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## 1.0 Introduction

This document outlines a series of preliminary alternatives for designation of deep-sea coral zones in the Northeast Region, as well as a range of possible management options for those zones as well as research suggestions. These alternatives were developed by a working group of the Habitat PDT, including a PDT representative from the MAFMC, and then presented to the full PDT on September 16, 2010 for their review.

Further development of these coral alternatives by the Habitat Committee was envisioned as two-stage process, with coral zones being identified first, followed by development of appropriate management measures. The distribution of various types of fishing effort in relation to coral zones would be evaluated as part of the management alternatives development process, using a combination of VTR, VMS, and observer data, as appropriate and available for the various fisheries operating in the areas.

## 2.0 Background information

### 2.1 What is a deep-sea coral?

Cold-water or deep-sea corals in the northwest Atlantic are a diverse assortment of Anthozoa that include the subclass Hexacorallia (Zoantharia), which includes the **hard or stony corals** (order Scleractinia) and **black and thorny corals** (order Antipatharia); and subclass Octocorallia (Alcyonaria or octocorals), which includes the **true soft corals** (order Alcyonacea), **gorgonians** (sea fans, sea whips, order Gorgonacea), and **sea pens** (order Pennatulacea). Worldwide, deep corals can build reef-like structures or occur as thickets, isolated colonies, or solitary individuals, and often are significant components of deep-sea ecosystems, providing habitat (substrate, refugia) for a diversity of other organisms, including many commercially important fish and invertebrate species. They are suspension feeders, but unlike most tropical and subtropical corals, do not require sunlight and do not have symbiotic algae (zooxanthellae) to meet their energy needs. Deep corals can be found from near the surface to 6000 m depth, but most commonly occur between **50-1000 m** on hard substrate (Puglise and Brock 2003), hence their “deep-sea” appellation. Descriptions of species found in the Northeast region, including

information about their vulnerability to fishing, can be found in section 6.2 the SASI Part 1 document, beginning on page 126.

The alternatives described in Section 3 of this document pertain to hard corals, gorgonians, and soft corals only. The Habitat Committee may wish to exclude sea pens from special management consideration at this stage for the following reasons:

- The two most common sea pen species are widely distributed in soft sediments throughout the region. *P. aculeata* (common sea pen) is common in the Gulf of Maine (Langton et al. 1990), and there are numerous records of *Pennatula* sp. on the outer continental shelf as far south as the Carolinas in the Theroux and Wigley database. *S. elegans* (white sea pen) is abundant on the Mid-Atlantic coast outer shelf (Theroux and Wigley 1998). Unlike other types of corals, these species are not dependent on hard bottom habitats, which are relatively rare in the deep ocean. Other known sea pen taxa in the region are found in soft sediments at continental slope depths (200-4300 m).
- Because the two species listed above are relatively common, sea pen vulnerability to fishing gears was considered in the Vulnerability Assessment for the SASI model.

## 2.2 Authority and guidance

Corals may be protected under the EFH authority in the MSA as a component of essential fish habitat, in the context of minimizing, to the extent practicable, the effects of fishing on EFH (see section 305(b)). Of course, any action taken under the EFH authority must occur within areas that are designated as EFH. In the Northeast region, this authority has been used in Monkfish FMP Amendment 2 to protect deep-sea corals and associated habitat features in two offshore canyons, Lydonia and Oceanographer, from fishing activity occurring under a monkfish day at sea. Options for minimizing the adverse effects of fishing on EFH include fishing equipment restrictions, time/area closures, and harvest limits (in this case, direct harvest of corals).

Section 303 of the 2007 reauthorization of the MSA includes the following discretionary provisions related to deep-sea corals:

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

- (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, 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;

Section 408, referenced above, describes the deep-sea coral research and technology program:

(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;

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(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.

In May of this year, the Council received guidance from NMFS NERO regarding implementation of the discretionary provisions. Important aspects of this guidance include:

- Coral areas must have a nexus to a fishery managed by the Council under an FMP. Councils need to show that the DSC areas are located within the geographical range of the fishery as described in the FMP.
- Coral zones can include additional area beyond the locations of deep-sea corals if necessary to ensure the effectiveness of protection measures, which may include the following:
  - Restrictions on time/location of fishing within zones,
  - Limiting fishing to specific vessel types or vessels fishing with specific gear types/quantities of gear, and
  - Closure of zones to fishing.
- Protective measures can apply to any MSA regulated fishing activity, even if that activity or gear type is not managed by the FMP that includes the measures.
- Long term sustainable use of fishery resources must be considered prior to designating DSC protection zones.
- Action taken under the discretionary authority may be used to complement action taken under the EFH authority.

- Unlike the EFH authority, the discretionary authority does not carry a consultation requirement.
- Councils may adopt gear restrictions via an omnibus amendment that applies to several FMPs, and can include in such an amendment measures that apply to fisheries under the jurisdiction of other Councils. Environmental, economic, and social analyses must be conducted, and consultation with the other affected Council will almost certainly be required.
- For coral management provisions to apply to fisheries managed under the Atlantic Coastal Cooperative Fisheries Management Act (ACA), either the ASMFC must take complementary action in their FMP, or there must be a Council FMP for the same resource. The relevant example in our region is the offshore component of the American lobster fishery, which would not be subject to coral protection measures enacted in an MSA FMP.

Other sections of the MSA can also be interpreted as applying to deep-sea corals and associated ecosystems (NOAA 2010b, p 9):

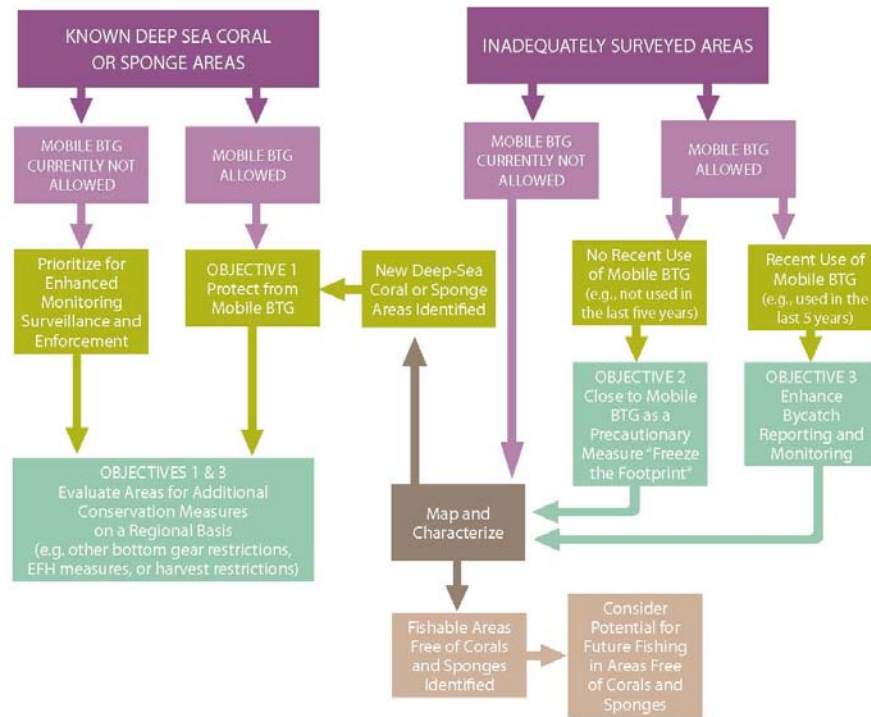
- Section 301(a)(9) requires Councils to include conservation and management measures that, to the extent practicable, minimize bycatch.
- Section 303(b)(12), authorizes Councils to include management measures in FMPs to conserve target and non-target species and habitats.

Additional NOAA guidance on coral conservation is provided in the NOAA Strategic Plan for Deep-Sea Coral and Sponge Ecosystems (NOAA 2010b). This plan has six conservation and management objectives; those in bold are most relevant to the Council's decisions. Objective 2 appears to be somewhat more precautionary than the regional guidance discussed above.

- 1. Protect areas containing known deep-sea coral or sponge communities from impacts of bottom-tending fishing gear.**
- 2. Protect areas that may support deep-sea coral and sponge communities where mobile bottom-tending fishing gear has not been used recently, as a precautionary measure.**
- 3. Develop regional approaches to further reduce interactions between fishing gear and deep-sea corals and sponges.**
4. Enhance conservation of deep-sea coral and sponge ecosystems in National Marine Sanctuaries and Marine National Monuments.
- 5. Assess and encourage avoidance or mitigation of adverse impacts of non-fishing activities on deep-sea coral and sponge ecosystems.**
6. Provide outreach and coordinated communications to enhance public understanding of these ecosystems.

Figure 1, which is reproduced from the Strategic Plan, depicts the agency's approach to managing the impacts of mobile bottom-tending gears on deep-sea corals and associated ecosystems.

Figure 1 – NOAA’s precautionary approach to manage bottom-tending gear (BTG), especially mobile BTG and other adverse impacts of fishing on deep-sea coral and sponge ecosystems. Reproduced from NOAA 2010b.



NOAA’s DSCRTP has identified the following areas as containing deep-sea corals (Table 1):

Table 1 – Deep sea coral areas and current management status. Adapted from NOAA 2010a.

Identified areas with deep-sea corals	Current status	Reference
Bear seamount	NEFMC proposed HAPC	Packer et al. 2007; NEFMC 2007
Retriever seamount	NEFMC proposed HAPC	Packer et al. 2007; NEFMC 2007
Heezen Canyon	NEFMC proposed HAPC	Hecker and Belchschmidt 1980; Watling et al. 2003; Packer et al. 2007; NEFMC 2007
Lydonia Canyon	NE & MAFMC monkfish bottom-trawl & gill net closure; MAFMC squid, mackerel, & butterfish bottom-trawl closure; MAFMC closed to bottom-trawling to protect tilefish EFH; NEFMC Proposed HAPC	Watling et al. 2003; Packer et al. 2007; MAFMC 2008a; MAFMC 2008b (final rule effective 2009); NEFMC 2007
Oceanographer Canyon	NE & MAFMC monkfish bottom-trawl & gill net closure; MAFMC squid, mackerel, & butterfish bottom-trawl closure; MAFMC closed to bottom-trawling to protect tilefish EFH; NEFMC Proposed HAPC	Watling et al. 2003; Packer et al. 2007; MAFMC 2008a; MAFMC 2008b (final rule effective 2009); NEFMC 2007

Identified areas with deep-sea corals	Current status	Reference
Veatch Canyon	MAFMC closed to bottom-trawling to protect tilefish EFH, NEFMC proposed HAPC	Hecker and Belchschmidt 1980; Hecker et al. 1983; Watling et al. 2003; Packer et al. 2007; MAFMC 2008b (final rule effective 2009); NEFMC 2007
Slope near Alvin Canyon	NEFMC proposed HAPC	Hecker and Belchschmidt 1980; Watling et al. 2003; Packer et al. 2007; NEFMC 2007
Toms/Cartaret Canyon	NEFMC proposed HAPC	Hecker and Belchschmidt 1980; Watling et al. 2003; Packer et al. 2007; NEFMC 2007
Hendrickson Canyon	NEFMC proposed HAPC	Watling et al. 2003; Packer et al. 2007; NEFMC 2007
Baltimore Canyon	NEFMC proposed HAPC	Watling et al. 2003; Packer et al. 2007; NEFMC 2007
Norfolk Canyon	MAFMC closed to bottom-trawling to protect tilefish EFH; NEFMC Proposed HAPC	Watling et al. 2003; Packer et al. 2007; MAFMC 2008; NEFMC 2007
Western Jordan Basin	No special protections	Auster 2005 and Watling et al. 2003; Auster (unpublished)
Mount Desert Rock Area	No special protections	Auster 2005 and Watling et al. 2003
Georges Tower off the Northern Edge of Georges Bank	No special protections	Watling and Auster 2005

### 2.3 Deep-sea coral data

A variety of data sets are available that document locations of the various deep-sea coral species (Table 2). Generally speaking, these data sets show presence of corals only, vs. presence/absence and/or presence/absence with abundance information. The records vary in age from the 1850s through present. Unlike the more widely known trawl surveys, which provide broad spatial coverage, the various coral surveys tend to be narrowly focused/of limited spatial extent. These datasets (referred to as the DSCRTP database) were compiled and audited by NOAA’s Deep-Sea Coral Research and Technology Program, with the assistance of NEFSC and others, and were used to prepare Figures 2, 3, 4, 6 and 7.

**Table 2 – Deep-sea coral data sources for the Northeast Region (To be completed and added to reference list)**

Data set	Description (dates, purpose, data collection method, coral types observed)
Cairns, 1976	
Cairns, 1978	
Cairns, 1979	
Deichmann, 1936	
Hecker et al., 1980	

Lamont-Doherty Geological observatory for BLM/MMS	
Moore and Bullis, 1960	
NEFSC HUDMAP	
NEFSC Sea Pens	
NES CR Dives	
Reed, 1980	
Smithsonian	
Theroux and Wigley	
NMFS	
US Fish Commission	
VIMS for BLM/MMS	
Watling and Auster, 2005	
Watling et al, 2003	
Yale University Peabody Museum Collection	

### 3.0 Alternatives

The following alternatives were developed based on an examination of coral presence data for the following taxa: gorgonians, soft corals, hard corals. The boundaries of the suggested areas will need to be modified. In particular, some of the canyon HAPCs have maximum depth limits of 1500 m, and thus have an irregular seaward boundary which would likely not be enforceable as a management area. In addition, the two seamounts designated as HAPCs (Bear and Retriever) have a 2000 m depth limit, based on the maximum depth for deep-sea red crab EFH, which produces an irregular perimeter around each seamount. The precise extents of the various areas would likely be modified to simplify enforcement of any management measures. Similarly, the two depth-range alternatives would also need to be simplified by drawing straight line boundaries that roughly correspond to the appropriate contours.

#### 3.1 Alternatives to define Deep-Sea Coral Zones

##### 3.1.1 Shelf-slope area from 50 m to boundary of EEZ

This alternative would designate the entire shelf-slope area from 50 meter to the boundary of the EEZ as a deep-sea coral zone. The specific northern and southern extents of this coral zone would need to be determined.

##### 3.1.2 Shelf-slope area from 100 m to 2000 m

This alternative would designate the entire shelf-slope area between depths of 100 and 2000 m as a deep-sea coral zone. The specific northern and southern extents of this coral zone would need to be determined.

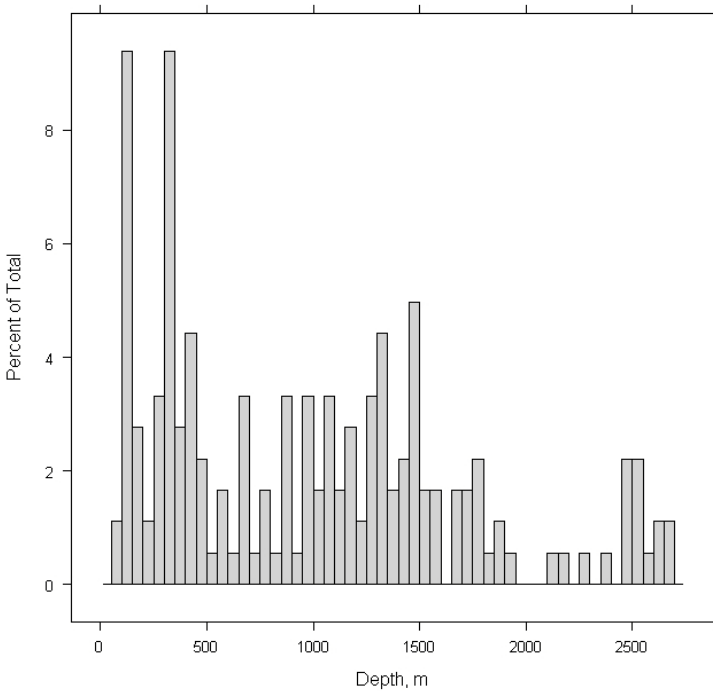
The PDT discussed that the minimum and maximum depth limits for this alternative should be based on the samples available, and additional work should be undertaken to define the appropriate threshold. In addition, the literature on coral distribution in relation to depth will be reviewed in order to refine this alternative. The addition of a third depth-based alternative



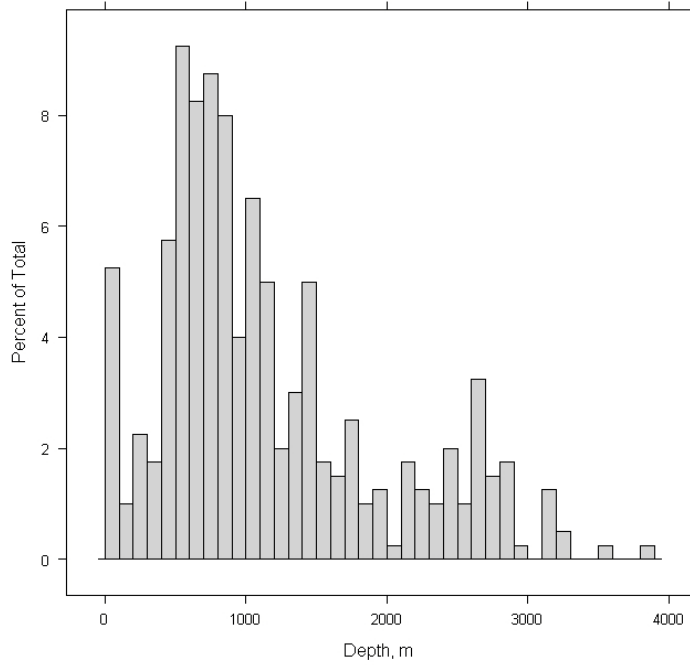
may be appropriate as well; the PDT discussed including a deeper depth range option but did not select a particular depth range at their most recent meeting.

The figures below (Figure 2 - Figure 4) show the depth distribution of coral samples for each of the three major coral groups (zero/null depths were excluded). Data are taken from the DSCRTP database. Other information on depth distributions should be examined as well, as this distribution of samples may overweight certain common coral types, or may overweight individual surveys/datasets with many observations. For example, the Hecker publications go into a great deal of detail on the depths where they found coral (see Table 42 – Deep-sea coral species of the Northeast Region, in the SASI Part 1 document, as well as Packer et al. 2007, Appendix 5.2).

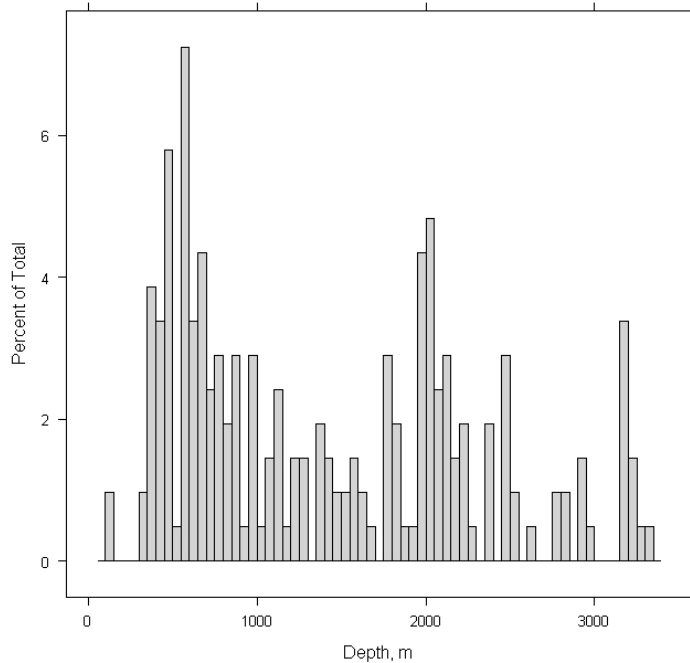
**Figure 2 – Depth distribution of hard coral records in the DSCRTP database.**  
**Depth distribution of Scleractinian corals**



**Figure 3 – Depth distribution of soft coral records in the DSCRTP database.  
Depth distribution of Alcyonacean corals**



**Figure 4 – Depth distribution of gorgonian coral records in the DSCRTP database.  
Depth distribution of Gorgonian corals**



### 3.1.3 All canyon and seamount HAPCs

These alternatives would designate deep-sea coral zones in all the proposed canyon and seamount HAPCs from Phase 1: Heezen, Lydonia, Oceanographer, Hendrickson,

Toms/Cartaret, Baltimore, Norfolk, Gilbert (between Lydonia and Oceanographer), Veatch, Alvin, Atlantis, Hudson, Hydrographer, Wilmington, and Washington Canyons, in addition to on Bear and Retriever Seamounts. Two sub-options are listed below.

Note that there are additional named canyon areas in the Northeast Region that might warrant inclusion in this alternative. Figure 6 at the conclusion of this document shows the proposed HAPCs and known coral locations.

### 3.1.3.1 Only canyons and seamounts

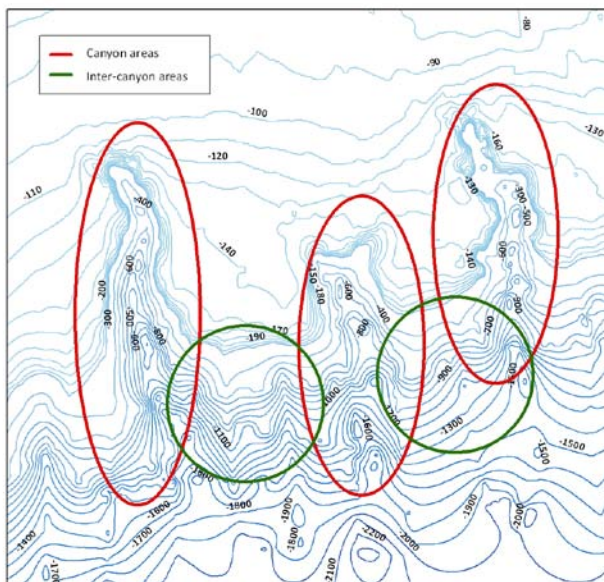
This alternative would include only the canyon areas and the seamounts listed in Alternative 3.1.3, and would not include inter-canyon areas. Canyon areas are defined as those locations with steeper topography, while inter-canyon areas are defined as those areas between canyons with a more gradual slope.

### 3.1.3.2 Canyons plus some inter-canyon areas

This alternative would include some inter-canyon areas, in addition to the canyon areas listed in Alternative 3.1.3. The rationale for this is that inter-canyon areas may provide important habitat for some coral species.

The figure below indicates the intended meanings of 'canyon' and 'inter-canyon', using Lydonia, Gilbert, and Oceanographers canyons as an example.

Figure 5 – Distinction between 'canyon areas' and 'inter-canyon areas', using the Lydonia/Gilbert/Oceanographer Canyon region as an example.



### 3.1.4 Canyon and seamount HAPCs with known corals

This alternative would designate deep-sea coral zones in the proposed canyon and seamount HAPCs with documented corals (good data support). These include Heezen, Lydonia,

Oceanographer, Hendrickson, Toms/Cartaret (corals documented as heads of canyons – assume presence in deeper areas), Baltimore, and Norfolk Canyons, in addition to on Bear and Retriever Seamounts. Two sub-options are listed below:

#### **3.1.4.1 Only canyons and seamounts**

This alternative would designate only the canyon areas and the seamounts listed in Alternative 3.1.4 as deep-sea coral zones, and would not include inter-canyon areas.

#### **3.1.4.2 Including some inter-canyon areas**

This alternative would designate inter-canyon areas in addition to the canyon areas listed in Alternative 3.1.4 as deep-sea coral zones. The rationale for this is that inter-canyon areas may provide important habitat for some coral species.

#### **3.1.5 Existing tilefish GRAs**

This alternative would designate the four existing Tilefish Amendment 1 Gear Restricted Areas as deep-sea coral zones. Figure 7 at the conclusion of this document shows the tilefish GRAs and associated HAPCs, and known coral locations.

#### **3.1.6 Gulf of Maine coral zones**

The PDT also discussed the designation of coral zones in the Gulf of Maine – two areas identified by the DSCRTP are western Jordan Basin and the Mount Desert Rock area. The available information on GOM corals needs to be further investigated.

### **3.2 Management measures for deep-sea coral zones**

#### **3.2.1 Gear restrictions**

The following range of alternatives would protect deep-sea corals via restrictions on various types of commercial and/or recreational fishing within deep-sea coral zones.

##### **3.2.1.1 Status quo**

This alternative would maintain any existing gear restrictions in designated deep-sea coral zones. These might include the mobile gear restrictions implemented via Amendment 1 to the Tilefish FMP in the four canyons identified as Tilefish GRAs, as well as prohibitions on fishing during a monkfish DAS enacted via Amendment 2 to the Monkfish FMP.

##### **3.2.1.2 Prohibition on mobile bottom tending gears**

This alternative would prohibit all mobile bottom-tending fishing gear operation in deep-sea coral zones.

##### **3.2.1.3 Prohibition on all commercial bottom-tending gears**

This alternative would prohibit all commercial bottom-tending fishing gear operation in deep-sea coral zones.

#### **3.2.1.4 Prohibition on all commercial fishing gear**

This alternative would prohibit all commercial fishing gear operation in deep-sea coral zones.

#### **3.2.1.5 Prohibition on all fishing gear**

This alternative would prohibit all commercial and recreational fishing gear operation in deep-sea coral zones.

### **3.2.2 Access areas**

This alternative would allow access to designated deep-sea coral zones for specific fisheries, following the SAFMC example.

## **3.3 Research recommendations**

### **3.3.1 Fully document all coral catch in NEFSC survey data**

This alternative would require documentation of deep sea corals during Northeast Fishery Science Center resource surveys, with documentation to include identification to lowest taxonomic level possible and quantification of catch by weight.

### **3.3.2 Fully document all coral bycatch during observed fishing trips**

This alternative would require documentation of deep sea corals during observed fishing trips, with documentation to include identification to lowest taxonomic level possible and quantification of catch by weight.

### **3.3.3 Additional focused coral surveys**

This alternative would specify Council support for resource surveys specific to coral distribution mapping. Specific suggested locations include Hudson Canyon, Gilbert Canyon, and along the shelf/slope break.

### **3.3.4 Create coral guide to support collection of data during research trips and fishing trips**

This alternative would specify Council support for the development of a deep sea coral guidebook, which would support identification of corals during research and fishing trips. Staff at NEFSC's Sandy Hook lab would direct guidebook development.

## 4.0 References

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### 5.0 Additional figures

Figure 6 – Known locations of soft, gorgonian, and hard corals in the Northeast Region, from the DSCRTP database.

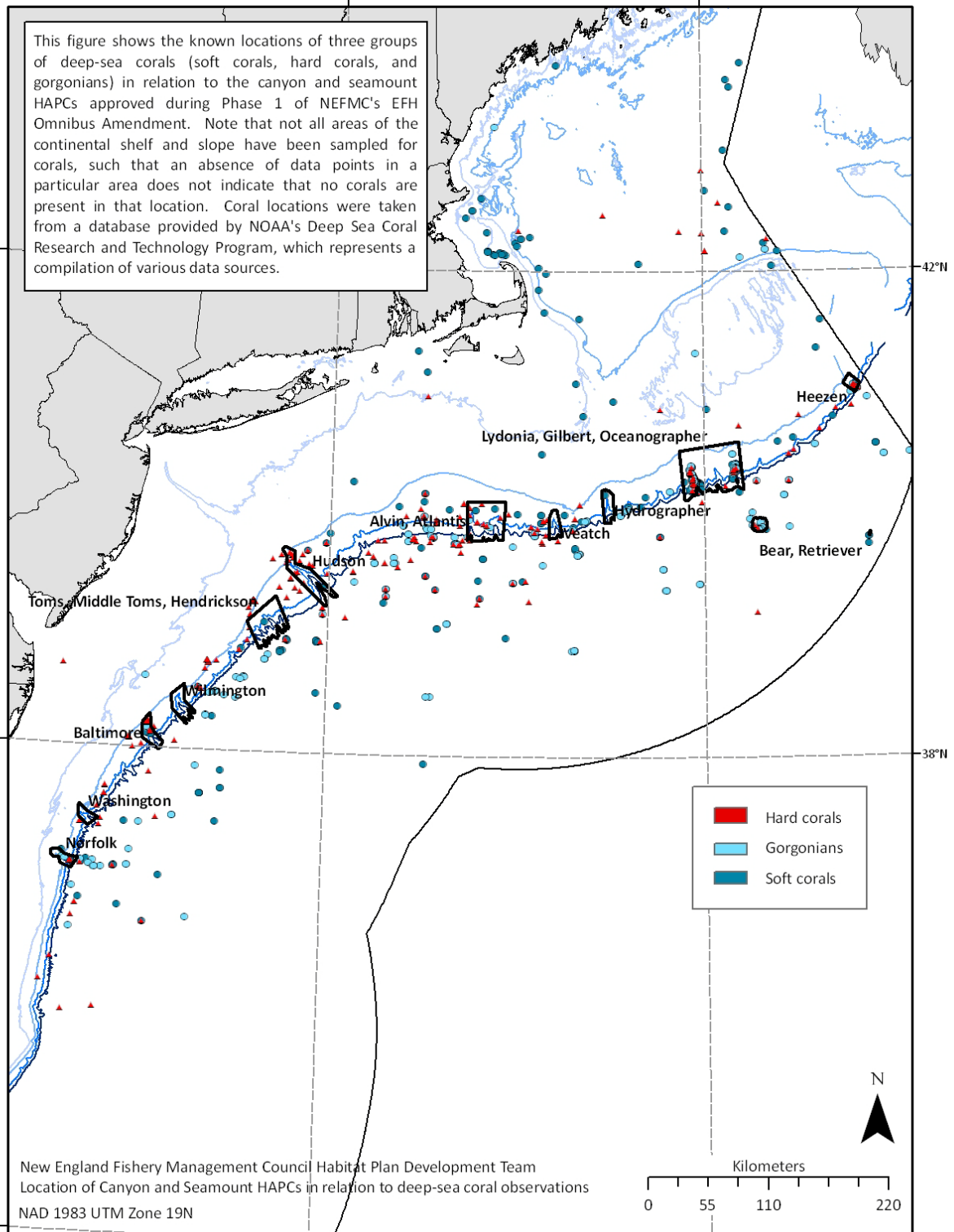


Figure 7 - Location of tilefish gear restricted areas (GRAs), outlined in green. Associated HAPCs are shown with hatch marks. Coral presence data from the DSCRTP database is shown in the insets.

