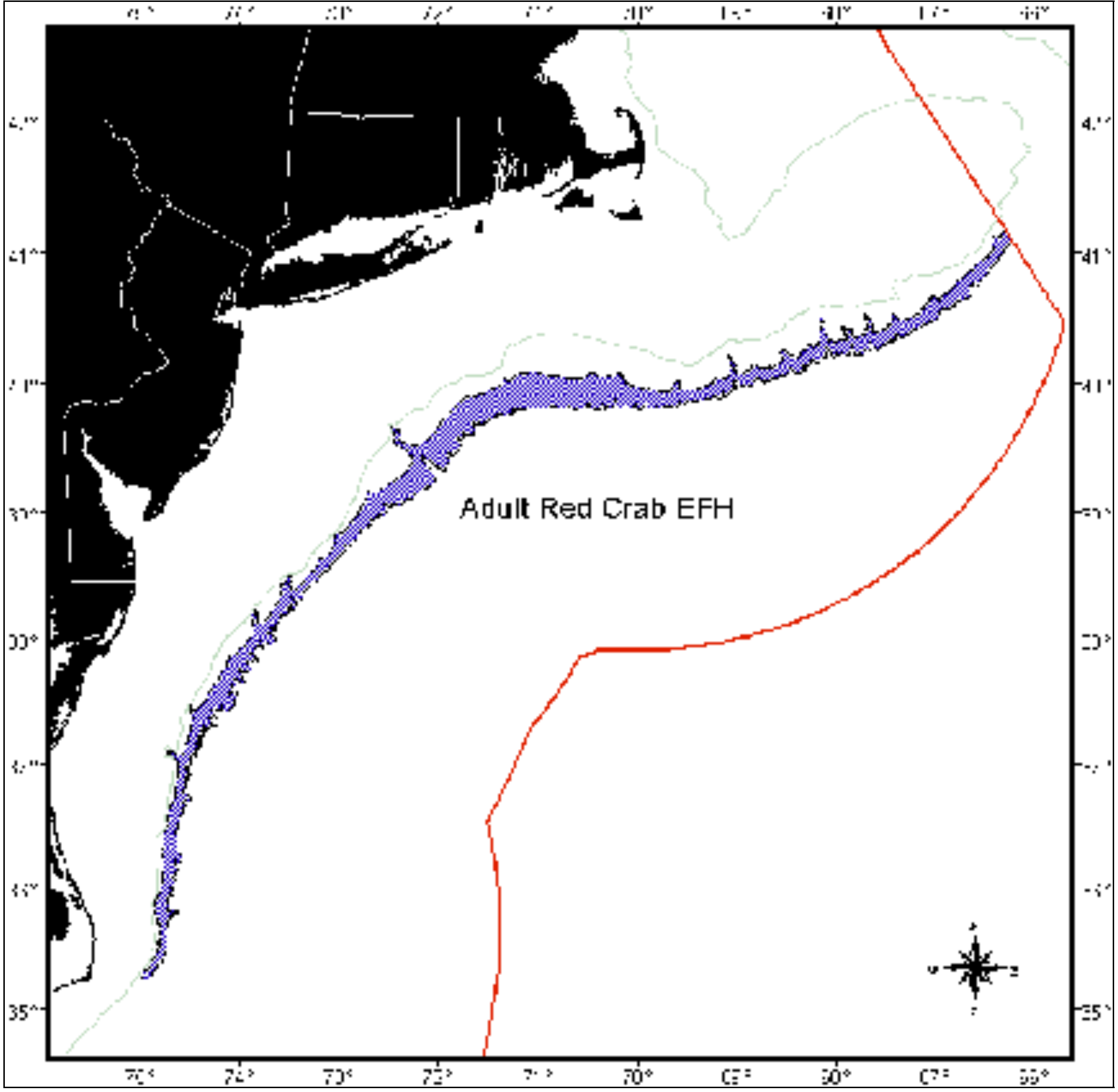
This map represents the designation of EFH for this life history stage based on known depth zone affinities. This provides the broadest possible delineation based on known depth ranges by utilizing the union of the full adult and juvenile depth ranges, 200 - 1800 meters (Steimle et al. 2001). The union of the juvenile and adult depth ranges is meant to serve as a proxy for the actual range of red crab larvae, which is unknown. This map represents the total area within the preferred depth range for adults and juveniles of this species and thus representative of the area of the water column where red crab larvae are most likely to be found.

Map 545. Deep-sea red crab juveniles, Alternative 1 (No Action)



This map represents the designation of EFH for this life history stage based on known depth zone affinities. This includes the total area known to be within the preferred depth range for juveniles of this species. The depth range presented is 700 - 1800 meters (Steimle et al. 2001).

Map 546. Deep-sea red crab adults, Alternative 1 (No Action)



This map represents the designation of EFH for this life history stage based on known depth zone affinities. This includes the total area known to be within the preferred depth range for adults of this species. The depth range presented is 200 - 1300 meters (Steimle et al. 2001).

4.1.7.2.2 Alternative 2

Alternative 2 includes the Status Quo text descriptions as revised for refined slope depth occurrences of deep-sea red crab and modifies the map representations to illustrate the new depth ranges. The new depth ranges were based on relative abundance trawl survey data for the continental slope found in Wigley et al. (1975).

Eggs: Red crab eggs are brooded attached to the underside of the female crab until they hatch into larvae and are released into the water column. The EFH designation for red crab eggs is therefore the same as the known distribution of egg-bearing females, i.e., in benthic habitats at depths of 320 - 640 meters along the outer continental slope, as depicted on Map 547. EFH for red crab eggs is generally found in silt-clay bottom habitats with water temperatures between 5 and 9°C.

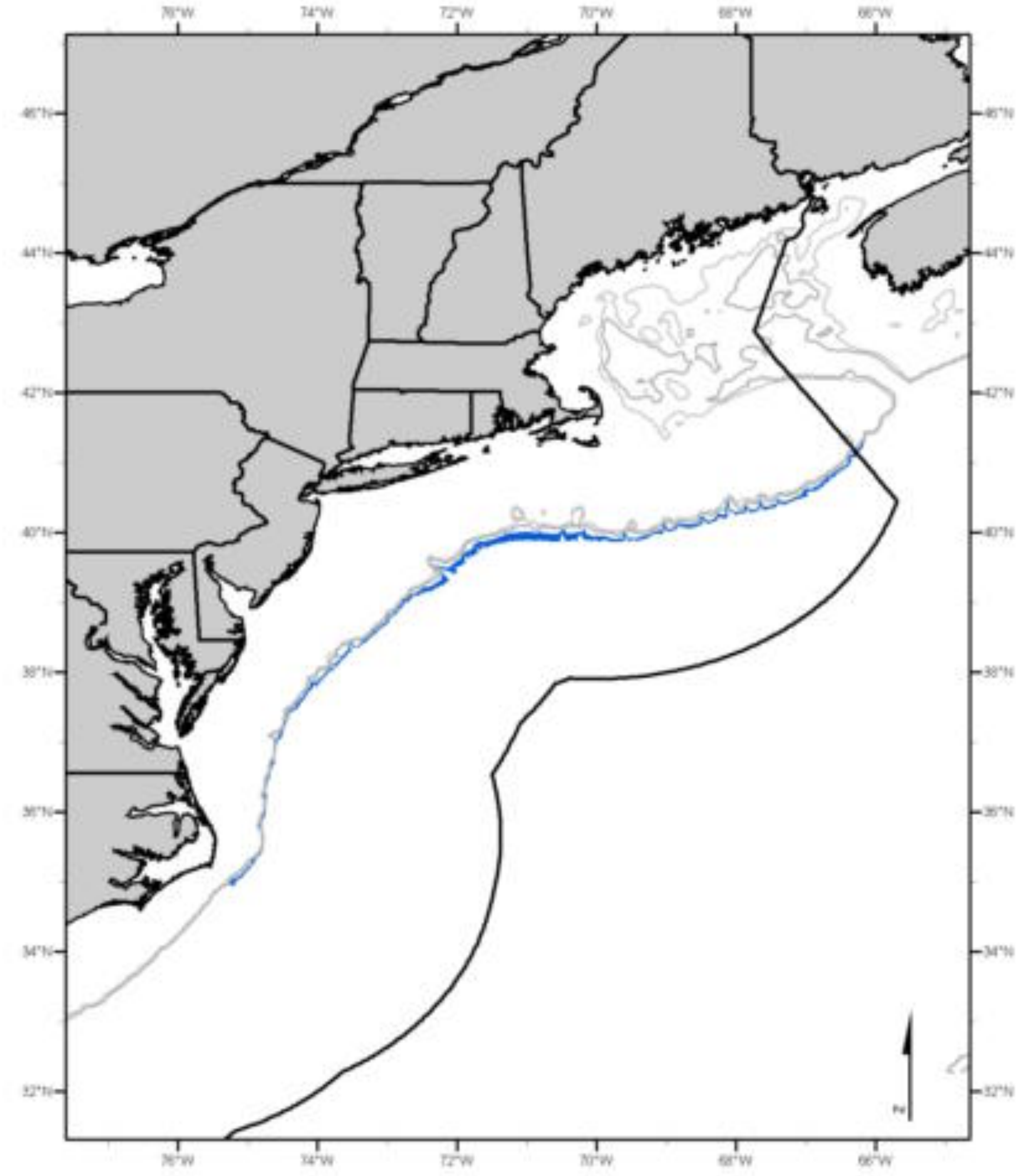
Larvae*: Near-surface water habitats on the outer continental slope across the entire depth range identified for the species (320 - 1300 meters on the slope, as depicted on Map 548. Generally, the following conditions exist where EFH for red crab larvae is found: water temperatures of 4 - 25°C and salinities of 29 - 36 ppt. Red crab larvae feed on zooplankton.

*Entire depth range of the species was used as a proxy for EFH designation mapping as the actual range of red crab larvae is unknown.

Juveniles: Bottom habitats with a silt-clay substrate and depths of 320 - 1300 meters on the continental slope, as depicted on Map 548. Generally, the following conditions exist where EFH for red crab juveniles is found: bottom water temperatures of 3 - 9°C and dissolved oxygen concentrations of 3-7 ml/l. Juvenile red crabs feed on a variety of benthic invertebrates and on dead organisms (e.g., fish and squid) that sink to the bottom.

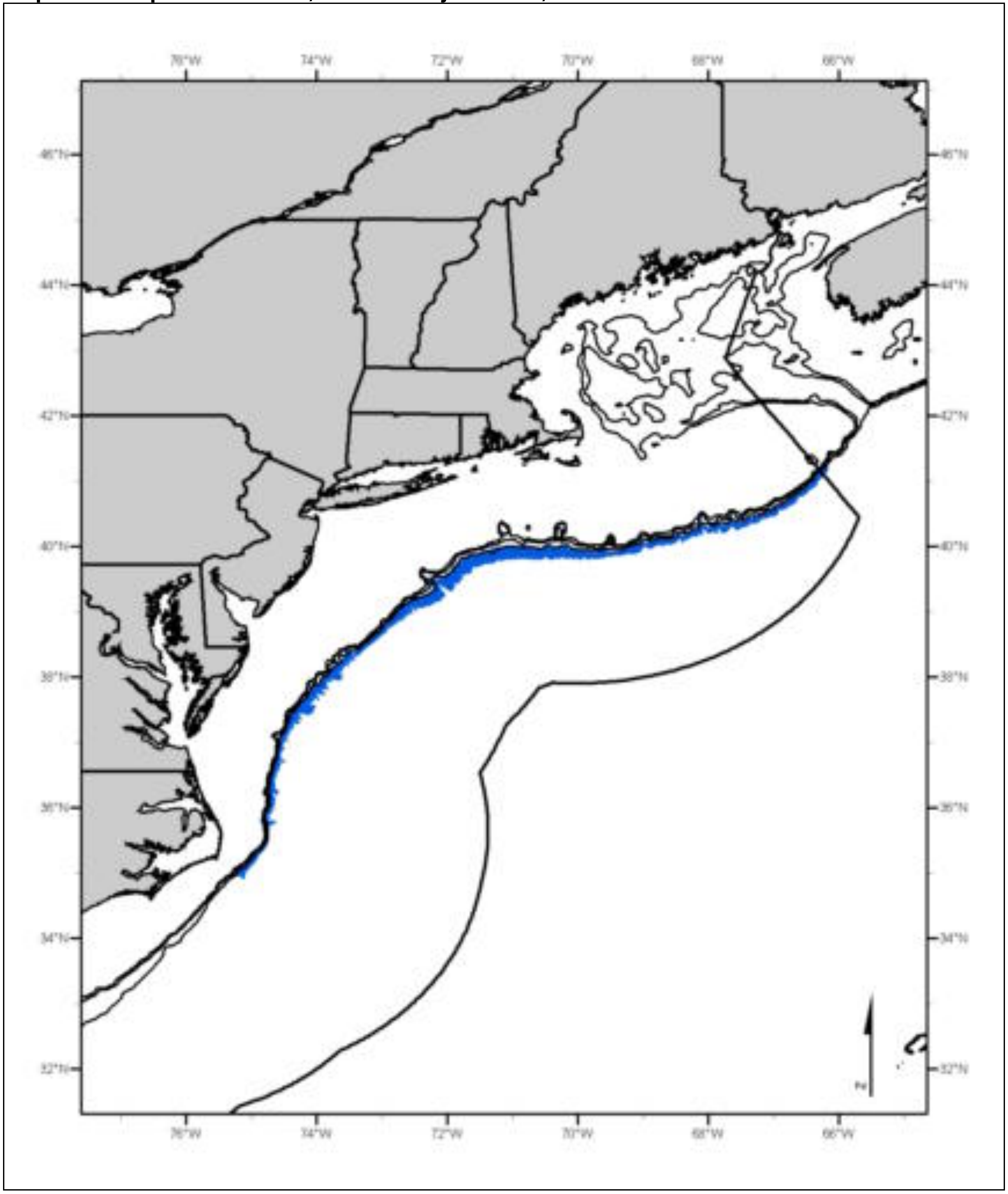
Adults: Bottom habitats with a silt-clay substrate and depths of 320 - 900 meters on the continental slope, as depicted on Map 549. Generally, the following conditions exist where EFH for red crab adults is found: bottom water temperatures of 3 - 8°C and dissolved oxygen concentrations of 3-7 ml/l. Red crabs generally spawn on the slope at depths of 320 – 640 meters. Adult red crabs feed on a variety of benthic invertebrates and on dead organisms (e.g., fish and squid) that sink to the bottom.

Map 547. Deep-sea red crab eggs, Alternative 2



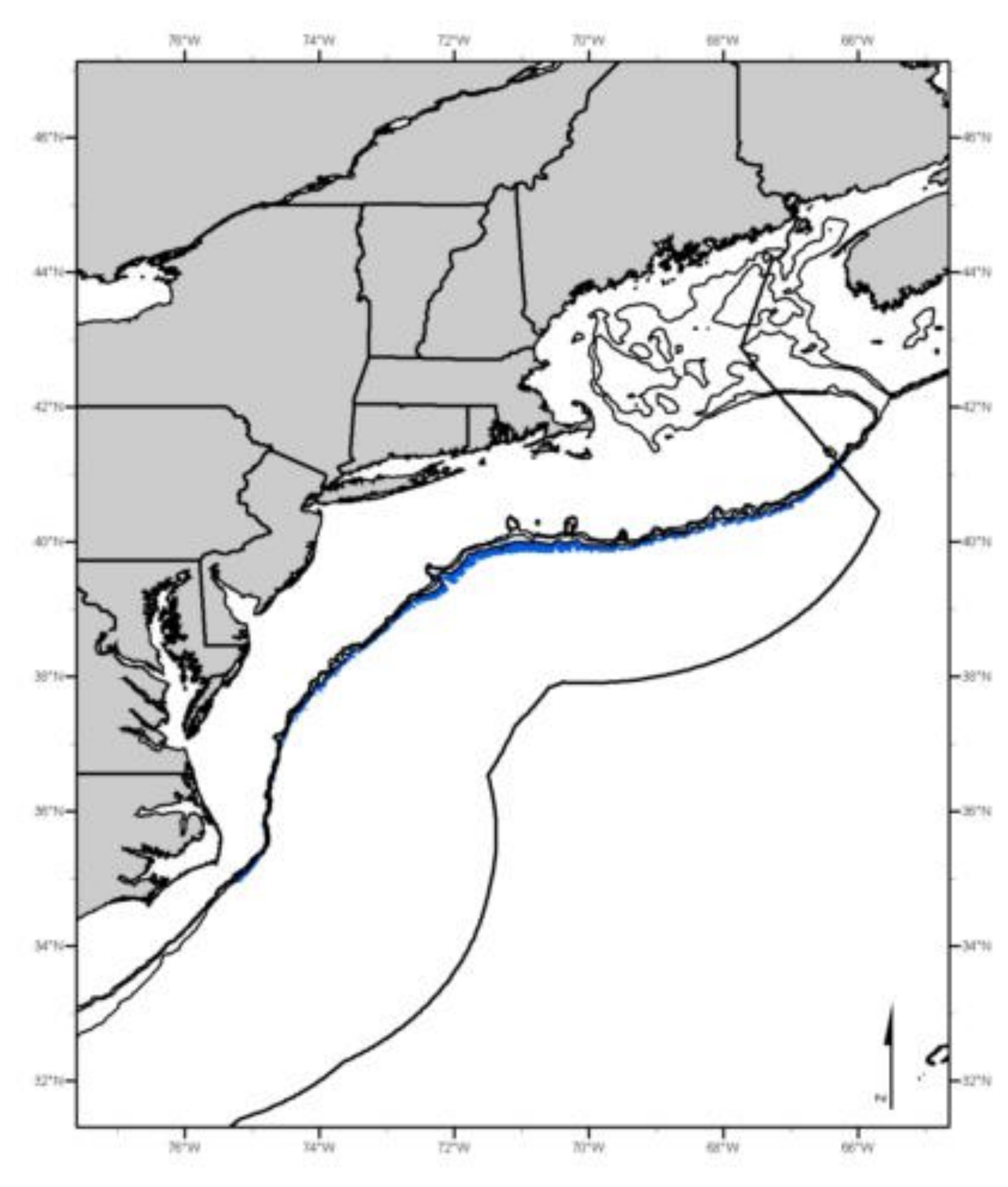
The Alternative 2 EFH designation for red crab eggs on the continental slope is based on the depth range for spawning females as described in Wigley et al. (1975).

Map 548. Deep-sea red crab, larvae and juveniles, Alternative 2



The Alternative 2 EFH designation for red crab larvae and juveniles on the continental slope is based on the maximum depth range for this species as described in Wigley et al. (1975).

Map 549. Deep-sea red crab adults, Alternative 2



The Alternative 2 EFH designation for red crab adults on the continental slope is based on the depth range for adults as described in Wigley et al. (1975).

4.1.7.2.3 Alternative 3

Alternative 3 includes the refined slope definitions in Alternative 2 as well as the areas in the "seamount" realm where deep-sea red crabs have been observed. Alternative 3 only includes parts of the seamounts that fall within the depth range given in the EFH text descriptions below.

Eggs: No alternative EFH Designation.

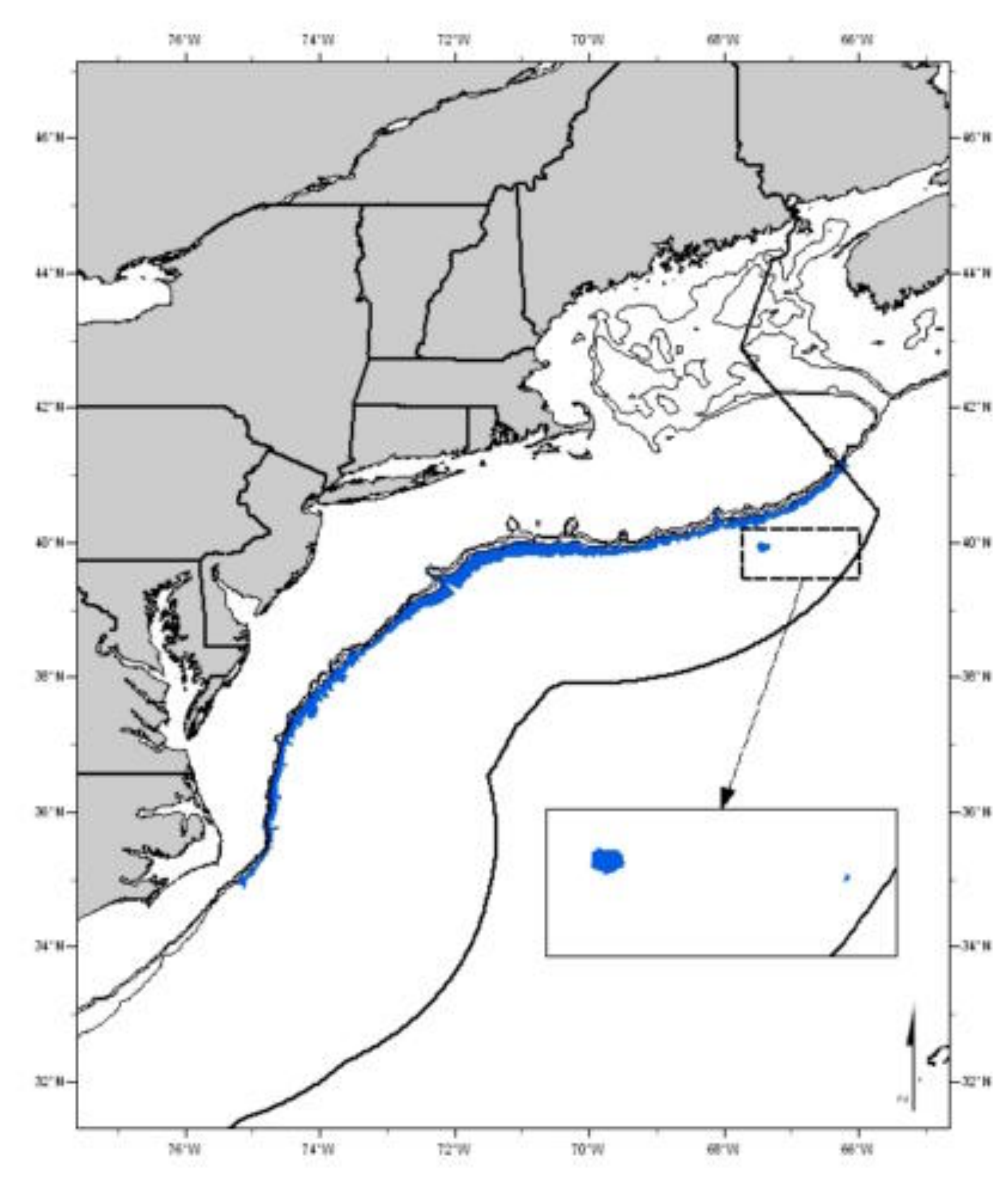
Larvae*: Near-surface water habitats on the outer continental slope and over the seamounts across the entire depth range identified for the species (320 - 1300 meters on the slope and above 2000 meters on the seamounts), as depicted on Map 550 or Map 552. Generally, the following conditions exist where EFH for red crab larvae is found: water temperatures of 4 - 25°C and salinities of 29 - 36 ppt. Red crab larvae feed on zooplankton.

*Entire depth range of the species was used as a proxy for EFH designation mapping as the actual range of red crab larvae is unknown.

Juveniles: Bottom habitats with a silt-clay substrate and depths of 320 - 1300 meters on the continental slope, and to a maximum depth of 2000 meters on the seamounts, as depicted on Map 550 or Map 552. Generally, the following conditions exist where EFH for red crab juveniles is found: bottom water temperatures of 3 - 9°C and dissolved oxygen concentrations of 3-7 ml/l. Juvenile red crabs feed on a variety of benthic invertebrates and on dead organisms (e.g., fish and squid) that sink to the bottom.

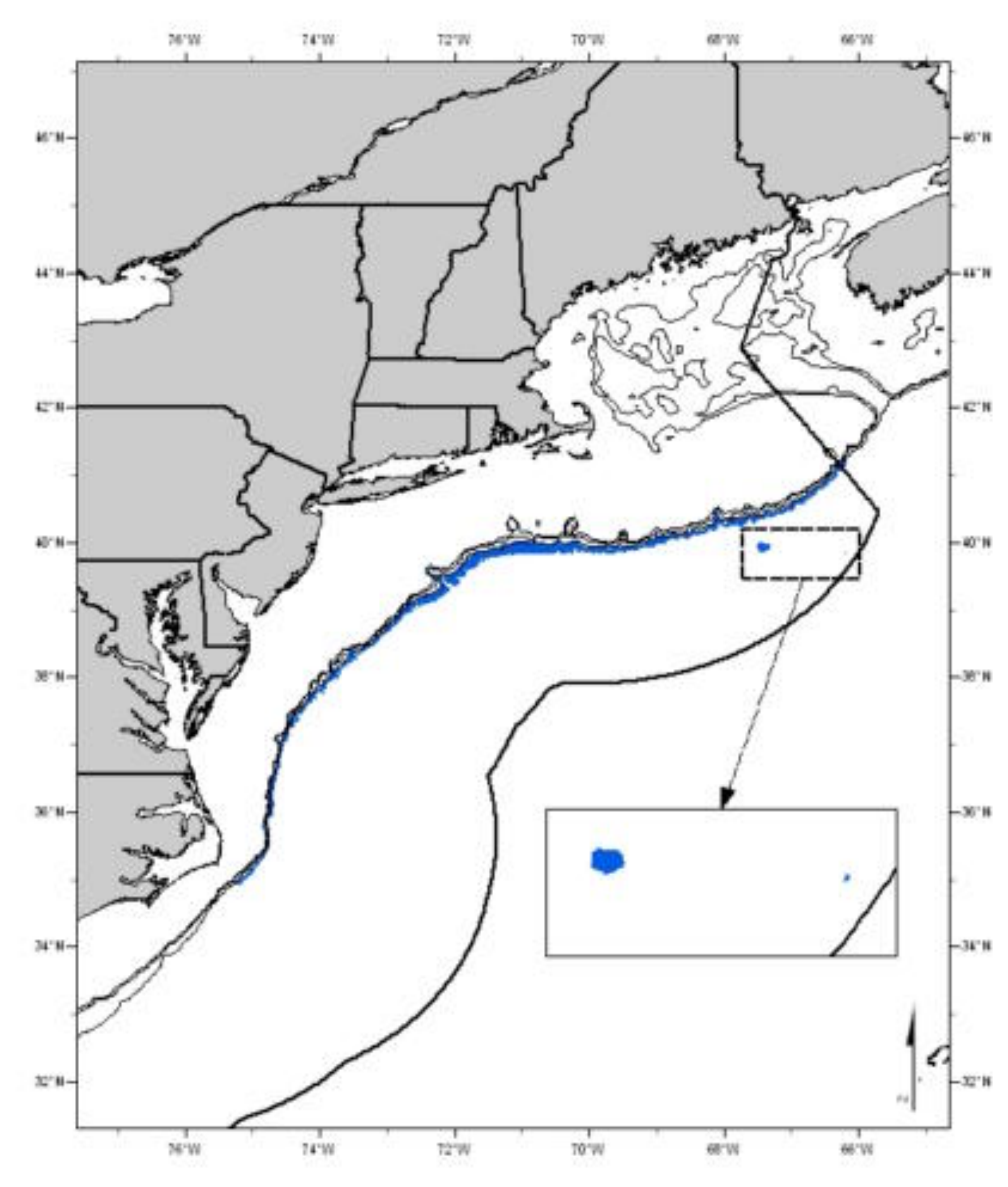
Adults: Bottom habitats with silt-clay substrate and depths of 320 - 900 meters on the continental slope, and to a maximum depth of 2000 meters on the seamounts, as depicted on Map 551 or Map 553. Generally, the following conditions exist where EFH for red crab adults is found: bottom water temperatures of 3 - 8°C and dissolved oxygen concentrations of 3-7 ml/l. Red crabs generally spawn on the slope at depths of 320 – 640 meters. Adult red crabs feed on a variety of benthic invertebrates and on dead organisms (e.g., fish and squid) that sink to the bottom.

Map 550. Deep-sea red crab larvae and juveniles, Alternative 3A (*Observed Seamounts, Depth-Defined)*



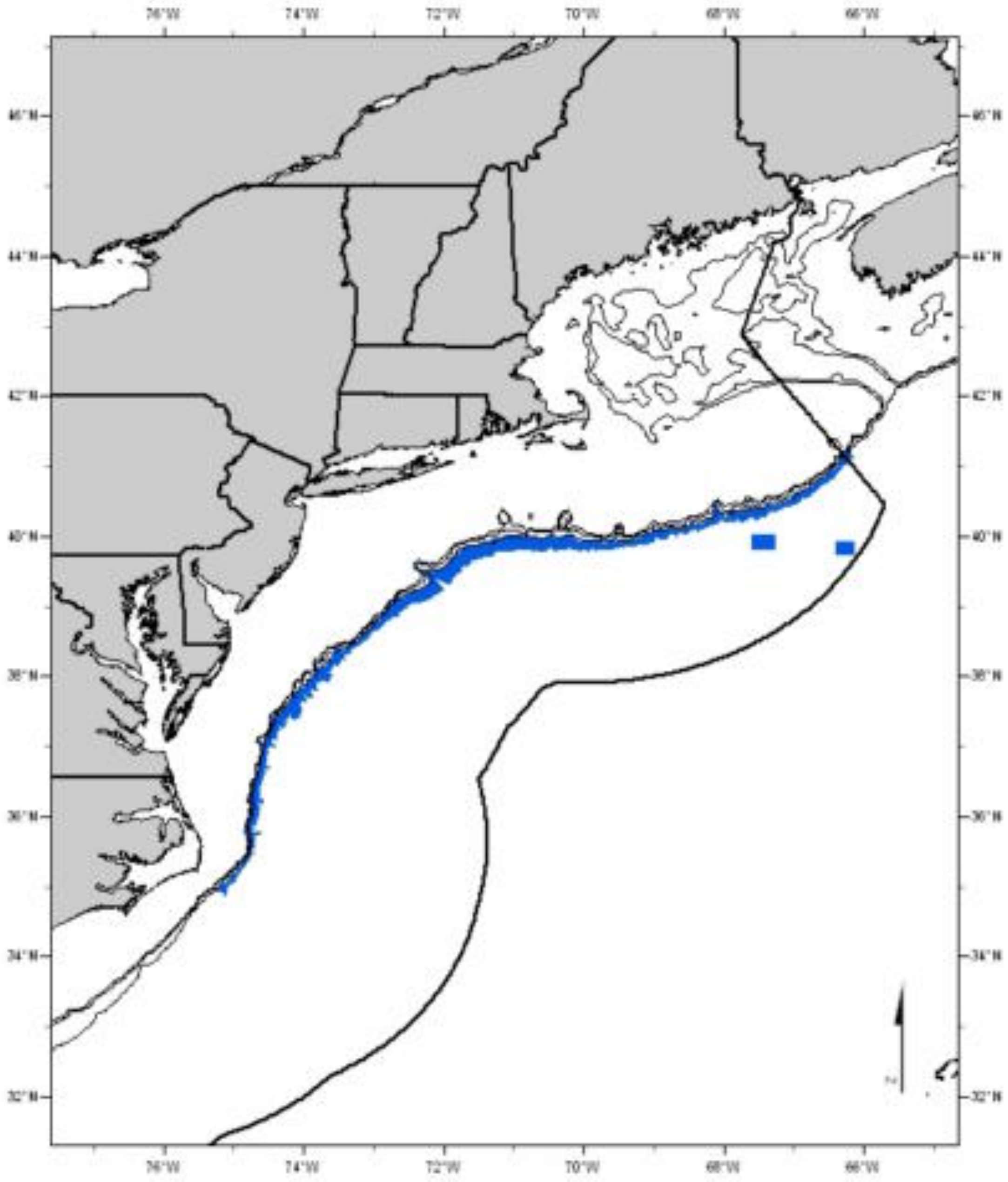
The Alternative 3A EFH designation for red crab larvae and juveniles is based on the maximum depth range for this species on the continental slope as described in Wigley et al. (1975) and on the maximum depth where red crabs have been observed on two seamounts. The seamounts are mapped according to this maximum depth (2000 meters).

Map 551. Deep-sea red crab adults, Alternative 3A *(Observed Seamounts, Depth-Defined)*



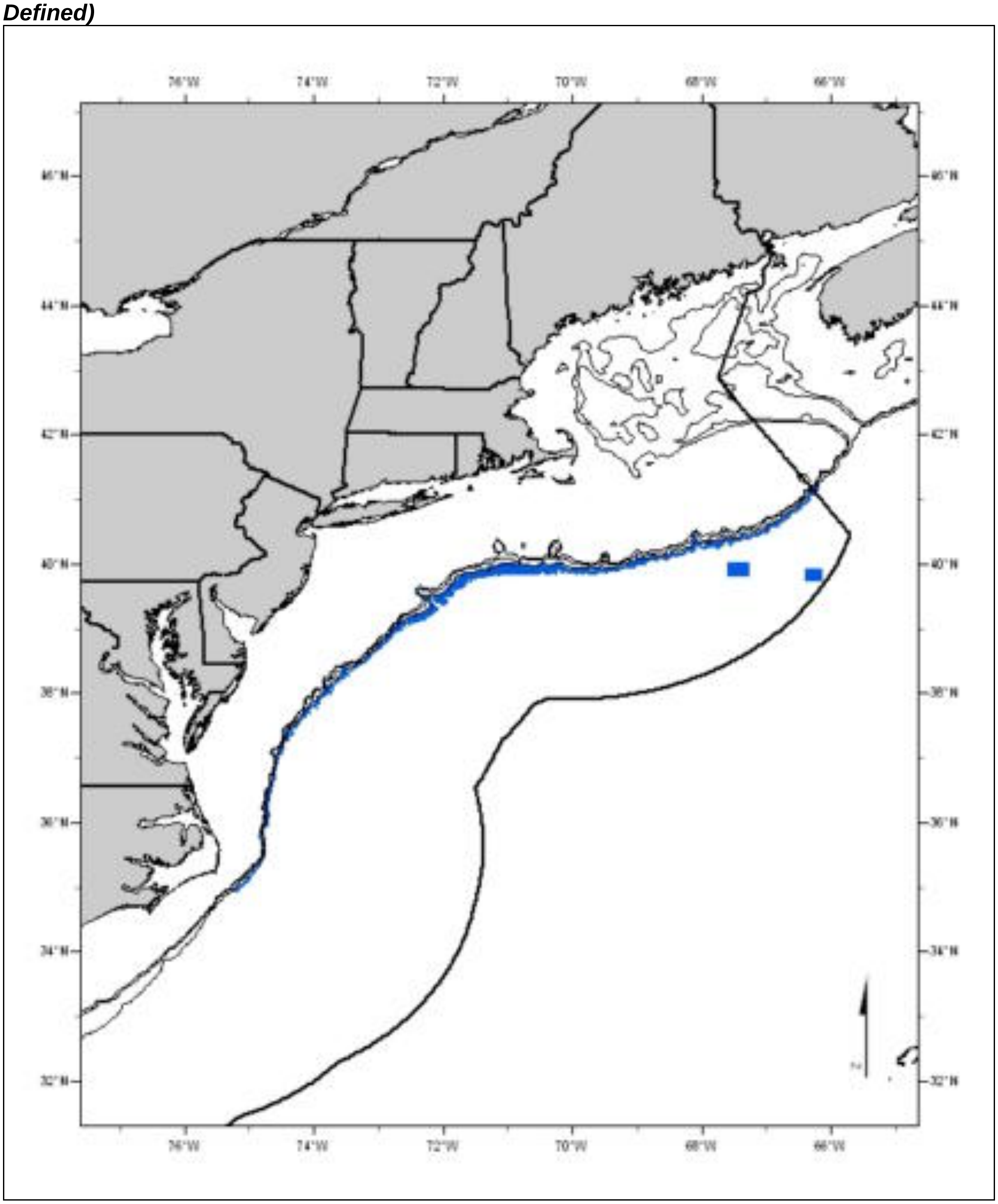
The Alternative 3A EFH designation for red crab adults is based on the maximum depth range for adults on the continental slope as described in Wigley et al. (1975) and on the maximum depth where red crabs have been observed on two seamounts. The seamounts are mapped according to this maximum depth (2000 meters).

Map 552. Deep-sea red crab larvae and juveniles, Alternative 3B *(Observed Seamounts, Feature-Defined Seamounts)*



The Alternative 3B EFH designation for red crab larvae and juveniles is based on the maximum depth range for this species on the continental slope as described in Wigley et al. (1975) and on the maximum depth where red crabs have been observed on two seamounts. The seamounts are represented by a polygon that defines the extent of the feature on the seafloor, but EFH is limited to the portion of each polygon that is shallower than 2000 meters.

Map 553. Deep-sea red crab adults, Alternative 3B (*Observed Seamounts, Feature-Defined)*



The Alternative 3B EFH designation for red crab adults is based on the maximum depth range for adults on the continental slope as described in Wigley et al. (1975) and on the maximum depth where red crabs have been observed on two seamounts. The seamounts are represented by a polygon that defines the extent of the feature on the seafloor, but EFH is limited to the portion of each polygon that is shallower than 2000 meters.

4.1.7.2.4 Alternative 4

Alternative 4 includes the Alternative 2 off-shelf/slope designations as well as the occurrences deeper than 40 meters in the Gulf of Maine. The depth range in the Gulf of Maine is based on information in the EFH Source Document for this species that indicates red crabs are generally present below 40 meters.

Eggs*: No alternative EFH designation.

*Red crabs may reproduce in shallower water in the Gulf of Maine as well, but no information is available to confirm it.

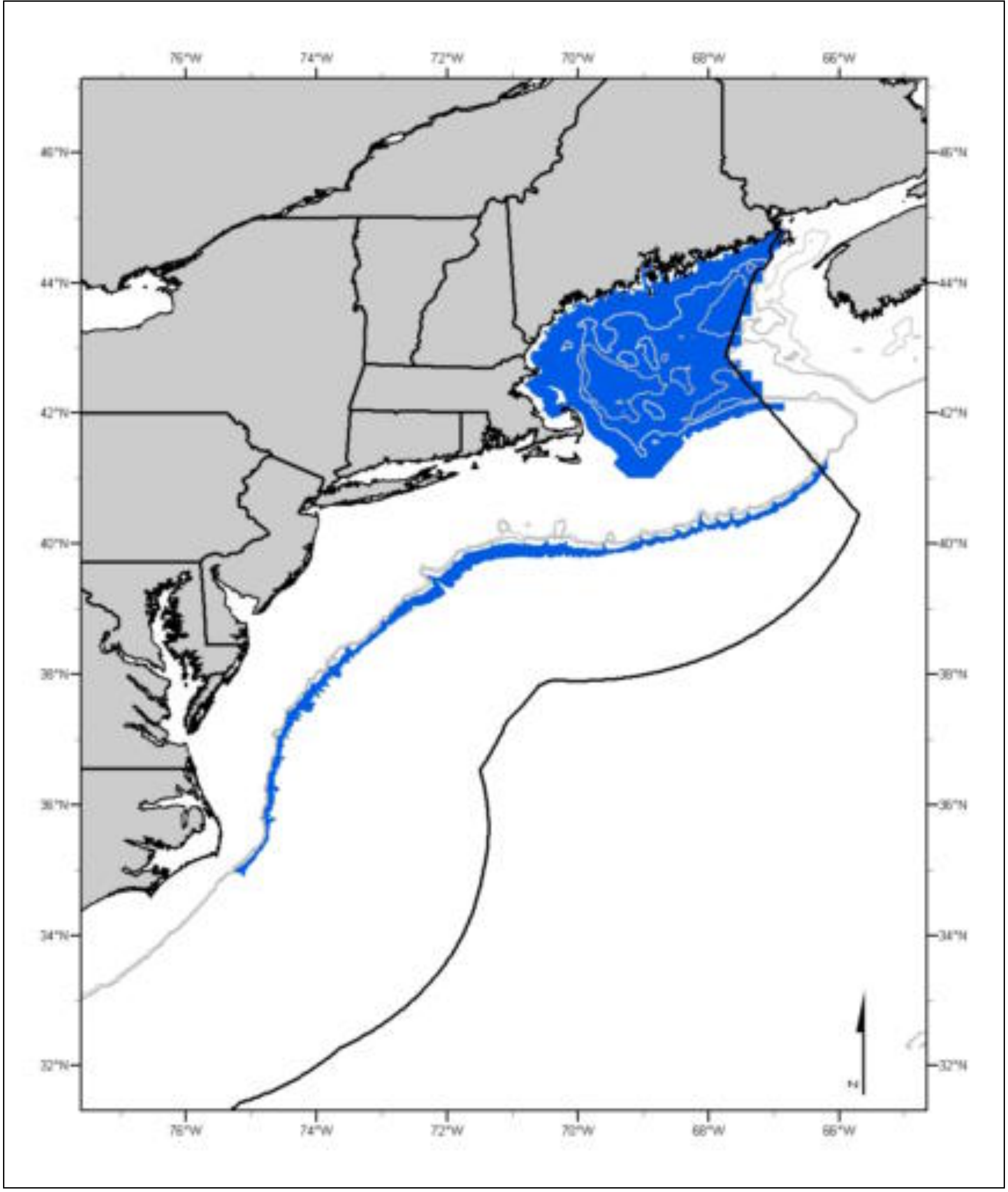
Larvae:** Near-surface water habitats on the continental shelf and slope, at depths below 40 meters in the Gulf of Maine and 320 - 1300 meters on the continental slope, as depicted on Map 554. Generally, the following conditions exist where EFH for red crab larvae is found: water temperatures of 4 - 25°C and salinities of 29 - 36 ppt. Red crab larvae feed on zooplankton.

** Entire depth range of the species was used as a proxy for EFH designation mapping as the actual range of red crab larvae is unknown.

Juveniles: Bottom habitats with a variety of sediment types, at depths below 40 meters in the Gulf of Maine and 320 - 1300 meters on the continental slope, as depicted on Map 554. EFH for juvenile red crabs is generally found where bottom water temperatures are between 3 and 13°C and the substrate is composed of a mixture of silt and clay. Juvenile red crabs feed on a variety of benthic invertebrates and on dead organisms (e.g., fish and squid) that sink to the bottom.

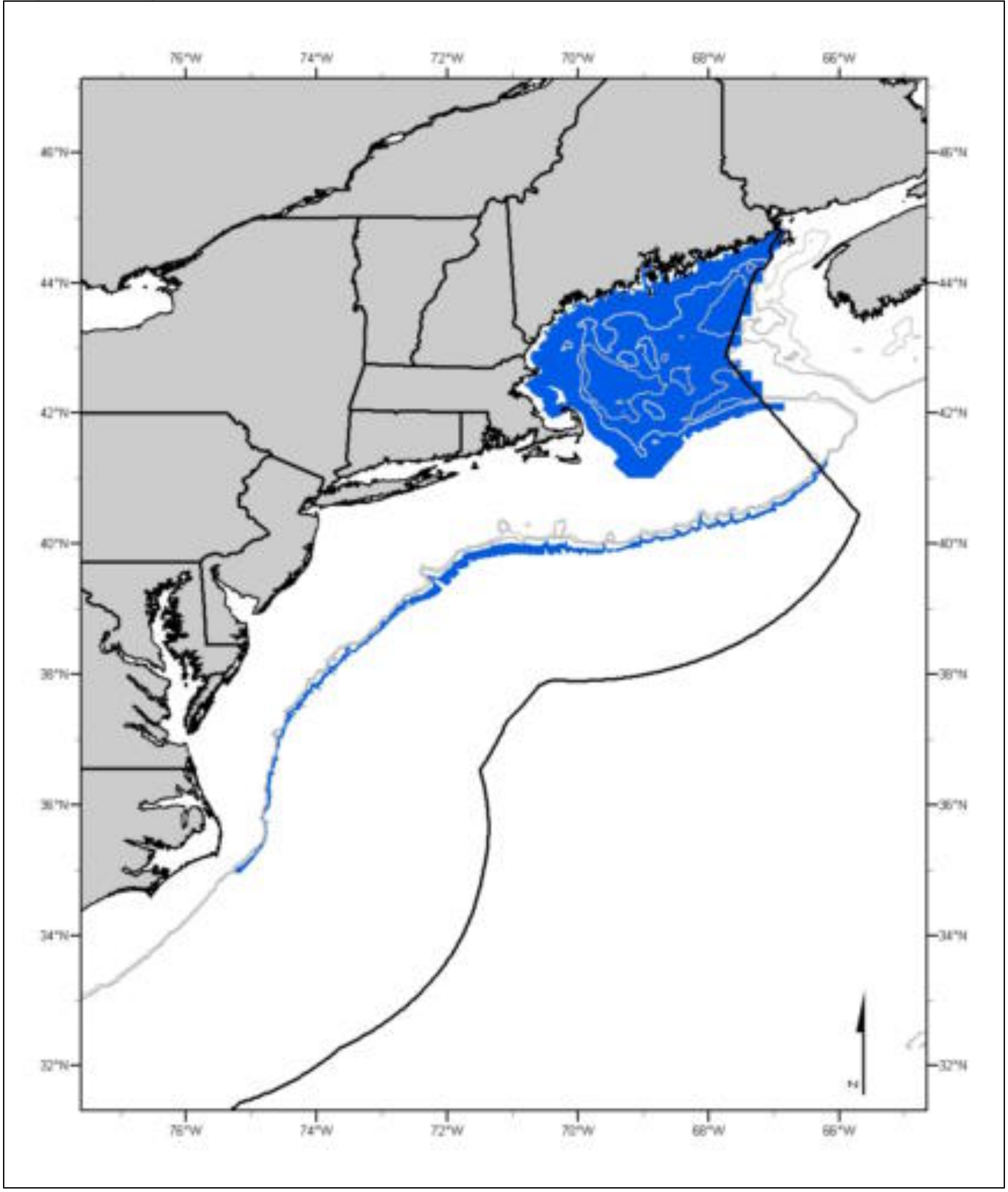
Adults: Bottom habitats with a variety of sediment types, at depths below 40 meters in the Gulf of Maine and 320 - 900 meters on the continental slope, as depicted on Map 555. EFH for adult red crabs is generally found where bottom water temperatures are between 3 and 13°C and the substrate is composed of a mixture of silt and clay. Red crabs generally spawn on the slope at depths of 320 – 640 meters. Adult red crabs feed on a variety of benthic invertebrates and on dead organisms (e.g., fish and squid) that sink to the bottom.

Map 554. Deep-sea red crab larvae and juveniles, Alternative 4



The Alternative 4 EFH designation for red crab larvae and juveniles is based on the maximum depth range for this species on the continental slope and in the Gulf of Maine as described in Wigley et al. (1975) and in the EFH Source Document for this species.

Map 555. Deep-sea red crab adults, Alternative 4



The Alternative 4 EFH designation for red crab adults is based on the maximum depth range for adults on the continental slope and for this species in the Gulf of Maine as described in Wigley et al. (1975) and in the EFH Source Document.

4.1.7.2.5 Alternative 5

Alternative 5 includes the Alternative 2 off-shelf/slope definition, the Alternative 3 seamounts definition and the Alternative 4 Gulf of Maine definition.

Eggs*: No alternative EFH designation.

*Red crabs may reproduce in shallower water in the Gulf of Maine as well, but no information is available to confirm it.

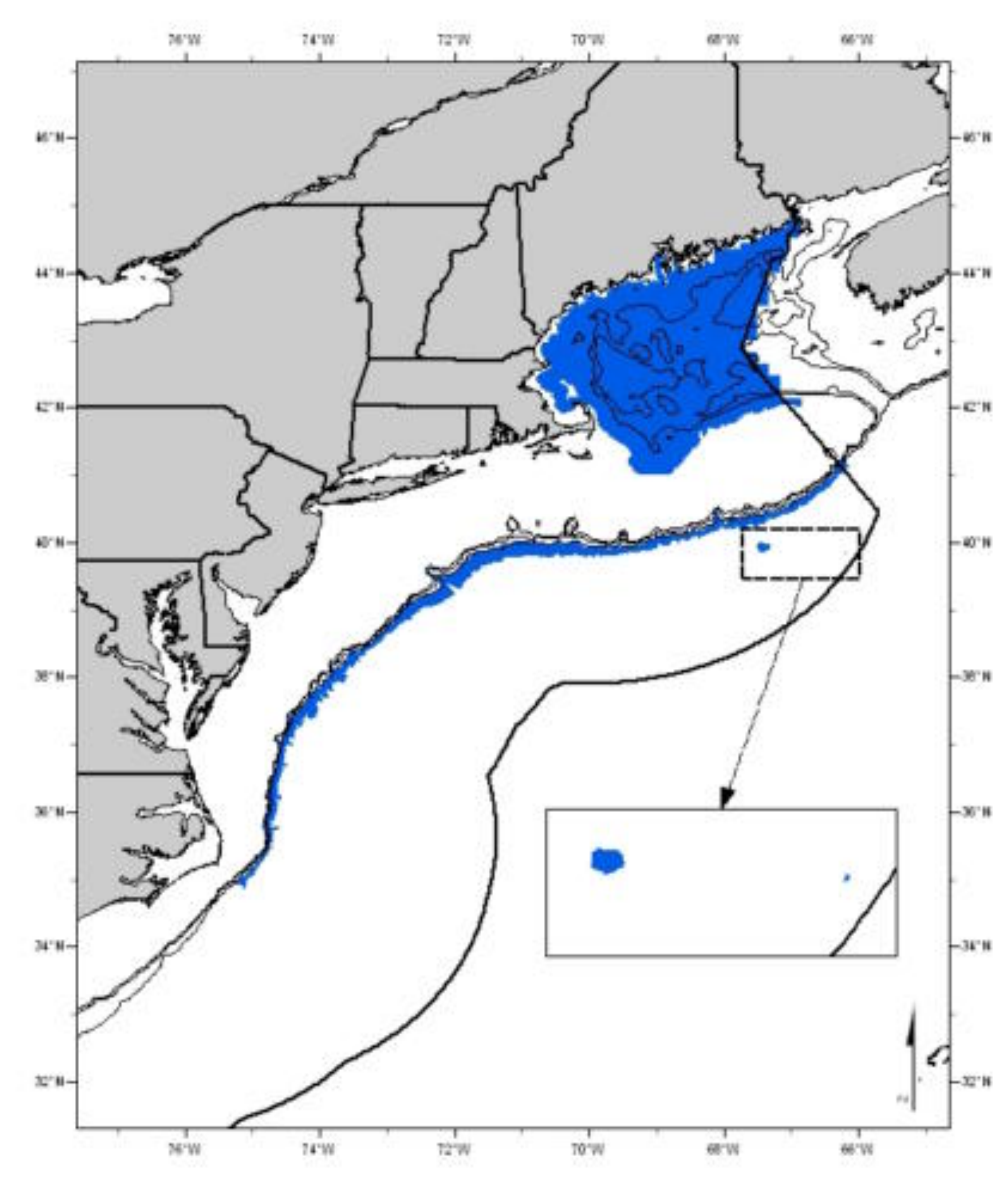
Larvae:** Near-surface water habitats on the continental shelf and slope, at depths below 40 meters in the Gulf of Maine, 320 - 1300 meters on the continental slope, and to a maximum depth of 2000 meters on the seamounts, as depicted on Map 556 or Map 558. Generally, the following conditions exist where EFH for red crab larvae is found: water temperatures of 4 - 25°C and salinities of 29 - 36 ppt. Red crab larvae feed on zooplankton.

**Entire depth range of the species was used as a proxy for EFH designation mapping as the actual range of red crab larvae is unknown.

Juveniles: Bottom habitats with a variety of sediment types, at depths below 40 meters in the Gulf of Maine, 320 - 1300 meters on the continental slope, and to a maximum depth of 2000 meters on the seamounts, as depicted on Map 556 or Map 558. EFH for juvenile red crabs is generally found where bottom water temperatures are between 3 and 13°C and the substrate is composed of a mixture of silt and clay. Juvenile red crabs feed on a variety of benthic invertebrates and on dead organisms (e.g., fish and squid) that sink to the bottom.

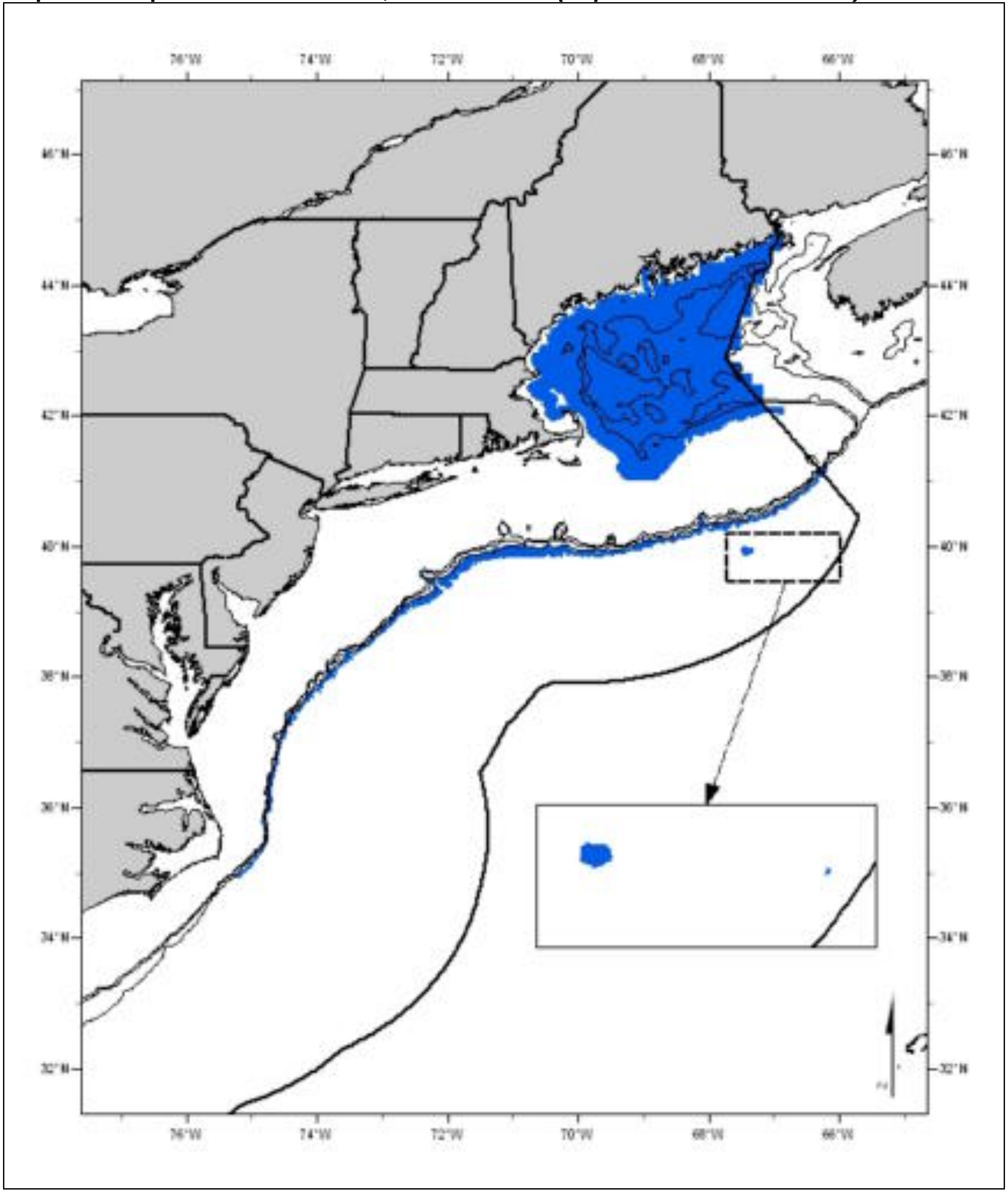
Adults: Bottom habitats with a variety of sediment types, at depths below 40 meters in the Gulf of Maine, 320 - 900 meters on the continental slope, and to a maximum depth of 2000 meters on the seamounts, as depicted on Map 557 or Map 559. EFH for adult red crabs is generally found where bottom water temperatures are between 3 and 13°C and the substrate is composed of a mixture of silt and clay. Red crabs generally spawn on the slope at depths of 320 – 640 meters. Adult red crabs feed on a variety of benthic invertebrates and on dead organisms (e.g., fish and squid) that sink to the bottom.

Map 556. Deep-sea red crab larvae and juveniles, Alternative 5A *(Depth-Defined Seamounts)*



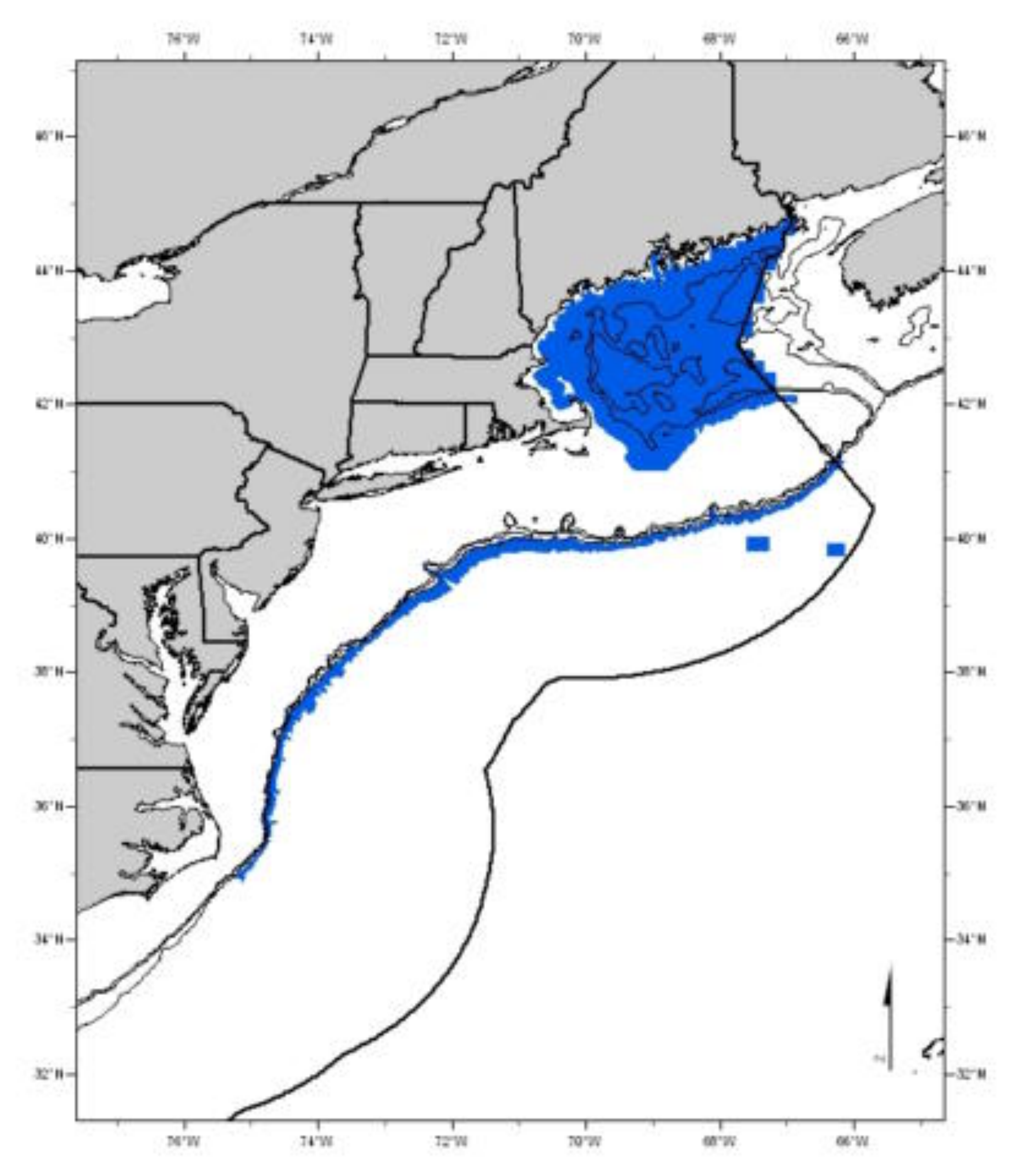
The Alternative 5A EFH designation for red crab larvae and juveniles is based on the maximum depth range for this species on the continental slope as described in Wigley et al. (1975), in the Gulf of Maine as described in the EFH Source Document, and on two seamounts where red crabs have been observed. The seamounts are mapped according to the maximum depth (2000 meters) where red crabs have been observed.

Map 557. Deep-sea red crab adults, Alternative 5A *(Depth-Defined Seamounts)*



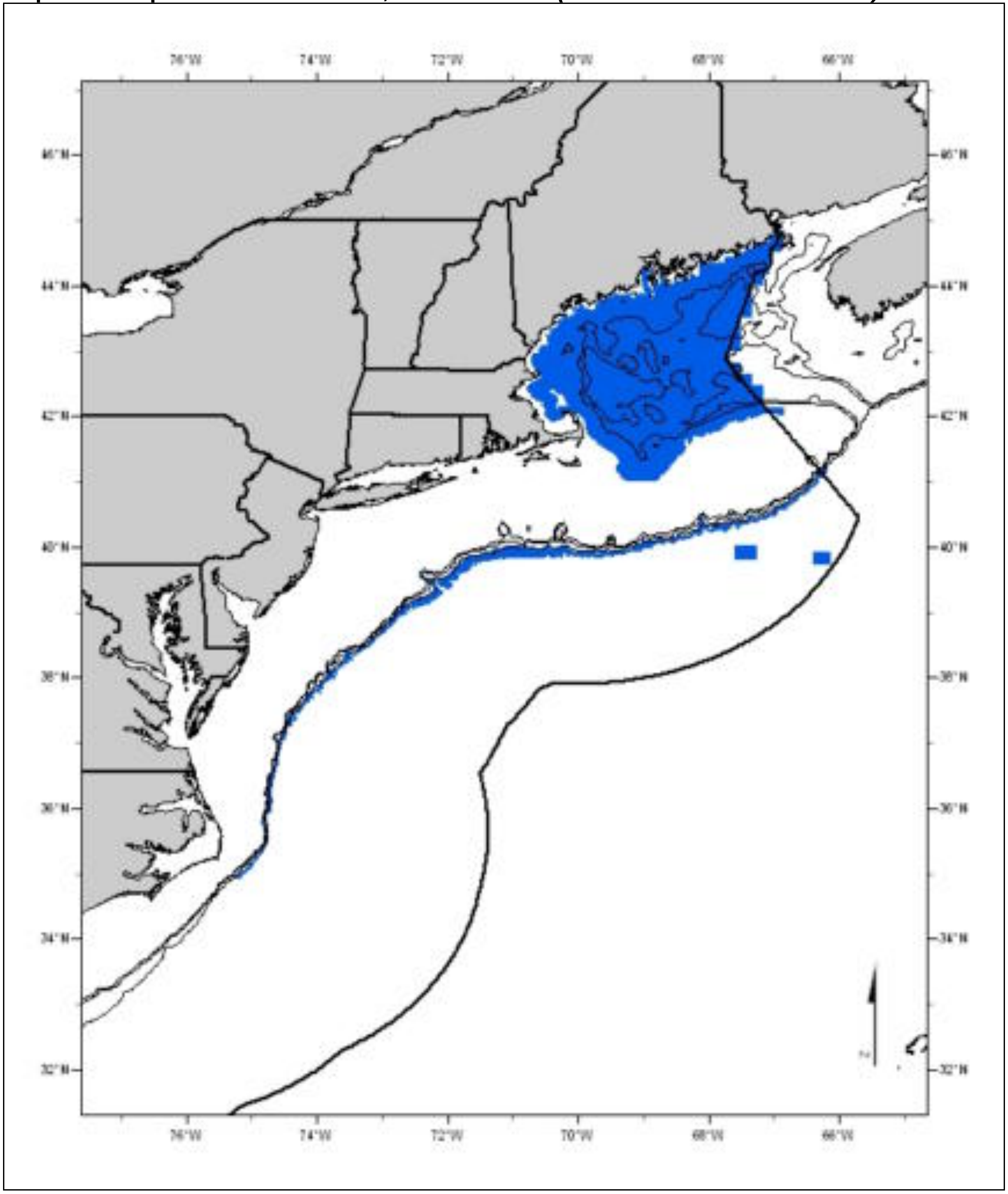
The Alternative 5A EFH designation for red crab adults is based on the maximum depth range for adults on the continental slope as described in Wigley et al. (1975), the minimum depth where this species occurs in the Gulf of Maine as described in the EFH Source Document, and on two seamounts where red crabs have been observed. The seamounts are mapped according to the maximum depth (2000 meters) where red crabs have been observed.

Map 558. Deep-sea red crab larvae and juveniles, Alternative 5B *(Feature-Defined Seamounts)*



The Alternative 5B EFH designation for red crab larvae and juveniles is based on the maximum depth range for this species on the continental slope as described in Wigley et al. (1975), in the Gulf of Maine as described in the EFH Source Document, and on two seamounts where red crabs have been observed. Each seamount is represented by a polygon that defines the extent of the feature on the seafloor, but EFH is limited to the portion of each polygon that is shallower than 2000 meters.

Map 559. Deep-sea red crab adults, Alternative 5B *(Feature-Defined Seamounts)*



The Alternative 5B EFH designation for red crab adults is based on the maximum depth range for adults on the continental slope as described in Wigley et al. (1975), the minimum depth where this species occurs in the Gulf of Maine as described in the EFH Source Document, and on two seamounts where red crabs have been observed. Each seamount is represented by a polygon that defines the extent of the feature on the seafloor, but EFH is limited to the portion of each polygon that is shallower than 2000 meters.

4.1.7.2.6 Alternative 6

Alternative 6 includes the 100% observed range of deep-sea red crab in addition to an extended seamount range (those seamounts in the EEZ that meet the depth criteria) by analogy.

Eggs*: No alternative EFH designation.

*Red crabs may reproduce in shallower water in the Gulf of Maine as well, but no information is available to confirm it.

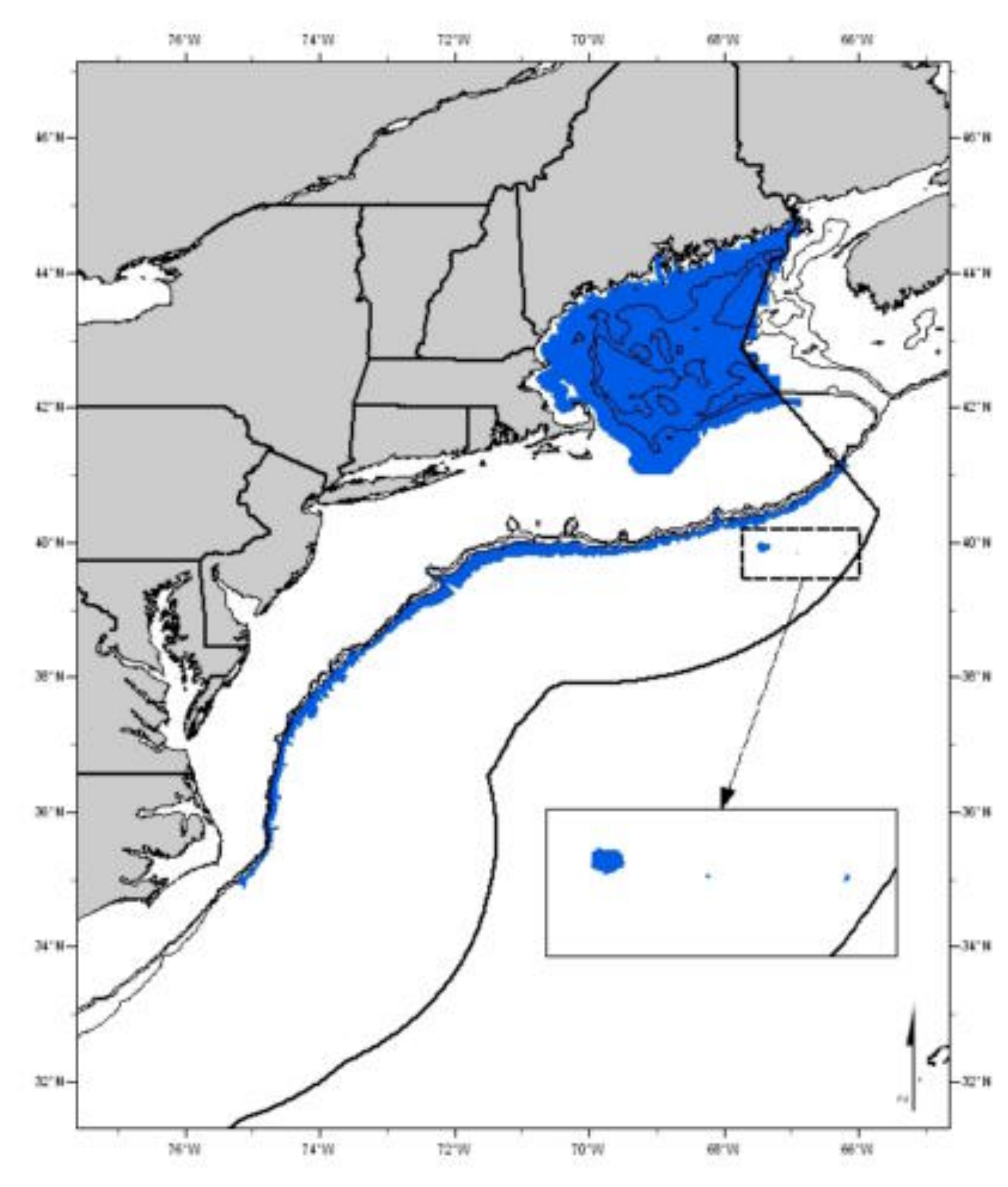
Larvae:** Near-surface water habitats on the continental shelf and slope, at depths below 40 meters in the Gulf of Maine, 320 - 1300 meters on the continental slope, and to a maximum depth of 2000 meters on the seamounts), as depicted on Map 560 or Map 562. Generally, the following conditions exist where EFH for red crab larvae is found: water temperatures of 4 - 25°C and salinities of 29 - 36 ppt. Red crab larvae feed on zooplankton.

**Entire depth range of the species was used as a proxy for EFH designation mapping as the actual range of red crab larvae is unknown.

Juveniles: Bottom habitats with a variety of sediment types, at depths below 40 meters in the Gulf of Maine, 320 - 1300 meters on the continental slope, and to a maximum depth of 2000 meters on the seamounts, as depicted on Map 560 or Map 562. EFH for juvenile red crabs is generally found where bottom water temperatures are between 3 and 13°C and the substrate is composed of a mixture of silt and clay. Juvenile red crabs feed on a variety of benthic invertebrates and on dead organisms (e.g., fish and squid) that sink to the bottom.

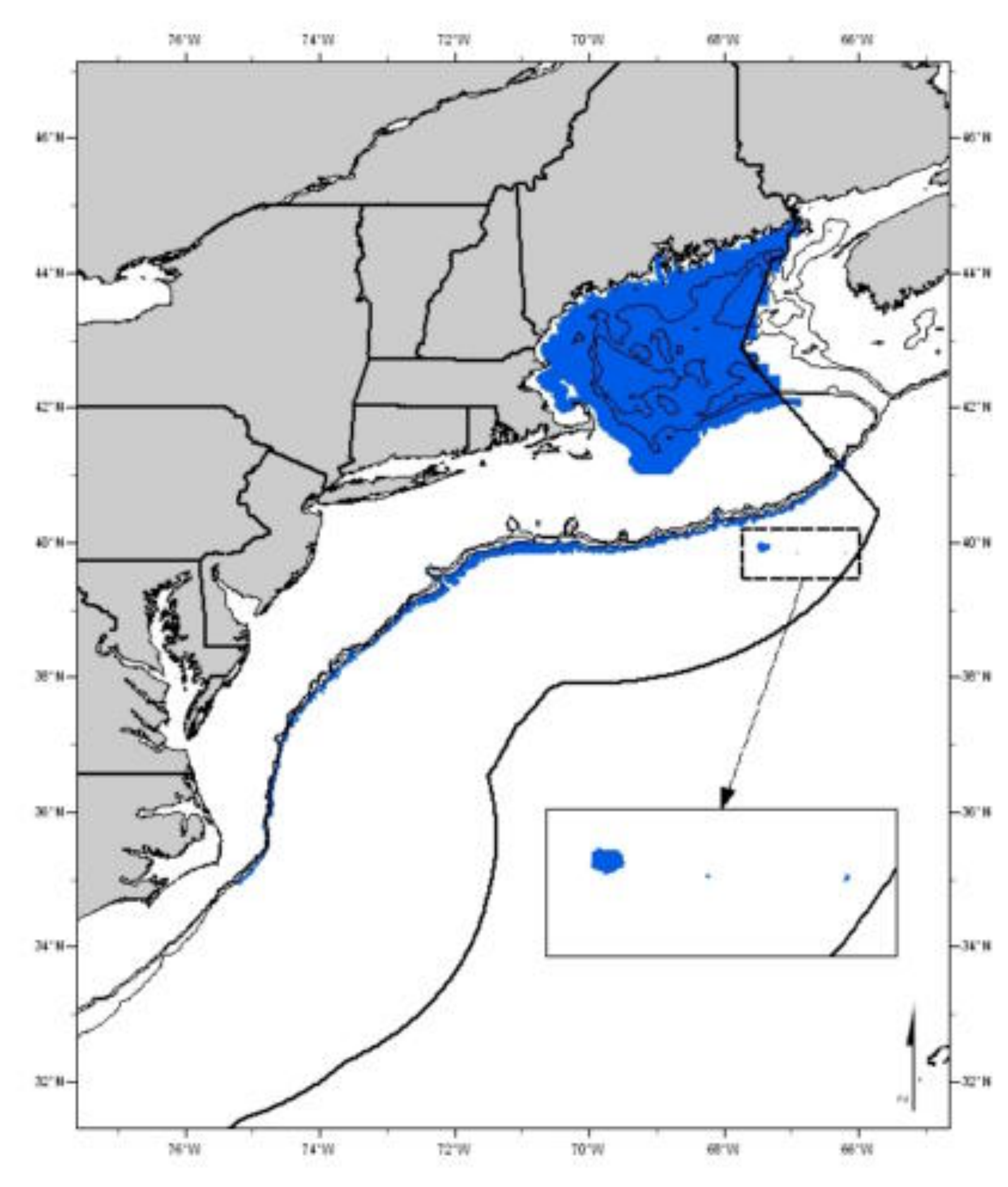
Adults: Bottom habitats with a variety of sediment types, at depths below 40 meters in the Gulf of Maine, 320 - 900 meters on the continental slope, and to a maximum depth of 2000 meters on the seamounts, as depicted on Map 561 or Map 563. EFH for adult red crabs is generally found where bottom water temperatures are between 3 and 13°C and the substrate is composed of a mixture of silt and clay. Red crabs generally spawn on the slope at depths of 320 – 640 meters. Adult red crabs feed on a variety of benthic invertebrates and on dead organisms (e.g., fish and squid) that sink to the bottom.

Map 560. Deep-sea red crab larvae and juveniles, Alternative 6A *(Depth-Defined Seamounts)*



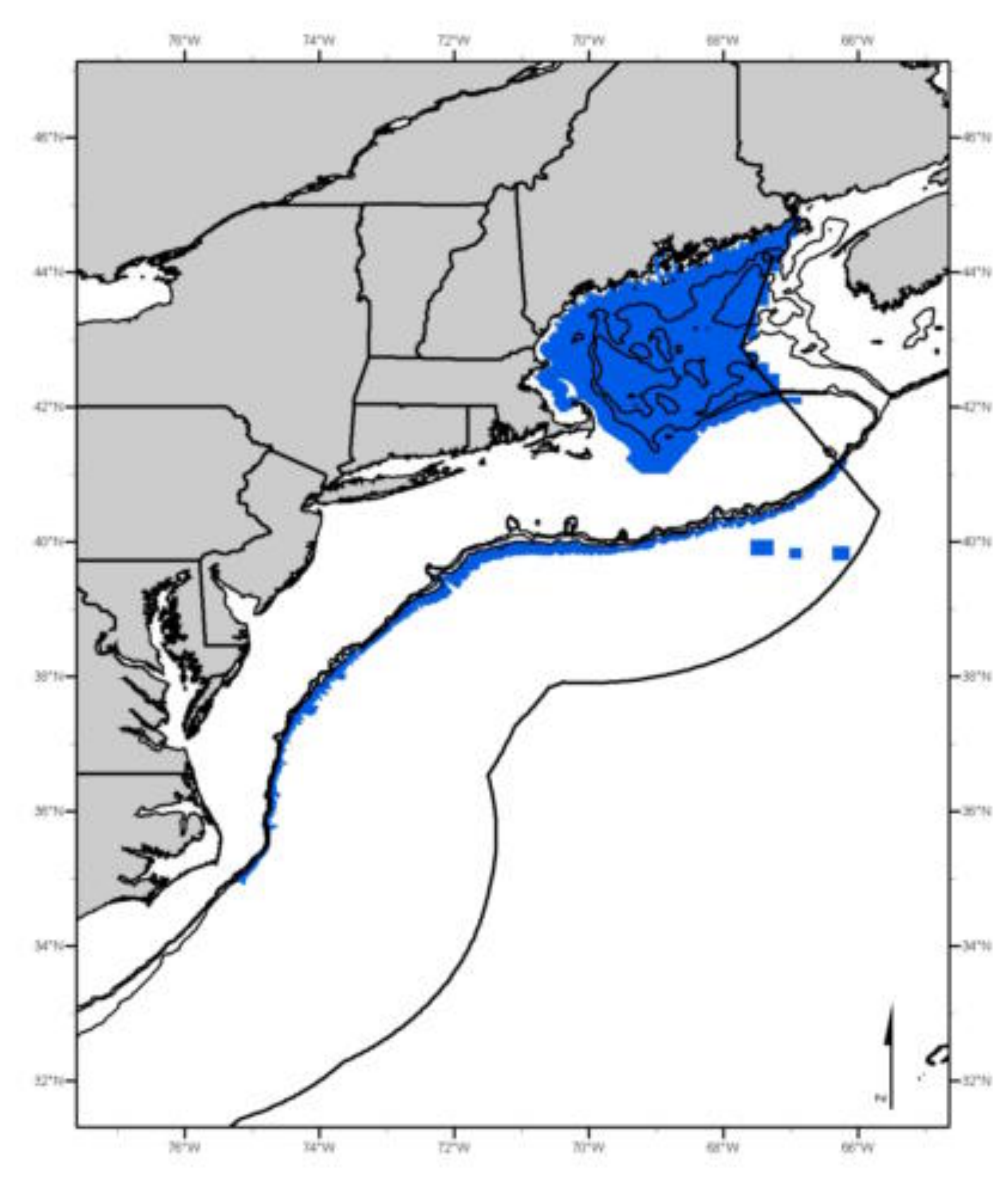
The Alternative 6A EFH designation for red crab larvae and juveniles is based on the maximum depth range for this species on the continental slope as described in Wigley et al. (1975), in the Gulf of Maine as described in the EFH Source Document, and on three seamounts that meet the maximum depth criterion for this species. The seamounts are mapped according to the maximum depth (2000 meters) where red crabs have been observed on two of these seamounts.

Map 561. Deep-sea red crab adults, Alternative 6A *(Depth-Defined Seamounts)*



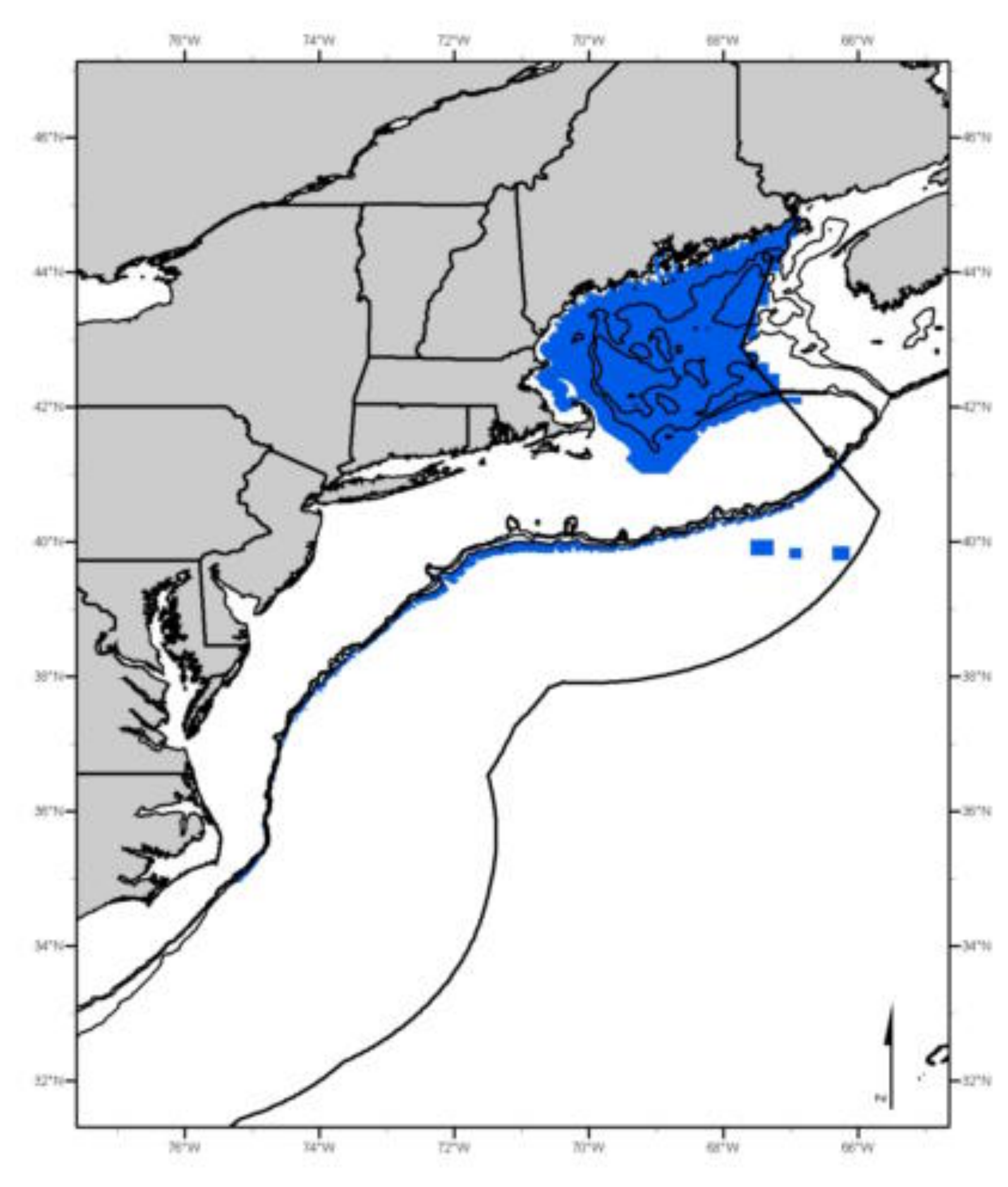
The Alternative 6A EFH designation for red crab adults is based on the maximum depth range for this species on the continental slope as described in Wigley et al. (1975), in the Gulf of Maine as described in the EFH Source Document, and on three seamounts that meet the maximum depth criterion for this species. The seamounts are mapped according to the maximum depth (2000 meters) where red crabs have been observed on two of these seamounts.

Map 562. Deep-sea red crab larvae and juveniles, Alternative 6B *(Feature-Defined Seamounts)*



The Alternative 6B EFH designation for red crab larvae and juveniles is based on the maximum depth range for this species on the continental slope as described in Wigley et al. (1975), in the Gulf of Maine as described in the EFH Source Document, and on three seamounts that meet the maximum depth criterion for this species. Each seamount is represented by a polygon that defines the extent of the feature on the seafloor, but EFH is limited to the portion of each polygon that is shallower than 2000 meters.

Map 563. Deep-sea red crab adults, Alternative 6B *(Feature-Defined Seamounts)*



The Alternative 6B EFH designation for red crab adults is based on the maximum depth range for this species on the continental slope as described in Wigley et al. (1975), in the Gulf of Maine as described in the EFH Source Document, and on three seamounts that meet the maximum depth criterion for this species. Each seamount is represented by a polygon that defines the extent of the feature on the seafloor, but EFH is limited to the portion of each polygon that is shallower than 2000 meters.

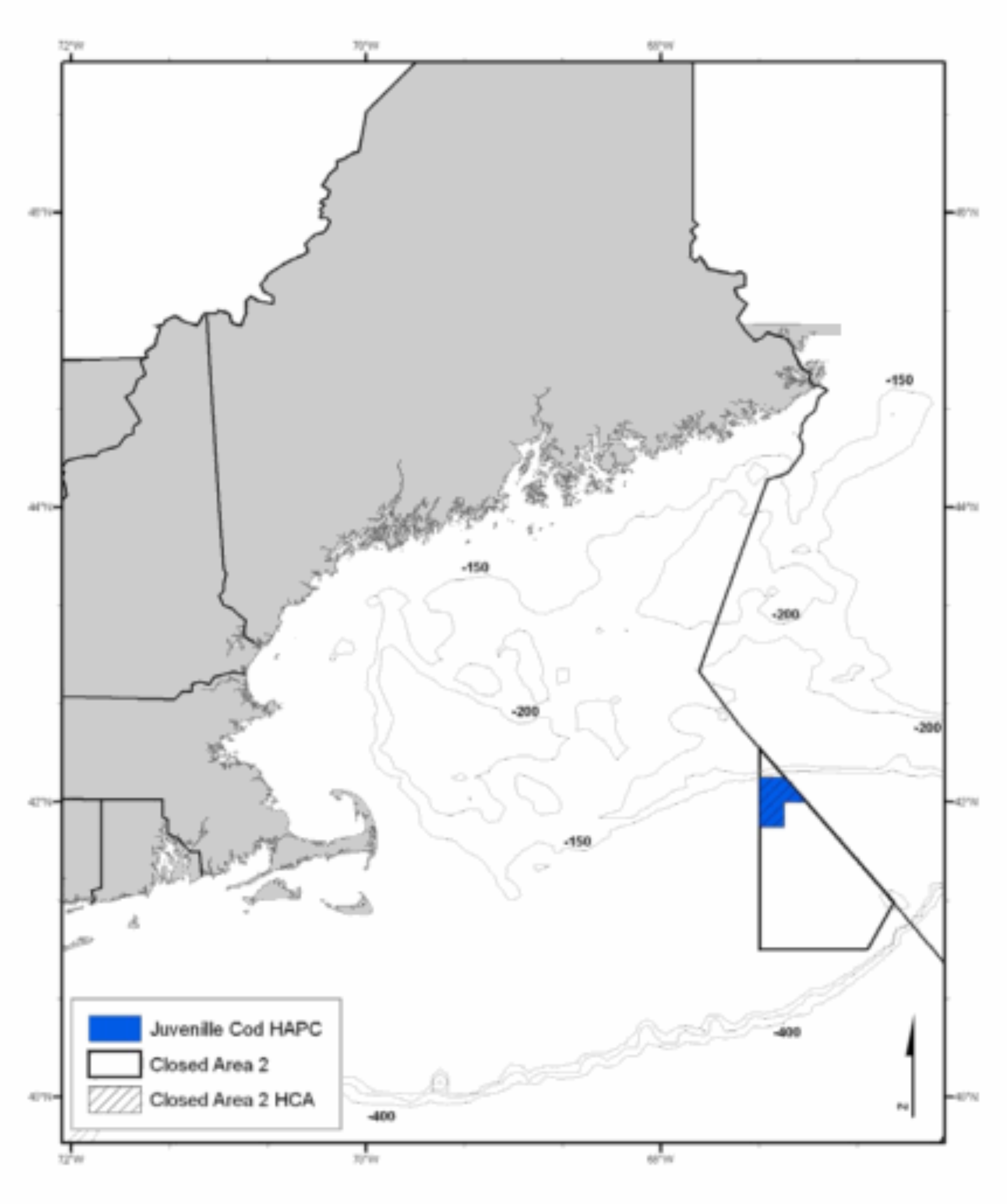
4.2 Alternatives to Designate Habitat Areas of Particular Concern (HAPC)

4.2.1 Alternative 1: Status Quo

Following a review of the scientific literature for information on areas deserving special attention or species with particular habitat associations, the Council designated an area on Georges Bank as an HAPC for juvenile Atlantic cod (Map 564) and eleven rivers in Maine as HAPC for Atlantic salmon (Map 565) in 1998.

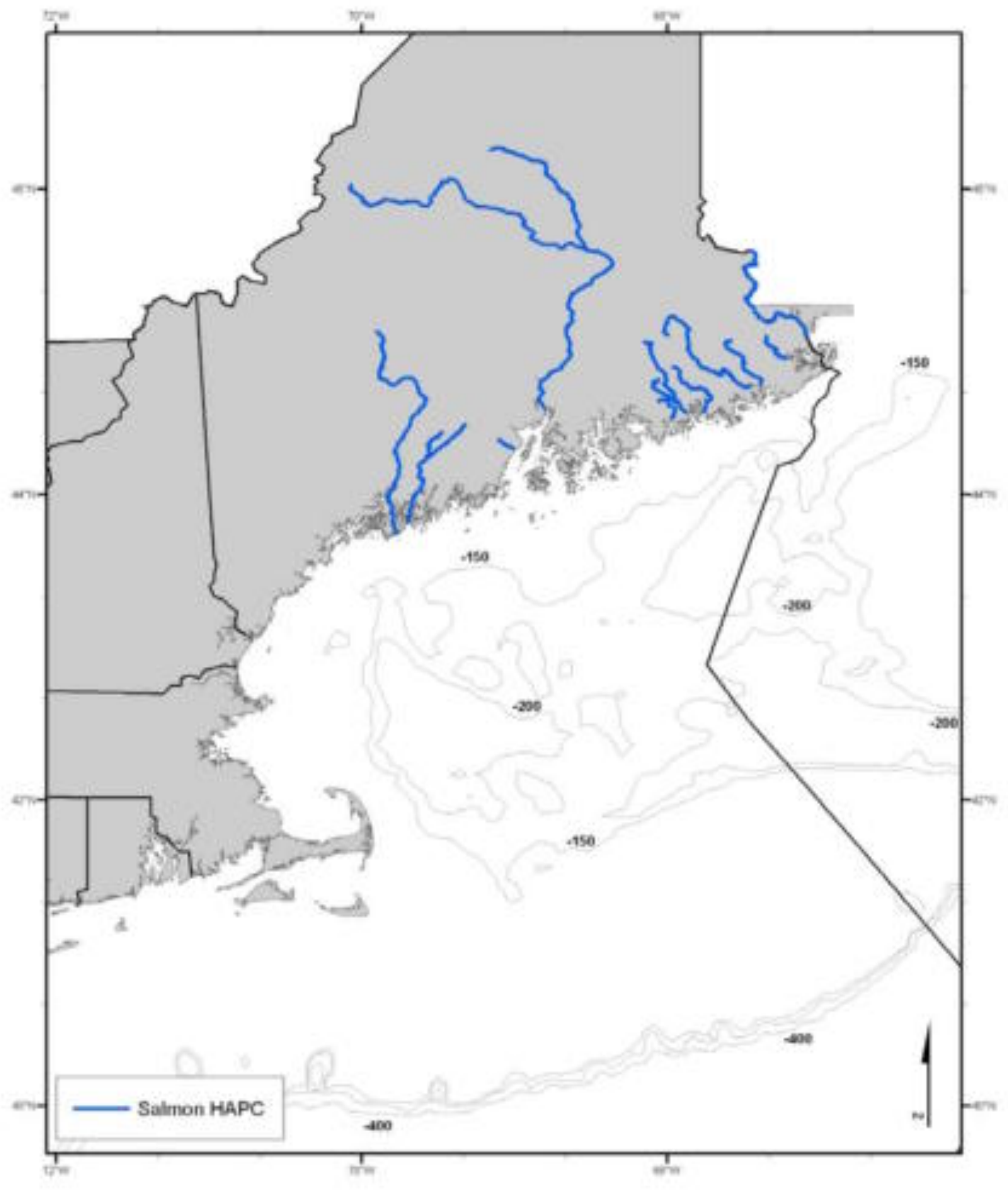
4.2.1.1 Alternative 1A: Cod Status Quo HAPC

Map 564. Alternative 1A: Cod Status Quo HAPC



4.2.1.2 Alternative 1B: Atlantic Salmon Status Quo HAPC

Map 565. Alternative 1B: Atlantic Salmon Status Quo HAPC



4.2.2 Alternative 2: Seamounts

Alternative 2 seeks to designate seamounts within the New England Seamount chain inside the U.S. EEZ. An HAPC designation is proposed for Bear, Physalia and Retriever seamounts, and the minor topographic rises surrounding them, that are within the U.S. EEZ off the southern edge of Georges Bank.

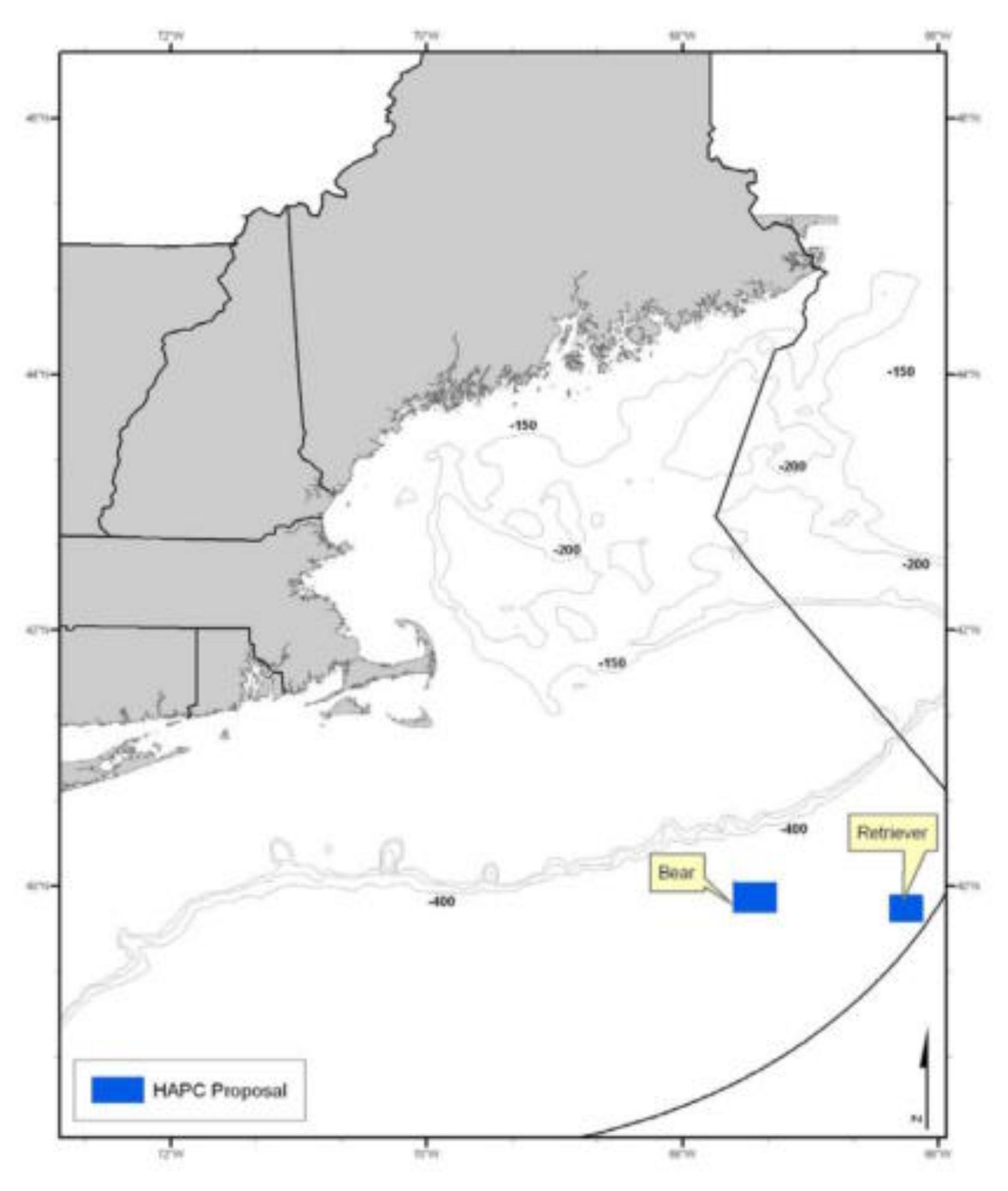
This alternative includes two options:

Option A: Bear and Retriever where managed species (deep-sea red crab) have been documented (Map 566)

Option B: Bear, Retriever and Physalia seamounts where managed species have been documented or can be inferred to exist by analogy (Map 567).

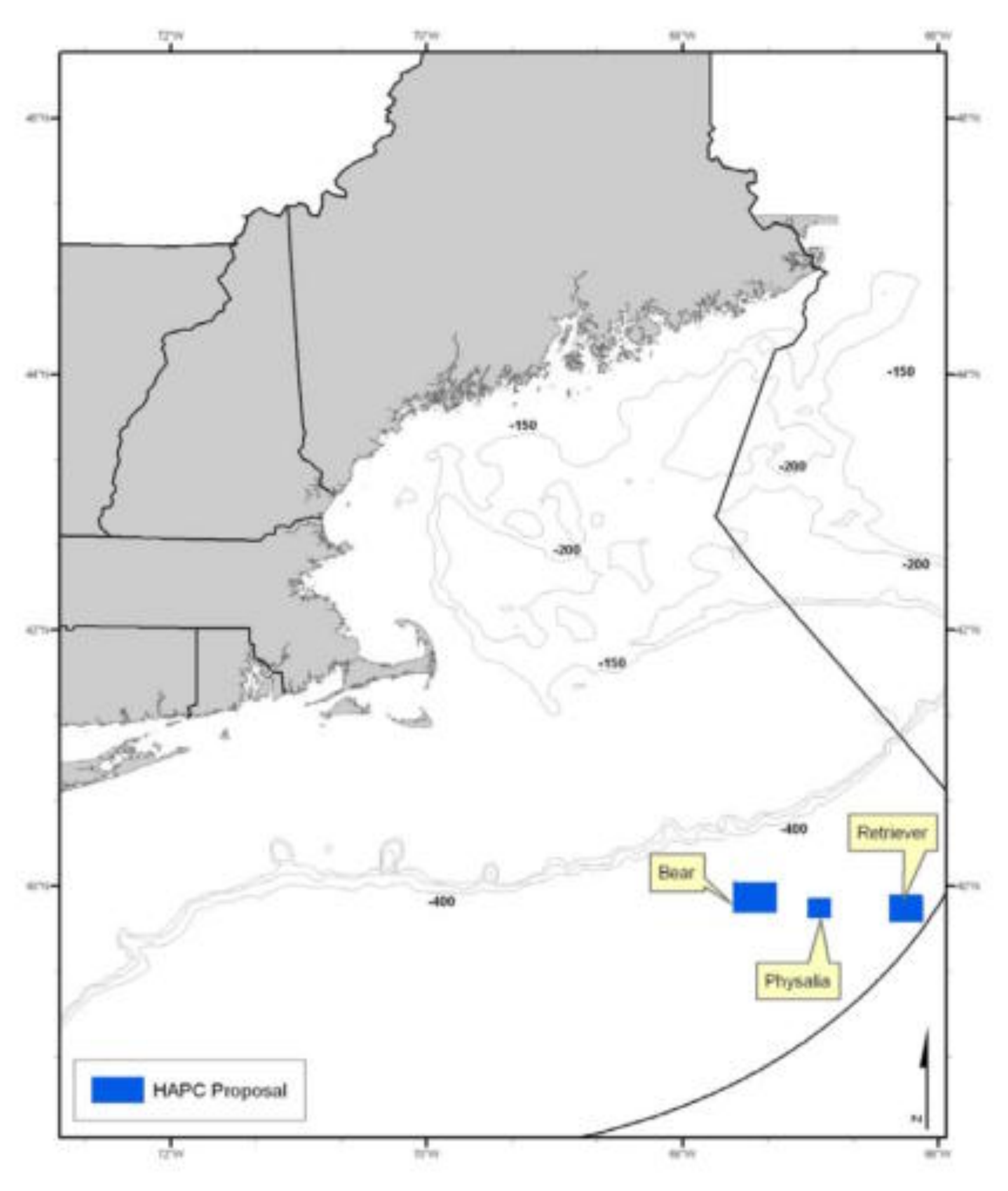
4.2.2.1 Alternative 2A: Bear and Retriever Seamounts

Map 566. Seamount Alternative 2A (Bear and Retriever Seamounts)



4.2.2.2 Alternative 2B: Bear, Retriever and Physalia Seamounts

Map 567. Seamount Alternative 2B (Bear, Retriever and Physalia)



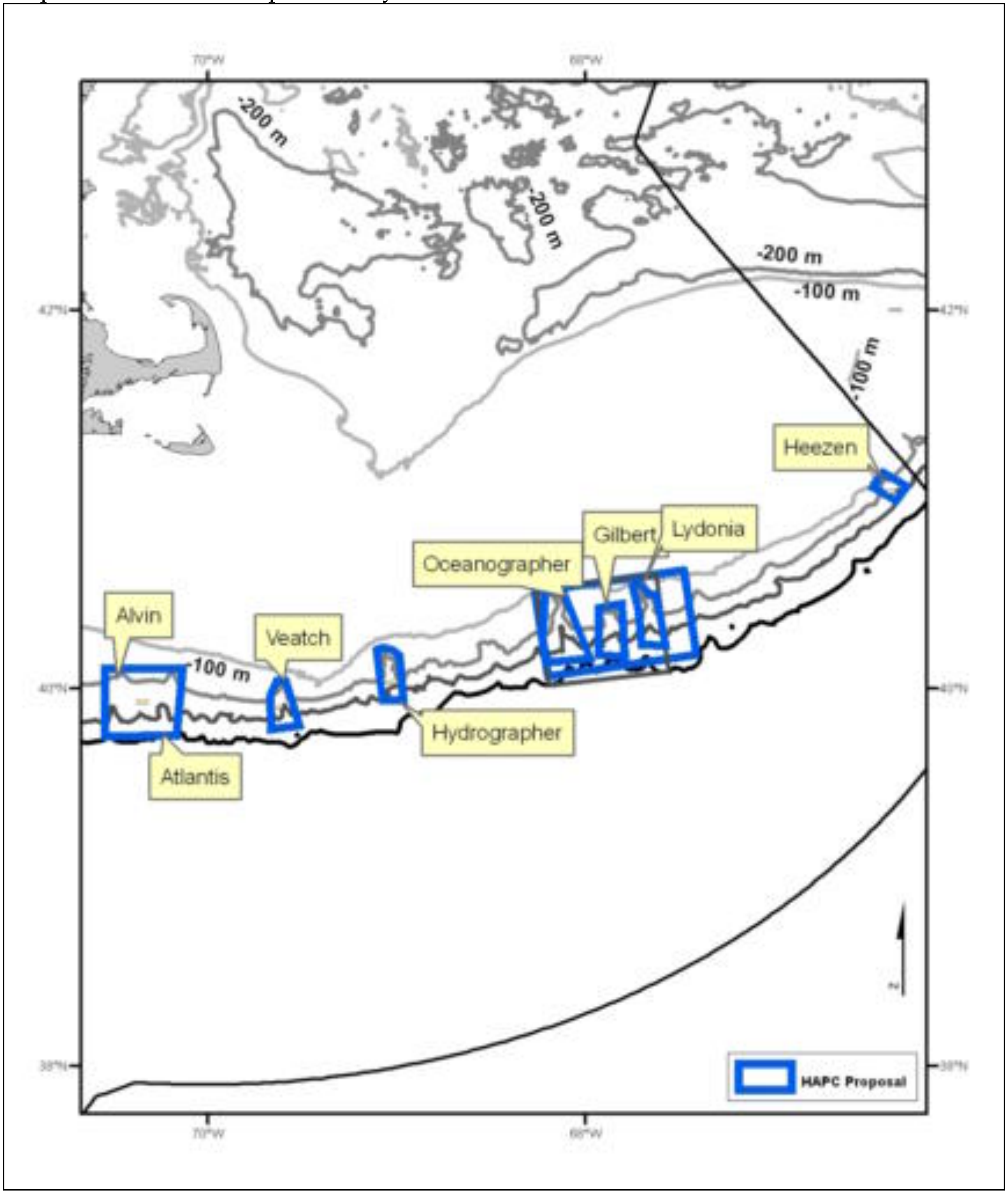
4.2.3 Alternative 3: Deep-Sea Canyons

This alternative (- Map 584) identifies deep-sea canyon habitats that contain, or are believed to contain, structure- or habitat-forming organisms including, but not limited to, stone corals (Cnidaria, Anthozoa, Hexacorallia, Sceractinia), black corals (Anthipitharians), cerianthid anemones (Cnidaria, Anthozoa, Hexacorallia, Cerianthania), soft corals (Cnidaria, Anthozoa, Octocorallia), sea pens (Cnidaria, Anthozoa, Octocorallia, Pennatulacea) and sponges (porifera).

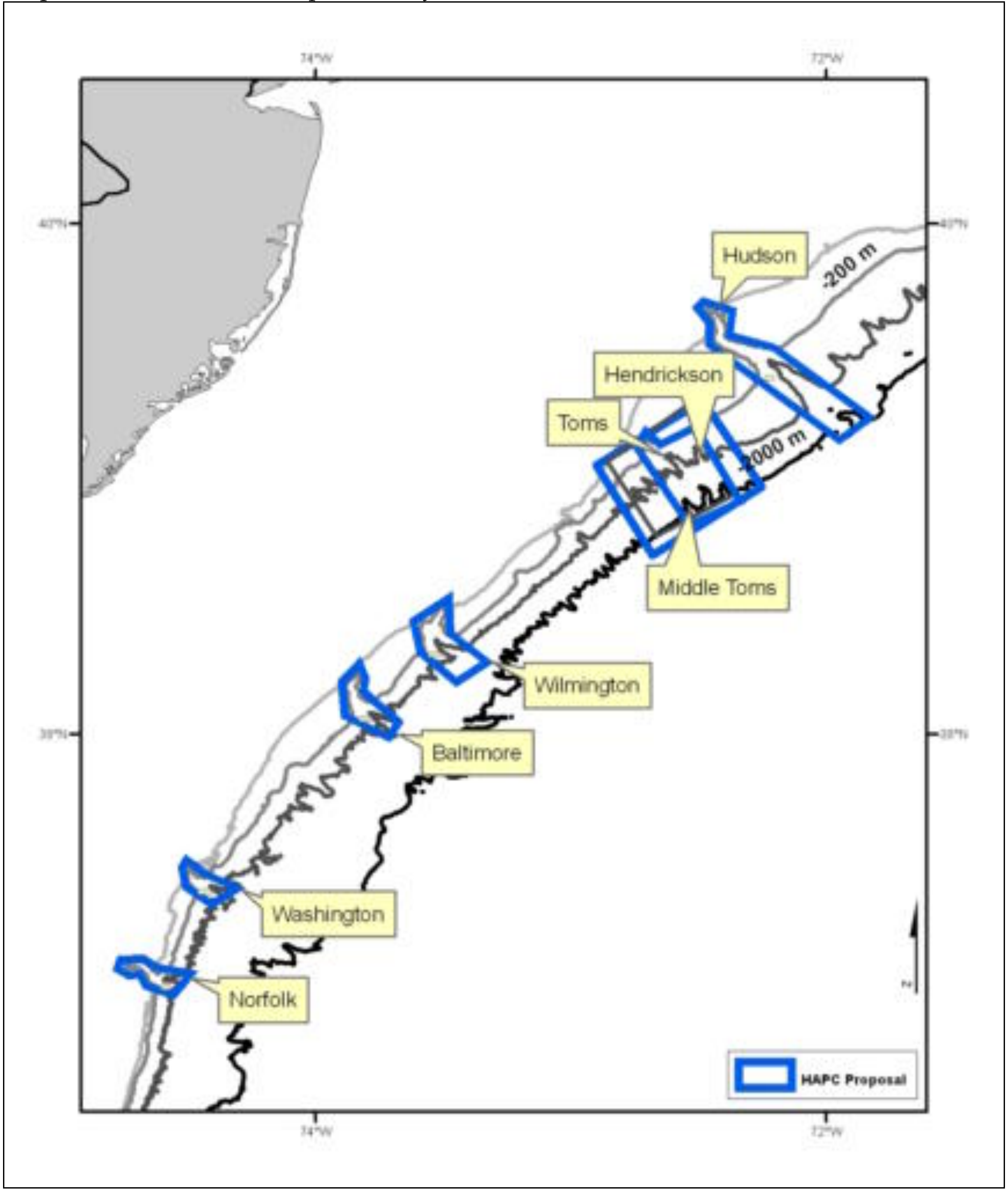
Although the Alternatives (3A – 3O) are housed under one main umbrella of "Deep-Sea Canyons", each canyon(s) alternative will be treated individually.

3A: Heezen
3B: Lydonia
3C: Gilbert
3D: Oceanographer
3E: Hydrographer
3F: Veatch
3G: Alvin and Atlantis
3H: Hudson
3I: Toms and Hendrickson
3J: Wilmington
3K: Baltimore
3L: Washington
3M: Norfolk
3N: Oceanographer, Gilbert and Lydonia
3O: Toms, Hendrickson and Inter-Canyon Areas

Map 568. Northern Deep-Sea Canyon HAPC Alternatives.



Map 569. Mid-Atlantic Deep-Sea Canyon HAPC Alternatives



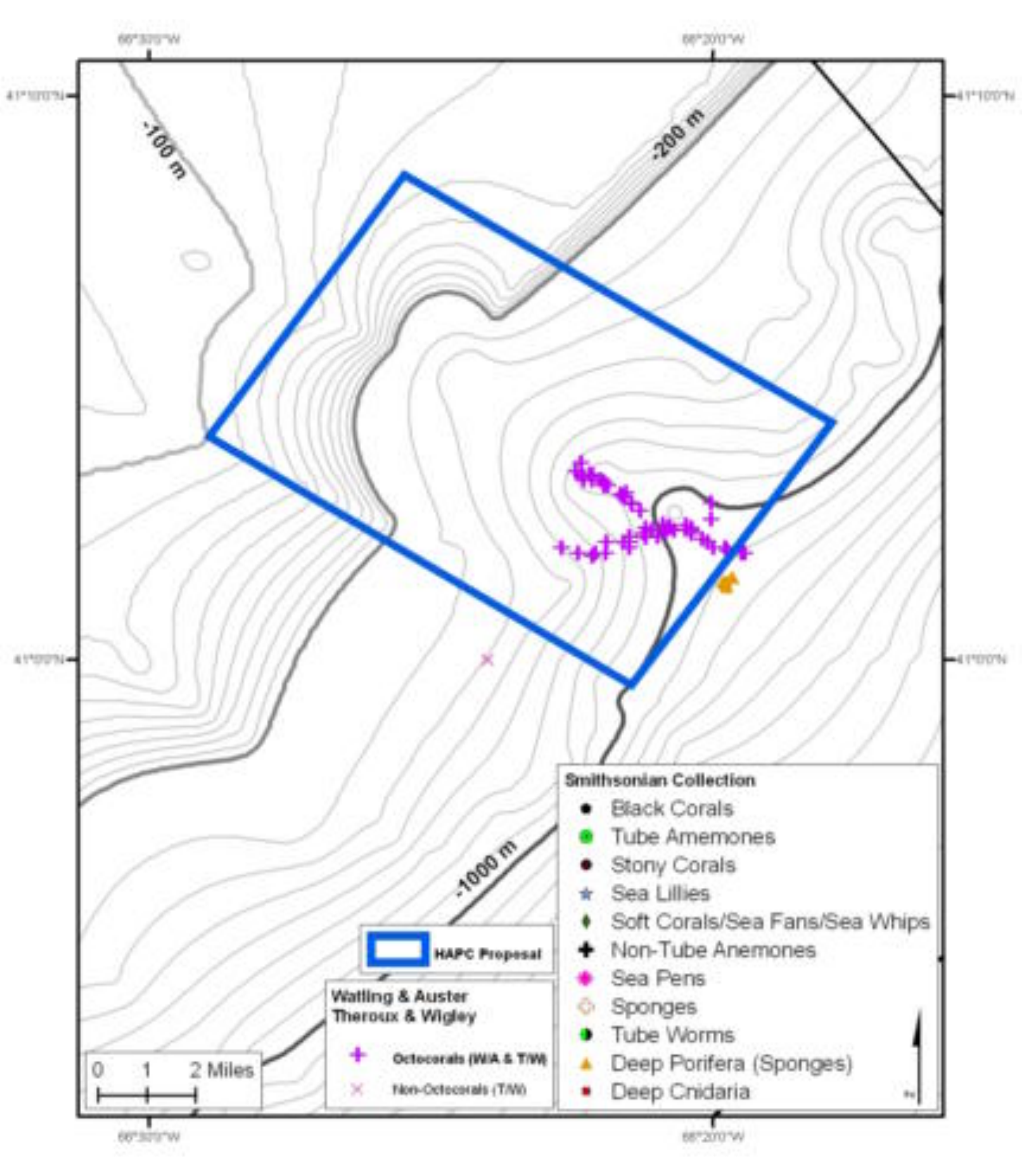
List of Canyon HAPC Alternatives

The following canyons* will be considered by the Council as individual HAPC alternatives (from NE to SW):

** With documented presence of structured forming organisms.*

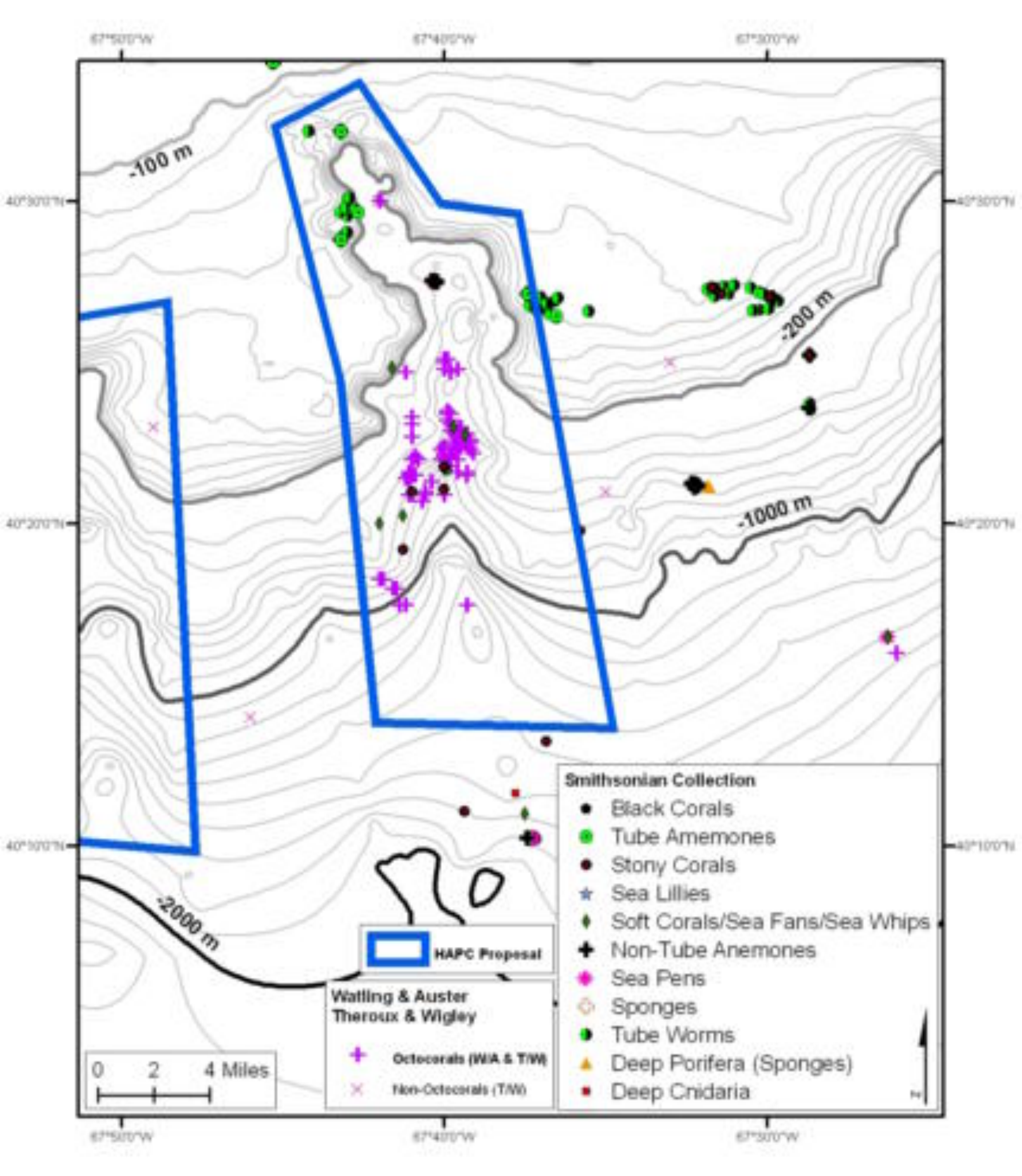
4.2.3.1 Alternative 3A: Heezen Canyon

Map 570, Alternative 3A: Heezen Canyon



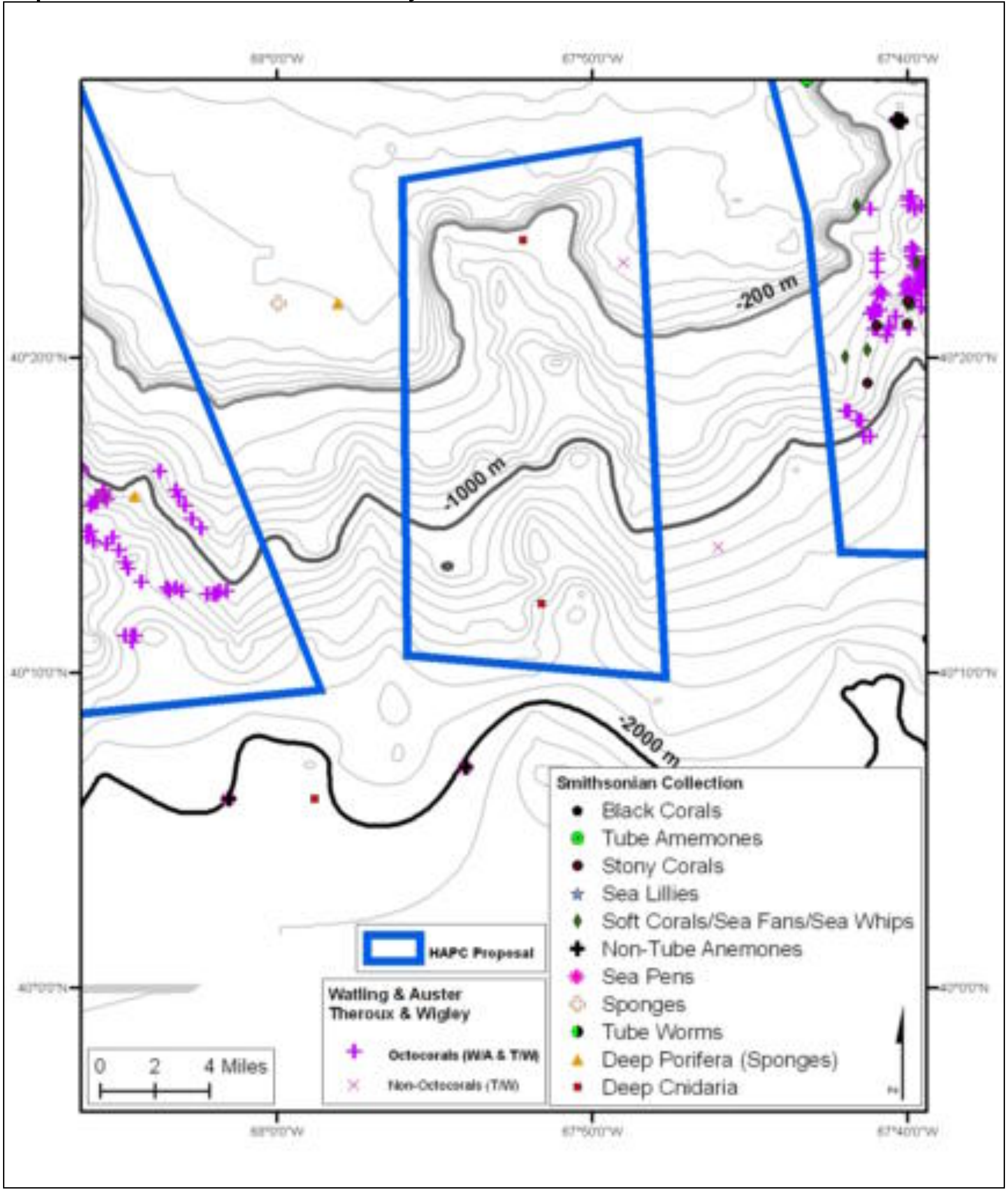
4.2.3.2 Alternative 3B: Lydonia Canyon

Map 571. Alternative 3B: Lydonia Canyon



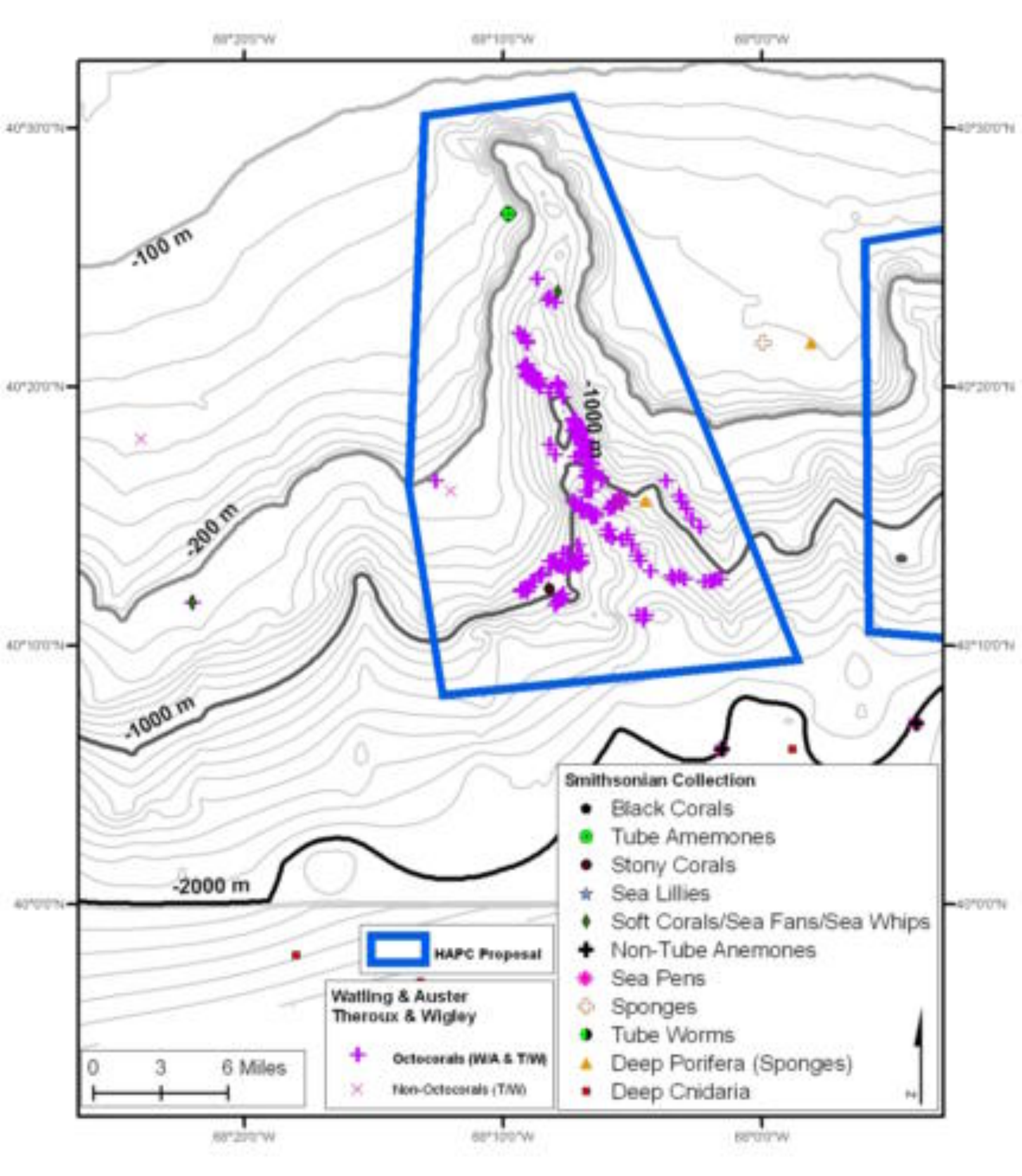
4.2.3.3 Alternative 3C: Gilbert Canyon

Map 572. Alternative 3C: Gilbert Canyon



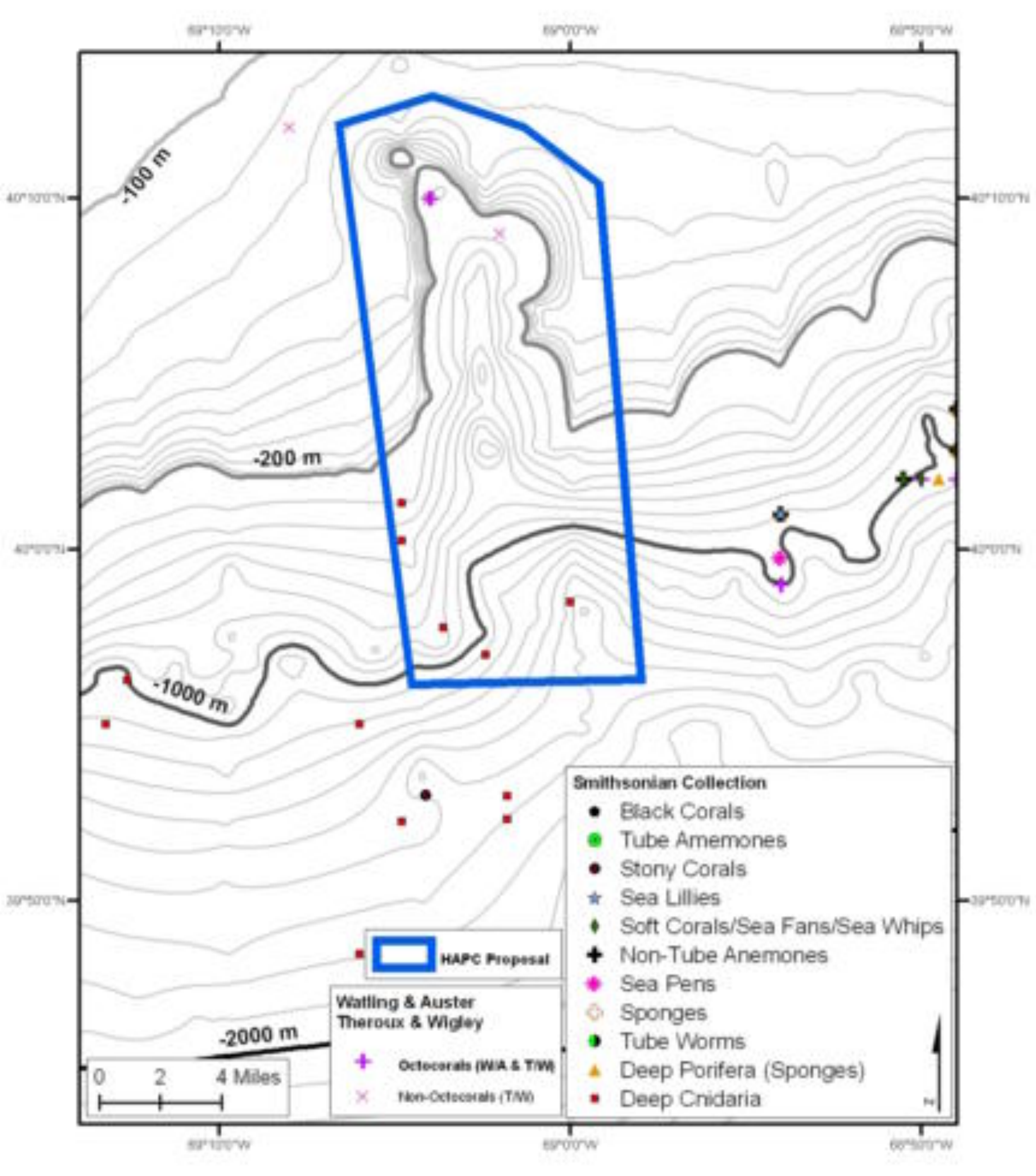
4.2.3.4 Alternative 3D: Oceanographer Canyon

Map 573. Alternative 3D: Oceanographer Canyon



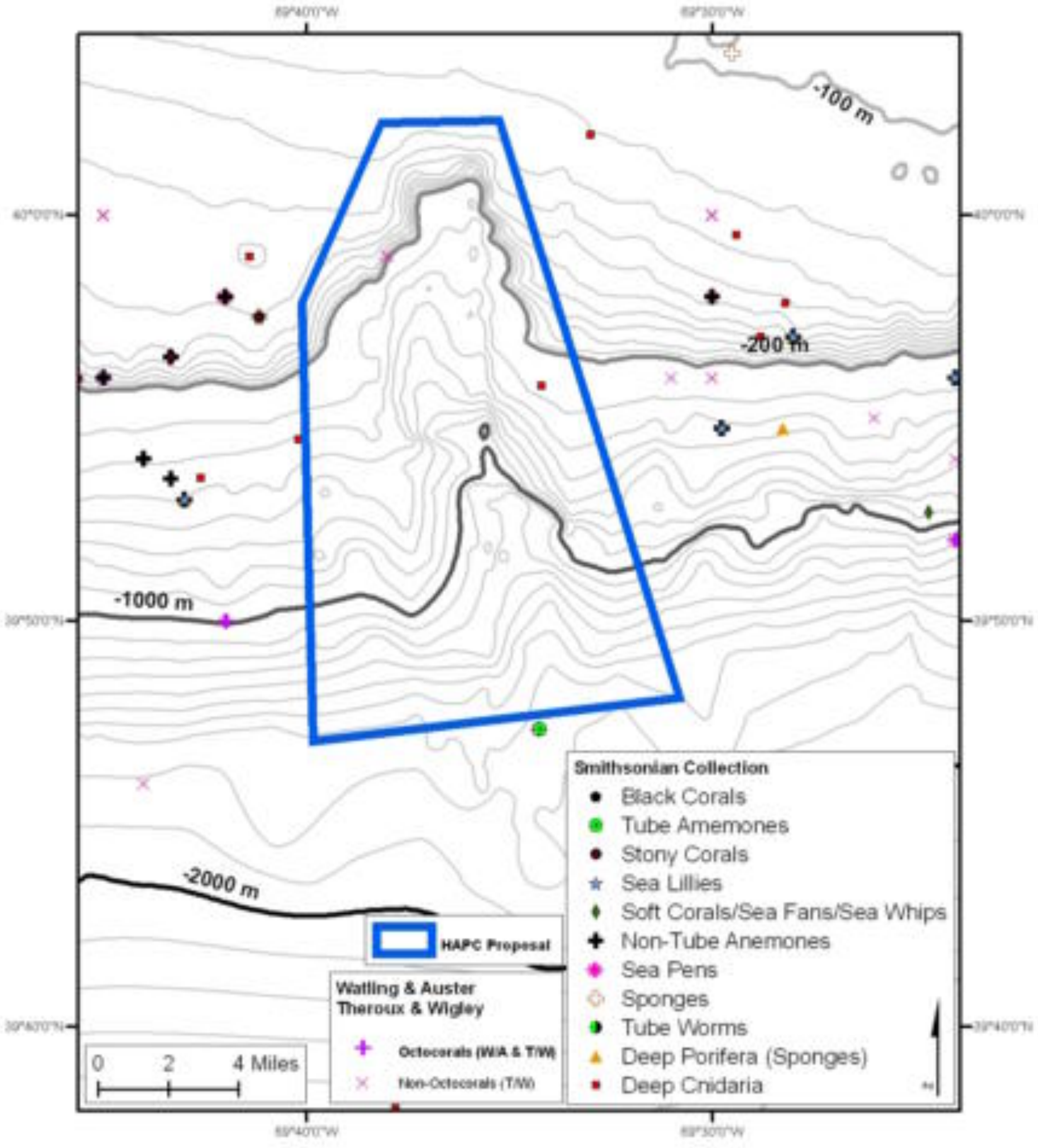
4.2.3.5 Alternative 3E: Hydrographer Canyon

Map 574. Alternative 3E: Hydrographer Canyon



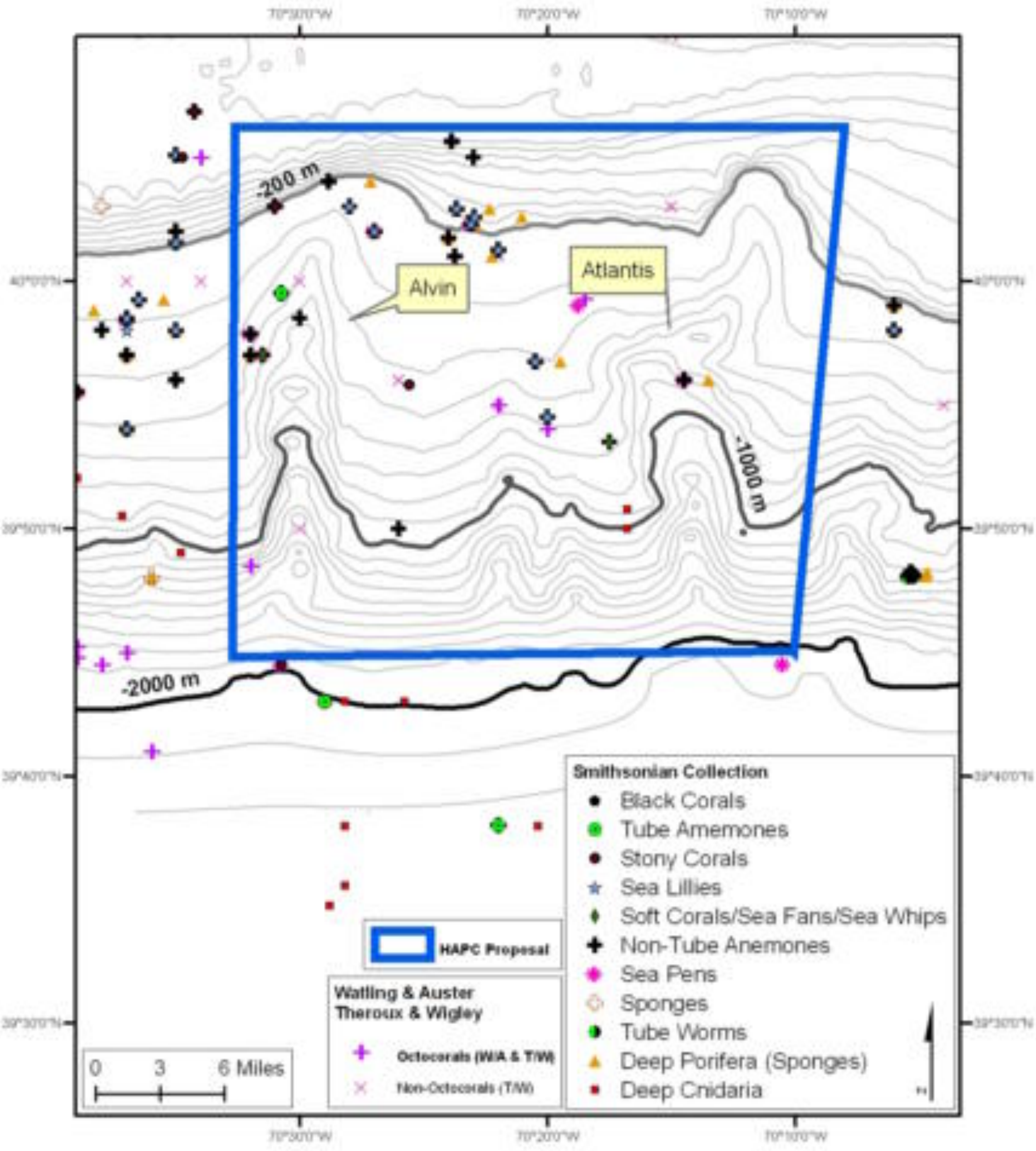
4.2.3.6 Alternative 3F: Veatch Canyon

Map 575. Alternative 3F: Veatch Canyon



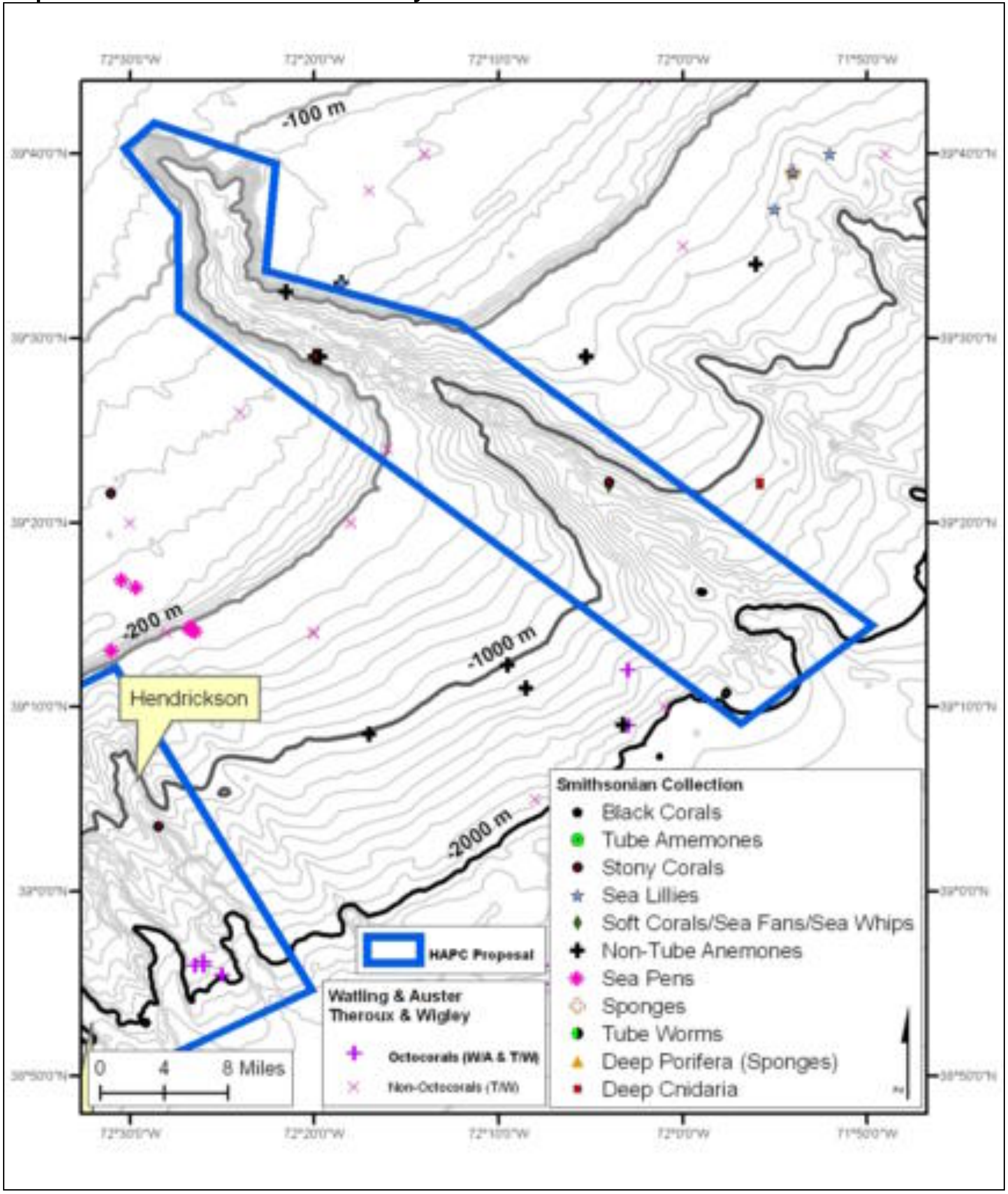
4.2.3.7 Alternative 3G: Alvin and Atlantis Canyons

Map 576. Alternative 3G: Alvin and Atlantis Canyons



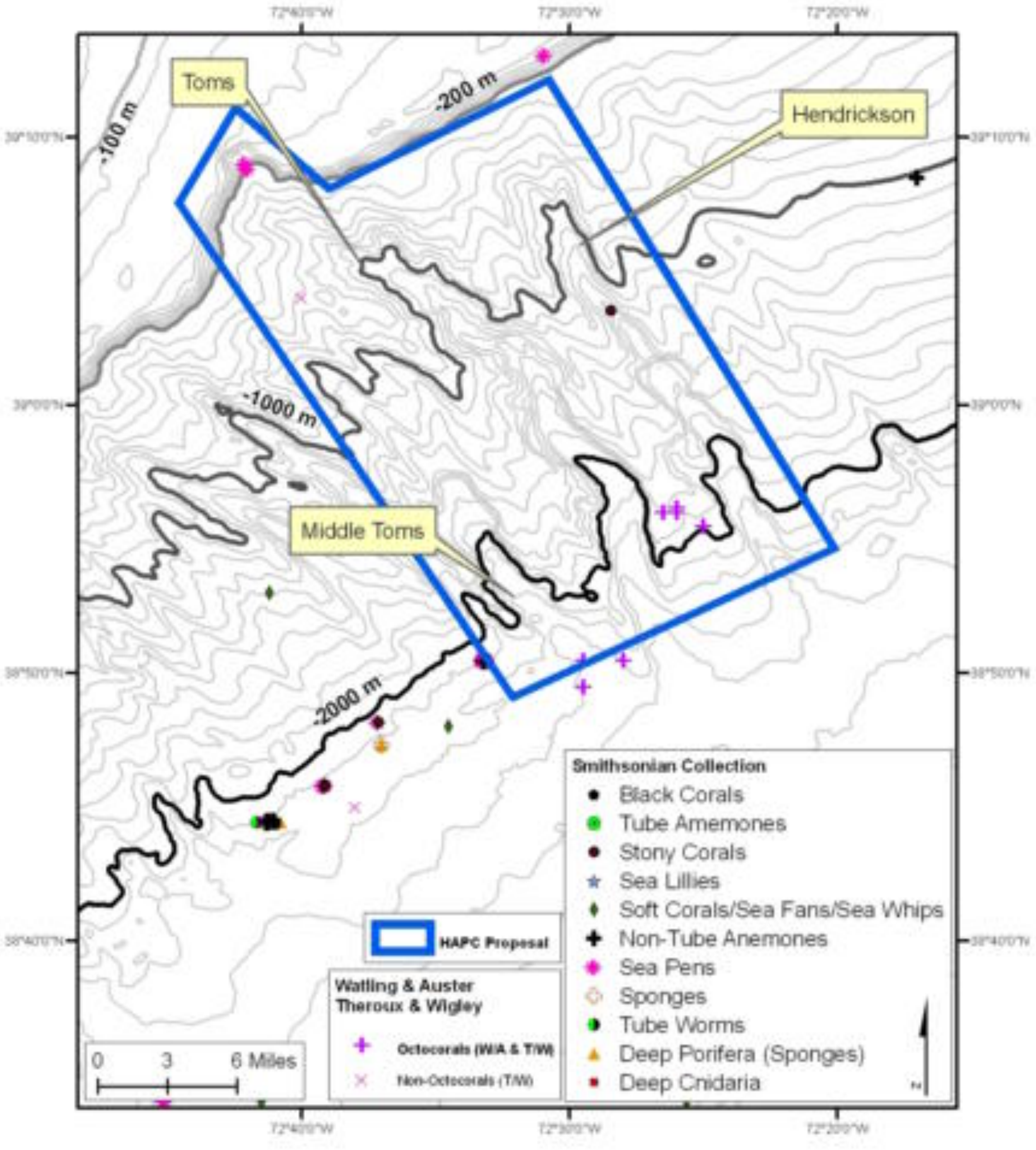
4.2.3.8 Alternative 3H: Hudson Canyon

Map 577. Alternative 3H: Hudson Canyon



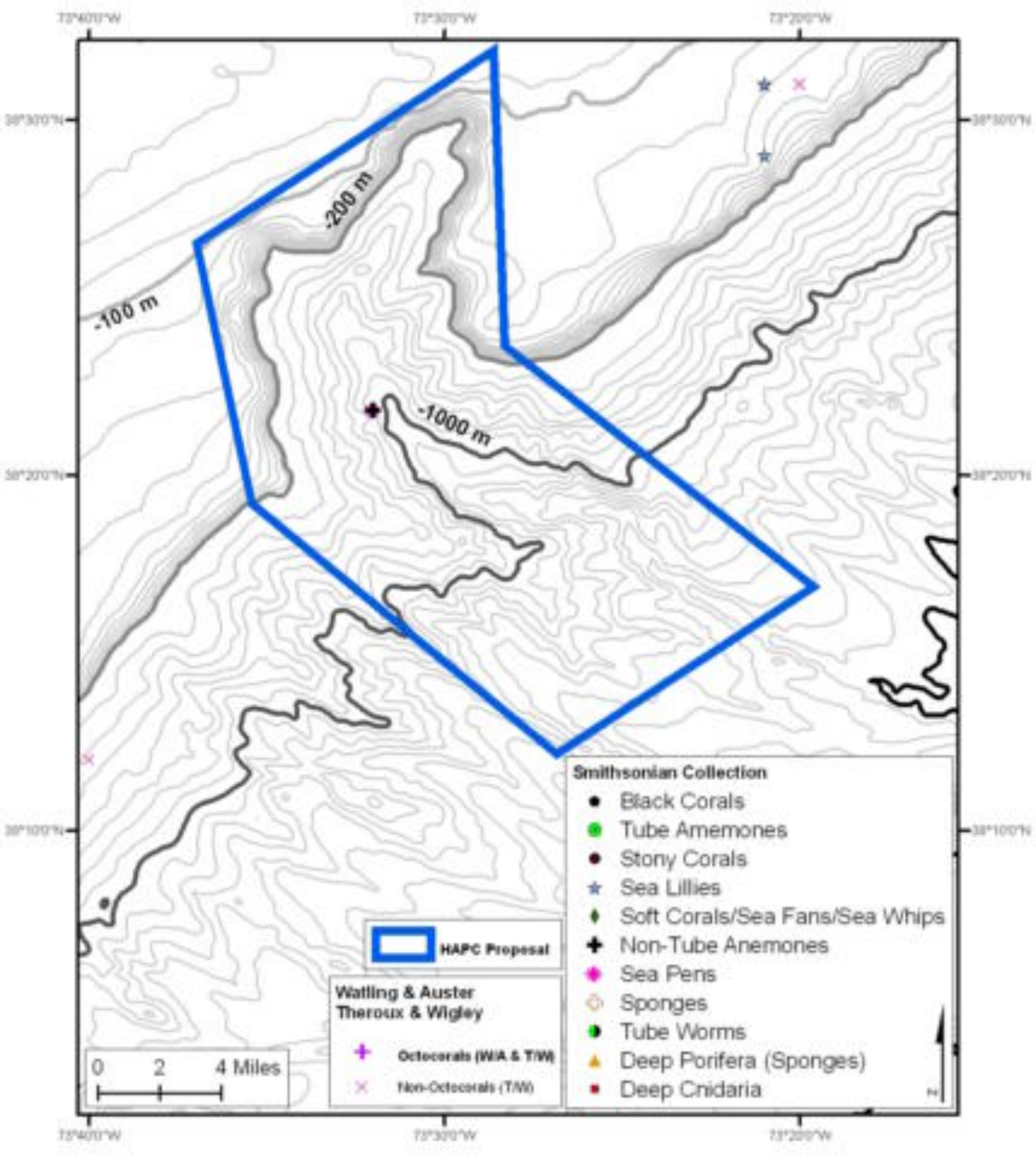
4.2.3.9 Alternative 3I: Toms and Hendrickson Canyons

Map 578. Alternative 3I: Toms and Hendrickson Canyons



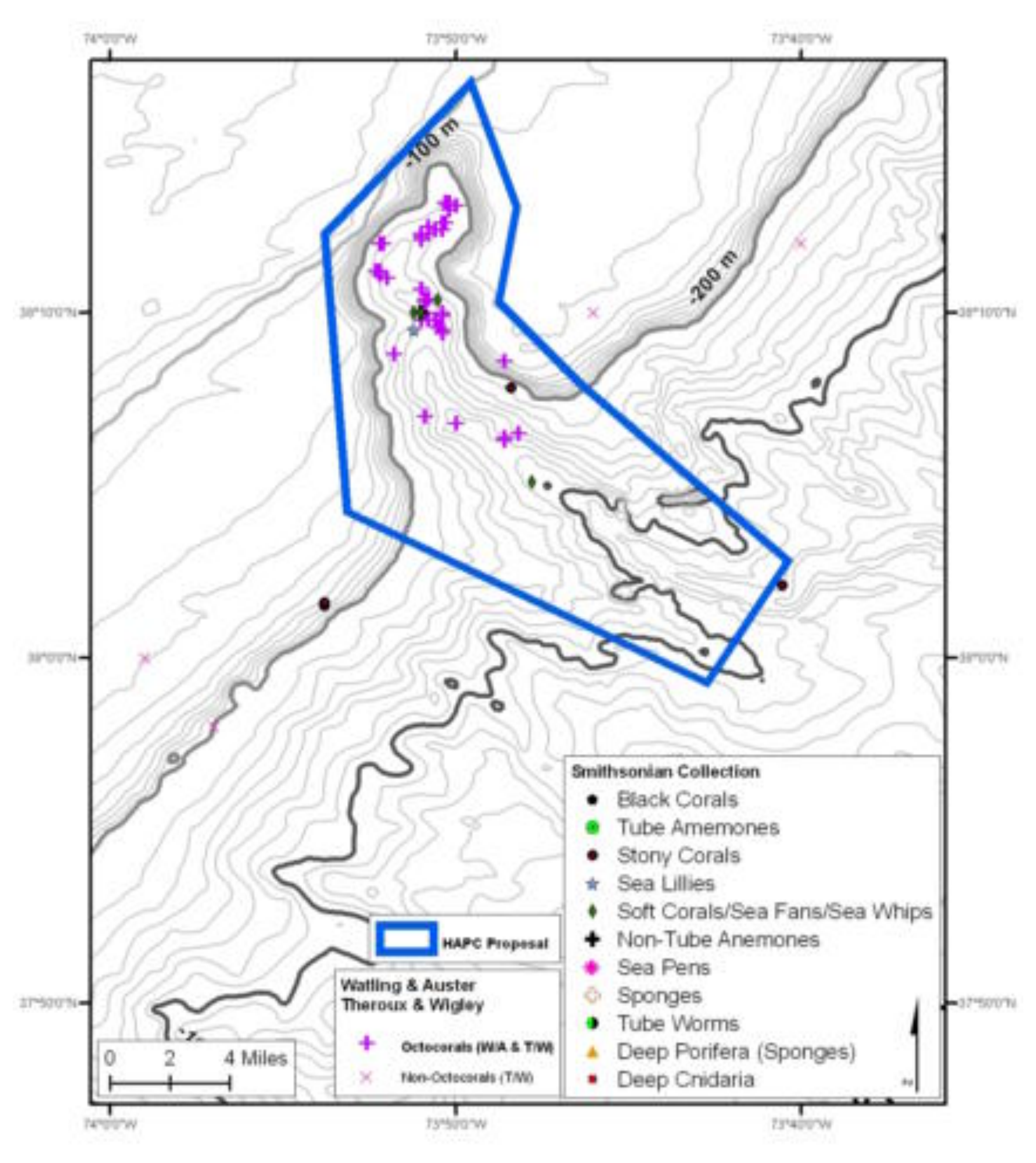
4.2.3.10 Alternative 3J: Wilmington Canyon

Map 579. Alternative 3J: Wilmington Canyon



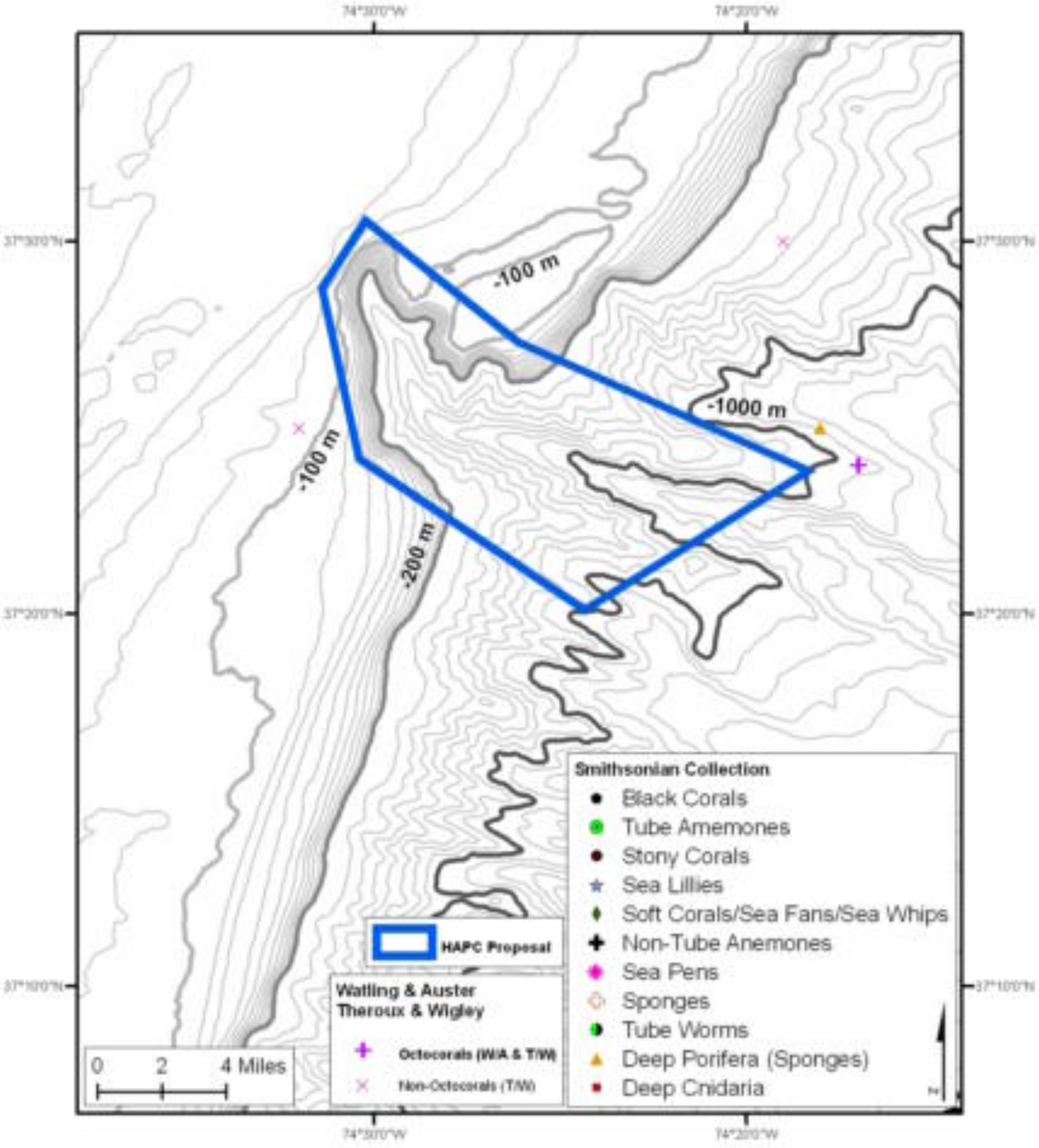
4.2.3.11 Alternative 3K: Baltimore Canyon

Map 580. Alternative 3K: Baltimore Canyon



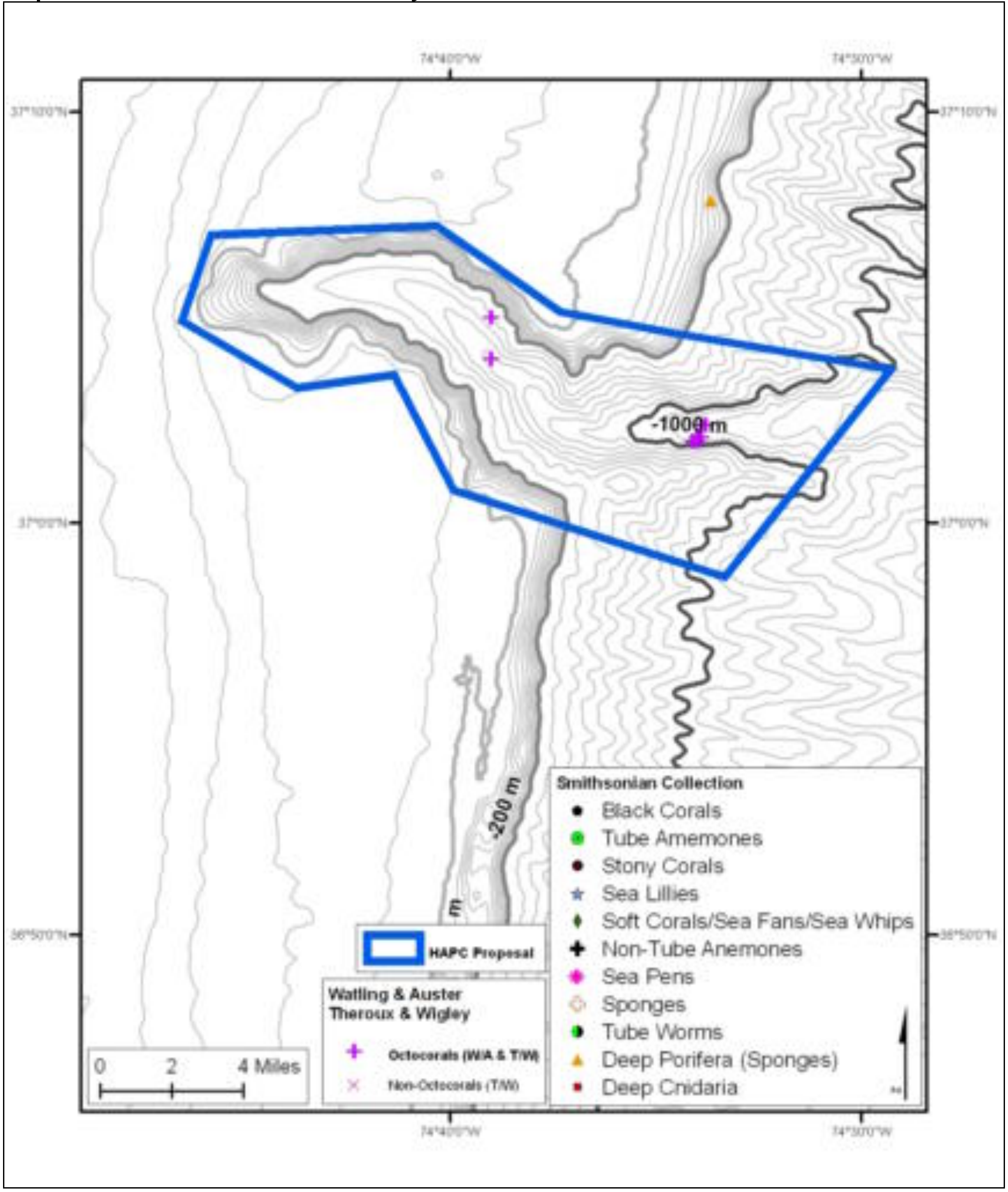
4.2.3.12 Alternative 3L: Washington Canyon

Map 581. Alternative 3L: Washington Canyon



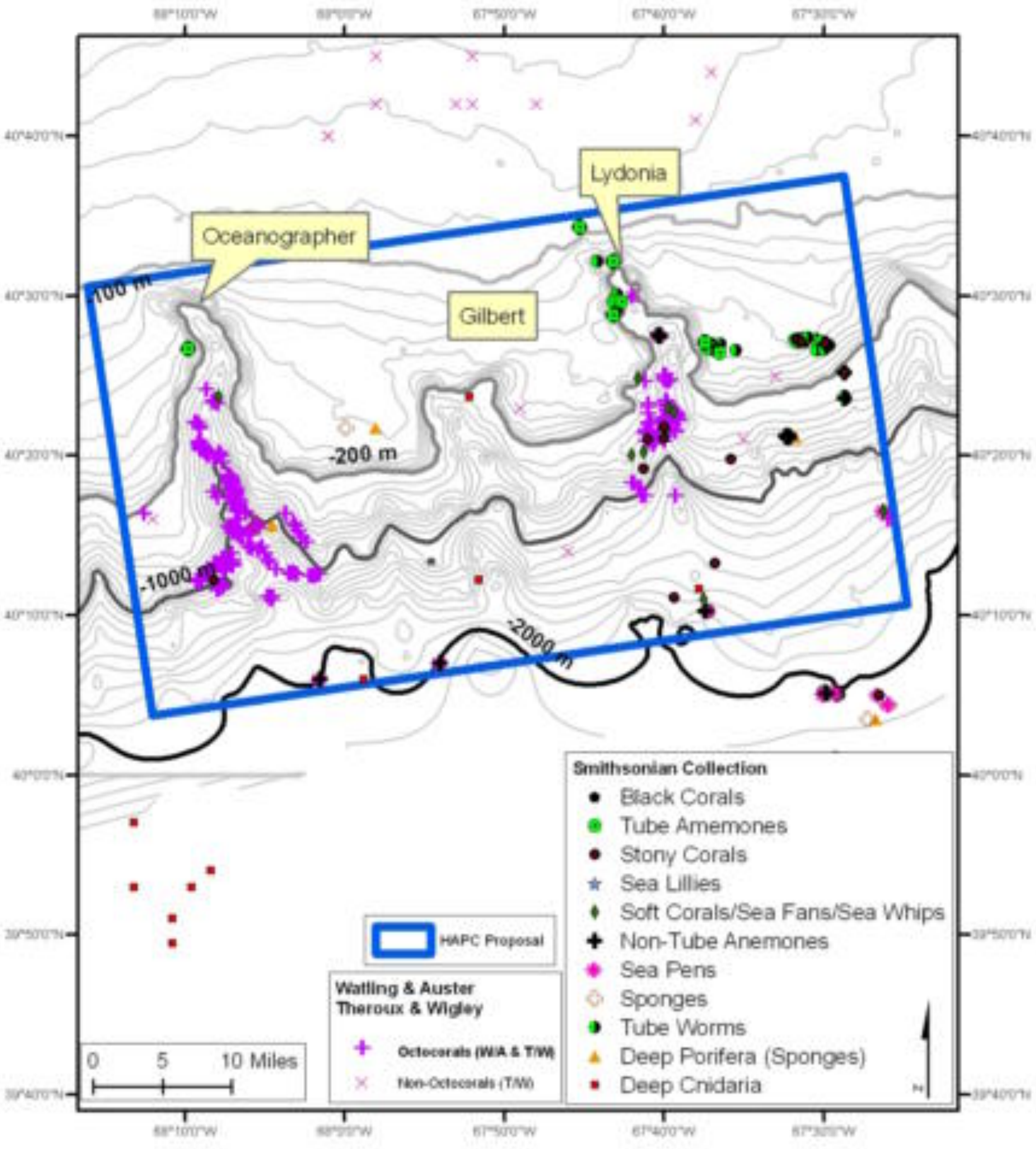
4.2.3.13 Alternative 3M: Norfolk Canyon

Map 582. Alternative 3M: Norfolk Canyons



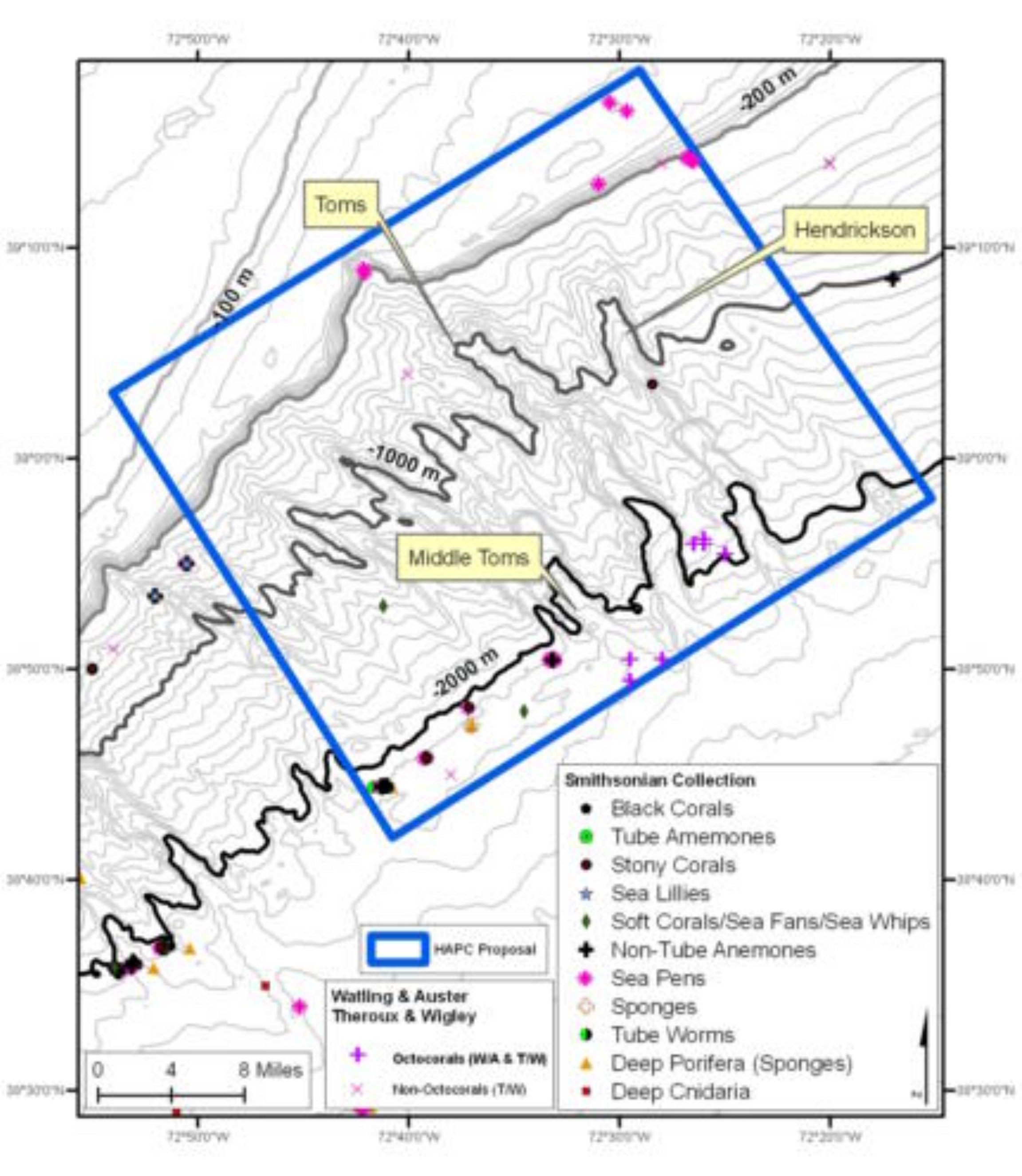
4.2.3.14 Alternative 3N: Oceanographer, Gilbert and Lydonia Canyons

Map 583. Alternative 3N: Oceanographer, Gilbert and Lydonia Canyons



4.2.3.15 Alternative 3O: Toms, Hendrickson and Inter-Canyon Areas

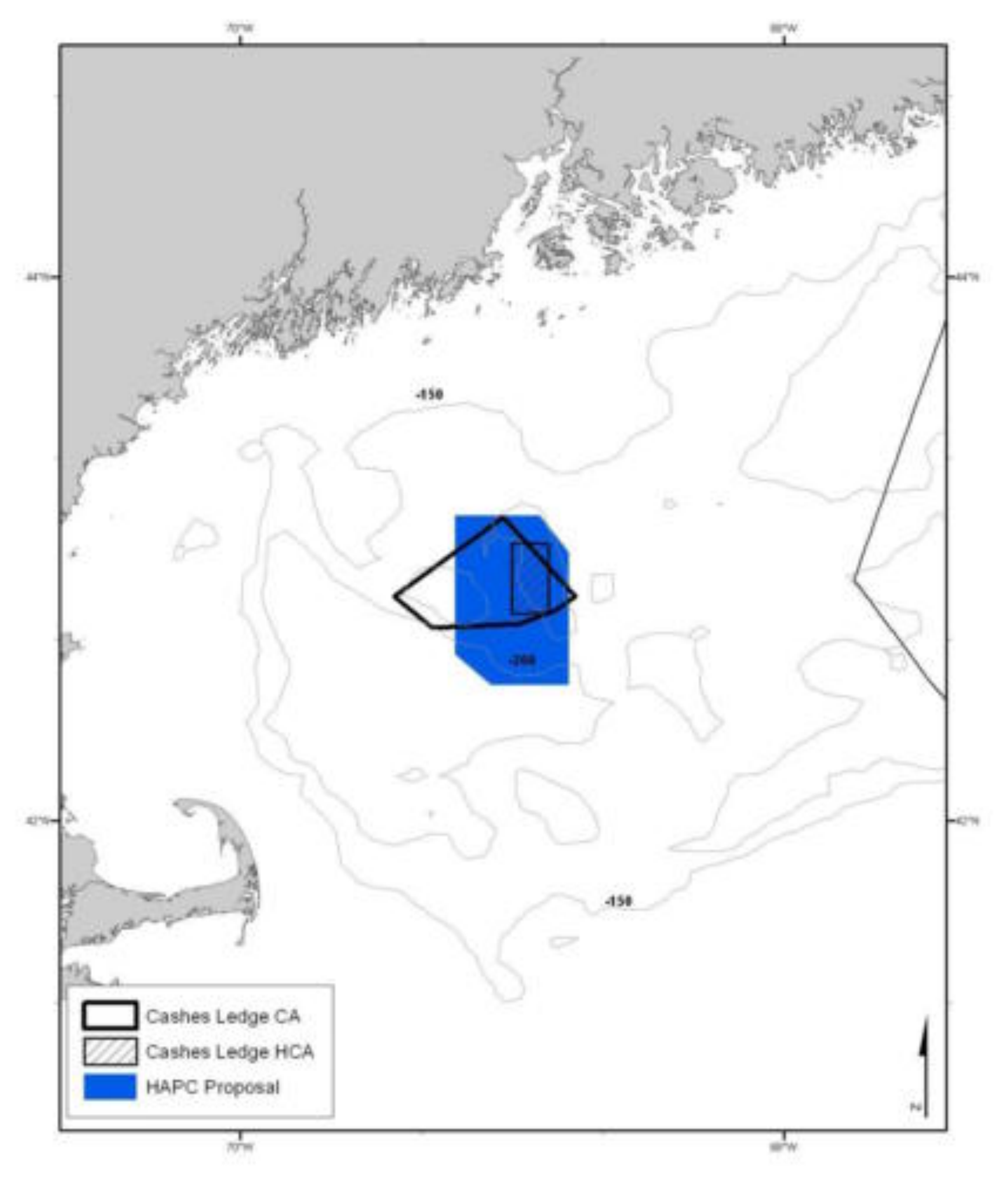
Map 584. Alternative 3O: Toms, Hendrickson and Inter-Canyon Areas



4.2.4 Alternative 4: Cashes Ledge Area

This alternative (Map 585) seeks to extend the boundaries of the Cashes Ledge Habitat Closed Area and designate the area as an HAPC. The larger area includes deeper water habitats and ridges associated with Cashes Ledge.

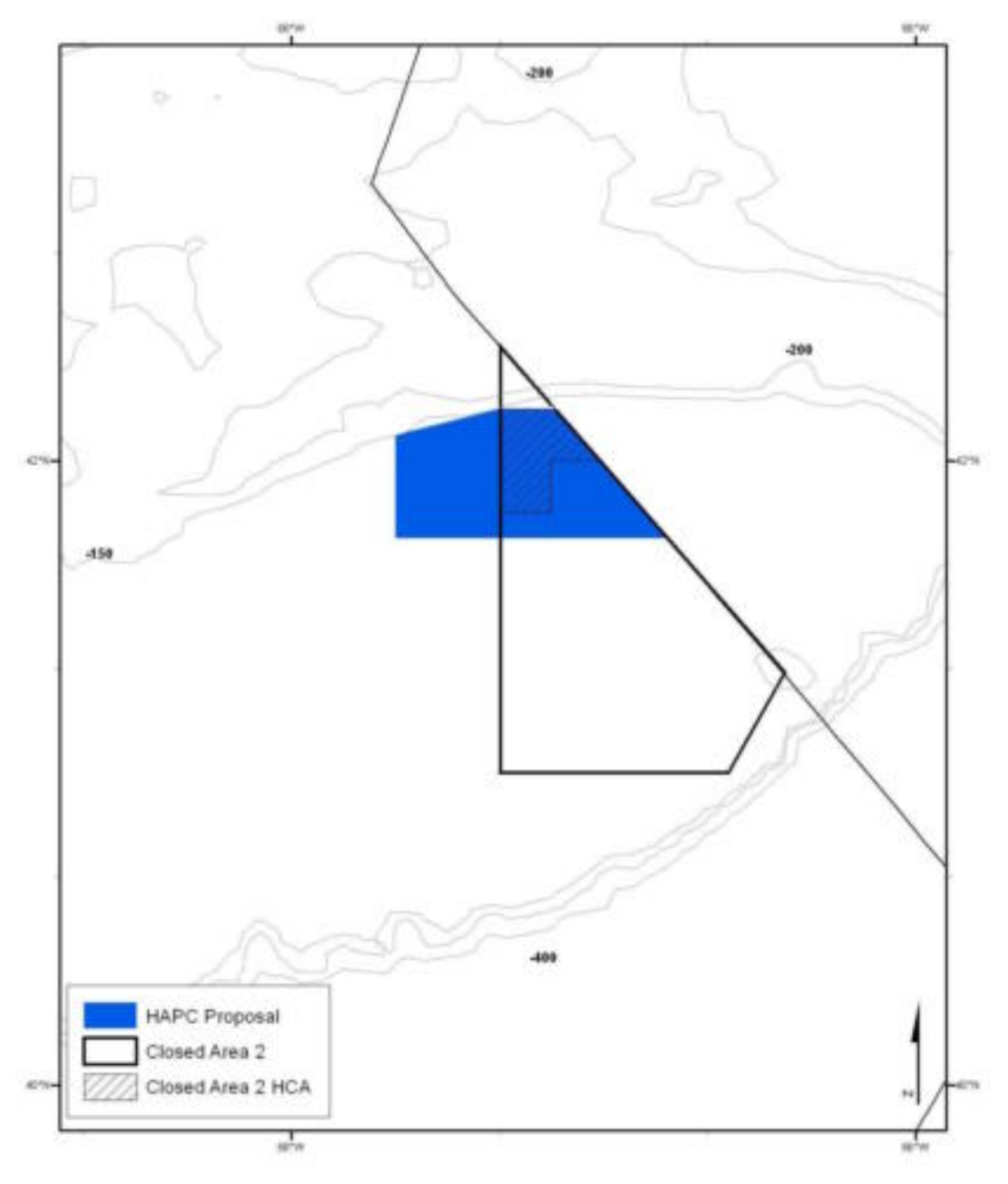
Map 585. Alternative 4: Cashes Ledge Area HAPC Alternative



4.2.5 Alternative 5: George’s Bank / Northern Edge Area

The purpose of this alternative (Map 586) is to expand the existing HAPC designation westward to encompass more gravel, cobble, and boulder habitat features known to improve the survival of juvenile cod and other species.

Map 586. Alternative 5: George’s Bank / Northern Edge HAPC Alternative



4.2.6 Alternative 6: Jeffreys Ledge / Stellwagen Bank Area

This alternative (Map 587 - Map 589) seeks to designate portions of Jeffreys Ledge and Stellwagen Bank as diverse and highly productive habitat features within the Gulf of Maine.

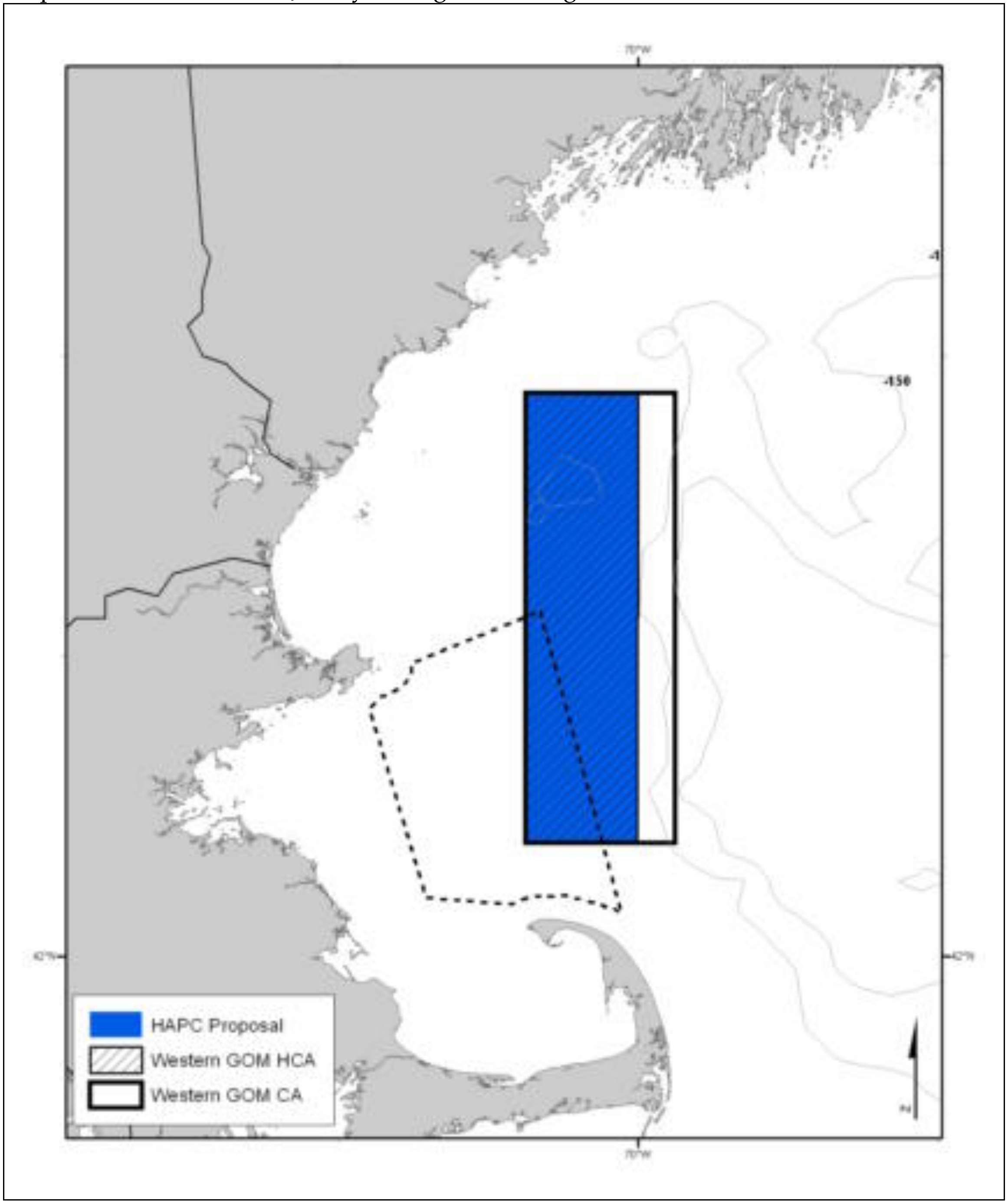
This alternative includes three options for public comment:

<u>Option A</u>: Designate as HAPC the Western Gulf of Maine Habitat Closed Area (Map 587)

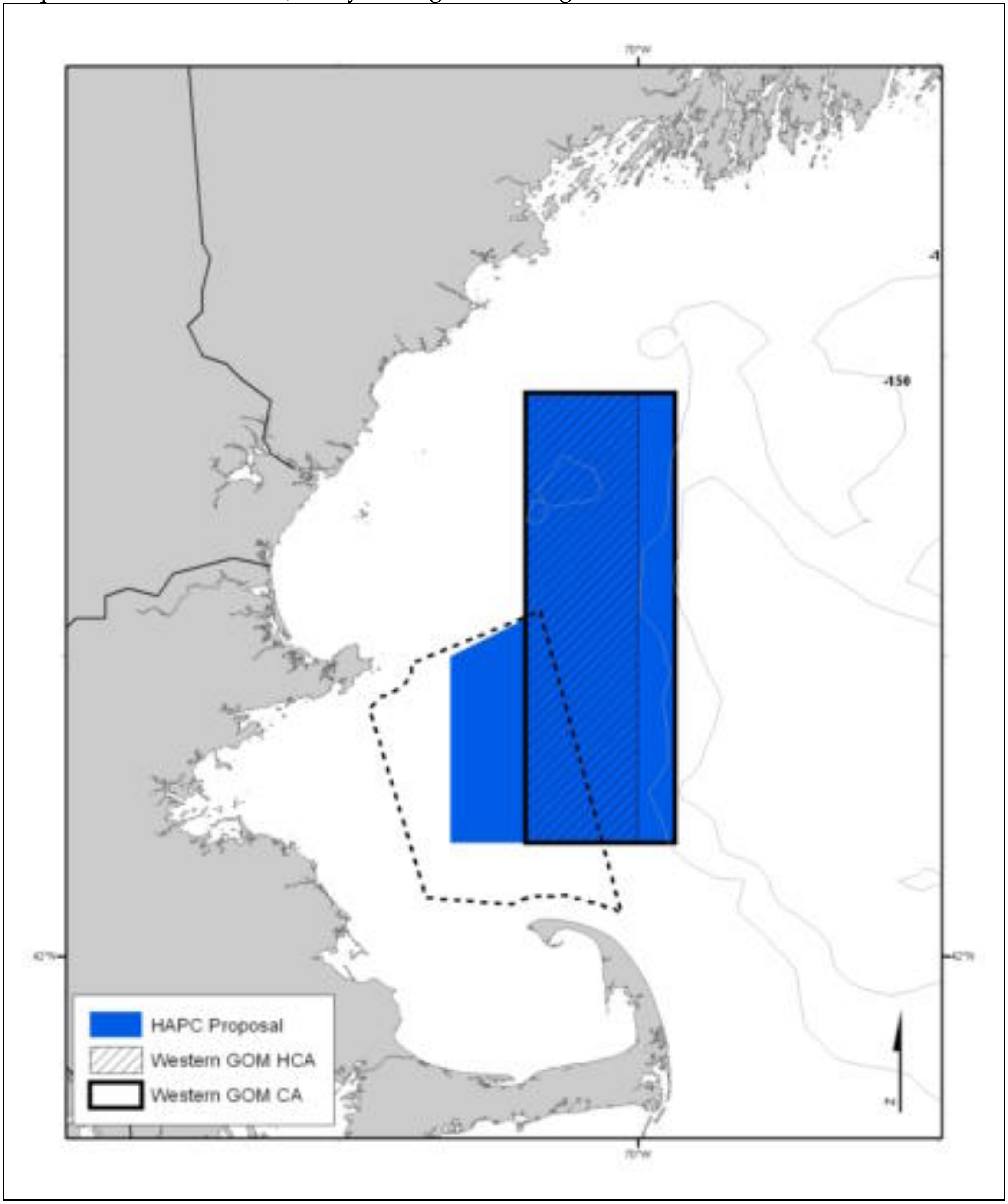
<u>Option B</u>: Designate as HAPC the Western Gulf of Maine Groundfish Closure plus a westward extension into the Stellwagen Bank National Marine Sanctuary (Map 588)

<u>Option C</u>: Designate as HAPC the Western Gulf of Maine Groundfish Closure and the Stellwagen Bank National Marine Sanctuary in their entirety (Map 589)

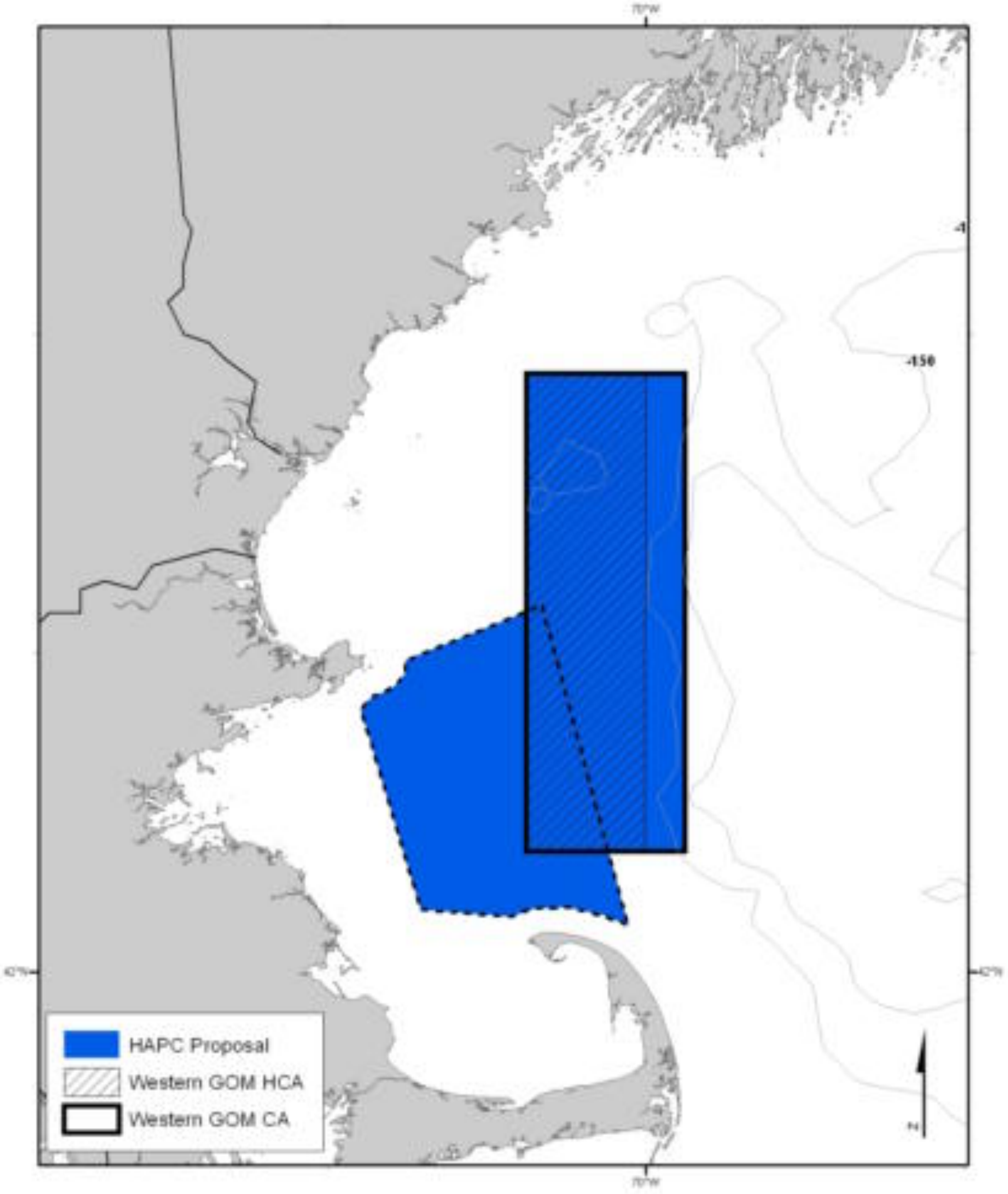
Map 587. Alternative 6A: Jeffrey's Ledge / Stellwagen Bank Alternative



Map 588. Alternative 6B: Jeffrey's Ledge / Stellwagen Bank Alternative



Map 589. Alternative 6C: Jeffrey's Ledge / Stellwagen Bank Alternative



4.2.7 Alternative 7: Inshore Juvenile Cod

This alternative seeks to designate the inshore areas of the Gulf of Maine and Southern New England specifically to recognize the importance of the inshore areas to juvenile Atlantic cod. In 1999, the Council voted to approve this alternative and include it in the next appropriate fishery management plan vehicle. Since that time, the Habitat Plan Development Team has advised the Habitat Committee, based on the supporting information, that the Alternative should be expanded to include two options for public comment:

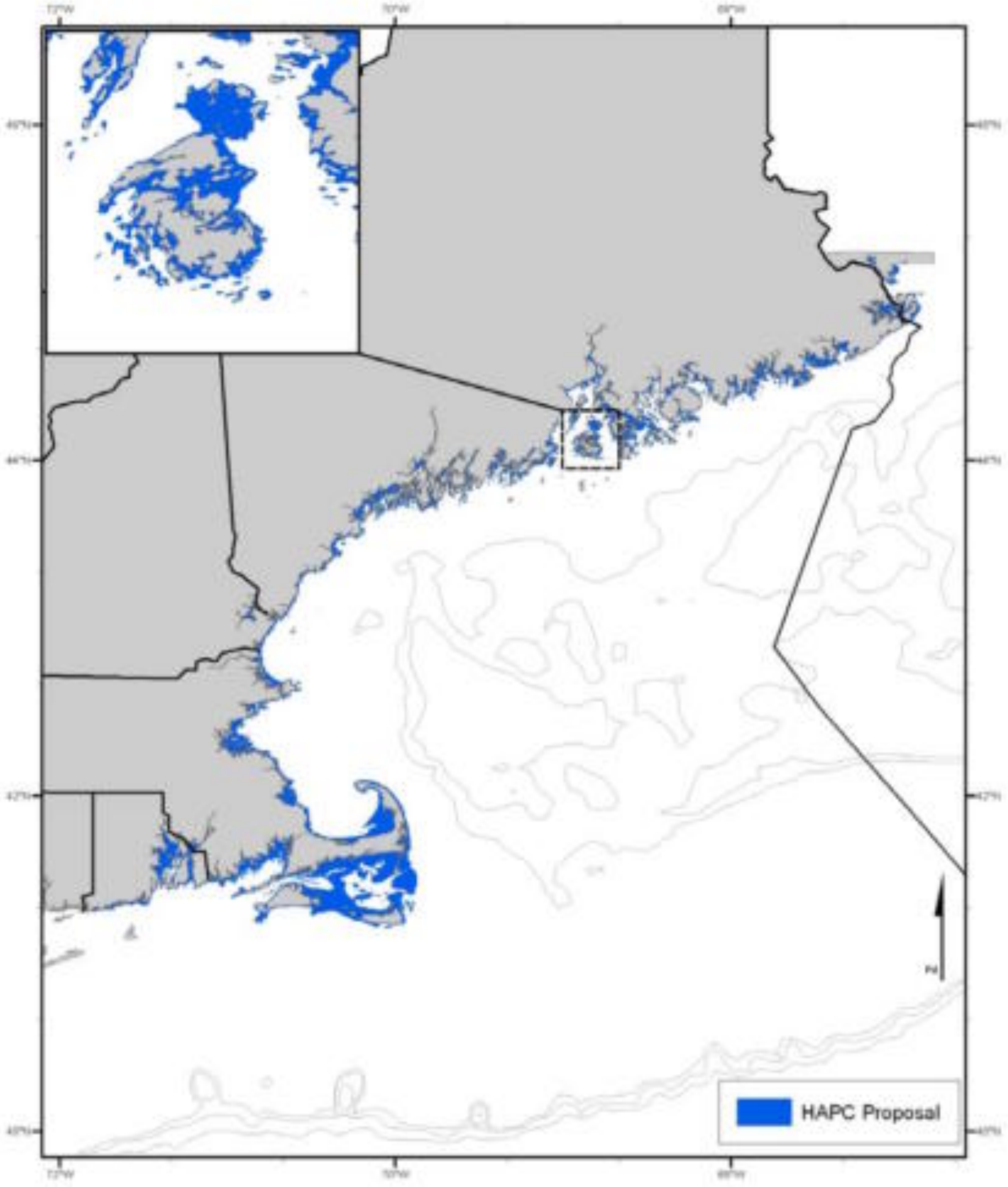
The most practical approach for delineating an HAPC for settled age-0 cod is to circumscribe the reported center of distribution for this life stage throughout the range of the stock. The information available suggests that the HAPC should be from the low tide line to a depth of 10 m (33') MLLW (Option A) or alternatively from the low tide line to a depth of 20 m (33') MLLW (Option B) from eastern Maine to the Rhode Island/Connecticut border. This narrow depth range describes critical habitat from settlement through the first autumn of life and overlaps seasonal habitat of age-1 juvenile cod. It also bounds the critical nursery zone for early benthic stages of important juvenile habitat for some other groundfish.

Option A: 0-10 meters (MLLW)

Option B: 0-20 meters (MLLW)

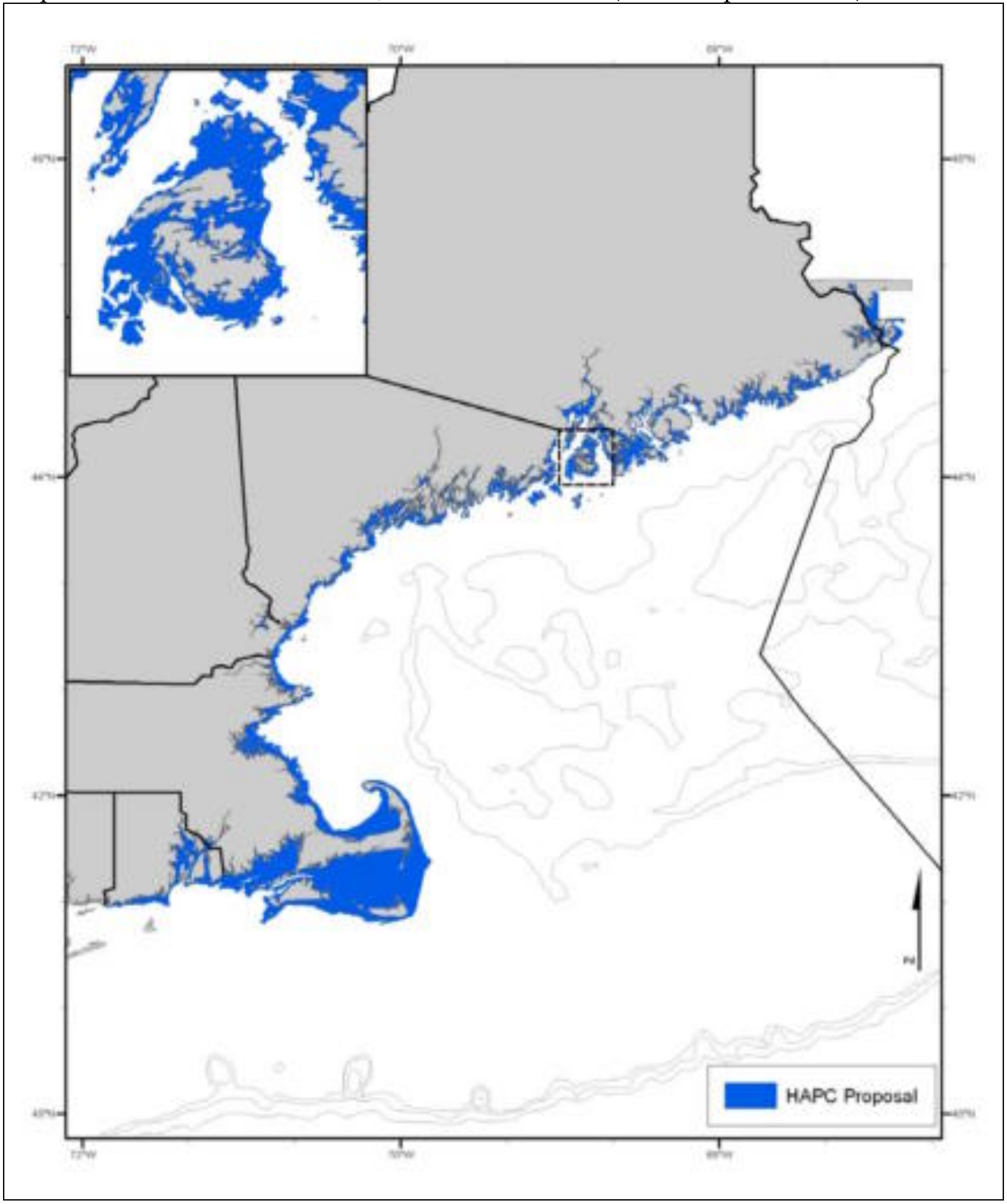
4.2.7.1 Alternative 7A: Inshore Juvenile Cod (0-10m depth contour)

Map 590. Alternative 7A: Inshore Juvenile Cod HAPC Alternative (0 - 10m depth contour)



4.2.7.2 Alternative 7B: Inshore Juvenile Cod (0-20m depth contour)

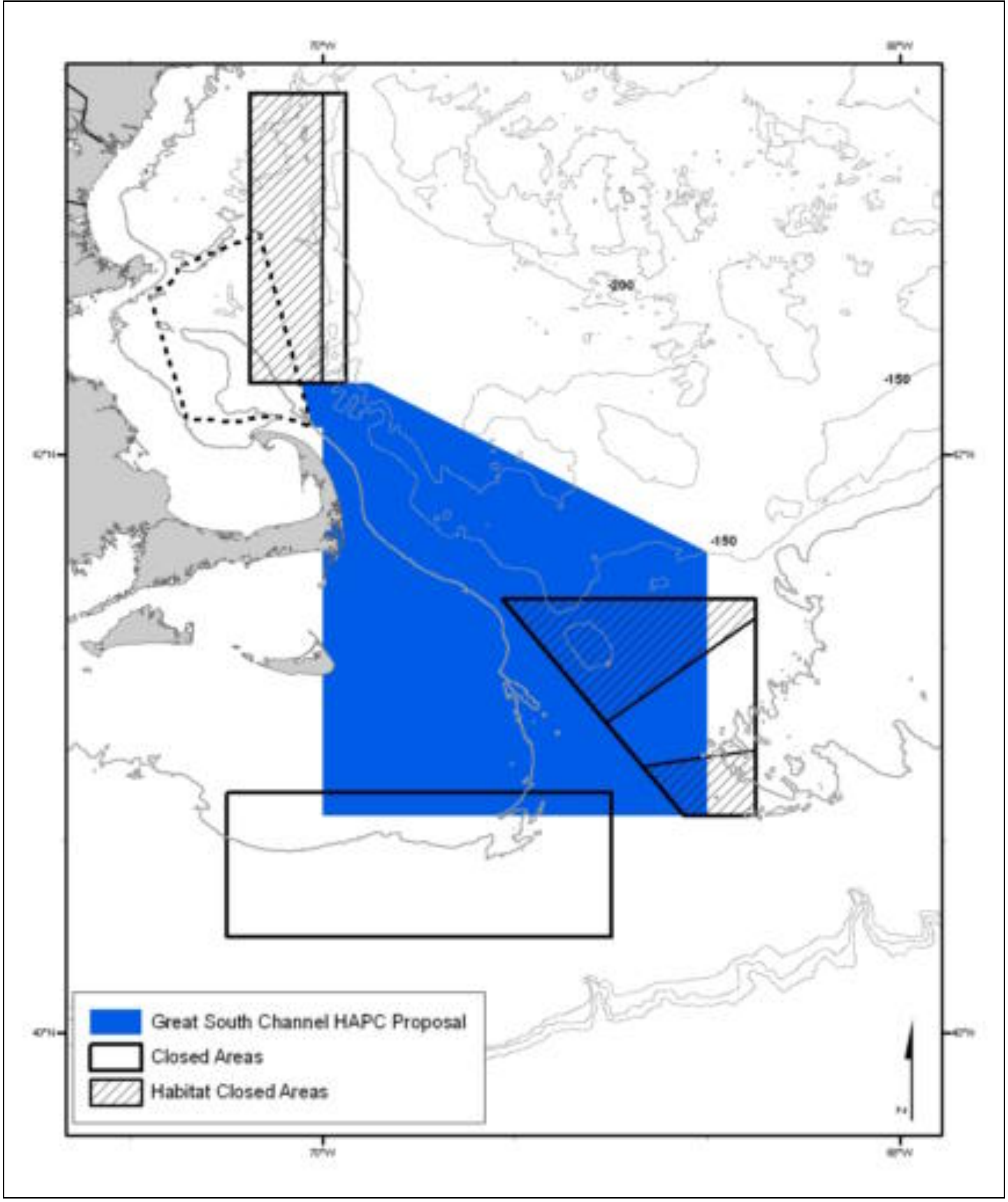
Map 591. Alternative 7B: Inshore Juvenile Cod HAPC (0-20m depth contour)



4.2.8 Alternative 8: Great South Channel Cod HAPC

This alternative proposes to designate the Great South Channel area as an HAPC for Atlantic cod (Map 592) in order to recognize the importance of the area for its high benthic productivity and hard bottom habitats, which provide structured benthic habitat and food resources for cod and other demersal-managed species.

Map 592. Alternative 8: Great South Channel Cod HAPC Alternative

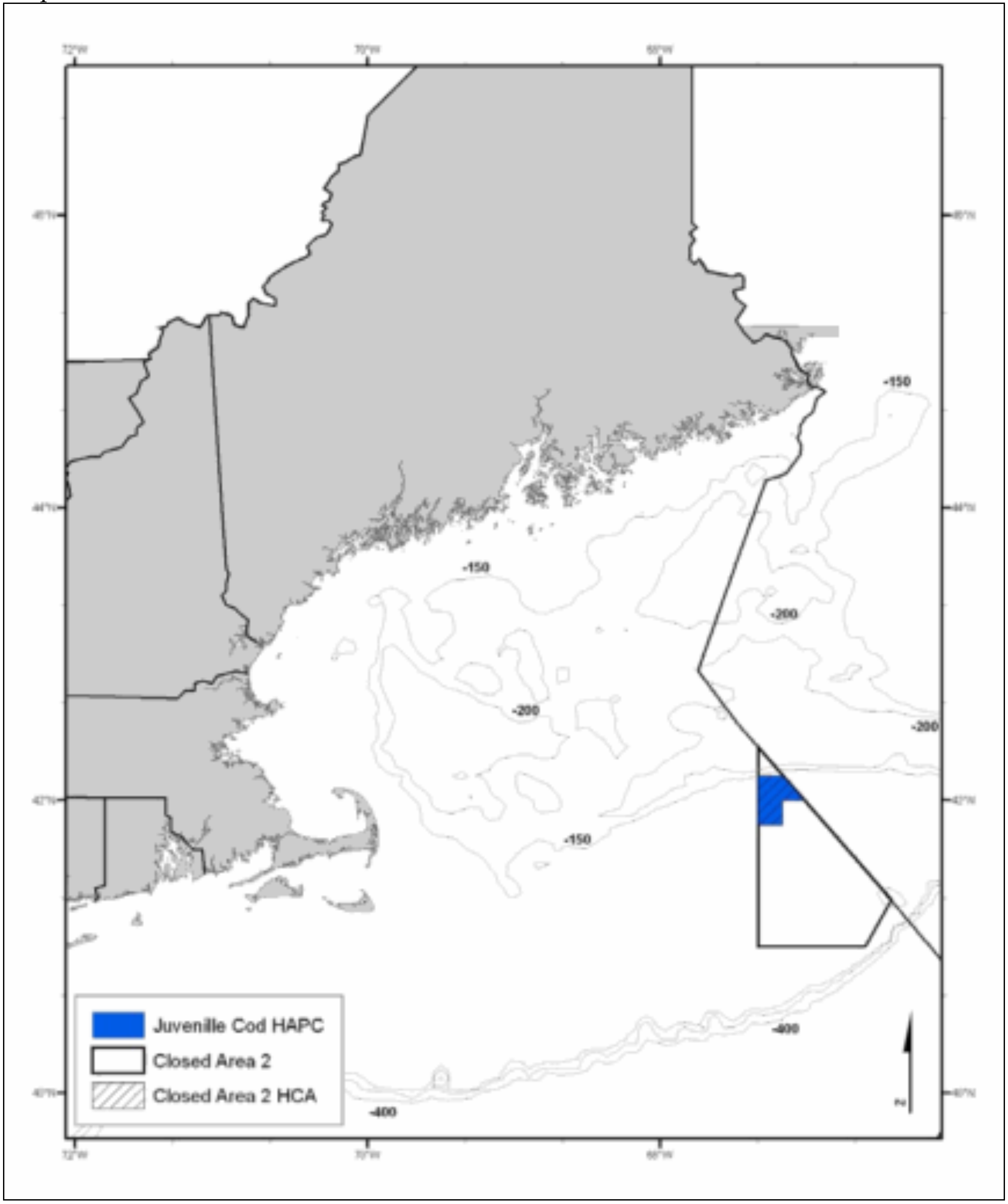


4.2.9 Alternative 9: Elimination of Status Quo HAPCs

This alternative provides a mechanism for the Council to remove or “un-designate” the current HAPCs that are designated on George’s Bank (Map 593) and in Maine (Map 594).

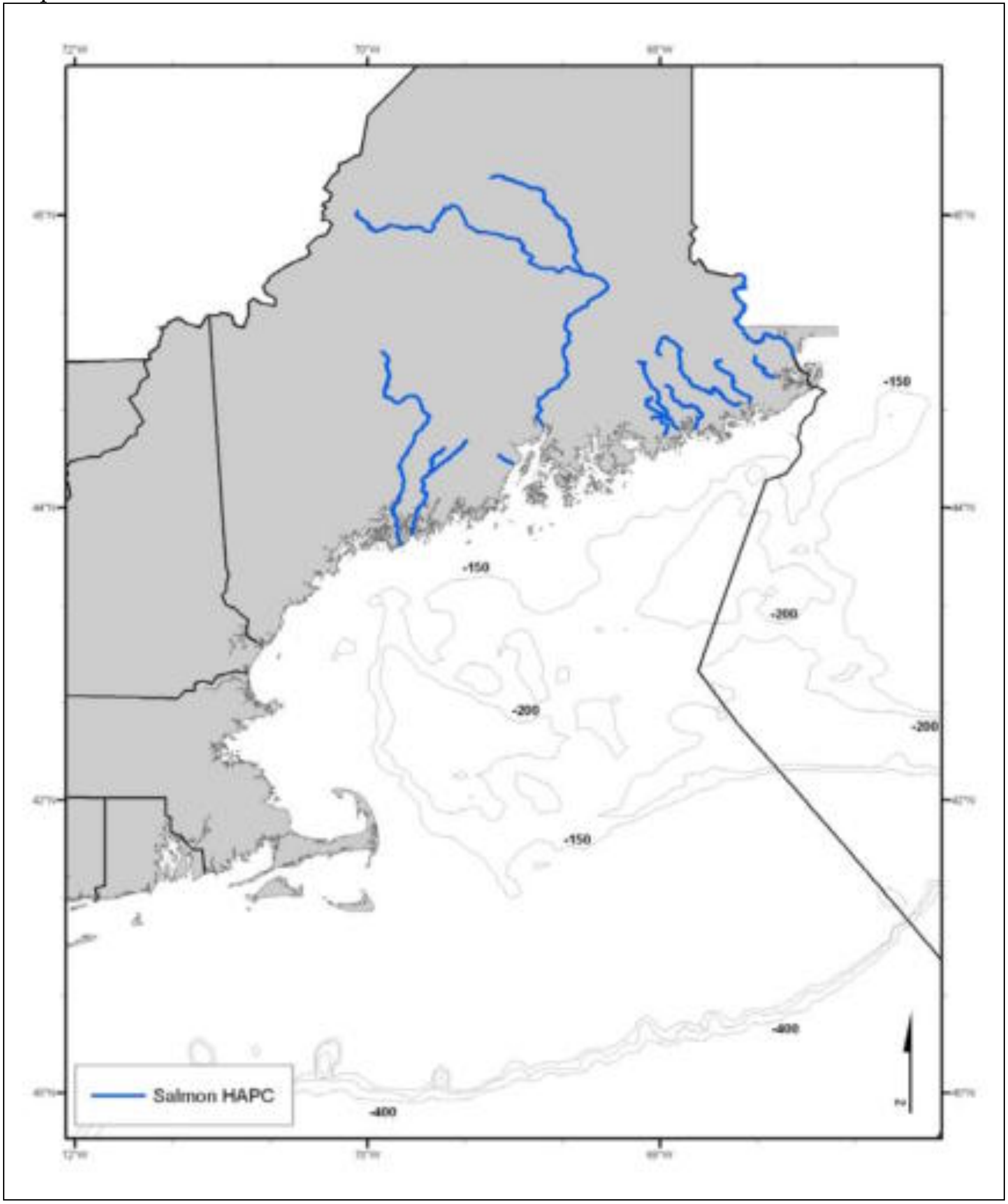
4.2.9.1 Alternative 9A: Eliminate Cod Status Quo HAPC

Map 593. Alternative 9A: Cod Status Quo HAPC



4.2.9.2 Alternative 9B: Eliminate Atlantic Salmon Status Quo HAPC

Map 594. Alternative 9B: Atlantic Salmon Status Quo HAPC



5.0 Additional Essential Fish Habitat (EFH) Components

5.1 Evaluation of Prey Species of Species in the Fishery Management Units

5.1.1 Background and Introduction

The EFH Final Rule (50 CFR 600) requires that Fishery Management Plans (FMPs) established or amended under the Sustainable Fisheries Act of 1996 defines essential fish habitat (EFH) as *"those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity. For the purpose of interpreting the definition of essential fish habitat: ''Waters'' 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."*

Further, the Rule requires that these FMPs *"list the major prey species for the species in the fishery management unit and discuss the location of prey species' habitat."* According to the Rule, *"loss of prey may be an adverse effect on EFH and managed species because the presence of prey makes waters and substrate function as feeding habitat, and the definition of EFH includes waters and substrate necessary to fish for feeding. Therefore, 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 EFH if such actions reduce the quality of EFH. … Adverse effects on prey species and their habitats may result from fishing and non-fishing activities."*

National Marine Fisheries Service has offered the Councils the following draft guidance (April 2006) on implementing the Prey Species Requirement of the EFH Final Rule as follows:

The definition of EFH in the regulatory guidelines acknowledge that prey, as part of "associated biological communities", may be considered a component of EFH for a species and/or lifestage (50 CFR 600.10). However, including prey in EFH identifications and descriptions has considerable implications for the overall scope of EFH when those prey are considered during the EFH consultation process. It is important that prey do not become a vehicle for overly expansive interpretations of EFH descriptions. To avoid this pitfall, the following suggestions should be considered when including prey in an EFH description:

4. *Prey species alone should not be described as EFH. Instead, prey should be included in EFH descriptions as a component of EFH (along with others components such as depth, temperature,*

sediment type).

5. *If the FMP identifies prey as a component of EFH, the FMP should specify those prey species and how their presence "makes the waters and substrate function as feeding habitat" (50 CFR 600.815(a)(7)).*

6. *While prey may be considered a component of EFH, prey habitat should not be identified as EFH in FMPs unless it is also EFH for a managed species. Identifying prey habitat as EFH could be viewed as over-extending the scope of EFH which should consist of habitat necessary for the managed species (50 CFR Preamble). However prey species habitat should be discussed in the FMP (52 CFR 600.815 (a)(7)).*

Accordingly, the New England Fishery Management Council has developed a description of the major prey species for each FMP and each fishery management unit (FMU) species under its jurisdiction and maps of these species location.

5.1.1.1 Description and Text Methods

The sources of information used to describe the primary prey for a managed species include the EFH species source documents (1st and 2nd editions) and the new EFH species update memos and references therein, plus a few published sources that were not included in the source documents or update memos. The major data source used for locations on the continental shelf is the NEFSC bottom trawl survey food habits database from 1963 to the present (see Link and Almeida [2000] for methods). This database has been used in many food habits studies and publications over the years, and these studies and publications often covered different years or subsets of the database. Generally the results agree; it is often the details at a certain prey taxonomic level that may differ. The section of the prey tables that cover the continental shelf are by and large based upon these various studies or publications, and because the use of these studies and publications often varied from one EFH species source document or update memo to another, this is reflected in the prey tables for each species. Generally, major prey phyla are defined as those prey items exceeding, depending on the study, the 5% threshold for one or several of the following measures in the stomachs of a managed species: percent frequency of occurrence, percent numerical abundance, percent stomach volume, and precent prey weight. It should be noted that prey species, families, etc. mentioned in the text or tables, depending on the study from which they came, are sometimes just examples of the primary prey within a phyla; thus, the tables, for example, should not be taken as an exhaustive list of prey items.

5.1.1.2 Mapping Methods

One of two sources was used to produce the major prey species maps. Only those species which exceeded 5% occurrence in a managed species stomach were mapped. All fish species and squids maps were created using the NMFS Bottom Trawl Survey database for 1963-2005. These points represent catches of the prey species themselves. The data used was geographically limited to north of the border between North Carolina and South Carolina and west of the eastern most extent of U.S. waters. This was done to captures the entire designated ranges of all NEFMC managed species without including extraneous data. All other invertebrate prey were mapped from data in the Northeast Fisheries Science Center Bottom Trawl Survey Food Habits Database from 1973-2005. These are not actual catches of the species, but the location of any predator species (not limited to managed species) caught with the prey present in their stomachs.

Maps of the major or dominant prey species can be found in Appendix C.

5.1.2 Prey Species Description

5.1.2.1 American Plaice

The main source of information on the prey consumed by the larval, juvenile and adult stages of American plaice (*Hippoglossoides platessoides*) comes from the EFH Source Document (Johnson 2004 and references therein). Larvae feed on plankton, diatoms, and copepods found in the upper water layers. Prior to settling, juveniles feed on small crustaceans, polychaetes, and cumaceans. According to the NEFSC food habits database, dominant (exceeds 5% weight threshold in fish stomachs) prey of smaller juveniles (< 20 cm) was ophiuroids and polychaetes (Fig. 2 in source document); Bowman and Michaels (1984) reported that polychaetes [including Nephtyidae (Bowman *et al*. 2000)] were especially important prey of plaice < 20 cm. Another important prey item of juveniles 21-25 cm appears to be nematodes (Bowman *et al*. 2000). Larger juveniles and smaller adults (20-40 cm) feed on echinoderms, especially ophiuroids (*Ophiura sarsi*) but also echinoids, crustaceans (decapods such as the sand shrimp *Crangon septemspinosa*, and euphausiids), and bivalves (Fig. 2 in source document, and Bowman *et al*. 2000). Previous studies suggest there are ontogenetic shifts in diet, with American plaice consuming fewer polychaetes as their body size increased. Smaller, mostly juvenile (< 16-30 cm) individuals fed predominately on polychaetes, crustaceans, and small brittle stars, while adults > 30 cm fed primarily on bivalve mollusks, brittle stars and other echinoderms, decapods, and fish.

Adult plaice are opportunistic feeders, flexible in their dietary habits, and will take whatever is most abundant or accessible. The stomach contents of plaice from the Gulf of Maine, Georges Bank, and southern New England are generally similar although the specific prey consumed can vary geographically. Dominant prey of adults 41-70 cm includes echinoderms (ophiuroids, such as *O. sarsi*; asteroids; and echinoids such as the sand dollar, *Echinarachnius parma*) and bivalves (including *Chlamys islandica* and *Cyclocardia borealis*) (Fig. 2 in source document, and Bowman *et al*. 2000).

In Sheepscot Bay, Maine, polychaetes, mysid shrimp, amphipods, sand shrimp (*Crangon septemspinosa*), and Atlantic herring are important prey; mysids generally decrease in importance with increasing fish size while polychaetes appear to increase.

Table 27. Major prey items of American plaice (*Hippoglossoides platessoides*)

Life Stage	Major prey	Location
Larvae	**Diatoms, copepods,** other plankton	U.S. northeast continental shelf
Early juveniles (pre-settlement)	**Polychaetes** **Crustaceans**: cumaceans	U.S. northeast continental shelf
Small juveniles (< 20 cm)	**Polychaetes**: *Nephtyidae* **Echinoderms:** ophiuroids	U.S. northeast continental shelf
Large juveniles, small adults (20-40 cm)	**Nematodes** (*juveniles* 21-25 cm) **Crustaceans:** decapods (sand shrimp *Crangon septemspinosa*), euphausiids **Mollusks:** bivalves **Echinoderms**: ophiuroids (*Ophiura sarsi*), echinoids	U.S. northeast continental shelf
Larger adults (41-70 cm)	**Mollusks:** bivalves (*Chlamys islandica*, *Cyclocardia borealis*) **Echinoderms**: ophiuroids (*O. sarsi*), asteroids, echinoids, (sand dollar, *Echinarachnius parma*)	U.S. northeast continental shelf
INSHORE SURVEYS		
	Polychaetes **Crustaceans**: amphipods, mysid shrimp, sand shrimp (*Crangon septemspinosa*) **Fish:** Atlantic herring	Sheepscot Bay, ME

5.1.2.2 Atlantic Cod

The main source of information on the prey consumed by the larval, juvenile and adult stages of Atlantic cod (*Gadus morhua*) comes from the EFH Source Document (Lough 2005 and references therein), Klein-MacPhee (2002), and Link and Garrison (2002). Larvae feed on copepods, changing from the naupliar and copepodite stages at smaller sizes (4-18 mm SL) to adult copopods at larger (> 18 mm) sizes. Common copepod prey on Georges Bank include *Pseudocalanus*, *Calanus*, and *Oithona*. Late pelagic juveniles on Georges Bank feed on calanoid copepods, mysid shrimp (*Neomysis americana*), harpacticoid copepods (*Tisbe* sp.) and hermit crab larvae. After settling to the bottom, age 0 juveniles (< 10 cm TL) feed on benthic prey, predominantly mysids. There is a rapid transition from pelagic to benthic prey at a size of 60-100 mm SL.

Older juvenile cod (10-35 cm TL) feed primarily on crustaceans, including amphipods, and to a lesser extent on pandalid shrimp, euphausiids, and the sand shrimp, *Crangon septemspinosa*. Small adult cod (35-50 cm TL) feed on crustaceans (including crabs, amphipods and pandalid shrimp), and fish (sand lance and silver hake). Medium-sized (50-90 cm TL) adults feed primarily on fish (herrings, silver hake, sand lance), and crabs (including *Cancer* sp.). Larger (90-120+ cm TL) adult cod feed on herring, other fish (including gadids, silver hake, other hakes, bluefish, mackerels, toadfish, redfish, and flatfish), *Cancer* crabs, and squid.

Jason Link (NOAA/NMFS/NEFSC, Woods Hole Laboratory, personal communication) has updated the NEFSC food habits database from 1973-2005 and reports that the prey exceeding the 5% by weight threshold in the stomachs of juvenile and adult cod include:
Atlantic herring (9%), herring (7%), silver hake (8%), other fish (16%), crangonid shrimp (8%), and decapod crabs (6%).

Table 28. Major prey items of Atlantic cod (*Gadus morhua*)

Life Stage	Major Prey	Location
Larvae (< 20-50 mm SL) Small (4-18 mm) -------------- Large (> 18 mm)	**Nauplii and Copepodite Stages of Copepods:** *Pseudocalanus* sp., *Calanus* sp., *Oithona* sp. --------------------- **Adult Copepods:** *Pseudocalanus* sp., *Calanus* sp., *Centropages* sp., *Paracalanus* sp.	Georges Bank
Juveniles (< 35 cm TL) Pelagic YOY (<10 cm TL)	**Crustaceans:** copepods and mysid shrimp (*Tisbe* sp., *Neomysis americana*)	U.S. northeast continental shelf

Life Stage	Major Prey	Location
------ Benthic YOY (<10 cm TL) ------ Juveniles (10-35 cm TL)	--------- **Crustaceans:** mysid shrimp --------- **Crustaceans**: amphipods, decapods (pandalid shrimp, *Crangon septemspinosa*), euphausiids	
Adults (>35 cm TL) Small adults (35 - 50 cm TL) ------ Medium-sized adults (50-90 cm TL) ------ Large adults (90-120+ cm TL)	**Crustaceans**: amphipods, decapods (crabs, pandalid shrimp) **Fish**: sand lance, silver hake -------- **Crustaceans:** *Cancer* sp. **Fish**: herrings, silver hake, sand lance -------- **Crustaceans**: *Cancer* sp. **Mollusks**: squids **Fish**: herrings, gadids, silver hake, other hakes, bluefish, mackerels, redfish, toadfish, flatfish.	U.S. northeast continental shelf

5.1.2.3 Atlantic Halibut

The main source of information on the prey consumed by the juvenile and adult stages of Atlantic halibut (*Hippoglossus hippoglossus*) comes from the EFH Update Memo (Essential Fish Habitat Source Document Update Memo: Atlantic Halibut, *Hippoglossus hippoglossus*, Life History and Habitat Characteristics, 2004, and references therein). Given the benthic occurrence of the eggs and larval development, no eggs were collected during the MARMAP (Marine Monitoring Assessment and Prediction) ichthyoplankton surveys and larvae were only collected at 2 out of 1,672 stations. Thus, we have no information on the food habits of the larvae. Larval exogeneous feeding occurs 28-35 days after hatching when the yolk sac has been completely absorbed at a size of roughly 11-13 mm (SL).

The range of lengths of Atlantic halibut collected in the NEFSC bottom trawl survey is 20-120 cm (TL), with most sizes less than 80-90 cm (TL). Since the length at maturity is 103 cm for females and 82 cm for males, most of the NEFSC food habits database is based upon juveniles and immature adults, and the limited information on the prey preferences of the juvenile/immature adult stages are combined in the prey table. Based on Fig. 3 in update memo, which is based on the NEFSC food habits database from 1973-2001, dominant (exceeds 5% weight threshold in fish stomachs) prey are fish (gadids, clupeids, eelpouts), squids, and decapod crustaceans. Jason Link (NOAA/NMFS/NEFSC, Woods Hole Laboratory, personal communication) has updated the food habits database from 1973-2005 and reports that the prey exceeding the 5% by weight threshold in the fish stomachs include: longhorn sculpin (18%); other fish (10%); cod (8%); *Cancer* crabs (8%); pandalids (8%); silver hake (7%); and *Illex* squid (5%).

The diet of Atlantic halibut changes with increasing size. Fish up to 30 cm feed almost exclusively on invertebrates, mainly annelids and crustaceans (crabs, shrimps); those 30-80 cm in length feed on both invertebrates (mainly crustaceans, some mollusks) and fish; and those greater than 80 cm in length feed almost exclusively on fish (Kohler (967). However, Bowman *et al.* (2000) found that fish less than 31 cm had diets composed of mostly unidentified fishes (76.6%), as well as crustaceans (23.4%, mostly *Crangon septemspinosa*) (Table 2 in update memo). The most important prey of larger halibut during that same study were squid (*Illex*), crustaceans (pandalid shrimp, *Cancer* crabs), and fish including rock eel, silver hake, northern sand lance, ocean pout, and longhorn sculpin (Bowman *et al.* 2000; Table 2 in update memo). With the exception of the Scotian Shelf, fish were the major prey item in all regions sampled (Bowman *et al.* 2000; Table 3 in update memo). In an earlier study, Maurer and Bowman (1975) reported that 91% (by weight) of the stomach contents of juvenile and adult halibut were fish, of which greater than 50% were longhorn sculpin and its eggs, but also included cod and other gadids. Nickerson (1978) reported that the fish prey of halibut included cod, cusk, haddock, ocean perch, sculpins, silver hake, herring, capelin, skates, flounder, and mackerel.

Table 29. Major prey items of Atlantic halibut (*Hippoglossus hippoglosus*)

Life Stage	Major Prey
Juveniles and adults	**Crustaceans**: decapods (*Cancer* crabs, pandalid shrimp, *Crangon septemspinosa*) **Squid**: *Illex* **Fish**: gadids (e.g., cod), clupeids, eelpouts (ocean pout), longhorn sculpin, silver hake, rock eel, northern sand lance

5.1.2.4 Atlantic Herring

The main source of information on the prey consumed all life stages of Atlantic herring (*Clupea harengus*) comes from the EFH Source Document (Stevenson and Scott 2005 and references therein). Atlantic herring prey upon a variety of planktivorous organisms. All life stages of herring are opportunistic feeders, and will take advantage of whatever prey of the appropriate size is available. As they grow and the size of their jaws increases, they consume larger organisms. Their diet therefore varies with season, their age and size, and location.

Newly-hatched larvae (7-20 mm) in coastal waters of central Maine feed primarily on the small, early developmental stages of copepods; during the winter, larger larvae (21-30 mm) feed on the adult stages of small copepods as well. During the spring, when a wider variety of planktonic organisms are available and the larvae are larger, their diet includes organisms such as barnacle larvae, crustacean eggs, copepods, and free-swimming ciliate protozoans (tintinnids). Three copepod species preyed upon by larval herring on Georges Bank are *Pseudocalanus* sp., *Paracalanus parvus*, and *Centropages typicus*.

Juveniles feed on up to 15 different groups of zooplankton; the most common are copepods, decapod larvae, barnacle larvae, cladocerans, and molluscan larvae. Adults have a diet dominated by euphausiids, chaetognaths, and copepods. The most important prey items of adults herring collected on Georges Bank were chaetognaths (*Sagitta elegans*, 43% by weight), euphausiids (*Meganyctiphanes norvegica*, 23%; *Thysanoessa inermis*, 6.1%), pteropods (*Limacina retroversa*, 6.2%), and copepods (3%). The copepod *Calanus finmarchicus* is a common prey item. In addition, adults also consume fish eggs and larvae, including larval herring, sand lance, and silversides.

Food habits data collected during NEFSC bottom trawl surveys reveal that the most abundant identifiable prey items (percent by weight) for Atlantic herring include amphipods, copepods, and euphausiids. Jason Link (NOAA/NMFS/NEFSC, Woods Hole Laboratory, personal communication) has updated the food habits database from 1973-2005 and reports that the prey exceeding the 5% by weight threshold in the stomachs of juvenile and adult Atlantic herring include: euphausiids (18%), copepods (16%), and gammarid amphipods (7%).

Table 30. Major prey items of Atlantic herring (*Clupea harengus*)

Life Stage	Major Prey	Location
Larvae Newly hatched (7-20 mm) -------------- Large (21-30	**Copepods**: small, early developmental stages ------------ **Copepods**: adult stages of small copepods (e.g.; are	Central Gulf of Maine, Georges Bank

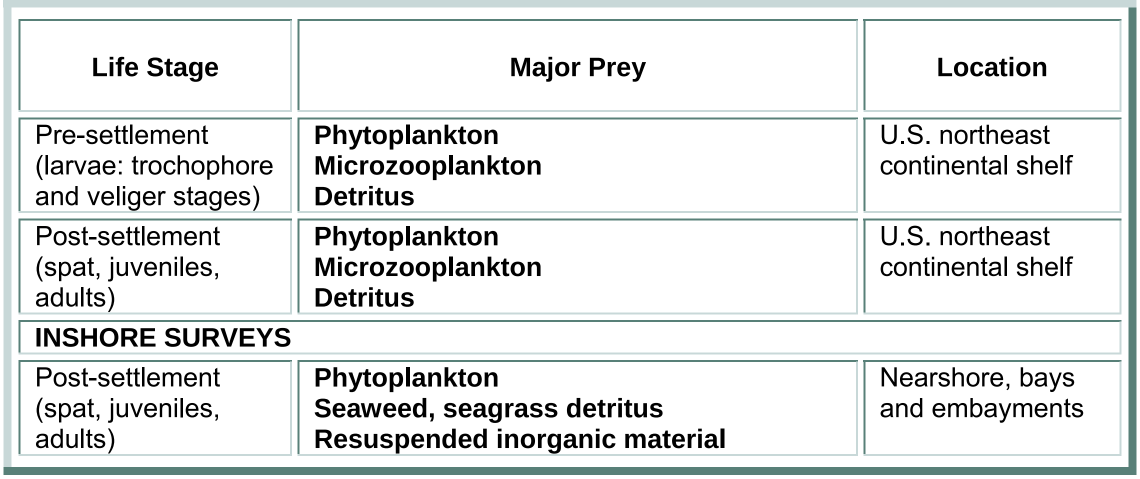
Life Stage	**Major Prey**	**Location**
mm) ------------- Larger (> 30 mm)	*Pseudocalanus* sp., *Paracalanus parvus*, and *Centropages typicus* are *Pseudocalanus* sp., *Paracalanus parvus*, and *Centropages typicus*) ------------ **Barnacle larvae, crustacean eggs, copepods, free-swimming ciliate protozoans (tintinnids)**	
Juveniles (< 25 cm TL)	**Zooplankton: copepods, decapod larvae, barnacle larvae, cladocerans, molluscan larvae.**	U.S. northeast continental shelf
Adults (≥ 25 cm TL)	**Chaetognaths**: *Sagitta elegans* **Crustaceans**: euphausiids (*Meganyctiphanes norvegica*, *Thysanoessa inermis*), amphipods, copepods **Mollusks**: pteropods (*Limacina retroversa*)	U.S. northeast continental shelf; Georges Bank

5.1.2.5 Atlantic Sea Scallop

The main source of information on the prey consumed by the larval, juvenile, and adult stages of the Atlantic sea scallop (*Placopecten magellanicus*) comes from the EFH Source Document (Hart *et al*. 2004 and references therein). The Atlantic sea scallop is a pelagic filter feeder in the larval stage and benthic suspension feeders as juveniles/adults. Their diet primarily consists of phytoplankton and microzooplankton (such as ciliated protozoa), but particles of detritus can also be ingested, especially during periods of low phytoplankton concentrations. Dissolved organic matter (absorbed through the tissues) has been suggested as an additional minor source of nutrition, particularly for scallop larvae. Palp-pedal feeding (using the ciliated end of the foot to bring organic matter from biofilms to the labial palps) as well as DOM absorption may also be used by post-settlement scallops, during the time that feeding structures on the gill develop. It is presumed that DOM is a minor nutritional source despite its high concentration, since much of it is found as refractory organic carbon.

Atlantic sea scallops in coastal areas and embayments digest detritus from seaweeds and sea grasses and may be exposed periodically to significant amounts of resuspended inorganic material, while offshore scallops consume primarily phytoplankton and resuspended organic matter. Phytoplankton appears necessary to meet scallop energetic demands, although seaweed detritus may be an important food supplement in nearshore environments. One study showed that a scallop population in shallow water (20 m) fed equally on pelagic and benthic food species, while a deep water population (180 m) fed primarily on benthic species. In both populations, seasonal variations in food items occurred and coincided with bloom periods of individual algal species. The gut contents generally reflected the available organisms in the surrounding habitat, indicating that sea scallops are opportunistic filter feeders which take advantage of both benthic and pelagic food. A total of 27 species of algae, ranging in size from 10-350 μm were identified, plus a number of miscellaneous items including pollen grains, ciliates, zooplankton tests, detrital material, and bacteria.

Table 31. Major prey items of Atlantic sea scallop (*Plactopecten magellanicus*)



Life Stage	Major Prey	Location
Pre-settlement (larvae: trochophore and veliger stages)	**Phytoplankton** **Microzooplankton** **Detritus**	U.S. northeast continental shelf
Post-settlement (spat, juveniles, adults)	**Phytoplankton** **Microzooplankton** **Detritus**	U.S. northeast continental shelf
INSHORE SURVEYS		
Post-settlement (spat, juveniles, adults)	**Phytoplankton** **Seaweed, seagrass detritus** **Resuspended inorganic material**	Nearshore, bays and embayments

5.1.2.6 Barndoor Skate

The main source of information on the prey consumed by barndoor skate (*Dipturus laevis*) comes from the EFH Source Document (Packer *et al*. 2003 and references therein). Food of the barndoor skate consists of benthic invertebrates and fishes. Prey includes polychaetes, gastropods, bivalve mollusks, squids, crustaceans, hydroids, and fishes. Smaller individuals apparently subsist mainly on benthic invertebrates, such as polychaetes, copepods, amphipods, isopods, the shrimp *Crangon septemspinosa*, and euphausiids, while larger skate eat larger and more active prey such as razor clams (*Ensis directus*), large gastropods, squids, crabs (*Cancer* spp. and spider crabs), lobsters and fishes. Fish prey includes spiny dogfish, alewife, Atlantic herring, menhaden, hakes, sculpins, cunner, tautog, sand lance, butterfish, and various flounders.

Jason Link (NOAA/NMFS/NEFSC, Woods Hole Laboratory, personal communication) has updated the food habits database from 1973-2005 and reports that the prey exceeding the 5% by weight threshold in the stomachs of juvenile and adult barndoor skate include: *Cancer* crabs (23%); decapod crabs (18%); other fish (10%); Atlantic herring (9%); pandalid shrimp (8%); and silver hake (7%).

Table 32. Major prey items of barndoor skate (*Dipturus laevis*)

Life Stage	Major Prey	Location
Juveniles and Adults	Smaller individuals **Polychaetes** **Crustaceans**: copepods, amphipods, isopods, the sand shrimp *Crangon septemspinosa*, euphausiids Larger individuals **Crustaceans**: decapods (*Cancer* spp., spider crabs, lobsters) **Mollusks**: razor clams (*Ensis directus*), large gastropods, squids **Fish**: Atlantic herring, hakes (esp. silver), spiny dogfish, alewife, menhaden, sculpins, cunner, tautog, sand lance, butterfish, various flounders	U.S. northeast continental shelf

5.1.2.7 Clearnose Skate

The main source of information on the prey consumed by clearnose skate (*Raja eglanteria*) comes from the EFH Source Document (Packer *et al*. 2003 and references therein). Clearnose skate appear to feed mostly on crustaceans and fish. Crustacean prey include amphipods, mysid shrimps (e.g. *Neomysis americana*), the shrimp *Crangon septemspinosa*, mantis shrimps, crabs including *Cancer*, mud, hermit, and spider crabs, and *Ovalipes ocellatus* (lady crab). Fish prey include soles, weakfish, butterfish, and scup. Other prey include polychaetes and mollusks (bivalves, e.g. *Ensis directus*; squids). Jason Link (NOAA/NMFS/NEFSC, Woods Hole Laboratory, personal communication) has updated the food habits database from 1973-2005 and reports that the prey exceeding the 5% by weight threshold in the stomachs of juvenile and adult clearnose skate include: other fish (20%); decapod crabs (16%); *Cancer* or rock crabs (16%); *Loligo* squids (14%); and tonguefish or *Symphurus* sp.(6%).

In the Hudson-Raritan estuary, crustaceans (*Crangon septemspinosa*, juvenile or small Atlantic rock crabs, *Ovalipes ocellatus*), fish (conger eel, juvenile winter flounder, juvenile windowpane), and mollusks (*Ensis directus*) were most frequently found in the stomachs (Steimle *et al*. 2000). In Delaware Bay, crustaceans (*Crangon septemspinosa*, mud crabs, *Neomysis americana*) dominated the diet (Fitz and Daiber 1963). Kimmel (1973) examined juveniles (< 44 cm TL) from the mouth of Chesapeake Bay and found crustaceans (*Crangon septemspinosa*; mud shrimp, *Upogebia affinis*) and mollusks (*Ensis directus*) dominated the diet. This is consistent with the prey that Hildebrand and Schroeder (1928) noted in the few clearnose skate that they examined from inside Chesapeake Bay. In North Carolina, fish prey included striped anchovy, croaker, spot, and blackcheek tonguefish (Schwartz 1996).

Table 33. Major prey items of clearnose skate (*Raja eglanteria*)

Life Stage	Major Prey	Location
Juveniles and Adults	**Crustaceans**: amphipods, mysid shrimps (*Neomysis americana*), the shrimp *Crangon septemspinosa*, mantis shrimps, crabs including *Cancer*, mud, hermit, and spider crabs, lady crab (*Ovalipes ocellatus*) **Mollusks**: squids (*Loligo*) **Fish**: soles, weakfish, butterfish, scup, tonguefish	U.S. northeast continental shelf
INSHORE SURVEYS		
Juveniles	**Crustaceans**: *Crangon septemspinosa*, mud shrimp (*Upogebia affinis*) **Mollusks**: razor clams (*Ensis directus*)	Mouth of Chesapeake Bay
Juveniles and Adults	**Crustaceans**: *Crangon septemspinosa*, juvenile or small Atlantic rock crabs, *Ovalipes ocellatus*, mud crabs, *Neomysis americana* **Mollusks**: razor clams (*Ensis directus*) **Fish**: conger eel, juvenile winter flounder, juvenile	Hudson-Raritan estuary, Delaware Bay, North Carolina

Life Stage	Major Prey	Location
	windowpane, striped anchovy, croaker, spot, and blackcheek tonguefish.	

5.1.2.8 Deep-Sea Red Crab

The main source of information on the prey consumed by red deepsea crab [*Chaceon (Geryon) quidquedens*] comes from the EFH Source Document (Steimle *et al*. 2002 and references therein). No information is known on the natural diets of red crab larvae, but it is probably zooplanktivorous, as they were found to thrive on rotifers, brine shrimp, and chopped mollusk meats in laboratory cultures.

Red crabs are opportunistic feeders. Post-larval, benthic red crabs eat a wide variety of infaunal and epifaunal benthic invertebrates (e.g. bivalves) that they find in the silty sediment or pick off the seabed surface. Smaller red crabs eat sponges, hydroids, mollusks (gastropods and scaphopods), small polychaetes and crustaceans, and possibly tunicates. Larger crabs eat similar small benthic fauna and larger prey, such as demersal and mid-water fish (*Nezumia* and myctophids), squid, and the relatively large, epibenthic, quill worm (*Hyalinoecia artifex*).They can also scavenge deadfalls (e.g., trawl discards) of fish and squid, as they are readily caught in traps with these as bait and eat them when held in aquaria.

Table 34. Major prey items of red deepsea crab [*Chaceon (Geryon) quidquedens*]

Life Stage	**Major Prey**	**Location**
Larvae (4 zoeal and 1 megalopa stages)	**Zooplankton**	U.S. northeast continental shelf/slope
Juveniles and Adults	<u>Smaller</u> **Sponges** **Hydroids** **Polychaetes** **Mollusks**: gastropods, scaphopods <u>Larger</u> **Sponges** **Hydroids** **Annelids**: polychaetes, quill worm (*Hyalinoecia artifex*) **Mollusks**: gastropods, scaphopods, squids **Fish**: *Nezumia*, myctophids	U.S. northeast continental shelf/slope

5.1.2.9 Haddock

The main source of information on the prey consumed by haddock (*Melanogrammus aeglefinus*) comes from the EFH Source Document (Brodziak 2005 and references therein). Haddock diet changes with life history stage. Pelagic larvae and small juvenile haddock feed on phytoplankton, copepods, and invertebrate eggs in the upper part of the water column. Juvenile haddock eat small crustaceans, primarily copepods and euphausiids, as well as polychaetes and small fishes. During the transition from pelagic to demersal habitat, juvenile diet changes to primarily benthic prey. Planktonic prey, such as copepods and pteropods decrease in importance after juveniles become demersal, while ophiuroids and polychaetes increase in importance. When juveniles reach 8 cm in length, they feed primarily on echinoderms, small decapods, and other benthic prey. Benthic juveniles above 30 cm and adults feed primarily on crustaceans, polychaetes, mollusks, echinoderms, and some fish. Regional variation in haddock food habits also exists. Echinoderms are more common prey items in the Gulf of Maine than on Georges Bank. In contrast, polychaetes are more common prey on Georges Bank than in the Gulf of Maine.

Food habits data collected during NEFSC bottom trawl surveys reveal that the species composition of haddock prey varies by haddock size class. Unidentified fish, amphipods, and euphausiids were the most common prey items by weight for small haddock less than 20 cm in length. The diet of haddock between 20 and 50 cm in length was more varied and included amphipods, ophiuroids, polychaetes, decapods, *Ammodytes* sp. (sand lance), and bivalves. Ophiuroids, amphipods, polychaetes, cnidarians, scombrids (mackerel), and *Ammodytes* sp. were the most common prey items of large haddock with lengths between 50-80 cm. Extra-large haddock over 80 cm in length fed primarily upon clupeids (herring), ophiuroids, amphipods, scombrids, and euphausiids. Overall, the NEFSC food habits data show that haddock diet includes more ophiuroids and becomes more varied as fish increase in size. It also shows that amphipods are an important prey item for all demersal life history stages and that fish are an important component of the diet of very large haddock. Jason Link (NOAA/NMFS/NEFSC, Woods Hole Laboratory, personal communication) has updated the food habits database from 1973-2005 and reports that the prey exceeding the 5% by weight threshold in the stomachs of juvenile and adult haddock include: ophiuroids (22%), gammarid amphipods (14%), polychaetes (9%) and fish eggs (8%).

Table 35. Major prey items of Haddock (*Melanogrammus aeglefinus*)

Life Stage	Major prey	Location
Larvae, small juveniles	**Phytoplankton, copepods, invertebrate eggs**	U.S. northeast continental shelf
Small	**Polychaetes**	U.S. northeast

Life Stage	**Major prey**	**Location**
juveniles	**Crustaceans**: copepods, euphausiids, amphipods, decapods **Echinoderms**: ophiuroids **Fish**	continental shelf
Large juveniles, small adults	**Polychaetes** **Crustaceans**: amphipods, euphausiids, decapods **Mollusks**: bivalves **Echinoderms**: ophiuroids **Fish**: *Ammodytes* sp. (sand lance)	U.S. northeast continental shelf
Large adults	**Cnidarians** **Crustaceans**: amphipods, euphausiids **Echinoderms**: ophiuroids **Fish**: *Ammodytes* sp. (sand lance), scombrids (mackerel), clupeids (herring)	U.S. northeast continental shelf

5.1.2.10 Little Skate

The main source of information on the prey consumed by little skate (*Leucoraja erinacea*) comes from the EFH Source Document (Packer *et al*. 2003 and references therein). Generally, invertebrates such as decapod crustaceans (e.g.; crabs and sand shrimp, *Crangon septemspinosa*) and amphipods are the most important prey items, followed by polychaetes. Isopods, bivalves, and fishes are of minor importance. The fishes that are eaten included sand lance, alewives, herring, cunners, silversides, tomcod, and silver hake. Hydroids, copepods, ascidians and squid are also ingested.

McEachran (1973) studied skates collected from Nova Scotia to Cape Hatteras during 1967-1970; the following diet descriptions are from him and McEachran *et al*. (1976).

Crangon septemspinosa, *Pagurus acadianus*, *Cancer irroratus*, and *Dichelopandalus leptocerus* were the most frequently eaten decapods in the Mid-Atlantic Bight and on Georges Bank. *C. septemspinosa* was the most numerous decapod in the stomachs while *P. acadianus* and *C. irroratus* accounted for most of the stomach volume. In the Gulf of Maine and on the Nova Scotian shelf *Pagurus pubescens*, *C. septemspinosa*, *Hyas* sp., and *Eualus pusiolus* were the most frequently eaten decapods.

The most frequently consumed amphipods in the Mid-Atlantic Bight and on Georges Bank were *Monoculoides* sp., *Unciola* sp., *Leptocheirus pinguis*, ampeliscids, haustoriids, and *Dulichia* (= *Dyopedos*) *monacantha*. *L. pinguis* predominated in the Mid-Atlantic Bight and *Monoculodes* sp. and *Unciola* predominated in little skate from Georges Bank. Haustoriid amphipods were abundant only in the little skate from Georges Bank and contributed significantly to the stomach contents only during the autumn survey. *Pleustes panoplus*, *L. pinguis*, *Hippomedon serratus*, *Monoculodes* sp., and *Unciola* sp. were the most frequently eaten amphipods in the Gulf of Maine and on the Nova Scotian shelf.

Eunice pennata and *Nereis* spp. were the most numerous polychaetes, with *E. pennata* abundant only on the Nova Scotian shelf and *Nereis* spp. numerous only in the Mid-Atlantic Bight. Other major polychaetes consumed in the Mid-Atlantic Bight and on Georges Bank were *Nepthys* spp., *Lumbrineris fragilis*, *Aphrodite hastata*, maldanids, (mostly *Clymenella torquata*), *Glycera* spp., and *Pherusa affinis*. *A. hastata* contributed most to the stomach volume. The polychaetes *Ophelia denticulata*, *Nothria conchylega*, and *Pectinaria* sp. predominated in stomachs from the Gulf of Maine and the Nova Scotian shelf.

McEachran (1973) and McEachran *et al*. (1976) showed that the diet of little skate is size-dependent. Skate < 41 cm TL consumed considerably fewer decapods and more amphipods than those that were ≥ 41 cm TL. Most decapods eaten by skates ≤ 30 cm TL were *C. septemspinosa*. Haustoriid amphipods were almost never found in skates > 30 cm TL. Cumaceans and copepods were also limited to the smaller skates. All sizes fed on fishes, but the frequency of occurrence increased with the size of the skate. Polychaetes were eaten by all sizes.

The 1973-1990 NEFSC food habits database for little skate generally confirms the McEachran (1973) and McEachran *et al*. (1976) studies. Crustaceans dominated the diet overall, but declined in importance with increasing skate size while the percent occurrence of polychaetes increased with increasing skate size. Amphipods occurred more frequently than decapods until the skates were > 41 cm TL. *C. septemspinosa* was the major decapod prey for all sizes of skate. The following is a description of the diet from the NEFSC food habits database broken down by little skate size class.

For juvenile little skate 1-10 cm TL, 97% of the diet consisted of crustaceans, with 42% of the diet consisting of identifiable amphipods. The most abundant amphipod species included *B. serrata*, *U. irrorata*, *Monoculodes intermedius*, *Synchelidium* sp., as well as several unidentifiable Gammaridea. Identifiable cumaceans made up 27% of the diet, notable species included *Cyclaspis varians* and *Diastylis* spp. Identifiable decapods made up only 8% of the diet, all of which were either *C. septemspinosa* or classified as unidentifiable Crangonidae.

For juveniles 11-20 cm TL, 90% of the diet consisted of crustaceans, and at least half of the diet consisted of identifiable amphipods. Major amphipod species included *B. serrata*, *U. irrorata*, *L. pinguis*, *Ericthonius rubricornis*, and several unidentifiable gammarids, ampeliscids, oedicerotids, and caprellids. Identifiable decapods made up 18-20% of the diet, most of which were *C. septemspinosa*; other important decapods included pagurid and *Cancer* crabs.

The percentage of crustaceans in the diet of juvenile little skate 21-30 cm TL dropped to 83%, although almost half of the diet still consisted of identifiable amphipods. The major amphipod prey species were similar to the 11-20 cm TL size class, with the addition of *M. edwardsi*. Identifiable decapods again made up 18-20% of the diet, the majority of which were again *C. septemspinosa* along with *Cancer* and pagurid crabs. Identifiable polychaetes made up only 10-11% of the diet, most of which were terebellids.

The percent occurrence of crustaceans in the diet of juveniles 31-40 cm TL dropped further, down to 73-78%, with identifiable amphipods making up only 32-36% of the overall diet. The usual amphipods were dominant; in order of abundance they were *U. irrorata*, *L. pinguis*, unidentifiable gammarids, *B. serrata*, unidentifiable ampeliscids, *M. edwardsi*, and unidentifiable caprellids, haustoriids, and oedicerotids. Identifiable decapods made up 25-28% of the diet; *C. septemspinosa* was again the dominant decapod prey, followed by *Cancer* and pagurid crabs, and *Dichelopandalus leptocerus*. Identifiable polychaetes made up only 14-15% of the diet; the majority were terebellids and maldanids.

The percent occurrence of crustaceans in the diet continued to decline for juvenile/small adult little skate 41-50 cm TL: down to 66-71%, with identifiable amphipods making up only 22-28% of the diet, while identifiable decapods made up 29-32%. The usual amphipods were dominant, especially *L. pinguis* and *U. irrorata*, followed by the others previously mentioned. *C. septemspinosa* continued to be the dominant decapod prey, followed by *Cancer* and pagurid crabs. Identifiable polychaetes made up 17-18% of the diet, with the dominant family being the Terebellidae. Other abundant families included the Nephtyidae, Maldanidae, Aphroditidae, and the Flabelligeridae.

Finally, the percent occurrence of crustaceans in the diet declined to 64-69% for adult skate 51-60 cm TL, with identifiable amphipods making up only 19-22% of the diet, while identifiable decapods 29-34%. *L. pinguis* was the dominant amphipod; *C. septemspinosa*, *Cancer*, and pagurid crabs were the dominant decapods. Identifiable polychaetes made up 19-20% of the diet, with the dominant family being the Terebellidae.

Jason Link (NOAA/NMFS/NEFSC, Woods Hole Laboratory, personal communication) has updated the food habits database from 1973-2005 and reports that the prey exceeding the 5% by weight threshold in the stomachs of juvenile and adult little skate include: gammarid amphipods (15%), decapod crabs and shrimps (12%), *Cancer* crabs (11%), polychaetes (11%), *C. septemspinosa* (7%), and bivalves (6%).

Other authors also show similar size-dependent trends in the diet of little skate. Bowman and Michaels (1984) and Bowman *et al*. (1987) reported that while crustaceans were the dominant prey of all sizes of little skate, juvenile skate < 35 cm TL preyed mostly on amphipods (including *Unciola*) and those > 35 cm TL ate large quantities of decapods (including *C. septemspinosa*). Polychaetes, mollusks, and fish were found primarily in little skate > 20 cm TL. Again, using NEFSC data from 1977-1980, Bowman *et al*. (2000) also found that in terms of percent weight, crustaceans were important for all size classes of skate. Juvenile skate < 15-30 cm TL fed mostly on amphipods, including *L. pinguis*, *Unciola* spp, *Gammarus annulatus*, and Oedicerotidae. Juvenile and small adult skate 36 to > 51 cm TL fed mostly on decapods, including *C. irroratus*, *C. borealis*, *P. acadianus*, and *C. septemspinosa* [although, as in the McEachran (1973) and McEachran *et al*. (1976) studies, *C. septemspinosa* was eaten mostly by juvenile skates ≤ 30 cm TL]. On Georges Bank, Nelson (1993) discovered that colonial amphipods and small epibenthic decapods dominated the diets of juvenile little skate < 39 cm TL at both of his study sites, but species composition was site and size dependent. At one site, *Ericthonius fasciatus* and *U. inermis* comprised the largest portions of the diet of juvenile skates < 39 cm TL. As skate length increased, *E. fasciatus* declined while *U. inermis* became increasingly important in the diets. For skates > 40 cm TL, the epibenthic decapods *C. septemspinosa* and young-of-the-year *C. irroratus* and the isopod *C. polita* were large components of the diet. The polychaete *Glycera dibranchiata* and young-of-the-year hakes (eaten mostly in summer) also increased in the diet. At a second site, the dominant prey items for juvenile skate < 39 cm TL was *C. septemspinosa,* followed by (except for juvenile skates 10-19 cm TL) the amphipod *Protohaustorius wigleyi*. Other notable amphipods were *Monoculodes edwardsi*, *Rhepoxynius hudsoni*, *Pontogeneia inermis*, and *Aeginina longicornis; C. polita* and *C. irroratus* were the most important epibenthic arthropods. For skates > 40 cm TL, *M. edwardsi*, *C. septemspinosa*, *C. polita*, and *P. inermis* were dominant; the cnidarian *Cerianthus* spp. dominated in terms of weight.

Information and citations for the inshore studies can be found in the Little Skate EFH Source Document (Packer *et al*. 2003). In Sheepscot Bay, Maine, little skate ate a variety of prey, but seemed to focus most on crustaceans and Atlantic herring. *C. septemspinosa*, the jonah crab *Cancer borealis*, the amphipods *L. pinguis* and *U. inermis*, and several other varieties of crustaceans were important in the diet, followed by polycheates such as *Nephtys* spp. In Johns Bay, Maine, little skate fed primarily on the decapod crustaceans *C. septemspinosa* and *C. irroratus*, followed by the amphipods *L. pinguis*, *Unciola* spp. and *Monoculodes* spp. Polychaetes were the next major prey group. In Block Island Sound, *L. pinguis* was most abundant in the diet, followed by *C. irroratus*, *C. septemspinosa*, *Upogebia affinis* (a mud shrimp), *Glycera dibranchiata*, *Byblis serrata* (an amphipod), *Unciola irrorata*, *Nephtys incisa*, and *E. directus*. Decapods made up 76% of the diet by weight in New Haven Harbor. *C. septemspinosa* and *C. irroratus* were the most important prey items, followed by mantis shrimp, *Squilla empusa*. Fish were the next major group, but only made up 10% of the diet by weight and only 4% by number. In the Hudson-Raritan estuary, he most frequently found prey, overall, was *Crangon septemspinosa* at a frequency of occurrence of 82.8%. This prey was followed by juvenile or small Atlantic rock crabs at a frequency of occurrence of 49.5%, then by the mysid shrimp, *Neomysis americana*), at a frequency of occurrence of 16.3%, and finally the lady crab, *Ovalipes ocellatus*, at a frequency of occurrence of 10.9% (Steimle *et al*. 2000). In Delaware Bay, *C. septemspinosa* made up > 70% of the diet, followed by *E. directus* and *Euceramus praelongus* (a burrowing crab).

In Sheepscot Bay, a study by Packer and Langton (unpublished manuscript) again indicated that the percentage of crustacean prey in the diet decreased as the skate size increased. This was due to decreases in amphipods, cumaceans, and *C. septemspinosa*. Polychaetes (including *Nephtys* spp.) were a small but important part of the diet for juvenile skate > 20 cm TL. Atlantic herring occurred only in the stomachs of fish > 40 cm TL, but were only prominent in terms of percent weight. In Long Island Sound, Richards (1963) found that amphipods and *C. septemspinosa* were more important to smaller skates. Tyler (1972) also noted that smaller skates (≤ 44 cm TL) ate mysids and amphipods and larger skate consumed decapods, euphausids, and polychaetes.

In the inshore diet studies mentioned above, the skates generally depended more on a few major prey species than skates from the McEachran (1973) and McEachran *et al*. (1976) studies. This may be attributable to the benthic faunal composition in these inshore areas; these areas have a less diverse fauna than the wide region sampled as part of the McEachran (1973) and McEachran *et al*. (1976) studies. But it is clear that the food habits of little skate are fairly generalized, and it is an opportunistic predator.

Table 36. Major prey items of little skate (*Leucoraja erinacea*)

Life Stage	Major prey	Location
Juveniles, ≤	**Polychaetes**: terebellids, maldanids	U.S. northeast

Life Stage	Major prey	Location
40 cm[1]	**Crustaceans**: amphipods (*B. serrata*, *U. irrorata*, *Monoculodes intermedius*, *Synchelidium* sp., *L. pinguis*, *Ericthonius rubricornis*, *M. edwardsi*, unidentifiable gammarids, ampeliscids, haustoriids, oedicerotids, caprellids), cumaceans (*Cyclaspis varians*, *Diastylis* spp.), decapods (*C. septemspinosa*, pagurid and *Cancer* crabs, *Dichelopandalus leptocerus*), isopods **Mollusks** **Fish**	continental shelf
Large juveniles, very small adults, 41-50 cm[1]	**Polychaetes**: Terebellidae, Nephtyidae, Maldanidae, Aphroditidae, Flabelligeridae **Crustaceans**: amphipods (*L. pinguis*, *U. irrorata*, etc.), decapods (*C. septemspinosa*, *Cancer* and pagurid crabs), isopods **Mollusks** **Fish**	U.S. northeast continental shelf
Adults, 51-60 cm[1]	**Polychaetes**: Terebellidae **Crustaceans**: amphipods (*L. pinguis*), decapods (*C. septemspinosa*, *Cancer* and pagurid crabs), isopods **Fish**	U.S. northeast continental shelf
INSHORE SURVEYS		
	Polychaetes: e.g., *Nephtys* spp. **Crustaceans**: amphipods (*L. pinguis*, *U. inermis*), decapods (*C. septemspinosa*, *Cancer borealis*) **Fish**: Atlantic herring	Sheepscot Bay, Maine
	Polychaetes: e.g., *Nephtys* spp. **Crustaceans**: amphipods (*L. pinguis*, *U. inermis*, *Monoculodes* spp.), decapods (*C. septemspinosa*, *Cancer irroratus*)	Johns Bay, Maine
	Polychaetes: *Glycera dibranchiata*, *Nephtys incisa* **Crustaceans**: amphipods (*L. pinguis*, *Byblis serrata*, *Unciola irrorata*), decapods (*C. septemspinosa*, *Cancer irroratus*, the mud shrimp *Upogebia affinis*) **Mollusks**: *Ensis directus*	Block Island Sound, RI
	Crustaceans: decapods (*C. septemspinosa*, *Cancer irroratus*, mantis shrimp *Squilla empusa*) **Fish**	New Haven Harbor
Mostly adults	**Crustaceans**: decapods (*C. septemspinosa*, *Cancer irroratus,* the lady crab, *Ovalipes ocellatus*), the mysid shrimp *Neomysis americana*	Hudson-Raritan estuary
	Crustaceans: decapods (*C. septemspinosa*, the burrowing crab *Euceramus praelongus*) **Mollusks**: *Ensis directus*	Delaware Bay

[1] *From NEFSC food habits database in Packer et al. (2003) and Figure 3 therein, and J. Link (pers. comm.). For a list of other major prey species from other studies, see text.*

5.1.2.11 Monkfish

The main source of information on the prey consumed by the juvenile and adult stages of monkfish (goosefish) (*Lophius americanus*) comes from the EFH Update Memo (Essential Fish Habitat Source Document Update Memo: Goosefish, *Lophius americanus*, Life History and Habitat Characteristics, 2006, and references therein). Monkfish are opportunistic feeders; prey found in their stomachs include a variety of benthic and pelagic species. Diets can vary regionally and seasonally, depending on what is available as prey. Larger monkfish eat larger prey and often have empty stomachs. Monkfish eat spiny dogfish, *Squalus acanthias*, skates, *Raja* spp., eels, sand lance, Atlantic herring, Atlantic menhaden, *Brevoortia tyrannus*, smelt, *Osmerus mordax*, mackerel, *Scomber* spp., weakfish, *Cynoscion regalis*, cunner, tautog, *Tautoga onitis*, black sea bass, *Centropristis striata*, butterfish, pufferfish, sculpins, sea raven, *Hemitripterus americanus*, searobins, *Prionotus* spp., silver hake, *Merluccius bilinearis*, Atlantic tomcod, *Microgadus tomcod*, cod, *Gadus morhua*, haddock, *Melanogrammus aeglefinus*, hake, *Urophycis* spp., witch and other flounders, squid, large crustaceans, and other benthic invertebrates. They even have been known to prey on sea birds and diving ducks.

Larvae feed on zooplankton, including copepods, crustacean larvae, and chaetognaths. Pelagic YOY juveniles consume chaetognaths, hyyperiid amphipods, calanoid copepods, and ostracods. Small benthic juveniles (5-20 cm TL) start eating fish, such as sand lance (*Ammodytes* spp.), soon after they settle to the bottom, but invertebrates, especially crustaceans such as red (bristle-beaked) shrimp (*Dichelopandalus leptocerus*) and squid, can make up a large part of their diet. The consumption of invertebrates decreases among larger juveniles (20-40 cm TL) and monkfish > 40 cm TL (larger juveniles and adults) eat comparatively few invertebrates.

The 1973-2001 NEFSC food habits database showed that monkfish consumed primarily fish, as well as squids, and the type of prey consumed varied with the size of the monkfish. Gadids are always a dominant component, but small to medium size monkfish also consume relatively large amounts of clupeids and squid. Flatfish and scombrids also contribute significantly to the diets of larger monkfish. Bowman *et al*. (2000), using the same NEFSC food habits database, but only for the years 1977-1980, also found the same general trends in changing prey consumption with size, with the addition of skates being important in the diet of larger monkfish. Regionally, Bowman *et al*. (2000) showed that fish dominated the diet in the Mid-Atlantic, southern New England, Gulf of Maine, and on the Scotian Shelf, while squids, particularly *Illex*, dominated at inshore North of Cape Hatteras. Fish (including, and especially, skates) and squids co-dominated on Georges Bank. Jason Link (NOAA/NMFS/NEFSC, Woods Hole Laboratory, personal communication) has updated the food habits database from 1973-2005 and reports that the prey exceeding the 5% by weight threshold in the stomachs of juvenile and adult monkfish include: other fish (32%); silver hake (6%) and Atlantic herring (5%).

Cannibalism (non-kin, inter-cohort) may be important and perhaps explains the apparent high mortality of smaller males although the reported occurrence of cannibalism is low. In 2001, only nine incidences of cannibalism were detected among 2160 stomachs examined (0.42%) by the NEFSC. All of the cannibals were females 63-105 cm TL, and the size of the prey was 45-49 cm.

Table 37. Major prey items of monkfish (*Lophius americanus*)

Life Stage	Major prey	Location
Larvae	**Zooplankton**: copepods, crustacean larvae, chaetognaths.	U.S. northeast continental shelf
YOY juveniles	**Zooplankton**: chaetognaths, hyperiid amphipods, calanoid copepods, ostracods.	U.S. northeast continental shelf
Juveniles 1-40 cm	**Mollusks**: squids **Fish**: sand lance, silver hake, fourbeard rockling, witch flounder	U.S. northeast continental shelf
Large juveniles, small adults 41-50 cm	**Mollusks**: squids (*Illex* sp.) **Fish**: silver hake, flounders	U.S. northeast continental shelf
Adults > 50 cm	**Mollusks**: squids (*Illex* and *Loligo* sp.) **Fish**: e.g., spiny dogfish, skates, eels, sand lance, Atlantic herring, Atlantic menhaden, smelt, mackerel, weakfish, cunner, tautog, black sea bass, butterfish, pufferfish, sculpins, sea raven, searobins, silver hake, other hakes, Atlantic tomcod, cod, haddock, witch flounder, other flounders.	U.S. northeast continental shelf

5.1.2.12 Ocean Pout

The main source of information on the prey consumed by the juvenile and adult stages of ocean pout (*Macrozoarces americanus*) comes from the EFH Update Memo and EFH Source Document (Essential Fish Habitat Source Document Update Memo: Ocean Pout, *Macrozoarces americanus*, Life History and Habitat Characteristics, 2004; Steimle *et al*. 1999, and references therein). Crustaceans and echinoderms are the major prey items for almost all sizes of ocean pout. Bowman *et al*. (2000) showed that ocean pout 1-10 cm in length fed exclusively on the amphipod *Parathemisto* sp. Ocean pout 11-20 cm ate mostly polychaetes, followed by crustaceans, while those 21-30 cm fed on ophiuroids and crustaceans in equal proportions, followed by polychaetes. Echinoderms (ophiuroids and sand dollars) were the major prey items in the diet for larger ocean pout. In terms of the geographic areas sampled in the Bowman *et al*. (2000) study, crustaceans were the major prey items in New England and on the Scotian Shelf, while echinoderms dominated on Georges Bank, in the Gulf of Maine, and inshore north of Cape Hatteras. Jason Link (NOAA/NMFS/NEFSC, Woods Hole Laboratory, personal communication) has updated the food habits database from 1973-2005 and reports that the prey exceeding the 5% by weight threshold in the stomachs of juvenile and adult ocean pout include: echinoids (44%); asteroids (20%); and C*ancer* crabs (9%).

Sand dollars (*Echinarachnius parma*) are a primary prey in waters of coastal Maine, Georges Bank, southern New England, Block Island Sound, and Middle Atlantic Bight; brittlestars and mollusks are also eaten. In the northern Gulf of Maine, ocean pout switch from crustaceans during the spring to mollusks and polychaetes during the summer and fall; off southern Maine, ocean pout primarily ate bivalve mollusks. Jonah crabs (*Cancer borealis*) constituted 76% of ocean pout diet (by total prey weight) off Nantucket shoals, while sand dollars and amphipods were dominant prey on Georges Bank. Juveniles on the sandy, mid- to outer-continental shelf (approximately 35-95 m) of the New York Bight fed primarily on gammarid amphipods and polychaetes. This is consistent with data in the NEFSC food habits database Many benthic species preyed upon by ocean pout are commercially valuable, including sea urchins, scallops, juvenile American lobsters, and crabs. Fish are rarely eaten, although demersal sculpin eggs are consumed when encountered.

Table 38. Major prey items of ocean pout (*Macrozoarces americanus*)

Life Stage	Major prey	Location
Juveniles, very small adults 1-30 cm	**Polychaetes**: Aphroditidae, Cirratulidae **Crustaceans**: amphipods (*Parathemisto* sp., *Leptocheirus pinguis*, *Unciola irrorata*) **Mollusks**: Pectinidae **Echinoderms**: ophiuroids (*Ophiopholis aculeata*)	U.S. northeast continental shelf, coastal, inshore
Adults	**Crustaceans**: amphipods (*Leptocheirus pinguis*, *Unciola*	U.S. northeast

Life Stage	Major prey	Location
	irrorata), decapods (*Cancer borealis, Hyas coarctatus*) **Mollusks**: *Cerastoderma pinnulatum*, *Placopectin magellanicus* **Echinoderms**: ophiuroids (*Ophiura sarsi*), echinoids (*Echinarachnius parma*)	continental shelf, coastal, inshore

5.1.2.13 Offshore Hake

The main source of information on the prey consumed by the juvenile and adult stages of offshore hake (*Merluccius albidus*) comes from the EFH Update Memo and EFH Source Document (Essential Fish Habitat Source Document Update Memo: Offshore Hake, *Merluccius albidus*, Life History and Habitat Characteristics, 2004; Chang *et al*. 1999, and references therein). Offshore hake feed on pelagic invertebrates, e.g. euphausiids and other shrimps, and pelagic fish, including conspecifics.

Data from the NEFSC food habits database (1973-2001) show that offshore hake fed mostly on fish (gadids, hakes, and other fish), squids, and euphausiids. Analysis of samples from the same dataset from 1973-1997 by Garrison and Link (2000) showed decapod shrimp to be the primary prey of small (< 20 cm) juvenile *M. albidus*. Larger juveniles/small adults (20-50 cm) fed primarily on euphausiids and unclassified fish. Large-sized offshore hake (> 50 cm) were primarily piscivorous, feeding heavily on silver hake, its congener. Euphausiid prey have been identified as *Meganyctiphanes* sp. and *Thysanoessa raschi*; decapod prey includes pandalid shrimp, *Pandalus* sp. and *Dichelopandalus* sp., and pelagic shrimp, *Pasiphaea* sp. Jason Link (NOAA/NMFS/NEFSC, Woods Hole Laboratory, personal communication) has updated the food habits database from 1973-2005 and reports that the prey exceeding the 5% by weight threshold in the stomachs of juvenile and adult offshore hake include: silver hake (26%), other fish (20%), *Illex* squid (14%), and cephalopods (9%).

Table 39. Major prey items of offshore hake (*Merluccius albidus*)

Life Stage	Major prey	Location
Small juveniles, < 20 cm	**Crustaceans**: decapod shrimp (pandalid shrimp, *Pandalus* sp. and *Dichelopandalus* sp.; pelagic shrimp, *Pasiphaea* sp.)	U.S. northeast continental shelf, slope
Larger juveniles/small adults, 20-50 cm	**Crustaceans**: euphausiids (*Meganyctiphanes* sp., *Thysanoessa raschi*) **Mollusks**: squid (*Illex* sp.) **Fish**: gadids, hakes (especially silver hake)	U.S. northeast continental shelf, slope
Large adults, > 50 cm	**Crustaceans**: euphausiids (*Meganyctiphanes* sp., *Thysanoessa raschi*) **Mollusks**: squid (*Illex* sp.) **Fish**: gadids, hakes (especially silver hake)	U.S. northeast continental shelf, slope

5.1.2.14 Pollock

The main source of information on the prey consumed by the juvenile and adult stages of pollock (*Pollachius virens*) comes from the EFH Update Memo and EFH Source Document (Essential Fish Habitat Source Document Update Memo: Pollock, *Pollachius virens*, Life History and Habitat Characteristics, 2004; Cargnelli *et al*. 1999, and references therein). The primary prey of small larvae (4-18 mm) is larval copepods while larger larvae (> 18 mm) feed primarily on adult copepods. The primary prey of juvenile pollock is crustaceans. Euphausiids, in particular *Meganyctiphanes norvegica*, are the most important crustacean prey of juveniles. Fish and mollusks make up a smaller proportion of the juvenile diet; however, in some cases fish may play a more important role in the diet. For example, one study showed that the diet of subtidal juveniles in the Gulf of Maine was dominated by fish, especially young Atlantic herring (*Clupea harengus*). The diet of adults is comprised of, in order of decreasing importance, euphausiids, fish and mollusks. *M. norvegica* is the single most important prey item and Atlantic herring is the most important fish species. Jason Link (NOAA/NMFS/NEFSC, Woods Hole Laboratory, personal communication) has updated the food habits database from 1973-2005 and reports that the prey exceeding the 5% by weight threshold in the stomachs of juvenile and adult pollock include: silver hake (19%); krill (14%); decapod shrimp (10%); sand lance (9%); crustacean shrimp (8%); and Atlantic herring (7%).

Bowman and Michaels (1984) found that the diet preferences of adults vary with size: crustaceans were the most important prey item among smaller adults (41-65 cm), fish were most important among medium size adults (66-95 cm), and mollusks (the squid *Loligo*) were the most important prey among the largest adults (> 95 cm). Bowman *et al*. (2000) summarized stomach contents, primarily from the NEFSC bottom trawl surveys from 1977-1980 by length. For fish < 31 cm, the main prey choices were chaetognatha and crustaceans; of the latter, the major identifiable crustacean was *Meganyctiphanes norvegica*. Crustacea often remain a major prey choice for larger pollock, but fish, particularly *Ammodytes*, become important for fish > 61 cm. Cephalopods are also important prey items for fish between 61-70 cm.

Table 40. Major prey items of pollock (*Pollachius virens*)

Life Stage	Major prey	Location
Larvae	**Larval and adult copepods**	U.S. northeast continental shelf
Juveniles, very small adults 1-40	**Chaetognaths**: *Sagitta elegans* **Crustaceans**: amphipods (*Ericthonius rubricornis*), euphausiids (*Meganyctiphanes norvegica*)	U.S. northeast continental

Life Stage	Major prey	Location
cm	**Mollusks**: squids	shelf
Adults	**Nematodes** **Crustaceans**: amphipods, euphausiids (*Meganyctiphanes norvegica*), decapods (*Crangon septemspinosa, Dichelopandalus leptocerus, Pandalus borealis*) **Mollusks**: squids (*Loligo* sp., *Illex* sp.) **Fish**: sand lance, Myctophidae, silver hake, Anarhichadidae, Atlantic herring	U.S. northeast continental shelf

5.1.2.15 Redfish

The main source of information on the prey consumed by the juvenile and adult stages of redfish (*Sebastes* spp.) comes from the EFH Update Memo (Essential Fish Habitat Source Document Update Memo: Acadian redfish, *Sebastes* spp., Life History and Habitat Characteristics, 2004, and references therein).

Redfish larvae feed on copepods, euphausiids, and fish and invertebrate eggs. Redfish feed on the pelagic calanoid-euphausiid assemblage throughout ontogeny and prey size is proportional to fish size. Small larvae eat larval copepods and eggs. Larger larvae and fry eat copepods and euphausiids.

The most frequently observed food items from the 1973-2001 NEFSC food habits database for both juvenile and adult redfish up to 50 cm, were crustaceans, mostly euphausiids, decapods, and larvaceans (subphylum Urochordata). Bowman *et al*. (2000), using the NEFSC food habits database from 1977-1980, also noted the dominance of crustaceans in the diet of all size classes of redfish and in all geographic locations sampled (Georges Bank, Gulf of Maine, and Scotian Shelf). Juveniles < 21 cm fed primarily on copepods (*Calanus* sp.) and the euphausiid, *Meganyctiphanes norvegica*. Large juveniles/adults 21-40 cm consumed mostly copepods (*Calanus* sp.), the euphausiid, *Meganyctiphanes norvegica*, and decapods (the latter for fish 36-40 cm). Adults 41-45 cm fed primarily on amphipods (*Parathemisto* sp.) and the euphausiid, *Meganyctiphanes norvegica*. Silver hake was the only fish prey of note, being a significant prey item of adults 31-35 cm in the Gulf of Maine. The proportion of fish in the diet is positively correlated with body size and depth. Jason Link (NOAA/NMFS/NEFSC, Woods Hole Laboratory, personal communication) has updated the food habits database from 1973-2005 and reports that the prey exceeding the 5% by weight threshold in the stomachs of juvenile and adult redfish include: euphausiids, (28%), crustacean shrimp (19%), pandalid shrimp (18%), silver hake (10%), other fish (8%), and decapod shrimp (6%).

Table 41. Major prey items of redfish (*Sebastes spp.*)

Life Stage	**Major prey**	**Location**
Larvae	**Larval and adult copepods, euphausiids, fish and invertebrate eggs**	U.S. northeast continental shelf
Juveniles, very small adults, ≤ 25 cm	**Crustaceans**: copepods (*Calanus* sp.), euphausiids (*Meganyctiphanes norvegica*), decapods **Larvaceans (subphylum Urochordata)**	U.S. northeast continental shelf

Life Stage	Major prey	Location
Adults, > 25 cm	**Crustaceans**: copepods (*Calanus* sp.), amphipods (*Parathemisto* sp.), euphausiids (*Meganyctiphanes norvegica*), decapods (pandalid shrimp, other shrimp) **Larvaceans (subphylum Urochordata)** **Fish**: silver hake, other fish	U.S. northeast continental shelf

5.1.2.16 Red Hake

The main source of information on the prey consumed by the juvenile and adult stages of red hake (*Urophycis chuss*) comes from the EFH Update Memo (Essential Fish Habitat Source Document Update Memo: Red Hake, *Urophycis chuss*, Life History and Habitat Characteristics, 2004, and references therein). Larvae prey mainly on copepods and other micro-crustaceans. Juvenile red hake commonly prey on small benthic and pelagic crustaceans, including larval and small decapod shrimp and crabs, mysids, euphausiids, and amphipods. Based on the NEFSC food habits database (1973-2001), the primary prey items of juvenile hake ($\leq$ 20 cm) were amphipods, decapods, euphausiids, and polychaetes. Larger juveniles/small adult hake (21-40 cm) consumed mostly decapods and gadids, with each making up approximately 23% of the diet. Other major prey included amphipods, euphausiids, squids, and other fish. Bowman *et al*. (2000), using the NEFSC food habits database from 1977-1980, showed that the principal prey items of juveniles (< 26 cm) were polychaetes, amphipods (*Pontogeneia inermis*, *Leptocheirus pinguis*), decapods (*Crangon septemspinosa*, pagurid crabs, *Dichelopandalus leptocerus*), euphausiids (*Meganyctiphanes norvegica*), and fish (silver hake, searobins). Garrison and Link (2000) conducted a multivariate analysis on NEFSC diet data from over 12,000 red hake. The amount of fish consumed increased as the fish size increased. The diet of juvenile red hake < 20 cm consisted mainly of decapod shrimp (Crangonidae, Pandalidae), euphausiids, gammarid and other amphipods, and polychaetes. Larger juvenile/adult hake 20-50 cm consumed fish, decapod shrimp (Pandalidae), and euphausiids. In the Middle Atlantic Bight, amphipods, small decapods (e.g., the shrimp *Crangon septemspinosa*), and polychaetes are important prey of juveniles, but dominant prey can change seasonally and include copepods and chaetognaths.

The NEFSC food habits database from 1973-2001 shows that adult red hake > 40 cm fed primarily on fish (gadids, clupeids, and unidentified), followed by decapods and euphausiids. Jason Link (NOAA/NMFS/NEFSC, Woods Hole Laboratory, personal communication) has updated the food habits database from 1973-2005 and reports that the prey exceeding the 5% by weight threshold in the stomachs of juvenile and adult red hake include: other fish (15%), pandalid shrimp (11%), euphausiids (11%), crustacean shrimp (9%), and silver hake (7%). Bowman *et al*. (2000), using the NEFSC food habits database from 1977-1980, showed that the principal prey items of adults were amphipods (*Leptocheirus pinguis*), euphausiids (*Meganyctiphanes norvegica*), decapods (*Dichelopandalus leptocerus*; the crab *Cancer irroratus* for hake > 35 cm, the shrimp *Pandalus borealis* for hake > 45 cm), mollusks (bivalves, squids), and fish (sand lance, silver hake). In the Garrison and Link (2000) study mentioned previously, fish such as clupeids and silver hake, decapod shrimp (Pandalidae), and euphausiids were important prey for large hake > 50 cm.

Bowman *et al*. (2000), using the NEFSC food habits database from 1977-1980, also enumerated diets from six principal offshore areas (offshore of Cape Hatteras, Middle Atlantic, Southern New England, Georges Bank, Gulf of Maine, and Scotian Shelf) and two inshore areas (inshore north of Cape Hatteras and inshore south of Cape Hatteras). Combined percentages of crustaceans, fish, and mollusks made up 70-80% of the total food composition for the Gulf of Maine, Scotian Shelf, and Georges Bank regions. In the Southern New England, Middle Atlantic, and inshore north of Cape Hatteras regions, diet composition was evenly divided among the three categories of mollusks, crustacean, and fish. Crustaceans and fish were also heavily consumed in Middle Atlantic and inshore areas. Garrison and Link (2000) showed that fish prey were generally more important in northern habitats. Euphausiids and pandalid shrimps typically accounted for > 10% of the diets on Georges Bank, the Gulf of Maine, and the southwest Scotian Shelf., and generally were < 5% of the diets in the Mid-Atlantic Bight and southern New England. Decapod larvae (8.5%), crangonid shrimp (9.1%), and C*ancer* crabs (8.7%) were important prey in the Mid-Atlantic Bight, while they accounted for < 1% of diets in the Gulf of Maine and southwest Scotian Shelf.

Garrison and Link (2000) also observed annual and seasonal trends in the diet of red hake. Euphausiid shrimp made up 30% from 1976-1980, but declined to 2% in 1996-1997, while the occurrence of pandalid shrimp increased from 4-8% in the 1970s to 12-15% in the 1990s. During the spring, euphausiids were the dominant prey, while pandalids were consumed primarily during summer (33%). In winter months, cephalopods (28%) and *Cancer* crabs (11%) were the dominant prey. Red hake preyed upon silver hake particularly during the winter months (13.5%); predation on silver hake decreased by spring and summer and they contributed to only a small part of the diet by autumn (3%).

For the inshore areas north of Cape Hatteras, Bowman *et al*. (2000) noted that crustaceans (decapods such as *Dichelopandalus leptocerus*, *Crangon septemspinosa*) and fish (silver hake, Atlantic mackerel) were heavily preyed upon. Other major prey included polychaetes. For a list of other inshore diet studies of red hake, see the table, below.

Table 42. Major prey items of red hake (*Urophyis chuss*)

Life Stage	Major prey	Location
Larvae	**Copepods and other micro-crustaceans**	U.S. northeast continental shelf
Juveniles, < 26 cm	**Polychaetes** **Crustaceans**: amphipods (*Pontogeneia inermis*, *Leptocheirus pinguis*), decapods (*Crangon septemspinosa*, pagurid crabs, *Dichelopandalus leptocerus*, other pandalid shrimp), euphausiids (*Meganyctiphanes norvegica*) **Fish**: silver hake, searobins	U.S. northeast continental shelf
Larger juveniles/smaller adults, 20-50 cm	**Crustaceans**: amphipods, decapods (Pandalid shrimp), euphausiids **Mollusks**: squids **Fish**: gadids	U.S. northeast continental shelf

Life Stage	Major prey	Location
Adults, ≥ 26 cm	**Polychaetes** **Crustaceans**: amphipods (*Leptocheirus pinguis*), decapods (*Dichelopandalus leptocerus*, *Pandalus borealis*, *Cancer irroratus*), euphausiids (*Meganyctiphanes norvegica*) **Mollusks**: bivalves, squids **Fish**: gadids, clupeids, silver hake, sand lance	U.S. northeast continental shelf
INSHORE SURVEYS		
	Polychaetes: (*Glycera* sp.) **Crustaceans**: amphipods (*Ampelisca* sp.**,** *Leptocheirus pinguis*), decapods (*Crangon septemspinosa*), mysids (*Neomysis americana*, *Heteromysis Formosa*)	Long Island Sound (Richards 1963)
Mostly juveniles	**Crustaceans**: amphipods (*Gammarus lawrencianus*), decapods (*Crangon septemspinosa*), mysid shrimp (*Neomysis americana*)	Hudson-Raritan estuary (Steimle *et al*. 2000)
Juveniles	**Crustaceans**: calanoid copepods, amphipods (*Unciola* sp., *L. pinguis*, *Monoculodes* sp., and *Ericthonius* sp.), decapods (*Crangon septemspinosa*), mysids	Coastal New Jersey (Luczkovich and Olla 1983)
Mostly juveniles	**Nematodes** **Crustaceans**: copepods, amphipods, isopods, decapods (*Crangon septemspinosa*), mysids (*Neomysis americana*) **Fish**	Central New Jersey (Rachlin and Warkentine 1988)

5.1.2.17 Rosette Skate

The main source of information on the prey consumed by rosette skate (*Leucoraja garmani virginica*) comes from the EFH Source Document (Packer *et al*. 2003 and references therein). The major prey items of juvenile and adult rosette skate are crustaceans, followed by polychaetes. Crustacean prey includes copepods, amphipods, cumaceans, and decapods such as the shrimp *Crangon septemspinosa* and *Cancer* and galatheoid crabs. Other prey include cephalopods such as squids and octopods, and small fishes. Jason Link (NOAA/NMFS/NEFSC, Woods Hole Laboratory, personal communication) has updated the food habits database from 1973-2005 and reports that the prey exceeding the 5% by weight threshold in the stomachs of juvenile and adult rosette hake include: decapod crabs (15%), polychaetes (14%), *Cancer* crabs (10%), other crabs (7%), and gammarid amphipods (6%).

Table 43. Major prey items of rosette skate (*Leucoraja garmani vriginica*)

Life Stage	Major prey	Location
Juveniles and adutls	**Polychaetes** **Crustaceans**: gammarid amphipods, decapods (*Cancer* crabs, other crabs)	U.S. northeast continental shelf

5.1.2.18 Silver Hake

The main source of information on the prey consumed by the juvenile and adult stages of silver hake (*Merluccius bilinearis*) comes from the EFH Source Document (Lock and Packer 2004, and references therein).

Variations in diet in diet of silver hake are dependent upon size, sex, season, migration, spawning, and age with size having the most influence on diet. Silver hake larvae feed on planktonic organisms such as copepod larvae and younger copepodites. The diet of young silver hake consists of euphausiids, shrimp, amphipods, and decapods. All silver hake are ravenous piscivores that feed on smaller hake and other schooling fishes such as young herring, mackerel, menhaden, alewives, sand lance, or silversides, as well as crustaceans and squids.

The 1973-2001 NEFSC food habits database for silver hake generally confirms previous studies. Several other studies, such as Garrison and Link (2000) and Tsou and Collie (2001a, b) use the same database, although the years differ. Garrison and Link (2000) found that small (< 20 cm) silver hake consumed large amounts of euphausiids, pandalids, and other shrimp species. The diet of medium sized (20-50 cm) silver hake consisted of fishes, squids, and shrimp taxa. The diet of large (> 50 cm) silver hake consisted of over 50% fish, including Atlantic herring, clupeids, Atlantic mackerel, and other scombrids. A higher proportion of cephalopods, sand lance, and amphipods are present in the diets of silver hake that occupy southern habitats (Southern Atlantic Bight, Mid- Atlantic Bight, Southern New England). Silver hake of northern regions (Gulf of Maine, Georges Bank, Scotian Shelf) prey more heavily on pelagic fishes, euphausiids, and pandalid shrimps. For example, euphausiids make up 25% of the diet for silver hake of the Gulf of Maine and 7.2% for the Middle Atlantic Bight. Atlantic herring comprise 0.2% of the Middle Atlantic Bight diet and 12.9% of the Georges Bank diet. Squids (*Loligo* sp. and cephalopods), sand lance, and butterfish accounted for 5-10% of silver hake diets in the Middle Atlantic Bight and Southern New England compared to less than 1% in the Gulf of Maine and Southwestern Nova Scotian Shelf regions. Other studies confirm that silver hake is a major piscivore on Georges Bank, with an ontogenetic shift in diet towards increased piscivory.

Jason Link (NOAA/NMFS/NEFSC, Woods Hole Laboratory, personal communication) has updated the food habits database from 1973-2005 and reports that the prey exceeding the 5% by weight threshold in the stomachs of juvenile and adult silver hake include: other fish (16%), Atlantic herring (9%), crangonids (8%), silver hake (8%), clupeids (7%), and decapod crabs (6%).

Bowman (1984) studied samples collected from 8 NEFSC Marine Resources Monitoring, Assessment, and Prediction (MARMAP) bottom trawl surveys conducted by NMFS between March 1973 and November 1976. These surveys were concentrated in the Middle Atlantic, Southern New England, and Georges Bank. It was found that 80% of the diet by weight was fish, 10.2% crustaceans, and 9.2% squid. Euphausiids consisted mainly of *Meganyctiphanes* *norvegica* and *Euphausia*. Decapod groups included Crangonidae (*Crangon septemspinosa* and *Sclerocrangon boreas*), Pandalidae (*Dichelopandalus leptocerus* and *Pandulus borealis*), and Pasiphaedae (*Pasiphaea multidentata*), as well as other unidentifiable decapods, which were mostly shrimp. Amphipods present in the stomachs of silver hake were mainly from the Ampeliscidae (*Ampelisca agaxxize, A. spinipes, A. vadorum*, and *Byblis serrata*), Oedicerotidae (*Manoculodes edwardsi* and *M. intermedius*), and Hyperiidea families. Other crustacean groups included the Mysidacea, Cumacea, and Copepoda. Additional stomach contents that were identified include cephalopods (*Loligo pealei* and *Rossia*), Polychaeta, and miscellaneous organisms such as Echinodermata, and Chaetognatha. The study also found that silver hake measuring less than 20 cm fork length (FL) ate mostly crustaceans, while those that were greater than 20 cm FL ate mostly fish and squid. Silver hake 3-5 cm FL contained the largest percentage of smaller crustacean forms, such as amphipods and copepods. Fish 6-20 cm FL ate decapods, euphausiids, and mysids.

Bowman (1984) found Cephalopoda to be another important prey group of silver hake. Fish in Southern New England ate the largest quantities of squid, 13.7% by weight. Squid comprised 6.7% of the silver hake diet of Georges Bank and 4.3% of the diet for Middle Atlantic. The percentage of euphausiids and squid in the diet tends to increase at deeper bottom depths, while the percent weight of fish in the diet shows a corresponding decrease. The trend is that fish sampled at deeper depths will have less food on average in their stomachs. Availability of prey is probably one of the most important factors in determining what type and how much food silver hake eat.

Cannibalism is common among silver hake. Conspecific juveniles contribute more than 10% to the adult diet and more than 20% to the total diet.Cannibalism can account for more than 50% of predation rates on Georges Bank, and was observed to be especially important to silver hake in the spring. Cannibalism is most common in adult silver hake, although it can occur at the early juvenile stage.

Migration results in seasonal and yearly variations in silver hake diet. The diet changes from fish in the spring and autumn to fish, crustaceans, and mollusks during the summer. Small fish 26-55 mm consume more food in October and November, while larger fish 86-115 mm experience increased food consumption by January. Tsou and Collie (2001a) used the NMFS food-habits database to identify trophic relationships for silver hake on Georges Bank for years 1978-1992. It was discovered that more fish were consumed in the autumn with herring being the major prey item during that season.

In terms of sex differences, male diets have the largest percentage of crustaceans, while female diets have the largest percentage of fish and squid. Crustaceans constitute 48% of the total weight of all prey in the diet of male silver hake. Fish consumption is half that of crustaceans and consists of mainly myctophids and other silver hake. Crustaceans rank highest in frequency of occurrence in the diet of female silver hake; however, weight contribution is less for males. Fish prey represent 53% of the female silver hake diet. Females generally consume twice the amount by weight of fish prey as males. The noted differences between the sexes in prey selection are associated with size. Because females are larger, hence faster, they are able to consume larger, highly mobile prey such as fish and squid. Males on the other hand tend to be smaller at age and therefore concentrate much of their feeding activity on crustaceans, which are abundant and easily obtained. After the age of 5, females constitute over 70% of the silver hake population, so it is expected that the diet of older silver hake will consist of larger prey.

Diet also differs between the northern and southern stocks. The northern stock primarily consumes euphausiids, Atlantic herring, silver hake, and other fish, while the southern stock consumes crangonid shrimp, squids, cephalopods, and sand lance. *Illex* sp. and *Loligo* sp. of squid are found in the diet of silver hake that live in southern habitats (Garrison and Link 2000).

For inshore diet studies, see Table, below.

Table 44. Major prey items of silver hake (*Merluccius bilinearis*)

Life Stage	Major prey	Location
Larvae	**Copepod larvae and younger copepodites**	U.S. northeast continental shelf
Juveniles, ≤ 22 cm	**Crustaceans**: copepods, amphipods (Ampeliscidae, including *Ampelisca agaxxize, A. spinipes, A. vadorum*, *Byblis serrata*; Oedicerotidae, including *Manoculodes edwardsi*, *M. intermedius*; Hyperiidea), cumaceans, decapods (Crangonidae, including *Crangon septemspinosa*, *Sclerocrangon boreas*; pandalid shrimp, including *Dichelopandalus leptocerus*, *Pandulus borealis*; Pasiphaedae, including *Pasiphaea multidentata*), euphausiids (*Meganyctiphanes norvegica*, *Euphausia*), mysids	U.S. northeast continental shelf
Larger juveniles/adults, ≥ 20 cm	**Crustaceans**: copepods, amphipods (Ampeliscidae, including *Ampelisca agaxxize, A. spinipes, A. vadorum*, *Byblis serrata*; Oedicerotidae, including *Manoculodes edwardsi*, *M. intermedius*; Hyperiidea), cumaceans, decapods (Crangonidae, including *Crangon septemspinosa*, *Sclerocrangon boreas*; pandalid shrimp, including *Dichelopandalus leptocerus*, *Pandulus borealis*; Pasiphaedae, including *Pasiphaea multidentata*; crabs), euphausiids (*Meganyctiphanes norvegica*, *Euphausia*), mysids **Mollusks**: squids (*Loligo* sp., *Rossia*) **Fish**: Atlantic herring, other clupeids, Atlantic mackerel, other scombrids, sand lance, butterfish, silversides, silver hake	U.S. northeast continental shelf
INSHORE SURVEYS		
	Crustaceans: copepods, amphipods (*Leptocheirus pinguis*), decapods (*Crangon septemspinosa*), mysid shrimp (*Neomysis americana*) **Mollusks**: squid **Fish**: bay anchovy, sand lance, juvenile silver hake	Block Island Sound, RI (Smith 1950)

Life Stage	Major prey	Location
	Polychaetes: (*Glycera* sp.) **Crustaceans**: amphipods (*Ampelisca* sp.**,** *Leptocheirus pinguis*), decapods (*Crangon septemspinosa*), mysids (*Neomysis americana*, *Heteromysis Formosa*)	Long Island Sound (Richards 1963)
Mostly juveniles	**Crustaceans**: amphipods (*Gammarus lawrencianus*, *Ampelisca abdita*), decapods (*Crangon septemspinosa*), mysid shrimp (*Neomysis americana*) **Fish**: juvenile silver hake, Atlantic menhaden, anchovies	Hudson-Raritan estuary (Steimle *et al*. 2000)
Adults	**Crustaceans**: amphipods, decapods (*Crangon septemspinosa*), mysid shrimp **Fish**: juvenile silver hake, blueback herring, silversides	New Jersey surf zone (Schaefer 1960)

5.1.2.19 Smooth Skate

The main source of information on the prey consumed by smooth skate (*Malacoraja senta*) comes from the EFH Source Document (Packer *et al*. 2003 and references therein). Generally, the diet of smooth skate is limited to epifaunal crustaceans. Decapod shrimps and euphausiids are the primary food items although amphipods and mysids are also important. Larger smooth skate also feed on small fish.

McEachran (1973) studied skates collected from Nova Scotia to Cape Hatteras during 1967-1970; the following diet description is from him and McEachran *et al*. (1976).

On Georges Bank, *Pagurus pubescens*, *Dichelopandalus leptocerus*, *Crangon septemspinosa*, and *Eualus pusiolus* were the major decapods eaten, while on the Nova Scotian shelf, *P. pubescens*, *Pandulus* spp., and *C. septemspinosa* were the most numerious decapod prey consumed. *Meganyctiphanes norvegica* was the only euphausiid eaten, and was eaten more frequently during the winter than during the autumn. *Monoculodes* sp. was the major amphipod eaten on Georges Bank and *Dulichia* (= *Dyopedos*) *monacantha* and *Pontogeneia inermis* were the most frequently eaten amphipods eaten in the Gulf of Maine and on the Nova Scotian shelf. The mysids *Erythrops erythrophthalma* and *Neomysis americana* were also consumed in large numbers.

As smooth skate grow, the diet shifts from amphipods and mysids to decapods, and euphausiids appear to be directly correlated to the size of the skate (McEachran *et al*. 1976). Using NEFSC data from Georges Bank and the Gulf of Maine from 1977-1980, Bowman *et al*. (2000) reported that that in terms of percent weight, the major decapods consumed by skate 36-51 cm TL included *Pandalus borealis* and *D. leptocerus*. Skate 51-55 cm TL consumed pagurid crabs. *M. norvegica* was eaten by skate 56-60 cm TL, but also by skate < 31 cm TL.

The 1981-1990 NEFSC food habits database for smooth skate generally confirms the McEachran (1973) and McEachran *et al*. (1976) studies, even though the sample sizes are often quite small. Decapods and crustaceans are the major components of the skates' diet, particularly for skates > 21 or 31 cm TL. Several fish species are minor, but important components of the diet of skates > 31 cm TL. Amphipods, which are a major part of the diet of skates 11-20 cm TL, rapidly decrease in occurrence for larger skates. However, there doesn't seem to be a remarkable increase in the occurrence of decapods or euphausiids with increasing skate size. It is interesting to note though the rather high (54%) occurrence of euphausiids in the stomachs of skates 21-30 cm TL, this may mirror the previously mentioned presence of *M. norvegica* in skate < 31 cm TL as reported by Bowman *et al*. (2000).

The following is a description of the diet from the NEFSC food habits database broken down by smooth skate size class.

For smooth skate 11-20 cm TL, 39% of the diet consisted of identifiable amphipods. Identifiable euphausiids made up 23% of the diet, while pagurid crabs and pandalid shrimp, both decapods, together made up 15% of diet. Identifiable mysids and isopods each made up only 8% of the diet. For skate 21-30 cm TL, 54% of the diet consisted of identifiable euphausiids, and 23% of the diet identifiable amphipods.

The percent occurrence of identifiable amphipods in the diet of smooth skate 31-40 cm TL dropped to 17% and identifiable euphausiids dropped to 29% of the diet. Identifiable decapods made up 21% of the diet; they included pagurid crabs, pandalid shrimp, and *C. septemspinosa*. Identifiable fish made up 13% of the diet, among which were a yellowtail flounder and a hake. Minor prey items included polychaetes (4%) and stomatopods (4%).

The percent occurrence of identifiable euphausiids in the diet of skate 41-50 cm TL increased to 38%, while identifiable amphipods continued to decrease, down to 7%. Identifiable decapods, including pandalid shrimp and *C. septemspinosa*, made up 21% of the diet. Identifiable fish increased to 17% of the diet, species included silver hake and witch flounder.

The percent occurrence of identifiable euphausiids in the diet of 51-60 cm TL skate decreased to 32%, while identifiable amphipods dropped down to 2%. Identifiable decapods, including pagurid crabs, pandalid shrimp, and *C. septemspinosa*, increased to 29%. Identifiable fish, including silver hake and sand lance, made up 13% of the diet.

Finally, for smooth skate 61-70 cm TL, identifiable euphausiids made up 38% of the diet, identifiable pandalid shrimp 25% of the diet, identifiable fish 13%, and identifiable polychaetes 13%. However, only 7 skate stomachs were examined, making any conclusions about diet preference for this size class suspect.

Jason Link (NOAA/NMFS/NEFSC, Woods Hole Laboratory, personal communication) has updated the food habits database from 1973-2005 and reports that the prey exceeding the 5% by weight threshold in the stomachs of juvenile and adult smooth skate include: pandalid shrimp (27%), euphausiids (14%), crustacean shrimp (13%), silver hake (5%), other fish (5%), and decapod crabs (5%).

Table 45. Major prey items of smooth skate (*Malacoraja senta*)

Life Stage	Major prey	Location
Juveniles, ≤ 50 cm[1]	**Crustaceans**: amphipods (gammarid), isopods, mysids, euphausiids, decapods (*C. septemspinosa*, pagurid crabs, pandalid shrimp) **Fish**: yellowtail flounder, silver hake, witch flounder	U.S. northeast continental shelf
Large juveniles, adults > 50	**Polychaetes**: [for skate 61-70 cm, but small sample size makes this suspect] **Crustaceans**: euphausiids, decapods (*C. septemspinosa*,	U.S. northeast continental shelf

Life Stage	Major prey	Location
cm[1]	pagurid crabs, pandalid shrimp) **Fish**: silver hake, sand lance	

[1] *From NEFSC food habits database in Packer et al. (2003) and Figure 2 therein, and J. Link (pers. comm.). For a list of other major prey species from other studies, see text.*

5.1.2.20 Thorny Skate

The main source of information on the prey consumed by thorny skate (*Amblyraja radiata*) comes from the EFH Source Document (Packer *et al*. 2003 and references therein). Prey of thorny skate in the western North Atlantic includes hydrozoans, aschelminths, gastropods, bivalves, squids, octopus, polychaetes, pycnogonids, copepods, stomatopods (larvae), cumaceans, isopods, amphipods, mysids, euphausids, shrimps, hermit crabs, crabs, holothuroideans, and fishes. The feeding habits of thorny skate are size-dependent, but it is also an opportunistic feeder on the most abundant and available prey species in an area.

McEachran (1973) studied skates collected from Nova Scotia to Cape Hatteras during 1967-1970; the following diet descriptions are from him and McEachran *et al*. (1976).

Polychaetes and decapods were the major prey items eaten, followed by amphipods and euphausids. Fishes and mysids contributed little to the diet.

Nephtys spp. and *Glycera* spp. were the most frequently eaten polychaetes on Georges Bank while *Nephtys* spp., *Eunice pennata*, and *Aphrodite hastata* were the most abundant polychaetes eaten in the Gulf of Maine and on the Nova Scotian shelf.

Orchomonella minuta and *Leptocheirus pinguis* were the most numerous amphipod prey in the Mid-Atlantic Bight, while *L. pinguis*, ampeliscids, and *Orchomonella* sp. were the most frequently eaten amphipods on Georges Bank. *Pontogeneia inermis* and *Tmetonyx* sp. were the most abundant amphipods eaten in the Gulf of Maine, while on the Nova Scotian shelf ampeliscids and *L. pinguis* were the most frequently eaten amphipods. On Georges Bank, *Hyas* sp., *Eualus pusiolus*, *Dichelopandalus leptocerus*, and *Crangon septemspinosa* were the most frequently eaten decapods. *Pandalus* spp., *Pagurus pubescens*, *Axius serratus*, and *Pasiphaea* sp. were the dominant species eaten in the Gulf of Maine. *Hyas* sp., *P. pubescens*, *E. pusiolus*, *A. serratus* were the major decapod prey eaten on the Nova Scotian shelf.

Meganctiphanes norvegica was the only euphausid in the diet. The mysids eaten were *Neomysis americana* and *Erythrops erythrophthalma*.

The most commonly eaten fishes were sand lance, longhorn sculpin, and Atlantic hagfish.

McEachran (1973) and McEachran *et al*. (1976) found that the diet of thorny skate was size dependent. Fish ≤ 40 cm TL fed mostly on amphipods while fish > 40 cm TL fed mostly on polychaetes and decapods. Mysids decreased in the diet while fishes increased with increase in size of the skate. Fishes were a major component of the diet of skates > 70 cm TL. Consumption of euphausids was independent of skate size (McEachran 1973; McEachran *et al*. 1976).

The 1973-1990 NEFSC food habits database for thorny skate generally confirms the previous studies. Overall, crustaceans declined in importance with increasing skate size. Amphipods, which included species such as *Psammonyx nobilis* and *L. pinguis*, decreased with increasing skate size, while the percent occurrence of decapods, which included *C. septemspinosa*, *Cancer* and pagurid crabs, and pandalid shrimp, generally did not change with skate size. The percent occurrence of polychaetes, which included those from the Nephtyidae and Aphroditidae families, increased with increasing skate size until the skate were about 60 cm TL. Fish became noticeable in the diet of the larger skates, around > 50-60 cm TL, but were never a major component of the diet (at least as measured here in terms of percent occurrence).

The following is a detailed description of the diet from the NEFSC food habits database broken down by thorny skate size class.

For thorny skate 11-20 cm TL, 61-78% of the diet consisted of crustaceans, with 24-48% of the diet consisting of identifiable amphipods. The most abundant amphipod species included *Ericthonius rubricornis*, *Psammonyx nobilis*, *Monoculodes edwardsi*, and several unidentifiable gammarid amphipods. Identifiable decapods (11% of the diet during the 1973-1980 study period) included *C. septemspinosa* and *Cancer* and *Pagurus* crabs. Euphausids (*M. norvegica*), mysids (*E. erythrophthalma*), and cumaceans were also eaten. Identifiable polychaetes (15-34% of the diet) included those from the Nephtyidae and Aphroditidae families.

For skate 21-30 cm TL, 56-66% of the diet consisted of crustaceans, with 23-34% of the diet consisting of identifiable amphipods. Major amphipod species included *L. pinguis*, *Melita dentata*, and *Hippomedon serratus*. Identifiable decapods (5-10% of the diet) again included *C. septemspinosa* and *Cancer* and pagurid crabs. *Cirolana* (= *Politolana*?) *polita* was one of the identifiable isopods. Identifiable polychaetes made up 18-39% of the diet and included those from the Aphroditidae and Terebellidae families.

The percentage of crustaceans in the diet of thorny skate 31-40 cm TL dropped to 44-52%. Some of the more numerous identifiable amphipods (10-26% of the diet) included *P. nobilis*, *L. pinguis*, and *Byblis serrata*. *C. septemspinosa*, pagurid crabs, and *E. pusiolus* were the major identifiable decapod prey (8-15% of the diet). Identifiable polychaete prey (38-48% of the diet) included members of the families Aphroditidae, Nephtyidae, Lumbrineridae, as well as the species *Sternaspis scutata*.

The percent occurrence of crustaceans in the diet of thorny skate 41-50 cm TL was between 42-59%. Identifiable decapods (5-11% of the diet) included *C. septemspinosa*, pandalid shrimp, and *E. pusiolus*. Identifiable amphipods, which decreased to 8-17% of the diet, included *L. pinguis*, while identifiable euphausids (10% of the diet during the 1981-1990 study period) included *M. norvegica*. Identifiable polychaetes made up 35-50% of the diet; major families included the Aphroditidae and Nephtyidae.

The percent occurrence of crustaceans in the diet for skate 51-60 cm TL declined to 37-41%. Identifiable decapods (13-15% of the diet) included *E. pusiolus*, pandalid shrimp, pagurid crabs, and *D. leptocerus*. *M. norvegica* was a dominant euphausid (7% of the diet during the 1981-1990 study period). Among the polychaetes, which were 40-48% of the diet, were found members of the Nephtyidae (e.g., *N. discors*) and Aphroditidae (e.g., *A. hastata*) families, as well as *E. pennata*. The percent occurrence of identifiable fish in the diet increased to 5-11%.

The percent occurrence of crustaceans dropped to 34-40% for skate 61-70 cm TL. Among the identifiable decapods (13-23% of the diet) were pagurid crabs, pandalid shrimp, *Hyas* sp., *D. leptocerus*, and *C. septemspinosa*. Identifiable polychaetes (36-49% of the diet) again included members of the Nephtyidae and Aphroditidae families. The percent occurrence of identifiable fish in the diet increased to 10-14%.

For skate 71-80 cm TL, crustaceans made up 25-42% of the diet. Major identifiable decapods (16-18% of the diet) again included pagurid crabs, pandalid shrimp, *Hyas* sp., and *D. leptocerus*. Identifiable polychaetes made up 38-47% of the diet and included members of the Aphroditidae, Nephtyidae, Nereidae, Sabellidae, and Opheliidae families. The percent occurrence of identifiable fish in the diet increased to 13-17% and included sand lance, wrymouth, and silver hake.

Finally, the percent occurrence of crustaceans in the diet for skate 81-90 cm TL declined to 34-35%. Identifiable decapods (12-16% of the diet) included pandalid shrimp, *Hyas* sp., *Cancer* crabs, and *D. leptocerus*. *M. norvegica* was a dominant euphausid. Identifiable polychaetes comprised 31-35% of the diet, most of which were in the Nephtyidae, Aphroditidae, and Nereidae families. Identifiable fish, which made up 10-22% of the diet, included hagfish, wrymouth, and herring.

Jason Link (NOAA/NMFS/NEFSC, Woods Hole Laboratory, personal communication) has updated the food habits database from 1973-2005 and reports that the prey exceeding the 5% by weight threshold in the stomachs of juvenile and adult thorny skate include: polychaetes (21%), other fish (13%), Atlantic herring (7%), wrymouth (6%), and decapod crabs (5%).

Using NEFSC data from 1977-1980, Bowman *et al*. (2000) found that in terms of percent weight, crustaceans and polychaetes were dominant in the diet of skate < 31-60 cm TL, while fish, including herring, sand lance, and wrymouth were dominant in the diet of skate 61-90 cm TL. Squid and herring dominated the diet of skate > 90 cm TL.

Table 46. Major prey items of thorny skate (*Amblyraja radiata*)

Life Stage	Major prey	Location
Juveniles, < 81 cm[1]	**Polychaetes**: Nephtyidae (e.g., *N. discors*), Aphroditidae (e.g., *A. hastata*), Terebellidae, Lumbrineridae, Nereidae,	U.S. northeast continental

Life Stage	Major prey	Location
	Sabellidae, and Opheliidae, *Sternaspis scutata*, *Eunice pennata* **Crustaceans**: amphipods (*Ericthonius rubricornis*, *Psammonyx nobilis*, *Monoculodes edwardsi*, *Leptocheirus pinguis*, *Melita dentata*, *Hippomedon serratus*, *Byblis* serrata, unidentifiable gammarids), cumaceans, isopods (*Cirolana* [= *Politolana*?] *polita*), decapods (*Crangon septemspinosa*, pagurid crabs, *Cancer* crabs, spider crabs *Hyas* sp., *Eualus pusiolus*, pandalid shrimp including *Dichelopandalus leptocerus*), euphausiids (*Meganctiphanes norvegica*), mysids (*Erythrops erythrophthalma*) **Mollusks** **Fish**: sand lance, wrymouth, silver hake	shelf
Very large juveniles, adults, ≥ 81 cm[1]	**Polychaetes**: Nephtyidae, Aphroditidae, Nereidae **Crustaceans**: decapods (*Cancer* crabs, spider crabs *Hyas* sp., pandalid shrimp including *Dichelopandalus leptocerus*), euphausiids (*Meganctiphanes norvegica*) **Mollusks** **Fish**: hagfish, wrymouth, Atlantic herring.	U.S. northeast continental shelf

[1] *From NEFSC food habits database in Packer et al. (2003) and Figure 3 therein, and J. Link (pers. comm.). For a list of other major prey species from other studies, see text.*

5.1.2.21 White Hake

The main source of information on the prey consumed by the juvenile and adult stages of white hake (*Urophycis tenuis*) comes from the EFH Update Memo and EFH Source Document (Essential Fish Habitat Source Document Update Memo: White hake, *Urophycis tenuis*, Life History and Habitat Characteristics, 2004; Cargnelli *et al*. 1999, and references therein).

Using the NEFSC food habits database from 1977-1980, Bowman *et al*. (2000) showed that the primary prey of juveniles < 21 cm were polychaetes and crustaceans. Crustacean prey included calanoid copepods, amphipods (*Anonyx sarsi*), and decapods (*Crangon septemspinosa*). Large juveniles/smaller adults 21-50 cm fed mostly on crustaceans, squids, and fish. Crustacean prey included decapods (*Crangon septemspinosa*; the pandalid shrimp *Dichelopandalus leptocerus* and *Pandalus borealis*), and euphausiids (*Meganyctiphanes norvegica*). Squids included *Loligo pealeii*. Fish prey included gadids, silver hake, and white hake (most likely juveniles). Adults > 50 cm also fed primarily on crustaceans, squid, and fish. Crustacean prey included euphausiids (*Meganyctiphanes norvegica)* and decapods (pandalid shrimp *Dichelopandalus leptocerus*). Squids included *Illex* sp. Fish prey included gadids, red hake, and silver hake. Regionally, fish dominated the diet in all locations sampled.

Using NEFSC diet data from 1973-1997, Garrison and Link (2000) observed an increasing amount of piscivory in white hake with increasing size. Euphausiids (12.8% of diet), crangonid shrimp (15.7%), pandalid shrimp (14.2%), and unclassified shrimp (19.9%) account for the majority of juvenile (< 20 cm) white hake diets. Larger juvenile/smaller adult white hake 20-50 cm had a large proportion of shrimp taxa in their diets, but unclassified fishes (25.5%) and silver hake (16.2%) were also important components. Large adults > 50 cm fed almost exclusively on fish taxa, with silver hake (21.7%), clupeids (7.1%), Atlantic herring (6.5%), argentines (6.6%), and unclassified fishes (33.5%) as major prey. Jason Link (NOAA/NMFS/NEFSC, Woods Hole Laboratory, personal communication) has updated the food habits database from 1973-2005 and reports that the prey exceeding the 5% by weight threshold in the stomachs of juvenile and adult white hake include: other fish (32%), silver hake (22%), Atlantic herring (7%), and other herrings (6%).

Table 47. Major prey items of white hake (*Urophycis tenuis*)

Life Stage	Major prey	Location
Juveniles, < 20-21 cm	**Polychaetes** **Crustaceans**: calanoid copepods, amphipods (*Anonyx sarsi*), decapods (*Crangon septemspinosa*, pandalid shrimp), euphausiids	U.S. northeast continental shelf
Larger juveniles/	**Crustaceans**: decapods (*Crangon septemspinosa*; the pandalid shrimp *Dichelopandalus leptocerus* and *Pandalus borealis*),	U.S. northeast

Life Stage	Major prey	Location
smaller adults, 20-21 to 50 cm	euphausiids (*Meganyctiphanes norvegica*) **Mollusks**: squids (*Loligo pealeii*) **Fish**: gadids, silver hake, white hake (most likely juveniles)	continental shelf
Larger adults, > 50 cm[1]	**Fish**: silver hake, clupeids, Atlantic herring, argentines	U.S. northeast continental shelf

[1] Based on Garrison and Link (2000) only.

5.1.2.22 Windowpane Flounder

The main source of information on the prey consumed by the juvenile and adult stages of windowpane (*Scophthalmus aquosus*) comes from the EFH Update Memo and EFH Source Document (Essential Fish Habitat Source Document Update Memo: Windowpane, *Scophthalmus aquosus*, Life History and Habitat Characteristics, 2006; Chang *et al*. 1999, and references therein). The 1973-1990 NEFSC food habits database indicates windowpane feed on small crustaceans (e.g., mysid shrimp and decapod shrimp) and various fish larvae including hakes and tomcod, as well as their own species (Langton and Bowman 1981). Fish become more important in the diet of larger windowpane.

Jason Link (NOAA/NMFS/NEFSC, Woods Hole Laboratory, personal communication) has updated the food habits database from 1973-2005 and reports that prey exceeding the 5% by weight threshold in the stomachs of juvenile and adult windowpane include: mysids (18%), crangonidae (14%), gammarid amphipods (11%), sand lance (7%), other fish (6%), and pandalid shrimp (6%).

Bowman *et al*. (2000) summarized the diet composition of windowpane, based on the NEFSC bottom trawl surveys from 1977-1980 by both length and geographic area. Crustaceans, including amphipods, mysids (*Mysidopsis bigelowi* and *Neomysis americana*), and decapods (decapod larvae) were the dominant prey for juveniles up to 20 cm. Other important prey for windowpane 16-20 cm were polychaetes and fish. Large juveniles/adults $\geq$ 21 cm also fed primarily on crustaceans, including amphipods (*Gammarus annulatus*), mysids (*Neomysis americana*), and decapods (*Crangon septemspinosa*). Fish, including silver hake, sand lance, cusk, were also important prey items for that size class, especially for adults $\geq$ 36 cm, where they were the dominant prey items. Of the geographic areas sampled, decapod crustaceans made up 100% of the diet of windowpane found inshore south of Cape Hatteras. Fish, particularly sand lance, were the dominant prey items for fish in the Mid-Atlantic and on Georges Bank. Crustaceans dominated in southern New England and inshore north of Cape Hatteras.

A similar dietary analysis by Link *et al*. (2002) focused on flatfish of the northwest Atlantic taken during the NEFSC bottom trawl surveys from 1973-1998 for all seasons. In this study, the major portion of the windowpane diet was composed of shrimps (mysids, *Crangon septemspinosa*, pandalids) and benthic invertebrates. Fish were an important but secondary component of the diet. The study also noted that there was no significant change in the diet in the 25 years covered by the study.

For inshore diet studies, see Table, below.

Table 48. Major prey items of windowpane flounder (*Scopthalamus aquosus*)

Life Stage	Major prey	Location
Juveniles, ≤ 20 cm	**Crustaceans**: amphipods, mysids (*Mysidopsis bigelowi*, *Neomysis americana*), decapods (decapod larvae)	U.S. northeast continental shelf
Larger juveniles/adults, > 20 cm	**Crustaceans**: amphipods (*Gammarus annulatus*), mysids (*Neomysis americana*), decapods (*Crangon septemspinosa*, pandalid shrimp) **Fish**: silver hake, sand lance, cusk	U.S. northeast continental shelf
INSHORE SURVEYS		
Juveniles, adults	**Crustaceans**: mysids	Johns Bay, Maine (Hacunda 1981)
	Crustaceans: decapods (*Crangon septemspinosa*), mysid shrimp (*Neomysis americana*) **Fish**: bay anchovy, goby, naked goby	New Haven Harbor, CT (Carlson 1991)
	Crustaceans: mysid shrimp (*Neomysis americana*) **Mollusks**: squid **Fish**	Block Island Sound, RI (Smith 1950)
	Chaetognaths **Crustaceans**: decapods (*Crangon septemspinosa*), mysid shrimp (*Neomysis americana*) **Fish**: larval sand lance and silver hake	Long Island/Block Island Sounds (Moore (1947)
	Crustaceans: decapods (*Crangon septemspinosa*), mysid shrimp (*Neomysis americana*)	Long Island Sound (Richards 1963)
	Crustaceans: decapods (*Crangon septemspinosa*), mysid shrimp (*Neomysis americana*) **Fish**: eggs, larvae	Eastern Long Island Sound (Hickey 1975)
YOY to adult	**Crustaceans**: amphipods (*Gammarus lawrencianus*), decapods (*Crangon septemspinosa*), mysid shrimp (*Neomysis americana*)	Hudson-Raritan estuary (Steimle *et al*. 2000)
	Crustaceans: mysid shrimp (*Neomysis americana*)	New Jersey coast (Warkentine and Rachlin 1988)

Life Stage	Major prey	Location
	Crustaceans: decapods (*Crangon septemspinosa*), mysid shrimp (*Neomysis americana*) **Fish**: sand lance	Little Egg Harbor, NJ (Festa 1979)
	Crustaceans: amphipods, decapods (*Crangon septemspinosa*, crab larvae), mysid shrimp	Hereford Inlet, NJ (Allen *et al*. 1978)
	Crustaceans: copepods, decapods (*Crangon septemspinosa*), mysid shrimp (*Neomysis americana*)	Delaware Bay (de Sylva *et al*. 1962)
	Crustaceans: decapods (*Crangon septemspinosa*), mysid shrimp (*Neomysis americana*) **Fish**: bay anchovy	Mouth of Chesapeake Bay (Kimmel 1973)

5.1.2.23 Winter Flounder

The main source of information on the prey consumed by the juvenile and adult stages of winter flounder (*Pseudopleuronectes americanus*) comes from the EFH Source Document and EFH Update Memo (Pereira *et al*. 1999; Pereira 2004, and references therein).

Pearcy (1962) investigated the food habits of winter flounder larvae from hatching through metamorphosis in the Mystic River, CT estuary. A large percentage of the stomach contents were unidentifiable but nauplii, harpacticoids, calanoids, polychaetes, invertebrate eggs, and phytoplankton were all present. Food item preference changed with larval size: smaller larvae (3-6 mm) ate more invertebrate eggs and nauplii while larger larvae (6-8 mm) preferred polychaetes and copepods. Plant material was found in larval stomachs but usually with other food items and was probably incidentally ingested (Pearcy 1962). Copepods and harpacticoids were important foods for metamorphosing and recently metamorphosed winter flounder. Amphipods and polychaetes gradually become more important for both YOY and yearling flounder (Pearcy 1962).

Winter flounder have been described as omnivorous or opportunistic feeders, consuming a wide variety of prey. Polychaetes and crustaceans (mostly amphipods; e.g., gammarids) generally make up the bulk of the diet (Link *et al*. 2002). The major prey items in the diet of juvenile/small adult winter flounder (≤ 30 cm), based on the NEFSC food habits database from 1973-1990, are amphipods (*Ericthonius* sp., *Unciola irrorata*, *Leptocheirus pinguis*, *Ampelisca agassizi*, *Byblis serrata, Aeginina longicornis*) and polychaetes (Ampharetidae, Sabellidae, Maldanidae, *Trichobranchus glacialis*, *Lumbrineris fragilis*, *Nereis* sp.), as well as hydroids. Adults ≥ 31 cm feed mostly on amphipods (*Pontogeneia inermis*, *Unciola irrorata*, *Leptocheirus pinguis*, *Aeginina longicornis*), cnidarians (anthozoans, hydroids, sea anemones), polychaetes, and mollusks (bivalves). Jason Link (NOAA/NMFS/NEFSC, Woods Hole Laboratory, personal communication) has updated the food habits database from 1973-2005 and reports that the prey exceeding the 5% by weight threshold in the stomachs of juvenile and adult winter flounder include: polychaetes (39%), anemones/corals (16%), and gammarid amphipods (6%).

In the Navesink River and Sandy Hook Bay (NJ) estuary, ontogenetic shifts in dietary preferences suggest that winter flounder should be divided into three size classes (15-49 mm, 5.0-29.9 cm, and ≥ 30.0 cm) based on a cluster analysis of the winter flounder diet's (Stehlik and Meise 2000). The smallest group fed on spionid polychaetes and copepods, which were scarce in the diets of the two larger size groups. The intermediate size group fed on other polychaetes, amphipods, and bivalve siphons but increased consumption of sand shrimp (*Crangon septemspinosa*) in the summer and fall. The largest size group fed extensively on a bivalve (*Mya arenaria*) and glycerid polychaetes.

Winter flounder may modify their diet based on availability of prey, and degradation or improvement of environmental conditions causing shifts in benthic invertebrate populations may also cause shifts in prey selection such as eating the pollution-tolerant annelid *Capitella* or eating the pollution-sensitive amphipod, *Unciola irrorata*, once environmental conditions have improved. In addition, winter flounder are one of only a handful of species that consume planktonic hydroids (Avent *et al*. 2001). Twenty-eight percent of the winter flounder populations on Georges Bank eat planktonic hydroids, *Clytia gracilis*, but they compose only about 4.1% of the diet by weight. Hydroid consumption was not related to fish size and they were found in the stomachs of fish measuring approximately 100-400 mm in length (Avent *et al*. 2001).

For inshore diet studies, see Table, below.

Table 49. Major prey items of winter flounder (*Pseudopleuronectes americanus*)

Life Stage	Major prey	Location
Juveniles, small adults, ≤ 30 cm	**Cnidarians**: hydroids **Polychaetes**: Ampharetidae, Sabellidae, Maldanidae, *Trichobranchus glacialis*, *Lumbrineris fragilis*, *Nereis* sp. **Crustaceans**: amphipods (*Ericthonius* sp., *Unciola irrorata*, *Leptocheirus pinguis*, *Ampelisca agassizi*, *Byblis serrata, Aeginina longicornis*)	U.S. northeast continental shelf
Adults, ≥ 31 cm	**Cnidarians**: anthozoans, hydroids, sea anemones **Polychaetes** **Crustaceans**: amphipods (*Pontogeneia inermis*, *Unciola irrorata*, *Leptocheirus pinguis*, *Aeginina longicornis*) **Mollusks**: bivalves	U.S. northeast continental shelf
INSHORE SURVEYS		
Juveniles	**Crustaceans**: ostracods, copepods, amphipods, isopods, "shrimp"	Woods Hole harbor, MA (Linton 1921)
Juveniles, adults	**Polychaetes**: *Nereis* sp., *Glycera* sp., *Capitella* sp. **Crustaceans**: amphipods (*Ampelisca* sp.), decapods (*Pagurus* sp., *Crangon septemspinosa*) **Mollusks**: bivalves (*Macoma* sp., *Solemya* sp., *Mya* siphons)	Woods Hole harbor, MA (Lux *et al*. 1996)
Ages 1+	**Polychaetes** **Crustaceans**: amphipods **Mollusks**: bivalves (*Nucula proxima, Tellina agilis, Yoldia* sp.)	Buzzards Bay, MA (Frame 1974)
	Cnidarians: *Obelia* sp. **Crustaceans**: amphipods (*Unciola irrorata*, *Leptocheirus pinguis*)	Block Island Sound, RI (Smith 1950)
Juveniles, adults	**Cnidarians**: *Ceriantheopsis americanus* (tube anemone) **Polychaetes**: *Nephtys incisa, Pherusa affinis, Nereis* sp.	Narragansett Bay, RI (Bharadwaj

Life Stage	Major prey	Location
		1988)
Juveniles	**Polychaetes**: *Nereis* sp., spionids **Crustaceans**: amphipods (*Ampelisca* sp., *Lembos* sp.), isopods (*Edotea* sp.), tanaids (*Leptochelia* sp.)	Rhode Island coast (Mulkana 1966)
Juveniles	**Nematodes** **Polychaetes** **Crustaceans**: amphipods	Charles Pond, RI (Worobec 1984)
Larvae, metamporhosing, YOY, yearling	**Invertebrate eggs, nauplii** -- smaller larvae (3-6 mm): **Polychaetes, copepods --** larger larvae (6-8 mm): **Copepods, harpacticoids** -- metamorphosing and recently metamorphosed **Amphipods, polychaetes** -- YOY, yearling	Mystic River, CT estuary (Pearcy 1962)
Juveniles, adults	**Cnidarians**: hydroids **Polychaetes**: *Streblospio* sp. **Crustaceans**: amphipods (*Ampelisca abdita*), decapods (*Crangon septemspinosa*), mysid shrimp	New Haven Harbor, CT (Carlson 1991)
Juveniles	**Crustaceans**: amphipods *(Ampelisca abdita*)	Jamaica Bay, NY (Franz and Tanacredi 1992)
Juveniles	**Cnidarians**: hydroids **Nemerteans** **Polychaetes**: *Ampharete* sp., *Nereis succinea*, *Nephtys incise*, *Melinna cristata* **Crustaceans**: amphipods (*Leptocheirus pinguis*), decapods (mysid shrimp *Neomysis americana*)	Long Island Sound (Richards 1963)
Juveniles	**Nematodes** **Polychaetes** **Crustaceans**: ostracods, copepods, amphipods, isopods	Southern Long Island, NY (Tressler and Bere 1938)
Juveniles, adults	**Polychaetes**: sabellids, terebelllids **Crustaceans**: amphipods **Mollusks**: bivalves (clam siphons)	Southern Long Island, NY (Kurtz 1975)
Juveniles	**Polychaetes**: *Asabellides oculata* **Crustaceans**: amphipods (*Gammarus* sp.)	Raritan Bay, NY (Conover *et al*. 1985)

Life Stage	Major prey	Location
Juveniles, small adults, < 30 cm; adults, > 30 cm	Juveniles, small adults **Cnidarians**: hydroids **Polychaetes**: *Glycera* sp. **Crustaceans**: amphipods (*Ampelisca vadorum*, *Unciola* sp.), decapods (mysid shrimp *Neomysis americana*) **Mollusks**: bivalves (northern quahog siphons, Atlantic surfclam siphons, *Ensis directus*) Adults **Mollusks**: bivalves (northern quahog siphons, other bivalves) Other prey that may be important in the diet: **Nemerteans** **Polychaetes**: *Asabellides oculata* **Crustaceans**: amphipods (*Gammarus lawrencianus*, *Ampelisca abdita*, *Corophium* sp.), decapods (juvenile rock crab *Cancer irroratus*, *Crangon septemspinosa*) **Mollusks**: bivalves (blue mussel spat/juveniles)	Hudson-Raritan estuary (Steimle *et al*. 2000)
Juveniles, adults	**Polychaetes**: spionids, glycerids **Crustaceans**: copepods (the calanoid *Eurytemora affinis*), amphipods *(*ampeliscid), decapods (*Crangon septemspinosa*), mysid shrimp **Mollusks**: bivalves (*Mya* siphons)	Navesink River, Sandy Hook Bay (NJ) estuary (Stehlik and Meise 2000)
Juveniles, adults	**Nemerteans** **Polychaetes** **Crustaceans**: amphipods (*Ampelisca* sp.), decapods (*Palaemonetes* sp.) **Mollusks**: bivalves (clam siphons)	Little Egg Harbor, NJ (Festa 1979)
Juveniles, adults	**Polychaetes** **Crustaceans**: amphipods, isopods, decapods (*Crangon septemspinosa*) **Mollusks**: bivalves	Hereford Inlet, NJ (Allen *et al*. 1978)
Juveniles, adults	**Cnidarians**: hydroids **Polychaetes**: *Nereis succinea* **Crustaceans**: decapods (*Crangon septemspinosa*) **Mollusks**: bivalves (clam siphons) **Fish**: sand lance	Manasquan River, NJ (Scarlett and Giust 1989)
Juveniles, adults	**Cnidarians**: hydroids **Polychaetes**: *Nereis* sp., *Glycera* sp. **Crustaceans**: isopods (*Cyathura* sp.) **Mollusks**: bivalves (clam siphons)	Central NJ estuaries (Scarlett 1986, 1988)
Juveniles	**Polychaetes** **Crustaceans**: isopods (*Edotea* sp.)	Delaware Bay (de Sylva 1962)
	Polychaetes	Rehobeth

Life Stage	Major prey	Location
		Bay, DE (Timmons 1995)
Juveniles	**Polychaetes**: *Scolecolepides viridis*, *Nereis succinea* **Crustaceans**: amphipods (*Corophium lacustra*) **Mollusks**: bivalves (*Macoma* sp.)	Chesapeake Bay (Homer and Boynton 1978)

5.1.2.24 Winter Skate

The main source of information on the prey consumed by winter skate (*Leucoraja ocellata*) comes from the EFH Source Document (Packer *et al*. 2003 and references therein). Generally, polychaetes and amphipods are the most important prey items in terms of numbers or occurrence, followed by decapods, isopods, bivalves, and fishes. Hydroids are also ingested. In terms of weight, amphipods, decapods and fish can be most important; fish are especially prevalent in the larger winter skate. Bigelow and Schroeder (1953) reported rock crabs and squid as favorite prey, other items included polychaetes, amphipods, shrimps, and razor clams. The fishes that were eaten included smaller skates, eels, alewives, blueback herring, menhaden, smelt, sand lance, chub mackerel, butterfish, cunners, sculpins, silver hake, and tomcod.

McEachran (1973) studied skates collected from Nova Scotia to Cape Hatteras during 1967-1970; the following diet descriptions are from him and McEachran *et al*. (1976).

Nephtys spp., *Nereis* spp., *Lumbrineris fragilis*, *Ophelia denticulata*, and maldanids (mostly *Clymenella torquata*) were the most abundant polychaetes in the Mid-Atlantic Bight and Georges Bank stomachs. *Nephtys* spp., *Pectinaria* sp., *O. denticulata*, and *Aphrodite hastata* were the most frequently consumed prey in the Gulf of Maine and on the Nova Scotian shelf.

Haustoriids, *Leptocheirus pinguis*, *Monoculodes* sp., *Hippomedon serratus*, ampeliscids, *Paraphoxus* sp., and *Tmetonyx* sp. were the most frequently eaten amphipods over the survey area. *Crangon septemspinosa* was the most abundant decapod in the diet. *Cancer irroratus*, *Dichelopandalus leptocerus*, *Pagurus acadianus*, and *Hyas* sp. were consistently eaten but in small numbers.

Among the minor prey items included *Cirolana* (= *Politolana*?) *polita*, which was the dominant isopod. Other isopods eaten included *Chiridotea tuftsi* and *Edotea triloba*, but they contributed little to the overall diet. The only identifiable bivalves eaten were *Solemya* sp. and *Ensis directus*. The most frequently eaten fish was sand lance, while yellowtail flounder and longhorn sculpin were occasionally eaten.

Winter skate from Georges Bank had the most diverse diet and those from the Mid-Atlantic Bight the least diverse diet. There was no significant change in the diet with increase in skate size; however, the numbers of polychaetes gradually increased and amphipods gradually decreased with increasing skate size. The number of fish and bivalves also increased with predator size and the two taxa were a major part of the diet of skate > 79 cm TL. The ingestion of decapods was independent of skate size.

The 1973-1990 NEFSC food habits database for winter skate generally confirms the McEachran (1973) and McEachran *et al*. (1976) studies. Crustaceans made up > 50% of the diet for skate < 61 cm TL, while fish dominated the diet of skate > 91 cm TL. Overall crustaceans declined in importance with increasing skate size (includes both amphipods and decapods) while the percent occurrence of polychaetes increased with increasing skate size until the skate were about 81 cm TL. Amphipods occurred more frequently than decapods until the skates were > 71 cm TL. Among the most frequently occurring prey species for almost all sizes of skate included the decapods *C. septemspinosa* and *Cancer* and pagurid crabs, the isopod *Cirolana* (= *Politolana*?) *polita*, and sand lance. The following is a detailed description of the diet from the NEFSC food habits database broken down by winter skate size class.

For winter skate 21-30 cm TL, 74-84% of the diet consisted of crustaceans, with 38-43% of the diet consisting of identifiable amphipods. The most abundant amphipod species included *Unciola irrorata*, *Byblis serrata*, and *H. serratus*. Identifiable decapods made up 23-25% of the diet, most of which were species such as *C. septemspinosa* and *C. irroratus*. Identifiable polychaete species (9-13% of the diet) included *Ampharete arctica*. Identifiable isopod species (9% of the diet) included *Cirolana* (= *Politolana*?) *polita*. Nematodes, bivalves, and fish were included in the "other prey phyla" category (3-17% of the diet).

For skate 31-40 cm TL, 72-76% of the diet consisted of crustaceans, with 37-39% of the diet consisting of identifiable amphipods. Major amphipod species included *B. serrata*, *U. irrorata*, *H. serratus*, and several unidentified haustoriids. Identifiable decapods made up 17-23% of the diet, most of which were *C. septemspinosa* and *C. irroratus*. Identifiable polychaetes (12-17% of the diet) included *Scalibregma inflatum*, *L. fragilis*, and unidentified maldanids. Identifiable isopods (5-8% of the diet) included *Cirolana* (= *Politolana*?) *polita*. Miscellaneous items (6-9% of the diet) included nematodes and bivalves. Among the identifiable fish present in the diet (3-4%) were sand lance, yellowtail flounder, and hakes.

The percentage of crustaceans in the diet of winter skate 41-50 cm TL dropped to 62-69%, although identifiable amphipods still made up the major portion (33-35%) followed by decapods (14-22%). Identifiable polychaetes made up 19-23% of the diet; other prey species (including mollusca), 6-9% of the diet; identifiable isopods, 7% of the diet; and identifiable fish, 3-8% of the diet. All the major prey species (except for the lack of the polychaete *S. inflatum*) were similar to the 31-40 cm TL size class, with the additions of several more *Unciola* species, *L. pinguis* (an amphipod), unidentified pagurid crabs, and nephtyid polychaetes.

The percent occurrence of crustaceans in the diet of winter skate 51-60 cm TL dropped further, down to 53-54%, with identifiable amphipods making up only 26-32% of the overall diet. Some of the dominant identifiable amphipods included *Psammonyx nobilis*, unidentified oedicerotids, *H. serratus*, and unidentified haustoriids. Identifiable decapods made up only 9-12% of the diet; *C. septemspinosa* was again the dominant decapod prey, followed by *C. irroratus* and pagurid crabs. *Cirolana* (= *Politolana*?) *polita* was again one of the major identifiable isopods, which all together made up 7-12% of the diet. The percent occurrence of identifiable polychaetes continued to increase in the diet, up to 26-29%; several of the more numerous species present were in the genera *Nephtys* and *Nereis*. Identifiable fish also increased in the diet, up to 6-13%, with sand lance the dominant species. Other prey phyla, including bivalves and nematodes, accounted for 9-11% of the diet.

The percent occurrence of crustaceans in the diet continued to decline for winter skate 61-70 cm TL: down to 38-44%, with identifiable amphipods making up only 13-20% of the diet, while identifiable decapods made up 11-12%. Major amphipod species included *M. edwardsi*, *U. irrorata*, *H. serratus*, and unidentified haustoriids and oedicerotids. *C. septemspinosa* continued to be the dominant decapod prey, followed by *Cancer* and pagurid crabs. Identifiable isopods again made up 7-12% of the diet; *Cirolana* (= *Politolana*?) *polita* continued to be one of the major prey species. The percent occurrence of identifiable polychaetes in the diet increased, up to 28-32%; species in the genera *Nephtys* and *Nereis* were again dominant. The percent occurrence of identifiable fish in the diet continued to increase also, up to 11-24%, most of which were sand lance. Nine percent of the diet consisted of identifiable mollusks, with bivalves being dominant.

While the percent occurrence of crustaceans dropped to 29-36% for winter skate 71-80 cm TL, the percent occurrence of identifiable decapods was greater than the percent occurrence of amphipods: 11-13% versus 7-12%. The former were dominated by *C. septemspinosa*, *Cancer* and pagurid crabs, and *D. leptocerus*, while several haustoriid species and *U. irrorata* were some of the major amphipod prey. Identifiable isopods made up 8-9% of the diet, the dominant species continued to be *Cirolana* (= *Politolana*?) *polita*. Identifiable polychaetes (25-35% of the diet) included *L. fragilis* and several *Nephtys* and *Nereis* species. The percent occurrence of identifiable fish in the diet varied widely between the two sampling periods, from 16-36%, although sand lance was still the dominant species. Identifiable mollusks made up 9-10% of the diet, most of which were bivalves.

Fish as prey items became increasingly important for winter skate 81-90 cm TL. They made up 29-42% of the overall diet. As usual sand lance were the dominant fish prey, other species ingested included other skate, longhorn sculpin, and silver hake. Crustaceans in the diet declined to 19-30%. The major identifiable decapod species (8-11% of the diet) continued to be *C. septemspinosa* and *Cancer* and pagurid crabs as well as pandalid shrimp and *Ovalipes ocellatus*. The major identifiable amphipod species (3-8% of the total diet) were several haustoriid species. *Cirolana* (= *Politolana*?) *polita* was once again the dominant identifiable isopod (all isopods together made up 5-7% of the diet). Several *Nephtys* species were the major identifiable polychaetes ingested, all polychaetes together made up 22-28% of the diet. Bivalves, particularly of the familiy Solenidae, were the dominant identifiable molluscan prey ingested, with all mollusks together accounting for 7-17% of the diet.

Identifiable fish made up >50% of the diet of winter skate 91-100 cm TL. Sand lance was the overwhelming dominant, some of the minor fish prey included silver hake, herring, and butterfish. Crustaceans were down to 12-23% of the diet. Identifiable decapods made up 5-10% of the diet, *C. septemspinosa*, *Cancer* and pagurid crabs, *D. leptocerus*, and pandalid shrimp were some of the major decapods ingested. Identifiable amphipods made up only 4-5% of the total diet, with few conspicuous species. Identifiable polychaetes accounted for 10-13% of the diet, with the genus *Nephtys* the most notable. “Other prey phyla” and identifiable mollusks together accounted for 10-12% of the diet, bivalves and nematodes dominated this category.

Finally, identifiable fish made up > 60% of the diet of 101-110 cm TL winter skate from the 1981-1990 NEFSC trawl surveys. Most were sand lance. Mollusks were 14% of the diet, polychaetes were 13% of the diet, and crustaceans were down to 11% of the diet.

Jason Link (NOAA/NMFS/NEFSC, Woods Hole Laboratory, personal communication) has updated the food habits database from 1973-2005 and reports that the prey exceeding the 5% by weight threshold in the stomachs of juvenile and adult winter skate include: sand lance (17%), bivalve mollusks (13%), polychaetes (12%), other fish (8%), and gammarid amphipods (7%).

Using NEFSC data from 1977-1980, Bowman *et al*. (2000) found that in terms of percent weight, crustaceans were dominant in the diet of skate < 31-50 cm TL, while fish, mostly sand lance, were dominant in the diet of skate 51-110 cm TL. For skate < 31 cm TL, amphipods dominated, especially *L. pinguis*. For skate 31-50 cm TL, decapods dominated, especially *C. septemspinosa* and *C. irroratus*. On Georges Bank Tsou and Collie (2001a), using NEFSC dietary data from 1989-1990, also showed that fish, especially sand lance, were most important for winter skate > 50 cm TL. Other noted fish prey included sliver hake, mackerel, and herring (see also Tsou and Collie 2001b).

For inshore diet studies, see Table, below.

Table 50. Major prey items of winter skate (*Leucoraja ocellata*)

Life Stage	Major prey	Location
Juveniles, < 81 cm[1]	**Nematodes** **Polychaetes**: *Ampharete arctica*, Nephtyidae, *Scalibregma inflatum*, *Lumbrineris fragilis*, unidentified maldanids, Nereidae **Crustaceans**: amphipods (*Unciola irrorata* and spp., *Psammonyx nobilis*, *Monoculodes edwardsi*, *Leptocheirus pinguis*, *Hippomedon serratus*, *Byblis* serrata, unidentified haustoriids, unidentified oedicerotids, unidentified gammarids), isopods (*Cirolana* [= *Politolana*?] *polita*), decapods (*Crangon septemspinosa*, pagurid crabs, *Cancer irroratus* crabs, the pandalid shrimp *Dichelopandalus leptocerus*) **Mollusks**: bivalves **Fish**: sand lance	U.S. northeast continental shelf
Very large juveniles, adults, ≥ 81 cm[1]	**Nematodes** **Polychaetes**: Nephtyidae **Crustaceans**: amphipods (unidentified haustoriids, unidentified gammarids), isopods (*Cirolana* [= *Politolana*?] *polita*), decapods (*Crangon septemspinosa*, pagurid crabs, *Cancer* crabs, the lady crab *Ovalipes ocellatus*, pandalid shrimp including *Dichelopandalus leptocerus*) **Mollusks**: bivalves (Solenidae) **Fish**: sand lance, other skate, longhorn sculpin, silver hake, herring, butterfish	U.S. northeast continental shelf
INSHORE SURVEYS		
	Polychaetes: *Nephtys incisa*, *Nereis* sp., *Lumbrineris* sp. **Crustaceans**: amphipods (*Leptocheirus pinguis*, *Monoculodes edwardsi*), decapods (*Crangon septemspinosa*, *Cancer irroratus*) **Mollusks**: *Ensis directus*	Block Island Sound, RI (Smith 1950)
Juveniles	**Crustaceans**: decapods (*Crangon septemspinosa*, *Cancer irroratus*, the lady crab *Ovalipes ocellatus* **Fish**: sand lance, longhorn sculpin, Atlantic herring, winter flounder	Hudson-Raritan estuary (Steimle *et al*. 2000)

[1] From NEFSC food habits database in Packer et al. (2003) and Figure 3 therein, and J. Link (pers. comm.). For a list of other major prey species from other studies, see text.

5.1.2.25 Witch Flounder

The main source of information on the prey consumed by the juvenile and adult stages of witch flounder (*Glyptocephalus cynoglossus*) comes from the EFH Update Memo and EFH Source Document (Essential Fish Habitat Source Document Update Memo: Witch Flounder, *Glyptocephalus cynoglossus*, Life History and Habitat Characteristics, 2006; Cargnelli *et al*. 1999, and references therein). The main food items in the witch flounder diet are polychaetes and crustaceans, although mollusks and echinoderms are also important. Overall, polychaetes were by far the most important food item, accounting for greater than 70% of the diet. However, there is a distinct ontogenetic shift in diet, with polychaetes increasing in importance and crustaceans decreasing in importance with age. By sexual maturity, polychaetes dominate the diet considerably, while crustaceans are far less important.

The 1973-1990 NEFSC food habits data for witch flounder verify that polychaetes are the most important food source of witch flounder. During 1973-1980, small (5-30 cm) witch flounder fed primarily on polychaetes (37%) and crustaceans (27%). Polychaetes remained the most important food source among larger (> 30 cm) individuals; however, crustaceans declined in importance, replaced in the diet by mollusks and echinoderms. The 1981-1990 data also show that polychaetes dominate the witch flounder diet. Again, an ontogenetic shift in diet is evident, although this shift contrasts with that described above: crustaceans increase in importance while polychaetes decrease in importance in larger fish.

Jason Link (NOAA/NMFS/NEFSC, Woods Hole Laboratory, personal communication) has updated the food habits database from 1973-2005 and reports that the only prey exceeding the 5% by weight threshold in the stomachs of juvenile and adult witch flounder was polychaetes (71%).

Bowman and Michaels (1984) reported that the major food items of smaller juveniles (< 20 cm) were crustaceans (74% of the diet), while polychaetes accounted for only 19%. However, larger juveniles (21-30 cm) fed primarily on polychaetes (45-65%) followed by crustaceans (15-37%). Mollusks and echinoderms were consumed in smaller quantities (0-5%) (Bowman and Michaels 1984). Adults 31-60 cm fed primarily on polychaetes (60-66%) and echinoderms (6-18%), with crustaceans, mollusks, and coelenterates accounting for a smaller part of the diet. Adults > 60 cm fed almost exclusively on polychaetes (98%) (Bowman and Michaels 1984). There is little variation in diet with geographic area. An exception is southern New England, where squid can be almost as important a food source as polychaetes.

Using the NEFSC food habits database from 1977-1980, Bowman *et al*. (2000) showed that in all areas sampled, polychaetes made up at least 75% of the stomach contents by weight. The primary prey of juveniles < 30 cm were polychaetes (Lumbrineridae, including *Lumbrineris fragilis*; Sternaspidae), followed by ascidians and crustaceans (amphipods). Polychaetes also dominated the diets of all the adult size classes; family/species included Lumbrineridae, including *Lumbrineris fragilis* and *Ninoe brevipes*; *Nephtys* sp.; *Glycera dibranchiata*, Goniadidae, including *Goniada* sp. and *Ophioglycera gigantea*; Terebellidae; and Capitellidae. Other important prey included bivalves (*Yoldia* sp.) for adults 36-40 cm, and echinoderms (sea cucumbers) for fish 56-60 cm.

Table 51. Major prey items of witch flounder (*Glyptocephalus cynoglossus*)

Life Stage	Major prey	Location
Juveniles, < 30 cm	**Polychaetes**: (Lumbrineridae, including *Lumbrineris fragilis*; Sternaspidae) **Crustaceans**: amphipods	U.S. northeast continental shelf
Adults, ≥ 30 cm	**Polychaetes**: (Lumbrineridae, including *Lumbrineris fragilis* and *Ninoe brevipes*; *Nephtys* sp.; *Glycera dibranchiata*, Goniadidae, including *Goniada* sp. and *Ophioglycera gigantea*; Terebellidae; and Capitellidae)	U.S. northeast continental shelf

5.1.2.26 Yellowtail Flounder

The main source of information on the prey consumed by the juvenile and adult stages of yellowtail flounder (*Limanda ferruginea*) comes from the EFH Update Memo and EFH Source Document (Essential Fish Habitat Source Document Update Memo: Yellowtail Flounder, *Limanda ferruginea*, Life History and Habitat Characteristics, 2006; Johnson *et al*. 1999, and references therein). The 1973-2001 NEFSC food habits database for yellowtail flounder shows that polychaetes comprised approximately 35% of the adult yellowtail diet. This was closely followed by amphipods (29%). Unidentified well-digested prey accounted for > 20% of the total diet, other items occurring in lower volumes include bivalves, cnidarians, decapods, and mysids. Other studies mention echinoderms (sand dollars, *Echinarachius parma*) as well. Jason Link (NOAA/NMFS/NEFSC, Woods Hole Laboratory, personal communication) has updated the food habits database from 1973-2005 and reports that the prey exceeding the 5% by weight threshold in the stomachs of juvenile and adult yellowtail flounder include: polychaetes (38%), gammarid amphipods (19%), and other amphipods (6%).

Bowman *et al*. (2000) summarized the diet composition of yellowtail flounder, based on the NEFSC bottom trawl surveys from 1977-1980 by both length and geographic area. Juveniles 6-25 cm ate primarily polychaetes and crustaceans. Polychaete prey included *Ampharete arctica*, *Ophelia* sp. and Sigalionidae. Crustacean prey included amphipods (*Unicola irrorata,* Oedicerotidae) and decapods (*Crangon septemspinosa*). Large juveniles/small adults 26-30 also preyed primarily on polychaetes (*Spiophanes bombyx*, Nephtyidae) and crustaceans (amphipods, including *Unicola irrorata* and *Dulichia* sp.; the decapod *Crangon septemspinosa*); nemertians (phylum Rhynchocoela) were also significant in the diet. Adults ≥ 31 cm consumed primarily polychaetes and crustaceans, as well as tube anemones. Polychaete prey including mostly *Spiophanes bombyx*, but also *Drilonereis* sp. Crustacean prey was mostly amphipods, including *Leptocheirus pinguis*, *Ericthonius rubricornis*, and gammarids, including *Gammarus annulatus*. Of the geographic areas sampled, polychaetes were the most selected prey type on Georges Bank, followed by crustaceans. In southern New England and inshore north of Cape Hatteras, the most selected prey choice was crustaceans, followed by polychaetes. The decapod *Crangon septemspinosa* was only eaten in significant quantities inshore north of Cape Hatteras, while tube anemones were only important in southern New England.

A similar dietary analysis by Link *et al*. (2002) focused on flatfish of the northwest Atlantic taken during the NEFSC bottom trawl surveys from 1973-1998 for all seasons. In this study, juvenile and adult yellowtail flounder consumed primarily polychaetes, gammarid and other amphipods, and other benthic invertebrates. Unclassified amphipods and unidentified digested prey comprised 10% of the total diet. There were no significant ontogenetic shifts in diet across the 25-year time series.

Table 52. Major prey items of yellowtail flounder (*Limanda ferruginea*)

Life Stage	Major prey	Location
Juveniles, 6-25 cm	**Polychaetes**: *Ampharete arctica*, *Ophelia* sp., Sigalionidae **Crustaceans**: amphipods (*Unicola irrorata,* gammarids, Oedicerotidae), decapods (*Crangon septemspinosa*)	U.S. northeast continental shelf
Large juveniles/small adults, 26-30 cm	**Nemerteans** **Polychaetes**: *Spiophanes bombyx*, Nephtyidae **Crustaceans**: amphipods (*Unicola irrorata, Dulichia* sp., gammarids), decapods (*Crangon septemspinosa*)	U.S. northeast continental shelf
Adults, $\geq$ 31 cm	**Cnidarians**: tube anemones (Ceriantharia) **Polychaetes**: *Spiophanes bombyx*, *Drilonereis* sp. **Crustaceans**: amphipods (*Leptocheirus pinguis*, *Ericthonius rubricornis*, *Gammarus annulatus*, gammarids)	U.S. northeast continental shelf

5.1.3 Major Prey Species Maps

Maps showing the locations of the major prey species listed in **Table 27** through **Table 52** are found in Appendix C. See Section 5.1.1.2 for mapping methods.

5.2 Evaluation of the Potential Impact of Non-Fishing Activities on EFH

5.2.1 Impacts to Habitat

Habitat alteration and disturbance occurs from natural processes and human activities. Deegan and Buchsbaum (2005) placed human impacts to marine habitats into three categories: 1) permanent loss; 2) degradation and; 3) periodic disturbance. Permanent loss of habitat can result from activities such as wetland filling, coastal development, harbor dredging and offshore mining operations (Robinson and Pederson 2005). These activities lead to a loss of habitat quantity (Deegan and Buchsbaum 2005). Habitat degradation may be caused by physical changes, such as increased suspended sediment loading, overshadowing from new piers and wharves, as well as introduction of chemical contamination from land-based human activities (Robinson and Pederson 2005). Periodic disturbances are created by activities such as trawling and dredging for fish and shellfish, and maintenance dredging of navigation channels. Habitat degradation and periodic disturbances result in a loss of habitat quality.

Losses of habitat quantity and quality may reduce the ability of a region to support healthy and productive fish populations. The difference is that permanent loss is irreversible, habitat degradation may or may not be reversible, and periodic disturbance is generally reversible once the source of disturbance is removed (Deegan and Buchsbaum 2005). Deegan and Buchsbaum (2005) state that recovery times for degraded habitat depend on the nature of the agent causing the degradation and the physical characteristics of the habitat. Recovery times for periodic disturbances will vary depending on the intensity and periodicity of the disturbance and the nature of the habitat itself. Superimposed on these human-related alterations are natural fluctuations in habitats, such as storms, and long term climatic changes.

Habitat quantity is a measure of the total area available, while habitat quality is a measure of the carrying capacity of an existing habitat (Deegan and Buchsbaum 2005). The degradation of habitat quality, such as through siltation and alteration of salinity, food webs and flow patterns, may be just as devastating to the biological community as a loss in quantity (Deegan and Buchsbaum 2005). The physical structure of the habitat does not need to be directly altered for negative consequences to occur (Deegan and Buchsbaum 2005).

Habitat loss and degradation are interrelated because habitat loss is the ultimate end point of gradual declines in habitat quality (Deegan and Buchsbaum 2005). From the population perspective, the loss of habitat quantity and quality creates stress on that population. Populations stressed by one factor are generally more susceptible to additional stresses caused by other factors (Robinson and Pederson 2005).

The review by Lotze *et al.* (2006) shows that severe depletion (50 percent abundance level) of marine resources first began with the onset of European colonization. Lotze *et al.* (2006) found that 45 percent of species depletions and 42 percent of extinctions involved multiple human impacts, mostly exploitation and habitat loss. Seventy eight percent of resource recoveries are attributed to both habitat protection and restricted exploitation. Only 22 percent of recoveries are attributed to reduced exploitation alone (Lotze *et al*. 2006). Therefore, Lotze *et al.* (2006) conclude that reduced exploitation, habitat protection, and improved water quality need to be considered together, and the cumulative effects of multiple human interventions must be included in both management and conservation strategies.

5.2.2 Essential Fish Habitat

In 1996, the United States Congress declared that "one of the greatest long-term threats to the viability of the commercial and recreational fisheries is the continuing loss of marine, estuarine, and other aquatic habitats. Habitat considerations should receive increased attention for the conservation and management of fishery resources of the United States." Along with this declaration, Congress added new habitat conservation provisions to the Magnuson-Stevens Fishery Conservation and Management Act (MSA), the federal law that governs U.S. marine fisheries management. The MSA requires that any fishery management plan (FMP) describe and identify essential fish habitat, minimize adverse effects on habitat caused by fishing, and identify other actions to encourage the conservation and enhancement of such habitat. Essential fish habitat (EFH) has been defined as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity."

The MSA also requires federal agencies to consult with the Secretary of Commerce, acting through the National Oceanic and Atmospheric Administration – National Marine Fisheries Service (NMFS), on all actions authorized, funded, or undertaken, or proposed to be authorized, or undertaken, by the agency, that may adversely affect EFH. The process developed for conducting these EFH consultations is described in the EFH regulations [50 CFR 600.905 – 920]. In summary, Federal agencies initiate consultation by preparing and submitting an EFH Assessment to NMFS which describes the action, analyzes the potential adverse effects of the action on EFH, and provides the agency's conclusions regarding the effects of the action on EFH. In response, NMFS provides the agencies conservation recommendations to conserve EFH by avoiding, minimizing, mitigating, or otherwise offsetting the adverse effects to EFH. Adverse effect is defined as any impact which reduces the quality and/or quantity of EFH. Adverse effects may include direct or indirect physical, chemical, or biological alterations of the waters or substrate and loss of, or injury to benthic organisms, prey species, and their habitat, and other ecosystem components. Adverse effects may be site- specific or habitat-wide impacts, including individual, cumulative, or synergistic consequences of actions [50 CFR 600.910(a)].

Once NMFS provides conservation recommendations, the federal action agencies must provide a detailed response in writing to NMFS. The response must include measures proposed for avoiding, mitigating, or offsetting the impact of a proposed activity on EFH. If the federal action agency chooses not to adopt NMFS' conservation recommendations it must explain its reasons for not following the recommendations.

5.2.3 Report on Impacts to Marine Fishery Habitats from Non-Fishing Activities

The *Impacts to Marine Fishery Habitats in the New England and Mid-Atlantic Regions from Non-Fishing Activities* report is a manuscript in preparation by the Habitat Conservation Division at NMFS’ Northeast Regional Office. The development of this report is based on a workshop organized and hosted by NMFS, the New England Fishery Management Council, and the Atlantic States Marine Fisheries Commission in Mystic, CT in January 10-12, 2005 (Appendix D).

The purpose of this report is to:

1. Identify human activities that may adversely impact essential fish habitat (EFH). Since Stevenson *et al.* (2004) characterized the impacts to EFH from fishing activities in the Northeast region of the U.S., the focus of this report is on non-fishing activities;
2. Review and characterize existing scientific information regarding human induced impacts to EFH;
3. Provide best management practices (BMPs) and conservation measures that can be implemented for specific types of activities which avoid or minimize adverse impacts to EFH;
4. Provide a comprehensive reference document for use by federal and state marine resource managers, permitting agencies, professionals engaged in marine habitat assessment activities, the regulated community, and the public, and to;
5. Insure that the best scientific information is available for use in making sound decisions with respect to project planning, environmental assessment, and permitting.

One of the goals of this report was to provide technical information and references that could be used by governmental agencies and resource managers, and private industry and their consultants in the preparation of environmental assessment documents, such as environmental impact statements and EFH assessments. In addition, it is hoped this report will assist NMFS habitat specialists in: 1) reviewing proposed projects; 2) considering potential impacts that may adversely affect EFH; and 3) providing consistent and scientifically supported EFH conservation recommendations. This report may also provide insight for the public and the regulated community on the issues of concern to NMFS along with approaches to design and implementation of projects that avoid and minimize adverse effects to fish habitat.

The report is organized by activities that may potentially impact EFH occurring in riverine, estuarine/coastal, and marine/offshore areas. The initial chapter describes the technical workshop that was conducted, and presents the results of those discussions and habitat impact evaluations. The major activities that were identified as impacting fishery habitat in these areas include:

- Coastal Development
- Energy-Related Activities
- Alterations to Freshwater Systems
- Marine Transportation
- Offshore Dredging and Disposal
- Physical and Chemical Effects of Water Intake and Discharge Facilities
- Agriculture and Silviculture
- Introduced/Nuisance Species and Aquaculture
- Global Affects and Other Impacts

Each subsequent chapter is dedicated to the characterization of impacts associated with the major activities listed above. Each chapter describes the adverse effects on fishery habitat and the species associated with those habitats caused by an activity, provides the scientific references to support those findings, and concludes with conservation measures and BMPs that could be implemented to avoid or minimize those particular adverse effects. Although the preparers of this report have attempted to characterize the current knowledge of impact assessment from existing and potential activities in the coastal areas of the Northeast region of the U.S., the readers should not consider the information in the report as comprehensive for all activities and impacts on fishery habitats. For more detailed analyses and understanding, the readers should refer to the cited references and most current literature regarding specific activities and impacts.

The conservation measures and BMPs included with each activity present a series of measures that can be undertaken to avoid or minimize impacts to EFH. Not all of these suggested measures are necessarily applicable to every proposed project or activity that may adversely affect EFH. More specific or different measures based on the best and most current scientific information may be developed as part of the project planning or regulatory process. The conservation measures and BMPs provided represent a generalized menu of the types of measures that can contribute to the conservation of coastal aquatic habitats and EFH. The final chapter contains a brief discussion of the purpose and application of compensatory mitigation used to offset unavoidable adverse effects on EFH.

Each chapter has been developed as a potential stand-alone document so many of the impact types and effects described in one chapter may be found in other chapters containing similar impacts. This format was chosen so that the reader could remain focused on one category of activities without having to search other chapters for applicable discussions. Therefore, the reader will find some redundancy in the various chapters.

5.2.4 Technical Workshop

The workshop, entitled *Technical Workshop on Impacts to Coastal Fishery Habitat from Non-Fishing Activities*, convened a group of experts in the field of environmental, marine habitat and fisheries impact assessment from federal and state government agencies. The goals of the workshop were to: 1) describe known and potential adverse effects of human induced, non-fishing, activities on fisheries habitats; 2) create a matrix on the degree of impacts associated with various activities in riverine, estuarine, and marine habitats and; 3) develop a suite of best management practices and conservation recommendations that could be used to avoid or minimize adverse impacts to fisheries habitats.

The specific goals/tasks of the technical workshop included:

1) Identify all known and potential adverse effects for each category of non-fishing activity by life history strategies or stages (i.e., benthic/demersal and pelagic) and ecosystem strata (i.e., riverine, estuarine, and marine). This list of activities may also include adverse impacts to identified prey species or other specific life history requirements for species.
2) Create a matrix of non-fishing impacts for life history strategies/stages and ecosystem strata and ask the participants of the workshop to score the intensity of each impact using a relative scoring method.
3) Develop a suite of conservation recommendations or BMPs intended to avoid and minimize the adverse effects on fishery habitat and resources.

The format of the two-day workshop consisted of a series of breakout sessions, attended by the workshop participants, which represented the primary categories of non-fishing activities believed to threaten fishery resources and habitats in the northeast coast. There were ten separate breakout sessions conducted during the workshop, which are reflected in the chapters of this report. For each of the breakout sessions, a matrix of activities and known or potential adverse effects to fishery habitat, prepared by the workshop organizers, was reviewed by the workshop participants. The participants were encouraged to openly discuss and evaluate the relevance and significance for each of the activities and effects, and to provide any additional activities and effects not included in the matrix. A large number of non-fishing activities occur within the coastal region, and those activities have a wide range of effects and intensities on fishery habitat. In order to identify the importance of life history requirements of species and the physical and chemical differences of the coastal environments for which fishery resources occur, each impact type and effect was evaluated in the context of life history strategies or stages (i.e., benthic and demersal) and ecosystem stata (i.e., riverine, estuarine/nearshore, and marine/offshore). Following an open discussion, the participants were asked to score, by life history strategies/stages and ecosystem stata, the various activities and adverse effects on the impact matrix. In addition, participants were asked to include specific and relevant "conservation recommendations" or BMPs to avoid and minimize adverse effects to fishery habitat and resources.

The results of the scoring from the workshop sessions are listed in Table 53 through Table 62 might be expected, there were positive correlations between the highest scoring effects and the ecosystem types that those activities take place. For example, the high scoring effects in the Alteration to Freshwater Systems and Agriculture and Silviculture sessions were generally all in the Riverine ecosystem. Except for the Offshore Dredging and Disposal session, there were fewer effects that were scored as high in the Marine/Offshore ecosystem compared to the Riverine and Estuarine/Nearshore ecosystems. This suggests the workshop participants view the intensity of effects from non-fishing impacts to decrease as the distance from the coastline and activity increases. As one might expect, many of the far field effects scored as high were those activities that effect the water column (e.g., ocean noise, impacts to water quality, nutrient release) or effects that are capable of being transported by currents (oil spills or drilling mud releases). In addition, the Global Effects and Other Impacts session had high scores more evenly distributed across all ecosystems due to the nature of the impacts discussed in this session (e.g., climate change, atmospheric deposition, ocean noise).

Table 53. Habitat Impact Categories in Coastal Development Workshop Session

IMPACT TYPE	POTENTIAL EFFECTS	HABITAT IMPACT CATEGORIES (HIC)					
		LIFE HISTORY/ECOSYSTEM TYPE					
		Benthic/Demersal Stages			Pelagic Stages		
		Riverine	Estuarine/Nearshore	Marine/ Offshore	Riverine	Estuarine/Nearshore	Ma Off
Nonpoint Source Pollution and Urban Runoff	Nutrient loading/eutrophication	H	H	M	H	H	
	Loss/alteration of aquatic vegetation	H	H	L	H	H	
	Release of petroleum products (PAH)	M	M	M	M	M	
	Alteration to water alkalinity	M	M	L	M	M	
	Release of heavy metals	H	H	M	M	H	
	Release of radioactive wastes	M	M	L	M	M	
	Release of pesticides	H	H	M	H	H	
	Release of pharmaceuticals	H	M	L	H	H	
	Alteration to temperature regimes	H	M	L	H	M	
	Sedimentation/turbidity	H	H	L	H	H	
	Altered hydrological regimes	M	M	L	M	M	
	Introduction of pathogens (bacterial loading)	M	M	L	M	M	
Road Construction and Operation	Release of fine sediments in aquatic habitat	H	M	L	M	M	
	Increased sedimentation/turbidity	H	H	L	H	H	
	Impaired fish passage	H	M	L	H	H	
	Altered hydrological regimes	H	H	L	H	H	
	Altered temperature regimes	H	M	L	H	M	
	Altered stream morphology	H	M	L	H	M	
	Altered stream bed characteristics	H	M	L	H	M	

IMPACT TYPE	POTENTIAL EFFECTS	HABITAT IMPACT CATEGORIES (HIC)					
		LIFE HISTORY/ECOSYSTEM TYPE					
		Benthic/Demersal Stages			Pelagic Stages		
		Riverine	Estuarine/Nearshore	Marine/ Offshore	Riverine	Estuarine/Nearshore	Ma Off
	Reduced dissolved oxygen	H	H	L	H	H	
	Introductions of exotic invasive species	M	M	L	M	M	
	Loss/alteration of aquatic vegetation	H	H	L	H	H	
	Altered tidal regimes	H	H	L	H	M	
	Contaminant releases	M	M	L	M	M	
	Fragmentation of habitat	H	M	L	H	H	
	Altered salinity regimes	M	M	L	M	M	
Flood Control/Shoreline Protection	Altered hydrological regimes	H	H	L	H	M	
	Altered temperature regimes	M	M	L	M	M	
	Altered stream morphology	H	M	L	H	M	
	Altered sediment transport	H	H	L	H	H	
	Alteration/loss of benthic habitat	H	H	L	M	M	
	Reduction of dissolved oxygen	M	M	L	M	M	
	Impaired fish passage	H	M	L	H	M	
	Alteration in natural communities	H	M	L	M	M	
	Impacts to riparian habitat (bank stabilization)	H	M	L	H	M	
	Loss of intertidal habitat	H	H	L	M	H	
	Reduced ability to counter sea level rise	H	H	L	M	H	
	Increased erosion/accretion	H	H	L	H	H	
Beach Nourishment	Altered hydrological regimes	M	M	L	M	M	
	Altered temperature regimes	L	L	L	L	L	
	Altered sediment transport	M	M	L	M	M	

IMPACT TYPE	**POTENTIAL EFFECTS**	**HABITAT IMPACT CATEGORIES (HIC)**					
		LIFE HISTORY/ECOSYSTEM TYPE					
		Benthic/Demersal Stages			**Pelagic Stages**		
		Riverine	**Estuarine/Nearshore**	**Marine/ Offshore**	**Riverine**	**Estuarine/Nearshore**	**Ma Off**
	Alteration/loss of benthic habitat	M	M	L	L	M	
	Alteration in natural communities	M	M	M	L	M	
	Increased sedimentation/turbidity	M	M	L	M	M	
Wetland Dredging and Filling	Alteration/loss of habitat	H	H	L	H	H	
	Loss of submerged aquatic vegetation	H	H	L	M	H	
	Altered hydrological regimes	H	H	L	H	H	
	Reduction of dissolved oxygen	M	M	L	M	M	
	Release of nutrients/eutrophication	M	M	L	M	M	
	Release of contaminants	M	M	L	M	M	
	Altered tidal prism	M	M	L	M	M	
	Altered current patterns	M	M	L	M	M	
	Altered temperature regimes	M	M	L	M	M	
	Loss of wetlands	H	H	L	H	H	
	Loss of fishery productivity	H	H	L	H	H	
	Introduction of invasive species	M	M	L	M	M	
	Loss of flood storage capacity	H	H	L	H	H	
	Increased sedimentation/turbidity	M	M	L	M	M	
Overwater Structures	Shading impacts to vegetation	M	M	L	M	M	
	Altered hydrological regimes	M	M	L	M	M	
	Contaminant releases	M	M	L	M	M	
	Benthic habitat impacts	M	M	L	M	M	
	Increase erosion/accretion	M	M	L	M	M	

IMPACT TYPE	POTENTIAL EFFECTS	HABITAT IMPACT CATEGORIES (HIC)					
		LIFE HISTORY/ECOSYSTEM TYPE					
		Benthic/Demersal Stages			Pelagic Stages		
		Riverine	Estuarine/Nearshore	Marine/ Offshore	Riverine	Estuarine/Nearshore	Ma Off
	Eutrophication due to bird roosting	M	M	L	M	M	
	Shellfish closures due to bird roosting	H	M	L	M	M	
	Changes in predator/prey interactions	H	H	L	H	H	
Pile Driving and Removal	Energy Impacts (i.e. sound and vibration)	M	M	L	M	M	
	Benthic habitat impacts	M	M	L	M	M	
	Increased sedimentation/turbidity	M	M	L	M	M	
	Contaminant releases	M	M	L	M	M	
	Shading impacts to vegetation	M	M	L	M	M	
	Changes in hydrological regimes	M	M	L	M	M	
	Changes in species composition	M	M	L	M	M	
Marine Debris and Illegal Dumping	Entanglement	M	M	L	M	M	
	Ingestion	L	M	L	M	M	
	Contaminant releases	L	M	L	L	M	
	Introduction of invasive species	M	M	L	M	M	
	Introduction of pathogens (e.g. medical wastes)	L	M	L	L	M	
	Conversion of habitat (e.g. tires on ocean floor)	L	M	L	L	M	

Table 54. Habitat Impact Categories in Energy-Related Activities Workshop Session

IMPACT	POTENTIAL EFFECTS	HABITAT IMPACT CATEGORIES (HIC)

		LIFE HISTORY/ECOSYSTEM TYPE					
		Benthic/Demersal Stages			**Pelagic Stages**		
		Riverine	**Estuarine/Nearshore**	**Marine/ Offshore**	**Riverine**	**Estuarine/Nearshore**	**Marine/ Offshore**
Petroleum Exploration, Production and Transportation	Underwater noise	M	M	M	M	M	M
	Habitat conversion	H	H	H	H	H	M
	Loss of benthic habitat	M	H	M	M	M	M
	Contaminant discharge (e.g. bilge/ballast)	M	H	M	M	H	M
	Discharge of debris	M	M	M	M	M	L
	Oil spills	H	H	H	H	H	H
	Siltation/sedimentation/turbidity	M	M	M	M	M	M
	Resuspension of contaminants	M	H	M	M	M	L
	Impacts from clean-up activities	H	H	M	M	H	M
Liquified Natural Gas	Habitat conversion	H	H	M	M	M	M
	Loss of benthic habitat	H	H	M	M	M	L
	Discharge of contaminants	H	H	H	H	H	H
	Discharge of debris	M	M	M	M	M	L
	Siltation/sedimentation/turbidity	M	H	M	M	M	M
	Resuspension of contaminants	M	H	M	M	H	L
	Entrainment/Impingement	M	M	M	M	H	M
	Alteration in temperature regimes	M	M	L	M	M	L
	Alteration of hydrological regimes	M	M	L	M	M	L
	Underwater noise	M	M	M	H	H	M
	Release of contaminants (i.e. spills)	H	H	M	H	H	M
	Exclusion zone impacts (habitat?)	M	M	L	M	M	L
	Physical barriers to habitat	M	M	M	M	M	L
	Introduction of invasive species	H	H	M	H	M	M

IMPACT TYPE	POTENTIAL EFFECTS	HABITAT IMPACT CATEGORIES (HIC)					
		LIFE HISTORY/ECOSYSTEM TYPE					
		Benthic/Demersal Stages			Pelagic Stages		
		Riverine	Estuarine/Nearshore	Marine/ Offshore	Riverine	Estuarine/Nearshore	Marine/ Offshore
	Vessel impacts (e.g. need to dredge)	H	H	L	M	M	L
	Benthic impacts from pipelines	H	H	M	M	M	M
Offshore Wind Energy Facilities	Loss of benthic habitat	M	H	H	L	M	M
	Habitat conversion	M	H	H	L	M	M
	Siltation/sedimentation/turbidity	L	M	M	L	M	M
	Resuspension of contaminants	L	M	L	L	M	L
	Alteration of hydrological regimes	L	M	M	L	M	M
	Altered current patterns	L	M	M	L	M	M
	Alteration of electromagnetic fields	L	L	L	L	L	L
	Underwater noise	L	L	M	L	M	H
	Alteration of community structure	M	H	M	L	H	M
	Erosion around structure	L	M	M	L	L	L
	Spills associated with service structure	M	H	M	L	M	M
Wave/Tidal Energy Facilities	Habitat conversion	H	H	M	M	M	M
	Loss of benthic habitat	H	H	M	M	M	L
	Siltation/sedimentation/turbidity	M	H	M	M	M	L
	Resuspension of contaminants	M	M	L	M	M	L
	Alteration of hydrological regimes	M	M	M	M	H	L
	Altered current patterns	M	M	M	M	H	M
	Entrainment/Impingement (i.e. turbine)	M	M	L	H	H	M
	Impacts to migration	M	M	L	H	M	L

IMPACT TYPE	POTENTIAL EFFECTS	HABITAT IMPACT CATEGORIES (HIC)					
		LIFE HISTORY/ECOSYSTEM TYPE					
		Benthic/Demersal Stages			Pelagic Stages		
		Riverine	Estuarine/Nearshore	Marine/ Offshore	Riverine	Estuarine/Nearshore	Marine/ Offshore
	Electromagnetic fields	L	L	L	L	L	L
Cables and Pipelines	Loss of benthic habitat	H	H	M	L	M	L
	Habitat conversion	H	H	M	M	M	M
	Siltation/sedimentation/turbidity	M	H	M	M	M	M
	Resuspension of contaminants	H	H	M	M	M	M
	Altered current patterns	M	M	M	L	M	L
	Alteration of electromagnetic fields	L	L	L	L	L	L
	Underwater noise	L	L	L	L	M	M
	Alteration of community structure	M	M	M	M	M	M
	Erosion around structure	L	M	M	L	M	M
	Biocides from hydrostatic testing	M	M	M	M	M	M
	Spills associated with service structure	H	H	M	M	M	M
	Physical barriers to habitat	H	H	H	L	L	L
	Impacts to submerged aquatic vegetation	M	H	M	M	M	L
	Water withdrawal	M	M	L	H	H	L
	Impacts from construction activities	M	H	H	M	M	M
	Impact from maintenance activities	M	M	M	L	M	M
	Thermal impacts associated with cables	L	L	L	L	L	L
	Impacts associated with armoring of pipe	M	M	M	L	L	L

IMPACT TYPE	POTENTIAL EFFECTS	HABITAT IMPACT CATEGORIES (HIC)					
		LIFE HISTORY/ECOSYSTEM TYPE					
		Benthic/Demersal Stages			Pelagic Stages		
		Riverine	Estuarine/Nearshore	Marine/ Offshore	Riverine	Estuarine/Nearshore	Marine/ Offshore
	Impacts to migration	H	H	H	L	L	L

Table 55. Habitat Impact Categories in Alteration to Freshwater Systems Workshop Session

IMPACT TYPE	POTENTIAL EFFECTS	HABITAT IMPACT CATEGORIES (HIC)					
		LIFE HISTORY/ECOSYSTEM TYPE					
		Benthic/Demersal Stages			Pelagic Stages		
		Riverine	Estuarine/Nearshore	Marine/ Offshore	Riverine	Estuarine/Nearshore	Marine/ Offshore
Dam Construction/ Operation	Impaired fish passage	H	H	L	H	H	L
	Altered hydrological regimes	H	H	L	H	M	L
	Altered temperature regimes	H	H	L	H	M	L
	Altered sediment/LWD transport	H	M	L	H	M	L
	Altered stream morphology	H	M	L	H	M	L
	Altered stream bed characteristics	H	M	L	H	M	L
	Reduced dissolved oxygen	H	M	L	H	M	L
	Alteration of extent of tide	H	H	L	H	H	L
	Alteration of wetlands	H	H	L	H	H	L
	Change in species communities	H	M	L	H	M	L
	Bank erosion due to drawdown	M	L	L	M	L	L
	Riparian zone development	H	M	L	H	M	L
	Acute temperature shock from water	H	M	L	H	M	L

IMPACT TYPE	POTENTIAL EFFECTS	HABITAT IMPACT CATEGORIES (HIC)					
		LIFE HISTORY/ECOSYSTEM TYPE					
		Benthic/Demersal Stages			Pelagic Stages		
		Riverine	Estuarine/Nearshore	Marine/ Offshore	Riverine	Estuarine/Nearshore	Marine/ Offshore
	releases						
Dam Removal	Release of contaminated sediments	H	H	L	H	M	L
	Alteration of wetlands	H	M	L	H	M	L
Stream Crossings	Impacts to fish passage	H	M	L	H	M	L
	Alteration of hydrological regimes	H	M	L	H	M	L
	Bank erosion	H	L	L	M	L	L
	Habitat conversion	H	M	L	H	M	L
Water Withdrawal/ Diversion	Entrainment & Impingement	M	M	L	H	M	L
	Impaired fish passage	H	H	L	H	H	L
	Altered hydrological regimes	H	M	L	H	M	L
	Reduced dissolved oxygen	H	M	L	H	M	L
	Altered temperature regimes	H	H	L	H	M	L
	Release of nutrients/eutrophication	H	M	L	H	M	L
	Release of contaminants	H	M	L	H	M	L
	Altered stream morphology	H	L	L	H	M	L
	Altered stream bed characteristics	H	M	L	H	M	L
	Siltation/sedimentation/turbidity	H	M	L	H	M	L
	Change in species communities	H	M	L	H	H	L
	Alteration in groundwater levels	H	L	L	H	L	L
	Loss of forested/palustrine wetlands	H	L	L	H	L	L
	Impacts to water quality	H	M	L	H	M	L
	Loss of flood storage	M	L	L	M	L	L

IMPACT TYPE	POTENTIAL EFFECTS	HABITAT IMPACT CATEGORIES (HIC)					
		LIFE HISTORY/ECOSYSTEM TYPE					
		Benthic/Demersal Stages			Pelagic Stages		
		Riverine	Estuarine/Nearshore	Marine/ Offshore	Riverine	Estuarine/Nearshore	Marine/ Offshore
Dredging and Filling, Mining	Reduced flood water retention	H	M	L	H	M	L
	Reduced nutrient uptake and release	M	M	L	M	M	L
	Reduced detrital food source	H	M	L	M	M	L
	Altered hydrological regimes	H	M	L	H	M	L
	Increased storm water runoff	H	M	L	H	M	L
	Loss of riparian and riverine habitat	H	M	L	H	M	L
	Altered stream morphology	H	M	L	H	L	L
	Altered stream bed characteristics	H	M	L	H	M	L
	Siltation/sedimentation/turbidity	H	M	L	H	M	L
	Reduced dissolved oxygen	H	M	L	H	M	L
	Altered temperature regimes	H	M	L	H	M	L
	Release of nutrients/eutrophication	H	M	L	H	H	L
	Release of contaminants	H	M	L	H	M	L
	Loss of submerged aquatic vegetation	H	H	L	H	H	L
	Change in species communities	H	H	L	H	M	L

Table 56. Habitat Impact Categories in Marine Transportation Workshop Session

IMPACT TYPE	POTENTIAL EFFECTS	HABITAT IMPACT CATEGORIES (HIC)					
		LIFE HISTORY/ECOSYSTEM TYPE					
		Benthic/Demersal Stages			Pelagic Stages		
		Riverine	Estuarine/Nearshore	Marine/	Riverine	Estuarine/Nearshore	Marine/

Construction and Expansion of Ports and Marinas	Loss of benthic habitat	H	H	H	M	M	M
	Siltation/sedimentation/turbidity	H	H	M	M	M	M
	Contaminant releases	H	H	M	M	H	M
	Altered hydrological regimes	H	H	L	H	H	L
	Altered tidal prism	M	H	L	M	H	L
	Altered current patterns	M	M	L	M	M	L
	Altered temperature regimes	H	M	L	H	M	L
	Loss of wetlands	H	H	L	H	H	L
	Underwater blasting/noise	M	M	L	M	M	M
	Loss of submerged aquatic vegetation	H	H	M	H	H	M
	Conversion of substrate/habitat	H	H	M	M	M	M
	Loss of intertidal flats	H	H	L	L	M	L
	Loss of water column	M	M	L	H	H	L
	Altered light regime	M	M	L	M	M	L
	Derelict structures	M	M	L	M	M	L
Operations and Maintenance of Ports and Marinas	Contaminant releases	H	H	M	M	M	M
	Storm water runoff	H	H	M	M	M	L
	Underwater noise	M	M	L	M	M	L
	Alteration of light regimes	M	M	L	M	M	L
	Derelict structures	M	M	L	L	L	L
	Mooring impacts	M	M	L	L	L	L
	Release of debris	M	M	L	M	L	L
Operation and Maintenance of Vessels	Impacts to benthic habitat	H	H	L	M	M	L
	Resuspension of bottom sediments/turbidity	M	M	L	M	M	L
	Erosion of shorelines	M	M	L	M	M	L
	Contaminant spills and discharges	M	H	M	M	H	M

IMPACT TYPE	**POTENTIAL EFFECTS**	**HABITAT IMPACT CATEGORIES (HIC)**					
		LIFE HISTORY/ECOSYSTEM TYPE					
		Benthic/Demersal Stages			**Pelagic Stages**		
		Riverine	**Estuarine/Nearshore**	**Marine/ Offshore**	**Riverine**	**Estuarine/Nearshore**	**Marine/ Offshore**
	Underwater noise	M	M	M	M	M	M
	Derelict structures	M	M	L	L	L	L
	Increased air emissions	L	L	L	L	L	L
	Release of debris	M	M	L	L	L	L
Navigation Dredging	Conversion of substrate/habitat	H	H	M	M	M	L
	Loss of submerged aquatic vegetation	H	H	M	H	H	L
	Siltation/sedimentation/turbidity	H	H	M	H	M	L
	Contaminant releases	H	H	M	M	M	M
	Release of nutrients/eutrophication	M	M	M	M	M	L
	Entrainment and impingement	M	M	M	M	M	L
	Underwater blasting/noise	M	M	L	M	M	L
	Altered hydrological regimes	H	H	L	H	M	L
	Altered tidal prism	M	M	L	M	M	L
	Altered current patterns	M	M	L	M	M	L
	Altered temperature regimes	H	H	L	M	M	L
	Loss of intertidal flats	H	H	L	H	H	L
	Loss of wetlands	H	H	L	H	H	L
	Contaminant source exposure	M	M	M	M	M	L

Table 57. Habitat Impact Categories in Offshore Dredging and Disposal Workshop Session

IMPACT	**POTENTIAL EFFECTS**	**HABITAT IMPACT CATEGORIES (HIC)**

		LIFE HISTORY/ECOSYSTEM TYPE					
		Benthic/Demersal Stages			**Pelagic Stages**		
		Riverine	**Estuarine/Nearshore**	**Marine/ Offshore**	**Riverine**	**Estuarine/Nearshore**	**Marine/ Offshore**
Offshore Mineral Mining	Loss of benthic habitat types	L	L	H	L	L	M
	Conversion of substrate/habitat	L	L	H	L	L	L
	Siltation/sedimentation/turbidity	L	L	M	L	L	M
	Changes in bottom topography	L	L	M	L	L	L
	Changes in sediment composition	L	L	H	L	L	L
	Sediment transport from site (erosion)	L	L	M	L	L	L
	Impacts to water quality	L	L	M	L	L	M
	Release of contaminants	L	L	M	L	L	M
	Change in community structure	L	L	H	L	L	M
	Changes in water flow	L	L	M	L	L	M
	Noise impacts	L	L	L	L	L	M
Petroleum Extraction	Contaminant releases	L	L	H	L	L	H
	Drilling mud impacts	L	L	H	L	L	H
	Siltation/sedimentation/turbidity	L	L	M	L	L	M
	Release of debris	L	L	M	L	L	L
	Noise impacts	L	L	M	L	L	M
	Changes in light regimes	L	L	M	L	L	M
	Habitat conversion	L	L	M	L	L	M
	Pipeline installation	L	L	M	L	L	L
Offshore Dredge Material Disposal	Burial/disturbance of benthic habitat	L	M	H	L	L	M
	Conversion of substrate/habitat	L	L	H	L	L	M
	Siltation/sedimentation/turbidity	L	L	M	L	L	M

IMPACT TYPE	POTENTIAL EFFECTS	HABITAT IMPACT CATEGORIES (HIC)					
		LIFE HISTORY/ECOSYSTEM TYPE					
		Benthic/Demersal Stages			Pelagic Stages		
		Riverine	Estuarine/Nearshore	Marine/ Offshore	Riverine	Estuarine/Nearshore	Marine/ Offshore
	Release of contaminants	L	L	M	L	L	M
	Release of nutrients/eutrophication	L	L	M	L	L	M
	Altered hydrological regimes	L	L	M	L	L	M
	Altered current patterns	L	L	M	L	L	M
	Changes in bottom topography	L	L	M	L	L	L
	Changes in sediment composition	L	L	H	L	L	L
	Changes in water bathymetry	L	L	M	L	L	L
Fish Waste Disposal	Introduction of pathogens	L	L	H	L	L	H
	Release of nutrients/eutrophication	L	L	H	L	L	H
	Release of biosolids	L	L	H	L	L	M
	Loss of benthic habitat types	L	L	H	L	L	L
	Behavioral affects	L	L	M	L	L	M
Vessel Disposal	Release of contaminants	L	L	M	L	L	M
	Conversion of substrate/habitat	L	L	H	L	L	M
	Changes in bathymetry	L	L	M	L	L	L
	Changes in hydrodynamics	L	L	M	L	L	M
	Changes in community structure	L	L	H	L	L	M
	Impacts during deployment	L	L	M	L	L	M
	Release of debris	L	L	M	L	L	L

Table 58. Habitat Impact Categories in Chemical Effects: Water Discharge Facilities Workshop Session

IMPACT TYPE	POTENTIAL EFFECTS	HABITAT IMPACT CATEGORIES (HIC)					
		LIFE HISTORY/ECOSYSTEM TYPE					
		Benthic/Demersal Stages			Pelagic Stages		
		Riverine	Estuarine/Nearshore	Marine/ Offshore	Riverine	Estuarine/Nearshore	Marine/ Offshore
Sewage Discharge Facilities	Release of nutrients/eutrophication	H	H	H	H	H	H
	Release of contaminants	H	H	H	H	H	H
	Impacts to submerged aquatic vegetation	H	H	M	H	H	M
	Reduced dissolved oxygen	H	H	M	H	H	M
	Siltation/sedimentation/turbidity	H	H	M	H	H	M
	Impacts to benthic habitat	H	H	M	M	M	M
	Changes in species composition	H	H	M	H	H	M
	Trophic level alterations	H	H	M	H	H	M
	Introduction of pathogens	H	H	M	M	H	M
	Introduction of harmful algal blooms	H	H	H	H	H	M
	Contaminant bioaccumulation/biomagnification	H	H	H	H	H	M
	Behavioral avoidance	M	H	M	M	H	M
	Release of pharmaceuticals	M	M	M	M	M	M
Industrial Discharge Facilities	Alteration in water alkalinity	H	M	M	M	M	L
	Release of heavy metals	H	H	M	M	M	M
	Release of chlorine compounds	H	H	M	H	H	M
	Release of pesticides	H	H	M	H	H	M
	Release of organic compounds (e.g. PCBs)	H	H	H	M	H	M
	Release of petroleum products (PAH)	H	H	M	M	H	M
	Release of inorganic compounds	H	H	M	H	H	M
	Release of organic wastes	M	M	M	M	M	M

IMPACT TYPE	POTENTIAL EFFECTS	HABITAT IMPACT CATEGORIES (HIC)					
		LIFE HISTORY/ECOSYSTEM TYPE					
		Benthic/Demersal Stages			Pelagic Stages		
		Riverine	Estuarine/Nearshore	Marine/ Offshore	Riverine	Estuarine/Nearshore	Marine/ Offshore
	Introduction of pathogens	M	M	M	M	M	M
Combined Sewer Overflows	Potential for all of the above effects	H	H	H	H	H	H

Table 59. Habitat Impact Categories in Physical Effects: Water Intake and Discharge Facilities Workshop Session

IMPACT TYPE	POTENTIAL EFFECTS	HABITAT IMPACT CATEGORIES (HIC)					
		LIFE HISTORY/ECOSYSTEM TYPE					
		Benthic/Demersal Stages			Pelagic Stages		
		Riverine	Estuarine/Nearshore	Marine/ Offshore	Riverine	Estuarine/Nearshore	Marine/ Offshore
Discharge Facilities	Scouring of substrate at discharge point	M	M	L	L	L	L
	Turbidity/sedimentation	H	H	M	M	M	L
	Alteration of sediment composition	H	H	M	L	L	L
	Reduced dissolved oxygen	H	H	M	H	H	L
	Alteration of salinity regimes	H	H	L	H	H	M
	Alteration of temperature regimes	H	H	M	H	H	M
	Conversion/loss of habitat	M	M	M	M	M	M
	Habitat exclusion/avoidance	H	H	L	H	H	L
	Restrictions to migration	H	H	L	H	H	L
	Acute toxicity	M	H	M	H	H	M
	Behavioral changes	M	M	L	M	M	L

IMPACT TYPE	**POTENTIAL EFFECTS**	**HABITAT IMPACT CATEGORIES (HIC)**					
		LIFE HISTORY/ECOSYSTEM TYPE					
		Benthic/Demersal Stages			**Pelagic Stages**		
		Riverine	**Estuarine/Nearshore**	**Marine/ Offshore**	**Riverine**	**Estuarine/Nearshore**	**Marine/ Offshore**
	Cold shock	M	M	M	H	M	L
	Stunting of growth in fishes	M	M	L	M	M	L
	Attraction to flow	H	H	M	H	H	M
	Alteration of community structure	H	H	M	H	H	M
	Changes in local current patterns	M	M	L	M	M	L
	Physical/chemical synergies	M	H	M	M	M	M
	Increased need for dredging	H	H	L	H	H	L
	Ballast water discharge	H	H	M	M	M	M
	Gas-bubble disease/mortality	M	M	L	M	H	L
	Release of radioactive wastes	H	H	M	H	H	M
Intake Facilities	Entrainment/impingement	H	H	H	H	H	H
	Alteration of hydrological regimes	H	H	M	H	H	L
	Flow restrictions	H	H	L	H	H	L
	Construction related impacts	H	M	M	M	M	M
	Conversion/loss of habitat	H	H	M	H	H	M
	Seasonal loss of habitat	M	M	L	M	M	M
	Backwash (cleaning of system)	M	M	L	M	M	L
	Alteration of community structure	H	H	L	H	H	L
	Increased need for dredging	H	H	M	H	H	L
	Ballast water uptake	H	H	M	H	H	M

Table 60. Habitat Impact Categories in Agriculture and Silviculture Workshop Session

IMPACT TYPE	POTENTIAL EFFECTS	HABITAT IMPACT CATEGORIES (HIC)					
		LIFE HISTORY/ECOSYSTEM TYPE					
		Benthic/Demersal Stages			Pelagic Stages		
		Riverine	Estuarine/ Nearshore	Marine/ Offshore	Riverine	Estuarine/Nearshore	Marine/ Offshore
Cropland, Rangelands, Livestock and Nursery Operations	Release of nutrients/eutrophication	H	H	L	H	H	L
	Bank/soil erosion	H	H	L	M	M	L
	Altered temperature regimes	M	M	L	M	M	L
	Siltation/sedimentation/turbidity	H	H	L	H	H	L
	Altered hydrological regimes	M	M	L	M	M	L
	Entrainment & Impingement	M	L	L	H	L	L
	Impaired fish passage	M	L	L	H	M	L
	Reduced soil infiltration	M	L	L	M	L	L
	Release of pesticides, herbicides, fungicides	H	H	L	H	M	L
	Reduced dissolved oxygen	H	M	L	H	M	L
	Soil compaction	M	M	L	M	L	L
	Loss/Alteration of wetlands/riparian zone	H	H	L	M	M	L
	Land-use change (post agriculture)	H	M	L	H	M	L
	Introduction of invasive species	M	M	L	M	L	L
	Introduction of pathogens	H	M	L	M	M	L
	Endocrine disruptors	H	H	L	H	H	L
	Change of community structure	M	M	L	M	M	L
	Change in species composition	H	M	L	M	M	L
Silviculture and Timber Harvest Activities	Reduced soil infiltration	M	M	L	M	L	L
	Siltation/sedimentation/turbidity	H	M	L	H	M	L
	Altered hydrological regimes	M	M	L	M	M	L

IMPACT TYPE	POTENTIAL EFFECTS	HABITAT IMPACT CATEGORIES (HIC)					
		LIFE HISTORY/ECOSYSTEM TYPE					
		Benthic/Demersal Stages			Pelagic Stages		
		Riverine	Estuarine/ Nearshore	Marine/ Offshore	Riverine	Estuarine/Nearshore	Marine/ Offshore
	Impaired fish passage	M	L	L	H	M	L
	Bank/soil erosion	H	M	L	H	M	L
	Altered temperature regimes	H	M	L	H	M	L
	Release of pesticides, herbicides, fungicides	H	H	L	H	H	L
	Release of nutrients/eutrophication	H	H	L	H	H	L
	Reduced dissolved oxygen	H	M	L	H	M	L
	Loss/Alteration of wetlands/riparian zone	H	M	L	H	M	L
	Soil compaction	M	L	L	M	L	L
Timber and Paper Mill Processing Activities	Chemical contamination release	H	H	L	H	H	L
	Entrainment & Impingement	M	L	L	H	M	L
	Thermal discharge	H	L	L	M	L	L
	Reduced dissolved oxygen	H	M	L	H	M	L
	Conversion of benthic substrate	H	M	L	M	L	L
	Loss/Alteration of wetlands/riparian zone	M	M	L	M	M	L
	Alteration of light regimes	M	L	L	M	L	L

Table 61. Habitat Impact Categories in Introduced/Nuisance Species and Aquaculture Workshop Session

IMPACT TYPE	POTENTIAL EFFECTS	HABITAT IMPACT CATEGORIES (HIC)	
		LIFE HISTORY/ECOSYSTEM TYPE	
		Benthic/Demersal Stages	Pelagic Stages

		Riverine	Estuarine/Nearshore	Marine/ Offshore	Riverine	Estuarine/Nearshore	Marine/ Offshore
Introduced/ Nuisance Species	Habitat alterations	H	H	M	M	M	M
	Trophic alterations	M	H	M	M	M	M
	Gene pool alterations	H	H	M	H	H	M
	Alterations to communities/comp. w/ native spp.	H	H	M	M	H	M
	Introduced diseases	M	H	M	M	H	M
	Changes in species diversity	H	H	H	H	H	M
	Alteration in health of native species	M	M	M	M	M	M
	Impacts to water quality	M	M	M	M	M	M
Aquaculture	Discharge of organic waste/contaminants	M	H	M	M	M	M
	Seafloor impacts	M	H	M	M	M	M
	Introduction exotic invasive species	H	H	M	M	H	M
	Food web impacts	H	H	M	H	H	M
	Gene pool alterations	H	H	M	H	M	M
	Impacts to water column	M	M	M	M	H	M
	Impacts to water quality	M	H	L	M	H	M
	Changes in species diversity	M	H	M	M	H	M
	Sediment deposition	H	H	M	L	L	L
	Introduction of diseases	M	H	M	M	M	M
	Habitat replacement/exclusion	H	H	M	M	M	L
	Habitat conversion	H	H	M	M	H	M

Table 62. Habitat Impact Categories in Global Effects and Other Impacts Workshop Session

IMPACT TYPE	POTENTIAL EFFECTS	HABITAT IMPACT CATEGORIES (HIC)					
		LIFE HISTORY/ECOSYSTEM TYPE					
		Benthic/Demersal Stages			Pelagic Stages		
		Riverine	Estuarine/Nearshore	Marine/ Offshore	Riverine	Estuarine/Nearshore	Marin Offsho
Climate Change	Alteration of hydrological regimes	H	H	M	H	H	H
	Alteration of temperature regimes	H	H	H	H	H	H
	Changes in dissolved oxygen concentrations	H	H	M	H	H	M
	Nutrient loading/eutrophication	M	H	M	M	M	M
	Release of contaminants	H	H	M	M	M	M
	Bank/soil erosion	H	M	L	M	M	L
	Alteration in salinity	M	H	M	M	H	M
	Alteration of weather patterns	H	H	M	H	H	H
	Alteration in alkalinity	M	M	M	M	M	M
	Changes in community structure	H	H	H	H	H	H
	Changes in ocean/coastal use	M	M	M	M	M	M
	Changes in ecosystem structure	M	H	L	M	H	L
	Loss of wetlands	H	H	L	H	H	L
Ocean Noise	Mechanical injury to marine organisms	M	M	H	M	M	H
	Impacts to feeding behavior	M	M	M	M	M	M
	Impacts to spawning behavior	M	M	M	M	M	M
	Impacts to migration	M	M	M	M	M	M
	Exclusion of organisms to habitat	M	M	M	M	M	M
	Attractant/changes in community structure	M	M	M	M	M	M
Atmospheric Deposition	Nutrient loading/eutrophication	H	H	M	H	H	M
	Mercury loading/bioaccumulation	H	H	M	H	H	H

IMPACT TYPE	POTENTIAL EFFECTS	HABITAT IMPACT CATEGORIES (HIC)					
		LIFE HISTORY/ECOSYSTEM TYPE					
		Benthic/Demersal Stages			Pelagic Stages		
		Riverine	Estuarine/Nearshore	Marine/ Offshore	Riverine	Estuarine/Nearshore	Marin Offsho
	PCB's and other contaminants	H	H	M	H	H	M
	Alteration to ocean alkalinity	M	M	M	M	M	M
	Alteration of climatic cycle (e.g. cloud formation)	M	M	M	M	M	M
Military/Security Activities	Exclusion of organisms to habitat	L	L	M	L	M	M
	Noise impacts	M	M	M	M	M	H
	Chemical releases	M	H	M	M	M	M
	Impacts to tidal/intertidal habitats	M	M	L	L	M	L
	Blasting injuries from ordinances	M	M	M	M	M	M
Natural Disasters and Events	Loss/alteration of habitat	H	H	M	H	H	M
	Impacts to habitat from debris/disposal	M	M	M	M	M	L
	Impacts to water quality	M	H	M	H	H	M
	Impacts to habitat from emergency response	M	M	L	M	M	L
	Alteration of hydrological regimes	M	M	M	M	M	L
	Changes in community composition	M	H	M	M	M	M
	Underwater landslides	L	L	M	L	L	M
Electromagnetic Fields (Natural & Manmade)	Changes to migration of marine organisms	M	M	M	M	M	M
	Behavioral changes	M	M	M	M	M	M
	Changes to predator/prey relationships	L	M	M	M	M	M

Many of the effects that were scored as high in the workshop session were those that are well documented in the literature as having adverse effects on coastal resources. For example, nutrient enrichment and siltation/sedimentation effects were scored as high in nearly all workshop sessions and demonstrates the widely accepted views that these impacts translate to general reductions in the quality and quantity of fishery resources and habitats. Some of the more unexpected results of the workshop session scores are those effects that had high mean and/or median values, but may be a topic does not have a wealth of research documenting those impacts. Some of these results may be based upon a collective judgment by the participants that these activities or effects require additional scientific investigations to resolve the perceived risks and concerns. In several of the effects or activities, the authors of the associated report chapters were unable to locate information in the scientific literature regarding those threats. For example, Release of Pharmaceuticals and Endocrine Disruptors were two effects that were scored as high in the workshop session, and yet the potential scope and intensity of adverse effects that these chemicals have on fishery resources has not been thoroughly investigated.

The impact type and effect were scored as high in the workshop sessions are listed separately in Table 63 through Table 72. These effects were considered to be the most impacting to fishery habitats by the workshop participants. Further investigation may be warranted for these activities and affects, including research in characterizing and quantifying the impacts to fishery resources, as well as investigating methods of avoiding and/or minimizing the impacts.

Table 63. High Scoring Effects in Coastal Development Workshop Session

IMPACT TYPE	POTENTIAL EFFECTS	LIFE HISTORY/ECOSYSTEM TYPE					
		Benthic/Demersal Stages			Pelagic Stages		
		Riverine	Estuarine/Nearshore	Marine/ Offshore	Riverine	Estuarine/Nearshore	Marine Offshor
Nonpoint Source Pollution and Urban Runoff	Nutrient loading/eutrophication	●	●		●	●	
	Loss/alteration of aquatic vegetation	●	●		●	●	
	Release of heavy metals	●	●			●	
	Release of pesticides	●	●		●	●	
	Release of pharmaceuticals	●			●	●	
	Alteration to temperature regimes	●			●		
	Sedimentation/turbidity	●	●		●	●	
Road Construction and Operation	Release of fine sediments in aquatic habitat	●					
	Increased sedimentation/turbidity	●	●		●	●	
	Impaired fish passage	●			●	●	
	Altered hydrological regimes	●	●		●	●	
	Altered temperature regimes	●			●		
	Altered stream morphology	●			●		
	Altered stream bed characteristics	●			●		
	Reduced dissolved oxygen	●	●		●	●	
	Loss/alteration of aquatic vegetation	●	●		●	●	
	Altered tidal regimes	●	●		●		
	Fragmentation of habitat	●			●	●	
Flood Control/Shoreline Protection	Altered hydrological regimes	●	●		●		
	Altered stream morphology	●			●		
	Altered sediment transport	●	●		●	●	

IMPACT TYPE	**POTENTIAL EFFECTS**	**LIFE HISTORY/ECOSYSTEM TYPE**					
		Benthic/Demersal Stages			**Pelagic Stages**		
		Riverine	**Estuarine/Nearshore**	**Marine/ Offshore**	**Riverine**	**Estuarine/Nearshore**	**Marine Offshor**
	Alteration/loss of benthic habitat	●	●				
	Impaired fish passage	●			●		
	Alteration in natural communities	●					
	Impacts to riparian habitat (bank stabilization)	●			●		
	Loss of intertidal habitat	●	●			●	
	Reduced ability to counter sea level rise	●	●			●	
	Increased erosion/accretion	●	●		●	●	
Wetland Dredging and Filling	Alteration/loss of habitat	●	●		●	●	
	Loss of submerged aquatic vegetation	●	●			●	
	Altered hydrological regimes	●	●		●	●	
	Loss of wetlands	●	●		●	●	
	Loss of fishery productivity	●	●		●	●	
	Loss of flood storage capacity	●	●		●	●	
Overwater Structures	Shellfish closures due to bird roosting	●					
	Changes in predator/prey interactions	●	●		●	●	

Table 64. High Scoring Effects in Energy-Related Activities Workshop Session

IMPACT TYPE	**POTENTIAL EFFECTS**	**LIFE HISTORY/ECOSYSTEM TYPE**					
		Benthic/Demersal Stages			**Pelagic Stages**		
		Riverine	**Estuarine/Nearshore**	**Marine/ Offshore**	**Riverine**	**Estuarine/Nearshore**	**Marine/ Offshore**

Petroleum Exploration, Production and Transportation	Habitat conversion	●	●	●	●	●	
	Loss of benthic habitat		●				
	Contaminant discharge (e.g. bilge/ballast)		●			●	
	Oil spills	●	●	●	●	●	●
	Resuspension of contaminants		●				
	Impacts from clean-up activities	●	●			●	
Liquified Natural Gas	Habitat conversion	●	●				
	Loss of benthic habitat	●	●				
	Discharge of contaminants	●	●	●	●	●	●
	Siltation/sedimentation/turbidity		●				
	Resuspension of contaminants		●			●	
	Entrainment/Impingement					●	
	Alteration of hydrological regimes						
	Underwater noise				●	●	
	Release of contaminants (i.e. spills)	●	●		●	●	
	Physical barriers to habitat						
	Introduction of invasive species	●	●		●		
	Vessel impacts (e.g. need to dredge)	●	●				
	Benthic impacts from pipelines	●	●				
Offshore Wind Energy Facilities	Loss of benthic habitat		●	●			
	Habitat conversion		●	●			
	Underwater noise						●
	Alteration of community structure		●			●	
	Spills associated with service structure		●				
Wave/Tidal Energy Facilities	Habitat conversion	●	●				
	Loss of benthic habitat	●	●				
	Siltation/sedimentation/turbidity		●				
	Alteration of hydrological regimes					●	
	Altered current patterns					●	
	Entrainment/Impingement (i.e. turbine)				●	●	

	Impacts to migration				●		
Cables and Pipelines	Loss of benthic habitat	●	●				
	Habitat conversion	●	●				
	Siltation/sedimentation/turbidity		●				
	Resuspension of contaminants	●	●				
	Spills associated with service structure	●	●				
	Physical barriers to habitat	●	●	●			
	Impacts to submerged aquatic vegetation		●				
	Water withdrawal				●	●	
	Impacts from construction activities		●	●			
	Impacts to migration	●	●	●			

Table 65. High Scoring Effects in Alteration to Freshwater Systems Workshop Session

IMPACT TYPE	POTENTIAL EFFECTS	LIFE HISTORY/ECOSYSTEM TYPE					
		Benthic/Demersal Stages			Pelagic Stages		
		Riverine	Estuarine/Nearshore	Marine/ Offshore	Riverine	Estuarine/Nearshore	Marine/ Offshore
Dam Construction/ Operation	Impaired fish passage	●	●		●	●	
	Altered hydrological regimes	●	●		●		
	Altered temperature regimes	●	●		●		
	Altered sediment/LWD transport	●			●		
	Altered stream morphology	●			●		
	Altered stream bed characteristics	●			●		
	Reduced dissolved oxygen	●			●		
	Alteration of extent of tide	●	●		●	●	
	Alteration of wetlands	●	●		●	●	

IMPACT TYPE	**POTENTIAL EFFECTS**	**LIFE HISTORY/ECOSYSTEM TYPE**					
		Benthic/Demersal Stages			**Pelagic Stages**		
		Riverine	**Estuarine/Nearshore**	**Marine/ Offshore**	**Riverine**	**Estuarine/Nearshore**	**Marine/ Offshore**
	Change in species communities	●			●		
	Riparian zone development	●			●		
	Acute temperature shock from water releases	●			●		
Dam Removal	Release of contaminated sediments	●	●		●		
	Alteration of wetlands	●			●		
Stream Crossings	Impacts to fish passage	●			●		
	Alteration of hydrological regimes	●			●		
	Bank erosion	●					
	Habitat conversion	●			●		
Water Withdrawal/ Diversion	Entrainment & Impingement				●		
	Impaired fish passage	●	●		●	●	
	Altered hydrological regimes	●			●		
	Reduced dissolved oxygen	●			●		
	Altered temperature regimes	●	●		●		
	Release of nutrients/eutrophication	●			●		
	Release of contaminants	●			●		
	Altered stream morphology	●			●		
	Altered stream bed characteristics	●			●		
	Siltation/sedimentation/turbidity	●			●		
	Change in species communities	●			●	●	
	Alteration in groundwater levels	●			●		
	Loss of forested/palustrine wetlands	●			●		

IMPACT TYPE	**POTENTIAL EFFECTS**	**LIFE HISTORY/ECOSYSTEM TYPE**					
		Benthic/Demersal Stages			**Pelagic Stages**		
		Riverine	**Estuarine/Nearshore**	**Marine/ Offshore**	**Riverine**	**Estuarine/Nearshore**	**Marine/ Offshore**
	Impacts to water quality	●			●		
Dredging and Filling, Mining	Reduced flood water retention	●			●		
	Reduced detrital food source	●					
	Altered hydrological regimes	●			●		
	Increased storm water runoff	●			●		
	Loss of riparian and riverine habitat	●			●		
	Altered stream morphology	●			●		
	Altered stream bed characteristics	●			●		
	Siltation/sedimentation/turbidity	●			●		
	Reduced dissolved oxygen	●			●		
	Altered temperature regimes	●			●		
	Release of nutrients/eutrophication	●			●	●	
	Release of contaminants	●			●		
	Loss of submerged aquatic vegetation	●	●		●	●	
	Change in species communities	●	●		●		

Table 66. High Scoring Effects in Marine Transportation Workshop Session

IMPACT TYPE	**POTENTIAL EFFECTS**	**LIFE HISTORY/ECOSYSTEM TYPE**					
		Benthic/Demersal Stages			**Pelagic Stages**		
		Riverine	**Estuarine/Nearshore**	**Marine/ Offshore**	**Riverine**	**Estuarine/Nearshore**	**Marine/ Offshore**

IMPACT TYPE	**POTENTIAL EFFECTS**	**LIFE HISTORY/ECOSYSTEM TYPE**					
		Benthic/Demersal Stages			**Pelagic Stages**		
		Riverine	**Estuarine/Nearshore**	**Marine/ Offshore**	**Riverine**	**Estuarine/Nearshore**	**Marine/ Offshore**
Construction and Expansion of Ports and Marinas	Loss of benthic habitat	●	●	●			
	Siltation/sedimentation/turbidity	●	●				
	Contaminant releases	●	●			●	
	Altered hydrological regimes	●	●		●	●	
	Altered tidal prism		●			●	
	Altered temperature regimes	●			●		
	Loss of wetlands	●	●		●	●	
	Loss of submerged aquatic vegetation	●	●		●	●	
	Conversion of substrate/habitat	●	●				
	Loss of intertidal flats	●	●				
	Loss of water column				●	●	
Operations and Maintenance of Ports and Marinas	Contaminant releases	●	●				
	Storm water runoff	●	●				
Operation and Maintenance of Vessels	Impacts to benthic habitat	●	●				
	Contaminant spills and discharges		●			●	
Navigation Dredging	Conversion of substrate/habitat	●	●				
	Loss of submerged aquatic vegetation	●	●		●	●	
	Siltation/sedimentation/turbidity	●	●		●		
	Contaminant releases	●	●				

IMPACT TYPE	POTENTIAL EFFECTS	LIFE HISTORY/ECOSYSTEM TYPE					
		Benthic/Demersal Stages			Pelagic Stages		
		Riverine	Estuarine/Nearshore	Marine/ Offshore	Riverine	Estuarine/Nearshore	Marine/ Offshore
	Altered hydrological regimes	●	●		●		
	Altered temperature regimes	●	●				
	Loss of intertidal flats	●	●		●	●	
	Loss of wetlands	●	●		●	●	

Table 67. High Scoring Effects in Offshore Dredging and Disposal Workshop Session

IMPACT TYPE	POTENTIAL EFFECTS	LIFE HISTORY/ECOSYSTEM TYPE					
		Benthic/Demersal Stages			Pelagic Stages		
		Riverine	Estuarine/Nearshore	Marine/ Offshore	Riverine	Estuarine/Nearshore	Marine/ Offshore
Offshore Mineral Mining	Loss of benthic habitat types			●			
	Conversion of substrate/habitat			●			
	Changes in sediment composition			●			
	Change in community structure			●			
Petroleum Extraction	Contaminant releases			●			●
	Drilling mud impacts			●			●
Offshore Dredge Material Disposal	Burial/disturbance of benthic habitat			●			
	Conversion of substrate/habitat			●			
	Changes in sediment composition			●			
Fish Waste Disposal	Introduction of pathogens			●			●
	Release of			●			●

IMPACT TYPE	POTENTIAL EFFECTS	LIFE HISTORY/ECOSYSTEM TYPE					
		Benthic/Demersal Stages			Pelagic Stages		
		Riverine	Estuarine/Nearshore	Marine/ Offshore	Riverine	Estuarine/Nearshore	Marine/ Offshore
	nutrients/eutrophication						
	Release of biosolids			●			
	Loss of benthic habitat types			●			
Vessel Disposal	Conversion of substrate/habitat			●			
	Changes in community structure			●			

Table 68. High Scoring Effects in Chemical Effect: Water Discharge Facilities Workshop Session

IMPACT TYPE	POTENTIAL EFFECTS	LIFE HISTORY/ECOSYSTEM TYPE					
		Benthic/Demersal Stages			Pelagic Stages		
		Riverine	Estuarine/Nearshore	Marine/ Offshore	Riverine	Estuarine/Nearshore	Marine/ Offshore
Sewage Discharge Facilities	Release of nutrients/eutrophication	●	●	●	●	●	●
	Release of contaminants	●	●	●	●	●	●
	Impacts to submerged aquatic vegetation	●	●		●	●	
	Reduced dissolved oxygen	●	●		●	●	
	Siltation/sedimentation/turbidity	●	●		●	●	
	Impacts to benthic habitat	●	●				
	Changes in species composition	●	●		●	●	
	Trophic level alterations	●	●		●	●	
	Introduction of pathogens	●	●			●	
	Introduction of harmful algal blooms	●	●	●	●	●	
	Contaminant	●	●	●	●	●	

IMPACT TYPE	POTENTIAL EFFECTS	LIFE HISTORY/ECOSYSTEM TYPE					
		Benthic/Demersal Stages			Pelagic Stages		
		Riverine	Estuarine/Nearshore	Marine/ Offshore	Riverine	Estuarine/Nearshore	Marine/ Offshore
	bioaccumulation/biomagnification						
	Behavioral avoidance		●			●	
Industrial Discharge Facilities	Alteration in water alkalinity	●					
	Release of heavy metals	●	●				
	Release of chlorine compounds	●	●		●	●	
	Release of pesticides	●	●		●	●	
	Release of organic compounds (e.g. PCBs)	●	●	●		●	
	Release of petroleum products (PAH)	●	●			●	
	Release of inorganic compounds	●	●		●	●	
Combined Sewer Overflows	Potential for all of the above effects	●	●	●	●	●	●

Table 69. High Scoring Effects in Chemical Effect: Water Intake and Discharge Facilities Workshop Session

IMPACT TYPE	POTENTIAL EFFECTS	LIFE HISTORY/ECOSYSTEM TYPE					
		Benthic/Demersal Stages			Pelagic Stages		
		Riverine	Estuarine/Nearshore	Marine/ Offshore	Riverine	Estuarine/Nearshore	Marine/ Offshore
Discharge Facilities	Turbidity/sedimentation	●	●				
	Alteration of sediment composition	●	●				
	Reduced dissolved oxygen	●	●		●	●	
	Alteration of salinity regimes	●	●		●	●	

IMPACT TYPE	**POTENTIAL EFFECTS**	**LIFE HISTORY/ECOSYSTEM TYPE**					
		Benthic/Demersal Stages			**Pelagic Stages**		
		Riverine	**Estuarine/Nearshore**	**Marine/ Offshore**	**Riverine**	**Estuarine/Nearshore**	**Marine/ Offshore**
	Alteration of temperature regimes	●	●		●	●	
	Habitat exclusion/avoidance	●	●		●	●	
	Restrictions to migration	●	●		●	●	
	Acute toxicity		●		●	●	
	Cold shock				●		
	Attraction to flow	●	●		●	●	
	Alteration of community structure	●	●		●	●	
	Physical/chemical synergies		●				
	Increased need for dredging	●	●		●	●	
	Ballast water discharge	●	●				
	Gas-bubble disease/mortality					●	
	Release of radioactive wastes	●	●		●	●	
Intake Facilities	Entrainment/impingement	●	●	●	●	●	●
	Alteration of hydrological regimes	●	●		●	●	
	Flow restrictions	●	●		●	●	
	Construction related impacts	●					
	Conversion/loss of habitat	●	●		●	●	
	Alteration of community structure	●	●		●	●	
	Increased need for dredging	●	●		●	●	
	Ballast water uptake	●	●		●	●	

Table 70. High Scoring Effects in Agriculture and Silviculture Workshop Session

IMPACT TYPE	POTENTIAL EFFECTS	LIFE HISTORY/ECOSYSTEM TYPE					
		Benthic/Demersal Stages			Pelagic Stages		
		Riverine	Estuarine/ Nearshore	Marine/ Offshore	Riverine	Estuarine/Nearshore	Marine/ Offshore
Cropland, Rangelands, Livestock and Nursery Operations	Release of nutrients/eutrophication	●	●		●	●	
	Bank/soil erosion	●	●				
	Siltation/sedimentation/turbidity	●	●		●	●	
	Entrainment & Impingement				●		
	Impaired fish passage				●		
	Release of pesticides, herbicides, fungicides	●	●		●		
	Reduced dissolved oxygen	●			●		
	Loss/Alteration of wetlands/riparian zone	●	●				
	Land-use change (post agriculture)	●			●		
	Introduction of pathogens	●					
	Endocrine disruptors	●	●		●	●	
	Change in species composition	●					
Silviculture and Timber Harvest Activities	Siltation/sedimentation/turbidity	●			●		
	Impaired fish passage				●		
	Bank/soil erosion	●			●		
	Altered temperature regimes	●			●		
	Release of pesticides, herbicides, fungicides	●	●		●	●	
	Release of nutrients/eutrophication	●	●		●	●	
	Reduced dissolved oxygen	●			●		
	Loss/Alteration of wetlands/riparian zone	●			●		
Timber and	Chemical contamination release	●	●		●	●	

IMPACT TYPE	POTENTIAL EFFECTS	LIFE HISTORY/ECOSYSTEM TYPE					
		Benthic/Demersal Stages			Pelagic Stages		
		Riverine	Estuarine/ Nearshore	Marine/ Offshore	Riverine	Estuarine/Nearshore	Marine/ Offshore
Paper Mill Processing Activities	Entrainment & Impingement				•		
	Thermal discharge	•					
	Reduced dissolved oxygen	•			•		
	Conversion of benthic substrate	•					

Table 71. High Scoring Effects in Introduced/Nuisance Species and Aquaculture Workshop Session

IMPACT TYPE	POTENTIAL EFFECTS	LIFE HISTORY/ECOSYSTEM TYPE					
		Benthic/Demersal Stages			Pelagic Stages		
		Riverine	Estuarine/Nearshore	Marine/ Offshore	Riverine	Estuarine/Nearshore	Marine/ Offshore
Introduced/ Nuisance Species	Habitat alterations	•	•				
	Trophic alterations		•				
	Gene pool alterations	•	•		•	•	
	Alterations to communities/comp. w/ native spp.	•	•			•	
	Introduced diseases		•			•	
	Changes in species diversity	•	•	•	•	•	
Aquaculture	Discharge of organic waste/contaminants		•				
	Seafloor impacts		•				
	Introduction exotic invasive species	•	•			•	
	Food web impacts	•	•		•	•	
	Gene pool alterations	•	•		•		

IMPACT TYPE	**POTENTIAL EFFECTS**	**LIFE HISTORY/ECOSYSTEM TYPE**					
		Benthic/Demersal Stages			**Pelagic Stages**		
		Riverine	**Estuarine/Nearshore**	**Marine/ Offshore**	**Riverine**	**Estuarine/Nearshore**	**Marine/ Offshore**
	Impacts to water column					●	
	Impacts to water quality		●			●	
	Changes in species diversity		●			●	
	Sediment deposition	●	●				
	Introduction of diseases		●				
	Habitat replacement/exclusion	●	●				
	Habitat conversion	●	●			●	

Table 72. High Scoring Effects in Global Effects and Other Impacts Workshop Session

IMPACT TYPE	**POTENTIAL EFFECTS**	**LIFE HISTORY/ECOSYSTEM TYPE**					
		Benthic/Demersal Stages			**Pelagic Stages**		
		Riverine	**Estuarine/Nearshore**	**Marine/ Offshore**	**Riverine**	**Estuarine/Nearshore**	**Marine/ Offshore**
Climate Change	Alteration of hydrological regimes	●	●		●	●	●
	Alteration of temperature regimes	●	●	●	●	●	●
	Changes in dissolved oxygen concentrations	●	●		●	●	
	Nutrient loading/eutrophication		●				
	Release of contaminants	●	●				
	Bank/soil erosion	●					
	Alteration in salinity		●			●	
	Alteration of weather patterns	●	●		●	●	●

IMPACT TYPE	POTENTIAL EFFECTS	LIFE HISTORY/ECOSYSTEM TYPE					
		Benthic/Demersal Stages			Pelagic Stages		
		Riverine	Estuarine/Nearshore	Marine/ Offshore	Riverine	Estuarine/Nearshore	Marine/ Offshore
	Changes in community structure	●	●	●	●	●	●
	Changes in ecosystem structure		●			●	
	Loss of wetlands	●	●		●	●	
Ocean Noise	Mechanical injury to marine organisms			●			●
Atmospheric Deposition	Nutrient loading/eutrophication	●	●		●	●	
	Mercury loading/bioaccumulation	●	●		●	●	●
	PCB's and other contaminants	●	●		●	●	
Military/Security Activities	Noise impacts						●
	Chemical releases		●				
Natural Disasters and Events	Loss/alteration of habitat	●	●		●	●	
	Impacts to water quality		●		●	●	
	Changes in community composition		●				

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6.0 Affected Environment

6.1 Biological and Physical Environment (VEC 1)

The description of the affected environment is presented to provide sufficient background information on the various resources and entities likely to be affected by the actions proposed or under consideration in the SEIS. Several recent reports have been published which add to our understanding of the physical and biological environment of this region. This section deals with the *affected* environment and does not present the effects of the proposed management program.

6.1.1 Physical Environment

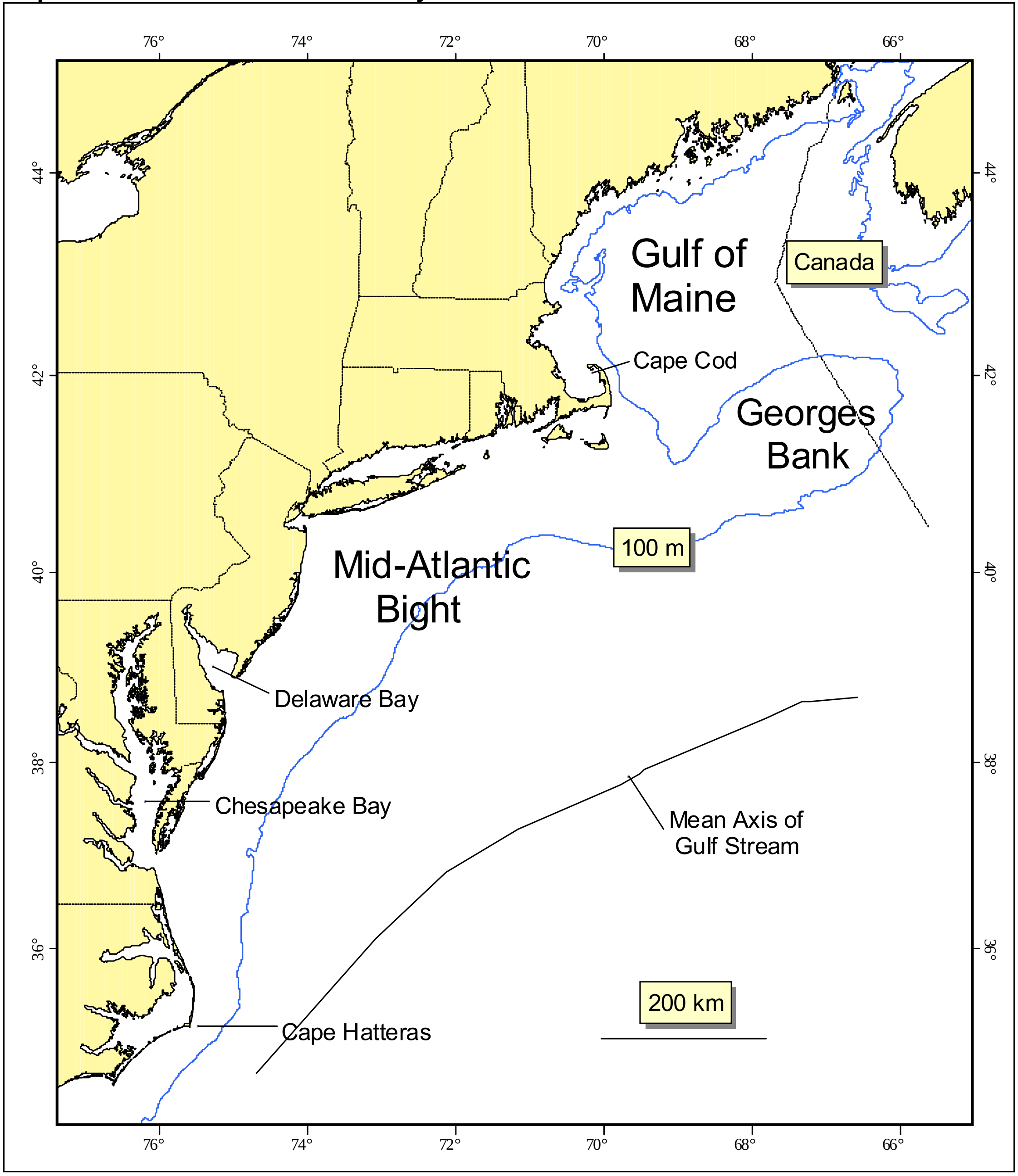
This section contains a description of the physical environment of the Northeast multispecies fishery, including physical habitat conditions in the terrestrial/inshore areas and continental shelf and slope of the Gulf of Maine – Georges Bank and Mid-Atlantic regions. Some of the information presented in this section was originally included in the EA for the Omnibus Essential Fish Habitat (EFH) Amendment #1 (NEFMC 1998).

The Northeast shelf ecosystem (Map 595) has been described as including the area from the Gulf of Maine south to the state of North Carolina, extending from the coast seaward to the edge of the continental shelf, including the slope sea offshore to the Gulf Stream (Sherman et al. 1996). The continental slope of this region includes the area east of the shelf, out to a depth of 2000m. A number of distinct sub-systems comprise the region, including the Gulf of Maine, Georges Bank, the Mid-Atlantic Bight, the continental slope, and some of the New England Seamounts. Occasionally another subsystem, Southern New England, is described; however, we incorporated the distinctive features of this region into the descriptions of Georges Bank and the Mid-Atlantic Bight.

The Gulf of Maine is an enclosed coastal sea, characterized by relatively cold waters and deep basins, with a patchwork of various sediment types. Georges Bank is a relatively shallow coastal plateau that slopes gently from north to south and has steep submarine canyons on its eastern and southeastern edge. It is characterized by highly productive, well-mixed waters and strong currents. The Mid-Atlantic Bight is comprised of the sandy, relatively flat, gently sloping continental shelf from Southern New England to Cape Hatteras, NC. The continental slope begins at the continental shelf break and continues eastward with increasing depth until it becomes the continental rise. It is fairly homogenous, with exceptions at the shelf break, some of the canyons, the Hudson Shelf Valley, and in areas of glacially rafted hard bottom. Pertinent aspects of the physical characteristics of each of these systems are described in sections that follow. This review is based on several summary reviews (Backus 1987; Schmitz et al. 1987;

Tucholke 1987; Wiebe et al. 1987; Cook 1988; Stumpf and Biggs 1988; Abernathy 1989; Dorsey 1998; Townsend 1992; Mountain et al. 1994; Conkling 1995; Beardsley et al. 1996; Brooks 1996; Sherman et al. 1996; Kelley 1998; NEFMC 1998; EPA 2003; Packer 2003; StormCenter Communications, Inc. 2004). Literature citations are not included for generally accepted concepts; however, new research and specific results of research findings are cited.

Map 595. U.S. Northeast Shelf Ecosystem



6.1.1.1 Terrestrial

The Gulf of Maine watershed is extensive, covering 178,709 km^2 (69,000 mi^2) in three (3) States and three (3) Canadian Provinces, and stretches from the north shore of Cape Cod, MA., to Cape Sable, Nova Scotia, in Canada. There are 25 major watersheds and 11 minor coastal drainage areas, 60 counties, 57 U.S. Geological Survey (USGS) Hydrologic Cataloging Units, and 453 subbasins. The U.S. portion includes more than 43,000 mi^2 of land in the State of Maine (33,215 mi^2), the State of New Hampshire (6,500 mi^2) and Commonwealth of Massachusetts (3,400 mi^2). Freshwater habitats in the watershed include wetlands, creeks, streams, and rivers; major rivers that empty into the Gulf of Maine include the Penobscot, Kennebec, Androscoggin, Saco, and Merrimack. On average, 950 billion liters (250 billion gal) of fresh water empty into the Gulf each year from more than 60 rivers; this drainage contributes an abundance of nutrients that influences productivity in the Gulf of Maine.

The Mid-Atlantic region includes the Mid-Atlantic watershed drainage area, as well as parts of the New England watershed drainage area and South Atlantic-Gulf watershed drainage area. The Mid-Atlantic watershed drainage area ultimately discharges into the Atlantic Ocean within and between the State of New York and the Commonwealth of Virginia; Long Island Sound south of the New York-Connecticut State Line; and the Riviere Richelieu, a tributary of the St.Lawrence River. This area includes all of the States of Delaware and New Jersey and the District of Columbia, and parts of the States of Connecticut, Maryland, the Commonwealth of Massachusetts, the States of New York, Pennsylvania, Vermont, the Commonwealth of Virginia, and the State of West Virginia. Part of the New England watershed drainage area also discharges into the Atlantic Ocean and Long Island Sound north of the New York-Connecticut state line, and covers the States of New Hampshire and Rhode Island as well. The South Atlantic-Gulf watershed drainage area most relevant to the Mid-Atlantic includes the Commonwealth of Virginia and the State of North Carolina, and ultimately discharges into the Atlantic Ocean.

Three major watersheds within the Mid-Atlantic region include Chesapeake Bay, the Delaware River basin, and Albermarle-Pamlico Sound. Major rivers that drain into the Atlantic via major estuaries include the Connecticut, Hudson, and Delaware; the Susquehanna, Potomac, Rappahannock, York, and James, all of which drain into Chesapeake Bay; and the Roanoke, Chowan, Pamlico, and Neuse, all of which drain into the Albermarle-Pamlico estuary.

A wide variety of non-tidal freshwater wetlands exist in the Mid-Atlantic region, including marshes and swamps, bottomland hardwood forests, wet meadows, ponds, and bogs further inland. They often occur on flood plains along rivers and streams, along the margins of lakes and ponds, and in isolated depressions in upland areas.

Some freshwater wetlands also occur in the freshwater portions of tidal coastal rivers, such as the Potomac, Nanticoke, and Delaware Rivers.

6.1.1.2 Inshore

The Gulf of Maine includes more than 59,570 km^2 (23,000 mi^2) of estuarine drainage areas, and the long State of Maine coast supports the largest number of estuaries; west to east, important ones are Saco Bay, Casco Bay, Merrymeeting Bay, Sheepscot Bay, Muscongus Bay, Penobscot Bay, Blue Hill Bay, Frenchman Bay, Narraguagus Bay, Englishman Bay, Machias Bay, Cobscook Bay, and Passamaquoddy Bay (which straddles the international border). Among the major estuaries in the southwestern part of the Gulf are Massachusetts Bay and Great Bay in the State of New Hampshire. Estuarine features such as salt marshes, mud flats, and submerged aquatic vegetation are critical to inshore and offshore fishery resources of the Gulf. Estuaries are important for nutrient recycling, primary production, and function as important breeding and feeding grounds for many fish and shellfish populations and shorebirds, migratory waterfowl, and mammals. Sheltered areas may support salt marshes at higher tide levels, intertidal mudflats, and seagrass beds and muddy substratum subtidally; salt marshes are not as prominent in the Gulf region as they are farther south. Sandy beaches are also found more extensively farther south than in the Gulf.

The coast of the Gulf of Maine consists of rocky intertidal zones and sand beaches that are important habitats for fishery resources of the Gulf. As with the estuaries, coastal areas are important for nutrient recycling and primary production. Exposed or high wave energy places with bedrock or boulders support seaweed communities both intertidally and subtidally. Fishery resources, such as American lobster and green sea urchins, may depend upon particular habitat features of the rocky intertidal/subtidal that provide important levels of refuge and nutrient sources.

The estuarine systems from southern New England to the Commonwealth of Virginia/State of North Carolina border include more than 20,176 km^2 (7,790 mi^2) of surface water area. Fresh water enters the Mid-Atlantic Bight principally at the mouth of the Hudson-Raritan, Delaware, and Chesapeake Bays. Such local sources of fresh water are responsible for about 70% of the large year-to-year variation in salinity in the Bight and strongly influence hydrographic conditions. The combined area of Southern New England and the Mid-Atlantic Bight accounts for more than 124,320 km^2 (48,000 mi^2) of estuarine drainage, extending from Buzzards Bay in the Commonwealth of Massachusetts through Chesapeake Bay in the Commonwealth of Virginia. Chesapeake Bay and Albermarle-Pamlico Sound are the nation’s two largest estuaries. Chesapeake Bay has the largest total drainage area in the region and is one of the largest estuaries in the world. Almost half of all fresh water entering estuaries in the Northeast Region flows into Chesapeake Bay.

A great diversity of shoreline types is found along the Southern New England and Mid-Atlantic coasts. The shoreline along this region is irregular, with wide sandy beaches and extensive coastal and barrier island formations. Pocket beaches (small sheltered areas between rocky headlands) are the dominant shoreline type in the Commonwealth of Massachusetts, the State of Rhode Island, the State of Connecticut, and along Long Island Sound. Much of the ocean frontage along Cape Cod and from Long Island south consists of sandy beach-dune and/or barrier beach areas. The coastline of the Mid-Atlantic is typified by elongated spit-barrier island complexes which separate the Atlantic Ocean from shallow, and usually narrow, lagoonal bays. The exceptions to this rule are the mouths of large drowned-river valley type estuaries (e.g., Chesapeake Bay, Delaware Bay, and the Hudson-Raritan Estuary) and the unique back barrier lagoons of the Albermarle-Pamlico Sound system. Where large river valley estuarine embayments are absent, the mainland is generally protected from the wave-dominated coastal ocean by coastal barriers.

As in the Gulf of Maine, coastal and estuarine features of the Bight such as barrier islands, sand beaches, salt marshes, tidal and subtidal mud flats, sand flats, and submerged aquatic vegetation are critical habitats for fisheries resources. Salt marshes are found extensively throughout the region, and often occur behind barrier islands. Salt marshes provide nursery and spawning habitat for many important shellfish and finfish species such as blue crabs and summer flounder. Salt marsh vegetation is also a large source of organic material that is important to the biological and chemical processes of the estuarine and marine environment. Different zones of a sandy beach present suitable habitat conditions for a variety of marine and terrestrial organisms. For example, the intertidal zone presents suitable habitat conditions for many invertebrates, and transient fish find suitable conditions for foraging during high tide. Several invertebrate and fish species, such as Atlantic surfclams, are adapted for living in the high energy subtidal zone adjacent to sandy beaches.

For estuaries/coastal embayments, some of the critical drivers for estuarine hydrology include freshwater input, tidal forcing, embayment length, and surface area. It is important to recognize that areas north of the Wisconsin age glaciers have coastal plains dominated by sandy glacial outwash deposits or rocky coasts in the Gulf of Maine which influences the sediment types in the adjacent embayments, while further south of this region the sediments reflect the processes of soil surface erosion, transport, and deposition. Due to sea level rise following the retreat of the glaciers, the Delaware and Chesapeake Bays are drowned river valleys. Thus past history, in addition to current processes, provides an important part of the context for the habitat support value of estuaries.

Human activities in the surrounding watersheds influences the chemical loading of nutrients (especially nitrogen and phosphorus) and contaminants (heavy metals and organic) that enter estuarine systems. The biological effects of the loading is influenced by processes occurring within the estuaries, such as hydrology (balance between freshwater input from rivers and tidal/wind forced saltwater transport from ocean), sediment type on the bottom and bioavailability of contaminants to biota, metabolism of imported non-living dissolved organic carbon (DOC) and particulate organic carbon (POC) by biota in the water column and sediments, burial of DOC and POC in the sediments and chemical coagulation processes that transport toxics attached to suspended particles to the bottom, geochemical processes linking the sediments to the water column, biological processes that convert nutrients to phytoplankton and POC to DOC, and export of living and non-living total organic matter (TOC = DOC + POC) to the coastal ocean. These physical, chemical, geological and biological processes provide the context for the water column and benthic sedimentary habitat characteristics and biological/physical structure.

Another important set of estuarine characteristics is the seasonal/interannual changes in temperature and salinity as influenced by changes in the positive and negative stages of the North Atlantic Oscillation (NAO). The NAO is based on atmospheric pressure differences between the North Atlantic Ocean (Greenland or Iceland) and Mid-Atlantic regions (Lisbon or Azores) which influence the strength of the westerly winds. As pointed out by Oviatt (2004) for Narragansett Bay, the positive NAO index is associated with warmer water temperatures, higher salinity values, decline of winter-spring diatom bloom and higher early spring zooplankton abundance (due to increased grazing by benthic filter feeders and macrozooplankton), decrease in demersal fish biomass (including winter flounder, windowpane flounder, red hake) and increase in demersal decapods (crabs and lobsters), and immigration of smaller, southern pelagic fish species (anchovy, butterfish, long finned squid). The negative NAO index is associated with colder, less saline water masses with lower nutrient values and a well developed winter-spring diatom bloom and strong recruitment of benthic fauna (polychaetes).The warmer winters and increased spring zooplankton levels fueled increases in ctenophore grazing on zooplankton and fish/invertebrate larvae. This grazing activity influences recruitment of fish and shellfish and increases the summer phytoplankton biomass. The opposite pattern occurs during cold winters. Thus large scale meteorological events affect the interannual temperature and salinity seasonal patterns in Narragansett Bay and other East coast estuaries.

Another critical environmental variable for estuaries is depth which influences: 1) the relative contributions of benthic primary production and planktonic production in the water column; 2) development of water column stratification in the water column during the summer and development of low dissolved oxygen (DO) conditions in the bottom waters (guideline levels for fish: < 5 mg/l DO and hypoxia: < 2 mg/l DO); and 3) balance between TOC input, metabolism, burial in sediments and export to coastal ocean. The allochthonous input of TOC from rivers and autochthonous production of TOC within the estuary are often less than the metabolic demand and burial in the sediments (Smith and Hollibaugh 1993) which implies that estuaries are net heterotrophic (photosynthesis < respiration). The same situation appears to apply to the coastal ocean. Locations like Narragansett Bay receive an input of nutrients from sewage treatment plants and is thus net autotrophic (P>R) because of the primary production derived from the nutrient loading. Delaware Bay is net heterotrophic in spite of high nutrient levels in the water column, presumably because the high suspended sediment levels in the water column reduce the primary production, while the POC/DOC inputs stimulate microbial respiration. Due to the shallow water column and well mixed conditions, anoxia and hypoxia don't develop in the bottom waters. In contrast the much deeper Chesapeake Bay exhibits significant hypoxia/anoxia in the bottom waters of its main stem and subestuaries as a consequence of summer stratification and nutrient loading from its large watershed (nutrients stimulate primary production in the surface waters with microbial degradation of this phytoplankton biomass reducing oxygen levels in the bottom water).

Major Estuary Descriptions

The following is a description of some of the major estuaries of the Northeast Region from north to south. For the estuaries along the States of Maine and New Hampshire coasts, the major documents utilized for these descriptions include EPA/NOAA (1987), Stevenson and Braasch (1994), and Platt (1998).

Passamaquoddy Bay

The Passamaquoddy Bay estuarine system is found near the mouth of the Bay of Fundy and U.S.-Canadian border region. The major freshwater sources are the St. Croix, Magaguadevic, and Digdeguash Rivers with a watershed area of 2724 sq km (1,048 sq mi). The estuarine area is 86 sq km (33 sq mi) which gives a watershed drainage/estuarine area ratio of 31.7. Roman et al. (2000) reports this ratio as being 20 which makes it similar to Chesapeake and Delaware Bays (18).

Passamaquoddy Bay has a fairly large tidal amplitude of 6 m (19.7 ft) as one might expect from its location at the mouth of the Bay of Fundy. This results in strong tidal mixing, a large intertidal region, and rich plankton production resulting from high natural nutrient levels and diverse habitat types. There are three (3) principal channels (Big L'Etete, Little L'Etete, and Western Passage) connecting Passamaquoddy Bay to the Bay of Fundy. The limited flushing capacity of the Bay is indicated by a flushing time of 95 days (freshwater fraction method). The tidal freshwater volume in Passamaquoddy Bay is 4.4 billion cu ft, with an estuarine mixing zone volume of 17.8 billion cu ft and seawater volume of 293.1 billion cu ft. Thus this is a moderately stratified and mixed estuary with macrotidal characteristics and limited freshwater input (EPA/NOAA1987). This is the type of estuary that has relatively high dissolved oxygen levels in the bottom waters during summer stratification (Kelly 1997).

The intertidal zone of Passamaquoddy Bay is dominated (60%) by mud and clam flats, while 60% of the subtidal habitat is composed of mud (Platt 1998). The remaining subtidal habitat is cobble/boulder/bedrock (20%), seaweed beds (20%), and eelgrass beds 5%. Passamaquoddy Bay and the adjacent West Isles archipelago are the principal areas for benthic plant production in the northern GOM.

Penobscot Bay

Penobscot Bay is the second largest (1726 sq km or 1070 sq mi) embayment on the Atlantic coast of the U.S. and drains a fairly large watershed (14,742 sq km or 9,140 sq. mi).The watershed drainage/estuarine area ratio is 8.5 (Platt 1998). Roman et al. (2000) report this ratio to be 26 which is similar to Passamaquoddy Bay (20) to the north. The mean tidal range at Belfast, ME is 2.9 m (9.7 ft) with a range of tidal amplitude from 2.9 to 4.0 m. Thus Penobscot Bay is characterized as a macrotidal estuary with a large intertidal zone, strong tidal currents with vigorous mixing, large nutrient input from offshore waters and a resulting high rate of primary production and rich species diversity (Platt 1998). Depending on the strength of the neap and spring flood and ebb tides, the fresher riverine surface layer overrides the marine water on the bottom, forming a salt wedge estuary during periods of high freshwater discharge or strong coastal water intrusion. The main source of freshwater is the Penobscot River watershed which drains 25% of the state and provides 20% of the freshwater entering the GOM. This discharge interacts with the Maine Coastal Current, forming its eastern and western branches.

There are several physiographic regions within Penobscot Bay. They include subtidal muddy bottoms (often occupied by eelgrass), intertidal mudflats (23,000 acres of productive clam beds), and rocky bottoms, which surround the islands and ledges within Penobscot Bay (often occupied by seaweeds) and are areas rich in nutrients and high productivity as a result of tidal mixing. Gravel plains and outwash are located further down the estuary where either strong currents exist or in regions of glacial deposits, and may provide spawning beds for cod and haddock. There are sand bottoms near the head of the estuary and in northeastern Penobscot Bay (spawning areas for sea scallops).

Kennebec River

The Kennebec River estuary connects the GOM with Merrymeeting Bay, where the Kennebec and Androscoggin Rivers juncture represents the head of the Bay. Thus the Kennebec River estuary is a large delta type estuarine system with a large watershed area of 15,064 sq km (9,340 sq. mi) and estuarine area of 59.7 sq km (37 sq mi), with a subsequent large ratio of watershed drainage/estuarine area of 252. Merrymeeting Bay and the Kennebec River are tidally influenced as far inland as Augusta, ME, even though the salinity in the Bay is quite low. Since the Kennebec River connects with the Back River and Sheepscot River at various points, there are different values listed for the size of its watershed. The average annual freshwater discharge into the GOM is 425 cu m/sec with a wide seasonal variation (100-4000 cu m/s). Roughly 60% of the freshwater comes from the Kennebec River with the remaining 40% emanating from the

Androscoggin River watershed (Kistner and Pettigrew 2001). The high freshwater flow rates (varies seasonally and between spring and neap tides) and a narrow rocky channel (400 m wide) influence the position of the estuarine turbidity maximum. The estuarine turbidity maximum location can vary seasonally between MB and near the mouth of the estuary (Kistner and Pettigrew 2001).

These rivers meet at the low salinity, lake-like Merrymeeting Bay which is 30 km from the mouth of the estuary. This estuary is a partially mixed to stratified mesotidal estuary with variable river discharge (Buynevich and FitzGerald 2003). Thus a strong residual estuarine circulation is established seasonally. This discharge interacts with the Maine Coastal Current and moves to the right, entering the eastern portion of Casco Bay. The mean tidal range at Popham, ME is 2.6 m (8.4 ft), but is reduced to 1.9 m (6.4 ft) at Bath, ME (Platt 1998).

Casco Bay

Casco Bay is located in the south of the State of Maine and has a watershed area of 1589 sq km (985 sq mi) and an estuarine area of 369 sq km (229 sq mi, which provides an watershed/estuarine area ratio of 4.3 (Platt 1998). Roman et al. (2000) give this ratio as seven (7), which is low compared to other State of Maine systems such as Penobscott Bay (26) and Passamaquoddy Bay (20) to the north. The watershed encompasses the metropolitan areas of Portland, Yarmouth, and Brunswick and the major tributaries of Casco Bay are the Presumpscot and Fore Rivers. The streams and tributaries that provide the freshwater discharge extend inland 1,356 miles (includes Sebago Lake Watershed). Casco Bay has 12,100 acres of mud flats (52% of estuarine area; Roman et al. 2000), 7,000 acres of eelgrass beds, 4,100 acres of salt marsh, and 500 acres of rocky shores, so that it has a diverse, rich marine fauna and flora (Platt 1998).

The tidal amplitude is 2.7 m (9 ft) with a modest tidal prism (11 trillion cu ft). The estuarine water mass volume is distributed amongst freshwater (0.5 trillion cu ft), mixing zone (1.2), and sea water (190). This leads to Casco Bay being will mixed and moderately stratified in the summer with a flushing rate of 134 days (result of large preponderance of seawater over freshwater discharge into the bay when one uses the freshwater fraction method). Since the Kennebec River estuary discharge influences outer Casco Bay, the above estimates for flushing time and relative volume of the different water masses is conservative.

The Saco River is part of a southern State of Maine system of loosely connected estuaries that either lie behind barrier beach/salt marsh complexes or represent areas where rivers discharge into the GOM. This loosely connected estuarine complex has a watershed area of 4403 sq km (170 sq mi) with an estuarine area of 819 sq km which gives a ratio of watershed drainage/estuarine area of 5.4. The Wells barrier beach system has a 1,200 acre salt marsh system and is home to the Wells National Estuarine Research Reserve and Rachel Carson National Wildlife Refuge. The Saco River estuary is 6 miles in length with the head of the estuary occurring at the Cataract Dam between the towns of Saco and Biddeford, ME. There are 11 dams on the Saco River between Saco and Fryeburg, ME which has impacts on anadromous fish species (river herring, Atlantic salmon, eels, etc.). The Cataract and Skelton dams have fish passageways.

The tidal range in this region is 2.65 m (8.6 ft). The daily freshwater discharge is fairly low (22 cu ft/sec) with a tidal freshwater volume within the estuary of 0.4 billion cu ft. The estuarine mixing zone volume is 0.6 billion cu ft, while the seawater volume is 14.4. The portions of the estuary complex receiving riverine input is highly stratified during peak flow periods and during the summer with a short flushing time (8 days from freshwater fraction method).

Great Bay/Hampton Bay

The Great Bay/Hampton Bay estuary has a watershed area of 1500 sq km (977 sq mi) and an estuarine area of 20 sq km (13 sq mi) which makes this the smallest system to be described. This estuary is composed of the lower/upper Piscataqua River (bordered by Portsmouth, NH and Kittery, ME) and Little Bay which are more industrialized and contain most of the 250,000 residents and the more rural Great Bay. The Piscataqua River connects with the GOM and provides flow into Little Bay at Dover Point which lies below the Salmon Falls and Cocheco River split. Little Bay connects through Furber Strait to Great Bay (site of a National Estuarine Research Reserve and Pease Wildlife Refuge). Two small rivers (Oyster and Bellamy) enter Little Bay, while the Squamscott and Lamprey Rivers are the major freshwater sources to Great Bay. Dover Point is the major hydraulic choke point in the system. The section of the estuary from the mouth to Dover Point has strong tidal mixing (currents up to 2 m/sec) and a progressive tidal wave, while the tidal wave through Dover Point and into Little Bay/Great Bay has the characteristics of a standing wave and less vigorous mixing (usually less than 0.5 m/sec). At low tide, 50% of Great Bay has exposed tidal mud flats. The tidal range at the mouth of the Piscataqua River is 2.65 m (8.7 ft) and 1.8 m in Little/Great Bays. The mean depth is 3.2 m which means this is a relatively shallow estuary. One of the consequences of having minimal freshwater input (32 cu m/sec) and tidal amplitude/mead depth ratio of 0.8 is that this is a tidally-dominated, well mixed estuary (Bilgili et al. 2005). The flushing time ranges from 8 days (freshwater fraction method; EPA/NOAA Team 1987) to roughly a month (lagrangian particle method; Bilgili et al. 2005).

The geomorphology of this estuary is complex and reflects the influences of glacial history (cycles of transgression/regression of sea level inundation, rebounding land levels following removal of the ice sheet, and a drowned-river valley). The most active transport of sandy sediments occurs in the Piscataqua River, with its deep channel and active tidal mixing (Bilgili et al. 2003).

Massachusetts Bay

Massachusetts Bay is located in the southwestern portion of the Gulf of Maine and is roughly 100 by 50 km in size (Signell and List 1997). The ratio of watershed drainage area to estuarine surface area is three (3) (low value similar to Buzzards Bay). The Bay is bordered on the north by Cape Ann, to the south by Cape Cod, to the east by Stellwagen Bank, and to the west by Boston Harbor (103 sq km in size). The western portion of the Bay is impacted (nutrients and toxic chemicals) by water flow from Boston Harbor which is the major metropolitan area (four million residents) in the watershed. Three (3) rivers discharge into Boston Harbor: the Charles River (80 miles long), the Neponset River (30 miles long), and the Mystic River (17 miles long). These rivers provide roughly 35% of the total freshwater discharge into the harbor (960 million cu m/yr) with most of the rest coming from wastewater treatment from six (6) plants within the watershed. Kelly (1998) estimated the freshwater discharge into the harbor from rivers as 20 cu m/sec versus 17 cu m/sec from effluent, which reflects reductions in the groundwater infiltration into the sewer pipes. Much of the sewer system combines stormwater and sewage flow (i.e; combined sewer overflows are an important pollutant loading source for inner harbor).

The net tidal volume exchange at the harbor mouth with western Massachusetts Bay is 3500 to 4300 cu m/sec (54-65% of tidal prism), which suggests that the non-advective tidal volume exchange is 100 fold more than the advective volume through input induced by the total freshwater input (37 cu m/sec). The mean flushing time for the harbor is 0.92 days (Kelly 1998) with a range of 0.24-1.77 days (depends on tidal range and freshwater input). The tidal range dominates the flushing time given its fairly large neap/spring tidal height variation (as part of GOM tidal wave) and low freshwater input values. The largest freshwater river discharge (200-500 cu m/sec) into the Bay comes from the Merrimack River, which is north of Boston Harbor, while portions of the Maine Coastal Current come around Cape Ann and influence circulation in the Bay.

The circulation within Massachusetts Bay represents the combined influences of tides, wind, river runoff, and heat flux (Blumberg et al. 1993; Signell and List 1997). Freshwater outflow from Androscoggin-Kennebec estuary in Maine gets trapped as buoyant plume along the coast, forming the Western Maine Coastal Current. Winds from the north and east create downwelling near the coast (offshore surface waters move inshore and toward the bottom with a return bottom flow offshore) and enhance the coastal trapping, while winds from the south and west favor upwelling of bottom waters into the surface layer and movement of the plume offshore. In Massachusetts Bay there are two passages on either side of Stellwagen Bank (20 m deep) that link the Bay to the wider GOM circulation. Water enters from the GOM through the North Passage (60 m deep channel between Cape Ann and northern edge of Stellwagen Bank), flows counterclockwise around the Bay margin and exits through the South Passage (80 m deep channel between southern edge of Stellwagen Bank and Race Point on Cape Cod). Depending upon the local wind stress, the Western Maine Coastal Current can move into Massachusetts Bay or bifurcate and move across the eastern flank of Stellwagen Bank towards Georges Bank.

The counterclockwise residual circulation described above can be altered in the spring and summer due to freshwater discharge from Boston Harbor/Merrimack River and the development of a strong thermocline which reduces bottom friction effects on the surface currents. These surface currents are strongest during the summer, even though the wind forcing is weak. The surface currents are weakest during the winter, even though this is the peak period for wind forcing. During winter storm events when the wind blows from the north-northeast direction, surface waves cause resuspension of the sediments which are transported toward Cape Cod from western Massachusetts Bay by the alongshore currents induced by along-bay winds (Signell and List 1997). During the summer the wind direction and strength can cause downwelling or upwelling in a fashion similar to that described for the Western Maine Coastal Current. Large river runoff events in the spring (from Merrimack and mid-Maine coastal rivers) can create southward flowing currents off of Cape Ann (20-40 cu m/sec velocities) which approximates strong northwest wind (blows in along bay axis) induced currents (Blumberg et al. 1993). Winds and freshwater discharge interact in complex ways seasonally to alter the residual circulation in Massachusetts Bay. This often results in the fall in a reverse (clockwise flow) in the residual circulation (Butman et al. 1992).

The complex bottom topography also has an influence on the circulation within Massachusetts Bay. This topography reflects the action of glaciers. Hills on the sea floor represent elliptical drumlins which are armored by glacially derived coarse gravel and boulders. This bottom type covers 23% of the U.S. Geological Survey sampling area near the outfall pipe discharge location. Depression areas (6%) are covered with fine grained sediments (60% silt and 15% clay). The dominant sediment type is coarse sand and gravel which covers 42% of the area. This sediment type is often found on the slopes of the hills. A diverse matrix of patches of sand and gravel intermixed with finer grained sediments occupies 29% of the area. Well defined sandy bedforms occupy 5% of the area with large sand ripples oriented along the direction of storm swells from winter storms from the north/northeast. The geology of Boston Harbor reflects periods of glaciation, crustal movement, and sea-level change. Tidal currents interact with the complex Boston Harbor topography and geometry to create areas of erosion (coarse grained sediments near mainland and in tidal channels and topographic highs where the currents are strong), deposition areas (fine grained sediments with high organic carbon levels in shallow tidal flats and low bathymetric relief subtidal regions with low currents), and areas of reworked sediments which reflect a combination of erosion/deposition processes.

Buzzards Bay

Buzzards Bay and its watershed lie between Cape Cod and the Elizabeth Islands on the east and the Commonwealth of southeastern Massachusetts on the west. At its mouth the Bay connects southward with Rhode Island Sound (inshore shelf waters), with connections to Vineyard Sound to the east through passage ways between the Elizabeth Islands and to the north to Cape Cod Bay through the Cape Cod Canal. The Bay has a north/south orientation as a consequence of the Buzzards Bay moraine that formed the western part of Cape Cod and subsequent filling of the Bay and its major watersheds on the western shore by rising sea level. Buzzards Bay tides are forced by the Southern New England tidal wave that influences Rhode Island/Block Island Sounds. Tidal circulation and wind forced circulation play a key role in the sediment distribution within the Bay and the water circulation in the water column. Cape Cod Bay to the north is part of the Gulf of Maine system which has higher tidal amplitude and colder water temperatures. Vineyard Sound tidal circulation is forced by a combination of the Gulf of Maine and Southern New England tidal waves emanating from the coastal ocean. The southern shore of Cape Cod and Vineyard Sound are an important biogeographic boundary between the Acadian Province flora and fauna to the north and Virginian Province plants and animals to the south. Buzzards Bay lies at the northern edge of this southern biogeographic zone (Howes et al. 1996).

Buzzards Bay is smaller than the other southern New England estuaries, being 45 km long, 12 km in width and having a mean depth of 11 m. The drainage basin is 1104-1120 sq km compared to a Bay surface area of 550-590 sq km (Howes et al. 1996), so that its ratio of watershed drainage area/estuarine surface area is only 2-3 (Howes et al. 1996; Roman et al. 2000). This ratio is similar to Massachusetts Bay to the north, but less than Narragansett Bay and Long Island Sound to the south (11-13). One of the consequences of the small watershed size is that the riverine discharge from the watershed (22 cu m/sec) is roughly the same as the precipitation directly to the Bay (18 cu m/sec). Since a lot of the freshwater discharge from the Cape Cod side of the Bay comes from groundwater and not rivers, the freshwater input rate is underestimated slightly by the riverine discharges (most of which come from the western side of the Bay). In spite of most of the riverine input of freshwater occurring near the head of the estuary, the longitudinal salinity gradient rarely exceeds 2-3 ppt. There is a comparable range in the vertical salinity gradient in the bay between the fresher surface and more saline bottom waters. Given these small salinity gradients the density driven estuarine circulation is small in magnitude (1 cm/sec). By comparison the average tidal currents are 20-30 cm/sec in the central bay and near 50 cm/sec at the mouth. Of special importance for the distribution of coarse grained sediments is the strong ebb and flood tide currents that run along the Elizabeth Islands and a similar one that runs along the NW shore of the bay. The mean tidal range in Buzzards Bay is 1.2 m. In Buzzards Bay the residence time of water is 10 days (Howes et al 1996) to 11.5 days (Abdelrham 2005).

Howes et al. (1996) describe the geological history of the Buzzards Bay system and its influence on the distribution of sediment types within the Bay. The eastern shore on Cape Cod represents an area in which retreating moraines from the Buzzards Bay and Cape Cod glacial ice lobes converged. The Buzzards Bay lobe retreated before the Cape

Cod lobe creating a split through which water flowed (present site of Cape Cod Canal). Much of the western shore of Buzzards Bay represents the outwash plain, while the eastern shore on Cape Cod contains the remnants of the moraines. Rising sea level flooded Buzzards Bay 5000-6000 years ago and since then marine transport processes have eroded some areas and deposited sediments in other areas. The role of tidal circulation on sediment transport and wind driven waves on erosion of shallow water regions is critical to understanding the bottom sediment type distribution within the Bay (Howes et al. 1996). Most of the gravel and coarse sand occurs along the inshore area of Cape Cod/Elizabeth Islands and off the headlands on the western side of the Bay. The deeper central axis is filled with fine sediments (silts) as a consequence of the greater depth, reduced current levels and transport of finer sediments in from the shelf. Much of the rest of the basin is filled with fine/medium grained sediments. A number of benthic investigations in Buzzards Bay have described the dominance of suspension/filter feeders on sandy bottoms with deposit feeders in the silty/clay sediments (Sanders 1958; Rhodes 1974).

Northeasterly storms which blow along the north/south axis of the Bay can be important in mixing of the water column and eroding sediments in shallow waters from the headlands (causing coarse grained sediments in these regions). The seasonal wind pattern is from the southwest in the summer and northwest in the winter. Since the late spring/summer stratification within Buzzards Bay comes from warming of the surface waters and formation of a thermocline, strong wind events or diurnal tidal mixing can destratify the water column. From a biological perspective this influence of winds and tides on vertical mixing results in fairly high dissolved oxygen levels in the bottom waters of the Bay throughout the summer. Some of the riverine embayments entering Buzzards Bay suffer hypoxia and fish kills during the summer when rain events bring in nitrogen rich groundwater/surface flow and salinity stratification which generates algal blooms. During sunny, windless days the stratification is enhanced by a thermocline which is followed by hypoxia resulting from bacterial decay of organic matter in the sediments.

Narragansett Bay

Narragansett Bay estuary has a north-south orientation and is part of a watershed that covers two-thirds of the State of Rhode Island and parts of the central/southeastern Commonwealth of Massachusetts. The watershed drainage area/estuarine surface ratio is 11 (roughly equivalent to the Long Island Sound value of 13, but much less than the Hudson-Raritan estuary value of 55) (Roman et al. 2000). The estuarine surface area is 328 sq km with a total volume of 2724 million cu m (at half tide) and average depth of 8.3 m (at half tide). The drainage basin area is roughly 4700 sq km, even though estimates vary depending on whether the Pettaquamscutt and Sakonnet River Basins are included (Pilson 1985). At the mouth Narragansett Bay connects to Rhode Island and Block Island Sounds through the East Passage (15.2 m depth) and West Passage (7.5 m depth). These passages lie on either side of Conanicut Island. The Bay receives a relatively small freshwater discharge (105 cu m/sec) at the head from riverine discharge and wastewater treatment plants. The head of the estuary is usually considered at the Blackstone Dam where the major freshwater source (Blackstone River) enters the Seekonk River. Given this limited freshwater input to a relatively large volume of saltwater in the day, the longitudinal salinity gradient which drives the estuarine circulation is usually around 15 ppt (from 18 ppt at Providence River to 33 ppt at the Bay mouth). Narragansett Bay represents a drowned river valley that has been filled by rising sea level following retreat of the glaciers. This accounts for its relatively deep mean depth and north/south orientation.

Riverine discharge peaks in March and April and is lowest during the summer; Pilson (1985) estimates that estuarine flushing time varies from 10-40 days with a mean value of 26 days. Abdelrham (2005) used a simplified numerical model that estimated the flushing time as 12.6 days and mentions that the published values range from 9.8-64.7 days. The Bay almost always exhibits a vertical salinity gradient between the surface and bottom waters, even though this is usually less than 2 ppt. The semidiurnal tide ranges from 1.1 m at the mouth to 1.4 m at the head. The mean tidal prism is 13% of the volume of the estuary which is 250 times the volume of the average freshwater discharge at the head of the estuary (Kremer and Nixon 1978). Thus tidal circulation plays an important role in mixing the surface and bottom layers, with well developed summer stratification only occurring in the Providence River and upper bay regions. Wind induced mixing can also be important if the wind blows in a north-south direction (dominant wind direction is from the northeast during the winter and from the southwest during the summer). Estimates for the wind-induced flushing time in Narragansett Bay are 86 days (Goodrich 1988).

Long Island Sound

The Long Island Sound (LIS) estuary has a surface area of 3284 sq km which makes it the sixth largest in the U.S. Its volume is 62 trillion cu m which ranks third among U.S. estuaries. The watershed drainage area is 44,652 sq km which ranks it nineteenth. The Connecticut River watershed occupies 71% of this area (Robertson et al. 1991). This river is the major source of freshwater discharge to this estuary at 560 cu m/sec. (Signell et al. 2000). The Housatonic and Thames Rivers in the State of Connecticut contribute 130 cu m/sec of freshwater, while 10-60 cu m/sec enters from the East River. The East River connects LIS to the Hudson-Raritan estuary through a narrow tidal straight (head of estuary).

LIS is oriented in an east-west direction between the State of Connecticut and Long Island. It is 150 km long; 30 m km wide and has an average depth of 24 m. An axial depression (77 km long) which is 30-60 m. deep runs through the western and central basins of LIS. These basin areas are separated by the Stratford and Norwalk shoal complexes. The mouth of this estuary connects with the Atlantic Ocean through the "Race" which lies between the tip of long Island and the State of Connecticut shoreline east of the Connecticut River input. Since a large amount of tidal water must flow through the "Race," the peak tidal currents reach 100-160 cm/sec. which results in deep tidal scouring areas with depths of 40-50 m. The tidal currents in most of LIS are 20-30 cm/sec.

The longitudinal salinity gradient (5-6 ppt) from the western basin to the eastern basin creates the density gradients (generates estuarine circulation) which results in a net eastward flow in the surface layers and net westward flow in the bottom waters (5-10 cm/sec). When the wind blows from the west along the axis of LIS, it induces downwind (west to east) flow in the shallow regions and a return flow against the wind (east to west) at depth which reinforces the estuarine bottom flow (Signell et al. 2000). The main driver of currents in LIS is the tidal circulation (semidiurnal M2 component) with common speeds of 20-30 cm/sec and much higher values (maxima: 100-160 cm/sec) at the "Race." The semidiurnal tide has a resonance frequency with the LIS basin length which sets up a standing wave resulting in 0.8 m tidal amplitude in the eastern end and 2.2 m on the western end. Frictional effects on this tidal wave results in the flood tide being shorter than the ebb tide (asymmetry) and hence the flood tidal currents being stronger than those at the ebb. In addition, much of the freshwater discharge occurs nearer to the mouth of the estuary than the head. Thus the combination of tidal, wind-driven, and estuarine circulation combines in the eastern basin of LIS bottom waters to drive the sedimentary regimes (gradient from erosion/nondeposition zone to coarse grained sediment bedload transport to sediment sorting/reworking zone to fine grained deposition areas). The maximum tidal current speeds one (1) meter above the bottom vary between 60 cm/sec in the eastern basin to 20 cm/sec at the western end, with inshore tidal current velocities of 20-30 cm/sec in the eastern sound to 15-20 cm/sec in the central/western sound.

Knebel and Poppe (2000) describe this relationship in more detail. In the eastern basin of LIS where the currents are strong, one finds gravel and gravelly sand sediment types dominating. As a result of past geological history one finds glacial tills at Falkner Island, in the central axis of Fisher Island Sound, and at Stratford and Norwalk shoal complexes. Gravel sediments are also found inshore off of promontories and knoll regions where strong bottom currents winnow out the finer sediment sizes. In the central and western basins irregular outcroppings of bedrock and boulders occur just offshore from the State of Connecticut coastline and are often encrusted with mussels or covered with a thin layer of detritus. Moderately well sorted medium-to-fine grained sands dominate the bottom in the western portion of the eastern basin and eastern portion of the central basin and at Stratford and Norwalk shoal complexes and nearshore margins. Tidal currents create a system of sand waves on the ridges and sand ribbons in the channels. Adjacent to some of these sandy shoal areas one finds beds of shell debris that have been winnowed of finer sediments by strong bottom currents which provide a unique habitat. In the lower tidal energy environments one finds silty sand and sand-silt-clay sediments dominating on the sides of the central and western basins, the flanks of bathymetric highs, in the lee of coastal headlands, in shallow depressions on the nearshore margins, and in a number of the bays on Long Island. The depositional areas (greater than 20 m depth) are dominated by clayey silts. These areas include the flat sea floor of the western basin and western portion of the central basin, the protected nearshore bays in the State of Connecticut, and in isolated depressions. The fine grained sediments are poorly sorted and tend to be finer in the western basin than the central basin. Zajac et al. (2000) discuss the interaction between hydrodynamics, sediment distribution patterns and benthic infauna in LIS. Traditionally it was thought that sediment grain size and organic carbon content were the key drivers for infauna distribution, but the modern perspective utilizes a more dynamic conceptual model.

In LIS the vertical density gradients (summer stratification) are driven more by temperature differences between surface and bottom layers rather than salinity differences (like in Chesapeake Bay).Thermal stratification starts to develop in April/May with temperature differentials in June between the surface and bottom waters being 3-5˚C indicating the establishment of the thermocline. The salinity differences between the surface and bottom layer is only 0.5 to 1 ppt. As a result of strong tidal mixing in the "Race," it doesn't become vertically stratified. In late August/early September, overturn occurs as the surface waters become cooler and the bottom water warms, allowing storm events and tidal mixing to destroy the stratification. The summer hypoxia (< 3 ppm DO) develops from west to east and often covers 1/3 to 1/2 of the western and central basins of LIS. During the stratified period the pycnocline is at 6-12 m deep, which leaves 10-30 hypoxic layer in the bottom layer. Even though the vertical density gradient between the surface and bottom layers is not that great the large mass of bottom water prevents overturn from winds or tidal action (Welsh and Eller 1991).

<u>Hudson-Raritan Estuary</u>

The Hudson-Raritan Estuary system is quite complex geomorphologically since it combines the drainage into the upper bay (adjacent to New York City) from the Hudson and East River (which connects to Long Island Sound), the Kill Van Kull which connects the upper bay to Newark Bay and which receives drainage from the Passaic and Hackensack Rivers, and the Arthur Kill which connects the Newark Bay system to Raritan Bay and which receives freshwater input from the Raritan River. The lower bay region receives input from Raritan Bay, the upper bay, and Sandy Hook Bay which receives discharge from the Navesink River. The lower bay is connected to the inner continental shelf (New York Bight Apex which extends from Montauk Point, Long Island to Cape May, NJ) through the Sandy Hook-Rockaway Point Transect. Since the Hudson River is tidal from New York City to the dam at Green Island (just north of Albany, NY) with saltwater intrusion about half this distance during low river discharge periods, it has its own estuarine flow regime.

The ratio of watershed/estuarine area for the Hudson-Raritan system is 55 which is larger than that for Delaware and Chesapeake Bays (18) and other systems in the Northeast (Roman et al. 2000). The drainage area for the estuary is 21,000 sq. km with an estuary volume of 0.9 cu km (Fisher et al. 1988). The mean freshwater inflow is 390 cu m/sec with a flushing time of 9 days (short) and tidal range of 1.5 m (large). The Hudson River dominates the freshwater discharge (range 100-2000 cu m/sec) with the discharge from New Jersey rivers (Raritan, Hackensack, and Passaic) being roughly 10% of the Hudson River value. Treated sewage from the municipal area contributes roughly 120 cu m/sec., so it is a significant contributor to freshwater flow when the river discharge values are low. The sewage treatment discharge is responsible for much of the nutrient and toxic chemical loading. The high tidal amplitude and river discharge drive the estuarine circulation with fresher water moving out in the surface layers and saline water penetrating in the bottom layers.

Hires and Mellor (1988) have developed models of this residual estuarine circulation. The deep channel and strong tidal currents can transport the saline bottom water from the lower bay into the Hudson River. The relative rates of freshwater discharge and saline bottom water intrusion are responsible for turbidity maxima in the river and sediment transport either from the river to the Bay or in the opposite direction (Menon et al. 1988).The suspended particles in the turbidity maxima are enriched in heavy metals due to interactions with iron-manganese hydroxides (cadmium, copper, lead and zinc) or organic coatings (chromium).Interactions between the fresh and saline water masses flocculate out the mud and the attached heavy metals from the water column into the sediments. Resuspension events associated with spring tidal cycle interacting with high freshwater discharge rates can transport these fine sediments from the river into the lower bay (Geyer and Nepf 1996). At the estuary/open ocean boundary (mouth) the plume moves into the New York Bight with the direction/extent determined by freshwater discharge rate, degree of statification on inner continental shelf, far field forcing on the shelf water masses, wind intensity and direction, etc. Thus the hydrologic forcings of interest occur over a variety of temporal/spatial scales. Generally the Hudson River plume flows south along the State of New Jersey coast.

Twenty thousand years ago the Wisconsin glacier ice sheet extended to the mouth of the Hudson River. This lead to a number of morraines being formed which trapped meltwater in glacial-era lakes (Hackensack, Passaic, Hudson, etc.) from which drainage supported the ancestral Hudson and Raritan Rivers. Bokuniewicz (1988) describes this process in more detail, but the important features of the system are: north/south orientation of Hudson River which penetrates inland beyond the mountains (includes coastal plan, piedmont and Appalachian mountain regions in its drainage area), early formation of the Raritan and Hudson Rivers before the rise of sea level cut deep channels, and estuarine conditions that were formed 12,000 years ago when sea level was 28 m lower than its present position. Thus muds were deposited early on in the Hudson-Raritan estuary and rising sea levels not only increased the volume of water in the estuary, but also brought in coarse grained (sand) sediments from the coastal ocean to the lower bay and formed the spit at Sandy Hook. North of the muddy bottoms in Raritan and Sandy Hook Bays lay the relict glacial sands that cover the floor of the lower bay. In the present day strong tidal currents and wave action rework these deposits into large shoal areas and prevent the deposition of finer sediments. The upper bay is underlain by remnant rock outcrops covered by finer sediments transported in from the river.

Delaware Bay

Delaware Bay's watershed is 35,000-40,275 sq km in size with an average freshwater discharge of 332- 411 cu m/sec. The Bay is 18 km wide at its mouth with a maximum width of 45 km. The combined Delaware River-Bay length is 547 km with 154 km exhibiting tidal influence. The estuary volume is roughly 19 cu km with a tidal range of 1.3-1.5 m (Fisher et al. 1988). The flushing time for this system is 80-100 days. As a result of the low level of density stratification in the Bay, the ratio of the tidal/freshwater volume flux is 350, which defines this system as a partially mixed estuary. The maximum density stratification occurs during the spring and is associated with the maximum freshwater discharge. About 50% of the freshwater discharge comes from the Delaware River and 20% from the Schuylkill River which is at the head of the Bay. The Delaware Bay has two turbidity maxima which occur upstream and downstream of the Chesapeake and Delaware Canal entrance. There have never been any reports of submerged aquatic vegetation in Delaware Bay which suggests that it is a naturally turbid system (Biggs 1986).

The deep shipping channel is the remnants of the river channel when the sea level was lower. There are also two (2) fairly deep tidal scour channels in lower Delaware Bay on the sides of the shipping channel. Because of the relatively large tidal mixing and winnowing of the sediments the deep channels contain coarse grained sediments with the finer grained sediments occurring on the shallow flanks. Sand waves occur in the coarse grained sediments roughly half way up the estuary. The coarse grained sediments are unstable which influences the benthic communities that can develop there. The fringing salt marshes are depositional areas for fine grained sediments which allow the wetlands to keep up with rising sea levels. Some of these wetland areas are being restored to increase their habitat support value for fish and shellfish.

In addition to the estuarine driven residual flow (subtidal currents are 1-10 cm/sec) and tidal forcing (currents are up to 100 cm/sec) of the system hydrology, wind-induced transport has an important role on the movement of saline water into the Bay from the inner continental shelf and can reduce the stratification in the water column between the fresher surface layer and saltier bottom water (Sharp et al. 1986; Goodrich 1988). The influence of wind on stratification is greatest during periods of low freshwater discharge when the density gradient is reduced between the fresher surface and more saline bottom layers. The wind-induced flushing time is roughly 135 days (Goodrich 1988).

Normally because of the Coriolis effect (due to earth's rotation) the Delaware Bay plume exits to the south along the Delmarva Peninsula, but strong winds can reverse this normal pattern. These wind induced changes in current patterns and salinity distribution occur at subtidal frequencies (2-10 days). The wind events are superimposed upon the mean circulation patterns associated with the density driven residual circulation (monthly and annual time periods) and tidal circulation (daily and bi-weekly due to spring/neap cycles of high and low water).

The Ekman upwelling on the inner shelf accompany is induced by strong northeast winds that persist for a couple of days and leads to cross shelf transport that transports saline water further up the Bay in the bottom layer. This often leads to fronts either within the Bay mouth or just outside which can enhance biological activity. Along-shore density gradients on the inner shelf can lead to coastally-propagated waves which influence the exchange between the inner shelf and Bay. Generally the brackish water masses in the Bay are found on the State of Delaware side with more saline water on the State of New Jersey side. This situation induces a return cross-bay flow in the bottom water near the mouth.

Chesapeake Bay

As mentioned previously, Chesapeake Bay is the largest estuary in the U.S. with an area of 6500 sq km; mean low water volume of 50 cu km; and mean depth of 8.4 m (Schubel and Pritchard 1987).The entire Chesapeake Bay system has an area of 11,500 sq km, mean low water volume of 74 cu km, and mean depth of 6.5 m. The Bay and its tributaries only covers 7% of its 64,000 sq mi watershed (70% of which represents the Susquehanna River watershed), so that loading from the watershed of freshwater, sediments, nutrients, and allochthonous organic matter (TOC) has impacts on the physical, geological, and chemical processes occurring within the Bay proper. The Bay is 320 km long with an average width of 20 km (range: 5-56 km).The Bay represents a drowned river valley filled by rising sea levels following the retreat of the Wisconsin glacial stage 12,000-14,000 years ago. The deep channel of the Bay represents the incised channel formed when sea level was low and is bounded by broad shallow regions adjacent to the eastern and western shores which have been flooded in more recent geological times (less than 3000 yrs). Roughly 16 million people live in the watershed with most of the industrial activity in the Baltimore region of the upper bay and tidewater region in the lower bay. Much of the western shore of the Bay close to the shore has urban/suburban land uses with agricultural and forested land uses further inland, while the eastern shore has more natural land areas and agricultural land uses.

Susquehanna River

The Susquehanna River discharges an average of 1100 cu m/sec at the head of the estuary (48% of total freshwater input of 2280 cu m/sec) which is 320 km from the discharge point into the ocean. This establishes a longitudinal salinity gradient from the head to the mouth of the Bay which is responsible for the partially mixed estuary characteristics. This leads to saline water from the ocean moving in along the bottom and less saline water layers moving at the surface. In addition the narrow width of the Bay reduces lateral mixing, so that saline water moves up the eastern shore with fresher water moving down the western shore. Since there is vertical mixing between the surface and bottom layers, more water leaves (roughly five (5) times the Susquehanna River inflow) at the mouth of the estuary than comes in from freshwater discharge (consequence of saltwater entrainment in surface layer). Other major freshwater discharges come from the: Potomac River (310 cu m/sec; 13.6%), James River (284 cu m/sec; 12.5%), Rappahannock River (70 cu m/sec; 3.1 %), and York River (68 cu m/sec; 3.0%). All of these rivers discharge on the western shore with minor inputs from the eastern shore rivers (Choptank- 27; 1.2% and Nanticoke- 26; 1.1%). The mean residence time of freshwater in the Bay is seven (7) months which is long in relationship to many of the biological processes at lower trophic levels, but short compared to many geological processes.

The peak discharge of water and suspended material from the Susquehanna River occurs in the spring due to snow melt and rains in its large watershed. This discharge reaches a minimum in the summer and early fall. The freshwater discharge helps create a halocline density layer between the surface and bottom layers which combines with seasonal warming to create a stratified water column in the deeper areas of the Bay. Fisher et al. (1988) present a conceptual model that links this hydrology to some of chemical and physical processes in the system. The flocculation of suspended material from the rivers as salinity increases leads to a turbidity maximum in the area where the saltwater/freshwater mixing is initiated. The high suspended levels in the turbidity maximum cause light limitation of primary production. The chlorophyll maximum lies down estuary of the turbidity maximum where clearer water is found and relatively high nutrient uptake (ammonium, nitrate, phosphate, and silicate) occurs. The zooplankton maximum is hypothesized to occur down estuary of the chlorophyll maximum due to longer water residence times. These same types of processes influence the planktonic stages of fish and invertebrates.

The sedimentary budget for Chesapeake Bay (Hobbs et al. 1999) suggests that shoreline/shallow flank erosion is the major source for coarse grained (sand) and fine grained (mud) sediments deposited on the Bay floor. In the lower bay, sand transport from the continental shelf is important, while in the upper bay mud input from the Susquehanna River plays a role and helps explain the fine grained sediments in the northern portion of the Bay. The southern portion of Chesapeake Bay is dominated by coarser grained sediments. As much as 40% of these coarse grained sediments may enter through the Bay mouth and be transported upgradient by the bottom currents (both residual and tidal).The deepwater channel is filled by finer grained sediments. The area between the Rapahannock and Potomac Rivers exhibits the largest clay deposition, while the central basin region between the York River and Tangier and Pocomoke Sounds had the greatest deposition of silts.

6.1.1.3 Gulf of Maine/Georges Bank/Mid-Atlantic

Gulf of Maine

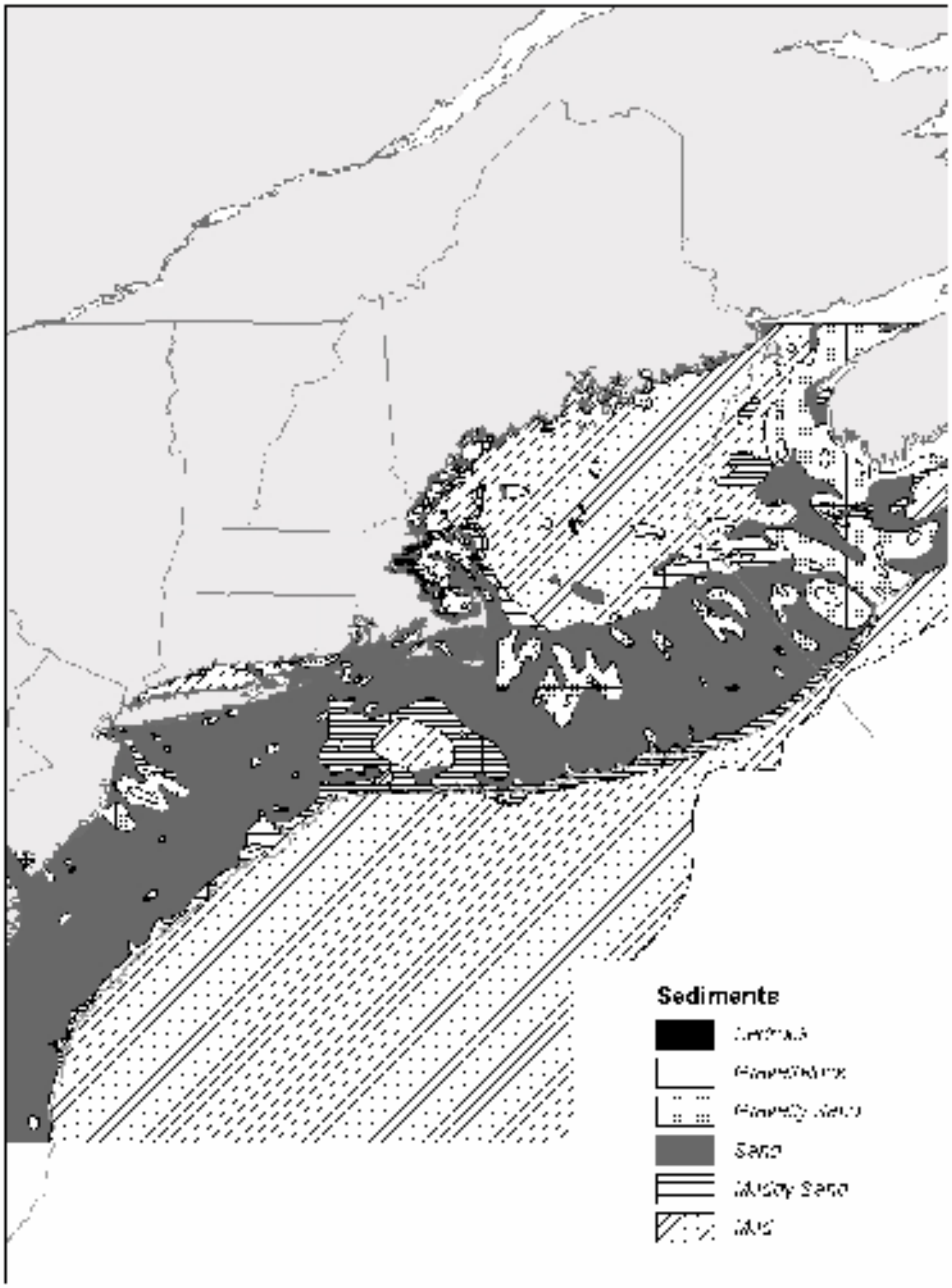
Although not obvious in appearance, the Gulf of Maine is actually an enclosed coastal sea of 90,700 km^2, bounded on the east by Browns Bank, on the north by the Nova Scotian (Scotian) Shelf, on the west by the New England states and on the south by Cape Cod and Georges Bank (GB). The Gulf of Maine (GOM) was glacially derived, and is characterized by a system of deep basins, moraines and rocky protrusions with limited access to the open ocean. This geomorphology influences complex oceanographic processes which result in a rich biological community.

The Gulf of Maine is topographically unlike any other part of the continental border along the U.S. east coast. It contains 21 distinct basins separated by ridges, banks, and swells. The three (3) largest basins are Wilkinson, Georges, and Jordan. Depths in the basins exceed 250 m, with a maximum depth of 350 m in Georges Basin, just north of Georges Bank. The Northeast Channel between Georges Bank and Browns Bank, leads into Georges Basin, and is one of the primary avenues for exchange of water between the GOM and the North Atlantic Ocean.

High points within the Gulf include irregular ridges, such as Cashes Ledge, which peaks at 9 m below the surface, as well as lower flat-topped banks and gentle swells. Some of these rises are remnants of the sedimentary shelf left after the glaciers removed most of it. Others are glacial moraines and a few, like Cashes Ledge, are out-croppings of bedrock. Very fine sediment particles created and eroded by the glaciers have collected in thick deposits over much of the Gulf of Maine, particularly in its deep basins. These mud deposits blanket and obscure the irregularities of the underlying bedrock, forming topographically smooth terrains. Some shallower basins are covered with mud as well, including some in coastal waters. In the rises between the basins, other materials are usually at the surface. Unsorted glacial till covers some morainal areas, as on Sewell Ridge to the north of Georges Basin and on Truxton Swell to the south of Jordan Basin. Sand predominates on some high areas and gravel, sometimes with boulders, predominates on others.

Coastal sediments exhibit a high degree of small-scale variability. Bedrock is the predominant substrate along the western edge of the Gulf of Maine north of Cape Cod in a narrow band out to a depth of about 60 m. Rocky areas become less common with increasing depth, but some rock outcrops poke through the mud covering the deeper sea floor. Mud is the second most common substrate on the inner continental shelf. Mud predominates in coastal valleys and basins that often border abruptly on rocky substrates. Many of these basins extend without interruption into deeper water. Gravel, often mixed with shell, is common adjacent to bedrock outcrops and in fractures in the rock. Large expanses of gravel are not common, but do occur near reworked glacial moraines and in areas where the seabed has been scoured by bottom currents. Gravel is most abundant at depths of 20-40 m, except in eastern Maine where a gravel-covered plain exists to depths of at least 100 m. Bottom currents are stronger in eastern Maine where the mean tidal range exceeds 5 m. Sandy areas are relatively rare along the inner shelf of the western Gulf of Maine, but are more common south of Casco Bay, especially offshore of sandy beaches.

Map 596. Distribution of surficial sediments, Gulf of Maine, Georges Bank, and the Mid-Atlantic Bight (modified from original map by Poppe *et al.* 1989a, b)



An intense seasonal cycle of winter cooling and turnover, springtime freshwater runoff, and summer warming influences oceanographic and biologic processes in the Gulf of Maine. The Gulf has a general counterclockwise nontidal surface current that flows around its coastal margin. It is primarily driven by fresh, cold Scotian Shelf water that enters over the Scotian Shelf and through the Northeast Channel, and freshwater river runoff, which is particularly important in the spring. Dense relatively warm and saline slope water entering through the bottom of the Northeast Channel from the continental slope also influences gyre formation. The gyre moves surface waters at a rate of approximately 7 nm/day, with a single revolution around the entire Gulf taking about three (3) months. These surface gyres are more pronounced in spring and summer; with winter, they weaken and become more influenced by the wind. Counterclockwise gyres generally form in Jordan, Wilkinson, and Georges Basins and the Northeast Channel as well; they circulate more slowly, taking about a year for deep Gulf water to cycle through the basin system. In the summer, the water of these basins becomes layered into warm, nutrient-poor surface water; cold, nutrient-rich intermediate water; and cool, high-salinity bottom water. Water exits the Gulf primarily through the 75 m deep Great South Channel, between western Georges Bank and Nantucket Shoals. Water also flows out of the Gulf over the eastern portion of Georges Bank.

Stratification of surface waters during spring and summer seals off a mid-depth layer of water that preserves winter salinity and temperatures. This cold layer of water is called "Maine intermediate water" (MIW) and is located between more saline Maine bottom water and the warmer, stratified Maine surface water. The stratified surface layer is most pronounced in the deep portions of the western GOM. Tidal mixing of shallow areas prevents thermal stratification and results in thermal fronts between the stratified areas and cooler mixed areas. Typically, mixed areas include Georges Bank, the southwest Scotian Shelf, eastern Maine coastal waters, and the narrow coastal band surrounding the remainder of the Gulf.

The Northeast Channel provides an exit for cold MIW and outgoing surface water while it allows warmer more saline slope water to move in along the bottom and spill into the deeper basins. The influx of water occurs in pulses, and appears to be seasonal, with lower flow in late winter and a maximum in early summer.

Gulf of Maine circulation and water properties can vary significantly from year to year. Notable episodic events include shelf-slope interactions such as the entrainment of shelf water by Gulf Stream rings, and strong winds that can create currents as high as 1.1 meters/second over Georges Bank. Warm core Gulf Stream rings can also influence upwelling and nutrient exchange on the Scotian shelf, and affect the water masses entering the GOM. Annual and seasonal inflow variations also affect water circulation.

Internal waves are episodic and can greatly affect the biological properties of certain habitats. Internal waves can shift water layers vertically, so that habitats normally surrounded by cold MIW are temporarily bathed in warm, organic-rich surface water. On Cashes Ledge, it is thought that deeper nutrient rich water is driven into the photic zone, providing for increased productivity. Localized areas of upwelling interaction occur in numerous places throughout the Gulf.

Georges Bank

Georges Bank is a shallow (3-150 m depth), elongate (161 km wide by 322 km long) extension of the continental shelf which was formed by the Wisconsinian glacial episode and is characterized by a steep slope on its northern edge and a broad, flat, gently sloping southern flank. The Great South Channel lies to the west of the bank and separates it from Nantucket Shoals and the mainland. Natural processes continue to erode and rework the sediments on Georges Bank. It is anticipated that erosion and reworking of sediments will reduce the amount of sand available to the sand sheets, and cause an overall coarsening of the bottom sediments (Valentine et al. 1993).

Glacial retreat during the late Pleistocene deposited the bottom sediments currently observed on the eastern section of Georges Bank, and the sediments have been continuously reworked and redistributed by the action of rising sea level, and by tidal, storm and other currents. The strong, erosive currents affect the character of the biological community. Bottom topography on Georges Bank is characterized by linear ridges in the western shoal areas; a relatively smooth, gently dipping sea floor on the deeper, easternmost part; a highly energetic peak in the north with sand ridges up to 30 m high and extensive gravel pavement, and steeper and smoother topography incised by submarine canyons on the southeastern margin. The nature of the seabed sediments varies widely, ranging from sand to mixtures of sand and gravel, patches of gravel pavement, and very small exposures of clay.

The central region of the bank is shallow; shoals and troughs characterize the bottom, with sand dunes superimposed upon them. The two most prominent elevations on the ridge and trough area are Cultivator and Georges Shoals. This shoal and trough area is a region of strong currents, with average flood and ebb tidal currents greater than 4 km per hour, and as high as 7 km per hour. The dunes migrate at variable rates, and the ridges may move, also. In an area that lies between the central part and Northeast Peak, Almeida et al. (2000) identified high energy areas as between 35-65 m deep, where sand is transported on a daily basis by tidal currents; and a low energy area at depths > 65 m that is affected only by storm currents. The area west of the Great South Channel, known as Nantucket shoals (Map 596), is similar in nature to the central region of the bank. Currents in these areas are strongest where water depth is shallower than 50 m. This type of traveling dune and swale morphology is also found in the Mid-Atlantic Bight.

The Great South Channel separates the main part of Georges Bank from Nantucket Shoals. Sediments in the Great South Channel include gravel pavement and mounds, some scattered boulders, sand with storm generated ripples, scattered shell and mussel beds. Tidal and storm currents may range from moderate to strong, depending upon location and storm activity (Valentine, pers. comm).

In the Georges Bank region, strong oceanographic frontal systems occur between water masses of the Gulf of Maine, Georges Bank, and the Atlantic Ocean. These water masses differ in temperature, salinity, nutrient concentration, and planktonic communities, which influence productivity and may influence fish abundance and distribution. Tidal currents over the shallow top of Georges Bank can be very strong, and keep the waters over the bank well mixed vertically. This results in a tidal front that separates the cool waters of the well-mixed shallows of the central bank from the warmer, seasonally stratified shelf waters on the shoreward and seaward sides of the bank. There is a persistent clockwise gyre around the Bank; a strong semidiurnal tidal flow predominantly northwest and southeast; and very strong, intermittent, storm-induced currents; all of which can all occur simultaneously. The clockwise gyre is instrumental in distribution of the planktonic community, including larval fish. For example, Lough and Potter (1993) describe passive drift of Atlantic cod and haddock eggs and larvae in a southwest residual pattern around Georges Bank. Larval concentrations are found at varying depths along the southern edge between 60-100 m.

Mid-Atlantic Bight

The Mid-Atlantic Bight includes the shelf and slope waters from Georges Bank south to Cape Hatteras, and east to the Gulf Stream (Map 597 and Map 598). Like the rest of the continental shelf, the topography of the Mid-Atlantic Bight was shaped largely by sea level fluctuations caused by past ice ages. Unlike Georges Bank, glaciers did not advance onto the Mid-Atlantic Bight shelf, and the sandy sediments are generally finer-grained than those on the bank. The shelf’s basic morphology and sediments derive from the retreat of the last ice sheet, and the subsequent rise in sea level. Since that time, currents and waves have modified this basic structure.

Shelf and slope waters of the Mid-Atlantic Bight have a slow southwestward flow that is occasionally interrupted by warm core rings or meanders from the Gulf Stream. On average, shelf water moves parallel to bathymetry isobars at speeds of 5-10 cm/second at the surface and 2 cm/second or less at the bottom. Storm events can cause much more energetic variations in flow. Tidal currents on the inner shelf have a higher flow rate of 20 cm/second that increases to 100 cm/second near inlets.

Slope water tends to be warmer than shelf water because of its proximity to the Gulf Stream, and also tends to be more saline. The abrupt gradient where these two water masses meet is called the shelf-slope front. This front is usually located at the edge of the shelf and touches bottom at about 75-100 m depth of water, and then slopes up to the east (seaward) towards the ocean surface. It reaches surface waters approximately 25-55 km further offshore. The position of the front is highly variable, and can be influenced by many physical factors. Vertical structure of temperature and salinity within the front can develop complex patterns because of the interleaving of shelf and slope waters – for example cold shelf waters can protrude offshore, or warmer slope water can intrude up onto the shelf.

The seasonal effects of warming and cooling increase in shallower, near shore waters. Stratification of the water column occurs over the shelf and the top layer of slope water during the spring-summer and is usually established by early June. Fall mixing results in homogenous shelf and upper slope waters by October in most years. A permanent thermocline exists in slope waters from 200-600 m. Temperatures decrease at the rate of about 0.02°C per meter and remain relatively constant except for occasional incursions of Gulf stream eddies or meanders. Below 600 m, temperature declines, and usually averages about 2.2°C at 4000 m. A warm, mixed layer approximately 40 m thick resides above the permanent thermocline.

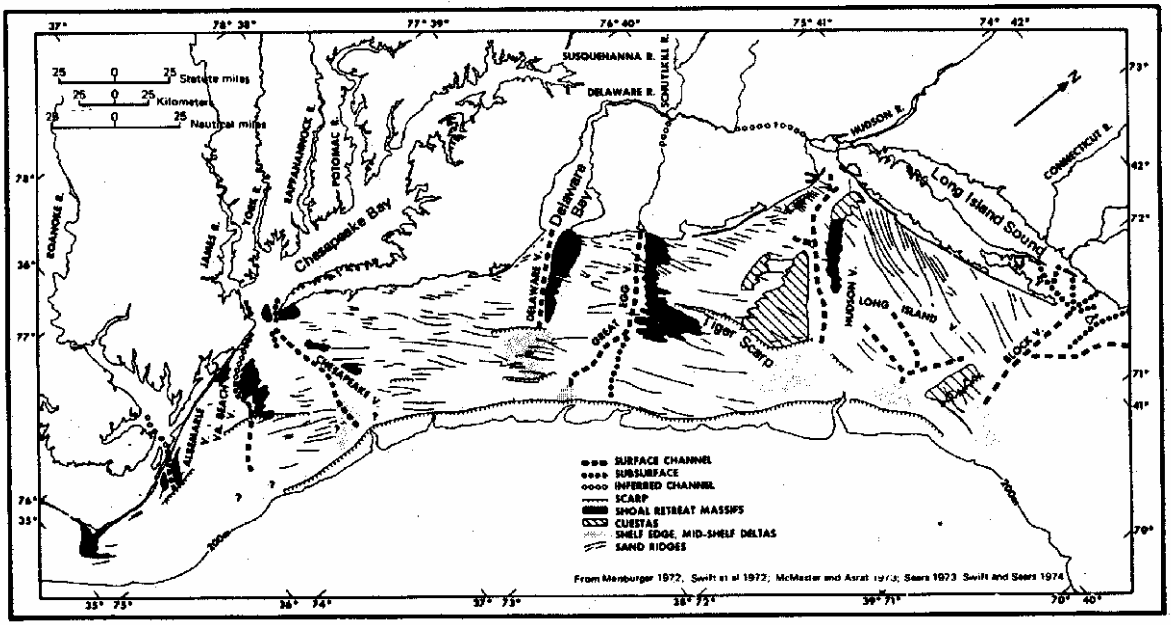
The "cold pool" is an annual phenomenon particularly important to the Mid-Atlantic Bight. It stretches from the Gulf of Maine along the outer edge of Georges Bank and then southwest to Cape Hatteras. It becomes identifiable with the onset of thermal stratification in the spring and lasts into early fall until normal seasonal mixing occurs. It usually exists along the bottom between the 40 m and 100 m isobaths and extends up into the water column for about 35 m, to the bottom of the seasonal thermocline. The cold pool usually represents about 30% of the volume of shelf water. Minimum temperatures for the cold pool occur in early spring and summer, and range from 1.1°C to 4.7°C.

The shelf slopes gently from shore out to between 100 and 200 km offshore where it transforms to the slope (100 – 200 m water depth) at the shelf break. In both the Mid-Atlantic and on Georges Bank, numerous canyons incise the slope, and some cut up onto the shelf itself. The primary morphological features of the shelf include shallow shelf valleys and channels, shoal massifs, scarps, and low sand ridges and swales (Map 599 and Map 600)

Most of these structures are relic except for some sand ridges and smaller sand-formed features. Shelf valleys and slope canyons were formed by rivers of melted glacier that deposited sediments on the outer shelf edge as they entered the ocean. Most valleys cut about 10 m into the shelf, with the exception of the Hudson Shelf Valley, which is about 35 m deep. The valleys were partially filled as glacial meltwater transported sediments seaward from land. Rising sea level also left behind a lengthy scarp near the shelf break from Chesapeake Bay north to the eastern end of Long Island. Shoal retreat massifs were produced by extensive deposition at a cape or estuary mouth. Massifs were also formed as estuaries retreated across the shelf.

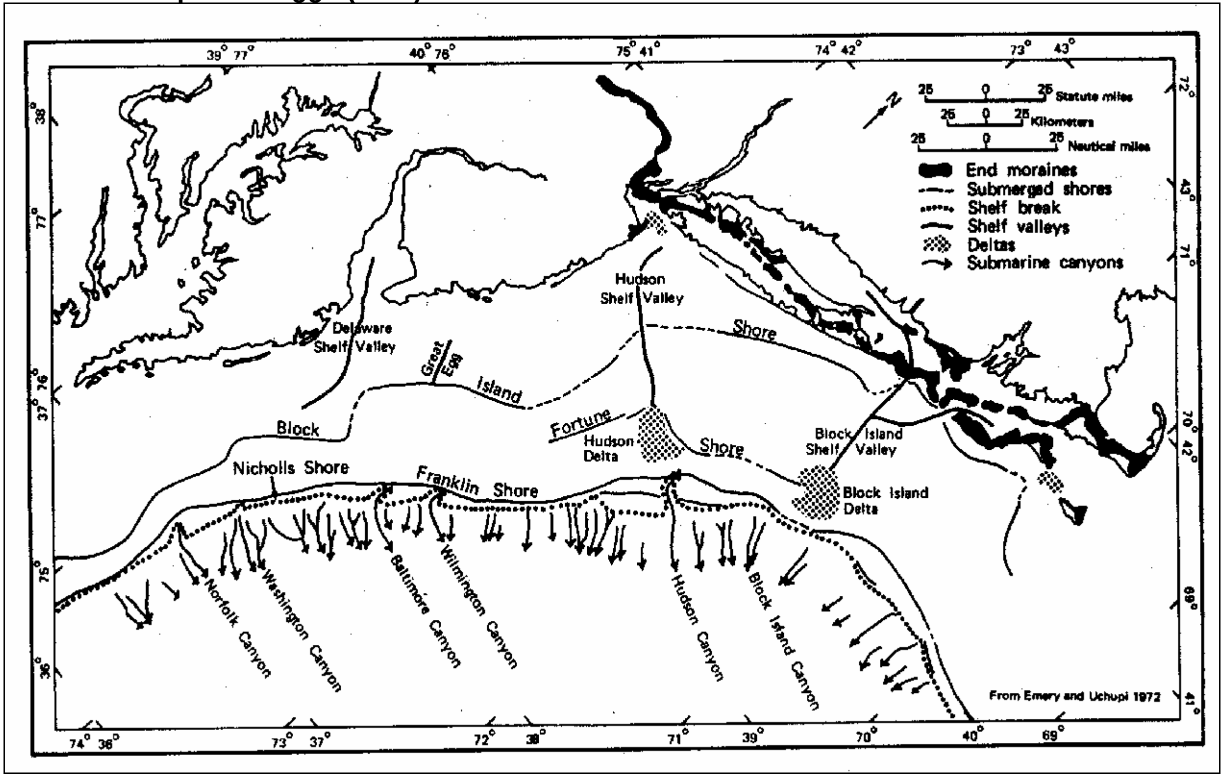
The sediment type covering most of the shelf in the Mid-Atlantic Bight is sand, with some relatively small, localized areas of gravel and gravelly sand (Map 596). On the slope, muddy sand and mud predominate. Sediments are fairly uniformly distributed over the shelf in this region. A sheet of sand and gravel varying in thickness from 0 to 10 m covers most of the shelf. The mean bottom flow from the constant southwesterly current is not fast enough to move sand, so sediment transport must be episodic and storm-related. Net sediment movement is in the same southwesterly direction as the current. The sands are mostly medium- to coarse-grained, with finer sand in the Hudson Shelf Valley and on the outer shelf. Mud is rare over most of the shelf, but is common in the Hudson Shelf Valley. Occasionally relic estuarine mud deposits are re-exposed in the swales between sand ridges. Fine sediment content increases rapidly at the shelf break, which is sometimes called the "mud line," and sediments are 70-100% fine-grained on the slope.

Map 597. Mid-Atlantic Bight submarine morphology. Source: Stumpf and Biggs (1988).



From Meisburger 1972, Swift et al 1972; McMaster and Asrat 1973; Sears 1973 Swift and Sears 1974

Map 598. Major features of the Mid-Atlantic and Southern New England continental shelf. Source: Stumpf and Biggs (1988).



In addition to sand ridges that were formed during rising sea level, some sand ridges have been formed since the end of the last ice age. Their formation is not well understood; however, they appear to develop from the sediments that erode from the shore face. They maintain their shape, so it is assumed that they are in equilibrium with modern current and storm regimes. They are usually grouped, with heights of about 10 m, lengths of 10-50 km and spacing of 2 km. Ridges are usually oriented at a slight angle towards shore, running in length from northeast to southwest. The seaward face usually has the steepest slope. Sand ridges are often covered with smaller similar forms such as sand waves, megaripples, and ripples. Swales occur between sand ridges. Since ridges are higher than the adjacent swales, they are exposed to more energy from water currents, and experience more sediment mobility than swales. Ridges tend to contain less fine sand, silt and clay while relatively sheltered swales contain more of the finer particles. Swales have greater benthic macrofaunal density, species richness and biomass, due in part to the increased abundance of detrital food and the physically less rigorous conditions.

Low sand waves are usually found in patches of 5-10 with heights of about 2 m, lengths of 50-100 m and 1-2 km between patches. Sand waves are primarily found on the inner shelf, and often observed on sides of sand ridges. They may remain intact over several seasons. Megaripples occur on sand waves or separately on the inner or central shelf. During the winter storm season, they may cover as much as 15% of the inner shelf. They tend to form in large patches and usually have lengths of 3-5 m with heights of 0.5-1 m. Megaripples tend to survive for less than a season. They can form during a storm and reshape the upper 50-100 cm of the sediments within a few hours. Ripples are also found everywhere on the shelf, and appear or disappear within hours or days, depending upon storms and currents. Ripples usually have lengths of about 1-150 cm and heights of a few centimeters.

The northern portion of the Mid-Atlantic Bight is sometimes referred to as the southern New England Shelf. Some of the features of this area were described earlier; however, one other formation of this region that deserves note is the "mud patch" which is located on the outer shelf just southwest of Nantucket Shoals and southeast of Long Island (Map 2). Tidal currents in this area slow significantly, which allows silts and clays to settle out. The mud is mixed with sand, and is occasionally re-suspended by large storms. This habitat is an anomaly of the outer continental shelf.

6.1.1.4 Offshelf

Continental Slope

The continental slope extends from the continental shelf break, at depths between 60 m and 200 m, eastward to a depth of 2000 m. The width of the slope varies from 10-50 km, with an average gradient of 3-6°; however, local gradients can be nearly vertical. The base of the slope is defined by a marked decrease in seafloor gradient where the continental rise begins.

The morphology of the present continental slope appears largely to be a result of sedimentary processes that occurred during the Pleistocene, including:

1) slope upbuilding and progradation by deltaic sedimentation principally during sea-level low-stands;
2) canyon-cutting by sediment mass movements during and following sea-level low-stands;
3) sediment slumping.

The slope is cut by at least 70 large canyons between Georges Bank and Cape Hatteras (

Map 599) and numerous smaller canyons and gullies, many of which may feed into the larger canyon systems.

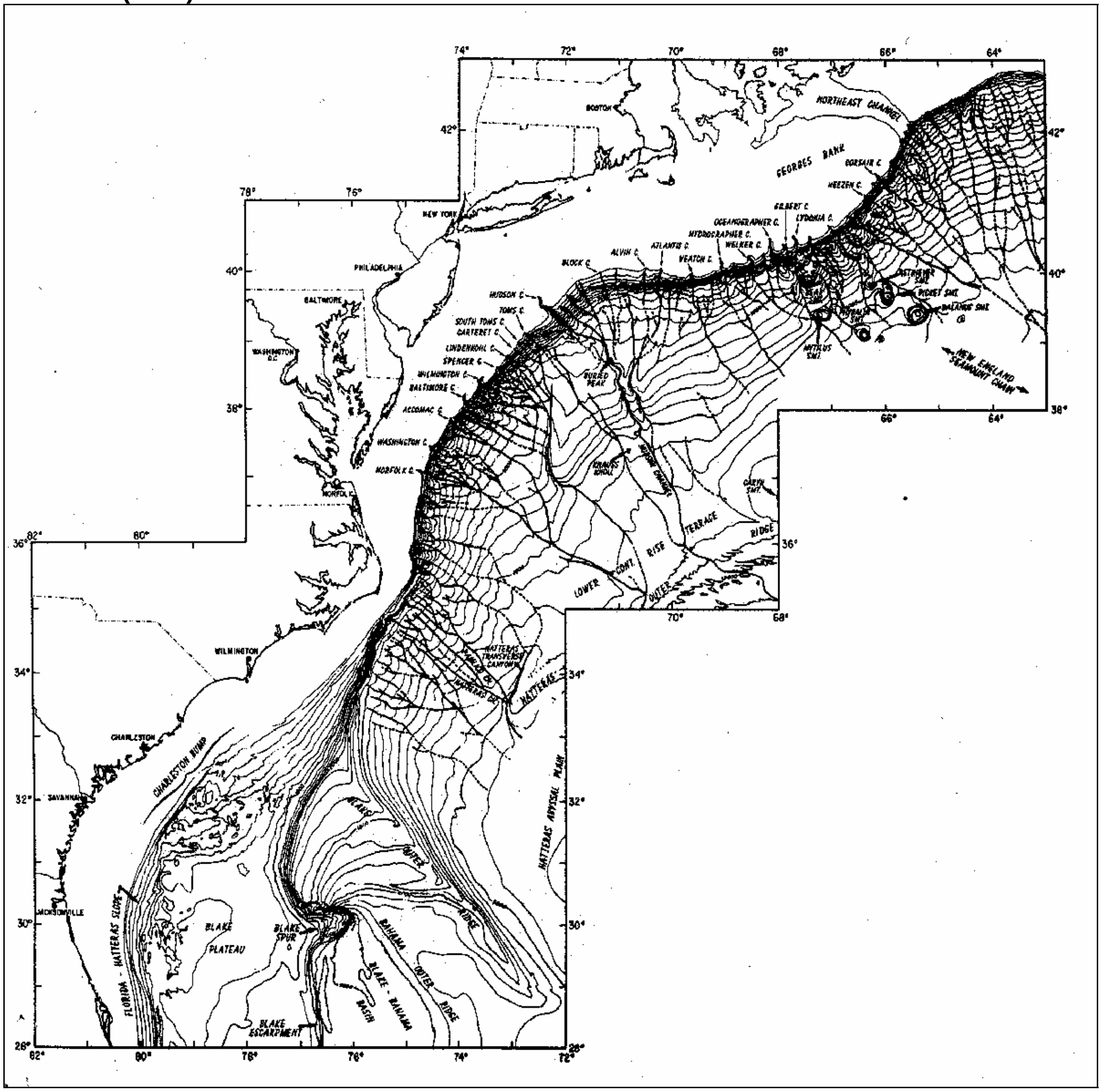
A “mud line” occurs on the slope at a depth of 250-300 m, below which fine silt and clay-size particles predominate (

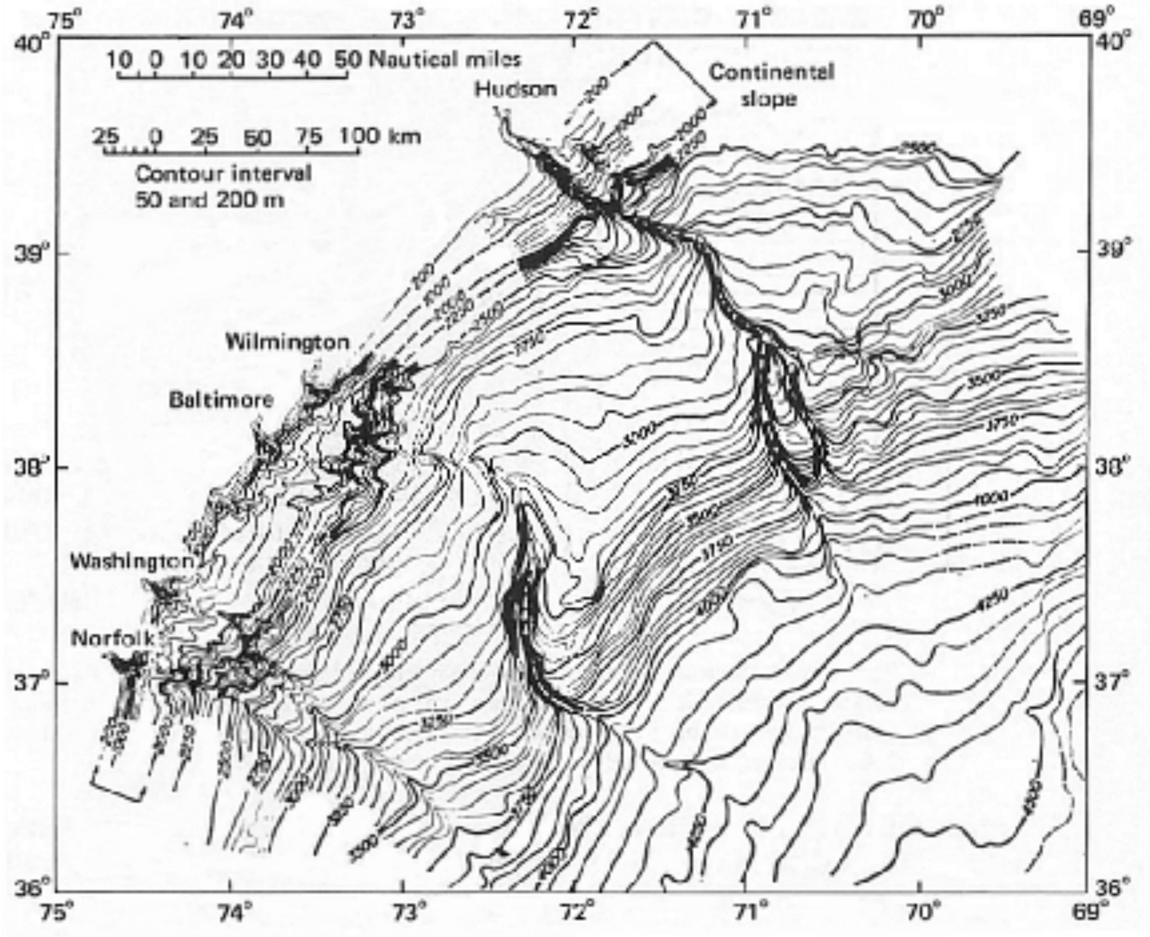
Map 599). Localized coarse sediments and rock outcrops are found in and near canyon walls, and occasional boulders occur on the slope as a result of glacial rafting. Sand pockets may also be formed as a result of downslope movements.

Gravity induced downslope movement is the dominant sedimentary process on the slope, and includes slumps, slides, debris flows, and turbidity currents, in order from thick cohesive movement to relatively non-viscous flow. Slumps are localized blocks of sediment that may involve short downslope movement. However, turbidity currents can transport sediments thousands of kilometers.

The water masses of the Atlantic continental slope and rise are essentially the same as those of the North American Basin (defined in Wright and Worthington 1970). Worthington (1976) divided the water column of the slope into three vertical layers: deep water (colder than 4°C), the thermocline (4°-17°C), and warm water (warmer than 17°C). In the North American Basin the deep water accounts for two-thirds of all the water, the thermocline for about one quarter, and the warm water the remainder. In the slope water north of Cape Hatteras, the only warm water occurs in the Gulf Stream and seasonally influenced summer waters.

Map 599. Bathymetry of the U.S. Atlantic continental margin. Contour interval is 200 m below 1000 m water depth and 100 m above 1000 m. Axes of principal canyons and channels are shown by solid lines (dashed where uncertain or approximate). Source: Tucholke (1987).





Map 600. Bathymetry of the Mid-Atlantic shelf and slope showing details of submarine canyons and their extensions across part of the continental rise. Source: Pratt (1967).

The principal cold-water mass in the region is the North Atlantic Deep Water. North Atlantic Deep Water is comprised of a mixture of five (5) sources: Antarctic Bottom Water, Labrador Sea Water, Mediterranean Water, Denmark Strait Overflow Water, and Iceland-Scotland Overflow Water. The thermocline represents a fairly straightforward water mass compared with either the deep water or the surface water. Nearly 90% of all thermocline water comes from the water mass called the Western North Atlantic Water. This water mass is slightly less saline northeast of Cape Hatteras due to the influx of southward flowing Labrador Coastal Water.

Seasonal variability in slope waters penetrates only the upper 200 m of the water column. In the winter months, cold temperatures and storm activity create a well-mixed layer down to about 100-150 m, but summer warming creates a seasonal thermocline overlain by a surface layer of low-density water. The seasonal thermocline, in combination with reduced storm activity in the summer, inhibits vertical mixing and reduces the upward transfer of nutrients into the photic zone.

Two currents found on the slope, the Gulf Stream and Western Boundary Undercurrent, together represent one of the strongest low frequency horizontal flow systems in the world. Both currents have an important influence on slope waters. Warm and cold core rings that spin off the Gulf Stream are a persistent and ubiquitous feature of the Northwest Atlantic Ocean. The Western Boundary Undercurrent flows to the southwest along the lower slope and continental rise in a stream about 50 km wide. The boundary current is associated with the spread of North Atlantic Deep Water, and it forms part of the generally westward flow found in slope water. North of Cape Hatteras it crosses under the Gulf Stream in a manner not yet completely understood.

Shelf and slope waters of the Northeast are intermittently but intensely affected by the Gulf Stream. The Gulf Stream begins in the Gulf of Mexico and flows northeastward at an approximate rate of 1 m/second (2 knots), transporting warm waters north along the eastern coast of the United States, and then east towards the British Isles. Conditions and flow of the Gulf Stream are highly variable on time scales ranging from days to seasons. The principal sources of variability in slope waters off the northeastern shelf are intrusions from the Gulf Stream.

The location of the Gulf Stream's shoreward, western boundary is variable because of meanders and eddies. Gulf Stream eddies are formed when extended meanders enclose a parcel of seawater and pinch off. These eddies can be cyclonic, meaning they rotate counterclockwise and have a cold-core formed by enclosed slope water (cold core ring), or anticyclonic, meaning they rotate clockwise and have a warm core of Sargasso Sea water (warm core ring). The rings are shaped like a funnel, wider at the top and narrower at the bottom, and can have depths of over 2000 m. They range in size from approximately 150-230 m in diameter. There are 35% more rings and meanders in the vicinity of Georges Bank than in the Mid-Atlantic region. A net transfer of water on and off the shelf may result from the interaction of rings and shelf waters. These warm or cold core rings maintain their identity for several months until they are reabsorbed by the Gulf Stream. The rings and the Gulf Stream itself have a great influence over oceanographic conditions all along the continental shelf.

Submarine Canyons

Submarine canyons (

Map 599) are not spaced evenly along the slope, but tend to decrease in areas of increasing slope gradient. Canyons are typically "v"-shaped in cross section and often have steep walls and outcroppings of bedrock and clay. The canyons are continuous from the canyon heads to the base of the continental slope. Some canyons end at the base of the slope, but others continue as channels onto the continental rise. Larger and more deeply incised canyons are generally significantly older than smaller ones, and there is also evidence that some older canyons have experienced several episodes of filling and re-excavation. Many, if not all, submarine canyons may first form by mass-wasting processes on the continental slope, although there is evidence that some canyons formed as a result of fluvial drainage. Hudson Canyon extends landward across the continental shelf via the Hudson Shelf Valley.

Canyons can alter the physical processes in the surrounding slope waters. Fluctuations in the velocities of the surface and internal tides can be large near the heads of the canyons, leading to enhanced mixing and sediment transport in the area. Shepard et al. (1979) concluded that the strong turbidity currents initiated in study canyons were responsible for enough sediment erosion and transport to maintain and modify those canyons. Since surface and internal tides are ubiquitous over the continental shelf and slope, it can be anticipated that these fluctuations are important for sedimentation processes in other canyons as well. In Lydonia Canyon, Butman et al. (1982) found that the dominant source of low-frequency current variability was related to passage of warm core Gulf Stream rings rather than the atmospheric events that predominate on the shelf.

The continental slope that lies seaward of Georges Bank descends with a gradient of 6-7° from the shelf's edge at a depth of 120-160 m to the continental rise at a depth of about 2,000 m. The slope is incised as much as 1 km by submarine canyons and gullies, resulting in the exposure of pre-Quaternary strata. Submarine canyons have been described as V-shaped, sinuous valleys on the continental shelf or slope that resemble land canyons of fluvial origin; the resemblance is in size and in such features as tributaries, steep walls, and exposed ancient rocks (Shepard 1973). This description fits the canyons along the southern edge of Georges Bank quite well. There are at least 15 canyons cut in to the outer shelf and slope from Veatch Canyon in the west to Corsair Canyon in the east. The heads of these canyons are found well offshore (150 km or so) near the continental shelf edge and contrasts with conditions along the narrow California shelf, where canyon heads are close inshore.

Studies from the submersible *Alvin* (Ryan et al. 1978) show that tidal currents flowing up and down the canyons keep the canyons free of sediment. However, the presence of pits, mounds, and trails formed by benthic animals indicates, that these currents do not rework the sediment during each tidal cycle. According to Ryan et al. (1978), slumping and sliding of the unconsolidated sediment are also important in maintaining the canyons, and the underlying strata are eroded by the displaced sediment moving across them. Animal activity appears also to be significant in controlling the canyon's morphology. Such activity tends to stir up material, which often can be transported down canyon by tidal currents; it also weakens the strata and leads to slumping.

The canyons may be regarded as highly modified areas of the continental slope that exhibit to varying degrees a more diverse fauna, topography, and hydrography than the intervening slope areas. Alternating erosional and depositional episodes over geologic time have shaped and modified the canyon systems into specialized habitats distinct from the classically defined slope province. Diverse sedimentary environments are to be found in each canyon; these result from interaction of modern processes with glacial sediments of Quaternary age and with older, stratified rocks exposed in the canyon walls.

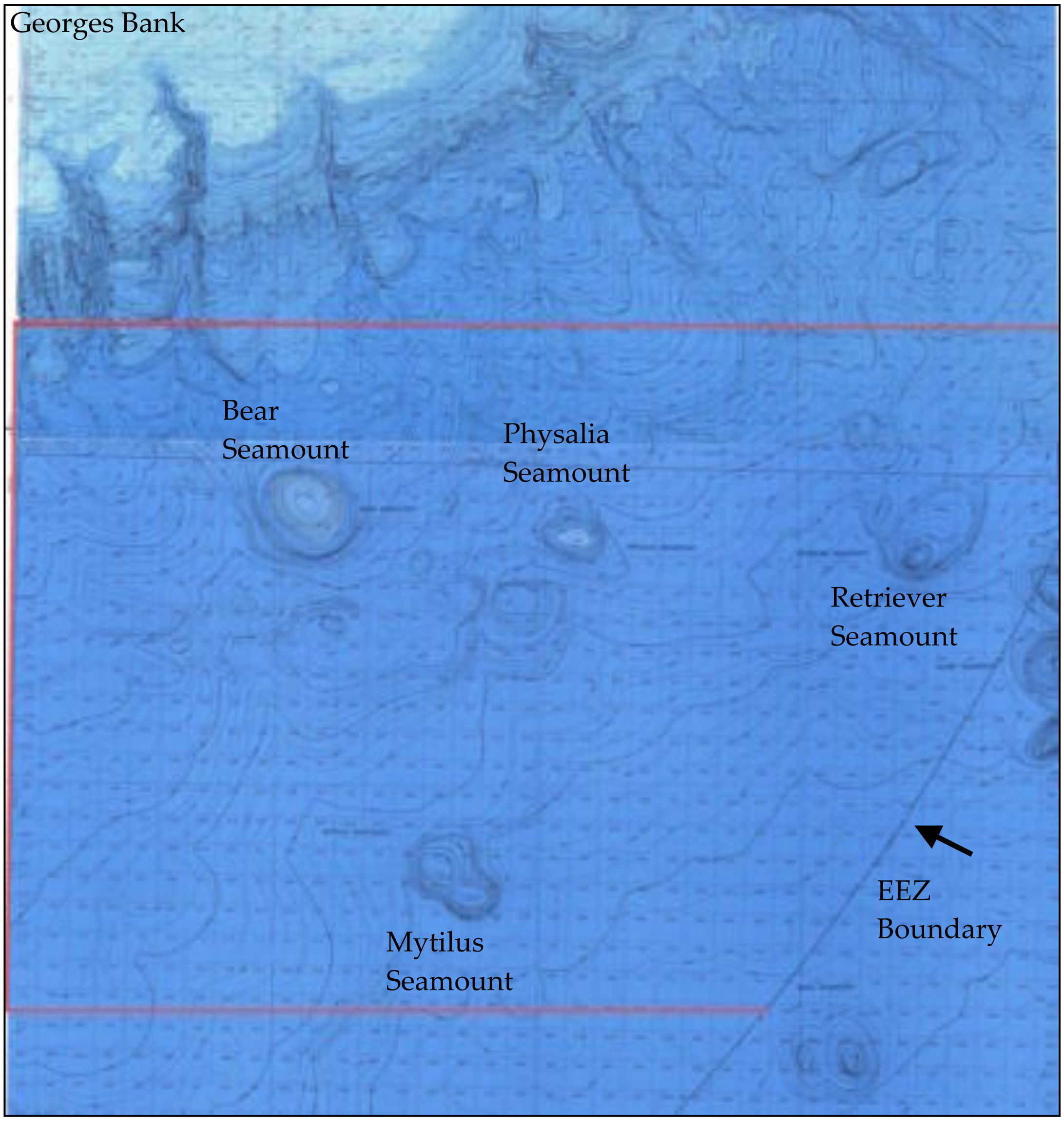
The largest and most studied Georges Bank canyon is Oceanographer Canyon, and its surficial geology is generally similar to that in the other major canyons in the region. The processes responsible for the present distribution of surficial sediments in and around Oceanographer Canyon may be summarized as follows: 1) as sea level fell, Wisconsinan glaciers advanced onto the Canadian Shelf and the northern margin of Georges Bank; 2) sand and gravel were deposited near the ice front in fluvial and nearshore marine environments; sandy silt containing cold water marine faunas was deposited farther offshore, mantling the outer shelf and slope and the walls and floor of a pre-existing canyon; 3) the ice front retreated, Georges Bank was isolated from continental sediment sources, and the Gulf of Maine became a sediment sink, remaining so today; 4) glacial sand and gravel were ice rafted southward from the Northeast Channel and the Canadian margin and deposited on the outer part of Georges Bank and in the canyons; 5) as sea level rose, glacial sand deposited on the inner shelf was reworked and transported seaward by submarine currents, covering the outer shelf and entering the canyons.

6.1.1.5 Seamounts

The New England Seamount Chain, the Corner Rise Seamounts, the mid-Atlantic Ridge, and the deep sides of the Azores constitute a nearly continuous series of hard substrate "islands" in a sea of abyssal mud extending across the North Atlantic Ocean. Seamounts have steep and complex topography, impinging currents with topographically induced upwellings, wide depth ranges, are dominated by hard substrates, are geographically isolated from continental platforms, and are dominated by invertebrate suspension feeders. Seamount faunas generally exhibit a high degree of endemism, owing to their isolation as well as the high degree of landscape variation at small and large spatial scales. These islands are therefore rare habitats within the context of the whole North Atlantic basin.

The New England Seamount chain is a line of more than 30 major extinct volcanoes (they were active between 100 and 80 million years ago) located off the continental shelf, rising as much as 4,000 m above the Sohm Abyssal Plain, and running from the southern side of Georges Bank for about 1,100 km to the eastern end of the Bermuda Rise. Several recent surveys have taken place here. Although most of the seamount chain is located outside the U.S. EEZ, the four (4) most westerly seamounts, which are Bear, Physalia, Mytilus, and Retriever, do occur within the EEZ (Map 601). Bear Seamount is the closest to the U.S. and is the oldest of the New England Seamounts. It was volcanically active just over 100 million years ago and rises from a depth of 2,000-3,000 m to a summit that is 1,100 m below the sea surface. The minimum depths of the others are: Physalia (1,848 m), Mytilus (2,269 m), and Retriever (1,819 m). Several other seamounts outside the U.S. EEZ are biologically significant because they rise to relatively shallow depths. They include Balanus (1,469 m), Kelvin (1,599 m), Atlantis II (1,645 m), Gosnold (1,409 m), Gregg (893 m), San Pablo (1,093 m), Manning (1,312 m) and Rehoboth (1,217 m). Nashville Seamount is much deeper (1,975 m) and also the youngest of the New England Seamounts, having been formed about 80 million years ago. Substrate types of the seamounts range from solid basalt to manganese crusts to rock and coral rubble to mixtures of basalt pebbles and sand to fine carbonate oozes (Auster et al. 2005). Sediments are thickest on the summits with rock surfaces exposed on the sides of the seamounts.

Map 601. The four (4) New England Seamounts within the EEZ


Georges Bank
Bear Seamount
Physalia Seamount
Retriever Seamount
EEZ Boundary
Mytilus Seamount

6.1.2 Biological Environment

From a biological perspective, habitats provide living things with the basic life requirements of nourishment and shelter. Habitats may also provide a broader range of benefits to the ecosystem. An illustration of the broader context is the way seagrasses physically stabilize the substrate and help recirculate oxygen and nutrients. In this general discussion, we will focus on the primary, direct value of habitats to federally managed species—feeding and shelter from predation.

The spatial and temporal variation of prey abundance influences the survivorship, recruitment, development, and spatial distribution of organisms at every trophic level. For example, phytoplankton abundance and distribution are a great influence on ichthyoplankton community structure and distribution. In addition, the migratory behavior of juvenile and adult fish is directly related to seasonal patterns of prey abundance and changes in environmental conditions, especially water temperature. Prey supply is particularly critical for the starvation-prone early life history stages of fish.

The availability of food for planktivores is highly influenced by oceanographic properties. The seasonal warming of surface waters in temperate latitudes produces vertical stratification of the water column, which isolates sunlit surface waters from deeper, nutrient-rich water, leading to reduced primary productivity. In certain areas, upwelling, induced by wind, storms, and tidal mixing, inject nutrients back into the photic zone, stimulating primary production. Changes in primary production from upwelling and other oceanographic processes affect the amount of organic matter available for other organisms higher up in the food chain, and thus influence their abundance and distribution. Some of the organic matter produced in the photic zone sinks to the bottom and provides food for benthic organisms. In this way, oceanographic properties can also influence the food availability for sessile benthic organisms. In shallower water, benthic macro and microalgae also contribute to primary production. Recent research on benthic primary productivity indicates that benthic microalgae may contribute more to primary production than has been originally estimated (Cahoon 1999).

Benthic organisms provide an important food source for many managed species. Populations of bottom-dwelling sand lance are important food sources for many piscivorous species, and benthic invertebrates are the main source of nutrition for many demersal fishes. Temporal and spatial variations in benthic community structure affect the distribution and abundance of bottom-feeding fish. Likewise, the abundance and species composition of benthic communities are affected by a number of environmental factors including temperature, sediment type, and the amount of organic matter.

A number of recent studies illustrate the research that has addressed habitat associations for demersal juvenile fish. In shallow, nearshore coastal and estuarine waters of the Northeast Region, effects of physical habitat factors, prey availability, and predation on the abundance and distribution of young-of-the-year flounder (various species) have been investigated in nearshore and estuarine habitats in the States of, for example, Rhode Island, Connecticut, New Jersey, and North Carolina (e.g.; Rountree and Able 1992; Howell et al. 1999; Walsh et al. 1999; Manderson et al. 2000, 2002, 2003, 2004; Phelan et al. 2001; Stoner et al. 2001; Goldberg et al 2002). There are few comparable studies of more open, continental shelf environments. Steves et al. (1989) identified depth, bottom temperature, and time of year as primary factors delineating settlement and nursery habitats for juvenile silver hake and yellowtail flounder in the Mid-Atlantic Bight. Auster et al. (2001, 2003a, b) identified physical habitat features, including sand waves, burrowed mud seafloor, burrowing anemone forests, and complex piled boulder reefs as features mediating distribution and abundance of demersal fishes in the Gulf of Maine. Also, in a series of publications, Auster et al. (1991, 1995, 1997) correlated the spatial distributions of benthic juvenile fish (e.g. silver hake) with changes in microhabitat type on sand bottom at various open shelf locations in Southern New England. Field, laboratory, and modeling studies both demonstrate and support the paradigm that physical habitat attributes can mediate patterns of survivorship, distribution, and abundance of demersal fishes, especially those at juvenile life history stages (e.g., Lough et al. 1989, Lindholm et al. 1999, 2001).

In addition to providing food sources, another important functional value of benthic habitat is the shelter and refuge from predators provided by structure. Three - dimensional structure is provided by physical features such as boulders, cobbles and pebbles, sand waves and ripples, and mounds, burrows and depressions created by organisms. Structure is also provided by attached and emergent epifauna.

The importance of benthic habitat complexity was discussed by Auster (1998) and Auster and Langton (1999) in the context of providing a conceptual model to visualize patterns in fishing gear impacts across a gradient of habitat types. Based on this model, habitat value increases with increased structural complexity, from the lowest value in flat sand and mud to the highest value in piled boulders. The importance of habitat complexity to federally managed species is a key issue in the Northeast Region.

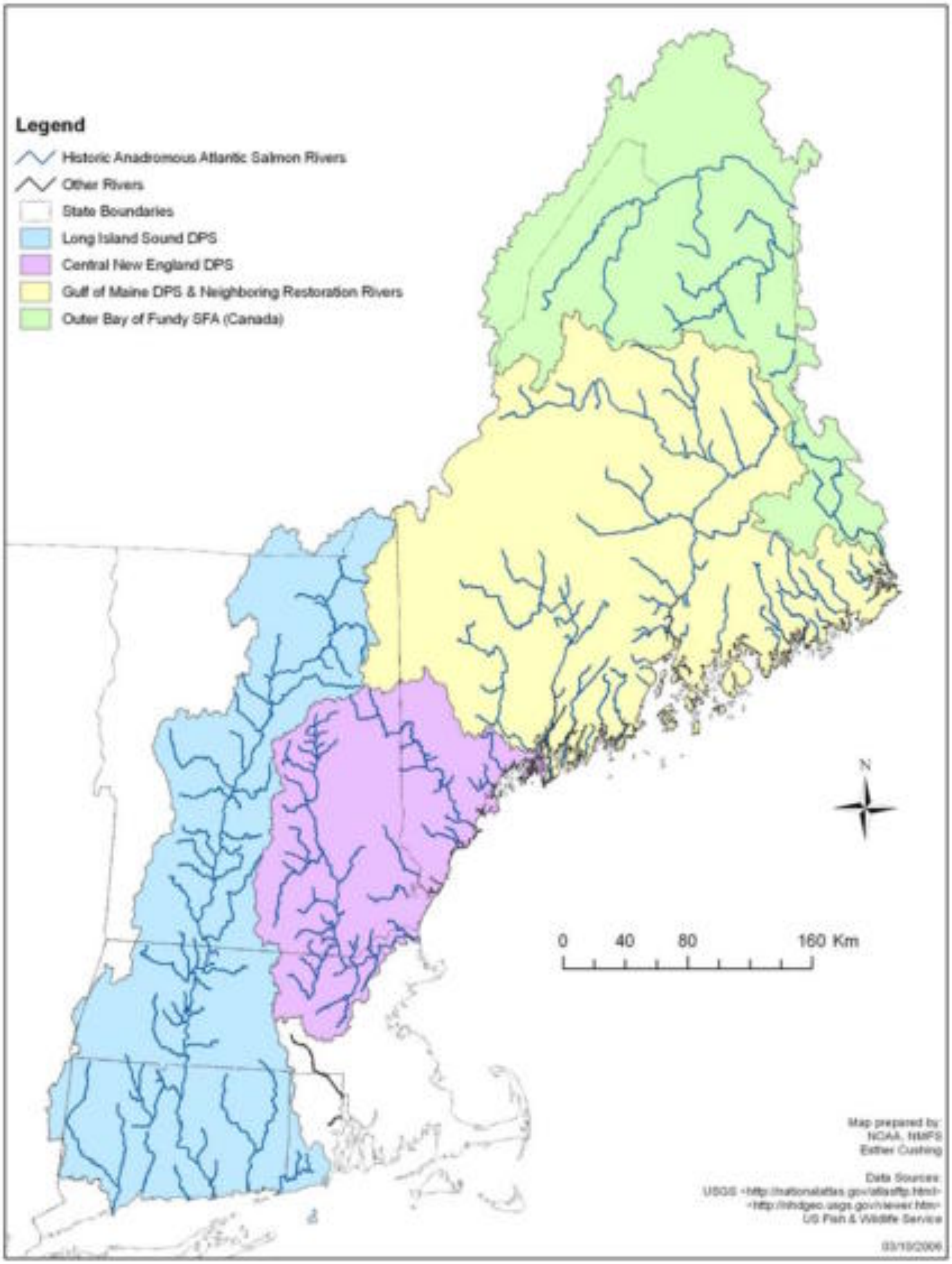
6.1.2.1 Terrestrial/Salmon

North American Atlantic salmon historically ranged from the Leaves River, Quebec, Canada southward to the Housatonic River in the State of Connecticut (Colligan et al. 1999). Salmon streams can generally be characterized as having moderately low (0.2%) to moderately steep (1.4%) gradient (Fay et al 2006). In New England, the majority of major river systems with unobstructed fish passage likely sustained population(s); however, the current range is severely restricted and many populations have been extirpated (Colligan *et al*. 1999). Remaining Atlantic salmon populations in the U.S. include the Penobscot, Gulf of Maine Distinct Population Segment (DPS), and several restoration stocks (Map 8). Within the Gulf of Maine DPS, eight rivers currently contain remnant populations that are naturally reproducing: the Dennys, Narraguagus, Machias, East Machias, Sheepscot, Ducktrap, and Pleasant Rivers and Cove Brook (Colligan et al. 1999) while much of this historic range is vacant.

Most Atlantic salmon adults ascend New England rivers beginning in the spring and continuing into fall with the peak occurring in June. They spawn from October to November; those having returned early in the spring spend nearly five (5) months in the river before spawning, seeking cool water refugia (e.g., deep pools, springs, and mouths of smaller tributaries) during the summer months (Fay et al 2006). Redds are constructed in riffles at sites of upwelling and downwelling and in gravel substrate consisting of particles < 100 mm in diameter (Elson 1975) and dominated by stones of 2-64 mm in diameter [Bjornn and Reiser (1991), cited in Webb *et al.* (2001)]. High intra-gravel water velocities through the redd are necessary to ensure sufficient oxygen delivery to eggs and alevins (Stanley and Trial 1995), and to prevent metabolic waste and sediment accumulation (DeCola 1970). Scarnecchia et al. (1989), Moir et al. (1998), and Webb et al. (2001) found that yearly and decadal changes in stream flow resulted in varied utilization of spawning sites. Less variable annual discharge allows a higher degree of predictably of habitat utilization, particularly at the low population densities currently found in the northeastern U.S. (Webb et al. 2001).

Juveniles prefer areas with adequate cover, water depths ranging from approximately 10-60 cm, water velocities between 30 and 92 cm per second, and water temperatures near 16°C (Beland 1984; Beland et al. 2004). They have also been shown to prefer riffles; however, young Atlantic salmon may inhabit a wide range of habitats such as pools, lakes, and weedy areas of lower velocity (cited in DeGraaf and Bain 1986).

Map 602. Current and historic Atlantic salmon rivers of the northeast.



Map prepared by:
NOAA, NMFS
Esther Cushing

Data Sources:
USGS <http://nationalatlas.gov/atlasftp.html>
<http://nhdgeo.usgs.gov/viewer.htm>
US Fish & Wildlife Service

03/10/2006

6.1.2.2 Inshore

Gulf of Maine to Long Island Sound

As described by Tyrrell (2005), the Gulf of Maine rocky intertidal zone is often inhabited by an abundance of brown seaweeds. At high tide, the algae form an underwater canopy similar to a kelp forest. When the tide is low, the algae lie on the rocks and protect snails, mussels, barnacles, and crabs from exposure to sun, wind, rain, and bird predators. Typical canopy-forming fucoid brown algal species are collectively known as rockweed and include knotted wrack (*Ascophyllum nodosum*), bladder wrack (*Fucus vesiculosus*), and spiral wrack (*Fucus spiralis*). *Ascophyllum nodosum* and *Fucus vesiculosus* are found in the mid-intertidal zone, and *F. spiralis* is found in the upper intertidal zone. Their abundance and primary productivity contributes to the high productivity of the rocky intertidal shores, which is nearly ten times greater than that of the adjacent open ocean (Harvey et al. 1995). On rocky shores, invertebrates and algae live in horizontal zones between the high and low tide marks. The zones reflect the varying abilities of species to tolerate the environmental conditions, predation, and competitive pressures at different heights. The highest zone is the splash zone, which is colored darkly by lichens that tolerate salt spray. Just below the splash zone, acorn barnacles inhabit the high intertidal zone. On wave-exposed shores, blue mussels often populate the middle and low intertidal zone with many small invertebrates living in crevices among them. At less wave exposed sites, rockweeds may dominate the mid-intertidal zone, and red algae (*Chondrus crispus* and *Mastocarpus stellatus*) may cover the low intertidal zone. Tide pools form in depressions in intertidal rock outcrops and provide habitat for some animals and algae that otherwise might not survive exposure to air.

Boulders in the Gulf of Maine intertidal zone support similar species as rocky outcrops because they are not frequently overturned by waves due to their large size (Tyrrell 2005). They serve as substrate for algae, mollusks, barnacles, hydroids, and other sessile organisms. In addition, boulders provide shelter from wind, sun, rain, and predators for small organisms that can take shelter underneath and beside them. Fish forage less efficiently in boulder fields than on flat, rocky outcrops because the boulders offer hiding places for prey (Tyrrell 2005).

Although sandy beaches and dunes are more common to the south of Cape Cod, they occur in every state along the Gulf of Maine coast. Cape Cod, for example, is notable for its prominent sandy beaches and dune systems. Sand beaches are constantly in motion, and their shape, size, and location shift continually due to wind, waves, and storms. During winter, beaches tend to have a steep profile and coarser sand due to stormy conditions that carry fine sand into deeper waters; in summer, beaches flatten and have a broader intertidal zone composed of fine sand deposited by gentler waves (Tyrrell 2005). Therefore, beaches are harsh environments, and the highest reaches have few animals except for nesting shorebirds and ghost crabs. At the high tide mark, waves deposit seaweeds and other debris, providing an important source of food and refuge for isopods and amphipods. In turn, shorebirds eat these small crustaceans. Mole crabs, razor clams, and coquina clams inhabit the surf zone, where they filter food and are hunted by shorebirds (Tyrrell 2005).

Intertidal mudflats are described by Roman et al. (2000) and Tyrrell (2005). They are common and extensive in New England, and in some parts of the Gulf of Maine, mudflats represent over 50% of the total area of estuarine habitat types (Roman et al. 2000). Farther south, such as along the States of New Jersey and Delaware estuarine shorelines, mudflats are far less common, mainly because of reduced tidal range (Roman et al. 2000). In the Gulf of Maine they frequently occur within protected areas next to eelgrass (*Zosteria marina*) meadows and salt marshes (Tyrrell 2005).

Mudflats support microalgal production, dominated by benthic diatoms, while some are dominated by macroalgal mats (Whitlatch 1982; Roman et al. 2000. Macroalgae such as the green alga, *Ulva lactuca*, are found in Long Island Sound under high nutrient loads, while the green filamentous algae, *Enteromorpha intestinalis* occur in relatively undeveloped State of Maine estuaries for unknown reasons (Welsh 1980; Vadas and Beal 1987). Roman et al. (2000) notes that these microalgal and macroalgal primary producers, coupled with the input of organic matter from adjacent habitats, play an important role in structuring and supporting a rich benthic fauna.

Many of the invertebrates in mudflat bottoms live near the mud's surface because oxygen typically becomes scarce within a few centimeters of the sediment surface. To adjust to the harsh, oxygen-deprived conditions, many organisms build and maintain burrows or tubes, while some have adaptations such as siphons or tubes for filter-feeding (Watling 1998). Some of the animals are suspension-feeders that obtain food particles from the water and thus act to transfer energy from the water column to the seafloor. In contrast, deposit-feeders ingest the sediments and extract the organic material from them. Predators are important in shaping benthic community structure and abundance in mudflats (Roman et al. 2000). North of Cape Cod, infaunal predators such as polychaetes dominate and mobile predators are not abundant, while south of Cape Cod, large mobile predators such as blue crab and spot dominate (Bertness 1999). Fish use the mudflats as feeding grounds at high tide. Mudflats are less biologically productive than salt marshes (Whitlatch 1982), but their role in the conversion of primary production to secondary production is nonetheless a valuable ecosystem function (Tyrrell 2005).

Roman et al. (2000) provides an overview of tidal marshes from the Gulf of Maine to Long Island. The northern region of the State of Maine may represent a transition to Bay of Fundy salt marshes. North and east of Penobscot Bay along the Maine coast, the low marsh is dominated by *Spartina alterniflora*, but the high marsh has a greater diversity of plant species (Calhoun et al. 1993). In addition to *Spartina patens* and *Juncus gerardii*, the mosaic pattern of northern State of Maine salt marshes may include *Juncus balticus*, *Festuca rubra*, *Agrostis gigantea*, and *Carex paleacea*, among others. Along the upland border of salt marshes throughout New England and extending into the southern State of Maine, *Phragmites australis* commonly occurs; it has not been noted by several authors (Roman et al. 2000) in more northern salt marshes of the State of Maine and the Bay of Fundy region.

Southern New England

For Southern New England, a distinct pattern of vegetation is observed, with a narrow band of tall *Spartina alterniflora* occupying the low marsh, areas flooded twice daily by tides, and with high marsh areas flooded less frequently and forming a mosaic of vegetation types that may include *Spartina patens*, *Distichlis spicata*, the short form of *S. alterniflora*, and *Juncus gerardii*. Salt marsh panes, shallow depressions on the marsh surface often vegetated with forbs, and salt marsh pools can be present throughout the high marsh mosaic (Roman et al. 2000).

Habitats dominated by seagrass and other submerged aquatic vegetation occur along the estuarine gradient from marine to freshwater tidal portions of estuaries from the State of Maine to Long Island (Roman et al. 2000). Seagrass species include eelgrass (*Zosteria marina*) and widgeon grass (*Ruppia maritima*); both of which have broad salinity tolerances, although *Ruppia* commonly occurs in brackish to freshwater estuarine areas or in salt marsh pools (Richardson 1980; Thayer et al. 1984). Within freshwater or brackish water tidal portions of the relatively shallow Hudson and Connecticut River estuaries, submerged aquatic vegetation can be extensive (e.g., *Ruppia, Vallisneria americana*, *Potamogeton perfoliatus*) (Roman et al. 2000). In the Hudson River, beds of submerged vegetation, primarily *Vallisneria*, can occupy as much as 20% of the river bottom in areas shallow enough for establishment and growth of these light-limited plants (Harley and Findlay 1994).

Salt marshes and submerged aquatic vegetation (sea grasses and macroalgae) provide an important food supplement in the form of detritus (POC) to the estuarine food web. This supplements the phytoplankton production in the water column and the riverine input of DOC/POC from the larger watershed that support the grazing food chain. The geomorphology (size, shape, volume, etc.) and hydrology of the estuary determine how important this detritus food web is in supplementing the grazing food chain. In general the detritus food web is an important supplement in shallow coastal embayments surrounded by wetlands or adjacent to urban areas which have high loading rates for DOC and POC.

Much of the POC in estuaries is converted to DOC by microbes, which is then exported to the coastal ocean. In the coastal ocean the ratio of DOC/POC/phytoplankton carbon is roughly 75:5:1. Much of the non-living DOC and POC is processed by the microbial loop (which is why P<R), while the phytoplankton carbon and some of the POC (detritus) supports the grazing food chain that leads to fish/shellfish. It is not known whether the microbial food loop is linked to the grazing food chain through the activity of micro-, meso- and macrozooplankton and filter feeding macrobenthic organisms, or whether most of the carbon in the microbial loop is respired (sink). Biogeochemical cycling is dominated by the lower trophic levels in the water column (microbial loop) with the majority of the primary production supported by recycled nutrients (ammonium). In the coastal ocean the spring or fall phytoplankton bloom is supported by new nutrients (nitrate) introduced from the bottom waters into the surface waters. This bloom transports carbon from diatoms to zooplankton which lies at the base of the grazing food chain supporting pelagic (directly) and demersal fish (indirectly).

6.1.2.3 Gulf of Maine/Georges Bank/Mid-Atlantic

The following summary of phytoplankton primary productivity and chlorophyll *a* of the Northeast shelf ecosystem and the sources for this summary can be found in Sherman et al. (2003). Estimates of annual total phytoplankton primary production from Nova Scotia to Cape Hatteras are shown in Map 603 by region. Annual production on the shelf ranges from 10,834 to 21,043 kJ m^{-2} yr^{-1} (260-505 gCm^{-2} yr^{-1}) with the annual average of 350 gCm^{-2} yr^{-1}. The areas of highest estimated production on the shelf occur on the central, shallow portion of Georges Bank [18,960 kJ m^{-2} yr^{-1} (445 gCm^{-2} yr^{-1})] and along the coast between the States of New Jersey and North Carolina [21,043 kJ m^{-2} yr^{-1} (505 gCm^{-2} yr^{-1})] which correspond to the areas with consistently high chlorophyll *a* concentrations (O'Reilly and Zetlin 1998). The areas of the shelf with the lowest estimated annual production include the outer shelf area between Cape Hatteras, the southern edge of Georges Bank and nearshore Gulf of Maine, and the mid-shelf area between Delaware Bay and Chesapeake Bay.

Map 603. Estimated annual primary production in the Northeast shelf ecosystem

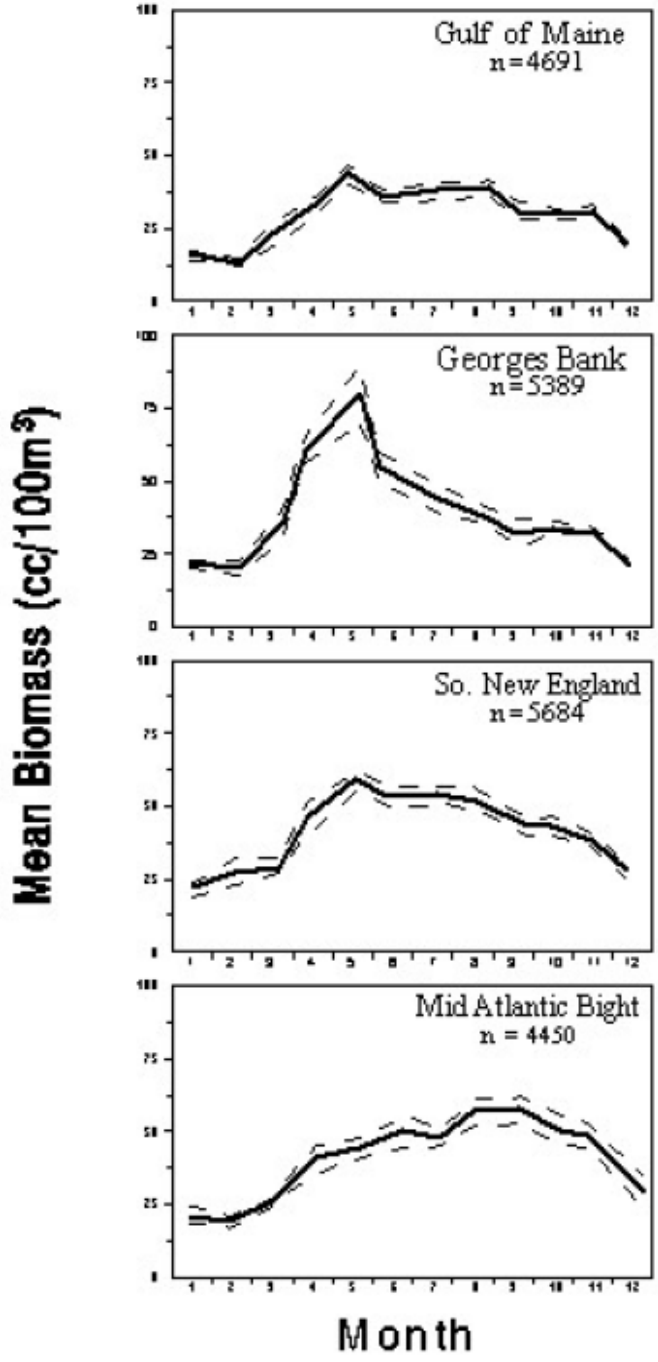
The regions selected are based on the recurring seasonal patterns of chlorophyll distribution along the continental shelf. Source: Sherman et al. (2003).

Sherman et al. (2003) also discussed the zooplankton of the Northeast shelf ecosystem. The zooplankton biodiversity during the NEFSC Marine Resources Monitoring, Assessment and Prediction (MARMAP) ichthyoplankton surveys of the shelf during the 1970s and 1980s included 394 taxa, with 50 dominant in at least one location in one (1) or more seasons. Taxa included copepods, chaetognaths, barnacle larvae, cladocerans, appendicularia, doliolids, brachyuran larvae, echinoderm larvae, and thaliaceans (Sherman et al. 1988). The annual cycle of zooplankton biomass on the Northeast shelf ecosystem is shown in Figure 1.

In the Gulf of Maine, biomass peaks during spring (44 cc/100 m^3) and remains high through the summer (36-39 cc/100 m^3). The biomass declines in autumn (September) to a winter low (January-February). On Georges Bank, the spring increase in biomass peaks in May at a level that is nearly twice the spring peak in the Gulf of Maine, followed by a decline that continues through autumn to a winter minimum (< 20.2 cc/100 m^3). The waters of Southern New England maintain a relatively high biomass from May through August (55-60 cc/100 m^3). The annual decline in biomass extends from late August through autumn to a winter minimum. Further south in the Mid-

Atlantic Bight, the annual peak is not reached until late August and September (60 cc/100 m^3) followed by a decline from November until the annual minimum in February (19 cc/100 m^3) (Sherman et al. 2003).

Figure 1. The annual cycle of zooplankton biomass on the Northeast shelf ecosystem. *The solid line is the time series monthly mean sample displacement volume and the dashed lines represent the 95% confidence interval. Source: Sherman et al. (2003).*



Gulf of Maine

The Gulf of Maine's geologic features, when coupled with the vertical variation in water properties, result in a great diversity of habitat types. The greatest numbers of invertebrates in this region are classified as mollusks, followed by annelids, crustaceans, and echinoderms (Theroux and Wigley 1998). By weight, the order of taxa changes to echinoderms, mollusks, annelids and cnidarians. Watling (1998) used numerical classification techniques to separate benthic invertebrate samples into seven types of bottom assemblages. These assemblages are identified in Table 73 and their distribution is depicted in Map 10. This classification system considers benthic assemblage, substrate type and water properties.

An in-depth review of GOM habitat types has been prepared by Brown (1993). Although still preliminary, this classification system is a promising approach. It builds on a number of other schemes, including Cowardin et al. (1979), and tailors them to the State of Maine's marine and estuarine environments. A significant factor that is included in this review (but has been neglected in others) is a measure of "energy" in a habitat. Energy could be a reflection of wind, waves, or currents present. This is a particularly important consideration in a review of fishing gear impacts since it indicates the natural disturbance regime of a habitat. The amount and type of natural disturbance is in turn an indication of the habitat's resistance to and recoverability from disturbance by fishing gear. Although this work appears to be complete in its description of habitat types; unfortunately, the distributions of many of the habitats are unknown.

Demersal fish assemblages for the Gulf of Maine and Georges Bank were part of broad scale geographic investigations conducted by Mahon et al. (1998) and Gabriel (1992). Both these studies and a more limited study by Overholtz and Tyler (1985) on Georges Bank found assemblages that were consistent over space and time in this region. In her analysis, Gabriel (1992) found that the most persistent feature over time in assemblage structure from Nova Scotia to Cape Hatteras was the boundary separating assemblages between the Gulf of Maine and Georges Bank, which occurred at approximately the 100 m isobath on northern Georges Bank.

Overholtz and Tyler (1985) identified five (5) assemblages for Georges Bank (Table 74). The Gulf of Maine-deep assemblage included a number of species found in other assemblages, with the exception of American plaice and witch flounder, which were unique to this assemblage. Gabriel's (1992) approach did not allow species to co-occur in assemblages, and also classified these two species as unique to the deepwater Gulf of Maine-Georges Bank assemblage. Results of these two studies are compared in Table 74. Auster et al. (2001) went a step further, and related species clusters on Stellwagen Bank to reflectance values of different substrate types in an attempt to use fish distribution as a proxy for seafloor habitat distribution. They found significant reflectance associations for 12 of 20 species, including American plaice (fine substrate), and haddock (coarse substrate). Species clusters and associated substrate types are given in Table 75.

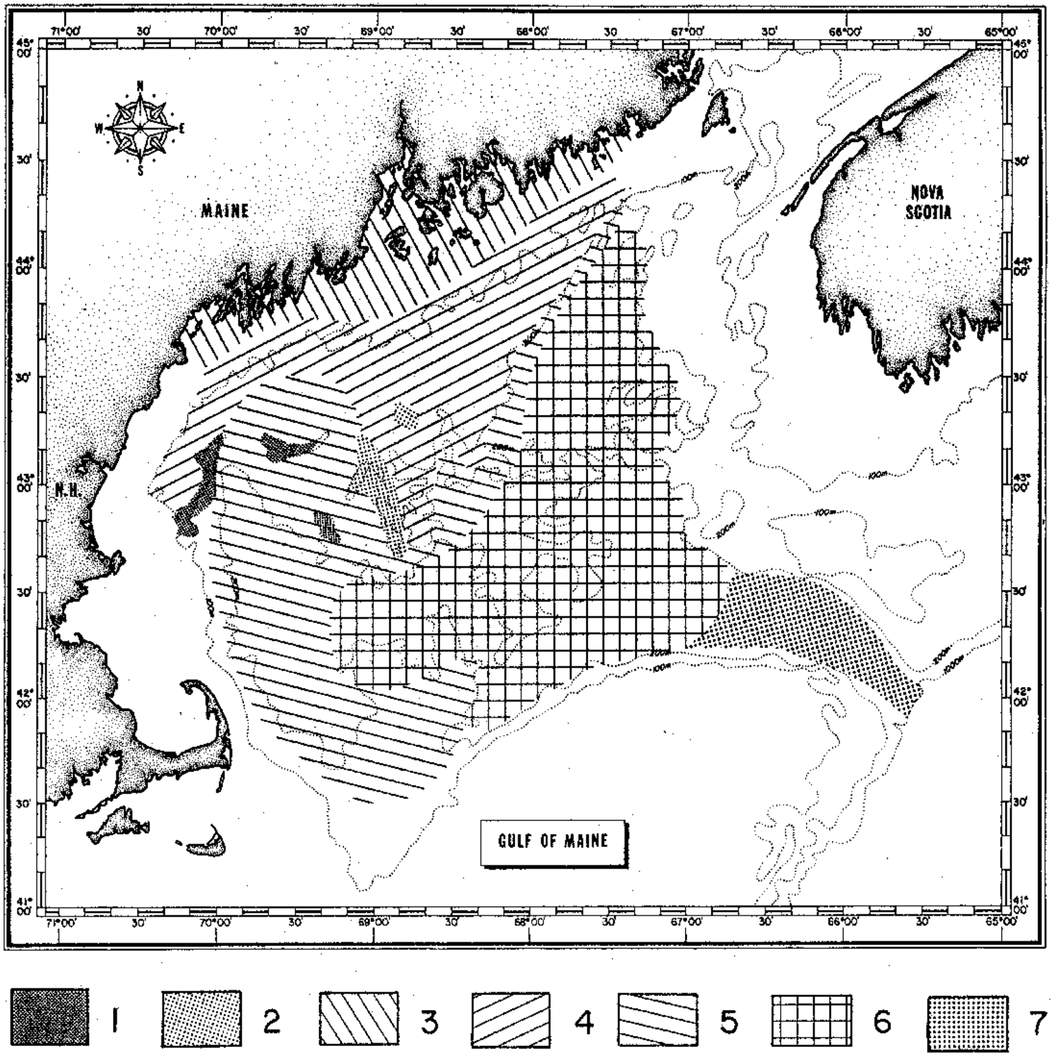
Auster (2002) did a multivariate analysis of annual trawl survey data at six year intervals (i.e.; 1970, 1975, 1981, 1987, 1993) from the Georges Bank-GOM region. Results demonstrated consistent patterns of a singular deep and shallow assemblage of fishes across the region. The shallow water assemblage occurred on Georges Bank and around the rim of the Gulf of Maine, while the deep water assemblage occurred within the deeper basins of the GOM proper. While patterns of species dominance shifted over time, the actual distribution of assemblages remained relatively constant (i.e.; there were shifts in assemblage boundaries that were attributed in part due to shifting station locations within survey strata). The differences between this study and the Overholtz and Tyler (1985) and Gabriel (1992) studies can in part be attributed to differences in spatial boundaries of the data. That is, multivariate approaches produce clusters and the variation in the data sets, based on variations in assemblage composition over space and time, produce variable boundaries. Overholtz and Tyler (1985) found a consistent pattern over Georges Bank alone while Auster (2002) showed a singular assemblage at the spatial scale that produced relevant patterns. Gabriel (1992) also found a deep assemblage within the GOM region and is consistent with the Auster (2002) study.

Table 73. Gulf of Maine benthic assemblages as identified by Watling (1998).

Benthic Assemblage	Benthic Community Description
1	Comprises all sandy offshore banks, most prominently Jeffreys Ledge, Fippennies Ledge, and Platts Bank; depth on top of banks about 70 m; substrate usually coarse sand with some gravel; fauna characteristically sand dwellers with an abundant interstitial component.
2	Comprises the rocky offshore ledges, such as Cashes Ledge, Sigsbee Ridge and Three Dory Ridge; substrate either rock ridge outcrop or very large boulders, often with a covering of very fine sediment; fauna predominantly sponges, tunicates, bryozoans, hydroids, and other hard bottom dwellers; overlying water usually cold Gulf of Maine Intermediate Water.
3	Probably extends all along the coast of the Gulf of Maine in water depths less than 60 m; bottom waters warm in summer and cold in winter; fauna rich and diverse, primarily polychaetes and crustaceans; probably consists of several (sub-) assemblages due to heterogeneity of substrate and water conditions near shore and at mouths of bays.
4	Extends over the soft bottom at depths of 60 to 140 m, well within the cold Gulf of Maine Intermediate Water; bottom sediments primarily fine muds; fauna dominated by polychaetes, shrimp, and cerianthid anemones.
5	A mixed assemblage comprising elements from the cold water fauna as well as a few deeper water species with broader temperature tolerances; overlying water often a mixture of Intermediate Water and Bottom Water, but generally colder than 7° C most of the year; fauna sparse, diversity low, dominated by a few polychaetes, with brittle stars, sea pens, shrimp,

Benthic Assemblage	Benthic Community Description
	and cerianthid also present.
6	Comprises the fauna of the deep basins; bottom sediments generally very fine muds, but may have a gravel component in the offshore morainal regions; overlying water usually 7 to 8° C, with little variation; fauna shows some bathyal affinities but densities are not high, dominated by brittle stars and sea pens, and sporadically by a tube-making amphipod.
7	The true upper slope fauna that extends into the Northeast Channel; water temperatures are always above 8° and salinities are at least 35 ppt; sediments may be either fine muds or a mixture of mud and gravel.

Map 604. Distribution of the seven (7) major benthic assemblages in the Gulf of Maine as determined from both soft bottom quantitative sampling and qualitative hard bottom sampling.



The assemblages are characterized as follows: 1. sandy offshore banks; 2. rocky offshore ledges; 3. shallow (< 50 m) temperate bottoms with mixed substrate; 4. boreal muddy bottom, overlain by Maine Intermediate Water, 50 – 160 m (approx.); 5. cold deep water, species with broad tolerances, muddy bottom; 6. deep basin warm water, muddy bottom; 7. upper slope water, mixed sediment. Source: Watling 1998.

Table 74. Comparison of demersal fish assemblages of Georges Bank and Gulf of Maine identified by Overholtz and Tyler (1985) (Georges Bank only) and Gabriel (1992).

Overholtz and Tyler (1984) – Georges Bank		**Gabriel (1992) – Georges Bank and Gulf of Maine**	
Assemblage	**Species**	**Species**	**Assemblage**
Slope & Canyon	offshore hake blackbelly rosefish Gulf stream flounder fourspot flounder monkfish, whiting white hake, red hake	offshore hake blackbelly rosefish Gulf stream flounder fawn cusk-eel, longfin hake, armored sea robin	Deepwater
Intermediate	whiting red hake monkfish Atlantic cod, haddock, ocean pout, yellowtail flounder, winter skate, little skate, sea raven, longhorn sculpin	whiting red hake monkfish short-finned squid, spiny dogfish, cusk	Combination of Deepwater Gulf of Maine/Georges Bank & Gulf of Maine-Georges Bank Transition
Shallow	Atlantic cod haddock pollock whiting white hake red hake monkfish ocean pout yellowtail flounder windowpane winter flounder winter skate little skate longhorn sculpin summer flounder sea raven, sand lance	Atlantic cod haddock pollock yellowtail flounder windowpane winter flounder winter skate little skate longhorn sculpin	Gulf of Maine-Georges Bank Transition Zone Shallow Water Georges Bank-Southern New England
Gulf of Maine-Deep	white hake American plaice witch flounder thorny skate whiting, Atlantic cod,	white hake American plaice witch flounder thorny skate, redfish	Deepwater Gulf of Maine-Georges Bank

Overholtz and Tyler (1984) – Georges Bank		**Gabriel (1992) – Georges Bank and Gulf of Maine**	
	haddock, cusk Atlantic wolfish		
Northeast Peak	Atlantic cod haddock pollock ocean pout, winter flounder, white hake, thorny skate, longhorn sculpin	Atlantic cod haddock pollock	Gulf of Maine-Georges Bank Transition Zone

Gabriel analyzed a greater number of species and did not overlap assemblages.

Table 75. Ten dominant species and mean abundance/tow^{-1} from each cluster species group and its associated substrate type as determined by reflectance value, from Stellwagen Bank, Gulf of Maine (Auster et al. 2001).

SUBSTRATE TYPE					
Coarse		**Coarse**		**Wide Range**	
Species	**Mean**	**Species**	**Mean**	**Species**	**Mean**
Northern Sand	1172.	Haddock	13.1	American plaice	63.3
Lance	0	Atlantic cod	7.3	Northern sand	53.0
Atlantic herring	72.2	American plaice	5.3	lance	28.5
Spiny dogfish	38.4	Whiting	3.3	Atlantic herring	22.4
Atlantic cod	37.4	Longhorn sculpin	2.0	Whiting	16.0
Longhorn sculpin	29.7	Yellowtail	1.9	Acadian redfish	14.0
American plaice	28.0	flounder	1.6	Atlantic cod	9.5
Haddock	25.7	Spiny dogfish	1.6	Longhorn sculpin	9.1
Yellowtail flounder	20.2	Acadian redfish	1.3	Haddock	7.9
Whiting	7.5	Ocean pout	1.1	Pollock	6.2
Ocean pout	9.0	Alewife		Red hake	
No. tows = 83		No. tows = 60		No. tows = 159	

SUBSTRATE TYPE			
Fine		**Fine**	
Species	**Mean**	**Species**	**Mean**
American plaice	152.0	Whiting	275.0
Acadian redfish	31.3	American plaice	97.1
Whiting	29.5	Atlantic mackerel	42.0
Atlantic herring	28.0	Pollock	41.1
Red hake	26.1	Alewife	37.2
Witch flounder	23.8	Atlantic herring	32.0
Atlantic cod	13.1	Atlantic cod	18.1
Haddock	12.7	Longhorn sculpin	16.8
Longhorn sculpin	12.5	Red hake	15.2
Daubed shanney	11.4	Haddock	13.2
No. tows = 66		No. tows = 20	

Georges Bank

The interaction of several environmental factors including availability and type of sediment, current speed and direction, and bottom topography have been found to combine to form seven sedimentary provinces on eastern Georges Bank (Valentine et al. 1993), which are outlined in Table 76 and depicted in Map 605.

Theroux and Grosslein (1987) identified four (4) macrobenthic invertebrate assemblages that corresponded with previous work in the geographic area. They noted that it is impossible to define distinct boundaries between assemblages because of the considerable intergrading that occurs between adjacent assemblages; however, the assemblages are distinguishable. Their assemblages are associated with those identified by Valentine et al. (1993) in Table 76.

The Western Basin assemblage (Theroux and Grosslein 1987) is found in the upper Great South Channel region at the northwestern corner of Georges Bank, in comparatively deep water (150-200 m) with relatively slow currents and fine bottom sediments of silt, clay and muddy sand. Fauna are comprised mainly of small burrowing detritivores and deposit feeders, and carnivorous scavengers. Representative organisms include bivalves (*Thyasira flexuosa, Nucula tenuis, Musculus discors*), annelids (*Nephtys incisa, Paramphinome pulchella, Onuphis opalina, Sternaspis scutata*), the brittle star *Ophiura sarsi*, the amphipod *Haploops tubicola*, and red crab (*Geryon quedens*). Valentine et al. 1993 did not identify a comparable assemblage; however, this assemblage is geographically located adjacent to Assemblage 5 as described by Watling (1998) (Table 73, Map 605).

The Northeast Peak assemblage is found along the Northern Edge and Northeast Peak, which varies in depth and current strength and includes coarse sediments, mainly gravel and coarse sand with interspersed boulders, cobbles, and pebbles. Fauna tend to be sessile (cnidarians, brachiopods, barnacles, and tubiferous annelids) or free-living (brittle stars, crustaceans, and polychaetes), with a characteristic absence of burrowing forms. Representative organisms include amphipods (*Acanthonotozoma serratum, Tiron spiniferum*), the isopod *Rocinela americana*, the barnacle *Balanus hameri*, annelids (*Harmothoe imbricata, Eunice pennata, Nothria conchylega,* and *Glycera capitata*), sea scallops (*Placopecten magellanicus*), brittle stars (*Ophiacantha bidentata, Ophiopholis aculeata*), and soft corals (*Primnoa resedaeformis*, *Paragorgia arborea*).

The Central Georges Bank assemblage occupies the greatest area, including the central and northern portions of Georges Bank in depths less than 100 m. Medium grained shifting sands predominate this dynamic area of strong currents. Organisms tend to be small to moderately large in size with burrowing or motile habits. Sand dollars (*Echinarachnius parma*) are most characteristic of this assemblage. Other representative species include mysids (*Neomysis americana*, *Mysidopsis bigelowi*), the isopod *Chiridotea tuftsi*, the cumacean *Leptocuma minor*, the amphipod *Protohaustorius wigleyi*, annelids

(*Sthenelais limicola, Goniadella gracilis, Scalibregma inflatum*), gastropods (*Lunatia heros, Nassarius trivittatus*), the starfish *Asterias vulgaris*, the shrimp *Crangon septemspinosa*, and the crab *Cancer irroratus*.

The Southern Georges assemblage is found on the southern and southwestern flanks at depths from 80-200 m, where fine grained sands and moderate currents predominate. Many southern species exist here at the northern limits of their range. Dominant fauna include amphipods, copepods, euphausiids, and the starfish genus *Astropecten*. Representative organisms include amphipods (*Ampelisca compressa, Erichthonius rubricornis, Synchelidium americanum*), the cumacean *Diastylis quadrispinosa,* annelids (*Aglaophamus circinata, Nephtys squamosa, Apistobranchus tullbergi*), crabs (*Euprognatha rastellifera, Catapagurus sharreri*), and the shrimp *Munida iris*.

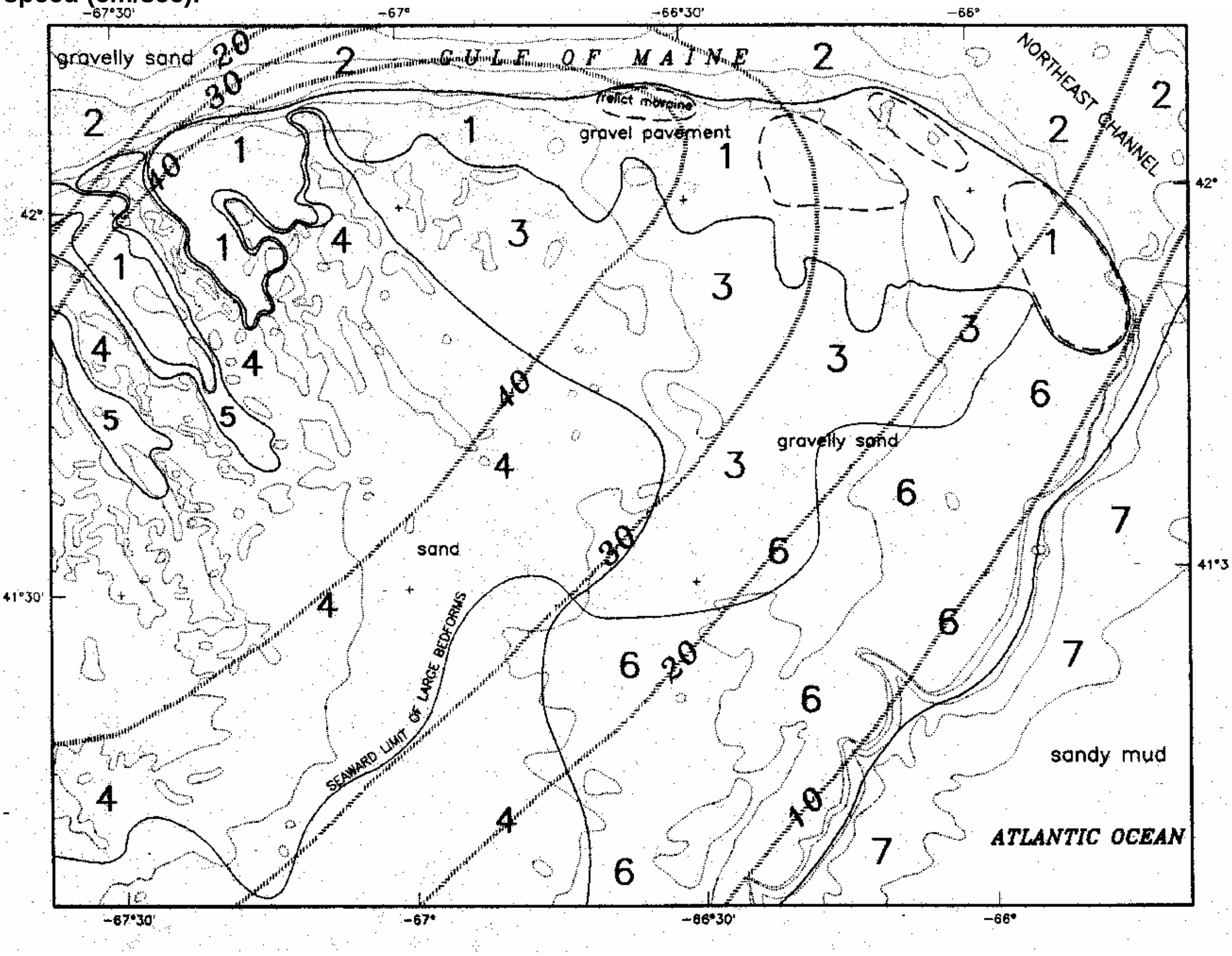
Table 76. Sedimentary provinces of eastern Georges Bank.

Sedimentary Province	**Depth (m)**	**Description**	**Benthic Assemblage**
Northern Edge / Northeast Peak (1)	40-200	Dominated by gravel with few deposits of coarse sand; boulders common in some areas; predominantly a tightly packed pebble pavement. Representative epifauna bryozoa, hydrozoa, *anemones*, and *calcareous* worm tubes. *Strong tidal and storm currents.*	Northeast Peak
Northern Slope and Northeast Channel (2)	200-240	Variable sediment type (gravel, gravelly sand, and sand) and scattered bedforms. This is a transition zone between the northern edge gravel and the sandy and silty sediment of the Gulf of Maine and the southern bank slope. *Strong tidal and storm currents.*	Northeast Peak
North / Central Shelf (3)	60-120	Highly variable sediment type (ranging from gravel to sand) with common rippled sand and large bedforms; patchy gravel lag deposits. *Minimal epifauna on gravel due to sand movement.*	Central Georges
Central and Southwestern Shelf - *shoal ridges* (4)	10-80	Dominated by sand (commonly fine- and medium-grained) with large sand ridges, dunes, waves, and ripples. Small bedforms in southern part. *Minimal epifauna on gravel due to sand movement.*	Central Georges
Central and Southwestern Shelf - *shoal troughs* (5)	40-60	Gravel (including gravel lag) and gravelly sand between large sand ridges. Patchy large bedforms. Strong currents. (Few samples; submersible observations noted presence of gravel lag, rippled gravelly sand, and large bedforms.) *Minimal epifauna on gravel due to sand movement.*	Central Georges
Southeastern Shelf (6)	80-200	Rippled gravelly sand (commonly medium- and fine-grained) with patchy large bedforms and gravel lag. Weaker currents; ripples are	Southern Georges

Sedimentary Province	Depth (m)	Description	Benthic Assemblage
		formed by intermittent storm currents. Representative epifauna include sponges attached to shell fragments.	
Southeastern Slope (7)	400-2000	Silt and clay greater than 10% of sediment associated with sand (commonly medium- and fine-grained); with rippled sand on shallow slope and smooth silty sand deeper.	none

As defined by Valentine et al. (1993) and Valentine and Lough (1991) with additional comments by Valentine (personal communication) and benthic assemblages assigned from Theroux and Grosslein (1987).

Map 605. Sedimentary provinces of eastern Georges Bank based on criteria of sea floor morphology, texture, sediment movement and bedforms, and mean tidal bottom current speed (cm/sec).



Relict moraines (bouldery sea floor) are enclosed by dashed lines. Source: Valentine and Lough (1991).

Along with high levels of primary productivity, Georges Bank has been historically characterized by high levels of fish production. Several studies have attempted to identify demersal fish assemblages over large spatial scales. Overholtz and Tyler (1985) found five depth-related groundfish assemblages for Georges Bank and the Gulf of Maine that were persistent temporally and spatially. Depth and salinity were identified as major physical influences explaining assemblage structure. Gabriel (1992) identified six assemblages, which are compared with the results of Overholtz and Tyler (1985) in Table 74. Mahon et al. (1998) found similar results.

A few recent studies (Garrison 2000, 2001; Garrison and Link 2000) demonstrate the persistence of spatio-temporal overlap among numerically dominant, commercially valuable and /or ecologically important species. The studies by Garrison and associates utilized an index of spatial overlap based on the NOAA spring and fall bottom trawl surveys (Figure 2 - Figure 8). He found that among the community of fish species on Georges Bank, only a very few species have high spatial overlaps with other species. The most notable example is silver hake (whiting), which had a very high overlap with most other species, suggestive of a broad distribution. Trends in spatial overlap over time generally reflect changes in species abundance. During the 1960s, haddock and yellowtail flounder were both widely distributed and had high spatial overlaps with other species. As abundance of these species declined through the 1970s into the 1990s, their spatial range contracted and their overlaps with other species subsequently declined. In contrast to this, species whose abundance has increased through time show an expansion of ranges and increased spatial overlap with other species. Interestingly and to confirm other studies of fish assemblages, the major species assemblages have been generally consistent across time given the changes in relative abundance.

Figure 2. Spatial overlap of primary finfish species on Georges Bank, 1970s (as modified from Garrison and Link 2000).

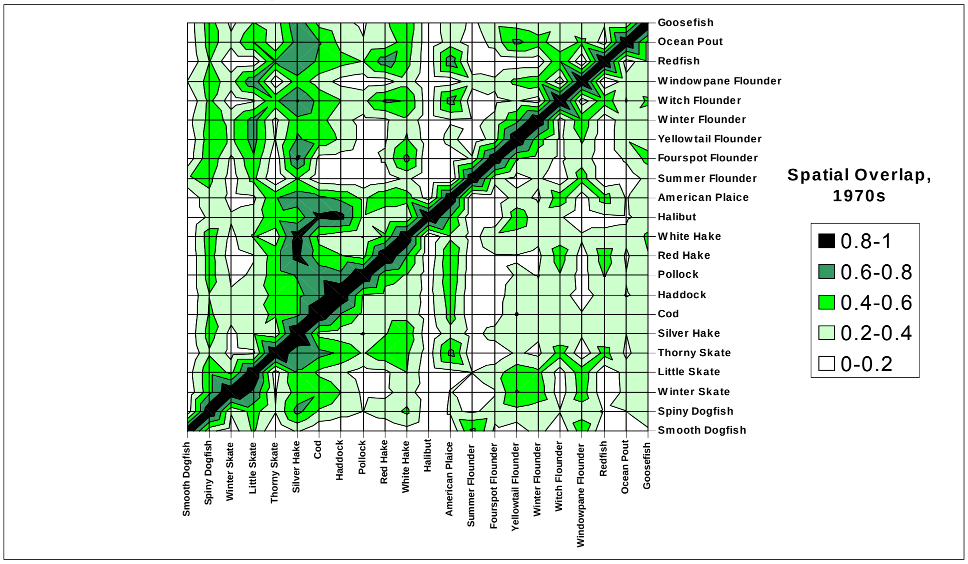


Figure 3. Spatial overlap of primary finfish species on Georges Bank, 1980s (as modified from Garrison and Link 2000

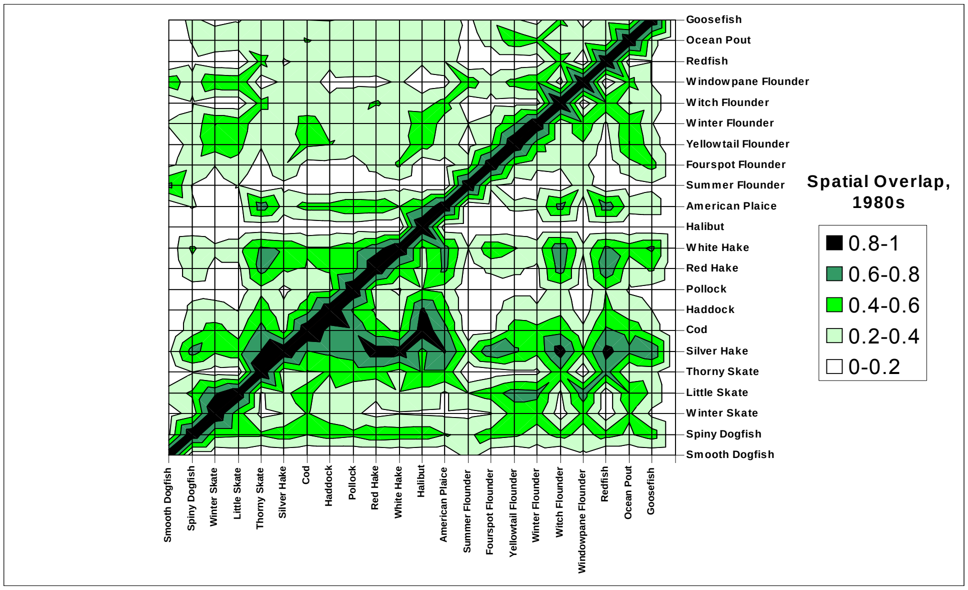
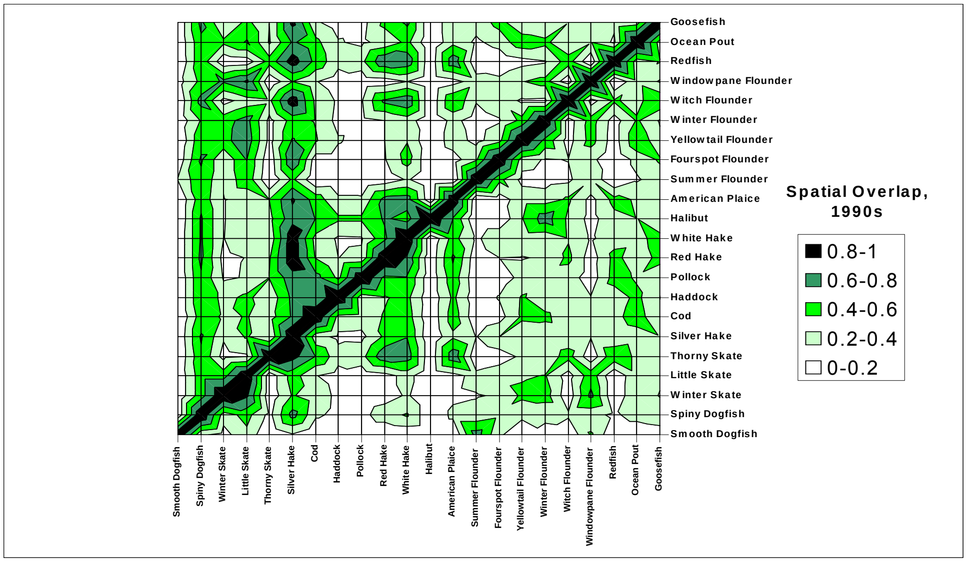


Figure 4. Spatial overlap of primary finfish species on Georges Bank, 1990s (as modified from Garrison and Link 2000)



Seasonal trends in spatial overlap are also apparent. Spiny dogfish, for example, has a far stronger association and a far broader range of species' associations in the winter than it does in the summer. Similarly, winter skate is a more prevalent co-correspondent in winter than other times of the year. This metric, like the spatial overlap trend over time (above), is sensitive to abundance as evidenced by the lack of spatial overlap between Atlantic halibut and any other species.

Figure 5. Spatial overlap of primary finfish species on Georges Bank, spring 1970-1998 (as modified from Garrison and Link 2000).

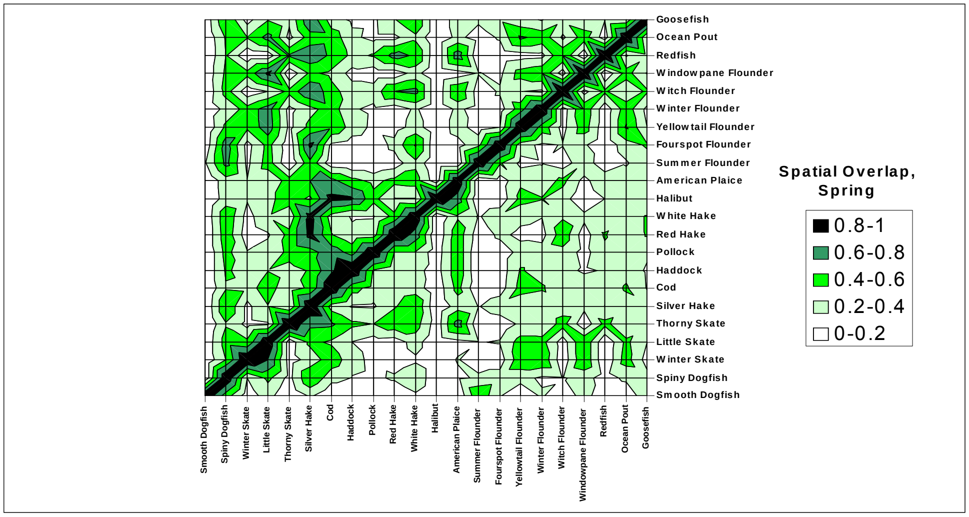


Figure 6. Spatial overlap of primary finfish species on Georges Bank, summer 1970-1998 (as modified from Garrison and Link 2000).

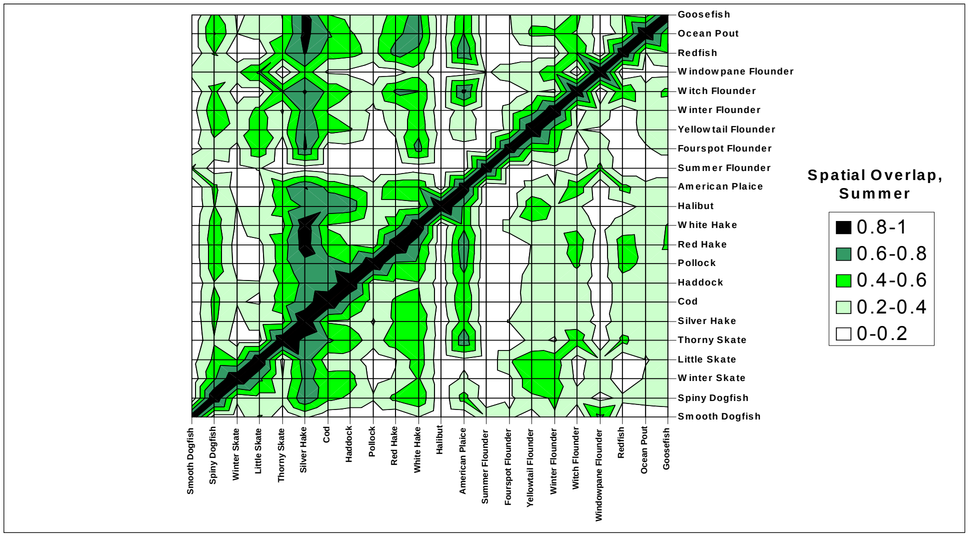


Figure 7. Spatial overlap of primary finfish species on Georges Bank, fall 1970-1998 (as modified from Garrison and Link 2000).

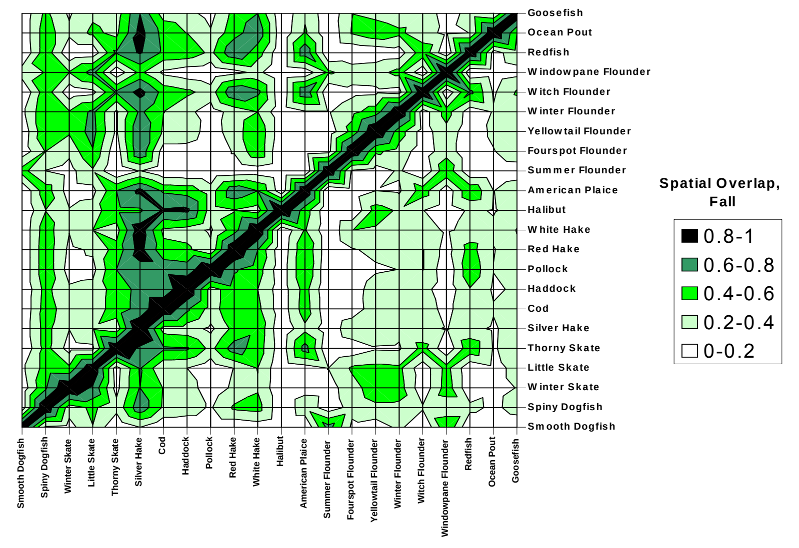
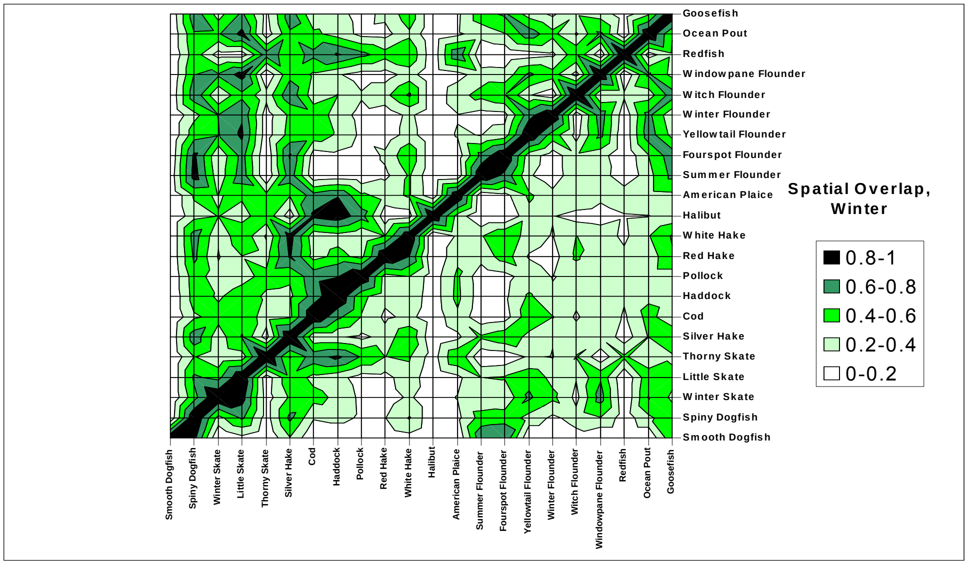


Figure 8. Spatial overlap of primary finfish species on Georges Bank, winter 1970-1998 (as modified from Garrison and Link 2000).



Mid-Atlantic Bight

Three broad faunal zones related to water depth and sediment type were identified for the Mid-Atlantic by Pratt (1973). The "sand fauna" zone was defined for sandy sediments (1% or less silt) which are at least occasionally disturbed by waves, from shore out to 50 m. The "silty sand fauna" zone occurred immediately offshore from the sand fauna zone, in stable sands containing at least a few percent silt and slightly more

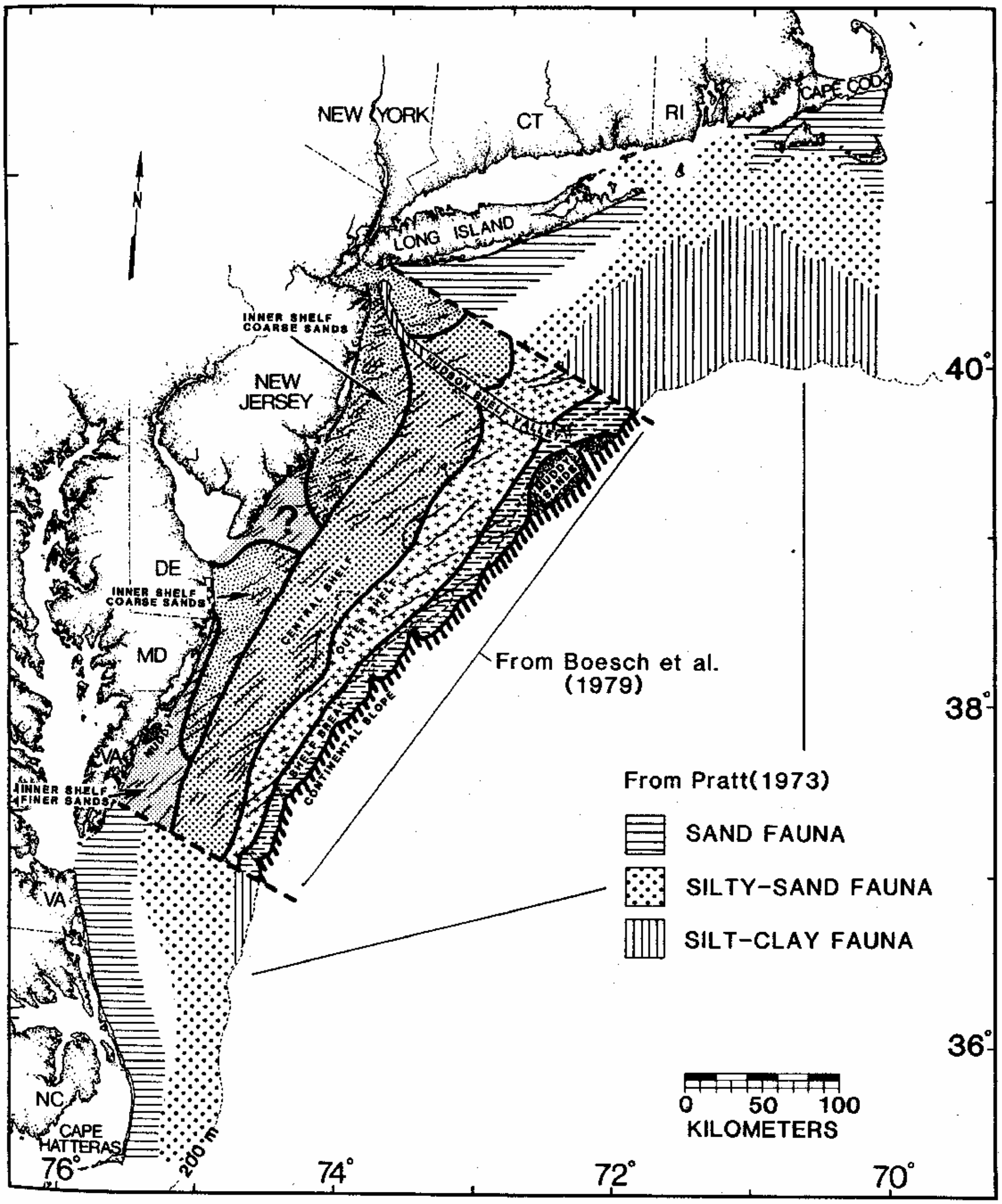
(2%) organic material. Silts and clays become predominant at the shelf break and line the Hudson Shelf Valley, and support the "silt-clay fauna."

Building on Pratt's (1973) work, the Mid-Atlantic shelf was further divided by Boesch (1979) into seven bathymetric/morphologic subdivisions based on faunal assemblages (Table 77, Map 606). Sediments in the region studied (Hudson Shelf Valley south to Chesapeake Bay) were dominated by sand with little finer material. Ridges and swales are important morphological features in this area. Sediments are coarser on the ridges, and the swales have greater benthic macrofaunal density, species richness and biomass. Faunal species composition differed between these features, and Boesch (1979) incorporated this variation in his subdivisions; much overlap of species distributions was found between depth zones, so the faunal assemblages represented more of a continuum than distinct zones.

Table 77. Mid-Atlantic habitat types as described by Pratt (1973) and Boesch (1979) with characteristic macrofauna as identified in Boesch (1979).

Habitat Type (after Boesch 1979)	**Description**		
	Depth (m)	Characterization (Pratt faunal zone)	Characteristic Benthic Macrofauna
Inner shelf	0-30	characterized by coarse sands with finer sands off MD and VA (sand zone)	Polychaetes: Polygordius, Goniadella, Spiophanes
Central shelf	30-50	(sand zone)	Polychaetes: Spiophanes, Goniadella Amphipod: Pseudunciola
Central and inner shelf swales	0-50	occurs in swales between sand ridges (sand zone)	*Polychaetes:* Spiophanes, Lumbrineris, Polygordius
Outer shelf	50-100	(silty sand zone)	Amphipods: Ampelisca vadorum, Erichthonius Polychaetes: Spiophanes
Outer shelf swales	50-100	occurs in swales between sand ridges (silty sand zone)	Amphipods: Ampelisca agassizi, Unciola, Erichthonius
Shelf break	100-200	(silt-clay zone)	not given
Continental slope	>200	(none)	not given

Map 606. Schematic representation of major macrofaunal zones on the Mid-Atlantic shelf.



Wigley and Theroux (1981) found a general trend in declining macrobenthic invertebrate density from coastal areas offshore to the slope, and on the shelf from Southern New England south to the Commonwealth of Virginia and State of North Carolina. There were no detectable trends in density from north to south on the slope. Number of individuals was greatest in gravel sediments, and declined in sand-gravel, sand-shell, sand, shell, silty sand, silt, and finally, clay. However, biomass of benthic macrofauna was greatest in shell habitat, followed by silty sand, gravel, sand-gravel, sand, sand-shell, silt, and clay.

Demersal fish assemblages were described at a broad geographic scale for the continental shelf and slope from Cape Chidley, Labrador to Cape Hatteras, North Carolina (Mahon et al. 1998) and from Nova Scotia to Cape Hatteras (Gabriel 1992). Factors influencing species distribution included latitude and depth.

Results of these studies were similar to an earlier study confined to the Mid-Atlantic Bight continental shelf (Colvocoresses and Musick 1984). In this study, there were clear variations in species abundances, yet they demonstrated consistent patterns of community composition and distribution among demersal fishes of the Mid-Atlantic shelf. This is especially true for five (5) strongly recurring species associations that varied slightly by season (Table 78). The boundaries between fish assemblages generally followed isotherms and isobaths. The assemblages were largely similar between the spring and fall collections, with the most notable change being a northward and shoreward shift in the temperate group in the spring.

Table 78. Major recurrent demersal finfish assemblages of the Mid-Atlantic Bight during spring and fall as determined by Colvocoresses and Musick (1984).

Season	**Species Assemblage**				
	Boreal	**Warm temperate**	**Inner shelf**	**Outer shelf**	**Slope**
Spring	Atlantic cod little skate sea raven monkfish winter flounder longhorn sculpin ocean pout whiting red hake white hake spiny dogfish	black sea bass summer flounder butterfish scup spotted hake northern searobin	windowpane	fourspot flounder	shortnose greeneye offshore hake blackbelly rosefish white hake
Fall	white hake whiting red hake monkfish longhorn sculpin winter flounder yellowtail flounder witch flounder little skate spiny dogfish	black sea bass summer flounder butterfish scup spotted hake northern searobin smooth dogfish	windowpane	fourspot flounder fawn cusk eel gulf stream flounder	shortnose greeneye offshore hake blackbelly rosefish white hake witch flounder

Steimle and Zetlin (2000) described representative finfish species and epibenthic/epibiotic and motile epibenthic invertebrates associated with Mid-Atlantic reef habitats (Table 79). Most of these reefs are human-made structures.

Table 79. Mid-Atlantic reef types, location, and representative flora and fauna, as described in Steimle and Zetlin (2000).

Location (Type)	Representative Flora and Fauna		
	Epibenthic/Epibiotic	**Motile Epibenthic Invertebrates**	**Fish**
Estuarine (Oyster reefs, blue mussel beds,other hard surfaces, semi-hard clay and Spartina peat reefs)	Oyster, barnacles, ribbed mussel, blue mussel, algae, sponges, tube worms, anemones, hydroids, bryozoans, slipper shell, jingle shell, northern stone coral, sea whips, tunicates, caprellid amphipods, wood borers	Xanthid crabs, blue crab, rock crabs, spider crab, juvenile American lobsters, sea stars	Gobies, spot, striped bass, black sea bass, white perch, toadfish, scup, drum, croaker, spot, sheepshead porgy, pinfish, juvenile and adult tautog, pinfish, northern puffer, cunner, sculpins, juvenile and adult Atlantic cod, rock gunnel, conger eel, American eel, red hake, ocean pout, white hake, juvenile pollock
Coastal (exposed rock/soft marl, harder rock, wrecks & artificial reefs, kelp, other materials)	Boring mollusks (piddocks), red algae, sponges, anemones, hydroids, northern stone coral, soft coral, sea whips, barnacles, blue mussel, horse mussel, bryozoans, skeleton and tubiculous amphipods, polychaetes, jingle shell, sea stars	American lobster, Jonah crab, rock crabs, spider crab, sea stars, urchins, squid egg clusters	Black sea bass, pinfish, scup, cunner, red hake, gray triggerfish, black brouper, smooth dogfish,

Location (Type)	**Representative Flora and Fauna**		
	Epibenthic/Epibiotic	**Motile Epibenthic Invertebrates**	**Fish**
			sumemr flounder, scad, bluefish amberjack, Atlantic cod, tautog, ocean pout, conger eel, sea raven, rock gunnel, radiated shanny
Shelf (rocks & boulders, wrecks & artificial reefs, other solid substrates)	Boring mollusks (piddocks) red algae, sponges, anemones, hydroids, stone coral, soft coral, sea whips, barnacles, blue mussels, horse mussels, bryozoans, amphipods, polychaetes	American lobster, Jonah crabs, rock crabs, spider crabs, sea stars, urchins, squid egg clusters (with addition of some deepwater taxa at shelf edge)	Black sea bass, scup, tautog, cunner, gag, sheepshead porgy, round herring, sardines, amberjack, spadefish, gray triggerfish, mackerels, small tunas, spottail pinfish, tautog, Atlantic cod, ocean pout, red hake, conger eel, cunner, sea raven, rock gunnel, pollock, white hake
Outer shelf (reefs and clay burrows including “pueblo village community”)			Tilefish, white hake, conger eel

6.1.2.4 Offshelf

Continental Slope

The following summary of the benthic communities of the continental slope and rise comes in part from Levin and Gooday (2003).

Hecker (1990) examined variation in the megafauna with depth and geographic location on the continental margin south of New England, on the eastern and western edges of Georges Bank, as well as along a transect known as SEEP I (34-2394 m). In this region, 80% of the continental slope consists of gully and ridge morphology (Scanlon 1984). Hecker (1990) described four megafaunal zones with fairly abrupt boundaries. In general, slope-inhabiting benthic organisms are strongly zoned by depth and/or water temperature, although these patterns are modified by the presence of topography, including canyons, channels, and current zonations (Hecker 1990). Moreover, at depths of less than 800 m, the fauna is extremely variable and the relationships between faunal distribution and substrate, depth, and geography are less obvious (Wiebe et al. 1987). Fauna occupying hard-surface sediments are not as dense as in comparable shallow-water habitats (Wiebe et al. 1987) but there is an increase in species diversity from the shelf to the intermediate depths of the slope. Diversity then declines again in the deeper waters of the continental rise and plain. Hecker (1990) identified four megafaunal zones on the slope of Georges Bank and southern New England (Table 8).

Table 80. Faunal zones of the continental slope of Georges Bank and Southern New England. Source: Hecker (1990).

Zone	Approximate Depth (m)	Gradient	Current	Fauna
Upper Slope	300-700	Low	strong	Dense filter feeders; scleratinians (*Dasmosmilia lymani, Flabellum alabastrum*), quill worm (*Hyalinoecia*)
Upper Middle Slope	500-1300	High	moderate	Sparse scavengers; red crab (*Geryon quinqueidens*), long-nosed eel (*Synaphobranchus*), common grenadier (*Nezumia*). Alcyonarians (*Acanella arbuscula*, *Eunephthya florida*) in areas of hard substrate
Lower Middle Slope/Transition	1200-1700	High	moderate	Sparse suspension feeders; cerianthids, sea pen (*Distichoptilum gracile*)
Lower Slope	>1600	Low	strong	Dense suspension and

Zone	Approximate Depth (m)	Gradient	Current	Fauna
				deposit feeders; ophiurid (*Ophiomusium lymani*), cerianthid, sea pen

The upper slope was dominated by solitary scleractinians and quill worms (*Hyalinoecia artifex*), and the lower slope by the brittle star *Ophiomusium lymani*, cerianthid anemones, sea pens and the urchin *Echinus affinis*. These two regions exhibited highest densities. The upper midslope was occupied by lower numbers of red crabs and fishes, and the transition zone by cerianthids, sea pens, and ophiuroids. Animal distributions were controlled by effects of local topography on currents, and accompanying effects on food availability. The mid-slope, where densities were lowest, is a broad depositional band; higher currents are present on the upper and lower slopes where megafaunal densities were greatest.

Comparable studies of megafaunal zonation in the Mid-Atlantic Bight were carried out by Hecker et al. (1983) on the continental margin (100-2300 m) east of the State of New Jersey. Five (5) major zones were observed, with faunal breaks at 400 m, 750 m, 1450 m, and 1600 m. The megafauna between 200 and 400 m comprised mainly crabs (*Cancer* spp., *Munida iris*), sea pens (*Stylatula elegans*), and anemones (*Cerianthus borealis*). Between 400 m and 750 m the dominants were the red crab (*Geryon quinquedens*), the anemone *Bolocera tuediae*, quill worms (*Hyalinoecia artifex*), rattails (*Nezumia* spp.), and hake (*Urophycis chesteri*). Between 700 m and 1400m the eel *Synaphobranchus* spp. became dominant. From 1400-2300 m *Ophiomusium lymani* and *Echinus affinis,* cerianthid anemones, and the sea pen *Distichoptilum gracile* were dominant. As off New England, megafaunal abundances were highest in the shallower (< 600 m) and deeper (> 1400 m) parts of the margin. Species richness was higher in areas with boulders, outcrops, and cliffs than in primarily muddy areas (Hecker et al. 1983).

Surveys of the macrofauna off of New England and Mid-Atlantic Bight margins have been carried out by Rowe et al. (1974, 1982), and Maciolek et al. (1987a, b), and Wigley and Theroux (1981). Wigley and Theroux (1981) reported on a study carried out in the 1960s of macrobenthic invertebrates (> 1 mm) in the Mid-Atlantic Bight between Boston and Cape Hatteras at 563 locations, at depths from 4-3080 m. Macrofaunal densities averaged 293 individuals m^{-2} at 400–999 m, 72 individuals m^{-2} from 1000–1999 m, and 46 individuals m^{-2} from 2000–3080 m. These low densities were probably a result of the large mesh size and sampling bias of the grab samplers used. Corresponding biomass values were 12, 7, and 8 gm^{-2}, respectively. Densities were generally higher off Southern New England than in the New York or Chesapeake Bight areas. A number of groups, including pogonophorans, thyasirid bivalves, hyalinoecid polychaetes, selected ophiuroids, and scaphopods were most abundant at slope and rise depths.

One group of organisms of interest because of the additional structure they can provide for habitat and their potential long life span are the alcyonarian soft corals. Soft corals can be bush or treelike in shape; species found in this form attach to hard substrates such as rock outcrops or gravel. These species can range in size from a few millimeters to several meters, and the trunk diameter of large specimens can exceed 10 cm. Other alcyonarians found in this region include sea pens and sea pansies (Order Pennatulacea), which are found in a wider range of substrate types. In their survey of northeastern U.S. shelf macrobenthic invertebrates, Theroux and Wigley (1998) found alcyonarians (including soft corals *Alcyonium sp., Acanella sp., Paragorgia arborea, Primnoa reseda*, and sea pens) in limited numbers in waters deeper than 50 m, and mostly at depths from 200-500 m. Alcyonarians were present in each of the geographic areas identified in the study (Nova Scotia, Gulf of Maine, Southern New England shelf, Georges slope, Southern New England slope) except Georges Bank. However, *Paragorgia* and *Primnoa* have been reported in the Northeast Peak region of Georges Bank (Theroux and Grosslein 1987). Alcyonarians were most abundant by weight in the Gulf of Maine, and by number on the Southern New England slope (Theroux and Wigley 1998). In this study, alcyonarians other than sea pens were collected only from gravel and rocky outcrops. Theroux and Wigley (1998) also found stony corals (*Astrangia danae* and *Flabellum sp*.) in the Northeast Region, but they were uncommon. In similar work on the mid-Atlantic shelf, the only alcyonarians encountered were sea pens (Wigley and Theroux 1981). The stony coral *Astrangia danae*, was also found, but its distribution and abundance was not discussed, and is assumed to be minimal.

Rowe et al. (1974) reported average densities and biomass on the continental slope south of New England (550–2080 m) to be 3325 individuals m^{-2} and 5.93 gm^{-2}, respectively. Values for the continental rise (2425–3923 m) were 789 individuals m^{-2} and 0.69 gm^{-2}; values for the abyssal plain (4901–4950 m) were 175 individuals m^{-2} and 0.22 gm^{-2}. These slope values were three (3) times the densities and 10 times the biomass observed at comparable depths by Rowe et al. (1974) in the Gulf of Mexico.

Rowe et al. (1982) observed that, on the margin off New England, densities and biomass of macrofauna (> 420 mm) showed significant declines with increasing water depth. Considerable overlap was observed between upper-slope assemblages and those characteristic of shallower waters in the Gulf of Maine. The sharpest faunal boundaries were observed at depths of 1400–1700 m. Dominant taxa were oligochaetes (30%) from 203-570 m; polychaetes (*Cossura longocirrata* and *Heteromastis filiformis* – 27%) from 1141-1437 m; bivalves and polychaetes (*Deminucula cancellata* and *Poecilochaetus fulgoris* – 19%) from 1707-1815 m (DOS I), polychaetes, oligochaetes, and aplacophorans (*Glycera capitata*, oligochaete spp., and *Prochaetoderma* sp. – 17%) from 2341-2673 m (DWD 106), sipunculans and spionid and oweniid polychaetes (20%) from 2749-3264 m (Hudson Rise) and scaphopods and the polychaete *Ophelina abranchiata* (15%) at 3659 m (DOS II). Diversity was greatest at mid-slope depths.

Detailed surveys of the macrofauna (> 0.3 mm) off New England and the Mid-Atlantic Bight were carried out by the United States Minerals Management Service as part of an oil exploration effort (Maciolek et al. 1987a, b). The New England study examined stations between 255 and 2180 m from the United States/Canada border to the region south of Georges Bank (Maciolek et al. 1987a). The Mid-Atlantic Bight study examined stations from 1500-2505 m off the State of New Jersey, near Dump Site 106, and in a test drilling area (Maciolek et al. 1987b). Faunas from off New England and in the Mid-Atlantic Bight were remarkably similar. Polychaetes comprised 44–47% of the total macrofauna, arthropods 22%, and mollusks 14%. Sipunculans and pogonophorans were common as well, particularly at the 1220–1350 m station off New England and the 2100 m station in the Mid-Atlantic Bight. Cirratulid, dorvilleid, paranoid, and spionid polychaetes were among the most abundant taxa. Diversities were maximal at 1220–1350 m in the New England region and 1500–1600 m in the Mid-Atlantic Bight.

Densities off New England ranged from a high of 18,778 individuals m^{-2} at 255 m to a low of 3078 individuals m^{-2} at 2100 m. Dominant taxa included the bivalve *Thyasira ferruginea* at 255 m (overall the most abundant in the study off New England), the polychaetes *Prionospio aluta* and *Tharyx* spp. at 550 m, the sipunculans *Aspidosiphon zinni* and *Golfingia (Nephasoma) daphanes* at 1220–1350 m, and the polychaete *Aurospio dibranchiata* at 2100 m (Maciolek et al. 1987a). In the Mid-Atlantic Bight (1500–2505 m) dominant taxa were polychaetes (*Aurospio dibranchiata* [6.6%], *Pholoe anoculata* [4.4%], *Tharyx* sp. 1 [4.1%], and *Prionospio* sp. [3%]) and 2 prochaetadermatid aplacophorans (together 7%) (Maciolek et al.1987b).

Levin and Gooday (2003) also discussed the benthic communities in the deeper portions of the shelf and on the slope off of Cape Hatteras. The slope off Cape Hatteras appears to be atypical with respect to the rest of the western Atlantic slope in terms of sedimentation and benthic standing stocks. It has been suggested that the sedimentary/nutrient regime is more typical of estuarine or shelf environments (Rhoads and Hecker 1994). The Cape Hatteras region receives high input of organic matter comparable to that occurring in coastal estuaries (DeMaster et al. 1994). The high inputs are associated with high sedimentation rates resulting from outwelling from nearshore embayments and topographic funneling of nutrients from the shelf out to the slope (Blake and Diaz 1994). The Gulf Stream and Virginia currents converge in this region. This convergence, combined with the topographic position of the Cape on the outer edge of the shelf, leads to a funneling of water masses and their constituents offshore (Rhoads and Hecker 1994). Thus, much of the organic input in this region is terrigenous, coming from Chesapeake and Delaware Bays to the north, North Carolina sounds, and the shelf. Evidence for terrigenous inputs comes from lighter $\delta^{13}C$ values for sediments (−21.2) than is observed at sites further south (−18.7 to −19.6) (Blair et al. 1994). The composition of fatty acids and sterols are typical of refractory shelf and estuarine sediments (Harvey 1994). The concentrations of chlorophyll *a* in sediments at depths from 530 m to 2003 m averaged 19.9 mg m^{-2}, a value much higher than observed elsewhere on the eastern continental slope of the United States. Viable diatoms present in cores up to 14 cm below the surface suggest high rates of bioturbation (Cahoon et al. 1994). Observations of rapid subduction of diatoms by maldanid polychaetes at this site support this idea (Levin et al. 1997, 1999), as do other experimental studies of particle mixing (DeMaster et al. 1994; Blair et al. 1996; Fornes et al. 1999). Analyses of fatty acids and sterols suggest that diatoms and dinoflagellates are the principal source of labile organic matter to the sediments, with a minor input of vascular-plant material (Harvey 1994).

The Cape Hatteras margin supports extraordinarily large numbers of megafauna (Hecker 1994) and dense infaunal assemblages with unusually low species diversity (Schaff et al. 1992; Blake and Grassle 1994; Blake and Hilbig 1994). The abundant megafauna includes large populations of brittle stars and asteroids, the foraminiferan *Bathysiphon filiformis*, three (3) demersal fish, two eelpouts and a large anemone (Hecker 1994). These taxa attain much higher population densities off Cape Hatteras than at any other site on the eastern margin of the United States (Hecker 1994).

Macrofaunal densities at depths between 530 and 850 m off Cape Hatteras are also extraordinarily high (46,000–89,000 individuals m^{-2}), about 2–9 times higher than at comparable depths elsewhere on the eastern United States slope (Schaff et al. 1992; Blake and Grassle 1994; Blake and Hilbig 1994). These densities are typical of those found in shallow water, and some of the species are characteristic of shelf depths (Schaff et al. 1992; Blake and Grassle 1994). Bioturbation activity in this area is much higher than in other regions of the Northwest Atlantic margin (Schaff et al. 1992; DeMaster et al. 1994; Diaz et al. 1994; Levin et al. 1997; Fornes et al. 1999).

Submarine Canyons

The following summary of the benthic communities of submarine canyons comes in part from Levin and Gooday (2003).

As opposed to most slope environments, canyons may develop a lush epifauna. Hecker et al. (1983) found faunal differences between the canyons and slope environments. Hecker and Blechschmidt (1979) suggested that faunal differences were due at least in part to increased environmental heterogeneity in the canyons, including greater substrate variability and nutrient enrichment. Hecker et al. (1983) found highly patchy faunal assemblages in the canyons, and also found additional faunal groups located in the canyons, particularly on hard substrates, that do not appear to occur in other slope environments. Canyons are also thought to serve as nursery areas for a number of species (Cooper et al. 1987; Hecker 2001). The canyon habitats in Table 81. Habitat types for the canyons of Georges Bank described by geologic attributes and characteristic fauna (from Cooper et al. 1987). were classified by Cooper et al. (1987).

Table 81. Habitat types for the canyons of Georges Bank described by geologic attributes and characteristic fauna (from Cooper et al. 1987).

Habitat Type	Geologic Description	Canyon Locations	Most Commonly Observed Fauna
I	Sand or semi-consolidated silt substrate (claylike consistency) with less than 5% overlay of gravel. Relatively featureless except for conical sediment mounds.	Walls and axis	Cerianthid, pandalid shrimp, white colonial anemone, Jonah crab, starfishes, portunid crab, greeneye, brittle stars, mosaic worm, red hake, four spot flounder, shell-less hermit crab, silver hake, gulf stream flounder
II	Sand or semi-consolidated silt substrate (claylike consistency) with more than 5% overlay of gravel. Relatively featureless.	Walls	Cerianthid, galatheid crab, squirrel hake, white colonial anemone, Jonah crab, silver hake, starfishes, ocean pout, brittle stars, shell-less hermit crab, greeneye
III	Sand or semi-consolidated silt (claylike consistency) overlain by siltstone outcrops and talus up to boulder size. Featured bottom with erosion by animals and scouring.	Walls	White colonial anemone, pandalid shrimp, cleaner shrimp, rock anemone, white hake, starfishes, ocean pout, conger eel, brittle star, Jonah crab, lobster, black-bellied rose fish, galatheid crab, mosaic worm, tilefish
IV	Consolidated silt substrate, heavily burrowed/excavated. Slope generally more than 5º and less than 50º termed “pueblo village” habitat.	Walls	Starfishes, black-bellied rosefish, Jonah crab, lobster, white hake, cusk, ocean pout, cleaner shrimp, conger eel, tilefish, galatheid crab, shell-less hermit crab
V	Sand dune substrate.	Axis	Starfishes, white hake, Jonah crab, and monkfish

Faunal characterization is for depths < 230 m only.

Submarine canyons offer a highly heterogeneous substratum relative to similar depths on slopes. Several investigations have focused on the benthic faunas of these canyons and the adjacent slope areas, often with differing results. Rowe (1971) reported that Hatteras Canyon, studied with camera and trawl samples, exhibited reduced abundances of some megafaunal species relative to slope habitats, but that other taxa were unique to the canyon. Haedrich et al. (1975, 1980) and Valentine et al. (1980), on the other hand, found that megafaunal assemblages in Alvin, Hudson, and Oceanographer Canyons were similar to those on nearby slopes. Rowe et al. (1982), in studies of the Hudson Canyon off New York, found that macrofaunal composition did not differ inside the canyon from the adjacent slope. Macrofaunal densities were higher within the canyon head only at upper continental slope depths, most likely a result of trapping of labile organic matter. Canyon densities in deeper regions were comparable to those on the outer slope.

Maciolek et al. (1987a) examined macrofauna within and outside Lydonia Canyon (off Georges Bank) at 550 and 2100 m during three cruises. At the shallower station, macrofauna were more abundant within the canyon, owing in part to high densities of the polychaetes *Tharyx annulosus* (32% of total fauna) and *Prionospio aluta* (8.3% of total fauna). Over half of the dominant species exhibited significant density differences at the canyon stations. No macrofaunal differences between the canyon and slope were observed at the deeper station, however.

A series of seven (7) cruises examined the megafauna of the canyons and slopes off New England and the Mid-Atlantic Bight, using bathymetric profiling, a towed camera sled, and submersible observations (Hecker et al. 1983). Lydonia Canyon was studied in detail. At most depths (300–2100 m), densities of megafauna in the canyon were greater than on the slope. Between 300 and 400 m this difference resulted from dense assemblages of the sea pen *Pennatula aculeata* and the brittle star *Ophiura* sp. in the sediment-covered axis, to the coral *Eunephthya florida* on cliffs and to the quill worm *Hyalinoecia artifex* on the lower flanks. Between 500 and 1500 m the canyon contained 38–614 individuals m^{-2}, consisting largely of localized, dense populations of corals, sponges, and shrimps. The sponge *Asbestopluma* sp. was especially abundant between 800 and 950 m. Below 1500m the brittle star *Ophiomusium lymani* became very abundant in Lydonia Canyon and on the slope. In the canyon, maximum *O. lymani* densities occurred between 1750 and 1800 m, and the species remained dominant to at least 2350 m. Other common taxa within Lydonia Canyon and on the nearby slope were the decapod crustaceans *Cancer borealis*, *C. irroratus*, and *Geryon quinquedens,* and a several species of hake (*Urophycis* spp.) and grenadier (*Coryphaenoides carpinus*, *C. rupestris*, and *Nezumia aequalis/bairdii*). At least two species, the longfin hake (*U. chesteri*) and the red crab (*G. quinquedens*), occurred at higher abundances on the slope outside the canyon. Filter feeders and scavengers dominated the canyon fauna at depths less than 1000 m, while deposit feeders (mainly *Ophiomusium lymani*) were dominant below 1500 m. In general, Hecker et al. (1983) found faunal patterns to be more complex and megafaunal assemblages less cohesive within Lydonia Canyon than on the slope.

Baltimore Canyon in the Mid-Atlantic Bight was compared to two slope areas located on the continental margin east of the State of New Jersey (Hecker et al. 1983). Consistent elevation of megafaunal densities was not observed within Baltimore Canyon relative to the comparison slope sites, as was the case in Lydonia Canyon. However, densities from Hedrickson Canyon were consistently higher than at comparable depths on the slope (Hecker et al. 1983). At depths greater than 500 m, dense aggregations of anemones (*Halcurias pilatus* and *Hormathia nodosa*) occurred on the canyon walls. Several dominants on the slope, including a burrowing brittle star (*Amphilimna* spp.), a sea pen (*Stylatula elegans*), and a hard coral (*Desmosmilia lymani*), were less abundant in the canyon. In the Mid-Atlantic Bight, as off New England, crabs and hake were dominant within canyons and on the surrounding slope, but they did not differentiate between these habitats. The rattail *Coryphaenoides rupestris* was the dominant grenadier within Baltimore and Hendrickson Canyons, and appears to be a canyon 'indicator' species. The holothurian *Peniagone* sp. and the sea pen *Distichoptilum gracile* were especially abundant within Hendrickson Canyon. In Baltimore Canyon, scavengers and carnivores dominated the megafauna above a depth of 1400 m, filter feeders dominated between 1400 and 1600 m and deposit feeders dominated below 1600 m (Hecker et al. 1983).

The extent to which canyon faunas appear distinct from those on the surrounding slope is a function of sampling technique and canyon attributes (Hecker et al. 1983). Canyons with low topographic relief and little exposed hard substratum are most likely to resemble open-slope environments. Similarly, trawl sampling is less effective in regions with high topographic relief, but obtains more sediment-dwelling fauna, again causing samples to resemble muddy-slope faunas (Levin and Gooday 2003).

6.1.2.5 Seamounts

Individual seamounts, or small groups of seamounts, may harbor endemic species. In 2003, 63 coral specimens were collected using the *Alvin* submersible during a research cruise that visited Bear, Kelvin, and Manning seamounts (Babb 2005). This collection contained 15 octocoral genera, six (6) antipatharian genera, and some unknown number of zoanthid genera. With an increased number of dives in 2004 using the ROV *Hercules*, 135 corals were collected at Bear, Retriever, Balanus, Kelvin, and Manning seamounts. These specimens represent 23 octocoral genera, seven (7) antipatharian genera, and an unknown number of zoanthid genera. In all, 14 genera were added in 2004, including at those seamounts visited in 2003, but viewing videotapes from the dives indicates there are other octocoral colonies present. There are a series of taxonomic problems in several of the genera, so no estimate of species can be made at this time. However, an initial inspection of the material collected suggests the occurrence of about 15 new species, most in the families Plexauridae, Chrysogorgiidae, and Primnoidae. Taxonomic, genetic, and reproductive studies are ongoing. However, given the greater degree of investigation of corals in the east Atlantic, the presence of these undescribed species also suggests that they have very limited distributions.

Video transects have been used to census deep sea fishes and characterize the landscape in which they operate. To date, 36 fish taxa from 24 families based on *Alvin*, *Hercules*, and *ABE* imagery, have been observed. Moore et al. (2003a) listed 591 species of deepwater fishes in the Northwest Atlantic Ocean that occur at depths greater than 200 m. However, the zoogeography of this region as whole has not been resolved to the level that can predict patterns of distribution and diversity at medium to small spatial scales (i.e., the spatial scale within and between seamounts across the region). Based on observations of variations in habitat features within seamount landscapes, and general patterns in the associations of fishes with such features, Auster et al. (2005) developed a hierarchical landscape classification scheme to classify patterns of habitat use in deepwater fishes. The classification scheme includes geological and biological features as well as the local flow regime as habitat attributes. Preliminary analysis suggests that seamount fishes can be divided into four (4) groups. The members of the first group are generalists and occur in all habitat types. These include halosaurids (i.e. *Aldrovandia* spp.), macrourids (i.e.; *Caelorinchus* spp., *Nezumia* spp.), and *Synaphobranchus kaupi*. The second group, which occurs primarily in basalt habitats, includes an oreosomatid (*Neocyttus helgae*) that appears to have an association with both corals and depressions within basalt pavements. Taxa that make up the third group occur in fine-grained sediment habitats, including macrourids (*Coryphaenoides* spp.), chimaerids (*Hydrolagus* spp.), rajids, alepocephalids, ipnopids (*Bathypterois* spp.), and synodontids (*Bathysaurus* spp.). One final group appears to be specialized in living along the ecotone of ledges and sediment and includes morids (*Antimora rostrata* and *Laemonema* spp.), ophidiid cusk-eels, and other synaphobranchids besides *S. kaupi*. Analysis of transect data is ongoing.

The observed size structures of coral colonies are intriguing. Prior anecdotal observations have indicated that stands of deepwater octocorals tend to be relatively uniform in size, and conspicuously lacking in small colonies. This general pattern has been being found in two species, *Paragorgia* sp. and *Lepidisis* sp., but in *Paragorgia*, tiny recruits have been discovered, consisting of just a few polyps. For this species, it may be that post-settlement mortality plays a role in the absence of small colonies. The size distributions of corals will become much more informative when they can be converted to age distributions. Studies to develop this size-age relationship are underway but regardless of the outcome, it appears that in general, coral communities are composed of cohorts from highly sporadic recruitment.

Distributions of several species (*Paragorgia* sp., *Lepidisis* spp., *Metallogorgia* sp., *Paramuricea* spp., *Candidella* sp., *and Corallium* sp., as well as other scleractinians and antipatharians) are currently being quantified using videotapes and digital still images.

Preliminary quantitative analyses of coral species distributions indicate that community composition differs considerably between seamounts, even at comparable depths. These differences correspond to biogeographical boundaries, or they may be due to species' responses to local habitat conditions, such as substratum type or flow. Substantial variation in faunal composition occurs between sites on a single seamount.

Merrett (1994) found that species richness of deepwater fishes in the North Atlantic, at depths greater than 250 m, was approximately 1094 species belonging to 143 families (589 pelagic and 505 demersal). That there are boundaries limiting the distribution of many species in this vagile fauna is evidenced by the reduced number of taxa (591) found in the Northwest Atlantic alone (Moore et al. 2003a). Further, given that most ichthyofaunal surveys beyond continental shelf waters have been conducted using various types of towed nets over widely separated sampling stations, understanding the actual distribution of many deepwater taxa remains elusive. For example, trawl sampling by Moore et al. (2003b) at Bear Seamount revealed two species known previously only from the eastern Atlantic (i.e., *Hydrolagus pallida* and *Bathypterois dubius*). *H. pallida* was also observed on Manning Seamount as well, using the *Hercules* ROV in 2004 (Auster and Moore, unpublished). Observations of false boarfish, *Neocyttus helgae*, nominally an eastern Atlantic species, were also made during video transects at multiple seamounts during both 2003 and 2004 expeditions (Auster et al., in prep.). These observations suggest that seamount chains may provide "stepping stones" for dispersal and maintenance of populations of deepwater demersal fishes across ocean basins where their vertical distributions are restricted to slope depths (sensu Moore et al. 2003b).

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6.1.2.6 Protected Species Description

The following protected species are found in the environment utilized by the fisheries affected by this action (Table 82). A number of them are listed under the Endangered Species Act of 1973 (ESA) as endangered or threatened, while others are identified as protected under the Marine Mammal Protection Act of 1972 (MMPA). Two right whale critical habitat designations are located in the area in which NEFMC fisheries are prosecuted. The information provided here is summary of the full descriptions provided in the most recent Final Supplemental Environmental Impact Statements or Environmental Assessments prepared for the Northeast Multispecies, Scallop, Herring, Monkfish, Red Crab, Skate and Atlantic Salmon Fishery Management Plans.

Table 82. Protected Species in the Northeast U.S.

Protected Species	***Status***
Cetaceans	
Northern right whale (*Eubalaena glacialis*)	Endangered
Humpback whale (*Megaptera novaeangliae*)	Endangered
Fin whale (*Balaenoptera physalus*)	Endangered
Blue whale (*Balaenoptera musculus*)	Endangered
Sei whale (*Balaenoptera borealis*)	Endangered
Sperm whale (*Physeter macrocephalus*)	Endangered
Minke whale (*Balaenoptera acutorostrata*)	Protected
Pilot whale (*Globicephala* spp.)	Protected
Spotted dolphin (*Stenella frontalis*)	Protected
Risso’s dolphin (*Grampus griseus*)	Protected
White-sided dolphin (*Lagenorhynchus acutus*)	Protected
Common dolphin (*Delphinus delphis*)	Protected
Bottlenose dolphin: coastal stocks (*Tursiops truncatus*)	Protected

Harbor porpoise (*Phocoena phocoena*)	Protected
Seals	
Harbor seal (*Phoca vitulina*)	Protected
Gray seal (*Halichoerus grypus*)	Protected
Harp seal (*Phoca groenlandica*)	Protected
Hooded seal (*Crystophora cristata*)	
Sea Turtles	
Leatherback sea turtle (*Dermochelys coriacea*)	Endangered
Kemp's ridley sea turtle (*Lepidochelys kempii*)	Endangered
Green sea turtle (*Chelonia mydas*)	Endangered*
Loggerhead sea turtle (*Caretta caretta*)	Threatened
Fish	
Shortnose sturgeon (*Acipenser brevirostrum*)	Endangered
Atlantic salmon (*Salmo salar*)	Endangered

* *Green turtles in U.S. waters are listed as threatened except for the Florida breeding population which is listed as endangered.*

6.1.2.6.1 Critical Habitat

Critical Habitat has been designated for Right Whales in Cape Cod Bay and the Great South Channel. There is no evidence to suggest the operation of these fisheries has any adverse effects on the habitat features (e.g., copepod abundance) in the specific areas designated as right whale critical habitat. Therefore, the action is not expected to have effects on critical habitat for right whales that has been designated for Cape Cod Bay and the Great South Channel.

6.1.2.6.2 Description

All of the species identified above have the potential to be affected by the operation of the NEFMC fisheries that are considered in this action. However, given differences in abundance, distribution and migratory patterns, it is likely that effects will occur as well and that the magnitude of effects, when they do occur, will vary amongst the species. Summary information is provided here that describes the general distribution of cetaceans, pinnipeds, and sea turtles within the management areas for the FMPs, as well as the known interactions of gear used in the fisheries with these protected species. Additional background information on the range-wide status of marine mammal and sea turtle species that occur in the area can be found in a number of published documents. These include sea turtle status reviews and biological reports (NMFS and USFWS 1995; Hirth 1997; USFWS 1997; Marine Turtle Expert Working Group (TEWG) 1998 & 2000), recovery plans for Endangered Species Act-listed sea turtles and marine mammals (NMFS 1991; NMFS and USFWS 1991a; NMFS and USFWS 1991b; NMFS and USFWS 1992; NMFS 1998; USFWS and NMFS 1992; NMFS 2005), the marine mammal stock assessment reports (*e.g.*, Waring *et al*. 2005), and other publications (*e.g.*, Clapham *et al.* 1999; Perry *et al.* 1999; Wynne and Schwartz 1999; Best *et al.* 2001; Perrin *et al*. 2002).

Atlantic Salmon

Atlantic salmon belonging to the Gulf of Maine distinct population segment (DPS) of Atlantic salmon occurs within the general geographical area covered by the FMPs considered in this action. A description of the biological affected environment for Atlantic salmon is included earlier in Section 6.1.1.1.

Sea Turtles

Loggerhead, leatherback, Kemp's ridley, and green sea turtles occur seasonally in southern New England and Mid-Atlantic continental shelf waters north of Cape Hatteras. In general, turtles move up the coast from southern wintering areas as water temperatures warm in the spring (James *et al*. 2005; Morreale and Standora 2005; Braun-McNeill and Epperly 2004; Morreale and Standora 1998; Musick and Limpus 1997; Shoop and Kenney 1992; Keinath *et al.* 1987). The trend is reversed in the fall as water temperatures cool. By December, turtles have passed Cape Hatteras, returning to more southern waters for the winter (James *et al*. 2005; Morreale and Standora 2005; Braun-McNeill and Epperly 2004; Morreale and Standora 1998; Musick and Limpus 1997; Shoop and Kenney 1992; Keinath *et al.* 1987). Hard-shelled species are typically observed as far north as Cape Cod whereas the more cold-tolerant leatherbacks are observed in more northern Gulf of Maine waters in the summer and fall (Shoop and Kenney 1992; STSSN database).

Sea turtles are known to be captured in scallop dredge, gillnet and trawl gear, gear types that are used in the fisheries affected by this action. Interactions with scallop gear are likely where sea turtles distribution overlaps with the operation of the fishery. All four species overlap, in part, with the distribution of scallop dredge and trawl gear. To date, all known interactions have occurred during the months of June through October, although interactions also could occur during May and November given the seasonal movements of turtles and the range of the scallop fishery.

To summarize the information available concerning sea turtles interactions with scallop gear, the most recent Biological Opinion issued by NMFS (September 18, 2006) stated 64 sea turtles have been observed captured in scallop gear during the period 1996-2005. All have been identified as hard-shelled sea turtles (loggerheads, Kemp's ridleys, or greens); however, 18 have not been specifically identified to species. Four were four were fresh dead upon retrieval or died on the vessel, 1 was alive but required resuscitation, 26 were alive but injured, 20 were alive and uninjured and 13 were listed as alive but condition unknown.

The 2006 Biological Opinion also discussed observed takes of sea turtles in scallop trawl gear. In October 2004, three loggerheads were observed taken in separate tows on a single trip by a vessel operating off of the Delmarva Peninsula. All three were uninjured and released. Five sea turtles, all identified as loggerheads, were observed captured in scallop trawl gear during the 2005 scallop fishing year. Four of the five were described as alive/uninjured, with the fifth requiring resuscitation.

Large Cetaceans (Baleen Whales and Sperm Whale)

The western North Atlantic baleen whale species (Northern right, humpback, fin, sei, and minke) follow a general annual pattern of migration from high latitude summer foraging grounds, including the Gulf and Maine and Georges Bank, and low latitude winter calving grounds (Perry *et al.* 1999; Kenney 2002). However, this is an oversimplification of species movements, and the complete winter distribution of most species is unclear (Perry et al. 1999; Waring et al. 2005). Studies of some of the large baleen whales (right, humpback, and fin) have demonstrated the presence of each species in higher latitude waters even in the winter (Swingle *et al*. 1993; Wiley *et al*. 1995; Perry *et al*. 1999; Brown *et al*. 2002).

In comparison to the baleen whales, sperm whale distribution occurs more on the continental shelf edge, over the continental slope, and into mid-ocean regions (Waring *et al*. 2005). However, sperm whales distribution in U.S. EEZ waters also occurs in a distinct seasonal cycle (Waring *et al*. 2005). Typically, sperm whale distribution is concentrated east-northeast of Cape Hatteras in winter and shifts northward in spring when whales are found throughout the Mid-Atlantic Bight (Waring *et al*. 2005). Distribution extends further northward to areas north of Georges Bank and the Northeast Channel region in summer and then south of New England in fall, back to the Mid-Atlantic Bight (Waring *et al.* 1999).

Gillnet gear is known to pose a risk of entanglement causing injury and death to large cetaceans. Right whale, humpback whale, and minke whale entanglements in gillnet gear have been documented (Johnson *et al*. 2005; Waring *et al*. 2005). However, it is often not possible to attribute the gear to a specific fishery.

Small Cetaceans (Dolphins, Harbor Porpoise and Pilot Whale)

Numerous small cetacean species (dolphins, pilot whales, and harbor porpoise) occur within the area from Cape Hatteras through the Gulf of Maine. Seasonal abundance and distribution of each species in Mid-Atlantic, Georges Bank, and/or Gulf of Maine waters varies with respect to life history characteristics. Some species primarily occupy continental shelf waters (e.g., white sided dolphins, harbor porpoise), while others are found primarily in continental shelf edge and slope waters (e.g., Risso's dolphin), and still others occupy all three habitats (e.g., common dolphin, spotted dolphins). Information on the western North Atlantic stocks of each species is summarized in Waring *et al*. (2005). Small cetaceans are known be captured in gillnet and trawl gear (Waring *et al*. 2005) that are used in a number of the NEFMC-managed fisheries considered in this action.

<u>Pinnipeds</u>

Of the four species of seals expected to occur in the area, harbor seals have the most extensive distribution with sightings occurring as far south as 30° N (Katona *et al*. 1993). Grey seals are the second most common seal species in U.S. EEZ waters, occurring primarily in New England (Katona *et al.* 1993; Waring *et al*. 2005). Pupping colonies for both species are also present in New England, although the majority of pupping occurs in Canada. Harp and hooded seals are less commonly observed in U.S. EEZ waters. Both species form aggregations for pupping and breeding off of eastern Canada in the late winter/early spring, and then travel to more northern latitudes for molting and summer feeding (Waring *et al*. 2005). However, individuals of both species are also known to travel south into U.S. EEZ waters and sightings as well as strandings of each species have been recorded for both New England and Mid-Atlantic waters (Waring *et al*. 2005). All four species of seals are known to be captured in gillnet and/or trawl gear (Waring *et al*. 2005).

<u>Actions to Minimize Interactions with Protected Species</u>

Many of the factors that serve to mitigate the impacts of NEFMC-managed fisheries on protected species are currently being implemented in the Northeast Region under either the Atlantic Large Whale Take Reduction Plan (ALWTRP) or the Harbor Porpoise Take Reduction Plan (HPTRP). In addition, the Council's FMPs have each undergone repeated consultations pursuant to Section 7 of the Endangered Species Act (ESA). Conclusions in the Opinions have stated that these fisheries are not likely to jeopardize the continued existence of Northern right whales provided that the fisheries are complying with the ALWTRP. NMFS implemented a set of Reasonable and Prudent Alternatives (RPAs) to remedy an earlier jeopardy finding. These RPAs were implemented as revisions to the ALWTRP. As described below, the regulatory measures of the ALWTRP and the HPTRP must be adhered to by any vessel fishing with gillnet gear.

Similarly, the most recent Biological Opinion for the sea scallop fishery concluded that the fishery would not likely jeopardize the continued existence of threatened and endangered sea turtles. Actions taken to mitigate takes of sea turtles are described below.

Harbor Porpoise Take Reduction Plan

NMFS published the rule implementing the Harbor Porpoise Take Reduction Plan on December 1, 1998. The HPTRP includes measures for gear modifications and area closures, based on area, time of year, and gillnet mesh size. In general, the Gulf of Maine component of the HPTRP includes time and area closures, some of which are complete closures; others are closures to gillnet fishing unless pingers (acoustic deterrent devices) are used in the prescribed manner. The Mid-Atlantic component includes time and area closures in which gillnet fishing is prohibited regardless of the gear specifications.

Atlantic Large Whale Take Reduction Plan

The ALWTRP contains a series of regulatory measures designed to reduce the likelihood of fishing gear entanglements of right, humpback, fin, and minke whales in the North Atlantic. The main tools of the plan include a combination of broad gear modifications and time/area closures (which are being supplemented by progressive gear research), expanded disentanglement efforts, extensive outreach efforts in key areas, and an expanded right whale surveillance program to supplement the Mandatory Ship Reporting System.

Key regulatory changes implemented in 2002 included: 1) new gear modifications; 2) implementation of a Dynamic Area Management system (DAM) of short-term closures to protect unexpected concentrations of right whales in the Gulf of Maine; and 3) establishment of a Seasonal Area Management system (SAM) of additional gear modifications to protect known seasonal concentrations of right whales in the southern Gulf of Maine and Georges Bank.

On June 21, 2005, NMFS published a proposed rule (70 *Federal Register* 35894) for changes to the ALWTRP. The new ALWTRP measures proposed to be implemented would expand the gear mitigation measures by: (a) including additional trap/pot and net fisheries (*i.e.*, gillnet, driftnet) to those already regulated by the ALWTRP, (b) redefining the areas and seasons within which the measures would apply, (c) changing the buoy line requirements, (d) expanding and modifying the weak link requirements for trap/pot and net gear, and (e) requiring (within a specified timeframe) the use of sinking and/or neutrally buoyant groundline in place of floating line for all fisheries regulated by the ALWTRP on a year-round or seasonal basis. A final rule for this action has not yet been published.

Atlantic Trawl Gear Take Reduction Team

The first meeting of the Atlantic Trawl Gear Take Reduction Team (ATGTRT) was held in September 2006. The ATGTRT was convened by NMFS as part of a settlement agreement between the Center for Biological Diversity and NOAA Fisheries Service to address the incidental mortality and serious injury of long-finned pilot whales, short-finned pilot whales, common dolphins, and white-sided dolphins in several trawl gear fisheries operating in the Atlantic Ocean. Incidental takes of pilot whales, common dolphins and white-sided dolphins have occurred in fisheries operating under the Atlantic Mackerel, Squid, and Butterfish FMP, as well as in mid-water and bottom trawl fisheries in the Northeast.

The Western North Atlantic stocks of pilot whales, common dolphins, and white-sided dolphins were designated as non-strategic in the 2005 Marine Mammal Stock Assessment Report. Therefore, the charge to the ATGTRT is to develop a take reduction plan within 11 months that, once implemented, will achieve the long-term goal of the Marine Mammal Protection Act of reducing serious injury and mortality of affected stocks to a level approaching a zero mortality rate goal (ZMRG) (which is 10% of the Potential Biological Removal (PBR) of each stock).

Sea Turtle Conservation

On December 3, 2002, the agency published a final rule (67 *Federal Register* 71895) establishing seasonally adjusted gear restrictions by closing portions of the mid-Atlantic EEZ waters to fishing with large-mesh (>8") to protect migrating sea turtles, following an interim final rule published March 21 that year. The basis of this rule was that sea turtles migrate northward as water temperatures warmed. At the time the interim and final rules were published, there was no evidence that the primary fishery involved – monkfish – was being prosecuted in state waters. In 2002, when most monkfish fishermen were not permitted under the FMP to fish in the EEZ and the rest were faced with the sea turtle closures, the proportion of North Carolina monkfish landings from state waters increased five-fold to 92%, posing an unforeseen risk to migrating sea turtles since they were not protected in state waters. In response, NMFS published a final rule on April 26, 2006 (71 *Federal Register* 24776) that included modifications to the large-mesh gillnet restrictions. Specifically, the new final rule revises the gillnet restrictions to apply to stretched mesh that is 7 inches or greater and extends the prohibition on the use of such gear to North Carolina and Virginia state waters. Federal and state waters north of Chincoteague, VA remain unaffected by the large-mesh gillnet restrictions.

NMFS has recently finalized a rule (71 FR 50361, August 23, 2006) that requires modification of scallop dredge gear by use of a chain mat when the gear is fished in Mid-Atlantic waters south of 49 9.0'N form the shoreline to the outer boundary of the EEZ during the period May 1 through November 30 each year. The intent of the dredge gear modification is to reduce the severity of some turtle interactions that might occur by preventing turtles from entering the dredge bag.

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6.2 Economic Environment (VEC 2)

6.2.1 Background

The Sustainable Fisheries Act of 1996 added EFH to the list of resource attributes for councils and NOAA Fisheries to manage side-by-side with the stock biomass and age structure of targeted species. This decision by Congress adds considerable uncertainty and complexity to decision-making, however. Uncertainty increases because the relationship between a fish's habitat and its productivity is only vaguely understood from a qualitative standpoint at this time – not by enough to predict how changing habitat will affect the productivity of target species. Nor have fishermen's responses to spatially-based management been adequately studied to predict behavior at sea where there already are scores of marine managed areas. Also adding to the uncertainty is whether managers will be required to establish harvest rules on sub-populations instead of stocks, although experience is being gained from the area rotation strategy in the Atlantic sea scallop fishery. Finally, management decisions will be based, in part, on data collection programs that were primarily designed for unit-stock management, not populations defined by habitat characteristics. Survey data and fisheries where VMS are required (e.g., the limited access sea scallop fishery) are rich in geographic detail. In contrast, most economic analyses rely on the more sparse geographic content of the vessel logbook data which provides, at best, one point per trip inside a Statistical Area.

The requirement to manage EFH makes management more complex because it forces all parties into adopting a specific strategy for an ecosystem approach to fisheries management. It is difficult to imagine managing the habitat requirements of each species separately because combinations of individual habitat types and species are not partitioned in the environment that way. This strategy would result in the same kinds of management problems that surround regulatory bycatch and single-species management when fishing gear is unspecialized (i.e., catches several species).

Until recently, managed attributes of fish stocks were treated as being spatially homogeneous. Stocks have geographic boundaries, but location was not explicitly managed. Place-based management has increased in usage since at least 1994 when several areas were closed to protect Atlantic cod, haddock, yellowtail flounder, and harbor porpoise. Since then, the number of management areas designed to conserve living marine resources and their habitat has mushroomed to over a hundred, including several habitat closures to protect EFH from the effects of fishing. Place-based management has also become more sophisticated with the advent of area rotation in the Atlantic sea scallop plan, and the designation of Special Access Programs in the multi-species groundfish fisheries.

EFH Omnibus Amendment 2 will be an ecosystem approach to fisheries management because it manages the environment as well as the commodity (i.e., fish in demand by consumers and anglers). The amendment will integrate the Council's nine (9) management plans for multispecies groundfish (large mesh and small mesh), monkfish, dogfish, skates, Atlantic sea scallops, Atlantic herring, red crab, and, to an extent, Atlantic salmon via the requirement to manage habitat. In addition, the amendment could influence the Mid-Atlantic in three (3) ways: (1) restrictions on the use of fishing gears that impact the EFH of species managed by the Council, including in HAPCs; (2) impacts on Mid-Atlantic fishermen (e.g., scallopers) who fish in New England fisheries; and (3) several canyon HAPCs in the Mid-Atlantic.

Scientific uncertainty about how habitat affects the productivity of fish populations, and data bases that were not designed to capture the spatial heterogeneities of asset attributes and fishermen's behavior constrain a description of the Affected Human Environment and any impact analyses of management alternatives that might be done in phase II. A framework for economic analysis is described next.

6.2.2 Economics Framework

A modification of the Gordon-Schaefer model introduces habitat into a conventional economics abstraction of the fishery and its management. This model is used to differentiate types of management objectives, and leads to a framework for describing the AHE and, in phase 2, an analysis of management alternatives.

The Gordon-Schaefer model assumes equilibrium between surplus production from a stock (X):

$$\frac{\partial X}{\partial t} = rX(1 - \frac{X}{K_j})$$

and commercial and recreational harvests:

$$h = qXE$$

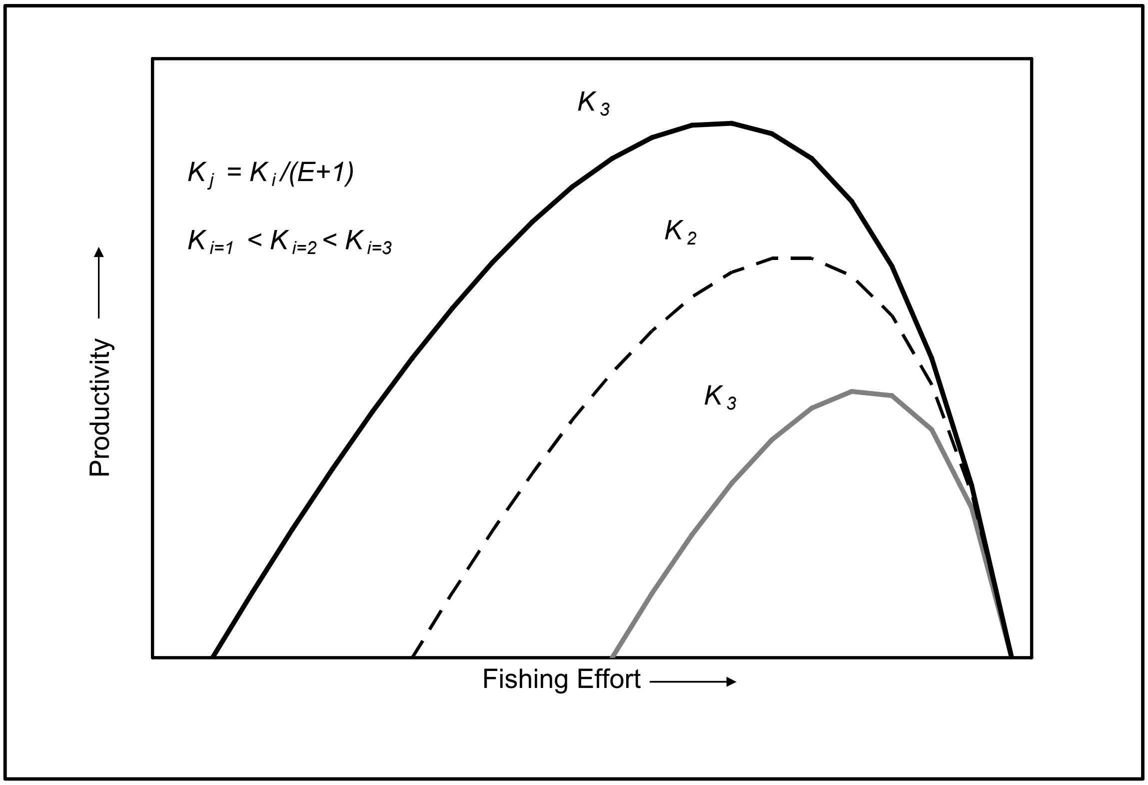
where r is the instantaneous growth rate, K_j is carrying capacity of the environment, q is a catchability parameter, and E is fishing effort. Habitat can be introduced by making carrying capacity a function of fishing effort:

$$K_j = \frac{K_i}{[E+1]}$$

where K_j varies depending on the level of fishing effort or on exogenous changes in the environment which influence K_i, such as shifts in temperature regimes and primary production, habitat alterations caused naturally by storms, or grazers or other species that alter physical structure (e.g., sea urchins eating the holdfasts of kelp, the tunicate introduced to Georges Bank). In EFH policy, fishing effort is assumed to be adverse; therefore, K_j is modeled here to vary inversely to levels E. Also, $K_j = K_i$ when $E=0$.

Substituting the K_j relationship into the growth equation results in the growth relationships diagramed in Figure 9. These curves are not symmetrical like the "camel's hump" from the traditional Gordon-Schaefer model because of the increasing influence of E on K_j and, therefore the population's growth rate. That is, K_j changes in response to the value of E. In addition, the curves shift in and out depending on the value of K_i.

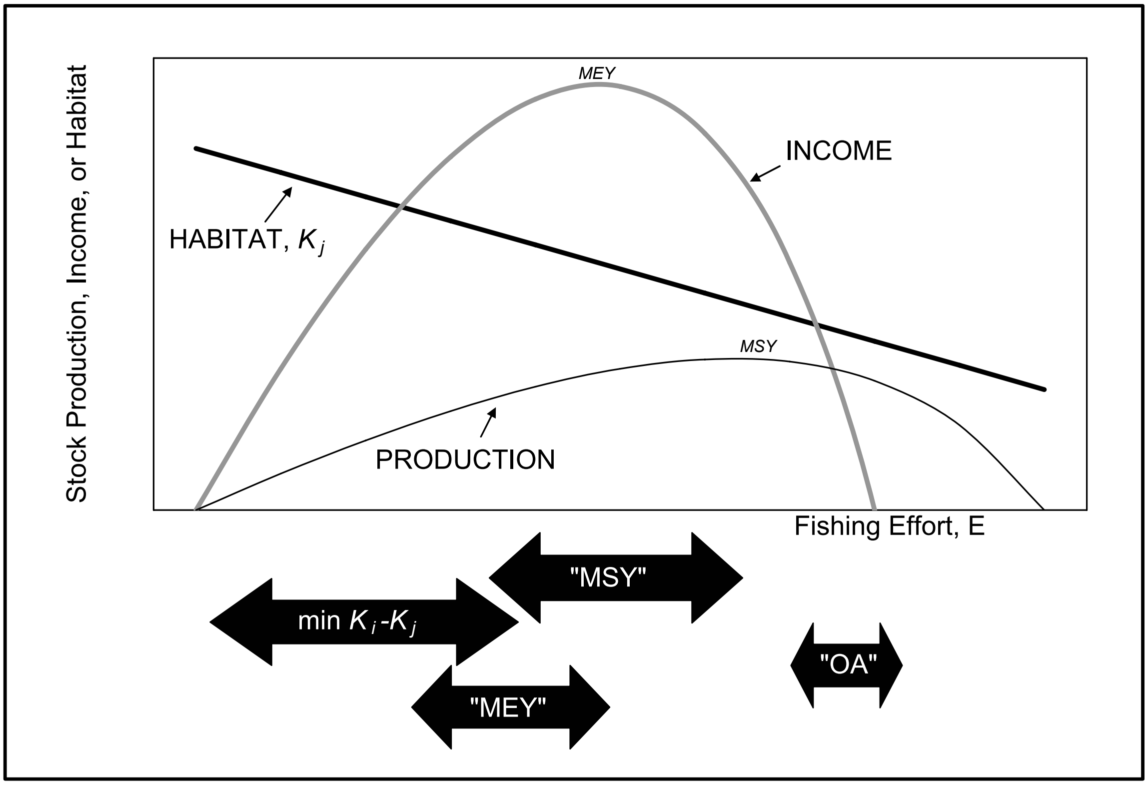
Figure 9. Influence of Fishing Effort (along a curve) and Exogenous Changes in K_i on Resource Productivity



Finally, Figure 10 illustrates four (4) types of fishery management policies and where they position themselves vis-à-vis protecting EFH. Under open access (pure open access and regulated open access, such as the General Category scallop fishery), all objectives are harmed – habitat, stock production and stock size, and income. An MSY policy reduces fishing effort, moving us somewhere along the stock production curve into a precautionary region. An economic policy which maximizes aggregate net benefits (such as income, not revenue) has a similar effect. This region begins somewhere less than the MSY point because of the influence of stock size on operating costs. Finally, the requirement to "minimize to the extent practicable adverse impacts from fishing on EFH" positions management at high levels of habitat, providing the most protection to

EFH. Faced with scientific uncertainty about the relationships between habitat, stock productivity, and economic and cultural benefits, EFH policy focuses on a precautionary strategy to conserve habitat at whatever level is deemed practicable. Without knowledge of the relationship between habitat levels and fish productivity, there will be too much emphasis on one. Most likely, stock biomass will be "too large" and resource productivity and income will be too low depending on the location of the practicability threshold.

Figure 10. Policy Scenarios



The economics framework for this amendment is dictated by the objective to minimize habitat losses and the characteristics of the geographic data available from extant reporting systems. Conventional benefit-cost-analysis of the present value of the commodity benefits of commercial and recreational fisheries will be precluded in Phase 2 by the absence of a 10-20 year time stream of predicted net gains (or losses) in catches resulting from alternative EFH/HAPC policies. Instead, recent data on fishing activities in the 10-minute squares occupied by EFH and HAPCs will be used to approximate current activity spatially.

In addition, the public's valuation of habitat protection is an important factor in an economics assessment of the net benefits of an EFH policy, particularly if the policy includes HAPCs which restrict fishing activities and enhance ecological diversity (diversity of species and habitats). Survey data on the "non-market" values of things such as the existence of protected marine areas are deemed less reliable than actual behavior. Yet, there rarely are alternatives, and we need some understanding of the public's preferences for non-market activities (e.g., recreational fishing) and services (e.g., ecological diversity) in order to evaluate tradeoffs and find an appropriate balance (NRC 1999).

6.2.3 Data and methods

Although VMSs are part of fisheries management in some plans, vessel logbooks are the primary source of fishing data. By providing only one location per trip, logbook data are not a complete trace of a trips path, but this level of detail is not necessarily needed for this amendment provided that the captains report a representative set of coordinates for their trip. In this case, an accurate picture should emerge from hundreds and thousands of records.

Table 83 addresses how often geographic coordinates are reported. In 2005, 3500 vessels in the commercial (including surfclam and ocean quahogs) and for-hire recreational fisheries reported 165 thousand fishing trips. Trips that landed primarily estuarine species (such as blueclaw crabs, oysters, soft-shell clams, and menhaden) were excluded, as were trips landing in ports outside the jurisdiction of the Northeast Region (e.g., Florida). This adjustment reduced the number of commercial seafood trips and vessels by seven (7) and 10 percent, respectively, but it had little effect on the for-hire fishing industry. Records missing fishing coordinates resulted in a further 5% reduction in trips and nearly 2% reduction in vessels in both industries. Finally, an audit of the data resulted in a further decrease in the number of vessels and trips in the final data set. The audit involved filling in fishing coordinates (10-minute-squares) where obvious from a vessel's recent activity, correcting port spellings and key vessel characteristics (mesh size and vessel length), and culling trips with locations on land (whether misreported on the logbook or mistyped by technicians). (The audit will continue while Phase 2 develops.) The final data base used to describe the spatial distribution of fishing activity in the region comprised nearly 90% of the total number of reported trips and vessels in the commercial seafood sector. Records from the for-hire recreational fishing sector were reduced by 5%.

Table 83. Dataset Size. Trip reports are from the vessel logbook system and the surfclam/ocean quahog database.

Scenario	Commercial Fishing		Party and Charter Boat Fishing	
	Number of trips	Number of vessels	Number of trips	Number of vessels
Total	137,642	2932	27,004	619
Total (excluding estuarine species and states outside the Northeast Region)	127,610	2653	26,998	618
Exclude records without fishing coordinates	121,852	2618	25,747	608
Net effect of preliminary audit (e.g., filling gaps in coordinate data, subtracting coordinates on land)	117,685	2616	25,252	609
Percent of total	86%	89%	95%	98%

Table 84 compares captains' hail weights to dealer weighout data for the major species caught in the region. This comparison suggests that misreporting in the logbook system is not a significant problem. In most cases, including those for Atlantic sea scallops and the major groundfish species, the statistics were either within 5% of each other, or the hail weights were greater than the landed weights reported be dealers. Some of the large percentage differences are associated with small numbers (e.g., the tilefish bottom longline fishery and the shrimp fishery). However, the discrepancies in the monkfish, surfclam, and lobster data are noteworthy.

Monkfish weights can be confusing to calculate because of the distinctly different market categories for livers, tails, cheeks, gutted, and whole fish. In this case, hail weights exceed dealer weighouts. Surfclams and ocean quahogs are managed with Individual Transfereable Quotas (ITQs) in a fishery that is vertically integrated with processing. What causes the discrepancy between surfclam estimates is not obvious. The lobster mismatch is most likely due to state reports of catches by the inshore fishery which do not have geographic coordinates. Fishermen who fish only in state waters are not required to submit Federal logbooks.

The high rate of reporting of fishing coordinates and the mostly favorable comparison of hail weights with dealer landings statistics support use of the logbook data. The 10-minute-square was selected as the spatial unit for reporting fishing activity because it conforms to the methods used to describe and map EFH. As mentioned above, however, there still are unanswered questions about (1) whether a single 10-minute-square adequately represents a fishing trip, and (2) whether the locations are reported and transcribed accurately in a sufficient number of cases. Industry might comment on these questions after seeing the maps.

Table 84. Comparison of Logbook Hail Weights and Landings Reported by Dealers, 2005

Species	Hail weight from logbook (M pounds)	Landed weight from dealer reports (M pounds)	% Difference
Cod	11.5	11.9	3
Haddock	13.9	14.6	5
Yellowtail flounder	8.7	9.1	4
Monkfish	29.6	22.1	-34
Spiny dogfish	1.8	2.3	22
Silver hake	16.9	15.1	-12
Lobster	15.4	87.4	82
Red crab	3.6	3.7	3
Sea scallops	55.0	56.6	3
Herring	212.6	213.4	0
Mackerel	98.1	93.1	-5
Tilefish	1.7	1.4	-21
Illex squid	26.1	25.9	-1
Loligo squid	36.3	37.4	3
Pandalid shrimp	5.2	4.1	-27
Surfclam	46.9	59.3	21
Ocean quahog	30.5	30.4	0
Total (without lobster)	598	600	0

Other questions arise around the choice of only one year as the basis for predicting the spatial distribution of fishing activity in the near future. This choice will be affected by resource conditions and access to closed areas which can change between years. An effort will be made to include more years in phase II and to factor in changes in fishery management areas between years (e.g., openings of areas to the scallop fishery).

Logbook data and current regulations were used to identify and describe 20 fisheries for GIS analysis (18 commercial and two (2) recreational). The fisheries were defined in terms of industry (commercial seafood or for-hire recreation), gear type, mesh size, principal species, state-landed, and whether the principal species comprised at least 50% of a trip's revenue (Table 85). The selection of species and gear was based primarily on the management plans in the Northeast Region, including the Mid-Atlantic because of the connections mentioned above. However, target species were not limited to management plans, but rather included all species commonly caught by a gear. For example, lobster pots also consistently catch rock crabs which are landed. From an economics perspective, the lobster pot is a somewhat unspecialized gear which produces two outputs. An additional category called "other" includes unspecified gear types and species.

Table 85. Definition of Fisheries Used to Analyze the Geographic Distribution of Fishing Activity, 2005

Fishery	Managed Species	Gear	Other criteria
Large mesh groundfish	Cod, haddock, pollock, white hake, redfish, yellowtail flounder, winter flounder, American plaice, dab, windowpane flounder, halibut, catfish. Plus monkfish, skates, spiny dogfish, fluke	Fish otter trawl	Mesh size: > 3inches and ≤ 8.5 inches Land in New England ports
		Sink gillnet	
		Handlines and bottom longlines	Land in New England ports
	Monkfish, spiny dogfish, and skate fishery	Fish otter trawl or sink gillnet	Mesh size: > 8.5 inches
Small mesh groundfish	Whiting, red hake, black hake, ocean pout Plus: scup, mackerel, herring, skates, fluke	Fish otter trawl or sink gillnet	Mesh size: ≤ 3 inches Land in New England ports
Atlantic sea scallop	Atlantic sea scallops Plus monkfish, skates, yellowtail flounder, fluke	Limited access dredge	Trips > 400 pounds
		Limited access otter trawl	
		General category	Trips land >50 but ≤400 pounds
Northern shrimp	Pandalid shrimp	Shrimp otter trawl, fish otter trawl, and shrimp pair-trawl	Mesh size: ≤ 3 inches Land in ME, NH, or MA
Red crab	Red crab	Crab pots	Land in ME or MA
Lobster	American lobster Plus: rock crabs	Lobster pots	
Mid-Atlantic large-mesh fishery	Monkfish, fluke, skates, black sea bass, scup, bluefish, croaker, weakfish, striped bass	Fish otter trawl	Mesh size: > 3 inches Land in Mid-Atlantic ports
		Sink gillnet	
Mid-Atlantic small-mesh fishery	Hakes, fluke, scup, mackerel, skates, weakfish, herring, croaker	Fish otter trawl or sink gillnet	Mesh size: ≤ 3 inches Land MA to NC
Squid and	Loligo, Illex, and butterfish	Fish otter trawl	Mesh size: ≤3

Fishery	**Managed Species**	**Gear**	**Other criteria**
butterfish			inches Trips ≥ 2500 pounds
Herring and Mackerel	Herring and mackerel	Purse seine, pair-trawls (mid-water and bottom, mid-water otter trawl)	Mesh size: ≤3 inches Trips ≥ 1000 pounds
Tilefish	Tilefish	Bottom longline	Land in RI, NY, or NJ
Clam ITQ	Surfclam and ocean quahogs	Hydraulic clam dredge	
Party boat for-hire	Cod, black sea bass, bluefish, haddock, scup, fluke	Rod and reel	
Charter boat for-hire	Bluefish, striped bass, large pelagics	Rod and reel	
OTHER			

Logbook data on number of vessels, number of trips, quantity of fish, days-absent from port, crew, and number of anglers were allocated to 10-minute-squares by fishery using the reported coordinates. In some cases, the data categories were subdivided into length classes that closely correspond to the traditional gross tonnage classification. Price data by species and state-landed were taken from the 2005 dealer table and multiplied by hail weights to get revenues. The surfclam/ocean quahog logbooks report price per bushel. A bushel of surfclams yields 17 pounds of meat, and ocean quahog bushels yield 10 pounds.

Coverages of fishing activity were generated in decimal degrees using ESRI's ArcGIS software, and then projected into the NAD-1983 Mercator coordinate system. The Mercator conserves shape, but area is increasingly distorted towards the poles.

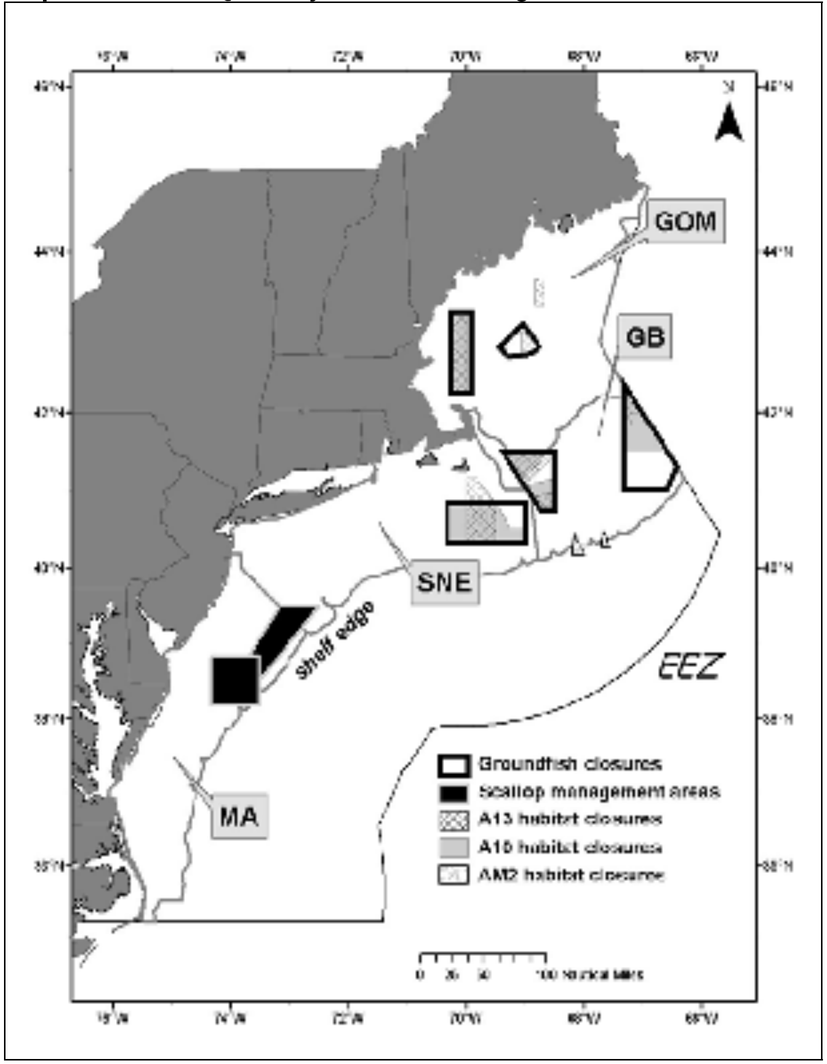
HAPC coverages were used to clip the fishery coverages to learn how much harvesting took place in these areas in 2005. Care was taken to delete duplicated records which result from some ArcGIS functions.

6.2.4 The Fisheries Seascape

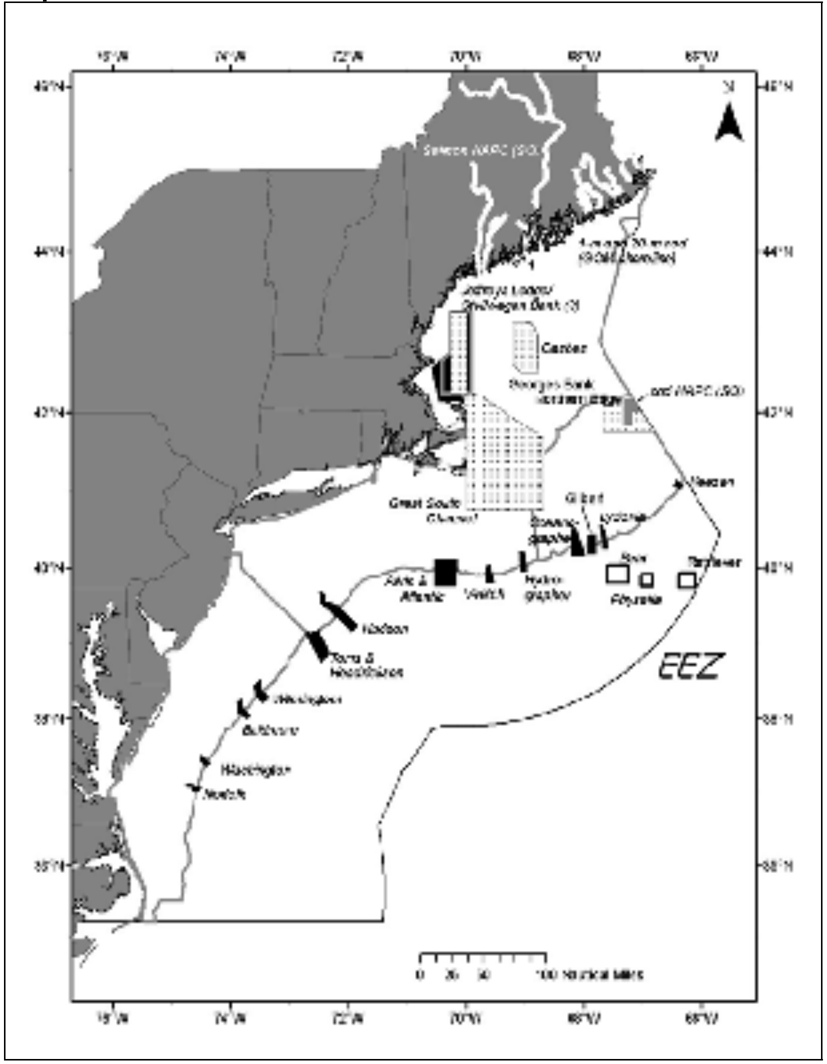
6.2.4.1 Status quo

The Council and NOAA Fisheries' Regional Office have used placed-based policies to conserve fish stocks and to preserve marine mammals and endangered species for more than a decade. Some of the areas that will interact with an EFH policy that affects gear usage spatially appear on Map 607with the four (4) ecological sub-regions that will be referred to in this section. The groundfish closed areas exclude mobile bottom gears and any other gear capable of catching large mesh groundfish. The scallop fishery and SAPs allow limited access which is strictly controlled. The sea scallop management areas exclude only scallop gear while closed. The 11 habitat closures for groundfish and scallops exclude mobile bottom gear except for shrimp trawls in the Western Gulf of Maine Closure. There also are two canyon closures created by an amendment to the monkfish plan to protect cold water corals, a juvenile cod HAPC in Closed Area II, and five (5) rivers in Maine with salmon HAPCs. For comparison, Section 4.1.3 displays areas the HAPC Alternatives under consideration by the Council.

Map 607. Status Quo Major Marine Managed Areas



Map 608. Locations of HAPCs Under Consideration



6.2.4.2 Description of the economics seascape: commercial fishing

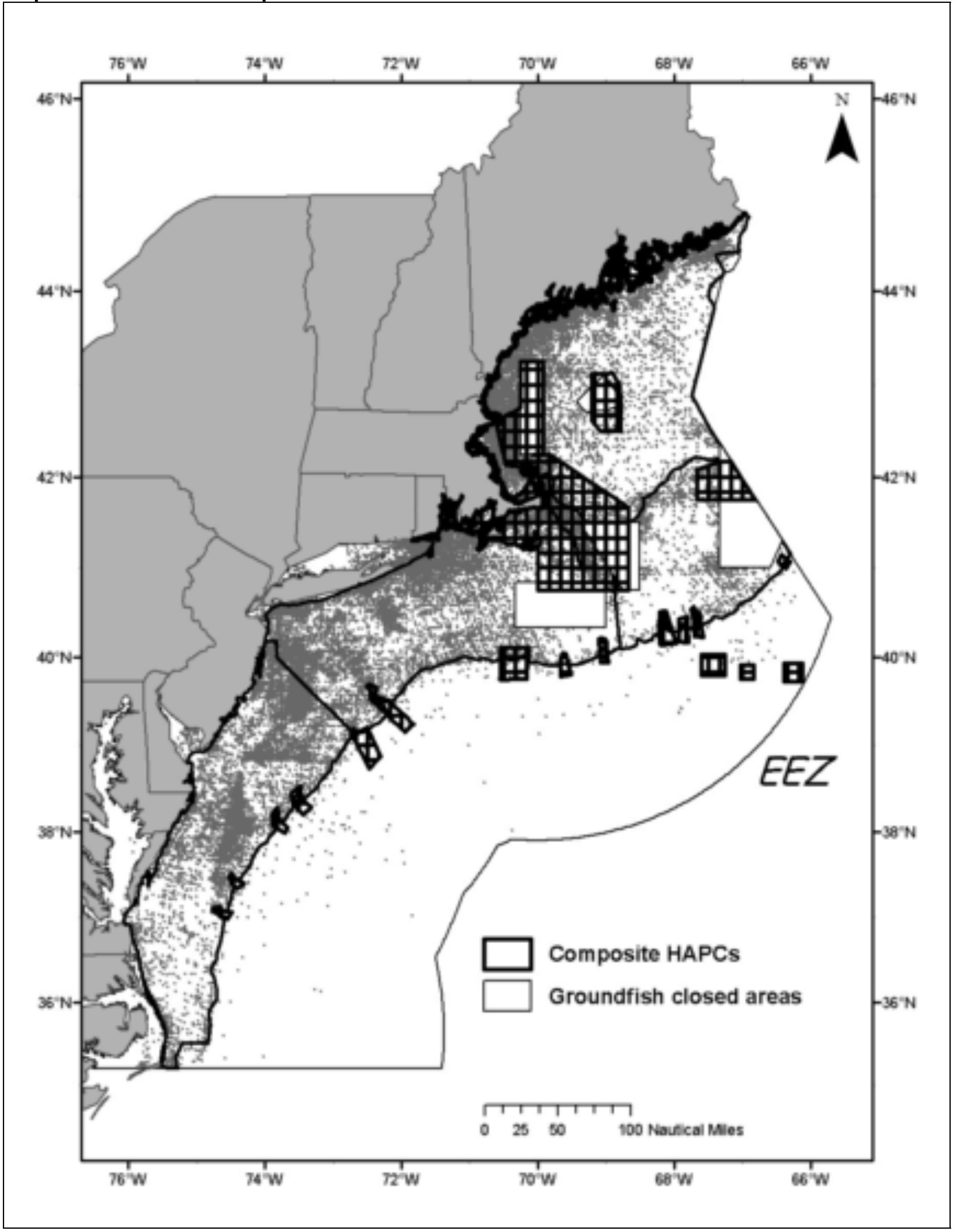
6.2.4.2.1 Locations of fishing trips

The EFH Alternative maps, found in Section 4.1, give the impression that the entire EEZ and state waters is EFH for at least one stage of a managed species life history. In fact, the maps of only a relatively few species, such as cod, sea scallops, and the skates, cover much of the region's marine environment by several layers. Even a relatively conservative cutoff for the percent distribution of EFH for the species/life stages will blanket the region by several layers.

It should come as no surprise that the spatial distribution of fishing activity corresponds closely to the species' EFH. Naturally, fishermen are drawn to areas where fish abundance is greatest, although this decision is subject to several other economic and cultural factors, including habit, vessel size and the cost of fuel which affect distance from port, the relative prices and operating costs (i.e., relative net prices) of species and species complexes at different locations, and regulations that restrict access and gear characteristics in managed areas.

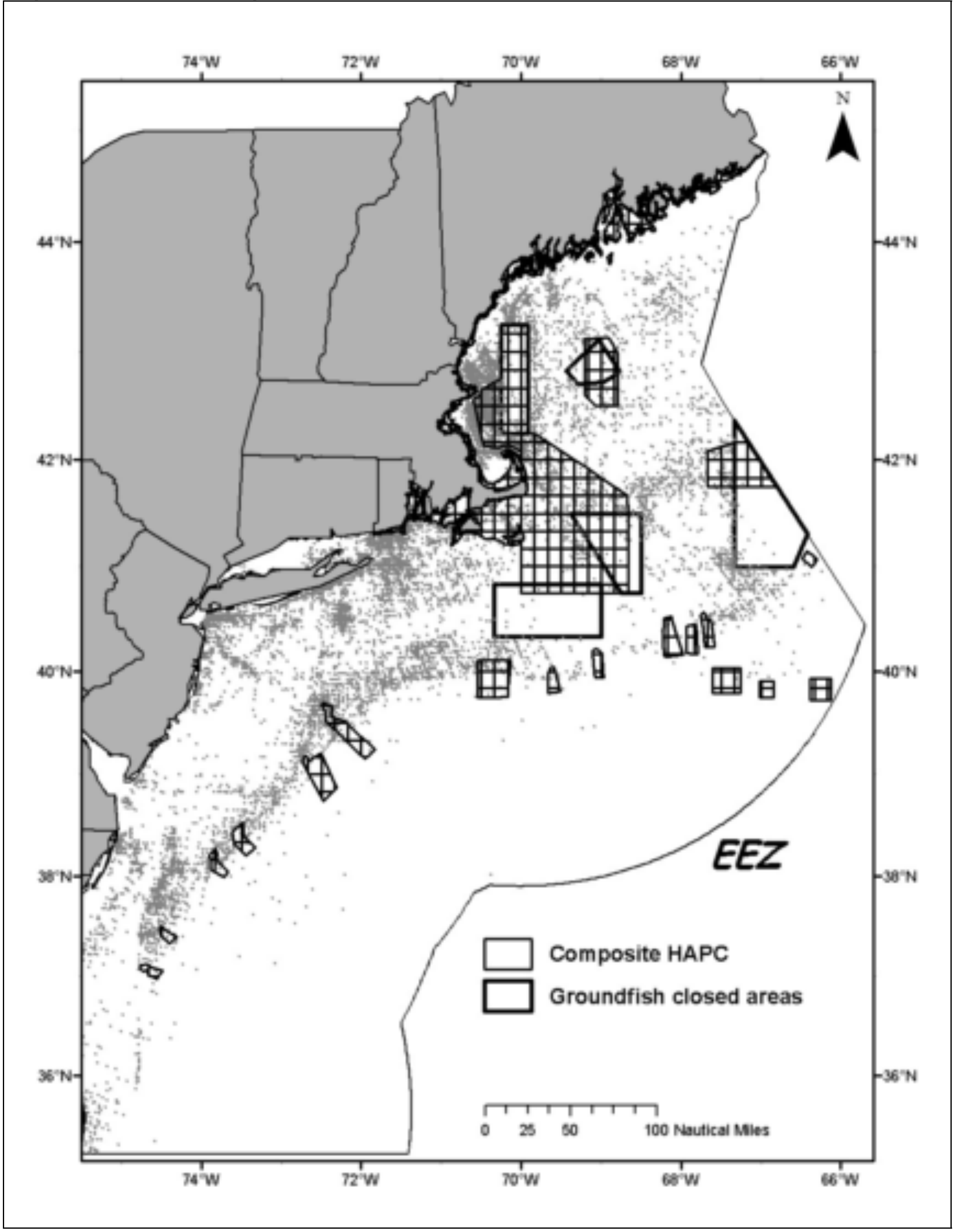
Map 609 - Map 615, which show the reported locations of fishing trips, illustrate what is known intuitively. Map 609 displays the reported locations of nearly 138 thousand trips taken by over 2900 commercial fishing vessels during 2005. Commercial trips in New England are concentrated along the coasts of the Gulf of Maine and Southern New England and throughout the Great South Channel. Georges Bank had relatively few trips presumably because of the groundfish and habitat area closure policies which have been in effect since May 2004. Very few trips extend as far the seamounts. In the Mid-Atlantic, commercial trips are spread more evenly, including along the shelf edge where HAPCs are being considered submarine canyons.

Map 609. Commercial Trip Locations

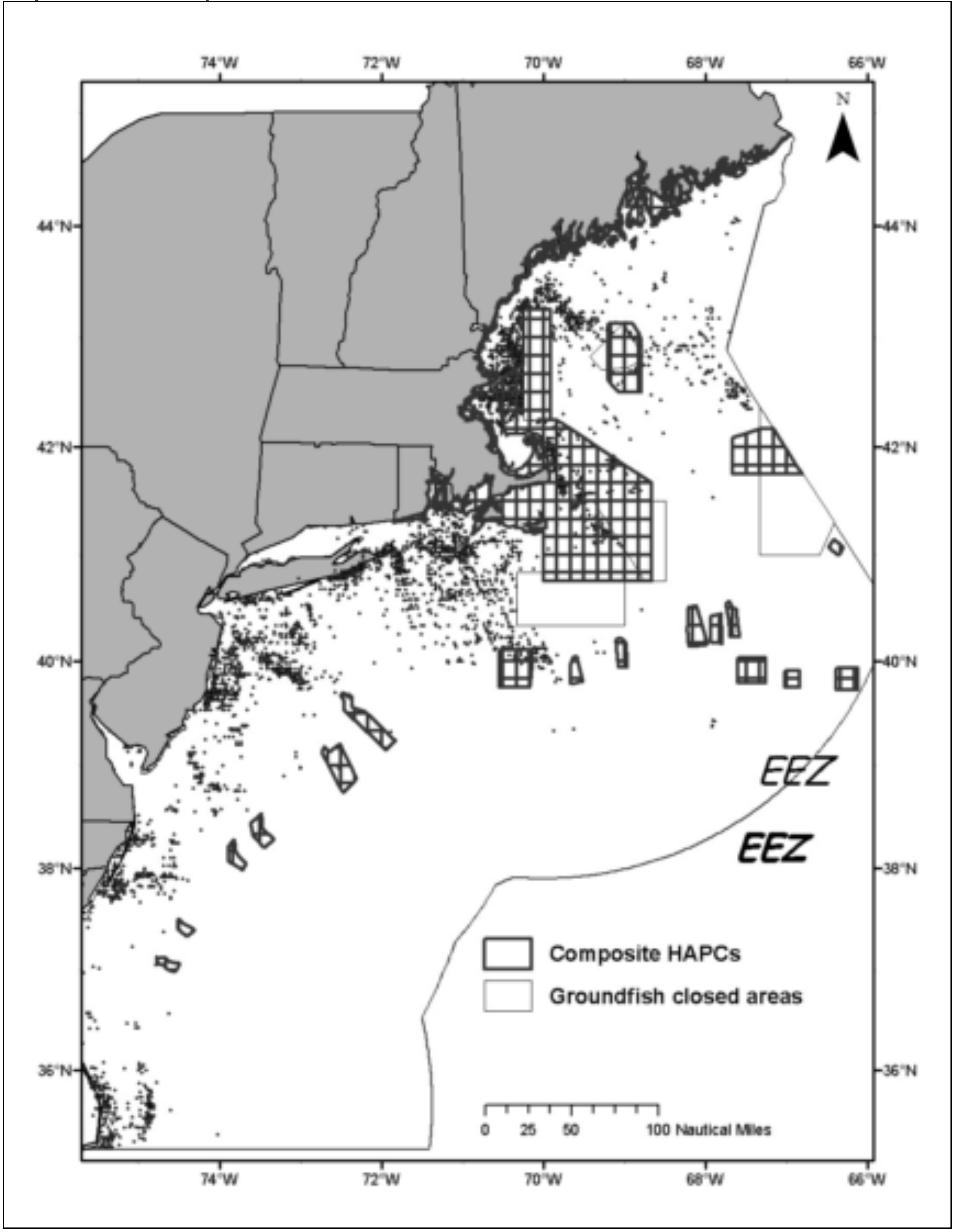


The New England otter trawl fisheries were located predominantly off the coasts of Massachusetts and New Hampshire in the Gulf of Maine and of Rhode Island in Southern New England (Map 610). In the Mid-Atlantic, the otter trawl fisheries frequented the shelf edge. In contrast, sink gillnet trips were reported to be relatively close to the coast between Downeast Maine and Cape Cod, Massachusetts, and in bands across the shelf in Southern New England, Hudson Canyon, and Maryland (Map 611).

Map 610. Otter Trawl Trip Locations

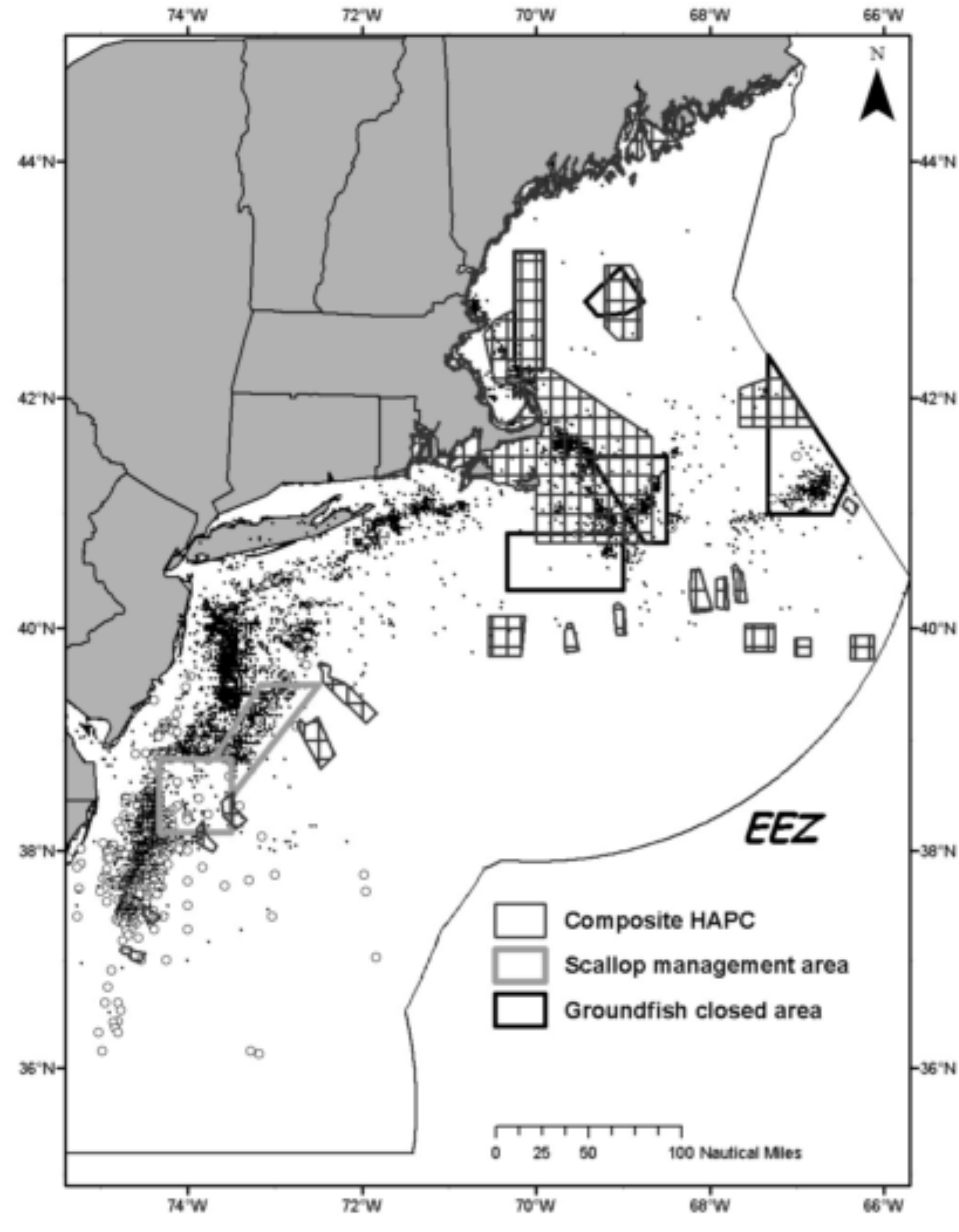


Map 611. Gillnet Trip Locations



The choice of areas to harvest sea scallop is dictated to a large extent by the areas that are opened to the fishery by regulation because this is where to find the greatest abundance, although trip limits and requirements to forfeit 10 days regardless of trip length constrain this decision. In 2005, scallopers with limited access permits and dredges focused on the short openings of the groundfish closed areas (S/SE portion of Closed Area II, middle of Closed Area I, NE corner of Nantucket Lightship), a narrow band through the Great South Channel west of the Closed Area I, and in (Hudson Canyon Area) and around (Elephant Trunk Area) the scallop management areas in the Mid-Atlantic (Map 612). In contrast, limited access scallopers who use otter trawl gear aggregated in and around the sea scallop management areas of the Mid-Atlantic coast. Finally, General Category scallopers, being restricted by 400 pound trip limits, worked close to shore in the Gulf of Maine and along the Mid-Atlantic coast.

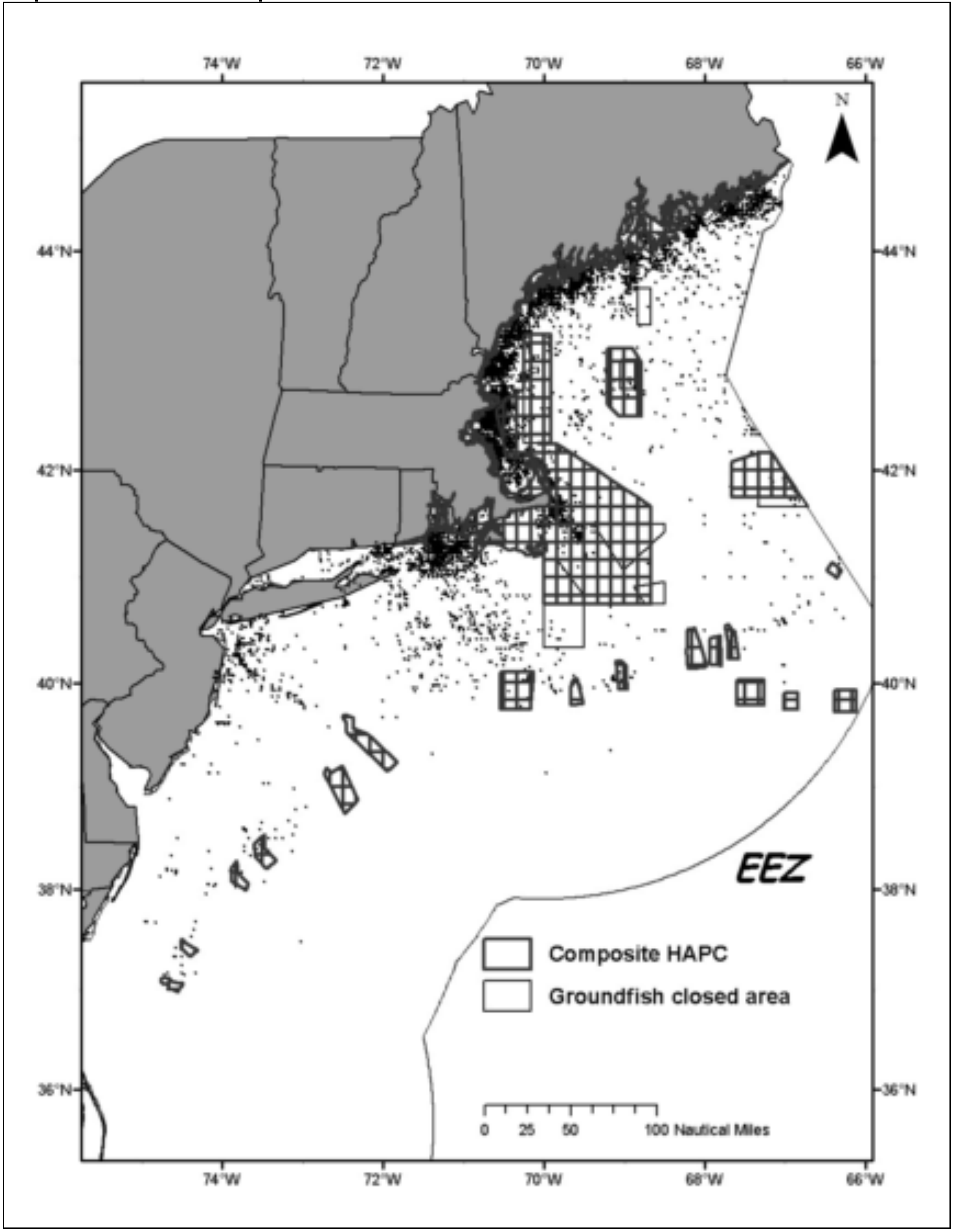
Map 612. Scallop Dredge and Trawl Trip Fishing Locations



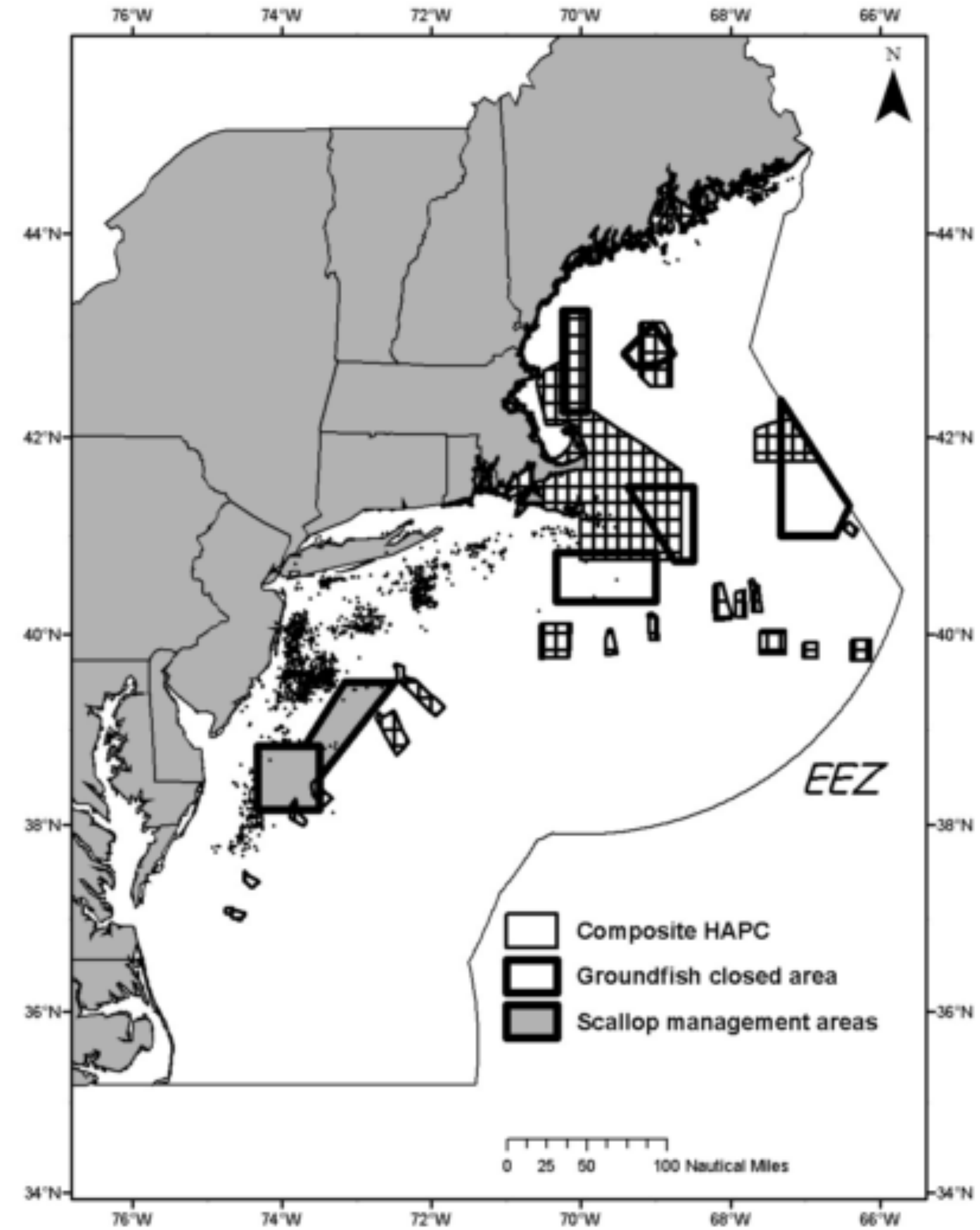
Although the inshore lobster fishery is under-represented in the vessel logbook system, its importance is still evident on Map 613, particularly along the coast of the entire U.S. portion of the Gulf of Maine and in Southern New England. Trips into Federal waters are mostly seen off the coast of Rhode Island.

Map 614 reports locations of the ITQ fishery for surfclams and ocean quahogs. Trips are aggregated in areas between DELMARVA and Nantucket Island, especially off the coasts of New Jersey and Long Island. There is also a small area off the coast of Maine near the Hague Line where numerous trips targeted ocean quahogs outside of the ITQ fishery.

Map 613. Lobster Pot Trip Locations



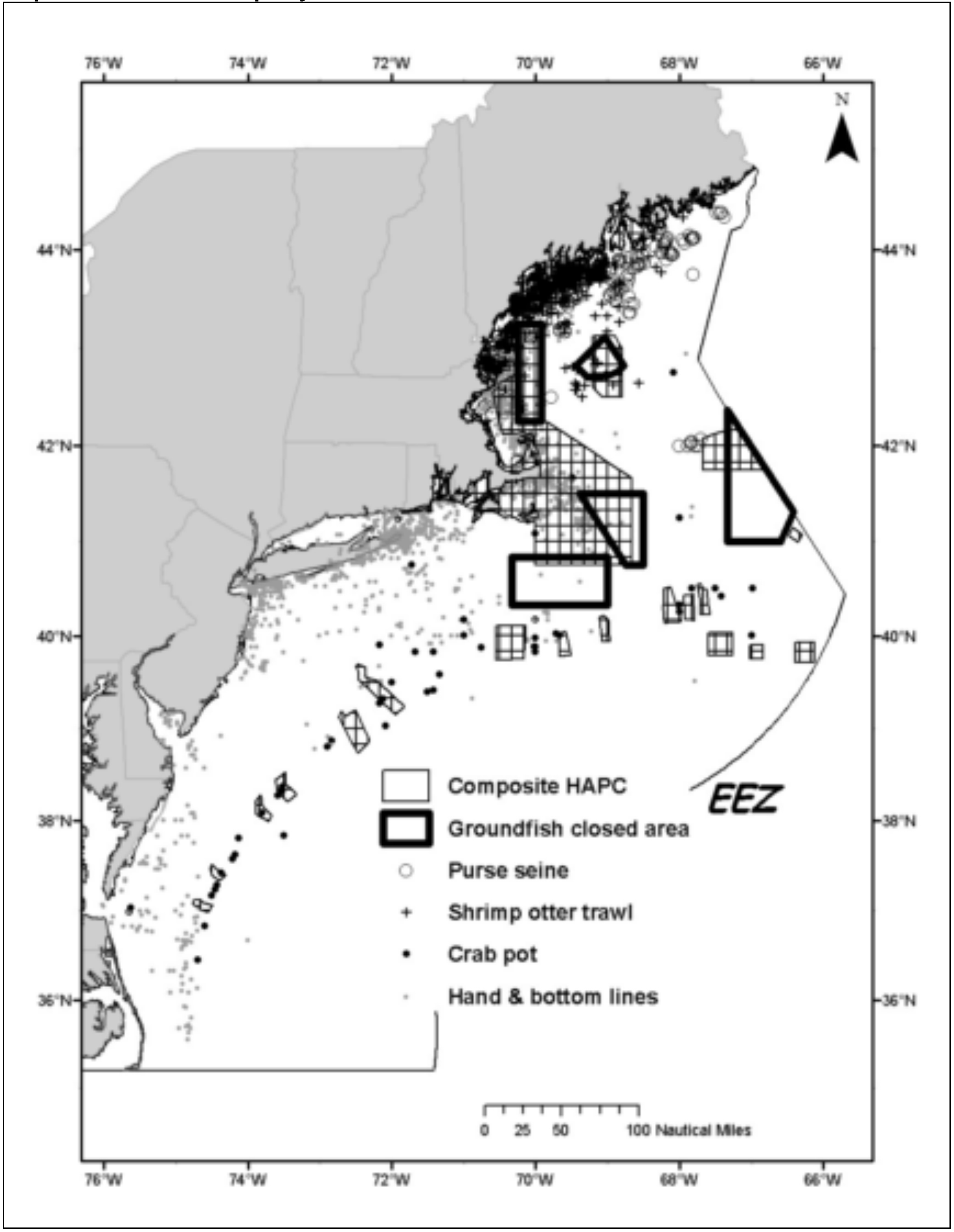
Map 614. Surf Clam and Ocean Quahog Trip Locations



The distributions of trips taken by several other, smaller fisheries are combined on Map 615. Purse seine trips for herring and/or mackerel are found inside Federal waters in the Gulf of Maine and west of Closed Area II. The Northern shrimp fishery is piled up near Downeast Maine. The red crab fishery operates along the shelf edge where the canyon

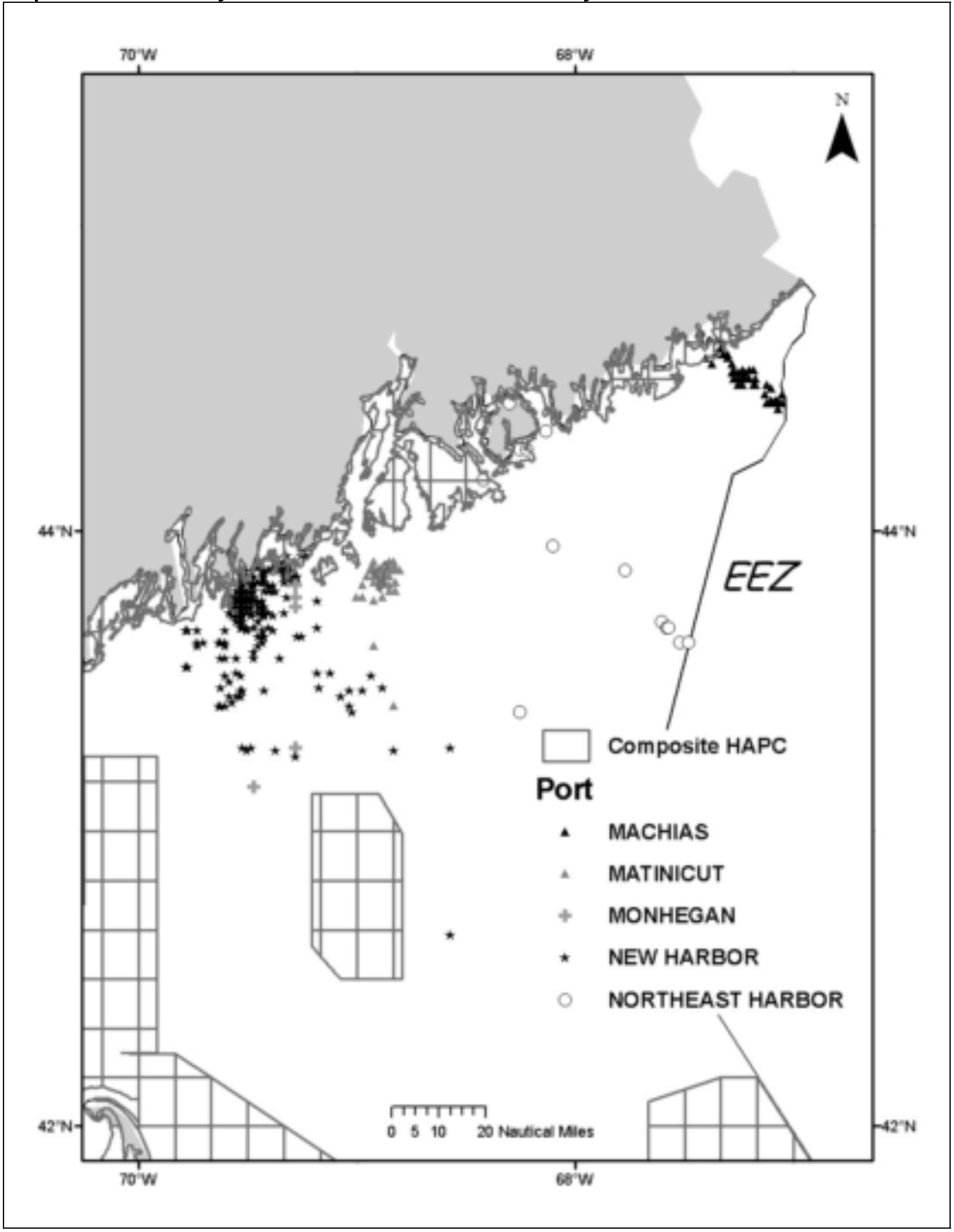
HAPCs proposals are found. Handline and bottom long-line fisheries are concentrated near the coasts between Downeast Maine and eastern Long Island, including around Cape Cod. Finally, the otter trawl scallop fishery lies off the coast between Cape May, New Jersey and Virginia.

Map 615. Location of Trips by Small Fisheries



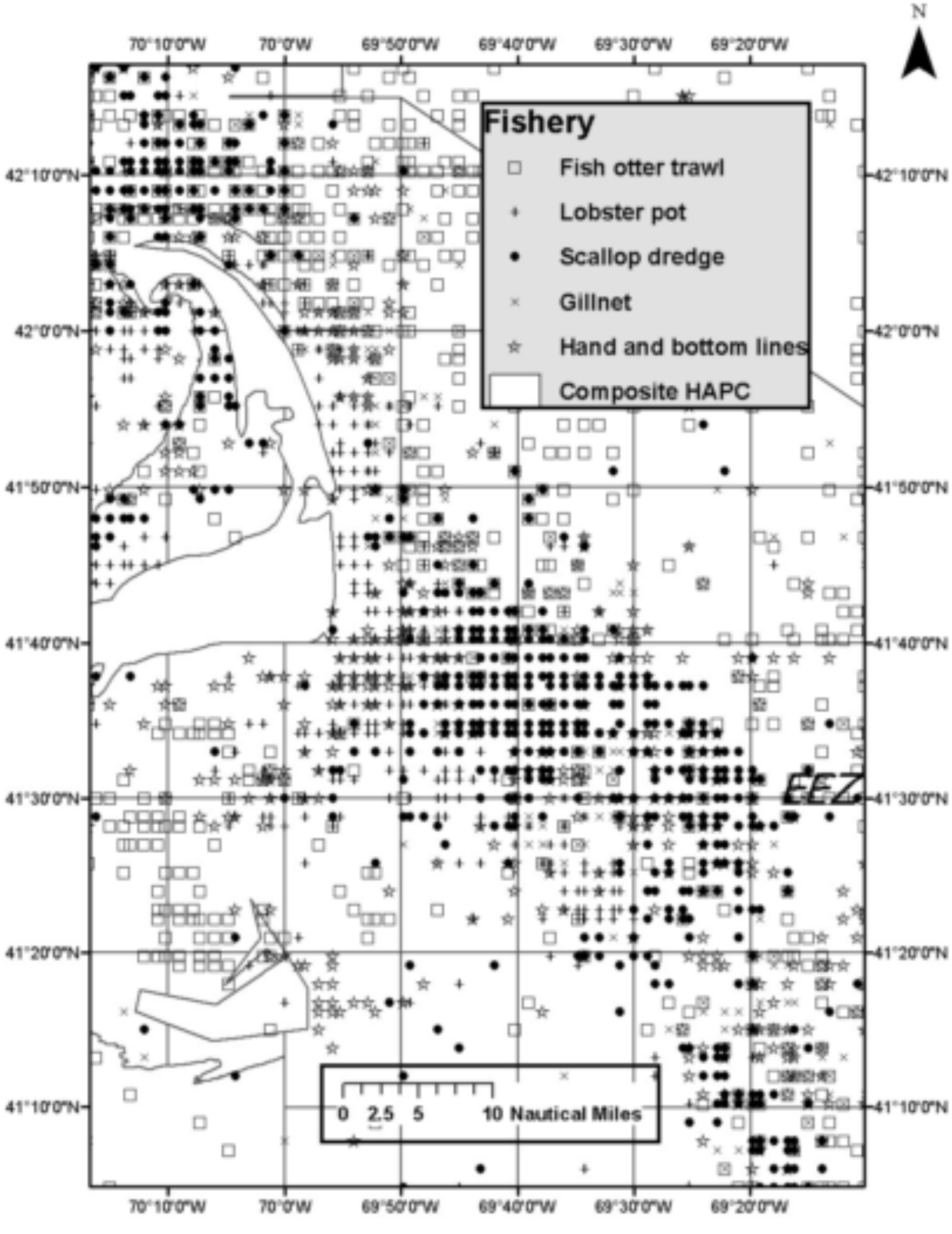
Map 616 captures a well-known territorial behavior in the Maine lobster fishery where fishermen claim de facto property rights to access fishing grounds outside their port. This behavior is important to understand because EFH regulations could have the greatest impact on small scale fishermen whose vessels and cultural traditions preclude mobility. Inshore lobstermen tend to set their pots close to their port, excluding fishermen from other ports. There are some, though, who venture farther offshore into the Gulf of Maine where community territoriality is less well-defined (e.g., lobstermen from New Harbor and Northeast Harbor).

Map 616. Territoriality Behavior of Maine Lobster Fishery



Quite the opposite behavior is found in other parts of the ocean, including in the Great South Channel found E/SE of Cape Cod (Map 617). Virtually all of the New England fisheries makes trips to this area, including groundfish, sea scallop, and lobster fisheries.

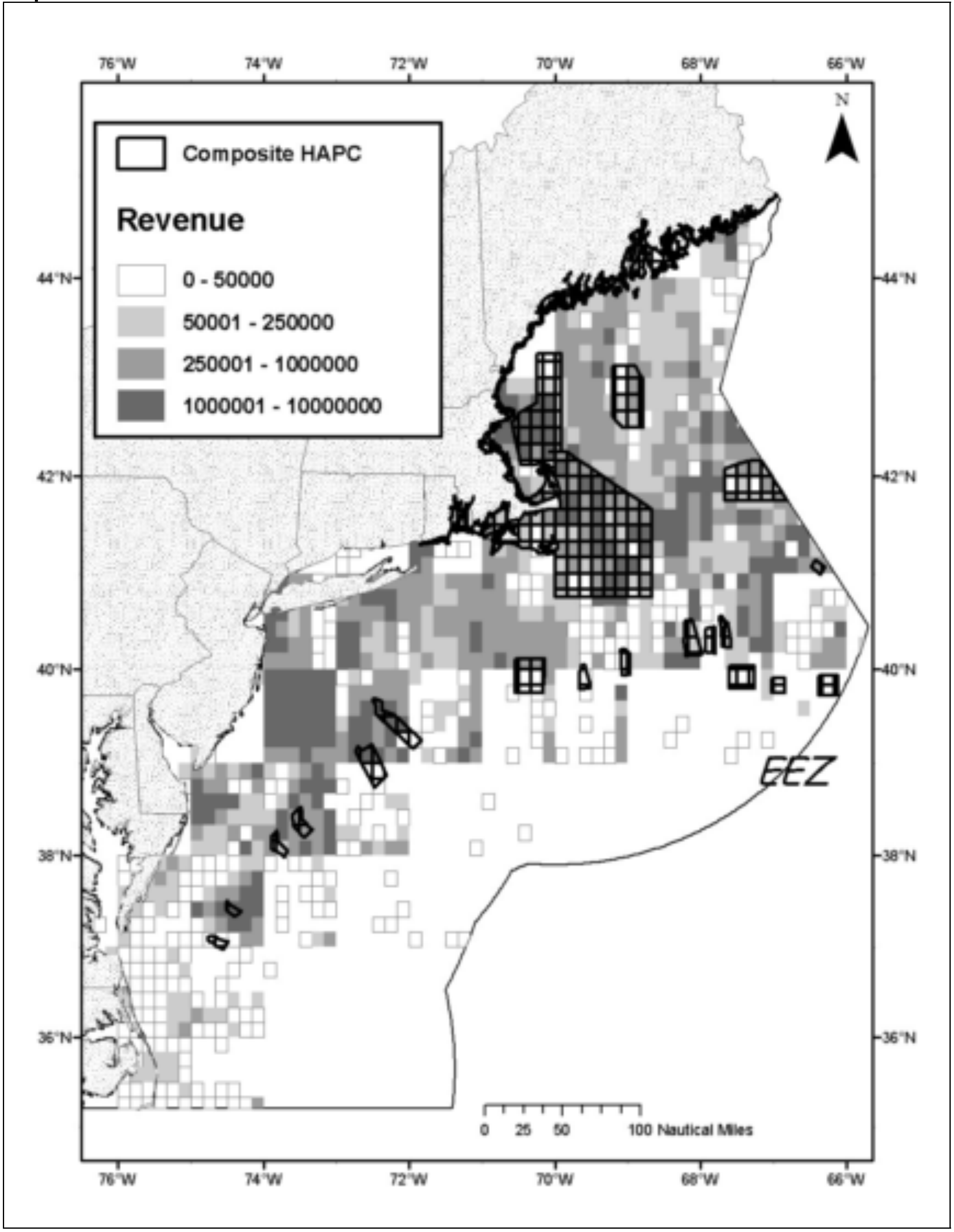
Map 617. Mixed Fisheries in the Great South Channel Area



6.2.4.2.2 *Commercial revenues*

The spatial distributions of dockside revenues reflect those of trips, but they are not identical because of the large fishing capacity of offshore vessels. This is noticeable on Map 618 where total commercial revenues are more evenly distributed than trip locations (but still not homogeneously distributed). Total gross revenues averaged \$3940/km^2 in 10-minute-squares showing fishing activity.

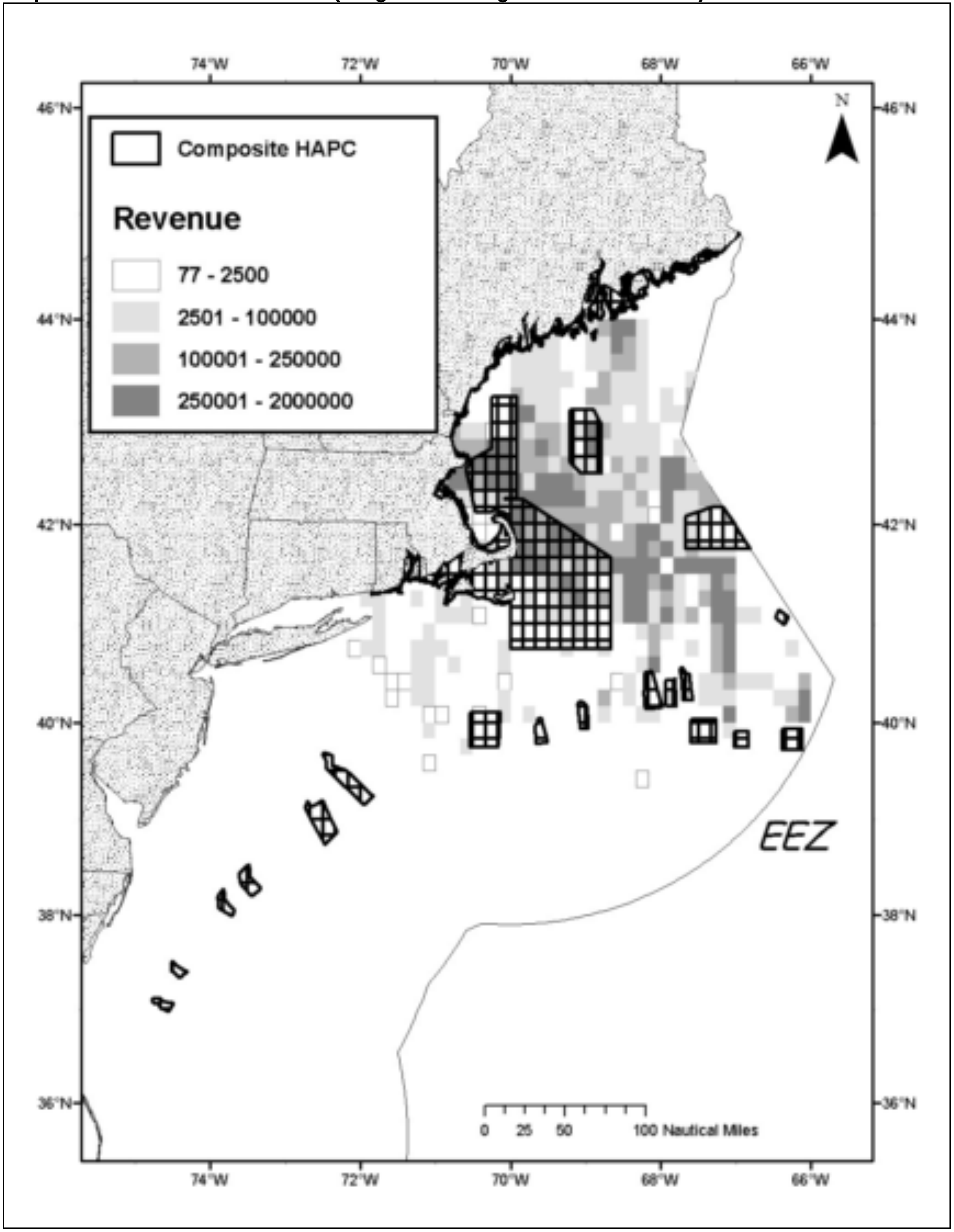
Map 618. Commercial Revenues



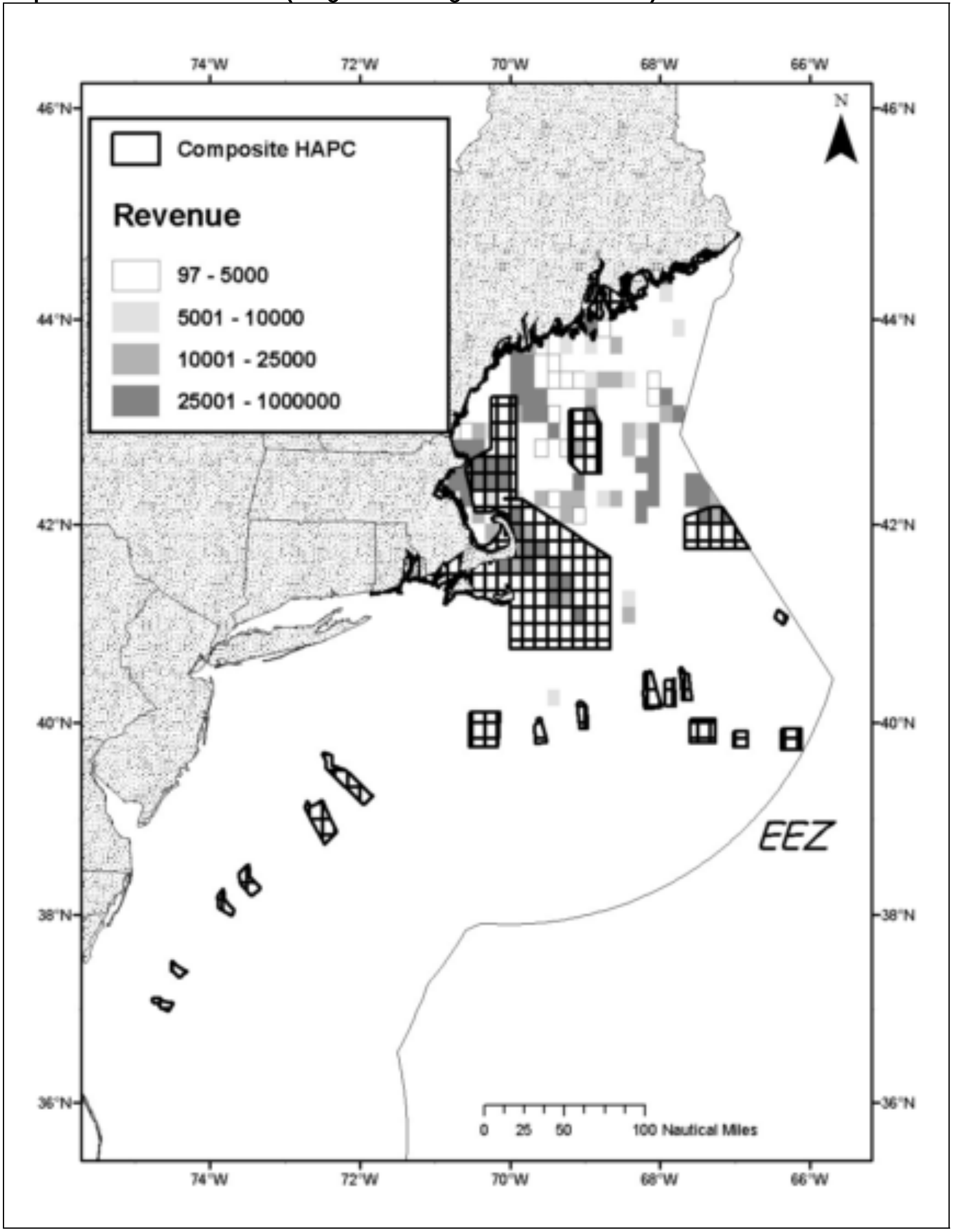
Gross returns to the large mesh groundfish fisheries in New England are greatest near the coast in the southern part of the Gulf of Maine, through the Great South Channel, and out to Georges Bank. While the otter trawl fishery operates throughout this area (Map 619), the sink gillnet (Map 620) and line fisheries depend more on the Gulf of

Maine and the Great South Channel for revenue. Revenues averaged \$1280/ km² and \$310/ km² in the otter trawl and sink gillnet fisheries, respectively.

Map 619. Otter Trawl Revenues (Large Mesh Regulated Groundfish)



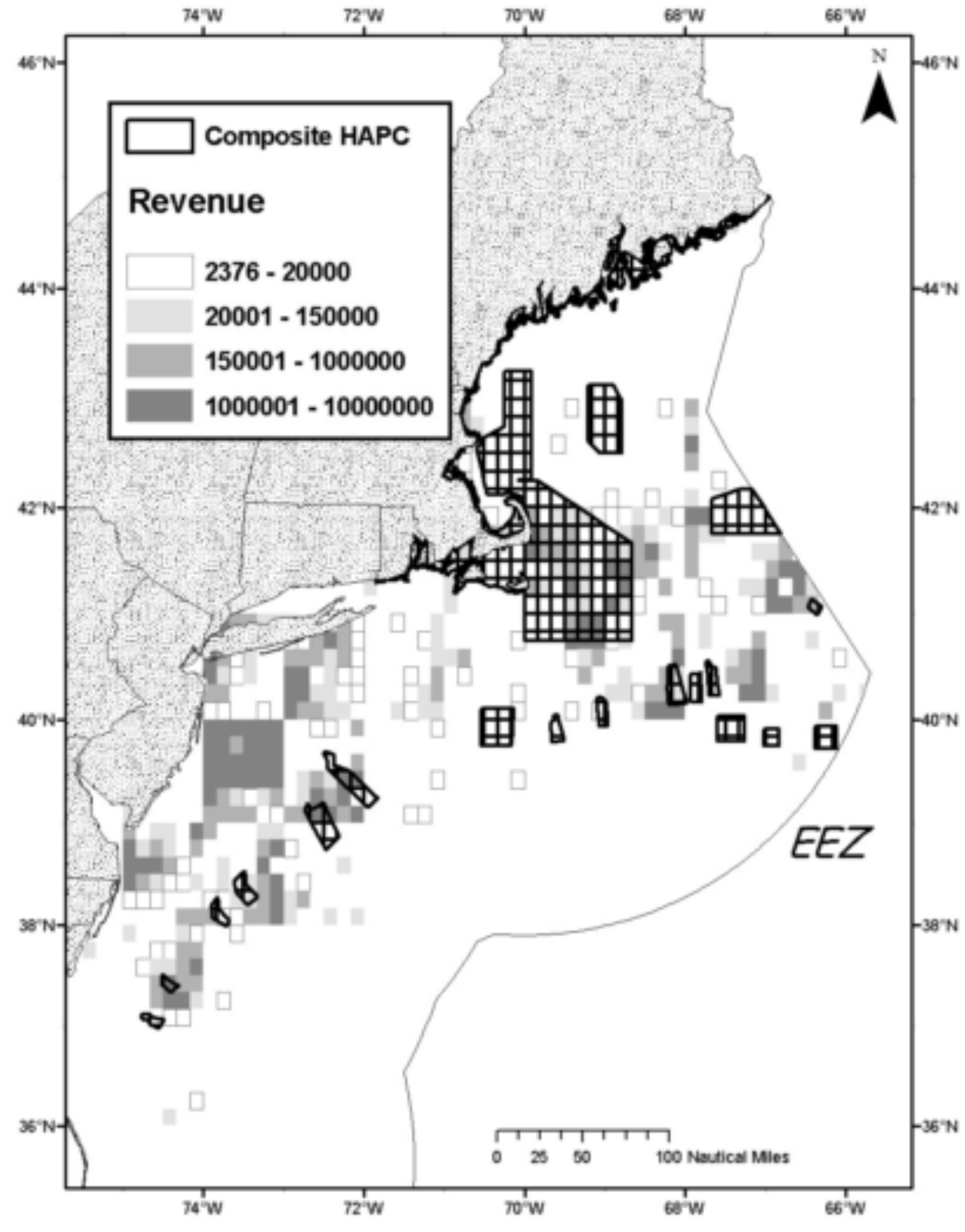
Map 620. Gillnet Revenues (Large Mesh Regulated Groundfish)



The revenue earned by the limited access sea scallop dredge fishery came primarily from the Great South Channel, an area west of Closed Area II, and the openings of the groundfish closed areas and, in the Mid-Atlantic, the scallop management areas (Map

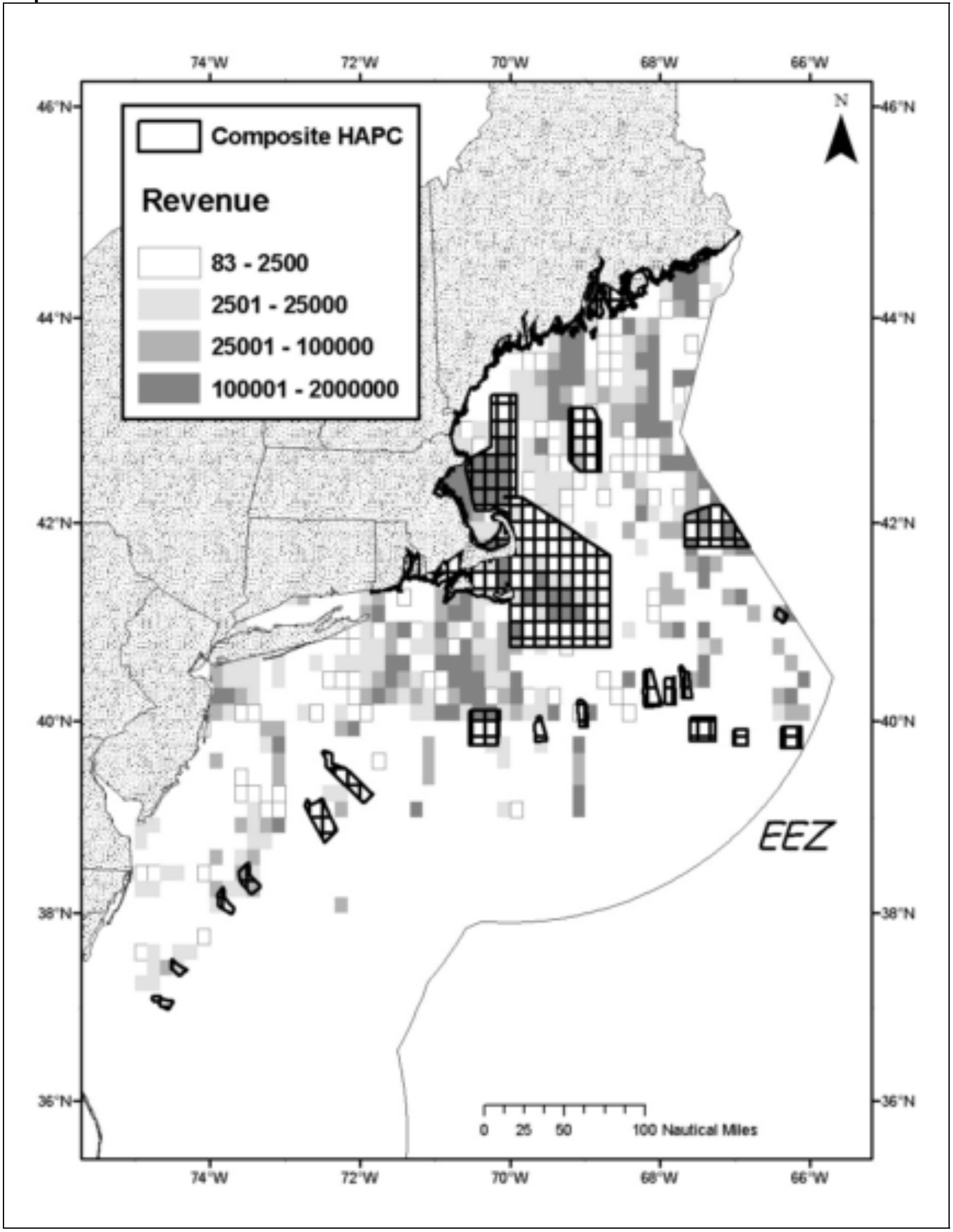
621). There is considerable revenue along the shelf edge as well. Revenues in this fishery averaged \$4400/ km^2.

Map 621. Scallop Dredge Revenue



Revenues received by lobster fishermen who submitted logbook reports were greatest in the Gulf of Maine, but earnings are substantial along the Hague Line cutting through the Gulf of Maine and Georges Bank, including inside Closed Area 2 (Map 622). The Southern New England sub-region out to the shelf edge is likewise productive. Overall, gross returns in the available data on the lobster fishery averaged \$930/ km^2.

Map 622. Lobster Pot Revenue



Surfclam and ocean quahog revenues were high off the coasts of New Jersey and Long Island, as well as in the Maine quahog fishery. Overall, revenues averaged \$855/ km^2.

6.2.4.2.3 HAPCs

The HAPC Alternatives under consideration are especially important to the human environment because of the future potential to minimize the adverse effects of fishing in these areas. Although not an estimate of potential short-term economic losses for a variety of reasons, the revenues earned from fishing in these areas give an idea of the recent dependence of different fisheries on the areas. The maps in the previous section are overlaid by the composite of the HAPC Alternatives in order to visualize where the interaction between fisheries and EFH policy would be greatest.

Total dockside revenues for fish harvested inside areas delineated by the composite HAPC are reported in Table 86. In 2005, the total area encompassed by the HAPCS under consideration (an estimated 48 thousand km^2, or 11% of the Northeast Region, including state waters due to the Inshore Cod HAPCs) produced 98 million pounds of landings with an estimated gross dockside value $135 million. These figures are 15% of landings in the dataset, and 17% of estimated revenues.

Alternative 8 (Great South Channel HAPC) alone generated over $80 million in revenues by far the highest of any HAPC (Table 86) and more than all other HAPCs combined. This importance is due to the presence of all of the major fisheries in the region shown previously in Map 617. The channel was followed by the Jeffreys Ledge/Stellwagen Bank options ($22 million for the NMS), and Hudson Canyon (nearly $14 million). At the low end of the ranking were the seamount proposal and five (5) of canyon areas which encompassed less than $50 thousand each. The combination of all canyon HAPCs areas yielded $32 million when the North and South Canyons options are factored in.

The next comparison the relationship is between the combination of HAPCs and the spatial distribution of revenues in the fisheries (Table 86). Total landings and estimated revenues in the final dataset were 672 million pounds and $815 million, respectively. Total landings and revenues on the same species as reported by dealers were 879 million pounds and $1264 million. The large-mesh otter trawl fishery obtained more than $19 million from the areas nominated for HAPCs, or 17% of the fishery's gross earnings in 2005. The sink gillnet (39% dependence) and hand line/bottom longline (69% dependence) fisheries are executed closer to shore than the trawl fishery where the Great South Channel and Jeffreys Ledge/Stellwagen Bank HAPC proposals are located.

The sea scallop fisheries obtained the greatest amount of revenue from the composite HAPC area. The limited access dredge fishery alone received $70 million for scallops caught in the HAPC areas, more than all other fisheries combined. However, relative to the entire fishery in 2005, this dependence amounted to 20% of the fishery.

The lobster pot fishery is difficult to assess because the inshore fishery, which partly coincides with the Alternative 7 (10-meter and 20-meter cod HAPC), is underrepresented in the dataset. The 18% dependence could be too low.

The Northern shrimp fishery earned 17% of its annual revenues in the HAPC areas, particularly Alternative 6 (Jeffreys Ledge/Stellwagen Bank areas). The herring and mackerel purse seine fisheries were equally dependent. All other fisheries, but especially those in the Mid-Atlantic, earned a relatively small amount of revenues from the areas within the HAPC Alternative - $3 million dollars or less, and less than 10% of gross revenues that year.

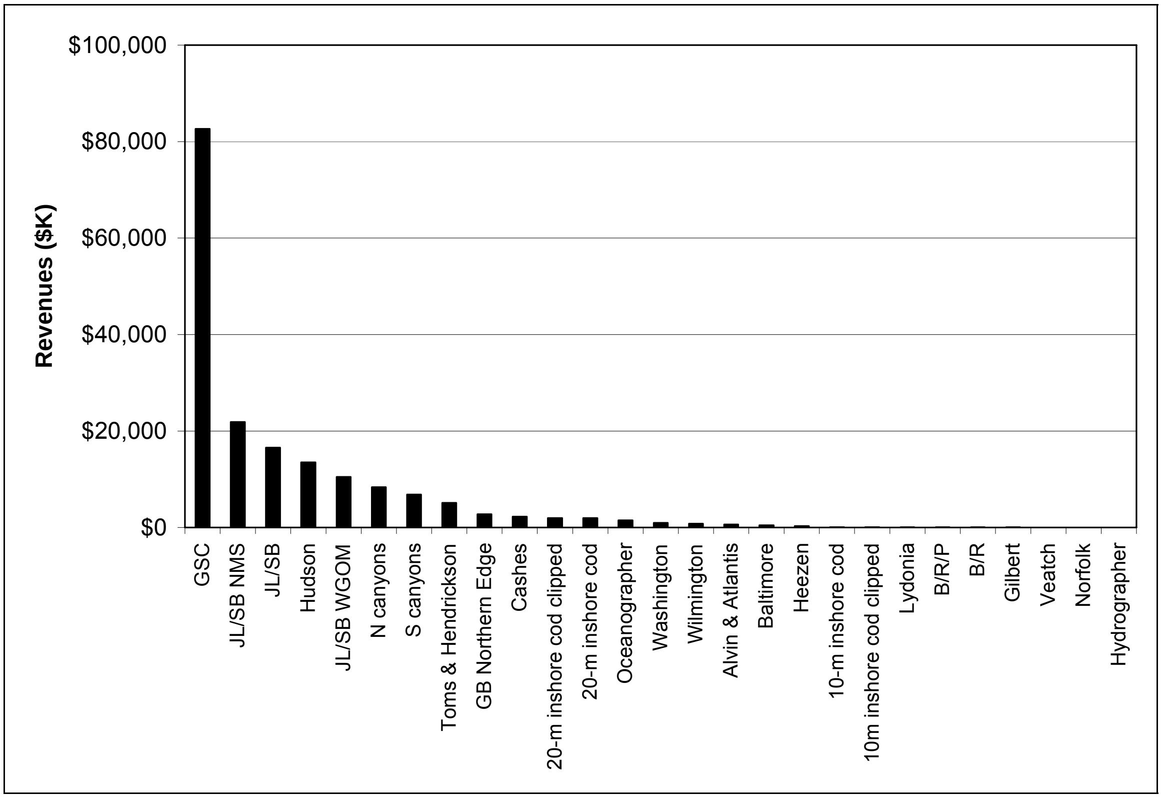
Table 86. 2005 Commercial Fishing Activity Inside Each Area Nominated as an HAPC.

Alternative	HAPC	Vessels		Landings		Revenue	
		Number	%	Pounds (M)	%	$M	%
A1. SQ	Cod			0.26	0.04	0.37	0.05
	Salmon	Not applicable					
A2. Sea-mounts	Bear & Retriever			0.033	0.00	0.031	0.00
	Bear, Retriever & Physalia			0.043	0.01	0.039	0.00
A3. Canyons	Heezen			0.041	0.01	0.29	0.04
	Lydonia			0.051	0.01	0.058	0.01
	Gilbert			0.018	0.00	0.023	0.00
	Oceanographer			0.21	0.03	1.52	0.19
	Hydrographer			0.00014	0.00	0.0011	0.00
	Veatch			0.018	0.00	0.015	0.00
	Alvin & Atlantis			0.51	0.08	0.64	0.08
	Hudson			8.6	1.27	13.5	1.66
	Toms & Hendrickson			1.4	0.21	5.1	0.63
	Wilmington			1.7	0.25	0.80	0.10
	Baltimore			0.73	0.11	0.47	0.06
	Washington			0.23	0.03	1.0	0.12
	Norfolk			0.0024	0.00	0.0077	0.00
	North (Oceanographer, Gilbert, Lydonia)			1.4	0.20	8.4	1.03
	South (Toms, Hendrickson & inter-areas)			2.3	0.35	6.8	0.84

Alternative	**HAPC**	**Vessels**		**Landings**		**Revenue**	
		Number	**%**	**Pounds (M)**	**%**	**$M**	**%**
A4. Cashes Ledge				1.4	0.21	2.2	0.28
A5. Georges Bank N. Edge				1.2	0.18	2.8	0.34
A6. Jeffrey Ledge /Stell-wagen Bank	JL/Stell			37.8	5.62	16.6	2.03
	JL/Stell NMS			45.5	6.77	21.9	2.69
	JL/Stell WGOM			24.6	3.66	10.5	1.29
A7.In-shore juvenile cod	0-10 meter			0.034	0.01	0.071	0.01
	0-10 meter (adjusted for GSC)			0.034	0.01	0.068	0.01
	0-20 meter			0.85	0.13	2.0	0.24
	0-20 meter (adjusted for GSC)			0.79	0.12	1.8	0.22
A8. Elim-inate SQ	Juvenile Cod				0.04		0.05
	Salmon rivers	Not applicable					
A9. Great South Channel				36.0	5.36	82.6	10.15
TOTAL	Smallest			77	11	122	15
	Largest			98	15	135	17

Percentages are with respect to the dataset.

Figure 11. 2005 Dockside Revenues from Fish Caught in Areas Under Consideration as HAPCs



6.2.4.3 Description of the economics seascape: for-hire recreational

6.2.4.3.1 EFH

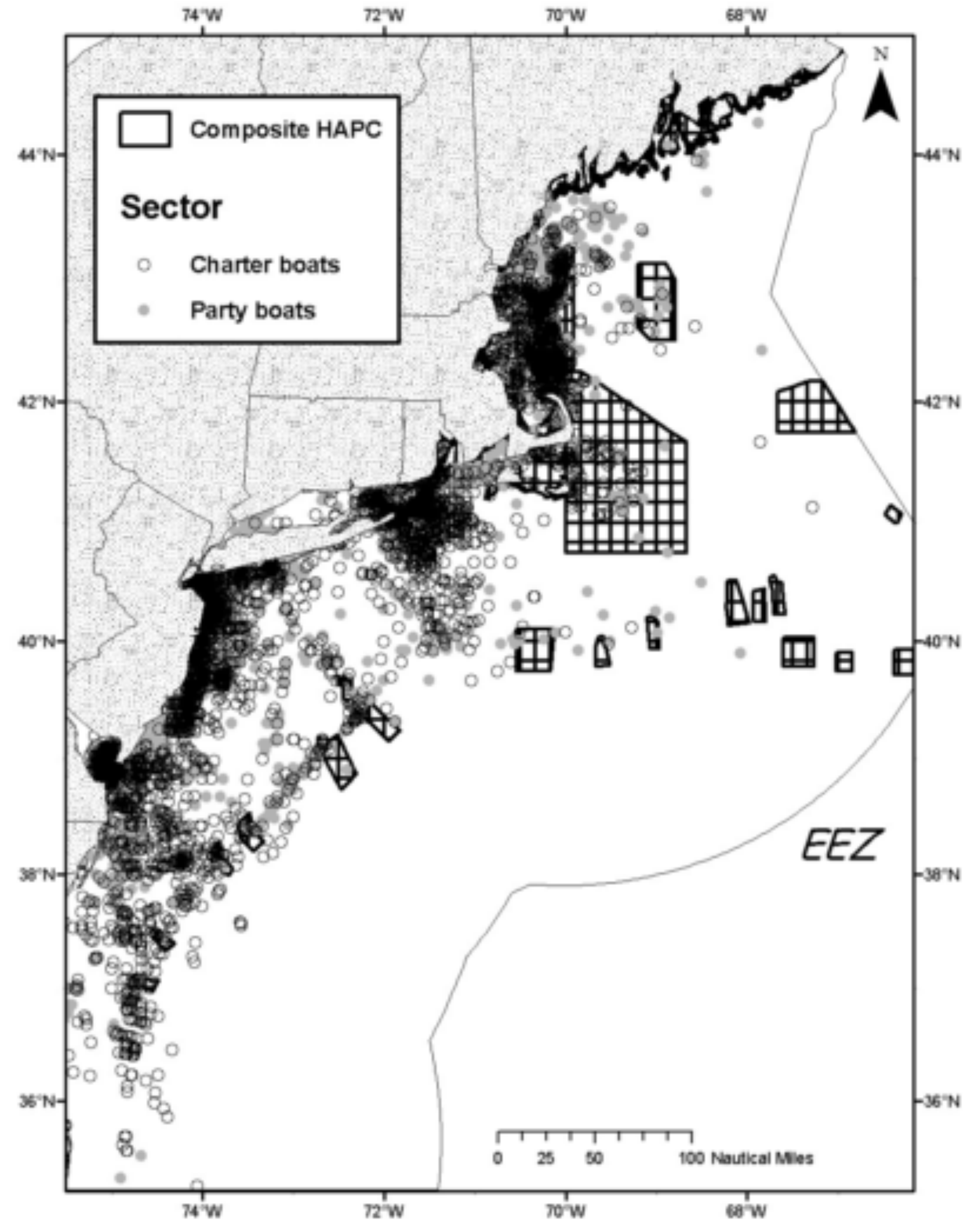
The for-hire recreational fishing industry took passengers recreational fishing on over over 25 thousand trips in the Northeast Region during 2005 (Table 87). Total landings and estimated revenues in the final dataset were 672 million pounds and $815 million, respectively. Total landings and revenues for the same species reported by dealers were 879 million pounds and $1264 million. Trips were concentrated in the western Gulf of Maine into Cape Cod Bay, between Buzzards Bay and eastern Long Island through Block Island Sound, and along the entire coast of New Jersey into Delaware Bay (Map 623). Party boat trips and charter boat trips have similar spatial distributions, but charter boats take relatively more offshore trips. The EFH for species within about 40 n.m. of the shoreline in the Gulf of Maine, Southern New England, and the Mid-Atlantic is important to the party boat and charter boat industry.

Table 87. 2005 Commercial Fishing Activity by Fisheries within Areas Nominated as HAPCs.

Fishery	Gear	Vessels		Landings		Revenue	
		Number	%	Pounds (M)	%	$M	%
Large-mesh ground-fish	Otter trawl			14.0	16	19.2	17
	Sink gillnet			4.4	38	5.1	39
	Lines			2.0	65	2.5	66
	Otter trawl & sink gillnet (mesh > 8.5”)			3.9	29	4.0	23
Small-mesh groundfish	Otter trawl & sink gillnet (mesh ≤ 3”)			1.4	8	0.59	7
Sea scallop	Scallop dredge			9.2	19	70.5	20
	Scallop trawl			0.18	19	1.3	20
	General category			0.80	15	6.25	16
Lobster	Lobster pot			3.0	14	12.6	18
Red crab	Crab pot			0.28	9	0.30	8
Shrimp	Shrimp trawl			0.74	16	0.45	17
Squid	Otter trawl			2.4	4	1.5	5
Mid-Atlantic large mesh	Otter trawl (mesh>3”)			1.3	5	1.6	7
	Sink gillnet (mesh>3”)			0.016	0.2	0.023	0.2
Mid-Atlantic large mesh	Otter trawl & sink gillnet (mesh ≤ 3”)			0.11	2	0.08	2
Herring/mack-erel	Purse seine			51.3	20	4.3	17
Tilefish	Bottom longline			0.017	1	0.036	1
Surfclam/ ocean quahog	Clam dredge			2.5	3	3.1	7
Other				2.3	11	3.1	9
TOTAL		Not additive due to participation in more than one fishery		100	15	137	17

Percentages are with respect to totals for individual fisheries.

Map 623. For-Hire Trip Locations



The 183 party boat vessels took over 333 thousand passengers to catch mostly food-fish species, particularly cod, haddock, scup, black sea bass, fluke, and flounders (Table 88). In contrast, the more numerous charter boats targeted gamefish, especially bluefish, striped bass, and large pelagic species. The party boat sector reported catching 1.7 million pounds of fish, and the charter boat sector caught 0.6 million pounds.

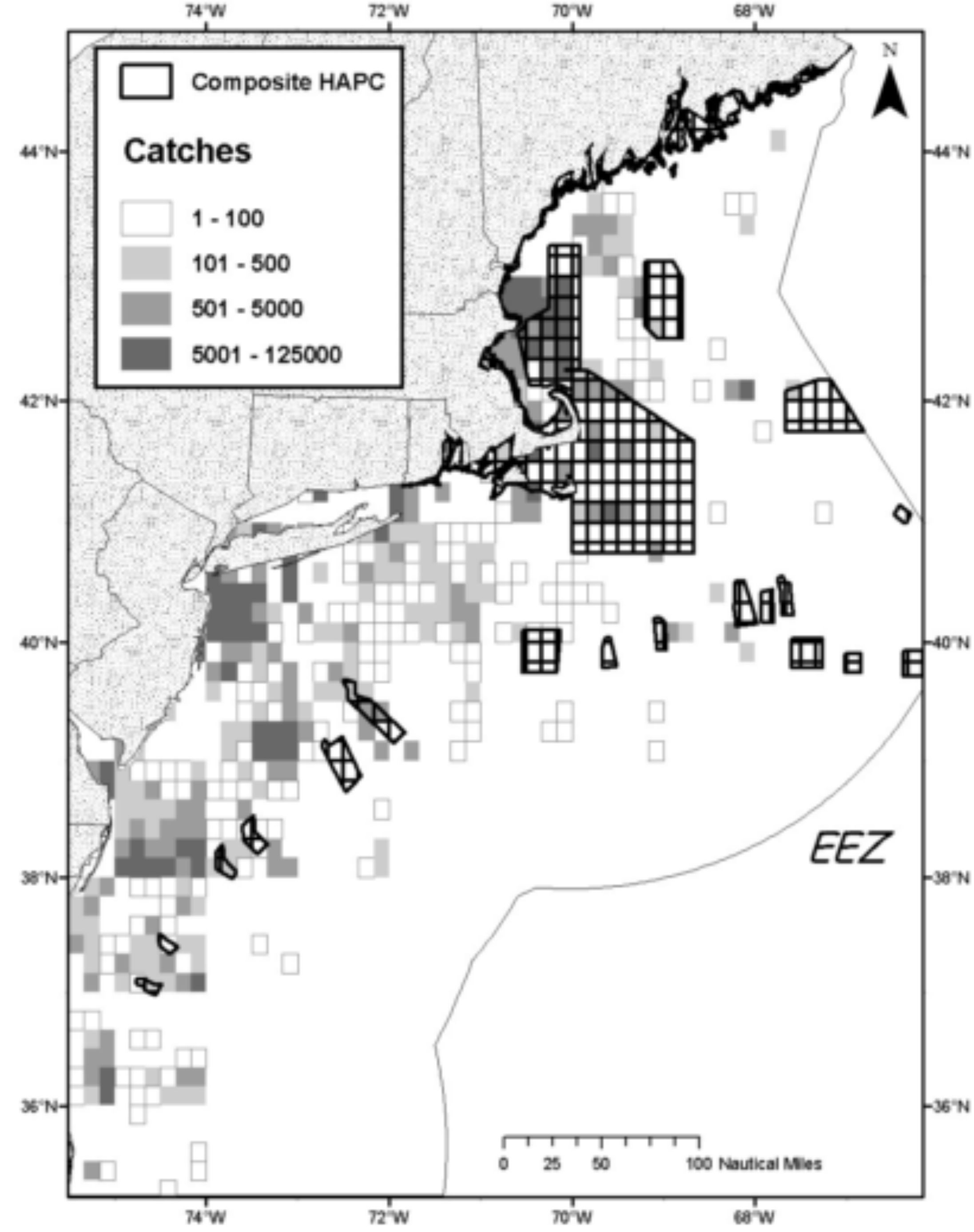
Table 88. 2005 Fishing Activity by the For-Hire Recreational Fishing Industry.

Fishery	Number of vessels	Number of trips	Catch (M lbs)	Number of passengers	Crew
PARTY BOATS	183	11,624	1.7	333,483	504
CHARTER BOATS	516	14,479	0.6	108,452	1019

6.2.4.3.2 HAPCs

The numerous for-hire trips in western Gulf of Maine coincides with the two largest areas under consideration for HAPC designation – i.e., Alternative 8 (the Great South Channel Area) and Alternative 6 (the three (3) options for Jeffreys Ledge and Stellwagen Bank) (Map 624). In addition, several of the areas in Alternative 3 (Deep-Sea Canyons) in the Mid-Atlantic are frequented by the for-hire industry. In 2005, an estimated 15% of the industry's catches came from these areas.

Map 624. For-Hire Catches



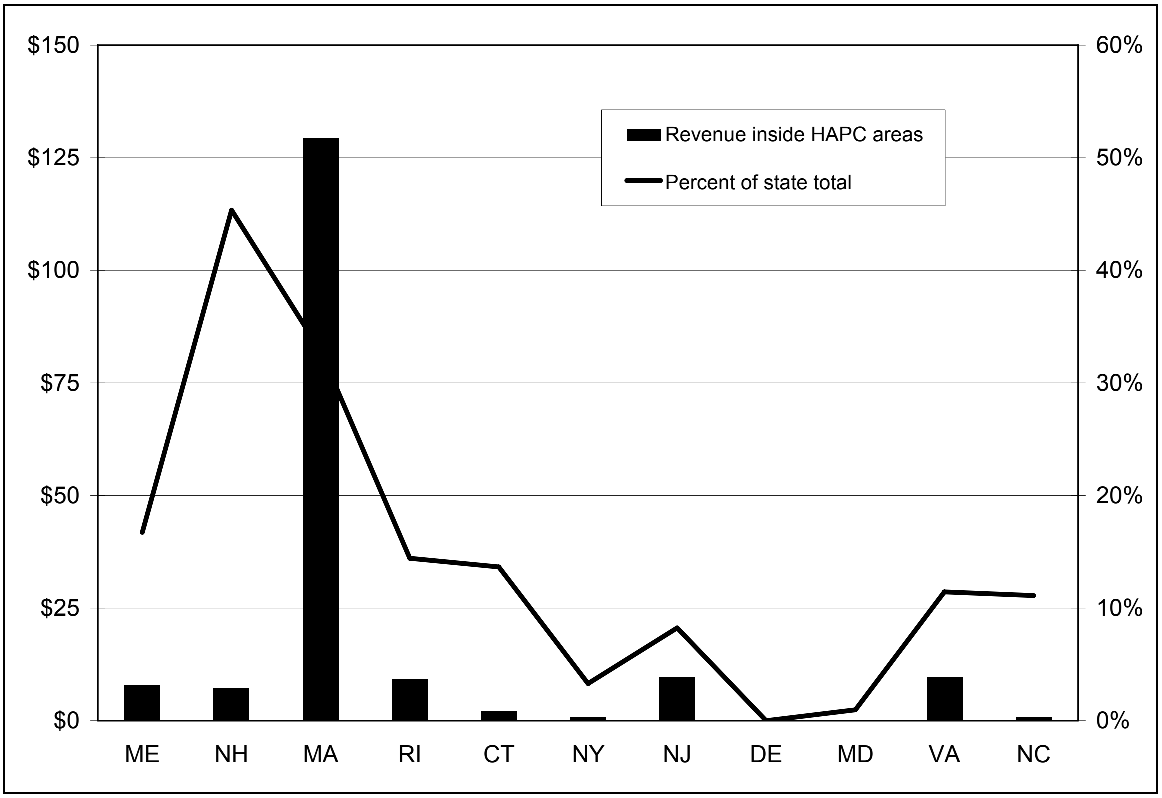
6.2.5 Connections to Land

No regulatory action on industry is proposed by this phase of the amendment; therefore, an input-output analysis of impacts income and employment in ports and states is premature. However, the link between the spatial distribution of fishing activity and where catches are landed is important to describe because EFH could restrict some fisheries spatially, especially HAPCs.

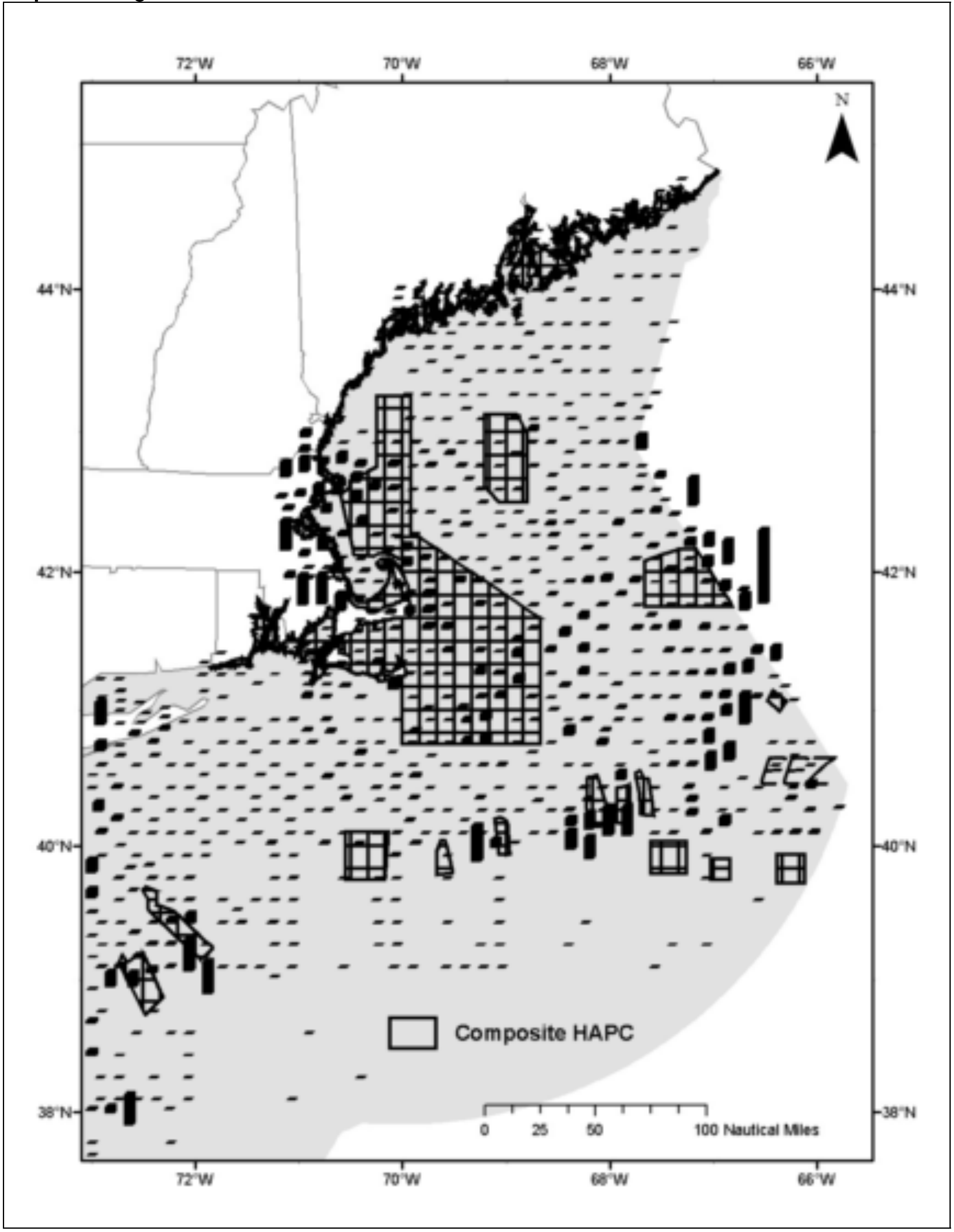
Over all, Massachusetts was by far the leading state-of-landing of fish caught in area inside the HAPC Alternatives under consideration (Figure 12). Nearly $139 million dollars changed hands dockside, which was a third of the state's total dockside revenues as determined from the logbook dataset. Other states were less dependent on these areas in terms of absolute dollars (less than $10 million), but the percentage of known landings from the HAPC Alternatives under consideration was relatively high for Maine and, especially, New Hampshire, and less so (< 15%) for the remaining states in the region, especially in the Mid-Atlantic. These results are distorted by state-reporting of commercial fishing activity which does not include geographic coordinates.

Map 625 provides one way to look at a connection between a state and the spatial incidence of EFH policy. This map displays dockside revenues in Massachusetts for landings from each 10-minute-square in the region. The importance of the Great South Channel, western Gulf of Maine, Georges Bank along the Hague Line, and, to an extent, some of the canyons – all of which are being considered for HAPC designation – is evident.

Figure 12. 2005 State Dockside Revenues from Fish Caught in Areas Under Consideration for HAPCs



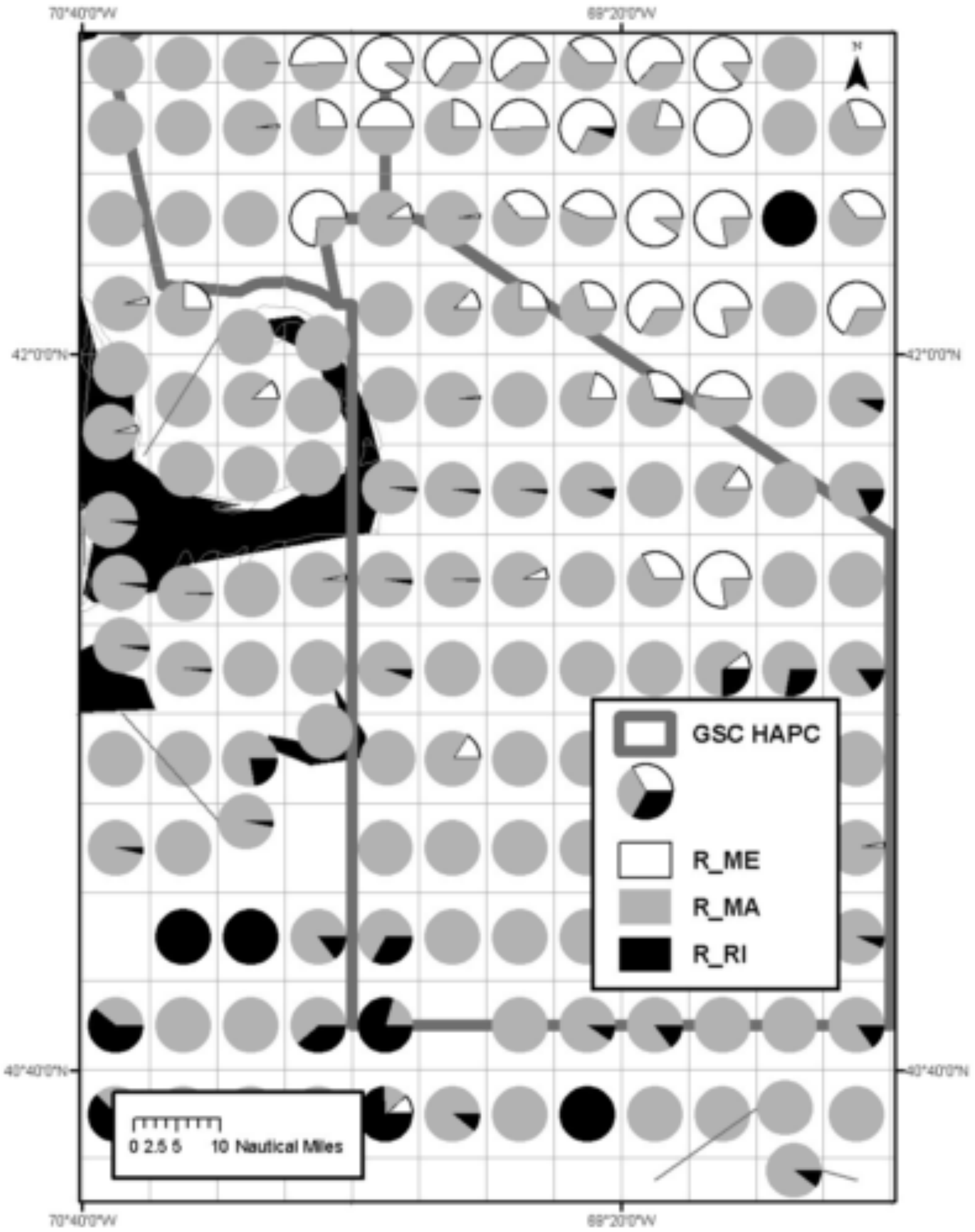
Map 625. Origin of Dockside Revenues in Massachusetts



Map 626 is the final illustration of the spatial character of fisheries and the HAPC Alternatives under consideration. State-shares of dockside revenues in 2005 are shown for 10-minute squares in the vicinity of the Great South Channel, Stellwagen Bank, and

Jeffreys Ledge. In general, the geographic importance of proximity is suggested by the spatial pattern are displayed. Massachusetts received fish caught from nearly every 10-minute-square in the area, and was often the only state where fish were landings, including in the Alternative 8 (Great South Channel Area). Maine was present north/northeast of Cape Cod, and Rhode Islands presence showed up south/southwest of the Cape Cod.

Map 626. State Revenues from Great South Channel Area



6.2.6 The Public's Valuation of EFH and HAPCs

The absence of exclusive and enforceable property rights to many natural resource commodities and services, including marine resources, exposes them in the public domain where they are depleted or degraded. However, the absence of an effective property rights regime, characterized partly by the absence of the right to exchange, either in markets or through negotiations and contracts, should not imply that the stakeholders and general public do not value natural resources. This way of thinking would place no value on seafood or recreational fishing unless they were bought from markets, restaurants, or the party or charter boat industry. Likewise, reef fish would be worthless until captured and sold in aquaria at Walmart, and wild animals would be valueless unless placed in zoos where people pay an entrance fee.

The problem with this logic is that it confounds money with the economic notion of value, which are what people would be willing to pay for a natural resource or environmental protection given the opportunity. People's likes and dislikes (constrained by their income) determine value, not money exchange.

With this in mind, economists at NOAA Fisheries conducted a random survey of households in the Northeast Region of the U.S. in 2005 for information that could be used to estimate the general public's valuation of protecting the diversity of marine species and habitats in the region by designating areas for special protection. Ecological diversity was selected as the commodity because it seemed that EFH policy having to do with HAPCs was tracking more towards environmental protection than enhancing the productivity of fish stocks.

A sample of 1,342 households, selected by a randomized-digit-dialing method (77% return rate and 74% complete response rate), was asked to compare sets of three (3) scenarios in what is known as a contingent choice experiment. The scenarios differed in terms of the size of the areas to be protected (percentage of region) and the types of activities that might be allowed, beginning with scientific research and ending with activities that do not contact the seafloor, including certain fishing methods. Table 89 provides one (1) of the 200 orthogonally-designed versions of contingent choices that were assigned at random to individuals in the sample. The size and use attributes are similar to those currently being discussed for HAPCs.

Table 89. Sample Choice Task

	Alternative A	**Alternative B**	**Current Situation**
What is the combined SIZE of all of the MPA areas in the network?	2% (2 million acres)	2% (2 million acres)	<1% of federal waters (0.6 million acres, about the size of RI)

	Alternative A	**Alternative B**	**Current Situation**
What are the ALLOWABLE USES within the MPA network?	Level 4 Limited Fishing	Level 2 Science and Education	All current activities continue to be allowed
What is the COST to you each year if you voluntarily support an MPA network?	$25	$150	No new costs
Which do you most prefer for the Federal Waters of the Northeast Region?	___ I prefer Alternative A	___ I prefer Alternative B	___ I prefer the Current Situation

In addition, each comparison included different levels of payments to an environmental organization which would negotiate with the fishing and other industries, fishery managers, and the local and Federal governments for the rights to protect specific areas (Table 89). This payment vehicle is gaining popularity now that The Nature Conservancy and Environmental Defense successfully negotiated with fishermen and other stakeholders, the Pacific Fishery Management Council, and the Federal government for the rights to protect 150 thousand square miles of the seafloor off the coast of central California, Oregon, and Washington in exchange for a vessel and permit buyback program financed by the non-governmental environmental organizations (The Nature Conservancy).

The research results identify three (3) types of preferences among households: (1) 58% of the sample revealed classical preferences for size and uses being normal goods with valuations that increased at a decreasing rate; (2) 24% of the sample opposed reserve areas (negative utility) unless uses were allowed; and (3) 18% of the sample had such strong preferences for marine reserves that costs were ignored despite a budget constraint.

Table 90 presents estimates of the value of size and use levels for groups I and II. Preferences of the third group are important for policy-makers to take into account, but their preference structure appears to fall outside the economic calculus. For this illustration, the size attribute was assigned values of nearly 3% of the region which corresponds to the sum of canyon and seamount HAPCs and the Stellwagen Bank MPA, and nearly 10%, or the area occupied by the largest combination of HAPC alternatives. The estimates for group I increase from about $100 a year per household for 3% of the region set aside as no-take reserves to $126 at the 10% level. Adding uses, including pelagic fishing, nearly doubles this class's valuation of protected areas.

Table 90. Estimates of Household Valuations of Marine Ecological Reserves in the Northeast Region.

Class Preferences	**Attributes**			
	Total Size of Areas Protected in Perpetuity (% of region)	**Uses**		
		No-take	**Scientific Research**	**Commercial and recreational uses that do not contact the seafloor (e.g. pelagic fishing)**
Class I – normal good	2.8%	$104	$209	$200
	9.6%	$126	$232	$223
Class II – negative valuation only preservation	2.8%	-$114	-$81	$16
	9.6%	-$209	-$175	-$78

Amounts are annual values per household.

In contrast, the negative valuation of no-take reserves by group II indicates what they would need as compensation annually to accept this policy. Their valuation becomes less negative as use levels increase, but they do not become positive at the higher, 10% size level.

These results indicate that Northeast households have heterogeneous preferences for protecting species and habitat diversity in regional waters. The reader is cautioned not to extrapolate these results or to make comparisons to the revenues figures (a comparison of apples and oranges). A proper comparison of the tradeoffs will be undertaken in phase II of the amendment if the Council elects to include any HAPCs in its alternatives.

6.3 Social Environment (VEC 3)

This Plan covers all areas affected by any New England Fishery Management Council FMP. Thus we will be describing it will describe areas relative to all coastal counties in all states from Maine south through North Carolina. Because of the breadth of the area to cover, and in order to keep this section to a readable length, we have adopted the following strategy has been adopted.

AIn creating an Affected Human Environment section , we generally provides a few fishery wide statistics in order to show the relative importance of the fisheries in question to particular communities and then focuses on the communities showing the greatest landings, value and/or dependence on that fishery. Because this Plan covers so many FMPs we are beginningit begins by providing county wide statistics and state level profiles from the census here in the main body of the AHE. County- level profiles from the census and more general individual community profiles are provided in appendices for top ports and communities by number of permits or level of landings or value.

The variables for countywide statistics are:

1. Average number of vessels by homeport and owner's residence from the NMFS permit files for 2000-2005.

2. Average landings and value by FMP by county from the NMFS landings data as averages for 2000-2005.

3. Basic demographic data by state and county from the census' American Communities Survey of 2005 (e.g., population, race, ethnicity, primary industries, education) – county data will be in Appendix F.

4. Economic dependence on fishing as a range of monthly employment and percentage of establishments in fishing and fishing-related sectors for 2000-2003 (latest year available) from the Census County Business Patterns data.

In addition we will provide qualitative summary data are provided on the following variables:

1. A brief overview of current major fisheries-related issues -- below
2. A brief overview of the level/type of cultural attributes and fishing organizations – in community profiles in Appendix G
3. A brief overview of recreational/subsistence fishing as we know itto the extent data are available -- in the community profiles in Appendix G.

6.3.1 Vessels by Homeport and Owner's Residence

When applying for a permit the vessel owner must identify a "Homeport" for the vessel, theoretically the port where their vessel is primarily docked when not at sea. Further, the vessel owner must provide his or her home address. These two locations (which are sometimes the same place) provide two ways of discussing potential impacts. Some impacts may fall mainly on the place where the boat docks and likely does general maintenance and restocking. Others may fall on the place where the owner lives.

Table 91. All Counties with an Average of at least 3 Federally Permitted Vessels Listing a Port in this County as "Homeport" in the Combined Years of 2000-2005

County	*ST*	*Average No. of Vessels With Homeport in 2000-2005*	*Percent of All Vessels With Homeport in 2000-2005*
ESSEX[1]	MA	573	9.74%
BARNSTABLE[1]	MA	503	8.55%
BRISTOL[1]	MA	355	6.03%
HANCOCK[1]	ME	331	5.63%
CUMBERLAND[1]	ME	321	5.45%
KNOX[1]	ME	310	5.27%
PLYMOUTH[1]	MA	296	5.03%
WASHINGTON[1]	ME	290	4.92%
SUFFOLK[1]	NY	285	4.84%
WASHINGTON[1]	RI	284	4.82%
OCEAN[1]	NJ	209	3.55%
YORK[2]	*ME*	*207*	*3.52%*
ROCKINGHAM[2]	*NH*	*199*	*3.38%*
LINCOLN[2]	*ME*	*180*	*3.06%*
CAPE MAY[2]	*NJ*	*179*	*3.03%*
MONMOUTH[2]	*NJ*	*129*	*2.19%*
NEWPORT[2]	*RI*	*94*	*1.59%*
DARE[2]	*NC*	*90*	*1.53%*
SAGADAHOC[2]	*ME*	*76*	*1.29%*
NEW LONDON[2]	*CT*	*74*	*1.25%*
NASSAU[2]	*NY*	*69*	*1.17%*
NORFOLK (CITY) [2]	*VA*	*61*	*1.03%*
ACCOMACK[2]	*VA*	*58*	*0.98%*
SUFFOLK[2]	*MA*	*52*	*0.88%*
DUKES[2]	*MA*	*43*	*0.73%*
VIRGINIA BEACH (CITY) [2]	*VA*	*39*	*0.66%*
ATLANTIC[2]	*NJ*	*38*	*0.64%*
PAMLICO[2]	*NC*	*37*	*0.63%*
CARTERET[2]	*NC*	*35*	*0.60%*
NORFOLK[2]	*MA*	*33*	*0.57%*
WORCESTER[2]	*MD*	*30*	*0.51%*
SUSSEX[2]	*DE*	*29*	*0.50%*

County	ST	Average No. of Vessels With Homeport in 2000-2005	Percent of All Vessels With Homeport in 2000-2005
HYDE[2]	*NC*	*29*	*0.50%*
NEWPORT NEWS (CITY)	VA	24	0.40%
NEW YORK	NY	22	0.37%
KINGS	NY	21	0.36%
CUMBERLAND	NJ	19	0.32%
NANTUCKET	MA	16	0.27%
BEAUFORT	NC	14	0.24%
WORCESTER	MA	14	0.23%
PROVIDENCE	RI	13	0.22%
KENT	RI	10	0.17%
CRAVEN	NC	10	0.16%
NEW HAVEN	CT	10	0.16%
BRISTOL	RI	10	0.16%
FAIRFIELD	CT	9	0.16%
HAMPTON (CITY)	VA	9	0.16%
NEW CASTLE	DE	9	0.14%
NORTHAMPTON	VA	8	0.13%
MIDDLESEX	CT	7	0.12%
ONSLOW	NC	7	0.12%
BRUNSWICK	NC	7	0.11%
QUEENS	NY	7	0.11%
MIDDLESEX	MA	6	0.10%
STRAFFORD	NH	6	0.10%
POQUOSON (CITY)	VA	5	0.08%
SOMERSET	MD	5	0.08%
GLOUCESTER	VA	5	0.08%
WALDO	ME	5	0.08%
MIDDLESEX	NJ	4	0.07%
TALBOT	MD	4	0.07%
RICHMOND	NY	4	0.07%
KENT	DE	4	0.06%
MATHEWS	VA	4	0.06%
HAMPDEN	MA	3	0.05%
PORTSMOUTH (CITY)	VA	3	0.05%
YORK	VA	3	0.05%

[1] *counties with 5% (when rounded up) of all federal permits in the Northeast listed homeports within that county*

[2] *counties with 1% (when rounded up) of all federal permits in the Northeast listed homeports within that county*

Because there are many ports in the Northeast, the percentage of all federally permitted vessels which claimed any single port as their "Homeport" on their permit forms is low. Even the sum of all permits which claimed ports within a given county is generally a small number. Of the counties in , only 11 reach the level where of 5% (when rounded up) of all federal permits in the Northeast listed homeports within that countywhen rounded up. These are distributed from Maine through New Jersey, but primarily in Maine and Massachusetts. An additional 22 reach the level of 1% when rounded up. These counties are distributed throughout the region. By individual port data (not presented here in tabular format) the top homeports are Gloucester and New Bedford, MA with 5% each; followed by Cape May, NJ; Montauk, NY; Point Judith, RI; Chatham, MA and Portland, ME – all with 2-4%. Going to ports with at least 1% (without rounding up) adds in Stonington, Harpswell and Jonesport, ME; Barnegat Light and Point Pleasant, NJ; Plymouth and Scituate, MA; and Portsmouth, NH. If we added in otherthe ports that round up to 1% were added in there would be an additional 39 ports distributed throughout the region. Full community profiles for these named ports are located in Appendix G.

Table 92. All Counties with an Average of at least 3 Federally Permitted Vessels Listing a Town in this County as Owner's Residence in the Combined Years of 2000-2005

County	ST	Average No. of Vessels With Owner's Residence in 2000-2005	Percent of All Vessels With Owner's Residence in 2000-2005
ESSEX[1]	MA	532	9.03%
BARNSTABLE[1]	MA	451	7.66%
HANCOCK[1]	ME	336	5.71%
BRISTOL[1]	MA	334	5.67%
PLYMOUTH[1]	MA	305	5.18%
CUMBERLAND[1]	ME	297	5.04%
KNOX[1]	ME	295	5.01%
WASHINGTON[1]	ME	287	4.87%
SUFFOLK[1]	NY	273	4.64%
WASHINGTON[1]	RI	265	4.50%
YORK[2]	ME	222	3.77%
ROCKINGHAM[2]	NH	190	3.22%
LINCOLN[2]	ME	189	3.20%
OCEAN[2]	NJ	186	3.15%

County	**ST**	**Average No. of Vessels With Owner's Residence in 2000-2005**	**Percent of All Vessels With Owner's Residence in 2000-2005**
CAPE MAY[2]	NJ	180	3.06%
MONMOUTH[2]	NJ	105	1.78%
NEWPORT[2]	RI	81	1.37%
SAGADAHO[2]C	ME	81	1.37%
DARE[2]	NC	74	1.26%
NASSAU[2]	NY	71	1.20%
NORFOLK[2]	MA	69	1.17%
NEW LONDON[2]	CT	64	1.09%
ACCOMACK[2]	VA	58	0.98%
MIDDLESEX[2]	MA	50	0.84%
VIRGINIA BEACH (CITY) [2]	VA	48	0.81%
PAMLICO[2]	NC	43	0.72%
DUKES[2]	MA	41	0.69%
WORCESTER[2]	MA	36	0.62%
CARTERET[2]	NC	36	0.61%
HAMPTON (CITY) [2]	VA	32	0.54%
SUSSEX[2]	DE	29	0.50%
KENT	RI	26	0.43%
HYDE	NC	25	0.43%
WORCESTER	MD	24	0.41%
KINGS	NY	23	0.39%
BEAUFORT	NC	20	0.34%
CUMBERLAND	NJ	19	0.33%
SUFFOLK	MA	19	0.32%
BRISTOL	RI	17	0.29%
ATLANTIC	NJ	17	0.28%
NEW HAVEN	CT	16	0.28%
QUEENS	NY	16	0.28%
YORK	VA	16	0.27%
NANTUCKET	MA	16	0.27%
NORTHAMPTON	VA	14	0.24%
NEWPORT NEWS (CITY)	VA	14	0.24%
MIDDLESEX	NJ	13	0.22%
PROVIDENCE	RI	12	0.21%
STRAFFORD	NH	12	0.20%

County	ST	Average No. of Vessels With Owner's Residence in 2000-2005	Percent of All Vessels With Owner's Residence in 2000-2005
CRAVEN	NC	12	0.20%
NORFOLK (CITY)	VA	12	0.20%
MIDDLESEX	CT	10	0.18%
CAMDEN	NJ	10	0.16%
FAIRFIELD	CT	10	0.16%
BURLINGTON	NJ	9	0.15%
ONSLOW	NC	8	0.14%
ISLE OF WIGHT	VA	8	0.13%
BERGEN	NJ	7	0.12%
HILLSBOROUGH	NH	7	0.12%
GLOUCESTER	VA	7	0.12%
MORRIS	NJ	7	0.11%
WALDO	ME	6	0.10%
GLOUCESTER	NJ	6	0.10%
WESTCHESTER	NY	6	0.10%
ANNE ARUNDEL	MD	6	0.10%
POQUOSON (CITY)	VA	6	0.10%
HAMPSHIRE	MA	6	0.09%
BRUNSWICK	NC	5	0.09%
HARTFORD	CT	5	0.09%
RICHMOND	NY	5	0.09%
HAMPDEN	MA	5	0.08%
SOMERSET	MD	5	0.08%
TALBOT	MD	5	0.08%
MERRIMACK	NH	4	0.07%
NEW YORK	NY	4	0.07%
RICHMOND (CITY)	VA	4	0.07%
NEW CASTLE	DE	4	0.07%
SOMERSET	NJ	4	0.06%
BUCKS	PA	4	0.06%
MATHEWS	VA	4	0.06%
TOLLAND	CT	4	0.06%
ESSEX	NJ	3	0.06%
FRANKLIN	MA	3	0.06%
ORANGE	NY	3	0.05%

County	ST	Average No. of Vessels With Owner's Residence in 2000-2005	Percent of All Vessels With Owner's Residence in 2000-2005
PASSAIC	NJ	3	0.05%
MERCER	NJ	3	0.05%
TYRRELL	NC	3	0.05%
WICOMICO	MD	3	0.05%
DELAWARE	PA	3	0.04%
KENT	DE	3	0.04%
WINDHAM	CT	3	0.04%

[1] *counties with 5% (when rounded up) of all federal permits in the Northeast listed homeports within that county*

[2] *counties with 1% (when rounded up) of all federal permits in the Northeast listed homeports within that county*

Analogous to the situation for homeport, because there are so many towns or cities claimed as owner's residence in the Northeast federal permits the percentage of all federal permit holders residing in any one city or town is low, as is even the number residing within any given county. Of the counties in , only 10 reach the level whereof 5% (when rounded up) of federal permit holders in the Northeast listed home addresses in that county. These are distributed from Maine through New Jersey, but primarily in Maine and Massachusetts. An additional 21 reach the level of 1%. These counties are distributed throughout the region. By individual port data (not presented here in tabular format) the top ports for owner residence in 2005 are Gloucester and New Bedford, MA – with over 3% each, followed by Montauk, NY and Wakefield, RI – with at least 2% each. Going to ports with at least 1% (without rounding up) adds in Beals, Harpswell and Vinalhaven, ME; Cape May, NJ; and Chatham and Fairhaven, MA. If we added in other ports that round up to 1%If the ports that round up to 1% were added in there would be an additional 42 ports distributed throughout the region. Full community profiles for the namedse ports are located in Appendix G.

6.3.2 Commercial Landed Value and Landed Pounds by FMP by County

These tables provide basic data on commercial landings and ex-vessel value for each Northeast Region FMP by county, as well as identify key ports for each FMP. Individual community profiles for these key ports are available in an appendix. To provide the widest possible coverage, combined data from 2000-2005 are used. Data are provided for all counties where percent of ex-vessel value or of landed pounds for the combined years 2000-2005 equals at least 0.01% and/or average dollars or pounds for the combined years 2000-2005 equal at least 10,000.

Additionally, counties are identified where a) landings or value reach the level of at least 5% of all landings or value under that FMP or b) landings or value reach at least 1% of all landings or value under that FMP. One exception to the grouping by FMP is that of Northeast Multispecies, where large mesh groundfish are distinguished from small mesh groundfish due to the rather different fishing patterns of these two groups. Data are sorted in descending order by percent of total value. Where prices differ between counties this can lead to a county with higher percent landings than another actually showing up as lower in percent value.

Finally, directed commercial fishing for Atlantic salmon in the EEZ has been prohibited since 1987 (NEFMC 1987), as have all directed commercial recreational Atlantic salmon fisheries in Maine since 2000 (Fay, et al. 2006:117). Therefore only a qualitative discussion is provided rather than tables of landings and value as for other FMP species/groups.

Table 93. Landed Value and Pounds for All Counties with Landings of Large Mesh Groundfish in the Combined Years of 2000-2005

County	ST	Avg Landed Value 2000-2005	% of Total Landed Value	Avg Landed Lbs 2000-2005	% of Total Landed Lbs
BRISTOL[1]	MA	$34,519,316	36.49%	32,569,963	37.66%
ESSEX[1]	MA	$19,206,444	20.30%	16,574,244	19.16%
CUMBERLAND[1]	ME	$14,898,987	15.75%	14,527,996	16.80%
BARNSTABLE[1]	MA	$7,005,490	7.41%	5,650,241	6.53%
SUFFOLK[1]	MA	$4,610,319	4.87%	3,903,919	4.51%
ROCKINGHAM[2]	NH	$3,596,949	3.80%	3,400,336	3.93%
PLYMOUTH[2]	MA	$2,610,738	2.76%	2,118,715	2.45%
WASHINGTON[2]	RI	$2,221,656	2.35%	2,063,510	2.39%
NEWPORT[2]	RI	$1,407,996	1.49%	1,368,086	1.58%
KNOX[2]	ME	$1,071,587	1.13%	1,080,206	1.25%
SUFFOLK[2]	NY	$1,050,407	1.11%	920,231	1.06%
LINCOLN[2]	ME	$524,754	0.55%	522,444	0.60%
NEW LONDON[2]	CT	$440,286	0.47%	465,596	0.54%
YORK[2]	ME	$416,268	0.44%	399,542	0.46%
OCEAN	NJ	$341,673	0.36%	290,347	0.34%
MONMOUTH	NJ	$294,235	0.31%	263,150	0.30%
HANCOCK	ME	$186,515	0.20%	190,509	0.22%
NASSAU	NY	$66,541	0.07%	66,496	0.08%

County	ST	Avg Landed Value 2000-2005	% of Total Landed Value	Avg Landed Lbs 2000-2005	% of Total Landed Lbs
SAGADAHOC	ME	$40,527	0.04%	37,528	0.04%
NEW HAVEN	CT	$31,712	0.03%	33,618	0.04%
CAPE MAY	NJ	$10,327	0.01%	6,435	0.01%
KINGS	NY	$9,485	0.01%	9,582	0.01%
NANTUCKET	MA	$8,589	0.01%	4,738	0.01%
DUKES	MA	$5,284	0.01%	5,950	0.01%
WASHINGTON	ME	$4,508	0.00%	5,467	0.01%

[1] *counties with 5% (when rounded up) of all federal permits in the Northeast listed homeports within that county*

[2] *counties with 1% (when rounded up) of all federal permits in the Northeast listed homeports within that county*

Of the counties in , only 5 reach the level of 5% landed value or pounds, when rounded up. These are concentrated in Maine and Massachusetts, with Bristol County, MA far surpassing other locations. An additional 9 reach the level of 1%. These range from Maine through New York. By individual port data (not presented here in tabular format), the top ports in 2005 for large mesh groundfish are New Bedford and Gloucester, MA and Portland, ME – all with 15% or more of landings or value, followed distantly by Boston, MA – the only other port with 5% or more of landings or value. Full community profiles for these ports are located in an appendix.

Table 94. Landed Value and Pounds for All Counties with Landings of Small Mesh Groundfish in the Combined Years of 2000-2005

County	ST	Avg Landed Value 2000-2005	% of Total Landed Value	Avg Landed Lbs 2000-2005	% of Total Landed Lbs
SUFFOLK[1]	NY	$3,708,611	26.92 %	5,008,932	21.69%
WASHINGTON[1]	RI	$3,493,043	25.36 %	6,833,852	29.60%
NEW LONDON[1]	CT	$2,455,374	17.83 %	3,773,904	16.34%
BRISTOL[1]	MA	$1,733,151	12.58 %	3,643,635	15.78%
ESSEX[1]	MA	$755,842	5.49%	1,198,417	5.19%
BARNSTABLE[2]	MA	$470,254	3.41%	710,431	3.08%
NEWPORT[2]	RI	$391,588	2.84%	714,155	3.09%
OCEAN[2]	NJ	$248,262	1.80%	368,300	1.60%

County	ST	Avg Landed Value 2000-2005	% of Total Landed Value	Avg Landed Lbs 2000-2005	% of Total Landed Lbs
NEW YORK[2]	NY	$144,964	1.05%	219,519	0.95%
ROCKINGHAM[2]	NH	$118,370	0.86%	208,363	0.90%
NASSAU[2]	NY	$117,220	0.85%	193,152	0.84%
MONMOUTH[2]	NJ	$78,657	0.57%	125,063	0.54%
CAPE MAY	NJ	$16,151	0.12%	22,089	0.10%
SUFFOLK	MA	$9,404	0.07%	20,236	0.09%
CUMBERLAND	ME	$7,743	0.06%	9,564	0.04%
BRUNSWICK	NC	$6,057	0.04%	5,556	0.02%
PROVIDENCE	RI	$4,546	0.03%	11,160	0.05%
PLYMOUTH	MA	$4,173	0.03%	9,050	0.04%
UNION	NJ	$2,691	0.02%	2,714	0.01%
KINGS	NY	$1,977	0.01%	1,997	0.01%
NEW HAVEN	CT	$1,050	0.01%	2,543	0.01%
ACCOMACK	VA	$939	0.01%	1,324	0.01%

[1] *counties with 5% (when rounded up) of all federal permits in the Northeast listed homeports within that county*

[2] *counties with 1% (when rounded up) of all federal permits in the Northeast listed homeports within that county*

Of the counties in , only 5 reach the level of 5% either landed value or landed pounds, when rounded up. These are located in Massachusetts through New York, with Suffolk County, NY and Washington County, RI have the highest levels. An additional 7 reach the level of 1%. These counties are distributed from Massachusetts through New Jersey. By individual port data (not presented here in tabular format), the top ports in 2005 are Point Judith, RI; Montauk, NY; New Bedford, MA; and New London, CT – all with 15% or more of landings or value. They are followed distantly by Gloucester, MA that is the only other port with at least 5% of landings or value. Full community profiles for these ports are located in an appendix.

Table 95. Landed Value and Pounds for All Counties with Landings of Dogfish in the Combined Years of 2000-2005

County	ST	Avg Landed Value 2000-2005	% of Total Landed Value	Avg Landed Lbs 2000-2005	% of Total Landed Lbs
BARNSTABLE[1]	MA	$401,607	35.22%	2,004,955	35.80%
OCEAN[1]	NJ	$144,499	12.67%	774,301	13.82%

County	**ST**	**Avg Landed Value 2000-2005**	**% of Total Landed Value**	**Avg Landed Lbs 2000-2005**	**% of Total Landed Lbs**
ROCKINGHAM[1]	NH	$140,766	12.34%	562,177	10.04%
DARE[1]	NC	$93,204	8.17%	480,011	8.57%
ESSEX[1]	MA	$80,764	7.08%	466,543	8.33%
SUFFOLK[1]	NY	$66,543	5.83%	289,801	5.17%
PLYMOUTH[2]	MA	$50,664	4.44%	248,204	4.43%
ACCOMACK[2]	VA	$36,868	3.23%	196,419	3.51%
HYDE[2]	NC	$28,565	2.50%	52,558	0.94%
NEWPORT[2]	RI	$23,868	2.09%	120,111	2.14%
MONMOUTH[2]	NJ	$17,135	1.50%	89,288	1.59%
WORCESTER[2]	MD	$14,391	1.26%	75,782	1.35%
WASHINGTON[2]	RI	$9,249	0.81%	62,499	1.12%
VIRGINIA BEACH [2] (CITY)	VA	$8,235	0.72%	54,005	0.96%
NORTHAMPTON[2]	VA	$6,445	0.57%	35,951	0.64%
BRISTOL	MA	$4,400	0.39%	17,215	0.31%
NEW LONDON	CT	$3,466	0.30%	23,441	0.42%
CARTERET	NC	$2,412	0.21%	11,550	0.21%
CAPE MAY	NJ	$1,966	0.17%	9,997	0.18%
NASSAU	NY	$1,920	0.17%	7,927	0.14%
SUFFOLK	MA	$1,527	0.13%	9,135	0.16%
YORK	ME	$773	0.07%	3,389	0.06%
CUMBERLAND	ME	$578	0.05%	2,713	0.05%
KNOX	ME	$352	0.03%	1,759	0.03%
NORFOLK (CITY)	VA	$103	0.01%	574	0.01%

[1] *counties with 5% (when rounded up) of all federal permits in the Northeast listed homeports within that county*

[2] *counties with 1% (when rounded up) of all federal permits in the Northeast listed homeports within that county*

Of the counties in , only 6 (in **bold** above) reach the level of 5% either landed value or landed pounds, when rounded up. These counties are distributed from Massachusetts through North Carolina, though Barnstable County, MA far exceeds the other locations. An additional 9 (in *italics* above) reach the level of 1%. These counties are also distributed from Massachusetts through North Carolina, but the total number of states involved in greater. By individual port data (not presented here in tabular format), the top ports in 2005 for dogfish are Gloucester and Chatham, MA – with 30% or more of landings or value. Following distantly is Plymouth, MA – the only other port with at least 5% of landings or value. . Full community profiles for these ports are located in an appendix. Though Ocean County, NJ is number two in county landings for 2000-2005, no individual port in Ocean County even shows up in the 2005 landings

Table 96. Landed Value and Pounds for All Counties with Landings of Sea Scallops in the Combined Years of 2000-2005

County	ST	Avg Landed Value 2000-2005	% of Total Landed Value	Avg Landed Lbs 2000-2005	% of Total Landed Lbs
BRISTOL[1]	MA	121,809,040	47.26%	23,587,940	45.38%
NEWPORT NEWS (CITY) [1]	VA	34,633,372	13.44%	7,661,188	14.74%
CAPE MAY[1]	NJ	33,149,457	12.86%	6,938,267	13.35%
OCEAN[1]	NJ	15,934,876	6.18%	3,004,674	5.78%
HAMPTON (CITY) [1]	VA	15,101,124	5.86%	3,461,432	6.66%
YORK[1]	VA	13,461,506	5.22%	2,921,029	5.62%
NEW LONDON[2]	CT	7,578,461	2.94%	1,564,958	3.01%
BARNSTABLE[2]	MA	4,074,856	1.58%	750,348	1.44%
ACCOMACK[2]	VA	3,365,629	1.31%	607,660	1.17%
NEWPORT[2]	RI	1,716,811	0.67%	217,460	0.42%
WASHINGTON[2]	RI	1,005,488	0.39%	165,931	0.32%
ESSEX	MA	961,527	0.37%	170,886	0.33%
SUFFOLK	NY	913,196	0.35%	199,378	0.38%
WORCESTER	MD	884,605	0.34%	133,689	0.26%
HANCOCK	ME	537,074	0.21%	91,740	0.18%
ROCKINGHAM	NH	454,225	0.18%	95,605	0.18%
DARE	NC	396,810	0.15%	107,270	0.21%
ATLANTIC	NJ	382,389	0.15%	51,566	0.10%
WASHINGTON	ME	323,133	0.13%	52,896	0.10%
CARTERET	NC	198,862	0.08%	45,513	0.09%
KNOX	ME	172,060	0.07%	37,404	0.07%
PAMLICO	NC	164,373	0.06%	29,857	0.06%
HYDE	NC	80,741	0.03%	19,530	0.04%
NANTUCKET	MA	73,761	0.03%	11,142	0.02%
PLYMOUTH	MA	57,968	0.02%	9,104	0.02%
LINCOLN	ME	45,423	0.02%	5,859	0.01%
MONMOUTH	NJ	43,822	0.02%	7,105	0.01%
SUFFOLK	MA	37,617	0.01%	8,377	0.02%
DUKES	MA	34,251	0.01%	4,758	0.01%
CUMBERLAND	ME	33,539	0.01%	5,439	0.01%

County	ST	Avg Landed Value 2000-2005	% of Total Landed Value	Avg Landed Lbs 2000-2005	% of Total Landed Lbs
SUSSEX	DE	18,837	0.01%	2,465	0.00%
YORK	ME	14,154	0.01%	1,835	0.00%
NASSAU	NY	13,786	0.01%	2,097	0.00%

[1] *counties with 5% (when rounded up) of all federal permits in the Northeast listed homeports within that county*

[2] *counties with 1% (when rounded up) of all federal permits in the Northeast listed homeports within that county*

Of the counties in , only 6 reach the level of 5% either landed value or landed pounds, when rounded up. These are located in Massachusetts, New Jersey, and especially Virginia, though Bristol County, MA far surpasses all other locations. An additional 4 reach the level of 1%. These counties are located in Connecticut, Massachusetts, Rhode Island and Virginia. By individual port data (not presented here in tabular format), the top port in 2005 for sea scallops is New Bedford, MA – with nearly 50% of all landings and value. It is followed by Cape May, NJ and Newport News, VA – each with 10% or more of landings and value, and Barnegat Light/Long Beach, NJ – the only other port to reach 5% or more in landings or value. Full community profiles for these ports are located in an appendix.

Table 97. Landed Value and Pounds for All Counties with Landings of Lobster in the Combined Years of 2000-2005

County	ST	Avg Landed Value 2000-2005	% of Total Landed Value	Avg Landed Lbs 2000-2005	% of Total Landed Lbs
KNOX[1]	ME	$75,730,515	24.36%	20,252,912	26.02%
HANCOCK[1]	ME	$57,793,654	18.59%	14,801,774	19.02%
WASHINGTON[1]	ME	$28,646,501	9.21%	7,113,407	9.14%
CUMBERLAND[1]	ME	$27,616,195	8.88%	7,470,197	9.60%
LINCOLN[1]	ME	$19,637,429	6.32%	5,404,382	6.94%
ESSEX[1]	MA	$19,610,785	6.31%	4,343,648	5.58%
YORK[2]	ME	$12,497,614	4.02%	3,129,335	4.02%
BARNSTABLE[2]	MA	$10,294,106	3.31%	2,212,533	2.84%
WASHINGTON[2]	RI	$9,731,159	3.13%	2,130,632	2.74%
PLYMOUTH[2]	MA	$9,477,058	3.05%	2,092,149	2.69%
BRISTOL[2]	MA	$9,365,758	3.01%	2,006,119	2.58%
ROCKINGHAM[2]	NH	$8,081,413	2.60%	1,765,707	2.27%
SAGADAHOC[2]	ME	$3,995,464	1.29%	997,205	1.28%

County	ST	Avg Landed Value 2000-2005	% of Total Landed Value	Avg Landed Lbs 2000-2005	% of Total Landed Lbs
SUFFOLK[2]	NY	$3,232,332	1.04%	750,624	0.96%
NEWPORT[2]	RI	$3,158,499	1.02%	706,958	0.91%
SUFFOLK[2]	MA	$2,546,589	0.82%	567,965	0.73%
NEW LONDON[2]	CT	$1,754,924	0.56%	391,393	0.50%
NORFOLK[2]	MA	$1,625,938	0.52%	344,445	0.44%
FAIRFIELD[3]	CT	$1,164,248	0.37%	259,971	0.33%
NEW HAVEN[3]	CT	$858,555	0.28%	200,155	0.26%
OCEAN[3]	NJ	$776,380	0.25%	166,030	0.21%
CAPE MAY[3]	NJ	$674,825	0.22%	139,027	0.18%
WALDO[3]	ME	$585,649	0.19%	131,958	0.17%
MONMOUTH[3]	NJ	$547,131	0.18%	132,135	0.17%
DUKES[3]	MA	$495,754	0.16%	102,451	0.13%
NASSAU[3]	NY	$435,152	0.14%	92,678	0.12%
NANTUCKET[3]	MA	$218,986	0.07%	44,551	0.06%
WORCESTER[3]	MD	$101,830	0.03%	22,567	0.03%
ACCOMACK	VA	$85,448	0.03%	17,231	0.02%
MIDDLESEX	CT	$66,597	0.02%	15,057	0.02%
KENT	RI	$32,378	0.01%	6,507	0.01%
SUSSEX	DE	$23,581	0.01%	4,707	0.01%

[1] *counties with 5% (when rounded up) of all federal permits in the Northeast listed homeports within that county*

[2] *counties with 1% (when rounded up) of all federal permits in the Northeast listed homeports within that county*

[3] *counties below the 1% threshold that still earn an average of $100,000 per year or more*

Of the counties in , only 6 reach the level of 5% either landed value or landed pounds, when rounded up. These are located in Maine and Massachusetts, with Knox and Hancock County in Maine standing far ahead of the others. An additional 12 reach the level of 1%. These are distributed from Maine through New York. However, because of the high ex-vessel price for lobster, 10 counties below the 1% level still earn an average $100,000 or more per year from lobster. By individual port data (not presented here in tabular format), the top ports in 2005 for lobster are Stonington and Vinalhaven, ME – both with 7% or more of landings or value, and Other Hancock, ME – the only other "port" with 5% or more of total landings or value. Full community profiles for these ports are located in Appendix G.

Table 98. Landed Value and Pounds for All Counties with Landings of Tilefish in the Combined Years of 2000-2005

County	ST	Avg Landed Value 2000-2005	% of Total Landed Value	Avg Landed Lbs 2000-2005	% of Total Landed Lbs
SUFFOLK[1]	NY	$2,583,751	78.12%	1,332,026	71.53%
OCEAN[1]	NJ	$468,524	14.17%	302,418	16.24%
WASHINGTON[1]	RI	$164,263	4.97%	140,361	7.54%
ESSEX[2]	MA	$41,704	1.26%	41,380	2.22%
NEW LONDON[2]	CT	$12,155	0.37%	12,844	0.69%
NEWPORT[2]	RI	$10,942	0.33%	13,632	0.73%
CUMBERLAND	ME	$6,462	0.20%	3,522	0.19%
BRISTOL	MA	$4,173	0.13%	5,434	0.29%
DARE	NC	$3,726	0.11%	2,473	0.13%
CAPE MAY	NJ	$3,284	0.10%	2,076	0.11%
ACCOMACK	VA	$1,926	0.06%	1,574	0.08%
NASSAU	NY	$1,514	0.05%	761	0.04%
BRUNSWICK	NC	$1,345	0.04%	477	0.03%
BARNSTABLE	MA	$720	0.02%	570	0.03%
SUFFOLK	MA	$606	0.02%	624	0.03%
HYDE	NC	$522	0.02%	426	0.02%
PLYMOUTH	MA	$480	0.01%	483	0.03%
MONMOUTH	NJ	$355	0.01%	211	0.01%
CARTERET	NC	$209	0.01%	471	0.03%
HAMPTON (CITY)	VA	$179	0.01%	121	0.01%
KINGS	NY	$150	0.00%	111	0.01%
WORCESTER	MD	$137	0.00%	103	0.01%

[1] *counties with 5% (when rounded up) of all federal permits in the Northeast listed homeports within that county*

[2] *counties with 1% (when rounded up) of all federal permits in the Northeast listed homeports within that county*

Of the counties in , only 3 (in **bold** above) reach the level of 5% either landed value or landed pounds, when rounded up. These are located in New York, New Jersey and Rhode Island. However, Suffolk County, NY far surpasses all other counties. An additional 3 (in *italics* above) reach the level of 1%, when rounded up. These are located in Massachusetts, Connecticut and Rhode Island. By individual port data (not presented here in tabular format), the top ports in 2005 for tilefish are Montauk, NY – with nearly 70% of landings and value, followed distantly by Hampton Bays/Shinnecock, NY and Barnegat Light, NJ with approximately 10% each of value or landings. There are no ports with 5-9% of landings. Full community profiles for these ports are located in an appendix.

Table 99. Landed Value and Pounds for All Counties with Landings of Monkfish in the Combined Years of 2000-2005

County	ST	Avg Landed Value 2000-2005	% of Total Landed Value	Avg Landed Lbs 2000-2005	% of Total Landed Lbs
BRISTOL[1]	MA	$10,090,897	24.10%	5,837,344	21.91%
CUMBERLAND[1]	ME	$6,331,189	15.12%	3,277,648	12.30%
OCEAN[1]	NJ	$5,153,155	12.31%	3,935,307	14.77%
ESSEX[1]	MA	$4,322,441	10.32%	2,600,868	9.76%
WASHINGTON[1]	RI	$2,738,623	6.54%	1,776,637	6.67%
NEWPORT[1]	RI	$2,321,534	5.54%	1,748,169	6.56%
SUFFOLK[1]	MA	$2,020,027	4.82%	1,247,979	4.68%
ROCKINGHAM[1]	NH	$1,774,882	4.24%	1,229,835	4.62%
SUFFOLK[2]	NY	$1,278,663	3.05%	944,544	3.54%
BARNSTABLE[2]	MA	$1,188,025	2.84%	920,525	3.45%
PLYMOUTH[2]	MA	$848,037	2.03%	588,568	2.21%
NEW LONDON[2]	CT	$845,087	2.02%	521,182	1.96%
KNOX[2]	ME	$781,344	1.87%	414,474	1.56%
ACCOMACK[2]	VA	$650,366	1.55%	544,570	2.04%
LINCOLN[2]	ME	$318,767	0.76%	170,120	0.64%
DARE[2]	NC	$307,666	0.73%	248,202	0.93%
CAPE MAY[2]	NJ	$300,673	0.72%	201,675	0.76%
WORCESTER[2]	MD	$152,449	0.36%	120,293	0.45%
YORK	ME	$118,749	0.28%	84,820	0.32%
NEWPORT NEWS (CITY)	VA	$77,443	0.18%	61,503	0.23%
HAMPTON (CITY)	VA	$68,556	0.16%	41,594	0.16%
MONMOUTH	NJ	$39,980	0.10%	34,183	0.13%
YORK	VA	$38,127	0.09%	28,585	0.11%
HANCOCK	ME	$36,889	0.09%	19,708	0.07%
SAGADAHOC	ME	$16,889	0.04%	7,923	0.03%
PAMLICO	NC	$12,414	0.03%	10,021	0.04%
NASSAU	NY	$11,985	0.03%	5,322	0.02%
HYDE	NC	$10,278	0.02%	8,857	0.03%
CARTERET	NC	$6,718	0.02%	5,605	0.02%
VIRGINIA BEACH (CITY	VA	$4,240	0.01%	4,045	0.02%
WASHINGTON	ME	$3,222	0.01%	2,414	0.01%
KENT	RI	$1,366	0.00%	1,391	0.01%

[1] *counties with 5% (when rounded up) of all federal permits in the Northeast listed homeports within that county*

[2] *counties with 1% (when rounded up) of all federal permits in the Northeast listed homeports within that county*

Of the counties in , only 8 reach the level of 5% either landed value or landed pounds, when rounded up. These are located in Maine through New Jersey. The highest values are for Bristol County, MA. An additional 10 reach the level of 1%. These are distributed throughout the region. By individual port data (not presented here in tabular format), the top ports in 2005 for monkfish are New Bedford, MA – with nearly a quarter of landings and value, followed by Portland, ME and Gloucester, MA – with 10-24% of landings or value. Remaining ports with 5-9% of landings or value are Boston and Chatham, MA; Barnegat Light/Long Beach, NJ; Point Judith, RI. Full community profiles for these ports are located in Appendix G.

Table 100. Landed Value and Pounds for All Counties with Landings of Herring in the Combined Years of 2000-2005

County	ST	Avg Landed Value 2000-2005	% of Total Landed Value	Avg Landed Lbs 2000-2005	% of Total Landed Lbs
KNOX[1]	ME	$3,107,197	21.75%	36,560,180	18.78%
ESSEX[1]	MA	$3,060,259	21.42%	44,799,938	23.01%
CUMBERLAND[1]	ME	$2,656,133	18.59%	37,684,930	19.36%
BRISTOL[1]	MA	$1,305,464	9.14%	18,124,850	9.31%
WASHINGTON[1]	RI	$1,168,764	8.18%	15,152,093	7.78%
HANCOCK[1]	ME	$1,062,871	7.44%	14,585,305	7.49%
ROCKINGHAM[1]	NH	$904,407	6.33%	13,072,692	6.72%
SAGADAHOC[2]	ME	$313,610	2.20%	4,841,334	2.49%
PROVIDENCE[2]	RI	$224,349	1.57%	3,834,959	1.97%
CAPE MAY[2]	NJ	$163,386	1.14%	2,076,051	1.07%
NEWPORT[2]	RI	$103,959	0.73%	1,900,771	0.98%
WASHINGTON	ME	$55,481	0.39%	665,305	0.34%
SUFFOLK	MA	$53,015	0.37%	365,189	0.19%
NEW LONDON	CT	$52,370	0.37%	355,304	0.18%
LINCOLN	ME	$30,865	0.22%	299,647	0.15%
BRISTOL	RI	$15,411	0.11%	305,603	0.16%
SUFFOLK	NY	$1,602	0.01%	12,619	0.01%

[1] *counties with 5% (when rounded up) of all federal permits in the Northeast listed homeports within that county*

[2] *counties with 1% (when rounded up) of all federal permits in the Northeast listed homeports within that county*

Of the counties in , only 7 reach the level of 5% either landed value or landed pounds, when rounded up. These are located in Maine, Massachusetts, New Hampshire and Rhode Island. Knox and Cumberland County, ME along with Essex County, MA have the highest values. An additional 4 reach the level of 1%. These are located in Maine, Rhode Island and New Jersey. By individual port data (not presented here in tabular format), the top port in 2005 for herring is Gloucester, MA – with just over a third of landings and value. It is followed by Rockland and Portland, ME and New Bedford, MA with 10-30% of landings or value, and Newington, NH with 5-9% of landings or value. Full community profiles for these ports are located in Appendix G.

Table 101. Landed Value and Pounds for All Counties with Landings of Bluefish in the Combined Years of 2000-2005

County	ST	Avg Landed Value 2000-2005	% of Total Landed Value	Avg Landed Lbs 2000-2005	% of Total Landed Lbs
DARE[1]	NC	$731,354	32.77%	2,911,118	40.96%
SUFFOLK[1]	NY	$492,119	22.05%	1,405,318	19.77%
OCEAN[1]	NJ	$369,837	16.57%	891,136	12.54%
BARNSTABLE[1]	MA	$115,052	5.16%	236,022	3.32%
WASHINGTON[1]	RI	$97,608	4.37%	346,007	4.87%
MONMOUTH[2]	NJ	$77,655	3.48%	203,885	2.87%
BRISTOL[2]	MA	$42,597	1.91%	58,480	0.82%
NEWPORT[2]	RI	$38,588	1.73%	120,431	1.69%
ACCOMACK[2]	VA	$29,120	1.30%	111,663	1.57%
NASSAU[2]	NY	$25,505	1.14%	74,522	1.05%
VIRGINIA BEACH (CITY) [2]	VA	$22,297	1.00%	89,760	1.26%
NORTHUMBERLAND[2]	VA	$21,420	0.96%	78,420	1.10%
HAMPTON (CITY) [2]	VA	$21,363	0.96%	86,623	1.22%
ESSEX[2]	MA	$17,082	0.77%	34,803	0.49%
HYDE[2]	NC	$16,254	0.73%	76,267	1.07%
CAPE MAY[2]	NJ	$15,054	0.67%	52,675	0.74%
NEW LONDON[2]	CT	$10,678	0.48%	33,778	0.48%
MATHEWS[2]	VA	$8,044	0.36%	36,527	0.51%
DUKES	MA	$7,632	0.34%	7,404	0.10%
WORCESTER	MD	$7,583	0.34%	28,057	0.39%
GLOUCESTER	VA	$6,551	0.29%	29,598	0.42%
CARTERET	NC	$6,105	0.27%	28,187	0.40%
ROCKINGHAM	NH	$5,988	0.27%	13,167	0.19%
NORTHAMPTON	VA	$5,198	0.23%	20,653	0.29%
LANCASTER	VA	$4,387	0.20%	17,859	0.25%
SUSSEX	DE	$4,275	0.19%	14,848	0.21%
NEWPORT NEWS (CITY)	VA	$3,347	0.15%	11,436	0.16%
PLYMOUTH	MA	$3,310	0.15%	8,399	0.12%
QUEENS	NY	$3,267	0.15%	5,052	0.07%

County	ST	Avg Landed Value 2000-2005	% of Total Landed Value	Avg Landed Lbs 2000-2005	% of Total Landed Lbs
YORK	VA	$3,034	0.14%	15,168	0.21%
ST. MARY'S	MD	$2,537	0.11%	8,402	0.12%
PAMLICO	NC	$2,400	0.11%	7,192	0.10%
NEW HAVEN	CT	$1,894	0.08%	6,233	0.09%
BRUNSWICK	NC	$1,645	0.07%	6,257	0.09%
MIDDLESEX	VA	$1,233	0.06%	5,507	0.08%
CUMBERLAND	NJ	$1,191	0.05%	4,325	0.06%
WESTMORELAND	VA	$1,153	0.05%	4,031	0.06%
NORFOLK (CITY)	VA	$1,009	0.05%	3,965	0.06%
NANTUCKET	MA	$913	0.04%	917	0.01%
NORFOLK	MA	$883	0.04%	1,545	0.02%
SUFFOLK	MA	$873	0.04%	1,821	0.03%
KENT	DE	$850	0.04%	3,145	0.04%
ATLANTIC	NJ	$736	0.03%	1,449	0.02%
KINGS	NY	$616	0.03%	1,401	0.02%
KENT	RI	$575	0.03%	573	0.01%
NEW YORK	NY	$216	0.01%	313	0.00%
CHESAPEAKE (CITY)	VA	$164	0.01%	871	0.01%

[1] *counties with 5% (when rounded up) of all federal permits in the Northeast listed homeports within that county*

[2] *counties with 1% (when rounded up) of all federal permits in the Northeast listed homeports within that county*

Of the counties in , only 5 reach the level of 5% either landed value or landed pounds, when rounded up. These are located in Massachusetts through North Carolina. Dare County, NC has by far the highest values, with Suffolk County, NY and Ocean County, NJ being next most important by a large margin. An additional 13 reach the level of 1%. These are distributed from Massachusetts through North Carolina. By individual port data (not presented here in tabular format), the top port in 2005 for bluefish is Wanchese, NC with nearly a quarter of total value and a third of total landings. Other ports with 5% or more of total landings or value are Barnegat Light/ Long Beach and Belford, NJ; New Bedford, MA; Hampton Bays/Shinnecock, NY; Point Judith, RI and Montauk, NY. Full community profiles for these ports are located in Appendix G.

Table 102. Landed Value and Pounds for All Counties with Landings of Red Crab in the Combined Years of 2000-2005

County	ST	Avg Landed Value 2000-2005	% of Total Landed Value	Avg Landed Lbs 2000-2005	% of Total Landed Lbs
BRISTOL[1]	MA	$3,560,554	74.99%	3,849,249	75.04%
NEWPORT[1]	RI	$576,944	12.15%	720,581	14.05%
NEWPORT NEWS (CITY) [1]	VA	$312,059	6.57%	236,342	4.61%
ESSEX[1]	MA	$213,328	4.49%	230,957	4.50%
CAPE MAY[2]	NJ	$41,679	0.88%	47,324	0.92%
VIRGINIA BEACH (CITY[2]	VA	$26,228	0.55%	21,857	0.43%
WASHINGTON	RI	$15,905	0.33%	19,903	0.39%
NEW LONDON	CT	$1,371	0.03%	3,433	0.07%

[1] counties with 5% (when rounded up) of all federal permits in the Northeast listed homeports within that county

[2] counties with 1% (when rounded up) of all federal permits in the Northeast listed homeports within that county

Of the counties in , only 4 reach the level of 5% either landed value or landed pounds, when rounded up. These are located in Massachusetts, Rhode Island and Virginia. Bristol County, MA has by far the highest landings. An additional 2 reach the level of 1%. These are located in New Jersey and Virginia. By individual port data (not presented here in tabular format), the only port for red crab in 2005 is Fall River, MA. A full community profile for this port is located in Appendix G.

Table 103. Landed Value and Pounds for All Counties with Landings of Skates in the Combined Years of 2000-2005

County	ST	Total Landed Value 2000-2005	Avg Landed Value 2000-2005	% of Total Landed Value	Total Landed Lbs 2000-2005	Avg Landed Lbs 2000-2005	% of Total Landed Lbs
BRISTOL[1]	MA	$12,869,429	$2,144,905	51.54%	33,822,937	5,637,156	29.76%
WASHINGTON [1]	RI	$3,603,681	$600,614	14.43%	39,710,014	6,618,336	34.94%
BARNSTABLE[1]	MA	$3,109,818	$518,303	12.45%	9,546,408	1,591,068	8.40%
NEWPORT[1]	RI	$1,634,981	$272,497	6.55%	15,862,890	2,643,815	13.96%
OCEAN[2]	NJ	$770,909	$128,485	3.09%	2,057,322	342,887	1.81%
SUFFOLK[2]	NY	$618,072	$103,012	2.48%	1,738,6	289,780	1.53%

County	ST	Total Landed Value 2000-2005	Avg Landed Value 2000-2005	% of Total Landed Value	Total Landed Lbs 2000-2005	Avg Landed Lbs 2000-2005	% of Total Landed Lbs
					78		
NEW LONDON[2]	CT	$557,570	$92,928	2.23%	4,732,918	788,820	4.16%
SUFFOLK[2]	MA	$481,809	$80,302	1.93%	1,252,395	208,733	1.10%
ESSEX[2]	MA	$440,136	$73,356	1.76%	1,120,346	186,724	0.99%
PLYMOUTH[2]	MA	$271,705	$45,284	1.09%	804,045	134,008	0.71%
CUMBERLAND[2]	ME	$185,832	$30,972	0.74%	362,677	60,446	0.32%
CAPE MAY[2]	NJ	$128,676	$21,446	0.52%	1,137,681	189,614	1.00%
MONMOUTH	NJ	$64,155	$10,693	0.26%	321,705	53,618	0.28%
ROCKINGHAM	NH	$43,402	$7,234	0.17%	136,190	22,698	0.12%
ACCOMACK	VA	$42,665	$7,111	0.17%	192,019	32,003	0.17%
NEWPORT NEWS (CITY)	VA	$42,059	$7,010	0.17%	401,143	66,857	0.35%
NASSAU	NY	$20,616	$3,436	0.08%	88,051	14,675	0.08%
KNOX	ME	$18,135	$3,023	0.07%	41,115	6,853	0.04%
WORCESTER	MD	$14,532	$2,422	0.06%	76,441	12,740	0.07%
LINCOLN	ME	$12,456	$2,076	0.05%	24,203	4,034	0.02%
HAMPTON (CITY)	VA	$12,061	$2,010	0.05%	112,321	18,720	0.10%
DARE	NC	$6,862	$1,144	0.03%	43,372	7,229	0.04%
DUKES	MA	$3,690	$615	0.01%	13,851	2,309	0.01%
HANCOCK	ME	$3,263	$544	0.01%	6,832	1,139	0.01%
KINGS	NY	$3,181	$530	0.01%	7,542	1,257	0.01%
NORTHAMPTON	VA	$2,345	$391	0.01%	23,524	3,921	0.02%
YORK	ME	$2,107	$351	0.01%	5,021	837	0.00%
SAGADAHOC	ME	$1,340	$223	0.01%	2,314	386	0.00%
LANCASTER	VA	$1,020	$170	0.00%	3,000	500	0.00%
CHESAPEAKE (CITY)	VA	$845	$141	0.00%	1,407	235	0.00%
NEW HAVEN	CT	$566	$94	0.00%	7,578	1,263	0.01%

[1] *counties with 5% (when rounded up) of all federal permits in the Northeast listed homeports within that county*

[2] *counties with 1% (when rounded up) of all federal permits in the Northeast listed homeports within that county*

Of the counties in , only 4 reach the level of 5% either landed value or landed pounds, when rounded up. These are located in Massachusetts and Rhode Island. However, Bristol County, MA and Washington County, RI far surpass other counties. An additional 8 reach the level of 1%. These are distributed from Maine through New Jersey. By individual port data (not presented here in tabular format), by far the top port in 2005 for skate is New Bedford, MA – with over half the value and over a third of landings. Other ports with at least 10% of landings or value are Chatham, MA and Point Judith and Tiverton, RI. No other ports reach even the 5% level. Full community profiles for these ports are located in an appendix.

Table 104. Landed Value and Pounds for All Counties with Landings of Squid, Mackerel, Butterfish in the Combined Years of 2000-2005

County	ST	Avg Landed Value 2000-2005	% of Total Landed Value	Avg Landed Lbs 2000-2005	% of Total Landed Lbs
WASHINGTON[1]	RI	$17,691,571	46.37%	35,780,225	29.08%
CAPE MAY[1]	NJ	$6,141,158	16.10%	40,071,920	32.56%
SUFFOLK[1]	NY	$5,713,364	14.98%	7,281,224	5.92%
BRISTOL[1]	MA	$1,996,510	5.23%	16,947,384	13.77%
NEWPORT[2]	RI	$1,625,686	4.26%	3,195,766	2.60%
NEW LONDON[2]	CT	$1,265,249	3.32%	1,915,151	1.56%
ESSEX[1]	MA	$1,109,619	2.91%	12,772,543	10.38%
BARNSTABLE[1]	MA	$508,594	1.33%	732,303	0.60%
NASSAU[2]	NY	$405,351	1.06%	535,611	0.44%
OCEAN[2]	NJ	$397,463	1.04%	773,405	0.63%
UNION[2]	NJ	$249,267	0.65%	404,362	0.33%
SUFFOLK[2]	MA	$189,183	0.50%	269,058	0.22%
DARE[2]	NC	$186,540	0.49%	890,286	0.72%
HAMPTON (CITY) [2]	VA	$172,953	0.45%	653,921	0.53%
MONMOUTH[2]	NJ	$171,948	0.45%	232,424	0.19%
ACCOMACK	VA	$55,947	0.15%	99,334	0.08%
DUKES	MA	$49,852	0.13%	73,758	0.06%
PLYMOUTH	MA	$34,814	0.09%	60,531	0.05%
WORCESTER	MD	$31,430	0.08%	51,101	0.04%
VIRGINIA BEACH (CITY	VA	$24,851	0.07%	36,958	0.03%
NEW YORK	NY	$23,183	0.06%	23,417	0.02%
KINGS	NY	$18,276	0.05%	16,492	0.01%
CUMBERLAND	ME	$16,624	0.04%	65,061	0.05%
KENT	RI	$10,841	0.03%	10,929	0.01%
NEWPORT NEWS	VA	$9,796	0.03%	17,128	0.01%

County	ST	Avg Landed Value 2000-2005	% of Total Landed Value	Avg Landed Lbs 2000-2005	% of Total Landed Lbs
(CITY)					
NORTHAMPTON	VA	$9,462	0.02%	19,768	0.02%
ROCKINGHAM	NH	$6,535	0.02%	64,447	0.05%
MATHEWS	VA	$6,112	0.02%	9,756	0.01%
CARTERET	NC	$6,061	0.02%	15,646	0.01%
GLOUCESTER	VA	$5,267	0.01%	8,033	0.01%
NEW HAVEN	CT	$4,336	0.01%	6,111	0.00%
PAMLICO	NC	$2,899	0.01%	5,780	0.00%
HYDE	NC	$2,829	0.01%	7,517	0.01%

[1] *counties with 5% (when rounded up) of all federal permits in the Northeast listed homeports within that county*

[2] *counties with 1% (when rounded up) of all federal permits in the Northeast listed homeports within that county*

Of the counties in , only 6 reach the level of .1% either landed value or landed pounds, when rounded up. These are located from Massachusetts through New Jersey. However, Washington County, RI and Cape May County, NJ far surpass other counties. An additional 9 reach the level of 1%. These are distributed from Massachusetts trough North Carolina. By individual port data (not presented here in tabular format), the top ports in 2005 for squid, mackerel and butterfish are North Kingstown and Point Judith, RI and Cape May, NJ – all with 10% or more of landings or value. Other ports with 5-9% of landings or value are Montauk, NY and New Bedford, MA. Full community profiles for these ports are located in Appendix G.

Table 105. Landed Value and Pounds for All Counties with Landings of Summer Flounder, Scup and Black Sea Bass in the Combined Years of 2000-2005

County	ST	Avg Landed Value 2000-2005	% of Total Landed Value	Avg Landed Lbs 2000-2005	% of Total Landed Lbs
WASHINGTON[1]	RI	$5,051,043	15.36%	3,786,326	14.72%
SUFFOLK[1]	NY	$4,074,448	12.39%	2,827,656	10.99%
OCEAN[1]	NJ	$2,123,072	6.46%	1,788,039	6.95%
CAPE MAY[1]	NJ	$2,121,487	6.45%	1,905,802	7.41%
NEWPORT[1]	RI	$2,008,230	6.11%	2,001,901	7.78%
HAMPTON (CITY) [1]	VA	$1,878,838	5.72%	1,584,802	6.16%
DARE[1]	NC	$1,856,631	5.65%	1,566,824	6.09%
BRISTOL[1]	MA	$1,579,462	4.80%	1,166,671	4.54%

NEWPORT NEWS (CITY)[1]	VA	$1,466,468	4.46%	1,215,198	4.72%
MONMOUTH[2]	NJ	$1,333,937	4.06%	879,981	3.42%
ACCOMACK[2]	VA	$1,326,543	4.04%	995,470	3.87%
CARTERET[2]	NC	$1,121,952	3.41%	966,234	3.76%
BARNSTABLE[2]	MA	$1,064,083	3.24%	777,109	3.02%
PAMLICO[2]	NC	$1,029,824	3.13%	886,069	3.45%
WORCESTER[2]	MD	$935,112	2.84%	572,183	2.22%
HYDE[2]	NC	$910,910	2.77%	779,213	3.03%
NEW LONDON[2]	CT	$855,664	2.60%	592,198	2.30%
VIRGINIA BEACH (CITY)[2]	VA	$550,952	1.68%	276,002	1.07%
DUKES[2]	MA	$316,869	0.96%	228,072	0.89%
NASSAU[2]	NY	$278,883	0.85%	272,131	1.06%
NANTUCKET	MA	$141,738	0.43%	96,510	0.38%
SUSSEX	DE	$137,979	0.42%	73,729	0.29%
NORTHUMBERLAND	VA	$103,165	0.31%	77,052	0.30%
NORFOLK (CITY)	VA	$101,554	0.31%	42,254	0.16%
NORTHAMPTON	VA	$93,221	0.28%	61,147	0.24%
NEW HAVEN	CT	$83,116	0.25%	55,358	0.22%
ATLANTIC	NJ	$36,914	0.11%	26,908	0.10%
LANCASTER	VA	$32,304	0.10%	21,171	0.08%
UNION	NJ	$31,098	0.09%	23,432	0.09%
BEAUFORT	NC	$29,345	0.09%	27,095	0.11%
PLYMOUTH	MA	$20,929	0.06%	13,867	0.05%
SUFFOLK	MA	$20,263	0.06%	12,149	0.05%
MATHEWS	VA	$15,987	0.05%	12,027	0.05%
YORK	VA	$14,870	0.05%	15,596	0.06%
NEW HANOVER	NC	$12,501	0.04%	10,359	0.04%
CUMBERLAND	ME	$11,922	0.04%	9,167	0.04%
KINGS	NY	$11,445	0.03%	8,609	0.03%
CUMBERLAND	NJ	$10,346	0.03%	9,230	0.04%
ST. MARY'S	MD	$8,039	0.02%	8,008	0.03%
KENT	RI	$7,806	0.02%	7,327	0.03%

CURRITUCK	NC	$5,827	0.02%	3,887	0.02%
GLOUCESTER	VA	$5,482	0.02%	3,428	0.01%
PENDER	NC	$5,308	0.02%	3,472	0.01%
NEW YORK	NY	$5,302	0.02%	2,321	0.01%
BRISTOL	RI	$5,218	0.02%	2,859	0.01%
PHILADELPHIA	PA	$4,920	0.01%	2,460	0.01%
MIDDLESEX	CT	$4,843	0.01%	2,993	0.01%
DELAWARE	PA	$4,133	0.01%	4,929	0.02%
ESSEX	NJ	$3,612	0.01%	2,970	0.01%
FAIRFIELD	CT	$2,732	0.01%	1,781	0.01%
KENT	DE	$2,279	0.01%	1,172	0.00%
CHESAPEAKE (CITY)	VA	$2,127	0.01%	1,155	0.00%
QUEENS	NY	$2,120	0.01%	686	0.00%
SOMERSET	MD	$1,939	0.01%	849	0.00%
ONSLOW	NC	$1,873	0.01%	1,194	0.00%
ESSEX	MA	$1,699	0.01%	1,217	0.00%

[1] *counties with 5% (when rounded up) of all federal permits in the Northeast listed homeports within that county*

[2] *counties with 1% (when rounded up) of all federal permits in the Northeast listed homeports within that county*

Of the counties in , only 9 (in **bold** above) reach the level of 5% either landed value or landed pounds, when rounded up. These are distributed from Massachusetts through North Carolina. However, Washington County, RI and Suffolk County, NY far surpass other counties. An additional 11 (in *italics* above) reach the level of 1%. These are also distributed from Massachusetts through North Carolina. By individual port data (not presented here in tabular format), the top ports in 2005 for summer flounder, scup and black sea bass are Point Judith, RI (the only port to reach 10% or more of landings or value) and Montauk, NY; Point Pleasant and Belford, NJ; Hampton, VA; New Bedford, MA and Wanchese, NC – all with 5-9% of landings or value. Full community profiles for these ports are located in an appendix.

Table 106. Landed Value and Pounds for All Counties with Landings of Surf Clams and Ocean Quahogs in the Combined Years of 2000-2005 (includes Mahogany Quahogs)

County	ST	Avg Landed Value 2000-2005	% of Total Landed Value	Avg Landed Lbs 2000-2005	% of Total Landed Lbs
ATLANTIC[1]	NJ	$21,140,378	37.93%	39,526,600	40.85%
OCEAN[1]	NJ	$10,195,341	18.29%	20,519,833	21.21%

County	ST	Avg Landed Value 2000-2005	% of Total Landed Value	Avg Landed Lbs 2000-2005	% of Total Landed Lbs
BRISTOL[1]	MA	$7,715,177	13.84%	14,963,866	15.47%
WORCESTER[1]	MD	$4,798,306	8.61%	7,790,300	8.05%
CAPE MAY[1]	NJ	$3,918,362	7.03%	6,648,929	6.87%
WASHINGTON[1]	ME	$3,847,811	6.90%	1,109,425	1.15%
NASSAU[2]	NY	$1,570,241	2.82%	2,588,671	2.68%
BRISTOL[2]	RI	$972,046	1.74%	1,751,662	1.81%
BARNSTABLE[2]	MA	$502,041	0.90%	584,389	0.60%
PROVIDENCE[2]	RI	$260,352	0.47%	245,888	0.25%
YORK	ME	$176,385	0.32%	70,238	0.07%
SUFFOLK	NY	$168,920	0.30%	266,112	0.28%
NEW LONDON	CT	$139,333	0.25%	222,933	0.23%
NEWPORT	RI	$104,035	0.19%	109,525	0.11%
MONMOUTH	NJ	$77,544	0.14%	152,239	0.16%
NORFOLK (CITY)	VA	$40,800	0.07%	65,280	0.07%
ESSEX	MA	$28,425	0.05%	27,899	0.03%
HANCOCK	ME	$21,545	0.04%	5,745	0.01%
CUMBERLAND	ME	$15,773	0.03%	14,773	0.02%
ACCOMACK	VA	$13,376	0.02%	28,224	0.03%
SAGADAHOC	ME	$11,925	0.02%	27,479	0.03%
PLYMOUTH	MA	$7,071	0.01%	11,287	0.01%
KENT	RI	$6,720	0.01%	11,424	0.01%
CUMBERLAND	NJ	$2,987	0.01%	5,973	0.01%

[1] *counties with 5% (when rounded up) of all federal permits in the Northeast listed homeports within that county*

[2] *counties with 1% (when rounded up) of all federal permits in the Northeast listed homeports within that county*

Of the counties in , only 6 reach the level of 5% either landed value or landed pounds, when rounded up. These are distributed from Maine through New Jersey. However, Atlantic County, NJ far surpasses other counties. An additional 4 reach the level of 1%. These are distributed from Massachusetts through New York. By individual port data (not presented here in tabular format), the top port in 2005 for surf clams and ocean quahogs is Atlantic City, NJ – with 35-40% of landings and value. Other ports with 10% or more of landing or value are New Bedford, MA and Point Pleasant, NJ. The only port with 5-9% of landings or value is Ocean City, MD. Jonesport. ME is close with just over 4% of value. Full community profiles for these ports are located in Appendix G.

Table 107. Landed Value and Pounds for All Counties with Landings of "Other Fish" in the Combined Years of 2000-2005

County	ST	Avg Landed Value 2000-2005	% of Total Landed Value	Avg Landed Lbs 2000-2005	% of Total Landed Lbs
NORTHUMBERLAND[1]	VA	$27,198,153	12.74%	400,182,313	68.77%
SUFFOLK[1]	NY	$14,365,903	6.73%	3,349,559	0.58%
WASHINGTON[1]	ME	$11,796,419	5.53%	8,938,553	1.54%
DARE[1]	NC	$9,623,960	4.51%	16,628,669	2.86%
BARNSTABLE[2]	MA	$9,166,175	4.29%	4,256,199	0.73%
HANCOCK[2]	ME	$8,139,353	3.81%	13,029,581	2.24%
ACCOMACK[2]	VA	$7,805,011	3.66%	9,477,696	1.63%
LINCOLN[2]	ME	$7,330,193	3.43%	3,307,521	0.57%
WORCESTER[2]	MD	$7,303,901	3.42%	6,661,055	1.14%
NASSAU[2]	NY	$6,309,584	2.96%	904,034	0.16%
MONMOUTH[2]	NJ	$5,694,281	2.67%	3,645,993	0.63%
FAIRFIELD[2]	CT	$5,497,880	2.58%	1,892,159	0.33%
GLOUCESTER[2]	VA	$5,188,580	2.43%	8,552,761	1.47%
CUMBERLAND[2]	ME	$5,056,908	2.37%	3,775,091	0.65%
NEW HAVEN[2]	CT	$5,048,687	2.36%	1,796,353	0.31%
KNOX[2]	ME	$5,037,157	2.36%	5,388,476	0.93%
BRISTOL[2]	MA	$4,718,000	2.21%	3,055,843	0.53%
CUMBERLAND[2]	NJ	$4,638,658	2.17%	3,030,403	0.52%
WASHINGTON[2]	RI	$3,836,093	1.80%	2,443,361	0.42%
OCEAN[2]	NJ	$3,650,389	1.71%	9,564,303	1.64%
CAPE MAY[2]	NJ	$3,490,109	1.63%	17,498,459	3.01%
ESSEX[2]	MA	$3,277,248	1.53%	3,972,121	0.68%
KENT[2]	DE	$2,944,328	1.38%	2,440,084	0.42%
VIRGINIA BEACH (CITY) [2]	VA	$2,915,491	1.37%	3,644,488	0.63%
NORTHAMPTON[2]	VA	$2,814,370	1.32%	4,245,798	0.73%
SAGADAHOC[2]	ME	$2,617,503	1.23%	659,046	0.11%
MATHEWS[2]	VA	$2,451,489	1.15%	4,150,744	0.71%
KENT[2]	RI	$2,147,442	1.01%	391,434	0.07%
HYDE[2]	NC	$2,114,048	0.99%	1,841,344	0.32%
PAMLICO[2]	NC	$2,088,638	0.98%	2,065,564	0.35%
CARTERET[2]	NC	$2,044,553	0.96%	1,978,922	0.34%
ATLANTIC[2]	NJ	$2,010,137	0.94%	995,956	0.17%
HAMPTON (CITY) [2]	VA	$1,965,473	0.92%	3,676,521	0.63%

County	ST	Avg Landed Value 2000-2005	% of Total Landed Value	Avg Landed Lbs 2000-2005	% of Total Landed Lbs
NEWPORT[2]	RI	$1,896,681	0.89%	907,731	0.16%
NEWPORT NEWS (CITY)[2]	VA	$1,882,199	0.88%	1,432,985	0.25%
YORK[2]	VA	$1,844,600	0.86%	2,351,537	0.40%
LANCASTER[2]	VA	$1,552,450	0.73%	2,800,128	0.48%
WESTMORELAND[2]	VA	$1,437,220	0.67%	1,525,772	0.26%
ST. MARY'S[2]	MD	$1,189,745	0.56%	3,216,203	0.55%
MIDDLESEX[2]	VA	$1,062,175	0.50%	1,076,090	0.18%
SUSSEX[2]	DE	$1,003,557	0.47%	775,169	0.13%
CHARLES[2]	MD	$967,141	0.45%	1,127,775	0.19%
NEW CASTLE	DE	$929,979	0.44%	713,029	0.12%
BRISTOL	RI	$872,896	0.41%	145,150	0.02%
ROCKINGHAM	NH	$823,600	0.39%	912,105	0.16%
DUKES	MA	$657,439	0.31%	264,415	0.05%
NEW LONDON	CT	$592,597	0.28%	296,854	0.05%
PLYMOUTH	MA	$556,725	0.26%	221,064	0.04%
YORK	ME	$527,466	0.25%	372,319	0.06%
NORFOLK (CITY)	VA	$452,493	0.21%	562,304	0.10%
SALEM	NJ	$452,399	0.21%	424,842	0.07%
ISLE OF WIGHT	VA	$403,890	0.19%	300,249	0.05%
SUFFOLK (CITY)	VA	$378,341	0.18%	338,935	0.06%
RICHMOND	VA	$365,847	0.17%	350,734	0.06%
PROVIDENCE	RI	$347,755	0.16%	65,953	0.01%
STAFFORD	VA	$282,612	0.13%	517,770	0.09%
KING GEORGE	VA	$247,037	0.12%	396,586	0.07%
BEAUFORT	NC	$234,733	0.11%	109,413	0.02%
JAMES (CITY)	VA	$217,465	0.10%	209,616	0.04%
NANTUCKET	MA	$199,603	0.09%	129,843	0.02%
CHESTERFIELD	VA	$196,924	0.09%	579,984	0.10%
ONSLOW	NC	$174,691	0.08%	75,995	0.01%
PRINCE GEORGE	VA	$163,638	0.08%	492,215	0.08%
KING AND QUEEN	VA	$163,023	0.08%	91,429	0.02%
PORTSMOUTH (CITY)	VA	$130,352	0.06%	168,771	0.03%
SURRY	VA	$127,632	0.06%	219,924	0.04%
NEW HANOVER	NC	$125,257	0.06%	81,511	0.01%
ESSEX	VA	$98,573	0.05%	80,784	0.01%

County	ST	Avg Landed Value 2000-2005	% of Total Landed Value	Avg Landed Lbs 2000-2005	% of Total Landed Lbs
MIDDLESEX	CT	$75,656	0.04%	110,846	0.02%
SUFFOLK	MA	$71,769	0.03%	82,212	0.01%
KING WILLIAM	VA	$71,654	0.03%	83,360	0.01%
CHESAPEAKE (CITY)	VA	$64,407	0.03%	80,019	0.01%
WALDO	ME	$63,935	0.03%	390,892	0.07%
PRINCE WILLIAM	VA	$62,501	0.03%	92,293	0.02%
FAIRFAX	VA	$45,384	0.02%	130,863	0.02%
NORFOLK	MA	$32,494	0.02%	6,844	0.00%
DORCHESTER	MD	$22,527	0.01%	9,114	0.00%
PENOBSCOT	ME	$15,977	0.01%	4,868	0.00%
COLUMBIA	NY	$15,406	0.01%	15,406	0.00%
MIDDLESEX	NJ	$14,409	0.01%	10,785	0.00%
NEW YORK	NY	$12,663	0.01%	7,013	0.00%
KENNEBEC	ME	$11,042	0.01%	68,797	0.01%
BRUNSWICK	NC	$10,936	0.01%	13,055	0.00%
KINGS	NY	$10,454	0.00%	4,109	0.00%

[1] *counties with 5% (when rounded up) of all federal permits in the Northeast listed homeports within that county*

[2] *counties with 1% (when rounded up) of all federal permits in the Northeast listed homeports within that county*

Of the counties in , only 4 reach the level of 5% either landed value or landed pounds, when rounded up. These are distributed in Maine, New York, Virginia and North Carolina. However, Northumberland County, VA far surpasses other counties. An additional 38 reach the level of 1%. These are distributed throughout the region. By individual port data (not presented here in tabular format), the current top port by far for “other fish” is Other Northumberland, VA. Most other top ports are also “Other” rather than individual ports. If we look only at individual ports are examined, none reach the level of 5% of total landings or value. In fact, the only individual port with landings and/or value of at least 3% of the total is Wanchese, NC. A full community profile for this port is located in Appendix G.

Atlantic Salmon

As noted earlier, there are no commercial landings of Atlantic salmon, so a table equivalent to those provided for other species cannot be compiled; neither does Atlantic salmon appear in the MRFSS database. Further, even most recreational salmon fishing is for hatchery stocks rather than wild stocks, and both wild and hatchery stocks can generally be caught for catch and release only.

Limited wild salmon angling currently occurs in Maine for a 30 day season on a very short section of the Penobscot downstream of the Veazie Dam to the site of the old Bangor Dam. The once vital salmon club culture here has almost died out during the ban, but may revive slightly with this opening. (see http://www.nytimes.com/2006/09/28/us/28salmon.html?ex=1317096000&en=57d8146276a67e50&ei=5088&partner=rssnyt&emc=rss). Approximately 200 licenses were sold but only a few fish were actually hooked. It is a catch and release only fishery.

Salmon fishing on hatchery broodstock stock occurs in New Hampshire on the Merrimack and the Lower Pemigewasset Rivers. That fishery is mapped here: http://www.wildlife.state.nh.us/Fishing/Fishing_PDFs/Salmon_map_11x17.pdf Like, Maine, this NH fishery has a longstanding culture of salmon clubs, though due to declining numbers of salmon membership in these clubs has also dropped and new members are uncommon. Connecticut has a similar broodstock fishery on the Naugatuck and Shetucket Rivers.

Native Americans in Massachusetts have the right to fish for salmon, but no longer do so because of stock declines. The Penobscot Indian Nation also has had rights to fish for sustenance on their reservation since 1980, but has taken only two fish since then and none since 1988 – again due to lack of fish.

Thus, no communities have been identified as heavily involved in or dependent on salmon at this time.

Cumulative Impacts Data for Counties Relative to FMP Data

Some ports appear as top port for only one species, while others are top port for multiple species. , below, makes explicit those relationships.

Table 108. Top Ports for All Individual FMP Groupings

Port	*ST*	*FMP Species*
New London	CT	small mesh groundfish
Boston	MA	large mesh groundfish, monkfish
Chatham	MA	dogfish, monkfish
Fall River	MA	red crab
Gloucester	MA	large mesh groundfish, small mesh groundfish, dogfish, monkfish, herring

Port	***ST***	***FMP Species***
New Bedford	MA	large mesh groundfish, small mesh groundfish, scallops, monkfish, herring, bluefish, skates, squid/mackerel/butterfish, summer flounder/scup/black sea bass ,surf clams/ocean quahogs
Plymouth	MA	Dogfish
Ocean City	MD	surf clams/ocean quahogs
Jonesport	ME	surf clams/ocean quahogs
Portland	ME	large mesh groundfish, monkfish, herring
Rockland	ME	Herring
Stonington	ME	Lobster
Vinalhaven	ME	Lobster
Wanchese	NC	other fish, bluefish, summer flounder/scup/black sea bass
Newington	NH	Herring
Atlantic City	NJ	surf clams/ocean quahogs
Barnegat Light/Long Beach	NJ	tilefish, scallops, monkfish, bluefish
Belford/Middletown	NJ	bluefish, summer flounder/scup/black sea bass
Cape May	NJ	scallops, squid/mackerel/butterfish
Point Pleasant	NJ	summer flounder/scup/black sea bass, surf clams/ocean quahogs
Hampton Bays/Shinnecock	NY	tilefish, bluefish
Montauk	NY	tilefish, small mesh groundfish, bluefish, squid/mackerel/butterfish, summer flounder/scup/black sea bass
North Kingstown	RI	squid/mackerel/butterfish
Point Judith	RI	small mesh groundfish, monkfish, bluefish, skates, squid/mackerel/butterfish, summer flounder/scup/black sea bass
Tiverton	RI	Skates
Hampton	VA	summer flounder/scup/black sea bass
Newport News	VA	Scallops

shows all ports listed as top ports by homeport or by owner's residence. Where is port is top in both categories it is more vulnerable to potential impacts. Ports dependent on a single species are obviously vulnerable to regulations affecting that species. Ports dependent on multiple fisheries may have more opportunity for switching among species in response to regulation, but only if enough residents have multiple permits. And if multiple species are affected by regulations, then they may be at least as hard hit as single species ports.

Table 109. Top Ports for Permits by Homeport or Owner's Residence

Port	*ST*	*Homeport*	*Owner's Residence*
Chatham	MA	yes	yYes
Fairhaven	MA	no	yYes
Gloucester	MA	yes	yYes
New Bedford	MA	yes	yYes
Plymouth	MA	yes	nNo
Scituate	MA	yes	nNo
Beals	ME	no	yYes
Harpswell	ME	yes	yYes
Jonesport	ME	yes	nNo
Portland	ME	yes	nNo
Stonington	ME	yes	nNo
Vinalhaven	ME	no	yYes
Portsmouth	NH	yes	nNo
Barnegat Light	NJ	yes	nNo
Cape May	NJ	yes	yYes
Point Pleasant	NJ	yes	nNo
Montauk	NY	yes	yYes
Point Judith	RI	yes	nNo
Wakefield	RI	no	yYes

Obviously, ports that are key for multiple fisheries are more at risk due to possible impacts from multiple habitat restrictions. But so are small ports with only one or two main species and little alternative employment. County Business Patterns Data below help to elucidate the overall fisheries dependence of counties. Port level census data in the community profiles of Appendix B further elucidate this dependence at the port level.

County Business Patterns Data

County Business Patterns (CBP) data are not yet available for 2004-2005. Therefore, data are presented only for 2000-2003. Two main types of CBP data are presented here: number of establishments and employment. A third potential variable, annual payroll was not used due to the multiple instances of non-reportability that would have seriously affected the reliability of any averages or summary statistics. Some additional caveats are also important.

First, the CBP data represent data collected from establishments that have paid employees subject to payroll taxes. As such, reported employment and number of establishments do not include sole proprietorships. Data are also not collected for employees of private households, agricultural production, railroad, or most governmental employees. For this reason, total reported employment in a county or state will be less than the total number of peopled employed and employment for sectors with a large number of sole proprietorships, commercial fishing for example, would be under-represented.

Second, each establishment is classified by North American Industry Classification System (NAICS) according to the primary product or service produced by the establishment. This means that establishments that produce multiple products or services are classified into only one sector. In this manner the total number of employees and establishments classified as seafood processing, for example, would be less than the total number of establishments that are engaged in the processing of seafood. For number of establishments, an average of 2000-2003 is presented, similar to the average of 2000-2005 used for the fishery data. However, unlike landings data that can have significant year-to-year fluctuations for individual fisheries, these data are relatively stable. Thus, the lack of more recent data is unlikely to mean significant change has been missed.

Third, although employment is seasonal CBP collects employment based on numbers of employees (both part-time and full-time) in Mid-March for each calendar year. Fourth, employment data are suppressed in cases where the number of reporting establishments is fewer than three, or one or more establishments are dominant in the reporting area (i.e. state or county). However, even for suppressed data, CBP does report the number of establishments by employment size category. Each category has a defined range based on a minimum and a maximum number of employees from which a mid-point may also be computed. In cases where the number of employees is suppressed, a range estimate was calculated by summing the product of the lower and upper end of each employee size category by the number of establishments across each size category. The mid-point estimate of employment is calculated in the same manner using the mid-point for each size category. Since this is already a calculated variable, it is presented by year and not as an average of the 4 years so as not to introduce calculation errors.

The counties represented here are all those that had landings or permits in at least one year of 2000-2005 and reached the level of 1% of total marine establishments or of mid-range total employees in the marine sector in 2000-2003, as described above.

Under the NAICS, the marine sector is defined as particular business listed in Table 110.

Table 110. Marine Sector as defined by NAICS

Fishing
Seafood product preparation & packaging

Ice manufacturing
Food product machinery manufacturing
Engine, turbine & power transmission equipment
Ship & boat building
Motorcycle, bicycle & parts manufacturing
Sporting & athletic goods manufacturing
Refrigeration equipment & supplies
Industrial machinery & equipment wholesale
Sporting & recreational goods & supplies
Toy & hobby goods & supplies wholesale
General line grocery wholesale
Packaged frozen food wholesale
Fish & seafood wholesale
Recreational vehicle dealers
Boat dealers
Meat markets
Fish & seafood markets
Sporting goods stores
Heating oil dealers
Liquefied petroleum gas (bottled gas)
Other fuel dealers
Water transportation
Scenic & sightseeing transportation
Port & harbor operations
Marine cargo handling
Navigational services to shipping
Refrigerated warehousing & storage
Direct property & casualty insurance
Reinsurance carriers
Recreational goods rental
Commercial transportation equipment (exc Motor Vehicles) ren
Sports & recreation instruction
Nature parks & other similar institutions
Marinas
Recreational, vacation camps (exc campgrounds)

Table 111. CBP Data on Numbers of Establishments in the Marine Sector Relative to Total Establishments

County	State	Annual Average Marine Sector Establishments 2000 to 2003	Annual Average Total Establishments 2000 to 2003	Average Annual Percent Marine Sector Establishments 2000 to 2003
PAMLICO[1]	NC	36	220	16.29%
MIDDLESEX[1]	VA	46	368	12.42%
NORTHUMBERLAND[1]	VA	40	357	11.06%
HYDE[1]	NC	19	174	10.65%
LINCOLN[1]	ME	147	1,403	10.50%
KNOX[1]	ME	163	1,560	10.41%
MATHEWS[1]	VA	22	220	9.77%
WASHINGTON[1]	ME	88	914	9.66%
HANCOCK[1]	ME	197	2,149	9.18%
TYRRELL[1]	NC	7	77	9.12%
SOMERSET[1]	MD	34	397	8.51%
DARE[1]	NC	143	1,806	7.92%
NORTHAMPTON[1]	VA	25	340	7.36%
KENT[1]	MD	50	692	7.19%
CARTERET[1]	NC	134	1,907	7.02%
DORCHESTER[1]	MD	46	739	6.19%
LANCASTER[1]	VA	30	499	5.91%
NEWPORT[1]	RI	153	2,735	5.60%
WESTMORELAND[1]	VA	21	380	5.59%
DUKES[1]	MA	56	1,002	5.54%
WALDO[2]	ME	49	911	5.41%
ACCOMACK[2]	VA	44	817	5.36%
QUEEN ANNE'S[2]	MD	67	1,254	5.35%
BRISTOL[2]	RI	62	1,177	5.25%
SAGADAHOC[2]	ME	40	825	4.85%
CAPE MAY[2]	NJ	196	4,080	4.80%
WASHINGTON[2]	RI	171	3,630	4.70%
CARROLL[2]	NH	88	1,894	4.65%
GLOUCESTER[2]	VA	39	836	4.64%
TALBOT[2]	MD	67	1,501	4.48%
WARREN	NY	97	2,324	4.16%
CECIL	MD	69	1,686	4.11%

County	State	Annual Average Marine Sector Establishments 2000 to 2003	Annual Average Total Establishments 2000 to 2003	Average Annual Percent Marine Sector Establishments 2000 to 2003
CUMBERLAND	ME	428	10,521	4.07%
SCHUYLER	NY	14	340	4.05%
NANTUCKET	MA	32	786	4.01%
RICHMOND	VA	9	225	4.00%
MIDDLESEX	CT	170	4,261	3.99%
SULLIVAN	NY	78	1,948	3.98%
BELKNAP	NH	75	1,889	3.96%
LAMOILLE	VT	37	960	3.85%
BRISTOL	MA	520	13,492	3.85%
CURRITUCK	NC	19	502	3.83%
OXFORD	ME	54	1,417	3.81%
BARNSTABLE	MA	324	8,524	3.80%
WORCESTER	MD	79	2,170	3.62%
BEAUFORT	NC	42	1,160	3.60%
GREENE	NY	41	1,137	3.58%
GRAFTON	NH	105	2,960	3.56%
NEW LONDON	CT	204	5,816	3.51%
ORANGE	VT	28	801	3.47%
SOMERSET	ME	41	1,202	3.37%
ADDISON	VT	38	1,115	3.36%
TRANSYLVANIA	NC	26	760	3.36%
POQUOSON (CITY)	VA	6	187	3.35%
OCEAN	NJ	381	11,455	3.33%
WAYNE	NY	57	1,741	3.29%
BRUNSWICK	NC	59	1,810	3.26%
PRINCE GEORGE	VA	12	368	3.26%
MECKLENBURG	NC	799	24,563	3.25%
CHOWAN	NC	12	362	3.25%
ESSEX	MA	600	18,662	3.21%
COOS	NH	32	982	3.21%
ROCKINGHAM	NH	304	9,478	3.21%
SULLIVAN	NH	34	1,063	3.18%

County	State	Annual Average Marine Sector Establishments 2000 to 2003	Annual Average Total Establishments 2000 to 2003	Average Annual Percent Marine Sector Establishments 2000 to 2003
YORK	ME	168	5,301	3.17%
SUFFOLK	NY	1,419	44,735	3.17%
CUMBERLAND	NJ	97	3,068	3.15%
WASHINGTON	NY	34	1,086	3.09%
SURRY	VA	3	82	3.06%
JEFFERSON	NY	71	2,332	3.05%
KING AND QUEEN	VA	4	116	3.02%
CALVERT	MD	48	1,590	3.00%
KENNEBEC	ME	97	3,255	2.98%
ANNE ARUNDEL	MD	378	12,692	2.98%
DELAWARE	NY	34	1,156	2.96%
STRAFFORD	NH	73	2,508	2.91%
RUTLAND	VT	68	2,321	2.91%
KENT	RI	142	4,971	2.86%
PORTSMOUTH (CITY)	VA	49	1,722	2.83%
NORFOLK (CITY)	VA	155	5,534	2.81%
PENOBSCOT	ME	117	4,181	2.79%
PLYMOUTH	MA	335	12,010	2.79%
CHARLES (CITY)	VA	5	162	2.79%
CHESHIRE	NH	55	1,984	2.77%
SUSSEX	DE	134	4,819	2.77%
BERTIE	NC	10	379	2.71%
ULSTER	NY	121	4,497	2.69%
SUFFOLK (CITY)	VA	31	1,170	2.67%
HARTFORD	CT	613	23,062	2.66%
ONTARIO	NY	70	2,657	2.63%
TOLLAND	CT	66	2,514	2.63%
ONONDAGA	NY	304	11,775	2.58%
SALEM	NJ	34	1,322	2.57%
ANDROSCOGGIN	ME	71	2,781	2.54%
WINDSOR	VT	56	2,206	2.52%
PUTNAM	NY	68	2,729	2.50%

County	State	Annual Average Marine Sector Establishments 2000 to 2003	Annual Average Total Establishments 2000 to 2003	Average Annual Percent Marine Sector Establishments 2000 to 2003
NEW HANOVER	NC	151	6,133	2.45%
COLUMBIA	NY	41	1,678	2.44%
HILLSBOROUGH	NH	266	10,879	2.44%
WINDHAM	CT	55	2,234	2.44%
PENDER	NC	18	741	2.43%
MONROE	PA	82	3,368	2.43%
FRANKLIN	NC	19	795	2.42%
LITCHFIELD	CT	126	5,187	2.42%
HANOVER	VA	67	2,759	2.42%
WAYNE	NC	56	2,323	2.39%
NEW HAVEN	CT	493	20,645	2.39%
PASQUOTANK	NC	22	927	2.37%
OTSEGO	NY	33	1,370	2.37%
CHESTER	PA	301	12,708	2.37%
GLOUCESTER	NJ	136	5,742	2.37%
NORFOLK	MA	465	19,677	2.36%
SUSSEX	NJ	85	3,580	2.36%
BURLINGTON	NJ	246	10,433	2.35%
BERKS	PA	194	8,300	2.34%
WICOMICO	MD	60	2,552	2.33%
KING WILLIAM	VA	8	323	2.32%
BUCKS	PA	420	18,119	2.32%
HUNTERDON	NJ	92	3,992	2.30%
MONMOUTH	NJ	430	18,871	2.28%
MONTGOMERY	PA	589	25,844	2.28%
LANCASTER	PA	262	11,563	2.27%
YORK	PA	188	8,324	2.26%
ERIE	PA	156	6,883	2.26%
NASSAU	NY	1,062	47,151	2.25%

County	State	Annual Average Marine Sector Establishments 2000 to 2003	Annual Average Total Establishments 2000 to 2003	Average Annual Percent Marine Sector Establishments 2000 to 2003
ATLANTIC	NJ	145	6,462	2.24%
UNION	NC	71	3,171	2.22%
HAMPTON (CITY)	VA	54	2,444	2.22%
FAIRFIELD	CT	628	28,399	2.21%
BERGEN	NJ	733	33,155	2.21%
LEHIGH	PA	180	8,188	2.20%
ST. MARY'S	MD	38	1,715	2.20%
BROOME	NY	94	4,316	2.18%
HENRICO	VA	158	7,232	2.18%
UNION	NJ	319	14,650	2.18%
ALBANY	NY	195	8,958	2.17%
CHESTERFIELD	VA	125	5,741	2.17%
NORTHAMPTON	PA	126	5,812	2.16%
ROANOKE	VA	38	1,760	2.16%
WARREN	PA	21	975	2.15%
BALTIMORE	MD	418	19,417	2.15%
MERRIMACK	NH	88	4,092	2.14%
NEWPORT NEWS (CITY)	VA	79	3,688	2.14%
WORCESTER	MA	391	18,278	2.14%
MORRIS	NJ	373	17,472	2.13%
YORK	VA	26	1,232	2.13%
ONSLOW	NC	55	2,567	2.12%
DELAWARE	PA	278	13,238	2.10%
HARFORD	MD	104	4,954	2.09%
JEFFERSON	PA	25	1,183	2.09%
DUTCHESS	NY	146	6,979	2.08%
SPOTSYLVANIA	VA	32	1,548	2.08%
ESSEX	VA	7	325	2.08%
ROCKLAND	NY	180	8,703	2.06%
GASTON	NC	83	4,077	2.04%

County	State	Annual Average Marine Sector Establishments 2000 to 2003	Annual Average Total Establishments 2000 to 2003	Average Annual Percent Marine Sector Establishments 2000 to 2003
RENSSELAER	NY	56	2,755	2.03%
EDGECOMBE	NC	20	975	2.03%
VIRGINIA BEACH (CITY	VA	208	10,276	2.03%
CHESAPEAKE (CITY)	VA	94	4,647	2.02%
HAMPDEN	MA	231	11,437	2.02%
DAUPHIN	PA	133	6,631	2.00%
ORANGE	NY	167	8,339	2.00%
KINGS	NY	791	39,608	2.00%
CATAWBA	NC	88	4,409	2.00%
RANDOLPH	NC	54	2,733	1.97%
SOMERSET	NJ	190	9,674	1.97%
ALLEGHENY	PA	681	34,747	1.96%
POWHATAN	VA	10	498	1.96%
ROCKINGHAM	VA	23	1,181	1.95%
GUILFORD	NC	265	13,615	1.95%
HAMPSHIRE	MA	70	3,604	1.93%
CAMDEN	NJ	241	12,553	1.92%
KENT	DE	58	3,020	1.91%
PROVIDENCE	RI	312	16,300	1.91%
WESTCHESTER	NY	592	31,063	1.91%
CRAVEN	NC	41	2,168	1.90%
TIOGA	NY	15	789	1.90%
MOORE	NC	40	2,114	1.89%
BALTIMORE (CITY)	MD	249	13,200	1.89%
ISLE OF WIGHT	VA	10	545	1.88%
WARREN	NJ	52	2,782	1.88%
PITT	NC	61	3,243	1.87%
DAVIE	NC	13	710	1.87%
PHILADELPHIA	PA	483	25,926	1.86%
NORTHAMPTON	NC	6	323	1.86%
MIDDLESEX	MA	799	43,017	1.86%

County	State	Annual Average Marine Sector Establishments 2000 to 2003	Annual Average Total Establishments 2000 to 2003	Average Annual Percent Marine Sector Establishments 2000 to 2003
MIDDLESEX	NJ	389	20,930	1.86%
BRONX	NY	272	14,655	1.85%
STAFFORD	VA	29	1,572	1.84%
RICHMOND	NY	139	7,612	1.83%
ESSEX	NJ	363	19,961	1.82%
WESTMORELAND	PA	161	8,953	1.80%
FRANKLIN	MA	32	1,759	1.79%
SUFFOLK	MA	363	20,431	1.78%
NEW CASTLE	DE	290	16,412	1.77%
PASSAIC	NJ	212	12,047	1.76%
CHARLES	MD	45	2,558	1.75%
FRANKLIN	PA	50	2,845	1.75%
FULTON	PA	5	286	1.75%
MONTGOMERY	VA	32	1,820	1.74%
FORSYTH	NC	148	8,505	1.74%
HUDSON	NJ	234	13,478	1.74%
OHIO	WV	27	1,560	1.73%
RICHMOND (CITY)	VA	127	7,542	1.68%
QUEENS	NY	628	37,829	1.66%
UNION	PA	14	855	1.64%
BUNCOMBE	NC	106	6,480	1.64%
JAMES (CITY)	VA	18	1,119	1.63%
FREDERICK	MD	85	5,259	1.62%
COLUMBUS	NC	19	1,185	1.60%
WAKE	NC	335	20,978	1.60%
STEUBEN	NY	29	1,804	1.59%
LYNCHBURG (CITY)	VA	38	2,434	1.56%
CHARLOTTESVILLE (CITY)	VA	36	2,325	1.53%
MERCER	NJ	151	10,110	1.50%
ORANGE	NC	43	2,943	1.45%

County	State	Annual Average Marine Sector Establishments 2000 to 2003	Annual Average Total Establishments 2000 to 2003	Average Annual Percent Marine Sector Establishments 2000 to 2003
CAROLINE	MD	9	634	1.42%
NEW KENT	VA	4	265	1.42%
CUMBERLAND	NC	74	5,289	1.40%
RUTHERFORD	NC	19	1,326	1.40%
PRINCE WILLIAM	VA	68	4,941	1.38%
FAIRFAX (CITY)	VA	31	2,248	1.37%
WILLIAMSBURG (CITY)	VA	10	751	1.36%
PRINCE GEORGE'S	MD	181	14,067	1.29%
PETERSBURG (CITY)	VA	10	812	1.23%
FAIRFAX	VA	314	25,949	1.21%
MONTGOMERY	MD	311	25,842	1.20%
SOUTHAMPTON	VA	3	256	1.17%
GREENE	PA	8	679	1.14%
DURHAM	NC	63	5,964	1.06%
NEW YORK	NY	1,093	105,321	1.04%
HARNETT	NC	15	1,491	0.99%
KING GEORGE	VA	4	394	0.95%
BEDFORD (CITY)	VA	4	409	0.86%
ALEXANDRIA (CITY)	VA	38	4,583	0.83%
AMHERST	VA	5	599	0.79%
POTTER	PA	3	425	0.76%
ESSEX	VT	1	135	0.74%
FALLS CHURCH (CITY)	VA	6	875	0.69%
DINWIDDIE	VA	2	300	0.50%

[1] *counties with 10% (when rounded up) dependence level on the marine sector*
[2] *counties with 5% (when rounded up) dependence level on the marine sector*

Of the counties in , 20 showed at least a 10% dependence level on the marine sector, as calculated by percent of total establishments in the marine sector in the summed years 2000-2003. These counties are distributed throughout the region. An additional 10 counties have 5% dependence. These are distributed from Maine through Virginia. The remaining 210 counties show 1-4% dependence, and are also distributed throughout the region.

Table 112. Mid-Point Estimate of Percent of Marine Sector Employment of Total County Employment

County	ST	2000	2001	2002	2003
SAGADAHOC[1]	ME	38.24%	37.96%	39.37%	38.60%
SOMERSET[1]	MD	12.49%	9.78%	25.23%	27.12%
NORTHUMBERLAND[1]	VA	27.19%	21.47%	19.99%	18.80%
STAFFORD[1]	VA	25.75%	23.97%	22.14%	18.08%
PAMLICO[1]	NC	18.86%	21.29%	20.52%	16.97%
HYDE[1]	NC	15.13%	17.10%	12.33%	16.26%
MIDDLESEX[1]	VA	16.96%	17.42%	14.62%	16.04%
WESTMORELAND[2]	VA	12.91%	11.96%	12.39%	13.38%
BRISTOL[2]	RI	S	S	S	10.40%
TYRRELL[1]	NC	15.13%	15.07%	24.63%	10.10%
WASHINGTON[2]	ME	9.50%	8.59%	9.13%	9.88%
LINCOLN[2]	ME	10.21%	9.31%	8.50%	9.87%
CARTERET[2]	NC	10.28%	10.44%	10.13%	9.19%
CHOWAN[2]	NC	9.71%	10.12%	8.32%	8.56%
HANCOCK[2]	ME	7.82%	7.37%	7.15%	8.02%
NEWPORT NEWS (CITY) [2]	VA	7.86%	8.03%	7.67%	7.77%
ROANOKE[2]	VA	10.19%	9.95%	7.47%	7.63%
EDGECOMBE[2]	NC	1.70%	2.03%	6.74%	7.59%
LANCASTER[2]	VA	7.46%	7.46%	6.41%	7.42%
KNOX[2]	ME	8.30%	8.56%	6.92%	7.42%
MATHEWS[2]	VA	5.03%	6.85%	7.11%	7.07%
DAUPHIN	PA	3.09%	2.90%	2.64%	7.03%
CECIL[2]	MD	2.79%	3.05%	3.94%	6.95%
HARTFORD[2]	CT	5.90%	4.67%	5.01%	6.94%
NORFOLK (CITY) [2]	VA	6.88%	6.87%	6.60%	6.89%
CHESHIRE[2]	NH	8.45%	7.50%	7.93%	6.77%
NEW LONDON[2]	CT	6.72%	6.75%	6.88%	6.73%
DARE[2]	NC	6.47%	7.13%	7.72%	6.61%
NORTHAMPTON[2]	VA	6.36%	6.25%	8.00%	6.27%
WALDO[2]	ME	9.04%	5.75%	6.19%	6.17%
BEAUFORT[2]	NC	5.97%	5.33%	5.64%	5.91%

County	ST	2000	2001	2002	2003
DORCHESTER[2]	MD	7.41%	6.73%	6.70%	5.79%
GLOUCESTER[2]	VA	6.88%	4.80%	5.61%	5.71%
NEWPORT[2]	RI	5.05%	6.14%	6.05%	5.71%
QUEEN ANNE'S[2]	MD	7.70%	7.73%	7.66%	5.70%
PORTSMOUTH (CITY) [2]	VA	12.07%	8.14%	7.34%	5.45%
OTSEGO[2]	NY	5.61%	5.50%	5.31%	5.41%
SOMERSET[3]	NJ	4.94%	5.05%	5.09%	5.11%
LAMOILLE	VT	4.20%	4.51%	4.74%	5.07%
KENT[3]	MD	5.11%	5.34%	4.54%	5.05%
CAPE MAY[3]	NJ	5.03%	5.52%	4.38%	4.88%
SUSSEX[3]	NJ	4.92%	4.31%	4.38%	4.82%
SULLIVAN[2]	NY	14.07%	5.82%	5.29%	4.64%
FREDERICK[3]	MD	4.96%	4.93%	4.88%	4.59%
DUKES[3]	MA	4.24%	4.07%	4.74%	4.54%
YORK	PA	4.65%	4.59%	4.54%	4.42%
ORANGE	VT	4.07%	3.53%	3.51%	4.40%
NANTUCKET	MA	3.73%	4.12%	S	4.38%
BRISTOL	MA	4.16%	4.18%	4.13%	4.37%
SALEM	NJ	0.99%	1.28%	2.93%	4.34%
SUFFOLK (CITY)	VA	2.90%	3.94%	5.31%	4.31%
GREENE	NY	2.55%	2.63%	3.36%	4.28%
ROCKINGHAM	NH	3.52%	3.47%	3.59%	4.27%
BRUNSWICK[2]	NC	4.06%	5.72%	4.71%	4.08%
WARREN	NY	3.23%	2.37%	2.27%	3.80%
ERIE	PA	3.44%	3.39%	3.44%	3.79%
WORCESTER	MA	1.85%	2.06%	2.22%	3.70%
ACCOMACK[3]	VA	5.08%	4.81%	3.14%	3.66%
BARNSTABLE	MA	3.44%	3.96%	3.87%	3.61%
CRAVEN[2]	NC	3.53%	5.45%	3.60%	3.60%
BALTIMORE (CITY)	MD	3.03%	2.98%	3.13%	3.55%
UNION	PA	3.36%	1.81%	3.26%	3.49%
CUMBERLAND	ME	3.46%	3.22%	3.22%	3.41%
WAYNE	NY	3.48%	3.04%	3.25%	3.40%
MECKLENBURG	NC	3.51%	3.28%	3.33%	3.39%

County	ST	2000	2001	2002	2003
RICHMOND[3]	VA	3.15%	4.27%	5.41%	3.36%
MORRIS	NJ	2.36%	2.29%	3.75%	3.34%
TRANSYLVANIA	NC	2.93%	3.04%	3.59%	3.30%
MERCER	NJ	3.13%	3.12%	3.77%	3.27%
PENOBSCOT	ME	2.64%	2.62%	3.42%	3.27%
CURRITUCK	NC	1.71%	1.64%	2.19%	3.26%
HANOVER	VA	7.88%	8.38%	5.40%	3.25%
BURLINGTON	NJ	3.10%	3.20%	3.12%	3.17%
BELKNAP	NH	2.47%	2.69%	3.40%	3.13%
UNION	NJ	3.15%	2.93%	2.89%	3.12%
ULSTER	NY	3.26%	3.40%	3.80%	3.10%
WASHINGTON	RI	2.97%	3.28%	3.04%	3.06%
BROOME	NY	3.08%	3.36%	3.42%	3.05%
PASQUOTANK	NC	2.64%	2.64%	3.37%	3.04%
NORFOLK	MA	2.82%	2.72%	2.82%	3.00%
CHESAPEAKE (CITY)	VA	2.81%	2.70%	2.74%	2.98%
CARROLL	NH	3.93%	2.97%	2.99%	2.96%
NASSAU	NY	2.86%	2.89%	2.67%	2.95%
MIDDLESEX	CT	3.90%	3.89%	3.31%	2.94%
KENNEBEC	ME	2.47%	2.07%	2.30%	2.91%
GLOUCESTER	NJ	3.01%	3.11%	2.56%	2.91%
LEHIGH	PA	2.97%	3.37 %	3.06%	2.91%
RICHMOND	NY	4.19%	3.38%	3.76%	2.89%
YORK	ME	2.63%	2.63%	2.97%	2.86%
HARFORD	MD	2.38%	2.77%	2.99%	2.84%
TALBOT	MD	3.04%	2.68%	2.33%	2.84%
DAVIE	NC	3.39%	2.87%	0.81%	2.81%
CUMBERLAND	NJ	3.22%	3.33%	2.62%	2.80%
DELAWARE	PA	2.84%	3.00 %	2.98%	2.78%
KING AND QUEEN[2]	VA	5.54%	4.46%	2.31%	2.71%
CAROLINE	MD	3.66%	1.82%	1.67%	2.70%
ALBANY	NY	2.65%	2.56%	2.38%	2.70%
HAMPDEN	MA	2.47%	2.66%	2.54%	2.65%
ANDROSCOGGIN	ME	2.29%	2.42%	2.35%	2.62%
CATAWBA	NC	2.13%	2.45%	2.61%	2.61%
BERKS	PA	2.65%	2.59	2.75%	2.61%

County	ST	2000	2001	2002	2003
			%		
FRANKLIN	NC	3.84%	2.84%	3.22%	2.61%
VIRGINIA BEACH (CITY)	VA	2.75%	2.69%	2.57%	2.61%
WESTMORELAND	PA	2.78%	2.83%	2.76%	2.61%
ESSEX	MA	3.11%	3.10%	2.85%	2.60%
WAYNE	NC	3.53%	4.08%	3.43%	2.60%
ONONDAGA	NY	2.65%	2.65%	2.58%	2.58%
CAMDEN	NJ	2.18%	2.09%	2.25%	2.54%
CALVERT	MD	3.45%	2.96%	2.57%	2.48%
ANNE ARUNDEL	MD	2.45%	2.35%	2.42%	2.44%
WORCESTER[3]	MD	6.00%	6.19%	2.26%	2.41%
ROCKINGHAM	VA	2.23%	2.41%	2.48%	2.38%
PENDER	NC	2.21%	2.06%	2.02%	2.36%
SUFFOLK	NY	2.50%	2.52%	2.54%	2.36%
HENRICO	VA	2.66%	2.22%	2.23%	2.35%
SCHUYLER	NY	3.53%	2.76%	2.59%	2.35%
ONSLOW	NC	1.36%	1.63%	1.13%	2.35%
SUSSEX	DE	1.57%	1.62%	2.53%	2.34%
GUILFORD	NC	1.92%	1.83%	1.80%	2.29%
HUDSON	NJ	2.63%	2.37%	2.27%	2.29%
MONTGOMERY	PA	3.02%	2.66%	2.17%	2.26%
GRAFTON	NH	1.84%	2.08%	2.17%	2.25%
ADDISON	VT	2.76%	2.68%	2.46%	2.25%
BUCKS	PA	2.28%	2.41%	2.32%	2.24%
FAIRFIELD	CT	2.01%	2.02%	1.92%	2.22%
BUNCOMBE	NC	1.73%	1.68%	1.67%	2.22%
HAMPSHIRE	MA	1.34%	1.40%	1.28%	2.20%
WINDSOR	VT	2.51%	2.81%	2.17%	2.20%
JEFFERSON	NY	2.01%	1.86%	2.09%	2.18%
NORTHAMPTON	PA	1.93%	2.07%	1.79%	2.18%
PROVIDENCE	RI	1.95%	2.01%	2.20%	2.17%
SULLIVAN	NH	1.89%	1.89%	1.93%	2.17%
UNION	NC	1.31%	1.17%	1.28%	2.16%

County	ST	2000	2001	2002	2003
RUTLAND	VT	1.91%	2.04%	1.99%	2.15%
FRANKLIN	PA	1.50%	2.04%	1.68%	2.13%
FORSYTH	NC	2.33%	2.26%	1.99%	2.11%
LITCHFIELD	CT	2.02%	2.24%	1.88%	2.09%
WARREN	PA	1.66%	1.82%	1.84%	2.08%
PLYMOUTH	MA	2.04%	2.10%	2.07%	2.07%
WICOMICO	MD	2.73%	2.47%	1.82%	2.07%
WAKE	NC	2.11%	2.12%	2.02%	2.07%
HILLSBOROUGH	NH	1.91%	1.89%	1.98%	2.06%
COLUMBIA	NY	1.81%	1.77%	2.45%	2.03%
OXFORD	ME	2.29%	2.19%	2.05%	2.02%
MERRIMACK	NH	1.97%	1.98%	1.78%	2.01%
WASHINGTON	NY	2.20%	2.11%	2.06%	2.00%
WESTCHESTER	NY	1.86%	1.94%	1.98%	1.98%
ORANGE	NY	2.50%	2.50%	2.99%	1.97%
STRAFFORD	NH	2.31%	2.44%	2.23%	1.95%
PUTNAM	NY	2.00%	2.25%	1.91%	1.94%
NEW HANOVER	NC	2.02%	1.63%	2.48%	1.94%
KENT[2]	RI	5.16%	5.05%	2.88%	1.94%
PHILADELPHIA	PA	2.27%	1.87%	1.82%	1.90%
MIDDLESEX	NJ	2.00%	2.02%	2.19%	1.90%
MONROE	PA	1.65%	1.67%	1.79%	1.87%
DUTCHESS	NY	1.52%	1.44%	1.56%	1.87%
NEW HAVEN	CT	1.72%	1.93%	1.93%	1.84%
OCEAN	NJ	2.28%	2.07%	1.91%	1.80%
NEW CASTLE	DE	1.75%	1.66%	1.74%	1.80%
CHESTERFIELD	VA	1.37%	1.50%	1.91%	1.80%
HAMPTON (CITY)	VA	1.27%	1.43%	1.33%	1.79%
SPOTSYLVANIA	VA	1.49%	1.83%	2.04%	1.75%
PRINCE WILLIAM	VA	1.12%	1.14%	1.49%	1.75%
BALTIMORE	MD	1.81%	1.70%	1.86%	1.72%
RUTHERFORD	NC	0.55%	0.80%	0.96%	1.72%
LANCASTER	PA	1.77%	1.95%	1.83%	1.71%

County	ST	2000	2001	2002	2003
BERGEN	NJ	2.00%	2.12%	2.16%	1.70%
PITT	NC	2.04%	1.79%	1.79%	1.67%
YORK	VA	0.98%	1.05%	1.42%	1.63%
SUFFOLK	MA	1.53%	1.46%	1.53%	1.57%
TOLLAND	CT	S	1.87%	1.40%	1.53%
SOMERSET	ME	2.11%	1.63%	1.66%	1.47%
MONMOUTH	NJ	1.81%	1.82%	1.75%	1.45%
ONTARIO	NY	1.48%	1.25%	1.36%	1.41%
JEFFERSON	PA	1.78%	1.84 %	2.20%	1.41%
CHESTER	PA	1.46%	1.29 %	2.14%	1.41%
KENT	DE	1.75%	2.03%	1.29%	1.40%
KINGS	NY	1.46%	1.36%	1.36%	1.39%
LYNCHBURG (CITY)	VA	1.08%	1.80%	1.94%	1.38%
ESSEX	NJ	1.79%	1.52%	1.45%	1.37%
HUNTERDON	NJ	1.40%	1.27%	1.35%	1.36%
ALLEGHENY	PA	1.37%	1.38 %	1.24%	1.35%
MONTGOMERY	MD	1.28%	1.22%	1.34%	1.33%
RICHMOND (CITY)	VA	1.74%	1.78%	1.25%	1.32%
CHARLES (CITY)	VA	1.52%	1.88%	1.26%	1.32%
MIDDLESEX	MA	1.45%	1.46%	1.50%	1.29%
WINDHAM	CT	2.71%	2.68%	2.75%	1.29%
CHARLOTTESVILLE (CITY)	VA	7.15%	7.18%	0.79%	1.26%
POQUOSON (CITY)	VA	2.72%	2.77%	1.24%	1.26%
FRANKLIN	MA	1.38%	1.28%	1.33%	1.25%
DELAWARE	NY	1.45%	1.45%	1.32%	1.24%
RANDOLPH	NC	0.80%	0.86%	1.66%	1.18%
CHARLES	MD	1.81%	1.75%	1.55%	1.17%
ST. MARY'S	MD	1.28%	1.13%	1.04%	1.17%
POWHATAN	VA	0.79%	1.25%	1.27%	1.15%
WARREN	NJ	1.64%	1.73%	1.21%	1.13%
PRINCE GEORGE'S	MD	0.90%	0.91%	1.00%	1.11%
GASTON	NC	1.18%	1.18%	1.15%	1.10%
PASSAIC	NJ	3.23%	3.12%	1.11%	1.07%
ROCKLAND	NY	1.99%	1.53%	1.33%	1.07%
STEUBEN	NY	0.70%	0.60%	0.64%	1.06%

County	ST	2000	2001	2002	2003
BERTIE	NC	1.46%	1.92%	0.91%	1.06%
ATLANTIC	NJ	1.03%	1.04%	1.08%	1.05%
PRINCE GEORGE	VA	1.59%	1.20%	1.77%	1.05%
NEW YORK	NY	1.29%	1.23%	1.08%	1.04%
HARNETT	NC	0.63%	0.56%	0.80%	1.04%
RENSSELAER	NY	0.96%	0.87%	1.13%	1.03%
QUEENS	NY	1.13%	1.08%	0.90%	1.02%
ESSEX	VA	0.71%	0.76%	1.34%	0.97%
MOORE	NC	1.01%	0.80%	0.90%	0.92%
ORANGE	NC	0.98%	0.83%	0.92%	0.88%
KING WILLIAM	VA	3.94%	3.75%	1.31%	0.85%
NORTHAMPTON	NC	1.24%	1.09%	0.93%	0.82%
ALEXANDRIA (CITY)	VA	0.80%	0.68%	0.77%	0.81%
AMHERST	VA	0.37%	0.37%	0.58%	0.81%
TIOGA	NY	1.54%	1.53%	1.40%	0.80%
FAIRFAX (CITY)	VA	0.89%	1.16%	0.97%	0.79%
SOUTHAMPTON	VA	0.18%	0.29%	0.43%	0.76%
OHIO	WV	0.86%	0.74%	1.24%	0.70%
BRONX	NY	1.15%	1.25%	1.02%	0.69%
FAIRFAX	VA	0.94%	1.00%	0.86%	0.68%
COLUMBUS	NC	0.52%	0.35%	0.55%	0.66%
MONTGOMERY	VA	1.44%	1.43%	1.66%	0.64%
JAMES (CITY)	VA	0.62%	0.53%	0.60%	0.63%
CUMBERLAND	NC	0.82%	0.69%	0.76%	0.62%
GREENE	PA	1.29%	1.14%	1.08%	0.62%
PETERSBURG (CITY)	VA	0.58%	0.76%	0.72%	0.58%
ISLE OF WIGHT	VA	0.73%	0.57%	0.61%	0.57%
DURHAM	NC	0.64%	0.73%	0.44%	0.52%
SURRY	VA	0.35%	0.52%	0.56%	0.37%
FALLS CHURCH (CITY)	VA	0.36%	0.35%	0.36%	0.35%
WILLIAMSBURG (CITY)	VA	0.38%	0.38%	0.40%	0.28%
NEW KENT	VA	0.57%	0.43%	0.53%	0.26%
CAROLINE	VA	0.08%	0.08%	0.08%	0.22%
FULTON	PA	0.64%	0.79%	0.56%	0.22%

S denotes suppressed data for the county totals so no percentages were calculated

[1] *Indicates more than 20% or more employment dependence*

[2] *Indicates more than 10 to 20% employment dependence*

[3] *Indicates 5-10% employment dependence*

Unlike the data on number of establishments, where annual percentages change only 10ths of a percent from year to year within 2000-2003, data on employment are more variable. (These data are ordered in descending order by 2003, then 2002, and then 2001. Programming did not allow for an additional sort by 2000.) Of the counties in , 8 have 20% or more employment dependence, after rounding up. These are located in Maine, Maryland, Virginia and North Carolina, with Sagahadoc County, ME being by far the most dependent and consistently so. Thirty-five (35) counties have more than 10% but not more than 20% dependence. These are distributed throughout the region. It should also be noted that these counties are scattered up and down the table, reflecting the inter-annual variability of the data. For instance, Worcester County, MD had only just under 2.5% dependence in 2002 and 2003, but 6% dependence in 2000 and 2001. The 10 counties with 5-10% dependence are similarly scattered. The remaining 82 counties have 1-4% dependence in terms of employment.

Finally, it is important to remember that these levels of dependency include the entire marine sector, even some industries likely to be only peripherally affected by changes in regulations.

Cumulative Impacts Data for Counties Relative to All Data Sources

While data by permits and individual fisheries is important, it is also critical to examine how these data combine and create cumulative effects. If we look at all counties which merited being highlighted in bold for any of the permit or fisheries tables are examined, it becomes obvious that some counties will be more heavily impacted by any eventual measures due to their multiple presence. If we add in the bold highlighted CBP data are included, additional counties are added and some previous counties gain additional importance. Counties with 10 or more appearances, counties with 5-9 appearances and counties that increased their number of appearances with the addition of CBP data to fisheries and permits are included in .Table 113.

Table 113. Respective Levels of Representation in Permit, Fisheries or CBP Data Tables
[1] *Counties with 10 or more appearances*
[2] *Counties with 5-9 appearances*
[3] *Counties that increased their number of appearances with the addition of CBP data to fisheries and permits*

County	ST	Number of Entries under Permits and Fisheries at Respective Threshold	County	ST	Number of Entries under Permits, Fisheries and CBP at Respective Threshold
Bristol[1]	MA	12	Bristol	MA	12

County	ST	Number of Entries under Permits and Fisheries at Respective Threshold	County	ST	Number of Entries under Permits, Fisheries and CBP at Respective Threshold
Essex [1]	MA	10	Essex	MA	10
Washington[1]	RI	10	Washington	RI	10
Suffolk[2]	NY	9	Suffolk[2]	NY	9
Ocean[2]	NJ	8	Ocean[2]	NJ	8
Barnstable[2]	MA	7	Barnstable[2]	MA	7
Cumberland[2]	ME	6	Cumberland[2]	ME	6
Washington[2]	ME	5	Washington[3]	ME	6
Hancock	ME	4	Hancock[3]	ME	5
Knox	ME	4	Knox[3]	ME	5
Newport	RI	4	Newport[3]	RI	5
Dare	NC	4	Dare[3]	NC	5
			Northumberland [3]	VA	4
Cape May	NJ	4	Cape May	NJ	4
Newport News	VA	3	Newport News	VA	3
Plymouth	MA	2	Plymouth	MA	2
Suffolk	MA	2	Suffolk	MA	2
Rockingham	NH	2	Rockingham	NH	2
Hampton	VA	2	Hampton	VA	2
Northumberland [3]	VA	2	Middlesex	VA	2
New London	CT	1	Hyde	NC	2
Worcester	MD	1	Pamlico	NC	2
Lincoln	ME	1	Lincoln	ME	2
Atlantic	NJ	1	Tyrrell	NC	2
York	VA	1	Somerset	MD	2
			Lancaster	VA	1
			Mathews	VA	1
			Northampton	VA	1
			Stafford	VA	1
			Westmoreland	VA	1
			York	VA	1
			Atlantic	NJ	1
			Carteret	NC	1

County	ST	Number of Entries under Permits and Fisheries at Respective Threshold	County	ST	Number of Entries under Permits, Fisheries and CBP at Respective Threshold
			Sagahadoc	ME	1
			Dorchester	MD	1
			Kent	MD	1
			Worcester	MD	1
			Dukes	MA	1
			New London	CT	1

The counties with 10 or more references in are Essex and Bristol in Massachusetts and Washington in Rhode Island. Those with 5-9 references, by fisheries and permits alone, were Suffolk County, New York; Ocean County, New Jersey; Barnstable County, Massachusetts; and Cumberland and Washington Counties in Maine. With the addition of the CBP data, additional counties move into this category of 5-9 references: Washington, Hancock and Knox Counties in Maine, plus Newport County, Rhode Island and Dare County, North Carolina.

Data from the Census

In order to provide the most up-to-date information possible, this section relies on the Census' 2005 American Community Survey. Unlike the full 2000 census, these data are limited to the household population and exclude the population living in institutions, college dormitories, and other group quarters. Further, detail may not add to totals due to rounding, and percentages are based on unrounded numbers. Finally, because so many counties are involved, and because individual community data for key communities in every fishery and county-level data for all counties marked in bold in the fishery tables are provided in appendices, for Phase 1 we will report basic demographic data are reported in the main text at the state level only. The narratives are excerpted from those accessible through the Census' American Factfinder site at http://factfinder.census.gov/home/saff/main.html.

** See and for complete list of communities in Appendix G.*

*** The counties in Appendix F are: in CT (New London), in MA (Barnstable, Bristol, Essex, Plymouth, Suffolk), in MD (Worcester), in ME (Cumberland, Hancock, Knox, Lincoln, Washington), in NC (Dare), in NH (Rockingham), in NJ (Atlantic, Cape May, Ocean), in NY*

(Suffolk), in RI (Newport, Washington), and in VA (Hampton, Newport News, Northumberland, York).

Maine

POPULATION: In 2005, Maine had a household population of 1.3 million - 657,000 (51 percent) females and 626,000 (49 percent) males. The median age was 41.2 years. Twenty-two percent of the population were under 18 years and 14 percent were 65 years and older. For people reporting one race alone, 98 percent were White; 1 percent were Black or African American; 1 percent were American Indian and Alaska Native; 1 percent were Asian; less than 0.5 percent were Native Hawaiian and Other Pacific Islander, and less than 0.5 percent were Some other race. One percent reported two or more races. One percent of the people in Maine were Hispanic. Ninety-six percent of the people in Maine were White non-Hispanic. People of Hispanic origin may be of any race.

HOUSEHOLDS AND FAMILIES: In 2005 there were 542,000 households in Maine. The average household size was 2.4 people. Families made up 66 percent of the households in Maine. This figure includes both married-couple families (51 percent) and other families (14 percent). Non-family households made up 34 percent of all households in Maine. Most of the non-family households were people living alone, but some were comprised of people living in households in which no one was related to the householder.

NATIVITY AND LANGUAGE: Three percent of the people living in Maine in 2005 were foreign born. Ninety-seven percent were native, including 65 percent who were born in Maine. Among people age five years or older that lived in Maine in 2005, 8 percent spoke a language other than English at home. Of those speaking a language other than English at home, 12 percent spoke Spanish and 88 percent spoke some other language; 26 percent reported that they did not speak English "very well."

GEOGRAPHIC MOBILITY: In 2005, 85 percent of the people at least one year old living in Maine were living in the same residence one year earlier; 9 percent had moved during the past year from another residence in the same county, 2 percent from another county in the same state, 3 percent from another state, and less than 0.5 percent from abroad.

EDUCATION: In 2005, 89 percent of people 25 years and over had at least graduated from high school and 26 percent had a bachelor's degree or higher.

Among people 16 to 19 years old, 7 percent were dropouts; they were not enrolled in school and had not graduated from high school. The total school enrollment in Maine was 296,000 in 2005. Nursery school and kindergarten enrollment was 29,000 and elementary or high school enrollment was 196,000 children. College or graduate school enrollment was 71,000.

DISABILITY: In Maine, among people at least five years old in 2005, 18 percent reported a disability. The likelihood of having a disability varied by age - from 10 percent of people 5 to 20 years old, to 16 percent of people 21 to 64 years old, and to 39 percent of those 65 and older.

INDUSTRIES: In 2005, for the employed population 16 years and older, the leading industries in Maine were Educational services, health care and social assistance, 25 percent, and Retail Trade, 14 percent. Agriculture, forestry, fishing and hunting, and mining constituted 2 percent.

OCCUPATIONS AND TYPE OF EMPLOYER: Among the most common occupations were: Management, professional, and related occupations, 32 percent; Sales and office occupations, 25 percent; Service occupations, 17 percent; Production, transportation, and material moving occupations, 12 percent; and Construction, extraction, maintenance and repair occupations, 11 percent. Seventy-five percent of the people employed were Private wage and salary workers; 15 percent were Federal, state, or local government workers; and 10 percent were self-employed in own not incorporated business workers – a category in which fishermen might be found.

TRAVEL TO WORK: Eighty percent of Maine workers drove to work alone in 2005, 10 percent carpooled, 1 percent took public transportation, and 5 percent used other means. The remaining 5 percent worked at home. Among those who commuted to work, it took them on average 23.3 minutes to get to work.

INCOME: The median income of households in Maine was $42,801. Seventy-eight percent of the households received earnings and 18 percent received retirement income other than Social Security. Thirty percent of the households received Social Security. The average income from Social Security was $12,725. These income sources are not mutually exclusive; that is, some households received income from more than one source.

POVERTY AND PARTICIPATION IN GOVERNMENT PROGRAMS: In 2005, 13 percent of people were in poverty. Seventeen percent of related children under

18 were below the poverty level, compared with 11 percent of people 65 years old and over. Nine percent of all families and 30 percent of families with a female householder and no husband present had incomes below the poverty level.

HOUSING CHARACTERISTICS: In 2005, Maine had a total of 684,000 housing units, 21 percent of which were vacant. Of the total housing units, 70 percent were in single-unit structures, 21 percent were in multi-unit structures, and 10 percent were mobile homes. Eighteen percent of the housing units were built since 1990.

OCCUPIED HOUSING UNIT CHARACTERISTICS: In 2005, Maine had 542,000 occupied housing units - 389,000 (72 percent) owner occupied and 153,000 (28 percent) renter occupied. Three percent of the households did not have telephone service and 6 percent of the households did not have access to a car, truck, or van for private use. Multi Vehicle households were not rare. Forty-one percent had two vehicles and another 20 percent had three or more.

HOUSING COSTS: The median monthly housing costs for mortgaged owners was $1,093, non-mortgaged owners $358, and renters $623. Thirty percent of owners with mortgages, 16 percent of owners without mortgages, and 43 percent of renters in Maine spent 30 percent or more of household income on housing.

New Hampshire

POPULATION: In 2005, New Hampshire had a household population of 1.3 million - 644,000 (51 percent) females and 628,000 (49 percent) males. The median age was 39.5 years. Twenty-four percent of the population were under 18 years and 12 percent were 65 years and older. For people reporting one race alone, 96 percent were White; 1 percent were Black or African American; less than 0.5 percent were American Indian and Alaska Native; 2 percent were Asian; less than 0.5 percent were Native Hawaiian and Other Pacific Islander, and 1 percent were Some other race. One percent reported two or more races. Two percent of the people in New Hampshire were Hispanic. Ninety-four percent of the people in New Hampshire were White non-Hispanic. People of Hispanic origin may be of any race.

HOUSEHOLDS AND FAMILIES: In 2005 there were 497,000 households in New Hampshire. The average household size was 2.6 people. Families made up 68 percent of the households in New Hampshire. This figure includes both married-couple families (54 percent) and other families (14 percent). Non-family households made up 32 percent of all households in New Hampshire. Most of the non-family households were people living alone, but some were comprised of people living in households in which no one was related to the householder.

NATIVITY AND LANGUAGE: Six percent of the people living in New Hampshire in 2005 were foreign born. Ninety-four percent were native, including 42 percent who were born in New Hampshire. Among people age five years or older that lived in New Hampshire in 2005, 9 percent spoke a language other than English at home. Of those speaking a language other than English at home, 22 percent spoke Spanish and 78 percent spoke some other language; 29 percent reported that they did not speak English "very well."

GEOGRAPHIC MOBILITY: In 2005, 86 percent of the people at least one year old living in New Hampshire were living in the same residence one year earlier; 7 percent had moved during the past year from another residence in the same county, 2 percent from another county in the same state, 4 percent from another state, and less than 0.5 percent from abroad.

EDUCATION: In 2005, 90 percent of people 25 years and over had at least graduated from high school and 32 percent had a bachelor's degree or higher. Among people 16 to 19 years old, 6 percent were dropouts; they were not enrolled in school and had not graduated from high school. The total school enrollment in New Hampshire was 318,000 in 2005. Nursery school and kindergarten enrollment was 32,000 and elementary or high school enrollment was 217,000 children. College or graduate school enrollment was 69,000.

DISABILITY: In New Hampshire, among people at least five years old in 2005, 14 percent reported a disability. The likelihood of having a disability varied by age - from 8 percent of people 5 to 20 years old, to 12 percent of people 21 to 64 years old, and to 37 percent of those 65 and older.

INDUSTRIES: In 2005, for the employed population 16 years and older, the leading industries in New Hampshire were Educational services, health care and social assistance, 21 percent, and Manufacturing, 14 percent. Agriculture, forestry, fishing and hunting, and mining constituted 1 percent.

OCCUPATIONS AND TYPE OF EMPLOYER: Among the most common occupations were: Management, professional, and related occupations, 37 percent; Sales and office occupations, 25 percent; Service occupations, 14 percent; Production, transportation, and material moving occupations, 13 percent; and Construction, extraction, maintenance and repair occupations, 10 percent. Seventy-eight percent of the people employed were Private wage and salary workers; 13 percent were Federal, state, or local government workers; and 8 percent were Self-employed in own not incorporated business workers - a category in which fishermen might be found.

TRAVEL TO WORK: Eighty-two percent of New Hampshire workers drove to work alone in 2005, 9 percent carpooled, 1 percent took public transportation, and 4 percent used other means. The remaining 4 percent worked at home. Among those who commuted to work, it took them on average 25 minutes to get to work.

INCOME: The median income of households in New Hampshire was $56,768. Eighty-three percent of the households received earnings and 17 percent received retirement income other than Social Security. Twenty-seven percent of the households received Social Security. The average income from Social Security was $13,714. These income sources are not mutually exclusive; that is, some households received income from more than one source.

POVERTY AND PARTICIPATION IN GOVERNMENT PROGRAMS: In 2005, 8 percent of people were in poverty. Nine percent of related children under 18 were below the poverty level, compared with 7 percent of people 65 years old and over. Five percent of all families and 22 percent of families with a female householder and no husband present had incomes below the poverty level.

HOUSING CHARACTERISTICS: In 2005, New Hampshire had a total of 583,000 housing units, 15 percent of which were vacant. Of the total housing units, 69 percent were in single-unit structures, 25 percent were in multi-unit structures, and 7 percent were mobile homes. Seventeen percent of the housing units were built since 1990.

OCCUPIED HOUSING UNIT CHARACTERISTICS: In 2005, New Hampshire had 497,000 occupied housing units - 363,000 (73 percent) owner occupied and 134,000 (27 percent) renter occupied. Three percent of the households did not have telephone service and 5 percent of the households did not have access to a car, truck, or van for private use. Multi Vehicle households were not rare. Forty-three percent had two vehicles and another 24 percent had three or more.

HOUSING COSTS: The median monthly housing costs for mortgaged owners was $1,566, non-mortgaged owners $574, and renters $854. Thirty-eight percent of owners with mortgages, 23 percent of owners without mortgages, and 43 percent of renters in New Hampshire spent 30 percent or more of household income on housing.

Vermont

POPULATION OF Vermont: In 2005, Vermont had a household population of 602,000 - 306,000 (51 percent) females and 296,000 (49 percent) males. The median age was 40.7

years. Twenty-two percent of the population were under 18 years and 13 percent were 65 years and older.

For people reporting one race alone, 98 percent were White; less than 0.5 percent were Black or African American; less than 0.5 percent were American Indian and Alaska Native; 1 percent were Asian; less than 0.5 percent were Native Hawaiian and Other Pacific Islander, and less than 0.5 percent were Some other race. One percent reported Two or more races. One percent of the people in Vermont were Hispanic. Ninety-six percent of the people in Vermont were White non-Hispanic. People of Hispanic origin may be of any race.

HOUSEHOLDS AND FAMILIES: In 2005 there were 249,000 households in Vermont. The average household size was 2.4 people.
Families made up 63 percent of the households in Vermont. This figure includes both married-couple families (49 percent) and other families (15 percent). Non-family households made up 37 percent of all households in Vermont. Most of the non-family households were people living alone, but some were comprised of people living in households in which no one was related to the householder.

NATIVITY AND LANGUAGE: Four percent of the people living in Vermont in 2005 were foreign born. Ninety-six percent were native , including 53 percent who were born in Vermont.

Among people at least five years old living in Vermont in 2005, 5 percent spoke a language other than English at home. Of those speaking a language other than English at home, 14 percent spoke Spanish and 86 percent spoke some other language; 26 percent reported that they did not speak English "very well."

GEOGRAPHIC MOBILITY: In 2005, 85 percent of the people at least one year old living in Vermont were living in the same residence one year earlier; 9 percent had moved during the past year from another residence in the same county, 2 percent from another county in the same state, 3 percent from another state, and less than 0.5 percent from abroad.

EDUCATION: In 2005, 89 percent of people 25 years and over had at least graduated from high school and 32 percent had a bachelor's degree or higher. Among people 16 to 19 years old, 5 percent were dropouts; they were not enrolled in school and had not graduated from high school.

The total school enrollment in Vermont was 145,000 in 2005. Nursery school and kindergarten enrollment was 13,000 and elementary or high school enrollment was 95,000 children. College or graduate school enrollment was 36,000.

DISABILITY: In Vermont, among people at least five years old in 2005, 16 percent reported a disability. The likelihood of having a disability varied by age - from 9 percent of people 5 to 20 years old, to 13 percent of people 21 to 64 years old, and to 40 percent of those 65 and older.

INDUSTRIES: In 2005, for the employed population 16 years and older, the leading industries in Vermont were Educational services, health care and social assistance, 25 percent, and Manufacturing, 12 percent. Agriculture, forestry, fishing and hunting, and mining constitute 2 percent.

OCCUPATIONS AND TYPE OF EMPLOYER: Among the most common occupations were: Management, professional, and related occupations, 37 percent; Sales and office occupations, 24 percent; Service occupations, 16 percent; Production, transportation, and material moving occupations, 11 percent; and Construction, extraction, maintenance and repair occupations, 10 percent. Seventy-five percent of the people employed were Private wage and salary workers; 14 percent were Federal, state, or local government workers; and 11 percent were Self-employed in own not incorporated business workers - a category in which fishermen might be found.

TRAVEL TO WORK: Seventy-six percent of Vermont workers drove to work alone in 2005, 11 percent carpooled, 1 percent took public transportation, and 7 percent used other means. The remaining 6 percent worked at home. Among those who commuted to work, it took them on average 21.2 minutes to get to work.

INCOME: The median income of households in Vermont was $45,686. Eighty-two percent of the households received earnings and 17 percent received retirement income other than Social Security. Twenty-seven percent of the households received Social Security. The average income from Social Security was $13,438. These income sources are not mutually exclusive; that is, some households received income from more than one source.

POVERTY AND PARTICIPATION IN GOVERNMENT PROGRAMS: In 2005, 11 percent of people were in poverty. Fifteen percent of related children under 18 were below the poverty level, compared with 10 percent of people 65 years old and over. Eight percent of all families and 25 percent of families with a female householder and no husband present had incomes below the poverty level.

HOUSING CHARACTERISTICS: In 2005, Vermont had a total of 307,000 housing units, 19 percent of which were vacant. Of the total housing units, 69 percent were in single-unit structures, 23 percent were in multi-unit structures, and 8 percent were mobile homes. Sixteen percent of the housing units were built since 1990.

OCCUPIED HOUSING UNIT CHARACTERISTICS: In 2005, Vermont had 249,000 occupied housing units - 177,000 (71 percent) owner occupied and 72,000 (29 percent) renter occupied. Two percent of the households did not have telephone service and 7 percent of the households did not have access to a car, truck, or van for private use. Multi Vehicle households were not rare. Forty-two percent had two vehicles and another 19 percent had three or more.

HOUSING COSTS: The median monthly housing costs for mortgaged owners was $1,242, non-mortgaged owners $484, and renters $683. Thirty-three percent of owners with mortgages, 21 percent of owners without mortgages, and 46 percent of renters in Vermont spent 30 percent or more of household income on housing.

Massachusetts

POPULATION: In 2005, Massachusetts had a household population of 6.2 million - 3.2 million (52 percent) females and 3.0 million (48 percent) males. The median age was 38.2 years. Twenty-three percent of the population were under 18 years and 13 percent were 65 years and older. For people reporting one race alone, 85 percent were White; 6 percent were Black or African American; less than 0.5 percent were American Indian and Alaska Native; 5 percent were Asian; less than 0.5 percent were Native Hawaiian and Other Pacific Islander, and 4 percent were Some other race. One percent reported two or more races. Eight percent of the people in Massachusetts were Hispanic. Eighty percent of the people in Massachusetts were White non-Hispanic. People of Hispanic origin may be of any race.

HOUSEHOLDS AND FAMILIES: In 2005 there were 2.4 million households in Massachusetts. The average household size was 2.5 people. Families made up 64 percent of the households in Massachusetts. This figure includes both married-couple families (48 percent) and other families (16 percent). Non-family households made up 36 percent of all households in Massachusetts. Most of the non-family households were people living alone, but some were comprised of people living in households in which no one was related to the householder.

NATIVITY AND LANGUAGE: Fourteen percent of the people living in Massachusetts in 2005 were foreign born. Eighty-six percent were native to the U.S., including 65 percent who were born in Massachusetts. Among people age five years or older that lived in Massachusetts in 2005, twenty (20) percent spoke a language other than English at home. Of those speaking a language other than English at home, 34 percent spoke Spanish and 66 percent spoke some other language; 44 percent reported that they did not speak English "very well."

GEOGRAPHIC MOBILITY: In 2005, 86 percent of the people age one year or older that lived in Massachusetts were living in the same residence one year earlier; 9 percent had moved during the past year from another residence in the same county, 3 percent from another county in the same state, 2 percent from another state, and 1 percent from abroad.

EDUCATION: In 2005, 88 percent of people 25 years and over had at least graduated from high school and 37 percent had a bachelor's degree or higher. Among people 16 to 19 years old, 5 percent were dropouts; they were not enrolled in school and had not graduated from high school. The total school enrollment in Massachusetts was 1.6 million in 2005. Nursery school and kindergarten enrollment was 189,000 and elementary or high school enrollment was 989,000 children. College or graduate school enrollment was 398,000.

DISABILITY: In Massachusetts, among people at least five years old in 2005, 14 percent reported a disability. The likelihood of having a disability varied by age - from 7 percent of people 5 to 20 years old, to 11 percent of people 21 to 64 years old, and to 37 percent of those 65 and older.

INDUSTRIES: In 2005, for the employed population 16 years and older, the leading industries in Massachusetts were Educational services, health care and social assistance, 25 percent, and Professional, scientific, and management, and administrative and waste management services, 12 percent. Agriculture, forestry, fishing and hunting, and mining constitute less than 1 percent.

OCCUPATIONS AND TYPE OF EMPLOYER: Among the most common occupations were: Management, professional, and related occupations, 41 percent; Sales and office occupations, 25 percent; Service occupations, 16 percent; Production, transportation, and material moving occupations, 10 percent; and Construction, extraction, maintenance and repair occupations, 8 percent. Eighty percent of the people employed were Private wage and salary workers; 13 percent were Federal, state, or local government workers; and 7 percent were Self-employed in own not incorporated business workers - a category in which fishermen might be found.

TRAVEL TO WORK: Seventy-five percent of Massachusetts workers drove to work alone in 2005, 8 percent carpooled, 8 percent took public transportation, and 5 percent used other means. The remaining 3 percent worked at home. Among those who commuted to work, it took them on average 27 minutes to get to work.

INCOME: The median income of households in Massachusetts was $57,184. Eighty percent of the households received earnings and 17 percent received retirement income other than Social Security. Twenty-seven percent of the households received Social Security. The average income from Social Security was $13,110. These income sources are not mutually exclusive; that is, some households received income from more than one source.

POVERTY AND PARTICIPATION IN GOVERNMENT PROGRAMS: In 2005, 10 percent of people were in poverty. Fourteen percent of related children under 18 were below the poverty level, compared with 10 percent of people 65 years old and over. Eight percent of all families and 25 percent of families with a female householder and no husband present had incomes below the poverty level.

HOUSING CHARACTERISTICS: In 2005, Massachusetts had a total of 2.7 million housing units, 9 percent of which were vacant. Of the total housing units, 57 percent were in single-unit structures, 42 percent were in multi-unit structures, and 1 percent were mobile homes. Eleven percent of the housing units were built since 1990.

OCCUPIED HOUSING UNIT CHARACTERISTICS: In 2005, Massachusetts had 2.4 million occupied housing units - 1.6 million (64 percent) owner occupied and 880,000 (36 percent) renter occupied. Four percent of the households did not have telephone service and 12 percent of the households did not have access to a car, truck, or van for private use. Multi Vehicle households were not rare. Thirty-seven percent had two vehicles and another 16 percent had three or more.

HOUSING COSTS: The median monthly housing costs for mortgaged owners was $1,781, non-mortgaged owners $551, and renters $902. Thirty-seven percent of owners with mortgages, 21 percent of owners without mortgages, and 46 percent of renters in Massachusetts spent 30 percent or more of household income on housing.

Connecticut

POPULATION: In 2005, Connecticut had a household population of 3.4 million - 1.7 million (52 percent) females and 1.6 million (48 percent) males. The median age was 39.3 years. Twenty-four percent of the population were under 18 years and 13 percent were 65 years and older. For people reporting one race alone, 83 percent were White; 9 percent were Black or African American; less than 0.5 percent were American Indian and Alaska Native; 3 percent were Asian; less than 0.5 percent were Native Hawaiian and Other Pacific Islander, and 5 percent were Some other race. Two percent reported two or more races. Eleven percent of the people in Connecticut were Hispanic. Seventy-five percent of the people in Connecticut were White non-Hispanic. People of Hispanic origin may be of any race.

HOUSEHOLDS AND FAMILIES: In 2005 there were 1.3 million households in Connecticut. The average household size was 2.6 people. Families made up 67 percent of the households in Connecticut. This figure includes both married-couple families (51 percent) and other families (16 percent). Non-family households made up 33 percent of all households in Connecticut. Most of the non-family households were people living alone, but some were comprised of people living in households in which no one was related to the householder.

NATIVITY AND LANGUAGE: Twelve percent of the people living in Connecticut in 2005 were foreign born. Eighty-eight percent were native to the U.S., including 56 percent who were born in Connecticut. Among people at least five years old living in Connecticut in 2005, 19 percent spoke a language other than English at home. Of those speaking a language other than English at home, 48 percent spoke Spanish and 52 percent spoke some other language; 40 percent reported that they did not speak English "very well."

GEOGRAPHIC MOBILITY: In 2005, 88 percent of the people at least one year old living in Connecticut were living in the same residence one year earlier; 7 percent had moved during the past year from another residence in the same county, 1 percent from another county in the same state, 2 percent from another state, and 1 percent from abroad.

EDUCATION: In 2005, 88 percent of people 25 years and over had at least graduated from high school and 35 percent had a bachelor's degree or higher. Among people 16 to 19 years old, 4 percent were dropouts; they were not enrolled in school and had not graduated from high school. The total school enrollment in Connecticut was 889,000 in 2005. Nursery school and kindergarten enrollment was 107,000 and elementary or high school enrollment was 581,000 children. College or graduate school enrollment was 200,000.

DISABILITY: In Connecticut, among people at least five years old in 2005, 13 percent reported a disability. The likelihood of having a disability varied by age - from 6 percent of people 5 to 20 years old, to 10 percent of people 21 to 64 years old, and to 35 percent of those 65 and older.

INDUSTRIES: In 2005, for the employed population 16 years and older, the leading industries in Connecticut were Educational services, health care and social assistance, 23 percent, and Manufacturing, 13 percent. Agriculture, forestry, fishing and hunting, and mining constitute less than 1 percent.

OCCUPATIONS AND TYPE OF EMPLOYER: Among the most common occupations were: Management, professional, and related occupations, 39 percent; Sales and office occupations, 26 percent; Service occupations, 15 percent; Production, transportation, and material moving occupations, 10 percent; and Construction, extraction, maintenance and repair occupations, 9 percent. Eighty percent of the people employed were Private wage and salary workers; 13 percent were Federal, state, or local government workers; and 7 percent were Self-employed in own not incorporated business workers - a category in which fishermen might be found.

TRAVEL TO WORK: Eighty-one percent of Connecticut workers drove to work alone in 2005, 8 percent carpooled, 4 percent took public transportation, and 3 percent used other means. The remaining 3 percent worked at home. Among those who commuted to work, it took them on average 24.8 minutes to get to work.

INCOME: The median income of households in Connecticut was $60,941. Eighty-one percent of the households received earnings and 18 percent received retirement income other than Social Security. Twenty-eight percent of the households received Social Security. The average income from Social Security was $14,508. These income sources are not mutually exclusive; that is, some households received income from more than one source.

POVERTY AND PARTICIPATION IN GOVERNMENT PROGRAMS: In 2005, 8 percent of people were in poverty. Twelve percent of related children under 18 were below the poverty level, compared with 8 percent of people 65 years old and over. Six percent of all families and 21 percent of families with a female householder and no husband present had incomes below the poverty level.

HOUSING CHARACTERISTICS: In 2005, Connecticut had a total of 1.4 million housing units, 7 percent of which were vacant. Of the total housing units, 65 percent were in single-unit structures, 35 percent were in multi-unit structures, and 1 percent were mobile homes. Eleven percent of the housing units were built since 1990.

OCCUPIED HOUSING UNIT CHARACTERISTICS: In 2005, Connecticut had 1.3 million occupied housing units - 920,000 (69 percent) owner occupied and

404,000 (31 percent) renter occupied. Three percent of the households did not have telephone service and 8 percent of the households did not have access to a car, truck, or van for private use. Multi Vehicle households were not rare. Forty percent had two vehicles and another 21 percent had three or more.

HOUSING COSTS: The median monthly housing costs for mortgaged owners was $1,718, non-mortgaged owners $611, and renters $839. Thirty-five percent of owners with mortgages, 23 percent of owners without mortgages, and 45 percent of renters in Connecticut spent 30 percent or more of household income on housing.

Rhode Island
POPULATION: In 2005, Rhode Island had a household population of 1.0 million - 535,000 (52 percent) females and 498,000 (48 percent) males. The median age was 38.4 years. Twenty-four percent of the population were under 18 years and 14 percent were 65 years and older. For people reporting one race alone, 85 percent were White; 5 percent were Black or African American; 1 percent were American Indian and Alaska Native; 3 percent were Asian; less than 0.5 percent were Native Hawaiian and Other Pacific Islander, and 7 percent were Some other race. Two percent reported two or more races. Eleven percent of the people in Rhode Island were Hispanic. Seventy-nine percent of the people in Rhode Island were White non-Hispanic. People of Hispanic origin may be of any race.

HOUSEHOLDS AND FAMILIES: In 2005 there were 406,000 households in Rhode Island. The average household size was 2.5 people. Families made up 64 percent of the households in Rhode Island. This figure includes both married-couple families (47 percent) and other families (17 percent). Non-family households made up 36 percent of all households in Rhode Island. Most of the non-family households were people living alone, but some were comprised of people living in households in which no one was related to the householder.

NATIVITY AND LANGUAGE: Thirteen percent of the people living in Rhode Island in 2005 were foreign born. Eighty-seven percent were native to the U.S. , including 61 percent who were born in Rhode Island. Among people at least five years old living in Rhode Island in 2005, twenty (20) percent spoke a language other than English at home. Of those speaking a language other than English at home, 47 percent spoke Spanish and 53 percent spoke some other language; 44 percent reported that they did not speak English "very well."

GEOGRAPHIC MOBILITY: In 2005, 88 percent of the people at least one year old living in Rhode Island were living in the same residence one year earlier; 7

percent had moved during the past year from another residence in the same county, 2 percent from another county in the same state, 2 percent from another state, and 1 percent from abroad.

EDUCATION: In 2005, 84 percent of people 25 years and over had at least graduated from high school and 29 percent had a bachelor's degree or higher. Among people 16 to 19 years old, 8 percent were dropouts; they were not enrolled in school and had not graduated from high school. The total school enrollment in Rhode Island was 264,000 in 2005. Nursery school and kindergarten enrollment was 26,000 and elementary or high school enrollment was 168,000 children. College or graduate school enrollment was 70,000.

DISABILITY: In Rhode Island, among people at least five years old in 2005, 16 percent reported a disability. The likelihood of having a disability varied by age - from 9 percent of people 5 to 20 years old, to 13 percent of people 21 to 64 years old, and to 39 percent of those 65 and older.

INDUSTRIES: In 2005, for the employed population 16 years and older, the leading industries in Rhode Island were Educational services, health care and social assistance, 24 percent, and Manufacturing, 13 percent. Agriculture, forestry, fishing and hunting, and mining constitute 1 percent.

OCCUPATIONS AND TYPE OF EMPLOYER: Among the most common occupations were: Management, professional, and related occupations, 36 percent; Sales and office occupations, 25 percent; Service occupations, 17 percent; Production, transportation, and material moving occupations, 13 percent; and Construction, extraction, maintenance and repair occupations, 9 percent. Eighty-one percent of the people employed were Private wage and salary workers; 13 percent were Federal, state, or local government workers; and 6 percent were Self-employed in own not incorporated business workers - a category in which fishermen might be found.

TRAVEL TO WORK: Eighty-two percent of Rhode Island workers drove to work alone in 2005, 9 percent carpooled, 3 percent took public transportation, and 4 percent used other means. The remaining 3 percent worked at home. Among those who commuted to work, it took them on average 22.7 minutes to get to work.

INCOME: The median income of households in Rhode Island was $51,458. Seventy-eight percent of the households received earnings and 18 percent received retirement income other than Social Security. Twenty-eight percent of the households received Social Security. The average income from Social Security was $13,499. These income sources are not mutually exclusive; that is, some households received income from more than one source.

POVERTY AND PARTICIPATION IN GOVERNMENT PROGRAMS: In 2005, 12 percent of people were in poverty. Nineteen percent of related children under 18 were below the poverty level, compared with 8 percent of people 65 years old and over. Ten percent of all families and 32 percent of families with a female householder and no husband present had incomes below the poverty level.

HOUSING CHARACTERISTICS: In 2005, Rhode Island had a total of 448,000 housing units, 9 percent of which were vacant. Of the total housing units, 58 percent were in single-unit structures, 41 percent were in multi-unit structures, and 1 percent were mobile homes. Ten percent of the housing units were built since 1990.

OCCUPIED HOUSING UNIT CHARACTERISTICS: In 2005, Rhode Island had 406,000 occupied housing units - 255,000 (63 percent) owner occupied and 151,000 (37 percent) renter occupied. Four percent of the households did not have telephone service and 8 percent of the households did not have access to a car, truck, or van for private use. Multi Vehicle households were not rare. Thirty-nine percent had two vehicles and another 18 percent had three or more.

HOUSING COSTS: The median monthly housing costs for mortgaged owners was $1,585, non-mortgaged owners $519, and renters $775. Thirty-eight percent of owners with mortgages, 22 percent of owners without mortgages, and 45 percent of renters in Rhode Island spent 30 percent or more of household income on housing.

New York

POPULATION: In 2005, New York had a household population of 18.7 million - 9.7 million (52 percent) females and 9.0 million (48 percent) males. The median age was 37.5 years. Twenty-four percent of the population were under 18 years and 13 percent were 65 years and older. For people reporting one race alone, 68 percent were White; 16 percent were Black or African American; less than 0.5 percent were American Indian and Alaska Native; 7 percent were Asian; less than 0.5 percent were Native Hawaiian and Other Pacific Islander, and 9 percent were Some other race. Two percent reported two or more races. Sixteen percent of the people in New York were Hispanic. Sixty-one percent of the people in New York were White non-Hispanic. People of Hispanic origin may be of any race.

HOUSEHOLDS AND FAMILIES: In 2005 there were 7.1 million households in New York. The average household size was 2.6 people. Families made up 65 percent of the households in New York. This figure includes both married-couple families (45 percent) and other families (20 percent). Non-family households made up 35 percent of all households in New York. Most of the non-family households were people living alone, but some were comprised of people living in households in which no one was related to the householder.

NATIVITY AND LANGUAGE: Twenty-one percent of the people living in New York in 2005 were foreign born. Seventy-nine percent were native to the U.S. , including 65 percent who were born in New York. Among people at least five years old living in New York in 2005, twenty-eight (28) percent spoke a language other than English at home. Of those speaking a language other than English at home, 50 percent spoke Spanish and 50 percent spoke some other language; 45 percent reported that they did not speak English "very well."

GEOGRAPHIC MOBILITY: In 2005, 89 percent of the people at least one year old living in New York were living in the same residence one year earlier; 7 percent had moved during the past year from another residence in the same county, 2 percent from another county in the same state, 1 percent from another state, and 1 percent from abroad.

EDUCATION: In 2005, 84 percent of people 25 years and over had at least graduated from high school and 31 percent had a bachelor's degree or higher. Among people 16 to 19 years old, 6 percent were dropouts; they were not enrolled in school and had not graduated from high school. The total school enrollment in New York was 4.8 million in 2005. Nursery school and kindergarten enrollment was 547,000 and elementary or high school enrollment was 3.1 million children. College or graduate school enrollment was 1.2 million.

DISABILITY: In New York, among people at least five years old in 2005, 14 percent reported a disability. The likelihood of having a disability varied by age - from 6 percent of people 5 to 20 years old, to 11 percent of people 21 to 64 years old, and to 39 percent of those 65 and older.

INDUSTRIES: In 2005, for the employed population 16 years and older, the leading industries in New York were Educational services, health care and social assistance, 26 percent, and Retail Trade, 11 percent. Agriculture, forestry, fishing and hunting, and mining constitute 1 percent.

OCCUPATIONS AND TYPE OF EMPLOYER: Among the most common occupations were: Management, professional, and related occupations, 38 percent; Sales and office occupations, 26 percent; Service occupations, 18 percent; Production, transportation, and material moving occupations, 10 percent; and Construction, extraction, maintenance and repair occupations, 8 percent. Seventy-six percent of the people employed were Private wage and salary workers; 17 percent were Federal, state, or local government workers; and 6 percent were Self-employed in own not incorporated business workers - a category in which fishermen might be found.

TRAVEL TO WORK: Fifty-five percent of New York workers drove to work alone in 2005, 8 percent carpooled, 26 percent took public transportation, and 7 percent used other means. The remaining 3 percent worked at home. Among those who commuted to work, it took them on average 31.2 minutes to get to work.

INCOME: The median income of households in New York was $49,480. Seventy-nine percent of the households received earnings and 18 percent received retirement income other than Social Security. Twenty-seven percent of the households received Social Security. The average income from Social Security was $13,702. These income sources are not mutually exclusive; that is, some households received income from more than one source.

POVERTY AND PARTICIPATION IN GOVERNMENT PROGRAMS: In 2005, 14 percent of people were in poverty. Nineteen percent of related children under 18 were below the poverty level, compared with 13 percent of people 65 years old and over. Eleven percent of all families and 28 percent of families with a female householder and no husband present had incomes below the poverty level.

HOUSING CHARACTERISTICS: In 2005, New York had a total of 7.9 million housing units, 9 percent of which were vacant. Of the total housing units, 47 percent were in single-unit structures, 50 percent were in multi-unit structures, and 3 percent were mobile homes. Nine percent of the housing units were built since 1990.

OCCUPIED HOUSING UNIT CHARACTERISTICS: In 2005, New York had 7.1 million occupied housing units - 3.9 million (55 percent) owner occupied and 3.2 million (45 percent) renter occupied. Five percent of the households did not have telephone service and 29 percent of the households did not have access to a car, truck, or van for private use. Twenty-seven percent had two vehicles and another 12 percent had three or more.

HOUSING COSTS: The median monthly housing costs for mortgaged owners was $1,652, non-mortgaged owners $573, and renters $841. Thirty-nine percent of owners with mortgages, 22 percent of owners without mortgages, and 48 percent of renters in New York spent 30 percent or more of household income on housing.

Pennsylvania

POPULATION OF Pennsylvania: In 2005, Pennsylvania had a household population of 12.0 million - 6.2 million (52 percent) females and 5.8 million (48 percent) males. The median age was 39.7 years. Twenty-three percent of the population were under 18 years and 15 percent were 65 years and older.

For people reporting one race alone, 86 percent were White; 10 percent were Black or African American; less than 0.5 percent were American Indian and Alaska Native; 2 percent were Asian; less than 0.5 percent were Native Hawaiian and Other Pacific Islander, and 2 percent were Some other race. One percent reported Two or more races. Four percent of the people in Pennsylvania were Hispanic. Eighty-three percent of the people in Pennsylvania were White non-Hispanic. People of Hispanic origin may be of any race.

HOUSEHOLDS AND FAMILIES: In 2005 there were 4.9 million households in Pennsylvania. The average household size was 2.5 people.

Families made up 66 percent of the households in Pennsylvania. This figure includes both married-couple families (50 percent) and other families (16 percent). Non-family households made up 34 percent of all households in Pennsylvania. Most of the non-family households were people living alone, but some were comprised of people living in households in which no one was related to the householder.

NATIVITY AND LANGUAGE: Five percent of the people living in Pennsylvania in 2005 were foreign born. Ninety-five percent were native, including 76 percent who were born in Pennsylvania.

Among people at least five years old living in Pennsylvania in 2005, 9 percent spoke a language other than English at home. Of those speaking a language other than English at home, 39 percent spoke Spanish and 61 percent spoke some other language; 38 percent reported that they did not speak English "very well."

GEOGRAPHIC MOBILITY: In 2005, 88 percent of the people at least one year old living in Pennsylvania were living in the same residence one year earlier; 7 percent had moved during the past year from another residence in the same county, 2 percent from another county in the same state, 2 percent from another state, and less than 0.5 percent from abroad.

EDUCATION: In 2005, 87 percent of people 25 years and over had at least graduated from high school and 26 percent had a bachelor's degree or higher. Among people 16 to 19 years old, 7 percent were dropouts; they were not enrolled in school and had not graduated from high school.

The total school enrollment in Pennsylvania was 2.9 million in 2005. Nursery school and kindergarten enrollment was 314,000 and elementary or high school enrollment was 1.9 million children. College or graduate school enrollment was 683,000.

DISABILITY: In Pennsylvania, among people at least five years old in 2005, 16 percent reported a disability. The likelihood of having a disability varied by age - from 8 percent of people 5 to 20 years old, to 13 percent of people 21 to 64 years old, and to 39 percent of those 65 and older.

INDUSTRIES: In 2005, for the employed population 16 years and older, the leading industries in Pennsylvania were Educational services, health care and social assistance, 24 percent, and Manufacturing, 14 percent. Agriculture, forestry, fishing and hunting, and mining constitute 1 percent.

OCCUPATIONS AND TYPE OF EMPLOYER: Among the most common occupations were: Management, professional, and related occupations, 34 percent; Sales and office occupations, 26 percent; Service occupations, 16 percent; Production, transportation, and material moving occupations, 14 percent; and Construction, extraction, maintenance and repair occupations, 9 percent. Eighty-one percent of the people employed were Private wage and salary workers; 12 percent were Federal, state, or local government workers; and 6 percent were Self-employed in own not incorporated business workers - a category in which fishermen might be found.

TRAVEL TO WORK: Seventy-seven percent of Pennsylvania workers drove to work alone in 2005, 10 percent carpooled, 5 percent took public transportation, and 5 percent used other means. The remaining 3 percent worked at home. Among those who commuted to work, it took them on average 25.1 minutes to get to work.

INCOME: The median income of households in Pennsylvania was $44,537. Seventy-seven percent of the households received earnings and 20 percent received retirement income other than Social Security. Thirty-one percent of the households received Social Security. The average income from Social Security was $13,709. These income sources are not mutually exclusive; that is, some households received income from more than one source.

POVERTY AND PARTICIPATION IN GOVERNMENT PROGRAMS: In 2005, 12 percent of people were in poverty. Seventeen percent of related children under 18 were below the poverty level, compared with 9 percent of people 65 years old and over. Nine percent of all families and 28 percent of families with a female householder and no husband present had incomes below the poverty level.

HOUSING CHARACTERISTICS: In 2005, Pennsylvania had a total of 5.4 million housing units, 10 percent of which were vacant. Of the total housing units, 75 percent were in single-unit structures, 21 percent were in multi-unit structures, and 5 percent were mobile homes. Fourteen percent of the housing units were built since 1990.

OCCUPIED HOUSING UNIT CHARACTERISTICS: In 2005, Pennsylvania had 4.9 million occupied housing units - 3.5 million (71 percent) owner occupied and 1.4 million (29 percent) renter occupied. Four percent of the households did not have telephone service and 11 percent of the households did not have access to a car, truck, or van for private use. Multi Vehicle households were not rare. Thirty-seven percent had two vehicles and another 18 percent had three or more.

HOUSING COSTS: The median monthly housing costs for mortgaged owners was $1,196, non-mortgaged owners $399, and renters $647. Thirty-one percent of owners with mortgages, 17 percent of owners without mortgages, and 43 percent of renters in Pennsylvania spent 30 percent or more of household income on housing.

New Jersey

POPULATION: In 2005, New Jersey had a household population of 8.5 million - 4.4 million (51 percent) females and 4.1 million (49 percent) males. The median age was 38 years. Twenty-five percent of the population were under 18 years and 13 percent were 65 years and older.

For people reporting one race alone, 71 percent were White; 13 percent were Black or African American; less than 0.5 percent were American Indian and Alaska Native; 7 percent were Asian; less than 0.5 percent were Native Hawaiian and Other Pacific Islander, and 8 percent were Some other race. One percent reported two or more races. Fifteen percent of the people in New Jersey were Hispanic. Sixty-three percent of the people in New Jersey were White non-Hispanic. People of Hispanic origin may be of any race.

HOUSEHOLDS AND FAMILIES: In 2005 there were 3.1 million households in New Jersey. The average household size was 2.7 people. Families made up 69 percent of the households in New Jersey. This figure includes both married-couple families (52 percent) and other families (17 percent). Non-family households made up 31 percent of all households in New Jersey. Most of the non-family households were people living alone, but some were comprised of people living in households in which no one was related to the householder.

NATIVITY AND LANGUAGE: Twenty percent of the people living in New Jersey in 2005 were foreign born. Eighty percent were native to the U.S., including 53 percent who were born in New Jersey. Among people at least five years old living in New Jersey in 2005, twenty-seven (27) percent spoke a language other than English at home. Of those speaking a language other than English at home, 49 percent spoke Spanish and 51 percent spoke some other language; 42 percent reported that they did not speak English "very well."

GEOGRAPHIC MOBILITY: In 2005, 88 percent of the people at least one year old living in New Jersey were living in the same residence one year earlier; 7 percent had moved during the past year from another residence in the same county, 2 percent from another county in the same state, 2 percent from another state, and 1 percent from abroad.

EDUCATION: In 2005, 86 percent of people 25 years and over had at least graduated from high school and 34 percent had a bachelor's degree or higher. Among people 16 to 19 years old, 6 percent were dropouts; they were not enrolled in school and had not graduated from high school. The total school enrollment in New Jersey was 2.3 million in 2005. Nursery school and kindergarten enrollment was 303,000 and elementary or high school enrollment was 1.5 million children. College or graduate school enrollment was 510,000.

DISABILITY: In New Jersey, among people at least five years old in 2005, 12 percent reported a disability. The likelihood of having a disability varied by age - from 5 percent of people 5 to 20 years old, to 9 percent of people 21 to 64 years old, and to 36 percent of those 65 and older.

INDUSTRIES: In 2005, for the employed population 16 years and older, the leading industries in New Jersey were Educational services, health care and social assistance, 21 percent, and Professional, scientific, and management, and administrative and waste management services, 12 percent. Agriculture, forestry, fishing and hunting, and mining constitute less than 1 percent.

OCCUPATIONS AND TYPE OF EMPLOYER: Among the most common occupations were: Management, professional, and related occupations, 38 percent; Sales and office occupations, 27 percent; Service occupations, 15 percent; Production, transportation, and material moving occupations, 10 percent; and Construction, extraction, maintenance and repair occupations, 8 percent. Eighty percent of the people employed were Private wage and salary workers; 14 percent were Federal, state, or local government workers; and 5 percent were Self-employed in own not incorporated business workers - a category in which fishermen might be found.

TRAVEL TO WORK: Seventy-three percent of New Jersey workers drove to work alone in 2005, 9 percent carpooled, 10 percent took public transportation, and 5 percent used other means. The remaining 3 percent worked at home. Among those who commuted to work, it took them on average 29.5 minutes to get to work.

INCOME: The median income of households in New Jersey was $61,672. Eighty-one percent of the households received earnings and 18 percent received retirement income other than Social Security. Twenty-eight percent of the households received Social Security. The average income from Social Security was $14,509. These income sources are not mutually exclusive; that is, some households received income from more than one source.

POVERTY AND PARTICIPATION IN GOVERNMENT PROGRAMS: In 2005, 9 percent of people were in poverty. Twelve percent of related children under 18 were below the poverty level, compared with 9 percent of people 65 years old and over. Seven percent of all families and 21 percent of families with a female householder and no husband present had incomes below the poverty level.

HOUSING CHARACTERISTICS: In 2005, New Jersey had a total of 3.4 million housing units, 9 percent of which were vacant. Of the total housing units, 63 percent were in single-unit structures, 36 percent were in multi-unit structures, and 1 percent were mobile homes. Fifteen percent of the housing units were built since 1990.

OCCUPIED HOUSING UNIT CHARACTERISTICS: In 2005, New Jersey had 3.1 million occupied housing units - 2.1 million (67 percent) owner occupied and 1.0 million (33 percent) renter occupied. Four percent of the households did not have telephone service and 12 percent of the households did not have access to a car, truck, or van for private use. Multi Vehicle households were not rare. Thirty-eight percent had two vehicles and another 17 percent had three or more.

HOUSING COSTS: The median monthly housing costs for mortgaged owners was $1,938, non-mortgaged owners $730, and renters $935. Forty-one percent of owners with mortgages, 28 percent of owners without mortgages, and 48 percent of renters in New Jersey spent 30 percent or more of household income on housing.

Delaware

POPULATION: In 2005, Delaware had a household population of 819,000 - 422,000 (52 percent) females and 397,000 (48 percent) males. The median age was 37.9 years. Twenty-four percent of the population were under 18 years and 13 percent were 65 years and older. For people reporting one race alone, 75 percent were White; 20 percent were Black or African American; less than 0.5 percent were American Indian and Alaska Native; 3 percent were Asian; less than 0.5 percent were Native Hawaiian and Other Pacific Islander, and 2 percent were Some other race. One percent reported two or more races. Six percent of the people in Delaware were Hispanic. Seventy percent of the people in Delaware were White non-Hispanic. People of Hispanic origin may be of any race.

HOUSEHOLDS AND FAMILIES: In 2005 there were 318,000 households in Delaware. The average household size was 2.6 people. Families made up 68 percent of the households in Delaware. This figure includes both married-couple families (50 percent) and other families (18 percent). Non-family households made up 32 percent of all households in Delaware. Most of the non-family households were people living alone, but some were comprised of people living in households in which no one was related to the householder.

NATIVITY AND LANGUAGE: Eight percent of the people living in Delaware in 2005 were foreign born. Ninety-two percent were native to the U.S., including 46 percent who were born in Delaware. Among people at least five years old living in Delaware in 2005, 12 percent spoke a language other than English at home. Of those speaking a language other than English at home, 54 percent spoke Spanish and 46 percent spoke some other language; 42 percent reported that they did not speak English "very well."

GEOGRAPHIC MOBILITY: In 2005, eight-four (84) percent of the people age one year or older that lived in Delaware were living in the same residence one year earlier; 10 percent had moved during the past year from another residence in the same county, 1 percent from another county in the same state, 4 percent from another state, and 1 percent from abroad.

EDUCATION: In 2005, 86 percent of people 25 years and over had at least graduated from high school and 28 percent had a bachelor's degree or higher. Among people 16 to 19 years old, 9 percent were dropouts; they were not enrolled in school and had not graduated from high school.

The total school enrollment in Delaware was 200,000 in 2005. Nursery school and kindergarten enrollment was 25,000 and elementary or high school enrollment was 128,000 children. College or graduate school enrollment was 46,000.

DISABILITY: In Delaware, among people at least five years old in 2005, 15 percent reported a disability. The likelihood of having a disability varied by age - from 8 percent of people 5 to 20 years old, to 13 percent of people 21 to 64 years old, and to 36 percent of those 65 and older.

INDUSTRIES: In 2005, for the employed population 16 years and older, the leading industries in Delaware were Educational services, health care and social assistance, 22 percent, and Retail Trade, 11 percent. Agriculture, forestry, fishing and hunting, and mining constitute 1 percent.

OCCUPATIONS AND TYPE OF EMPLOYER: Among the most common occupations were: Management, professional, and related occupations, 37 percent; Sales and office occupations, 26 percent; Service occupations, 15 percent; Production, transportation, and material moving occupations, 11 percent; and Construction, extraction, maintenance and repair occupations, 10 percent. Eighty-one percent of the people employed were Private wage and salary workers; 13 percent were Federal, state, or local government workers; and 6 percent were Self-employed in own not incorporated business workers - a category in which fishermen might be found.

TRAVEL TO WORK: Eighty percent of Delaware workers drove to work alone in 2005, 11 percent carpooled, 2 percent took public transportation, and 3 percent used other means. The remaining 4 percent worked at home. Among those who commuted to work, it took them on average 23.7 minutes to get to work.

INCOME: The median income of households in Delaware was $52,499. Eighty-one percent of the households received earnings and 23 percent received retirement income other than Social Security. Twenty-eight percent of the households received Social Security. The average income from Social Security was $14,289. These income sources are not mutually exclusive; that is, some households received income from more than one source.

POVERTY AND PARTICIPATION IN GOVERNMENT PROGRAMS: In 2005, 10 percent of people were in poverty. Fourteen percent of related children under 18 were below the poverty level, compared with 7 percent of people 65 years old and over. Eight percent of all families and 24 percent of families with a female householder and no husband present had incomes below the poverty level.

HOUSING CHARACTERISTICS: In 2005, Delaware had a total of 375,000 housing units, 15 percent of which were vacant. Of the total housing units, 70 percent were in single-unit structures, 18 percent were in multi-unit structures, and 11 percent were mobile homes. Twenty-eight percent of the housing units were built since 1990.

OCCUPIED HOUSING UNIT CHARACTERISTICS: In 2005, Delaware had 318,000 occupied housing units - 230,000 (72 percent) owner occupied and 88,000 (28 percent) renter occupied. Three percent of the households did not have telephone service and 7 percent of the households did not have access to a car, truck, or van for private use. Multi Vehicle households were not rare. Forty-one percent had two vehicles and another 19 percent had three or more.

HOUSING COSTS: The median monthly housing costs for mortgaged owners was $1,246, non-mortgaged owners $326, and renters $793. Twenty-nine percent of owners with mortgages, 13 percent of owners without mortgages, and 42 percent of renters in Delaware spent 30 percent or more of household income on housing.

Maryland

POPULATION: In 2005, Maryland had a household population of 5.5 million - 2.8 million (52 percent) females and 2.6 million (48 percent) males. The median age was 37.1 years. Twenty-six percent of the population were under 18 years and 11 percent were 65 years and older. For people reporting one race alone, 63 percent were White; 29 percent were Black or African American; less than 0.5 percent were American Indian and Alaska Native; 5 percent were Asian; less than 0.5 percent were Native Hawaiian and Other Pacific Islander, and 3 percent were Some other race. Two percent reported two or more races. Six percent of the people in Maryland were Hispanic. Fifty-nine percent of the people in Maryland were White non-Hispanic. People of Hispanic origin may be of any race.

HOUSEHOLDS AND FAMILIES: In 2005 there were 2.1 million households in Maryland. The average household size was 2.6 people. Families made up 67 percent of the households in Maryland. This figure includes both married-couple families (49 percent) and other families (18 percent). Non-family households made up 33 percent of all households in Maryland. Most of the non-family households were people living alone, but some were comprised of people living in households in which no one was related to the householder.

NATIVITY AND LANGUAGE: Twelve percent of the people living in Maryland in 2005 were foreign born. Eighty-eight percent were native to the U.S., including 48 percent who were born in Maryland. Among people at least age five or older that lived in Maryland in 2005, fourteen (14) percent spoke a language other than English at home. Of those speaking a language other than English at home, 40 percent spoke Spanish and 60 percent spoke some other language; 41 percent reported that they did not speak English "very well."

GEOGRAPHIC MOBILITY: In 2005, 85 percent of the people age one year or older that lived in Maryland were living in the same residence one year earlier; 8 percent had moved during the past year from another residence in the same county, 3 percent from another county in the same state, 3 percent from another state, and 1 percent from abroad.

EDUCATION: In 2005, 87 percent of people 25 years and over had at least graduated from high school and 35 percent had a bachelor's degree or higher. Among people 16 to 19 years old, 7 percent were dropouts; they were not enrolled in school and had not graduated from high school. The total school enrollment in Maryland was 1.5 million in 2005. Nursery school and kindergarten enrollment was 162,000 and elementary or high school enrollment was 944,000 children. College or graduate school enrollment was 378,000.

DISABILITY: In Maryland, among people at least five years old in 2005, 13 percent reported a disability. The likelihood of having a disability varied by age - from 7 percent of people 5 to 20 years old, to 10 percent of people 21 to 64 years old, and to 37 percent of those 65 and older.

INDUSTRIES: In 2005, for the employed population 16 years and older, the leading industries in Maryland were Educational services, health care and social assistance, 21 percent, and Professional, scientific, and management, and administrative and waste management services, 14 percent. Agriculture, forestry, fishing and hunting, and mining constitute 1 percent.

OCCUPATIONS AND TYPE OF EMPLOYER: Among the most common occupations were: Management, professional, and related occupations, 41 percent; Sales and office occupations, 26 percent; Service occupations, 15 percent; Construction, extraction, maintenance and repair occupations, 9 percent; and Production, transportation, and material moving occupations, 8 percent. Seventy-two percent of the people employed were Private wage and salary workers; 22 percent were Federal, state, or local government workers; and 6 percent were Self-employed in own not incorporated business workers - a category in which fishermen might be found.

TRAVEL TO WORK: Seventy-four percent of Maryland workers drove to work alone in 2005, 11 percent carpooled, 8 percent took public transportation, and 3 percent used other means. The remaining 4 percent worked at home. Among those who commuted to work, it took them on average 30.8 minutes to get to work.

INCOME: The median income of households in Maryland was $61,592. Eighty-four percent of the households received earnings and 20 percent received retirement income other than Social Security. Twenty-three percent of the households received Social Security. The average income from Social Security was $13,246. These income sources are not mutually exclusive; that is, some households received income from more than one source.

POVERTY AND PARTICIPATION IN GOVERNMENT PROGRAMS: In 2005, 8 percent of people were in poverty. Eleven percent of related children under 18 were below the poverty level, compared with 8 percent of people 65 years old and over. Six percent of all families and 19 percent of families with a female householder and no husband present had incomes below the poverty level.

HOUSING CHARACTERISTICS: In 2005, Maryland had a total of 2.3 million housing units, 8 percent of which were vacant. Of the total housing units, 72 percent were in single-unit structures, 26 percent were in multi-unit structures, and 2 percent were mobile homes. Twenty-two percent of the housing units were built since 1990.

OCCUPIED HOUSING UNIT CHARACTERISTICS: In 2005, Maryland had 2.1 million occupied housing units - 1.4 million (69 percent) owner occupied and 647,000 (31 percent) renter occupied. Four percent of the households did not have telephone service and 9 percent of the households did not have access to a car, truck, or van for private use. Multi Vehicle households were not rare. Thirty-seven percent had two vehicles and another 21 percent had three or more.

HOUSING COSTS: The median monthly housing costs for mortgaged owners was $1,561, non-mortgaged owners $424, and renters $891. Thirty-one percent of owners with mortgages, 13 percent of owners without mortgages, and 45 percent of renters in Maryland spent 30 percent or more of household income on housing.

Virginia

POPULATION: In 2005, Virginia had a household population of 7.3 million - 3.8 million (51 percent) females and 3.6 million (49 percent) males. The median age was 37.2 years. Twenty-five percent of the population were under 18 years and 11 percent were 65 years and older. For people reporting one race alone, 73 percent were White; 19 percent were Black or African American; less than 0.5 percent were American Indian and Alaska Native; 5 percent were Asian; less than 0.5 percent were Native Hawaiian and Other Pacific Islander, and 2 percent were Some other race. Two percent reported two or more races. Six percent of the people in Virginia were Hispanic. Sixty-eight percent of the people in Virginia were White non-Hispanic. People of Hispanic origin may be of any race.

HOUSEHOLDS AND FAMILIES: In 2005 there were 2.9 million households in Virginia. The average household size was 2.5 people. Families made up 67 percent of the households in Virginia. This figure includes both married-couple families (51 percent) and other families (16 percent). Non-family households made up 33 percent of all households in Virginia. Most of the non-family households were people living alone, but some were comprised of people living in households in which no one was related to the householder.

NATIVITY AND LANGUAGE: Ten percent of the people living in Virginia in 2005 were foreign born. Ninety percent were native to the U.S., including 51 percent who were born in Virginia. Among people at least five years old living in Virginia in 2005, 13 percent spoke a language other than English at home. Of those speaking a language other than English at home, 45 percent spoke Spanish and 55 percent spoke some other language; 43 percent reported that they did not speak English "very well."

GEOGRAPHIC MOBILITY: In 2005, 84 percent of the people age one year or older that lived in Virginia were living in the same residence one year earlier; 7 percent had moved during the past year from another residence in the same county, 5 percent from another county in the same state, 3 percent from another state, and 1 percent from abroad.

EDUCATION: In 2005, 85 percent of people 25 years and over had at least graduated from high school and 33 percent had a bachelor's degree or higher. Among people 16 to 19 years old, 6 percent were dropouts; they were not enrolled in school and had not graduated from high school. The total school enrollment in Virginia was 1.9 million in 2005. Nursery school and kindergarten enrollment was 227,000 and elementary or high school enrollment was 1.2 million children. College or graduate school enrollment was 465,000.

DISABILITY: In Virginia, among people at least five years old in 2005, 14 percent reported a disability. The likelihood of having a disability varied by age - from 6 percent of people 5 to 20 years old, to 11 percent of people 21 to 64 years old, and to 40 percent of those 65 and older.

INDUSTRIES: In 2005, for the employed population 16 years and older, the leading industries in Virginia were Educational services, health care and social assistance, 19 percent, and Professional, scientific, and management, and administrative and waste management services, 13 percent. Agriculture, forestry, fishing and hunting, and mining constitute 1 percent.

OCCUPATIONS AND TYPE OF EMPLOYER: Among the most common occupations were: Management, professional, and related occupations, 39 percent; Sales and office occupations, 25 percent; Service occupations, 15 percent; Production, transportation, and material moving occupations, 11 percent; and

Construction, extraction, maintenance and repair occupations, 10 percent. Seventy-four percent of the people employed were Private wage and salary workers; 20 percent were Federal, state, or local government workers; and 6 percent were Self-employed in own not incorporated business workers - a category in which fishermen might be found.

TRAVEL TO WORK: Seventy-eight percent of Virginia workers drove to work alone in 2005, 11 percent carpooled, 4 percent took public transportation, and 3 percent used other means. The remaining 3 percent worked at home. Among those who commuted to work, it took them on average 27 minutes to get to work.

INCOME: The median income of households in Virginia was $54,240. Eighty-three percent of the households received earnings and 20 percent received retirement income other than Social Security. Twenty-five percent of the households received Social Security. The average income from Social Security was $13,039. These income sources are not mutually exclusive; that is, some households received income from more than one source.

POVERTY AND PARTICIPATION IN GOVERNMENT PROGRAMS: In 2005, 10 percent of people were in poverty. Thirteen percent of related children under 18 were below the poverty level, compared with 10 percent of people 65 years old and over. Seven percent of all families and 24 percent of families with a female householder and no husband present had incomes below the poverty level.

HOUSING CHARACTERISTICS: In 2005, Virginia had a total of 3.2 million housing units, 9 percent of which were vacant. Of the total housing units, 73 percent were in single-unit structures, 22 percent were in multi-unit structures, and 6 percent were mobile homes. Twenty-six percent of the housing units were built since 1990.

OCCUPIED HOUSING UNIT CHARACTERISTICS: In 2005, Virginia had 2.9 million occupied housing units - 2.0 million (70 percent) owner occupied and 877,000 (30 percent) renter occupied. Four percent of the households did not have telephone service and 6 percent of the households did not have access to a car, truck, or van for private use. Multi Vehicle households were not rare. Thirty-eight percent had two vehicles and another 25 percent had three or more.

HOUSING COSTS: The median monthly housing costs for mortgaged owners was $1,411, non-mortgaged owners $328, and renters $812. Thirty-one percent of owners with mortgages, 12 percent of owners without mortgages, and 42 percent of renters in Virginia spent 30 percent or more of household income on housing.

North Carolina

POPULATION: In 2005, North Carolina had a household population of 8.4 million - 4.3 million (51 percent) females and 4.1 million (49 percent) males. The median age was 36.2 years. Twenty-five percent of the population were under 18 years and 12 percent were 65 years and older. For people reporting one race alone, 72 percent were White; 21 percent were Black or African American; 1 percent were American Indian and Alaska Native; 2 percent were Asian; less than 0.5 percent were Native Hawaiian and Other Pacific Islander, and 3 percent were Some other race. One percent reported two or more races. Six percent of the people in North Carolina were Hispanic. Sixty-eight percent of the people in North Carolina were White non-Hispanic. People of Hispanic origin may be of any race.

HOUSEHOLDS AND FAMILIES: In 2005 there were 3.4 million households in North Carolina. The average household size was 2.5 people. Families made up 67 percent of the households in North Carolina. This figure includes both married-couple families (49 percent) and other families (18 percent). Non-family households made up 33 percent of all households in North Carolina. Most of the non-family households were people living alone, but some were comprised of people living in households in which no one was related to the householder.

NATIVITY AND LANGUAGE: Seven percent of the people living in North Carolina in 2005 were foreign born. Ninety-three percent were native to the U.S., including 61 percent who were born in North Carolina. Among people age five years or older that lived in North Carolina in 2005, 9 percent spoke a language other than English at home. Of those speaking a language other than English at home, 66 percent spoke Spanish and 34 percent spoke some other language; 50 percent reported that they did not speak English "very well."

GEOGRAPHIC MOBILITY: In 2005, 83 percent of the people at least one year old living in North Carolina were living in the same residence one year earlier; 10 percent had moved during the past year from another residence in the same county, 3 percent from another county in the same state, 3 percent from another state, and 1 percent from abroad.

EDUCATION: In 2005, 82 percent of people 25 years and over had at least graduated from high school and 25 percent had a bachelor's degree or higher. Among people 16 to 19 years old, 9 percent were dropouts; they were not enrolled in school and had not graduated from high school. The total school enrollment in North Carolina was 2.2 million in 2005. Nursery school and kindergarten enrollment was 258,000 and elementary or high school enrollment was 1.4 million children. College or graduate school enrollment was 509,000.

DISABILITY: In North Carolina, among people at least five years old in 2005, 16 percent reported a disability. The likelihood of having a disability varied by age - from 7 percent of people 5 to 20 years old, to 14 percent of people 21 to 64 years old, and to 43 percent of those 65 and older.

INDUSTRIES: In 2005, for the employed population 16 years and older, the leading industries in North Carolina were Educational services, health care and social assistance, 21 percent, and Manufacturing, 15 percent. Agriculture, forestry, fishing and hunting, and mining constitute 1 percent.

OCCUPATIONS AND TYPE OF EMPLOYER: Among the most common occupations were: Management, professional, and related occupations, 32 percent; Sales and office occupations, 24 percent; Service occupations, 16 percent; Production, transportation, and material moving occupations, 15 percent; and Construction, extraction, maintenance and repair occupations, 12 percent. Seventy-eight percent of the people employed were Private wage and salary workers; 15 percent were Federal, state, or local government workers; and 7 percent were Self-employed in own not incorporated business workers - a category in which fishermen might be found.

TRAVEL TO WORK: Eighty-one percent of North Carolina workers drove to work alone in 2005, 12 percent carpooled, 1 percent took public transportation, and 3 percent used other means. The remaining 3 percent worked at home. Among those who commuted to work, it took them on average 23.3 minutes to get to work.

INCOME: The median income of households in North Carolina was $40,729. Eighty-one percent of the households received earnings and 17 percent received retirement income other than Social Security. Twenty-seven percent of the households received Social Security. The average income from Social Security was $12,987. These income sources are not mutually exclusive; that is, some households received income from more than one source.

POVERTY AND PARTICIPATION IN GOVERNMENT PROGRAMS: In 2005, 15 percent of people were in poverty. Twenty-one percent of related children under

18 were below the poverty level, compared with 12 percent of people 65 years old and over. Twelve percent of all families and 34 percent of families with a female householder and no husband present had incomes below the poverty level.

HOUSING CHARACTERISTICS: In 2005, North Carolina had a total of 3.9 million housing units, 13 percent of which were vacant. Of the total housing units, 68 percent were in single-unit structures, 17 percent were in multi-unit structures, and 15 percent were mobile homes. Thirty-four percent of the housing units were built since 1990.

OCCUPIED HOUSING UNIT CHARACTERISTICS: In 2005, North Carolina had 3.4 million occupied housing units - 2.3 million (68 percent) owner occupied and 1.1 million (32 percent) renter occupied. Six percent of the households did not have telephone service and 6 percent of the households did not have access to a car, truck, or van for private use. Multi Vehicle households were not rare. Thirty-nine percent had two vehicles and another 23 percent had three or more.

HOUSING COSTS: The median monthly housing costs for mortgaged owners was $1,089, non-mortgaged owners $302, and renters $635. Thirty-one percent of owners with mortgages, 14 percent of owners without mortgages, and 42 percent of renters in North Carolina spent 30 percent or more of household income on housing.

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7.0 Environmental Consequences

7.1 Alternatives to Designate Essential Fish Habitat (EFH)

In addition to the no action alternative (i.e., status quo conditions in the Council's FMPs if this amendment is not completed), the Council reviewed and refined through four main alternative and two other minor alternatives the EFH designations of all twenty-seven (27) species under management by the Council. The preferred alternatives selected for public comment are listed below.

Table 114. Preferred Alternatives for EFH Designation Alternatives

Species	Eggs	Larvae	Juveniles	Adults
American plaice	NAD	NAD	3C	3C
Atlantic cod	2E	2E	3E	3E
Atlantic halibut	3	3	3	3
Atlantic herring	5	NAD	2E	2E
Atlantic salmon	No PA	No PA	No PA	No PA
Atlantic sea scallop	NAD	NAD	5	5
Barndoor skate	NAD	N/A	3D	3D
Clearnose skate	NAD	N/A	3C	3C
Deep-sea red crab	NAD	3A	3A	3A
Haddock	NAD	N/A	3D	3E
Little skate	NAD	N/A	3E	3E
Monkfish	4	4	3C	3C
Ocean pout	2C	2	3C	3C
Offshore hake	NAD	NAD	5	5
Pollock	2D	2D	3D	3D
Red hake	3C	3C	3C	3D
Redfish	N/A	3D	3D	3D
Rosette skate	NAD	N/A	3C	3C
Silver hake	2D	2D	3C	3C

Species	Eggs	Larvae	Juveniles	Adults
Smooth skate	NAD	N/A	3D	3D
Thorny skate	NAD	N/A	3C	3D
White hake	2D	2D	3D	3D
Windowpane flounder	NAD	NAD	3E	3E
Winter flounder	5A	5A	3E	3E
Winter Skate	NAD	NAD	3E	3E
Witch flounder	NAD	N/A	3D	3E
Yellowtail flounder	NAD	NAD	3D	3D

***No PA**: indicates no preferred alternative selected by Council*
***N/A**: indicates that this does not exist as a distinct life history stage for this species.*
***NAD**: indicates No Alternative Designation due to lack of new information.*

An alternative that is identified as "preferred" reflects the Council's favored approach to designating EFH as this time. The Council selected preferred alternatives based on the information and analyses contained within the DSEIS (see Table 3). The analysis included available ecological, environmental and fisheries information and data relevant to each managed species, the habitat requirements by life stage and the species' distribution and habitat usage (see Section 4.1). The Council assessed this information and selected alternatives with text descriptions and geographic coverages that best represented essential habitats used by each species and life stage. This was done in a risk-averse manner such that the preferred alternatives included areas that were larger than "core habitats" that are potentially linked to high species productivity, but smaller than the entire current or historical range of the target species and life stage. Specifically, the Council selected preferred alternatives based on the best available scientific information and alternatives that addressed the following considerations: generally contiguous areas, good spawning ground coverage, areas not included in the NMFS or state survey but are known fishing areas, spawning grounds or important habitat areas.

7.1.1 Impacts on Biological and Physical Environment (VEC 1)

The impact analysis focuses on the valued ecosystem components (VECs) that were identified for the DSEIS and described in detail in Section 6.0 (Affected Environment). The VECs for consideration in the DSEIS: Physical and biological environment, economic environment and social environment. VECs represent the resources, areas, and human communities that may be affected by a range of alternatives under consideration and are the focus of the DSEIS since they are the "place" where the impacts of management actions are exhibited. An analysis of impacts is performed on each VEC to assess whether the direct/indirect effects of an alternative adds to or subtracts from the effects that are already affecting the VEC under the Status Quo or No Action condition. Additionally, considering different ways to designate EFH will lead to deliberations by the Council during Phase 2 about whether an how to restrict fishing gear and practices as a function of EFH attributes. Any new or expansion of current restrictions to protect EFH will have a positive effect on the physical and biological environment. However, until specific regulations are promulgated in Phase 2, no impact analysis can be conducted.

For reference, a complete description of the alternatives to designate EFH in this amendment is provided in Section 4.1.

7.1.2 Impacts to Physical and Biological Environment (VEC 1)

7.1.2.1 Introduction

This section evaluates the impacts of the range of alternatives (relative to the No Action alternative) on the affected physical and biological environment (VEC 1) described in Section 6.1 Each of the alternatives for describing EFH uses different methodologies and results in different areas being identified as EFH for managed species. Describing and identifying EFH does not alone have any direct environmental impacts, but could lead to indirect impacts because EFH designation would trigger Magnuson-Stevens Act requirements to minimize adverse effects of fishing on EFH and to consider the effects of non-fishing actions on EFH.

The effects of designating EFH are difficult to analyze because they are indirect and dependent on separate future actions by a variety of entities in addition to NMFS and the Council (e.g., federal agencies that may impose conditions on permits they issue for actions that could harm EFH). Those future actions and the associated environmental consequences are hard to predict, although reasonable conclusions about the likely effects can be drawn from experience gained since the first EFH designations took effect in October 1998. The following section provides a qualitative analysis of the effects to the biological and physical environment (VEC) of designating EFH.

To the extent possible, the discussion in this section determines whether the likely effects for each issue are negative (-), neutral (0), positive (+), or unknown (U). The analysis compares these effects to status quo conditions (Alternative 1). In general, if the analysis suggests either a potential effect or a known effect, the DSEIS assigns a rating of + or - . The DSEIS assigns a rating of 0 if the analysis suggests no discernible effect, and a rating of U if there is no basis for inferring the effect. This approach is used because the analysis of the EFH description and identification alternatives is necessarily qualitative.

Although the remainder of this section discusses the environmental consequences of the alternatives for describing and identifying EFH, the results of the analysis are very similar for some of the alternatives, and it can be difficult to distinguish between them.

The Council's fishery management plans (FMP) contain fishery management units (FMU) that include twenty-seven (27) species (Table 115). The environmental consequences described in Sections 7.1.2.2 - 7.1.2.6 are applicable to all of the species under management by the Council with the exception of Deep-sea red crab and Atlantic salmon. Due to the distinctly different life histories of these two species, it was necessary to develop a separate set of EFH designation alternatives using distinct methodologies not consistent with the other twenty-five (25) species.

Table 115. List of species under management by the New England Fishery Management Council*

Official Common Name	**Scientific Name**
American plaice	*Hippoglossoides platessoides*
Atlantic cod	*Gadus morhua*
Atlantic halibut	*Hippoglossus hippoglossus*
Atlantic herring	*Clupea harengus*
Atlantic salmon	*Salmo salar*
Atlantic sea scallop	*Placopecten magellanicus*
Barndoor skate	*Dipturus laevis*
Clearnose skate	*Raja eglanteria*
Deep-sea red crab	*Chaceon (Geryon) quinquedens*
Haddock	*Melanogrammus aeglefinus*
Little skate	*Leucoraja erinacea*
Monkfish	*Lophius americanus*
Ocean pout	*Macrozoarces americanus*
Offshore hake	*Merluccius albidus*
Pollock	*Pollachius virens*
Red hake	*Urophycis chuss*
Redfish	*Sebastes spp.*
Rosette skate	*Leucoraja garmani vriginica*
Silver hake	*Merluccius bilinearis*
Smooth skate	*Malacoraja senta*
Thorny skate	*Amblyraja radiata*

Official Common Name	**Scientific Name**
White hake	*Urophycis tenuis*
Windowpane flounder	*Scophthalmus aquosus*
Winter flounder	*Pseudopleuronectes americanus*
Winter skate	*Leucoraja ocellata*
Witch flounder	*Glyptocephalus cynoglossus*
Yellowtail flounder	*Limanda ferruginea*

** Monkfish is jointly managed by the MAFMC with the NEFMC as the Primary Council. Also, the NEFMC jointly manages Dogfish but is not the Primary Council and, as such, is not responsible for the EFH requirements under the SFA.*

7.1.2.2 Impacts of Alternative 1 (No Action)

Under Alternative 1, EFH description and identification would remain exactly as they were approved in FMP Amendments in 1998 (No Action). EFH would remain described and identified as those habitats currently **described in the EFH text description** within a general distribution for a life stage of a species, for all stock conditions. EFH would be a subset of the geographic range of each life stage, encompassing an area and represents a continuation of status quo conditions. Therefore, Alternative 1 would have no effect relative to existing conditions for habitat. This analysis includes information on the effects of all other EFH designation alternatives as compared to the Status Quo.

7.1.2.3 Impacts of Alternative 2 (+)

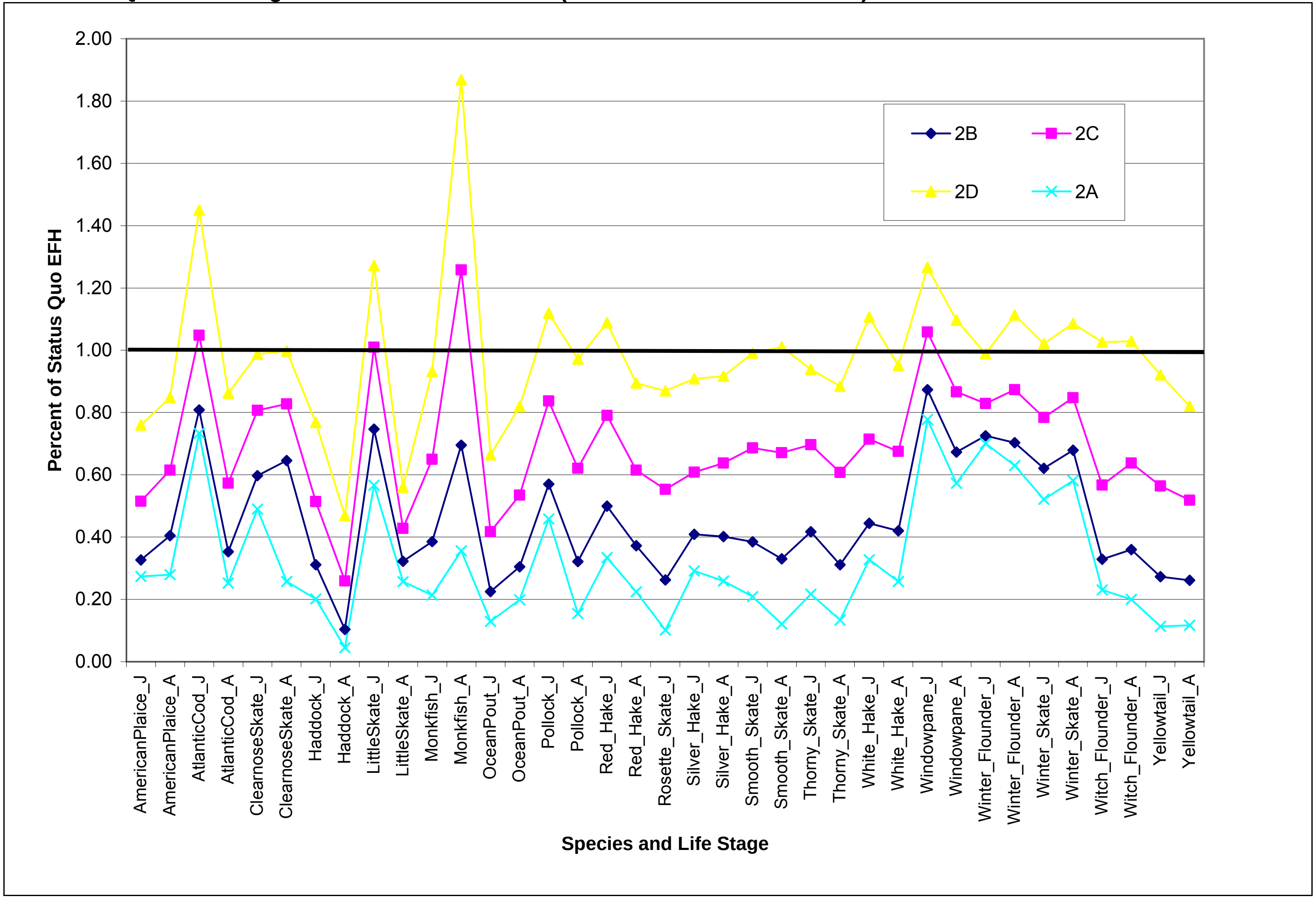
Under Alternative 2, EFH designations would be revised and, in most cases, the geographic extent of individual EFH designations would be about the same as in the No Action alternative. Alternative 2 uses the same types of information as Alternative 1 (See Appendix A), but applies the revised regulatory guidance from the EFH Final Rule (67 FR 2343; January 17, 2002) and a revised analytical methodology to improve the text descriptions and map representations. Alternative 2 also provides text and map descriptions for EFH in the inshore area that are based on state fisheries survey data (as compared to Alternative 1 which relies solely on ELMR designations for the inshore area) and for the off-shelf area (deeper than 400 m) for species with life histories that extend beyond the shelf edge. The comparison of Alternative 2 to the No Action alternative is of interest because Alternative 2 represents a refinement to the status quo method and uses more similar methods (to status quo) than Alternatives 3 and 4. In the development of Alternative 2, spring and fall NMFS survey catch data for the continental shelf were processed slightly differently in order to further reduce the impact of high abundance tows on average catch rates for each ten minute square and to remove data from poorly-sampled areas. Most of the survey data that were removed were collected on the Scotian Shelf, in Canada, prior to 1987. The Alternative 2 designations also relied on an up-dated data time series that added eight years to the end of the time series (1998-2005), and eliminated five years at the beginning when only sampling was only conducted in the fall (1963-1967). For a detailed look at the methods for Alternative 2, see Appendix A.

Figure 13 displays an analysis of the percent of status quo EFH area that would be designated for the juvenile and adult life stages under Alternative 2 for 19 species that utilized the same cumulative catch rate as status quo, in this case 90%. In all, 36 comparisons were made. The analysis was conducted in this way in order to standardize the extent to which survey catch rates affected the EFH area designations. Compared to the status quo EFH designations (Alternative 1), the vast majority of Alternative 2 designations that use 25, 50, and 75% cumulative catch rates (2A, 2B, and 2C) are smaller in area, whereas 27 (75%) of the 90% catch rate (2D) designations are within 20% – lower or higher – of the Alternative 1 designations. Overall, 13 are larger, 19 are smaller, and four are the same. The 2D designations are considerably larger for Atlantic cod juveniles, little skate juveniles, and monkfish adults, and considerably smaller for haddock adults, little skate adults, and ocean pout juveniles.

Compared to the No Action Alternative (which relies on the status quo methodology), Alternative 2 employs a revised methodological approach that makes better use of survey data, and an up-dated time series of survey data.

The impact of the Alternative 2 is positive due to the EFH refinement realized by reducing the impact of occasional high catch rate tows, by eliminating poorly-sampled survey areas, mostly in Canada, by relying on inshore state survey data, not just ELMR info, by adding the off-shelf area, and by incorporating habitat info from up-dated EFH source documents and survey data analyses into the text descriptions. Theoretically, more accurate EFH maps and descriptions will make it possible to more effectively minimize adverse impacts on managed fishery resources, and therefore, the impact to the biological and physical environment valued ecosystem component (VEC) is positive (+).

Figure 13. Status Quo EFH Designations with Alternative 2 (Modified Abundance-Based)



7.1.2.4 Impacts of Alternative 3 (+)

Under Alternative 3, EFH designations would be revised and, in most cases, the geographic extent of individual EFH designations would be larger than the status quo Alternative 1 designations. Alternative 3 implements the peer review panel's short-term recommendations for improving the EFH designation methodology by including specific habitat characteristics (spring and fall ranges of depth and bottom temperature that are correlated with high survey catch rates and, for some species, "preferred" substrate types) in the EFH maps and linking the maps more explicitly to the text descriptions. In addition, trawl survey data were used to "fill in" areas on the continental shelf that did not meet the habitat criteria where target species and life stages met the 25, 50, 75, and 90% cumulative catch rate thresholds. For most species, the habitat GIS coverages accounted for most of the designated area in all the Alternative 3 maps. Alternative 3 uses the same basic methodology as Alternative 2 to process the trawl survey data for the shelf and the inshore area, and to add any additional area beyond the edge of the shelf where there is evidence that any given life stage and species is present. It also applies the revised regulatory guidance from the EFH Final Rule (67 FR 2343; January 17, 2002) and incorporates additional scientific information available in updated EFH Source Documents and other sources into the text descriptions and improved map representations. For a detailed look at the methods used to develop Alternative 3, see Appendix A.

Figure 14 displays an analysis of the percent of status quo EFH area that would be designated for the juvenile and adult life stages under Alternative 3 for 19 species that utilized the same cumulative catch rate as the status quo designations, in this case 90%. In all, 36 comparisons were made. The analysis was conducted in this way in order to standardize the extent to which survey catch rates affect the EFH area designations. Compared to the status quo EFH designations (Alternative 1), the vast majority of the Alternative 3 designations that use 25, 50, and 75% cumulative catch rates (3A, 3B, and 3C) are smaller in area.

When comparing No Action alternatives and Alternative 3 (Option D) that utilized the same cumulative catch rate (90%), the geographic extent of EFH is larger in Alternative 3D in 21 of 36 cases (58%) and smaller in 14 (39%), with one the same. Twenty-one of the 3D designations are within 20% of the status quo designations, and most of these are larger. Eleven 3D designations are more than 20% larger than the status quo designations (four of these are more than 50% larger), whereas only four 3D designations are more than 20% smaller. 3D designations are more than 50% larger for Atlantic cod juveniles, monkfish adults, white hake juveniles, and witch flounder juveniles and more than 50% smaller for adult haddock.

When comparing Alternative 2D and Alternative 3D (Figure 15), showing a comparison of species/life stages under the same cumulative catch rate relative to the status quo, the biggest differences in area defined as EFH is seen in smooth skate, thorny skate, white hake, witch flounder (adults and juveniles) and winter skate adults in Alternative 3D only rosette skate juveniles are considerably smaller.

Like Alternative 2, Alternative 3 is positive due to the EFH refinement realized by reducing the impact of occasional high catch rate tows, by eliminating poorly-sampled survey areas, mostly in Canada, by relying on inshore state survey data, not just ELMR info, by adding the off-shelf area, and by incorporating habitat info from up-dated EFH source documents and survey data analyses into the text descriptions. However, Alternative 3 may be considered a more sophisticated methodological approach because in Alternative 3 habitat features are specifically incorporated into the maps, those that are described in detail in the text description. Said another way, Alternative 3 is a better use of available scientific information as recommended by the Habitat Evaluation Review Committee (peer review body). Theoretically, more accurate EFH maps and descriptions will make it possible to more effectively minimize adverse impacts on managed fishery resources, and therefore, the impact to the biological and physical environment valued ecosystem component (VEC) is positive (+).

Figure 14. Comparison of Status Quo EFH Designations with Alternative 3 (Habitat Approach)

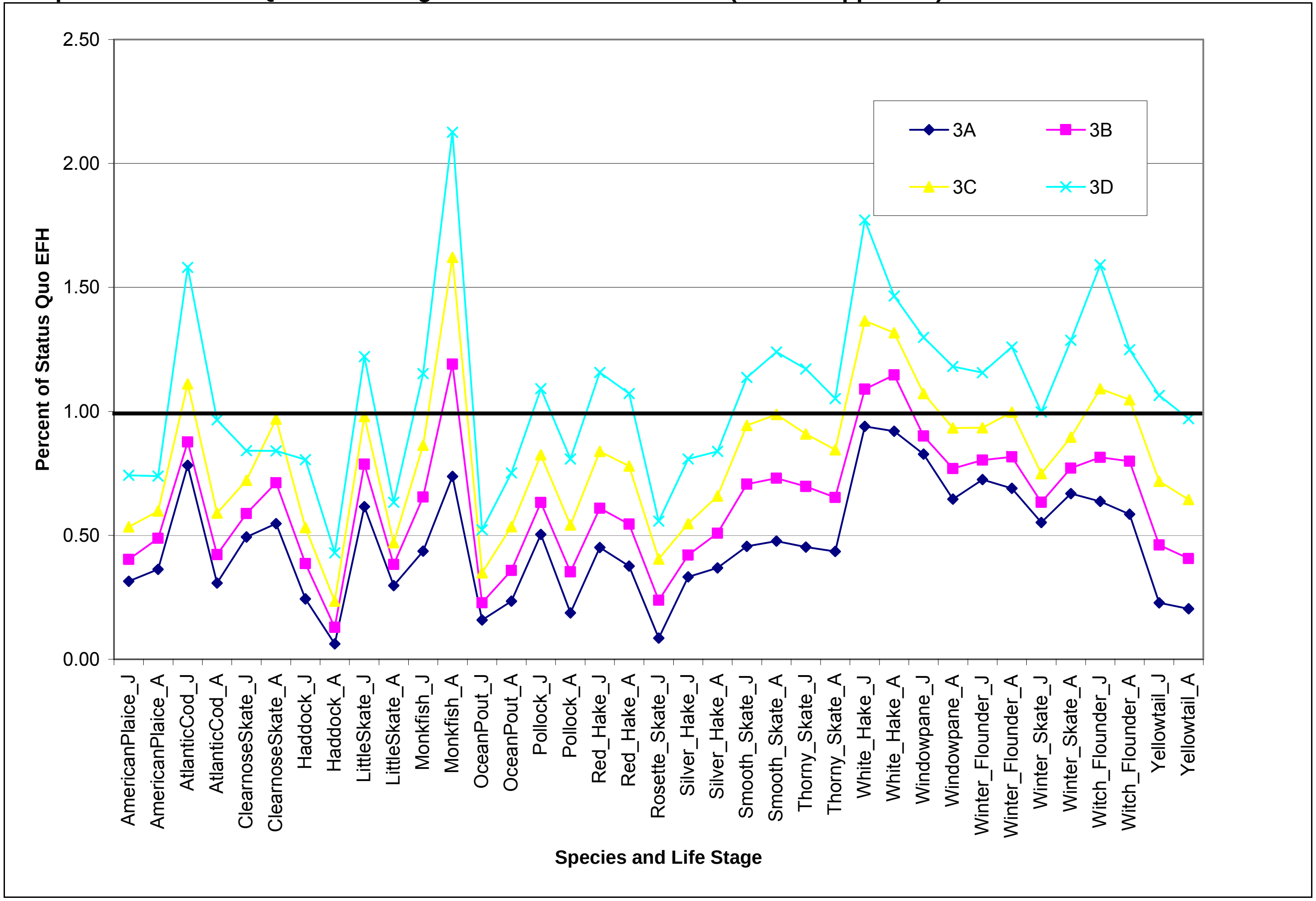
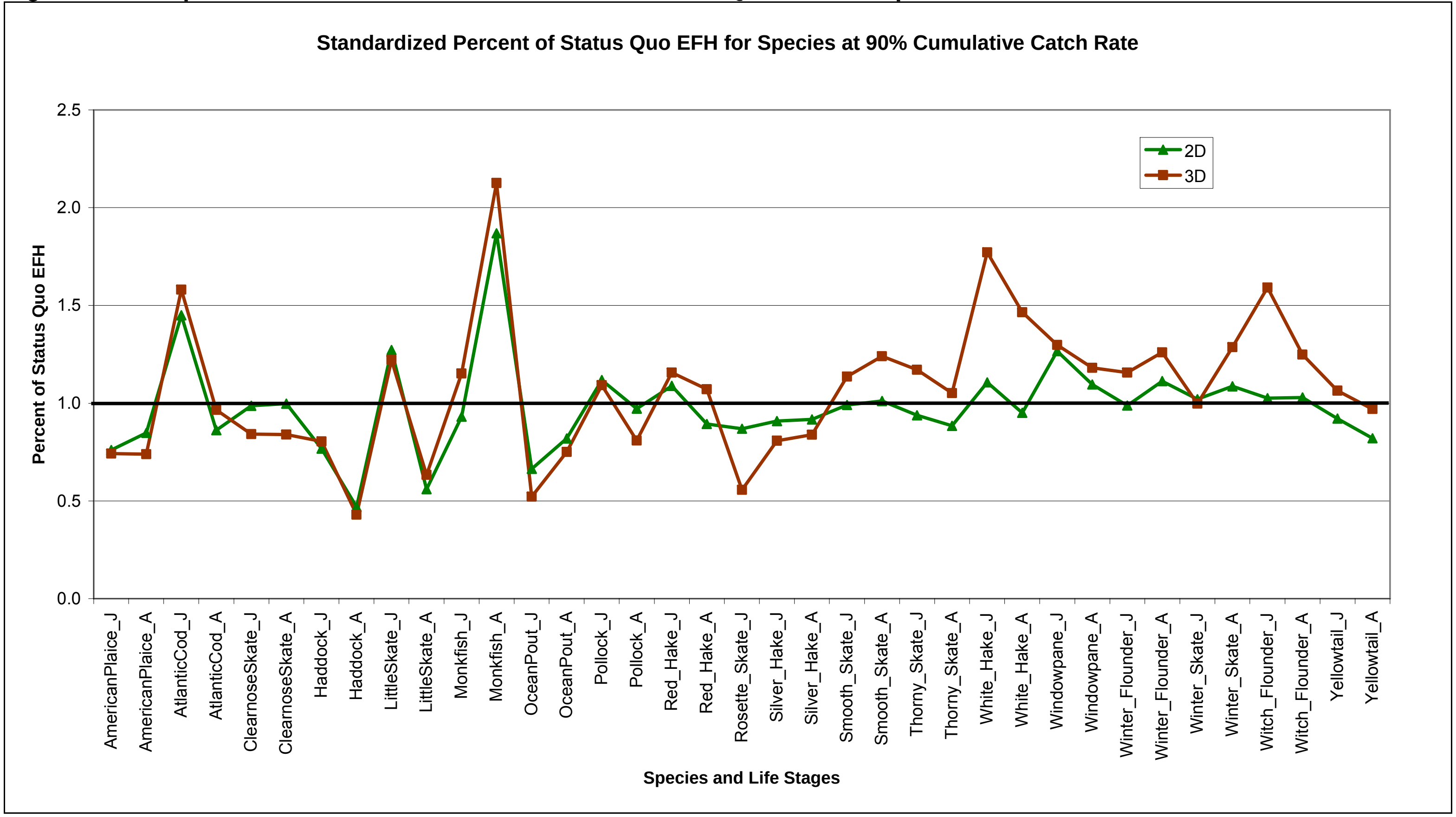


Figure 15. Comparison of the Standardized Percent of Status Quo EFH for Species at 90% Cumulative Catch Rate Make



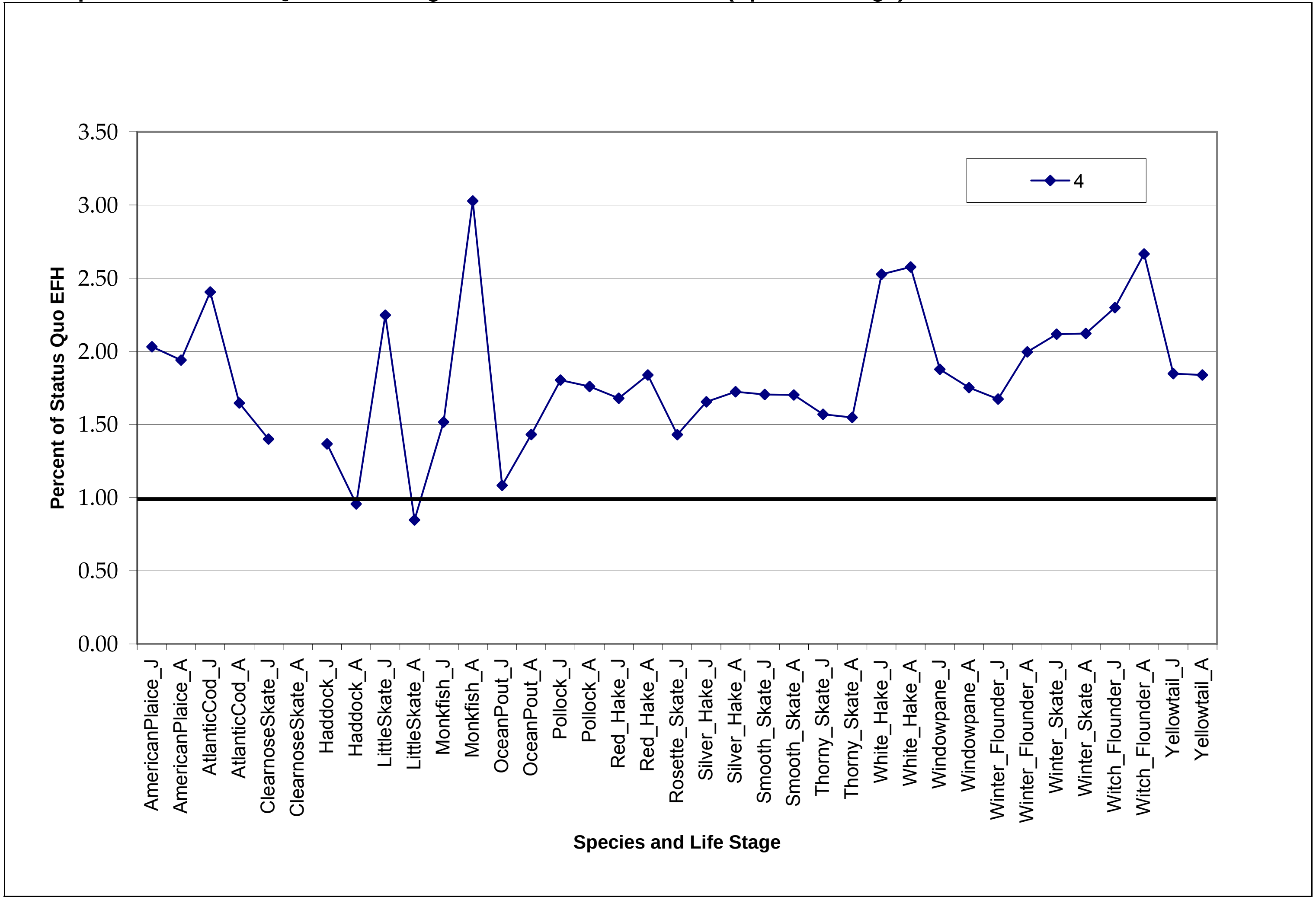
7.1.2.5 Impacts of Alternative 4 (+)

Under Alternative 4, EFH designations would be revised and improved but, in most cases, the geographic extent of individual EFH designations would be much larger than the status quo designations. Alternative 4 is intended to capture the habitats associated with the entire observed range of the species, as defined by survey data and other observations made in the off-shelf area, including information in the EFH source documents and other sources regarding the latitudinal range of each species. It is fundamentally different from the other alternatives because it relies almost entirely on Level 1 (presence only) information. This alternative uses the same basic methodology as Alternative 2 to map EFH. The spatial extent of EFH for any given life stage and species combines the GIS coverage for the inshore area developed for alternatives 2 and 3, the off-shelf coverage for alternative 3, and the ten minute squares on the continental shelf that represent 100% of the catch rate data. Since this alternative utilizes Level 1 information to map EFH, the text descriptions were modified to include broad ranges of depth, temperature, and salinity where a given lifestage and species is known to occur.

Because almost none of the status quo EFH designations were based on the 100% cumulative catch rate, it was not possible to conduct a standardized comparative analysis. However, as shown in Figure 16 the spatial extent of EFH for all but two of the 36 life stages/species that were analyzed is much larger than in the status quo designations. In fact, nine of them are more than twice as big as the corresponding status quo designations.

Alternative 4 clearly is more “risk-averse” than the other alternatives including the No Action Alternative (Alternative 1) because it designates very large areas but since it relies mostly on Level 1 data, with the exception of the inshore realm where Level 2 data is used. Although an argument can be made that Alternative 4 does provide a precautionary set of EFH designation alternatives, it not as robust as Alternative 3 because it does not incorporate any habitat features in the map representation. The geographic range of the designations is broader than Alternative 1 or 2 because it considers additional areas of important fish habitat in the offshelf realm.

Figure 16. Comparison of Status Quo EFH Designations with Alternative 4 (Species Range)



7.1.2.6 Impacts of Other EFH Designation Alternatives

ALTERNATIVE 5 (+)

Additional alternatives were developed for Atlantic sea scallop, offshore hake and winter flounder. In each case, the method is unique but based on one of the preceding alternatives.

Atlantic sea scallop

This alternative employs the text description from Alternative 4. The map is based on the Alternative 4 map representation with the addition of historic scallop areas. This alternative includes updated scientific information in the text description and map representation relative to the status quo (Alternative 1) and, as such, the impacts to the affected biological and physical environment will likely be positive.

Offshore hake

This alternative employs the text description from Alternative 3. The map is based on the juvenile Alternative 3D map representation with ten-minute-squares removed plus Alternative 3D for adults. This alternative includes updated scientific information in the text description and map representation relative to the status quo (Alternative 1) and, as such, the impacts to the affected biological and physical environment will likely be positive.

Winter flounder

This alternative employs the text description from Alternative 3. Alternative 5A map is based on Alternative 3 plus area bounded by 20m isobath and Alternative 5B map is based on Alternative 3 plus the area bounded by 20m isobath with ELMR data removed. This alternative includes updated scientific information in the text description and map representation relative to the status quo (Alternative 1) and, as such, the impacts to the affected biological and physical environment will likely be positive.

ALTERNATIVE 6 (+)

Winter Flounder

An additional alternative was developed for winter flounder. Alternative 6 for winter flounder employs the text description from Alternative 3. The map description is based on Alternative 3 but includes the depth range of 0-72 meters. This alternative includes updated scientific information in the text description and map representation relative to the status quo (Alternative 1) and, as such, the impacts to the affected biological and physical environment will likely be positive.

7.1.2.7 Impacts of Deep-Sea Red Crab EFH Designation Alternatives

The alternatives to designation EFH for deep-sea red crab include many different spatial realms (shelf, offshelf and seamounts) and a wide range of spatial coverage (area in square nautical miles) as depicted on Table 116. The result is a diverse approach to recognizing the importance of certain marine habitats to the unique life history characteristics of deep-sea red crab.

Table 116. Relative size of Alternatives to designate EFH for Deep-Sea Red Crab (sq. nm)

Alternative	1	2	3A	3B	4	5A	5B	6
Life Stage								
Eggs	7,978	1,577	1,621	NAD	NAD	NAD	NAD	NAD
Larvae	5,428	4,399	4,443	4,788	29,871	29,915	30,260	30,339
Juveniles	5,066	4,399	4,443	4,788	29,871	29,915	30,260	30,339
Adults	8,751	2,619	2,663	3,008	28,091	28,135	28,480	28,559

NAD: No alternative EFH designation.

The Alternatives to designate EFH for deep-sea red crab progressively include additional important habitats based on the best available scientific information available for the species sometimes in habitats that are not well studied or understood (e.g. seamounts) (Table 117). These habitats extend from the continental shelf in the Gulf of Maine to the farther reaches of the EEZ (seamounts) and, therefore, span a range of geographic scales (Table 118). The area in Alternative 2 is smaller than the status quo due to the refinement of the depth range. Even though Alternative 3 includes the addition of the seamounts where deep-sea red crab have been observed, it is also smaller in area than the status quo due to the refinement of the offshelf depth range and the very small size of the additional seamount EFH. It is not until Alternative 4, 5 and 6 that the area of EFH is widely broadened as compared to the status quo, which is due to the addition of areas in the Gulf of Maine deeper than 40 meters and in the case of Alternative 6 the use of the entire presumed range of the species in the region.

Table 117. Summary of Deep-Sea Red Crab EFH Designation Alternatives

Alternative	**Spatial Realm** → → →

↓	Shelf (GOM)	Off-Shelf/Slope	Observed Seamounts (depth-defined)	Observed Seamounts (feature-defined)	All EEZ Seamounts
1		X			
2		X			
3A		X	X		
3B		X		X	
4	X	X			
5A	X	X	X		
5B	X	X		X	
6	X	X			X

Table 118. Percent of EFH Designated for Each Life Stage of Deep-Sea Red Crab relative to the No Action Alternative

Percent of No Action Alternative	Alt. 2 % of SQ	Alt. 3A % of SQ	Alt. 3B % of SQ	Alt. 4 % of SQ	Alt. 5A % of SQ	Alt. 5B % of SQ	Alt. 6 % of SQ
Life Stage							
Eggs	19.8	20.3	N/A	N/A	N/A	N/A	N/A
Larvae	81.0	81.9	88.2	550.3	551.1	557.5	558.9
Juveniles	86.8	87.7	94.5	589.6	590.5	597.3	598.9
Adults	29.9	30.4	34.4	321.0	321.5	325.4	326.4

N/A: Not applicable due to no alternative designation

ALTERNATIVE 1 – No Action

The No Action EFH designations cover the geographic area included in the depth zones where deep-sea red crab is found and is **based on known depth zone affinities**. There are slight differences in the method for defining this depth zone between the life stages:

- *Eggs: Based on known depth zone affinities for female adults.*
- *Larvae: Based on the known depth zones as defined by the union of the full (female and male) adult and juvenile depth ranges*
- *Juveniles: Based on known depth zone affinities for juveniles.*
- *Adults: Based on known depth zone affinities for all adults.*

ALTERNATIVE 2 – Refined Status Quo

Alternative 2 includes the status quo text descriptions as revised for refined slope depth ranges where deep-sea red crab are more abundant (Level 2 information) and modifies the map representations to illustrate the new depth ranges. This provides an improved designation that utilizes a higher level of information than the No Action Alternative based on a detailed evaluation of the available literature and survey data.

ALTERNATIVE 3 – Refined Status Quo Plus Observed Seamounts

Alternative 3 includes the refined slope definitions in Alternative 2 as well as the areas in the "seamount" realm where deep-sea red crabs have been observed. Alternative 3 only includes parts of the seamounts that fall within the depth range given in the EFH text descriptions below. This alternative uses new information and includes the seamount areas within the U.S. EEZ where deep-sea red crabs have been observed. Deep-sea red crab are the only known managed species to occur on the seamounts within the EEZ and, as a result, Alternative 3 would have positive impacts on EFH by including this fragile environment as EFH for the first time.

ALTERNATIVE 4 – Refined Status Quo Plus Gulf of Maine

Alternative 4 includes the Alternative 2 off-shelf/slope designations as well as areas deeper than 40 meters in the Gulf of Maine. EFH was extended into the Gulf of Maine based on information (Level 1) in the deep-sea red crab EFH Source Document indicating that they are found in this depth range in the GOM. This information was not incorporated into the original EFH designations and marks an improvement of the inclusion of a new spatial realm (shelf) as EFH. This alternative does not include the seamount spatial realm.

ALTERNATIVE 5 – Refined Status Quo, Observed Seamounts and Gulf of Maine

Alternative 5 includes the Alternative 2 off-shelf/slope designation, the Alternative 3 seamounts designation and the Alternative 4 Gulf of Maine designation. In contrast to the preceding alternatives, Alternative 5 includes the improved depth-band on the continental shelf (Alternative 2), the seamount realm (Alternative 3), and the Gulf of Maine (Alternative 4) in the EFH description for deep-sea red crab. The EFH designation in this alternative is broader geographically and includes EFH for deep-sea red crab in each applicable spatial realm (shelf, offshelf and seamounts).

ALTERNATIVE 6 – Species Range

Alternative 6 includes the 100% observed range of deep-sea red crab in addition to an extended seamount range (those seamounts in the EEZ that meet the depth criteria). This alternative includes the largest spatial extent of deep-sea red crab EFH and includes all possible habitats where red crabs have been observed or where they can be presumed to be present (i.e., very similar habitats but no actual observations). As compared to any of the other alternatives under consideration for deep-sea red crab, Alternative 6 is by far the most pre-cautionary; selection of this alternative may be warranted because there is very little quantitative information available regarding their spatial distribution and its relation to habitat features such as depth, especially on the seamounts.

7.1.2.8 Impacts of Atlantic Salmon EFH Designation Alternatives

ALTERNATIVE 1 - No Action

Essential fish habitat for Atlantic salmon is described as all waters currently or historically accessible to Atlantic salmon within the streams, rivers, lakes, ponds, wetlands, and other water bodies of Maine, New Hampshire, Vermont, Massachusetts, Rhode Island and Connecticut that meet the habitat requirement in the text description for each life stage. “All waters” refers to all aquatic habitats in the watersheds of the identified rivers, including all tributaries, to the extent that they are currently or were historically accessible for salmon migration. EFH excludes areas upstream of longstanding naturally impassable barriers (not dams). The EFH designations of estuaries and embayments under the No Action Alternative are based on the NOAA Estuarine Living Marine Resources (ELMR) program as supporting Atlantic salmon eggs, larvae, juveniles and adults at the "abundant", "common" or "rare" level. Twenty-six (26) rivers and sixteen (16) bays and estuaries are included in the status quo Atlantic salmon designation. The 26 rivers included represented all rivers where Atlantic salmon were present (in the years immediately proceeding 1998).

ALTERNATIVE 2– Ten (10) Year Presence

Under this alternative, those rivers and estuaries that are “current(ly)” or have “recent(ly)” supported Atlantic salmon (i.e., where their presence has been documented in the last ten (10) years (1996-2005)) are included in the EFH designation. Thirty-three (33) drainage systems have supported Atlantic salmon in the past ten years (See table in Section 4.1) and, as such, are included in this designation.

As compared to the status quo designations for Atlantic salmon, Alternative 2 will slightly expand the list of rivers, estuaries and bays that are included in the EFH designation, from 26 to 33. This increase is due to a more precise identification of river systems that drain directly into the sea and meet the 10-year criterion. Additionally, Alternative 2 includes an option that would designate marine areas from the coastline to the extent of the potential oceanic component of the salmon’s anadromous life history. Because this extent is not well understood, a precautionary approach was taken in Alternative 2 Option 3 to include a vast area of the marine environment in U.S.

territorial waters. Although this alternative will include a broader geographic extent (a possible 54,314 square nautical miles) as compared to the status quo, it is not only precautionary (as warranted for a species listed on the Endangered Species Act list) but also is based on recent scientific information concerning the oceanic life history phase of Atlantic salmon that was not utilized in the original designation. Alternative 2 is more risk-averse than Alternative 3 which eliminates freshwater habitats where there was no evidence of salmon during 2003-2005 and it is based on a longer time-series of data collection for salmon returns which may better represent salmon utilization of river systems. In summary, the ten-year alternative makes better use of existing data and monitoring programs and would better reflect potential river usage by salmon, especially under current conditions of low population size when very few adults are returning to spawn in U.S. rivers.

ALTERNATIVE 3 - Three (3) Year Presence (Current)

Under this alternative, those rivers and estuaries that are "current(ly)" supporting Atlantic salmon (i.e., where they have been documented in the last three (3) years (2003-2005)) are included in the EFH designation. Twenty (20) drainage systems have supported Atlantic salmon in the past three years (See table in Section 4.1) and, as such, are included in this designation.

Alternative 3 utilizes a less restrictive approach than was taken under Alternative 2 as Alternative 3 includes only rivers with evidence of Atlantic salmon presence in the past three years (2003-2005) would be included in the EFH designation, but will use updated information to do this. The number of designated drainage systems is reduced from 33 to 20, and from 26 to 20 compared to the No Action Alternative. Additionally, Alternative 3 includes an option that would designate marine areas from the coastline to the extent of the potential oceanic component of the salmon's anadromous life history. Because this extent is not well understood, a precautionary approach was taken in Alternative 3 Option 3 to include a vast area of the marine environment in U.S. territorial waters. Although this alternative will include a broader geographic extent (a possible 54,314 square nautical miles) as compared to the status quo, it is not only precautionary (as warranted for a species listed on the Endangered Species Act list) but also is based on recent scientific information concerning the oceanic life history phase of Atlantic salmon that was not utilized in the original designation.

However, the three-year alternative may not sufficiently account for anomalous environmental river conditions, such as rainy, high flow years, which could prevent adult salmon from returning to specific rivers. It also requires a more ambitious monitoring program that would detect the presence of salmon in rivers that support very small spawning runs, or rivers where adults may return in some years, but not in others, even when environmental conditions are favorable. This could potentially lead to the exclusion of some river systems that normally exhibit favorable environmental conditions and should be designated as EFH.

7.1.2.9 Summary of Impacts to Bio and Physical Environment

Describing and identifying EFH does not alone have any direct environmental or economic impacts. Because of the large variability in the ecological requirements of the fish species managed under the Magnuson-Stevens Act, the areas identified as EFH will encompass a wide range of aquatic habitats. For example, streams and rivers supporting Atlantic salmon, marine and estuarine habitats, such as seagrass beds, coastal wetlands, submerged aquatic vegetation, cobble with attached epifauna, mud and clay burrows, and oceanic banks and continental shelf or slope areas extending to the 200-mile EEZ, all have the potential to be designated as EFH for one or more fishery species. Geographically, EFH is being designated in all states with a marine coastline. Overall, the environments directly affected by the plan amendment are likely to primarily include marine and estuarine habitat, except for Atlantic salmon where most of the EFH is in freshwater streams and rivers in coastal states.

The affected environment will be a subset of the habitat currently or historically used by fish managed under the Magnuson-Stevens Act. Marine, estuarine, and freshwater environments in coastal states are most likely to be affected. Fish populations managed under the Magnuson-Stevens Act will be affected when EFH receives increased protection or is restored.

In the case of riverine habitat, which is particularly important to Atlantic salmon, habitat loss has resulted from loss of fish access, water pollution, inadequate flow, and physical destruction of habitat. Activities determined to have an adverse impact on EFH may be redirected or concentrated in other areas such as uplands or aquatic areas not identified as EFH.

The goal of the EFH amendment is to improve the conservation and management of EFH by providing information and conservation recommendations to federal and state agencies and other entities whose actions may adversely affect EFH. The achievement of this goal depends on individual decisions made by the Council and federal and state agencies. Therefore, the consequences of this proposal can only be addressed in a general sense. NEPA documentation prepared for individual proposed actions by other than the Council will fully address the environmental consequences of site specific activities. Council-proposed actions, taking the form of framework adjustments or future FMP amendments, will address the specific impacts of the proposed actions.

The EFH designation alternatives selected by the Council include the most appropriate amount of habitat area, given the particular habitat requirements of each species and the limitations associated with the data and information available to the Council. Selecting more area to be included in the EFH designations could be considered as risk-averse, or precautionary, but is discouraged. "*Describing a broad geographic area (the entire EEZ) as EFH for a single species or life stage should be avoided*" according to the October 30, 2006 NMFS Guidance to Refine the Description and Identification of Essential Fish Habitat. Selecting less area to be included in the EFH designations would trigger fewer EFH consultations and place less of a burden on federal agencies to comply with the Magnuson-Stevens Act, but would not provide the prudent amount of habitat protection given the level of information available. The potential foreseeable impacts to fish habitat from the implementation of the Council's revised EFH designations would be improved habitat protection and increased productivity of the region's fishery resources.

The alternatives for describing and identifying EFH comprise a range of options that use different methodologies and result in different geographic areas being identified as EFH for each of the species managed under the Council's FMPs. The comparison of Alts 1 - 4 rests almost entirely on improved methods for using the available information, not on differences in size of designated areas. However, description and identification of EFH, regardless of the alternative selected, generally would have a positive effect on habitat because the purpose of the designation is to identify important fish habitats that would be subject to potential measures to protect, conserve, and enhance them. The broader the area identified as EFH, the more habitat that would be subject to such measures. The individual analysis presented within the impact analysis of each alternative above includes a quantitative measure of how much geographic area is designated as EFH on a species/life stage basis. While this is interesting and shows the subtle differences between each alternative in a comparative sense, it does not provide the public or the decision maker with the aggregate area (non-overlapping) that would be designated as EFH.

In Table 119, the aggregate geographic range for all species and life stages (no square nautical mile counted more than once) is documented for each alternative and alternative option. It is clear from this examination that, in aggregate, all of the proposed action alternatives except Alternative 4 will designate less geographic area than No Action (Alternative 1). Even Alternative 4 (the 100% cumulative catch alternative), largely thought to be the extreme of the range of alternatives during development by the Council, would only designate a slightly larger total area than Alternative 1. Alternatives 2D and 3D would, in aggregate, designate 11.2% and 12.3% less area than the No Action Alternative. This analysis indicates that selection of either of these risk-averse alternatives would reduce the area that would be subject to EFH consultations for at least one life stage of one species. Selection of any of the other alternative 2 or 3 options would subject even smaller areas to EFH consultations.

Table 119. Aggregate analysis of geographic range of EFH designation Alternatives

EFH Alternative	Aggregate Area (nm2)	Cumulative Catch Rate (%)

EFH Alternative	Aggregate Area (nm2)	Cumulative Catch Rate (%)
2A	43,955	25
3A	58,038	25
2B	64,673	50
3B	70,945	50
3C	78,412	75
2C	79,523	75
3D	84,795	90
2D	85,836	90
1	96,673	Variable
4	98,712	100

7.1.3 Impacts on Economic Environment (VEC 2)

Phase 1 of this Amendment (1) presents alternatives for designating EFH and (2) establishes a program to consult on federal actions. It does not, however, create any management rules or regulations that would impact the economy, small entities, or consumers either positively or negatively. It stands to reason, though, that considering different ways to designate EFH will lead to deliberations by the Council during Phase 2 about whether and how to restrict fishing gear and practices as a function of EFH attributes. Virtually every 10-minute-square in the EEZ is potentially EFH for some species or life stage depending on the designation process, so the potential for impacts is inherent to the Amendment. Nevertheless, until specific regulations are promulgated in Phase 2, no impact analysis can be conducted.

The literatures on MPAs and ecosystem-based fisheries management are closely related to EFH policy. Indeed, an omnibus amendment that cuts across all fisheries in New England (and some in the Mid-Atlantic), reconciles extant fishery management and habitat conservation areas, and manages fish stocks on the basis of spatial heterogeneities in habitat, including through use of HAPCs, is one form of an ecosystem approach. It is relevant, therefore, that several scientific committees suggest that fishing gears and practices should be matched to habitat characteristics. This would appear to be the most likely way for a change in the way EFH is designated to impact the fishing industry and other stakeholders. But again, this discussion awaits Phase 2.

Section 6.2.2 of the Affected Environment describes a framework for an economic analysis of the Amendment should the Council proceed to Phase 2 after public hearings. In addition, the descriptions of fishing patterns found there show the need to fold location and proximity into the analysis of impacts on the economy and small entities unlike anything normally done for evaluations of unit-stock management. The major economic issues are as follows.

(1) Scientific uncertainty about how habitat affects fish productivity, particularly in multi-species situations where there is predation and competition and habitat needs differ, precludes a traditional Cost-Benefit Analysis because future production by target species can not yet be predicted. It is therefore assumed that habitat protection is beneficial towards productivity.

(2) A key economics question that should be addressed, even if qualitatively, is whether losses due to habitat damage under the status quo are more than or less than the opportunity costs of regulations that alter fishing gear or access to fishing grounds. Is the cure worse than the bite?

(3) The inherent spatial quality of EFH management means that regulations will not be spread as evenly as they are in unit-stock management. Vessel size, fuel costs, habit, tradition, and so on affect where fishermen work. If EFH regulations are set down like a patchwork quilt which specifies where fishing gears of different types can be used, it is very likely that the quilt will not coincide with present patterns. Thus, another important question to ask is what are the costs in terms of differences in gross earnings and operating costs of modifying gear, switching to different fisheries, or traveling farther to stay in the same fishery. Further, any changes in fishing locations could change port-landed or even state-landed which has implications for processors and local economies.

7.1.4 Impacts on Social Environment (VEC 3)

This FMP does not create any management rules or regulations, so it does not have any direct impacts. However, it does designate EFH which may at some future date be used in the creation of fully closed areas or areas closed to particular gears or at particular times of year or other regulations. Thus the potential for impacts is already inherent in the designation of EFH. Until specific regulations are promulgated no true impact analysis can be conducted. Nonetheless, some basic issues can be discussed.

A number of issues are common to many fishermen and communities in the region. Many of the issues below are highlighted in more detail in the *Issues and Processes* sections of the community profiles in Appendix G.

7.1.4.1 General social impacts

Regulations can affect individuals, families and social groups in a variety of ways. For instance, any regulation which changes the timing or length of trips, amount of income earned, the level of job satisfaction of fishermen, ease of access to hub ports or other variables can alter social dynamics in either positive or negative ways. Some potential impacts from regulations likely to be promulgated in areas designated as EFH include:

1. Gentrification threatens many waterfront areas with development which pushes out fishing and related industries. Some towns are passing ordinances to protect waterfronts, but others are not. Not only does gentrification limit access to the waterfront, but it also raises property values. In some cases this means that fishermen and their families must move to inland towns with lower prices, increasing commute time to the docks. Any regulations which then add increased steam time due to needing to avoid closed areas, for instance, will potentially impact family life as fishermen spend more time away from home.

2. Increasingly strict regulations in multiple fisheries and in specialized FMPS such as this one for Essential Fish Habitat are making it difficult for fishermen to continue the annual rounds or portfolio of fisheries that has been common to most small boat fishermen and even many large boat fishermen. As fishermen lose the ability to conduct one or another fishery that was a critical component of their annual round two different outcomes have become common. Either the fishermen have difficulty in piecing together enough income for the full year or they become increasingly dependent on one or two species to which they retain access – making them more vulnerable to any drop in biomass or implementation of stricter regulations.

3. Regulations limiting time or location at sea can mean fishermen must choose whether to miss trips essential to their livelihood or to either fish in bad weather or steam around restricted areas to get to allowed fishing grounds. For smaller vessels the extra steam time involves extra fuel (or chancing that they will make it on their fuel capacity) or going further offshore than usual. All of these can negatively impact safety.

4. Lowered landings and incomes can mean that upgrades to vessels and shoreside facilities are delayed, potentially compromising safety and/or creating physical and economic inefficiencies.

5. As smaller ports lose infrastructure such as shipyards and companies specializing in maritime insurance, hub ports like Boston, Gloucester and a few others become critical to maintaining the access of the entire region's fleets to these necessary services. Any regulations which increase steam time form particular ports to hub ports, due for example to closures or gear stowage

requirements, increases the cost of reaching those hub ports. This may lower profitability or lead to delays in repairs that can compromise safety.

6. Higher fuel costs mean more fish are needed to simply cover trip expenses. Where FMPs decrease access to species or grounds this can become a hardship.

7. Especially in rural areas, but also in some urban centers, access to fish is part of a subsistence strategy that may also involve land-based subsistence activities. Limiting access to certain inshore areas may affect the ability of these families to provide food for their household use or to use these subsistence catches to trade for other food or services within local social networks.

8. Area closures can mean fishermen temporarily relocating to a different homeport, with attendant disruptions in family life. Those relocating may do so because they formerly fished within the now closed area or because the closed area is adjacent to their homeport.

7.1.4.2 Community impacts

Regulations can affect communities in multiple ways as well. For instance, any regulation which changes the preferred landing ports for one or more species, causes fishermen to change homeports or to alter social networks can have either positive or negative impacts. Some potential impacts from regulations likely to be promulgated in areas designated as EFH include:

1. To the extent that vessels which fish within areas designated as EFH concentrate their landings in particular ports, those may be forced to change landings ports. This could mean lowered revenues and adverse economic effects. This can create social problems that in turn could lead to increased need for social services.

2. To the extent that owners of vessels which fish in these areas are concentrated in particular communities, these locations will potentially be impacted. This could result in lower levels of spending within the community or out migration to be near new landings ports, both of which can create social problems or impact schools due to lowered populations.

3. Certain impacts which follow from changes in income will be more heavily concentrated in those communities or ports tied to EFH areas generating the highest revenues. Where the change in income or population is greatest, the impacts will be larger.

4. Other impacts will concentrate in communities situated closely adjacent to any EFH entailing closures or gear stowage requirements, as vessels will be more likely to relocate even if they did not formerly fish within that area – simply because constantly going around the area will be time consuming and costly.

5. Communities with heavy reliance on fisheries or maritime industries will be most impacted by any regulation which lowers incoming revenues.

7.2 Alternatives to Designate Habitat Areas of Particular Concern (HAPC)

7.2.1 Impacts on Biological and Physical Environment (VEC 1)

7.2.1.1 Introduction and Background

The intent of the habitat areas of particular concern designation is to identify those areas that are known to be important to species which are in need of additional levels of protection from adverse impacts. Management implications do result from their identification. Designation of habitat areas of particular concern is intended to determine what areas within EFH should receive more of the Council's and NMFS' attention when providing comments on federal and state actions, and in establishing higher standards to protect and/or restore such habitat. Certain activities should not be located in areas identified as habitat areas of particular concern due to the risk to the habitat. Habitats that are at greater risk to impacts, either individual or cumulative, including impacts from fishing, may be appropriate for this classification. Habitats that are limited in nature or those that provide critical refugia (such as sanctuaries or preserves) may also be appropriate. General concurrences may be granted for activities within habitat areas of particular concern; however, greater scrutiny is necessary prior to approval of the general concurrence.

The EFH Final Rule (50 CFR 600.815(8)) states that *"FMPs should identify specific habitat types or areas within EFH as habitat areas of particular concern based on one or more of the following considerations… (underlined text)"*. The corresponding text is a Council interpretation of the EFH Final Rule criteria.

CRITERION 1A: Importance of *Historic* Ecological Function - The area or habitat feature proposed for HAPC designation at one time provided an important ecological function to a currently managed species, but no longer provides that function due to some form of degradation. An important ecological function could include, but is not limited to, protection from predation, increased food supply, appropriate spawning sites, egg beds, etc. The importance of the ecological function should be documented in scientific literature and based on either field studies, laboratory experiments, or a combination of the two.

CRITERION 1B: Importance of *Current* Ecological Function - The area or habitat feature proposed for HAPC designation currently provides an important ecological function to a managed species. An important ecological function could include, but is not limited to, protection from predation, increased food supply, appropriate spawning sites, egg beds, etc. The importance of the ecological function should be documented in scientific literature and based on either field studies, laboratory experiments, or a combination of the two.

CRITERION 2: Sensitivity to Anthropogenic Stresses – The area or habitat feature proposed for HAPC designation is particularly sensitive (either in absolute terms or relative to other areas and/or habitat features used by the target species) to the adverse effects associated with anthropogenic activities. These activities may be fishing or non-fishing related. The stress or activity must be a recognizable or perceived threat to the area of the proposed HAPC.

CRITERION 3: Extent of Current or Future Development Stresses – The area or habitat feature proposed for HAPC designation faces either an existing and on-going development-related threat or a planned or foreseeable development-related threat. Development-related threats may result from, but are not limited to, activities such as sand mining for beach nourishment, gravel mining for construction or other purposes, the filling of wetlands, salt marsh, or tidal pools, shoreline alteration, channel dredging (but not including routine maintenance dredging), dock construction, marina construction, etc.

CRITERION 4: Rarity of the Habitat Type – The habitat feature proposed for HAPC designation is considered "rare" either at the scale of the New England region or at the scale of the range of at least one life history stage of one or more Council-managed species. A "rare" habitat feature is that which is considered to occur infrequently, is uncommon, unusual, or highly valued owing to its uniqueness. Keep in mind that the term "rare" usually implies unusual quality and value enhanced by permanent infrequency. We may usually think of rare habitats or features as those that are spatially or temporally very limited in extent, but it could also be applied to a unique combination of common features that occur only in a very few places.

The Council encouraged the development of HAPC proposals that (in no particular order):

- Will improve the fisheries management in the EEZ.
- Include EFH designations for more than one Council-managed species in order to maximize the benefit of the designations.
- Include juvenile cod EFH.

- Meet more than one of the EFH Final Rule HAPC criteria.

A Request for Proposals soliciting ideas from the public on Habitat Areas of Particular Concern, for consideration in the EFH Omnibus Amendment #2, was issued on December 18, 2004 and closed on March 25, 2005 during which time the public was freely able to prepare and submit candidate HAPC proposals for the Council's consideration. Nine (9) complete proposals were received by the Council. The Council has reviewed these proposals through their Habitat Plan Development Team, Habitat Advisory Panel and Habitat Oversight Committee and developed *management alternatives* for Council consideration.

7.2.1.2 Alternative 1 – No Action

Under the No Action alternative the current HAPCs on George's Bank for juvenile Atlantic cod and in Maine for Atlantic salmon remain in place. Refer to Section 4.1.

George's Bank Atlantic Cod HAPC

The status quo designation for juvenile Atlantic cod includes a small portion of northeastern Georges Bank, within the boundaries of Closed Area II, based on the identification of gravel habitat with an increasing biomass of emergent epifauna. Current scientific studies identify these types of habitat as important for recently settled juvenile Atlantic cod, serving to provide shelter from predation and possibly an increased food supply

The George's Bank Atlantic Cod HAPC is 188 square nautical miles (nm^2) in area. There are six life stages of five species with more than 1% of their currently defined (status quo) EFH area inside the status quo HAPC and fourty (40) life stages of sixteen (16) species which currently make up more than 50% of the status quo HAPC (Table 120.) With respect to Atlantic cod, 100% of the area is designated as EFH for juvenile and adult Atlantic cod.

Under the preferred EFH alternatives in the current EFH Omnibus Amendment, there would be three life stages of three species with more than 1% of their currently defined (status quo) EFH area inside the status quo HAPC and twenty-nine (29) life stages of fourteen (14) species which would make up more than 50% of the status quo HAPC Table 121. With respect to Atlantic cod, 98% and 96% of the area is designated as EFH for Atlantic cod juveniles and adults, respectively.

Table 120. Alternative 1, George's Bank Atlantic Cod HAPC – Summary Statistics for Status Quo EFH

Species	Life Stage	Total EFH Area (nm^2)	Overlap with Alternative (nm^2)	% of Total EFH inside Alternative
Atlantic Herring	Egg	2,992	188	6.28%
Barndoor Skate	Adult	5,036	75	1.49%
Haddock	Juvenile	13,971	188	1.35%
Haddock	Egg	8,751	112	1.29%
Atlantic Cod	**Juvenile**	**14,991**	**188**	**1.25%**
Winter Skate	Adult	18,462	188	1.02%
Species	**Life Stage**	**Total EFH Area (nm^2)**	**Overlap with Alternative (nm^2)**	**% of Alternative with This EFH**
Atlantic Cod	Adult	31,211	188	100%
Little Skate	Adult	29,950	188	100%
Rosette Skate	Adult	543	188	100%
Silver Hake	Egg and Larvae	49,328	188	100%
Haddock	Juvenile	13,972	188	100%
American Plaice	Adult	22,515	188	100%
Atlantic Cod	Egg	20,721	188	100%
Atlantic Cod	**Juvenile**	**14,991**	**188**	100%
Haddock	Adult	27,076	188	100%
Little Skate	Juvenile	38,156	188	100%
Winter Flounder	Adult	24,668	188	100%
Winter Skate	Juvenile	26,465	188	100%
Atlantic Herring	Adult	38524	188	100%
Haddock	Larvae	14,094	188	100%
Atlantic Cod	Larvae	22,698	188	100%
Witch Flounder	Adult	20,230	188	100%
Red Hake	Egg	57,802	188	100%
Red Hake	Larvae	57,778	188	100%
Windowpane	Egg	22,535	188	100%
Windowpane	Adult	31,991	188	100%
Winter Flounder	Egg and Larvae	24,399	188	100%
Winter Flounder	Juvenile	24,599	188	100%
Atlantic Halibut	All life stages	37,094	188	100%

Atlantic Herring	Larvae	12,325	150.46	80.0%
White Hake	Adult	24,974	112.92	60.0%
Haddock	Egg	8,751	112.92	60.0%
Atlantic Sea Scallop	All life stages	21,889	112.72	59.9%
Atlantic Herring	Juvenile	32,658	112.72	59.9%
Deep Sea Red Crab	All life stages	16,185	112.72	59.9%

Table 121. Alternative 1, George's Bank Atlantic Cod HAPC – Summary Statistics for <u>Omnibus Amendment Preferred Alternative</u> EFH

Species	Life Stage	Total EFH Area (nm^2)	Overlap with Alternative (nm^2)	% of Total EF inside Alternative
Atlantic Herring	Eggs	3,091	188	6.08
Ocean Pout	Juvenile	11,545	172	1.49
Winter Flounder	Eggs	11,687	152	1.30
Species	**Life Stage**	**Total EFH Area (nm^2)**	**Overlap with Alternative (nm^2)**	**% of Alternative with This EF**
Ocean Pout	Eggs	60,286	188	100
Ocean Pout	Larvae	60,286	188	100
Atlantic Salmon	Adults	54,315	188	100
Atlantic Sea Scallop	All life stages	35035	188	100
Atlantic Herring	Eggs	3,091	188	99.99
Atlantic Cod	Adult	22,656	183	97.76
Atlantic Cod	**Juvenile**	**25,068**	**181**	**96.25**
Haddock	Juvenile	21,726	178	94.39
Silver Hake	Juvenile	40,709	177	94.17
Little Skate	Adult	28,185	177	93.94
Ocean Pout	Juvenile	11,545	172	91.68
Ocean Pout	Adult	20,789	172	91.68
Yellowtail Flounder	Adult	28,858	169	89.97
Winter Flounder	Eggs	11,687	152	80.88
Winter Flounder	Adult	30,385	152	80.88
Winter Skate	Adult	21,981	152	80.87
Red Hake	Juvenile	37,825	130	68.99
Barndoor Skate	Juvenile and Adult	13,177	117	62.42
Haddock	Adult	27,004	117	62.03

Atlantic Herring	Adult	56,175	113	60.04
Pollock	Juvenile	19,878	112	59.46
Yellowtail Flounder	Juvenile	27,237	99	52.56

Importance of Historic or Current Ecological Function

Several sources document the importance of gravel/cobble substrate to the survival of newly settled juvenile cod (Lough *et al.* 1989; Valentine and Lough 1991; Gotceitas and Brown 1993; Tupper and Boutilier 1995; Valentine and Schmuck 1995). A substrate of gravel or cobble allows sufficient space for newly settled juvenile cod to find shelter and avoid predation (Lough *et al.* 1989; Valentine and Lough 1991; Gotceitas and Brown 1993; Tupper and Boutilier 1995; Valentine and Schmuck 1995). Particular life history stages or transitions are sometimes considered "ecological bottlenecks" if there are extremely high levels of mortality associated with the life history stage or transition. Extremely high mortality rates attendant to post-settlement juvenile cod are attributed to high levels of predation (Tupper and Boutilier 1995). Increasing the availability of suitable habitat for post-settlement juvenile cod could ease the bottleneck, increasing juvenile survivorship and recruitment into the fishery. For these reasons, areas with a gravel/cobble substrate meet the first criterion for habitat areas of particular concern.

Collie *et al.* (1997) also describe the relative abundance of several other species such as shrimps, polychaetes, brittle stars, and mussels in the undisturbed sites. These species are found in association with the emergent epifauna (bryozoans, hydroids, worm tubes) prevalent in the undisturbed areas. Several studies of the food habits of juvenile cod identify these associated species as important prey items (Hacunda 1981; Lilly and Parsons 1991; Witman and Sebens 1992; Casas and Paz 1994; NEFSC 1998). These areas provide two important ecological functions for post-settlement juvenile cod relative to other areas: increased survivability and readily available prey. These areas are also particularly vulnerable to adverse impacts from mobile fishing gear.

Sensitivity to Anthropogenic Stresses

Specific areas on the northern edge of Georges Bank have been extensively studied and identified as important areas for the survival of juvenile cod (Lough *et al.* 1989; Valentine and Lough 1991; Valentine and Schmuck 1995). These studies provide reliable information on the location of the areas most important to juvenile cod and the type of substrate found in those areas. These areas have also been studied to determine the effects of bottom fishing on the benthic megafauna (Collie *et al.* 1996; Collie *et al.* 1997). Gravel/cobble substrates not subject to fishing pressure support thick colonies of emergent epifauna, but bottom fishing, especially scallop dredging, reduces habitat complexity and removes much of the emergent epifauna (Collie *et al.* 1996; Collie *et al.*

1997). While acknowledging that a single tow of a dredge across pristine habitat will have few long-term effects, Collie *et al.* (1997) focuses on the cumulative effects and intensity of trawling and dredging as responsible for potential long-term changes in benthic communities. For these reasons, the identified area on the northern edge of Georges Bank meets the second criterion, as well as the cumulative effects consideration, for designation as a habitat area of particular concern.

Collie *et al.* (1997) also describe the relative abundance of several other species such as shrimps, polychaetes, brittle stars, and mussels in the undisturbed sites. These species are found in association with the emergent epifauna (bryozoans, hydroids, worm tubes) prevalent in the undisturbed areas. Several studies of the food habits of juvenile cod identify these associated species as important prey items (Hacunda 1981; Lilly and Parsons 1991; Witman and Sebens 1992; Casas and Paz 1994; NEFSC 1998). These areas provide two important ecological functions for post-settlement juvenile cod relative to other areas: increased survivability and readily available prey. These areas are also particularly vulnerable to adverse impacts from mobile fishing gear.

Extent of Current or Future Development Stresses

This criterion was not used as a justification for the status quo HAPC on George's Bank in the 1998 EFH Omnibus Amendment #1.

Rarity of the Habitat Type

This criterion was not used as a justification for the status quo HAPC on George's Bank in the 1998 EFH Omnibus Amendment #1.

Table 122. Summary of Alternative 1A (No Action) Suitability: HAPC Criteria and Council Preferences

HAPC Criteria (EFH Final Rule)	Criteria Met?	Discussion
Importance of Historic or Current Ecological Function	Yes	Substrate of gravel or cobble found in the area allows sufficient space for newly settled juvenile cod to find shelter and avoid predation.
Sensitivity to Anthropogenic Stresses	Yes	Bottom fishing, especially scallop dredging and otter trawling, reduces habitat complexity and removes much of the emergent epifauna.
Extent of Current or Future Development Stresses	No	N/A
Rarity of the Habitat Type	No	N/A

Council Preferences	**Preference Met?**	**Discussion**
Will improve the fisheries management in the EEZ	Yes	Area provides two important ecological functions for post-settlement juvenile cod, an overfished species, relative to other areas: increased survivability and readily available prey.
Include EFH designations for more than one Council-managed species	No	N/A
Include juvenile cod EFH	Yes	HAPC designed specifically to capture juvenile cod habitats.
Meet more than one of the EFH Final Rule HAPC criteria	Yes	Meets Criteria 1 and Criteria 2

Atlantic Salmon HAPC

Seven small, coastal drainages located in the downeast and mid-coast sections of Maine hold the last remaining populations of native Atlantic salmon in the United States (MASA and USFWS 1996). These important rivers are the Dennys, Machias, East Machias, Pleasant, Narraguagus, Ducktrap, and Sheepscot. The U.S. Fish and Wildlife Service (USFWS) and NMFS have determined that these rivers represent one distinct population segment (DPS). A DPS is defined as a population of vertebrates that is discrete and ecologically significant. Four other rivers in Maine -- the Kennebec, Penobscot, St. Croix, and Tunk Stream -- are being considered for possible inclusion in the DPS. In 1998, the Council concluded that the designation of the following eleven (11) rivers in Maine met at least two criteria for designation as habitat areas of particular concern: Dennys, Machias, East Machias, Pleasant, Narraguagus, Ducktrap, Sheepscot, Kennebec, Penobscot, St. Croix, and Tunk Stream.

Importance of Historic or Current Ecological Function

By supporting the only remaining U.S. populations of naturally spawning Atlantic salmon that have historic river-specific characteristics, these rivers provide an important ecological function. These river populations harbor an important genetic legacy that is vital to the persistence of these populations and to the continued existence of the species in the United States. Accordingly, this criterion was used as a justification for the designation of these rivers as HAPC in the 1998 EFH Omnibus Amendment #1 as they provide a unique and important ecological function.

Sensitivity to Anthropogenic Stresses

Unfortunately the habitat of these rivers is susceptible to a variety of human-induced threats, from dam construction and hydropower operations to logging, agriculture, and aquaculture activities. Human activities can threaten the ability of Atlantic salmon to migrate upriver to the spawning habitat, the quality and quantity of the spawning and rearing habitat, and also the genetic integrity of the native populations contained in the rivers. Accordingly, this criterion was used as a justification for the designation of these rivers as HAPC in the 1998 EFH Omnibus Amendment #1 as they are sensitive to human-induced environmental degradation.

Extent of Current or Future Development Stresses

This criterion was not used as a justification for the status quo Atlantic salmon HAPC in the 1998 EFH Omnibus Amendment #1.

Rarity of the Habitat Type

This criterion was not used as a justification for the status quo Atlantic salmon HAPC in the 1998 EFH Omnibus Amendment #1.

Table 123. Summary of Alternative 1B (No Action) Suitability: HAPC Criteria and Council Preferences

HAPC Criteria (EFH Final Rule)	**Criteria Met?**	**Discussion**
Importance of Historic or Current Ecological Function	Yes	Supports the only remaining U.S. populations of naturally spawning Atlantic salmon
Sensitivity to Anthropogenic Stresses	Yes	Habitat is susceptible to a variety of human-induced threats, from dam construction and hydropower operations to logging, agriculture, and aquaculture activities
Extent of Current or Future Development Stresses	No	N/A
Rarity of the Habitat Type	No	N/A
Council Preferences	**Preference Met?**	**Discussion**
Will improve the fisheries management in the EEZ	Yes	May assist in the rebuilding of the Atlantic salmon population, an ESA species.
Include EFH designations for more than one Council-managed species	No	N/A
Include juvenile cod EFH	No	N/A
Meet more than one of the EFH Final Rule HAPC criteria	Yes	Meets Criteria 1 and Criteria 2

7.2.1.3 Alternative 2 - Seamounts

Alternative 2 (Refer to Section 4.2.2) seeks to designate seamounts within the New England Seamount chain inside the U.S. EEZ with the goal of benefiting habitat by recognizing the seamounts physical structure and ecological function. An HAPC designation is proposed for Bear, Physalia and Retriever seamounts, and the minor topographic rises surrounding them, that are within the U.S. EEZ off the southern edge of Georges Bank.

Alternative 2A (Bear, Retriever and Physalia Seamounts)

The area of Alternative 2A is 389 nm^2. Under the Status Quo EFH designations, there is no EFH designated in any part of the seamounts as the EFH designations are restricted to the continental shelf. However, under the Preferred Alternative EFH for the Omnibus Amendment, deep-sea red crab would be designated in Alternative 2A.

Table 124. Alternative 2A, Seamounts (3) – Summary Statistics for Status Quo EFH

Species	Life Stage	Total EFH Area (nm^2)	Overlap with Alternative (nm^2)	% of Total EFH inside Alternative	% of HAPC that is EFH
None currently designated.					

Table 125. Alternative 2A, Seamounts (3) – Summary Statistics for Omnibus Amendment Preferred Alternative EFH

Species	Life Stage	Total EFH Area (nm^2)	Overlap with Alternative (nm^2)	% of Total EFH inside Alternative	% of HAPC that is EFH
Deep-sea red crab	Larvae Juveniles Adults	30,339	389	1.28%	100%

Alternative 2B (Bear, Retriever, Physalia and Mytilus Seamounts)

Table 126. Alternative 2B, Seamounts (4) – Summary Statistics for Status Quo EFH

Species	Life Stage	Total EFH Area (nm^2)	Overlap with Alternative (nm^2)	% of Total EFH inside Alternative	% of HAPC that is EFH
None currently designated.					

Table 127. Alternative 2B, Seamounts (4) – Summary Statistics for Omnibus Amendment Preferred Alternative EFH

Species	Life Stage	Total EFH Area (nm^2)	Overlap with Alternative (nm^2)	% of Total EFH inside Alternative	% of HAPC that is EFH
Deep-sea red crab	Larvae Juveniles	30,339	468	1.54%	100%

	Adults				

Importance of Historic or Current Ecological Function

Although these seamounts are further offshore than the shelf edge and slope, and are not within areas traditionally managed by current Fishery Management Plans (FMPs), they are within the EEZ and deep-sea red crab have been document in these areas and EFH for red crab is for these seamounts is under consideration.

Watling and Auster have used video transects to census deep sea fishes and characterize the landscape in which they operate. To date, they have observed 36 fish taxa from 24 families based on *Alvin*, *Hercules* and *ABE* imagery. Moore et al. (2003a) listed 591 species of deepwater fishes in the northwest Atlantic Ocean that occur at depths greater than 200 m. However, the zoogeography of this region as whole has not been resolved to the level that can predict patterns of distribution and diversity at medium to small spatial scales (i.e., the spatial scale within and between seamounts across the region). Based on observations of variations in habitat features within seamount landscapes, and general patterns in the associations of fishes with such features, a hierarchical landscape classification scheme was developed to classify patterns of habitat use in deepwater fishes (Auster et al. 2005). The classification scheme includes geological and biological features as well as the local flow regime as habitat attributes. Preliminary analysis suggests that seamount fishes can be divided into four groups. The members of the first group are generalists and occur in all habitat types. These include halosaurids (i.e. *Aldrovandia* spp.), macrourids (i.e., *Caelorinchus* spp., *Nezumia* spp.), and *Synaphobranchus kaupi*. The second group, which occurs primarily in basalt habitats, includes an oreosomatid (*Neocyttus helgae*) that appears to have an association with both corals and depressions within basalt pavements. Taxa that make up the third group occur in fine-grained sediment habitats, including macrourids (*Coryphaenoides* spp.), chimaerids (*Hydrolagus* spp.), rajids, alepocephalids, ipnopids (*Bathypterois* spp.), and synodontids (*Bathysaurus* spp.). One final group appears to be specialized in living along the ecotone of ledges and sediment and includes morids (*Antimora rostrata* and *Laemonema* spp.), ophidiid cusk-eels and other synaphobranchids besides *S. kaupi*. Analysis of transect data is ongoing.

The observed size structures of coral colonies are intriguing. Prior anecdotal observations have indicated that stands of deep-water octocorals tend to be relatively uniform in size, and conspicuously lacking in small colonies. This general pattern is being found in two species *Paragorgia* sp. and *Lepidisis* sp. However, in *Paragorgia* tiny recruits have been discovered, consisting of just a few polyps. For this species, it may be that post-settlement mortality plays a role in the absence of small colonies. The size distributions of corals will become much more informative when we can convert them to age distributions. Studies to develop this size-age relationship are underway but regardless of the outcome, it appears that in general, coral communities are composed of cohorts from highly sporadic recruitment.

The authors are in the process of quantifying distributions of several species (*Paragorgia* sp. *Lepidisis* spp. *Metallogorgia* sp., *Paramuricea* spp., *Candidella* sp., *and Corallium* sp., as well as other scleractinians and antipatharians) using videotapes and digital still images. Preliminary quantitative analyses of coral species distributions indicate that community composition differs considerably between seamounts, even at comparable depths. These differences correspond to biogeographical boundaries, or they may be due to species' responses to local habitat conditions, such as substratum type or flow. Substantial variation in faunal composition occurs between sites on a single seamount.

Merrett (1994) found that species richness of deepwater fishes in the North Atlantic, at depths greater than 250 m, was approximately 1094 species belonging to 143 families (589 pelagic and 505 demersal). Boundaries that limit the distribution of many species in this vagile fauna is evidenced by the reduced number of taxa (591) found in the northwest Atlantic alone (Moore et al. 2003a). Further, given that most ichthyofaunal surveys beyond continental shelf waters have been conducted using various types of towed nets over widely separated sampling stations, understanding the actual distribution of many deepwater taxa remains elusive. For example, trawl sampling by Moore et al. (2003b) at Bear Seamount revealed two species known previously only from the eastern Atlantic (i.e., *Hydrolagus pallida* and *Bathypterois dubius*). Watling and Auster have observed *H. pallida* on Manning Seamount as well, using the *Hercules* ROV in 2004. Observations of false boarfish, *Neocyttus helgae*, nominally an eastern Atlantic species, were also made during video transects at multiple seamounts during both 2003 and 2004 expeditions (Moore et al in prep.). These observations suggest that seamount chains may provide "stepping stones" for dispersal and maintenance of populations of deepwater demersal fishes across ocean basins where their vertical distributions are restricted to slope depths (sensu Moore et al. 2003b). These observations are consistent with those of Kukuev (2002) who showed that there was little differentiation in the deepwater fishes (>500 m) of the Corner Rise Seamounts, mid-Atlantic Ridge, and east Atlantic seamounts. However, the shallow water ichthyofauna (from those peaks with depths <300m) east of the mid-Atlantic Ridge showed affinities for east Atlantic shelf faunas.

For these reasons, Alternative 2 meets this criterion.

Sensitivity to Anthropogenic Stresses

Seamounts support ecological communities with a high level of biodiversity that includes deep-sea corals and a wide array of ocean species that rely on them. The seamount habitats, which contain structure-forming organisms such as deep-sea corals, are extremely sensitive to disturbance and likely have recovery periods on the order of centuries. While these seamounts are not currently fished, this is an important and limited opportunity to protect this habitat before it is disturbed and is a pre-cautionary alternative worth public input.

The HAPC is proposed to elevate recognition for the occurrence of habitat-forming organisms such as deepwater corals and co-occurring species (e.g., sponges) that are abundant within seamount landscapes. Corals are extremely sensitive to disturbance and, with low recruitment and growth rates, require extremely long periods of time to recover from any damage. Corals are clearly sensitive to fishing gear impacts and recovery rates are extremely slow based on our knowledge of recruitment, growth rates, and age structure. The ability to age deep-water scleractinians and octocorals is relatively new and different methods are used in different studies. For *Primnoa resedaeformis*, a common outer shelf-upper slope species, Risk et al. (2002) estimates linear growth rates at the distal tips of the colonies at 1.5-2.5 mm yr-1 based on comparisons of live specimens with growth rates through the base of a sub-fossil specimen collected from the Northeast Channel at 450 m. Growth rates of this same species in the Gulf of Alaska are reported as 1.60-2.32 cm yr-1 , although these samples were collected at less than 200 m depth (Andrews et al. 2002). Age estimates for only a few specimens demonstrate this species lives for hundreds of years. The colony collected from the Northeast Channel (Risk et al. 2002) has an estimated age of >300 years, which is in accordance with age estimates of the same species collected in Alaska (>100 years; Andrews et al. 2002). *Desmophyllum cristagalli*, a deep-water scleractinian, grows at 0.5-1.0 mm yr-1 and lives >200 years, with this growth rate verified by a specimen collected from an aircraft sunk in Baltimore Canyon in 1944 (Lazier et al. 1999; Risk et al. 2002). A 1.5 m high colony of the deep-water scleractinian coral *Lophelia pertusa* may be up to 366 years of age (Breeze et al. 1997). Deep-water reefs of *Oculina varicosa* form pinnacles and ridges 3-35 m in height off the east coast of Florida and have an average growth rate of 16.1 mm yr-1 (Reed 2002). Based simply on age and growth information, recovery of impacted colonies and thickets may take hundreds of years.

Data on recruitment patterns are even more limited. A single series of observations in the Gulf of Alaska suggest that recruitment of *Primnoa* sp. is patchy and aperiodic (Krieger 2001). No recruitment of new colonies was observed in an area where *Primnoa* was removed by trawling after seven years. However, six new colonies were observed at a second site one year after trawling. Four of these colonies were attached to the bases of colonies removed by trawling. Recruits of *Primnoa* were also observed on two 7 cm diameter cables (>15 colonies each). Limited observations of corals in the Gulf of Maine and in submarine canyons have not revealed widespread coral recruits (Watling, Auster, and France, unpublished observations). The Seamount HAPC alternatives should be considered as a precautionary management measure to preclude impacts to a highly sensitive fauna (Auster 2001).

Based on the above discussion, the New England Seamount Chain, included in this alternative, are sensitive to anthropogenic stresses such as bottom fishing.

Extent of Current or Future Development Stresses

No development is currently occurring on the New England Seamount Chain and it is unknown whether any will take place in the future. As such, the HAPC alternative does not meet this criterion.

Rarity of the Habitat Type
Seamounts have steep and complex topography, impinging currents with topographically induced upwellings, wide depth ranges, are dominated by hard substrates, are geographically isolated from continental platforms, and are dominated by invertebrate suspension feeders. Seamount faunas generally exhibit a high degree of endemism, owing to their isolation as well as the high degree of landscape variation at small and large spatial scales. The New England Seamount chain is a line of extinct volcanoes running from the southern side of Georges Bank to a point midway across the western Atlantic. The New England Seamount Chain, the Corner Rise Seamounts, the mid-Atlantic Ridge, and the deep sides of the Azores constitute a nearly continuous series of hard substrate "islands" in a sea of abyssal mud extending across the North Atlantic Ocean. These islands are therefore rare habitats within the context of the whole North Atlantic basin. The most westerly seamounts (i.e., Bear, Physalia, Retriever, and Mytilus) are within the boundary of the United States Exclusive Economic Zone. Several of the seamounts were visited by geologists in 1974, but there has been little biological exploration of the area. Our group (the Mountains-in-the-Sea Research Group) has conducted some of the first ecological studies along the New England Seamount Chain.

It is known, from preliminary work conducted along the western side of the North Atlantic, and by German scientists in the eastern Atlantic, that some species of deep-sea octocorals and fish can be found in both areas. The Watling and Auster (2005) collections also indicate that there is a biogeographic separation of the eastern and western basins faunas, each with their own endemic species. This suggests that individual seamounts, or small groups of seamounts, may also harbor endemic species. In 2003, 63 coral specimens were collected at Bear, Kelvin, and Manning seamounts using the submersible *Alvin*. This collection contained 15 octocoral genera, 6 antipatharian genera, and some unknown number of zoanthid genera. With an increased number of dives in 2004 using the ROV *Hercules*, 135 corals were collected at Bear, Retriever, Balanus, Kelvin, and Manning seamounts. These specimens represent 23 octocoral genera, 7 antipatharian genera, and an unknown number of zoanthid genera. In all, 14 genera were added in 2004, including at those seamounts visited in 2003. From the videotapes it has also been noted other octocoral colonies that so far remain uncollected. There are a series of taxonomic problems in several of the genera, so no estimate of species can be made at this time. However, an initial inspection of the material collected suggests the occurrence of about 15 new species, most in the families Plexauridae, Chrysogorgiidae, and Primnoidae. Taxonomic, genetic, and reproductive studies are ongoing. However, given the greater degree of investigation of corals in the east Atlantic, the presence of these undescribed species also suggests that they have very limited distributions.

The available evidence from both octocorals and fish distributions suggests that the fauna of the New England Seamount chain is a part of a broad North Atlantic fauna with a regional endemism component (Watling and Auster, 2005). Since the chain of seamounts is nearly continuous from Bear Seamount to the Azores, a transition to an eastern Atlantic fauna must occur somewhere along the chain of seamounts, either at the Corner Rise seamounts or in the vicinity of the mid-Atlantic ridge. From Reid's (1994) analysis of flow at 2000 m, it would appear that the Corner Rise seamounts, and perhaps the easternmost New England chain seamounts such as Nashville, receive flow directly from the east and so should look more like the deep Azorean fauna than do the seamounts at the western end of the New England chain. Still, there are difficulties with this interpretation. Reid's (1994) flow analysis suggests a general east to west deep flow across the Atlantic south of 30° N with no northeastward flow south of the Gulf Stream. However, several of the octocorals that we have been able to identify so far were originally described from the deep Antilles and Florida Straits and others have been found on the Reykjanes Ridge (Keller and Pasternak 2001). These species have so far not been identified from the eastern Atlantic, suggesting that they are western Atlantic endemics with a larval connection between the New England seamounts and the deep Antilles. On the other hand, there seems to be a slight correspondence between the Antillean deep octocoral fauna and that from eastern mid-latitude seamounts, such as Great Meteor and the deep sides of the Azores (Grasshoff 1977, 1981). The results of the work by Watling and Auster suggest a degree of endemism in seamount fauna that warrants considering a risk-averse approach at the only seamounts in the Atlantic EEZ of the United States.

Based on the above discussion, the New England Seamount Chain, included in this alternative, are clearly rare habitats.

Table 128. Summary of Alternative 2 Suitability: HAPC Criteria and Council Preferences

HAPC Criteria (EFH Final Rule)	Criteria Met?	Discussion
Importance of Historic or Current Ecological Function	Yes	May provide "stepping stones" for dispersal and maintenance of populations of deepwater demersal fishes across ocean basins where their vertical distributions are restricted to slope depths
Sensitivity to Anthropogenic	Yes	Extremely sensitive to

Stresses		disturbance and, with low recruitment and growth rates, require extremely long periods of time to recover from any damage
Extent of Current or Future Development Stresses	No	N/A
Rarity of the Habitat Type	Yes	Rare habitats within the context of the whole North Atlantic basin and contain species endemism.
Council Preferences	**Preference Met?**	**Discussion**
Will improve the fisheries management in the EEZ	Yes	An opportunity to recognize sensitive coral communities with no impact to current economic investments by the fishing industry.
Include EFH designations for more than one Council-managed species	No	N/A
Include juvenile cod EFH	No	N/A
Meet more than one of the EFH Final Rule HAPC criteria	Yes	1, 2 and 4.

7.2.1.4 Alternative 3 – Deep-Sea Canyons

This alternative (Section 4.2.3) identifies deep-sea canyon habitats that contain, or are believed to contain, structure-forming organisms (e.g. deep-sea coral species) and, in doing so, to recognize the benthic communities and marine ecosystems of which they are a part. Recognizing the importance of these species and their communities will be a first step towards maintaining the vital functions they provide for managed fish species, of which there is some evidence but also a clear need for further research.

The main purpose of the individual canyon HAPC alternatives is to designate as HAPC deep-sea canyons in the northeastern U.S. that contain or are believed to contain habitat-forming organisms including, but not limited to, stone corals (*Cnidaria, Anthozoa, Hexacorallia, Sceractinia*), black corals (*Anthipitharians*), cerianthid anemones (*Cnidaria, Anthozoa, Hexacorallia, Cerianthania*), soft corals (*Cnidaria, Anthozoa, Octocorallia*), sea pens (*Cnidaria, Anthozoa, Octocorallia, Pennatulacea*) and sponges (*Porifera*).

Table 129. Alternative 3, Deep-sea canyons: Summary Statistics for Status Quo EFH*

Canyon Option	Total EFH Area (nm^2)	EFH: Species	Life Stage	Overlap with Alternative (nm^2)
3A: Heezen	38.56	Atlantic Halibut	All Life Stages	38.56
		Redfish	All Life Stages	38.56
		Red Hake	Larvae	38.56
		Red Hake	Juvenile	38.56
		Red Hake	Adult	38.56
		Silver Hake	Adult	38.56
		White Hake	Egg	38.56
		White Hake	Larvae	38.56
		White Hake	Juvenile	38.56
		White Hake	Adult	38.56
		Haddock	Adult	38.38
		Little Skate	Juvenile	38.38
		Yellowtail Flounder	Juvenile	38.38
		Yellowtail Flounder	Adult	38.38
		Monkfish	Egg/Larvae	35.37
		Monkfish	Adult	35.37
		Atlantic Cod	Egg	35.19
		Atlantic Cod	Larvae	35.19
		Atlantic Sea Scallop	All Life Stages	35.19
		Barndoor Skate	Adult	35.19
		Haddock	Egg	35.19
		Haddock	Larvae	35.19
		Haddock	Juvenile	35.19
		Little Skate	Adult	35.19
		Offshore Hake	Egg	35.19
		Yellowtail Flounder	Egg	35.19
		American Plaice	Egg	35.19
		Deep Sea Red Crab	Larvae	26.33
		Deep Sea Red Crab	Adult	26.33
		Deep Sea Red Crab	Juvenile	9.28
		Deep Sea Red Crab	Egg	7.94
		Smooth Skate	Juvenile	3.36
		Offshore Hake	Adult	3.36
		Witch Flounder	Adult	3.36
		Ocean Pout	Egg/Larvae	3.18
		Ocean Pout	Juvenile	3.18
		Ocean Pout	Adult	3.18
		Smooth Skate	Adult	3.18
3B: Lydonia		Atlantic Halibut	All Life Stages	71.46
		Monkfish	Egg/Larvae	71.46
		Red Hake	Larvae	71.46
		Deep Sea Red Crab	Larvae	68.16
		Clearnose Skate	Adult	59.76
		Monkfish	Adult	59.76
		Offshore Hake	Larvae	59.76
		Red Hake	Adult	59.76
		Silver Hake	Adult	59.76
		Yellowtail Flounder	Egg	59.76

Canyon Option	Total EFH Area (nm^2)	EFH: Species	Life Stage	Overlap with Alternative (nm^2)
		Deep Sea Red Crab	Adult	57.79
		Offshore Hake	Egg	50.82
		Redfish	All Life Stages	50.82
		Atlantic Cod	Egg	44.44
		Silver Hake	Egg/Larvae	35.97
		Silver Hake	Juvenile	35.97
		Witch Flounder	Egg	35.97
		Atlantic Cod	Larvae	32.74
		Haddock	Egg	32.74
		Haddock	Larvae	32.74
		Witch Flounder	Larvae	32.74
		American Plaice	Larvae	32.73
		Deep Sea Red Crab	Juvenile	32.44
		White Hake	Egg	27.02
		White Hake	Larvae	27.02
		White Hake	Juvenile	27.02
		White Hake	Adult	27.02
		Witch Flounder	Juvenile	27.02
		American Plaice	Egg	23.79
		Deep Sea Red Crab	Egg	20.65
		Offshore Hake	Adult	11.70
		Thorny Skate	Adult	11.70
		Atlantic Herring	Adult	8.94
		Atlantic Sea Scallop	All Life Stages	8.94
		Haddock	Juvenile	8.94
		Haddock	Adult	8.94
		Little Skate	Juvenile	8.94
		Little Skate	Adult	8.94
		Monkfish	Juvenile	8.94
		Ocean Pout	Egg/Larvae	8.94
		Ocean Pout	Adult	8.94
		Red Hake	Juvenile	8.94
		Windowpane	Larvae	8.94
		Witch Flounder	Adult	8.94
		Yellowtail Flounder	Larvae	8.94
		Yellowtail Flounder	Juvenile	8.94
3C: Gilbert	96.72	Atlantic Halibut	All Life Stages	96.62
		Monkfish	Egg/Larvae	96.62
		Monkfish	Adult	80.88
		Red Hake	Adult	80.88
		Silver Hake	Adult	80.88
		White Hake	Egg	80.88
		White Hake	Larvae	80.88
		White Hake	Juvenile	80.88
		White Hake	Adult	80.88
		Deep Sea Red Crab	Larvae	73.79
		Witch Flounder	Adult	72.53
		Deep Sea Red Crab	Adult	53.48
		Redfish	All Life Stages	52.63
		Witch Flounder	Juvenile	52.63

Canyon Option	Total EFH Area (nm^2)	EFH: Species	Life Stage	Overlap with Alternative (nm^2)
		Deep Sea Red Crab	Juvenile	43.77
		Clearnose Skate	Adult	36.61
		Silver Hake	Egg/Larvae	36.61
		Silver Hake	Juvenile	36.61
		Atlantic Cod	Larvae	28.25
		Barndoor Skate	Adult	28.25
		Haddock	Larvae	28.25
		Monkfish	Juvenile	28.25
		Yellowtail Flounder	Larvae	28.25
		Red Hake	Larvae	24.09
		Deep Sea Red Crab	Egg	17.25
		Atlantic Cod	Egg	15.73
		Offshore Hake	Adult	15.73
		Thorny Skate	Adult	15.73
		Offshore Hake	Egg	8.36
		Offshore Hake	Larvae	8.36
		Witch Flounder	Egg	8.36
		Yellowtail Flounder	Egg	8.36
3D: Oceanographer	178.78	Atlantic Halibut	All Life Stages	178.17
		Monkfish	Egg/Larvae	165.71
		Monkfish	Adult	165.71
		Red Hake	Adult	165.71
		Silver Hake	Adult	165.71
		White Hake	Egg	165.71
		White Hake	Larvae	165.71
		White Hake	Juvenile	165.71
		White Hake	Adult	165.71
		Witch Flounder	Adult	140.52
		Clearnose Skate	Adult	138.84
		Offshore Hake	Adult	120.22
		Deep Sea Red Crab	Larvae	119.50
		Redfish	All Life Stages	96.09
		Deep Sea Red Crab	Adult	91.70
		Red Hake	Larvae	69.30
		Red Hake	Juvenile	69.30
		Silver Hake	Egg/Larvae	69.30
		Silver Hake	Juvenile	69.30
		Offshore Hake	Egg	65.15
		Deep Sea Red Crab	Juvenile	63.97
		Atlantic Cod	Egg	44.11
		Witch Flounder	Larvae	44.11
		Yellowtail Flounder	Larvae	44.11
		Atlantic Herring	Adult	42.45
		Atlantic Cod	Larvae	39.96
		Windowpane	Egg	39.96
		American Plaice	Egg	39.96
		American Plaice	Larvae	39.96
		Deep Sea Red Crab	Egg	32.09
		Witch Flounder	Juvenile	26.87
		Monkfish	Juvenile	26.85

Canyon Option	Total EFH Area (nm^2)	EFH: Species	Life Stage	Overlap with Alternative (nm^2)
		Windowpane	Larvae	25.19
		Witch Flounder	Egg	25.19
		Atlantic Sea Scallop	All Life Stages	4.15
		Haddock	Adult	4.15
		Little Skate	Juvenile	4.15
		Offshore Hake	Larvae	4.15
		Haddock	Larvae	2.49
		Haddock	Juvenile	2.49
		Ocean Pout	Egg/Larvae	2.49
		Ocean Pout	Adult	2.49
		Barndoor Skate	Adult	1.66
		Little Skate	Adult	1.66
		Windowpane	Adult	1.66
		Yellowtail Flounder	Egg	1.66
		Yellowtail Flounder	Adult	1.66
3E: Hydrographer	84.67	Clearnose Skate	Adult	65.31
		Monkfish	Egg/Larvae	65.31
		Red Hake	Adult	65.31
		Silver Hake	Adult	65.31
		Monkfish	Juvenile	55.47
		Red Hake	Larvae	55.47
		Offshore Hake	Egg	55.02
		Monkfish	Adult	53.96
		White Hake	Egg	53.96
		White Hake	Larvae	53.96
		White Hake	Juvenile	53.96
		White Hake	Adult	53.96
		Redfish	All Life Stages	53.51
		Deep Sea Red Crab	Larvae	52.83
		Deep Sea Red Crab	Adult	44.51
		Haddock	Larvae	44.12
		Offshore Hake	Larvae	44.12
		Silver Hake	Egg/Larvae	44.12
		Silver Hake	Juvenile	44.12
		Barndoor Skate	Adult	43.67
		Offshore Hake	Juvenile	43.67
		Offshore Hake	Adult	43.67
		Yellowtail Flounder	Egg	43.67
		Yellowtail Flounder	Larvae	43.67
		Deep Sea Red Crab	Juvenile	25.39
		Atlantic Halibut	All Life Stages	21.65
		Deep Sea Red Crab	Egg	18.21
		Haddock	Adult	11.80
		Red Hake	Juvenile	11.80
		Atlantic Cod	Larvae	11.35
		Haddock	Egg	11.35
		Witch Flounder	Egg	11.35
3F: Veatch	77.24	Deep Sea Red Crab	Larvae	64.36
		Monkfish	Egg/Larvae	60.65
		Monkfish	Adult	60.65

Canyon Option	Total EFH Area (nm^2)	EFH: Species	Life Stage	Overlap with Alternative (nm^2)
		Red Hake	Adult	60.65
		Silver Hake	Adult	60.65
		White Hake	Juvenile	60.65
		Silver Hake	Egg/Larvae	60.44
		Silver Hake	Juvenile	60.44
		Monkfish	Juvenile	53.93
		White Hake	Egg	53.93
		White Hake	Larvae	53.93
		White Hake	Adult	53.93
		Deep Sea Red Crab	Adult	50.70
		Deep Sea Red Crab	Juvenile	39.00
		Deep Sea Red Crab	Egg	14.55
		Atlantic Cod	Larvae	6.93
		Haddock	Egg	6.72
		Haddock	Larvae	6.72
		Haddock	Adult	6.72
		Offshore Hake	Egg	6.72
		Offshore Hake	Larvae	6.72
		Red Hake	Larvae	6.72
		Windowpane	Egg	6.72
		Witch Flounder	Egg	6.72
		Witch Flounder	Larvae	6.72
		Yellowtail Flounder	Egg	6.72
		Yellowtail Flounder	Larvae	6.72
		American Plaice	Larvae	6.71
3G: Alvin and Atlantis	388.14	Deep Sea Red Crab	Larvae	315.97
		Deep Sea Red Crab	Adult	265.93
		Monkfish	Egg/Larvae	221.37
		Monkfish	Adult	221.37
		Offshore Hake	Adult	213.30
		Deep Sea Red Crab	Juvenile	156.37
		Silver Hake	Adult	144.26
		Yellowtail Flounder	Juvenile	124.96
		Offshore Hake	Juvenile	104.87
		Deep Sea Red Crab	Egg	95.22
		Offshore Hake	Larvae	79.53
		White Hake	Egg	77.11
		White Hake	Larvae	77.11
		White Hake	Juvenile	77.11
		White Hake	Adult	77.11
		Red Hake	Adult	75.61
		Monkfish	Juvenile	47.85
		Offshore Hake	Egg	28.87
		Yellowtail Flounder	Adult	20.80
		Atlantic Cod	Larvae	12.72
		Haddock	Larvae	12.72
		American Plaice	Larvae	12.72
		Clearnose Skate	Adult	8.07
		Red Hake	Larvae	8.07
3H:	265.56	Deep Sea Red Crab	Larvae	184.73

Canyon Option	Total EFH Area (nm^2)	EFH: Species	Life Stage	Overlap with Alternative (nm^2)
Hudson		Monkfish	Egg/Larvae	167.02
		Deep Sea Red Crab	Adult	134.23
		Monkfish	Adult	129.11
		Silver Hake	Adult	129.11
		Monkfish	Juvenile	117.16
		Deep Sea Red Crab	Juvenile	109.78
		Red Hake	Adult	109.28
		Offshore Hake	Adult	104.80
		Witch Flounder	Juvenile	104.80
		Offshore Hake	Juvenile	104.04
		Red Hake	Larvae	70.37
		Offshore Hake	Larvae	70.30
		Offshore Hake	Egg	65.89
		Red Hake	Juvenile	61.73
		White Hake	Egg	57.25
		White Hake	Larvae	57.25
		White Hake	Juvenile	57.25
		White Hake	Adult	57.25
		Witch Flounder	Adult	57.25
		Deep Sea Red Crab	Egg	37.30
		Rosette Skate	Juvenile	17.11
		Silver Hake	Egg/Larvae	16.43
		Silver Hake	Juvenile	16.43
		Haddock	Larvae	7.96
		Rosette Skate	Adult	7.89
		Atlantic Sea Scallop	All Life Stages	4.48
		Little Skate	Juvenile	4.48
		Pollock	Adult	4.48
		Ocean Pout	Egg/Larvae	4.47
		Ocean Pout	Juvenile	4.47
		Witch Flounder	Larvae	4.47
		Yellowtail Flounder	Larvae	4.47
		Yellowtail Flounder	Adult	4.47
3I: Toms and Hendrickson	269.59	Deep Sea Red Crab	Larvae	161.35
		Deep Sea Red Crab	Juvenile	115.47
		Deep Sea Red Crab	Adult	111.78
		Rosette Skate	Adult	73.74
		Monkfish	Egg/Larvae	23.48
		Monkfish	Juvenile	23.48
		Red Hake	Adult	23.48
		Silver Hake	Adult	23.48
		Red Hake	Larvae	23.16
		Red Hake	Juvenile	23.16
		Rosette Skate	Juvenile	23.16
		Monkfish	Adult	22.61
		Silver Hake	Egg/Larvae	18.10
		Silver Hake	Juvenile	18.10
		Offshore Hake	Egg	17.79
		Offshore Hake	Larvae	17.79
		Deep Sea Red Crab	Egg	17.70

Canyon Option	Total EFH Area (nm^2)	EFH: Species	Life Stage	Overlap with Alternative (nm^2)
		Witch Flounder	Juvenile	5.69
3J: Wilmington	120.85	Deep Sea Red Crab	Larvae	93.46
		Monkfish	Egg/Larvae	78.46
		Monkfish	Juvenile	78.46
		Rosette Skate	Juvenile	78.46
		Silver Hake	Adult	78.46
		Monkfish	Adult	76.10
		Witch Flounder	Juvenile	76.10
		Deep Sea Red Crab	Adult	70.08
		Offshore Hake	Larvae	63.23
		Offshore Hake	Juvenile	63.23
		Deep Sea Red Crab	Juvenile	61.28
		Red Hake	Larvae	57.44
		Haddock	Larvae	43.88
		Offshore Hake	Egg	43.88
		Witch Flounder	Egg	43.88
		Witch Flounder	Larvae	43.88
		Yellowtail Flounder	Egg	43.88
		Yellowtail Flounder	Larvae	43.88
		Deep Sea Red Crab	Egg	16.93
		Offshore Hake	Adult	12.87
		Red Hake	Juvenile	12.87
		Red Hake	Adult	12.87
		Silver Hake	Egg/Larvae	12.87
		Silver Hake	Juvenile	12.87
		Atlantic Sea Scallop	All Life Stages	2.36
3K: Baltimore	80.78	Monkfish	Egg/Larvae	80.23
		Monkfish	Juvenile	80.23
		Rosette Skate	Juvenile	80.23
		Silver Hake	Adult	80.23
		Red Hake	Adult	61.14
		Witch Flounder	Juvenile	61.14
		Silver Hake	Egg/Larvae	56.41
		Silver Hake	Juvenile	56.41
		Deep Sea Red Crab	Larvae	55.28
		Deep Sea Red Crab	Adult	54.12
		Offshore Hake	Juvenile	43.97
		Offshore Hake	Egg	36.25
		Red Hake	Larvae	36.25
		Deep Sea Red Crab	Juvenile	27.83
		Witch Flounder	Egg	23.82
		Monkfish	Adult	17.17
		Offshore Hake	Larvae	17.17
		Witch Flounder	Larvae	17.17
		Deep Sea Red Crab	Egg	13.55
		Atlantic Sea Scallop	All Life Stages	12.44
		Red Hake	Juvenile	12.44
3L: Washingto	47.83	Monkfish	Egg/Larvae	46.64
		Monkfish	Juvenile	46.64

Canyon Option	Total EFH Area (nm^2)	EFH: Species	Life Stage	Overlap with Alternative (nm^2)
n		Red Hake	Larvae	46.64
		Rosette Skate	Juvenile	46.47
		Silver Hake	Adult	42.15
		Monkfish	Adult	42.08
		Red Hake	Juvenile	42.08
		Red Hake	Adult	42.08
		Witch Flounder	Juvenile	42.08
		Witch Flounder	Adult	42.08
		Deep Sea Red Crab	Adult	36.02
		Deep Sea Red Crab	Larvae	36.02
		Deep Sea Red Crab	Juvenile	18.84
		Deep Sea Red Crab	Egg	7.76
		Atlantic Sea Scallop	All Life Stages	4.55
3M: Norfolk	56.94	Monkfish	Juvenile	56.65
		Red Hake	Larvae	56.65
		Rosette Skate	Juvenile	56.65
		Silver Hake	Adult	56.65
		Monkfish	Egg/Larvae	38.44
		Deep Sea Red Crab	Larvae	37.27
		Deep Sea Red Crab	Adult	37.13
		Offshore Hake	Larvae	35.74
		Witch Flounder	Juvenile	35.74
		Yellowtail Flounder	Larvae	35.74
		Clearnose Skate	Juvenile	18.21
		Witch Flounder	Larvae	18.21
		Deep Sea Red Crab	Juvenile	15.11
		Deep Sea Red Crab	Egg	11.75
		Atlantic Sea Scallop	All Life Stages	2.70
		Monkfish	Adult	2.70
		Offshore Hake	Juvenile	2.70
		Red Hake	Juvenile	2.70
		Red Hake	Adult	2.70
3N: Oceanographer, Gilbert and Lydonia	919.13	Atlantic Halibut	All Life Stages	754.76
		Monkfish	Egg/Larvae	673.76
		Monkfish	Adult	596.59
		Red Hake	Adult	596.59
		Silver Hake	Adult	596.59
		White Hake	Egg	528.32
		White Hake	Larvae	528.32
		White Hake	Juvenile	528.32
		White Hake	Adult	528.32
		Clearnose Skate	Adult	490.25
		Witch Flounder	Adult	439.13
		Red Hake	Larvae	413.38
		Silver Hake	Egg/Larvae	384.52
		Silver Hake	Juvenile	384.52
		Deep Sea Red Crab	Larvae	380.90
		Redfish	All Life Stages	299.50
		Atlantic Cod	Egg	284.55
		Yellowtail Flounder	Larvae	267.89

Canyon Option	Total EFH Area (nm^2)	EFH: Species	Life Stage	Overlap with Alternative (nm^2)
		Deep Sea Red Crab	Adult	265.35
		Offshore Hake	Egg	253.15
		Atlantic Cod	Larvae	253.11
		Red Hake	Juvenile	230.60
		Deep Sea Red Crab	Juvenile	224.61
		Offshore Hake	Adult	223.12
		Offshore Hake	Larvae	207.45
		Witch Flounder	Larvae	207.38
		Haddock	Larvae	198.40
		Witch Flounder	Egg	187.25
		Yellowtail Flounder	Egg	185.24
		Witch Flounder	Juvenile	183.31
		Monkfish	Juvenile	177.44
		Atlantic Herring	Adult	150.95
		American Plaice	Larvae	145.17
		Barndoor Skate	Adult	129.13
		Atlantic Sea Scallop	All Life Stages	114.03
		Little Skate	Juvenile	114.03
		American Plaice	Egg	105.54
		Haddock	Juvenile	105.02
		Ocean Pout	Egg/Larvae	105.02
		Ocean Pout	Adult	105.02
		Haddock	Adult	101.84
		Haddock	Egg	99.25
		Little Skate	Adult	91.82
		Deep Sea Red Crab	Egg	91.30
		Windowpane	Larvae	79.29
		Thorny Skate	Adult	77.17
		Windowpane	Egg	76.91
		Yellowtail Flounder	Juvenile	39.64
		Ocean Pout	Juvenile	30.98
		Windowpane	Adult	21.20
		Yellowtail Flounder	Adult	9.01
3O: Toms, Hendrickson and Inter-Canyon Areas	375.88	Deep Sea Red Crab	Larvae	253.80
		Deep Sea Red Crab	Juvenile	187.16
		Deep Sea Red Crab	Adult	170.45
		Monkfish	Egg/Larvae	144.96
		Monkfish	Juvenile	144.96
		Red Hake	Adult	144.96
		Silver Hake	Adult	144.96
		Red Hake	Larvae	144.50
		Red Hake	Juvenile	144.50
		Rosette Skate	Juvenile	142.85
		Monkfish	Adult	140.73
		Offshore Hake	Egg	105.66
		Rosette Skate	Adult	78.28
		Silver Hake	Egg/Larvae	63.83
		Silver Hake	Juvenile	63.83
		Offshore Hake	Larvae	63.36
		Offshore Hake	Juvenile	42.76

Canyon Option	Total EFH Area (nm^2)	EFH: Species	Life Stage	Overlap with Alternative (nm^2)
		Witch Flounder	Adult	42.30
		Witch Flounder	Juvenile	37.66
		Deep Sea Red Crab	Egg	26.20
		Atlantic Sea Scallop	All Life Stages	4.22
		Haddock	Larvae	2.58
		Witch Flounder	Larvae	2.58
		Yellowtail Flounder	Larvae	2.58

** Species and life stages shown for those that have at least 1 square nautical mile of EFH in the Option.*

Table 130. Alternative 3, Deep-sea canyons: – Summary Statistics for Omnibus Amendment Preferred Alternative EFH*

Canyon Option	Total EFH Area (nm^2)	EFH: Species	Life Stage	Overlap with Alternative (nm^2)
3A: Heezen	38.56	Atlantic Sea Scallop	All Life Stages	37.98
		Deep Sea Red Crab	All Life Stages	37.98
		Ocean Pout	Eggs	35.37
		Ocean Pout	Larvae	35.37
		Haddock	Adult	35.19
		Atlantic Herring	Adult	35.19
		Witch Flounder	Juvenile/Adult	35.11
		Red Hake	Adult	32.99
		Silver Hake	Adult	22.13
		White Hake	Juvenile	21.26
		White Hake	Adult	20.42
		Offshore Hake	Juvenile/Adult	20.21
		Barndoor Skate	Juvenile/Adult	18.85
		Monkfish	Adult	18.53
		Monkfish	Juvenile	18.51
		Thorny Skate	Adult	15.95
		Thorny Skate	Juvenile	15.95
		Smooth Skate	Juvenile	15.95
		Smooth Skate	Adult	15.95
		Atlantic Halibut	Juvenile	14.14
		Redfish	Adult	8.01
		Redfish	Juvenile	8.01
		Silver Hake	Juvenile	4.83
3B: Lydonia	93.94	Witch Flounder	Juvenile/Adult	77.75
		Red Hake	Adult	61.28
		Ocean Pout	Eggs	59.75
		Ocean Pout	Larvae	59.75

		Monkfish	Adult	54.20
		White Hake	Juvenile	47.82
		White Hake	Adult	47.82
		Silver Hake	Adult	42.56
		Deep Sea Red Crab	All Life Stages	39.11
		Barndoor Skate	Juvenile/Adult	31.37
		Offshore Hake	Juvenile/Adult	26.36
		Monkfish	Juvenile	23.20
		Thorny Skate	Adult	20.72
		Thorny Skate	Juvenile	20.72
		Smooth Skate	Adult	20.72
		Smooth Skate	Juvenile	20.72
		Atlantic Halibut	All Life Stages	15.09
		Redfish	Adult	10.38
		Redfish	Juvenile	10.38
		Silver Hake	Juvenile	8.97
		Haddock	Adult	8.94
		Atlantic Sea Scallop	All Life Stages	8.94
		Atlantic Herring	Adult	8.94
3C: Gilbert	96.72	Monkfish	Adult	64.16
		White Hake	Juvenile	63.14
		White Hake	Adult	60.52
		Witch Flounder	Juvenile/Adult	59.14
		Red Hake	Adult	56.25
		Deep Sea Red Crab	All Life Stages	43.42
		Silver Hake	Adult	36.81
		Ocean Pout	Eggs	36.60
		Ocean Pout	Larvae	36.60
		Offshore Hake	Juvenile/Adult	31.27
		Barndoor Skate	Juvenile/Adult	29.04
		Atlantic Herring	Adult	28.25
		Monkfish	Juvenile	25.96
		Smooth Skate	Adult	22.63
		Thorny Skate	Adult	22.63
		Smooth Skate	Juvenile	22.63
		Thorny Skate	Juvenile	22.63
		Atlantic Halibut	All Life Stages	15.89
		Redfish	Juvenile	11.19
		Redfish	Adult	11.19
		Silver Hake	Juvenile	5.91
3D: Oceanographer	178.78	Ocean Pout	Eggs	164.33
		Ocean Pout	Larvae	164.33
		Witch Flounder	Juvenile/Adult	131.76
		Monkfish	Adult	130.24
		White Hake	Juvenile	119.69
		Red Hake	Adult	115.80
		White Hake	Adult	110.40
		Atlantic Herring	Adult	93.14
		Silver Hake	Adult	93.10
		Deep Sea Red Crab	All Life Stages	71.67
		Monkfish	Juvenile	69.50
		Barndoor Skate	Juvenile/Adult	66.51
		Offshore Hake	Juvenile/Adult	48.18
		Red Hake	Juvenile	39.98

		Redfish	Juvenile	37.27
		Thorny Skate	Adult	35.88
		Smooth Skate	Juvenile	35.88
		Thorny Skate	Juvenile	35.88
		Smooth Skate	Adult	35.88
		Atlantic Halibut	All Life Stages	30.05
		Redfish	Adult	17.55
		Silver Hake	Juvenile	10.03
		Pollock	Juvenile	4.21
		Haddock	Adult	4.15
		Atlantic Sea Scallop	All Life Stages	4.15
		Silver Hake	Eggs	2.49
		Silver Hake	Larvae	2.49
		Haddock	Juvenile	2.45
		Ocean Pout	Juvenile	1.66
		Atlantic Cod	Juvenile	1.39
3E: Hydrographer	84.67	Witch Flounder	Juvenile/Adult	72.57
		White Hake	Adult	66.00
		Red Hake	Adult	64.09
		Ocean Pout	Eggs	53.96
		Ocean Pout	Larvae	53.96
		Monkfish	Adult	51.72
		Atlantic Herring	Adult	44.12
		White Hake	Eggs	43.67
		White Hake	Larvae	43.67
		Silver Hake	Adult	39.13
		White Hake	Juvenile	38.94
		Monkfish	Juvenile	35.26
		Deep Sea Red Crab	All Life Stages	35.02
		Offshore Hake	Juvenile/Adult	30.41
		Smooth Skate	Juvenile	20.62
		Smooth Skate	Adult	20.62
		Thorny Skate	Adult	20.62
		Thorny Skate	Juvenile	20.62
		Atlantic Halibut	All Life Stages	19.88
		Redfish	Juvenile	9.46
		Redfish	Adult	9.46
		Silver Hake	Juvenile	4.84
3F: Veatch	77.24	Witch Flounder	Juvenile/Adult	60.54
		White Hake	Juvenile	55.85
		Monkfish	Adult	53.92
		White Hake	Adult	53.89
		Red Hake	Adult	44.83
		Monkfish	Juvenile	43.41
		Deep Sea Red Crab	All Life Stages	40.85
		Offshore Hake	Juvenile/Adult	28.28
		Silver Hake	Adult	22.90
		Thorny Skate	Juvenile	21.26
		Smooth Skate	Juvenile	21.26
		Smooth Skate	Adult	21.26
		Thorny Skate	Adult	21.26
		Barndoor Skate	Juvenile/Adult	18.55
		Atlantic Halibut	All Life Stages	14.39
		Redfish	Juvenile	9.91

		Redfish	Adult	9.91
		Atlantic Sea Scallop	All Life Stages	6.71
		Atlantic Herring	Adult	6.71
		Silver Hake	Juvenile	4.88
3G: Alvin and Atlantis	388.14	Witch Flounder	Juvenile/Adult	313.28
		Monkfish	Adult	277.57
		White Hake	Adult	250.65
		White Hake	Juvenile	240.24
		Deep Sea Red Crab	All Life Stages	201.72
		Red Hake	Adult	191.25
		Monkfish	Juvenile	177.48
		Offshore Hake	Juvenile/Adult	159.82
		Silver Hake	Adult	137.93
		Barndoor Skate	Juvenile/Adult	127.72
		Thorny Skate	Juvenile	113.95
		Thorny Skate	Adult	113.95
		Smooth Skate	Adult	113.95
		Atlantic Halibut	All Life Stages	85.28
		Redfish	Juvenile	54.09
		Redfish	Adult	54.09
		Ocean Pout	Eggs	47.84
		Ocean Pout	Larvae	47.84
		Atlantic Herring	Adult	47.84
		Silver Hake	Juvenile	29.44
3H: Hudson	265.56	White Hake	Adult	199.71
		Witch Flounder	Juvenile/Adult	185.17
		White Hake	Juvenile	180.69
		Monkfish	Adult	145.03
		Monkfish	Juvenile	135.53
		Red Hake	Adult	134.38
		Deep Sea Red Crab	All Life Stages	108.50
		Offshore Hake	Juvenile/Adult	79.80
		Atlantic Herring	Adult	58.81
		Smooth Skate	Adult	58.18
		Thorny Skate	Juvenile	58.18
		Thorny Skate	Adult	58.18
		Smooth Skate	Juvenile	58.18
		Atlantic Sea Scallop	All Life Stages	51.27
		Silver Hake	Adult	47.67
		Barndoor Skate	Juvenile/Adult	43.13
		Atlantic Halibut	All Life Stages	37.67
		Redfish	Juvenile	24.92
		Redfish	Adult	24.92
		Silver Hake	Juvenile	15.98
		Rosette Skate	Juvenile/Adult	11.47
		Ocean Pout	Eggs	4.47
		Ocean Pout	Larvae	4.47
		Silver Hake	Eggs	4.40
		Silver Hake	Larvae	4.40
3I: Toms and Hendrickson	269.59	White Hake	Adult	200.74
		White Hake	Juvenile	193.63
		Witch Flounder	Juvenile/Adult	133.26
		Deep Sea Red Crab	All Life Stages	98.50
		Monkfish	Juvenile	72.45

		Red Hake	Adult	67.82
		Monkfish	Adult	56.79
		Smooth Skate	Juvenile	46.18
		Thorny Skate	Juvenile	46.18
		Thorny Skate	Adult	46.18
		Smooth Skate	Adult	46.18
		Offshore Hake	Juvenile/Adult	40.60
		Barndoor Skate	Juvenile/Adult	31.17
		Atlantic Halibut	All Life Stages	26.27
		Ocean Pout	Eggs	22.29
		Ocean Pout	Larvae	22.29
		Silver Hake	Adult	20.78
		Atlantic Sea Scallop	All Life Stages	18.66
		Redfish	Adult	16.72
		Redfish	Juvenile	16.72
		Silver Hake	Juvenile	8.06
		Atlantic Herring	Adult	4.81
		Rosette Skate	Juvenile/Adult	4.33
3J: Wilmington	120.85	Witch Flounder	Juvenile/Adult	104.50
		White Hake	Juvenile	84.61
		White Hake	Adult	78.82
		Monkfish	Juvenile	75.64
		Monkfish	Adult	74.16
		Deep Sea Red Crab	All Life Stages	56.00
		Red Hake	Adult	53.49
		Atlantic Sea Scallop	All Life Stages	46.23
		Offshore Hake	Juvenile/Adult	38.20
		Rosette Skate	Juvenile/Adult	34.39
		Smooth Skate	Juvenile	28.55
		Thorny Skate	Juvenile	28.55
		Thorny Skate	Adult	28.55
		Smooth Skate	Adult	28.55
		Barndoor Skate	Juvenile/Adult	21.00
		Ocean Pout	Eggs	20.02
		Ocean Pout	Larvae	20.02
		Atlantic Halibut	All Life Stages	17.87
		Silver Hake	Adult	12.83
		Redfish	Juvenile	11.76
		Redfish	Adult	11.76
		Silver Hake	Juvenile	6.02
		Atlantic Herring	Adult	2.36
3K: Baltimore	80.78	Monkfish	Juvenile	69.78
		Witch Flounder	Juvenile/Adult	63.14
		Deep Sea Red Crab	All Life Stages	47.20
		White Hake	Adult	43.01
		White Hake	Juvenile	43.01
		Red Hake	Adult	42.09
		Monkfish	Adult	32.11
		Offshore Hake	Juvenile/Adult	31.26
		Rosette Skate	Juvenile/Adult	30.94
		Thorny Skate	Juvenile	26.74
		Smooth Skate	Juvenile	26.74
		Smooth Skate	Adult	26.74
		Thorny Skate	Adult	26.74

		Barndoor Skate	Juvenile/Adult	19.36
		Atlantic Halibut	All Life Stages	16.78
		Atlantic Sea Scallop	All Life Stages	12.44
		Redfish	Adult	11.49
		Redfish	Juvenile	11.49
		Atlantic Herring	Adult	6.64
		Silver Hake	Juvenile	5.67
		Silver Hake	Adult	5.67
3L: Washington	47.83	Witch Flounder	Juvenile/Adult	43.22
		Monkfish	Adult	43.10
		Monkfish	Juvenile	43.10
		Red Hake	Adult	39.34
		White Hake	Adult	38.12
		Deep Sea Red Crab	All Life Stages	30.73
		White Hake	Juvenile	27.87
		Offshore Hake	Juvenile/Adult	21.01
		Thorny Skate	Adult	19.69
		Smooth Skate	Adult	19.69
		Thorny Skate	Juvenile	19.69
		Smooth Skate	Juvenile	19.69
		Rosette Skate	Juvenile/Adult	15.98
		Barndoor Skate	Juvenile/Adult	12.68
		Atlantic Halibut	All Life Stages	10.64
		Redfish	Adult	6.62
		Redfish	Juvenile	6.62
		Atlantic Herring	Adult	4.55
		Atlantic Sea Scallop	All Life Stages	4.55
		Silver Hake	Juvenile	3.23
		Silver Hake	Adult	3.23
3M: Norfolk	56.94	Monkfish	Juvenile	49.14
		Red Hake	Adult	44.09
		Witch Flounder	Juvenile/Adult	39.35
		White Hake	Juvenile	34.73
		White Hake	Adult	33.68
		Deep Sea Red Crab	All Life Stages	28.54
		Rosette Skate	Juvenile/Adult	25.74
		Offshore Hake	Juvenile/Adult	19.41
		Monkfish	Adult	18.40
		Atlantic Herring	Adult	18.21
		Atlantic Sea Scallop	All Life Stages	18.21
		Thorny Skate	Juvenile	15.50
		Smooth Skate	Juvenile	15.50
		Smooth Skate	Adult	15.50
		Thorny Skate	Adult	15.50
		Barndoor Skate	Juvenile/Adult	11.22
		Atlantic Halibut	All Life Stages	9.87
		Redfish	Juvenile	7.02
		Redfish	Adult	7.02
		Silver Hake	Adult	3.81
		Silver Hake	Juvenile	3.81
		Ocean Pout	Eggs	2.71
		Ocean Pout	Larvae	2.71
3N: Oceanographer,	919.13	White Hake	Juvenile	572.78
		Ocean Pout	Eggs	519.42

Gilbert and Lydonia		Ocean Pout	Larvae	519.42
		Red Hake	Adult	518.41
		White Hake	Adult	498.91
		Monkfish	Adult	435.94
		Witch Flounder	Juvenile/Adult	381.79
		Barndoor Skate	Juvenile/Adult	375.69
		Silver Hake	Adult	321.22
		Atlantic Herring	Adult	315.51
		Deep Sea Red Crab	All Life Stages	202.55
		Atlantic Halibut	All Life Stages	191.28
		Monkfish	Juvenile	178.82
		Offshore Hake	Juvenile/Adult	135.54
		Atlantic Sea Scallop	All Life Stages	114.00
		Redfish	Juvenile	111.08
		Haddock	Adult	101.80
		Smooth Skate	Adult	101.08
		Thorny Skate	Adult	101.08
		Thorny Skate	Juvenile	101.08
		Smooth Skate	Juvenile	101.08
		Haddock	Juvenile	92.38
		Red Hake	Juvenile	76.91
		Silver Hake	Eggs	53.17
		Silver Hake	Larvae	53.17
		Silver Hake	Juvenile	51.18
		Redfish	Adult	49.15
		Ocean Pout	Juvenile	39.98
		Ocean Pout	Adult	34.72
		Little Skate	Adult	29.38
		Atlantic Cod	Juvenile	20.99
		Pollock	Adult	5.10
3O: Toms, Hendrickson and Inter-Canyon Areas	375.88	White Hake	Adult	294.61
		White Hake	Juvenile	277.95
		Witch Flounder	Juvenile/Adult	234.42
		Monkfish	Juvenile	171.14
		Red Hake	Adult	162.41
		Deep Sea Red Crab	All Life Stages	152.38
		Monkfish	Adult	113.03
		Ocean Pout	Eggs	97.96
		Ocean Pout	Larvae	97.96
		Smooth Skate	Juvenile	69.68
		Smooth Skate	Adult	69.68
		Thorny Skate	Juvenile	69.68
		Thorny Skate	Adult	69.68
		Atlantic Sea Scallop	All Life Stages	67.58
		Offshore Hake	Juvenile/Adult	66.40
		Silver Hake	Adult	61.54
		Rosette Skate	Juvenile/Adult	58.50
		Barndoor Skate	Juvenile/Adult	47.00
		Atlantic Halibut	All Life Stages	39.34
		Atlantic Herring	Adult	35.06
		Redfish	Adult	24.82
		Redfish	Juvenile	24.82
		Silver Hake	Juvenile	12.16

** Species and life stages shown for those that have at least 1 square nautical mile of EFH in the Option.*

Importance of Historic or Current Ecological Function

Structure- or Habitat-Forming Organisms

With respect to fisheries management and habitat protection, at least eight invertebrate groups contain species that potentially provide structures that form habitats for other marine organisms in deep water off the northeast coast of the United States.

Numerous specimens of structure-forming animal groups (mainly cnidarians and sponges) collected in deep water (>100m) off the northeast coast of the United States (37º-42ºN and 66º-75ºW) are housed in the Smithsonian's National Museum of Natural History. These specimens were obtained from a variety of sources from the late 1800's to the present. The vast majority was collect for two government entities, the Bureau of Land Management's Minerals Management Service (BLM/MMS) and the National Marine Fisheries Service (NMFS) and its predecessor the U. S. Fish Commission (USFC). Roughly one third of the specimens were obtained for BLM/MMS by various organizations (including Woods Hole Oceanographic Institute, the University of New England Marine Laboratory, and the Virginia Institute of Marine Science) and individuals. Collection data on the specimens directly indicate that 391 specimens were collected for NMFS/USFC. An additional 716 specimens can be inferred to have been collected for the USFC because the vessels (Albatross R/V and Fish Hawk R/V) used to make the collections were operated by USFC. Thus, nearly two thirds of the collections were obtained for NMFS/USFC. Only 660 of the specimens have the gear used to obtain them noted in their collection data. The majority of specimens were obtained using some form of trawl. Dredges, grabs, box corers, and bottom skimmers were also used to collect some of the specimens present in the Smithsonian collections.

Group 1: Antipatharia (*Cnidaria, Anthozoa, Hexacorallia*) – Black Corals

Antipatharians are colonial cnidarians. Colonies, which usually have a branching form, are held erect by a rigid skeleton composed of proteins with a horny consistency. Colonies grow on hard substrates and range from 10 to well over 100 cm in height. Antipatharians are predominantly tropical, but species are known to occur in the area of interest. Genera documented in Smithsonian Collections: *Leiopathes*

Group 2: Ceriantharia (*Cnidaria, Anthozoa, Hexacorallia*) – Tube Anemones

Cerianthharians live within self-constructed tubes. These tubes have a rubbery consistency and are formed by mucus and sediment grains held together by discharged nematocysts (typically the stinging cells of cnidarians). Cerianthharians are solitary animals that inhabit soft substrates. Usually their tubes, which can be up to one meter in length, are entirely below the sediment-water interface. In some species tubes may extend above the seafloor by up to 20 cm. Genera documented in Smithsonian Collections: *Cerianthiopsis* and *Cerianthus.*

Group 3: Other Anemones (*Cnidaria, Anthozoa, Hexacorallia*) including Actiniaria, Corallimorpharia, and Zoanthidea – Anemones Other Than Tube Anemones

Anemones are solitary hexacorals that lack mineralized skeletons. They are barrel shaped animals that primarily live attached to hard substrates. They are not commonly thought of as "structure forming" organisms. Nevertheless, they range in size from less than one cm to tens of centimeters in height and therefore potentially add to environmental complexity where they occur. Note however that many species are gregarious and may form mats. Numerous species, particularly of Actiniaria, have been documented in the area of interest. Genera documented in Smithsonian Collections: *Actinauge, Actinernus, Actinostola, Actinothoe, Adamsia, Antholoba, Bolocera, Dactylactis, Edwardsia, Halcampa, Hormathia, Metridium, Paracalliactis, Paraedwardsia, Peachia, Raphactis, Sagartia, Sagartiogeton, Stephanauge, Tealia, Urticina, Corynactis, and Epizoanthus.*

Group 4: Scleractinia (*Cnidaria, Anthozoa, Hexacorallia*) – Stony Corals

Scleractinians can be either solitary or colonial. While a majority of species live with their aragonitic skeletons firmly attached to hard substrate, roughly one third live unattached on soft sediments. The size range of scleractinians is great. Some of the solitary unattached species measure just a few mm across, whereas colonial species can make structures with dimensions measured in meters. Genera documented in Smithsonian Collections: *Caryophyllia, Dasmosmilia, Desmophyllum, Enallopsammia, Flabellum, Fungiacyathus, Javania, Lophelia, Solenosmilia and Vaughanella.*

Group 5: Pennatulacea (*Cnidaria, Anthozoa, Octocorallia*) – Sea Pens

Pennatulaceans are colonial octocorals that live in soft sediment habitats. They possess a large, primary axial polyp, which is differentiated into a bulbous region that anchors the colony in soft substrate, and a distal region from which secondary polyps arise. Sea pens do not have branching forms but instead have shapes that are elongate. They range in size from roughly 1 cm to well over 1 meter in height. Genera documented in Smithsonian Collections: *Anthoptilum, Balticina, Benthoptilum, Distichoptilum, Funiculina, Kophobelemnon, Pennatula, Renilla, Scleroptilum, Stylatula, Umbellula and Virgularia.*

Group 6: Other Octocorallia (*Cnidaria, Anthozoa, Octocorallia*) including species formerly classified as Gorgonacea and Alcyonacea – Soft Corals, Sea Fans, Sea Whips

Octocorals other than pennatulaceans are a heterogenous group of anthozoan cnidarians. Nearly all are colonial organisms. The group is predominantly associated with hard substrate but a small number of species are adapted to life in soft sediments. Adults range in size from around 10 cm to well over one meter. Many forms are branching. The gorgonians, or sea fans, possess a rigid scleroproteinaceous axis and form the most complex structures. Genera documented in Smithsonian Collections: *Acanella, Acanthogorgia, Anthothela, Chrysogorgia, Keratoisis, Lepidisis, Lepidogorgia, Paragorgia, Paramuricea, Primnoa, Radicipes, Swiftia, Anthomastus, Duva and Gersemia.*

<u>Group 7</u>: *Porifera* -- Sponges

Poriferans are diverse in form, varying from encrusting to ball-shaped, vase-shaped, and fan-shaped. Some forms branch or even anastomose, others are stalked. Some sponges have calcareous skeletons (composed of spicules), but most have siliceous skeletons. The siliceous spicules of some sponges in the group Hexactinellida (glass sponges) have fused spicules providing a rigid structure. Sizes range from minute to in excess of one meter. Poriferans can be found on both hard and soft substrates, but hard substrates appear to be favored by a majority of species. Genera documented in Smithsonian Collections: *Asbestopluma, Asconema, Axinella, Chondrocladia, Cliona, Gelliodes, Halichondria, Isodictya, Leucoselenia, Microciona, Reniera, Stylocordyla, Suberites, Sycon, Sympagella, Tethya and Trichostemma.*

<u>Group 8</u>: Crinoidea (*Echinodermata*) – Sea Lilies, Feather Stars

Crinoids known as sea lilies have a stalk, on top of which sits a calyx supporting numerous branched arms. Other crinoids, the feather stars, lack a stalk and thus do not extend very far off the sediment-water interface. Both types of crinoids are usually encountered on hard substrate, with the latter group frequently using a set of cirri to attach themselves (and move around upon) other structure forming organisms. Genera documented in Smithsonian Collections: *Antedon, Hathrometra and Rhizocrinus.*

<u>Group 9:</u> Sabellidae and Sabellerriidae (*Annelida, Polychaeta, Canalipalpata*) – Tubeworms, Fanworms, or Feather Duster Worms

Sabellid and Sabellerriid worms are worms that have a limited ability to creep or move along the substratum. With primarily to exclusively sessile life styles, they inhabit tubes constructed of mucus and sometimes tougher but not mineralized material. They are filter feeders, gathering suitable food with a tentacular crown that spreads out above their mouths. Most species are infaunal and small (just a few mm in length), but some can be as large 15-20 cm in height. Genera documented in Smithsonian Collections: *<u>Chone, Dedemona, Euchone, Jasmineira, Megalomma, Myxicola, Oriopsis and Potamilla.</u>*

In addition to the Smithsonian Collections, the Council has used the Watling and Auster (2005) "Distribution of deepwater alcyonacea off the northeast coast of the United States" database in the development of these alternatives. According to the authors, "a database of deep water alcyonacean records has been assembled using information that reaches back to the work of A.E. Verrill from the 1800s. These database records fall into two time periods, those from 1874 to 1920, and from 1950 to 2001. A total of 25 species in 10 families are so far known from the northeastern U.S. Most of these species are common in deeper waters of the continental shelf, with a few being restricted to the canyons and other slope environments."

Ecology of Georges Bank Canyons

The largest and most studied Georges Bank canyon is Oceanographer Canyon, and its surficial geology is generally similar to that in the other major canyons. The canyons present a spectrum of habitat types to the megabenthic and epibenthic fauna (crabs, lobster, shrimp, flounders, hake, tilefish, among others), and these habitats closely influence community structure. It is largely the diversity in substrate types that makes canyons richer biologically than the adjacent shelf and slope. This effect of substrate diversity may be aided by an abundance of nutrients introduced by the relatively strong currents in the canyons (Hecker, Blechschmidt, and Gibson, 1980).

The processes responsible for the present distribution of surficial sediments in and around Oceanographer Canyon may be summarized as follows: 1) as sea level fell, Wisconsinan glaciers advanced onto the Canadian Shelf and the northern margin of Georges Bank; 2) sand and gravel were deposited near the ice front in fluvial and nearshore marine environments; sandy silt containing cold water marine faunas was deposited farther offshore, mantling the outer shelf and slope and the walls and floor of a pre-existing canyon; 3) the ice front retreated, Georges Bank was isolated from continental sediment sources, and the Gulf of Maine became a sediment sink, remaining so today; 4) glacial sand and gravel were ice rafted southward from the Northeast Channel and the Canadian margin and deposited on the outer part of Georges Bank and in the canyons; 5) as sea level rose, glacial sand deposited on the inner shelf was reworked and transported seaward by submarine currents, covering the outer shelf and entering the canyons.

The Georges Bank canyons apparently serve as nurseries for a number of bottom animals, including such commercially valuable species as lobster, Jonah crab, red crab, tilefish, and several kinds of hake. The young of such animals have been observed both in naturally occurring and in excavated shelters in the bottom, in both the semi-consolidated sandy silts (which look like clay) and in boulder fields. Such substrates are common in the canyons (Cooper and Uzmann, 1980 a,b). Concentrations of lobsters (juvenile and adult), for example, are substantially greater in submarine canyons than in areas nearby (Cooper and Uzmann, 1980b); lobsters seen inside the canyons are usually juveniles, while those nearby but outside the canyons are usually adults.

In general, assemblages of animals in the heads of various Georges Bank canyons are similar. Within these assemblages, groups that favor shallow and middle depths can be distinguished. The distinction is most clearly seen in the relative abundance of red crabs, portunid crabs, lobsters, witch flounder, ocean pout, conger eels, tilefish, squirrel hake, common grenadier, slime eels, long-nosed eels, and black-bellied rosefish. An outer shelf/upper slope faunal zone (113-299m) and a mid-slope zone (300-1099m) were found by Haedrich, Rowe, and Polloni (1975) in Alvin Canyon and by Valentine, Uzmann, and Cooper (1980a) in Oceanographer Canyon. Further evidence for this zonation in Oceanographer and Lydonia Canyon has come from Hecker (pers. comm.).

Faunal diversity and, to some extent faunal abundance, in the canyon heads appear to be closely tied to the presence of cobbles and boulders on the ocean floor and to exposures of the consolidated sandy silt into which various animals tunnel and burrow.

Georges Bank canyons exhibit a range of habitat types, as follows:

Type I habitat (Cooper et al. 1982) which occurs on the canyon rim and walls, is a featureless bottom of sand or semi-consolidated silt (claylike in consistency) with less than 5% gravel cover; a burrowing anemone characterizes this habitat.

Type II habitat is also a generally featureless bottom, of gravelly sand with at least 5% gravel cover overlying a silt substratum on the canyon rim and walls. The burrowing anemone is again characteristic – a key member of what is probably the most common association of animals in the Georges Bank canyons in depths shoaler than 400m. The tubes frequently become refuges for a variety of associated fauna, including Jonah crabs, portunid crabs, lobsters, pandalid shrimp, black-bellied rosefish, redfish, and red and silver hake. The surface of the projecting tubes also provides a consolidated surface for settlement and attachment of suspension feeders, contributing to an increased species diversity and abundance (Shepard et al. 1986).

Type III habitat refers to featured, three-dimensional, very rough bottom, with siltstone outcrops and talus blocks of boulder size. These conditions are found on the rim and upper walls at the head of Oceanographer Canyon and farther down the canyon in several places at the base of the wall. White hake and ocean pout are found coexisting in surprising large numbers in this habitat. Other animals closely associated here are rock anemones, starfish, Jonah crab, and tilefish.

Type IV habitat is a featured bottom of densely burrowed, semi-consolidated silt; it occurs chiefly on the upper-to-middle canyon walls. Jonah crabs, lobsters, and tilefish predominate in this habitat. Their association is perhaps the most distinctive in the canyons; Cooper and Uzmann (1977, 1980a,b) have called it the "pueblo village" community. Type IV habitat has been found at depths of 150-1000m on the canyon walls, but is most evident at shoaler depths (150-300m). Pueblo villages deeper than 300 m are occupied primarily by red crab, Jonah crab, white hake, and ocean pout. The apex predator of the villages is the tilefish. Pueblo villages appear to be the prime habitat and "home ground" of offshore lobsters. Some 20-50% of the adult population migrates onshore from the villages in the spring and early summer (Uzmann, Cooper, and Pecci, 1977; Cooper and Uzmann, 1980a,b), returning in the late summer and fall.

Type V habitat refers to duned sand on the canyon floor. This has been found only in Oceanographer Canyon, from the very northern end south to a depth of at least 700m.

It is clear that the steep-walled canyons in the Northeast U.S. from Cape Hatteras north to the Hague Line., included in this Alternative, are ecologically distinct and important and, therefore, meet Criteria 1.

Sensitivity to Anthropogenic Stresses

The Georges Bank canyons apparently serve as nurseries for a number of bottom animals, including such commercially valuable species as lobster, Jonah crab, red crab, tilefish, and several kinds of hake. The young of such animals have been observed both in naturally occurring and in excavated shelters in the bottom, in both the semi-consolidated sandy silts (which look like clay) and in boulder fields. Such substrates are common in the canyons (Cooper and Uzmann, 1980 a,b). Concentrations of lobsters (juvenile and adult), for example, are substantially greater in submarine canyons than in areas nearby (Cooper and Uzmann, 1980b); lobsters seen inside the canyons are usually juveniles, while those nearby but outside the canyons are usually adults.

The steep slopes of the canyon walls are generally inaccessible to mobile fishing gear, such as dredges and otter trawls, and except for seasonal trapping, canyon inhabitants are not targets of a fishery. Hence the canyons serve as refuges for bottom species that are sought commercially elsewhere and for species that are disturbed or destroyed incidentally in the course of dredging and dragging. There is security in the canyons for a number of heavily exploited species common to the outer shelf and upper slope. In the canyons, therefore, community structure, behavior, and relations between animals and their habitats may well be represented in a virtually pristine state. However, the upper slopes and less steep parts of the canyon system are accessible to fishing for species such as monkfish, offshore hake, red crab and others and as such meet Criteria # 2.

Extent of Current or Future Development Stresses

In recent years, energy companies have suggested the use of the upper slope of the canyons as transmission lines for energy resources and products, such as natural gas, as a connection line between sources on the Scotian Shelf and the major U.S. metropolitan areas. This example is certainly not the only likely scenario of a future development stress. To be precautionary, it is reasonable to assume that fishing and non-fishing development stresses in these canyons will increase in the future; allowing this criterion to be met.

Rarity of the Habitat Type

The continental slope is cut by more than 20 large canyons between Georges Bank and Cape Hatteras and numerous smaller canyons and gullies, many of which may feed into the larger canyon systems. The continental slope extends from the continental shelf break (at depths between 60 m and 200 m) eastward to a depth of 2000 m. The width of the slope varies from 10-50 km, with an average gradient of 3-6°; however, local gradients can be nearly vertical. The base of the slope, where the continental rise begins, is defined by a marked decrease in seafloor gradient.

Occasional boulders occur on the slope as a result of glacial rafting, and coarse sediments and rock outcrops are found locally on and near canyon walls. Sand deposits may also be formed as a result of downslope movements. A "mud line" occurs on the slope at a depth of 250 m – 300 m, below which fine silt and clay size particles predominate over sand. Gravity-induced downslope movement is the dominant sedimentary process on the slope, and includes slumps, slides, debris flows, and turbidity currents, which range from thick cohesive movement to relatively non-viscous flow. Slumps are localized blocks of sediment that may involve short downslope movement. However, turbidity currents can transport sediments thousands of kilometers. The canyons may be regarded as highly modified areas of the continental slope that exhibit to varying degrees a more diverse fauna, topography, and hydrography than the intervening slope areas. Alternating erosional and depositional episodes over geologic time have shaped and modified these rare canyon systems into specialized habitats distinct from the classically defined slope province.

Table 131. Summary of Alternative 3 Suitability: HAPC Criteria and Council Preferences

HAPC Criteria (EFH Final Rule)	**Criteria Met?**	**Discussion**
Importance of Historic or Current Ecological Function	Yes.	Ecologically distinct and important.
Sensitivity to Anthropogenic Stresses	Yes	Accessible to fishing for species such as monkfish, offshore hake, red crab and others
Extent of Current or Future Development Stresses	Yes	Reasonable to assume that development stresses in these canyons will increase in the future
Rarity of the Habitat Type	Yes	Erosional and depositional episodes

		over geologic time have shaped and modified these rare habitats.
Council Preferences	**Preference Met?**	**Discussion**
Will improve the fisheries management in the EEZ	Yes	May reduce the development of these areas for fishing or non-fishing purposes and allow the natural processes to remain.
Include EFH designations for more than one Council-managed species	Yes	Many spp. Designated under status quo and preferred alternative EFH
Include juvenile cod EFH	Yes	Very small amount in Lydonia, Oceanographer, Gilbert and Heezen Canyons.
Meet more than one of the EFH Final Rule HAPC criteria	Yes	Meets all four criteria.

7.2.1.5 Alternative 4 – Cashes Ledge Area

This alternative (Section 4.2.4) seeks to extend the boundaries of the Cashes Ledge Habitat Closed Area in order to include deeper water habitats and ridges associated with Cashes Ledge.

The Cashes Ledge Area HAPC is 652 square nautical miles (nm^2) in area. There are forty-four (44) life stages of sixteen (16) species with more than 1% of their currently defined EFH (status quo) EFH area inside this alternative and forty-one (41) life stages and fourteen (14) species which currently make up more than 50% of the Cashes Ledge Area alternative (Table 132).

Under the preferred alternative EFH in the current EFH Omnibus Amendment, there would be thirty-seven (37) life stages of fourteen (14) species with more than 1% of their currently defined (status quo) EFH area inside this alternative and thirty-seven (37) life stages of fifteen (15) species which would make up more than 50% of the Cashed Ledge Area alternative (Table 133).

Table 132. Alternative 4, Cashes Ledge Area– Summary Statistics for Status Quo EFH

Species	Life Stage	Total EFH Area (nm^2)	Overlap with Alternative (nm^2)	% of Total EFH inside Alternative
Thorny Skate	Adult	15,482	652	4.21%
Pollock	Egg	15,885	589	3.71%
Pollock	Larvae	16,321	589	3.61%
Witch Flounder	Juvenile	15,896	562	3.53%
Smooth Skate	Adult	11,749	410	3.49%
American Plaice	Juvenile	19,632	645	3.28%
Witch Flounder	Adult	20,230	645	3.19%
Pollock	Juvenile	18,590	589	3.17%
Redfish	All life stages	21,369	652	3.05%
Smooth Skate	Juvenile	19,423	591	3.04%
American Plaice	Adult	22,514	652	2.90%
White Hake	Larvae	23,279	652	2.80%
White Hake	Egg	23,298	652	2.80%
Pollock	Adult	21,796	589	2.70%
White Hake	Adult	24,974	652	2.61%
White Hake	Juvenile	24,979	652	2.61%
Thorny Skate	Juvenile	26,722	652	2.44%
Atlantic Cod	Adult	31,211	626	2.01%
Atlantic Sea Scallop	All life stages	21,889	401	1.83%
Atlantic Halibut	All life stages	37,094	652	1.76%
Monkfish	Adult	39,291	652	1.66%
Red Hake	Adult	40,944	652	1.59%
Silver Hake	Adult	46,409	652	1.41%
Silver Hake	Egg and Larvae	49,328	652	1.32%
Haddock	Juvenile	13,972	185	1.32%
Silver Hake	Juvenile	50,972	652	1.28%
Red Hake	Juvenile	49,006	620	1.27%
Ocean Pout	Juvenile	13,349	148	1.11%
Monkfish	Juvenile	33,253	366	1.10%
Atlantic Herring	Adult	38,524	414	1.07%
Red Hake	Larvae	57,778	620	1.07%
Haddock	Egg	8,751	92	1.05%

Monkfish	Egg and Larvae	63,871	652	1.02%

Species	Life Stage	Total EFH Area (nm^2)	Overlap with Alternative (nm^2)	% of Alternative with This EFH
Atlantic Halibut	All life stages	37,094	652	100.00%
Monkfish	Egg and Larvae	63,871	652	100.00%
Monkfish	Adult	39,291	652	100.00%
Redfish	All life stages	21,369	652	100.00%
Red Hake	Adult	40,944	652	100.00%
Silver Hake	Egg and Larvae	49,328	652	100.00%
Silver Hake	Juvenile	50,972	652	100.00%
Silver Hake	Adult	46,409	652	100.00%
Thorny Skate	Juvenile	26,722	652	100.00%
Thorny Skate	Adult	15,482	652	100.00%
White Hake	Egg	23,298	652	100.00%
White Hake	Larvae	23,279	652	100.00%
White Hake	Juvenile	24,979	652	100.00%
White Hake	Adult	24,974	652	100.00%
American Plaice	Adult	22,514	652	100.00%
Witch Flounder	Adult	20,230	645	98.80%
American Plaice	Juvenile	19,632	645	98.80%
Atlantic Cod	Adult	31,211	626	95.93%
Red Hake	Larvae	57,778	620	95.07%
Red Hake	Juvenile	49,006	620	95.07%
Smooth Skate	Juvenile	19,423	591	90.51%
Pollock	Egg	15,885	589	90.33%
Pollock	Larvae	16,321	589	90.33%
Pollock	Juvenile	18,590	589	90.33%
Pollock	Adult	21,796	589	90.33%
Witch Flounder	Juvenile	15,896	562	86.09%
Atlantic Herring	Adult	38,524	414	63.42%
Smooth Skate	Adult	11,749	410	62.91%
Atlantic Sea Scallop	All life stages	21,889	401	61.53%

Monkfish	Juvenile	33,253	366	56.08%

Table 133. Alternative 4, Cashes Ledge Area – Summary Statistics for Omnibus Amendment Preferred Alternative EFH

Species	**Life Stage**	Total EFH Area (nm^2)	**Overlap with Alternative (nm^2)**	**% of Total EFH inside Alternative**
Redfish	Larvae	12,275	631	5.14%
American Plaice	Adult	13,453	587	4.36%
Redfish	Adult	11,869	438	3.69%
Thorny Skate	Adult	16,201	574	3.55%
Smooth Skate	Adult	14,489	513	3.54%
Redfish	Juvenile	17,191	564	3.28%
American Plaice	Juvenile	10,404	303	2.92%
Pollock	Adult	17,621	469	2.66%
Thorny Skate	Juvenile	24,220	644	2.66%
White Hake	Larvae	22,678	578	2.55%
White Hake	Eggs	22,697	578	2.55%
Witch Flounder	Juvenile and Adult	25,216	640	2.54%
Smooth Skate	Juvenile	21,999	534	2.43%
Monkfish	Adult	31,095	626	2.01%
Silver Hake	Adult	30,196	570	1.89%
White Hake	Adult	36,509	623	1.71%
Monkfish	Juvenile	33,781	527	1.56%
Red Hake	Adult	43,564	647	1.48%
Silver Hake	Eggs	45,494	652	1.43%
Silver Hake	Larvae	45,494	652	1.43%
Atlantic Sea Scallop	All life stages	35,035	436	1.24%
Atlantic Salmon	Adults	54,315	652	1.20%
Pollock	Juvenile	19,878	234	1.18%
Silver Hake	Juvenile	40,709	471	1.16%
White Hake	Juvenile	43,961	472	1.07%
Atlantic Herring	Adult	56,175	588	1.05%
Species	**Life Stage**	**Total EFH Area (nm^2)**	**Overlap with Alternative**	**% of Alternative with This EFH**

			(nm^2)	
Silver Hake	Eggs	45,494	652	100.00%
Silver Hake	Larvae	45,494	652	100.00%
Atlantic Salmon	Adults	54,315	652	100.00%
Deep Sea Red Crab	All life stages	30,339	651	99.79%
Red Hake	Adult	43,564	647	99.15%
Thorny Skate	Juvenile	24,220	644	98.76%
Witch Flounder	Juvenile and adult	25,216	640	98.14%
Redfish	Larvae	12,275	631	96.68%
Monkfish	Adult	31,095	626	96.00%
White Hake	Adult	36,509	623	95.55%
Atlantic Herring	Adult	56,175	588	90.06%
American Plaice	Adult	13,453	587	89.95%
White Hake	Eggs	22,697	578	88.65%
White Hake	Larvae	22,678	578	88.65%
Ocean Pout	Eggs	60,286	577	88.39%
Ocean Pout	Larvae	60,286	577	88.39%
Thorny Skate	Adult	16,201	574	88.04%
Silver Hake	Adult	30,196	570	87.38%
Redfish	Juvenile	17,191	564	86.51%
Smooth Skate	Juvenile	21,999	534	81.78%
Monkfish	Juvenile	33,781	527	80.81%
Smooth Skate	Adult	14,489	513	78.65%
White Hake	Juvenile	43,961	472	72.41%
Silver Hake	Juvenile	40,709	471	72.22%
Pollock	Adult	17,621	469	71.90%
Redfish	Adult	11,869	438	67.10%
Atlantic Sea Scallop	All life stages	35,035	436	66.79%

Importance of Historic or Current Ecological Function

Cashes Ledge is a granitic ridge located in the central Gulf of Maine which, including Ammen Rock Pinnacle, rises to within 26 meters of the ocean surface. The top of Cashes Ledge is primarily a steeply sided granitic outcrop that grades to boulder-talus-ledge, then cobble-sand and small outcrops, and finally sand-gravel as depth increases beyond approximately 75 m. Several unique features contribute to the ecological importance of the Cashes Ledge area. Productivity in the Cashes Ledge area is noteworthy because the area generates and receives internal waves that drive thick, plankton-rich layers down to the ledge (Witman et al. 1993). Dense aggregations of habitat forming invertebrates such as horse mussels, sea anemones, and sponges thrive on the productivity of the area and flourish along many of the peaks that distinguish the area (Witman and Sebens 1988, Lesser et al. 1994, Genovese and Witman, 1999, Hill et al. 2002) while burrowing anemones are abundant in the sand-gravel matrix beyond the base (Witman and Sebens 1988). Further, production of benthic macroalgae on Ammen Rock Pinnacle occurs at a record 63 m depth. The Cashes Ledge area continues to support a high abundance of large bodied predators such as cod, wolf fish, pollock, and sharks (Steneck 1997, Steneck and Carlton 2001, Steneck et al 2002, Witman and Sebens 1992) that are generally absent from rocky habitats along the coast of the Gulf of Maine. Fish may aggregate or have higher survival after settlement in the Cashes Ledge area due to increased availability of shelter (e.g., kelp forests, structure forming invertebrates) and abundant prey mediated by high water flow from nutrient-rich internal waves and other strong-current producing forces (Witman et al. 1993, Leichter and Witman 1997, Genovese and Witman 1999). For these reasons, Alternative 4 meets this criterion.

Sensitivity to Anthropogenic Stresses

Numerous studies on the impacts to marine habitats caused by various fishing gear types have been conducted. These studies and others demonstrate that benthic habitat features region-wide and within Alternative 4 are sensitive to anthropogenic stresses, including impacts caused by fishing gear.

Auster et al. (1996) conducted three studies of mobile fishing gear in the Gulf of Maine and concluded that mobile fishing gear alters the seafloor, and reduces habitat complexity, sedimentary structures, and emergent epifauna. Collie (1998) reviewed studies from New England and concluded that hard bottom benthic habitats (e.g. boulders and gravel pavement) experience significant impacts of mobile bottom-tending fishing gear. Jennings and Kaiser (1998) concluded that fishing activities lead to changes in the structure of marine habitats and influence the diversity, composition, biomass, and productivity of the associated biota. They further concluded these effects vary according to gears used, habitats fished and the magnitude of natural disturbance, but tend to increase with depth and the stability of the substrate.

Auster and Langton (1999) reviewed 22 studies from a wide geographic range and concluded that mobile fishing gear reduces 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 produces structure (i.e., taxa which produce burrows and pits). They also concluded that for fixed gear, the area impacted per unit effort is smaller than for mobile gear, but the types of damage to emergent benthos appear to be similar. These studies and others clearly demonstrate that benthic habitat features region-wide and within Alternative 4 are sensitive to anthropogenic stresses, including impacts caused by fishing gear. For these reasons, Alternative 4 meets this criterion.

Extent of Current or Future Development Stresses

The greatest potential threat to the unique habitat features contained in the proposed Cashes Ledge HAPC is impacts caused by fishing gear. Currently, a portion of Alternative 4 is designated as a Level 3 Habitat Closure. This designation prohibits the use of bottom-tending mobile gear (NEFMC 2004). However, the designation does not prohibit the use of a wide array of other fishing gears, including but not limited to: 1) herring and tuna purse seines, 2) herring mid-water trawls, 3) bottom gillnets, 4) lobster pots, and 5) bottom longlines. Spatial analysis of fishing effort from 1995-2001 shows a moderate to high levels of fishing effort by otter trawls and bottom gillnets in areas immediately adjacent to the proposed HAPC. (NEFMC 2004, Figures 1 and 2). As such, Alternative 4 meets this criterion to recognize the potential future development stress from fishing.

Rarity of the Habitat Type

The Cashes Ledge Area is a series of rocky pinnacles jutting up from the deep basins in the middle of the Gulf of Maine. Upwelling and internal waves deliver fish and invertebrate larvae to these pinnacles where settlement occurs. The combination of sunlight and nutrient-rich waters fuels the growth of these larvae creating a productive area that supports one of the largest kelp forests and deepest seaweed communities in the world, as well as abundant populations of large predatory fish including cod, pollock, wolf fish, and sharks. These unique conditions are found nowhere else in the greater Gulf of Maine/Georges Bank ecosystem, clearly making the Cashes Ledge area a rare habitat type. For these reasons, Alternative 4 meets this criterion.

Table 134. Summary of Alternative 4 Suitability: HAPC Criteria and Council Preferences

HAPC Criteria (EFH Final Rule)	Criteria Met?	Discussion
Importance of Historic or Current Ecological Function	Yes	Several unique features contribute to the ecological importance: productivity, dense aggregations of habitat forming invertebrates, production of benthic macroalgae at depths, high abundance of large bodied predators and higher fish survival after settlement due to the availability of shelter.
Sensitivity to Anthropogenic Stresses	Yes	Benthic habitat features region-wide and within

		Alternative 4 are sensitive to anthropogenic stresses, including impacts caused by fishing gear
Extent of Current or Future Development Stresses	Yes	Areas adjacent to Cashes Ledge Habitat Closed Area are fished.
Rarity of the Habitat Type	Yes	One of the largest and deepest continuous kelp beds in GOM
Council Preferences	**Preference Met?**	**Discussion**
Will improve the fisheries management in the EEZ	Yes	
Include EFH designations for more than one Council-managed species	Yes	See tables above.
Include juvenile cod EFH	No	Includes adult cod.
Meet more than one of the EFH Final Rule HAPC criteria	Yes	Meets all four criteria.

7.2.1.6 Alternative 5 – George’s Bank / Northern Edge

This alternative (Section 4.2.5) will expand the existing HAPC designation westward to encompass more gravel, cobble, and boulder habitat features known to improve the survival of juvenile cod and other species. The existing HAPC is bounded on the west at 67° 20′ by the western side of Closed Area II. However, the gravel pavement extends further to the west (Valentine and Lough 1991) and is included in the proposed alternative. In contrast to the existing HAPC on George’s Bank, which is a designation specifically for juvenile cod, this alternative applies the HAPC to all species and life stages with EFH designated in the area.

The George’s Bank/Northern Edge HAPC Alternative is 742 square nautical miles (nm^2) in area. There are fifty (50) life stages of eighteen (18) species with more than 1% of their currently defined EFH (status quo) EFH area inside this alternative and thirty-five (35) life stages of thirty-two (32) species which currently make up more than 50% of the George’s Bank/Northern Edge alternative (Table 135).

Under the preferred alternative EFH in the current EFH Omnibus Amendment, this area would be EFH for thirty-two (32) life stages of fifteen (15) species with more than 1% of their currently defined (status quo) EFH area inside this alternative and twenty-eight (28) life stages of thirteen (13) species which would make up more than 50% of this alternative (Table 136).

Table 135. Alternative 5, George's Bank/Northern Edge – Summary Statistics for Status Quo EFH

Species	Life Stage	Total EFH Area (nm^2)	Overlap with Alternative (nm^2)
Atlantic Herring	Egg	2,992	413
Haddock	Egg	8,751	570
Haddock	Juvenile	13,972	629
Atlantic Cod	**Juvenile**	**14,991**	**675**
Winter Skate	Adult	18,462	742
Atlantic Cod	Egg	20,721	739
Atlantic Cod	Larvae	22,698	741
Atlantic Sea Scallop	All life stages	21,889	702
Windowpane	Egg	22,535	639
Winter Skate	Juvenile	26,465	742
Windowpane	Larvae	24,227	676
Haddock	Adult	27,076	741
Yellowtail Flounder	Egg	23,713	648
Winter Flounder	Egg and Larvae	24,399	629
Winter Flounder	Juvenile	24,599	629
Winter Flounder	Adult	24,668	629
Little Skate	Adult	29,950	742
Haddock	Larvae	14,094	338
Atlantic Cod	Adult	31,211	741
Barndoor Skate	Juvenile	15,840	317
Atlantic Halibut	All life stages	37,094	741
Little Skate	Juvenile	38,156	695
Redfish	All life stages	21,369	337
American Plaice	Egg	9,502	149
Silver Hake	Egg and Larvae	49,328	741
Barndoor Skate	Adult	5,036	75
Silver Hake	Juvenile	50,972	741
Pollock	Egg	15,885	225

Windowpane	Adult	31,991	442
Pollock	Larvae	16,321	225
Yellowtail Flounder	Adult	24,225	329
Red Hake	Juvenile	49,006	638
Pollock	Juvenile	18,590	225
Monkfish	Egg and Larvae	63,871	741
Red Hake	Larvae	57,778	638
Ocean Pout	Adult	20,584	225
Windowpane	Juvenile	25,188	263
Pollock	Adult	21,796	225

Species	Life Stage	Total EFH Area (nm^2)	Overlap with Alternative (nm^2)
Little Skate	Adult	29,950	742
Winter Skate	Juvenile	26,465	742
Winter Skate	Adult	18,462	742
Atlantic Halibut	All life stages	37,094	741
Monkfish	Egg and Larvae	63,871	741
Silver Hake	Egg and Larvae	49,328	741
Silver Hake	Juvenile	50,972	741
Atlantic Cod	Larvae	22,698	741
Atlantic Cod	Adult	31,211	741
Haddock	Adult	27,076	741
Atlantic Cod	Egg	20,721	739
Atlantic Sea Scallop	All life stages	21,889	702
Little Skate	Juvenile	38,156	695
Windowpane	Larvae	24,227	676
Atlantic Cod	**Juvenile**	**14,991**	**675**
Yellowtail Flounder	Egg	23,713	648
Windowpane	Egg	22,535	639
Red Hake	Larvae	57,778	638
Red Hake	Juvenile	49,006	638
Winter Flounder	Egg and Larvae	24,399	629
Winter Flounder	Juvenile	24,599	629
Winter Flounder	Adult	24,668	629
Haddock	Juvenile	13,972	629
Haddock	Egg	8,751	570
Windowpane	Adult	31,991	442

Atlantic Herring	Egg	2,992	413	

Table 136. Alternative 5, George's Bank/Northern Edge – Summary Statistics for Omnibus Amendment Preferred Alternative EFH

Species	Life Stage	Total EFH Area (nm^2)	Overlap with Alternative (nm^2)	% of T inside A
Atlantic Herring	Eggs	3,091	413	
Winter Flounder	Eggs	11,687	570	
Atlantic Cod	Adult	22,656	662	
Atlantic Cod	**Juvenile**	**25,068**	**654**	
Winter Skate	Adult	21,981	570	
Haddock	Juvenile	21,726	538	
Little Skate	Adult	28,185	675	
Atlantic Sea Scallop	All life stages	35,035	742	
Haddock	Adult	27,004	560	
Yellowtail Flounder	Adult	28,858	558	
Winter Flounder	Adult	30,385	570	
Ocean Pout	Adult	20,789	389	
Barndoor Skate	Juvenile and Adult	13,177	217	
Red Hake	Juvenile	37,825	532	
Little Skate	Juvenile	29,590	411	
Yellowtail Flounder	Juvenile	27,237	377	
Atlantic Salmon	Adults	54,315	742	
Ocean Pout	Eggs	60,286	742	
Ocean Pout	Larvae	60,286	742	
Windowpane	Adult	36,492	442	
Winter Flounder	Juvenile	26,526	317	
Winter Skate	Juvenile	26,852	319	
Windowpane	Juvenile	31,115	362	
Silver Hake	Juvenile	40,709	458	
Pollock	Juvenile	19,878	216	
Species	**Life Stage**	**Total EFH Area (nm^2)**	**Overlap with Alternative (nm^2)**	**% of Al with T**
Ocean Pout	Eggs	60,286	742	
Ocean Pout	Larvae	60,286	742	

Atlantic Sea Scallop	All life stages	35,035	742
Atlantic Salmon	Adults	54,315	742
Little Skate	Adult	28,185	675
Atlantic Cod	Adult	22,656	662
Atlantic Cod	**Juvenile**	**25,068**	**654**
Winter Flounder	Eggs	11,687	570
Winter Flounder	Adult	30,385	570
Winter Skate	Adult	21,981	570
Haddock	Adult	27,004	560
Yellowtail Flounder	Adult	28,858	558
Haddock	Juvenile	21,726	538
Red Hake	Juvenile	37,825	532
Silver Hake	Juvenile	40,709	458
Windowpane	Adult	36,492	442
Atlantic Herring	Eggs	3,091	413
Little Skate	Juvenile	29,590	411
Ocean Pout	Adult	20,789	389
Silver Hake	Eggs	45,494	377
Silver Hake	Larvae	45,494	377
Yellowtail Flounder	Juvenile	27,237	377

Importance of Historic or Current Ecological Function

The historical importance of the ecological function of Georges Bank as a whole, and the proposed Georges Bank Northern Edge Cod HAPC, have been recognized for centuries with fleets from across the Atlantic coming to fish the rich, productive grounds on Georges Bank. The report entitled *Fishing Grounds of the Gulf of Maine* identified Georges Bank, including the Northern Edge, as a principle fishing ground for a number of groundfish species. The Northern Edge was found to hold Atlantic codfish year-round. Haddock were also known to aggregate along the Northern Edge. Halibut were also found along the Northern Edge during July and August (Rich 1929). These early reports demonstrate the historical ecological importance of the Northern Edge of Georges Bank.

Georges Bank is a relatively shallow water bank off the Coast of New England. The Northern Edge of Georges Bank is unique habitat area influenced by strong oceanographic currents and a substrate comprised of gravel/cobble and coarse sand with interspersed boulder piles and sand deposits. The northern edge of Georges Bank has a high level of biological production, fueled by nutrient-rich water upwelled from the

Gulf of Maine. This area contains horse mussel beds, and the cobble substrate provides suitable attachment sites for colonial epifauna such as hydroids and sponges. Benthic assemblages within the area include bryzoa, hydrozoa, anemones, calcareous worm tubes, and soft coral species that include *Primnoa* and *Paragorgia*. These structure and shelter provided by these unique habitat characteristics are well-recognized as important to the survival of many juvenile groundfish species, most notably Atlantic cod.

Gravel substrate is found only on the northern edge of Georges Bank and in patches in the Great South Channel. The U.S. Geological Survey has mapped a gravel pavement that covers an area of more than 3,000 square kilometers along the northern part of the bank. The pavement forms a residual deposit where strong tidal and storm currents winnow sand from coarse glacial sediment. The gravel is an important habitat for the spawning and survival of several fish species. Distribution patterns of juvenile cod indicate that gravel habitat is where they are best able to avoid predators and find food. Therefore, gravel may be essential for their survival and recruitment to the fishery. (USGS Fact Sheet 2003).

For these reasons, the Alternative meets this criterion.

Sensitivity to Anthropogenic Stresses

This area is heavily fished and has experienced an increase in frequency and intensity of fishing since the establishment of Closed Area II and there is presently little epifaunal cover (Collie et al. 2005). The southern part of Alternative 6, on either side of the Closed Area II boundary (67° 20’) is heavily infested with the colonial tunicate, *Didemnum* sp (personal observation from NEFSC cruise).

A number of recent studies have linked the survival of juvenile Atlantic cod with the type of habitat where the juvenile cod settle. Survivorship is greater in habitats of higher complexity, including gravel and cobble habitats with abundant sponges or seagrass, and less in habitats of lower complexity such as smoothed sand. Bottom tending mobile fishing gear, like trawls and dredges has also been found to reduce habitat complexity, thereby reducing the survival rate of juvenile cod (Lindholm, Auster, Ruth, and Kauffman 2001).

Specific areas on the northern edge of Georges Bank have been extensively studied and identified as important areas for the survival of juvenile cod (Lough et al. 1989; Valentine and Lough 1991; Valentine and Schmuck 1995). These studies provide reliable information on the location of areas most important to juvenile cod and the type of substrate found in those areas. These areas have also been studied to determine the effects of bottom trawling on benthic megfauna (Collie et al 1996; Collie et al. 1997). Gravel cobble substrates not subject to fishing pressure support thick colonies of emergent epifauna, but bottom fishing, especially scallop dredging, reduces habitat complexity and removes much of the emergent epifauna (Collie et al. 1996; Collie et al. 1997. Acknowledging that a single tow of a dredge across pristine habitat will have few long-term effects, Collie et al. (1997) focus on the cumulative effects and intensity of trawling and dredging as responsible for the long-term changes in benthic communities.

For these reasons, the Alternative meets this criterion.

Extent of Current or Future Development Stresses

The most obvious existing threat to the unique habitat features included in the proposed Georges Bank Northern Edge HAPC is the impacts caused by trawling and dredging activities in the area. While existing groundfish mortality closures and habitat closures adopted by the Council provide protection for the portion of the proposed area contained within the existing cod HAPC, habitat features located immediately adjacent to the closures continue to experience intense fishing effort. Analysis of the spatial distribution of fishing effort shows that the habitat immediately adjacent to the existing closed areas moderate to high levels of fishing activity by otter trawls and scallop dredges. (NEFMC 2004). Because trawls and dredges are known to reduce habitat complexity and function (NRC 2002), continued and increased fishing frequency and intensity are the greatest threats to habitat features in the proposed areas.

Potential threats to the unique habitat features in the proposed area include oil and gas exploration and pipeline construction. A 2002 Report by the U.S. Department of Interior Minerals Management Service reveals that from 1976-1982 ten test wells were drilled on Georges Bank and leases were awarded to a number of energy companies. Additionally, the Blue Atlantic energy company has expressed interest in constructing a 1 billion cubic foot per day natural gas pipeline from Nova Scotia to the Northeastern U.S. Proposed routes for this pipeline would cross Georges Bank.

For these reasons, the Alternative meets this criterion.

Rarity of the Habitat Type

The gravel, cobble, boulder habitats with emergent epifauna found within the proposed Georges Bank Northern Edge HAPC are rare relative to other habitat features found Georges Bank. Sediment mapping by Poppe et al and SMAST show that the Georges Bank area is dominated by sand substrates and that hard bottom habitats are relatively rare. The gravel and cobble substrates are interspersed across the bank are known to provide critical habitat for juvenile codfish and other species. The presence of gravel/cobble/boulder substrates and the unique oceanographic currents known to influence the area are a unique feature of the Northern Edge.

For these reasons, the Alternative meets this criterion.

Table 137. Summary of Alternative 5 Suitability: HAPC Criteria and Council Preferences

HAPC Criteria (EFH Final Rule)	**Criteria Met?**	**Discussion**
Importance of Historic or Current Ecological Function	Yes	Substrate of gravel or cobble found in the area allows sufficient space for newly settled juvenile cod to find shelter and avoid predation.
Sensitivity to Anthropogenic Stresses	Yes	Bottom fishing, especially scallop dredging and otter trawling, reduces habitat complexity and removes much of the emergent epifauna.
Extent of Current or Future Development Stresses	Yes	Continued and increased fishing frequency and intensity are the greatest threats to habitat features. Non-fishing threats exist from oil and gas exploration and pipeline construction.
Rarity of the Habitat Type	Yes	Presence of gravel/cobble/boulder substrates and the unique oceanographic currents.
Council Preferences	**Preference Met?**	**Discussion**
Will improve the fisheries management in the EEZ	Yes	Area provides two important ecological functions for post-settlement juvenile cod, an overfished species, relative to other areas: increased survivability and readily available prey.
Include EFH designations for more than one Council-managed species	Yes	50 life stages under status quo EFH and 33 life stages under preferred alternative EFH
Include juvenile cod EFH	Yes	HAPC designed specifically to capture juvenile cod habitats. 91% and 88% of the area is juvenile cod EFH under the status quo and preferred alternative, respectively.

Meet more than one of the EFH Final Rule HAPC criteria	Yes	Meets all four criteria

7.2.1.7 Alternative 6 – Jeffreys Ledge / Stellwagen Bank

This alternative (Section 4.2.6) will designate portions of Jeffreys Ledge and Stellwagen Bank as HAPC. This alternative includes three options for public comment:

Option A: Designate as HAPC the Western Gulf of Maine Habitat Closed Area Alternative 6A is 664 square nautical miles (nm^2) in area. There are fifty-six (56) species of sixteen (16) species with more than 1% of their currently defined EFH (status quo) EFH area inside this alternative and forty-eight (48) life stages of fifteen (15) species which currently make up more than 50% of the Jeffrey's Ledge/Stellwagon Bank alternative Option A (Table 138).

Under the preferred alternative EFH in the current EFH Omnibus Amendment, this area would be EFH for forty-one (41) life stages of seventeen (17) species with more than 1% of their currently defined (status quo) EFH area inside this alternative and thirty-five (35) life stages of sixteen (16) species which would make up more than 50% of this alternative (Table 139).

Option B: Designate as HAPC the Western Gulf of Maine Groundfish Closure plus a westward extension into the Stellwagen Bank National Marine Sanctuary

The George's Bank/Northern Edge HAPC Alternative is 1,090 square nautical miles (nm^2) in area. There are sixty (60) species of seventeen (17) species with more than 1% of their currently defined EFH (status quo) EFH area inside this alternative and forty-two (42) life stages of fifteen (15) species which currently make up more than 50% of the Jeffrey's Ledge/Stellwagen Bank alternative Option B (Table 140).

Under the preferred alternative EFH in the current EFH Omnibus Amendment, there are forty-six (46) of seventeen (17) species with more than 1% of their currently defined EFH (status quo) EFH area inside this alternative and thirty-six (36) life stages of sixteen (16) species which currently make up more than 50% of the Jeffrey's Ledge/Stellwagen Bank alternative Option B (Table 141).

Option C: Designate as HAPC the Western Gulf of Maine Groundfish Closure and the Stellwagen Bank National Marine Sanctuary in their entirety

The George's Bank/Northern Edge HAPC Alternative is 1,386 square nautical miles (nm^2) in area. There are sixty-seven (67) species of nineteen (19) species with more than 1% of their currently defined EFH (status quo) EFH area inside this alternative and forty-eight (48) life stages of fifteen (15) species which currently make up more than 50% of the Jeffrey's Ledge/Stellwagen Bank alternative Option C (Table 142).

Under the preferred alternative EFH in the current EFH Omnibus Amendment, there are forty-nine (49) of eighteen (18) species with more than 1% of their currently defined EFH (status quo) EFH area inside this alternative and thirty-three (33) life stages of fifteen (15) species which currently make up more than 50% of the Jeffrey's Ledge/Stellwagen Bank alternative Option C (Table 143).

Table 138. Alternative 6A, Jeffreys Ledge / Stellwagen Bank (Western Gulf of Maine Habitat Closed Area Only) – Summary Statistics for Status Quo EFH

Species	Life Stage	Total EFH Area (nm^2)	Overlap with Alternative (nm^2)
Atlantic Herring	Egg	2,992	147
Atlantic Herring	Larvae	12,325	554
Atlantic Cod	**Juvenile**	**14,991**	**664**
Smooth Skate	Adult	11,749	479
Pollock	Egg	15,885	646
Pollock	Larvae	16,321	646
Pollock	Juvenile	18,590	646
American Plaice	Juvenile	19,632	664
Atlantic Cod	Egg	20,721	664
Witch Flounder	Adult	20,230	646
Redfish	All life stages	21,369	664
Pollock	Adult	21,796	646
American Plaice	Adult	22,514	664
Atlantic Cod	Larvae	22,698	664
Haddock	Juvenile	13,972	388
Ocean Pout	Juvenile	13,349	369
American Plaice	Egg	9,502	258
Ocean Pout	Egg and Larvae	23,361	572
Thorny Skate	Juvenile	26,722	646
Haddock	Adult	27,076	628
White Hake	Larvae	23,279	498
White Hake	Egg	23,298	498

Atlantic Cod	Adult	31,211	664
Haddock	Egg	8,751	184
White Hake	Adult	24,974	498
White Hake	Juvenile	24,979	498
Smooth Skate	Juvenile	19,423	369
Atlantic Halibut	All life stages	37,094	664
Witch Flounder	Larvae	20,760	369
Witch Flounder	Juvenile	15,896	276
Atlantic Herring	Adult	38,524	664
Ocean Pout	Adult	20,584	352
Red Hake	Adult	40,944	664
Atlantic Herring	Juvenile	32,658	462
Monkfish	Adult	39,291	554
Thorny Skate	Adult	15,482	202
Monkfish	Juvenile	33,253	423
Witch Flounder	Egg	16,245	203
Atlantic Sea Scallop	All life stages	21,889	258
Red Hake	Juvenile	49,006	516
Monkfish	Egg and Larvae	63,871	664
Silver Hake	Adult	46,409	480
Silver Hake	Egg and Larvae	49,328	497

Species	Life Stage	Total EFH Area (nm^2)	Overlap with Alternative (nm^2)
American Plaice	Juvenile	19,632	664
American Plaice	Adult	22,514	664
Atlantic Cod	Adult	31,211	664
Atlantic Halibut	All life stages	37,094	664
Atlantic Herring	Adult	38,524	664
Monkfish	Egg and Larvae	63,871	664
Redfish	All life stages	21,369	664
Red Hake	Adult	40,944	664
Atlantic Cod	Egg	20,721	664
Atlantic Cod	Larvae	22,698	664
Atlantic Cod	**Juvenile**	**14,991**	**664**
Pollock	Egg	15,885	646
Pollock	Larvae	16,321	646
Pollock	Juvenile	18,590	646

Pollock	Adult	21,796	646
Witch Flounder	Adult	20,230	646
Thorny Skate	Juvenile	26,722	646
Haddock	Adult	27,076	628
Ocean Pout	Egg and Larvae	23,361	572
Atlantic Herring	Larvae	12,325	554
Monkfish	Adult	39,291	554
Red Hake	Larvae	57,778	516
Red Hake	Juvenile	49,006	516
Red Hake	Egg	57,802	507
White Hake	Egg	23,298	498
White Hake	Larvae	23,279	498
White Hake	Juvenile	24,979	498
White Hake	Adult	24,974	498
Silver Hake	Egg and Larvae	49,328	497
Silver Hake	Juvenile	50,972	497
Silver Hake	Adult	46,409	480
Smooth Skate	Adult	11,749	479
Atlantic Herring	Juvenile	32,658	462
Monkfish	Juvenile	33,253	423
Haddock	Juvenile	13,972	388
Ocean Pout	Juvenile	13,349	369
Witch Flounder	Larvae	20,760	369
Smooth Skate	Juvenile	19,423	369
Ocean Pout	Adult	20,584	352

Table 139. Alternative 6A, Jeffreys Ledge / Stellwagen Bank (Western Gulf of Maine Habitat Closed Area Only) – Summary Statistics for Omnibus Amendment Preferred Alternative EFH

Species	Life Stage	Total EFH Area (nm^2)	Overlap with Alternative (nm^2)
Atlantic Herring	Eggs	3,091	185
American Plaice	Juvenile	10,404	562
American Plaice	Adult	13,453	498
Pollock	Juvenile	19,878	646
Atlantic Halibut	All life stages	15,526	467
Pollock	Adult	17,621	470
Atlantic Cod	Adult	22,656	527

Thorny Skate	Juvenile	24,220	531
Deep Sea Red Crab	All life stages	30,339	656
Redfish	Larvae	12,275	257
Redfish	Juvenile	17,191	359
Haddock	Adult	27,004	542
Ocean Pout	Juvenile	11,545	215
Haddock	Juvenile	21,726	388
Atlantic Cod	**Juvenile**	**25,068**	**430**
White Hake	Larvae	22,678	349
White Hake	Eggs	22,697	349
Witch Flounder	Juvenile and Adult	25,216	378
Smooth Skate	Adult	14,489	217
Monkfish	Juvenile	33,781	495
Red Hake	Adult	43,564	598
Ocean Pout	Adult	20,789	277
Atlantic Salmon	Adults	54,315	664
Monkfish	Adult	31,095	368
Redfish	Adult	11,869	133
Ocean Pout	Eggs	60,286	664
Ocean Pout	Larvae	60,286	664
Silver Hake	Eggs	45,494	497
Silver Hake	Larvae	45,494	497
Atlantic Herring	Adult	56,175	591
Silver Hake	Juvenile	40,709	413

Species	**Life Stage**	**Total EFH Area (nm^2)**	**Overlap with Alternative (nm^2)**
Atlantic Salmon	Adults	54,315	664
Ocean Pout	Eggs	60,286	664
Ocean Pout	Larvae	60,286	664
Deep Sea Red Crab	All life stages	30,339	656
Pollock	Juvenile	19,878	646
Red Hake	Adult	43,564	598
Atlantic Herring	Adult	56,175	591
American Plaice	Juvenile	10,404	562
Haddock	Adult	27,004	542
Thorny Skate	Juvenile	24,220	531
Atlantic Cod	Adult	22,656	527

American Plaice	Adult	13,453	498
Silver Hake	Eggs	45,494	497
Silver Hake	Larvae	45,494	497
Monkfish	Juvenile	33,781	495
Pollock	Adult	17,621	470
Atlantic Halibut	All life stages	15,526	467
Atlantic Cod	**Juvenile**	**25,068**	**430**
Silver Hake	Juvenile	40,709	413
Haddock	Juvenile	21,726	388
Witch Flounder	Juvenile and Adult	25,216	378
Monkfish	Adult	31,095	368
Redfish	Juvenile	17,191	359
White Hake	Eggs	22,697	349
White Hake	Larvae	22,678	349

Table 140. Alternative 6B, Jeffreys Ledge / Stellwagen Bank (WGOM Groundfish Closed with Extension into SBNMS) – Summary Statistics for Status Quo EFH

Species	Life Stage	Total EFH Area (nm^2)	Overlap with Alternative (nm^2)	% of Total EFH inside Alternative
Atlantic Herring	Larvae	12,325	846	6.86%
Pollock	Egg	15,885	993	6.25%
Atlantic Herring	Egg	2,992	184	6.16%
Smooth Skate	Adult	11,749	716	6.09%
Pollock	Larvae	16,321	993	6.08%
Atlantic Cod	**Juvenile**	**14,991**	**869**	**5.80%**
American Plaice	Juvenile	19,632	1,090	5.55%
Pollock	Juvenile	18,590	993	5.34%
Witch Flounder	Adult	20,230	1,053	5.20%
Redfish	All life stages	21,369	1,090	5.10%
American Plaice	Adult	22,514	1,090	4.84%
Atlantic Cod	Egg	20,721	961	4.64%
Pollock	Adult	21,796	993	4.55%
Haddock	Juvenile	13,972	588	4.21%
American Plaice	Egg	9,502	370	3.89%
Ocean Pout	Juvenile	13,349	518	3.88%
Atlantic Cod	Larvae	22,698	869	3.83%

Thorny Skate	Juvenile	26,722	979	3.66%
White Hake	Larvae	23,279	830	3.57%
White Hake	Egg	23,298	830	3.56%
Haddock	Adult	27,076	938	3.47%
Witch Flounder	Juvenile	15,896	539	3.39%
Haddock	Egg	8,751	296	3.38%
Atlantic Cod	Adult	31,211	1,053	3.37%
Ocean Pout	Egg and Larvae	23,361	777	3.33%
White Hake	Adult	24,974	830	3.32%
White Hake	Juvenile	24,979	830	3.32%
Smooth Skate	Juvenile	19,423	628	3.23%
Thorny Skate	Adult	15,482	498	3.22%
Atlantic Halibut	All life stages	37,094	1,090	2.94%
Atlantic Herring	Adult	38,524	1,053	2.73%
Ocean Pout	Adult	20,584	555	2.70%
Red Hake	Adult	40,944	1,090	2.66%
Atlantic Herring	Juvenile	32,658	850	2.60%
Witch Flounder	Larvae	20,760	513	2.47%
Monkfish	Adult	39,291	965	2.46%
Monkfish	Juvenile	33,253	775	2.33%
Witch Flounder	Egg	16,245	333	2.05%
Silver Hake	Adult	46,409	867	1.87%
Red Hake	Juvenile	49,006	868	1.77%
Silver Hake	Egg and Larvae	49,328	867	1.76%
Atlantic Sea Scallop	All life stages	21,889	374	1.71%
Monkfish	Egg and Larvae	63,871	1,090	1.71%
Silver Hake	Juvenile	50,972	867	1.70%
Red Hake	Larvae	57,778	868	1.50%
Yellowtail Flounder	Egg	23,713	329	1.39%
Yellowtail Flounder	Adult	24,225	282	1.17%
American Plaice	Larvae	9,646	106	1.10%
Species	**Life Stage**	**Total EFH Area (nm^2)**	**Overlap with Alternative (nm^2)**	**% of Alternative with This EFH**
American Plaice	Juvenile	19,632	1,090	100.00%

American Plaice	Adult	22,514	1,090	100.00%
Atlantic Halibut	All life stages	37,094	1,090	100.00%
Monkfish	Egg/Larvae	63,871	1,090	100.00%
Redfish	All life stages	21,369	1,090	100.00%
Red Hake	Adult	40,944	1,090	100.00%
Atlantic Cod	Adult	31,211	1,053	96.63%
Atlantic Herring	Adult	38,524	1,053	96.62%
Witch Flounder	Adult	20,230	1,053	96.60%
Pollock	Egg	15,885	993	91.07%
Pollock	Larvae	16,321	993	91.07%
Pollock	Juvenile	18,590	993	91.07%
Pollock	Adult	21,796	993	91.07%
Thorny Skate	Juvenile	26,722	979	89.83%
Monkfish	Adult	39,291	965	88.55%
Atlantic Cod	Egg	20,721	961	88.15%
Haddock	Adult	27,076	938	86.09%
Atlantic Cod	Larvae	22,698	869	79.70%
Atlantic Cod	**Juvenile**	**14,991**	**869**	**79.70%**
Red Hake	Larvae	57,778	868	79.59%
Red Hake	Juvenile	49,006	868	79.59%
Silver Hake	Adult	46,409	867	79.58%
Silver Hake	Egg/Larvae	49,328	867	79.56%
Silver Hake	Juvenile	50,972	867	79.56%
Atlantic Herring	Juvenile	32,658	850	77.99%
Atlantic Herring	Larvae	12,325	846	77.61%
White Hake	Egg	23,298	830	76.17%
White Hake	Larvae	23,279	830	76.17%
White Hake	Juvenile	24,979	830	76.17%
White Hake	Adult	24,974	830	76.17%
Ocean Pout	Egg/Larvae	23,361	777	71.28%
Monkfish	Juvenile	33,253	775	71.06%
Smooth Skate	Adult	11,749	716	65.64%
Smooth Skate	Juvenile	19,423	628	57.57%
Haddock	Juvenile	13,972	588	53.94%
Ocean Pout	Adult	20,584	555	50.94%

Table 141. Alternative 6B, Jeffreys Ledge / Stellwagen Bank (WGOM Groundfish Closed with Extension into SBNMS) – Summary Statistics for Omnibus Amendment Preferred Alternative EFH

Species	Life Stage	Total EFH Area (nm^2)	Overlap with Alternative (nm^2)
Atlantic Herring	Eggs	3,091	259
American Plaice	Juvenile	10,404	823
American Plaice	Adult	13,453	787
Pollock	Juvenile	19,878	883
Pollock	Adult	17,621	681
Atlantic Halibut	All life stages	15,526	588
Redfish	Larvae	12,275	424
Deep Sea Red Crab	All life stages	30,339	1047
Thorny Skate	Juvenile	24,220	802
Redfish	Juvenile	17,191	568
Atlantic Cod	Adult	22,656	723
Haddock	Adult	27,004	772
Witch Flounder	Juvenile and Adult	25,216	676
Smooth Skate	Adult	14,489	382
White Hake	Larvae	22,678	590
White Hake	Eggs	22,697	590
Monkfish	Juvenile	33,781	851
Haddock	Juvenile	21,726	530
Atlantic Cod	**Juvenile**	**25,068**	**604**
Thorny Skate	Adult	16,201	388
Redfish	Adult	11,869	280
Ocean Pout	Juvenile	11,545	260
Red Hake	Adult	43,564	960
Monkfish	Adult	31,095	664
Smooth Skate	Juvenile	21,999	433
Ocean Pout	Adult	20,789	397
Silver Hake	Eggs	45,494	867
Silver Hake	Larvae	45,494	867
Atlantic Herring	Adult	56,175	979
Silver Hake	Juvenile	40,709	687
Ocean Pout	Eggs	60,286	961
Ocean Pout	Larvae	60,286	961
White Hake	Adult	36,509	573
Silver Hake	Adult	30,196	423

Species	Life Stage	Total EFH Area (nm^2)	Overlap with Alternative (nm^2)
Deep Sea Red Crab	All life stages	30,339	1047
Atlantic Herring	Adult	56,175	979
Ocean Pout	Eggs	60,286	961
Ocean Pout	Larvae	60,286	961
Red Hake	Adult	43,564	960
Pollock	Juvenile	19,878	883
Silver Hake	Eggs	45,494	867
Silver Hake	Larvae	45,494	867
Monkfish	Juvenile	33,781	851
American Plaice	Juvenile	10,404	823
Thorny Skate	Juvenile	24,220	802
American Plaice	Adult	13,453	787
Haddock	Adult	27,004	772
Atlantic Cod	Adult	22,656	723
Silver Hake	Juvenile	40,709	687
Pollock	Adult	17,621	681
Witch Flounder	Juvenile and Adult	25,216	676
Monkfish	Adult	31,095	664
White Hake	Juvenile	43,961	614
Atlantic Cod	**Juvenile**	**25,068**	**604**
White Hake	Eggs	22,697	590
White Hake	Larvae	22,678	590
Atlantic Halibut	All life stages	15,526	588
White Hake	Adult	36,509	573
Redfish	Juvenile	17,191	568

Table 142. Alternative 6C, Jeffreys Ledge / Stellwagen Bank (WGOM Groundfish Closed Area Plus Entire SBNMS) – Summary Statistics for Status Quo EFH

Species	Life Stage	Total EFH Area (nm^2)	Overlap with Alternative (nm^2)	% of Total EF
Atlantic Herring	Larvae	12,325	1,138	
Atlantic Herring	Egg	2,992	245	
Atlantic Cod	**Juvenile**	**14,991**	**1,165**	
Smooth Skate	Adult	11,749	845	

American Plaice	Juvenile	19,632	1,386	
Pollock	Egg	15,885	1,072	
Pollock	Larvae	16,321	1,072	
Redfish	All life stages	21,369	1,371	
American Plaice	Adult	22,514	1,386	
Witch Flounder	Adult	20,230	1,240	
Atlantic Cod	Egg	20,721	1,257	
American Plaice	Egg	9,502	564	
Haddock	Juvenile	13,972	809	
Pollock	Juvenile	18,590	1,072	
Ocean Pout	Juvenile	13,349	762	
Atlantic Cod	Larvae	22,698	1,165	
Pollock	Adult	21,796	1,072	
Haddock	Egg	8,751	411	
Ocean Pout	Egg and Larvae	23,361	1,073	
Witch Flounder	Juvenile	15,896	724	
Thorny Skate	Juvenile	26,722	1,204	
White Hake	Larvae	23,279	1,035	
White Hake	Egg	23,298	1,035	
Thorny Skate	Adult	15,482	673	
Atlantic Cod	Adult	31,211	1,350	
White Hake	Adult	24,974	1,056	
White Hake	Juvenile	24,979	1,035	
Ocean Pout	Adult	20,584	852	
Haddock	Adult	27,076	1,088	
Atlantic Halibut	All life stages	37,094	1,386	
Smooth Skate	Juvenile	19,423	723	
Atlantic Herring	Juvenile	32,658	1,146	
Atlantic Herring	Adult	38,524	1,349	
Red Hake	Adult	40,944	1,386	
Witch Flounder	Larvae	20,760	694	
Monkfish	Adult	39,291	1,239	
Monkfish	Juvenile	33,253	980	
Witch Flounder	Egg	16,245	468	
Atlantic Sea Scallop	All life stages	21,889	610	
American Plaice	Larvae	9,646	261	
Silver Hake	Adult	46,409	1,164	
Red Hake	Juvenile	49,006	1,164	

Silver Hake	Egg and Larvae	49,328	1,104	
Yellowtail Flounder	Adult	24,225	540	
Yellowtail Flounder	Egg	23,713	525	
Monkfish	Egg and Larvae	63,871	1,386	
Silver Hake	Juvenile	50,972	1,104	
Winter Flounder	Egg and Larvae	24,399	499	
Winter Flounder	Juvenile	24,599	499	
Winter Flounder	Adult	24,668	499	
Red Hake	Larvae	57,778	1,164	
Yellowtail Flounder	Juvenile	20,887	393	
Yellowtail Flounder	Larvae	23,894	304	
Clearnose Skate	Adult	13,387	147	

Species	Life Stage	Total EFH Area (nm^2)	Overlap with Alternative (nm^2)	% of Alterna
Atlantic Halibut	All life stages	37,094	1,386	
Monkfish	Egg and Larvae	63,871	1,386	
Red Hake	Adult	40,944	1,386	
American Plaice	Juvenile	19,632	1,386	
American Plaice	Adult	22,514	1,386	
Redfish	All life stages	21,369	1,371	
Atlantic Cod	Adult	31,211	1,350	
Atlantic Herring	Adult	38,524	1,349	
Atlantic Cod	Egg	20,721	1,257	
Witch Flounder	Adult	20,230	1,240	
Monkfish	Adult	39,291	1,239	
Thorny Skate	Juvenile	26,722	1,204	
Atlantic Cod	Larvae	22,698	1,165	
Atlantic Cod	**Juvenile**	**14,991**	**1,165**	
Red Hake	Larvae	57,778	1,164	
Red Hake	Juvenile	49,006	1,164	
Silver Hake	Adult	46,409	1,164	
Atlantic Herring	Juvenile	32,658	1,146	
Atlantic Herring	Larvae	12,325	1,138	
Silver Hake	Egg and Larvae	49,328	1,104	
Silver Hake	Juvenile	50,972	1,104	
Haddock	Adult	27,076	1,088	
Ocean Pout	Egg and Larvae	23,361	1,073	
Pollock	Egg	15,885	1,072	

Pollock	Larvae	16,321	1,072
Pollock	Juvenile	18,590	1,072
Pollock	Adult	21,796	1,072
White Hake	Adult	24,974	1,056
White Hake	Egg	23,298	1,035
White Hake	Larvae	23,279	1,035
White Hake	Juvenile	24,979	1,035
Monkfish	Juvenile	33,253	980
Ocean Pout	Adult	20,584	852
Smooth Skate	Adult	11,749	845
Haddock	Juvenile	13,972	809
Ocean Pout	Juvenile	13,349	762
Witch Flounder	Juvenile	15,896	724
Smooth Skate	Juvenile	19,423	723
Witch Flounder	Larvae	20,760	694

Table 143. Alternative 6C, Jeffreys Ledge / Stellwagen Bank (WGOM Groundfish Closed Area Plus Entire SBNMS) – Summary Statistics for Omnibus Amendment Preferred Alternative EFH

Species	Life Stage	Total EFH Area (nm^2)	Overlap with Alternative (nm^2)
Atlantic Herring	Eggs	3,091	320
American Plaice	Juvenile	10,404	1039
American Plaice	Adult	13,453	952
Pollock	Juvenile	19,878	1135
Atlantic Cod	Adult	22,656	1017
Atlantic Halibut	All life stages	15,526	694
Deep Sea Red Crab	All life stages	30,339	1299
Pollock	Adult	17,621	747
Redfish	Larvae	12,275	486
Thorny Skate	Juvenile	24,220	946
Haddock	Adult	27,004	1041
Ocean Pout	Juvenile	11,545	429
Redfish	Juvenile	17,191	626
Haddock	Juvenile	21,726	784
Atlantic Cod	**Juvenile**	**25,068**	**897**
Monkfish	Juvenile	33,781	1054
Ocean Pout	Adult	20,789	638

Witch Flounder	Juvenile and Adult	25,216	772
White Hake	Larvae	22,678	690
White Hake	Eggs	22,697	690
Smooth Skate	Adult	14,489	438
Monkfish	Adult	31,095	912
Thorny Skate	Adult	16,201	464
Red Hake	Adult	43,564	1171
Redfish	Adult	11,869	306
Silver Hake	Eggs	45,494	1104
Silver Hake	Larvae	45,494	1104
Silver Hake	Juvenile	40,709	931
Atlantic Herring	Adult	56,175	1239
Ocean Pout	Eggs	60,286	1258
Ocean Pout	Larvae	60,286	1258
Smooth Skate	Juvenile	21,999	434
Silver Hake	Adult	30,196	575
White Hake	Juvenile	43,961	827
White Hake	Adult	36,509	646
Yellowtail Flounder	Juvenile	27,237	404
Yellowtail Flounder	Adult	28,858	357
Red Hake	Juvenile	37,825	431

Species	**Life Stage**	**Total EFH Area (nm^2)**	**Overlap with Alternative (nm^2)**
Deep Sea Red Crab	All life stages	30,339	1299
Ocean Pout	Eggs	60,286	1258
Ocean Pout	Larvae	60,286	1258
Atlantic Herring	Adult	56,175	1239
Red Hake	Adult	43,564	1171
Pollock	Juvenile	19,878	1135
Silver Hake	Eggs	45,494	1104
Silver Hake	Larvae	45,494	1104
Monkfish	Juvenile	33,781	1054
Haddock	Adult	27,004	1041
American Plaice	Juvenile	10,404	1039
Atlantic Cod	Adult	22,656	1017
American Plaice	Adult	13,453	952
Thorny Skate	Juvenile	24,220	946

Silver Hake	Juvenile	40,709	931
Monkfish	Adult	31,095	912
Atlantic Cod	**Juvenile**	**25,068**	**897**
White Hake	Juvenile	43,961	827
Haddock	Juvenile	21,726	784
Witch Flounder	Juvenile and Adult	25,216	772
Pollock	Adult	17,621	747
Atlantic Halibut	All life stages	15,526	694
Atlantic Herring	Adult	56,175	1239
Red Hake	Adult	43,564	1171

Importance of Historic or Current Ecological Function

The important ecological functions known to occur with the area within Alternative 6 have been recognized for over a century. Captain Henry Stellwagen first described the Stellwagen Bank area in 1854 as a 15 fathom bank characterized by a rocky substrate on the northern flank, sand features in the middle and southern end, and deeper mud basins just inshore of the bank itself. After the turn of the century, the report entitled *Fishing Grounds of the Gulf of Maine* identified both Jeffreys Ledge and Stellwagen Bank (or Middle Bank) as key fishing grounds. Jeffreys was known to contain rocky bottom in the shoaler water with gravel and pebbles along the edges. It was considered one of the best fishing grounds in the Gulf of Maine with cod, haddock, pollock, cusk, hake, flounder, herring, and mackerel all found in the area. Stellwagen and Tillies Bank were also identified as important fishing grounds with cod, haddock, pollock, cusk, and hake all present during times of the year (Rich, 1929). Additionally, the area has been recognized as a preferred habitat for several marine mammal species and seabirds for decades.

Jeffreys Ledge and Stellwagen Bank are shallow, glacially formed features that include a diversity of habitat types, including gravel/cobble substrates, boulder reefs, sand plains, and deep mud basins in a complex matrix. Oceanographic currents driven by the Gulf of Maine Coastal Current as well as from the impingement of internal waves deliver nutrient-rich waters to the area and the topographic features of the area result in upwelling that drives production. The complex matrix of sedimentary habitats supports a wide diversity of structure forming invertebrates including frilled anemones, burrowing anemones, sponges, bryozoans, ascidians, cold water corals (Auster et al. 1998, Grannis 2001, Tamsett in prep). Such habitats are important areas for recruitment and survival of species such as cod, haddock, cusk, Acadian redfish, silver hake and a diversity of flounders (e.g., Auster et al. 2001, 2003a and 2003b). Further, the Jeffreys Ledge-Stellwagen Bank area supports a high diversity of fishes compared to many other areas in the Gulf (Auster 2002, Auster et al. in prep).

The ecological importance of the Stellwagen Bank portion of the area within Alternative 6 has been formally recognized by the National Marine Sanctuary Program. The Sanctuary Program was established to identify and recognize nationally significant marine areas and to promote long-term management of their conservation, ecological, and other values. The Stellwagen Bank National Marine Sanctuary was officially designated by Congress in 1992 in recognition of the unique physical and oceanographic conditions in the area that support a diverse biological community including plankton, benthic invertebrates, forage fish, large predatory fish, and a number of marine mammals, including endangered right whales.

For these reasons, Alternative 6 meets this criterion.

Sensitivity to Anthropogenic Stresses

Impacts to benthic habitat features have been widely studied, both in the Northeast region and across the Atlantic. Numerous studies and reports have documented the sensitivity of benthic habitats characterized by complex substrates with emergent epifauna to impacts caused by fishing gear. In its 2002 report, the National Research Council found that trawling and dredging changes the physical and biological structure of ecosystems and therefore can have potentially wide-ranging consequences. Mobile gear reduces benthic habitat complexity by removing or damaging the actual physical structure of the seafloor, and it causes changes in species composition. The reduction of physical structure in repeatedly trawled areas results in reduced productivity of benthic habitats and lower overall biodiversity (NRC 2002).

In addition to the broader-scale analyses conducted by the NRC, a Northeast region-specific analysis was also conducted. In 2001, the Northeast Region Essential Fish Habitat Steering Committee convened a panel workshop of experts in benthic ecology, fishery ecology, geology, and fishing gear technology and operations. The purpose of the workshop was to evaluate existing scientific research on the effects of fishing gear on benthic habitats, to assess the degree of impacts caused by various fishing gear types, and to offer recommendations on measures to minimize those adverse impacts. The Workshop participants concluded, among other things, that otter trawls and dredges were the fishing gears of greatest concern and that high energy gravels substrates containing attached biological organisms were most susceptible to impacts. Identified impacts to this habitat type included 1) changes in physical and biological structure, 2) removal of attached epifauna, and 3) changes in abundance of benthic prey species (NEFSC 2002).

The NEFMC has reviewed numerous studies on impacts to marine habitats caused by various fishing gear types and incorporated the findings into regional Fishery Management Plan Amendments. These studies and others clearly demonstrate that benthic habitat features region-wide and within the proposed Jeffreys Ledge/Stellwagen Bank HAPC are sensitive to anthropogenic sources, including impacts caused by fishing gear. A summary of those studies is provided below.

Auster and Langton (1999) reviewed 22 studies from a wide geographic range and concluded that mobile fishing gear reduces 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 produces structure (i.e., taxa which produce burrows and pits). They also concluded that for fixed gear, the area impacted per unit effort is smaller than for mobile gear, but the types of damage to emergent benthos appear to be similar. These studies and others clearly demonstrate that benthic habitat features region-wide and within the proposed Jeffreys Ledge/Stellwagen Bank HAPC are sensitive to anthropogenic sources, including impacts caused by fishing gear.

In addition to the area's sensitivity to direct disturbances caused by bottom-tending fishing gear, ecological processes within the area within Alternative 6 can be affected by fishing activities in other ways. The abundance of prey species such as herring and sand lance that provide critical forage for numerous marine species can be adversely affected by large-scale removals by directed fisheries. Additionally, continued fishing pressure on both forage species and predatory fish including cod, haddock, and tuna can affect the population structure and ecosystem function within the area within Alternative 6 area.

The unique habitat features and ecological processes within the area within Alternative 6 area are also vulnerable to a number of other anthropogenic stresses, including but not limited to: 1) alteration of ecological processes resulting from nutrient and chemical pollution caused by cruise ships and cargo vessel discharges, sewage discharges from coastal communities including the city of Boston's municipal wastewater discharge, and terrestrial non-point source pollution, and 2) habitat alteration and disturbance of benthic communities caused by future sand and gravel mining operations, waste disposal, construction of fiber-optic cable and pipelines, and potential new industrial uses of the coastal waters and the seabed including offshore aquaculture facilities, wind energy, LNG facilities, and other energy-related infrastructure.

For these reasons, Alternative 6 meets this criterion.

Extent of Current or Future Development Stresses

Impacts to benthic habitat features and ecological processes caused by fishing activities are a concern for the area inside Alternative 6. Despite the fact that portions of the proposed area have been designated as groundfish mortality closures, habitat closures, and a National Marine Sanctuary, there is still considerable commercial and recreational fishing effort in the proposed area. An analysis of the spatial distribution of fishing effort in the Northeast region from 1995 shows moderate to high intensity fishing effort by otter trawls, gillnets, and long-lines in areas outside the groundfish mortality closures. (NEFMC 2004). Additionally, spatial analysis of fishing effort within the WGOM Closed Area shows significant fishing effort in the area within Alternative 6 area by herring vessels, shrimp vessels, handlines, and lobster pots/traps. (NEFMC 2004). Stellwagen Bank and Jeffreys Ledge are also known to experience considerable fishing effort by recreational fishermen targeting cod, haddock, tuna and other species.

In addition to the potential and existing threats posed by fishing-related activities, the unique habitat features and ecological processes within the Alternative 6 boundaries are also vulnerable to a number of other anthropogenic stresses, including but not limited to: 1) vessel discharges (ballast and gray water) from cruise ships and cargo vessels, 2) future sand and gravel mining operations, 3) sewage discharges from coastal communities including the city of Boston's municipal wastewater discharge, 4) terrestrial non-point source pollution, 5) other waste disposal operations, 6) fiber-optic cable and pipeline construction, and 7) potential new industrial uses of the coastal waters and seabed including offshore aquaculture facilities, wind energy, LNG facilities, and other energy-related infrastructure.

For these reasons, Alternative 6 meets this criterion.

Rarity of the Habitat Type

Jeffreys Ledge and Stellwagen Bank are shallow, glacially formed features that include a diversity of habitat types, including gravel/cobble substrates, boulder fields, and deep mud basins. Oceanographic currents driven by the Gulf of Maine gyre deliver nutrient-rich waters to the area and the topographic features of the area result in upwelling that drives production of a number of plankton species. The high productivity of the area supports a wide diversity of marine life ranging from anemones, sponges, sea stars, and polychaete worms to herring and sand lance to large predatory fish including cod, haddock, tuna and sharks, to marine mammals including harbor porpoises, humpback whales, and endangered right whales. Unique aspects of the habitats contained within the area within Alternative 6 include their extreme depth range, which bathes these features in main surface and intermediate waters, as well as the fact that they represent the wide diversity of habitat types in the Gulf of Maine in a discrete location.

For these reasons, Alternative 6 meets this criterion.

Table 144. Summary of Alternative 6 Suitability: HAPC Criteria and Council Preferences

HAPC Criteria (EFH Final	Criteria Met?	Discussion

Rule)		
Importance of Historic or Current Ecological Function	Yes	Over 100 years ago the area was considered one of the best fishing grounds in the Gulf of Maine. Currently, the area supports a high diversity of fishes compared to many other areas in the Gulf complex and the matrix of sedimentary habitats supports a wide diversity of structure forming invertebrates.
Sensitivity to Anthropogenic Stresses	Yes	Potential fishing impacts from bottom gear and fishing pressure on both forage species (herring and sand lance) and predatory fish (cod, haddock, tuna, etc.).
Extent of Current or Future Development Stresses	Yes	Fishing threats: considerable commercial and recreational fishing effort in the proposed area Non-fishing threats: 1) vessel discharges (ballast and gray water) from cruise ships and cargo vessels, 2) future sand and gravel mining operations, 3) sewage discharges from coastal communities including the city of Boston’s municipal wastewater discharge, 4) terrestrial non-point source pollution, 5) other waste disposal operations, 6) fiber-optic cable and pipeline construction, and 7) potential new industrial uses of the coastal waters and seabed including offshore aquaculture facilities, wind energy, LNG facilities, and other

		energy-related infrastructure.
Rarity of the Habitat Type	Yes	Extreme depth range, which bathes these features in main surface and intermediate waters, as well as the fact that they represent the wide diversity of habitat types in the Gulf of Maine in a discrete location.
Council Preferences	**Preference Met?**	**Discussion**
Will improve the fisheries management in the EEZ	Yes	Recognition of habitats that are 1.) important areas for recruitment and survival of species such as cod, haddock, cusk, Acadian redfish, silver hake and a diversity of flounders and 2.) support a high diversity of fishes compared to many other areas in the Gulf of Maine.
Include EFH designations for more than one Council-managed species	Yes	Includes EFH for between 40 and 67 life stages depending on the option chosen and the EFH categories (no action or preferred alternative)
Include juvenile cod EFH	Yes	Between 55% and 100% of the area includes juvenile cod depending on the option chosen and the EFH categories (no action or preferred alternative).
Meet more than one of the EFH Final Rule HAPC criteria	Yes	Meets all of the criteria.

7.2.1.8 Alternative 7 – Inshore Juvenile Cod

This alternative (Section 4.2.7) seeks to designate the inshore areas of the Gulf of Maine and Southern New England as HAPC. The purpose of this HAPC is to specifically to recognize the importance of the inshore areas to juvenile Atlantic cod.

In 1999, the Council voted to approve this alternative and include it in the next appropriate fishery management plan vehicle. Since that time, the Habitat Plan Development Team has advised the Habitat Committee, based on the supporting information, that the Alternative should be expanded to include two options for public comment:

<u>Option A: 0-10 meters (Mean Lowest Low Water, MLLW)</u>

The Inshore cod HAPC Alternative is 1,502 square nautical miles (nm^2) in area. There are forty-eight (48) life stages of fifteen (15) species with more than 1% of their currently defined EFH (status quo) EFH area inside this alternative and ten (10) life stages of four species which currently make up more than 50% of the Inshore Juvenile Cod alternative, Option A (Table 145). With respect to juvenile Atlantic cod EFH, for which this alternative was designed, this alternative contains over 4% of the status quo juvenile cod EFH (610 nm2) and juvenile cod is found in almost 70% of Alternative 7A.

<u>Under the preferred alternative EFH</u> in the current EFH Omnibus Amendment, there are forty-four (44) of eighteen (18) species with more than 1% of their currently defined EFH (status quo) EFH area inside this alternative and twenty-two (22) life stages of twelve (12) species which currently make up more than 50% of the Inshore Juvenile Cod Alternative, Option A (Table 146). Alternative 7A contains approximately 5.5% of the juvenile cod EFH (1,399 nm^2) and over 93% of the area is juvenile cod EFH in the preferred alternative designation.

<u>Option B: 0-20 meters (MLLW)</u>

The Inshore Cod HAPC Alternative is 2,596 square nautical miles (nm^2) in area. There are fifty-nine (59) life stages of sixteen (16) species with more than 1% of their currently defined EFH (status quo) EFH area inside this alternative and thirteen (13) life stages of five species which currently make up more than 50% of the Inshore Juvenile Cod alternative, Option B (Table 147). With respect to juvenile Atlantic cod EFH, for which this alternative was designed, this alternative contains approximately 7.5% of the status quo juvenile cod EFH (1,135 nm^2) and juvenile cod is found in almost 44% of Alternative 7B.

Under the preferred alternative EFH in the current EFH Omnibus Amendment, there are forty-eight (48) of fourteen (14) species with more than 1% of their currently defined EFH (status quo) EFH area inside this alternative and twenty-six (26) life stages of twelve (12) species which currently make up more than 50% of the Inshore Juvenile Cod Alternative, Option B (Table 148). Alternative 7B contains almost 10% of the juvenile cod EFH (2,453 nm^2) and over 94% of the area is juvenile cod EFH in the preferred alternative designation.

Table 145. Alternative 7A, Inshore Cod 0-10 meters – Summary Statistics for Status Quo EFH

Species	Life Stage	Total EFH Area (nm^2)	Overlap with Alternative (nm^2)	% of Total EFH inside Alternative
Atlantic Herring	Egg	2,992	220	7.36%
American Plaice	Egg	9,502	626	6.59%
American Plaice	Larvae	9,646	596	6.17%
Atlantic Herring	Larvae	12,325	579	4.70%
Winter Flounder	Egg and Larvae	24,399	1,137	4.66%
Winter Flounder	Juvenile	24,599	1,137	4.62%
Winter Flounder	Adult	24,668	1,140	4.62%
Atlantic Cod	**Juvenile**	**14,991**	**610**	**4.07%**
Ocean Pout	Juvenile	13,349	505	3.79%
American Plaice	Juvenile	19,632	677	3.45%
Atlantic Cod	Adult	31,211	1,049	3.36%
American Plaice	Adult	22,514	689	3.06%
Pollock	Juvenile	18,590	553	2.97%
Windowpane	Egg	22,535	666	2.96%
Haddock	Egg	8,751	258	2.95%
Windowpane	Adult	31,991	934	2.92%
Atlantic Sea Scallop	All life stages	21,889	637	2.91%
Windowpane	Juvenile	25,188	731	2.90%
Windowpane	Larvae	24,227	659	2.72%
Ocean Pout	Adult	20,584	553	2.69%
Atlantic Cod	Larvae	22,698	579	2.55%
Atlantic Cod	Egg	20,721	498	2.40%
Ocean Pout	Egg and Larvae	23,361	545	2.33%
Atlantic Herring	Juvenile	32,658	724	2.22%

Haddock	Larvae	14,094	309	2.19%
Yellowtail Flounder	Egg	23,713	519	2.19%
Yellowtail Flounder	Larvae	23,894	502	2.10%
Atlantic Halibut	All life stages	37,094	760	2.05%
White Hake	Adult	24,974	505	2.02%
White Hake	Juvenile	24,979	502	2.01%
Atlantic Herring	Adult	38,524	729	1.89%
Yellowtail Flounder	Juvenile	20,887	352	1.68%
Yellowtail Flounder	Adult	24,225	378	1.56%
Red Hake	Adult	40,944	638	1.56%
Red Hake	Juvenile	49,006	699	1.43%
Pollock	Larvae	16,321	222	1.36%
Silver Hake	Adult	46,409	582	1.25%
Silver Hake	Juvenile	50,972	562	1.10%
Winter Skate	Juvenile	26,465	283	1.07%
Winter Skate	Adult	18,462	197	1.07%
Species	**Life Stage**	**Total EFH Area (nm^2)**	**Overlap with Alternative (nm^2)**	**% of Alternative with This EFH**
Winter Flounder	Adult	24,668	1,140	75.91%
Winter Flounder	Egg and Larvae	24,399	1,137	75.71%
Winter Flounder	Juvenile	24,599	1,137	75.71%
Atlantic Cod	Adult	31,211	1,049	69.84%
Windowpane	Adult	31,991	934	62.21%
Atlantic Halibut	All life stages	37,094	760	50.59%

Table 146. Alternative 7A, Inshore Cod 0-10 meters – Summary Statistics for <u>Omnibus Amendment Preferred Alternative EFH</u>

Species	Life Stage	Total EFH Area (nm^2)	Overlap with Alternative (nm^2)	% of Total EFH inside Alternative
Winter Flounder	Eggs	11,687	1,436	12.29%
Atlantic Herring	Eggs	3,091	206	6.66%
Atlantic Herring	Juvenile	11,377	698	6.14%

Atlantic Cod	Adult	22,656	1,296	5.72%
American Plaice	Juvenile	10,404	585	5.62%
Atlantic Cod	**Juvenile**	**25,068**	**1,399**	**5.58%**
Winter Flounder	Juvenile	26,526	1,384	5.22%
Winter Flounder	Adult	30,385	1,343	4.42%
Winter Skate	Juvenile	26,852	1,167	4.35%
Windowpane	Juvenile	31,115	1,333	4.28%
Pollock	Juvenile	19,878	851	4.28%
American Plaice	Adult	13,453	564	4.19%
Little Skate	Juvenile	29,590	1,213	4.10%
Windowpane	Adult	36,492	1,273	3.49%
Little Skate	Adult	28,185	961	3.41%
Ocean Pout	Adult	20,789	705	3.39%
Winter Skate	Adult	21,981	700	3.18%
Yellowtail Flounder	Juvenile	27,237	759	2.79%
Red Hake	Juvenile	37,825	982	2.60%
Yellowtail Flounder	Adult	28,858	737	2.55%
Silver Hake	Adult	30,196	749	2.48%
Silver Hake	Juvenile	40,709	991	2.43%
Thorny Skate	Juvenile	24,220	514	2.12%
Ocean Pout	Juvenile	11,545	241	2.09%
White Hake	Juvenile	43,961	912	2.07%
Silver Hake	Eggs	45,494	851	1.87%
Silver Hake	Larvae	45,494	851	1.87%
Atlantic Sea Scallop	All life stages	35,035	635	1.81%
Atlantic Herring	Adult	56,175	859	1.53%
Red Hake	Adult	43,564	656	1.51%
White Hake	Adult	36,509	496	1.36%
Smooth Skate	Juvenile	21,999	296	1.35%
Haddock	Juvenile	21,726	289	1.33%
Haddock	Adult	27,004	337	1.25%
Ocean Pout	Eggs	60,286	721	1.20%
Ocean Pout	Larvae	60,286	721	1.20%
Pollock	Adult	17,621	190	1.08%
Species	**Life Stage**	**Total EFH Area (nm^2)**	**Overlap with Alternative**	**% of Alternative with This EFH**

			(nm^2)	
Winter Flounder	Eggs	11,687	1,436	95.62%
Atlantic Cod	**Juvenile**	**25,068**	**1,399**	**93.15%**
Winter Flounder	Juvenile	26,526	1,384	92.16%
Winter Flounder	Adult	30,385	1,343	89.43%
Windowpane	Juvenile	31,115	1,333	88.77%
Atlantic Cod	Adult	22,656	1,296	86.31%
Windowpane	Adult	36,492	1,273	84.75%
Little Skate	Juvenile	29,590	1,213	80.73%
Winter Skate	Juvenile	26,852	1,167	77.69%
Silver Hake	Juvenile	40,709	991	65.97%
Red Hake	Juvenile	37,825	982	65.39%
Little Skate	Adult	28,185	961	64.01%
White Hake	Juvenile	43,961	912	60.73%
Atlantic Herring	Adult	56,175	859	57.20%
Silver Hake	Eggs	45,494	851	56.65%
Silver Hake	Larvae	45,494	851	56.65%
Pollock	Juvenile	19,878	851	56.65%
Yellowtail Flounder	Juvenile	27,237	759	50.54%

Table 147. Alternative 7B, Inshore Cod 0-20 meters – Summary Statistics for Status Quo EFH

Species	**Life Stage**	**Total EFH Area (nm^2)**	**Overlap with Alternative (nm^2)**	**% of Total EFH inside Alternative**
Atlantic Herring	Egg	2,992	339	11.34%
American Plaice	Egg	9,502	981	10.32%
American Plaice	Larvae	9,646	938	9.73%
Winter Flounder	Egg and Larvae	24,399	2,099	8.60%
Winter Flounder	Adult	24,668	2,111	8.56%
Winter Flounder	Juvenile	24,599	2,099	8.53%
Atlantic Herring	Larvae	12,325	958	7.78%
Atlantic Cod	**Juvenile**	**14,991**	**1,135**	**7.57%**
Ocean Pout	Juvenile	13,349	916	6.86%
Atlantic Cod	Adult	31,211	2,019	6.47%

American Plaice	Juvenile	19,632	1,097	5.59%
Haddock	Egg	8,751	473	5.40%
Windowpane	Adult	31,991	1,709	5.34%
Windowpane	Juvenile	25,188	1,330	5.28%
Atlantic Sea Scallop	All life stages	21,889	1,140	5.21%
Ocean Pout	Adult	20,584	1,050	5.10%
Windowpane	Egg	22,535	1,123	4.99%
American Plaice	Adult	22,514	1,119	4.97%
Pollock	Juvenile	18,590	916	4.93%
Atlantic Cod	Larvae	22,698	1,095	4.82%
Windowpane	Larvae	24,227	1,116	4.61%
Atlantic Cod	Egg	20,721	938	4.53%
Ocean Pout	Egg and Larvae	23,361	1,042	4.46%
Atlantic Herring	Juvenile	32,658	1,386	4.25%
Yellowtail Flounder	Egg	23,713	898	3.79%
Haddock	Larvae	14,094	519	3.68%
Atlantic Herring	Adult	38,524	1,400	3.63%
Yellowtail Flounder	Larvae	23,894	866	3.62%
Atlantic Halibut	All life stages	37,094	1,339	3.61%
White Hake	Juvenile	24,979	882	3.53%
White Hake	Adult	24,974	877	3.51%
Yellowtail Flounder	Juvenile	20,887	615	2.95%
Yellowtail Flounder	Adult	24,225	696	2.87%
Red Hake	Adult	40,944	1,114	2.72%
Red Hake	Juvenile	49,006	1,279	2.61%
Silver Hake	Adult	46,409	1,079	2.33%
Pollock	Larvae	16,321	356	2.18%
Winter Skate	Juvenile	26,465	574	2.17%
Winter Skate	Adult	18,462	383	2.08%
Red Hake	Egg	57,802	1,186	2.05%
Silver Hake	Juvenile	50,972	1,042	2.04%
Little Skate	Adult	29,950	569	1.90%
Haddock	Adult	27,076	428	1.58%
Red Hake	Larvae	57,778	866	1.50%
Pollock	Adult	21,796	323	1.48%
White Hake	Egg	23,298	325	1.39%

Little Skate	Juvenile	38,156	530	1.39%
White Hake	Larvae	23,279	315	1.35%
Silver Hake	Egg and Larvae	49,328	607	1.23%
Haddock	Juvenile	13,972	142	1.02%
Species	**Life Stage**	**Total EFH Area (nm^2)**	**Overlap with Alternative (nm^2)**	**% of Alternative with This EFH**
Winter Flounder	Adult	24,668	2,111	81.32%
Winter Flounder	Egg and Larvae	24,399	2,099	80.83%
Winter Flounder	Juvenile	24,599	2,099	80.83%
Atlantic Cod	Adult	31,211	2,019	77.77%
Windowpane	Adult	31,991	1,709	65.84%
Atlantic Herring	Adult	38,524	1,400	53.92%
Atlantic Herring	Juvenile	32,658	1,386	53.40%
Atlantic Halibut	All life stages	37,094	1,339	51.58%
Windowpane	Juvenile	25,188	1,330	51.23%

Table 148. Alternative 7B, Inshore Cod 0-20 – Summary Statistics for Omnibus Amendment Preferred Alternative EFH

Species	Life Stage	Total EFH Area (nm^2)	Overlap with Alternative (nm^2)	% of Total EFH inside Alternative
Winter Flounder	Eggs	11,687	2,422	20.73%
Atlantic Herring	Eggs	3,091	345	11.17%
Atlantic Herring	Juvenile	11,377	1,268	11.14%
Atlantic Cod	Adult	22,656	2,301	10.16%
Atlantic Cod	**Juvenile**	**25,068**	**2,453**	**9.78%**
American Plaice	Juvenile	10,404	1,006	9.67%
Winter Flounder	Juvenile	26,526	2,438	9.19%
Winter Flounder	Adult	30,385	2,395	7.88%
Winter Skate	Juvenile	26,852	2,079	7.74%
Windowpane	Juvenile	31,115	2,360	7.58%
Little Skate	Juvenile	29,590	2,174	7.35%
American Plaice	Adult	13,453	972	7.23%
Pollock	Juvenile	19,878	1,391	7.00%

Little Skate	Adult	28,185	1,766	6.27%
Windowpane	Adult	36,492	2,238	6.13%
Ocean Pout	Adult	20,789	1,252	6.02%
Winter Skate	Adult	21,981	1,301	5.92%
Yellowtail Flounder	Juvenile	27,237	1,362	5.00%
Red Hake	Juvenile	37,825	1,815	4.80%
Yellowtail Flounder	Adult	28,858	1,351	4.68%
Silver Hake	Adult	30,196	1,342	4.44%
Silver Hake	Juvenile	40,709	1,789	4.39%
Ocean Pout	Juvenile	11,545	472	4.09%
White Hake	Juvenile	43,961	1,604	3.65%
Thorny Skate	Juvenile	24,220	861	3.56%
Silver Hake	Eggs	45,494	1,597	3.51%
Silver Hake	Larvae	45,494	1,597	3.51%
Atlantic Sea Scallop	All life stages	35,035	1,070	3.05%
Red Hake	Adult	43,564	1,158	2.66%
Haddock	Juvenile	21,726	532	2.45%
Haddock	Adult	27,004	632	2.34%
White Hake	Adult	36,509	834	2.28%
Smooth Skate	Juvenile	21,999	492	2.23%
Ocean Pout	Eggs	60,286	1,320	2.19%
Ocean Pout	Larvae	60,286	1,320	2.19%
Atlantic Herring	Adult	56,175	1,124	2.00%
Pollock	Adult	17,621	321	1.82%
Redfish	Juvenile	17,191	290	1.69%
White Hake	Eggs	22,697	370	1.63%
White Hake	Larvae	22,678	360	1.59%
Monkfish	Juvenile	33,781	473	1.40%

Species	**Life Stage**	**Total EFH Area (nm^2)**	**Overlap with Alternative (nm^2)**	**% of Alternative with This EFH**
Atlantic Cod	**Juvenile**	**25,068**	**2,453**	**94.46%**
Winter Flounder	Juvenile	26,526	2,438	93.90%
Winter Flounder	Eggs	11,687	2,422	93.30%
Winter Flounder	Adult	30,385	2,395	92.25%
Windowpane	Juvenile	31,115	2,360	90.88%
Atlantic Cod	Adult	22,656	2,301	88.64%

Windowpane	Adult	36,492	2,238	86.20%
Little Skate	Juvenile	29,590	2,174	83.74%
Winter Skate	Juvenile	26,852	2,079	80.08%
Red Hake	Juvenile	37,825	1,815	69.91%
Silver Hake	Juvenile	40,709	1,789	68.90%
Little Skate	Adult	28,185	1,766	68.02%
White Hake	Juvenile	43,961	1,604	61.77%
Silver Hake	Eggs	45,494	1,597	61.49%
Silver Hake	Larvae	45,494	1,597	61.49%
Pollock	Juvenile	19,878	1,391	53.56%
Yellowtail Flounder	Juvenile	27,237	1,362	52.45%
Yellowtail Flounder	Adult	28,858	1,351	52.04%
Silver Hake	Adult	30,196	1,342	51.67%
Ocean Pout	Eggs	60,286	1,320	50.85%
Ocean Pout	Larvae	60,286	1,320	50.85%
Winter Skate	Adult	21,981	1,301	50.12%

Importance of Historic or Current Ecological Function

These areas proposed for juvenile cod HAPC designation contain structurally complex rocky-bottom habitat that supports a wide variety of emergent epifauna and benthic invertebrates. This habitat type provides two key ecological functions for juvenile cod: increased survivorship and readily available prey.

Benthic organisms provide a major food source for many commercially-managed groundfish, including juvenile cod. Benthic invertebrates are the main source of nutrition for many demersal fishes and abundant prey is particularly critical for the starvation-prone early life history stages of fish (NEFMC 1998) (Hermsen et al. 2003). Shrimps, polychaetes, brittle stars, and mussels are commonly found in association with the emergent epifauna (bryozoans, hydroids, worm tubes) that is prevalent in undisturbed gravel habitats (Collie et al. 1997). Several studies of the food habits of juvenile cod identify these associated species as important prey items (Hacunda 1981; Lilly and Parsons 1991; Witman and Sebens 1992; Casas and Paz 1994; NEFSC 1998). In summary, studies have shown a correlate increased post-settlement survivorship of Atlantic cod (*Gadus morhua*) with increased complexity of the seafloor where cod first settle. Survival is greater in habitats of higher complexity where cover provides shelter from predators (e.g., pebble-cobble with emergent epifauna > pebble-cobble > sand). Both scientific field studies and laboratory experiments show that gravel and hard bottom substrate provide greater habitat complexity than most other benthic substrates. These substrates make possible the development of epifauna and biogenic structure, which has been shown to enhance survivorship of juvenile cod.

During the late 1980's, Atlantic cod inhabiting the waters off southern Labrador and eastern Newfoundland (viz. northern cod stock) underwent a dramatic decline in biomass, with the result that the famous Grand Bank fishery collapsed in 1992. This led to a fishing moratorium as well as an economic and ecological disaster (Hutchings 1996; Myers, et al. 1996). It also triggered unprecedented research at federal fisheries laboratories and universities in eastern Canada under the auspices of the Government of Canada's Northern Cod Science Program and the government / industry-funded Ocean Production Enhancement Network program. In total, there were 58 study initiatives and projects covering a broad suite of research costing about $48 million from 1990-95 (Campbell 1997).

The following description of research results from Canada and other countries deals with life history and behavioral ecology of newly settled juvenile cod, particularly post-settlement events relating to habitat that may ultimately affect recruitment strength. Studies have focused on laboratory observation experiments as well as field capture efforts utilizing active sampling equipment, SCUBA and submersible vehicles for *in situ* observations, and seabed classification techniques for acoustically classifying juvenile habitat. Nearly three dozen scientific papers relating to this subject have been published in recent years. The information is directly applicable to coastal nursery areas in the Gulf of Maine, the inference being that knowledge gained from such studies should be used for more risk-adverse habitat management.

Juvenile Cod Community & Interactions - Research Results

Pelagic Juvenile Settlement

Post-larval pelagic juveniles are transported by prevailing currents to shallow waters off eastern Newfoundland beginning in May and may continue arriving in periodic pulses as late as December (Methven and Bajdik 1994; Grant and Brown 1998). Their length upon settlement is 25-45 mm (Pinsent and Methven 1997). In southwest Nova Scotia, pelagic juveniles arrive inshore slightly larger (≈40-50 mm) in May (Tupper and Boutilier 1995a and 1995b), whereas influxes of larvae begin earlier in Massachusetts waters two to three months after hatching (Bigelow and Schroeder 1953). On Georges Bank, cod settle out in July at 40-60 mm, and those reaching rough and cobble bottom may experience reduced predation risk. This particular habitat may be an important demographic bottleneck to benthic recruitment on Georges Bank (Lough et al. 1989).

Pelagic juveniles exhibit no preference for habitat types at settlement, and they occupy rock reef, cobble, eelgrass (*Zostera marina*) beds, and sand bottom (Tupper and Boutilier

1995b). Tupper and Boutilier (1995b) assumed that settling also occurred on macroalgae habitat, as noted by Keats et al. (1987) off eastern Newfoundland, however, algal stands were scarce in the St. Margaret's Bay, Nova Scotia, study area due to subtidal grazing by sea urchins (*Strongylocentrotus drobachiensis*). Urchins commonly leave a partially denuded or "barren" zone along nearshore (≈2-12 m below MLW) sections of the maritime provinces and Gulf of Maine.

Age-0 Movements and Diel Feeding

Shallow water depths (<5 m) and a strong attraction to features on most sub-stratums, except sand, afford settled juveniles an environment conducive to growth and survival (Tupper and Boutilier 1995a; Grant and Brown 1998b). A similar attraction to structure, particularly eelgrass and kelp, by age-0 cod was found in shallow waters (< 10 m) along the Maine mid coast in 2000 (Lazzari et al. 2003). The shallowness appears to ecologically segregate the 0-group cod from older age-groups at least during daylight (Tupper and Boutilier 1995a; Fraser et al. 1996; Gotceitas et al. 1997; Grant and Brown 1998a and 1998b). Age-0 cod maintain a strict diurnal foraging cycle, school (or shoal) feeding on zooplankton in a tide-related pattern during the day, and remain near protective bottom habitat which they readily seek when threatened (Gotceitas and Brown 1993; Gotceitas et al. 1995; Grant and Brown 1998a). The mottled coloring of young juveniles effectively conceals them in a pebble-gravel environment (Lough et al. 1989; Gregory and Anderson 1997). In contrast, pelagic juveniles on Georges Bank maintain a nocturnal feeding pattern (Perry and Neilson 1988). Age-0 cod cease feeding in surface waters and disperse to the substratum at night (Grant and Brown 1998b) where they are less active to reduce interactions with potential predators (Grant and Brown 1998a). The diel change in vertical distribution and activity of 0-group cod coincides with a nocturnal shoreward movement and foraging by older (age-1-3) conspecifics (Bosgstad et al. 1994; Gotceitas et al. 1997; Grant and Brown 1998a). Intercohort cannibalism is common. The occurrence of age-0 cod in very shallow water (<1.2 m) at night (Methven and Bajkik 1994) has also been interpreted as possibly an evasive response to predation risk (Grant and Brown 1998a).

Influence of Habitat Structure and Predation on Age-0 Demography

Tupper and Boutilier (1995b) found that the spatial pattern of settlement was altered by post-settlement mortality in St. Margaret's Bay, Nova Scotia. Age-0 survival was positively correlated with an index of rugosity, a measure of actual bottom surface or complexity. Capture success by fish predators (in this case, three species of Cottidae during a diurnal field study) was inversely related to the index of rugosity. As a result, higher densities of age-0 cod were found in cobble and rock reef habitats than in eelgrass. However, the rugosity index could not account for the complexity of surface area that eelgrass offered. Higher survival in sites of cobble and rock reef was attributed to increased shelter that the more structurally complex habitats afforded coupled with decreased predator efficiency (Keats et al. 1987; Lough et al. 1989; Tupper and Boutilier 1995b; Gotceitas et al. 1997; Grant and Brown 1998a and 1998b).

Tupper and Boutilier's (1995b) and Grant and Brown's (1998a) *in situ* studies confirmed earlier and subsequent laboratory experiments on substrate preference and predator efficiency. Clearly, the presence of conspecifics may influence the distribution and food intake of age-0 cod in the wild. Both age-0 and 1 cod preferred finer grained substrate in absence of a predator, but when in the presence of an age 3 conspecific, young-of-the-year and age-1 either avoided the predator or selected the coarser substrate (cobble vs. gravel) where they hid in interstitial spaces (Gotceitas and Brown 1993; Gotceitas et al. 1995; Fraser et al. 1996). Age-0 avoided the yearling conspecific resulting in a significant increase in use of gravel and cobble confirming the level of habitat segregation noted in the wild (Fraser et al. 1996). Also, age-0 cod avoided kelp (*Laminaria*) except when exposed to an actively foraging predator and cobble was unavailable. In this situation, kelp significantly reduced predation risk (Gotceitas et al. 1995). Both field and laboratory studies indicate that the association with coarse substrates, when coupled with behavior patterns that reduce predation risk, give young cod competitive advantage in avoiding detection or capture.

Eelgrass Habitat and Abiotic Factors

The presence of eelgrass beds or meadows appears to be a very important factor influencing the distribution of age-0 cod throughout the Canadian Maritime Provinces (Tupper and Boutilier 1995a; Gotceitas et al. 1997; Grant and Brown 1998a, 1998b) and along the Maine coast (Lazzari et al. 2003). Grant and Brown (1998b) noted that cod were more highly concentrated in eelgrass beds with >65% submersed canopy coverage. Gotceitas et al. (1997) captured age-0 cod almost exclusively in eelgrass beds of Trinity Bay, Newfoundland, where their usage by 0-group cod was consistent spatially and temporally. The eelgrass sites most sheltered to natural physical disturbance produced the highest catches; lower catches occurred at the shallowest and least saline sites (10.4-19.5 ppt). Salinities were usually high (>25 ppt) at most Newfoundland study sites (Methven and Bajkik 1994). Age-0 tolerate much lower salinities as was observed in coastal waters of Wales and England where catches occurred from 20-31 ppt (Riley and Parnell 1984).

Post-settlement cod may respond to environmental gradients in addition to substrate structure and salinity. For example, high water clarity may be important for feeding (Horne and Campana 1989). Strong tidal currents may be beneficial for concentrating food in seagrass beds (Tupper and Boutilier 1995b; Grant and Brown 1998a). Water temperatures coinciding with age-0 collections in St. Margaret's Bay, Nova Scotia, ranged between 4-9°C from May to July (Tupper and Boutilier 1995b) while July to September temperatures in age-0 habitat of Trinity Bay, Newfoundland, were 12-16°C with a year-round range of 1.7-17.0°C (Methven and Bajdik 1994). Water temperature might displace 0-group and yearlings to slightly deeper waters south of Newfoundland, however (Methven and Schneider 1998).

Among-Habitat Variation in Age-0 Growth

Growth of settled age-0 cod appears to be temperature dependent (Tupper and Boutilier 1995a). Growth was most rapid in eelgrass beds, which may positively effect overwinter survival of demersal 0-group juveniles. Growth was slowest on sand bottoms; differences in growth between young inhabiting reef and cobble bottoms were not significant (Tupper and Boutilier 1995b). The growth advantage conferred by seagrass is related to the variety of microhabitats therein that support a diverse community of invertebrates (Orth et al 1984; Heck and Crowder 1991; Heck et al. 1995; Grant and Brown 1998a). Planktonic organisms may be passively concentrated by water currents and effectively retained within the eelgrass canopy. Also, invertebrates and fish may actively seek its confines even crossing predation-risky sand to reach isolated patches (Sogard 1992).

Small planktonic crustaceans, but mostly copepods, are preyed upon by young cod (Keats and Steele 1992; Grant and Brown 1998a). When mouth gape size is large enough, at a length of 6 to 10 cm, cod transition to predominately benthic prey (Keats et al. 1987; Lomond et al. 1998) which they then consume at dusk and dawn (Grant and Brown 1998a).

Among-Habitat Variation in Age-0 Survival

Eelgrass provides age-0 cod protection from predators (Tupper and Boutilier 1995; Gotceitas et al. 1997; Grant and Brown 1998b). In a laboratory experiment, eelgrass significantly increased the time required for an age 3 cod to capture 0-group cod and decreased the number captured. With a predator present, young cod either hid in cobble or in eelgrass when stem density was >720 stems/m2. Time to capture was highest and total prey taken was lowest in combinations with cobble or vegetation of 1,000 stem/m^2 (Gotceitas et al. 1997). Results demonstrated that high plant density and/or biomass, whether eelgrass or macrophytic algae (Isaksson et al. 1994), means reduced predation risk just as does use of certain substrates. Moreover, there may be a trade-off between nutritional gain and enhanced predation risk for age-0 cod utilizing eelgrass habitat (Tupper and Boutilier 1995).

Mark-recapture experiments indicate age-0 cod remain very localized, not moving more than several hundred meters in both eelgrass and no-eelgrass habitats (Grant and Brown 1998b). Those that settled earliest and were largest at settlement grew faster and defended a larger territory than later/ smaller settlers (Tupper and Boutilier 1995a), thus a competitive advantage in growth and survival may exist for the earliest pulse of post-larval juveniles over those settling later when temperatures and day length are reduced (Tupper and Boutilier 1995b).

Abundance in the seagrass sites of St. Margaret's Bay, Nova Scotia, was noted to decline after early June. This was attributed to predation rather than emigration because young were strongly site-attached and defended territory as they grew. Marked individuals were not found in areas surrounding the study site (Tupper and Boutilier 1995b). As the summer season advanced, a greater decline in abundance occurred in eelgrass beds and on sand than in structurally more complex reef and cobble habitat. Observing *in situ* young-of-the-year seeking shelter in rock crevices, empty scallop shells, and other debris within dense grass beds, Tupper and Boutilier (1995b) believed that cod out-grew eelgrass blades as suitable refuge.

Unable to compete for nonexistent shelter on sand habitat, age-0 cod school for protection (Tupper and Boutilier 1995a); however, the population density in these areas reached zero by late June (Tupper and Boutilier 1995b). Predation by three Cottids - sea raven (*Hemitripterus americanus*), longhorn sculpin (*Myoxocephalus octodecemspinosus*), and grubby (*Myoxocephalus aeneus*) - was most successful on sand and least successful on cobble and rock reef. Age-0 cod schooling over sand bottoms have low site fidelity which is disadvantageous to survival (Grant and Brown 1998a).

Young-of-the-year juveniles appear to lose site fidelity and disperse into deeper water during the December-January period (Tupper and Boutilier 1995a; Gregory and Anderson 1997) adopting winter behavior of reduced activity and food consumption (Brown et al. 1989). Still, some marked demersal juveniles remained localized in the shallowest (<1.2 m) sampling site in Trinity Bay, Newfoundland, throughout the winter even when ice was present (Grant and Brown 1998b). Age-0 and older juveniles are more adapted than adult cod to survive icy subzero water due to elevated plasma antifreeze levels in their blood (Goddard et al. 1992).

Age-1 and Older Juvenile Habitat and Movements

Age-1 juveniles are found during day and night in shallow inshore waters, including locations with moderate to high wave exposure (Keats 1990). Older juveniles are generally distributed farther away from shore than 0-group and 1-group cod and at depths >25 m. Age-1 cod associate to a greater degree with rocky substrate and fleshy macroalgae or bottom dominated by sea urchins and coralline algae (Keats et al. 1987; Keats 1990; Gotceitas et al. 1997). The association with a macroalgal canopy seems to be more one of refuge from predators than feeding purposes (Keats et al. 1987; Gotceitas et al. 1995; Gotceitas et al. 1997). They congregate in small groups near boulders and in large crevices. In Newfoundland bays, age-1 cod have been collected within a slightly narrower temperature range, 1-16°C, than demersal 0-group fish (-1.7-17°C) (Methven and Bajdik 1994).

At dusk during summer and autumn seasons, age-1 and older juveniles move shoreward into warmer water feeding areas where the young-of-the-year cod are concentrated. The attracting stimulus appears to be the periodic influxes of early settled cod (Keats 1990; Clark and Green 1990; Methven and Bajkik 1994). Age-1 cod have usually been found feeding until dawn primarily on mysids and gammarid amphipods; however, when they become about three times larger than settled age-0 juveniles, they begin cannibalizing the demersal 0-group cod (Grant and Brown 1998a). By late fall, the earliest age-0 settlers may be large enough to begin intracohort cannibalism on the late settlers, as has been noted in waters of Iceland (Bogstad et al. 1994). When abundance of older juveniles is high, mortality may increase on young-of-the-year because of competition and predation from conspecifics (Grant and Brown 1998a).

Age-1 cod have also been observed feeding on plankton after moving inshore in spring (Keats et al. 1987) as well as resting near bottom in shallow water at night (Keats and Steele 1992). In the latter situation, age-1 were not feeding and analysis of stomach contents indicated daytime foraging on planktonic crustaceans leading the authors to speculate that post-transitional feeding on benthic invertebrates might be patchy in space and time. Where, when, and to some extent what yearlings eat is likely related to trade-offs between predation risk and food availability.

Juvenile cod may utilize the intertidal zone for feeding purposes although there is no mention of this in recent studies. Earlier, an underwater television camera mounted on a herding fence recorded 423 "young" Atlantic cod (no size given), and Atlantic tomcod (*Microgadus tomcod)*, which were sometimes indistinguishable from cod, as well as six, 30-40 cm (age 3 to 4) cod moving up and down a beach, either with or against tidal current, during daytime between June and October in Passamaquoddy Bay, New Brunswick (Tyler 1971). Of eight fish species observed undertaking these movements, the cod/ tomcod combination ranked third, behind only winter flounder (*Pseudopleuronectes amercianus*) and Atlantic herring (*Clupea harengus*) in their use of the intertidal zone.

Diel Differences in Abundance

Keats (1990) found one- and two-year-olds 16 times more abundant at night than during the day while making SCUBA transects at a depth of 5-10 m MLW. Methven and Bajdik (1994) were able to seine age-1 cod throughout the year but only at night in a cove of Trinity Bay, Newfoundland, whereas age-1 were caught both day and night by Grant and Brown (1998a) in a different cove of the same embayment. An explanation for the difference in catch of yearling cod between the two studies may be related to sampling techniques. The first study employed a 9 m seine pulled from a maximum depth of 1.2 m (no bridle). The second utilized a 30 m seine deployed by small boat 50 m from shore and pulled by towropes thereby encircling age-1 cod inhabiting a slightly greater depth range.

Researchers studying young cod recognized that gear avoidance occurred during daylight, but avoidance was secondary to diel activity in explaining abundance differences between day and night catches for both age-0 and the older juveniles

(Methven and Bajdik 1994; Gibson et al. 1996; Methven and Schneider 1998; Grant and Brown 1998b). Abundance of age-1 peaked in the shore zone from August-November and again in April-June period, but was much reduced in winter (temperature <0°C) indicating withdrawal to deeper habitat. The offshore movement by young cod was also reported in Passamaquoddy Bay, Bay of Fundy (MacDonald et al. 1984).

Juvenile Winter Habitat and Activity

Juveniles inhabit progressively deeper water and associate with coarser substratum as they grow and mature, especially in winter (Keats et al. 1987). Age-1-4 cod were observed at 18 to 150 m from submersible vehicles during April (-1°C at 25-75m), Placenta Bay, Newfoundland (Gregory and Anderson 1997; Gregory et al. 1997). They found that 80% of two-to four-year-olds fish was associated with rock, boulders, and high bathymetric relief (cliffs) and often maintained fidelity to such features including crevices in rocks. They exhibited significant increases in swimming speed with increasing distance from structure. Yearling cod showed no such connection, 59% of those observed were primarily over gravel and low relief with the fish appearing to rely on cryptic patterns to remain undetected. Macroalgae was neither avoided or preferred by either group. Age-1 and ages 2-4 co-occurred laterally and vertically throughout the study area most abundantly at depths of 60-120 m. Juveniles did not appear to undertake a diel movement shoalward during the winter/ early spring season. However, onshore movements may be initiated during March and April after ice break-up and coincident with nearshore water temperature of ≈2-3°C. The same temperature prompts offshore movements in late autumn (Methven and Bajkik 1994).

Sonic tagged age 3 cod (28-33 cm) rested almost exclusively in rocky areas at night during winter (Clark and Green 1990). Between June and September, however, individuals were active nocturnally and wide ranging (>3 km/day), moving daily between deep (30 m) cold water, where they were inactive in rocky areas, to shallow (<15 m) sandy substratum where they were active at night in relatively small feeding areas (≈540-2,580 m^2). When the water column became isothermal in September, age 3 cod remained in the shallow water during daylight leading researchers to speculate that the switch from nocturnal to diurnal feeding might be an antipredator strategy, i.e., to avoid being cannibalized at night when adult cod are seasonally active in relatively shallow water. Other common predators of juvenile cod off Newfoundland are pollock (*Pollachius virens*) and shortfinned squid (*Illex illecebrosus*).

Spatial Depth Gradient of Juveniles

For three years following stock collapse, Methven and Schneider (1998) undertook extensive sampling of the Newfoundland coastal zone to a depth of 55 m and by a variety of gears. Finding consistent spatial and diel changes in catch across gears, they interpreted results as characteristic of cod distribution. Catch rate of age-0 cod was inversely related to depth each year, highest at night, and higher at 4-7 m, the center of 0-group distribution during autumn. There was a sharp decrease in catch rate at 20 m

(Schneider et al. 1997). Demersal age-0 cod were found almost exclusively alongshore within the northeastern coastal bays of Newfoundland; the yearlings extended further offshore and older juveniles were widely distributed on the continental shelf confirming an ontogenetic pattern of movement to deeper water with increasing size. Age-dependent distribution was also obvious from trawl station catches on survey transects extending from the coast to hundreds of kilometers offshore (Dalley and Anderson 1997). When the stock was more robust, demersal age-0 cod were distributed more widely onto the shelf.

The only coastal region of eastern Canada where the seasonal pattern of distribution for young cod appears to be different is the coastal portion of southern Gulf of St. Lawrence where water temperatures might be too warm during summer months (Hanson 1996). Fine scale distribution studies with trawls found that cod did not occupy water 2-12 m deep along shores of Prince Edward Island during summer. They were mostly absent from shallow waters (<20 m deep) in the Miramichi estuary and the contiguous Shediac Valley coastal shelf during any time of year. Yearlings and 2-year-olds, but not age-0 cod, were almost exclusively found in 15-35 m depths of the Gulf from June to early October before joining older age-groups in an extensive migration to deep (>100 m) offshore water for winter.

The spatial depth gradient of juvenile cod from all other areas of eastern Canada seems consistent with published information from the Northeast Atlantic. The depth of highest age-0 cod abundance using a beam trawl off the British Isles was 6 m (Riley and Parnell 1984). Greatest density of age-1 cod sampled with gill nets off Greenland was <20 m (Hansen and Lehmann 1986; Hovgard and Nygaard 1990). Acoustic surveys off the Norwegian coast showed most juveniles at depths <35 m and highest densities of demersal 0-group cod very close to rocky shores where the research vessel could not survey (Olsen and Soldal 1989).

Density-dependent Habitat Use and Mortality

Contraction or expansion of geographic range with decreasing or increasing population size has been observed in a number of cod stocks including the Labrador-East Newfoundland complex and southern Gulf of St. Lawrence stock. In the latter region, the area occupied by age groups 3-8+ cod increased as abundance increased (Swain and Wade 1993). In comparison to the older cod, age 3 were more spatially restricted at low population size, their range expanded more slowly as abundance increased, and changes in relative density among parts of the Gulf were smaller between years of low- and high-abundance. Younger juveniles were thought to experience less severe competitive pressures for food or wider variation in habitat quality than the older age-groups.

A behavioral theory applied to explain the pattern of geographic distribution is density-dependent habitat use. This hypothesis was applied to young cod in coastal habitats

(Olsen and Soldal 1989) where catches of post-settlement juveniles showed a high degree of small-scale spatial consistency regardless of cohort size. In years of high year-class abundance, density increases to an upper limit in the most suitable habitat and as the fitness of individuals occupying the prime sites declines due to intraspecific competition, diffusion to and use of suboptimal habitat expands. Accordingly, at low population size, individuals occupy habitat with high basic foraging and protective suitability.

The theory was tested for the Labrador-East Newfoundland stock complex for which contraction has been confirmed for adult cod at low stock size (Taggart et al. 1994; Atkinson et al. 1997). Catches of age-groups 0-2 were analyzed from 1959-64 and 1992-94 at a series of fixed sampling sites extending over 1,500 miles of Newfoundland coastline (Schneider et al. 1997). In years of low cohort size, contraction did not occur in coastal habitats, i.e., density of juvenile cod was independent of area within the occupied <20 m depth range. They noted that sampling sites with high densities in some years had low densities in years of high abundance, an observation inconsistent with spillover theory in good years.

In support of density-dependent theory, high post-settlement densities of age-0 cod were found in eelgrass beds of Trinity Bay, Newfoundland, during 1994 and 1995, years of good and bad year-classes, respectively; however, a significant increase in abundance in less suitable no-eelgrass habitat was noted in 1994 when settlement strength was high (Grant and Brown 1998a). The high 1994 densities in less-utilized no-eelgrass habitat during a year of high abundance would be consistent with the hypothesis of density-dependent habitat use or selection. The researchers acknowledged that their observations were on a small temporal and spatial scale. Re-analysis of the fixed sampling site juvenile catch data from Newfoundland showed a stronger recruitment signal from a small number of sites visited frequently than the entire set of sites (Ings et al. 1997). The 1994 year class was ranked significantly stronger than the three previous year-classes following stock collapse in a broad-scale study (Anderson and Dalley 1997). On the other hand, there was no evidence of fewer settled 0-group juveniles anywhere along the coast in 1995 relative to the 1992-94 year-classes (Smedbol et al. 1998).

For a number of cod stocks, variability in year class strength is usually determined in the larval stage and attenuated by density-dependent juvenile mortality (Myers and Cadigan 1993a). Biological processes that may result in density-dependent mortality would include: (1) competition for food with mortality resulting from increased predation or starvation; (2) intercohort cannibalism; (3) predators switching to abundant year-classes; and (4) a circumscribed area of prime juvenile habitat with those settling surviving while others do not, resulting in a upper limit to the number of survivors regardless of egg/larval production. This mechanism could involve food limitation and/or increased predation risk outside a prime nursery area. It presumes mechanisms maintaining a relatively constant density such as territorial behavior or some other form of density-dependent habitat utilization.

Notwithstanding the study by Schneider et al. (1997), many of the research results discovered and re-confirmed by scientists undertaking the studies summarized herein, describe or infer habitat mediated density-dependent mortality rates. These mechanisms systematically affect cod survival rates from the post-settlement pelagic stage well into the demersal juvenile stage. Annual variation in survival rates on these life stages may be more important in affecting year class size than survival in pre-settlement stages (Sissenwine 1984). This suggests that the nearshore bottom habitat may become a potential bottleneck to year-class size particularly in areas where the availability of the most suitable habitat might be low.

Summary of Research

In shallow (< 5 m) coastal areas of eastern Canada, pelagic juvenile cod settle onto various subtidal habitats in several periodic pulses beginning in May. Age -0 cod settle in shallow waters (< 10m) of the Maine mid coast beginning in April. Space use is highly localized and primarily focused on the need to acquire food and avoid predators. Relative to fulfilling both needs, activity periods, substrate choices, and interactions with members of same species and others are critical. Diurnal feeding in inter-cohort schools aids location of patchily distributed plankton and provides protection against predators. Site fidelity and nightly concealment in all habitats, except sand, minimizes interactions with cannibalistic age-1 cod that move shoalward at dusk to feed. The spatial pattern of age-0 cod distribution is altered by post-settlement mortality such that abundance among bottom habitats matches substratum complexity: cobble/gravel ≥ rock reef > eelgrass ≥ macroalgae > sand. Of bottom habitats studied, eelgrass confers a significant advantage in growth to age-0 cod. Significantly reduced predation risk also occurs if eelgrass stems are above a threshold density and/or they are associated with cobble bottom. Eelgrass meadows are highly utilized as nursery habitat both spatially and temporally through at least mid-summer. The transition to a demersal existence occurs at a length of 6-10 cm and is marked by a switch to benthic prey foraged at dawn and dusk. The distribution of age-0 cod in autumn is centered at depths of 4-7 m MLW with a sharp drop off at 20 m. In late autumn/ early winter, age-0 lose site fidelity and disperse to deeper water where they congregate primarily over gravel and low relief cover.

Older juveniles inhabit progressively deeper water and associate with coarser, hard-bottom features as they grow. Seasonal inshore movements are usually associated with nocturnal feeding. Age-1 cod, while co-existing in all but the shallowest depths with young-of-the-year, are many times more abundant in the shore zone at night than during the day apparently attracted there by the presence of periodic influxes of post-larval pelagic juvenile cod.

Competitive advantage accrues to the largest and earliest settling juveniles especially those finding coarse substratum with vegetative cover. Those less favored must disperse from feeding patches more often thereby accepting a lower rate of food intake in order to avoid detection and capture. As Tupper and Boutilier (1995b) hypothesized: "one habitat might supply the population with a greater number of smaller recruits, each with a somewhat lesser chance of survival, while another habitat supplies fewer, larger recruits, each with a relatively high chance of survival".

The trade-offs between habitat use and frequencies of feeding in the face of predation risk are processes consistent with density-dependent habitat use and mortality. Although empirical evidence of density-dependent usage off Newfoundland is contradictory, stock size/recruitment may not yet be large enough following the northern cod stock collapse to induce significant density-dependent effects on a large spatial scale. Nevertheless, behavioral research details ways age-0 juveniles respond to spatial heterogeneity, the consequences for fitness through utilization of resources, and the intra-specific competitive effects which emphasizes the importance of habitat availability and quality in determining recruitment success.

For these reasons, Alternative 7 meets this criterion.

Sensitivity to Anthropogenic Stresses

Inshore and nearshore areas are sensitive to anthropogenic stresses. A variety of non-fishing activities could impact essential fish habitat (EFH) for Atlantic cod. The diversity, widespread distribution, and ecological linkages with other aquatic and terrestrial environments make the water and substrates that comprise Atlantic cod EFH susceptible to a wide array of human activities unrelated to fishing. This analysis includes reviews of human, non-fishing activities that are generally known or expected to have adverse affects on living marine resources.

Table 149 below describes eight (8) types of potential chemical threats, 19 categories of potential physical threats and 4 types of potential biological threats to the four life history stages of Atlantic cod EFH, which are categorized as low, moderate or high threats (L, M and H, respectively) based on their geographic location (inshore and offshore). Some types and categories of potential chemical, physical and biological threats were unable to be characterized for this document and were assigned “U” (unknown). The categories were modified from a table in Amendment 13 to the Northeast Multispecies FMP developed by the New England Fishery Management Council (NEFMC 2003a). In general, the closer the proximity to the coast (i.e., close to pollution sources and habitat alterations) the greater the potential for impact.

Table 149. Summary of potential inshore of various non-fishing activities to Atlantic cod EFH by lifestage.

Potential Threats				
	Eggs	**Larvae**	**Juveniles**	**Adults**
Chemical				
PAH	M	M	M	M
PCB	M	M	M	M
Heavy Metals	M	M	M	M
Nutrients	M	M	M	M
Pesticides/Herbicides	U	U	U	U
Acid	M	M	M	L
Chlorine	M	M	M	M
Greenhouse Gases	U	U	U	U
Physical				
Channel Dredging	M	M	M	M
Dredge and Fill	M	M	M	M
Dredge Material Disposal	H	M	M	M
Marina/Docks	M	M	M	L
Vessel Operation	M	L	L	L
Utility Lines/Pipelines	U	U	U	U
Oil/Gas Operations	M	M	M	M
Erosion/Flood Control Structures	U	U	U	U
Road Building/Maintenance	U	U	U	U
Dam Construction/Operation	U	U	U	U
Agriculture/Silviculture	U	U	U	U
Water Intake	M	M	L	L
Water Discharge	L	M	M	M
Sewage/Septic Discharge	M	M	M	M
Marine Mining	M	L	L	L
Salinity	L	L	L	L
Suspended Particles	M	M	M	L
Thermal	M	M	M	L
Dissolved Oxygen	M	M	M	M
Biological				
Exotic Species	U	U	U	U
Pathogens	U	U	U	U
Aquaculture Operations	U	U	U	U
Plankton Blooms	U	U	U	U

Key: H = high, M = moderate, L = low, and U = unknown.

For these reasons, Alternative 7 meets this criterion.

Extent of Current or Future Development Stresses

The area contained in Alternative 7 faces existing and on-going development-related threats and planned or foreseeable development-related threat. Development-related threats may result from, but are not limited to, chemical, physical and biological impacts from the following anthropogenic sources (more fully described in Criteria 2 analysis):

PAH
PCB
Heavy Metals
Nutrients
Pesticides/Herbicides
Acid
Chlorine
Greenhouse Gases
Channel Dredging
Dredge and Fill
Dredge Material Disposal
Marina/Docks
Vessel Operation
Utility Lines/Pipelines
Oil/Gas Operations
Erosion/Flood Control Structures
Road Building/Maintenance
Dam Construction/Operation
Agriculture/Silviculture
Water Intake
Water Discharge
Sewage/Septic Discharge
Marine Mining
Salinity
Suspended Particles
Thermal
Dissolved Oxygen
Exotic Species
Pathogens
Aquaculture Operations
Plankton Blooms

For these reasons, Alternative 7 meets this criterion.

Rarity of the Habitat Type

Alternative 7 does not meet this criterion.

Table 150. Summary of Alternative 7 Suitability: HAPC Criteria and Council Preferences

HAPC Criteria (EFH Final Rule)	Criteria Met?	Discussion
Importance of Historic or Current Ecological Function	Yes	The localized use of inshore habitat allows for food acquisition and predator avoidance for Age 0 cod and is highly utilized as nursery habitats both spatially and temporally. Age 1 cod rely on these habitats for seasonal, nocturnal feeding on benthic prey. Nearshore bottom habitat may become a potential bottleneck to year-class size particularly in areas where the availability of the most suitable habitat might be low.
Sensitivity to Anthropogenic Stresses	Yes	Inshore or nearshore habitats are particularly susceptible to the effects listed in Table 149.
Extent of Current or Future Development Stresses	Yes	Inshore or nearshore habitats are threatened by the effects from stressors listed in Table 149.
Rarity of the Habitat Type	No	N/A
Council Preferences	**Preference Met?**	**Discussion**
Will improve the fisheries management in the EEZ	Yes	Recognition of the importance of critical inshore habitats which provide habitat for cod fro settlement through the first autumn of life and overlaps seasonal habitat of age-1 juvenile cod. The alternative

		also bounds the critical nursery zone for early benthic stages of important juvenile habitat for some other groundfish. This designation will assist in improvements in the future.
Include EFH designations for more than one Council-managed species	Yes	Includes EFH for between 44 and 68 life stages depending on the option chosen and the EFH categories (no action or preferred alternative)
Include juvenile cod EFH	Yes	Between 44% and 94% of the area includes juvenile cod depending on the option chosen and the EFH categories (no action or preferred alternative).
Meet more than one of the EFH Final Rule HAPC criteria	Yes	Meets 3 of the criteria.

7.2.1.9 Alternative 8 – Great South Channel Area

This alternative (Section 4.2.8) proposes to designate the Great South Channel area as an HAPC for Atlantic cod. The purpose of this HAPC is to recognize the importance of the area for its high benthic productivity and hard bottom habitats, which provide structured benthic habitat and food resources for cod and other demersal-managed species.

Alternative 8 is 4537 square nautical miles (nm^2) in area. There are eighty (80) life stages of twenty-four (24) species with more than 1% of their currently defined EFH (status quo) EFH area inside this alternative and thirty-five (35) life stages of eleven (11) species which currently make up more than 50% of the Great South Channel Area alternative (Table 151). With respect to Atlantic cod EFH, for which this alternative was developed, Alternative 8 contains 19% and 14% of the currently designated Atlantic cod EFH for juveniles and adults, respectively. Additionally, approximately 63% and 90% of the area is EFH for juvenile and adult Atlantic cod, respectively.

Under the preferred alternative EFH in the current EFH Omnibus Amendment, there are sixty-four (64) of twenty-four (24) species with more than 1% of their currently defined EFH (status quo) EFH area inside this alternative and nineteen (19) life stages of eight species which currently make up more than 50% of the Great South Channel Area alternative (Table 152). With respect to Atlantic cod EFH, for which this alternative was developed, Alternative 8 contains 8.5% and 10.5% of the preferred alternative Atlantic cod EFH for juveniles and adults, respectively. Additionally, approximately 47% and 53% of the area is preferred alternative EFH for juvenile and adult Atlantic cod, respectively.

Table 151. Alternative 8, Great South Channel Area – Summary Statistics for Status Quo EFH

Species	Life Stage	Total EFH Area (nm^2)	Overlap with Alternative (nm^2)	% of Total EFH inside Alternative
Atlantic Cod	**Juvenile**	**14,991**	**2,863**	**19.10%**
Haddock	Adult	27,076	4,494	16.60%
Haddock	Juvenile	13,972	2,311	16.54%
Pollock	Egg	15,885	2,447	15.40%
Atlantic Cod	**Egg**	**20,721**	**3,181**	**15.35%**
Winter Skate	Adult	18,462	2,774	15.03%
Pollock	Larvae	16,321	2,447	14.99%
Atlantic Cod	**Larvae**	**22,698**	**3,051**	**13.44%**
Pollock	Juvenile	18,590	2,447	13.16%
Atlantic Cod	**Adult**	**31,211**	**4,080**	**13.07%**
Haddock	Egg	8,751	1,135	12.97%
Atlantic Herring	Larvae	12,325	1,579	12.81%
Winter Flounder	Egg and Larvae	24,399	2,992	12.26%
Winter Flounder	Juvenile	24,599	2,992	12.16%
Winter Flounder	Adult	24,668	2,992	12.13%
Atlantic Halibut	All life stages	37,094	4,496	12.12%
Pollock	Adult	21,796	2,447	11.23%
Redfish	All life stages	21,369	2,373	11.11%
Thorny Skate	Adult	15,482	1,715	11.08%
Yellowtail Flounder	Juvenile	20,887	2,183	10.45%
Smooth Skate	Adult	11,749	1,208	10.28%
Atlantic Herring	Egg	2,992	306	10.24%

American Plaice	Juvenile	19,632	1,963	10.00%
Winter Skate	Juvenile	26,465	2,624	9.91%
Atlantic Sea Scallop	All life stages	21,889	2,167	9.90%
Yellowtail Flounder	Adult	24,225	2,258	9.32%
Ocean Pout	Adult	20,584	1,915	9.30%
Ocean Pout	Egg and Larvae	23,361	2,142	9.17%
Smooth Skate	Juvenile	19,423	1,729	8.90%
American Plaice	Adult	22,514	1,964	8.72%
Atlantic Herring	Juvenile	32,658	2,722	8.33%
Witch Flounder	Egg	16,245	1,349	8.30%
Yellowtail Flounder	Egg	23,713	1,918	8.09%
Thorny Skate	Juvenile	26,722	2,145	8.03%
Windowpane	Egg	22,535	1,727	7.67%
American Plaice	Larvae	9,646	718	7.45%
White Hake	Larvae	23,279	1,728	7.42%
White Hake	Egg	23,298	1,728	7.42%
Witch Flounder	Larvae	20,760	1,500	7.23%
Clearnose Skate	Adult	13,387	946	7.07%
Monkfish	Adult	39,291	2,763	7.03%
Atlantic Herring	Adult	38,524	2,703	7.02%
White Hake	Adult	24,974	1,728	6.92%
White Hake	Juvenile	24,979	1,728	6.92%
Witch Flounder	Adult	20,230	1,388	6.86%
Little Skate	Adult	29,950	2,054	6.86%
Red Hake	Juvenile	49,006	3,200	6.53%
Red Hake	Larvae	57,778	3,689	6.39%
Monkfish	Egg and Larvae	63,871	3,974	6.22%
Haddock	Larvae	14,094	873	6.19%
Windowpane	Adult	31,991	1,942	6.07%
Red Hake	Adult	40,944	2,269	5.54%
Silver Hake	Egg and Larvae	49,328	2,595	5.26%
Little Skate	Juvenile	38,156	1,971	5.17%
Silver Hake	Juvenile	50,972	2,595	5.09%
Ocean Pout	Juvenile	13,349	656	4.92%
Silver Hake	Adult	46,409	2,042	4.40%
American Plaice	Egg	9,502	414	4.36%

Yellowtail Flounder	Larvae	23,894	1,008	4.22%
Witch Flounder	Juvenile	15,896	547	3.44%
Windowpane	Juvenile	25,188	756	3.00%
Barndoor Skate	Adult	5,036	150	2.98%
Windowpane	Larvae	24,227	669	2.76%
Clearnose Skate	Juvenile	14,965	378	2.52%
Offshore Hake	Larvae	3,352	76	2.27%
Monkfish	Juvenile	33,253	739	2.22%
Barndoor Skate	Juvenile	15,840	170	1.08%
Species	**Life Stage**	**Total EFH Area (nm^2)**	**Overlap with Alternative (nm^2)**	**% of Alternative with This EFH**
Atlantic Halibut	All life stages	37,094	4,496	99.09%
Haddock	Adult	27,076	4,494	99.03%
Atlantic Cod	**Adult**	**31,211**	**4,080**	**89.92%**
Monkfish	Egg and Larvae	63,871	3,974	87.57%
Red Hake	Larvae	57,778	3,689	81.31%
Red Hake	Juvenile	49,006	3,200	70.53%
Atlantic Cod	**Egg**	**20,721**	**3,181**	**70.11%**
Atlantic Cod	**Larvae**	**22,698**	**3,051**	**67.24%**
Winter Flounder	Egg and Larvae	24,399	2,992	65.95%
Winter Flounder	Juvenile	24,599	2,992	65.95%
Winter Flounder	Adult	24,668	2,992	65.95%
Atlantic Cod	**Juvenile**	**14,991**	**2,863**	**63.09%**
Winter Skate	Adult	18,462	2,774	61.15%
Monkfish	Adult	39,291	2,763	60.88%
Atlantic Herring	Juvenile	32,658	2,722	59.98%
Atlantic Herring	Adult	38,524	2,703	59.56%
Winter Skate	Juvenile	26,465	2,624	57.82%
Silver Hake	Egg and Larvae	49,328	2,595	57.19%
Silver Hake	Juvenile	50,972	2,595	57.19%
Pollock	Juvenile	18,590	2,447	53.93%
Pollock	Larvae	16,321	2,447	53.93%
Pollock	Adult	21,796	2,447	53.93%
Pollock	Egg	15,885	2,447	53.93%

Redfish	All life stages	21,369	2,373	52.30%
Haddock	Juvenile	13,972	2,311	50.93%
Red Hake	Adult	40,944	2,269	50.01%

Table 152. Alternative 8, Great South Channel Area – Summary Statistics for Omnibus Amendment Preferred Alternative EFH

Species	Life Stage	Total EFH Area (nm^2)	Overlap with Alternative (nm^2)	% of Total EFH inside Alternative
Atlantic Cod	**Adult**	**22,656**	**2,387**	**10.53%**
Pollock	Adult	17,621	1,831	10.39%
Winter Skate	Adult	21,981	2,275	10.35%
Haddock	Adult	27,004	2,709	10.03%
Atlantic Herring	Eggs	3,091	304	9.83%
Smooth Skate	Adult	14,489	1,380	9.52%
Pollock	Juvenile	19,878	1,818	9.15%
Atlantic Halibut	All life stages	15,526	1,397	9.00%
Thorny Skate	Adult	16,201	1,456	8.98%
Winter Skate	Juvenile	26,852	2,395	8.92%
American Plaice	Adult	13,453	1,151	8.55%
Atlantic Cod	**Juvenile**	**25,068**	**2,140**	**8.53%**
American Plaice	Juvenile	10,404	851	8.18%
Thorny Skate	Juvenile	24,220	1,979	8.17%
Deep Sea Red Crab	All life stages	30,339	2,420	7.98%
Redfish	Adult	11,869	945	7.96%
Haddock	Juvenile	21,726	1,726	7.95%
Redfish	Juvenile	17,191	1,336	7.77%
Atlantic Sea Scallop	All life stages	35,035	2,693	7.69%
Redfish	Larvae	12,275	923	7.52%
Barndoor Skate	Juvenile and Adult	13,177	968	7.34%
Little Skate	Adult	28,185	2,061	7.31%
Yellowtail Flounder	Juvenile	27,237	1,922	7.06%
Winter Flounder	Adult	30,385	2,058	6.77%
Yellowtail Flounder	Adult	28,858	1,937	6.71%

Smooth Skate	Juvenile	21,999	1,441	6.55%
Ocean Pout	Eggs	60,286	3,781	6.27%
Ocean Pout	Larvae	60,286	3,781	6.27%
Little Skate	Juvenile	29,590	1,843	6.23%
Winter Flounder	Juvenile	26,526	1,638	6.18%
Winter Flounder	Eggs	11,687	691	5.91%
Red Hake	Adult	43,564	2,504	5.75%
White Hake	Larvae	22,678	1,225	5.40%
White Hake	Eggs	22,697	1,225	5.40%
Windowpane	Adult	36,492	1,898	5.20%
Ocean Pout	Adult	20,789	1,072	5.16%
Silver Hake	Juvenile	40,709	2,028	4.98%
Red Hake	Juvenile	37,825	1,835	4.85%
Silver Hake	Eggs	45,494	2,137	4.70%
Silver Hake	Larvae	45,494	2,137	4.70%
Silver Hake	Adult	30,196	1,398	4.63%
Witch Flounder	Juvenile and Adult	25,216	1,094	4.34%
White Hake	Juvenile	43,961	1,819	4.14%
Atlantic Herring	Adult	56,175	2,155	3.84%
Monkfish	Adult	31,095	1,152	3.70%
White Hake	Adult	36,509	1,339	3.67%
Windowpane	Juvenile	31,115	1,109	3.56%
Monkfish	Juvenile	33,781	1,139	3.37%
Ocean Pout	Juvenile	11,545	245	2.12%
Species	**Life Stage**	**Total EFH Area (nm^2)**	**Overlap with Alternative (nm^2)**	**% of Alternative with This EFH**
Ocean Pout	Eggs	60,286	3,781	83.34%
Ocean Pout	Larvae	60,286	3,781	83.34%
Haddock	Adult	27,004	2,709	59.70%
Atlantic Sea Scallop	All life stages	35,035	2,693	59.34%
Red Hake	Adult	43,564	2,504	55.19%
Deep Sea Red Crab	All life stages	30,339	2,420	53.33%
Winter Skate	Juvenile	26,852	2,395	52.79%
Atlantic Cod	**Adult**	**22,656**	**2,387**	**52.60%**

Winter Skate	Adult	21,981	2,275	50.14%

Importance of Historic or Current Ecological Function

The Great South Channel is a large funnel-shaped bathymetric feature at the southern extreme of the Gulf of Maine between Georges Bank and Cape Cod, MA. The channel is bordered on the west by Cape Cod and Nantucket Shoals, and on the east by Georges Bank. The channel is generally deeper to the north and shallower to the south, where it narrows and rises to the continental shelf edge. To the north, the channel opens into several deepwater basins of the Gulf of Maine. The V-shaped 100-m isobath effectively delineates the steep drop-off from Nantucket Shoals and Georges Bank to the deeper basins.

The Great South Channel separates the main part of Georges Bank from Nantucket Shoals. Sediments in this region include gravel pavement and mounds, some scattered boulders, sand with storm generated ripples, scattered shell and mussel beds. Tidal and storm currents may range from moderate to strong, depending upon location and storm activity (Valentine, pers. comm.). The area west of the Great South Channel, known as Nantucket shoals is similar in nature to the central region of the bank. Currents in these areas are strongest where water depth is shallower than 50 m. The channel separates the western part of Georges Bank from Nantucket Shoals and is a region of high productivity due to an oceanic frontal system formed by the interaction of the Gulf of Maine and continental shelf waters and strong tidal currents.

A source of valuable information on the location of important and sensitive habitats is the commercial fishing industry itself. While survey data provide the best means to identify the distribution and relative abundance of fish species, most currently available survey data contain little quantitative or qualitative information on the characteristics of important habitat. Commercial fishermen are one of the best available sources of qualitative, if not quantitative, information on the location and characteristics of habitat important to commercial fish species. Commercial fishermen are also a good source of information on the sensitivity to fishing gears and practices of various habitat types.

This areas contains structurally complex gravel, cobble, and boulder habitat, which supports a wide array of emergent epifauna that juvenile cod rely on for food and shelter from predation. Within the area, many different types of habitats exist that are important to juvenile cod:

Deep water spots (45 - 75 fathoms): hard bottom with glacially deposited boulders which are fished for groundfish and include a greater diversity of species than shallow areas. Common fishing area names in this region include: (1) East Southeast Ridge; (2) Figs; (3) Jim Dwyers Ridge; (4) The Sixty-sixes; and (5) Pimple Ridges.

Shallower waters (15 - 40 fathoms): Rock and gravel with benthic organisms such as horse mussels, sea "lemons" and sponges. Common fishing area names in this area include: (1) Lemons and (2) Mussels; (3) Crushed Shells; (4) East of Pollock Hole; (5) Codfish Grounds; (6) Big Mussels Cove; (7) Middle Rip; and (8) Pumpkins.

Sensitivity to Anthropogenic Stresses

The Great South Channel area is used by commercial fishermen, and some parts of it have been closed to fishing since 1994. The distribution of biological habitats in the channel is of special interest to the New England Fishery Management Council. The area contains habitat features that are particularly sensitive, both in absolute terms and relative to other habitat types, like flat sand habitats, to the adverse effects associated with bottom trawling and scallop dredging.

Extent of Current or Future Development Stresses

The area faces threats from bottom trawling and scallop dredging, both of which occur throughout the proposed HAPC areas. According to Scallop Framework 16, nearly 50% of the projected scallop effort is expected to occur in the Great South Channel vicinity. Bottom-trawling is also extensive throughout juvenile cod EFH in areas west of the Great South Channel and in gravel habitats on Georges Bank. VTR Maps prepared for Groundfish Amendment 13 show similar effort concentrations in the area.

Rarity of the Habitat Type

The Great South Channel is a large funnel-shaped bathymetric feature at the southern extreme of the Gulf of Maine between Georges Bank and Cape Cod, MA. The channel is bordered on the west by Cape Cod and Nantucket Shoals, and on the east by Georges Bank. The channel is generally deeper to the north and shallower to the south, where it narrows and rises to the continental shelf edge. To the north, the channel opens into several deepwater basins of the Gulf of Maine. The V-shaped 100-m isobath effectively delineates the steep drop-off from Nantucket Shoals and Georges Bank to the deeper basins. There is a persistent thermal front, which roughly parallels the V-shaped 100-m isobath typically slightly south of that isobath in 60-70 m of water. The front divides stratified waters with warmer surface temperatures to the north of the front from tidally mixed waters with cooler surface temperatures over the shallower area south of the front. This areas contains relatively rare structurally complex gravel, cobble, and boulder habitat, which supports a wide array of emergent epifauna that juvenile cod rely on for food and shelter from predation.

Table 153. Summary of Alternative 8 Suitability: HAPC Criteria and Council Preferences

HAPC Criteria (EFH Final Rule)	**Criteria Met?**	**Discussion**
Importance of Historic or Current Ecological Function	Yes	Contains structurally complex gravel, cobble, and boulder habitat, which supports a wide array of emergent epifauna that juvenile cod rely on for food and shelter from predation
Sensitivity to Anthropogenic Stresses	Yes	Contains habitat features that are particularly sensitive, to the adverse effects associated with bottom trawling and scallop dredging
Extent of Current or Future Development Stresses	Yes	Faces threats from bottom trawling and scallop dredging.
Rarity of the Habitat Type	Yes	Habitat type is rare in NE
Council Preferences	**Preference Met?**	**Discussion**
Will improve the fisheries management in the EEZ	Yes	Could improve understanding of importance of structurally complex areas for future fishery produvity.
Include EFH designations for more than one Council-managed species	Yes	Includes 80 life stages under the status quo EFH and 64 life stages under the preferred alternative EFH.
Include juvenile cod EFH	Yes	63% of the area is EFH for juvenile cod under status quo EFH and 47% of the areas is designated EFH for juvenile cod under the preferred alternative EFH. 90% of the area is EFH under adult cod under status quo EFH and 53% of the areas is designated EFH for adult cod under preferred alternative

		EFH.
Meet more than one of the EFH Final Rule HAPC criteria	Yes	Meets all criteria.

7.2.1.10 Alternative 9

This alternative provides a mechanism for the Council to remove or "un-designate" the current HAPCs that are designated on George's Bank (Section 4.2.1.1) and in Maine (Section 4.2.1.2).

Alternative 9A – Remove the George's Bank Cod HAPC

The George's Bank Atlantic Cod HAPC is 188 square nautical miles (nm^2) in area. With respect to currently (status quo) defined EFH, this area is EFH for 6 life stages, encompasses more than 1% of EFH for the species and life stages and the area inside the HAPC boundaries be at least 50% EFH for any species/life stage listed in Table 120. With respect to Atlantic cod, 100% of the area is designated as EFH for juvenile and adult Atlantic cod.

Under the preferred alternative EFH in the current EFH Omnibus Amendment, this area would be EFH for 3 life stages, encompasses more than 1% of EFH for the species and life stages and the area inside the HAPC boundaries be at least 50% EFH for any species/life stage listed in Table 121. With respect to Atlantic cod, 98% and 96% of the area is designated as EFH for Atlantic cod juveniles and adults, respectively.

Based on the original justification provided in the EFH Omnibus Amendment #1 (1998), this HAPC meets two HAPC criteria (Table 154). However, if examined more closely, the George's Bank Cod HAPC may provide more recognition for critical habitats than provided initially. More detail on this can be found in Alternative 5 which includes the entire status quo HAPC (Table 135 - Table 137). See the discussion under Alternative 1A for more information on the status quo designation.

Table 154. Summary of Alternative 1A (No Action) Suitability: HAPC Criteria and Council Preferences

HAPC Criteria (EFH Final Rule)	Criteria Met?	Discussion
Importance of Historic or Current Ecological Function	Yes	Substrate of gravel or cobble found in the area allows sufficient space for newly settled juvenile cod to find shelter and

		avoid predation.
Sensitivity to Anthropogenic Stresses	Yes	Bottom fishing, especially scallop dredging and otter trawling, reduces habitat complexity and removes much of the emergent epifauna.
Extent of Current or Future Development Stresses	No	N/A
Rarity of the Habitat Type	No	N/A
Council Preferences	**Preference Met?**	**Discussion**
Will improve the fisheries management in the EEZ	Yes	Area provides two important ecological functions for post-settlement juvenile cod, an overfished species, relative to other areas: increased survivability and readily available prey.
Include EFH designations for more than one Council-managed species	No	N/A
Include juvenile cod EFH	Yes	HAPC designed specifically to capture juvenile cod habitats.
Meet more than one of the EFH Final Rule HAPC criteria	Yes	Meets Criteria 1 and Criteria 2

Alternative 9B – Remove the Atlantic Salmon HAPC

In 1998, the Council concluded that the designation of the following eleven (11) rivers in Maine met at least two criteria for designation as habitat areas of particular concern: Dennys, Machias, East Machias, Pleasant, Narraguagus, Ducktrap, Sheepscot, Kennebec, Penobscot, St. Croix, and Tunk Stream (Table 155). Removal of this designation will result in the loss of recognition of these important areas that support the only remaining populations of naturally spawning Atlantic salmon in the U.S. It should be noted that Atlantic salmon are protected by the Endangered Species Act. See the discussion under Alternative 1B for more information.

Table 155. Summary of Alternative 1B (No Action) Suitability: HAPC Criteria and Council Preferences

HAPC Criteria (EFH Final	Criteria Met?	Discussion

Rule)		
Importance of Historic or Current Ecological Function	Yes	Supports the only remaining U.S. populations of naturally spawning Atlantic salmon
Sensitivity to Anthropogenic Stresses	Yes	Habitat is susceptible to a variety of human-induced threats, from dam construction and hydropower operations to logging, agriculture, and aquaculture activities
Extent of Current or Future Development Stresses	No	N/A
Rarity of the Habitat Type	No	N/A
Council Preferences	**Preference Met?**	**Discussion**
Will improve the fisheries management in the EEZ	Yes	May assist in the rebuilding of the Atlantic salmon population, an ESA species.
Include EFH designations for more than one Council-managed species	No	N/A
Include juvenile cod EFH	No	N/A
Meet more than one of the EFH Final Rule HAPC criteria	Yes	Meets Criteria 1 and Criteria 2

7.2.1.11 Summary of HAPC Alternatives

Table 156. Summary of HAPC Criteria and Council Preference Determinations

Alternative	Ecological Function	Anthropogenic Stress	Development Stresses	Rarity	Improve Management	Multiple EFH Designations	Juvenile Cod EFH	Meets > 1 Criteria
1 – Status Quo								
1A	X	X			X		X	X
1B	X	X			X			X
2 - Seamounts	X	X		X	X			X
3 – Deep-Sea Canyons	X	X	X	X	X	X	X	X
4 – Cashes Ledge Area	X	X	X	X	X	X		X
5 – George's Bank / Northern Edge	X	X	X	X	X	X	X	X
6 – Jeffreys / Stellwagen Bank	X	X	X	X	X	X	X	X
7 – Inshore Cod	X	X	X		X	X	X	X
8 – Great South Channel Area	X	X	X	X	X	X	X	X
9 – Eliminate SQ HAPCs								
1A	X	X			X		X	X
1B	X	X			X			X

References

Alternative 1
None

Alternative 2
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Alternative 8

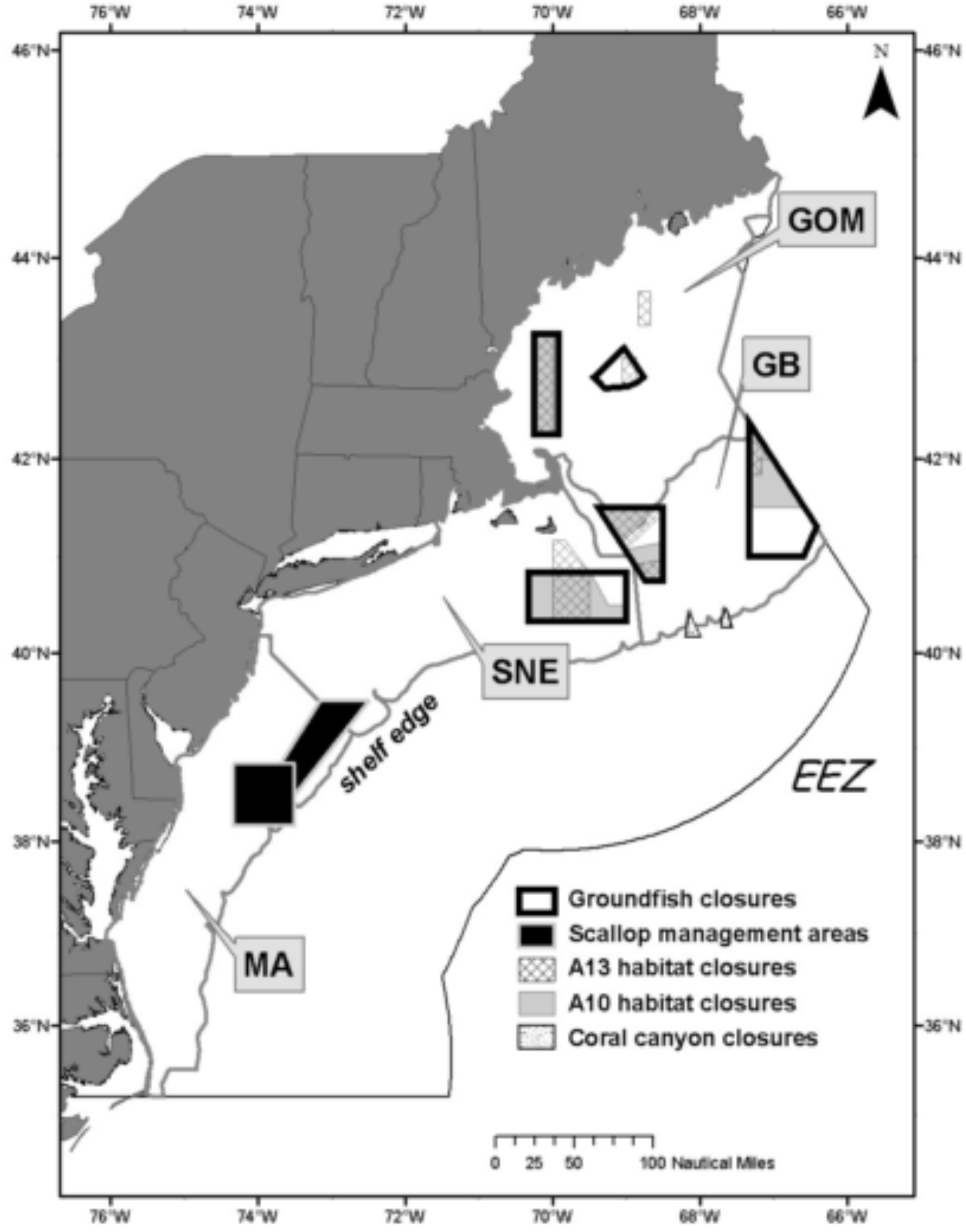
None

7.2.2 Impacts on Economic Environment (VEC 2)

In addition to alternatives for designating EFH and a program to consult on federal actions, Phase 1 of this Amendment includes for comment nine (9) alternatives with 26 options for HAPCs which were mostly received from Non-Governmental Organizations (NGOs) in response to a Council Request for Proposals (RFP). It does not, however, create any HAPCs, or management rules or regulations for HAPCs. That is, there is nothing in Phase 1 that would impact the economy, small entities, consumers, or the public either positively or negatively. It stands to reason, though, that because the Council solicited recommendations from the public, it will most likely include fishery restrictions in its alternatives in Phase 2. A Regulatory Impact Review (RIR) or study of small entities is not possible, though, until the Council selects areas and regulations for new HAPCs.

At present (status quo/Alternative 1), the northern portion of Closed Area II for juvenile cod and several rivers in Maine for Atlantic salmon are designated as HAPC. Nine (9) Habitat Closed Areas (HCA) have been implemented by the Council, which are intended to minimize the adverse effects of fishing on EFH (those effects that are more than minimal and less than temporary in nature) and include seven (7) on the continental shelf and two in the region's deep-sea canyons (Map 627). This experience in New England, which is akin to the rules governing access to the groundfish closed areas, strongly suggests that bottom-tending mobile gear (i.e., the various otter trawls and dredges) are of concern to areas designated as HAPCs and will be evaluated in a gear effects evaluation in Phase 2. Other bottom-tending gear (e.g., lobster pots, handlines, bottom longline) and pelagic or mid-water gear will also be evaluated in Phase 2.

Map 627. Network of Habitat Closed Areas Implemented by the NEFMC



Section 6.2.2 of the Affected Environment describes a framework for an economic analysis of the Amendment should the Council proceed to Phase 2 after public hearings.

In addition, it describes revenues that were earned during 2005 in the areas that were nominated for HAPCs. The major economic issues stemming from that section are as follows.

(4) Being similar to MPAs, HAPCs will take very long to negotiate if they are to be located in areas that generate much fishing revenues unless compensations are made (e.g, The Nature Conservancy's negotiations with west coast draggers and the North Pacific Council for a large marine reserve in return for funding to buy out vessels and permits and reduce overcapacity) or all competing uses of the area are spelled.

(5) As for EFH (even more so), a key economics question that should be addressed, even if qualitatively, is whether losses due to habitat damage under the status quo are more than or less than the opportunity costs of regulations that exclude specific fishing gears. Do you get more than you paid for?

(6) The specific location of an HAPC means that regulations will not be spread as evenly as they are in unit-stock management. Vessel size, fuel costs, habit, tradition, and so on affect where fishermen work. Thus, another important question to ask is what are the costs in terms of differences in gross earnings and operating costs of traveling second-best locations. One response that we have seen is that fishermen pile up along the edges of closed areas (e.g., groundfish closed areas and the sea scallop management areas).

(7) Although possibly relevant to EFH management too, HAPCs with rules that protect the ecological diversity of species and habitat will be valued by some in the general public how place importance on environmental protection. While the long term benefits of improved habitat for fish production are currently speculative, the public can be surveyed for their valuation of HAPCs that act like marine reserves.

7.2.3 Impacts on Social Environment (VEC 3)

This FMP does not create any management rules or regulations, so it does not have any direct impacts. However, it does designate HAPCs which may at some future date be used in the creation of fully closed areas or areas closed to particular gears or at particular times of year or other regulations. Thus the potential for impacts is already inherent in the designation of HAPCs. The only difference between general EFH designations and HAPC designations at this point is that HAPC designations are more likely to entail regulations in Phase 2 of the FMP. Until specific regulations are promulgated no true impact analysis can be conducted. Nonetheless, some basic issues can be discussed.

A number of issues are common to many fishermen and communities in the region. Many of the issues below are highlighted in more detail in the *Issues and Processes* sections of the community profiles in Appendix G.

7.2.3.1 General social impacts

Regulations can affect individuals, families and social groups in a variety of ways. For instance, any regulation which changes the timing or length of trips, amount of income earned, the level of job satisfaction of fishermen, ease of access to hub ports or other variables can alter social dynamics in either positive or negative ways. Some potential impacts from regulations likely to be promulgated in areas designated as HAPC include:

1. Gentrification threatens many waterfront areas with development which pushes out fishing and related industries. Some towns are passing ordinances to protect waterfronts, but others are not. Not only does gentrification limit access to the waterfront, but it also raises property values. In some cases this means that fishermen and their families must move to inland towns with lower prices, increasing commute time to the docks. Any regulations which then add increased steam time due to needing to avoid closed areas, for instance, will potentially impact family life as fishermen spend more time away from home.

2. Increasingly strict regulations in multiple fisheries and in specialized FMPS such as this one for Essential Fish Habitat are making it difficult for fishermen to continue the annual rounds or portfolio of fisheries that has been common to most small boat fishermen and even many large boat fishermen. As fishermen lose the ability to conduct one or another fishery that was a critical component of their annual round two different outcomes have become common. Either the fishermen have difficulty in piecing together enough income for the full year or they become increasingly dependent on one or two species to which they retain access – making them more vulnerable to any drop in biomass or implementation of stricter regulations.

3. Regulations limiting time or location at sea can mean fishermen must choose whether to miss trips essential to their livelihood or to either fish in bad weather or steam around restricted areas to get to allowed fishing grounds. For smaller vessels the extra steam time involves extra fuel (or chancing that they will make it on their fuel capacity) or going further offshore than usual. All of these can negatively impact safety.

4. Lowered landings and incomes can mean that upgrades to vessels and shoreside facilities are delayed, potentially compromising safety and/or creating physical and economic inefficiencies.

5. As smaller ports lose infrastructure such as shipyards and companies specializing in maritime insurance, hub ports like Boston, Gloucester and a few others become critical to maintaining the access of the entire region's fleets to these necessary services. Any regulations which increase steam time form particular ports to hub ports, due for example to closures or gear stowage requirements, increases the cost of reaching those hub ports. This may lower profitability or lead to delays in repairs that can compromise safety.

6. Higher fuel costs mean more fish are needed to simply cover trip expenses. Where FMPs decrease access to species or grounds this can become a hardship.

7. Especially in rural areas, but also in some urban centers, access to fish is part of a subsistence strategy that may also involve land-based subsistence activities. Limiting access to certain inshore areas may affect the ability of these families to provide food for their household use or to use these subsistence catches to trade for other food or services within local social networks.

8. Area closures can mean fishermen temporarily relocating to a different homeport, with attendant disruptions in family life. Those relocating may do so because they formerly fished within the now closed area or because the closed area is adjacent to their homeport.

7.2.3.2 Community impacts

Regulations can affect communities in multiple ways as well. For instance, any regulation which changes the preferred landing ports for one or more species, causes fishermen to change homeports or to alter social networks can have either positive or negative impacts. Some potential impacts from regulations likely to be promulgated in areas designated as HAPC include:

1. To the extent that vessels which fish within areas designated as HAPC concentrate their landings in particular ports, those may be forced to change landings ports. This could mean lowered revenues and adverse economic effects. This can create social problems that in turn could lead to increased need for social services.

2. To the extent that owners of vessels which fish in these areas are concentrated in particular communities, these locations will potentially be impacted. This could result in lower levels of spending within the community or out migration to be near new landings ports, both of which can create social problems or impact schools due to lowered populations.

3. Certain impacts which follow from changes in income will be more heavily concentrated in those communities or ports tied to HAPC s generating the highest revenues. Where the change in income or population is greatest, the impacts will be larger.

4. Other impacts will concentrate in communities situated closely adjacent to any HAPC entailing closures or gear stowage requirements, as vessels will be more likely to relocate even if they did not formerly fish within that area – simply because constantly going around the area will be time consuming and costly.

5. Communities with heavy reliance on fisheries or maritime industries will be most impacted by any regulation which lowers incoming revenues.

7.3 Cumulative Effects

7.3.1 Introduction

A cumulative effects assessment (CEA) is a required part of an EIS according to the Council on Environmental Quality (CEQ) (40 CFR part 1508.7). The purpose of the CEA is to integrate into the impact analyses, the combined effects of many actions over time that would be missed if each action were evaluated separately. CEQ guidelines recognize that it is not practical to analyze the cumulative effects of an action from every conceivable perspective but rather, the intent is to focus on those effects that are truly meaningful. This section serves to examine the potential direct and indirect effects of the alternatives contained in this amendment, together with past, present, and reasonably foreseeable future actions that affect habitat and EFH.

In 1997, the CEQ published a handbook entitled, *Considering Cumulative Effects Under the National Environmental Policy* Act. The CEQ identified the following eight principles of cumulative effects analysis, which should be considered in the discussion of the cumulative effects of this action:

1. Cumulative effects are caused by the aggregate of past, present, and reasonably foreseeable future actions.
2. Cumulative effects are the total effect, including both direct and indirect effects, on a given resource, ecosystem, and human community of all actions taken, no matter who (federal, non-federal, or private) has taken the actions.

3. Cumulative effects need to be analyzed in terms of the specific resource, ecosystem, and human community being affected.
4. It is not practical to analyze the cumulative effects of an action on the universe; the list of environmental effects must focus on those that are truly meaningful.
5. Cumulative effects on a given resource, ecosystem, and human community are rarely aligned with political or administrative boundaries.
6. Cumulative effects may result from the accumulation of similar effects or the synergistic interaction of different effects.
7. Cumulative effects may last for many years beyond the life of the action that caused the effects.
8. Each affected resource, ecosystem, and human community must be analyzed in terms of its capacity to accumulate additional effects, based on its own time and space parameters.

7.3.2 Valued Ecosystem Components (VECs)

As indicated in CEQ (1997), one of the fundamental principles of cumulative effects analysis, is that "… the list of environmental effects must focus on those that are truly meaningful." VECs represent the resources, areas, and human communities that may be affected by a proposed action or alternatives and by other actions that have occurred or will occur outside the proposed action. VECs are the focus of an EIS since they are the "place" where the impacts of management actions are exhibited. An analysis of impacts is performed on each VEC to assess whether the direct/indirect effects of an alternative adds to or subtracts from the effects that are already affecting the VEC from past, present and future actions outside the proposed action (i.e., cumulative effects).
As such, the range of VECs described in this section is limited to those for which a reasonable likelihood of meaningful impacts is expected. These VECs are listed below.

1. Physical and Biological Environment (i.e., habitat and fisheries and protected resources)
2. Social Environment
3. Economic Environment

The physical and biological environment VEC comprises all of the species managed under the Atlantic herring, Northeast Multispecies, Atlantic Sea Scallop, Monkfish, Skate, Red Crab and Atlantic Salmon FMPs as well as protected resources and the physical aspects of the area under management. Changes to FMPs, such as those proposed in this amendment, may have the potential to directly affect the condition of one or more of the stocks managed under these FMPs. These impacts would come about when management actions either reduce or expand the harvest or bycatch of these species. Similarly, management actions that would change the distribution and/or magnitude of fishing effort for managed resources could indirectly affect non-target species (species incidentally captured as a result of directed fishing activities); the physical environment (especially types vulnerable to activities related to directed fishing for the managed resources); and protected resources (especially those species with a history of encounters with managed fisheries). The social and economic environments could be affected directly or indirectly through a variety of complex economic and social relationships associated with the either the managed species or any of the other VECs.

This document was structured such that the cumulative effects can be readily identified by analyzing the impacts on valued ecosystem components (VECs).
The descriptive and analytic components of this document are constructed in a consistent manner. The Affected Environment section traces the history of each VEC and consequently addresses the impacts of past actions. The Affected Environment section is designed to enhance the readers' understanding of the historical, current, and near-future conditions (baselines and trends) in order to fully understand the anticipated environmental impacts of the management alternatives and independent measures under consideration in this amendment. The direct/indirect and cumulative impacts of these alternatives and measures are then assessed in Section 7.0 of this document using a very similar structure to that found in the Affected Environment.

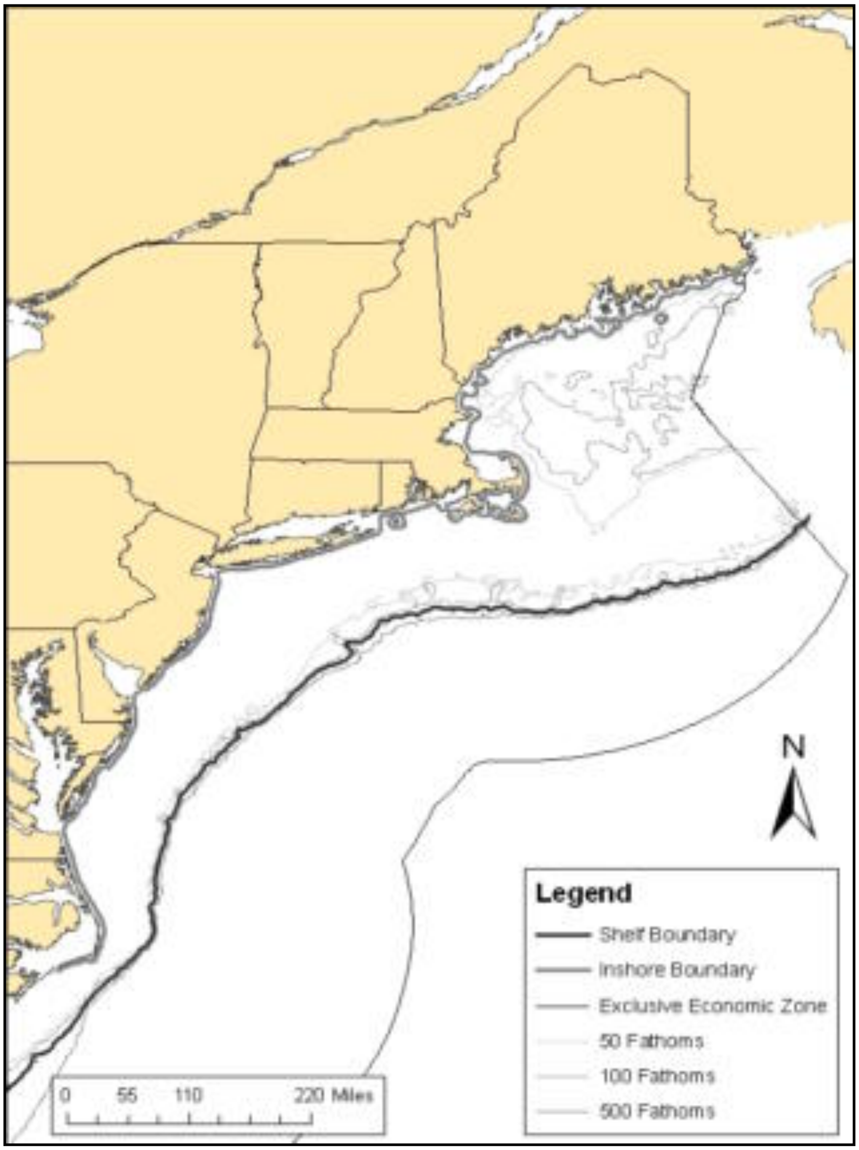
7.3.3 Spatial and Temporal Boundaries

Geographic Scope of the VECs

The overall geographic scope for the physical and biological environment can be considered as the total range of these VECs in the Western Atlantic Ocean. However, because fishing activity managed by the FMPs amended by this document occurs in the U.S. EEZ, a more limited geographic area is used to define the core geographic scope within which the majority of harvest effort for the managed resources occurs.

Map 628 illustrates the extent of these various geographic area.

Map 628. Geographic Scope of EFH Omnibus Amendment 2



Because the potential exists for far-reaching sociological or economic impacts on U.S. citizens who may not be directly involved in fishing for the managed resources, the overall geographic scope for the social and economic environment is defined as all U.S. human communities. Limitations on the availability of information needed to measure sociological and economic impacts at such a broad level necessitate the delineation of core boundaries for the human communities. These are defined as those U.S. fishing communities directly involved in the harvest of the managed resources. These communities were found to occur in coastal states from Maine to North Carolina. Communities heavily involved in the managed fisheries are identified in the port and community description (Appendix G).

Temporal Scope of the VECs

While the effects of the historical fisheries are considered, the temporal scope of past and present actions for the physical and biological environment, the social environment and the economic environment is focused on actions that have occurred after implementation of the various FMPs. An assessment using this timeframe demonstrates changes to the resources and human community that have resulted through management under the Council process.

For protected species, the scope of past and present actions is on a species-by-species basis (Affected Environment Section 6.0) and is largely focused on the 1980s and 1990s through the present, when NMFS began generating stock assessments for marine mammals and turtles that inhabit waters of the U.S. EEZ.

The temporal scope of future actions for all three (3) VECs, which includes the measures proposed by this amendment, extends five years into the future. This period was chosen because the MSFMA includes a five year EFH review and revision requirement specified in 50 CFR Section 600.815(a)(10). This revision makes it difficult to predict impacts beyond this timeframe with any certainty.

7.3.4 Past, Present and Reasonably Foreseeable Future Actions

The CEQ process calls for the identification of other actions that affect the VECs (i.e., actions other than those being developed in this document). Note that many of the other actions summarized below come from fishery-related activities (e.g., Federal fishery management actions). As expected, these activities have fairly straight-forward effects on environmental conditions, and were, are, or will be taken, in large part, to improve those conditions. The reason for this is the statutory basis for Federal fisheries management - the Magnuson-Stevens Act, as amended by the SFA in 1996. That legislation was enacted to promote long-term positive impacts on the environment in the context of fisheries activities. Under this regulatory regime, the cumulative impacts of past, present, and future Federal fishery management actions on the VECs should be expected to result in positive long-term outcomes. As such, it is not practical or necessary to summarize all of the fisheries-related impacts that have had an impact on the three (3) VECs. Rather, for the purpose of this assessment, other fishery management actions are assumed to have had long-term positive impacts to the environment and economic/social resources as measures are taken to improve and sustain stock abundance.

Non-fishing activities that have meaningful effects on the VECs are summarized in Section 4.4.

The major activities that were identified as impacting fishery habitat in these areas include:

- Coastal Development
- Energy-Related Activities
- Alterations to Freshwater Systems
- Marine Transportation
- Offshore Dredging and Disposal
- Physical and Chemical Effects of Water Intake and Discharge Facilities
- Agriculture and Silviculture
- Introduced/Nuisance Species and Aquaculture
- Global Affects and Other Impacts

These activities pose a risk to the all of the identified VECs in the long term. Wherever these activities occur, they are likely to work additively or synergistically to decrease habitat quality and, as such, may indirectly constrain the sustainability of fisheries and protected species resources.

The overall impacts of the past, present, and reasonably foreseeable actions are discussed below. These impacts, in addition to the impacts of the management actions being developed in this document, comprise the total cumulative effects that will contribute to the significance determination for each of the VECs.

1998 EFH Omnibus Amendment

The 1996 amendments to the Magnuson-Stevens Fishery Conservation and Management Act, known as the Sustainable Fisheries Act (SFA), changed the focus of the Act by emphasizing the importance of habitat protection to healthy fisheries and by strengthening the ability of the National Marine Fisheries Service (NMFS) and the Councils to protect and conserve the habitat of marine, estuarine, and anadromous finfish, mollusks, and crustaceans. This habitat is termed "essential fish habitat" and is broadly defined to include "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity."

The purpose of the 1998 EFH Omnibus Amendment was to identify and describe the EFH for all species of marine, estuarine, and anadromous finfish, and mollusks managed by the Council to better protect, conserve, and enhance this habitat. This amendment also identified the major threats to essential fish habitat from both fishing and non-fishing related activities and identified conservation and enhancement measures.

None of the alternatives or provisions of the 1998 EFH amendment were found to significantly affect the quality of the human environment, and the preparation of an environmental impact statement for the proposed action was not required by Section 102(2)(C) of the National Environmental Policy Act or its implementing regulations. The initial designating of EFH under the SFA resulted in indirect impacts to the social and economic environment due to the new SFA requirement for federal agencies to consult with NMFS and the Council on the potential impacts of their actions on EFH. From a biological perspective, this action increased NMFS focus on habitat protection for marine resources, beyond anadromous species. It also laid the ground work for future measures to protect EFH, such as those taken in the recent major plan amendments (Multispecies Amendment 13, Atlantic Sea Scallop Amendment 10 and Monkfish Amendment 2). With respect to the designation of HAPCs in the 1998 EFH Omnibus Amendment, because the proposed new cod HAPC was inside the existing Groundfish Closed Area 2, which was closed to all gear capable of catching groundfish, and no additional management restrictions were implemented with the cod HAPC designation, the impact of the cod HAPC designation was not significant and resulted in no additional impacts. The designation of the Atlantic salmon HAPC in the rivers in Maine also resulted in no additional impacts as these were areas that were already under the protection of the Endangered Species Act Listing Process. As such, maintaining the current Closed Area II restrictions for the juvenile Atlantic cod HAPC and implementing HAPCs for Atlantic salmon were unlikely to significantly affect the quality of the human environment, and the preparation of an environmental impact statement for the proposed action was not required by Section 102(2)(C) of the National Environmental Policy Act or its implementing regulations.

Amendment 10 to the Atlantic Sea Scallop FMP

In 2004 Amendment 10 introduced rotation area management and changed the way that the Scallop FMP allocates fishing effort for limited access scallop vessels. Instead of allocating an annual pool of DAS for limited vessels to fish in any area, vessels now use a portion of their total DAS allocation in controlled access areas defined by the plan, or exchange them with another vessel to fish in a different controlled access area. Vessels can fish their open area DAS in any area that is not designated a controlled access area. The amendment also adopted several alternatives to minimize impacts on EFH, including designating EFH closed areas, which included portions of the groundfish mortality closed areas. Furthermore, a gear modification (4-inch ring size) was implemented to reduce contact with the bottom. And total DAS allocated under Amendment 10 were reduced, which had additive benefits for EFH by reducing overall scallop fishing effort.

Framework 16 to the Scallop FMP also attempted to make the habitat closed area boundaries implemented under Amendment 10 consistent with the areas later implemented under Amendment 13 to the Northeast Multispecies FMP. However, in August 2005, the Court, in Oceana v. Evans, ruled that any revisions to the boundaries under the Scallop FMP must be implemented under a full rule making process via an FMP amendment rather than through the abbreviated rule-making process used in a framework adjustment, and reinstated the EFH closed areas implemented under

Amendment 10 to the Scallop FMP. Thus, the habitat closed area boundaries implemented under Amendment 10 are currently in effect.

It should be kept in mind that the benefit of closure areas might be limited by the fact that when areas are closed, effort is often displaced to other fishing areas. This may reduce the beneficial effect of this management measure over a larger area, i.e., impacts in the closure area may be reduced but impacts to other areas may be increased.

Amendment 13 to the Northeast Multispecies FMP

The principal objectives of Amendment 13 to the Northeast Multispecies FMP, which was implemented on May 1, 2004, included rebuilding overfished stocks, ending overfishing, reducing unused effort in the fishery, addressing administrative issues, maintaining flexibility in the fishery, reducing bycatch, and minimizing the impact of the fishery on fish habitat and protected species (such as whales and turtles). In addition, this Amendment responded to the requirements of the court orders in the lawsuits of *Conservation Law Foundation et al. v. Donald Evans et al* and *American Oceans Campaign et al. v Daley et al*. This Amendment incorporated and expands on the *Draft Environmental Impact Statement for the Essential Fish Habitat Components of Amendment 13 to the Northeast Multispecies Fishery Management Plan.*

The actions proposed in Amendment 13 predicted the following impacts:

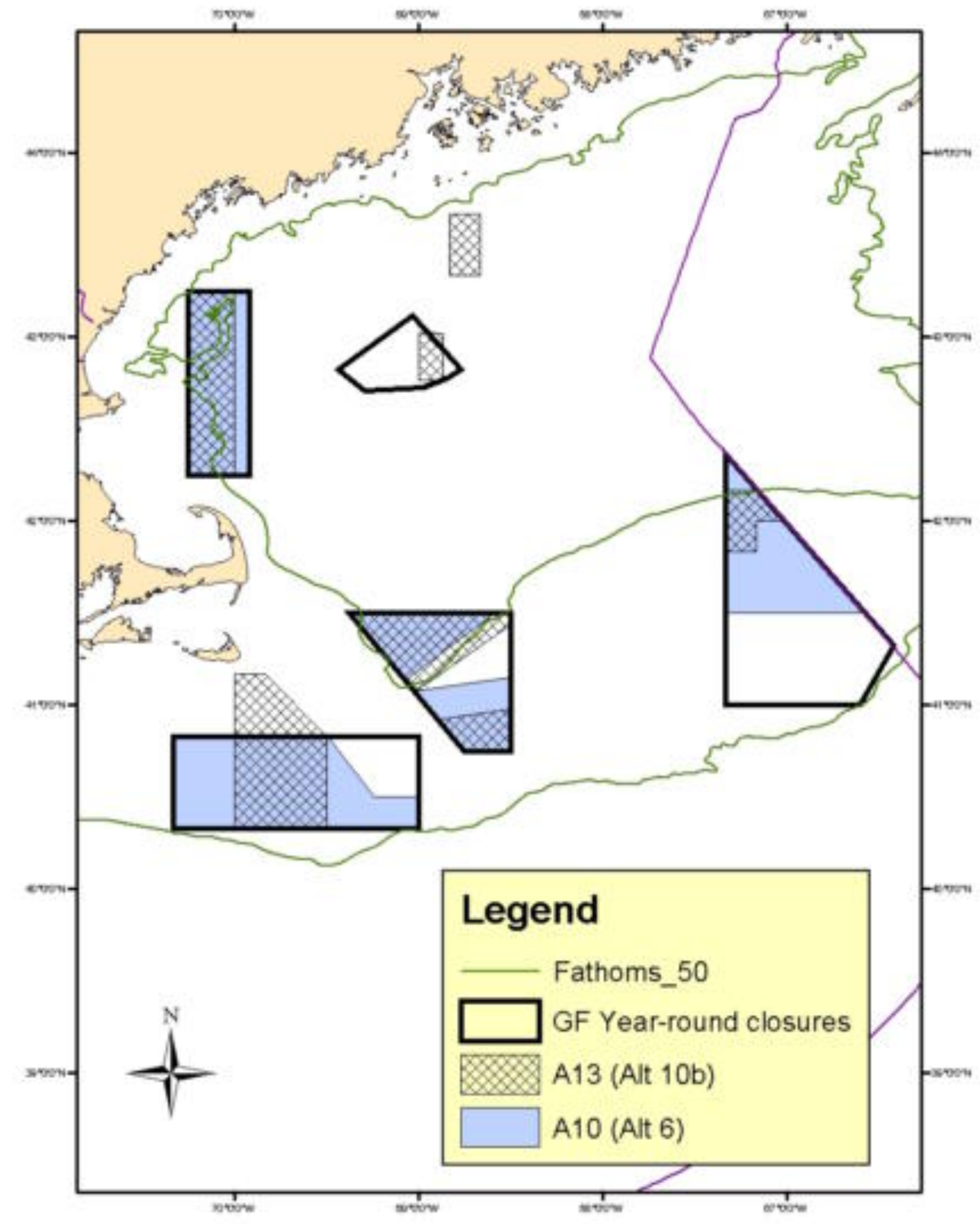
1. For regulated stocks, an end to overfishing for all groundfish stocks, to rebuild overfished stocks by 2014 for most stocks (2018 for CC/GOM yellowtail flounder, 2026 for GB cod, and 2047 for redfish), reduce discards due to the adoption of an increased mesh size and create opportunities for groundfish vessels to target healthy stocks (SAPS);
2. For other stocks, reduce the bycatch of skates, dogfish and monkfish as a result of effort reductions;
3. No specific measures to protect endangered and other protected species were adopted however, effort reductions for regulated and other stocks would have negligible or possibly beneficial impacts;
4. Specific measures to protect habitat included the adoption of areas closed to mobile gear, further benefits could also result from effort reductions on regulated and other stocks; and
5. Short term reductions in revenue would have negative impacts on fishing communities, but over the period of the rebuilding program revenues would increase, however, there was considerable uncertainty over whether current fishery participants would benefit from rebuilding.

With respect to EFH, the central protection measures implemented include a suite of Habitat Closed Areas as depicted in Map 629. These areas were closed to all bottom-tending mobile gear indefinitely. Additionally, measures such as gear restrictions/alterations, permitting restrictions, reductions in effort allowed or days at sea (DAS), and possession/trip limits can clearly benefit habitat. It should be kept in mind that the benefit of closure areas might be limited by the fact that when areas are closed, effort is often displaced to other fishing areas. This may reduce the beneficial effect of this management measure over a larger area, i.e., impacts in the closure area may be reduced but impacts to other areas may be increased.

Amendment 2 to the Monkfish FMP

The Monkfish FMP is jointly managed by the NEFMC and the MAFMC with the NEFMC as the lead Council. The Councils adopted Amendment 2 to the Monkfish FMP on April 28, 2005 and it contained a number of measures that the Councils developed to address essential fish habitat (EFH). Since the offshore fisheries take place along the edge of the continental shelf and canyon areas where deep-sea corals exist, the Councils implemented Habitat Closed Areas in Lydonia and Oceanographer Canyons where corals have been observed or are expected to occur, in a manner that minimizes the economic impact on the fishery. While coral habitats are not part of the strict essential fish habitat (EFH) designation for any managed species, protecting coral habitats may have indirect benefits for species with EFH in adjacent areas. Furthermore, the Councils took precautionary steps to protect these vulnerable areas from potential fishing that could occur in those areas as the offshore monkfish fishery becomes established, and deepwater fishing technology advancements enable vessels to extend their activity into the canyon areas. Also, the Councils implemented a restriction on the trawl roller gear diameter to six inches maximum on vessels fishing on a monkfish DAS (monkfish-only or combined) in the Southern Fishery Management Area (SFMA). Such a restriction effectively ensured that such vessels do not fish in areas of more complex bottom characteristics, particularly in the offshore canyons.

Map 629. Network of Habitat Closed Areas Implemented by NEFMC



Future Actions

Non-Fishing Activities

The EFH Omnibus Amendment will enter into its second phase immediately after Phase 1 decisions have been made in June 2007. The Amendment is one action with two phases, one EIS and two opportunities for public comment on the EIS (Phase 1 DSEIS and a combined Phase 1/Phase 2 DSEIS after the Phase 2 development). Phase 2 will include an assessment of the potential impact of fishing gears on EFH, a determination of what gears, if any, are adversely affecting EFH in a manner that is more than minimal and less than temporary in nature and alternatives to minimize these impacts to the extent practicable, if necessary. Additionally, Phase 2 will include consideration of Dedicated Habitat Research Areas and an update of research and information needs. The status quo habitat protection measures include a broad suite of Habitat Closed Areas implemented in recent Multispecies, scallop and monkfish amendments as well as effort reductions and gear modifications. While Phase 2 will review these measures and consider others in their place, if necessary, it is impossible to determine at this time whether the cumulative effects of the measures in Phase 2 will be positive or negative as compared to the status quo protection measures.

With regards to other non-fishing activities that may adversely affect EFH, this Amendment includes a comprehensive analysis of their potential impacts in Section 5.2 and Appendix D. Thousands of projects occur in the marine environment in places that are designated as EFH each year. Many more will continue to be proposed given the interest in coastal development and servicing the needs of the inhabitants of these and inland areas via the marine environment. The overall impact of these projects is negative, however, the Council does not have the regulatory authority to alter or prevent these impacts.

Fishery Management Activities

Scallop Framework 19

This framework will serve as the biennial adjustment for FY 2008-09 and may include additional measures to prevent or end overfishing and may prove beneficial to EFH if additional effort reductions are implemented.

Multispecies Amendment 16

Amendment 16 will implement measures that continue the rebuilding programs adopted by Amendment 13. The Council may consider adjustments to the current effort control system (that is, days-at-sea, closed areas, gear requirements, trip limits, recreational measures, etc.). The Council may also consider alternative management systems, such as a "hard" total allowable catch (TAC) system, area management, individual quotas, or fishery sectors. If the action reduces the fishing effort, modifies gear to be less impacting on EFH or additional closed areas are implemented, this action could be beneficial to the protection of EFH.

Multispecies Amendment 18
The Council initiated the development of this amendment to address three issues: 1) limited entry into the small mesh multispecies fishery, 2) the possible use of a hard total allowable catch to maintain fishing mortality at acceptable levels, and 3) the possible use of dedicated access privileges in the small mesh multispecies fishery.

Summary of Past, Present and Reasonably Forseeable Future Actions
The cumulative effect of past and present future actions has generally had a positive impact on the physical and biological environment. Because the nature of actions taken under the MSFCMA tends to reduce or stabilize fishing effort and afford some level of habitat protection, this trend is expected to continue as future actions are implemented. However, non-fishing impacts such as coastal development, marine transportation, dredging, etc. do pose a risk to habitat and thus fishery resources. This has the potential to negatively impact the physical and biological environment along with the communities that rely on marine resources. Further, reductions in fishing effort and measures to protect habitat and resources have had negative consequences on the social and economic environment in the short-term. Nonetheless, it is anticipated that in the long-term, improved habitat quality and sustainable resources will lead to positive socal and economic returns.

7.3.5 Cumulative Impacts

Phase 1 of this FMP does not create any management rules or regulations, so it does not have any direct or indirect impacts on any of the identified VECs. However, this action does designate EFH and HAPCs. These designations may in the future, through Phase 2 of this action or a subsequent fisheries management action, be used to develop measures to minimize impacts to EFH such as the creation of fully closed areas, areas closed to particular gears or at particular times of year or other regulations. Thus, the potential for impacts is already inherent in the designation of EFH and HAPCs. However, until specific measures have been developed, it is not possible to predict future impacts with any certainty. Nonetheless, based on the impacts that have resulted from past measures to protect EFH, some very qualitative trends can be noted. For example, should future measures, in addition to those already implemented, be taken to protect EFH, they would likely have positive cumulative biological and physical impacts, with some short-term negative social and economic impacts. Further, protection afforded to EFH through future measures could help mitigate the impacts associated with non-fishing activities.

References

Council on Environmental Quality (CEQ). 1997. Considering Cumulative Effects Under the National Environmental Policy Act. CEQ Executive Office of the President. 64p.

8.0 Data and Research Needs

The Council has not recently developed data and research priorities for essential fish habitat with advice and input from the Habitat Plan Development Team. A new list will be produced during Phase 2 of the EFH Omnibus Amendment.

9.0 Consistency with the Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA)

This analysis was prepared in accordance with the requirements of the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act) and related regulatory requirements. A review of how this analysis, including the alternatives, comports with the Magnuson-Stevens Act national standards for fishery management and with the regulations implementing the EFH provisions of the Magnuson-Stevens Act is provided in this section.

9.1 National Standards

Section 301 of the Magnuson-Stevens Fishery Conservation and Management Act requires that fishery management plans (FMPs) contain conservation and management measures that are consistent with the ten National Standards:

In General. – Any fishery management plan prepared, and any regulation promulgated to implement any such plan, pursuant to this title shall be consistent with the…national standards for fishery conservation and management.

(1) Conservation and management measures shall prevent overfishing while achieving, on a continuing basis, the optimum yield from each fishery for the United States fishing industry.

In terms of achieving 'optimum yield' from the fishery, the Magnuson-Stevens Act defines 'optimum' as the amount of fish that will provide the greatest overall benefit to the nation, particularly with respect to food production and recreational opportunities, and taking into account the protection of marine ecosystems; is prescribed as such on the basis of the maximum sustainable yield from the fishery, as reduced by any relevant economic, social, or ecological factor; and in the case of an overfished fishery, provides for rebuilding to a level consistent with producing the maximum sustainable yield in such fishery. National Standard 1 thus involves a number of tradeoffs to achieve optimum yield. Overall benefits to the nation may be affected by these tradeoffs, though our ability to quantify those effects is quite limited. Nevertheless, all alternatives considered in this analysis are consistent with National Standard 1. All alternatives for describing EFH (except for no action Alternative 1) would provide additional conservation benefits by increasing attention on the location and use of habitats by managed fish species. Likewise, the alternative approaches for identifying HAPCs (except for no action Alternative 1) would provide potential conservation benefits.

(2) Conservation and management measures shall be based upon the best scientific information available.

This document uses information of known quality from sources acceptable to the relevant scientific and technical communities. Several sources of data were used in the development of this document, including the analysis of potential impacts. These data sources include, but are not limited to:

Inshore
- ME Beam Trawl Survey (2000 - 2004)
- ME/NH Inshore Trawl Survey(2000 – 2004)
- NH Estuarine Seine Survey
- MA Inshore Trawl Survey (1978 – 2005)
- RI Trawl Survey (seasonal and monthly)
- RI Coastal Ponds Survey
- RI Narragansett Bay Juvenile Finfish Survey
- CT Long Island Sound Trawl Survey (1984 – 2004)
- CT Small Mesh Trawl Survey (1991-93, 1996)
- NY Raritan Bay Survey (1992 – 1997)
- NJ Trawl Survey (1988-2004)
- NJ Delaware Bay Trawl Survey (1991 – 2005)
- DE 16ft Trawl Survey (1980-2004)
- DE 30ft Trawl Survey (1966-2004)
- MD Coastal Bays Fisheries Investigation Project
- MD Seine Survey
- VA Juvenile Fish and Trawl Survey
- NC Trawl Survey
- NOAA Estuarine Living Marine Resource information

Shelf
- NMFS bottom trawl survey (1968 - 2005)
- NMFS sea scallop survey (1982-2005)
- NMFS MARMAP ichthyoplankton survey (1977 – 1987)

Offshelf
- NMFS Deep-Sea Survey
- Deep Sea Experimental Fishery project reports
- Smithsonian collection data
- Literature

Seamounts
- Literature

Habitat Data Sources

<u>Shelf</u>

- NGDC 2-Minute Gridded Bathymetry Data (ETOPO2)
- usSEABED Marine Substrate Database
- Bottom temperature derived from NMFS MARMAP, bottom trawl, and hydrographic survey data.

Although there are some limitations to the data used in the analysis of impacts of management measures and in the description of the affected environment, these data are considered to be the best available. The information in this analysis represents the most current, comprehensive set of information available, recognizing that some significant information, including ecological, biological, economic, and sociocultural information, is unavailable. Furthermore, the analyses were prepared by and reviewed by the Council's Habitat Plan Development Team, which is compiled of fisheries experts from academia and state/Federal agencies (for a list of preparers, see Section 10.1.5). Furthermore, all analyses comply with the Data Quality Act (DQA). Each of the alternatives was analyzed based on information that appears to be consistent with this standard to the fullest extent practicable.

(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.

This action amends all of the Council's FMPs including the Northeast Multispecies, Atlantic sea scallop, Monkfish, Atlantic Herring, Skates, Deep-sea red crab and Atlantic salmon which manage the species in the respective FMUs throughout the range of the species in U.S. waters, in accordance with the jurisdiction of U.S. law. As this action will continue the management of the fishery management units throughout their range, all alternatives appear to be consistent with this standard.

(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 manner that no particular individual, corporation, or other entity acquires an excessive share of such privileges.

The management measures proposed in this amendment do not discriminate between residents of different States. The proposed management measures have been analyzed in this DSEIS document and are expected to promote conservation of EFH. None of the alternatives makes explicit or implicit differentiation among residents of different states, and no direct allocation or assignment of fishing privileges is included in any of the alternatives.

(5) Conservation and management measures shall, where practicable, consider efficiency in the utilization of fishery resources; except that no such measure shall have economic allocation as its sole purpose.

This action does not allocate or remand fishery resources but rather moves forward the Magnuson-Stevens Act intent to identify important habitats and ecosystem components. As such, this standard is not affected.

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

Changes in fisheries occur continuously, both as the result of human activity (for example, new technologies or shifting market demand) and natural variation (for example, oceanographic perturbations). This action takes into account these variations by including data with long time series and synthesis of scientific studies.

(7) Conservation and management measures shall, where practicable, minimize costs and avoid unnecessary duplication.

Since no restrictions on fishing practices to protect EFH are being considered at this time by the Council, no additional economic cost will be imposed on fishing communities and no duplication is expected.

(8) Conservation and management measures shall, consistent with the conservation requirements of this 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.

Since no restrictions on fishing practices to protect EFH are being considered at this time by the Council, fishing communities are not impacted by this action and, as such, the sustained participation of the communities is not jeopardized and no adverse economic impacts are predicted.

(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.

None of the alternatives will change the amount of bycatch or the mortality of bycatch taken incidentally in the fisheries. Regulatory provisions that are in place at present will continue to provide incentives to fleets to minimize bycatch and mortality of such bycatch to the maximum extent practicable.

(10) Conservation and management measures shall, to the extent practicable, promote the safety of human life at sea.

None of the alternatives under consideration in this action will substantially change safety considerations for fishing vessels.

9.2 Other Required Provisions of MSFCMA including EFH

Essential Fish Habitat
This section provides a review of how this analysis addresses the required EFH contents of FMPs as specified in Section 303(a)(7) of the Magnuson-Stevens Act and the EFH final rule (50 CFR 600 Subpart J).

(1) Description and identification of EFH.
This analysis provides alternatives that describe and identify EFH in text that clearly states the habitats or habitat types determined to be EFH for each life stage of the managed species. The alternatives explain the physical, biological, and chemical characteristics of EFH and, if known, how these characteristics influence the use of EFH by the species/life stage. All EFH alternatives considered identify the geographic location or extent of habitats described as EFH. Maps of the geographic locations of EFH, or the geographic boundaries within which EFH for each species and life stage is found, for all alternatives considered are provided. For all EFH description alternatives, the description of EFH provides information on the usage of various habitats by each managed species.

Proposed descriptions and identification of EFH were based on the best available sources, including peer-reviewed literature, unpublished scientific reports, data files of government resource agencies, and other sources of information. The best scientific information available was used in the description and identification of EFH, consistent with National Standard 2.

All EFH description alternatives include maps that display, within the constraints of available information, the geographic locations of EFH or the geographic boundaries within which EFH for each FMP managed species and life stage is found. The data used for mapping were incorporated into a geographic information system (GIS) to facilitate analysis and presentation.

(2) Fishing activities that may adversely affect EFH.
This action does not include an evaluation of the fishing activities that may adversely affect EFH as it will be included in the subsequent action (Phase 2). In addition, this evaluation has been completed in recent years for each FMP independently.

(3) Non-Magnuson-Stevens Act fishing activities that may adversely affect EFH.
This evaluation will be included in the subsequent action (Phase 2). In addition, this evaluation has been completed in recent years for each FMP independently.

(4) Non-fishing related activities that may adversely affect EFH.
An extensive evaluation of the potential effect of non-fishing activities has been completed in this action (See section 5.2 and Appendix G).

(5) Cumulative impacts analysis.
A cumulative impact analysis is provided in Section 7.3

(6) Conservation and enhancement.
The rule requires that FMPs must identify actions to encourage the conservation and enhancement of EFH, including recommended options to avoid, minimize, or compensate for any adverse effects, including effects of non-Magnuson-Stevens Act fisheries, non-fishing related activities, and cumulative effects. Conservation and enhancement recommendations are included in the Section 5.2 and Appendix D.

(7) Prey species.
Section 5.1 contains a thorough evaluation of the major prey species in the fishery management units (FMU). In addition, prey species information, where known, has been included in the EFH text descriptions for each species and life stage.

(8) Identification of habitat areas of particular concern.
This EIS includes a range of HAPC designation alternatives for consideration by the Council.

(9) Research and information needs.
Recommendations for research to improve upon the description and identification of EFH, the identification of threats to EFH from fishing and other activities, and the development of conservation and enhancement measures for EFH, were previously included in individual FMPs amendments and will be reviewed under Phase 2 of this action.

(10) Review and revision of EFH components of FMPs.
The Council and NMFS will periodically review the EFH provisions of FMPs and revise or amend EFH provisions as warranted based on available information. A complete review of all EFH information should be conducted as recommended by the Secretary, but at least once every 5 years.

10.0 Relationship to Other Applicable Laws

10.1 National Environmental Policy Act (NEPA)

The DSEIS was prepared in full compliance with the requirements of NEPA. All established procedures to ensure that federal agency decision makers take environmental factors into account, including the use of a public process were followed. This DSEIS contains all the components required by NEPA, including a brief discussion of the purpose and need for the action (Section 2.2) , the alternatives considered (Section 4.0), the affected environment (Section 6.0), the environmental consequences of the proposed action and the alternatives (Section 7.0), a list of document preparers (Section 10.1.5), and other relevant information. NEPA requires preparation of an EIS for major Federal actions that significantly affect the quality of the environment. To prepare this Draft Amendment/DSEIS, the Council also held 12 meetings of its Habitat/MPA Oversight Committee and 6 meetings of its Habitat Advisory Panel. All of these meetings, as well as numerous Habitat Plan Development Team meetings, were open to the public. The proposed management measures in this integrated amendment/DSEIS document will be the subject of public hearings during 2007. The Council will take public comment into consideration when selecting the final management measures during 2007.

The following Table of Contents for the DSEIS is provided to aid reviewers in referencing the appropriate corresponding sections of this integrated amendment/DSEIS document.

10.1.1 Introduction and DSEIS Table of Contents

Refer to Table of Contents provided at the beginning of the document.

10.1.2 Scoping Process

Scoping on issues of significance was conducted by the Council and the details can be found in Section 2.3 and Appendix H.

10.1.3 Areas of Controversy and Issues to be Resolved

NOAA Administrative Order 216-6 defines “controversial” as referring to a substantial dispute which may concern the nature, size, or environmental effects, but not the propriety, of a Proposed Action. In this context, the Council does not recognize any areas of controversy and issues to be resolved relative to the action proposed in this amendment.

10.1.4 Determination of Significance

National Oceanic and Atmospheric Administration Administrative Order 216-6 (NAO 216-6) (May 20, 1999) contains criteria for determining the significance of the impacts of a Proposed Action. In addition, the Council on Environmental Quality regulations at 40 CFR. 1508.27 state that the significance of an action should be analyzed both in terms of "context" and "intensity." Each criterion listed below is relevant in making a determination of significance relative to the Proposed Action and has been considered individually, as well as in combination with the others. The significance of this action is analyzed based on the NAO 216-6 criteria and CEQ's context and intensity criteria. These include:

1. Can the Proposed Action reasonably be expected to jeopardize the sustainability of any target species that may be affected by the action?
2. Can the Proposed Action reasonably be expected to jeopardize the sustainability of any non-target species?
3. Can the Proposed Action reasonably be expected to cause substantial damage to the ocean and coastal habitats and/or essential fish habitat as defined under the Magnuson-Stevens Act and identified in FMPs?
4. Can the Proposed Action be reasonably expected to have a substantial adverse impact on public health or safety?
5. Can the Proposed Action reasonably be expected to adversely affect endangered or threatened species, marine mammals, or critical habitat of these species?
6. Can the Proposed Action be expected to have a substantial impact on biodiversity and/or ecosystem function within the affected area (e.g., benthic productivity, predator-prey relationships, etc.)?
7. Are significant social or economic impacts interrelated with natural or physical environmental effects?
8. Are the effects on the quality of the human environment likely to be highly controversial?
9. Can the Proposed Action reasonably be expected to result in substantial impacts to unique areas, such as historic or cultural resources, park land, prime farmlands, wetlands, wild and scenic rivers or ecologically critical areas?
10. Are the effects on the human environment likely to be highly uncertain or involve unique or unknown risks?
11. Is the Proposed Action related to other actions with individually insignificant, but cumulatively significant impacts?
12. Is the Proposed Action likely to adversely affect districts, sites, highways, structures, or objects listed in or eligible for listing in the National Register of Historic Places or may cause loss or destruction of significant scientific, cultural or historical resources?
13. Can the Proposed Action reasonably be expected to result in the introduction or spread of a non-indigenous species?

14. Is the Proposed Action likely to establish a precedent for future actions with significant effects or represents a decision in principle about a future consideration?
15. Can the Proposed Action reasonably be expected to threaten a violation of Federal, State, or local law or requirements imposed for the protection of the environment?
16. Can the Proposed Action reasonably be expected to result in cumulative adverse effects that could have a substantial effect on the target species or non-target species?

The Council has reviewed the above criteria (see the Cumulative Impacts Assessment in Section 7.3) relative to the action in Phase 1 of the EFH Omnibus Amendment. Based on these criteria, the Council has determined that Phase 1 of the Amendment will not pose a significant action, however, it is anticipated that Phase 2 will pose a significant action. Phase 2 will include the remaining EFH components of the EFH Final rule: Fishing activities that may adversely affect EFH, Non-Magnuson-Stevens Act fishing activities that may adversely affect EFH and research and information needs. As such, the Council has prepared this DSEIS in accordance with NEPA. The Draft Supplementary EIS for the action considered in this amendment is included in this integrated document.

10.1.5 List of Preparers and Point of Contact

This document was prepared by members of the New England Fishery Management Council staff and Habitat Plan Development Team with input from the Habitat Advisory Panel.

For questions or copies of this document, please contact:

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The following agencies were consulted during the development of this amendment, either through direct communication/correspondence and/or participation on the Habitat Committee or PDT:

- NOAA Fisheries, National Marine Fisheries Service, Northeast Regional Office, Gloucester MA
- Northeast Fisheries Science Center, Woods Hole MA
- Mid-Atlantic Fishery Management Council

10.1.6 DSEIS Circulation List

Initially, the Council distributes the Draft Amendment document and DSEIS to individuals who contributed to the development of this document, including Habitat PDT and AP members. These individuals are listed in the previous section of this document.

As part of the review process for consistency with applicable laws such as the CZMA and the ESA, the Council distributes this Draft FMP/EIS to the following individuals:

Ms. Kathleen Leydon, Maine Coastal Program
Mr. David Hartman, New Hampshire Coastal Program
Massachusetts Coastal Zone Management
Mr. Grover Fugate, Rhode Island Coastal Resources Council
Mr. Tom Oullette, Connecticut Office of Long Island Sound Programs
Mr. George Stafford, New York Division of Coastal Resources
Mr. Lawrence Torok, New Jersey Division of Coastal Resources
Mr. Nicholas Di Pasquale, Delaware DNREC
Ms. Gwynne Schultz, Maryland Coastal Zone Management Division
Ms. Laura McKay, Virginia Coastal Resources Management Program
Ms. Donna Moffitt, North Carolina Division of Coastal Management
Mr. E. James Tabor, Pennsylvania Department of Environmental Protection
Mr. Chris Brooks, South Carolina Ocean and Coastal Resources Management
Mr. Daniel Furlong, Mid-Atlantic Fishery Management Council
Captain Vincent O'Shea, Atlantic States Marine Fisheries Commission

In addition, the Council prepares a notice to its EFH "Interested Party" that announces the availability of the DSEIS and public hearing document and announces the schedule for public hearings. A Notice of Availability of the DSEIS is also published in the *Federal Register*. At that time, anyone on the "Interested Party" list or any other member of the public may call the Council office and request a copy of the DEIS for their review. There are approximately 374 individuals on the "Interested Party" mailing list for EFH. The Council also intends to make this DSEIS available for downloading through its website.

10.1.7 DSEIS Public Comments and Response

To be completed after public comment period.

10.2 Endangered Species Act (ESA)

Section 7 of the Endangered Species Act requires federal agencies conducting, authorizing or funding activities that affect threatened or endangered species to ensure those effects do not jeopardize the continued existence of listed species. The NEFMC has concluded, at this writing, that the proposed amendment and the EFH action described in the DSEIS will not jeopardize any ESA-listed species or alter or modify any critical habitat, based on the discussion of impacts in this document. The NEFMC is now seeking the concurrence of the National Marine Fisheries Service with respect to this action, adding measures that would enhance the effectives of the Council's management efforts. For further information, see the Protected Resources sections in this document (Section 6.1.2.6 and 7.1.1).

10.3 Marine Mammal Protection Act (MMPA)

The NEFMC has reviewed the impacts of the proposed action on marine mammals and has concluded that the measures proposed are consistent with the provisions of the MMPA and would not alter existing measures to protect the species likely to inhabit the management units of the subject fisheries. For further information, see the Protected Species sections of this document (Section 6.1.2.6 and 7.1.1).

10.4 Coastal Zone Management Act (CZMA)

Section 307(c)(1) of the Federal CZMA of 1972 requires that all Federal activities that directly affect the coastal zone be consistent with approved state coastal zone management programs to the maximum extent practicable. Pursuant to the CZMA regulations at 15 CFR 930.35, a negative determination may be made if there are no coastal effects and the subject action: (1) Is identified by a state agency on its list, as described in § 930.34(b), or through case-by-case monitoring of unlisted activities; or (2) which is the same as or is similar to activities for which consistency determinations have been prepared in the past; or (3) for which the Federal agency undertook a thorough consistency assessment and developed initial findings on the coastal effects of the activity. Accordingly, the Council has determined that this action would have no effect on any coastal use or resources of any state. Letters documenting the Council's negative determination, along with this document, were sent to the coastal zone management program offices of the states of Maine, New Hampshire, Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Pennsylvania, Delaware, Maryland, Virginia, and North Carolina. A list of the specific state contacts and a copy of the letters are available upon request.

10.5 Administrative Procedures Act (APA)

Section 553 of the Administrative Procedure Act establishes procedural requirements applicable to informal rulemaking by Federal agencies. The purpose of these requirements is to ensure public access to the Federal rulemaking process, and to give the public adequate notice and opportunity for comment. At this time, the Council is not requesting any abridgement of the rulemaking process for this action.

10.6 Paperwork Reduction Act (PRA)

The purpose of the PRA is to control and, to the extent possible, minimize the paperwork burden for individuals, small businesses, nonprofit institutions, and other persons resulting from the collection of information by or for the Federal Government. The authority to manage information and recordkeeping requirements is vested with the Director of the Office of Management and Budget (OMB). This authority encompasses establishment of guidelines and policies, approval of information collection requests, and reduction of paperwork burdens and duplications. There are no additional information requirements associated with the measures proposed in this amendment and as such a PRA analysis is not required.

10.7 Data Quality Act (DQA)

Section 515 of the Treasury and General Government Appropriations Act for Fiscal Year 2001 (Public Law 106-554, also known as the Data Quality Act or Information Quality Act) directed the Office of Management and Budget (OMB) to issue government-wide guidelines that "provide policy and procedural guidance to federal agencies for ensuring and maximizing the quality, objectivity, utility, and integrity of information (including statistical information) disseminated by federal agencies." OMB directed each federal agency to issue its own guidelines, establish administrative mechanisms allowing affected persons to seek and obtain correction of information that does not comply with the OMB guidelines, and report periodically to OMB on the number and nature of complaints. The NOAA Section 515 Information Quality Guidelines require a series of actions for each new information product subject to the Data Quality Act. Information must meet standards of utility, integrity and objectivity. This section provides information required to address these requirements.

10.7.1 Utility

Utility means that disseminated information is useful to its intended users. "Useful" means that the content of the information is helpful, beneficial, or serviceable to its intended users, or that the information supports the usefulness of other disseminated information by making it more accessible or easier to read, see, understand, obtain or use. The intended users of the information contained in this document are participants in the Atlantic herring fishery as well as other interested parties and members of the general public. The information contained in this amendment and DSEIS may be useful to owners of vessels holding federal and state permits as well as any federal applicant for a non-fishing related project that may adversely effect EFH as an EFH Assessment will be required. Information presented in this document is intended to support the proposed management action, which has been developed through a multi-stage process involving all interested members of the public. Consequently, the information pertaining to management measures contained in this document has been improved based on comments from the public, fishing industry, members of the Council, and NOAA Fisheries.

The media being used in the dissemination of the information contained in this document will be contained in a *Federal Register* notice announcing the Proposed and Final Rules for this action. This information will be made available through printed publication and on the Internet website for the Northeast Regional Office (NERO) of NOAA Fisheries. In addition, the EFH Omnibus Amendment DSEIS will be available on the Council's website (www.nefmc.org) in standard PDF format. Copies will be available for anyone in the public on CD ROM and paper from the Council's office.

10.7.2 Integrity

Integrity refers to security – the protection of information from unauthorized access or revision, to ensure that the information is not compromised through corruption or falsification. Prior to dissemination, NOAA information, independent of the intended mechanism for distribution, is safeguarded from improper access, modification, or destruction, to a degree commensurate with the risk and magnitude of harm that could result from the loss, misuse, or unauthorized access to or modification of such information.

All electronic information disseminated by NOAA adheres to the standards set out in Appendix III, "Security of Automated Information Resources," OMB Circular A-130; the Computer Security Act; and the Government Information Security Reform Act. If information is confidential, it is safeguarded pursuant to the Privacy Act and Titles 13, 15, and 22 of the U.S. Code (confidentiality of census, business and financial information).

10.7.3 Objectivity

Objective information is presented in an accurate, clear, complete, and unbiased manner, and in proper context. The substance of the information is accurate, reliable, and unbiased; in the scientific, financial, or statistical context, original and supporting data are generated and the analytical results are developed using sound, commonly-accepted scientific and research methods. "Accurate" means that information is within an acceptable degree of imprecision or error appropriate to the particular kind of information at issue and otherwise meets commonly accepted scientific, financial, and statistical standards.

This document uses information of known quality from sources acceptable to the relevant scientific and technical communities. Several sources of data were used in the development of this document, including the analysis of potential impacts. Although there are some limitations to the data used in the analysis of impacts of management measures and in the description of the affected environment, these data are considered to be the best available.

In preparing this amendment document, the Council(s) must comply with the requirements of the Magnuson-Stevens Act, Regulatory Flexibility Act, Administrative Procedures Act, Paperwork Reduction Act, Coastal Zone Management Act, Endangered Species Act, Marine Mammal Protection Act, Data Quality Act, and Executive Orders 12612 (Federalism), 12630 (Property Rights), 12898 (Environmental Justice), 12866 (Regulatory Planning), and 13158 (Marine Protected Areas). The policy choices (i.e., management measures) proposed in this amendment are supported by the best available scientific information.

The review process for any action under an FMP involves the Northeast Regional Office (NERO) of NOAA Fisheries, the Northeast Fisheries Science Center (Center), and NOAA Fisheries Headquarters (Headquarters). The Council review process involves public meetings at which affected stakeholders have the opportunity to provide comments on the proposed changes to the FMP. Reviews by staff at NERO are conducted by those with expertise in fisheries management and policy, habitat conservation, protected species, and compliance with the applicable law. The Center's technical review is conducted by senior-level scientists with specialties in population dynamics, stock assessment methodology, fishery resources, population biology, and the social sciences.

Final approval of this amendment and clearance of the Proposed and Final Rules is conducted by staff at NOAA Fisheries Headquarters, the Department of Commerce, and the U.S. Office of Management and Budget. This review process is standard for any action under an FMP, and provides input from individuals having various expertise who may not have been directly involved in the development of the management alternatives under consideration. Thus, the review process for any FMP modification, including those considered in this Amendment, is performed by technically-qualified individuals to ensure the action is valid, complete, unbiased, objective, and relevant.

10.8 E.O. 12866 and Regulatory Flexibility Act (RFA)

The requirements for all regulatory actions specified in EO 12866 are summarized in the following statement from the order: *In deciding whether and how to regulate, agencies should assess all costs and benefits of available regulatory alternatives, including the alternative of not regulating. Costs and benefits shall be understood to include both quantifiable measures (to the fullest extent that these can be usefully estimated) and qualitative measures of costs and benefits that are difficult to quantify, but nevertheless essential to consider. Further, in choosing among alternative regulatory approaches, agencies should select those approaches that maximize net benefits (including potential economic, environment, public health and safety, and other advantages; distributive impacts; and equity), unless a statute requires another regulatory approach.* The EO requires a determination of whether an action is "significant," as that term is defined under EO 12866. Because this action will not result in rulemaking, this analysis and determination is unnecessary.

The Regulatory Flexibility Act (RFA), first enacted in 1980, was designed to place the burden on the government to review all regulations to ensure that, while accomplishing their intended purposes, they do not unduly inhibit the ability of small entities to compete. The RFA emphasizes predicting significant adverse impacts on small entities as a group distinct from other entities and considering alternatives that may minimize the impacts while still achieving the stated objective of the action. When an agency publishes a proposed rule, unless it can provide a factual basis upon which to certify that no such adverse effects will accrue, it must prepare and make available for public review an Initial Regulatory Flexibility Analysis (IRFA) that describes the impact of the proposed rule on small entities. Because this action will not result in rulemaking, this analysis and determination is uncessary.

10.9 E.O. 13132 Federalism

The Executive Order on Federalism established nine fundamental federalism principles to which Executive agencies must adhere in formulating and implementing policies having federalism implications. The E.O. also lists a series of policy making criteria to which agencies must adhere when formulating and implementing policies that have federalism implications. However, no federalism issues or implications have been identified relative to the alternatives under consideration.

The action does not contain policies with federalism implications sufficient to warrant preparation of an assessment under E.O. 13132. The affected States have been closely involved in the development of the proposed management measures through their involvement in the Regional Fishery Management Council process (i.e., all affected states are represented as voting members on at least one Council). The proposed measures were developed with the full participation and cooperation of the State representatives of the New England Council.

10.10 E.O. 13158 Marine Protected Areas

The Executive Order on Marine Protected Areas requires each federal agency whose actions affect the natural or cultural resources that are protected by an MPA to identify such actions, and, to the extent permitted by law and to the extent practicable, avoid harm to the natural and cultural resources that are protected by an MPA. The E.O. defines a Marine Protected Area as “any area of the marine environment that has been reserved by Federal, State, territorial, tribal, or local laws or regulations to provide lasting protection for part or all of the natural and cultural resources therein.”

The Departments of Commerce and the Interior are jointly developing a list of MPAs that meet the definition of MPA for the purposes of this E.O. As of the date of submission of the DSEIS for this amendment, the list of MPA sites has not been developed by the departments.

The E.O. promotes the development of MPAs by enhancing or expanding the protection of existing MPAs and establishing or recommending new MPAs. However, Phase 1 of the EFH Omnibus Amendment does not propose to modify or expand any of the existing year-round closed areas (or MPAs), however, Phase 2 may.

11.0 List of Public Meetings

The public process for developing the EFH Omnibus Amendment began in mid-2004, prior to the scoping period for the amendment. The following table identifies all public meetings (Habitat Committee, Council, Habitat Advisory Panel, Habitat PDT) for which the development of the EFH Omnibus Amendment was on the agenda. There are approximately 374 individuals on the “Interested Party” mailing list for Habitat, all of whom receive advanced notification when these meetings are scheduled.

Table 157. List of Public Meetings Held for the Development of EFH Omnibus Amendment Phase 1

Date	Meeting	Location
March 5, 2004	Scoping Meeting	Rockland, ME
March 10, 2004	Scoping Meeting	New Bedford, MA
March 15, 2004	Scoping Meeting	Stonington, CT
March 16, 2004	Scoping Meeting	Wrightsville Beach, NC
March 23, 2004	Scoping Meeting	Gloucester, MA
March 23-25, 2004	Council	Gloucester, MA
May 25-26, 2004	Plan Development Team	Woods Hole, MA
June 16, 2004	Committee/Advisory Panel	Portsmouth, NH
July 13-15, 2004	Council	Portland, ME
September 8, 2004	Committee	Braintree, MA
September 14-16, 2004	Council	Fairhaven, MA
January 10-12, 2005	Scientific Workshop	Mystic, CT
February 1-3, 2005	Council	Portsmouth, NH
April 13, 2005	PDT/AP	Narragansett, RI
May 26, 2005	Committee	Narragansett, RI
August 22, 2005	Committee	Portland, ME
September 13-15, 2005	Council	Hyannis, MA
September 27, 2005	PDT	Woods Hole, MA
October 18, 2005	PDT	Mansfield, MA
October 27, 2005	PDT	Woods Hole, MA
November 14, 2005	Committee	Mansfield, MA
December 1, 2005	PDT	Newburyport, MA
December 14-15, 2005	PDT	Woods Hole, MA
January 11, 2006	Committee	Mystic, CT
January 25, 2006	PDT	Woods Hole, MA
January 31 – Feb 2, 2006	Council	Portland, ME
March 13-14, 2006	PDT	Woods Hole, MA
March 7, 2006	AP	Plymouth, MA
March 20, 2006	Committee	Plymouth, MA

April 4-5, 2006	Council	Mystic, CT
April 18, 2006	PDT	Woods Hole, MA
May 17-18, 2006	PDT	Woods Hole, MA
May 8, 2006	AP	Portsmouth, NH
June 6-7, 2006	Committee	Mansfield, MA
June 13-15, 2006	Council	Newport, RI
July 26, 2006	PDT	Woods Hole, MA
August 15, 2006	AP	Danvers, MA
September 7, 2006	Committee	Fairhaven, MA
September 26, 2006	Council	Peabody, MA
October 3, 2006	PDT	Woods Hole, MA
October 11, 2006	Council (MAFMC)	Kitty Hawk, NC
November 14, 2006	Committee	Gloucester, MA
November 14-16, 2006	Council	Gloucester, MA
December 12-14, 2006	Council (MAFMC)	New York, NY
January 16, 2006	Committee	Providence, RI
February 6-8, 2006	Council	Portsmouth, NH

12.0 List of Preparers

See Section10.1.5.

13.0 References

Refer to the individual reference lists included at the end of each major section.

14.0 Glossary

Adult stage – one of several marked phases or periods in the development and growth of many animals. In vertebrates, the life history stage where the animal is capable of reproducing, as opposed to the juvenile stage.

Adverse effect – any impact that reduces quality and/or quantity of EFH. May include direct or indirect physical, chemical, or biological alterations of the waters or substrate and loss of, or injury to, benthic organisms, prey species and their habitat, and other ecosystem components, if such modifications reduce the quality and or quantity of EFH. Adverse effects to EFH may result from actions occurring within EFH or outside of EFH and may include sites-specific of habitat wide impacts, including individual, cumulative, or synergistic consequences of actions.

Aggregation – a group of animals or plants occurring together in a particular location or region.

Anadromous species – fish that spawn in fresh or estuarine waters and migrate to ocean waters

Amphipods – a small crustacean of the order Amphipoda, such as the beach flea, having a laterally compressed body with no carapace.

Amendment – a formal change to a fishery management plan (FMP). The Council prepares amendments and submits them to the Secretary of Commerce for review and approval. The Council may also change FMPs through a "framework adjustment procedure" (see below). The Commission prepares amendments and submits them to the Commission's Atlantic Herring Section for approval. Implementing regulations are adopted by the states.

Benthic community – *Benthic* means the bottom habitat of the ocean, and can mean anything as shallow as a salt marsh or the intertidal zone, to areas of the bottom that are several miles deep in the ocean. *Benthic community* refers to those organisms that live in and on the bottom.

Biota – all the plant and animal life of a particular region.

Catch – the sum total of fish killed in a fishery in a given period. Catch is given in either weight or number of fish and may include landings, unreported landings, discards (bycatch), and incidental deaths.

Continental shelf waters – waters overlying the continental shelf, which extends seaward from the shoreline and deepens gradually to the point where the sea floor begins a slightly steeper descent to the deep ocean floor; the depth of the shelf edge varies, but is approximately 200 meters in many regions.

Crustaceans – invertebrates characterized by a hard outer shell and jointed appendages and bodies. They usually live in water and breathe through gills. Higher forms of this class include lobsters, shrimp and crawfish; lower forms include barnacles.

Demersal species – most often refers to fish that live on or near the ocean bottom. They are often called benthic fish, groundfish, or bottom fish.

Egg stage – one of several marked phases or periods in the development and growth of many animals. The life history stage of an animal that occurs after reproduction and refers to the developing embryo, its food store, and sometimes jelly or albumen, all surrounded by an outer shell or membrane. Occurs before the *larval* or *juvenile stage*.

Elasmobranch – any of numerous fishes of the class Chondrichthyes characterized by a cartilaginous skeleton and placoid scales: sharks; rays; skates.

Embayment – a bay or an indentation in a coastline resembling a bay.

Environmental Impact Statement (EIS) – an analysis of the expected impacts of a fishery management plan (or some other Proposed Action) on the environment and on people, initially prepared as a “Draft” (DEIS) for public comment. After an initial EIS is prepared for a plan, subsequent analyses are called “Supplemental” (i.e., DSEIS, FSEIS).

Essential Fish Habitat (EFH) – those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity. The EFH designation for most managed species in this region is based on a legal text definition and geographical area that are described in the Habitat Omnibus Amendment (1998).

Exclusive Economic Zone (EEZ) – for the purposes of the Magnuson-Stevens Fishery Conservation and Management Act, the area from the seaward boundary of each of the coastal states to 200 nautical miles from the baseline.

Fathom – a measure of length, containing six feet; the space to which a man can extend his arms; used chiefly in measuring cables, cordage, and the depth of navigable water by soundings.

FMP (fishery management plan) – also referred to as a “plan,” this is a document that describes a fishery and establishes measures to manage it. The New England Fishery Management Council prepares FMPs and submits them to the Secretary of Commerce for approval and implementation. The Atlantic States Marine Fisheries Commission prepares FMPs and implementing regulations are adopted by the States.

Juvenile stage – one of several marked phases or periods in the development and growth of many animals. The life history stage of an animal that comes between the *egg* or *larval stage* and the *adult stage*; juveniles are considered immature in the sense that they are not yet capable of reproducing, yet they differ from the larval stage because they look like smaller versions of the adults.

Larvae (or Larval) stage – one of several marked phases or periods in the development and growth of many animals. The first stage of development after hatching from the *egg* for many fish and invertebrates. This life stage looks fundamentally different than the juvenile and adult stages, and is incapable of reproduction; it must undergo metamorphosis into the juvenile or adult shape or form.

Meter – a measure of length, equal to 39.37 English inches, the standard of linear measure in the metric system of weights and measures. It was intended to be, and is very nearly, the ten millionth part of the distance from the equator to the north pole, as ascertained by actual measurement of an arc of a meridian.

Plan Development Team (PDT) – a group of technical experts responsible for developing and analyzing management measures under the direction of the Council.

Prey availability – the availability or accessibility of prey (food, forage) to a predator. Important for growth and survival.

Primary production – the synthesis of organic materials from inorganic substances by photosynthesis.

Recovery time – the period of time required for something (e.g. a habitat) to achieve its former state after being disturbed.

Recruitment – the amount of fish added to the fishery each year due to growth and/or migration into the fishing area. For example, the number of fish that grow to become vulnerable to fishing gear in one year would be recruitment to the fishery.

Species assemblage – several species occurring together in a particular location or region

Species composition – a term relating the relative abundance of one species to another using a common measurement; the proportion (percentage) of various species in relation to the total on a given area.

Species diversity – the number of different species in an area and their relative abundance.

Species richness – see *Species diversity*. A measurement or expression of the number of species present in an area; the more species present, the higher the degree of species richness.

Stock – a grouping of fish usually based on genetic relationship, geographic distribution and movement patterns. A region may have more than one stock of a species.

15.0 Appendices

Appendix A: EFH Designation Methodologies

Appendix B: EFH Designation Supplementary Tables

Appendix C: Major Prey Species Maps for Species in NEFMC Fishery Management Units

Appendix D: NMFS Northeast Regional Non-Fishing Effects Workshop Report

Appendix E: Affected Biological Environment –Spawning Information

Appendix F: Affected Social Environment – County Profiles

Appendix G: Affected Social Environment – Community Profiles

Appendix H: EFH Omnibus Amendment Scoping Report