Omnibus Essential Fish Habitat Amendment 2

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 Atlantic Herring FMP
Amendment 2 to the Red Crab FMP
Amendment 2 to the Skate FMP
Amendment 3 to the Atlantic Salmon FMP

DRAFT: 12 April 2012
Deep-sea coral management alternatives decision document

Prepared by the
New England Fishery Management Council

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1.0 Introduction

The purpose of this document is to summarize possible management alternatives to designate deep-sea coral zones and implement fishing restrictions necessary to protect the corals within those zones. Section 1.0 reviews the Council's management authority for deep-sea corals, describes which types of deep-sea corals the management alternatives are designed to protect, summarizes an overall management strategy, and summarizes exisiting measures that provide some coral protection. Section 2.0 presents three groups of management alternatives:

- Alternatives for broad coral zone boundaries
- Alternatives for discrete coral zone boundaries
- Management measures for both type of coral zones, including fishing restrictions, exemptions, and framework provisions

The reader is referred to the corresponding deep-sea coral background document for additional information. This document:

- Summarizes the species diversity and known distribution of deep sea corals in the region, and lists coral species of particular conservation interest
- Characterizes deep-sea coral habitats and coral distributions in specific areas, and identifies recommended coral protection zones
- Reviews the scientific literature on the vulnerability of deep-sea corals to fishing impacts.

1.1 What corals are these alternatives designed to protect?

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[1]), hence their "deep-sea" appellation.

An array of coral species live in the northeast region. These corals vary in terms of their size, shape, and flexibility, growth rates and reproductive strategies, and habitat associations. Some are relatively common, whereas other types are rare. All of these species

[1] Puglise, K. and R. Brock (2003). NOAA and deep-sea corals: background, issues, and recommendations. Unpublished work. National Oceanic and Atmospheric Administration. Silver Spring, MD**:** 8.

have some level of vulnerability to fishing gear impacts, but the degrees of susceptibility and the rates of recovery are likely variable. The PDT focused on a few types of corals in particular when developing management alternatives for coral zones. Specifically, the PDT recommends that coral zones should focus on species that:

- Are relatively large or have other attributes that make them more susceptible to fishing-related impacts. Specifically, the gorgonians and the black corals have fairly complex physical structure that is likely to be more susceptible to damage from fishing. Other species likely to be more vulnerable are listed in Table 1.
- Require hard substrates, which are relatively rare. While there is abundant soft substrate on the continental slope, hard substrate areas are much more limited in their distribution, and should be the focus of conservation efforts because of their rarity.

Table 1 – Species of coral in the NE region that are likely to be more vulnerable to fishing gear based on their physical characteristics

Species, Order	Form	Distribution
Acanella arbuscula; soft coral	Only 15 cm high, but stiff and delicate	Canyons (Watling et al 2011), including on soft bottom, few in Oceanographer Canyon (Hecker and Blechschmidt); also on seamounts
Acanthogorgia armata; soft coral	Up to 50 cm high, usually 10-20 cm	Western N. Atlantic, including on seamounts (Appendix B in Hecker & Blechschmidt 1980 MMS Report, Watling et al 2011)
Anthomastus agassizii and A. grandiflorus, soft corals	Stalked colonial corals	Deeper areas of canyons, *A. grandiflorus* on seamounts (Watling et al 2011)
Chrysogorgia agassizi; soft coral	30 cm or more, delicate-looking with fine branches	Several in deep water in vicinity of Hudson Canyon (Appendix B in Hecker & Blechschmidt 1980 MMS Report); other species of *Chrysogorgia* on seamounts (Watling et al 2011)
Paragorgia arborea, other *Paragorgia* species; soft corals	Very large, up to 1.5 m high	*P. arborea*: western North Atlantic, including in axes of Oceanographer, Baltimore and Norfolk canyons (Appendix B in Hecker & Blechschmidt 1980 MMS Report); other species on seamounts (Watling et al 2011)
Paramuricea grandis; soft coral	Up to 80 cm, frequently 20-30 cm	Not found south of Georges Bank (Appendix B in Hecker & Blechschmidt 1980 MMS Report)
Primnoa resedaeformis; soft coral	Large colonies up to 1 m or more, stiff yet flexible, hard/rigid at base	Found in Norfolk, Lydonia, Baltimore canyons (Appendix B in Hecker & Blechschmidt 1980 MMS Report)

Species, Order	Form	Distribution
Thouarella grasshoffi, soft coral	Colonies consist of 1–3 main branches, from which numerous closely spaced (usually less than 2 mm apart) branchlets originate on all sides of the main branch in a bottlebrush arrangement. The branchlets are undivided, about 4.5 cm in length, and flexible in tension. The holotype is a single main stem 35 cm tall and 8–9 cm in width that has been broken from its base, the axis being 2.4 mm in proximal diameter and brownish in color.	Manning and Bear Seamounts of the New England Seamount Chain, and Oceanographer Canyon (Cairns, S.D. 2006, probably common on the New England Seamounts, Watling, pers. comm.).
Desmophyllum cristagalli, hard coral	Large solitary horn coral (related species *D. dianthus* up to 10 cm high)	On hard substrates in canyon axes on hard bottom (Appendix C in Hecker & Blechschmidt 1980 MMS Report)
Solenosmilla variabilis, hard coral	Forms large bushy colonies	Lydonia Canyon, Hendrickson Canyon (Appendix C in Hecker & Blechschmidt 1980 MMS Report), Bear Seamount
The black corals (order Antipatharia), genera *Antipathes, Leiopathes, Parantipathes*	Branching colonial corals	Have only been documented on seamounts, but it is possible that they exist in other areas as well which haven't been surveyed

The discrete coral protection zones were not designed to focus on protection of sea pens, which typically inhabit soft substrates and might be less vulnerable to fishing disturbance than other coral types. Specifically, the white sea pen, *Stylatula elegans*, and the common sea pen, *Pennatula aculeata* possibly have lower susceptibility to fishing disturbance, and are more widely distributed than other types of corals. Other corals, fall into the category of lower susceptibility – specifically, the hard coral *Dasmosmilia lymani* was noted as being relatively common , including in shallower depths, small in size, and possibly less susceptible to fishing gear impacts.

While there is a focus on hard substrates, the PDT agreed that coral zones should encompass diverse substrate types (e.g. clay, silt, and sand) found in proximity to hard substrates. Some larger species such as the bamboo coral *Acanella arbuscula* are associated with these soft substrates. Because hard substrates occur amongst soft sediments in canyon environments, a coral zone designed around a canyon feature will encompass both hard and soft substrate areas.

1.2 Management authority

There are multiple provisions in the Magnuson Stevens Fishery Conservation and Management Act (MSA) that can be used to justify coral protection. One is the Essential Fish Habitat (EFH) authority, where corals are considered a component of essential fish habitat, and fishing restrictions are enacted in the context of minimizing, to the extent

practicable, the effects of fishing on EFH (see section 305(b)). In the Northeast region, this authority was 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). Any action taken under the EFH authority must occur within areas that are designated as EFH.

In the Northeast Region, coral distributions (both documented and inferred) extend beyond the bounds of designated EFH. The Section 303(b) discretionary provisions found in the 2007 reauthorization of the MSA (below) provide a second and more flexible mechanism by which to protect deep-sea corals from the effects of fishing.

> 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[2], 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

[2] Section 408 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;
  (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.

(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;

In May 2010, 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.

The NOAA Strategic Plan for Deep-Sea Coral and Sponge Ecosystems (NOAA 2010b) provides guidance on selection of coral conservation measures. This plan has six conservation and management objectives. The first three are most relevant to the Council's decisions.

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.**

1.3 Framework for selecting deep sea coral zones

Two frameworks are proposed for the development of coral zones. Both frameworks would rely on the discretionary coral protection authority provided in the 2007 MSA reauthorization.

The **'broad areas' framework** (section 2.1) would designate a coral zone along the entire shelf-slope region between the US/Canada EEZ boundary and the NC/VA border, beginning at the 300, 400, or 500 m depth contour and extending to the 200 mile limit. This zone would be designed to be outside the boundaries of most currently occurring fishing effort, and encompasses many coral habitats on the continental slope and on the seamounts.

The **'discrete areas' framework** (section 2.2) would designate narrowly defined coral zones based on discrete bathymetric/geological features. These zones include discrete ares of the GOM, single canyons, a few adjacent canyons and the adjacent continental slope region, and seamounts. Designation of discrete coral zones would be based on the best available data on known coral distributions/presence, and/or likely presence of suitable coral habitats.

A range of **management options restricting or modifying fishing operations** could be implemented in both types of zones. These include restrictions on mobile bottom-tending

gears, restrictions on bottom-tending gears, and authorized exemptions to these restrictions. The scientific literature documenting deep-sea coral and fishing interactions clearly demonstrates that mobile bottom-tending gears can have negative impacts on corals. However, the literature is less conclusive regarding fixed gears. The PDT is currently reviewing this information and plans to provide additional recommendations on this matter at a future meeting. The conservation benefits of each coral zone option will be assessed based on the PDT's understanding of regional coral species and their likely vulnerability to different types of fishing.

Broad areas and discrete areas could be implemented simultaneously. The individual discrete zones generally do not overlap one another, with the exception of the Mid-Atlantic Canyon and Slope zone, which overlaps the Toms Canyon and Lindenkohl Canyon zones. However, all discrete zones except for those in the Gulf of Maine overlap the broad coral zone options. Generally speaking, the landward boundary of the discrete canyon zones is slightly shallower than the landward boundary of the shallowest broad zone, so a combination approach would protect additional coral habitats. A combination approach might also be appropriate if more restrictive management measures are desired in the discrete areas. For example, the Council might prohibit all bottom-tending gears in a discrete deep-sea coral zone, but only prohibit mobile-bottom tending gears in the surrounding/overlapping broad deep-sea coral zone. Different exemptions could be authorized in broad vs. discrete zones as well.

Something to consider generally when developing fishing restrictions for coral zones is which Council has primary or sole management authority for a particular fishing activity. A few things to bear in mind on this issue:

- 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.
- MAFMC staff have worked collaboratively on development of coral zones as a part of the NEFMC Habitat PDT, but MAFMC has not formally reviewed or approved any of the proposed coral measures. Discussions between NEFMC and MAFMC on how to coordinate efforts on development of coral management alternatives are ongoing.
- 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. Lobster fishing would fall into this category in our region.

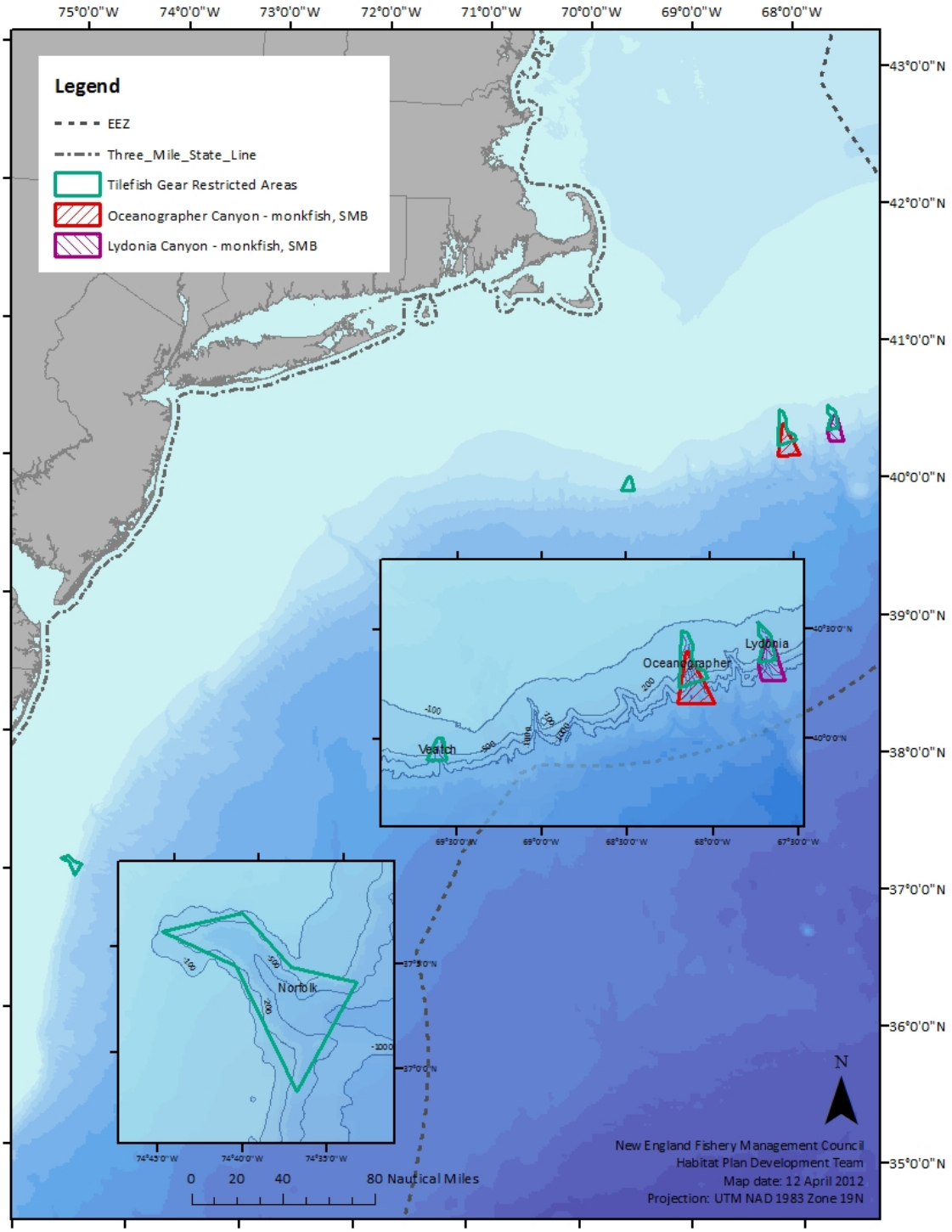
In order to to increase flexibility, particularly in cases where inferences about the presence of corals and/or suitable coral habitats are uncertain, the Habitat Committee has suggested

an alternative that would allow fishing restrictions in designated coral zones to be implemented via framework action.

Note that a few regulations currently in place offer some level of protection to deep-sea corals in the region. Both were developed via the MSA EFH authority, not using the discretionary provisions.

- **Tilefish FMP (Mid-Atlantic Council)**: mobile gear restrictions (Gear Restricted Areas, or GRAs) in four canyons – Lydonia, Oceanographer, Veatch, and Norfolk. The GRAs were implemented via Amendment 1. Note that the Tilefish GRAs are located towards the heads of the canyons, with the boundaries based on those of the Tilefish Habitat Areas of Particular Concern (HAPC). The HAPCs were designed to protect clay outcrop habitats in waters between 100 and 300 meters, although they cover deeper water areas along the axis of the canyons as well.
- **Monkfish FMP (Joint New England and Mid-Atlantic Councils)**: prohibitions on fishing during a monkfish DAS in Lydonia and Oceanographer Canyons. The management areas and associated restrictions were implemented via Amendment 2. These same areas were adopted as mackerel, squid, and butterfish bottom trawling restricted areas.

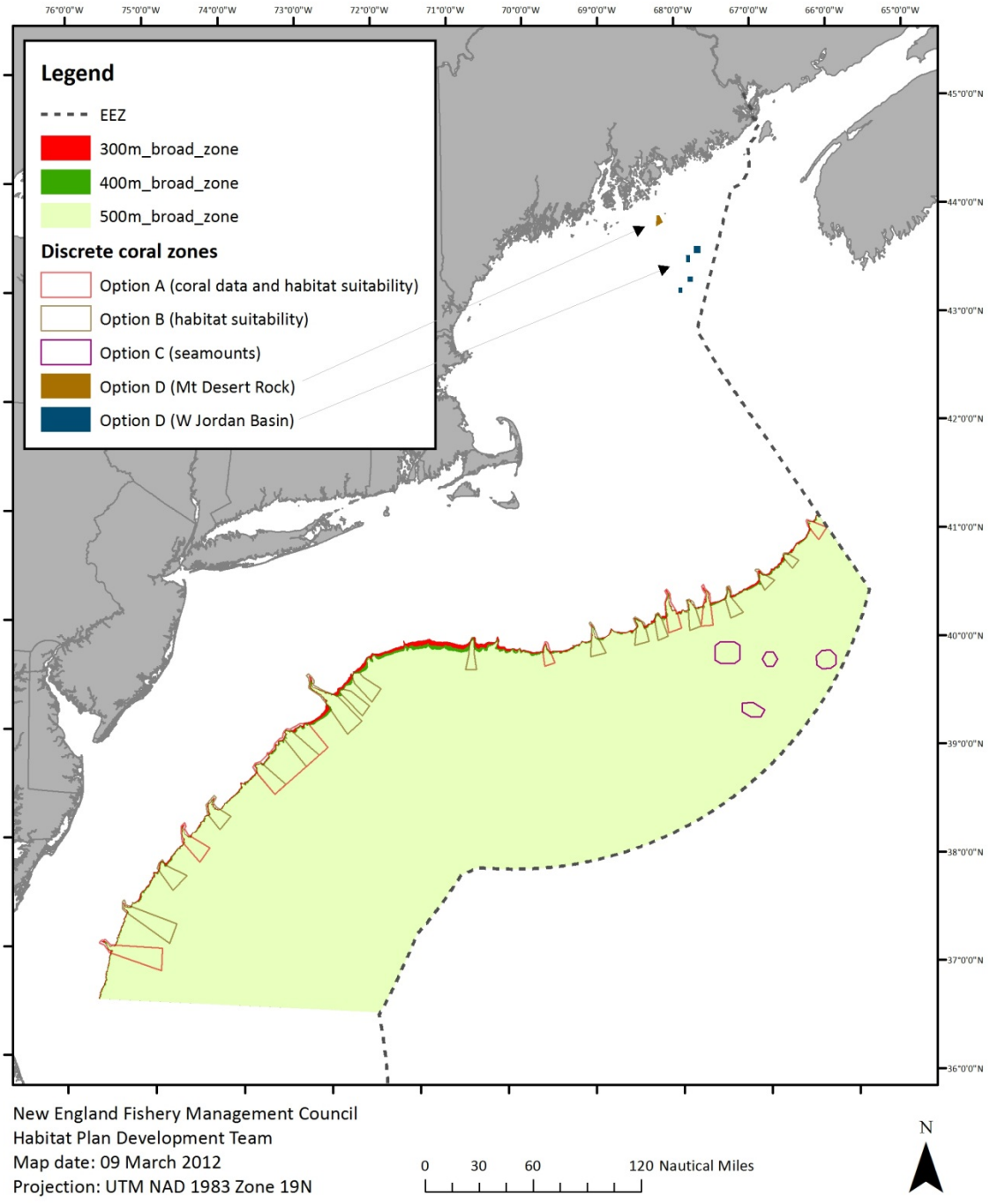
Map 1 - Current fishery management areas that provide deep-sea coral conservation benefits. Mobile bottom tending gears are prohibited in the Tilefish GRAs, shown in green/open symbols. Vessels with mackerel/squid/butterfish permits may not fish with trawls in the Oceangrapher and Lydonia canyon areas shown in red/45 degree hatched and purple/-45 degree hatched, respectively. Vessels fishing on a monkfish day at sea are also prohibited from the hatched areas.



2.0 Deep-sea coral zone alternatives

The following sections describe proposed deep-sea coral protection zones (Map 2). Broad zones are discussed in section 2.1, and discrete zones are discussed in section 2.2.

Map 2 - All proposed coral zones. Includes broad areas beginning at 300, 400, and 500 m depth, as well as discrete areas in canyons, on seamounts, and in the Gulf of Maine.



2.1 Boundary alternatives for a broad deep-sea coral zone on the shelf-slope

These alternatives would designate a broad shelf-slope area as a deep-sea coral zone. **The overall objective of this type of measure would be to prevent the expansion of fishing effort into deepwater coral areas, while not restricting current fishing operations.** This type of coral zone would extend from the boundary of the EEZ along the southern flank of Georges Bank to the Virginia-North Carolina border, where South Atlantic Fishery Management Council coral conservation measures begin. The landward boundary would be the 300 m, 400 m, or 500 m contour, and the seaward boundary would be the EEZ. These options are mutually exclusive, i.e., only one of the three options could be selected.

The PDT suggested designating a broad coral zone the September 2010 Habitat Committee meeting. This type of option, in particular one that is designed to 'freeze the footprint' of current fishing in deeper waters, has been recommended by various interested parties as well. The PDT originally proposed a shallow depth limit of 100 meters, which roughly corresponds to the heads of the canyons, and the Committee initially suggested a minimum depth of 200 m, which is deeper than the majority of current fishing effort, such that coral protection efforts would be expected to have a relatively small impact on fishing. Taking the boundary of the zone to the EEZ, rather than to a specific depth (e.g. 2000 m, as originally proposed by the PDT) was viewed a precautionary approach. The Committee recommended an additional depth threshold of 300 m for analysis at their July 2011 meeting, given a preliminary review of the observer data for depths at which fishing occurs by particular gear types. At their February 2012 meeting, the Committee recommended analyzing three depth-based boundary options: 300 m, 400 m, and 500 m. Also at this meeting, the Committee discussed developing boundaries that would use straight line segments to approximate these contours, but decided to recommended a range of boundary options based on the contours themselves.

Table 2 – Size and depth of broad coral zones

Area name	Area size, km^2	Minimum depth, m	Maximum depth, m
300 m broad zone	175,263	300	6000 m (approximate)
400 m broad zone	173,517	400	6000 m (approximate)
500 m broad zone	172,097	500	6000 m (approximate)

2.1.1 Boundary option A: Landward boundary at 300 m contour

This option would designate a broad coral zone from the US-CAN EEZ boundary to a straight line extension of the VA-NC border, with the landward boundary at the 300 m contour and the seaward boundary at the EEZ.

2.1.2 Boundary option B: Landward boundary at 400 m contour

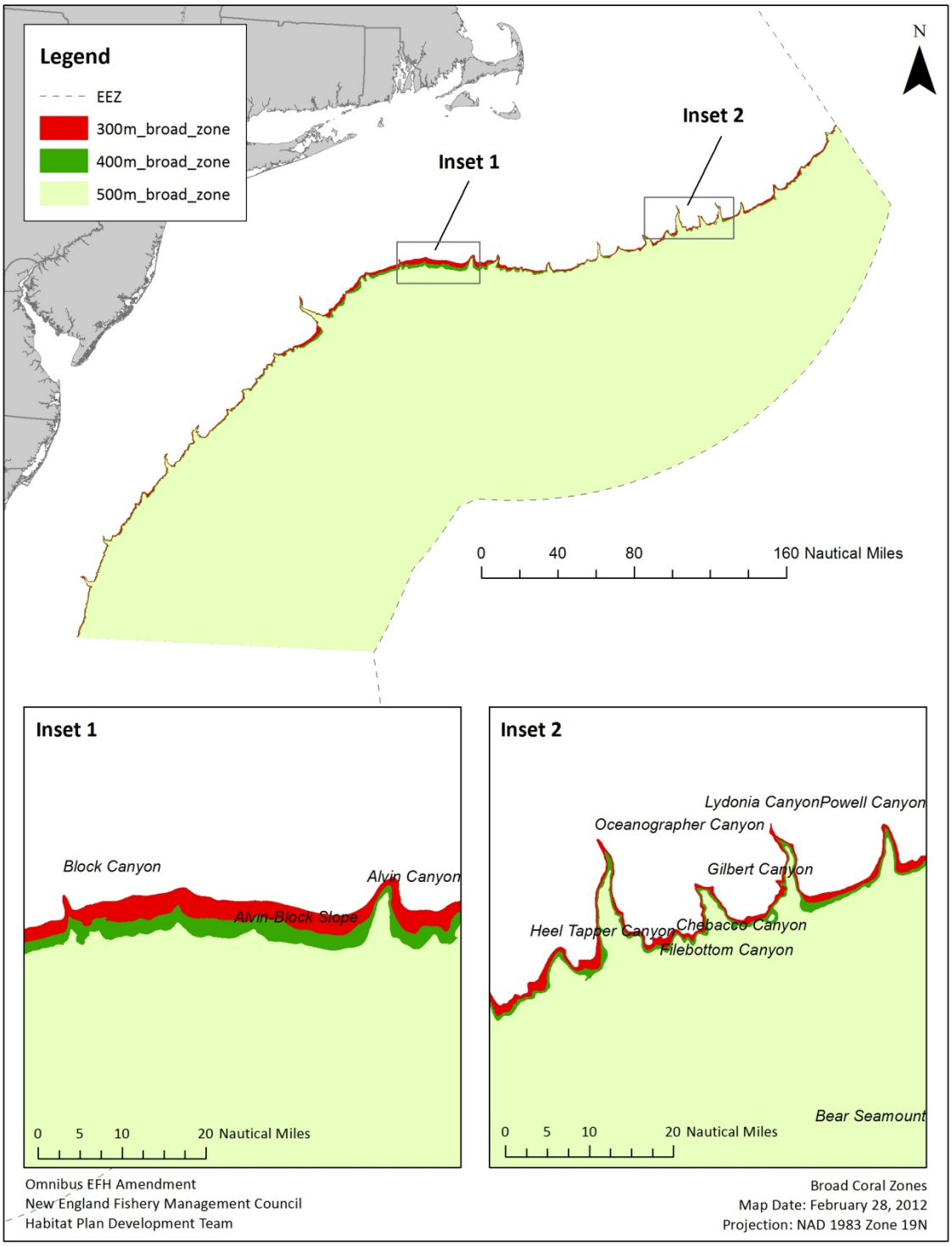
This option would designate a broad coral zone from the US-CAN EEZ boundary to a straight line extension of the VA-NC border, with the landward boundary at the 400 m contour and the seaward boundary at the EEZ.

2.1.3 Boundary option C: Landward boundary at 500 m contour

This option would designate a broad coral zone from the US-CAN EEZ boundary to a straight line extension of the VA-NC border, with the landward boundary at the 500 m contour and the seaward boundary at the EEZ.

Note that an additional option was discussed at the Habitat Committee meeting on April 6, 2012 to develop broad coral zone boundaries that are based on the footprint of 99% of current fishing effort and 95% of current fishing effort. In other words, the broad coral zone could include either 1% or 5% of current fishing effort. Presumably, effort would be measured according to the total number of trips occurring in fisheries that tend to overlap with the coral zones. The Committee's intention was that a depth contour would still be used, but that the appropriate contour should be empirically derived from the fishing effort data, rather than selecting a contour first and then evaluating the percentage of fishing effort impacted. This option will need to be developed further by the PDT for Committee and Council consideration.

Map 3 – Broad coral zones boundary options A (300 m), B (400 m), and C (500 m). The insets are shown at the same scale to indicate the variation in the difference between the zones at different locations where the slope is steeper, such as near Lydonia and Oceanographer Canyons (Inset 2) or less steep, such as near Block and Alvin Canyons (Inset 1).



2.2 Boundary alternatives for discrete Deep-sea Coral Zones

Discrete Deep-Sea Coral Zones are relatively smaller areas based on individual canyons, seamounts, or other features. The document called *"Deep-sea corals of the Northeast Region: Species, Habitats and Proposed Coral zones, and vulnerability to fishing impacts"* details the information reviewed by the PDT as the coral zone recommendations were developed. These discrete coral zones are intended to encompass known aggregations of corals, or habitats likely to be suitable for corals.

At their February 2012 meeting, the Committee identified a range of areas to be considered as discrete coral zones, based on recommendations from the PDT. Also at that meeting, the Committee developed a range of fishing restriction and exemption options to be analyzed for each of the broad zone options. A list of management measures that could be implemented by framework would be common to both broad and discrete coral zones, and can be found later in this document in section 2.3.3.

Four types of areas are recommended as discrete deep-sea coral zones. Other canyon and slope areas were evaluated but not recommended by the PDT (see summary in Table 3).

A. Canyons and a single slope region where coral data and inference of the presence of suitable habitat support the recommendation:
   - Heezen
   - Lydonia
   - Oceanographer
   - Veatch
   - Mid-Atlantic canyons and surrounding slope – Mey, Hendrickson, Toms, S. Toms, Berkley, Carteret, Lindenkohl
   - Baltimore
   - Norfolk

B. Canyons where inference of the presence of suitable habitat supports the recommendation:
   - Nygren
   - Munson
   - Powell
   - Gilbert
   - Heel Tapper
   - Welker
   - Hydrographer
   - Alvin
   - Emery
   - Babylon and Jones
   - Hudson
   - Toms
   - Lindenkohl

- Wilmington
- Accomac
- Washington

C. Seamounts:
- Bear
- Retriever
- Physalia
- Mytilus

D. Gulf of Maine coral zones
- Mt Desert Rock area
- Western Jordan Basin

Table 3 – Summary of discrete areas evaluated as potential coral zones

Area type	Number of areas recommended	Number of areas not recommended	Total number of areas
Canyons – coral evaluation (literature review) and GIS analysis	6	7	13
Canyons – GIS analysis only	16	6	22
Canyons – no GIS analysis possible	0	13	13
All canyons	22	26	48
Slope areas	1	4	5
Seamounts	4	0	4
Gulf of Maine	2	0	2

2.2.1 Option A: Canyon and slope area coral zones based on coral data and habitat suitability

These areas were all assessed as having adequate observations on which to base an assessment about coral abundance (either highly or moderately adequate), and coral abundance compared to other areas was found to be high to moderate. Suitable substrates for coral attachment have been documented in these areas as well.

In addition, all of the canyons listed under this option fell within the threshold of having at least a 450 meter or greater maximum relief, so likelihood of outcropping rocks and thus suitable habitats was inferred. Relief was measured from the canyon rim to the canyon floor along the center axis.

Each of the seven areas is described briefly below, listed from north to south.
Detailed information about each of these canyons, and about the bathymetry analysis conducted, can be found in the background document.

Map 4 - Discrete zone option A

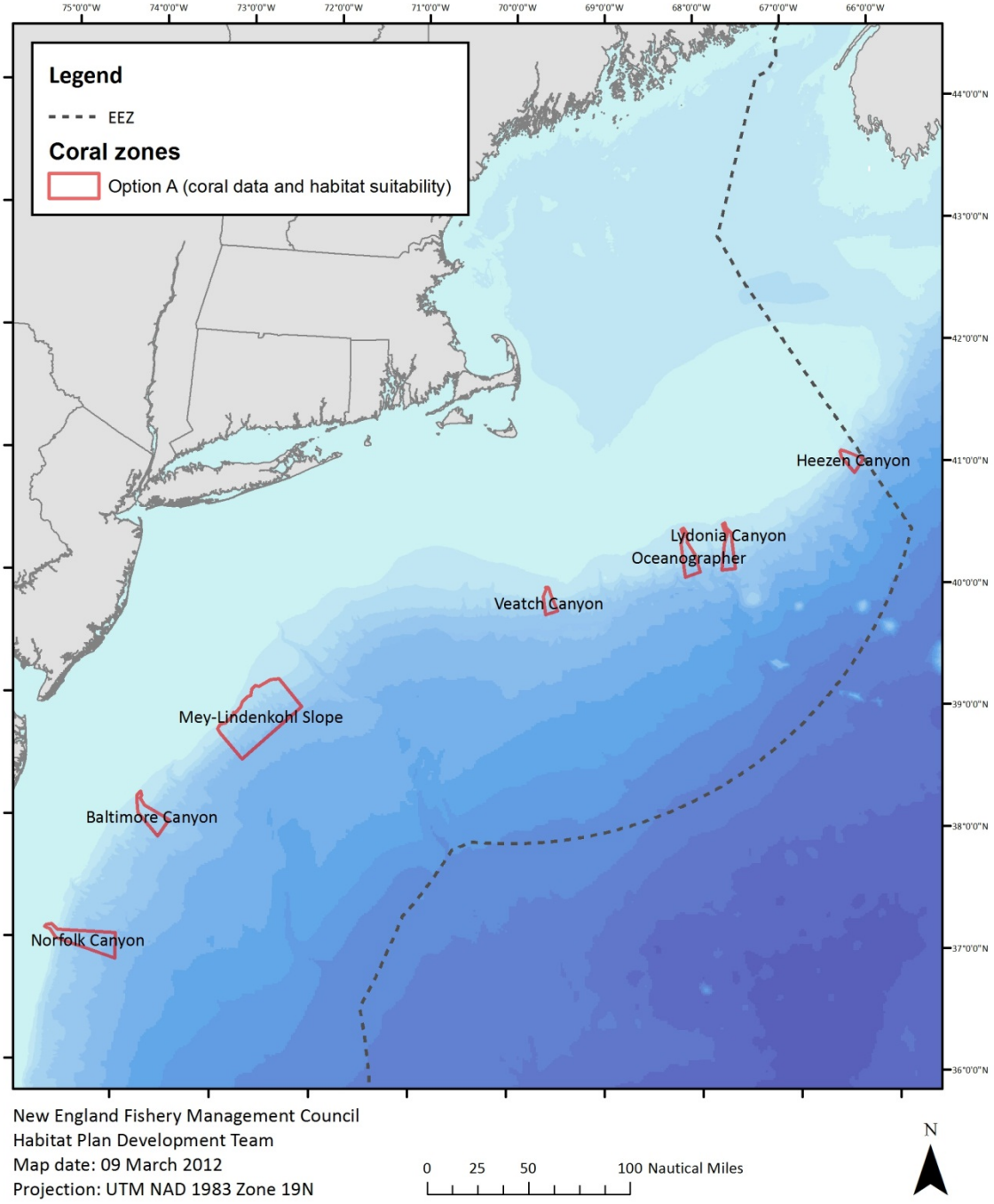


Table 4 – Coordinates for Option A coral zones

Option A – Canyon and slope areas	Point	Latitude	Longitude
Heezen Canyon	1	41° 7'	-66° 26'
	2	41° 6'	-66° 23'
	3	41° 2'	-66° 12'
	4	40° 55'	-66° 18'
	5	41° 3'	-66° 26'
	6	41° 6'	-66° 26'
Lydonia Canyon	1	40° 31'	-67° 44'
	2	40° 32'	-67° 42'
	3	40° 30'	-67° 41'
	4	40° 27'	-67° 38'
	5	40° 23'	-67° 38'
	6	40° 9'	-67° 36'
	7	40° 9'	-67° 45'
	8	40° 22'	-67° 43'
	9	40° 27'	-67° 41'
	10	40° 29'	-67° 43'
Oceanographer	1	40° 30'	-68° 09'
	2	40° 27'	-68° 07'
	3	40° 23'	-68° 07'
	4	40° 17'	-68° 02'
	5	40° 8'	-67° 59'
	6	40° 6'	-68° 08'
	7	40° 14'	-68° 10'
	8	40° 22'	-68° 11'
	9	40° 26'	-68° 09'
	10	40° 29'	-68° 11'
Veatch Canyon	1	40° 1'	-69° 38'
	2	40° 1'	-69° 36'
	3	39° 60'	-69° 36'
	4	39° 57'	-69° 35'
	5	39° 49'	-69° 30'
	6	39° 47'	-69° 38'
	7	39° 56'	-69° 39'
	8	39° 60'	-69° 38'
Mey-Lindenkohl Slope	1	39° 7'	-72° 44'
	2	39° 9'	-72° 41'
	3	39° 9'	-72° 39'
	4	39° 12'	-72° 32'
	5	39° 13'	-72° 26'
	6	38° 59'	-72° 12'
	7	38° 32'	-72° 48'

Option A – Canyon and slope areas	Point	Latitude	Longitude
	8	38° 44'	-73° 02'
	9	38° 47'	-73° 04'
	10	38° 49'	-73° 03'
	11	38° 50'	-72° 59'
	12	38° 53'	-72° 55'
	13	38° 55'	-72° 54'
	14	38° 55'	-72° 53'
	15	38° 58'	-72° 50'
	16	39° 0'	-72° 49'
	17	39° 3'	-72° 46'
	18	39° 4'	-72° 44'
Baltimore Canyon	1	38° 4'	-73° 51'
	2	38° 9'	-73° 52'
	3	38° 12'	-73° 52'
	4	38° 14'	-73° 50'
	5	38° 12'	-73° 49'
	6	38° 11'	-73° 50'
	7	38° 8'	-73° 47'
	8	38° 1'	-73° 32'
	9	37° 53'	-73° 38'
Norfolk Canyon	1	37° 6'	-74° 44'
	2	37° 7'	-74° 41'
	3	37° 4'	-74° 37'
	4	37° 4'	-74° 01'
	5	36° 52'	-74° 01'
	6	37° 0'	-74° 38'
	7	37° 4'	-74° 41'
	8	37° 5'	-74° 45'

Table 5 – Size and depth of Option A coral zones

Area name	Area size, km^2	Minimum depth, m	Maximum depth, m
Heezen Canyon	205	150	2250
Lydonia Canyon	311	200	2100
Oceanographer Canyon	380	250	2300
Veatch Canyon	179	200	1700
Mey-Lindenkohl slope	2732	200	2400
Baltimore Canyon	433	250	1600
Norfolk Canyon	898	250	2350

Although **Heezen Canyon** has only moderately adequate coral observations, corals have been found during all dives conducted. Also, suitable coral habitat (bathymetry and geology) has been documented.

Both **Lydonia Canyon** and **Oceanographer Canyon** have been relatively well surveyed. They are recommended as coral zones based on documented presence of corals and suitable coral habitat. In **Veatch Canyon**, there has been a lesser amount of survey work with some information on corals, although there are no images or physical samples. Substrate appears to be suitable, and the habitat suitability analysis indicated sufficient relief to expose rock outcrops.

A slope coral zone (**Mid-Atlantic canyons and surrounding slope – Mey, Hendrickson, Toms, S. Toms, Berkley, Carteret, Lindenkohl**) is also recommended. With the exception of Lindenkohl Canyon and Toms Canyon, the canyons in this region tend to have lower cross-sectional relief and are not individually recommended as coral zones. Further, some do not noticeably incise the shelf, and therefore were not able to be measured as part of the GIS analysis. However, this area offshore New Jersey including Mey, Hendrickson, Toms, S. Toms, Berkley, Carteret, and Lindenkohl canyons and the adjacent slope areas is recommended as a discrete coral zone because it is topographically and geologically complex, with rather unique sedimentary rock outcrop features. In particular, submersible dives near Berkley Canyon have documented exposed chalky sedimentary rocks dissected by furrows, and these same features were inferred to adjacent slope areas by comparing side scan sonar imagery between the dive site and adjacent sites (Robb et al 1983). These exposed rocks are suitable for coral attachment. Various types of corals have been found in the area, including species that inhabit soft sediments and species that require bedrock or other hard substrates for attachment (Hecker and Blechschmidt 1979, Hecker et al. 1983).

Baltimore Canyon has been relatively well surveyed for corals, and they are locally very abundant. **Norfolk Canyon** has been moderately well surveyed for corals, and a diversity of species have been found.

2.2.2 Option B: Canyon coral zones based of habitat suitability

All of these canyons fell within the threshold of having at least a 450 meter or greater maximum relief, so likelihood of outcropping rocks and thus suitable habitats was inferred. Relief was measured from the canyon rim to the canyon floor along the center axis, at a cross section taken based on the three degree slope contour. The details of this analysis are provided in the coral background document. All of the discrete areas recommended based on habitat suitability are shown on Map 6. Each of the 16 areas is described briefly below, listed from north to south.

Map 5 - Discrete coral zone option B. Note that the caption for Heel Tapper Canyon is not shown on the map – it is between Gilbert and Welker.

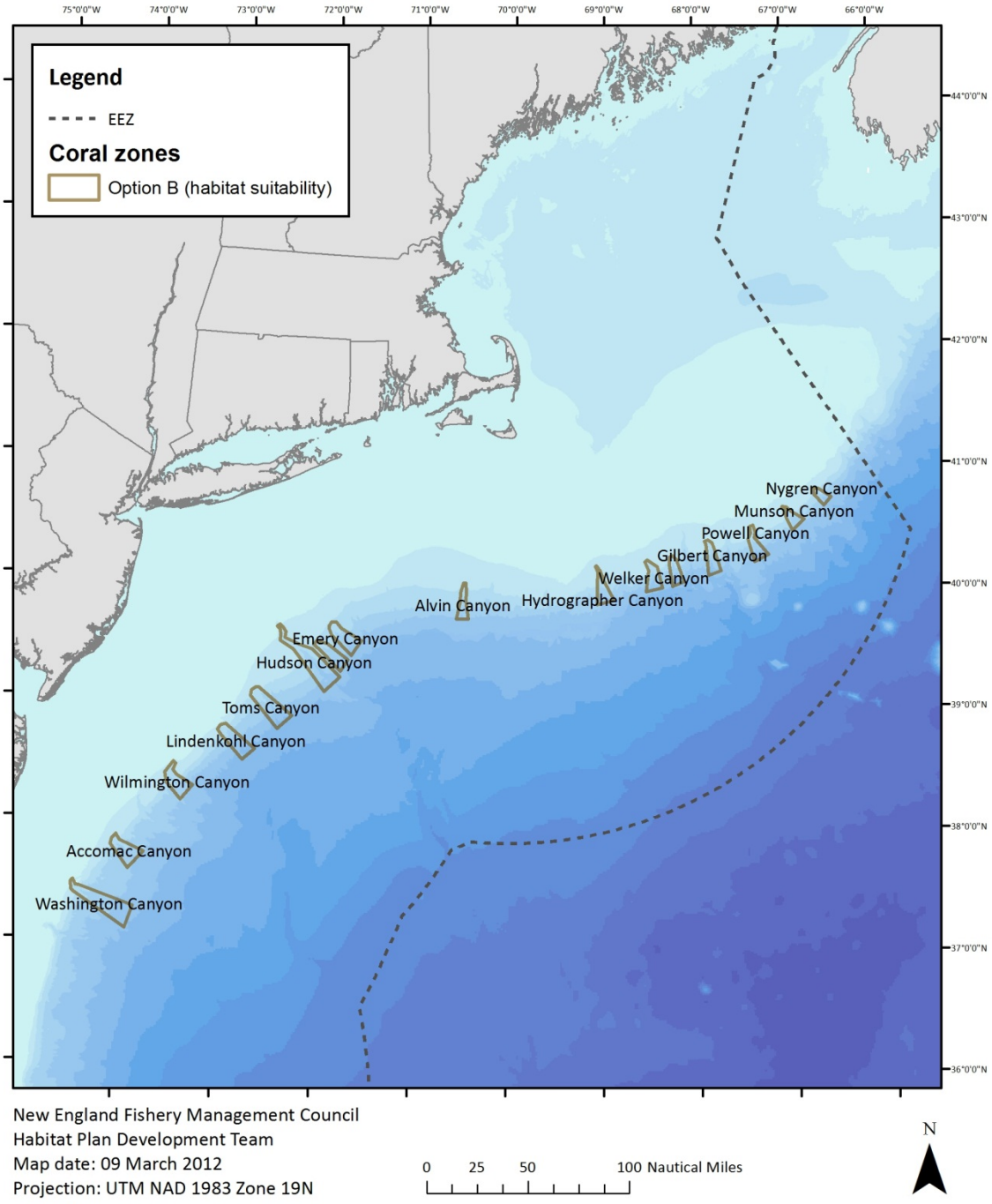


Table 6 – Coordinates for Option B coral zones

Option B – Canyon areas	Point	Latitude	Longitude
Nygren Canyon	1	40° 49'	-66° 41'
	2	40° 44'	-66° 33'
	3	40° 40'	-66° 38'
	4	40° 46'	-66° 44'
	5	40° 48'	-66° 44'
	6	40° 49'	-66° 43'
Munson Canyon	1	40° 40'	-67° 04'
	2	40° 40'	-67° 02'
	3	40° 37'	-66° 58'
	4	40° 34'	-66° 51'
	5	40° 28'	-66° 58'
	6	40° 34'	-67° 02'
	7	40° 39'	-67° 03'
	8	40° 39'	-67° 05'
Powell Canyon	1	40° 31'	-67° 24'
	2	40° 28'	-67° 22'
	3	40° 25'	-67° 23'
	4	40° 16'	-67° 14'
	5	40° 13'	-67° 23'
	6	40° 24'	-67° 27'
	7	40° 27'	-67° 26'
	8	40° 30'	-67° 26'
Gilbert Canyon	1	40° 22'	-67° 54'
	2	40° 23'	-67° 55'
	3	40° 24'	-67° 53'
	4	40° 23'	-67° 50'
	5	40° 20'	-67° 49'
	6	40° 9'	-67° 45'
	7	40° 7'	-67° 53'
	8	40° 19'	-67° 54'
Heel Tapper Canyon	1	40° 12'	-68° 18'
	2	40° 16'	-68° 18'
	3	40° 17'	-68° 16'
	4	40° 14'	-68° 13'
	5	40° 4'	-68° 09'
	6	40° 1'	-68° 16'
Welker Canyon	1	40° 13'	-68° 34'
	2	40° 14'	-68° 32'
	3	40° 11'	-68° 26'
	4	40° 1'	-68° 23'
	5	39° 59'	-68° 33'

Option B – Canyon areas	Point	Latitude	Longitude
	6	40° 9'	-68° 31'
Hydrographer Canyon	1	40° 11'	-69° 06'
	2	40° 12'	-69° 05'
	3	40° 9'	-69° 02'
	4	40° 4'	-68° 60'
	5	39° 55'	-68° 54'
	6	39° 52'	-69° 04'
	7	40° 2'	-69° 04'
	8	40° 9'	-69° 04'
Alvin Canyon	1	39° 45'	-70° 35'
	2	39° 53'	-70° 32'
	3	39° 58'	-70° 32'
	4	40° 3'	-70° 30'
	5	40° 3'	-70° 29'
	6	39° 58'	-70° 28'
	7	39° 54'	-70° 28'
	8	39° 45'	-70° 27'
Emery Canyon	1	39° 40'	-71° 56'
	2	39° 42'	-71° 54'
	3	39° 42'	-71° 51'
	4	39° 39'	-71° 48'
	5	39° 33'	-71° 35'
	6	39° 25'	-71° 41'
	7	39° 35'	-71° 54'
	8	39° 38'	-71° 56'
Jones, Babylon Canyons	1	39° 30'	-72° 05'
	2	39° 32'	-72° 03'
	3	39° 31'	-71° 56'
	4	39° 23'	-71° 43'
	5	39° 17'	-71° 48'
	6	39° 27'	-71° 60'
Hudson Canyon	1	39° 22'	-72° 12'
	2	39° 28'	-72° 18'
	3	39° 32'	-72° 26'
	4	39° 35'	-72° 26'
	5	39° 37'	-72° 27'
	6	39° 39'	-72° 29'
	7	39° 40'	-72° 27'
	8	39° 39'	-72° 25'
	9	39° 36'	-72° 23'
	10	39° 33'	-72° 23'
	11	39° 30'	-72° 15'
	12	39° 28'	-72° 06'

Option B – Canyon areas	Point	Latitude	Longitude
	13	39° 15'	-71° 48'
	14	39° 7'	-71° 58'
Toms Canyon	1	39° 7'	-72° 44'
	2	39° 9'	-72° 41'
	3	39° 9'	-72° 39'
	4	38° 55'	-72° 17'
	5	38° 48'	-72° 26'
	6	39° 4'	-72° 44'
Lindenkohl Canyon	1	38° 47'	-73° 04'
	2	38° 49'	-73° 02'
	3	38° 50'	-72° 59'
	4	38° 38'	-72° 40'
	5	38° 32'	-72° 48'
	6	38° 44'	-73° 02'
Wilmington Canyon	1	38° 20'	-73° 35'
	2	38° 25'	-73° 36'
	3	38° 30'	-73° 31'
	4	38° 29'	-73° 29'
	5	38° 26'	-73° 31'
	6	38° 24'	-73° 28'
	7	38° 19'	-73° 18'
	8	38° 11'	-73° 25'
Accomac Canyon	1	37° 48'	-74° 08'
	2	37° 51'	-74° 07'
	3	37° 53'	-74° 04'
	4	37° 50'	-74° 02'
	5	37° 45'	-73° 47'
	6	37° 36'	-73° 56'
Washington Canyon	1	37° 30'	-74° 30'
	2	37° 7'	-73° 56'
	2	37° 18'	-73° 52'
	2	37° 23'	-74° 28'
	2	37° 25'	-74° 30'
	2	37° 27'	-74° 26'
	2	37° 27'	-74° 28'
	2	37° 28'	-74° 31'

Table 7 – Size and depth of Option B coral zones

Area name	Area size, km^2	Minimum depth, m	Maximum depth, m
Nygren Canyon	128	250	2100
Munson Canyon	177	200	1650
Powell Canyon	253	250	2200
Gilbert Canyon	265	250	2400
Heel Tapper Canyon	221	300	2500
Welker Canyon	274	250	2150
Hydrographer Canyon	267	200	1800
Alvin Canyon	209	350	2000
Emery Canyon	400	400	1900
Jones, Babylon Canyons	325	450	2100
Hudson Canyon	871	150	2100
Toms Canyon	578	200	2300
Lindenkohl Canyon	448	200	2400
Wilmington Canyon	378	150	1700
Accomac Canyon	404	250	1700
Washington Canyon	820	200	2250

Nygren Canyon, **Munson Canyon**, and **Powell Canyon** are among the smaller canyons in the shelf/slope region south of Georges Bank, and we know very little about them. However, they are relatively deep, and at the three degree slope contour they all have a relief from the rim of the canyon to the seafloor at the thalweg that exceeds 450 m.

Gilbert Canyon lies between two well-studied canyons, Lydonia and Oceanographer, but has not been surveyed for corals. It is recommended on the basis of habitat suitability as its height exceeds the 450 m threshold.

Heel Tapper Canyon and **Welker Canyon** lie southwest of Oceanographer Canyon. While we know very little about them, they are relatively deep, and at the three degree slope contour they each have a relief from the rim of the canyon to the seafloor at the thalweg that exceeds 450 m.

Very limited survey work has been conducted in Hydrographer Canyon, so a recommendation could not be made on the basis of coral or geological data. **Hydrographer Canyon** is narrow and steep relative to other canyons, and has a cross sectional relief value of over 900 m. Therefore, the area is recommended as a coral zone based on the inference of suitable habitat.

Similar to Hydrographer, coral survey work to support assessment of **Alvin Canyon** as a coral zone is inadequate, as there have been no surveys for corals. However, the relief of Alvin Canyon from the canyon rim to the seafloor along the thalweg at the three degree slope contour was measured at 721 m, which is greater than the 450 m threshold for inferring suitable habitat. Therefore, Alvin Canyon is recommended as a discrete coral zone.

Emery Canyon and **Babylon/Jones Canyons** are also recommended on the basis of inferred habitat suitability. Note that a single set of bathymetry/slope measurements was taken for both Jones and Babylon Canyons combined. These canyons are just north of Hudson Canyon.

Hudson Canyon has had lots of survey work, but relative to its very large size, there are still many areas that have not been studied. Small corals and sea pens have been observed in the canyon, but other coral types have not. However, suitable habitat may exist, particularly on the eastern wall. Hudson Canyon's cross sectional relief was measured at 926 m, and it is therefore recommended on the basis of inferred habitat suitability.

Toms Canyon and **Lindenkohl Canyon** lie south of Hudson Canyon in an area that contains substantial chalk outcrops (see the Mid-Atlantic slope area described in the previous section). Most of the canyons in this area are not very deep, but Toms and Lindenkohl are large enough to meet the 450 m cross sectional relief criteria, so they are recommended individually as discrete coral zones. Note that if the entire slope are is selected, individual zones in Toms and Lindenkohl would not be necessary as the Toms and Lindenkohl Canyon boundaries are within the Mey-Lindenkohl slope zone boundaries.

Wilmington Canyon is large and steeply sloping, with a cross-sectional relief measurement of 989 m, such that the presence of suitable habitats is inferred. Neighboring **Accomac Canyon** has a cross-sectional relief measurement of 617 m, and is therefore also recommended as a discrete coral zone on the basis of inferred habitat suitability.

Survey work for corals in **Washington Canyon** is very limited, although new multibeam bathymetry data were collected in 2011 and additional coral studies are planned for the future. Washington Canyon has a cross-sectional relief measurement of 636 m, and is therefore recommended as a discrete coral zone on the basis of inferred habitat suitability.

2.2.3 Option C: Seamount coral zones

Four seamounts are recommended as discrete coral zones. **Bear Seamount** is relatively well studied in terms of coral distributions, and a variety of species have been documented. Although it has not been surveyed as well as Bear Seamount, **Retriever Seamount** has been surveyed for corals and a variety of species have been documented. **Physalia Seamount** and **Mytilus Seamount** have not been surveyed for corals, but suitable habitat is inferred

based on similarities with Bear and Retriever Seamounts. All the seamounts have been mapped using multibeam echosounders, and these bathymetry data were used to define the boundaries of each discrete zone. Compiled bathymetry data were obtained from USGS (Jason Chaytor, personal communication). Additional information about the seamounts can be found in the background document.

Map 6 - Discrete coral zone option C – Seamounts. A hillshaded bathymetry file is overlaid to provide a clearer depiction of seamount topography.

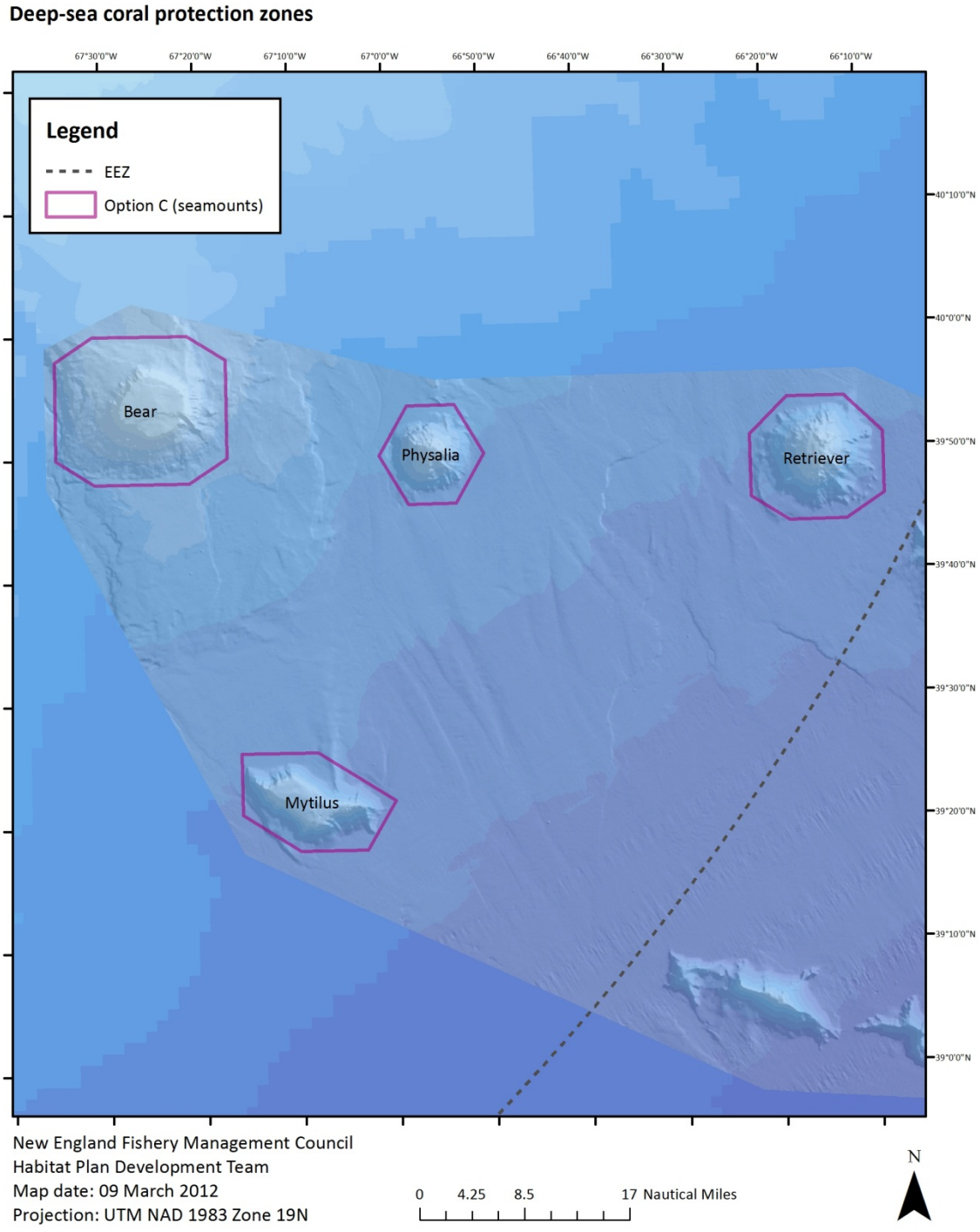


Table 8 – Coordinates for Option C coral zones

Option C – Seamounts	Point	Latitude	Longitude
Bear	1	40° 0'	-67° 21'
	2	39° 58'	-67° 17'
	3	39° 50'	-67° 17'
	4	39° 48'	-67° 21'
	5	39° 48'	-67° 31'
	6	39° 50'	-67° 35'
	7	39° 58'	-67° 35'
	8	40° 0'	-67° 31'
Physalia	1	39° 54'	-66° 58'
	2	39° 54'	-66° 53'
	3	39° 50'	-66° 50'
	4	39° 46'	-66° 53'
	5	39° 46'	-66° 58'
	6	39° 50'	-67° 01'
Retriever	1	39° 54'	-66° 18'
	2	39° 54'	-66° 12'
	3	39° 51'	-66° 08'
	4	39° 46'	-66° 08'
	5	39° 44'	-66° 12'
	6	39° 44'	-66° 18'
	7	39° 46'	-66° 22'
	8	39° 51'	-66° 22'
Mytilus	1	39° 26'	-67° 08'
	2	39° 22'	-67° 00'
	3	39° 18'	-67° 03'
	4	39° 18'	-67° 10'
	5	39° 21'	-67° 16'
	6	39° 26'	-67° 16'

Table 9 – Size and depth of seamount coral zones

Area name	Area size, km^2	Minimum depth, m	Maximum depth, m
Bear Seamount	527	1100	3100
Retriever Seamount	317	1900	4000
Physalia Seamount	169	1900	3700
Mytilus Seamount	258	2400	4000

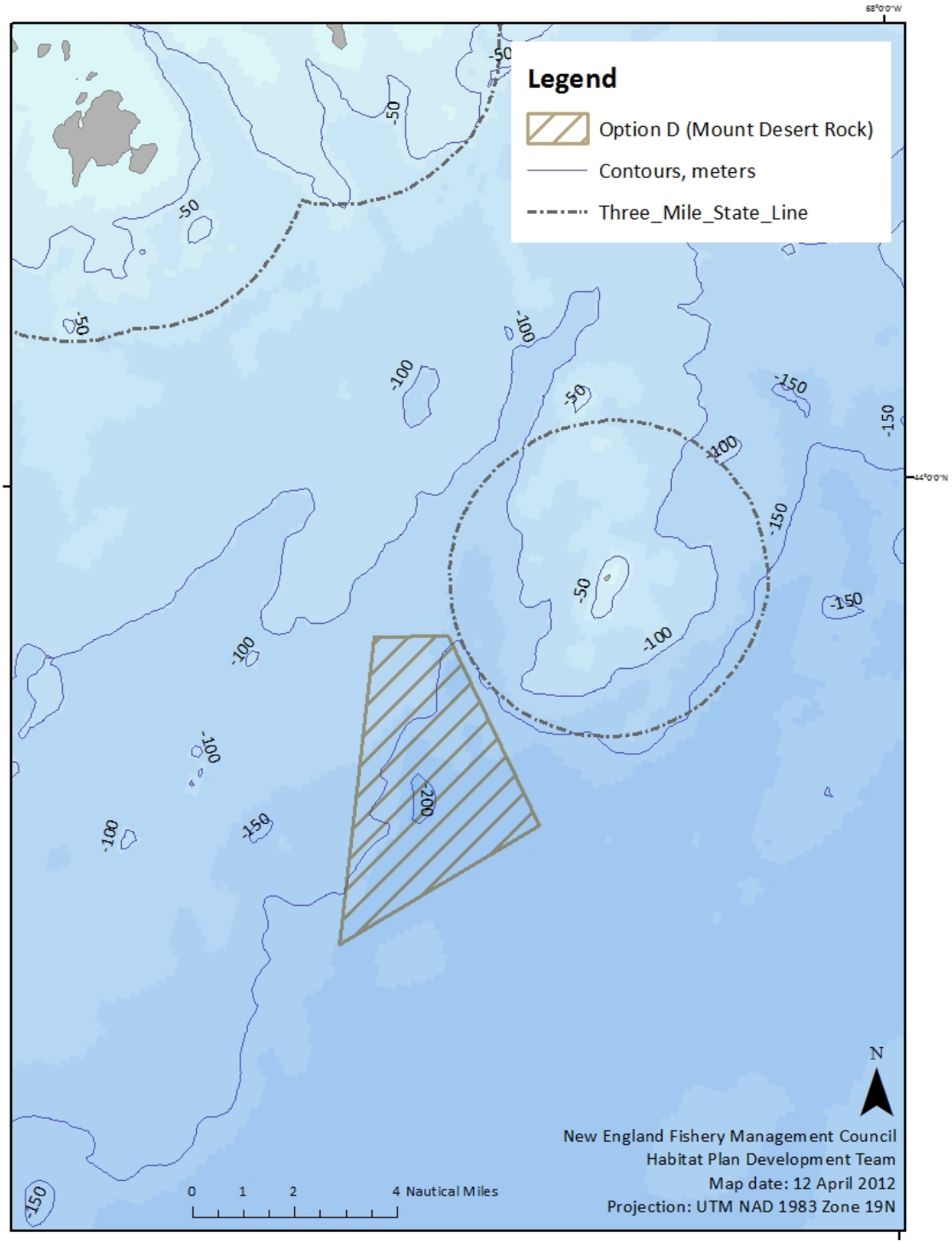
2.2.4 Option D: Gulf of Maine coral zones

Two locations in the Gulf of Maine are recommended as discrete coral zones.

Mount Desert Rock is located approximately 30 km offshore of Mt Desert Island, Maine. The waters immediately surrounding the rock itself are 30-40 meters deep. The suggested coral zone area to the southwest of Mount Desert Rock (see Map 7) has water depths ranging from approximately 100 m to 190 m. Corals in this area and associate hard substrates have been documented via remotely operated vehicle (ROV) surveys. The PDT also suggested designation of a larger area include some state waters as a coral zone, but not implementing any fishery restrictions in the area, but the Committee did not wish to move forward with this second option.

Jordan Basin is 200-270 m deep basin located in the eastern Gulf of Maine that straddles the US/CAN EEZ. Although much of the basin contains soft sediments, there are steep rock patches (bumps) in the western (US waters) part of the basin that have been found to harbor various types of corals. These bumps are generally somewhat shallower than the areas surrounding them. Corals have also been documented in eastern Jordan Basin, on the Canadian side of the EEZ. Four areas (Map 8) are suggested as coral zones in Western Jordan Basin, including three 'bumps' which have been surveyed using ROV and documented to have corals and suitable hard substrates (WJB 1-3), plus one additional area (WJB 4) that is also somewhat shallower than the area surrounding it and would be expected to have similar hard substrates and corals. The PDT suggested a second option grouping areas 1 and 2 into WJB 5 and areas 3 and 4 into WJB 6 to create larger zones that include the shallower coral areas and adjacent deeper habitats, but the Committee did not wish to move forward with this second option.

Map 7 - Discrete coral zone option D – Mt Desert Rock



Map 8 - Discrete coral zone option D – Western Jordan Basin

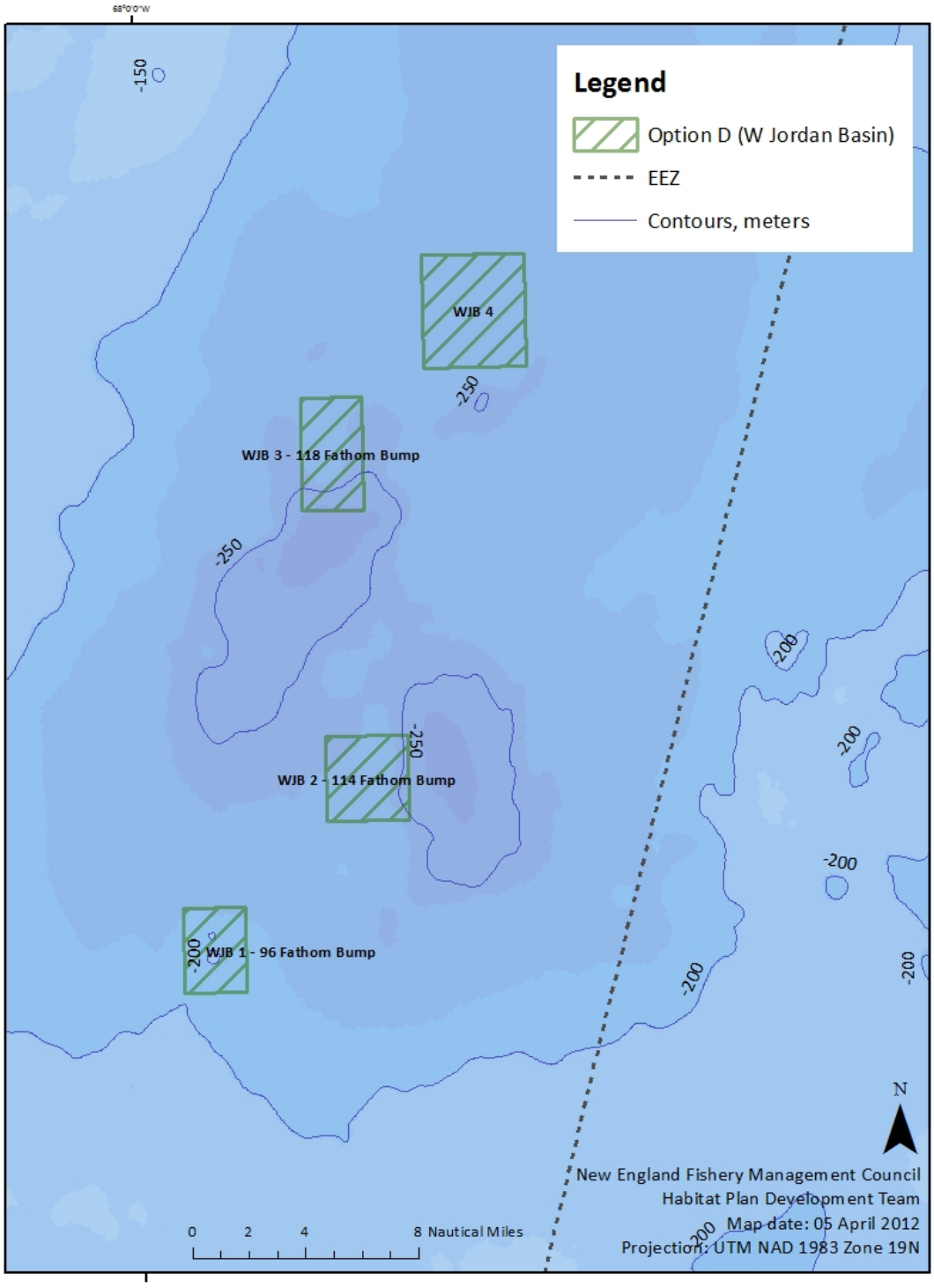


Table 10 – Coodinates for Option D coral zones

Option D – Gulf of Maine	Point	Latitude	Longitude
Mt Desert Rock	1	43° 53'	-68° 10'
	2	43° 51'	-68° 15'
	3	43° 57'	-68° 14'
	4	43° 57'	-68° 12'
WJB 1 - 96 Fathom Bump	1	43° 14'	-67° 58'
	2	43° 17'	-67° 58'
	3	43° 17'	-67° 55'
	4	43° 14'	-67° 55'
WJB 2 - 114 Fathom Bump	1	43° 23'	-67° 47'
	2	43° 20'	-67° 47'
	3	43° 20'	-67° 51'
	4	43° 23'	-67° 51'
WJB 3 - 118 Fathom Bump	1	43° 35'	-67° 49'
	2	43° 31'	-67° 49'
	3	43° 31'	-67° 52'
	4	43° 35'	-67° 52'
WJB 4	1	43° 40'	-67° 41'
	2	43° 36'	-67° 41'
	3	43° 36'	-67° 46'
	4	43° 40'	-67° 46'

Table 11 – Size and depth of Gulf of Maine coral zones

Area name	Area size, km^2	Minimum depth, m	Maximum depth, m
Mt Desert Rock	47	60	110
WJB 1 - 96 Fathom Bump	23	110	120
WJB 2 - 114 Fathom Bump	30	130	140
WJB 3 - 118 Fathom Bump	30	130	140
WJB 4	50	120	130

2.3 Fishing restrictions for broad and discrete coral zones

The following range of management measures would potentially apply to all coral zones. Different measures could be used in broad vs. discrete zones, or in different types of discrete zones, depending on the fisheries that occur there and the degree of precaution desired. Note that broad and discrete zones could be used in combination, with different types of measure applied in each. For example, a mobile bottom tending gear restriction could be applied across all zones, but exemptions to this might only be allowed in the broad zone, not in the discrete zones.

2.3.1 Fishing restriction options for coral zones

These options would determine the level of fishing restrictions applied to the coral zones.

2.3.1.1 Fishing restriction option A: Bottom-tending gears

This option would prohibit the use of bottom-tending fishing gears in deep-sea coral zones, but would allow the use of gears that do not contact the seabed. Note that the lobster trap fishery, which is managed by ASMFC, would not be subject to this restriction.

2.3.1.1.1 Suboption A1: Exempt the red crab fishery from coral zone restrictions

This option would exempt the red crab fishery from bottom-tending gear restrictions.

2.3.1.2 Fishing restriction option B: Mobile bottom-tending gears

This option would prohibit the use of mobile bottom-tending fishing gears in deep-sea coral zones, but would allow the use of fixed gears and any gears that do not contact the seabed.

2.3.2 Exemptions to fishing prohibitions

The intention of an exemption program would be to provide continued fishery access to the coral zone area in a way that considers coral conservation needs and allows for the collection of data to support coral management efforts. There is no single set of standards for issuance of exempted fishing permits or letters of authorization, but many have the following elements in common:

- Require vessel to apply for a permit or letter of authorization
- Detailed season, area, and gear requirements (seasonal issues might not be important for corals, but area and gear requirements would be)
- List of allowable target and incidental species
- Additional reporting requirements – this could include, for example, a requirement to carry an at-sea observer, or to retain any corals caught
- Vessel monitoring system requirement
- For an LOA, a specified participation period that is (1) a minimum of 7 days (for administrative reasons, (2) describes what, if any, fishing restrictions are put on the vessel during the time period, even if they are not in the exemption program, and (3) details the requirements of the exempted fishery
- "Good standing" requirement - requires that the vessel is up to date on VTRs, etc.

In addition, a move-along provision might be appropriate for coral zones - this option would require vessels fishing in a specified deep-sea coral zone to stop fishing if they catch corals at a rate greater than some specified threshold.

2.3.3 Framework provisions for deep-sea coral zones

These options would allow management measures for coral zones to be developed via framework action. Note that boundary issues, including creation of new coral zones, modification of the boundaries of existing coral zones, or removal of coral zones, would not be frameworkable.

2.3.3.1 Option A: Change fishing restrictions

This option would include changes to the types of fishing gears restricted from use in deep-sea coral zones.

2.3.3.2 Option B: Change exemption fishery requirements

This would include changes to management measures associated with exemption programs, such as permit and observer requirements, and move-along provisions.

2.4 Considered and rejected coral alternatives

2.4.1 Considered and rejected boundary options

2.4.1.1 Broad coral zone with landward boundary based on 200 m contour

The Committee discussed this option but rejected it from further consideration at their February 2012 meeting.

2.4.1.2 Considered and rejected discrete deep-sea coral zones

The PDT evaluated the following canyon and slope areas as possible discrete coral zones, but did not recommend them. The Committee concurred with the PDT's assessment and did not ask for further analysis of these options at their February 23, 2012 meeting.

- **Slope near U.S. – Canadian border.** Although there are some coral observations from camera tows in this area, and some hard substrates have been documented, the PDT did not think there was enough evidence to warrant recommending this slope area as a discrete coral zone.
- **Slope between Veatch and Hydrographer Canyons.** This area is not recommended as a coral zone. Although small cup corals (hard coral *Dasmosmilia lymani*) and some sea pens are relatively common, other coral types are not. Evidence suggests that hard substrates in this area consist of glacial erratics, not rock outcrops.
- **Slope west of Alvin and Atlantis Canyons.** Similar to above, this area is not recommended as a coral zone. Although small cup corals (hard coral *Dasmosmilia lymani*) and some sea pens are relatively common, other coral types are not. Evidence suggests that hard substrates in this area consist of glacial erratics, not rock outcrops.
- **Slope area between Baltimore and Accomac canyons.** This area is not recommended as a coral zone. Evidence suggests that hard substrates in this area consist of glacial erratics, not rock outcrops.
- **Canyons not recommended based on GIS analysis: Chebacco, Filebottom, Sharpshooter, Dogbody, Shallop, Nantucket, Atlantis, Block, McMaster, Ryan Canyon, Uchupi, and Spencer Canyons.** These canyons are not recommended as they are shallower and incise the shelf to a lesser degree. Specifically, their relief from canyon rim to the seafloor along the axis/thalweg were less than 450 m. Atlantis Canyon was discussed in the greatest detail as it was previously examined and recommended in the context of HAPC designations. It has no deep-sea extensions, and only incises the shelf 5 km (Pratt 1967). This shallow incision into the shelf edge was assumed to indicate a lesser likelihood of rock outcrops and thus suitable habitat. The GIS analysis indicated that the relief of Atlantis Canyon from the canyon rim to the seafloor along the thalweg at the three degree slope contour was less than 450 m, so suitable habitat was not inferred. In addition, coral survey work to support assessment of this canyon as coral zones is inadequate, as there have been no surveys for corals. Due to lack of coral data evidence and inferred lack

of suitable habitats, this canyon is not recommended as a coral zone. Neighboring Alvin Canyon has greater relief and is recommended on the basis of habitat suitability.

- **Canyons not recommended, did not incise shelf enough to conduct GIS analysis: Clipper, South Wilmington, North Heys, South Vries, Warr, Phoenix, and Leonard Canyons.** These canyons are not recommended as they do not noticeably incise the shelf. Their morphological attributes were not measured during the GIS analysis because they are smaller and shallower, and an appropriate cross section could not be readily identified for the analysis.

Larger discrete coral zones in the Gulf of Maine, not recommended for further analysis at the April 6, 2012 Committee meeting:

- The PDT recommended an expanded version of the Mt Desert Rock zone that extended into similar depths and habitats, and also included some shallower areas within state waters. The objective behind designation of a larger area was to highlight the locations as suitable coral habitat, even if no fishing restrictions were implemented within state waters.
- The PDT also recommended bounding two pairs of areas in Western Jordan Basin (combining areas 1 and 2 and areas 3 and 4), These larger areas would have encompassed a wider range of deeper and shallower habitat types within the basin.

2.4.2 Considered and rejected fishing restriction options

When initially developing a range of management options for coral zones in August 2012, the PDT discussed the following as possible fishing restrictions options, but at the Committee's February 2012 meeting did not recommend them for further analysis. At that meeting, the Committee did not develop fishing restriction options that included these concepts, so they are included here as considered but rejected.

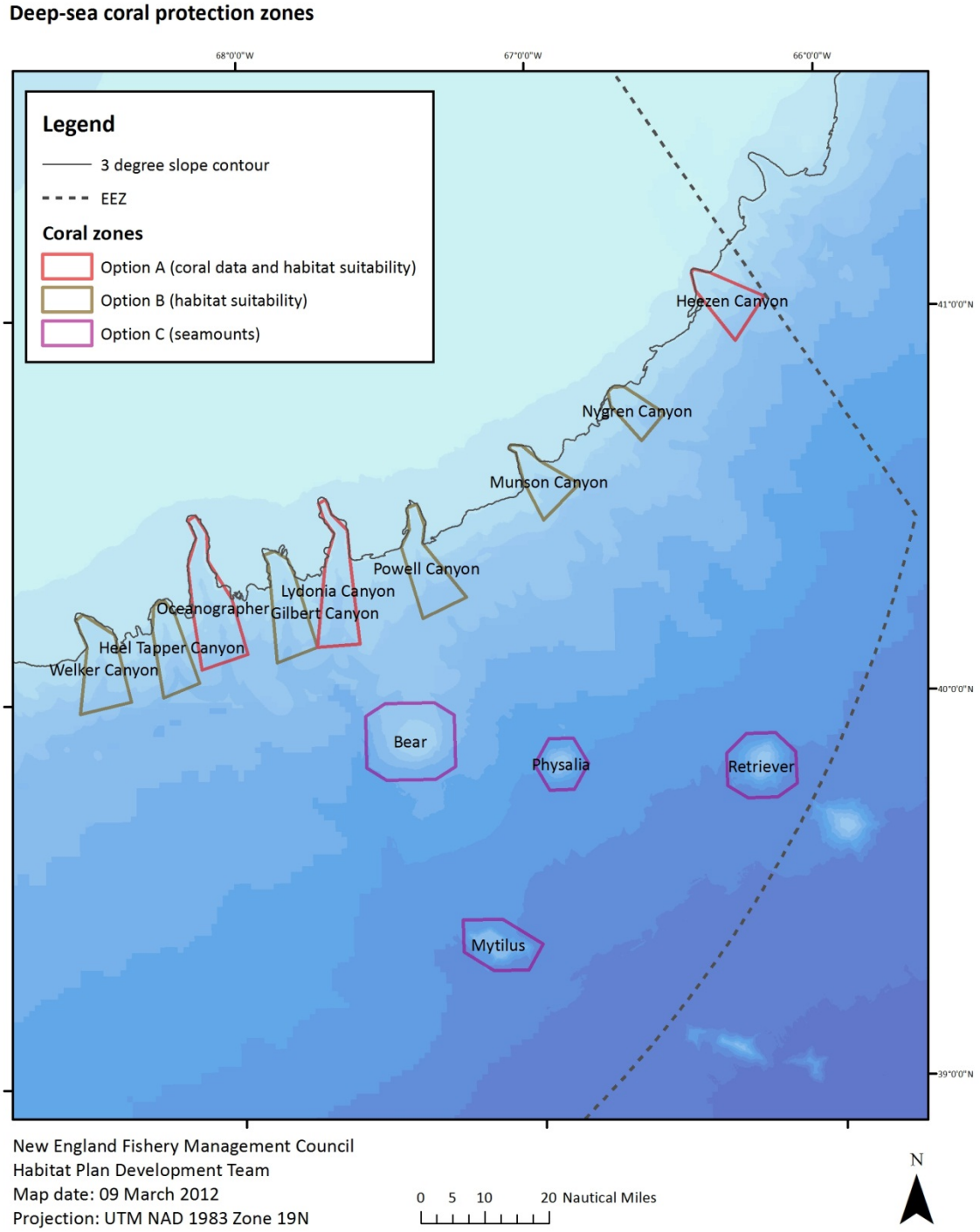
- **Restrict and/or prohibit commercial fishing gears.** This option would have restricted and/or prohibited commercial fishing gear operations in deep-sea coral zones but not recreational fishing gears. Rather than writing the alternatives this way, a better way to structure the document would be to determine the broad level of restriction (all bottom-tending gear, all mobile bottom-tending gear, and then specify which gear types and fisheries specifically the restrictions apply to).
- **Restrict and/or prohibit commercial bottom-tending gears.** This option would have restricted and/or prohibited commercial bottom-tending fishing gear operations in deep-sea coral zones but not recreational bottom tending gears. Again, rather than writing the alternatives this way, a better way to structure the document would be to determine the broad level of restriction (all bottom-tending gear, all mobile bottom-tending gear, and then specify which gear types and fisheries specifically the restrictions apply to).

- **Prohibit use of all fishing gears.** This option would prohibit all types of fishing activity in a specified deep-sea coral zone, including recreational fishing, and would apply to bottom-tending gears, both mobile and fixed, and non-bottom-tending gears. The PDT has discussed that gears that are not bottom tending are unlikely to impact deep-sea corals such that restrictions on these gears do not appear to be necessary for coral conservation.

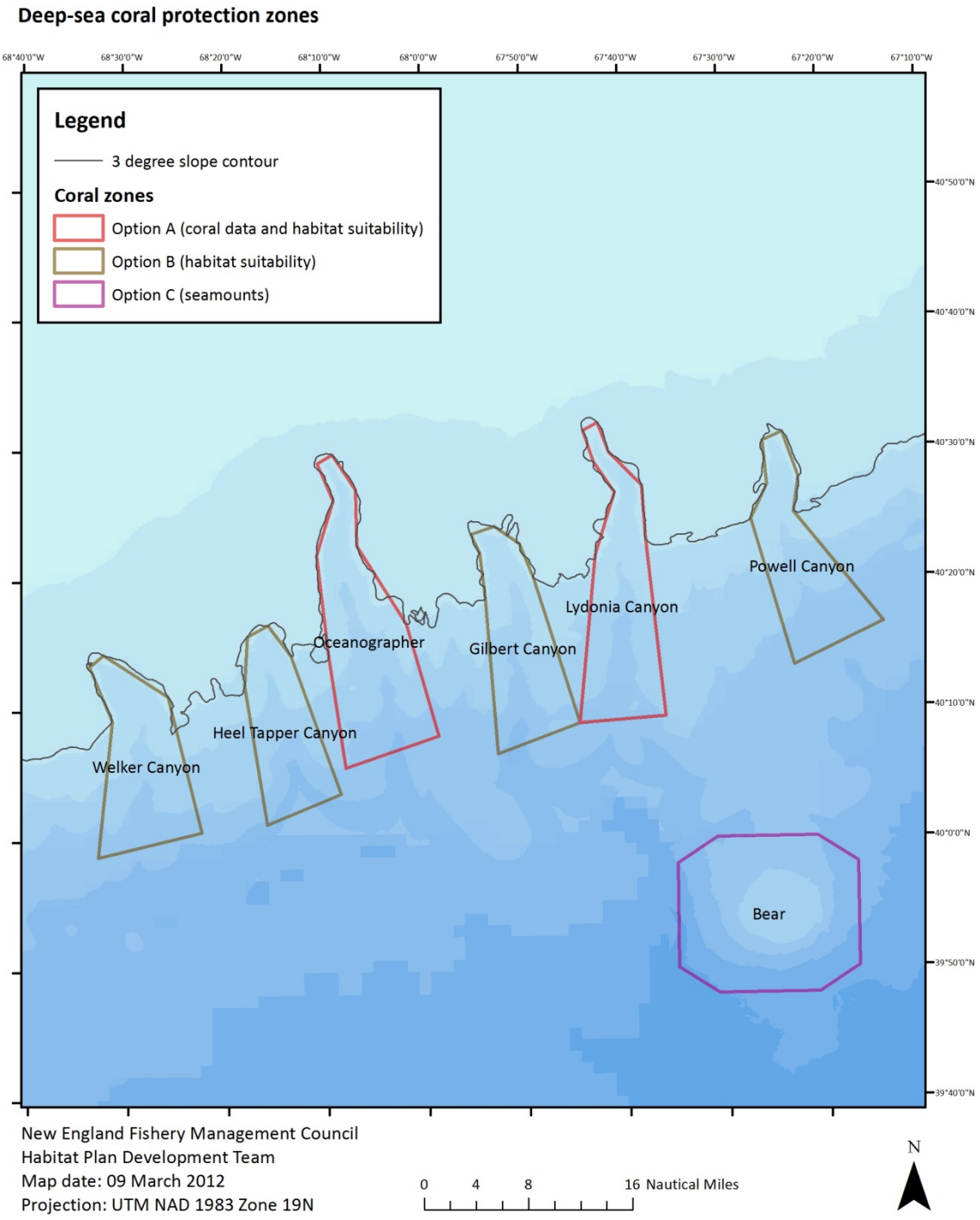
3.0 Additional discrete zone maps

The maps on the following pages show a more detailed view of the various discrete coral zones.

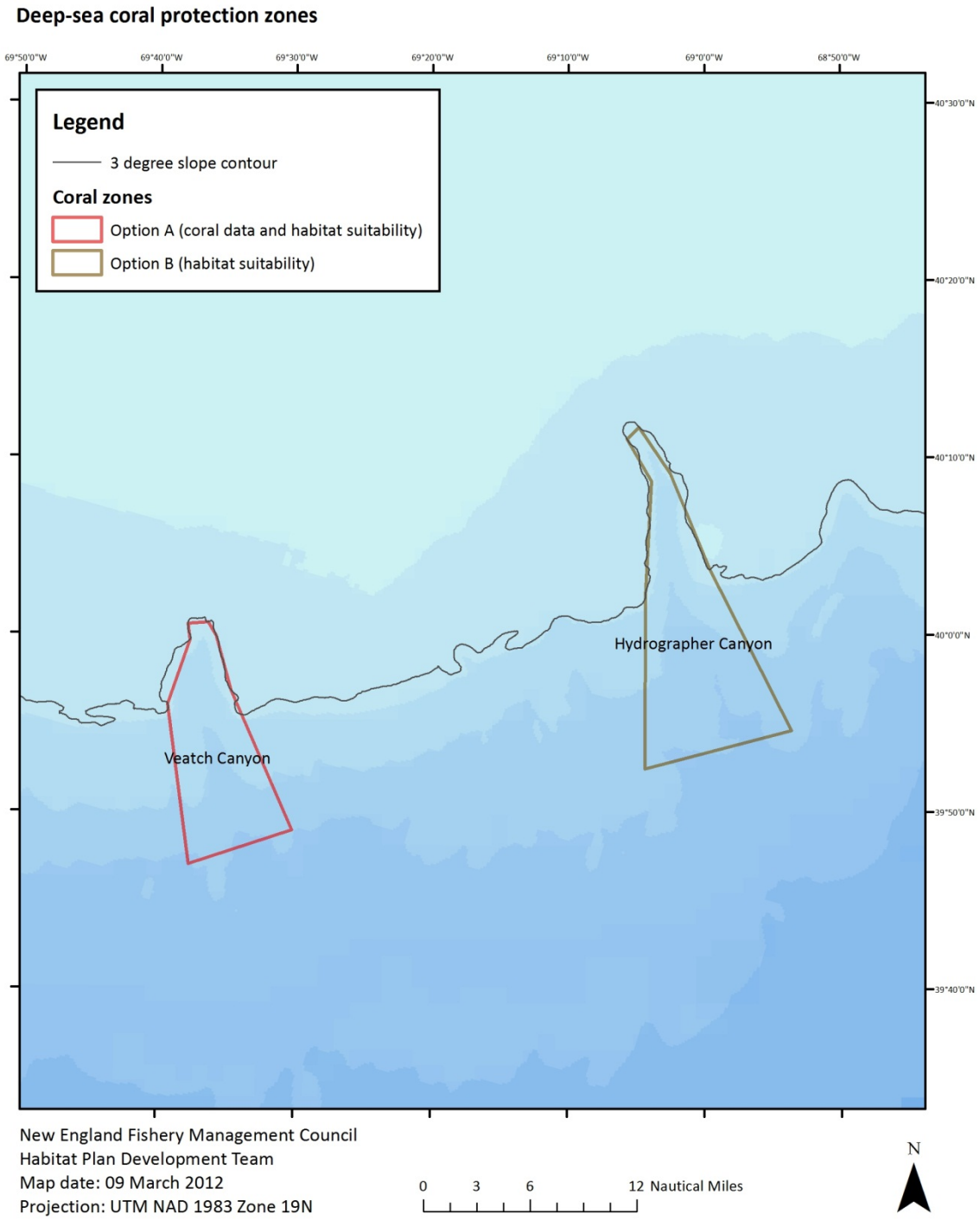
Map 9 – Heezen through Welker canyons, plus seamounts.



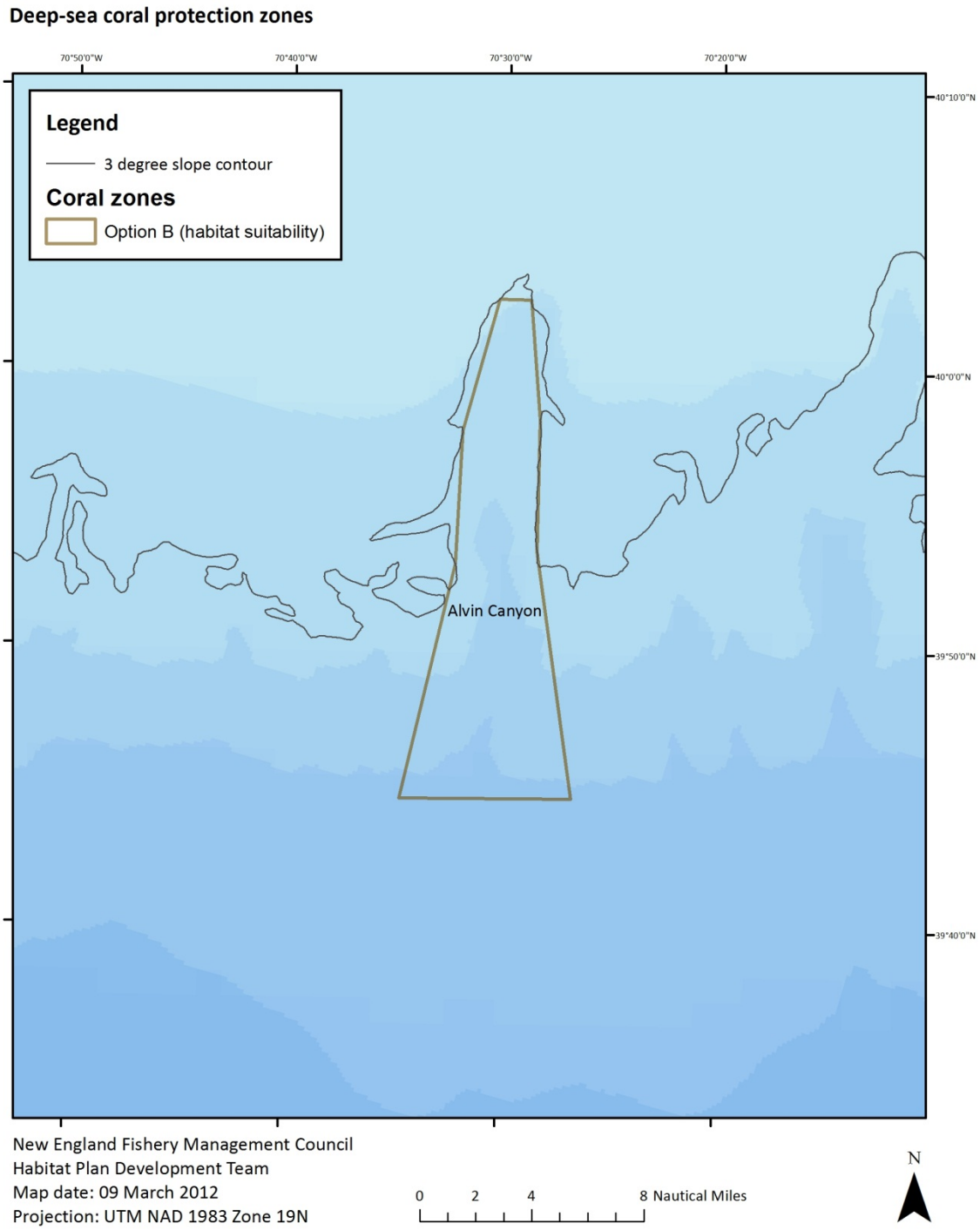
Map 10 – Powell through Welker canyons, plus Bear seamount.



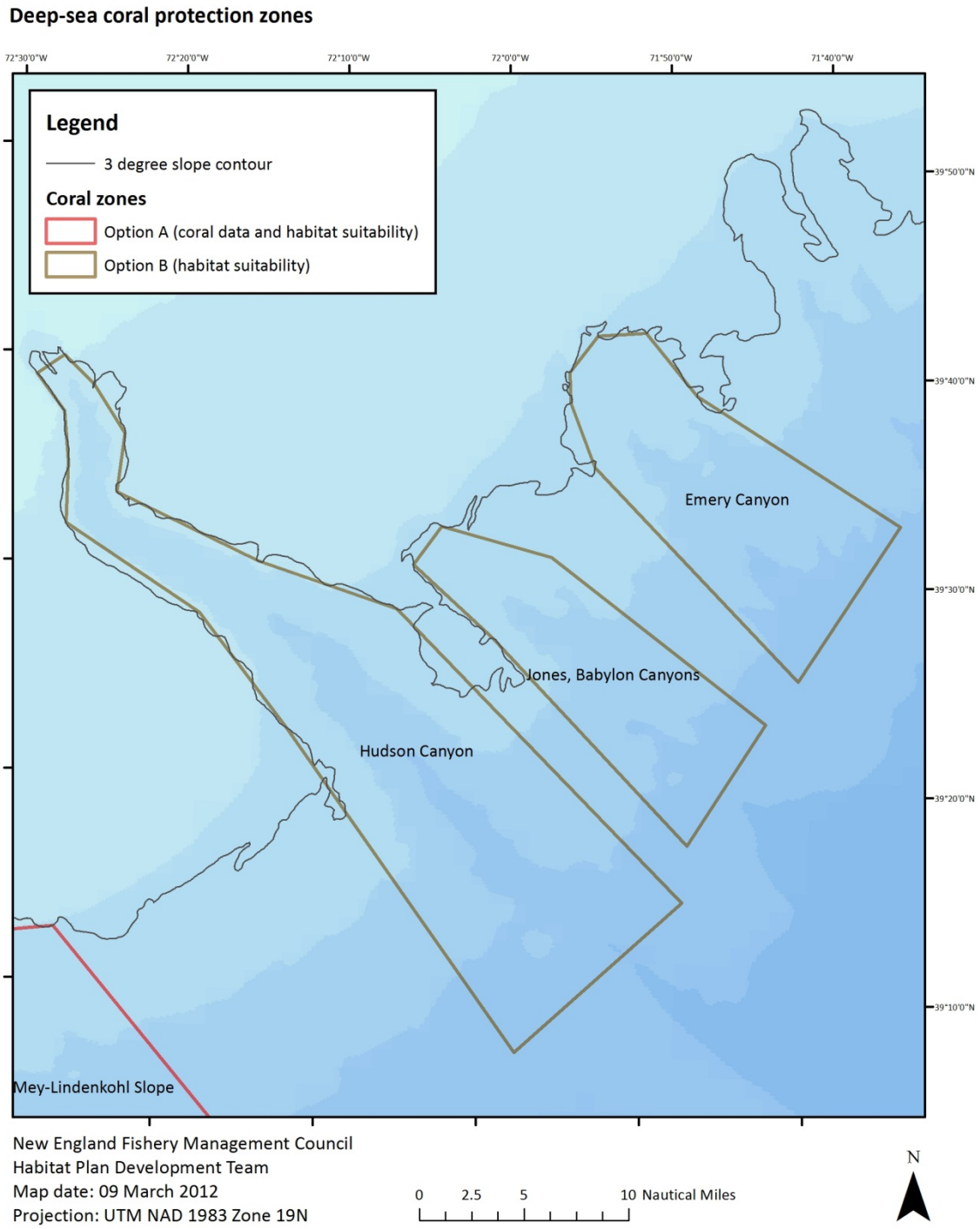
Map 11 – Hydrographer and Veatch canyons.



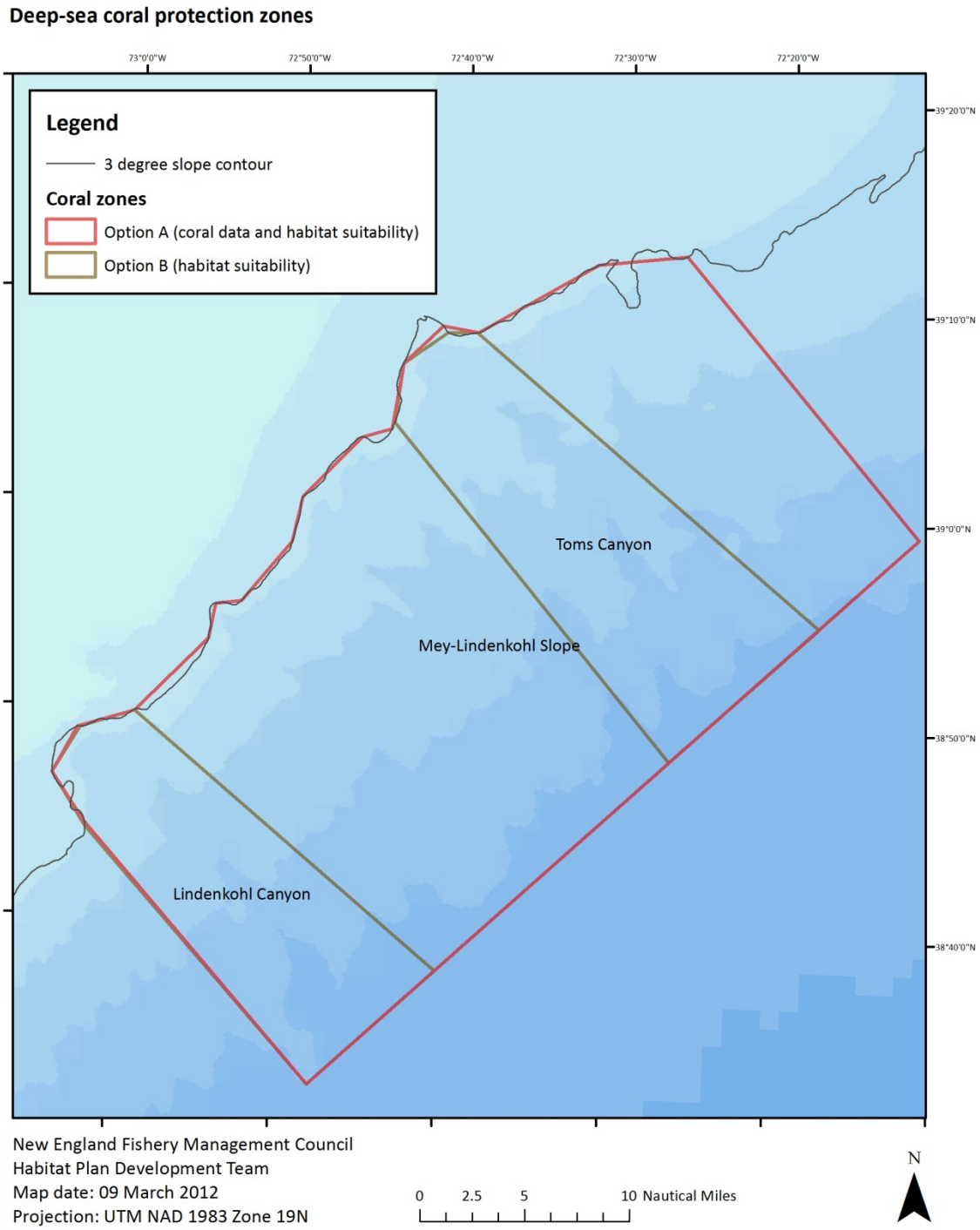
Map 12 – Alvin Canyon.



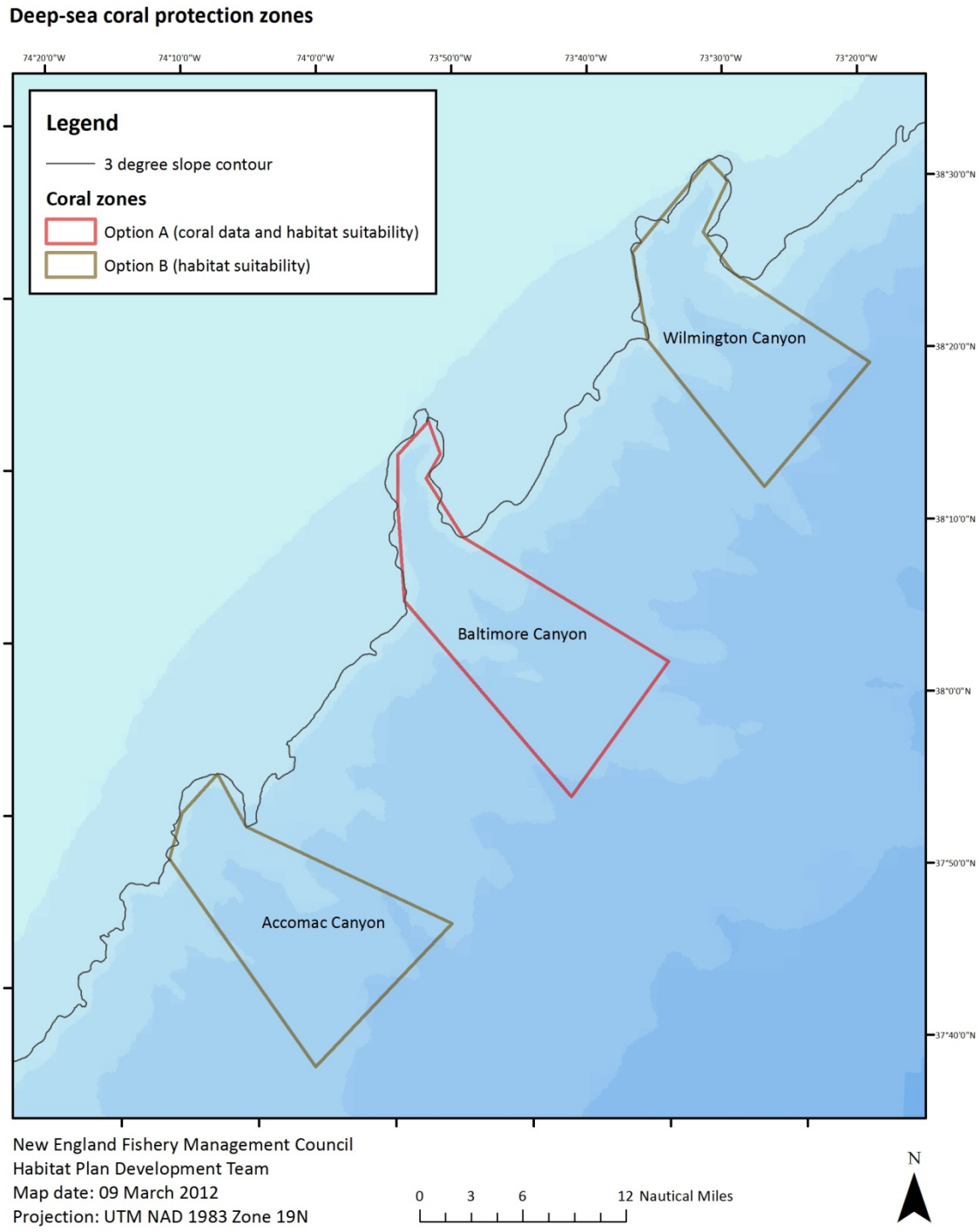
Map 13 – Emery through Hudson canyons.



Map 14 – Toms and Lindenkohl canyons, plus Mey-Lindenkohl slope zone.



Map 15 – Wilmington to Accomac canyons.



Map 16 – Washington and Norfolk canyons.