

DRAFT OMNIBUS DEEP-SEA CORAL AMENDMENT
PUBLIC HEARING DOCUMENT



Prepared by the New England Fishery Management Council
50 Water Street, Mill #2; Newburyport, Massachusetts 01950

The New England Fishery Management Council (NEFMC) is conducting seven public hearings to solicit comments on the alternatives under consideration in the Draft Omnibus Deep-Sea Coral Amendment. More specifically, the Council is seeking feedback from the public on which alternatives should be selected and why. These hearings are being held by the Council in accordance with the National Environmental Policy Act. The Council plans to take final action on the amendment during its June 20-22, 2017 meeting in Portland, Maine.

Deep-sea corals are fragile, slow-growing organisms that play an important role in the marine ecosystem and are vulnerable to various types of disturbance of the seafloor. The alternatives in the amendment are designed to reduce the potential impacts of fishing activity on corals, as allowed under the Council's discretionary authority. Restrictions on bottom-tending gear are being considered, with possible exemptions for some or all types of fixed gears. Potential coral management areas are located off the eastern Maine coast, in Jordan Basin and Georges Basin in the offshore Gulf of Maine, and in the canyon and slope region south of Georges Bank.

SCHEDULE OF PUBLIC HEARINGS

Date and Time	Location
Monday, May 22, 2017 6:00-8:00 p.m.	Montauk Playhouse Community Center 240 Edgemere Street, Montauk, NY 11954
Tuesday, May 23, 2017 1:00-3:00 p.m.	University of Rhode Island Bay Campus Corless Auditorium 215 South Ferry Road, Narragansett, RI 02882
Tuesday, May 23, 2017 5:30-7:30 p.m.	Fairfield Inn and Suites 185 MacArthur Drive, New Bedford, MA 02740
Wednesday, May 24, 2017 1:00-3:00 p.m.	MADMF Annisquam River Marine Fisheries Field Station 30 Emerson Ave., Gloucester, MA 01930
Wednesday, May 24, 2017 5:30-7:30 p.m.	Sheraton Harborside 250 Market Street, Portsmouth, NH 03801
Thursday, May 25, 2017 5:00-7:00 p.m.	Ellsworth High School 299 State Street, Ellsworth, ME 04605
Friday, May 26, 2017 1:00-2:30 p.m.	Webinar https://attendee.gotowebinar.com/register/98257139389273345

HOW TO COMMENT

During each hearing, Council staff will brief the public on the draft amendment before receiving comments. The hearings will begin promptly at the time indicated above. If all attendees who wish to do so have provided their comments prior to the end time indicated, the hearing may conclude early. To the extent possible, the Council may extend hearings beyond the end time indicated above to accommodate all attendees who wish to speak.

Members of the public may submit oral and/or written comments at any of the public hearings. You may also choose to submit written comments directly to the Council, in lieu of or in addition to comments provided at the hearings. Written comments must be received on or before close of business, Monday, June 5, 2017. Written comments received on or before Wednesday, May 24 at close of business, as well as comments provided at the hearings, will be reviewed by the Council's Habitat Committee on May 30 (see separate notice for information about this meeting). Written comments received after May 24 will be summarized in a report provided directly to the Council.

Written comments can be submitted via mail, email, or fax:

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50 Water Street, Mill 2
Newburyport, MA 01950

Email: comments@nefmc.org

Fax: (978) 465-3116

***Please note on your correspondence
"Comments on Deep-Sea Coral Amendment"***

***Written comments must be submitted
before 5:00 pm EST on Monday, June 5, 2017.***

Information about the coral amendment is posted on the Council's website at <http://www.nefmc.org/library/omnibus-deep-sea-coral-amendment>. To view interactive maps of the coral zone alternatives, please visit the Northeast Ocean Data Portal at <http://www.northeastoceandata.org/>. The coral zones can be found in the Data Explorer feature of the site, under Commercial Fishing, Draft Alternative Management Areas.

For questions, contact the Council office at (978) 465-0492.

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ACRONYMS

ASMFC	Atlantic States Marine Fisheries Commission
BTG	Bottom Tending Gear
EA	Environmental Assessment
FMP	Fishery Management Plan
GARFO	Greater Atlantic Regional Fisheries Office
GB	Georges Bank
GOM	Gulf of Maine
MAFMC	Mid-Atlantic Fishery Management Council
MBTG	Mobile Bottom Tending Gear
MSA	Magnuson-Stevens Act
MSFCMA	Magnuson-Stevens Fishery Conservation and Management Reauthorization Act
NEFMC	New England Fishery Management Council
NEFSC	Northeast Fisheries Science Center
NMFS	National Marine Fisheries Service
VMS	Vessel Monitoring System
VTR	Vessel Trip Report

1.0 BACKGROUND ON DEEP-SEA CORALS

1.1 WHAT ARE DEEP SEA CORALS?

Deep-sea corals are attached, benthic animals related to anemones and jellyfish that live in waters at least 50 meters (28 fathoms) deep. They are found in marine habitats worldwide. Offshore New England, the greatest species richness of corals occurs in the canyons south of Georges Bank, as well as on the surrounding continental slope and seamounts. Corals, primarily soft corals and sea pens, also occur in select locations in the Gulf of Maine, both relatively close to shore and in offshore basins. Deep-sea corals come in a diverse range of sizes, shapes and colors. Some types, including sea pens and soft corals, have a flexible structure, while the stony corals have a hard outer covering. Corals occur in both soft sediment habitats and in hard bottom areas. Many types require a hard substrate for attachment, but other corals anchor in fine sediments.



Figure 1 – Soft corals, anemones, and sponges in Jordan Basin. Image credit NMFS NEFSC/UConn. – NURTEC/UMaine.

1.2 WHAT ARE THE ROLES OF CORALS IN THE MARINE ENVIRONMENT?

Deep-sea corals are ecologically important. Deep-sea coral habitats have been noted to have higher associated concentrations of fish than surrounding areas, and are believed to serve as nursery grounds and provide habitat for many species of fish and invertebrates at various life stages, including commercially important fish species (Costello et al. 2005; Auster 2005; Foley et al. 2010). Many invertebrates are directly associated with deep-sea corals, and recent work in the canyons suggests that some of these relationships are very specific.



Figure 2 – Redfish, krill, and the soft coral *Primnoa resedaeformis* at Outer Schoodic Ridge. Image credit NMFS NEFSC/UConn. – NURTEC/UMaine.

In coral habitats surveyed in the Gulf of Maine, crustaceans such as shrimp, amphipods, krill, and king crab were commonly associated with coral communities along steep walls, and were seen foraging amongst structure-forming organisms, including corals, on the seafloor. In addition, commercially important species were observed in coral habitats, including Acadian redfish, haddock, pollock, cusk, monkfish, cod, silver hake, Atlantic herring, spiny dogfish, squid, and lobster. The fish were observed searching for and catching prey that were also found among the coral. The corals seemed to provide refuge from strong, tidally generated bottom currents.

2.0 WHAT IS THE PURPOSE OF THE DEEP-SEA CORAL AMENDMENT?

Deep-sea corals are vulnerable to anthropogenic impacts. In general, deep-sea corals are slow growing and some species have limited dispersal capability. These features, combined with the branching and sometimes brittle structure of some taxa, make them vulnerable to mechanical disturbance, such as from fishing gear. The Council has approved the following problem statement for this amendment:

Deep-Sea Coral Amendment Problem Statement

The Council is utilizing its discretionary authority under section 303(b) in the Magnuson Stevens Act to identify and implement measures that reduce, to the extent practicable, impacts of fishing gear on deep-sea corals in New England. This amendment contains alternatives that aim to identify and protect concentrations of corals in select areas and restrict the expansion of fishing effort into areas where corals are likely to be present.

Deep-sea corals are fragile, slow-growing organisms that play an important role in the marine ecosystem and are vulnerable to various types of disturbance of the seafloor. At the same time, the importance and value of commercial fisheries that operate in or near areas of deep-sea coral habitat is recognized by the Council. As such, measures in this amendment will be considered in light of their benefit to corals as well as their costs to commercial fisheries.

Given the ecological importance and vulnerability of corals, the overarching objective of this amendment is to identify and protect deep-sea corals in the New England region. Although there are uncertainties in terms of the precise extent of overlap between fishing activities and coral habitats, the problem statement approved for this action affirms the Council's desire to balance coral conservation with commercial fishing usage of coral management zones.

3.0 WHAT IS THE DEEP-SEA CORAL AMENDMENT TIMELINE?

The alternatives in this amendment were developed between 2011 and 2017, initially as part of Omnibus Habitat Amendment 2, but split into a separate coral-focused amendment in 2012. The New England Fishery Management Council, Mid-Atlantic Fishery Management Council (MAFMC), and the South Atlantic Fishery Management Council have signed a Memorandum of Understanding identifying areas of consensus and common strategy related to conservation of corals and mitigation of the negative impacts of fishery interactions with corals. As per the terms of the memorandum, the Council developed the alternatives in this document to be applicable only to areas within the New England region as defined in the current regulations (50 C.F.R. §600.105).

Table 1 summarizes recent and future actions associated with development of the amendment. Once the Council process has concluded, the National Marine Fisheries Service (NMFS) has responsibility for rulemaking and implementation. There will be an additional opportunity for public comment once NMFS publishes the proposed regulations (proposed rule) in the Federal Register. The amendment is expected to go into effect between six and seven months from initial submission of the draft environmental assessment by the Council.

Table 1 – Recent and future actions on the deep-sea coral amendment

Date	Action
March 13 and 15, 2017	Stakeholder workshops
April 14, 2017	Habitat Committee recommends preferred alternatives
April 18, 2017	Council selects preferred alternatives
May 1-June 5, 2017	Public comment period on management alternatives, including hearings
May 30, 2017	Habitat Committee meeting
June 20-22, 2017	Council meeting, final action
Late summer/early fall 2017 (target date)	Draft Environmental Assessment submitted to GARFO
6-7 months from submission of draft EA	GARFO and NEFSC review Environmental Assessment, GARFO drafts proposed rule
	Final EA submitted to GARFO
	GARFO review of proposed rule
	HQ review of proposed rule
	Notice of availability and proposed rule publish (triggers 90 day clock)
	30 day public comment period
	Draft and review final rule
	Implementation

4.0 MANAGEMENT APPROACHES UNDER CONSIDERATION

The management alternatives in this amendment include a range of coral zones and fishing restriction measures that may be applied within those zones. Special access programs as well as alternatives to modify coral conservation measures via framework adjustment are also being considered. Table 2 summarizes the management alternatives.

The measures would affect commercial fisheries operating with bottom-tending fishing gear (i.e., bottom trawls, dredges, bottom longlines, sink gillnets, or pots/traps). Management measures implemented via this amendment would apply based on gear type, and are not limited to fisheries directly managed by NEFMC. Fisheries operating in and around the coral zones are managed by NEFMC, MAFMC, and the Atlantic States Marine Fisheries Commission (ASMFC). Deep-sea coral protection measures were implemented in the Mid-Atlantic region in January 2017. There are many similarities between the NEFMC and MAFMC approaches.

Additional details about the alternatives, including maps of the coral zones, are provided following Table 2. The section numbers in this public hearing document match the section numbers in the more comprehensive amendment document, which includes additional information about the alternatives.

The Council recommends the following as preferred alternatives:

- A 600 meter minimum depth broad zone south of Georges Bank, closed to all bottom-tending gears, with an exemption for the red crab fishery.
- Coral zones at Mt. Desert Rock and Outer Schoodic Ridge closed to mobile bottom-tending gears.
- A closure to mobile bottom-tending gears is also the preferred approach for the offshore Gulf of Maine zones, but the Council is still debating whether or not to designate coral zones in the offshore Gulf of Maine.
- The Council recommended requesting letters of acknowledgement for scientific researchers working in coral zones, and recommended that changes to coral zone designations and measures could be developed through framework adjustments rather than amendments. The Council also recommended that special access and exploratory fishing programs could be developed and updated via framework adjustments.

Note that the Council is seeking public comment on all management alternatives and options under consideration in the amendment, not only the preferred alternatives.

Table 2 - Summary of alternatives considered. Numbers refer to sections in the environmental assessment. In terms of gear restrictions, 'BTG' refers to bottom-tending gears, fixed and mobile, and 'MBTG' refers to mobile bottom-tending gears only.

4.1 No Action		
Management areas	Fishing gear restrictions	Notes
<ul style="list-style-type: none"> • Monkfish/Mackerel-Squid-Butterfish closures in Lydonia and Oceanographer Canyons • Tilefish Gear Restricted Areas in Lydonia, Oceanographer, and Veatch Canyons • Northeast Canyons and Seamounts Marine National Monument 	<ul style="list-style-type: none"> • Monkfish/Mackerel-Squid-Butterfish: No fishing by vessels permitted under those plans • Tilefish: no MBTG • Monument: no commercial fishing of any kind; lobster and red crab restrictions not in effect until 2023 	<ul style="list-style-type: none"> • Monkfish closures developed in a joint fishery management plan with MAFMC • Mackerel-Squid-Butterfish and tilefish areas managed by MAFMC • Monument is a permanent designation by President Obama, not subject to modification by the Councils • These alternatives are not explicitly preferred, but they cannot be changed via this amendment
4.2.1 Broad zones 4.3 Fishing gear restrictions		
Management areas	Fishing gear restrictions	Notes
<ul style="list-style-type: none"> • Option 1: 300m zone • Option 2: 400m zone • Option 3: 500m zone • Option 4: 600m zone • Option 5: 900m zone • <u>Option 6: 600m minimum depth zone</u> 	<ul style="list-style-type: none"> • <u>Option 1: Prohibit BTG</u> <ul style="list-style-type: none"> • <u>Sub-option A: exempt red crab fishery</u> • Sub-option B: exempt other trap fisheries • Option 2: Prohibit MBTG 	<ul style="list-style-type: none"> • Zone options are mutually exclusive (select one or none)
4.2.2.1 Discrete canyon zones 4.3 Fishing gear restrictions		
Management areas	Fishing gear restrictions	Notes
Alvin Canyon , Atlantis Canyon, Nantucket Canyon, Veatch Canyon, Hydrographer Canyon, Dogbody Canyon, Clipper Canyon, Sharpshooter Canyon, Welker Canyon, Heel Tapper Canyon, Oceanographer Canyon, Filebottom Canyon, Chebacco Canyon, Gilbert Canyon, Lydonia Canyon, Powell Canyon, Munson Canyon, Nygren Canyon, Unnamed Canyon between Nygren and Heezen, Heezen Canyon	<ul style="list-style-type: none"> • Option 1: Prohibit BTG <ul style="list-style-type: none"> • Sub-option A: exempt red crab fishery • Sub-option B: exempt other trap fisheries • Option 2: Prohibit MBTG 	<ul style="list-style-type: none"> • Canyon zones are largely within broad zones, but generally cover additional area in the heads of the canyons, depending on broad zone boundary • Canyon zones could be adopted in addition to a broad zone, if shallower boundaries or different gear restrictions are desired

4.2.2.2 Discrete seamount zones 4.3 Fishing gear restrictions		
Management areas	Fishing gear restrictions	Notes
<ul style="list-style-type: none"> Bear Seamount Mytilus Seamount Physalia Seamount Retriever Seamount 	<ul style="list-style-type: none"> Option 1: Prohibit BTG <ul style="list-style-type: none"> Sub-option A: exempt red crab fishery Sub-option B: exempt other trap fisheries Option 2: Prohibit MBTG 	<ul style="list-style-type: none"> Seamount zones are encompassed spatially within the broad zones and the seamount section of the national monument Seamount zones could be adopted in addition to a broad zone if different gear restrictions are desired
4.2.2.3 Gulf of Maine zones 4.3 Fishing gear restrictions		
Management areas	Fishing gear restrictions	Notes
<p>Gulf of Maine inshore:</p> <ul style="list-style-type: none"> <u>Mount Desert Rock</u> <u>Outer Schoodic Ridge</u> <p>Gulf of Maine offshore:</p> <ul style="list-style-type: none"> WJB - 114 Fathom Bump WJB - 96 Fathom Bump WJB - 118 Fathom Bump Central Jordan Basin Lindenkohl Knoll <p><u>A preference for whether to designate the offshore Gulf of Maine zones was not specified.</u></p>	<ul style="list-style-type: none"> Option 1: Prohibit BTG <ul style="list-style-type: none"> Sub-option A: exempt red crab fishery Sub-option B: exempt other trap fisheries <u>Option 2: Prohibit MBTG</u> <p><u>If the offshore Gulf of Maine areas are designated during final action, the Council's preferred approach is MBTG restriction, Option 2.</u></p>	<ul style="list-style-type: none"> Gulf of Maine zones are separate and spatially distinct from one another and from canyon/seamount/broad zones. There are two sets of boundary options for all areas except Outer Schoodic Ridge. A preferred boundary option was not identified from among the two options.
4.4 Special fishery programs for coral zones		
Alternatives		Notes
<ul style="list-style-type: none"> Alternative 1: Special access program fishing Alternative 2: Exploratory fishing <u>Alternative 3: Request LOA for research activities in coral zones</u> 		<ul style="list-style-type: none"> Could adopt one or more alternatives, in any combination
4.5 Framework provisions for coral zones		
Alternatives		Notes
<ul style="list-style-type: none"> Alternative 1/No Action: No additional frameworkable coral management measures <u>Alternative 2: Add, revise, or remove coral zones</u> <u>Alternative 3: Change fishing restrictions</u> <u>Alternative 4: Allow adoption of or changes to special access or exploratory fishing programs</u> 		<ul style="list-style-type: none"> Could adopt one or more alternatives, in any combination. Substantial changes could require an amendment regardless of whether these alternatives are adopted.

4.1 NO ACTION – EXISTING AREAS THAT PROVIDE PROTECTIONS FOR CORALS

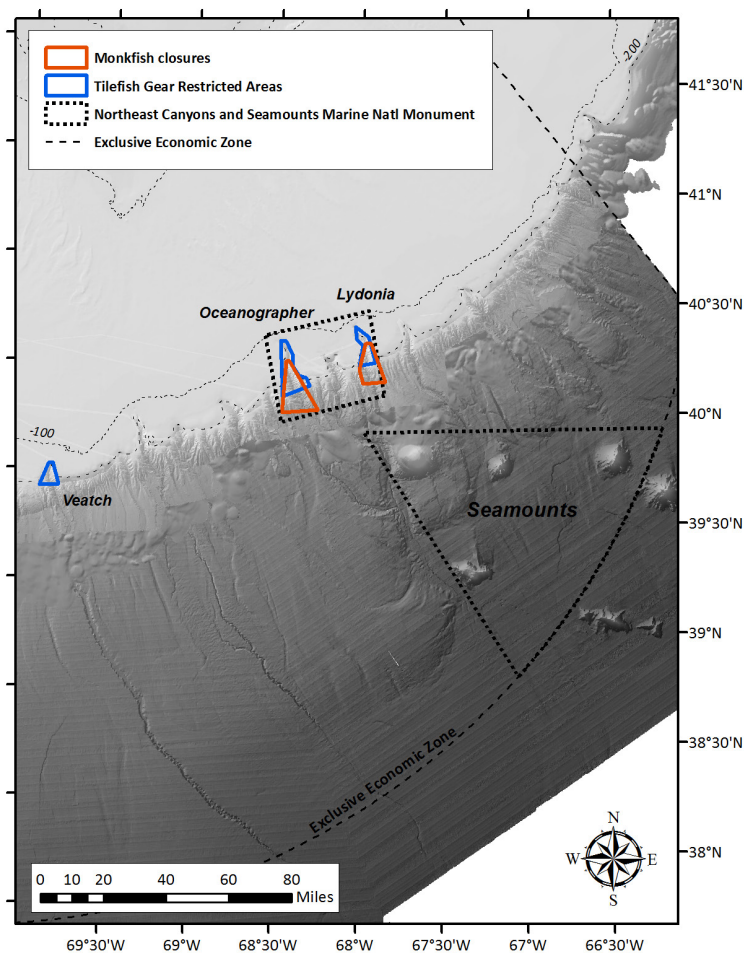
The No Action alternative includes management areas that provide some coral conservation benefits, but there are currently no management areas developed under the §303(b) discretionary authority in the New England region. These management areas cannot be modified via this amendment because they are not under the sole authority of the NEFMC.

Monkfish/Mackerel-Squid-Butterfish Areas: Monkfish Amendment 2 (2005) prohibited fishing with any gear type while on a monkfish day-at-sea in Lydonia and Oceanographer Canyons. These same two areas were later adopted as mackerel, squid, and butterfish bottom trawling restricted areas via Amendment 9 to that FMP (2008). Under the MSB FMP, no permitted mackerel, squid, or butterfish vessel may fish in the areas with bottom trawl gear on a year-round basis.

Tilefish Gear Restricted Areas: Amendment 1 to the Tilefish FMP (2009) adopted mobile bottom-tending gear restrictions in Lydonia, Oceanographer, and Veatch Canyons. These apply to any mobile bottom-tending gears regardless of fishery. The GRAs are located towards the heads of the canyons, with the boundaries based on those of the Tilefish Habitat Areas of Particular Concern, which were designed to protect clay outcrop habitats which occur in the heads of the canyons to roughly 300m. The GRAs cover deeper water areas as well, and would therefore have conservation benefits for deep-sea coral occurring below 300m.

Northeast Canyons and Seamounts Marine National Monument: On September 15, 2016, President Barack Obama designated the Northeast Canyons and Seamounts Marine National Monument, which has two sub-areas. The first encompasses the shelf-slope region from Oceanographer to Lydonia Canyons between about 100 meters and 2,000 meters, and the second encompasses all four seamounts in the EEZ. In November 2016 the areas closed to all commercial fishing as well as to energy exploration and development. Lobster and red crab fisheries will have seven years to cease operations within the Monument.

Map 1 – No Action alternative – various areas in the New England region that afford protection for deep-sea corals. Depth contours shown are in meters.



4.2 DEEP-SEA CORAL ZONE DESIGNATIONS

Two conceptual approaches are considered for designating coral zones. Both would rely on the discretionary coral protection authority provided in §303(b) of the Magnuson Stevens Act.

The ‘broad zone’ approach would designate a coral zone in a large area that encompasses the canyons, the continental slope and the seamounts, as well as the surrounding abyssal plain out to the exclusive economic zone (EEZ) boundary. The broad areas do not overlap the Gulf of Maine zones.

The ‘discrete areas’ approach would designate more narrowly defined coral zones based on discrete bathymetric features and groupings of corals. These zones encompass particular locations in the Gulf of Maine, single canyons, and individual seamounts. The boundaries of the discrete coral zones are based on direct observations of corals combined with inferences about the likely spatial extent of coral habitats, based on seafloor terrain data or habitat suitability models. The discrete coral zones were designed to encompass species that attach to hard substrates, are relatively large in size, or have other attributes that make them more susceptible to fishing-related impact. Because hard substrate areas tend to be patchy in their spatial distribution in the deep ocean, some soft sediment areas and associated fauna would be included within the discrete zone boundaries, incidental to the primary conservation target.

The broad areas and discrete areas could be implemented simultaneously in the canyon/slope region south of Georges Bank. While the individual discrete zones do not overlap one another, the canyon and seamount discrete zones overlap the depth-based broad zone alternatives. In some areas, the landward/shallow boundary of the discrete canyon zones is slightly shallower than the landward boundary of the shallowest broad zone, so combining the discrete zones with any one of the broad zones would protect additional coral habitats in the heads of the canyons. A combination approach might also be appropriate if different management measures are desired in the discrete vs. broad areas.

4.2.1 Broad deep-sea coral zone designation

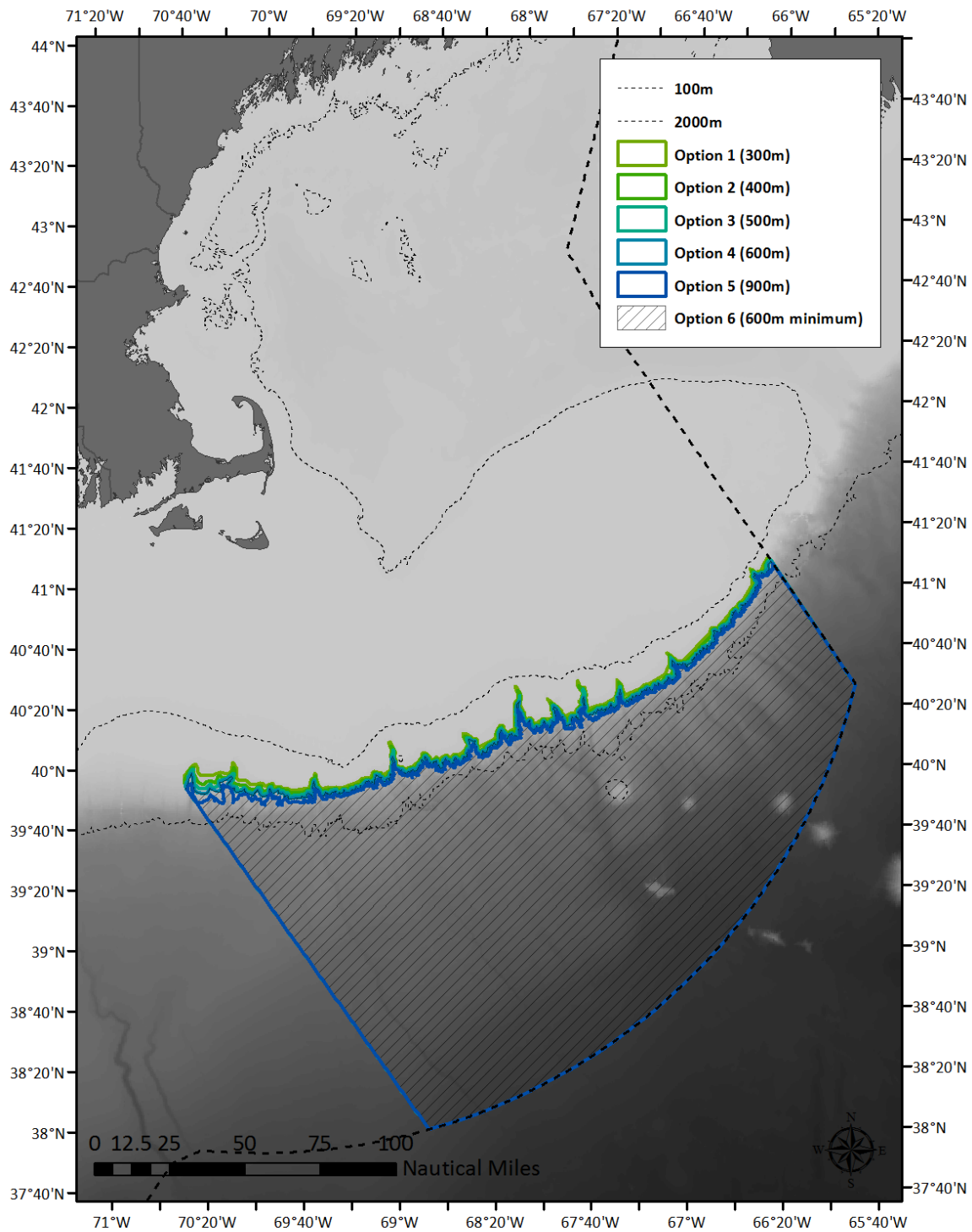
This alternative would designate a large area of the slope and abyssal plain out to the EEZ as a coral zone. There are six overlapping and mutually exclusive options (Map 2, Table 3), and only one may be selected. Options for fishing restrictions are described in Section 4.3.

The overall objective of this type of measure would be to prevent the expansion of fishing effort into deep-water coral areas, while limiting impacts on current fishing operations. Progressively deeper broad zones encompass less and less fishing activity.

The zones have their landward/shallow boundaries along the southern flank of Georges Bank, their seaward boundary at the EEZ, and their western boundary along the New England/Mid-Atlantic inter-council boundary line. The landward boundary options are simplified versions of 300m, 400m, 500m, 600m, and 900 m depth contours, with line segments connecting waypoints with specific latitude/longitude coordinates. The 600m contour was used to define two separate options. One (Option 4) has an average depth of 600m, bound by the 550m and 650m contours, and one (Option 6) has a minimum depth of 600m. **Option 6 is preferred, with a restriction on all bottom-tending gears and exemption for the red crab trap fishery.**

The environmental assessment details the methods used to define the broad coral zone boundaries. A close up view of the boundaries near Welker Canyon is shown on Map 3.

Map 2 – Broad coral zone alternatives



Map 3 – Broad zone boundary options near Welker Canyon.

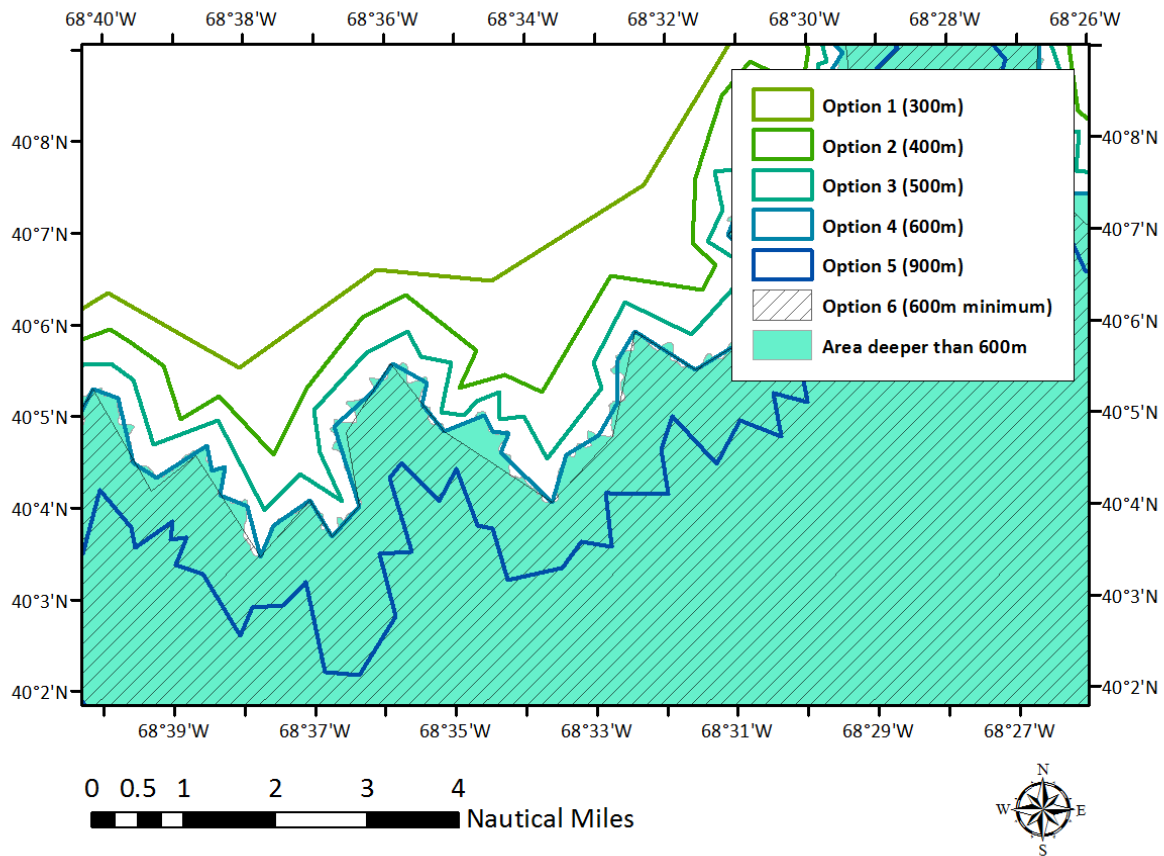


Table 3 – Summary of broad coral zone options

Zone option and name	Boundaries	Minimum depth and size
Option 1: 300m broad zone	Landward boundary approximates the 300m contour and the seaward boundary at the EEZ.	The zone has a minimum depth of 250m and is 67,142km ² .
Option 2: 400m broad zone	Landward boundary approximates the 400m contour and the seaward boundary at the EEZ.	The zone has a minimum depth of 350m and is 66,410km ² .
Option 3: 500m broad zone	Landward boundary approximates the 500m contour and the seaward boundary at the EEZ.	The zone has a minimum depth of 450m and is 65,838km ² .
Option 4: 600m broad zone	Landward boundary approximates the 600m contour and the seaward boundary at the EEZ.	The zone has a minimum depth of 550m and is 65,365km ² .
Option 5: 900m broad zone	Landward boundary approximates the 900m contour and the seaward boundary at the EEZ.	The zone has a minimum depth of 850m and is 64,193km ² .
Option 6: 600m minimum depth broad zone (preferred alternative)	Landward boundary approximates the 600m contour and the seaward boundary at the EEZ.	The zone is similar to Option 4, but has a minimum depth of 600m. The zone is 65,147km ² .

4.2.2 Discrete deep-sea coral zone designations

Discrete deep-sea coral zones overlap individual canyons, seamounts, or other features. Methods used to define discrete coral zone boundaries are detailed in the environmental assessment.

4.2.2.1 Canyon coral zones

This alternative would designate coral zones within 20 submarine canyons off the southern boundary of Georges Bank (Map 4). From west to east, these canyons include Alvin, Atlantis, Nantucket, Veatch, Hydrographer, Dogbody, Clipper, Sharpshooter, Welker, Heel Tapper, Oceanographer, Filebottom, Chebacco, Gilbert, Lydonia, Powell, Munson, Nygren, an unnamed canyon, and Heezen. The canyons that overlap the National Monument are Oceanographer, Filebottom, Chebacco, Gilbert, and Lydonia. Options for fishing restrictions in these zones are described in section 4.3. **Designation of coral zones in individual canyons is not a preferred alternative.**

The discrete canyon zones would protect deep-sea corals from the impacts of fishing throughout the full spatial extent of each canyon. All of these canyons have recent (2013 or later) remoted operated vehicle or towed camera exploratory survey dives indicating the presence of coral habitats. Some areas have earlier records as well.

The canyons vary in terms of their size, shape, geology, and biology, including the diversity and density of corals observed. The larger canyons tend to incise the shelf, and extend into shallower waters. The smaller canyons tend to be confined to the slope. The coral zones drawn around the shelf-incising canyons tend to have minimum depths around 300 meters, and the slope-confined canyons have minimum depths of around 400 meters.

Habitat suitability modeling

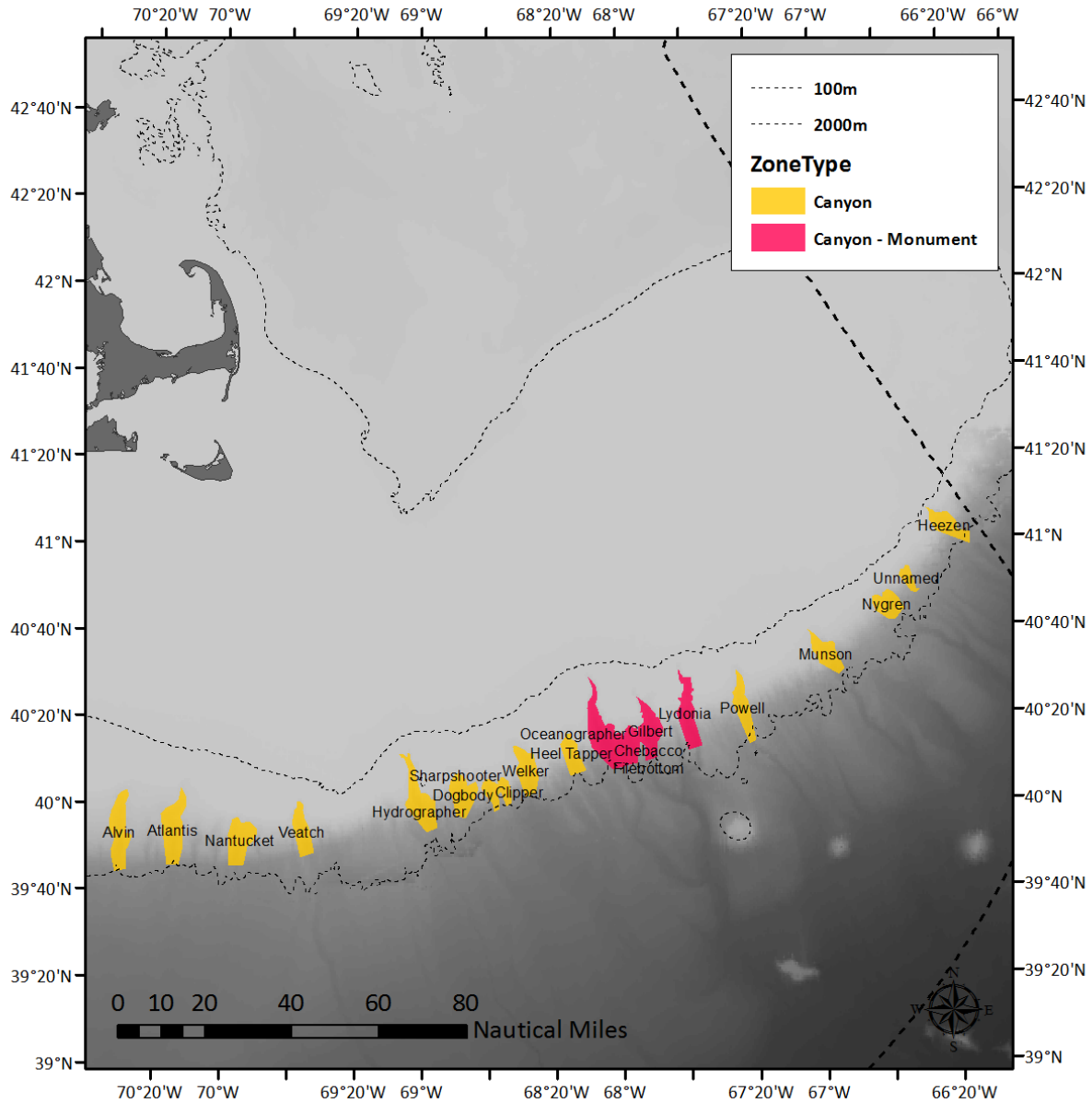
Many locations have not been directly sampled for deep-sea corals. Habitat suitability models combine coral presence data with environmental variable including seafloor terrain statistics; physical, chemical, and biological oceanographic data, and sediment/substrate information to predict where coral habitats are more or less likely to occur. In the northeast region, suitability models were developed for soft corals, stony corals, and sea pens. The soft coral model results were used in this amendment to design and evaluate the coral management zones.

Section 6.2.3.1 of the amendment document provides extensive summaries of the scientific information on deep-sea corals within each canyon. A series of maps in this document depict the discrete canyon boundaries, overlaid on high-resolution depth data.

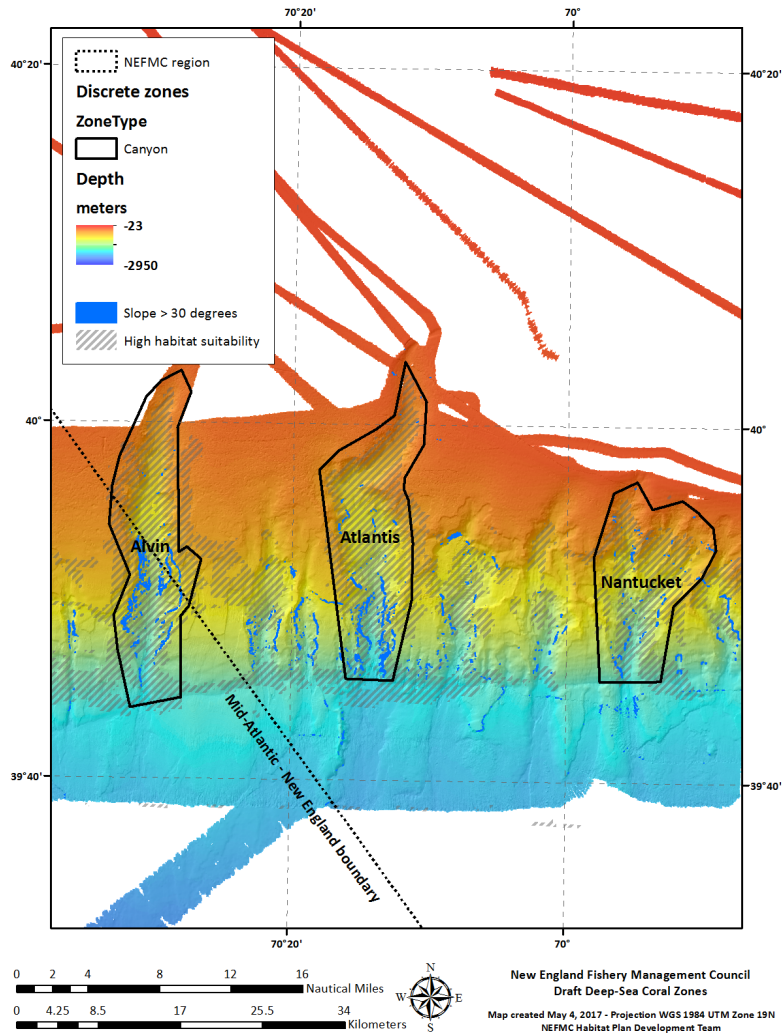
In the canyon/slope region, recent scientific surveys have shown that corals nearly always occur in locations where slopes are very steep. Steep slope in this context is classified as slopes greater than 30 degrees. These areas are shown on the maps in blue.

In addition, a suitability model (see box at left) was developed for the region to explore the distribution of locations likely to provide habitat for deep-sea corals. Areas highly likely to provide suitable habitat for soft corals are shown in grey hatching.

Map 4 – Summary of all 20 canyon coral zone alternatives



Map 5 – Alvin, Atlantis, and Nantucket Canyons



Skate on the wall of Atlantis Canyon



Cup coral (solitary deep-sea stony coral) in Alvin Canyon



Imaging the walls of Alvin Canyon with an ROV

Alvin Canyon

- Shelf-incising, area approximately 200 km²
- Zone follows the 300 m depth contour at the head of the canyon
- Extensive areas of predicted suitable habitat
- Some areas of high slope
- Corals documented in historical and recent data

Atlantis Canyon

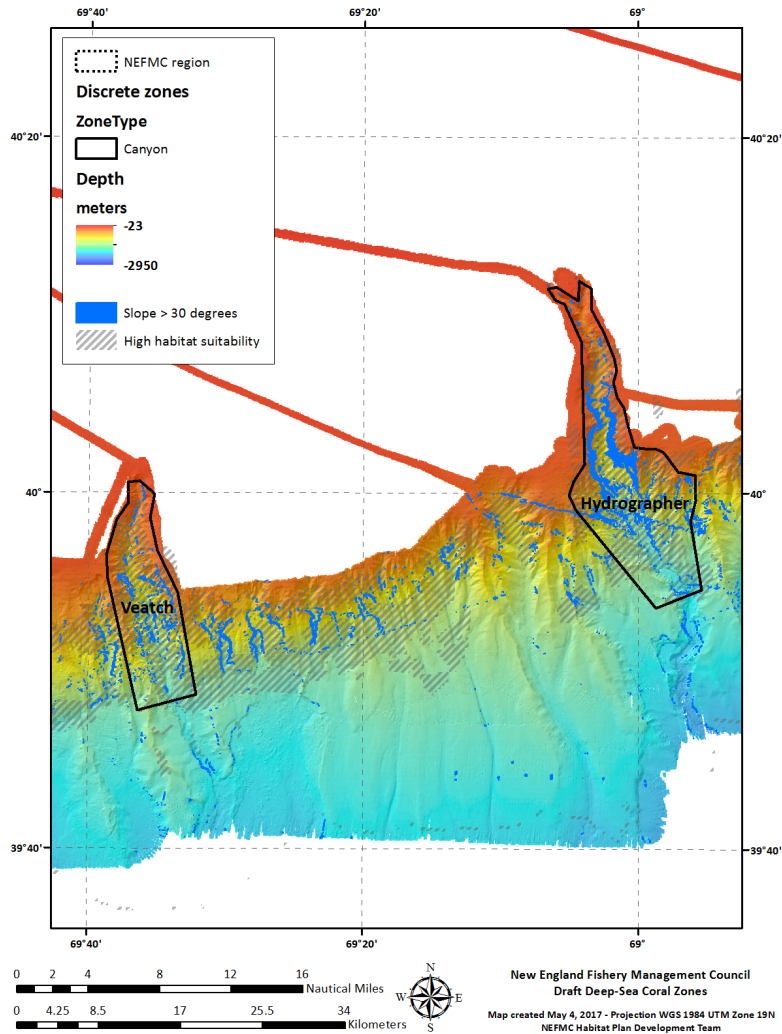
- Shelf-incising, area approximately 200 km²
- Zone follows the 300 m depth contour at the head of the canyon
- Extensive areas of predicted suitable habitat
- Some areas of high slope
- Corals documented in historical and recent data

Nantucket Canyon

- Shelf-incising, area approximately 200 km²
- Zone follows the 300 m depth contour at the head of the canyon
- Extensive areas of predicted suitable habitat
- Some areas of high slope
- Corals documented in historical and recent data

Images courtesy of NOAA Okeanos Explorer Program, 2013 Northeast U.S. Canyons Expedition.

Map 6 – Veatch and Hydrographer Canyons



Toppled *Paragorgia* coral colony in Hydrographer Canyon



Shrimp on soft coral in Hydrographer Canyon



Diverse deep sea corals in Hydrographer Canyon

Veatch Canyon

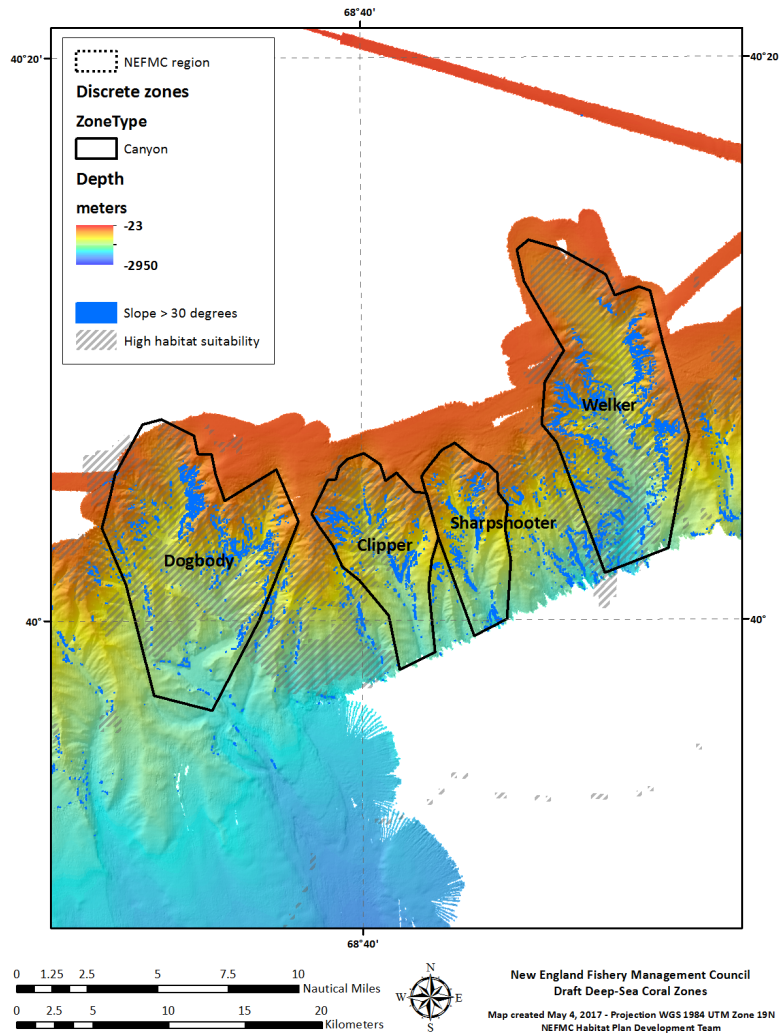
- Shelf-incising, area about 125 km²
- Depth is between 200m and 300m in the head of the canyon
- The No Action Tilefish Gear Restricted Area encompasses additional areas outside the discrete coral zone
- Most of the zone is mapped as high habitat suitability
- High slope areas, mainly in the deeper portions of the canyon
- Corals documented in recent data only

Hydrographer Canyon

- Shelf-incising, area about 200 km²
- Zone follows the 200 m depth contour at the head of the canyon
- Most of the zone is mapped as high habitat suitability
- Extensive areas of high slope within the zone
- Corals documented in historical and recent data

Images courtesy of NOAA Okeanos Explorer Program, 2013 Northeast U.S. Canyons Expedition.

Map 7 - Dogbody, Clipper, Sharpshooter, and Welker Canyons



An octopus in the rocks at Welker Canyon

Dogbody Canyon

- Shelf-incising, area about 150 km²
- Zone follows the 300m depth contour at the head
- Most of the zone predicted to have habitat suitable for soft corals
- Both branches include high slope areas
- Corals documented in historical and recent data

Clipper Canyon

- Slope-confined, area about 50 km²
- Zone follows the 400 m depth contour at the head
- Suitability model predicts soft coral habitat in shallower portions of the zone
- High slope areas along both branches
- Corals documented in historical and recent data

Sharpshooter Canyon

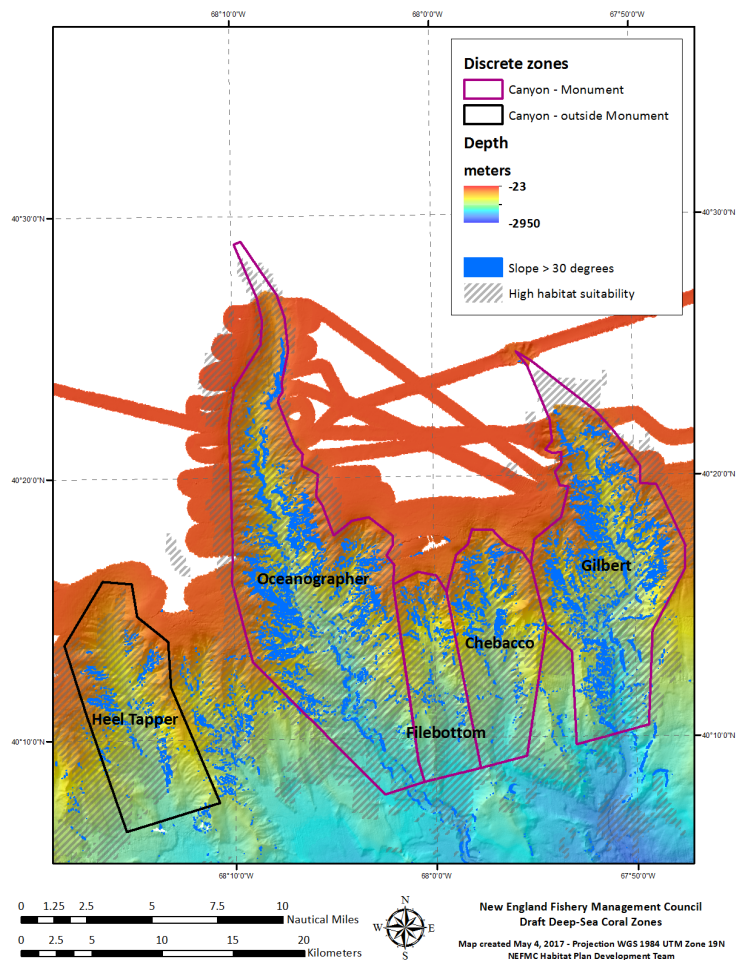
- Slope-confined, area about 50 km²
- Zone follows the 400 m depth contour at the head
- Few areas of predicted suitable habitat, but includes areas of high slope at various depths
- Corals documented in recent data only

Welker Canyon

- Shelf-incising, area about 150 km²
- Zone follows the 300 m depth contour at the head
- Large areas of high slope along both walls
- Most of the zone predicted to be high suitability soft coral habitat
- Corals documented in recent data only

Images courtesy of NOAA Okeanos Explorer Program, 2013 Northeast U.S. Canyons Expedition.

Map 8 – Heel Tapper, Oceanographer, Filebottom, Chebacco, and Gilbert Canyons



***Anthomastus* coral in Oceanographer**



Rockfall exposing a clean wall section within Oceanographer Canyon



Large black coral and two *Paramuricea* corals at Oceanographer

Heel Tapper Canyon

- Shelf-incising, area about 100 km²
- Zone follows the 300m depth contour at the head
- Most of the canyon is identified as having high likelihood of coral presence, some areas of high slope
- Corals documented in recent data only.

Oceanographer Canyon

- Shelf-incising, area over 200 km² (largest canyon)
- Zone follows the 300m depth contour at the head
- Most of the canyon is identified as having high likelihood of coral presence, extensive areas of high slope
- Well studied; corals documented in historical and recent data

Filebottom Canyon

- Slope-confined, area about 50 km²
- Zone follows the 300 m depth contour at the head

- Most of the zone is predicted high suitability habitat, less area of high slope compared with other canyons
- Corals documented in historical and recent data

Chebacco Canyon

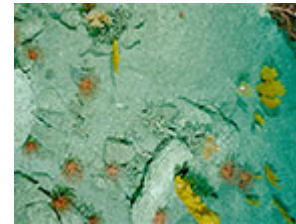
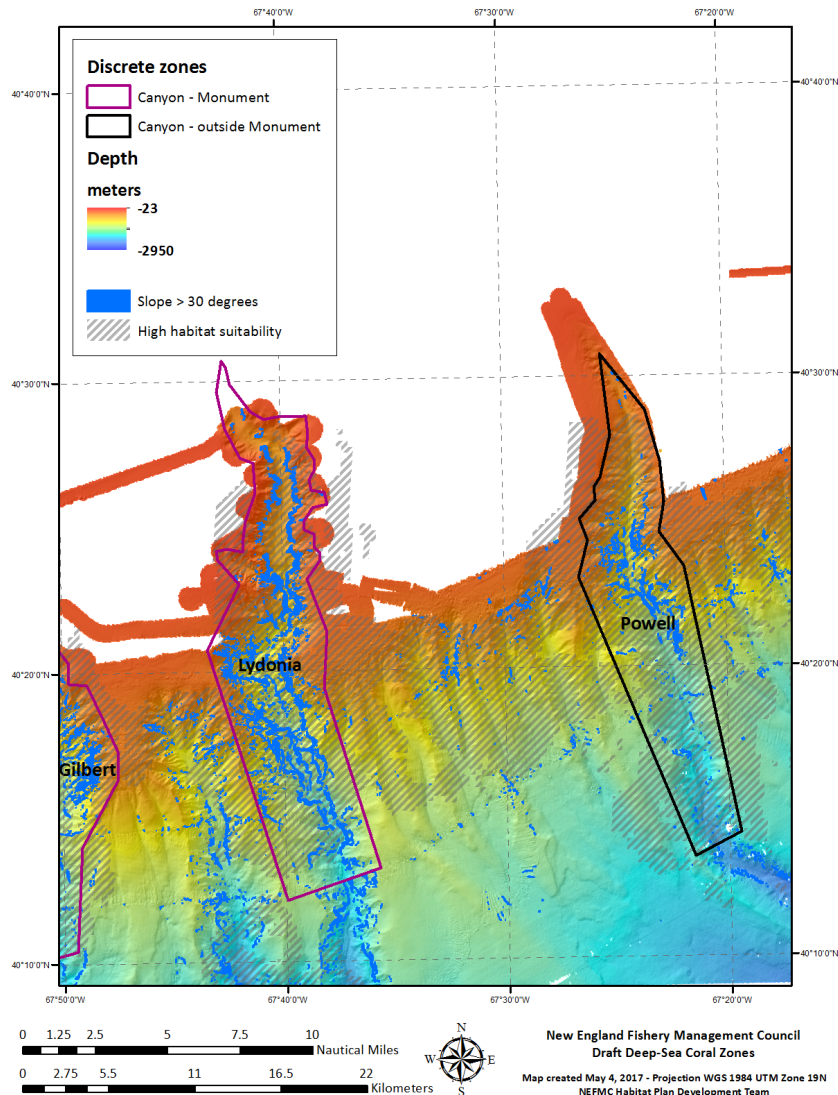
- Slope-confined, area about 100 km²
- Zone follows the 400m depth contour at the head
- Larger and steeper than Filebottom; much of the zone predicted to be suitable habitat for soft corals
- Corals documented in recent data only

Gilbert Canyon

- Shelf-incising, area about 175 km²
- Zone follows 300m depth contour at the head
- Most of the canyon is identified as having high likelihood of coral presence, extensive areas of high slope
- Corals documented in recent data only

Images courtesy of NOAA Okeanos Explorer Program, 2013 Northeast U.S. Canyons Expedition.

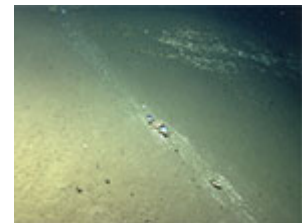
Map 9 – Lydonia and Powell Canyons



Diverse deep-sea corals on the eastern wall of Powell Canyon



Chimera in Lydonia Canyon



Sediment transport in Lydonia Canyon

Lydonia Canyon

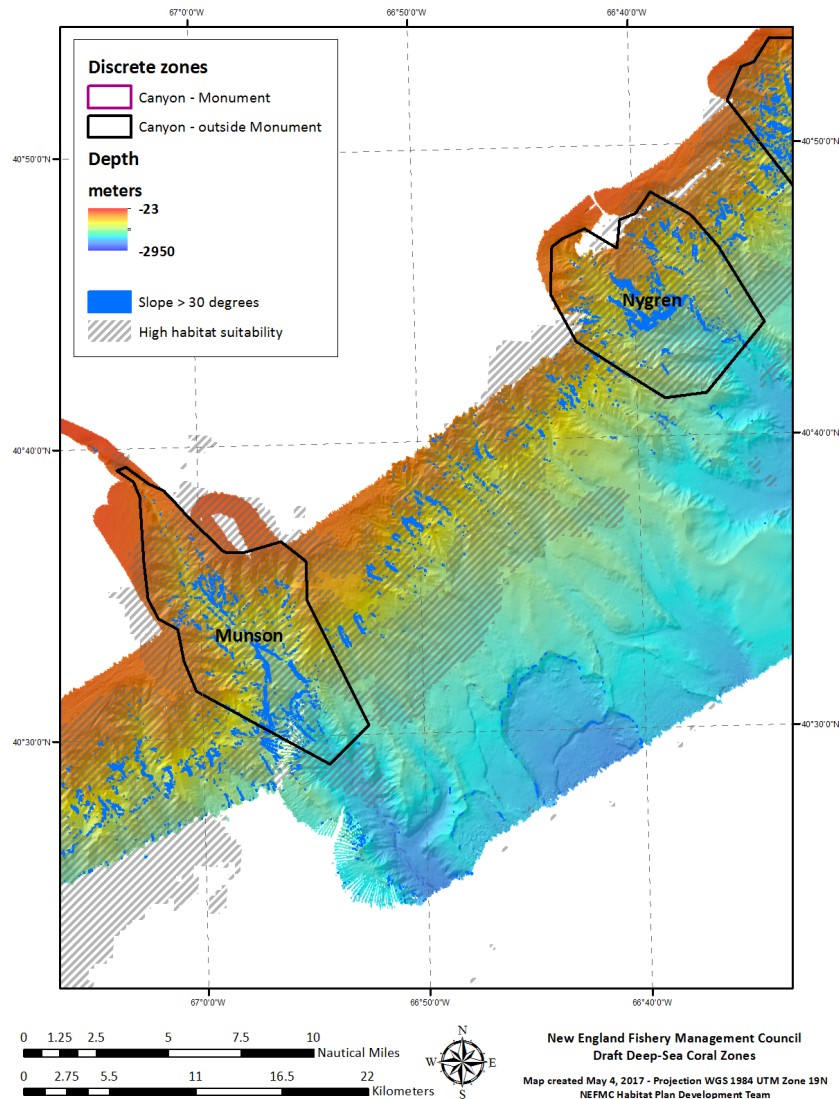
- Shelf-incising, area over 200 km², second in size only to Oceanographer Canyon
- Zone follows the 200 meter depth contour at the head
- Most of the zone is identified as having high likelihood of coral presence
- Extensive areas of high slope, including within the head of the canyon
- Well studied; corals documented in historical and recent data

Powell Canyon

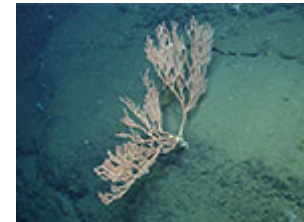
- Shelf-incising, area about 200 km²
- Zone follows the 300 m depth contour at the head
- Most of the zone is identified as having high likelihood of coral presence
- Some areas of high slope, concentrated just beyond the shelf break
- Corals documented in recent data only

Images courtesy of NOAA Okeanos Explorer Program, 2013 Northeast U.S. Canyons Expedition

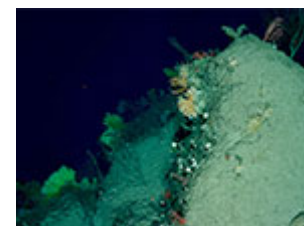
Map 10 – Munson and Nygren Canyons



Clavularia coral in Nygren Canyon



Giant bamboo fan, Jasonia, from Nygren Canyon



Diverse corals and sponges in western Munson Canyon

Munson Canyon

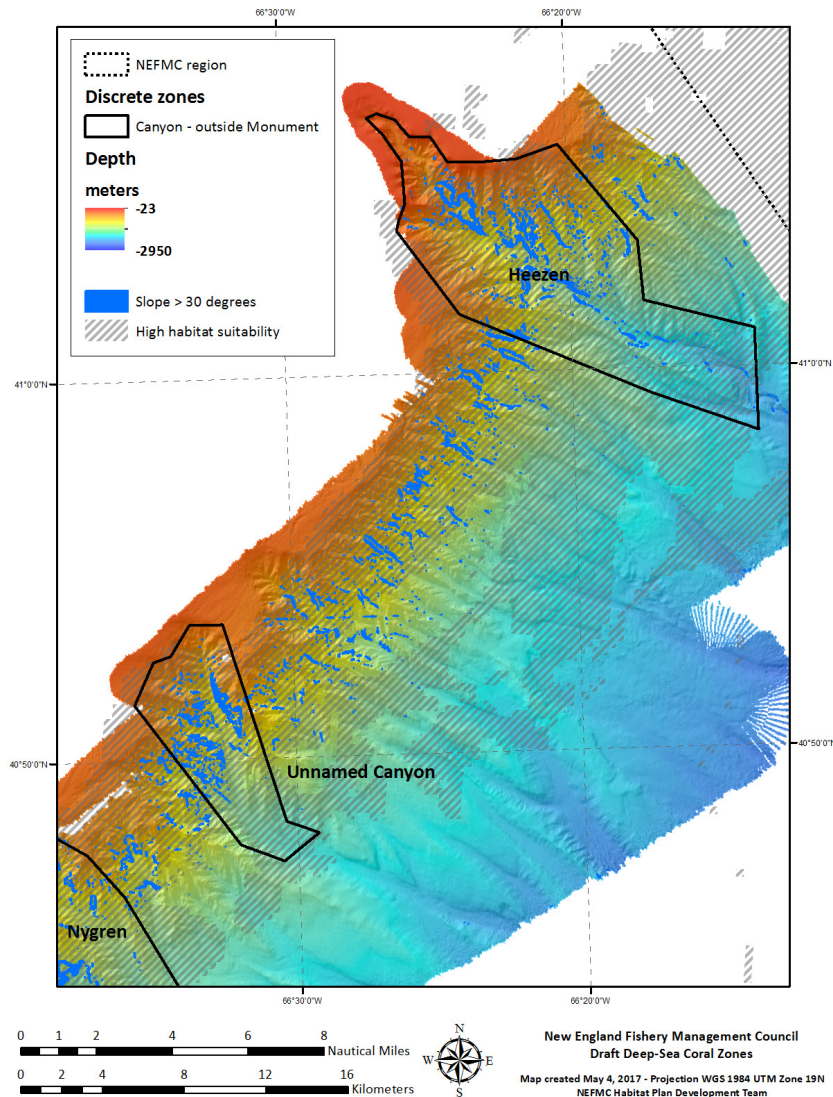
- Shelf-incising, area about 100 km²
- Zone follows the 300m depth contour at the head
- Most of the canyon is identified as having high likelihood of coral presence
- Areas of high slope throughout, except in the shallowest portion of the canyon
- Corals documented in historical and recent data

Nygren Canyon

- Slope-confined, area about 100 km²
- Zone follows the 400 m depth contour at the head
- Most of the canyon is identified as having high likelihood of coral presence
- Areas of high slope are concentrated in the middle of the proposed zone, but can be found on all major branches of the canyon
- The very high suitability areas coincide with the very high slopes
- Boundaries correspond with the habitat suitability results
- Corals have been documented in recent data only

Images courtesy of NOAA Okeanos Explorer Program, 2013 Northeast U.S. Canyons Expedition

Map 11 – Unnamed canyon and Heezen Canyon



Cup corals and sea star in Heezen Canyon



Scalloped wall in Heezen Canyon



Inspecting mudstone sediments in Heezen Canyon

Unnamed canyon

- Slope-confined, area about 50 km²
- Zone follows the 400 m contour at the head
- Most of the canyon is identified as having high or very high likelihood of coral presence
- Areas of high slope can be found throughout the zone, and generally coincide with areas of very high habitat suitability
- Corals documented in recent data only

Heezen Canyon

- Shelf-incising, area about 125 km²
- Zone follows the 200 m contour at the head
- Most of the recommended zone is identified as having high and very high likelihood of coral presence
- Areas of high slope can be found throughout the zone
- Well studied, corals documented in historical and recent data

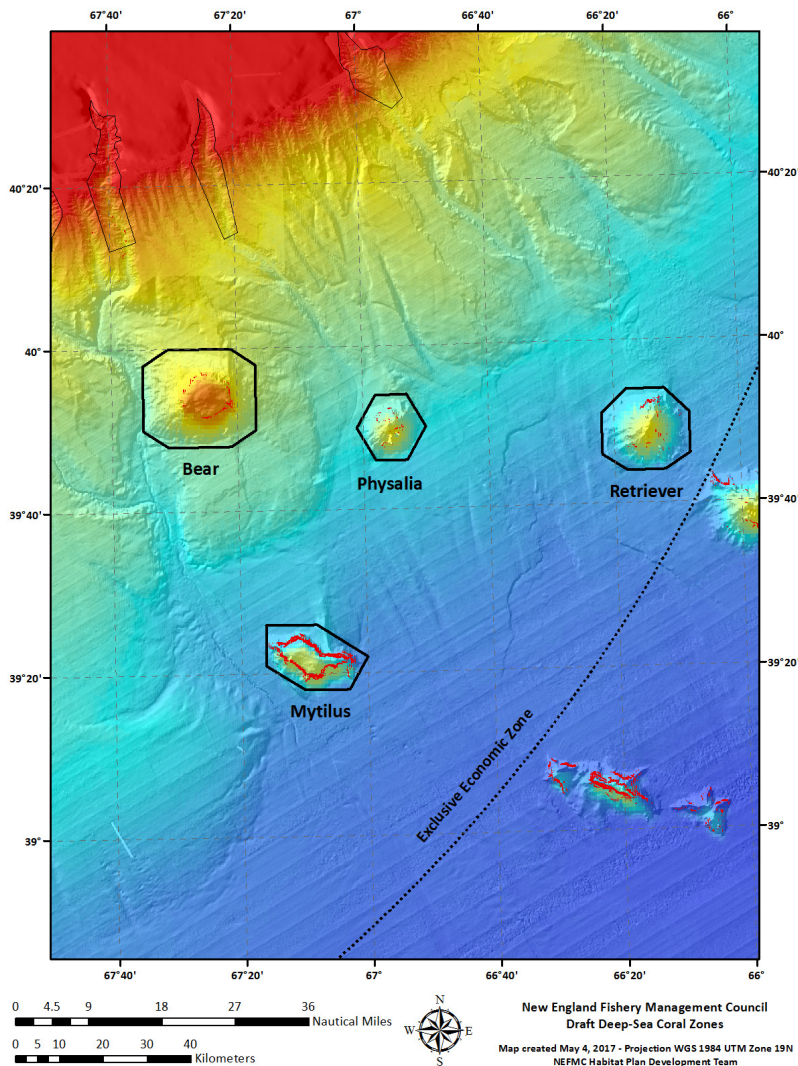
Images courtesy of NOAA Okeanos Explorer Program, 2013 Northeast U.S. Canyons Expedition

4.2.2.2 Seamount coral zones

This alternative would designate coral zones around the four seamounts within the U.S. EEZ, Bear, Retriever, Physalia, and Mytilus. Options for fishing restrictions in these zones are described in section 4.3.

Fishing with any type of bottom-tending gear is not currently known to occur on the seamounts. This alternative would protect corals occurring on seamounts from the negative impacts of fishing activity, should fisheries expand to include any of the four seamounts within in the U.S. EEZ at some time in the future. Deep-sea corals are known to occur on the seamounts on the basis of ROV and AUV surveys.

Map 12 – The four seamount coral zones are outlined in black and labeled individually. Depth increases from northwest (red) to southeast (blue). The Lydonia, Powell, and Munson Canyon zones are depicted along the shelf break in the northwest corner of the image. Additional seamounts shown on the map are outside the U.S. EEZ.



Bear is the largest of the New England seamounts. The summit is about 1,100 m below sea level, and the base of the seamount is at over 3,000 m. While it was not visited during recent (2012-2015) cruises, all four groups of corals (soft, stony, sea pens, and black corals) had been previously documented in the area.

Mytilus is the deepest of the four seamounts, with a minimum depth of 2,396 m and a maximum depth within the proposed coral zone boundary of 4,183 m. Corals have been documented in recent data only.

Physalia and Retriever seamounts have similar minimum and maximum depths. The summit of Physalia is at about 1,900 m, and the deepest part of the proposed zone is at over 3,700 m. Physalia was surveyed for the first time in 2012 using AUV technology (Kilgour et al. 2014), and was also observed during a 2014 *R/V Okeanos Explorer* cruise.

The summit of **Retriever Seamount** is at about 1900 m, and the deepest part of the proposed zone is at depths of over 4,000 m. Corals have been documented in recent data only.

4.2.2.3 Gulf of Maine coral zones

Deep-sea corals have been known to occur in the Gulf of Maine since the 19th century (Watling and Auster 2005), but targeted camera surveys to assess coral distribution have been conducted only in the last fifteen years, with most of this type of survey activity occurring since 2013. Coral habitats observed during 2002, 2003, and 2013-2015 surveys were classified as either low density corals or coral gardens. A density of 0.1 colonies per square meter is the threshold that the International Council for the Exploration of the Sea (ICES) used to define coral garden habitat (ICES 2007). Coral habitats in some areas of the Gulf of Maine exceed the coral garden threshold density (see sections below for details), although coral management zones are recommended in areas with both classifications.

The recommended zones are Outer Schoodic Ridge, Mount Desert Rock, Jordan Basin, and Lindenkohl Knoll, which is in Georges Basin. All sites with multiple dive observations, specifically Outer Schoodic Ridge, Mount Desert Rock, the 114 Bump site in western Jordan Basin, a site in central Jordan Basin, and Lindenkohl Knoll, had at least one dive where coral garden habitats were found.

In general, the boundaries of the coral zones were developed to encompass dive sites where corals were positively identified. Other recently collected data that inform the delineation of coral zones include high resolution multibeam bathymetry in the Outer Schoodic Ridge and western Jordan Basin regions. Because the spatial extent of high resolution bathymetric data is limited, it is not possible to delineate zone boundaries based on full spatial extent of specific terrain features, as is the case with the canyon and seamount sites. However, the bathymetric data confirm the presence of similar terrain at sampled locations and nearby unsampled locations, such that suitable habitat can be inferred beyond the dive sites.



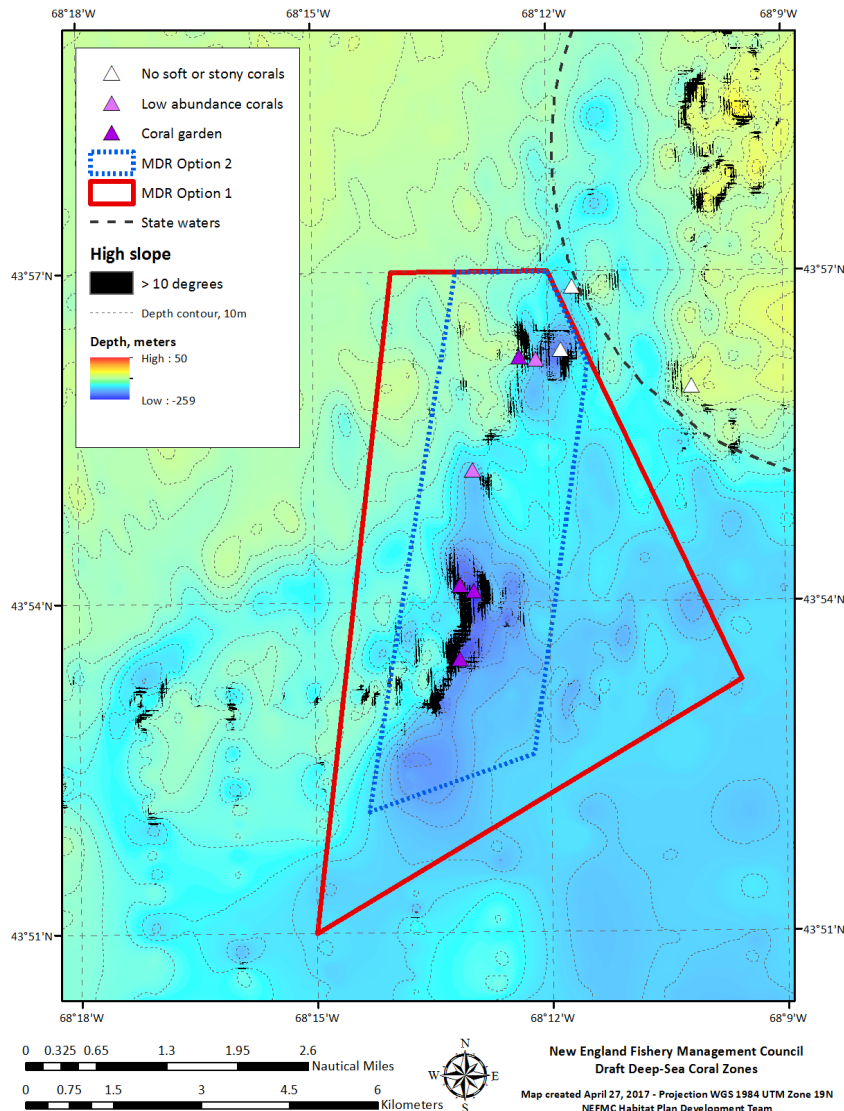
ROPOS remotely operated vehicle and soft corals in Jordan Basin. Images courtesy of Martha Nizinski, NOAA.

4.2.2.3.1 Mount Desert Rock

This alternative would designate a coral zone southwest of Mount Desert Rock, a small, rocky island off the eastern Maine coast, about 20 nm south of Mount Desert Island. Options for fishing restrictions in this zone are described in Section 4.3.

This alternative would protect corals in the Mt. Desert Rock region from fishing impacts. Corals have been documented in both the historical and recent data.

Map 13 – Mount Desert Rock Coral Zone options, including recent dive locations and relative abundance of corals. Contours are in 10 m intervals and areas of high slope are shown in black.



There are two boundary options for the Mt. Desert Rock zone.

Option 1 is the larger of the two, and encompasses an area of about 47 km²/18 mi². **Option 2** lies within Option 1, a smaller area about 21 km²/8 mi². Both options encompass depths of 100-200 m.

MDR Option 1 coordinates:

-68°09'34", 43°53'17"
-68°15'00", 43°51'00"
-68°14'00", 43°57'00"
-68°12'00", 43°57'00"

MDR Option 2 coordinates:

-68°14'19", 43°52'06"
-68°13'10", 43°56'59"
-68°12'00", 43°57'00"
-68°11'27", 43°56'10"
-68°12'13", 43°52'37"

LORAN for Option 1

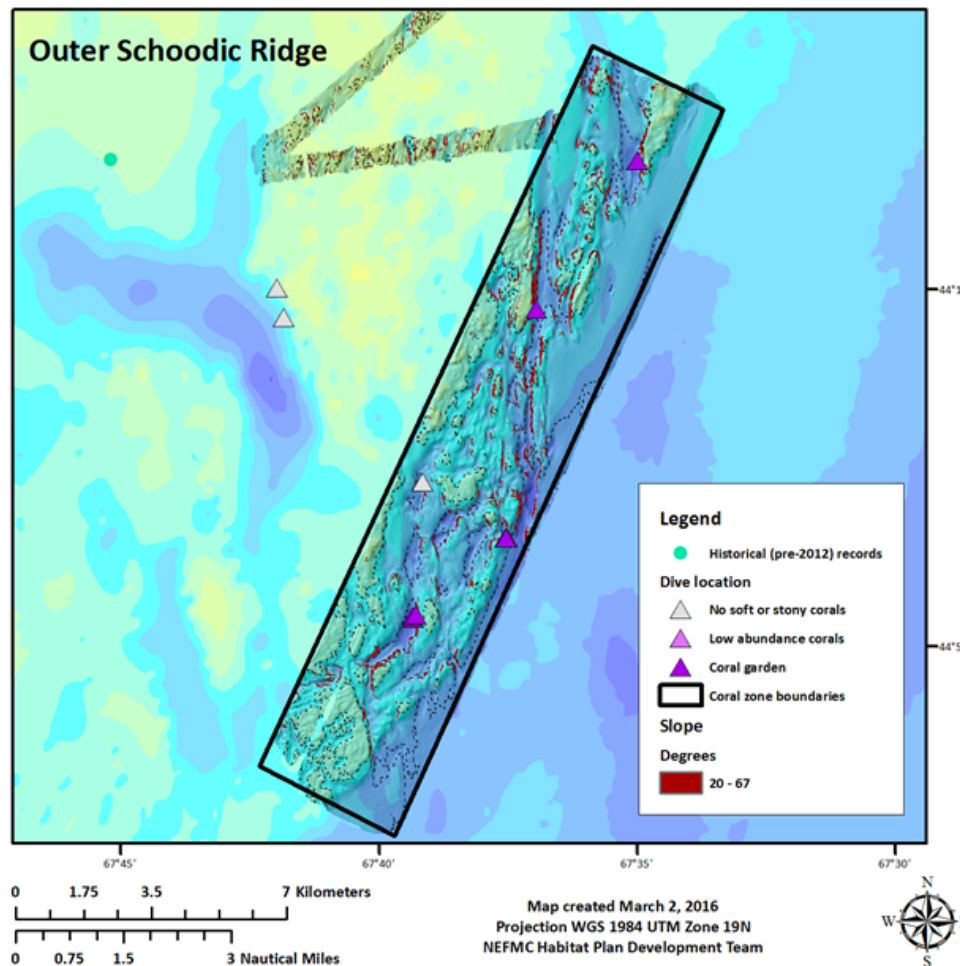
12490.3694/25708.0664
12480.9303/25703.2118
12495.5071/25680.0337
12537.0770/25682.3071

4.2.2.3.2 Outer Schoodic Ridge

This alternative would designate a coral zone on the Outer Schoodic Ridge, roughly 25nm southeast of Mt. Desert Island, within Statistical Area 511 and Maine Lobster Management Zone A. The coral zone encompasses a portion of the ridge that has been recently mapped with multibeam and surveyed using ROV. Options for fishing restrictions in this zone are described in Section 4.3.

This alternative would protect corals in the Outer Schoodic Ridge region from fishing impacts. Corals have been documented in both the historical and recent data. Corals at this location were studied during eight ROV dives and two camera tows during 2013, 2014, and 2015. Steeply sloped features that are likely to provide suitable attachment sites for corals are found in the vicinity of the dive sites, throughout the area with high resolution bathymetry data. Based on the presence of steep terrain, the entire footprint of this dataset, aside from a small amount of data to the west of the area in shallower waters, is recommended as a coral zone. It is possible that there are additional corals outside the recommended zone boundaries, but corals were not observed during dives at similar depths nearby.

Map 14 – Outer Schoodic Ridge Coral Zone and high resolution bathymetry.
Areas of high slope are shown in red. Relative coral densities during recent dives (triangles) are shown in purple shading.



Recent high resolution bathymetric mapping details the complex, slot canyon terrain in the area. These data indicate that depths in the zone range from 104 m to 248 m, with a mean depth of 174 m. The coral zone is about 79 km²/31 mi².

Outer Schoodic Ridge coral zone coordinates:

-67°35'36", 44°13'29"
-67°33'06", 44°12'34"
-67°39'42", 44°02'29"
-67°42'17", 44°03'29"

LORAN

12204.6723/25695.2795
12201.3736/25686.0884
12299.4582/25656.1406
12303.1351/25665.8443

4.2.2.3.3 Jordan Basin

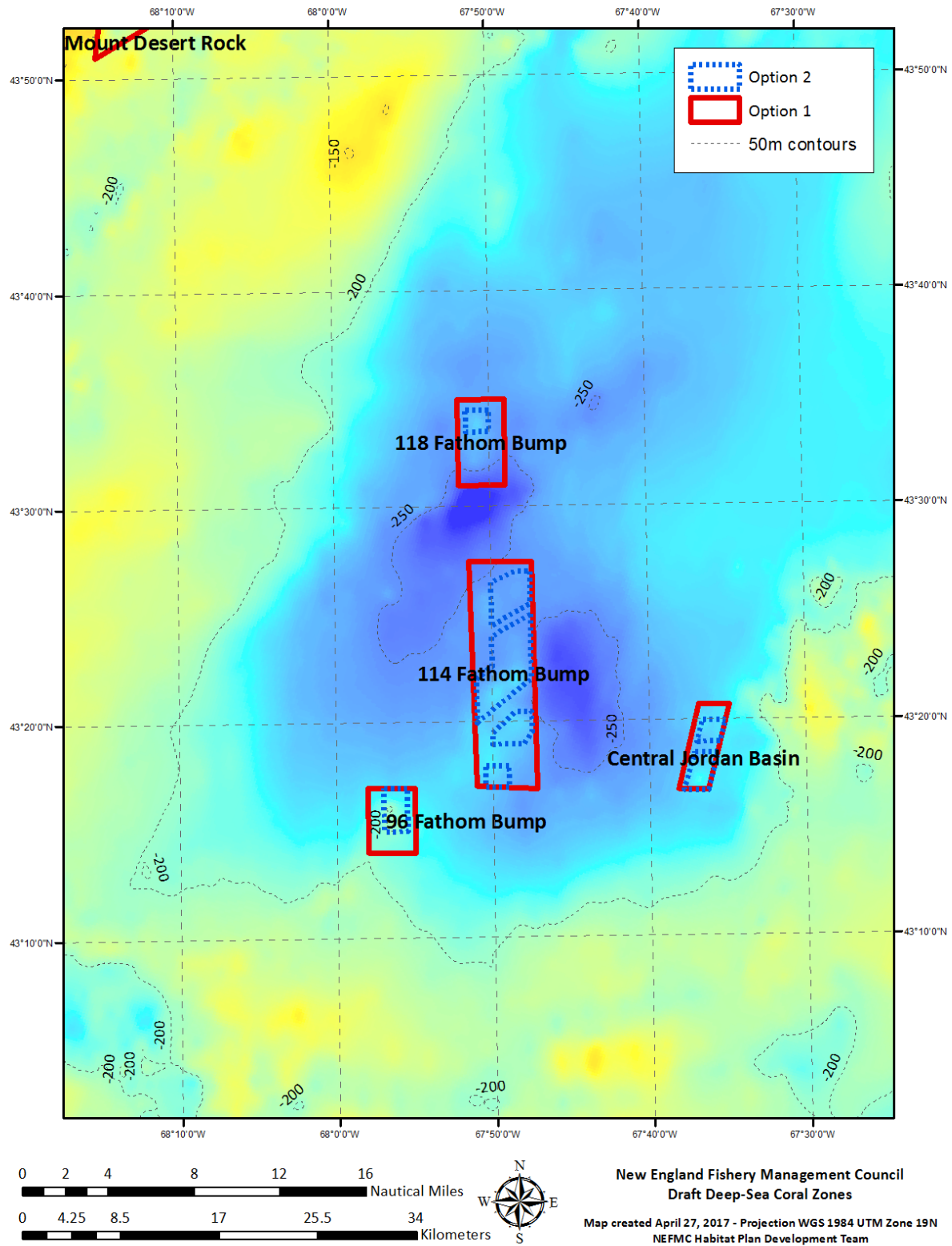
This alternative would designate coral zones in Jordan Basin, which straddles the EEZ boundary, with depths of about 175-250m. Deep-sea corals have been observed on shallower rocky features within the basin, named for their charted depths: 98 Fathom Bump (179m), 114 Fathom Bump (208m), and 118 Fathom Bump (216m). A site in central Jordan Basin encompasses depths of about 220-235m. The 114 Fathom Bump is the best mapped, and has the greatest number of survey dives.

Option 1 is comprised of four zones, one zone each feature. The smaller **Option 2** includes four areas at 114 Fathom Bump, two areas in Central Jordan Basin, and one area each at the 96 Fathom and 118 Fathom Bumps. Options for fishing restrictions in these zones are described in Section 4.3. These zones would protect coral habitats in Jordan Basin from the impacts of fishing gear.

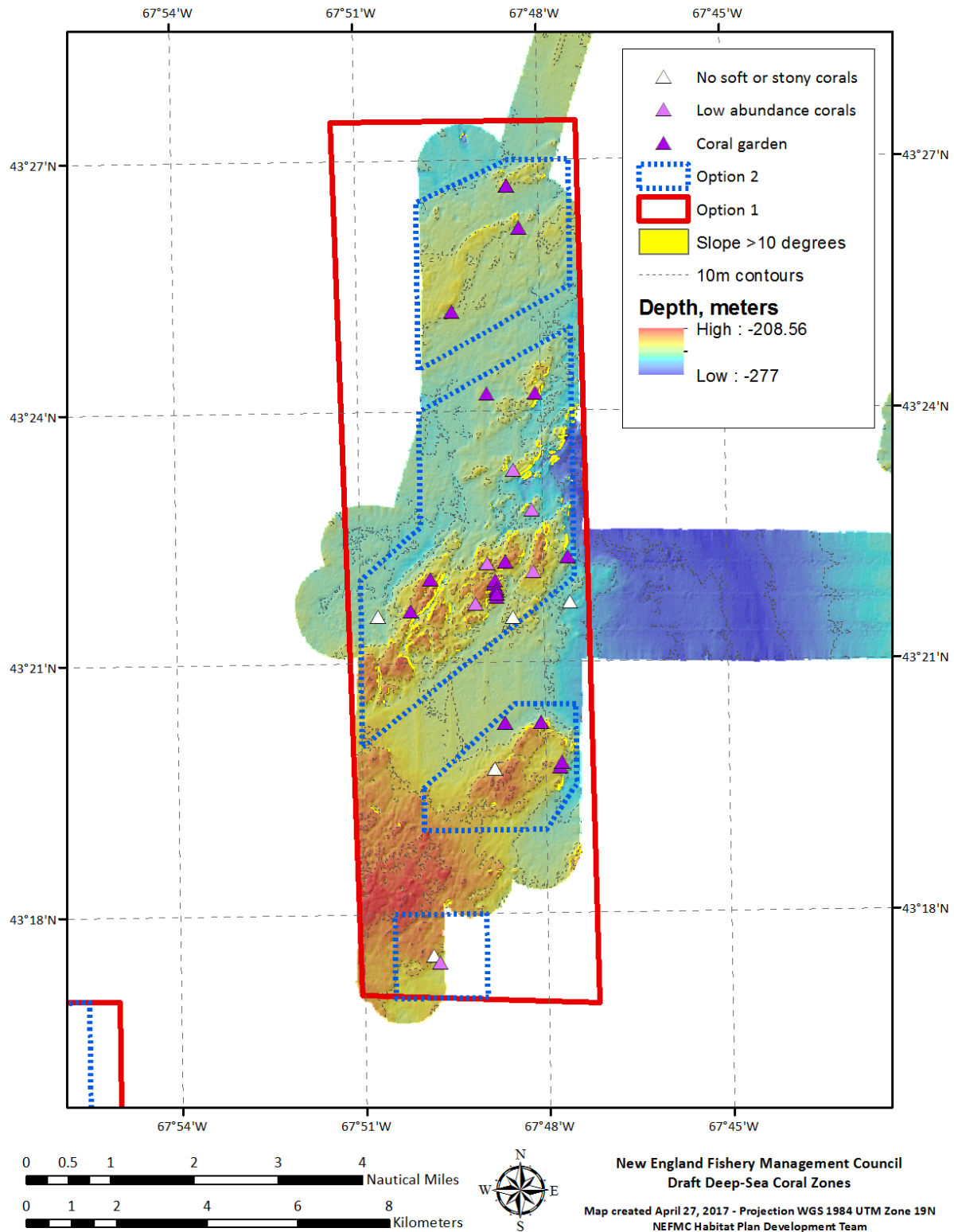
Table 4 – Summary of coordinates and sizes for the Jordan Basin coral zone options

		Option 1		Option 2	
		Coordinates	Size (km ²)	Coordinates	Size (km ²)
Feature	96 Fathom Bump	-67°58'0", 43°14'0" -67°58'0", 43°17'0" -67°55'0", 43°17'0" -67°55'0", 43°14'0"	22.5	-67°57'00", 43°17'00" -67°55'30", 43°17'00" -67°55'30", 43°15'00" -67°57'00", 43°15'00"	7.5
	114 Fathom Bump	-67°47'22.9", 43°27'27.8" -67°47'10.6", 43°16'55.2" -67°51'2.9", 43°17'2.8" -67°51'22.9", 43°27'28.2"	103.1	-67°49'60", 43°26'30" -67°48'30", 43°27'00" -67°47'30", 43°27'00" -67°47'30", 43°25'30"	11.5
				-67°47'30", 43°25'00" -67°47'30", 43°22'00" -67°51'00", 43°20'00" -67°50'59.2", 43°21'59.7" -67°49'60", 43°22'37.2" -67°49'60", 43°24'00"	25.1
				-67°49'60", 43°19'30" -67°48'30", 43°20'30" -67°47'30", 43°20'29.6" -67°47'30", 43°19'32.5" -67°48'0", 43°19'0" -67°49'60", 43°19'0"	7.2
				-67°50'30", 43°18'00" -67°48'60", 43°18'00" -67°48'60", 43°17'00" -67°50'30", 43°17'00"	3.8
	118 Fathom Bump	-67°49'0", 43°35'0" -67°49'0", 43°31'0" -67°52'0", 43°31'0" -67°52'0", 43°35'0"	29.9	-67°51'30", 43°34'30" -67°49'60", 43°34'30" -67°49'60", 43°33'30" -67°51'30", 43°33'30"	3.7
	Central Jordan Basin	-67°34'53.9", 43°20'43.7" -67°36'16.7", 43°16'47" -67°38'10.9", 43°16'47.8" -67°36'51.2", 43°20'43.8"	19.0	-67°36'36.7", 43°20'00" -67°35'09.0", 43°20'00" -67°35'29.6", 43°19'00" -67°36'58.0", 43°19'00"	3.7
				-67°37'07.5", 43°18'30" -67°35'40.0", 43°18'30" -67°36'16.7", 43°16'45" -67°37'50.9", 43°16'45"	6.6

Map 15 – Discrete coral zone options in Jordan Basin.



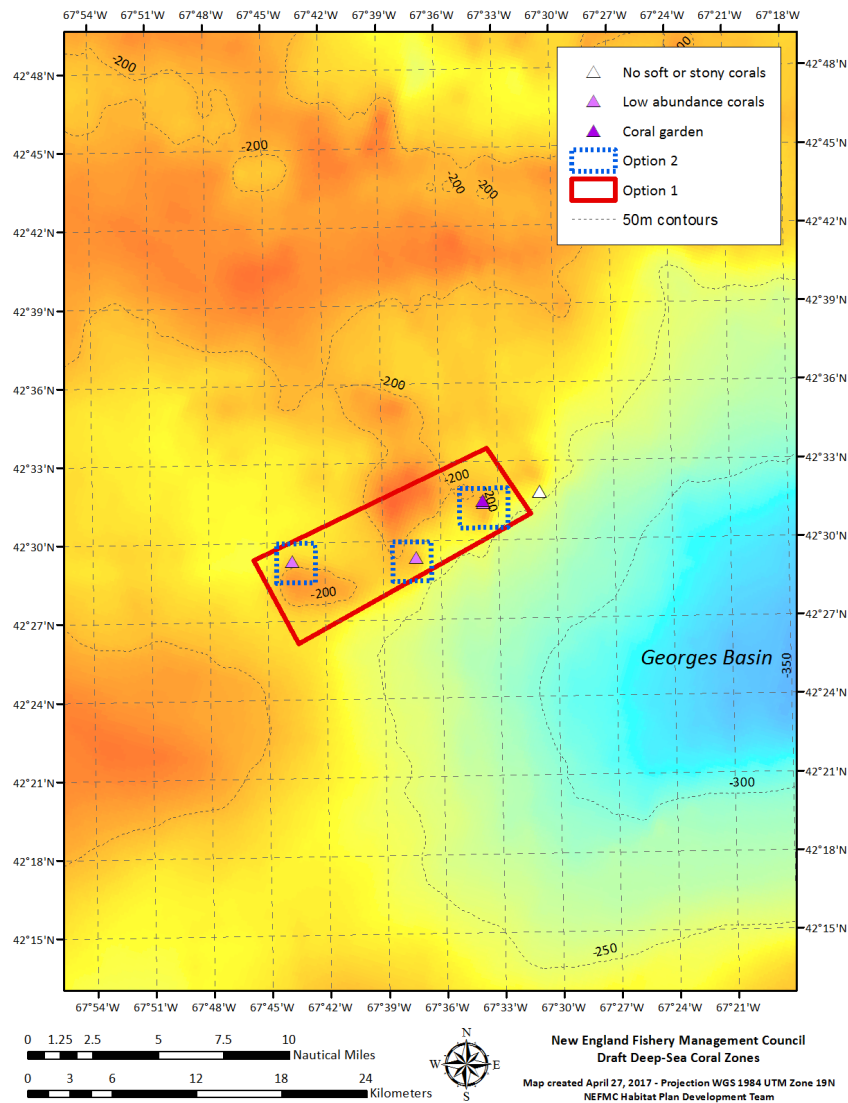
Map 16 – Larger scale image of the high resolution bathymetry at 114 fathom bump. This map uses a different color scale than the previous map of the Jordan Basin region.



4.2.2.3.4 Lindenkohl Knoll

This alternative would designate a coral zone or zones at Lindenkohl Knoll within Georges Basin, which is just north of Georges Bank, and includes the deepest waters in the Gulf of Maine (about 200fa, over 360m). Lindenkohl Knoll is a somewhat shallower feature on the western side of Georges Basin, roughly 25 miles north of the northern edge of Georges Bank. Corals have been documented in recently collected data. Options for fishing restrictions in this zone are described in Section 4.3. This zone would protect coral habitats at Lindenkohl Knoll from the impacts of fishing gear.

Map 17 – Discrete coral zone options at Lindenkohl Knoll



Two boundary options are under consideration. **Option 1** consists of a single zone. The eastern boundary of Option 1 is just over two nautical miles from the Hague Line. **Option 2** lies within Option 1 and consists of three smaller zones centered on locations where corals have been observed.

Lindenkholl Option 1 coordinates

-67°45'40.5", 42°29'23.3"
 -67°33'34.3", 42°33'30.8"
 -67°31'19.7", 42°30'59.8"
 -67°43'24.5", 42°26'09.8"

Lindenkholl Option 2 coordinates

Area 1

-67°44'30", 42°30'00"
 -67°42'30", 42°30'00"
 -67°42'30", 42°28'30"
 -67°44'30", 42°28'30"

Area 2

-67°38'30", 42°30'00"
 -67°36'30", 42°30'00"
 -67°36'30", 42°28'30"
 -67°38'30", 42°28'30"

Area 3

-67°34'60", 42°32'00"
 -67°32'30", 42°32'00"
 -67°32'30", 42°30'30"
 -67°34'60", 42°30'30"

4.3 FISHING RESTRICTIONS FOR CORAL ZONES

The following range of fishing restriction alternatives are under consideration for the coral zones described above. Different measures could be used in broad vs. discrete zones, or in different 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.

4.3.1 Option 1: Prohibit all bottom-tending gears

Option 1 would prohibit the use of all bottom-tending fishing gears in deep-sea coral zones, but would allow the use of gears that do not contact the seabed. Restricted gear types would include bottom-tending otter trawls, bottom-tending beam trawls, hydraulic dredges, non-hydraulic dredges, bottom-tending seines, bottom-tending longlines, sink or anchored gillnets, and pots and traps. This list is intended to be comprehensive, but some of these gears may not be active in the coral zones currently. Pots and traps could be exempted from this restriction by adopting one or both of the sub-options listed below in combination with this alternative.

4.3.1.1 Sub-option A: Exempt the red crab fishery from coral zone restrictions

Sub-option A would exempt the red crab trap fishery from gear restrictions. This exemption would be limited to vessels fishing under a limited access red crab permit (Category B or C). **Option 1, Sub-option A is the preferred alternative for the 600m minimum depth broad zone.**

4.3.1.2 Sub-option B: Exempt other trap fisheries from coral zone restrictions

Sub-option B would exempt vessels in all other pot and trap fisheries from gear restrictions. This exemption would cover vessels fishing for lobster and Jonah crab with federal lobster permits, as well as any other vessels fishing with traps or pots.

Transit provisions

Vessels may transit the coral zones provided bottom-tending trawl nets are out of the water and stowed on the reel and any other fishing gear that is prohibited in these areas is onboard, out of the water, and not deployed. Fishing gear would not be required to meet the definition of “not available for immediate use” in 50 CFR § 648.2. These transit provisions are consistent with those selected by the Mid-Atlantic Fishery Management Council for their coral zones, which went into effect on January 13, 2017.

4.3.2 Option 2: Prohibit use of mobile bottom-tending gears

Option 2 would prohibit the use of mobile bottom-tending fishing gears in deep-sea coral zones, including bottom-tending otter trawls, bottom-tending beam trawls, hydraulic dredges, non-hydraulic dredges, and bottom-tending seines. This list is intended to be comprehensive, but some of these gears may not be active in the coral zones currently. This option would allow fishing with fixed gears (bottom-tending longlines, sink or anchored gillnets, and pots and traps) and any gear that does not contact the seabed.

Option 2 is the preferred alternative for the Gulf of Maine discrete coral zones.

4.4 SPECIAL FISHERY PROGRAMS FOR CORAL ZONES

The alternatives in this section would create programs to allow special access fishing, exploratory fishing, and/or research activities within coral zones. The concepts in these alternatives come from existing special access programs in the groundfish, scallop, and herring fisheries, the exempted fishing permit process, and the Northwest Atlantic Fishery Organization exploratory fishing program. One or more of the action alternatives could be selected, in any combination, or Alternative 1/No Action.

4.4.1 Alternative 1/No Action. No special programs for access, exploratory fishing, or research tracking requirements

Under Alternative 1/No Action, the Council would not develop any new programs for special access or exploratory fishing, and would not request that researchers ask for a letter of acknowledgement.

4.4.2 Alternative 2. Special access program fishing

This alternative would implement a special access program within some or all of the deep-sea coral zones. The objectives of the program would be as follows:

- (1) To allow for continued fishery access to some or all coral areas
- (2) To ensure that such fishing does not conflict with coral conservation objectives

This program would generate sufficient data to understand fishing distributions in coral zones, as well as interactions between fishing and corals. The intent is to specify the possible the operational requirements for a vessel to fish within a coral zone.

4.4.3 Alternative 3. Exploratory fishing

This alternative would implement an exploratory fishing program within some or all of the deep-sea coral zones. The objectives of an exploratory program would be as follows:

- (1) To allow for exploration of the feasibility (technological, economic) of new fisheries
- (2) To collect data that indicate whether the new fishery conflicts with coral conservation objectives

Steps in the exploratory fishing process would be as follows:

- (1) Apply for an exempted fishing permit and letter of authorization to conduct research/exploratory fishing
- (2) Document feasibility of the fishery including evidence that the fishery does not compromise coral conservation objectives
- (3) If appropriate, add the target species to the list of special access program species via rulemaking

4.4.4 Alternative 4. Research activities

This alternative would request that individuals and organizations seek a letter of acknowledgement when conducting scientific research (see definition below) in coral zones, acknowledging that such letters are not required. A letter of acknowledgement would be useful to help NMFS and the Council keep track of research activities that may be occurring in coral zones, the results of which could benefit future management decisions.

4.5 FRAMEWORK PROVISIONS FOR DEEP-SEA CORAL ZONES

These options would allow the measures adopted via this amendment to be changed via framework adjustment versus fishery management amendment. This would not preclude the Council from determining, or NMFS from recommending, that an amendment is a more appropriate vehicle for consideration of the change. In some cases, an amendment might be more appropriate, particularly if the impacts of an action are likely to be substantial. Note that the decision about whether an environmental assessment vs. environmental impact statement is prepared is separate from the decision to pursue a framework or an amendment. Alternative 1/No Action, or one or more of the action Alternatives 2-4 could be selected.

4.5.1 Alternative 1: No Action

Under Alternative 1, there would be no change to framework adjustment provisions of the FMPs regarding deep-sea coral management measures.

4.5.2 Alternative 2: Add, revise, or remove coral zones via framework adjustment

Alternative 2 would allow coral zones to be added, revised, or removed via framework adjustment.

4.5.3 Alternative 3: Change fishing restrictions in coral zones via framework adjustment

Alternative 3 would allow the Council to change the types of fishing gears restricted within deep-sea coral zones via framework.

4.5.4 Alternative 4: Allow changes to special access or exploratory fishing programs via framework adjustment

Alternative 4 would allow changes to special access or exploratory fishing programs (e.g., permit and observer requirements, move-along provisions) via framework adjustment.

5.0 WHAT ARE THE IMPACTS OF THE MEASURES UNDER CONSIDERATION?

As required under the National Environmental Policy Act, the Council has begun to assess the potential impacts of the management proposals in this amendment on different components of the natural and human environment. These analyses will be completed following final Council action, before the Council submits the draft amendment and environmental assessment to the National Marine Fisheries Service. If the alternatives are modified by the Council during final action, the impacts analysis will be revised accordingly.

Given the Council's problem statement, which states that "measures in this amendment will be considered in light of their benefit to corals as well as their costs to commercial fisheries", work to date has focused largely on two ecosystem components: deep-sea corals and human communities, and to a lesser extent on managed resources. The potential impacts of the alternatives on these components are summarized very briefly below. The more detailed analyses in the draft environmental assessment should be reviewed when considering recommendations for final action. Analysis of impacts on additional ecosystem components, namely managed resources (i.e. fishery species) and protected resources (i.e. marine mammals, turtles, and Endangered Species Act-listed fishes) are in progress.

Although the alternatives in this document separate coral zone designations (section 4.2) from fishing restrictions (section 4.3), these two sets of management options must be considered together when assessing impacts to corals, human communities, and other ecosystem components. This is because the gear restrictions applied in a particular coral zone determine the conservation benefits to corals as well as the impacts or lack thereof on commercial fishing activities. The general approach was to evaluate the coral zones with respect to various coral-related or fishery-related metrics, and then develop a discussion around how the metrics contribute to positive or negative impacts associated with a zone and gear restriction option.

5.1 IMPACTS ON DEEP-SEA CORALS

Information considered: Pre-2012 coral presence records, 2013-2015 exploratory coral survey data, coral habitat suitability model results (canyon/slope region only), distribution and amount of high slope (steep) habitats and water depth, current distribution of fishing by gear type.

The coral zone alternatives proposed in this amendment, whether designated as closures to bottom-tending gears or mobile bottom-tending gears, are expected to have positive impacts on deep-sea corals. All of the zones under consideration are known to encompass deep-sea coral habitats, as evident from visual sampling with remotely operated vehicles, towed cameras, or autonomous underwater vehicles. The zones differ from one another in terms of how comprehensively they are likely to encompass coral habitats in a particular location.

In particular, considering the continental slope and canyons from about 100 to 2,000m depth, the 300m broad zone (Option 1) encompasses 88% of coral presence records, 96% of the areas determined to have a high or very high likelihood of soft coral occurrence based on the suitability model, and 99% of the areas where slopes exceed 30 degrees. The 900m coral zone (Option 5) encompasses 59% of the coral records, 59% of the area likely to be soft coral habitat, and 62% of the high slope habitat. Thus, while the 900m zone still provides precautionary protection for coral habitats in the event that fishing activities in the region expand into deeper waters, the 300m zone

protects substantial additional areas of coral habitat, and would prevent existing fisheries in the slope and canyon region from damaging deep-sea corals. The other broad zone alternatives, including the preferred alternative, are intermediate to these two extremes. Added to any of these broad zones, the canyon zones would protect additional coral habitats, because the shallowest parts of the canyon zones extend beyond the footprint of the broad zones, particularly the deeper ones (Options 3-6, 500m-900m).

In combination, designating coral zones in all four Gulf of Maine locations would protect all known deep-sea coral habitats in the Gulf of Maine from the effects of fishing gear. Whether the larger (Option 1) or more refined (Option 2) zone boundaries are considered, all remotely operated vehicle and towed camera dive sites where corals have been found are encompassed within the zone boundaries. The larger Option 1 boundaries for each location are more likely to encompass the full extent of coral habitat areas. While dives and camera tows without corals help to bound the spatial footprint of coral habitats, their full extent is not well understood. High resolution bathymetry are informative at the Mt. Desert Rock, Outer Schoodic Ridge, and Jordan Basin 114 Fathom Bump sites, but such data are not available in other locations.

Some zones and fishing gear restrictions represent precautionary approaches only. These include some of the preferred alternatives. The 600m minimum depth broad zone, closed to all bottom-tending gears with an exemption for the red crab trap fishery, would not affect any existing fishing activities in the continental slope and canyons region, because the zone is beyond the depth of all bottom-tending gear fisheries, except for red crab. However, it would prevent such fisheries from expanding into the area in the future. The Outer Schoodic Ridge and Mt. Desert Rock zones are actively fished, but the vast majority of fishing activity targets American lobster. The preferred alternative, a mobile bottom-tending gear closure of these two areas, will not restrict this fishery, but does guard against mobile gear use in the areas in the future. The offshore Gulf of Maine zones, if designated as mobile bottom-tending gear closures, would prevent bottom trawl activity occurring in Jordan and Georges Basins from impacting corals within the zones.

5.2 IMPACTS ON MANAGED FISHERY RESOURCES

Information considered: Spatial distribution of NEFMC-managed species, relative to various coral zones. Designated EFH was used to indicate a species' utilization or potential utilization of a particular coral zone.

Deep-sea corals have existence value in their own right, but they also provide habitat for other invertebrates and fishes. Some of these species are managed by the Councils or the Atlantic States Marine Fisheries Commission, and are the target of commercial and/or recreational fisheries. While the population statuses of some of these managed resources are positive, other stocks are in overfished condition. For all stocks, but especially for those that are depleted, conservation of habitats used for feeding, shelter from predation, or spawning activities is important.

Other than the seamount zones, which have very limited overlap with any managed resources, all of the coral zones under consideration are used as habitat by Council or Commission managed species. The inshore and offshore Gulf of Maine zones overlap with the distribution of multiple fishery species, including redfish, American plaice, Atlantic cod, Atlantic halibut, Atlantic wolffish, haddock, pollock, witch flounder, red hake, silver hake, monkfish, smooth skate, and thorny skate. Additional species including ocean pout, windowpane, winter flounder, yellowtail flounder, little

skate, and winter skate occur in and around the inshore Gulf of Maine zones at Mt. Desert Rock and Outer Schoodic Ridge. While the magnitude of the benefits these species derive from coral habitats is not understood, many of these species have been directly observed within coral habitats, and are likely using the areas for shelter and feeding. There is some evidence for a connection between sea pen corals and redfish reproduction, as larval fish have been observed amongst the coral polyps.

A subset of the species occurring in the Gulf of Main coral zones, namely redfish, halibut, white hake, witch flounder, red hake, silver hake, offshore hake, monkfish, smooth skate, and thorny skate, plus barndoor skate and red crab, occur in the canyon/slope coral zones. Overall, conservation of coral habitats is likely to positively impact managed resources that use the habitats for feeding, shelter, and reproduction.

5.3 IMPACTS ON HUMAN COMMUNITIES

Information considered: Vessel trip report data, by gear type and species landed (2010-2015), vessel monitoring system data (2010-2012) by gear type and species landed, results of a 2016 ASMFC survey of Area 3 lobster permit holders (lobster fishery only), Maine dealer data and harvester reports for Lobster Management Area 1 (lobster fishery, inshore Gulf of Maine zones only), fishing industry information on locations and depths fished, by gear type.

Various fisheries and fishing communities could be negatively affected by the designation of coral zones, if fishing effort is displaced by the zone designations. Exemptions from gear restrictions would alleviate impacts on associated fisheries. Specific exemptions include the red crab fishery and other trap gears. The mobile bottom-tending gear restriction option would avoid impacts on gillnet or longline fisheries as well.

In addition to the gear restrictions selected, the degree of overlap between existing fisheries and potential coral zones influences the magnitude of negative impacts. The seamount zones, as well as the 900m broad zone, are entirely precautionary in nature, as fishing is not known to occur within these areas at present. Thus, these zones would have neutral impacts on fisheries and fishing communities at the present time. The 600m and 600m minimum broad zones lie beyond the footprint of all known bottom-tending gear fishing activities, with the exception of red crab. Thus, these zones will likely have neutral impacts on fisheries and fishing communities, provided a red crab fishery exemption is adopted. The 600m minimum zone allows a larger operational buffer between adjacent fishing grounds and the coral zone, which would benefit commercial fishing operations.

The shallower broad zones at 300m, 400m, and 500m, as well as the Gulf of Maine zones, would displace fishing activities, depending on the gear restrictions selected. Species including lobster, Jonah crab, squid, whiting, and monkfish are fished in and around the shallower parts of the 300-500m broad zones with traps, bottom trawls, and gillnets. Red crab are caught in deeper water. Designating these zones would have negative impacts on these fisheries and associated fishing communities, via effort displacement, depending on the gear restriction adopted.

In the inshore Gulf of Maine, lobster is the only bottom-tending gear fishery with any substantial degree of overlap with the Mt. Desert Rock and Outer Schoodic Ridge coral zones. If these areas were closed to trap gears, there would be a negative impact on federally-permitted lobster fishermen

in Area 1, Zones A and B. If trap gears are exempted, or only mobile bottom-tending gears are restricted, these negative impacts would be eliminated.

In the offshore Gulf of Maine (Jordan Basin and Lindenkohl), traps, trawls, and gillnets are used to target lobster, groundfish, and monkfish. Hagfish pots are also fished in the Jordan Basin zones. Lobster is the top revenue generator in these locations. Any of the gear restriction options would displace some fishing activity; the smallest magnitude of negative impacts would be associated with a mobile bottom-tending gear closure. Additional negative impacts would be felt from a bottom-tending gear restriction that included gillnet and trap activity as well. The smaller Option 2 zones are expected to have fewer negative impacts than the larger Option 1 zones. Vessel monitoring system data suggest approximately 100 hours of fishing time with bottom trawls in the Jordan Basin Option 2 zones, roughly half the effort shown for the Option 1 zones.

Looking beyond the fishing community, the many individuals who support conservation of deep-sea coral habitats would derive positive impacts from designation of deep-sea coral zones.

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