



# Amendment 16 to the Atlantic Mackerel, Squid, and Butterfish FMP: Protections for Deep Sea Corals

Range of Alternatives Decision Document

August 2013

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## 1.0 Background

This document summarizes a range of possible management alternatives for the Mid-Atlantic Fishery Management Council (Council)'s Amendment 16 to the Atlantic Mackerel, Squid, and Butterfish Fishery Management Plan (FMP) to protect deep sea corals. The current range of alternatives is based on application of the discretionary provisions contained in the reauthorized Magnuson-Stevens Act (MSA) giving the Regional Fishery Management Councils authority to designate deep sea coral zones, within which fishing restrictions may be implemented to protect deep sea corals.

These alternatives were developed by the Council's Fishery Management Action Team (FMAT) for Amendment 16, with input from the Council's Ecosystems and Ocean Planning Committee, Ecosystems and Ocean Planning Advisory Panel, and Mackerel, Squid, and Butterfish Advisory Panel, as well as public comments received during the Amendment 16 scoping process.

### *1.1 Purpose and Need*

The purpose of this amendment is to minimize the impacts of fishing gear on deep sea corals in the mid-Atlantic. Deep sea corals are fragile and slow-growing, and as such are highly vulnerable to disturbance by fishing gear. Bottom-tending gear poses a particular threat to deep sea coral ecosystems, with the potential to cause negative impacts ranging from scarring and damage to crushing or complete removal. The reauthorized Magnuson-Stevens Act (MSA) contains provisions giving the Regional Fishery Management Councils authority to implement management measures to mitigate fishery impacts to deep sea corals. This amendment is necessary to develop management measures under these provisions that would limit the impact of fishing on deep sea corals.

### *1.2 Deep Sea Corals in the Mid-Atlantic*

Deep sea corals, or cold water corals, are generally defined as corals occurring at ocean depths below 50 meters. Several types of deep sea corals are found in the northeastern United States (Table 1). Types of deep sea corals observed to date in the mid-Atlantic range from small, solitary corals to larger colonies including complex structure-forming corals. Deep sea corals, in particular types that form complex structures, provide habitat for many species of fishes and invertebrates.

Records of deep sea coral observations are compiled from multiple sources and incorporated into a database maintained by NOAA's Deep Sea Coral Research and Technology Program.<sup>1</sup> These records include data from research surveys and cruise reports, peer-reviewed literature, incidental catch data, museum collections, and other sources from the 1850s through the present. Records contained in this database are **presence-only**, and little absence or abundance information is available. **Many areas have not been adequately surveyed for the presence of deep sea corals.**

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<sup>1</sup> See Appendix A for text from the reauthorized Magnuson-Stevens Act that establishes and describes this program.

**Table 1:** Overview of types of deep sea corals found in the northeast region of the U.S.

Deep sea coral type	Order	Example species	Notes
<b>True soft corals and Gorgonians<sup>2</sup></b>	Alcyonacea	<i>Alcyonium spp.</i> , <i>Paragorgia arborea</i> , <i>Acanthogorgia armata</i> , <i>Paramuricea spp.</i> , <i>Primnoa resedaeformis</i>	Limited on shelf in mid-Atlantic; mostly found on slope. Some reach relatively large sizes. May be two distinct species assemblages found above and below ~500 m depth.
<b>Stony corals</b>	Scleractinia	<i>Desmophyllum dianthus</i> , <i>Flabellum spp.</i> , <i>Lophelia pertusa</i>	Mostly solitary, with a few colonial species. A few species found in shallow water.
<b>Black corals</b>	Antipatharia	<i>Leiopathes sp.</i> , <i>Cirripathes sp.</i>	Several species observed from New England Seamount chain. Extremely limited evidence of presence in the Mid-Atlantic.
<b>Sea pens</b>	Pennatulacea	<i>Pennatula aculeate</i> , <i>Stylatula elegans</i>	Unlike most other corals, prefer muddy sediments. May be less vulnerable to fishing gear. Numerous records of <i>Pennatula sp.</i> on outer continental shelf as far south as the Carolinas. <i>S. elegans</i> is abundant on Mid-Atlantic coast outer shelf.

The alternatives contained in this document are primarily focused on the protection of deep sea corals that are structurally complex or require hard substrate. This encompasses many of the types of corals found in this region; however, sea pens are a type of deep sea coral common in soft substrates in the mid-Atlantic that do not fall into this category. Sea pens may have a lower susceptibility to impacts of fishing gear. While observations of sea pens occur in many areas of the coral zone alternatives, they appear to be more common than other types of corals in areas outside of these zones.

### 1.3 Management Authority

#### 1.3.1 Management Authority Overview

There are multiple provisions of the reauthorized Magnuson-Stevens Fishery Conservation and Management Act (MSA) that could be used to justify protections for deep sea corals. These include:

- Bycatch authority: mandate to minimize bycatch.

<sup>2</sup> Although previously separate orders, many taxonomists now group gorgonians with true soft corals.

- Essential Fish Habitat (EFH) authority: authority to designate Essential Fish Habitat, and mandate to minimize, to the extent practicable, adverse effects on Essential Fish Habitat caused by fishing.
- Conservation of non-target species: discretionary provision to conserve target and non-target species and habitats, considering the variety of ecological factors affecting fishery populations.
- Discretionary provision to designate deep sea coral zones: Designate zones in areas where deep-sea corals are identified to protect deep-sea corals from physical damage from fishing gear, or to prevent loss of damage to such gear from interactions with deep-sea corals.

Of these options, the Fishery Management Action Team (FMAT) has recommended pursuing management measures using the discretionary provisions to designate deep sea coral zones. This authority was determined to be the most appropriate mechanism for the protection of deep sea corals given the current state of knowledge about deep sea coral ecosystems and fishery interactions with corals. This discretionary authority gives the Regional Fishery Management Councils significant flexibility to designate deep sea coral zones in and around areas where deep sea corals have been observed.

To the extent that deep sea corals could be considered to be or to be associated with Essential Fish Habitat (EFH), EFH authority could be applied in some areas of the mid-Atlantic to protect deep sea corals. Management options such as fishing restrictions, time/area closures, and harvest limits could be applied to minimize, to the extent practicable, effects of fishing on EFH. However, in the Northeast region, deep sea coral presence (observed and inferred) extends well beyond the boundaries of currently designated EFH, particularly in deeper areas. To extend protections to additional areas of deep sea coral presence using EFH authority, an explicit link would need to be made between deep sea coral habitats and use of such habitat by managed fish species. Because there is relatively little information on the ecology and species linkages in deep sea coral ecosystems, analyses to support such linkages would likely require additional research. The extent of deep sea coral areas that could be designated as EFH may be much more limited compared to areas that could be designated as deep sea coral zones under the Magnuson discretionary authority, which allows protections beyond observed deep sea coral locations if necessary to ensure effectiveness.

Both authorities present a similar range of management measures that could be applied in order to minimize fishing gear impacts. However, one perceived advantage of using EFH authority is the associated consultation requirement, meaning that any major federal action agency proposing an action that may negatively impact EFH must consult with the National Marine Fisheries Service. This consultation requirement is not associated with the designation of deep sea coral zones under the MSA discretionary authority.

Additional authorities examined for this action include a mandate to minimize bycatch and a discretionary provision for the conservation of non-target species. Both of these are likely inappropriate for this action, due to limited data on fishery interactions with corals. Additionally, the use of the

“conservation of non-target species” authority would likely require that deep sea corals be considered federally managed species, subject to all MSA requirements (e.g., catch limits).

### 1.3.2 Discretionary Authority to Designate Deep Sea Coral Zones

The 2007 reauthorization of the Magnuson-Stevens Act gives the Councils discretionary authority to designate zones where fishing may be restricted in order to protect deep sea corals from physical damage caused by fishing gear, or to prevent loss or damage to such gear. Deep sea coral zones may include areas beyond known coral locations, if necessary, to ensure effectiveness. Management measures applied to deep sea coral zones may include restrictions on the location and timing of fishing activity, restrictions limiting fishing to specified vessel types, gear restrictions, and/or zones closed to fishing.

Section 303(b)(2)(B) of the reauthorized MSA reads:

303(b)—Any fishery management plan which is prepared by any Council, or by the Secretary, with respect to any fishery, may—

- (2)(A) designate zones where, and periods when, fishing shall be limited, or shall not be permitted, or shall be permitted only by specified types of fishing vessels or with specified types and quantities of fishing gear;
- (B) designate such zones in areas where deep sea corals are identified under section 408<sup>3</sup>, to protect deep sea corals from physical damage from fishing gear or to prevent loss or damage to such fishing gear from interactions with deep sea corals, after considering long-term sustainable uses of fishery resources in such areas; and
- (C) with respect to any closure of an area under this Act that prohibits all fishing, ensure that such closure—
  - (i) is based on the best scientific information available;
  - (ii) includes criteria to assess the conservation benefit of the closed area;
  - (iii) establishes a timetable for review of the closed area’s performance that is consistent with the purposes of the closed area; and
  - (iv) is based on an assessment of the benefits and impacts of the closure, including its size, in relation to other management measures (either alone or in combination with such measures), including the benefits and impacts of limiting access to: users of the area, overall fishing activity, fishery science, and fishery and marine conservation;

Management measures developed under this authority and implemented via Amendment 16 could be applied to any federally regulated fishing activity within the range of the Atlantic mackerel, squid, and

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<sup>3</sup> Section 408 of the reauthorized MSA describes NOAA’s Deep Sea Coral Research and Technology Program, the text of which is contained in **Appendix A**.

butterfish fishery as described in the FMP (even to activity or gears that are not used in these fisheries). **However, these management measures would not apply to any species managed solely by the Atlantic States Marine Fisheries Commission (such as American lobster) unless the Commission took complementary action.**

## *1.4 Alternative Development and Framework*

### 1.4.1 Process overview

In the course of developing alternatives for the New England Fishery Management Council's Omnibus Habitat Amendment 2, the New England Council's Habitat Plan Development Team (PDT) initially developed a set of deep sea coral alternatives for the entire northeast region. This included a set of alternatives for areas of the continental shelf and slope from the U.S.-Canada border down to the boundary line between Virginia and North Carolina, thus many of the alternatives were within the range of the Mid-Atlantic Council's management boundaries. Given the significant technical work that went into developing these alternatives and the overlap in expertise between membership of the New England Council's Habitat PDT and the Mid-Atlantic Council's Fishery Management Action Team (FMAT), the alternatives contained in this document have been largely developed using initial work done by the Habitat PDT as a starting point. Consideration was given to the benefits of consistency in measures between the two Council regions. **Appendix B** gives a brief overview of the New England Habitat PDT's process for recommending coral zones. The best scientific evidence for deep sea coral distribution and habitat has changed since this initial work (See Section 1.4.3), and the FMAT has attempted to incorporate new information into the set of recommended areas for deep sea coral protection.

In April 2013, a workshop was held to refine spatial alternatives for deep sea coral zones. This workshop brought together the Council's Ecosystems and Ocean Planning Advisory Panel, Mackerel, Squid, and Butterfish Advisory Panel, deep sea research scientists, and other invited participants in order to examine the tradeoffs between coral protections and fishing effort. Using interactive mapping technology, participants attempted to map new areas of known deep sea coral presence as well as important areas of fishing effort. Following the workshop, several fishing industry participants indicated their desire to provide more information to the Council about their fishing effort in these areas. Council staff met with several of these participants to examine fishing effort data that was not available during the workshop. As the result of the workshop and follow up meetings, a modified set of spatial alternatives was developed for several of the deep sea coral zones that reflect these discussions.

### 1.4.2 Broad and Discrete Coral Zones Framework

The FMAT recommended that the Council consider alternatives for both "broad" coral zones and "discrete" coral zones, consistent with the approach taken by the New England Fishery Management Council's Habitat PDT.

**These two types of deep sea coral zones could be implemented simultaneously.** Different management measures could be applied in each type of zone, allowing the flexibility to protect areas of known deep sea coral presence, while taking a precautionary approach in other areas.

**Broad deep sea coral zones** would be intended to encompass larger areas where management measures could be applied to “freeze the footprint” of fishing, with the primary intention being to prevent expansion of effort into areas where little or no fishing occurs as a precautionary approach. Options for management measures in such broad zones could include some combination of gear restrictions and/or additional requirements for reporting, monitoring, or authorization. The concept of these broad coral zones is in line with the “freeze the footprint” approach outlined in NOAA’s Strategic Plan for Deep Sea Corals:

“The expansion of fisheries using mobile bottom tending gear beyond current areas has the potential to damage additional deep-sea coral and sponge habitats. Potentially, many undocumented and relatively pristine deep-sea coral and sponge ecosystems may exist in unmapped areas untouched, or relatively untouched, by mobile bottom-tending gear. This objective takes a precautionary approach to “freeze the footprint” of fishing that uses mobile bottom-tending gear in order to protect areas likely to support deep-sea coral or sponge ecosystems until research surveys demonstrate that proposed fishing will not cause serious or irreversible damage to such ecosystems in those areas. Special emphasis is placed on mobile bottom-tending gear (e.g., bottom trawling), as this gear is the most damaging to these habitats. This objective applies to areas where use of such gear is allowed or might be allowed in the future. If subsequent surveys identify portions of these areas that do not contain deep-sea corals or sponges, NOAA may recommend that suitable areas be opened for fishing using such gear.”<sup>4</sup>

**Discrete deep sea coral zones** would be designated in smaller areas of known coral presence or highly likely (based on habitat suitability and/or predictive modeling) coral presence. These areas primarily include canyons along the shelf/slope break.

Pursuing alternatives under both of these frameworks additionally encourages consistency in coral measures between New England and the Mid-Atlantic, in line with the terms of the Memorandum of Understanding. This is particularly relevant in the case of broad deep sea coral zones, where potential designations would ideally be consistent across regional boundaries.

### 1.4.3 Recent Research Cruises and Updates to Best Available Science

Several recent research efforts have resulted in new records of deep sea corals in the mid-Atlantic. Some of this research is still ongoing, and there are plans for some work to continue into 2014 and 2015.

Some of the major recent research endeavors that will inform our understanding of deep sea coral distribution and ecology include:

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<sup>4</sup> The full Strategic Plan for Deep Sea Coral and Sponge Ecosystems is available at [http://coris.noaa.gov/activities/deepsea\\_coral/](http://coris.noaa.gov/activities/deepsea_coral/).

## **2012 BOEM Surveys**

In 2012, research cruises funded by the Bureau of Ocean Energy Management (BOEM) explored mid-Atlantic deepwater hard bottom habitat, focusing on canyon habitats and coral communities. This survey included many dives in Baltimore Canyon using a remotely operated vehicle (ROV), and a few dives in Norfolk Canyon.

Deep sea corals were locally abundant in both Baltimore and Norfolk Canyons, and the surveys resulted in the first observations of the species *Lophelia pertusa* in the mid-Atlantic. *L. pertusa* is a structure-forming coral commonly found off the coast of the southeastern U.S., and occasionally observed in New England, but has not previously been observed in the mid-Atlantic. In September 2012, *L. pertusa* was observed in live colonies on steep walls in both Baltimore and Norfolk Canyons, at depths between 381 and 434 m.<sup>5</sup> Many observations of lost fishing gear were also recorded in the two canyons, including traps, fishing lines, and nets. Baltimore and Norfolk Canyons are currently included in the range of possible deep sea coral zones under Alternative 3B (recommended based on coral presence).

## **2012 ACUMEN Surveys**

In the summer of 2012, the Atlantic Canyons Undersea Mapping Expeditions (ACUMEN) surveys concluded with a deep sea coral survey from aboard the NOAA vessel *Bigelow*. Areas sampled in the mid-Atlantic included Middle Toms Canyon, the edge of Hendrickson Canyon, the slope area between Toms and Hendrickson Canyons, and Toms Canyon. Using a towed camera system, high resolution images were collected to collect data on deep sea coral distribution and ground-truth locations of suspected deep sea coral habitat. Deep sea corals were observed in many locations within the Toms Canyon complex, which is currently included in the range of proposed deep sea coral zones (the Mey-Lindenkohl slope area) under Alternative 3B (recommended based on coral presence).

## **2013 Okeanos Explorer Surveys**

In the summer of 2013, the NOAA vessel *Okeanos Explorer* explored mid-Atlantic submarine canyons using an ROV. In the mid-Atlantic, this included work in Block Canyon, in which deep sea corals were observed in July 2013.<sup>6</sup> Block Canyon was not previously included in the list of recommended canyons for coral zones, but the FMAT has updated Alternative 3B to reflect this new information.

## **Predictive Habitat Modeling**

A statistical model to predict deep sea coral habitat in the US Atlantic is being developed by the Northeast Fisheries Science Center, NEFSC Sandy Hook Laboratory, and the National Systematics Laboratory. The model combines known coral locations with habitat information to predict and map suitable habitat for deep sea corals.

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<sup>5</sup> Brooke, S., and Ross, S.W. In press. First observations of the cold-water coral *Lophelia pertusa* in mid-Atlantic canyons of the USA. Deep-Sea Res. II. <http://dx.doi.org/10.1016/j.dsr2.2013.06.011>.

<sup>6</sup> <http://oceanexplorer.noaa.gov/okeanos/explorations/ex1304/dailyupdates/dailyupdates.html>

For recently completed research cruises, the resulting data has not yet been processed or analyzed to the point where records of deep sea corals can be spatially referenced, compiled, and added to the Deep Sea Coral Research and Technology Program database. Research is still ongoing and many data products will not be available within the current planned timeline for Amendment 16. Thus, the Council may wish to consider how to approach future protection of new areas as more information becomes available on deep sea coral distribution.

### *1.5 Geographic Scope of Alternatives*

The Mid-Atlantic Fishery Management Council, the New England Fishery Management Council, and the South Atlantic Fishery Management Council have signed a Memorandum of Understanding (MOU) identifying areas of consensus and common strategy related to conservation of corals and mitigation of the negative impacts of fishery interactions with corals.<sup>7</sup> As per the terms of the MOU, **the Mid-Atlantic Fishery Management Council has agreed to develop alternatives applicable only to areas within the Mid-Atlantic Council region boundary** as defined in the current regulations.<sup>9</sup> The New England Fishery Management Council has agreed to develop management measures applicable within the boundaries of their council region, and the South Atlantic Council will continue to manage deep sea corals via its Coral, Coral Reef and Live/Hardbottom Fishery Management Plan.

To promote continuity and consistency in deep sea coral measures between regions, the alternatives contained in this document were developed with consideration of consistency in approach to deep sea coral protections to that being considered by the New England Fishery Management Council (NEFMC). The NEFMC began developing deep sea coral alternatives as part of their Essential Fish Habitat Omnibus Amendment 2, which has since been split into a separate Omnibus Deep Sea Corals Amendment.<sup>11</sup>

Although the geographic range of the Atlantic Mackerel, Squid, and Butterfish fisheries includes the coastal and Exclusive Economic Zone (EEZ) waters of the U.S. East Coast, with a core fishery management area from North Carolina to Maine, the deep sea coral alternatives within this document are applicable only within the Mid-Atlantic Council region, as per the terms of the Memorandum of Understanding described above.

## **2.0 Alternatives**

Six sets of alternatives are presented below: 1) options for designations of broad deep sea coral zones, 2) options for management measures to be applied to broad zones, 3) options for designation of discrete deep sea coral zones, 4) options for management measures to be applied to discrete zones, 5)

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<sup>7</sup> The full Memorandum of Understanding is available on the Council's website, at <http://www.mafmc.org/actions/msb/am16>.

<sup>9</sup> Council boundaries are defined in the Code of Federal Regulations (CFR), at 50 C.F.R. §§ 600.105(a) and (b), available at <http://www.gpo.gov/fdsys/granule/CFR-2001-title50-vol3/CFR-2001-title50-vol3-sec600-105/content-detail.html>.

<sup>11</sup> For more information, see <http://nefmc.org/habitat/index.html>.

options for framework provisions for deep sea coral zones, and 6) options for vessel monitoring system requirements.

## *2.1 Broad Coral Zone Alternatives*

### **Alternative 1A: No Action/Status Quo**

No action would be taken to designate broad deep sea coral zones. This option is equivalent to the status quo. Within the Mid-Atlantic Fishery Management Council region, there are currently no measures in place designed specifically for the protection of deep sea corals. However, some current measures do have the effect of providing some level of protection to deep sea corals. Primarily, this includes one tilefish Gear Restricted Area (GRA) which restricts the use of mobile gear in Norfolk Canyon (Map 1).

### **Alternative 1B: Landward boundary at the 200 m depth contour**

Designation of a broad deep sea coral zone with a landward boundary at the 200 m depth contour and extending out to the edge of the EEZ (Map 2).

### **Alternative 1C: Landward boundary at the 300 m depth contour**

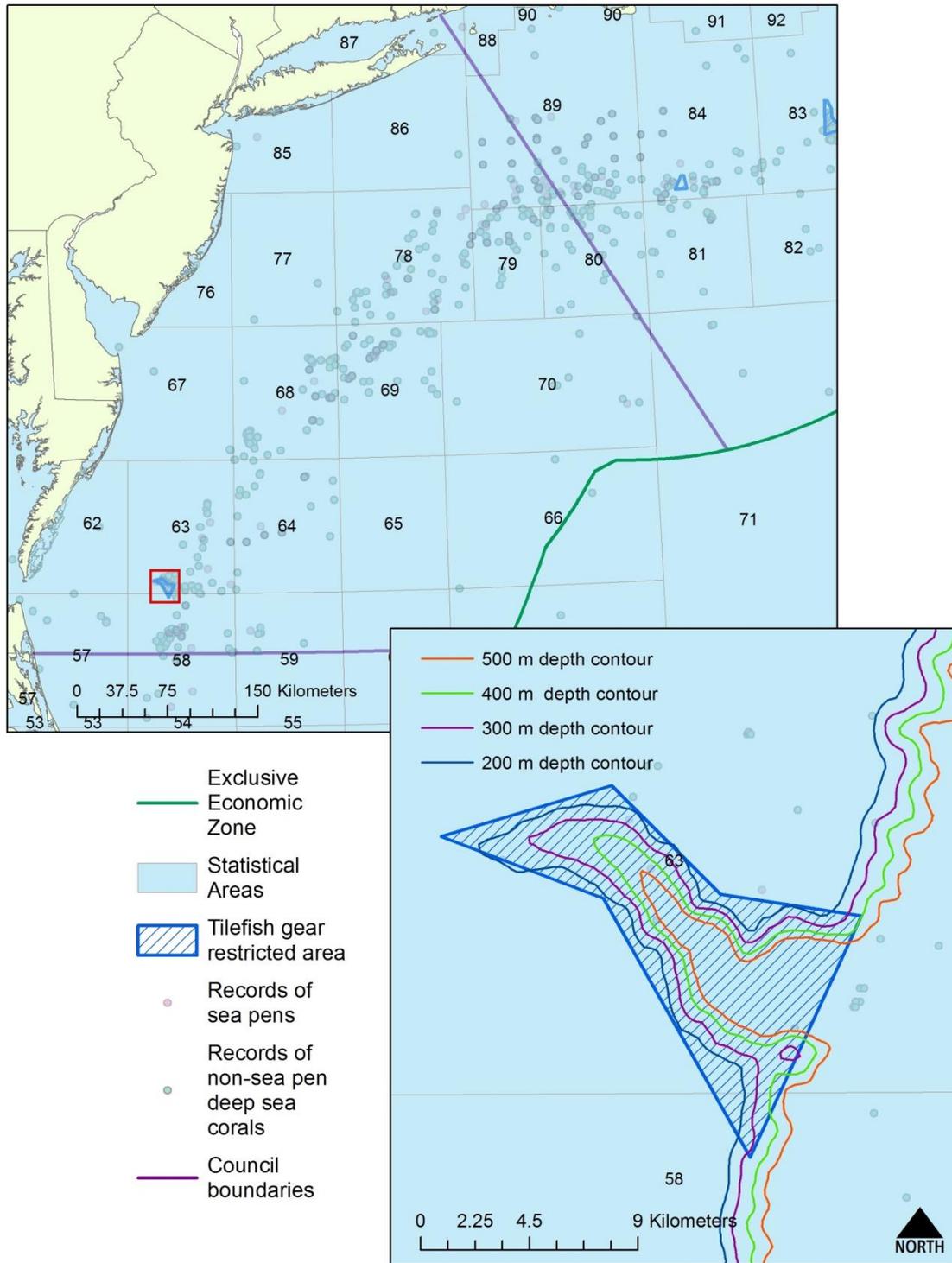
Designation of a broad deep sea coral zone with a landward boundary at the 300 m depth contour and extending out to the edge of the EEZ (Map 2).

### **Alternative 1D: Landward boundary at the 400 m depth contour**

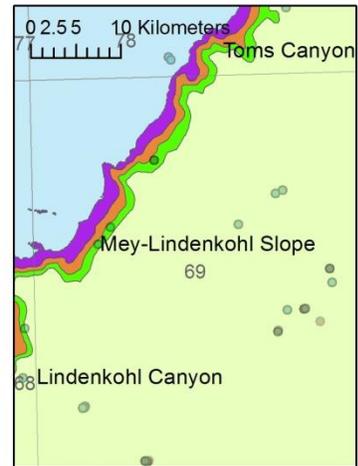
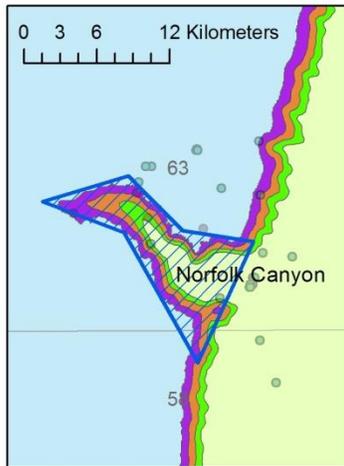
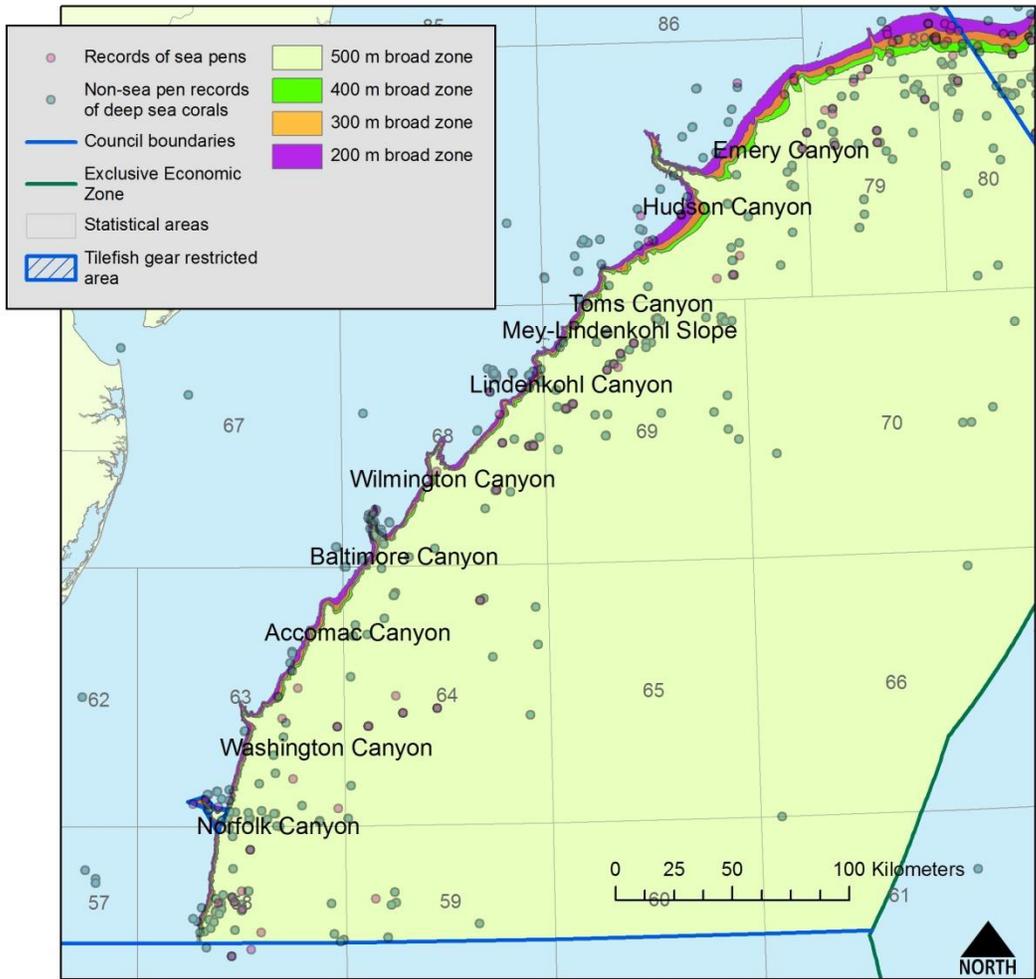
Designation of a broad deep sea coral zone with a landward boundary at the 400 m depth contour and extending out to the edge of the EEZ (Map 2).

### **Alternative 1E: Landward boundary at the 500 m depth contour**

Designation of a broad deep sea coral zone with a landward boundary at the 500 m depth contour and extending out to the edge of the EEZ (Map 2).



Map 1: Status quo/no action alternative, showing overview of the Mid-Atlantic Council region and tilefish gear restricted area (GRA) in Norfolk Canyon.



Map 2: Alternatives 1B-1E, showing broad deep sea coral zones with landward boundaries at multiple depth contours.

## *2.2 Management Measures within Broad Coral Zones*

Alternative 2A: No Action

Alternative 2B: Prohibit all bottom-tending gear

Alternative 2C: Prohibit mobile bottom-tending gear

Alternative 2D: Require Council review and approval for fishing within broad zones

This option would require special approval, including a Council review step, to fish within broad deep sea coral zones. This could be accomplished in several ways, including a potential set of categories of permitted fisheries with separate evaluation criteria. The FMAT recommended inclusion of alternatives currently being considered by the New England Council for their omnibus deep sea corals amendment. These include:

**2D-1. Implement special access program**

**2D-2. Implement exploratory fishing access program**

**2D-3. Implement research/experimental access program**

Alternative 2E: Exempt red crab fishery from broad coral zone restrictions

The red crab fishery operates exclusively within the proposed broad coral zones. The fishery currently consists of two full time vessels and one part time vessel, fishing with strings of traps, in a narrow depth range between approximately 300-400 fathoms (~550 to ~730 meters).

Alternative 2F: Require increased monitoring for vessels fishing in broad zones

**2F-1. Require observer coverage in broad coral zones**

**2F-2. Require VMS for vessels fishing in broad coral zones**

## *2.3 Discrete Coral Zone Alternatives*

### **Alternative 3A: No Action/Status Quo**

No action would be taken to designate discrete deep sea coral zones. This option is equivalent to the status quo. Within the Mid-Atlantic Fishery Management Council region, there are currently no measures in place designed specifically for the protection of deep sea corals. However, some current measures do have the effect of providing some level of protection to deep sea corals. Primarily, this includes one tilefish Gear Restricted Area (GRA) which restricts the use of mobile gear in Norfolk Canyon (Map 1).

### **Alternative 3B: Designation of canyons or slope areas with moderate to high observed coral presence**

These areas were assessed as having adequate observations on which to classify these areas as having moderate to high relative coral abundance. At the time the PDT developed these options, these areas included:

- Mey-Lindenkohl slope (encompassing several canyons: Mey, Hendrickon, Toms, S. Toms, Berkley, Carteret, Lindenkohl, and the slope area between them)
- Baltimore Canyon
- Norfolk Canyon

As the result of recent survey work, deep sea corals have also been observed in:

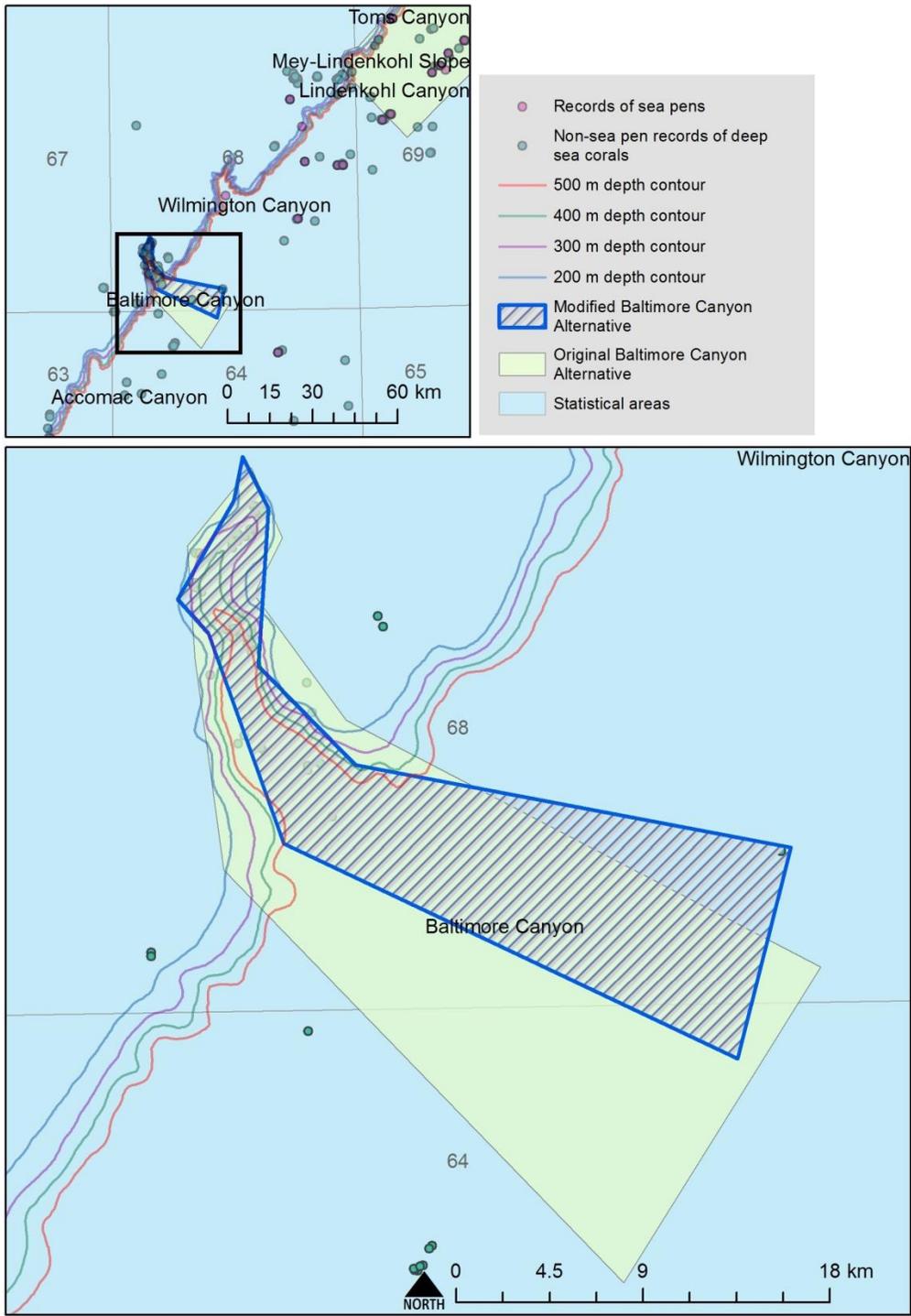
- Block Canyon
- Toms Canyon, Hendickson Canyon, and Middle Toms Canyon (Note that these are all contained within the Mey-Lindenkohl slope area referenced above)

#### **3B-1. Original boundaries**

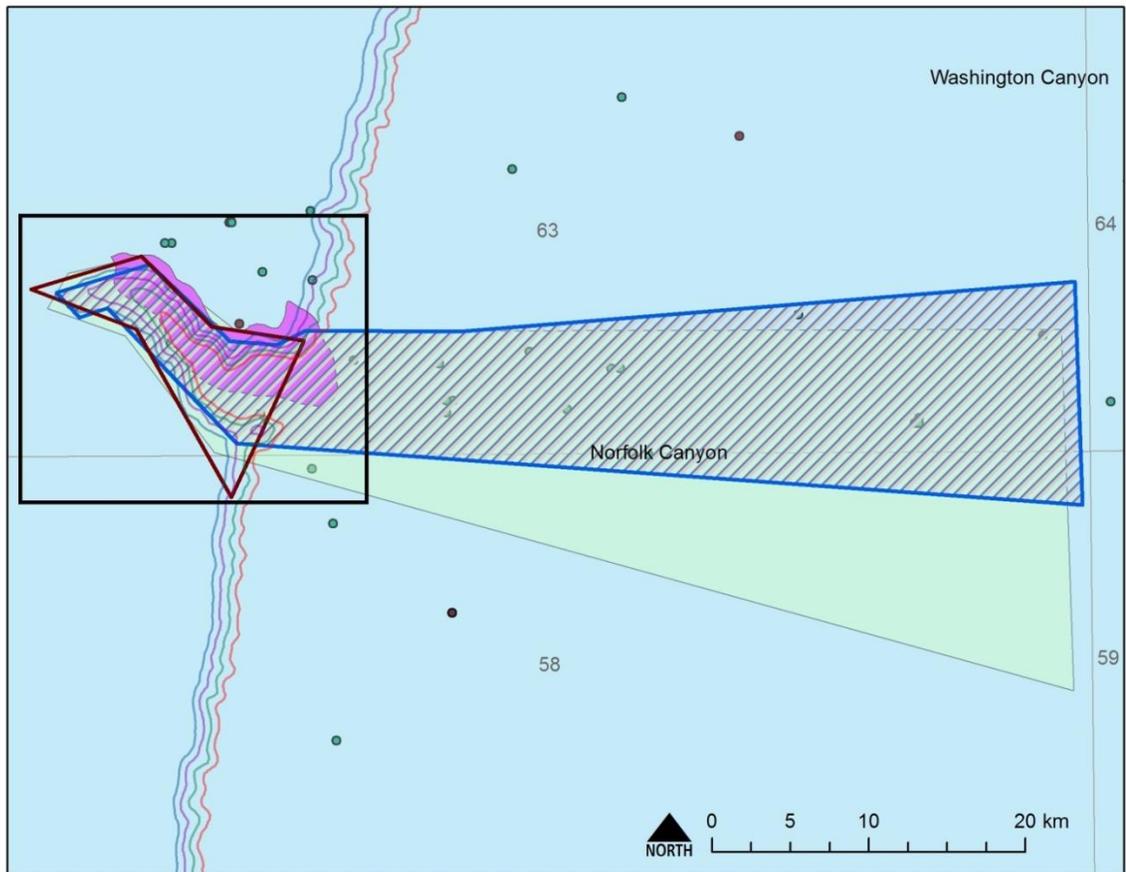
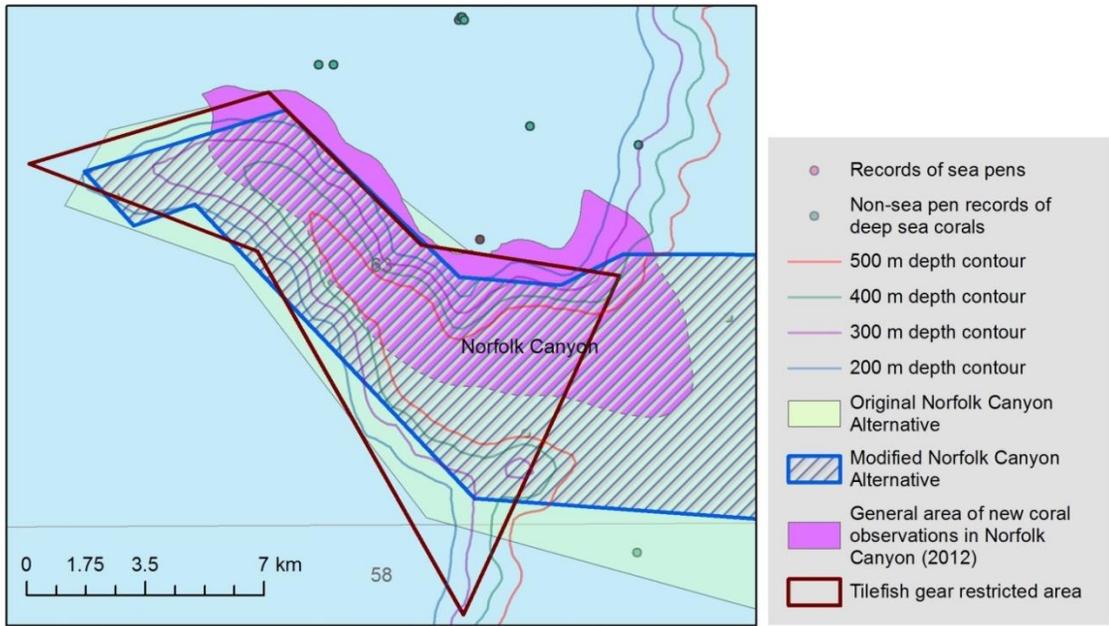
These alternatives reflect the original boundary designations developed by the New England Habitat Plan Development Team.

#### **3B-2. Modified boundaries**

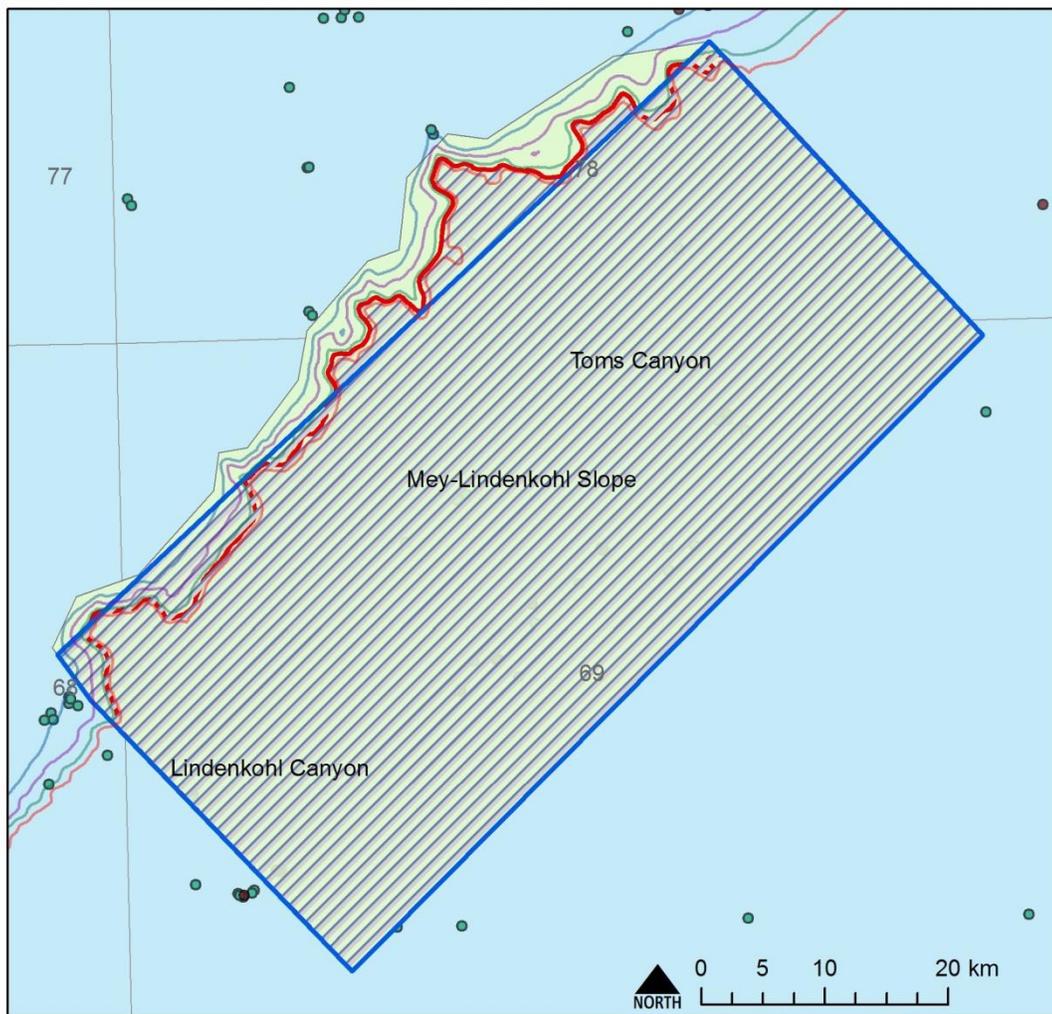
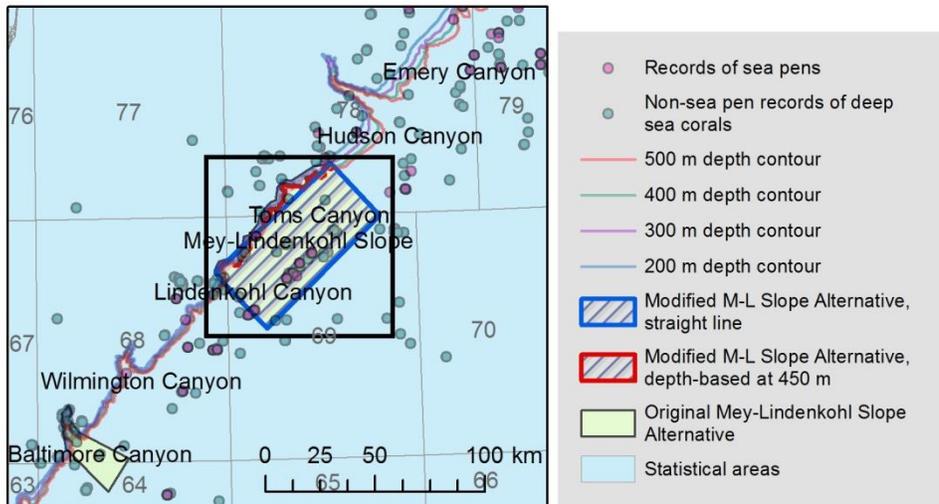
These alternatives reflect the modified boundary designations developed as the result of the April Deep Sea Corals Alternatives Workshop and follow-up work with industry representatives. Note that modified boundaries have not yet been developed for Block Canyon due to the recent reclassification of this canyon from “not recommended” to “recommended on the basis of deep sea coral presence.”



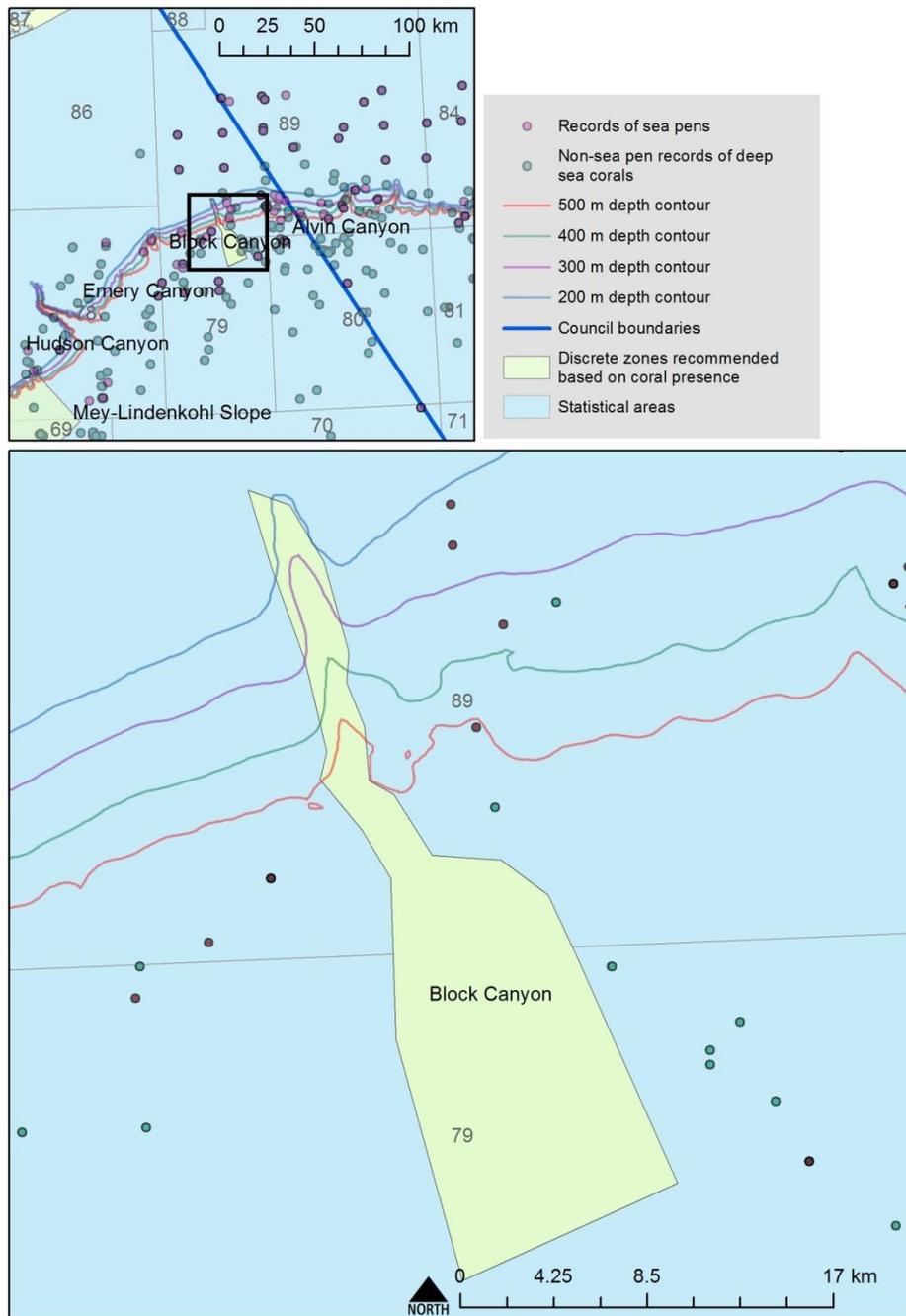
**Map 3: Alternative 3B in Baltimore Canyon, with sub-options including 1) original alternative and 2) modified alternative based on fishing industry input.**



**Map 4: Alternative 3B in to Norfolk Canyon, with sub-options including 3B-1) original alternative and 3B-2) modified alternative based on fishing industry input. Also shown is the current tilefish GRA, as well as the general location of new deep sea coral observations, drawn by Dr. Sandra Brooke at the April Deep Sea Coral Alternatives Workshop.**



**Map 5: Alternative 3B as applied to the Mey-Lindenkohl Slope, with sub-options including 1) original alternative and 2) modified alternative based on fishing industry input. Modified alternatives contain both a) a straight-line alternative and b) an alternative with the landward boundary drawn as a depth contour.**



**Map 6: Alternative 3B as applied to Block Canyon. Although this canyon was previously not recommended as a discrete coral zone, deep sea corals were observed in Block Canyon in July 2013.**

**Table 2: Relative size of original vs. modified Alternative 3B discrete zone designations.**

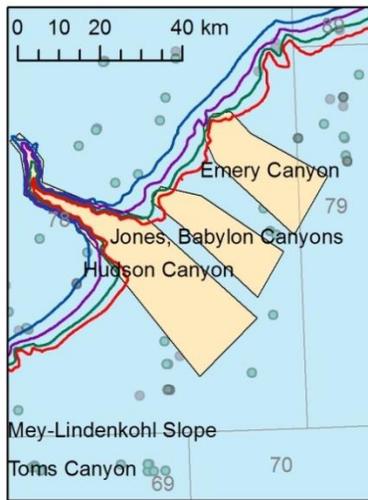
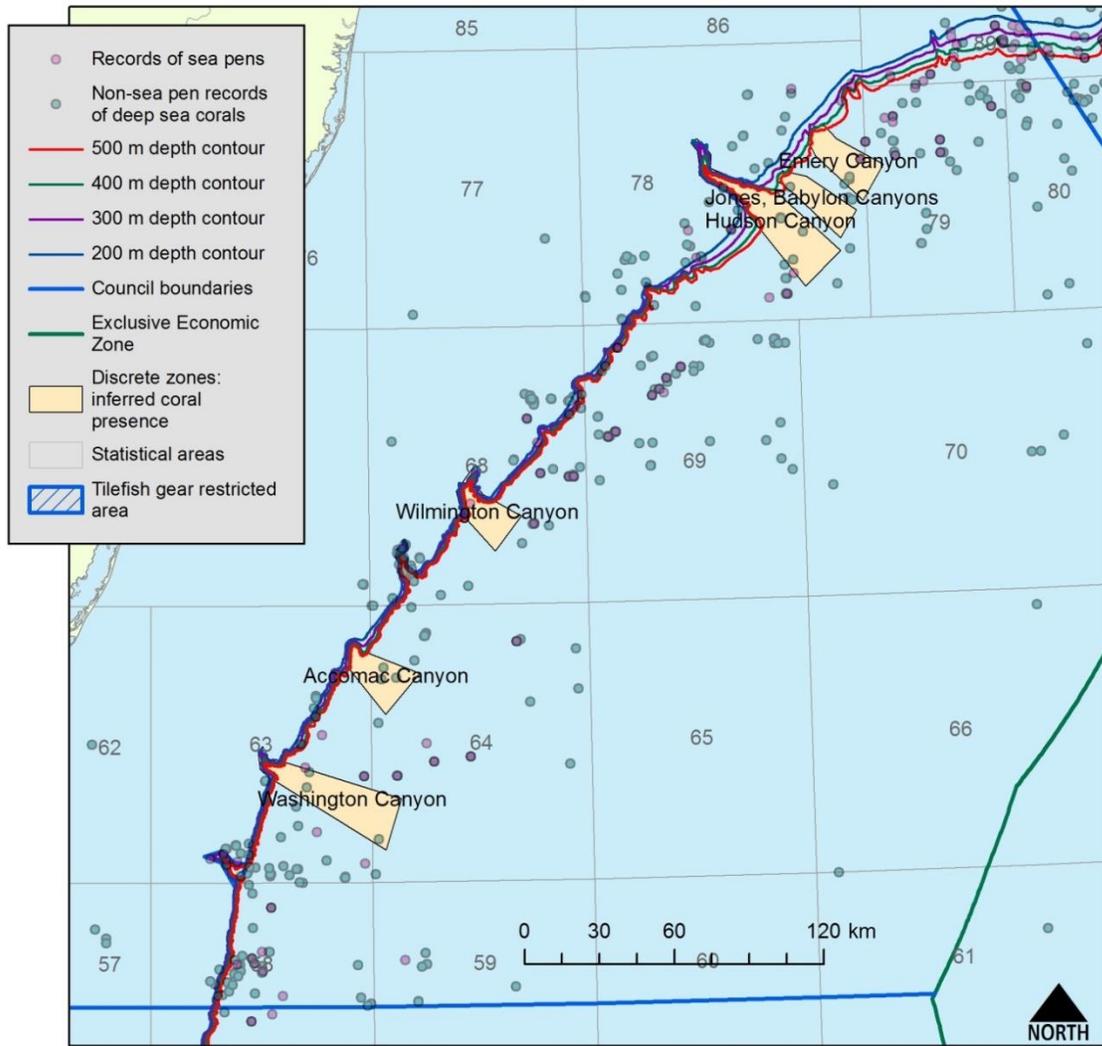
Area name	Area size, km <sup>2</sup>	
	Alt 3B-1, Original	Alt 3B-2, Modified
Mey-Lindenkohl slope	2728	Straight: 2445
		Depth-based: 2459
Baltimore Canyon	431	221
Norfolk Canyon	894	598
Block Canyon	195	N/A

### Alternative 3C: Designation of canyons with inferred coral presence

These canyons were recommended by the Habitat PDT on the basis of habitat suitability inferred for deep sea corals (see Appendix B). These canyons include Emery Canyon, Babylon and Jones Canyons, Hudson Canyon, Wilmington Canyon, Accomac Canyon, and Washington Canyon (Map 7).

**Table 3: Area of canyon zone options under Alternative 3C: designations based on inferred coral presence.**

Area name	Area, km <sup>2</sup>
<b>Emery Canyon</b>	400
<b>Jones, Babylon Canyons</b>	325
<b>Hudson Canyon</b>	871
<b>Toms Canyon</b>	577
<b>Lindenkohl Canyon</b>	447
<b>Wilmington Canyon</b>	377
<b>Accomac Canyon</b>	402
<b>Washington Canyon</b>	816



Map 7: Alternative 2C, showing canyons with inferred presence of deep sea corals.

## *2.4 Management Measures within Discrete Coral Zones*

### **Alternative 4A: No Action**

### **Alternative 4B: Prohibit all bottom-tending gear**

This option would prohibit use of all bottom-tending gears in discrete deep sea coral zones. Other gear types that do not contact the bottom would not be subject to restrictions. Note that the lobster trap fishery, managed by the Atlantic States Marine Fisheries Commission, would not be subject to this restriction.

### **Alternative 4C: Prohibit mobile bottom-tending gear**

This option would prohibit use of all mobile bottom-tending gears in discrete deep sea coral zones. Fixed gear and gear types that do not contact the seabed would not be subject to restrictions.

## *2.5 Framework Provisions for Deep Sea Coral Zones and Management Measures*

Recently completed survey cruises have discovered deep sea corals in areas where they have previously not been observed. Some of this research is still ongoing and many data products will not be available within the planned timeline for this amendment. Including options for framework provisions in Amendment 16 may allow the Council to modify deep sea coral zones or management measures in response to new information or issues arising after implementation of Amendment 16.

### **Alternative 5A: No Action**

### **Alternative 5B: Option to change boundaries for deep sea coral zones**

This option would allow the Council to modify the boundaries of deep sea coral zones.

### **Alternative 5C: Option to change management measures within zones**

This option would allow the Council to modify fishing restrictions and exemptions within deep sea coral zones.

### **Alternative 5D: Option to add additional discrete coral zones**

This option would allow the Council to add discrete coral zones as new evidence is presented for deep sea coral presence in such areas.

## *2.6 VMS Requirement*

### Alternative 6A: No Action

### Alternative 6B: Vessel Monitoring Systems (VMS) requirement for Illex squid moratorium vessels

Currently most Illex squid vessels must use VMS to meet requirements for other fisheries (e.g. Atlantic herring and groundfish), and a current proposed rule for Amendment 14 to the Mackerel, Squid, and Butterfish FMP would require VMS in the longfin squid and Atlantic mackerel fisheries. However, a VMS requirement for Illex moratorium vessels would standardize the requirement across the squid, mackerel, and butterfish fisheries and could be useful as an enforcement tool for management measures in the coral zones.

## **Appendix A: Magnuson-Stevens Act Text Pertaining to Deep Sea Coral Research and Technology Program**

### Monitoring and Research

- (a) IN GENERAL.—The Secretary, in consultation with appropriate regional fishery management councils and in coordination with other federal agencies and educational institutions, shall, subject to the availability of appropriations, establish a program—
- (1) to identify existing research on, and known locations of, deep sea corals and submit such information to the appropriate Councils;
  - (2) to locate and map locations of deep sea corals and submit such information to the Councils;
  - (3) to monitor activity in locations where deep sea corals are known or likely to occur, based on best scientific information available, including through underwater or remote sensing technologies and submit such information to the appropriate Councils;
  - (4) to conduct research, including cooperative research with fishing industry participants, on deep sea corals and related species, and on survey methods;
  - (5) to develop technologies or methods designed to assist fishing industry participants in reducing interactions between fishing gear and deep sea corals; and
  - (6) to prioritize program activities in areas where deep sea corals are known to occur, and in areas where scientific modeling or other methods predict deep sea corals are likely to be present.
- (b) REPORTING.—Beginning 1 year after the date of enactment of the Magnuson-Stevens Fishery Conservation and Management Reauthorization Act of 2006, the Secretary, in consultation with the Councils, shall submit biennial reports to Congress and the public on steps taken by the Secretary to identify, monitor, and protect deep sea coral areas, including summaries of the results of mapping, research, and data collection performed under the program.

## **Appendix B: Overview of NEFMC Habitat PDT Methodology for Discrete Zone Recommendations**

The New England Habitat Plan Development Team (PDT) has previously evaluated canyons and slope areas in the mid-Atlantic for coral presence data as well as bathymetric or geological features that would indicate likely coral presence based on habitat suitability. Recommendations for discrete coral zones contained in this document are based on this work; however, newly available and forthcoming data will require the reevaluation of some of the canyons and slope areas. The following is a brief overview of the evaluation approach and results. For more detailed information, see “Deep-Sea Corals of the Northeast Region: Species, Habitats, and Proposed Coral Zones” available at:

[http://www.nefmc.org/habitat/council\\_mtg\\_docs/April%202012/2\\_Deep%20sea%20coral%20background%20info.pdf](http://www.nefmc.org/habitat/council_mtg_docs/April%202012/2_Deep%20sea%20coral%20background%20info.pdf).

Canyons and slope areas in the mid-Atlantic were assessed and categorized by the NEFMC Habitat PDT as follows:

- 1) Category 1 – Recommended based on coral data: adequate scientific observations, abundant corals.
- 2) Category 2 – Recommended based on bathymetric data and/or geologic data: highly suitable habitat inferred.
- 3) Category 3 – Not recommended based on coral data: adequate scientific observations, but no or few corals.
- 4) Category 4 – Not recommended based on bathymetric and/or geologic data: appropriate habitat not inferred.

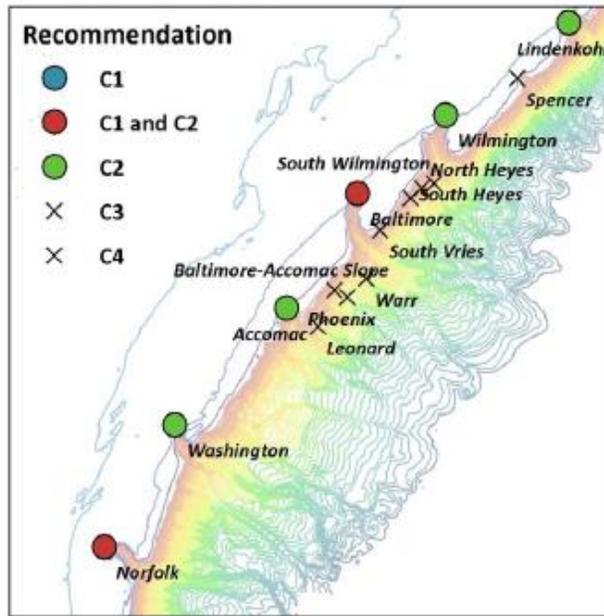
The results of this analysis are presented in the Table 1 and Map 1 below, with updated information from recent canyon surveys highlighted.

**Table 4: NEFMC Habitat PDT assessment summary for discrete coral zones (2011). Highlighted rows include updates from 2012 NEFSC research surveys and 2013 Okeanos Explorer surveys.**

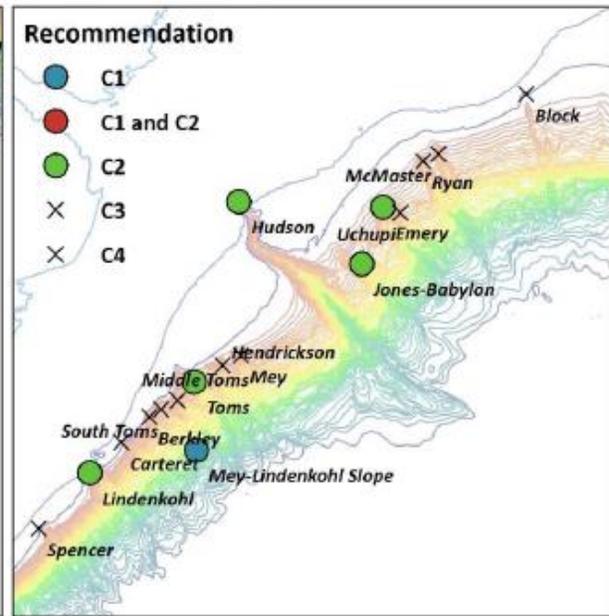
Area	Full literature review or bathymetric only	Adequacy of coral survey observations	Relative abundance of corals	Habitat Suitability	Recommendation and Category
<b>Block Canyon</b>	Bathy/recent Okeanos Explorer Survey	Not assessed	n/a	Not suitable	Yes – C1
McMaster Canyon	Bathy	Not assessed	n/a	Not suitable	No - C4
Ryan Canyon	Bathy	Not assessed	n/a	Not suitable	No - C4
Uchupi Canyon	Bathy	Not assessed	n/a	Not suitable	No - C4
Emery Canyon	Bathy	Not assessed	n/a	Suitable	Yes - C2
Jones Canyon	Bathy	Not assessed	n/a	Suitable	Yes - C2
Hudson Canyon	Both	Inadequate	n/a	Suitable	Yes - C2
Mey Canyon	Neither	Not assessed	n/a	Not suitable	No - C4
<b>Hendrickson Canyon</b>	Lit review, recent NEFSC surveys	Moderate to High	n/a	Suitable	Yes - C1
<b>Toms Canyon</b>	Bathy, recent NEFSC surveys	Low to Moderate	n/a	Suitable	Yes - C1
South Heyes Canyon	Neither	Not assessed	n/a	Not suitable	No - C4
<b>Middle Toms Canyon</b>	Recent NEFSC survey	Low/Moderate?	n/a	Suitable	Yes - C1

<b>South Toms Canyon</b>	Neither	Not assessed	n/a	Not suitable	No - C4
<b>Berkley Canyon</b>	Neither	Not assessed	n/a	Not suitable	No - C4
<b>Carteret Canyon</b>	Bathy	Not assessed	n/a	Not suitable	No - C4
<b>Lindenkohl Canyon</b>	Bathy	Not assessed	n/a	Suitable	Yes - C2
<b>Spencer Canyon</b>	Bathy	Not assessed	n/a	Not suitable	No - C4
<b>Wilmington Canyon</b>	Both	Inadequate	n/a	Suitable	Yes - C2
<b>South Wilmington Canyon</b>	Bathy	Not assessed	n/a	Not suitable	No - C4
<b>North Heyes Canyon</b>	Bathy	Not assessed	n/a	Not suitable	No - C4
<b>South Vries Canyon</b>	Bathy	Not assessed	n/a	Not suitable	No - C4
<b>Baltimore Canyon</b>	Both	High	High	Suitable	Yes - C1 and C2
<b>Warr Canyon</b>	Neither	Not assessed	n/a	Not suitable	No - C4
<b>Phoenix Canyon</b>	Neither	Not assessed	n/a	Not suitable	No - C4
<b>Leonard Canyon</b>	Neither	Not assessed	n/a	Not suitable	No - C4
<b>Accomac Canyon</b>	Bathy	Not assessed	n/a	Suitable	Yes - C2
<b>Washington Canyon</b>	Both	Inadequate	n/a	Suitable	Yes - C2
<b>Norfolk Canyon</b>	Both	Moderate	High	Suitable	Yes - C1 and C2
<b>Alvin-Block Slope</b>	Lit review	Moderate	Low	Not assessed	No - C3
<b>Mey-Lindenkohl Slope</b>	Lit review, recent NEFSC surveys	High	High	Suitable	Yes - C1
<b>Baltimore-Accomac Slope</b>	Lit review	Moderate	Low	Not assessed	No - C3

**Southern Mid-Atlantic**



**Northern Mid-Atlantic**



New England Fishery Management Council Habitat Plan Development Team  
 Map date: 19 January 2012

NAD 1983 UTM Zone 19N



**Map 8:** NEFMC Habitat PDT recommendations for discrete coral zones in the Mid-Atlantic. C1=Recommended based on coral data, C2=Recommended based on habitat suitability, C3=Not recommended based on coral data, C4=Not recommended based on habitat suitability.