DRAFT

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

Decision document for:
July 20, 2011 Habitat Advisory Panel Meeting
July 21, 2011 Habitat Committee Meeting
Draft 2

Prepared by the
New England Fishery Management Council

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1.0Measures to minimize the adverse effects of fishing on EFH

The Habitat PDT developed these management options based on SASI model outputs, other sources of scientific information, PDT discussions from June 2010-June 2011, and committee discussion from June 2010-March 2011. The purpose of this document is to provide information to the Habitat Committee so that they can make recommendations for further analysis, refinement, or elimination of specific options.

Note that individual area-based options listed below are likely to have synergistic effects on the total magnitude of adverse effects across one or more gear types/fisheries, because restrictions on fishing in one location will affect the magnitude of fishing in other locations. Thus, the PDT recommends that the individual options be grouped into a range of three or four alternatives for analysis. This step will be completed following the development of groundfish management measures.

1.1 Habitat areas

This section recommends changes to current habitat closed areas, and identifies vulnerable habitat areas that are suggested for possible management action or maintenance of exisiting protection measures.

1.1.1 Changes to current habitat closed areas

Six habitat closed areas were implemented via Amendment 13 to the Multispecies FMP. These included five that are sub areas within existing groundfish mortality closures: Closed Area I, Closed Area II, Nantucket Lightship Closed Area, Western Gulf of Maine Closed Area, and Cashes Ledge closed area, and one additional habitat closure on Jeffreys Ledge. Amendment 15 (approved June 2011) implements matching habitat closures for the Atlantic Sea Scallop FMP in CAI, CAII, NLCA, and WGOM. Currently, the areas are closed to all mobile, bottom-tending gear on a year round basis. Specifically, this includes all types of trawls and all types of dredges. The following options consider elimination of three of these closed areas from both the multispecies and scallop FMPs, as well as modifications to the WGOM habitat closure.

The PDT has previously presented two types of analyses for these areas. The first, an 'Equal Area Permutation Analysis' (June 2010) compared the theoretical vulnerability of the seabed habitats in these areas, based on SASI model outputs, to thousands of randomly selected, same-size areas throughout the model domain. The second, an 'Area Closure Analysis' (January 2011) considered the fishing effort shifts that might occur if these areas were reopened and calculated the increase or decrease in adverse effects throughout the model domain at the gear type level. The assumptions required for the Area Closure Analysis (which was considered by the Peer Review Panel) need further consideration by the PDT, but if these options go forward for additional analysis, this approach will be useful for determining the practicability of eliminiating or changing any of these areas.

The four options below to eliminate the CAII, CAI, and NLCA habitat areas, and to allow shrimp vessels to access the WGOM habitat area, have been previously recommended by the Committee for further analysis.

1.1.1.1 Eliminate CAII habitat closed area

This option would eliminate the CAII habitat closed area from both the multispecies and scallop FMPs.

Previous analysis: EAP analysis (presented June 2010) of generic otter trawl gear SASI model Z_∞ outputs indicated that the grid cells overlapping the CAII habitat closure rank relatively high in terms of habitat vulnerability in comparison with other areas throughout the model domain of the same size. However, results of the LISA cluster analysis for trawl gear outputs indicate that the most vulnerable structural habitats in that region are centered slightly to the west (area known as cluster 5/Georges Shoal cluster). Therefore, this option would eliminate the current closed area, and a new habitat area might potentially be implemented via a separate option. The Area Closure Analysis (presented January 2011) showed a decrease in adverse effect for some gear types, and no change in adverse effect for others, depending on whether the gear type was expected to fish in the area following reopening, and the expected catch rates in the area as compared to other areas.

Additional information and discussions: While there is vulnerable seabed in and around this habitat closure, a different closure in this region **might** better encompass habitats susceptible to fishing impacts, while allowing for efficient use of fishery resources in the area, such as sea scallops. However, despite potential increases in economic benefits to certain fisheries, it is important to bear in mind that habitat benefits which have accrued since the closure was first implemented, while difficult to quantify, may be extremely important to managed species. Thus, a precautionary approach would be to allow the area to remain closed, in whole or in part. Extra-SASI information related to this area needs to be formally reviewed by the PDT in order to present a balanced recommendation about whether this area should be altered or eliminated, and what the potential costs to habitat might be. Further analyses investigating the practicability of this measure are recommended in order to effectively consider tradeoffs between habitat protection and other goals. If this option is selected for further analysis, the PDT recommends that the option to develop of a Georges Shoal Habitat Area be considered in conjunction with this option (these options could potentially be combined into a single option that would modify the CAII habitat closure). A research area designation may be appropriate as well.

1.1.1.2 Eliminate CAI habitat closed areas

This option would eliminate the CAII habitat closed area from both the multispecies and scallop FMPs. Note that the CAI habitat closed area is comprised of two non-contiguous areas, CAI-N and CAI-S, and that this option would eliminate both areas.

Previous analyses: EAP analyses (presented June 2010) of trawl gear type SASI model outputs indicated that the grid cells overlapping the CAI-N and CAI-S habitat closures rank relatively low in terms of habitat vulnerability in comparison with other areas throughout the model domain of the same size. Similar to CAII , the Area Closure Analysis (presented January 2011) showed a decrease in adverse effect for some gear types, and no change in adverse effect for others, depending on whether the gear type was expected to fish in the area following reopening, and the expected catch rates in the area as compared to other areas.

Additional information and discussions: Despite potential increases in economic benefits to certain fisheries, it is important to bear in mind that habitat benefits which have accrued since the closure was first implemented, while difficult to quantify, may be extremely important to managed species. Thus, a precautionary approach would be to allow the area to remain closed, in whole or in part. Extra-SASI information related to this area needs to be formally reviewed by the PDT in order to present a balanced recommendation about whether this area should be altered or eliminated, and what the potential costs to habitat might be. Further analyses investigating the practicability of this measure are recommended in order to effectively consider tradeoffs between habitat protection and other goals. A research area designation may be appropriate as well.

1.1.1.3 Eliminate NLCA habitat closed area

This option would eliminate the NLCA habitat closed area from both the multispecies and scallop FMPs.

Previous analyses: EAP analyses (presented June 2010) of trawl gear type SASI model outputs indicated that the grid cells overlapping the NLCA habitat closure rank relatively low in terms of habitat vulnerability in comparison with other areas throughout the model domain of the same size. The Area Closure Analysis (presented January 2011) showed a decrease in adverse effect for some gear types, and no change in adverse effect for others, depending on whether the gear type was expected to fish in the area following reopening, and the expected catch rates in the area as compared to other areas.

Additional information and discussions: Despite potential increases in economic benefits to certain fisheries, it is important to bear in mind that habitat benefits which have accrued since the closure was first implemented, while difficult to quantify, may be extremely important to managed species. Thus, a precautionary approach would be to allow the area to remain closed, in whole or in part. Extra-SASI information related to this area needs to be formally reviewed by the PDT in order to present a balanced recommendation about whether this area should be altered or eliminated, and what the potential costs to habitat might be. Further analyses investigating the practicability of this measure are recommended in order to effectively consider tradeoffs between habitat protection and other goals. A research area designation may be appropriate as well.

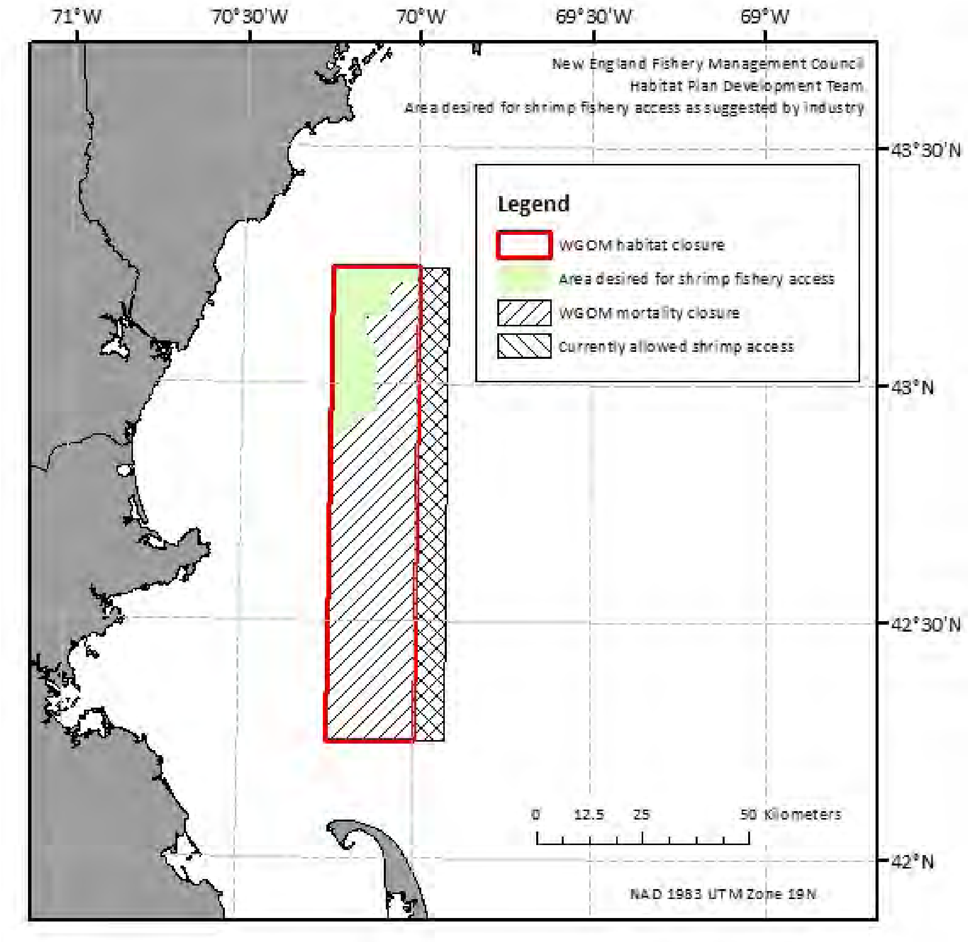
1.1.1.4 Exempt shrimp vessels from WGOM habitat closed area restrictions

This alternative would allow vessels operating under a northern shrimp permit to target northern shrimp inside the WGOM habitat closed area. This option could be further developed in at least two ways. One would be to create a shrimp fishery access area, based on the boundaries suggested by the industry, where shrimping would be allowed. Another would be exempt shrimp vessels from WGOM habitat area restrictions entirely. If shrimp, shrimp habitats, and expected shrimp fishing are largely restricted to the area specified in the figure below, the impacts and benefits of these two approaches would be similar. Further analysis will be required in order to better understand shrimp and shrimp habitat distributions in relation to vulnerable habitat areas identified within the WGOM habitat closure.

Background: The WGOM mortality closure was implemented temporarily in 1998 and then extended indefinitely. The WGOM habitat closure, which was implemented in 2004 via Amendment 13 to the Multispecies FMP, overlaps the western portion of WGOM mortality closure. Mobile bottom-tending gears (i.e. trawls and dredges) are excluded from the WGOM habitat closure in an effort to minimize the adverse effects of fishing on habitat. This restriction includes trawl vessels targeting northern shrimp, a species managed by the Atlantic States Marine Fisheries Commission.

Amendment 13 exempted shrimping from mortality closure restrictions because bycatch of managed groundfish is generally low in shrimp trawls due to the requirement for a fish-excluding Nordmore grate. Practically speaking, however, the exclusion from mortality closure regulations is of little benefit the northern shrimp industry because most of the shrimp in the WGOM mortality closures are found in the western portion, which overlaps with the WGOM habitat closure (M. Raymond, personal communication). From an industry perspective, the most desirable area for shrimp fishery access would be the northwestern portion of the WGOM habitat closure (see Figure 1, M. Raymond, personal communication).

Figure 1 – Suggested shrimp access area within the WGOM habitat closure.



1.1.2 Vulnerable habitat areas

Based on the results of the Vulnerability Assessment, areas with gravel substrates and complex associated biological and geological structures tend to be most vulnerable to the effects of fishing gears. SASI model $Z_{realized}$ outputs indicate the generic otter trawl gear category contributes the most to adverse effects in the region. Thus, the PDT recommends that, as a primary objective, the Committee focus on protection of gravel habitats from the effects of trawling. The PDT generated the following list of areas vulnerable to fishing, using the SASI model trawl Z_∞ outputs that clustered using the LISA (Local Indicators of Spatial Association) method as a starting point, in addition to other sources of information as noted (see also the Extra SASI discussion document). Various types of management actions (see Section 0) could be employed to protect the habitats in these locations.

1.1.2.1 Jeffreys Bank habitat closed area (status quo)

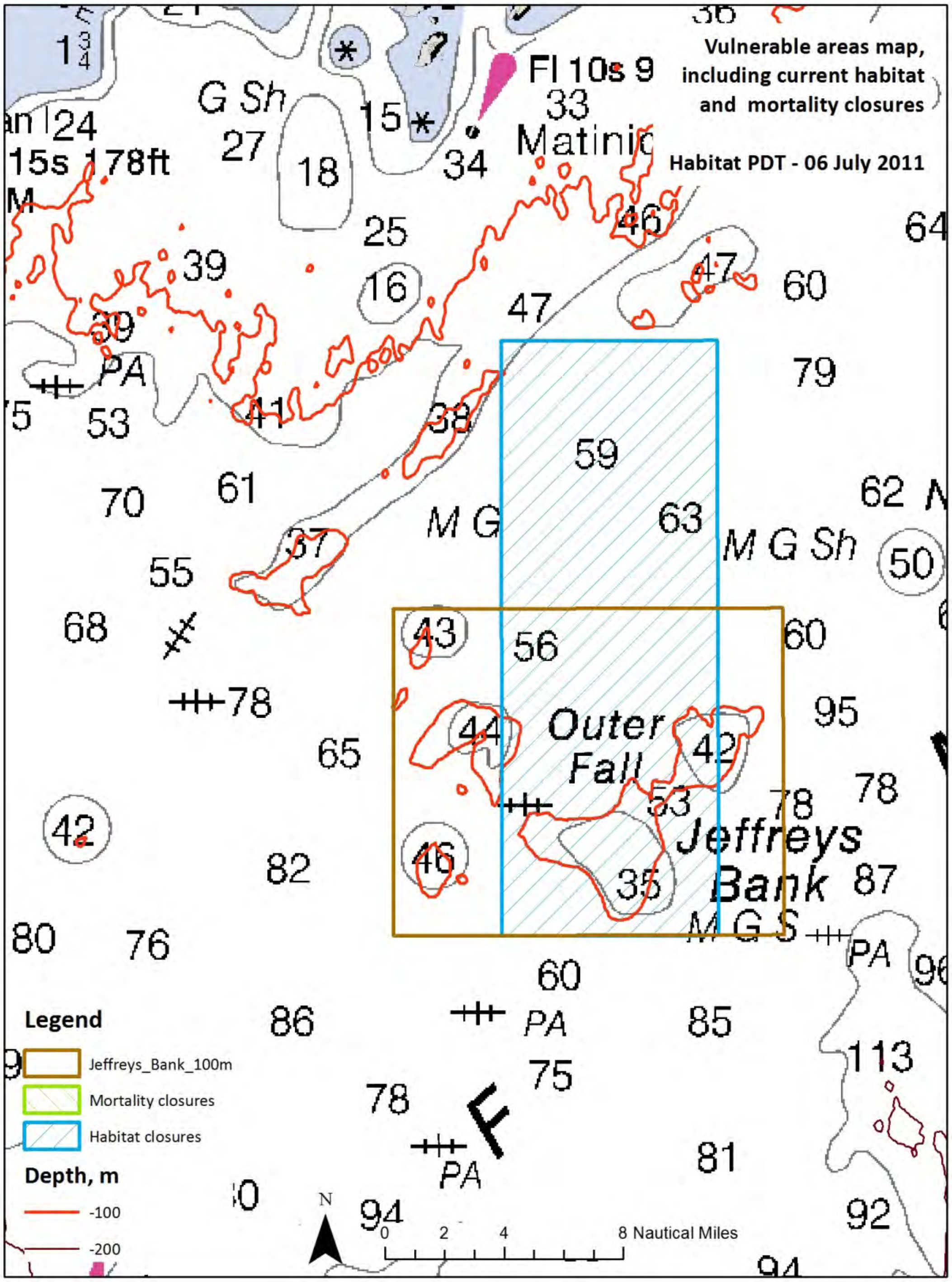
Background: There has been a habitat closed area on Jeffreys Bank since 2004. Map 1 shows the boundaries of the current area, in addition to a modified area that encompasses waters and seabed shallower than approximately 100 m.

Recommendation: The PDT recommends retaining the existing habitat closure on Jeffreys Bank.

Rationale: The area in and around Jeffreys Bank clustered in the LISA analysis. Jeffreys Bank contains gravel habitats vulnerable to fishing gear impacts

Extra-SASI information: To be completed

Map 1 – Jeffreys Bank



1.1.2.2 Cashes Ledge habitat closed area (status quo)

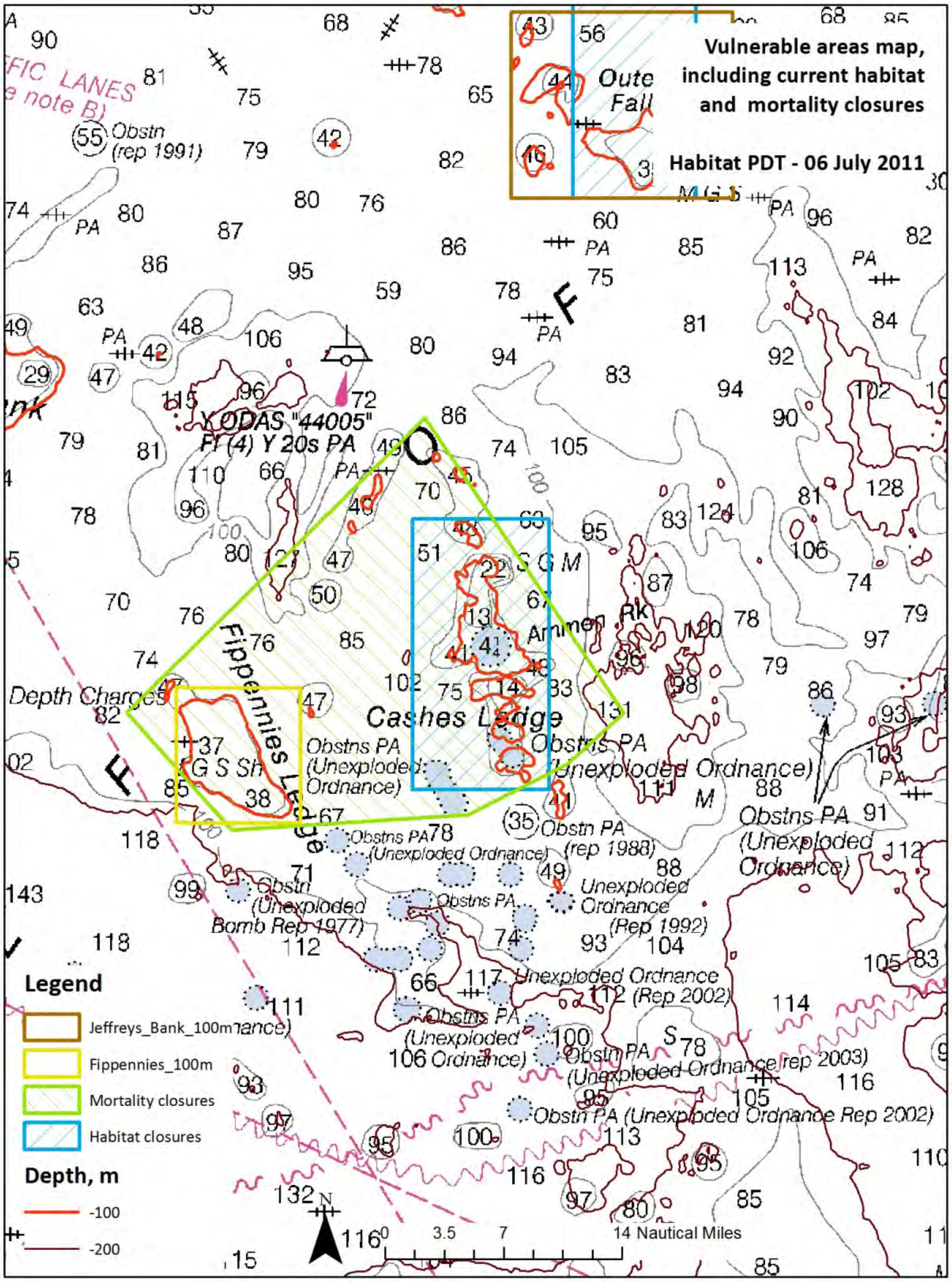
Background: There has been a habitat closed area on Cashes Ledge since 2004.
Exra-SASI information**:** Additional video, acoustic, and grab samples are available to characterize the seabed substrates on Cashes.
Map 2 shows the boundaries of the current area, which encompasses waters and seabed shallower than approximately 100 m.

Recommendation: The PDT recommends retaining the existing habitat closure on Cashes Ledge.

Rationale: Cashes Ledge contains gravel habitats vulnerable to fishing gear impacts

Exra-SASI information: Additional video, acoustic, and grab samples are available to characterize the seabed substrates on Cashes.

Map 2 – Cashes Ledge



1.1.2.3 Fippennies Ledge

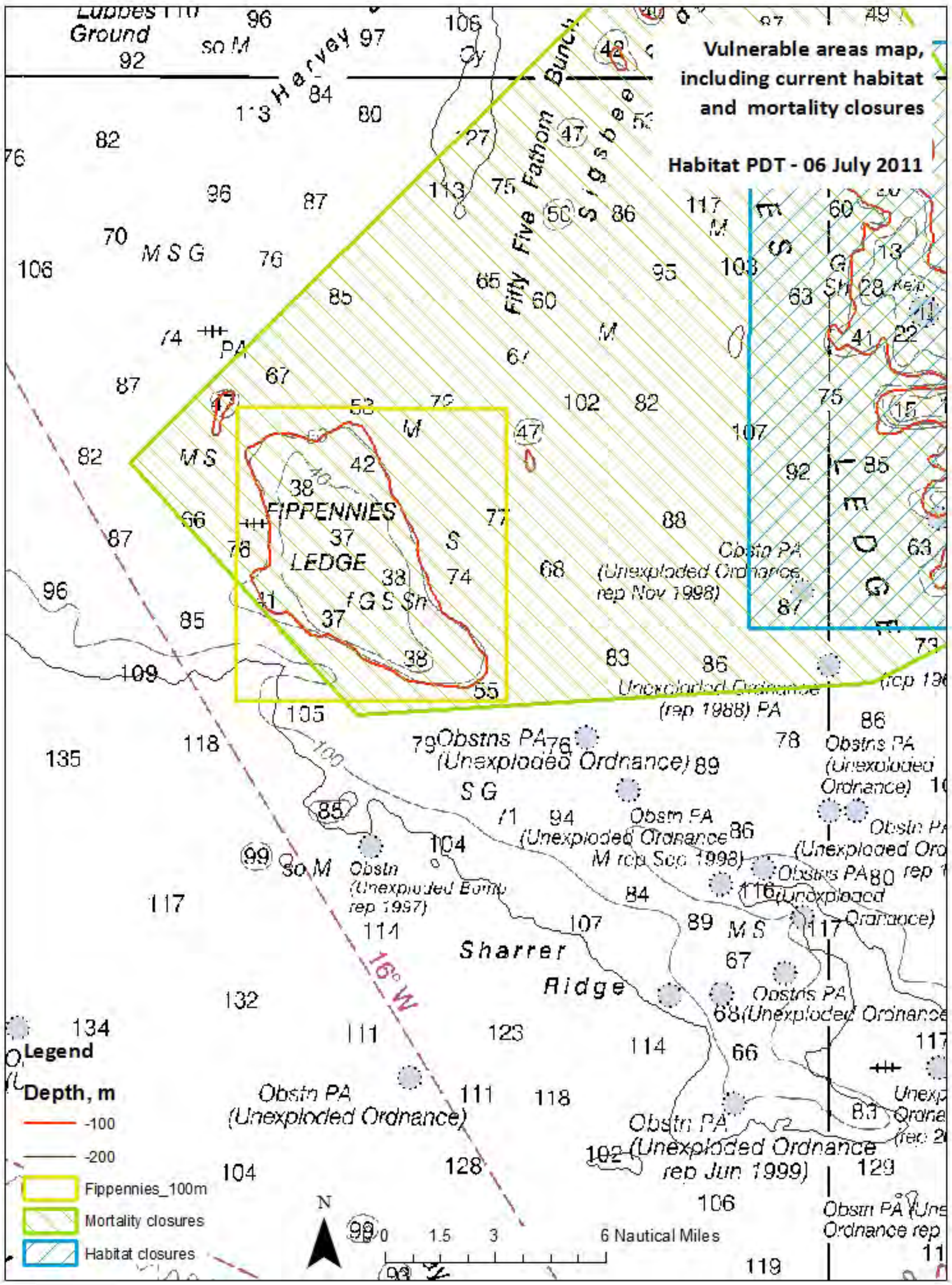
Background: Fippennies Ledge (Map 3) is a shallow ledge in the Gulf of Maine that lies within the Cashes Ledge Mortality Closure and to the west of the Cashes Ledge Habitat Closure. It has been closed to fishing by gear capable of catching groundfish since the Cashes Ledge Mortality Closure was implemented, first as a seasonal closure and then as a year round closure in 2002.

Recommendation: The PDT recommends considering management options to minimize the adverse effects of fishing on Fippennies Ledge. This might include gear restrictions/closures/limits on certain types of fishing, or gear modifications (ground gear or ground cable size limits). This type of option could be particularly relevant if the Cashes Ledge mortality closure is modified or eliminated as part of the Omnibus Amendment (note that consideration of the mortality closures will begin late 2011/early 2012, so specific options related to the mortality closures have not been discussed by either the groundfish or habitat committees).

Rationale: Fippennies Ledge contains gravel habitats vulnerable to fishing gear impacts.

Extra-SASI information: Additional video, acoustic, and grab samples are available to characterize the seabed substrates on Fippennies.

Map 3 – Fippennies Ledge



1.1.2.4 Platts Bank

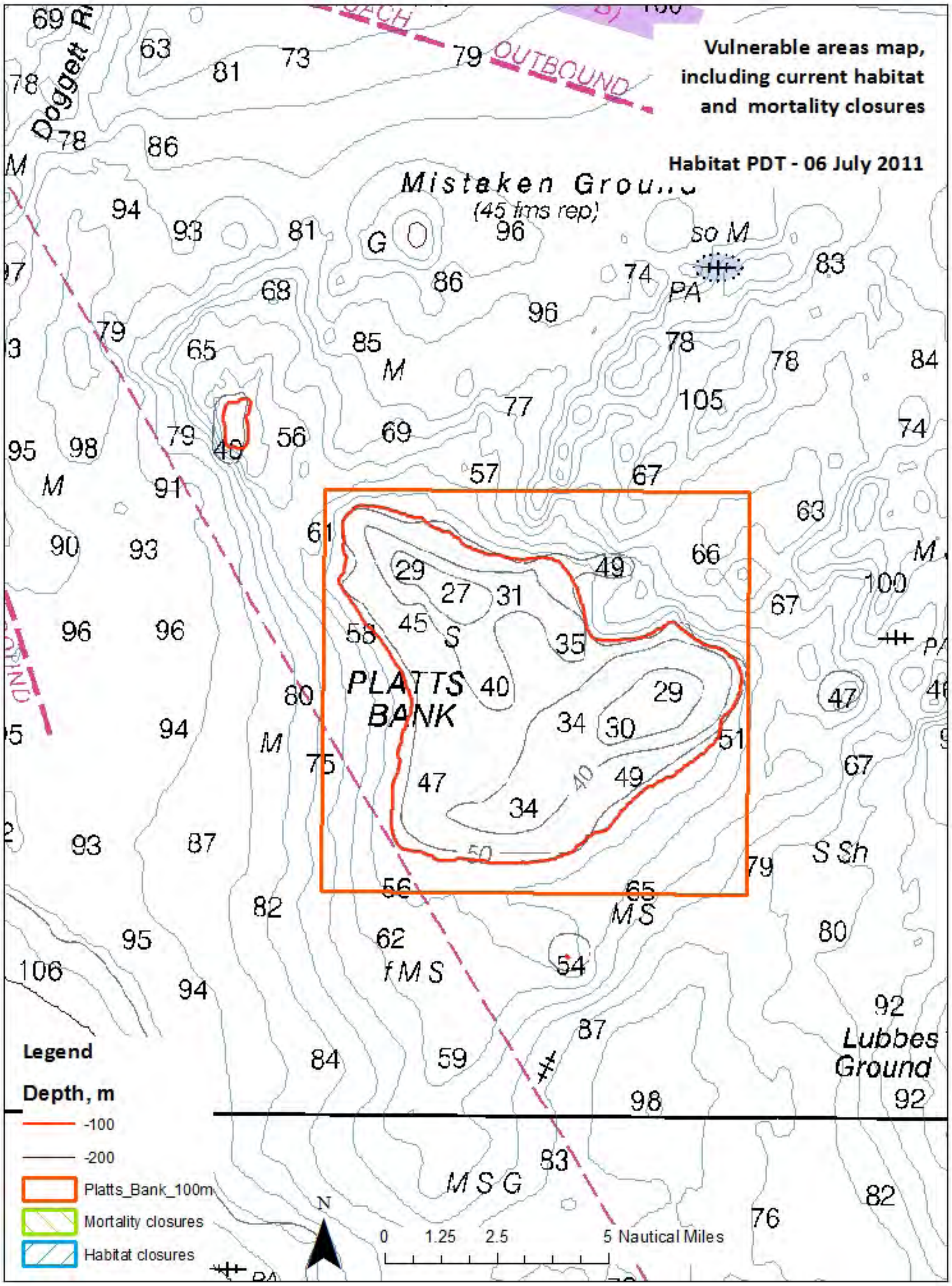
Background: Platts Bank (Map 4) is a shallow bank in the Gulf of Maine that is currently open to fishing.

Recommendation: The PDT recommends considering management options to minimize the adverse effects of fishing on Platts Bank. This might include gear restrictions/closures/limits on certain types of fishing, or gear modifications (ground gear or ground cable size limits).

Rationale: Platts Bank contains gravel habitats vulnerable to fishing gear impacts.

Extra-SASI information: To be completed

Map 4 – Platts Bank



1.1.2.5 Jeffreys Ledge

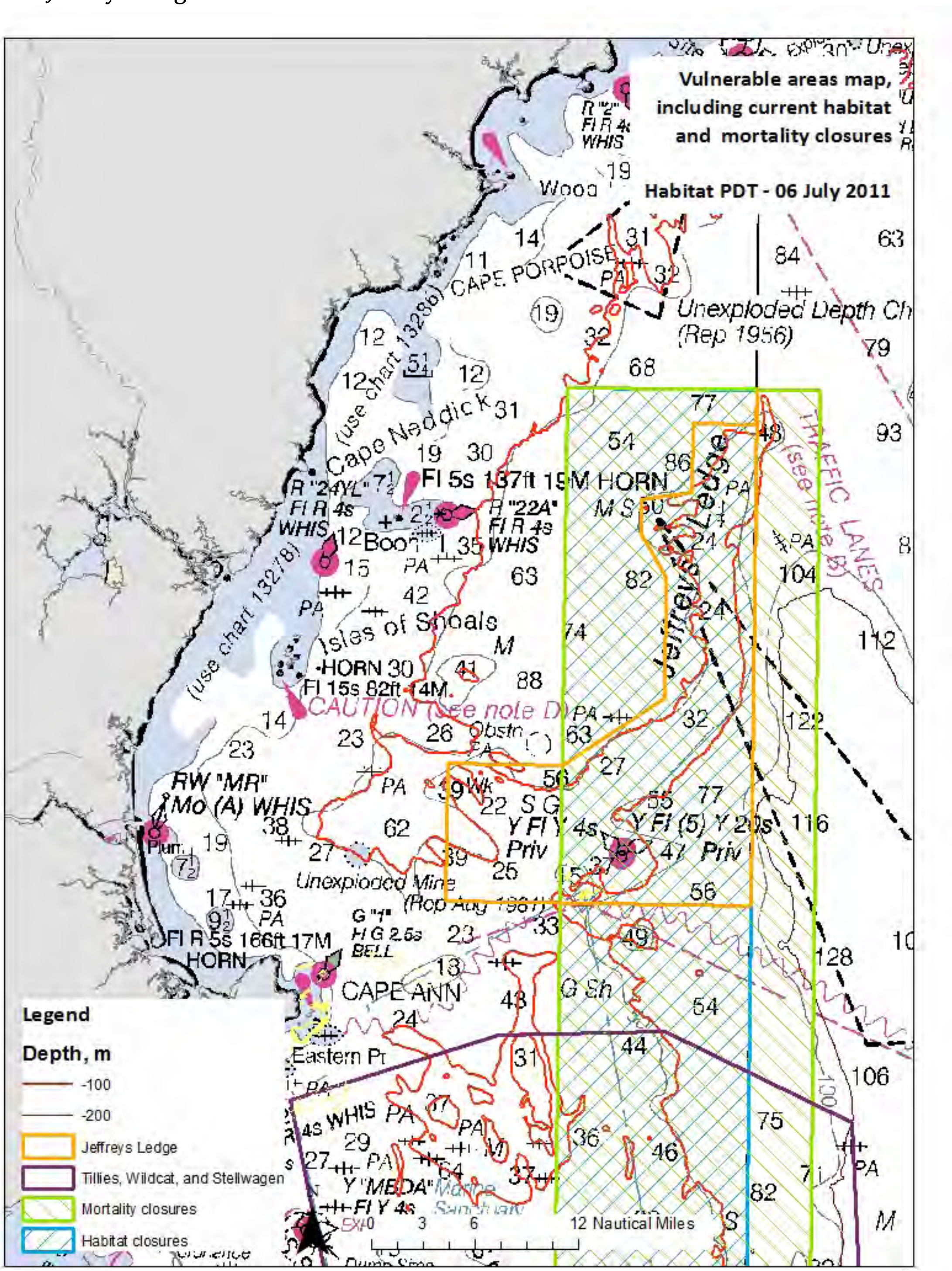
Background: Jeffreys Ledge (Map 5) is a shallow ledge in the Gulf of Maine that lies within the northern portions of the Western Gulf of Maine (WGOM) Habitat and Mortality Closures, extending west beyond the closure boundaries towards Cape Ann, Massachusetts. Portions of Jeffreys Ledge have been closed to fishing by gear capable of catching groundfish since the WGOM Mortality Closure was implemented in 1998.

Recommendation: The PDT recommends management options to minimize the adverse effects of fishing on Jeffreys Ledge. This might include maintaining the current WGOM closure, or modifying that area to better encompass additional portions of Jeffreys Ledge. Options appropriate for the area might include gear restrictions/closures/limits on certain types of fishing, or gear modifications (ground cable size limits; all of Jeffreys Ledge is within the current inshore GOM 12 inch roller gear area). The PDT discussed various area closure boundaries that might be appropriate, ranging from a small area encompassing the northernmost portion of Jeffreys Ledge, to a large area encompassing the full extent of the feature.

Rationale: Jeffreys Ledge contains gravel habitats vulnerable to fishing gear impacts.

Extra-SASI information: To be completed.

Map 5 – Jeffreys Ledge



1.1.2.6 Stellwagen Bank/Tillies Bank/Wildcat Knoll

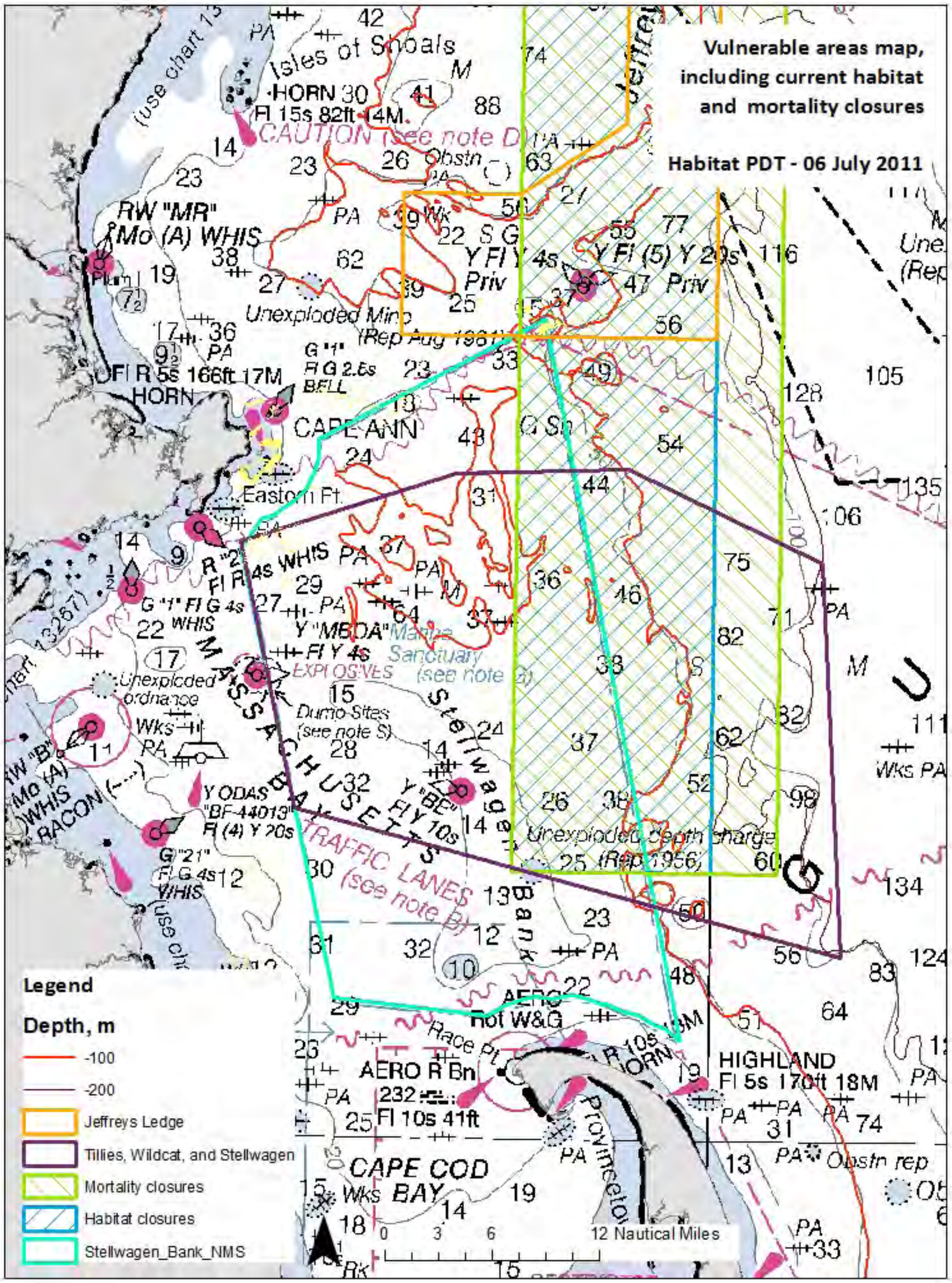
Background: Portions of Stellwagen Bank, Tillies Bank, and Wildcat Knoll lie within the WGOM habitat and mortality closures (Map 6). Those areas that overlap the WGOM mortality closure have been closed to fishing by gear capable of catching groundfish since the closure was implemented in 1998. The boundaries of Stellwagen Bank National Marine Sanctuary are also shown on the figure. While the Council regulates fishing activities in SBNMS, the Sanctuary does have its own management plan that contains goals and objectives for long and short term management of the area.

Recommendation: The PDT recommends management options to minimize the adverse effects of fishing on Stellwagen Bank, Tillies Bank, and Wildcat Knoll. This might include maintaining the current WGOM closure, or modifying that area. Options appropriate for the area might include gear restrictions/closures/limits on certain types of fishing, or gear modifications (ground cable size limits; the area iof interest identified in the figure below falls within the current inshore GOM 12 inch roller gear area).

Rationale: These areas contains gravel habitats vulnerable to fishing gear impacts.

Extra-SASI information: To be completed.

Map 6 – Stellwagen Bank, Tillies Bank, and Wildcat Knoll



1.1.2.7 Georges Shoal

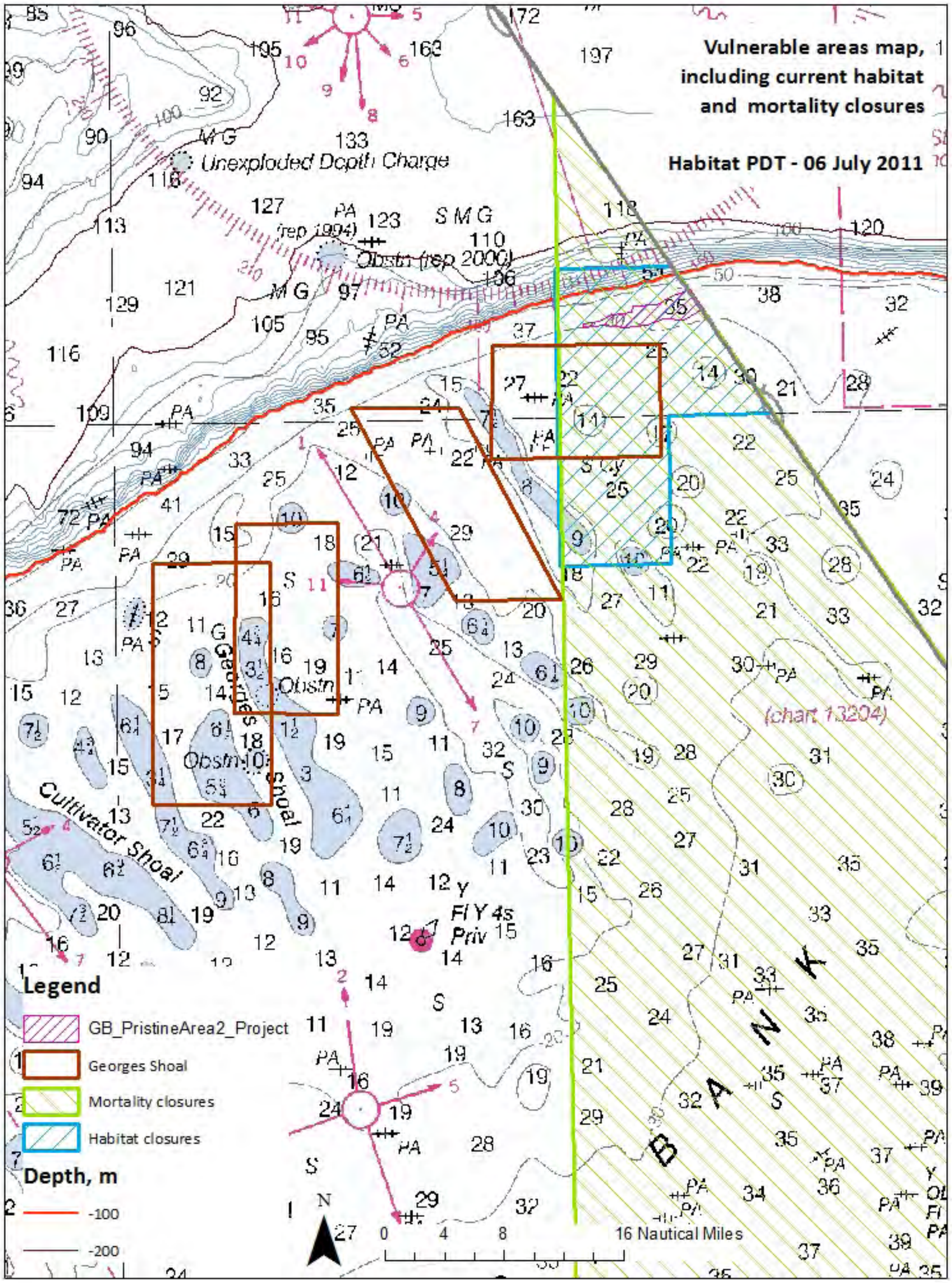
Background: The vulnerable habitat areas identified on Georges Shoal (Map 7) are adjacent to/overlap with both Closed Area II and the habitat closed area in CAII, but are generally centered further to the west. CAII has been closed to gear capable of catching groundfish on a year round basis since 1994. The habitat closure (with associated mobile bottom tending gear restrictions) was established via Amendment 13 in 2004 (although that area was identified as an HAPC for cod in the original Omnibus EFH Amendment in 1998). There are dense aggregations of sea scallops within the current closed area boundaries.

Recommendation: The PDT recommends management options to minimize the adverse effects of fishing on Georges Shoal. Options appropriate for the area might include gear restrictions/closures/limits on certain types of fishing, or gear modifications. One or more of the identified areas of interest could be combined into a Georges Shoal habitat area.

Rationale: Georges Shoal is one of the areas where grid cells highly vulnerable to trawl gear clustered in the SASI LISA analysis. This area contains a relatively large amount of gravel seabed, which is vulnerable to the adverse effects of fishing.

Extra-SASI information: The ecology and geology of the "GB Pristine Area" in the figure below is currently being investigated by USGS. The boundaries of the polygons in the figure are based on the locations of gravel outcrops as identified by Harris and Stokesbury 2010, which analyzed the distribution of sediments on Georges Bank based on video survey data. These data are included in the SASI model base grid.

Map 7 – Georges Shoals



1.1.2.8 Great South Channel

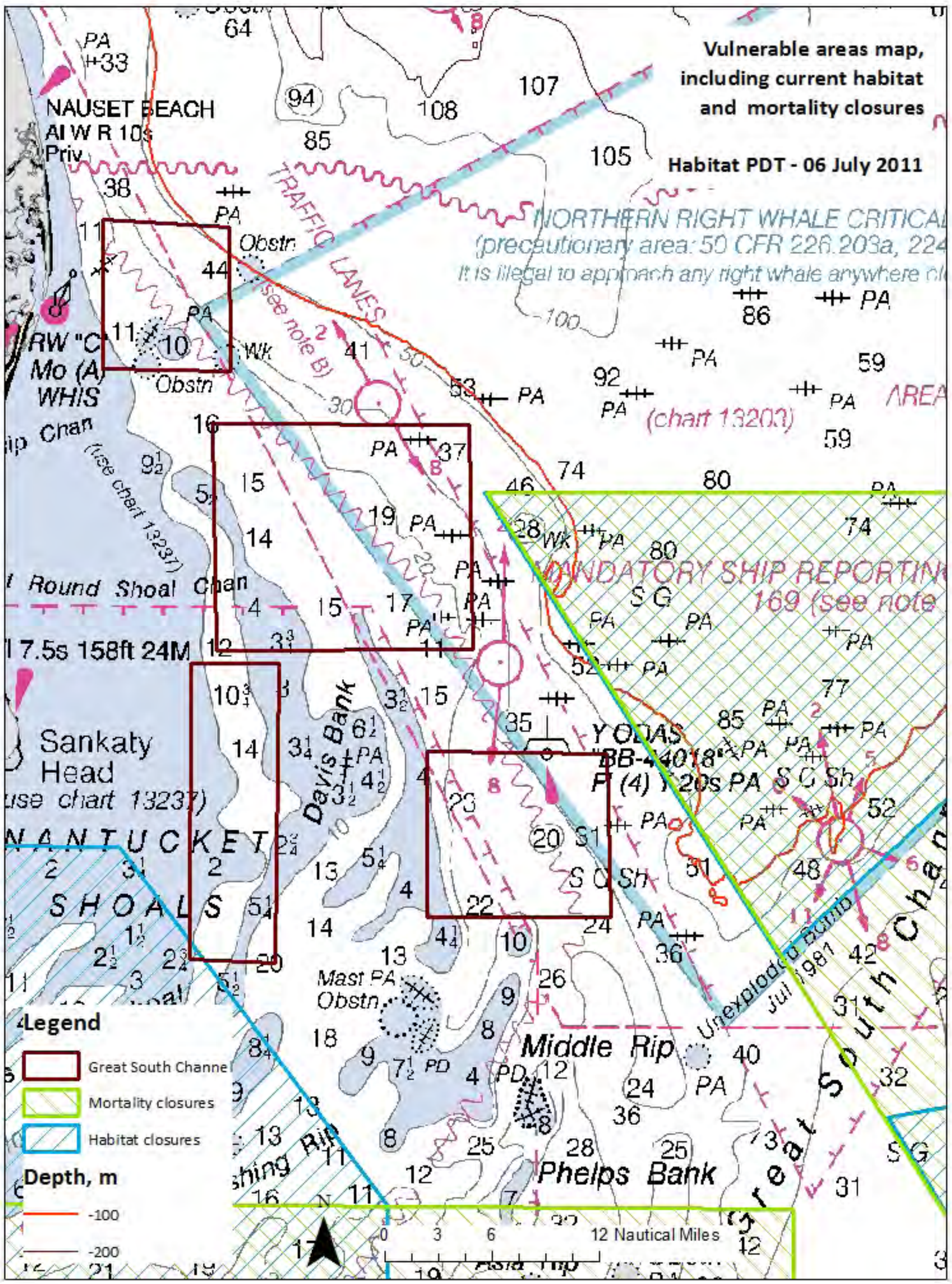
Background: The vulnerable habitat areas identified in the Great South Channel (Map 8) are currently open to fishing.

Recommendation: The PDT recommends management options to minimize the adverse effects of fishing in these areas of the Great South Channel. Options appropriate for the area might include gear restrictions/closures/limits on certain types of fishing, or gear modifications. One or more of the identified areas of interest could be combined into a Great South Channel habitat area.

Rationale: The Great South Channle is one of the areas where grid cells highly vulnerable to trawl gear clustered in the SASI LISA analysis. This area contains a relatively large amount of gravel seabed, which is vulnerable to the adverse effects of fishing.

Extra-SASI information: An additional area to the south and west of the identified polygons has been mapped by USGS using multibeam technology and found to contain gravel substrates. The boundaries of the polygons in the figure are based on the locations of gravel outcrops as identified by Harris and Stokesbury 2010, which analyzed the distribution of sediments on Georges Bank based on video survey data. These data are included in the SASI model base grid.

Map 8 – Great South Channel



1.1.2.9 Cox's Ledge

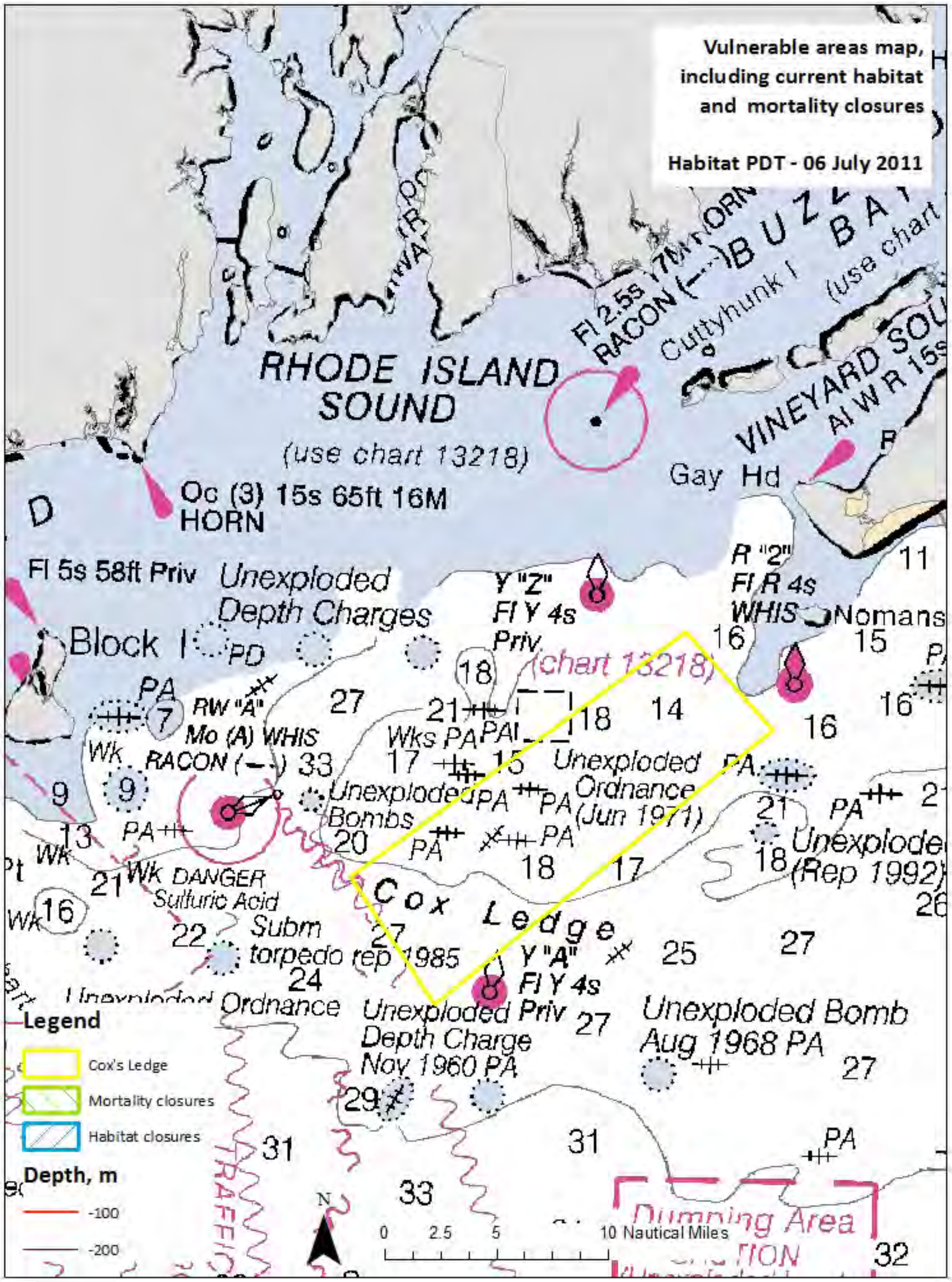
Background: Cox's Ledge (Map 9) is currently open to fishing.

Recommendation: The PDT recommends management options to minimize the adverse effects of fishing on Cox's Ledge. Options appropriate for the area might include gear restrictions/closures/limits on certain types of fishing, or gear modifications.

Rationale: The area contains gravel habitats vulnerable to fishing gear impacts.

Extra-SASI information: To be completed.

Map 9 – Cox's Ledge



1.2 Measures to minimize adverse effects in vulnerable habitat areas

One type of adverse effects minimization option currently in use is the closure of specified habitat areas to particular types of fishing gear. In order to protect EFH from the adverse effects of fishing, the Committee may wish to consider restricting the operation of certain gear types within the vulnerable habitat areas identified in the previous section. Different gear type restrictions may be appropriate for different areas (see section 1.2.1).

In some cases, gear modification options may be more appropriate than gear restrictions, although the PDT does not recommend localized application of these types of measures (see section 1.2.2).

Finally, dedicated habitat research area designations could be layered onto a gear restricted habitat area designation. The DHRA designation might specify additional restrictions, or might be used to specify a set of research objectives intended to address unanswered scientific questions about that area in particular or habitat impacts in general (see section 1.2.3).

In general, the degree of benefits to EFH realized from implementing habitat area designations and associated gear restrictions will depend on the inherent vulnerability of the habitat as well as the current magnitude of adverse effects in each area. Costs include loss of revenue from fishing the area, and shifts in habitat impacts to other locations. A detailed assessment of these costs and benefits was not completed for this meeting, as complexities associated with the Area Closure Analysis component of the SASI Approach are still being explored. Such an analysis will likely require further input from the habitat and species PDTs, advisors, and committees, and the results will be most realistic when a set of measures for different areas can be considered simultaneously, as the total footprint of fishing will depend on the mosaic of areas that are opened or closed to particular gears, as well as the total allocations of fish available, and the distribution of fishery resources.

A major assumption of the SASI approach is that adverse effects relate directly to the amount of bottom contact. Bottom contact time is broadly related to the amount of fishing effort expended, and for a given catch of fish with a certain gear type, will decrease if catch rates increase. In other words, the efficiency, not just the location of fishing, is assumed to influence the overall magnitude of adverse effects to EFH. Assuming a fixed amount of quota is available for each species, closures of areas to particular gear types will cause fishing effort to shift elsewhere, into habitats that may be more, less, or similarly vulnerable, and into areas where catch rates of particular target species are higher, lower, or about the same.

This assumption implies that reductions in adverse effects could be achieved by removing gear restrictions and allowing effort to shift naturally into the areas where fish could most efficiently be caught. This type of strategy is certainly valid, and forms part of the justification for removing some of the current habitat closed areas.

1.2.1 Gear restrictions

The following sections discuss general considerations for implementing various levels of gear restrictions in vulnerable habitat areas.

1.2.1.1 Status quo

Currently, the following habitat closed areas have prohibitions on mobile bottom tending gear, including all types of trawls and all types of dredges: Jeffreys Bank habitat closure area (HCA), Cashes Ledge HCA, Western Gulf of Maine HCA, Closed Area II HCA, Closed Area I HCA, and the Nantucket Lighship Closed Area HCA. Trawl gears are also restricted from the GRAs implemented via Tilefish Amendment 1 (generally, waters shallower than approximately 300 meters in and around Lydonia, Oceanographer, Veatch, and Norfolk Canyons), and fishing while on a monkfish DAS is restricted in both Lydonia and Oceanographer Canyons.

1.2.1.2 Restrictions on trawls only

This type of option would restrict the use of trawl gear only. Exemptions could be considered for particular types of trawls, such as a raised footrope trawl, which has reduced bottom contact, or a shrimp trawl, which is typically fished on soft bottoms and used seasonally. Realized fishing effort area swept calculations indicate that across all areas and years, the vast majority of area swept and adverse effect are attributable to trawl gears, specifically the 'generic otter trawl' category, which excludes squid, shrimp, and raised footrope effort. Thus, reducing or removing trawling from vulnerable habitat areas could lead to large reductions in adverse effect, assuming that effort is redirected into less vulnerable habitats and catches and catch rates are maintained (thus keeping area swept estimates at the same level).

1.2.1.3 Restrictions on all mobile-tending bottom gear

This restriction, which includes all types of trawls and dredges, currently applies to the habitat closed areas. Again, exemptions could be considered for specific types of trawls or dredges. Such exemptions could be considered because a type of trawl or dredge is expected to have a reduced impact on the seabed, or because that type of gear would be unlikely to operate in the area, either because the target species is not generally present or because the substrate type cannot be fished by that gear.

Although the magnitude of adverse effects resulting from dredge gears is generally less than that of trawl gears, because the footprint of the gear is so much narrower, seabed structures that are vulnerable to trawls were also identified as vulnerable to dredges during completion of the vulnerability assessment component of SASI. Further, although the SASI model assumes a linear impact function, where the amount of area swept is additive such that low area swept results in low adverse effect and higher area swept leads to higher adverse effect, if the more conservative 'first pass' hypothesis is a better representation of the habitat impact function for an area, habitats might be affected substantially by even a small amount of fishing effort, whether it is the result of trawling or dredging. The similar area for area impact estimated for both trawls and dredges in the vulnerability assessment provides an argument for treating these gears separately in terms of restrictions.

1.2.1.4 Retrictions on all bottom-tending gear

This type of option would restrict all types of bottom tending gear, including trawls, dredges, demersal longlines, sink gillnets, and traps. Although for an equal amount of area swept, fixed gears were estimated to have substantially reduced adverse effects in comparison to tarwls and dredges, for some types of benthic features, habitat impacts due to fixed gear use could be significant and long lasting (remember that 'adverse' effects are both 'more than minimal' and 'not temporary'). Despite this caveat, the area swept by fixed as compared to mobile gears is overall much less, which argues for exclusion of fixed gears from habitat area restrictions. It is worth noting that fixed gear area swept estimates are highly uncertain.

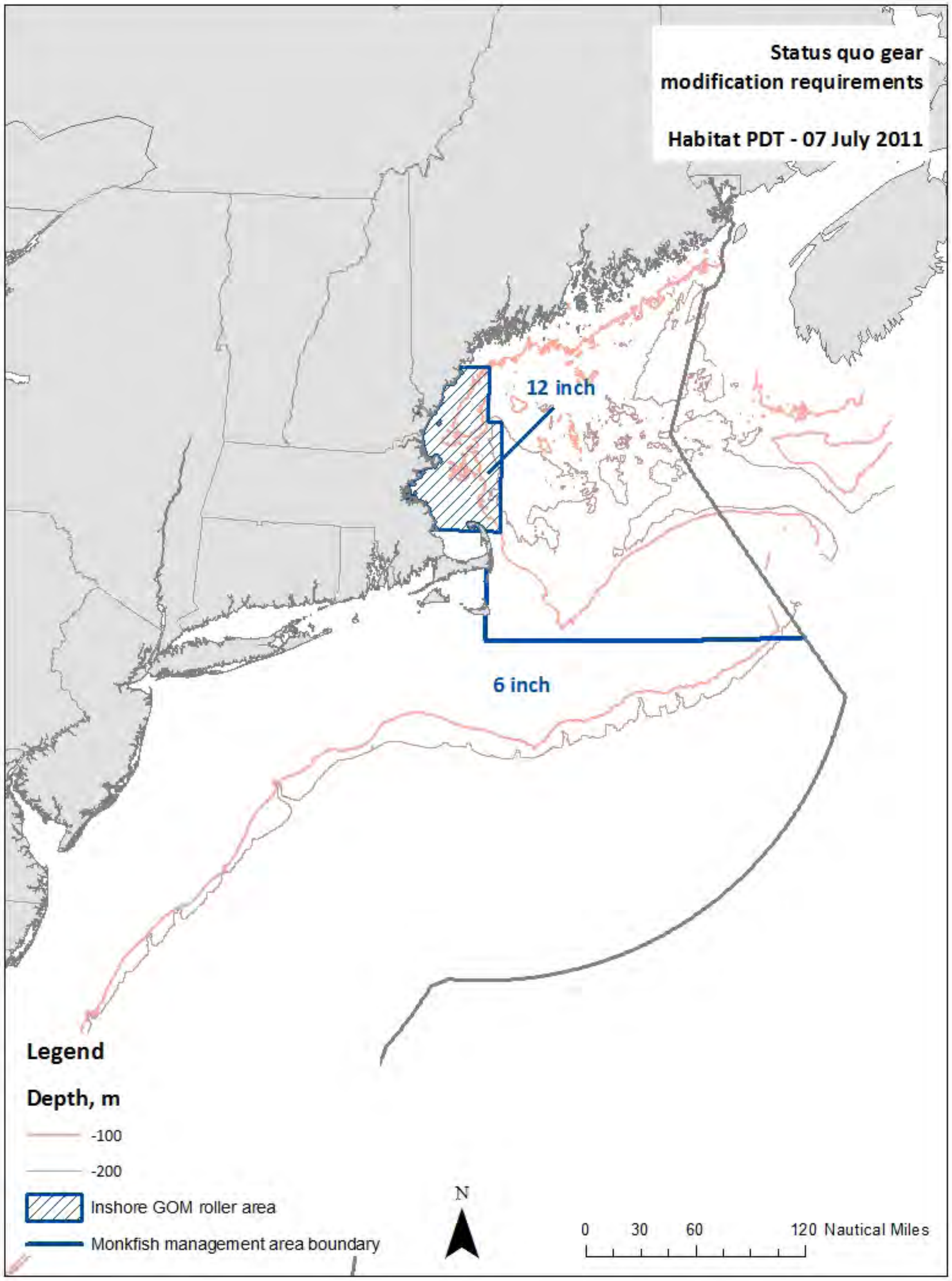
1.2.2 Gear modifications

Gear modifications could be used in addition to or in lieu of gear restricted closed areas to minimize the adverse effects of fishing on habitat. Two types of gear modification options that could be applied to bottom otter trawls include a maximum ground gear size (1.2.2.2) and a maximum ground cable size (1.2.2.3). These are recommended for application over large areas (Map 11).

1.2.2.1 Status quo

Currently, a maximum ground gear size of 12 inches applies in the inshore GOM, and a maximum groundgear size of 6 inches applies in the southern monkfish management area. The only regional measure similar to a maximum ground cable size is that in the northern shrimp fishery, where ground cable length is capped at a total of 25m. As noted in a previous section, this fishery is managed by ASMFC, not NEFMC, although current habitat closed area restrictions on the use of trawl gears do apply to shrimp trawls.

Map 10 - Status quo gear modification requirements



1.2.2.2 Ground gear maximum sizes

This option would set a maximum ground gear diameter for trawl vessels operating in a particular spatial area. This could be applied to all trawl vessels in the area, or only to those fishing under particular permits or FMPs.

Rationale: The Committee has previously discussed restrictions on trawl gear configurations as an option that would continue to allow fishing in areas of the Gulf of Maine, while achieving benefits in terms of minimizing impacts to EFH. Specifically, limiting the use of ground gears such as rollers or rockhoppers to smaller sizes would be expected to make it more difficult to fish in areas dominated by large gravel substrates, where associated habitat features are vulnerable to fishing. These expected benefits would need to be balanced with the change in availability and/or catchability of target species in different spatial areas or using different gear configurations, as well as the cost of updating or replacing sweeps. As discussed in the introduction to section 1.2, the location of fishing and rate of catch influences the overall magnitude of adverse effects to habitat. The size and direction of changes in adverse effect estimates can be estimated using applications of the SASI model, but this analysis will require assumptions to be made about spatially specific catch rates and changes in fleet behavior.

Background: Ground gear is defined as attachments to the bottom portion of the net to allow the net to be fished on certain bottom types, or to adjust selectivity for certain species. Different ground gear materials and ground gear sizes/compositions are used for various applications.

Some ground gears are smaller in size: for example, when fishing for certain species over smooth bottom, a chain sweep may be used consisting of loops of chain suspended from a steel cable, with only a few links of each loop contacting the seabed. At this time, it is unclear how extensive use of this gear is, or what species are targeted. An alternative is a sweep comprising a single length of chain in a raised footrope trawl. The chain contacts the seabed along its entire length. Another alternative is to use a cookie sweep, consisting of a wire (or chain) passed through rubber disks (cookies). Each cookie is similar in diameter (4 – 5 in) and usually tightly fitted (compressed) against one another to ensure no space between adjacent cookies. They do not usually roll when in seabed contact.

Rockhopper gear is possibly the most commonly used sweep design in the groundfish fishery. This gear is often constructed from rubber disks compressed together with larger diameter disks fitted at regular intervals. The disks are generally punched out truck or car tires. The 'classic' rockhopper sweep has a wire passing through each roller to prevent rolling and facilitate their passage over large obstacles (Classic rockhopper sweep, Figure 2), although not all fishermen use this additional wire (Classic rockhopper sweep – without additional wire, Figure 2). The diameter of the large disks may decrease in towards the wingends of the trawl. This gear allows the trawl to pass over rough substrates, and only the larger diameter disks contact the seabed.

Rockhopper gear can also be used on smooth seabed and the space between individual rollers can allow the escapement of bottom dwelling animals. For example, there are reports of some groundfish fishermen using this sweep to reduce the capture of skates.

An additional modification to this gear is to fit thin rubber disks at intervals between the large disks to prevent escapement of flatfish. The thin disks are the same diameter as the larger disks, so these too contact the seabed (Classic rockhopper sweep with thin disks, Figure 2).

Roller gear is another variation sometimes used. It consists of large diameter, wide (thick) rubber disks or bead-like rollers designed to roll over the seabed (Roller gear images, Figure 2). Along the wings of the trawl, the rollers are often replaced with cookies compressed together or a rockhopper-style ground gear without wire passing through each disk (Wings of roller sweep, Figure 2). The curvature of the sweep allows only the middle rollers to rotate; those located along the shoulders of the trawl are dragged laterally over the seabed.

As a general rule, ground gear type and construction reflects expected rugosity of the seabed and escape behavior of target species. The diameter of cookies may measure from 10 to 41 cm (4 to 16 in). Rubber disk diameter may measure around 15 cm (6 in) and the larger disks 45 to 90 cm (18 to 36 in).

The assumed mechanism for achieving habitat benefits under this type of regulation is that it would reduce the ability to fish as effectively/without damage to gear on larger gravel substrates. A difference in the weight in the water or the quality of the seabed contact of different roller or rockhopper configurations is possible, but very difficult to estimate. It is unlikely that fishermen finesse their gear sufficiently to add/remove weight of ground gear unless under exceptional circumstances. Also noteworthy is that the weight of ground gear does not change substantially with depth. A change in volume is required for this to occur, and compressive forces on ground gear components do not significantly alter volume between depths. Towing speed, rigging, or use of materials with different specific weight (density) will have a greater impact on ground gear weight in water and degree of seabed contact. Also, note that rubber disks lose about 70% of their weight in air as soon as they are submerged (and at greater depths the change is relatively minor because there is little further compression/change in volume that occurs).

Furthermore, the sweep is not frequently altered, particularly at sea, and it is often preferred to use another net with modified sweep attached, rather than exchanging sweeps between nets. This has implications for the size of areas in which such regulations might reasonably be applied so as not to be overly burdensome.

Figure 2 – Ground gear configurations.

	
Classic rockhopper sweep	Classic rockhopper sweep – without additional wire
	
Classic rockhopper sweep with thin disks	Roller gear
	
Roller gear	Roller gear

Wings of roller sweep

1.2.2.3 Ground cable length maximum sizes

This option would set a maximum total ground cable length for trawl vessels operating in a particular spatial area. This could be applied to all trawl vessels in the area, or only to those fishing under particular permits or FMPs.

Rationale: The Committee discussed that closure of LISA cluster areas in the GOM to various gears was not a reasonable option, given data limitations for these areas. Restrictions on trawl gear configurations, including reducing the length of ground cables, are an option that would be less restrictive than fishery closed areas, while achieving benefits in terms of minimizing impacts to EFH. Specifically, it is assumed that restricting the ground cable size would reduce area swept for each tow, and thus reduce overall seabed contact and therefore habitat impacts. These expected benefits would need to be balanced with the change in the catchability of target species given any change in herding ability, and also costs associated with physically altering the gear. As discussed in the introduction to section 1.2, catch rates can influence the overall magnitude of adverse effects to habitat. The size and direction of changes in adverse effect estimates can be estimated using applications of the SASI model, but this analysis will require assumptions to be made about changes to catch rates that might result from ground cable length reductions.

Background: Ground cables are defined as wires extending along the seabed between the trawl doors and the bridles or net; for the purpose of herding fish and increasing the area of seabed fished (swept) by the trawl gear. Ground cable diameter can be increased be passing the wires through rubber disks (cookies) or rollers; this modification is designed to assist passage of the ground cables over the seabed.

Ground cables are typically constructed from steel wire rope (twisted), often with small diameter rubber disks (cookies) compressed together along the entire cable length (Figure 3). There are some reports that a few fishermen use chain as an alternative to wire rope. Cable diameter ranges from 9/16 in to ¾ in, with 1¾ to 3 in diameter cookies (2 in to 2 3/8 in cookies are commonly used).

Ground cable length varies between boats and typically is 30-80 ftm (55-146 m) although some larger boats may use up to 120 ftm (219 m). Generally, longer lengths are used on smooth seabeds, when the risk of hooking up on obstacles is small, and/or when targeting flatfish. Inshore boats (which also tend to be smaller) tend to use shorter ground cables (30 – 50 ftm, 55-91 m) so they can maneuver the trawl gear around rocky outcrops and other potential hook up sites.

Some fishermen do not vary ground cable length much under different circumstances as it affects the herding angle of the cables and catch rates. Others have been known to add or remove substantial lengths to their ground cables; however it is not known if this is a regular or infrequent activity, or the circumstances that result in such a change. It appears that there is little variation cable/cookie in composition when targeting ground fish, although a small number of fishermen may change ground cables when changing nets.

Figure 3 - Ground cable with cookies

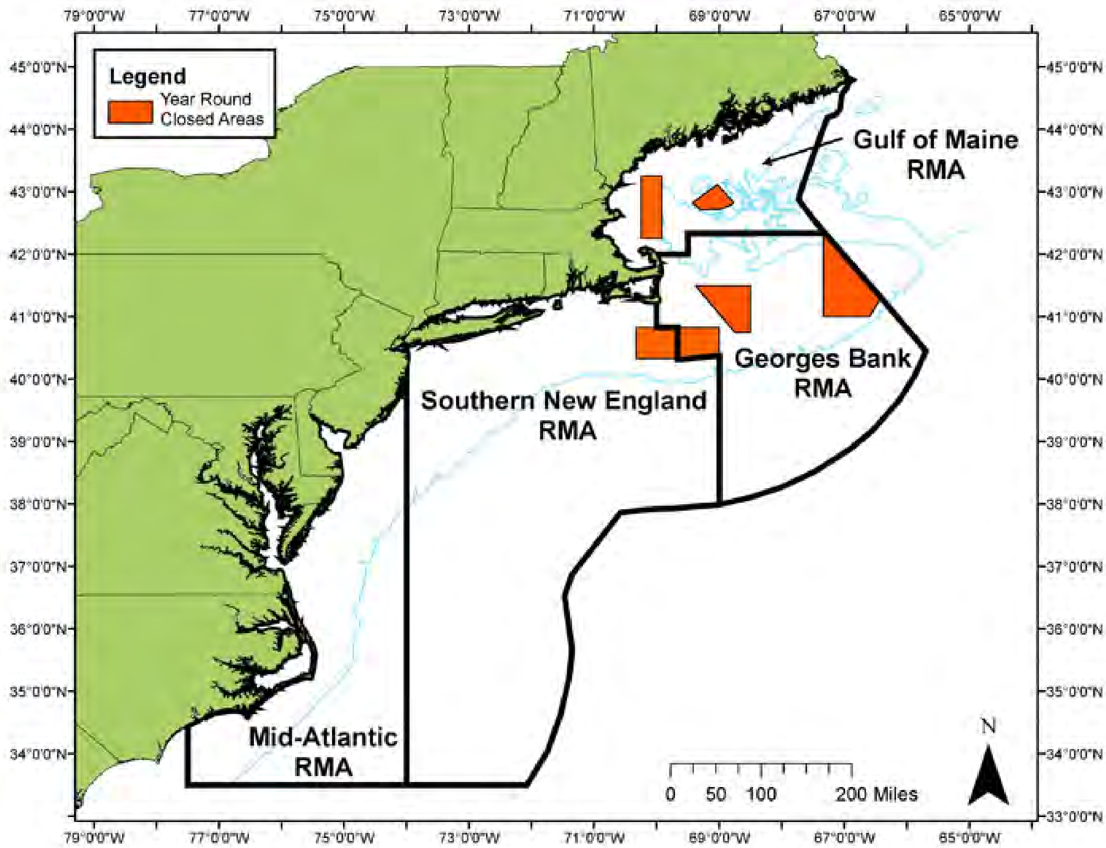
1.2.2.4 Recommended areas

The application of gear modification requirements had originally been discussed by the committee in the context of the GOM LISA clusters. This was due to uncertainties regarding the appropriate delineation of boundaries for habitat closed areas in the GOM identified by SASI/LISA, specifically trawl clusters 1, 3, and 4. In contrast, both of the current ground gear modifications apply to large areas; the inshore GOM roller gear restricted area covers over 11,000 km^2, and the southern monkfish area covers a very large area (east of Cape Cod, all areas south of 41° N latitude; plus all areas to the south and west of Cape Cod). The LISA clusters are substantially smaller than this (roughly 700, 2100, and 1300 km^2, respectively).

The PDT does not recommend applying gear restrictions to smaller habitat areas, except perhaps in a research context. Small gear modification areas based on the clusters could be impractical, because they might require fishermen to have two separate nets on board and in use for a single trip that crosses area boundaries. Such a localized implementation of these types of restrictions could thus have a larger than anticipated impact on industry, i.e. a series of small gear modification areas might effectively become a large gear modification area if fishermen opted to use the modified gear everywhere for ease of compliance. Furthermore, one of the rationales for implementing a gear modification requirement is that the precise locations of vulnerable habitats are not well known in portions of the Gulf of Maine. Thus, applying a ground gear restriction in small areas only does not provide habitat protections for areas of complex seabed that are known to and would be avoided by individual fishermen under such a regulation, but are not mapped/known to the management process.

Therefore, the PDT recommends applying gear modification requirements in large areas, based on the regulated mesh areas (RMAs). Three possible options are gear modifications in all RMAs, gear modifications in the Georges Bank and Gulf of Maine RMAs, and gear modifications in the Gulf of Maine RMA only.

Map 11 – Regulated Mesh Areas suggested as gear modification zones. Map reproduced from http://www.nero.noaa.gov/nero/fishermen/charts/mul3.html.



1.2.2.5 Are ground gear restrictions likely to be effective?

Again, for ground gear regulations, it is assumed that limiting the size or rollers or rockhoppers on sweeps changes the ability of fishermen to use their nets on larger gravel substrates. Because these seabed types are more vulnerable to accumulating the adverse effects of fishing, directing effort elsewhere could be expected to accrue habitat benefits. The precise ground gear size at which this shift in behavior would be observed it not known.

__**Comparison between ground gear sizes currently used in high and low Z areas**__: In order to investigate whether the distribution of fishing on certain substrates is influenced by restrictions on roller gear size, the PDT examined (July 2010) the size frequency distribution of ground gear by trawl gear type (generic otter trawl, shrimp trawl, squid trawl) in the observer data, and their distribution relative to high Z_∞ cells inside and outside of the inshore GOM 12 inch roller gear restricted area. A distribution of ground gear sizes are used for all three trawl types, with successively smaller sizes reported from generic trawl to shrimp trawl to squid trawl (Table 1).

Table 1 – Mean ground gear diameter and number of observed tows by SASI gear type

	Mean sweep diameter, inches	N
Otter trawl	11.2	34,902
Shrimp trawl	10.2	149
Squid trawl	4.3	1,481

To test whether roller gear size varies by habitat vulnerability, roller gear diameter in inches was compared between generic otter trawl and shrimp gear tows located in high Z∞ vs. low Z∞ cells. Data were disaggregated into two groups representing tows occurring inside grid cells with high Z∞ (>51.415) and low Z∞ (<51.416). A two-sample independent t-test evaluated whether differences in the mean values between these two groups were significant. For the generic otter trawl gear type (Table 2) there was a significant difference in mean sweep diameter between the low and high Z∞ groups at the 0.01 level, implying that vessels do tow with larger diameter roller gear in areas of high Z∞ accumulation. For the shrimp trawl (
Table 3), the difference in mean sweep diameter was significant at the 0.10 level but not the 0.05 level.[1]

Based on the results of the Vulnerability Assessment, areas of high Z∞ accumulation are more likely to contain high-relief substrates and fisherman chose to use larger diameter ground gear in such areas to minimize interactions between the bottom and their gear. Thus, it is possible that a reduction in roller gear size will result in changes in fishing locations such that high-relief substrates become less practicable for fishing.

Table 2 – Two-sample independent t-test for sweepdia in high and low Z∞ grid cells, generic otter trawl gear

Group	N	Mean	Std Dev	Std Err	Minimum	Maximum
High Z	4127	14.205	6.524	0.1016	2	24
Low Z	29169	10.8531	6.503	0.0381	2	36
Diff (1-2)		3.3519	6.5056	0.1082		

Method	Variances	DF	t-value	PR > |t|
Satterthwaite	Unequal	5352.6	30.91	**<.0001**

[1] An unequal variance statistic (Satterthwaite) was used for significance determination as between-group variance was unequal for both the generic and shrimp trawl categories. Also, the normalcy of residuals assumption was violated in both cases, but in both cases n was sufficiently large so it is unlikely that this violation will influence the t-statistic.

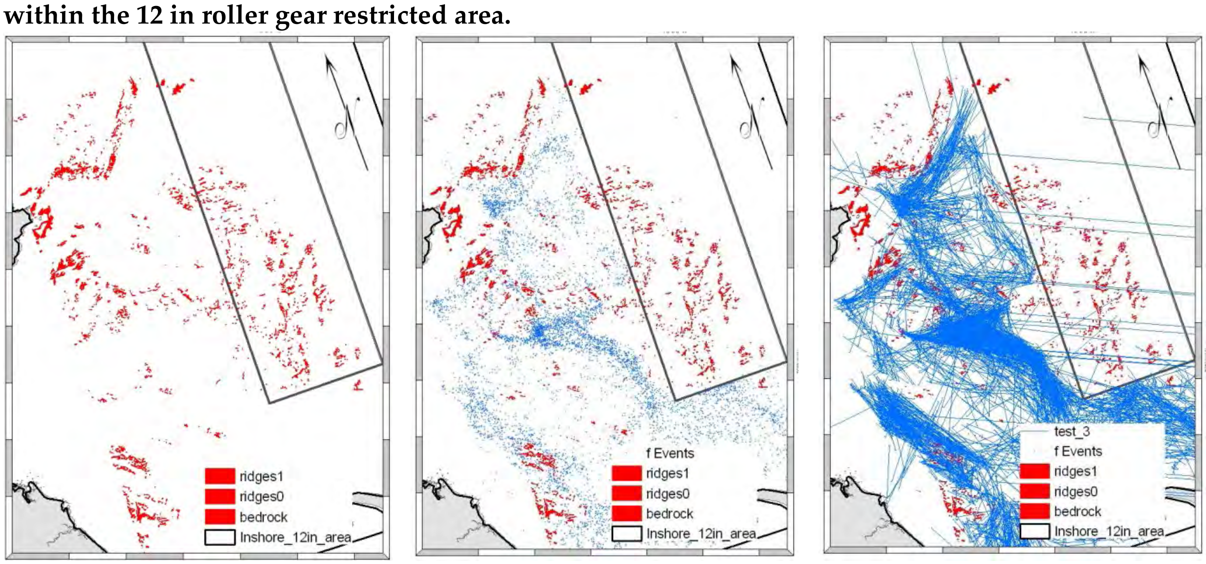
Table 3 - Two-sample independent t-test for sweepdia in high and low Z∞ grid cells, shrimp trawl gear

Group	N	Mean	Std Dev	Std Err	Minimum	Maximum
High Z	67	10.7164	3.1421	0.3839	5	16
Low Z	82	9.7439	2.9806	0.3292	2	16
Diff (1-2)		0.9725	3.0542	0.503		

Method	Variances	DF	t-value	PR > |t|
Satterthwaite	Unequal	137.96	1.92	**0.0565**

Inshore GOM boulder ridge data example: The PDT has also examined the locations of fishing relative to boulder reef distributions in the inshore GOM, where vessels are limited to 12 inch ground gear. If fishing locaitons and boulder reef locations do not generally coincide, it can be inferred that the 12 inch size limit on ground gear prevents trawling on the types of habitats that such a regulation is intended to protect. Maps of observed trawl tow start and end points and inferred straight line tow tracks with respect to boulder ridge data are shown below (Figure 4).

Figure 4 – Boulder ridges; tow start and end points of trawl tows in relation to boulder ridges; inferred straight line tow tracks in relation to boulder ridges. Note that the entire map is within the 12 in roller gear restricted area.



Pacific Fishery Management Council Example: The Pacific Fishery Management Council (PFMC) uses trawl gear restrictions in their groundfish FMP. It does appear that they were effective in reducing fishing effort on high-relief seabed types, but it is not clear how trip limits influenced resulting fishing patterns.

There are four types of permit holders in the fishery: 1) Limited entry; 2) Open access for fishermen that target groundfish without limited entry permits, as well as those that aren't targeting but incidentally catch groundfish; 3) Recreational; and 4) Tribal. Trawl gear may not generally be used in open access for groundfish, but those fishing for shrimp, halibut, ridgeback prawn, and sea cucumbers are exempt. Limited entry Quota Share and Quota Pound allocations were developed based on estimates from 1994-2003 takes. Regulations include quotas, trip and landing limits, area restrictions, seasonal closures and gear restrictions. Depth-based gear-specific restrictions (small footropes at a maximum diameter of 8 inches, depths vary according to area) have helped deter fishing on high relief rocky bottoms where rockfish species (which have been depleted due to a previously aggressive harvest policy) are most abundant. Chafing gear is also restricted if using small footrope configuration to reduce incentives to fish on high relief areas.

Hannah (2003) reviewed the efficacy of these gear restrictions, enacted in 2000, for meeting management goals. The strategies of the regulations as stated in Hannah (2003) was to rebuild shelf rockfish stocks using gear restrictions (the 8" max diameter footrope) and restrict use of chafing gear to dissuade fishing on high-relief rocky bottoms were rockfish were most abundant. Higher catch limits were allowed for continental slope species (like Dover sole, sablefish, and thornyheads) with larger roller gear, and other rockfish species taken with midwater trawls also had higher trawl limits. Hannah stated that in a "practical sense…all financial incentives for using such gear in areas with abundant rockfish were eliminated".

Data have suggested that the new gear restrictions and regulations are having the desired effect on the distribution of trawl effort, but also that catch limits could have an equal or greater bearing on fishing effort. Specifically, reduced limits alone (before gear restrictions) reduced the effort (number of tows per vessel) in "prime trawlable rockfish habitat" from 30.8-33.9% in 1992-1995 to 19% in 1999. After catch limits were increased, in 2001 (right after gear restrictions were implemented), there was increased trawling effort on rockfish areas, however effort did not reach the 1999 levels.

These results were corroborated by a spatial analysis conducted by Bellman et al. (2005). They evaluated the extent to which trawl tow start locations overlapped with various habitat types, mapped as rock, gravel, sand-gravel, sand, sand-mud, or mud-dominated. For a subset of reference sites, trawl towlines were calculated using haulback locations taken manually from logbook records. Following the 2000 footrope restriction, spatial shifts in effort away from rock-dominated habitats were observed. This decrease in fishing on rock habitats was against a background of generally decreasing trawl fishing effort off the Oregon coast between 1997 and 2002. However, it was not possible in the study to distinguish between the effects of the footrope restriction and the effects of changes in trip limits on trawling location, and the authors concurred with Hannah (2003) that both sets of management measures influenced fishermen's choice of tow locations.

Advisory Panel Comments: The advisory panel discussed gear modifications at their August 2010 meeting. In general, there were concerns about adopting these types of restrictions. Some members stated that area closures to protect the most vulnerable habitats were preferable to widespread gear modifications, if those gear modifications make it difficult to catch fish. They discussed the tradeoffs between efficiency and reduced area swept and thus reduced adverse effects, as compared to the reductions in adverse effects that might be achieved via gear modifications (change in area swept due to ground cable restrictions, shift in fishing location due to ground gear restrictions).

1.2.2.6 Frequency and location of use for various ground gear and ground cable sizes

An important consideration is the possible magnitude of adverse effect reductions that could be achieved via these types of regulations. One way to estimate this is to determine how many vessels currently fishing would be impacted by the following maximum ground gear or ground cable restrictions:

- Three different gear sizes, 12 inch, 20 inch, and 28 inch maximum diameter
- Three different maximum cable lengths, 50 fa (90 m), 80 fa (150 m), and 120 fa (225 m)

The table below shows the number of tows using ground gear with a particular diameter across all observed trawl trips, for all trawl types combined, between 2002-2009. Approximately 56% of tows used groundgear 12 inches in diameter or smaller,89% of tows used groundgear 20 inches or smaller, and >99% of tows use ground gear 28 inches or smaller. This analysis can be refined to explore the distribution of roller gear sizes used in different regulated mesh areas, and including/ignoring those tows occurring inside the 12 inch roller gear zone in the inshore GOM, where small ground gears are manadatory. In addition, the catches associated with these tows could be explored to determine whether particular species are associated with the larger ground gear sizes. Use of various ground cable lengths will be explored at a later time.

Table 4 - Ground gear use; size frequency by observed tows

Diameter, inches	Frequency	Percent	Cumulative frequency	Cumulative percent
2	1,714	3.14	1,714	3.14
3	5,629	10.31	7,343	13.45
4	4,383	8.03	11,726	21.47
5	2,955	5.41	14,681	26.88
6	4,114	7.53	18,795	34.42
7	172	0.31	18,967	34.73
8	1,620	2.97	20,587	37.7
9	36	0.07	20,623	37.76
10	2,049	3.75	22,672	41.51
11	31	0.06	22,703	41.57

Diameter, inches	Frequency	Percent	Cumulative frequency	Cumulative percent
12	**7,684**	**14.07**	**30,387**	**55.64**
13	86	0.16	30,473	55.8
14	2,473	4.53	32,946	60.33
15	400	0.73	33,346	61.06
16	7,658	14.02	41,004	75.08
17	126	0.23	41,130	75.31
18	7,094	12.99	48,224	88.3
19	268	0.49	48,492	88.79
20	**307**	**0.56**	**48,799**	**89.36**
21	3,396	6.22	52,195	95.57
22	286	0.52	52,481	96.1
23	25	0.05	52,506	96.14
24	1,465	2.68	53,971	98.83
25	8	0.01	53,979	98.84
26	97	0.18	54,076	99.02
28	**174**	**0.32**	**54,250**	**99.34**
30	27	0.05	54,277	99.39
31	7	0.01	54,284	99.4
32	279	0.51	54,563	99.91
34	12	0.02	54,575	99.93
35	32	0.06	54,607	99.99
40	5	0.01	54,612	100

1.2.2.7 Recommendation

Given the different potential combinations of maximum sizes and areas, as well as the variety of vessels that use bottom trawls to target various species under various FMPs/permit types, the PDT recommends narrowing the scope of gear modifications options down to the areas, gear configurations, and trawl types of interest. Table 6 and Table 5 present a range of options. While there is insufficient information for the PDT to recommend suboptions at this time, preliminary investigations indicate that large ground gear sizes (i.e. > 12 in) are rarely used in the SNE or MA RMAs, such that the 'All areas' options in the second column of Table 5 will have little benefit to habitat. Similarly, large ground gear sizes have not been observed in use by squid trawl vessels.

Table 5 – Decision table for ground gear modifications. 'Multispecies trawl' refers to bottom trawl vessels (gear code 310) operating under Multispecies DAS or sector program, 'Monkfish trawl' refers to bottom trawl vessels operating under a monkfish DAS, and 'All bottom trawl' includes groundfish, monkfish, summer flounder, squid, etc.

	All areas	GB/GOM only	GOM only

12 inches	• Multispecies trawl • Multispecies and monkfish* trawl • All trawl	• Multispecies trawl • Multispecies and monkfish* trawl • All trawl	• Multispecies trawl • Multispecies and monkfish* trawl • All trawl
20 inches**	• Multispecies trawl • Multispecies and monkfish* trawl • All trawl	• Multispecies trawl • Multispecies and monkfish* trawl • All trawl	• Multispecies trawl • Multispecies and monkfish* trawl • All trawl
28 inches**	• Multispecies trawl • Multispecies and monkfish* trawl • All trawl	• Multispecies trawl • Multispecies and monkfish* trawl • All trawl	• Multispecies trawl • Multispecies and monkfish* trawl • All trawl

*More restrictive 6 inch maximum size already applies in Southern Fishery Management Area
**More restrictive 12 inch maximum already applies in inshore GOM area, which is a subset of the GOM RMA

Table 6 – Decision table for ground cable gear modifications. 'Multispecies trawl' refers to bottom trawl vessels (gear code 310) operating under Multispecies DAS or sector program, 'Monkfish trawl' refers to bottom trawl vessels operating under a monkfish DAS, and 'All bottom trawl' includes groundfish, monkfish, summer flounder, squid, etc.

	All areas	**GB/GOM only**	**GOM only**
50 fa (90 m)	• Multispecies trawl • Multispecies and monkfish trawl • All trawl	• Multispecies trawl • Multispecies and monkfish trawl • All trawl	• Multispecies trawl • Multispecies and monkfish trawl • All trawl
80 fa (150 m)	• Multispecies trawl • Multispecies and monkfish trawl • All trawl	• Multispecies trawl • Multispecies and monkfish trawl • All trawl	• Multispecies trawl • Multispecies and monkfish trawl • All trawl
120 fa (225 m)	• Multispecies trawl • Multispecies and monkfish trawl • All trawl	• Multispecies trawl • Multispecies and monkfish trawl • All trawl	• Multispecies trawl • Multispecies and monkfish trawl • All trawl

1.2.3 Dedicated Habitat Research Areas

General rationale for designating Dedicated Habitat Research Areas: The Omnibus/SASI development process has indentified a variety of habitat research needs. Addressing these needs may be best accomplished by designated a DHRA with specific goals and regulations associated with it. In addition, both the goals for the amendment as well as the recent management review report note the desire/need to evaluate management actions after they have been implemented. DHRAs might be an important component of post-implementation evaluations.

Recommended areas: The PDT recommends DHRAs in reopened habitat closed areas, on Cashes Ledge, and in the vicinity of SBNMS. These areas are discussed individually below. Note that one option previously suggested was the establishment of a DHRA in and around Jeffreys Bank/trawl cluster 2. Upon preliminary review, the PDT recommends that areas such as Cashes Ledge and Jeffreys Ledge be prioritized for designations as DHRAs over Jeffreys Bank. Historically, less research has been conducted on Jeffreys Bank as compared to either Jeffreys Ledge or Cashes Ledge. The area is more remote as compared to Jeffreys Ledge, and the water depths are greater (mean depth for p=0.05 cluster cells is 125.6 m), which makes it less conducive to future study.

1.2.3.1 Existing habitat areas opened to fishing

Changes to existing habitat closures in the Omnibus Amendment creates a natural opportunity for environmental monitoring and assessment as fishing patterns shift following implementation. In this context, the PDT recommends establishing Dedicated Habitat Research Areas in any habitat closures being reopened to fishing. The size of these areas would need to be large enough to conduct research and encompass a representative variety of habitat types. Given that the areas would be implemented in locations where fishing restrictions were being lifted, some portion of the DHRA might remain closed to fishing to serve as a control as shown in the example below. Research objectives for these types of areas would be specified as part of the DHRA designation, and could include the evaluation of gear effects on the seabed in locations that were previously unfished. Changes in fishing locations or catch rates could also be examined.

Figure 5 – Schematic of Dedicated Habitat Research Area design for locations previously closed to one or more types of fishing

1.2.3.2 Cashes Ledge (Ammen Rock)

This option was first discussed at a June 2010 Committee meeting, and would establish a DHRA around Ammen Rock on Cashes Ledge. Assuming that the Cashes Ledge habitat closed area and the Cashes Ledge mortality closure are <u>not</u> being altered via this amendment, fishing would be restricted in the proposed DHRA to fixed gear not capable of catching groundfish.

Habitat types and ecology: The Gulf of Maine consists of a series of basins that occupy approximately 30% of the Gulf, with ledges and banks accounting for the remaining 70% (Uchupi and Bolmer, 2008). Cashes Ledge is one of the most prominent examples of these ledges and banks, and extends roughly 57 km long and 8-10 km wide. Cashes Ledge rises from local depths of 200 m to a depth of 9 m (Ammen Rock Pinnacle), and consists of Ordovician granite that is rugged and heavily fissured on the summit. Many of the recesses towards the top of the Ledge have been filled with reworked glacial deposits (Uchupi and Bolmer, 2008). Ammen Rock Pinnacle is covered by a thick expanse of *Laminaria laminaria* that extends to roughly 30 m (Vadas and Steneck, 1988) and encompasses a volume of 2.12-2.45 x 10^6 m^3 (McGonigle et al. 2011). This *Laminaria* kelp zone transitions to an *Agarum cribrosum* kelp zone that extends from ~20 m to 40 m water depth. These kelp areas are noted as important juvenile cod and other groundfish habitat (Witman and Sebens 1992, Steneck 1996).

Previous research in the area: Vadas and Steneck (1988) examined the extent of kelp on Cashes Ledge in the 1980's. McGonigle et al. (2011) estimated the volumetric extent of and mapped the kelp habitat on Cashes Ledge using high resolution multibeam acoustic backscatter data. McGonigle et al. (unpublished data) are working on developing a groundtruthed habitat map of the other habitats on Cashes Ledge. Witman and Sebens (1992) and Steneck (1996) determined that adult groundfish populations and predation pressure on macro-invertebrates were much higher on Cashes Ledge in the 1980's than in coastal waters of the Gulf of Maine. Grabowski et al. (unpublished data) have reexamined these processes over the past 5 years and found similar trends especially in offshore closed areas. Offshore open areas such as Platts Bank resemble inshore areas with groundfish stocks that are largely considered to be depleted. Grabowski et al. (unpublished data) have also examined the season and spatial patterns of juvenile cod use of habitat on Cashes Ledge, and interactions between cod and spiny dogfish.

Why would this area be a good DHRA? Cashes Ledge would be a productive location for a DHRA for the following reasons: (1) Cashes Ledge has been noted as important habitat for an array of commercially valuable fish species. (2) The kelp habitat on Cashes Ledge is unique to the offshore waters of the Gulf of Maine, and is important nursery habitat for juvenile cod and other economically and ecologically important species. (3) The high resolution maps of the kelp habitat at Cashes Ledge provide the opportunity to examine fish habitat associations and determine which habitats provide essential fish habitat for key life-history stages of cod and other groundfish species. (4) Resident cod likely exist at Cashes Ledge, which suggests that this area is particularly important for cod, and also provides an in situ laboratory to examine fish biology research questions.

Possible research goals (1) Use DHRA to examine groundfish habitat associations/essential fish habitat criteria. (2) Use DHRA to study impacts of fishing gear impacts on habitat susceptibility and recovery.

1.2.3.3 Stellwagen Bank/Jeffreys Ledge

A research area proposal (Sanctuary Ecological Research Area) is being developed by SBNMS staff in collaboration with the NEFSC and the headquarters office of National Marine Sanctuaries. The PDT concurs with SBNMS' assessment that waters in or around SBNMS are an appropriate location for a research area. The PDT recommends that the committee review the proposal developed by SBNMS, and use that proposal as a starting point for development of a SBNMS DHRA alternative for inclusion in the Omnibus Amendment.

Background information: The largest closure in the Gulf of Maine is the Western Gulf of Maine Closed Area (WGOM) which covers 2,962 km^2 of seascape. The WGOM encompasses parts of Stellwagen Bank, Jeffrey's Ledge and Wildcat Knoll. Within the WGOM, there are several habitat types such as mud, gravel, cobble, exposed rock ledge and a mix of biogenic structures that are potentially used by groundfish. These shallow waters were historically productive fishing and nursery grounds (Ames 1997, Kurlansky 1997), especially for cod.

Jeffreys Bank in particular has served as a hotbed for research on groundfish habitat and the effects of closures on habitat recovery and groundfish populations in the Gulf of Maine. The effects of fishing on habitat were examined in the northern section of the Gulf of Maine (Knight et al. 2008). Grabowski et al. (2006) determined that the proximity of habitat was more important than closure status for several groundfish species in the northern section of the Gulf of Maine. A network of scientists used a multi-pronged approach to studying the central portion of Jeffreys Bank where they developed and groundtruthed high resolution habitat maps using multibeam backscatter data and examined the effects of fishing on habitat recovery (Grizzle et al. 2009). They also determined that groundfish are inversely related to spiny dogfish abundances inside the reserve, and that individuals tend to be larger in the reserve (Grizzle et al. 2009). Witman and Sebens (1992) determined that adult groundfish populations and predation pressure on macro-invertebrates were much higher on offshore ledges including the southern portion of Jeffreys Ledge in the 1980's than in coastal waters of the Gulf of Maine. Grabowski et al. (unpublished data) has also examined the season and spatial patterns of juvenile cod use of habitat on Jeffreys Ledge.

Jeffrey's Ledge would be a productive location for a DHRA for the following reasons: (1) Jeffrey's Ledge has been noted as important habitat for an array of commercially valuable fish species. (2) The high resolution maps of the central/western portion provides the opportunity to examine fish/habitat associations and determine which habitats provide essential fish habitat for key life-history stages of cod and other groundfish species. A DHRA in this area could be used to (1) examine groundfish habitat associations/essential fish habitat criteria, and (2) to study impacts of fishing gear impacts on habitat susceptibility and recovery.

2.0Deep-sea coral alternatives

The following management alternatives designate deep-sea coral zones, and then implement fishing restrictions as necessary to protect the corals within those zones.

What are deep-sea corals? Cold-water or deep-sea corals in the northwest Atlantic are a diverse assortment of Anthozoa that include the subclass Hexacorallia (Zoantharia), which includes the **hard or stony corals** (order Scleractinia) and **black and thorny corals** (order Antipatharia); and subclass Octocorallia (Alcyonaria or octocorals), which includes the **true soft corals** (order Alcyonacea), **gorgonians** (sea fans, sea whips, order Gorgonacea), and **sea pens** (order Pennatulacea). Worldwide, deep-sea 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-sea corals can be found from near the surface to 6000 m depth, but most commonly occur between **50-1000 m** on hard substrate (Puglise and Brock 2003), hence their "deep-sea" appellation. Descriptions of species found in the Northeast region, including information about their vulnerability to fishing, will be detailed in an appendix to the Omnibus Amendment DEIS.

Authority and guidance There are a few different mechanisms in the MSA by which corals may be protected. One that has been used previously by NEFMC is the 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 has been used in Monkfish FMP Amendment 2 to protect deep-sea corals and associated habitat features in two offshore canyons, Lydonia and Oceanographer, from fishing activity occurring under a monkfish day at sea. Options for minimizing the adverse effects of fishing on EFH include fishing equipment restrictions, time/area closures, and harvest limits (in this case, direct harvest of corals).

Of course, 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 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, to protect deep sea corals from physical damage from fishing gear or to prevent loss or damage to such fishing gear from interactions with deep sea corals, after considering long-term sustainable uses of fishery resources in such areas; and

(C) with respect to any closure of an area under this Act that prohibits all fishing, ensure that such closure—
   (i) is based on the best scientific information available;
   (ii) includes criteria to assess the conservation benefit of the closed area;
   (iii) establishes a timetable for review of the closed area's performance that is consistent with the purposes of the closed area; and
   (iv) is based on an assessment of the benefits and impacts of the closure, including its size, in relation to other management measures (either alone or in combination with such measures), including the benefits and impacts of limiting access to: users of the area, overall fishing activity, fishery science, and fishery and marine conservation;

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

(a) IN GENERAL. The Secretary, in consultation with appropriate regional fishery management councils and in coordination with other federal agencies and educational institutions, shall, subject to the availability of appropriations, establish a program—
   (1) to identify existing research on, and known locations of, deep sea corals and submit such information to the appropriate Councils;
   (2) to locate and map locations of deep sea corals and submit such information to the Councils;
   (3) to monitor activity in locations where deep sea corals are known or likely to occur, based on best scientific information available, including through underwater or remote sensing technologies and submit such information to the appropriate Councils;
   (4) to conduct research, including cooperative research with fishing industry participants, on deep sea corals and related species, and on survey methods;
   (5) to develop technologies or methods designed to assist fishing industry participants in reducing interactions between fishing gear and deep sea corals; and
   (6) to prioritize program activities in areas where deep sea corals are known to occur, and in areas where scientific modeling or other methods predict deep sea corals are likely to be present.

(b) REPORTING. Beginning 1 year after the date of enactment of the Magnuson-Stevens Fishery Conservation and Management Reauthorization Act of 2006, the Secretary, in consultation with the Councils, shall submit biennial reports to Congress and the public on steps taken by the Secretary to identify, monitor, and protect deep-sea coral areas, including summaries of the results of mapping, research, and data collection performed under the program.

In May 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.

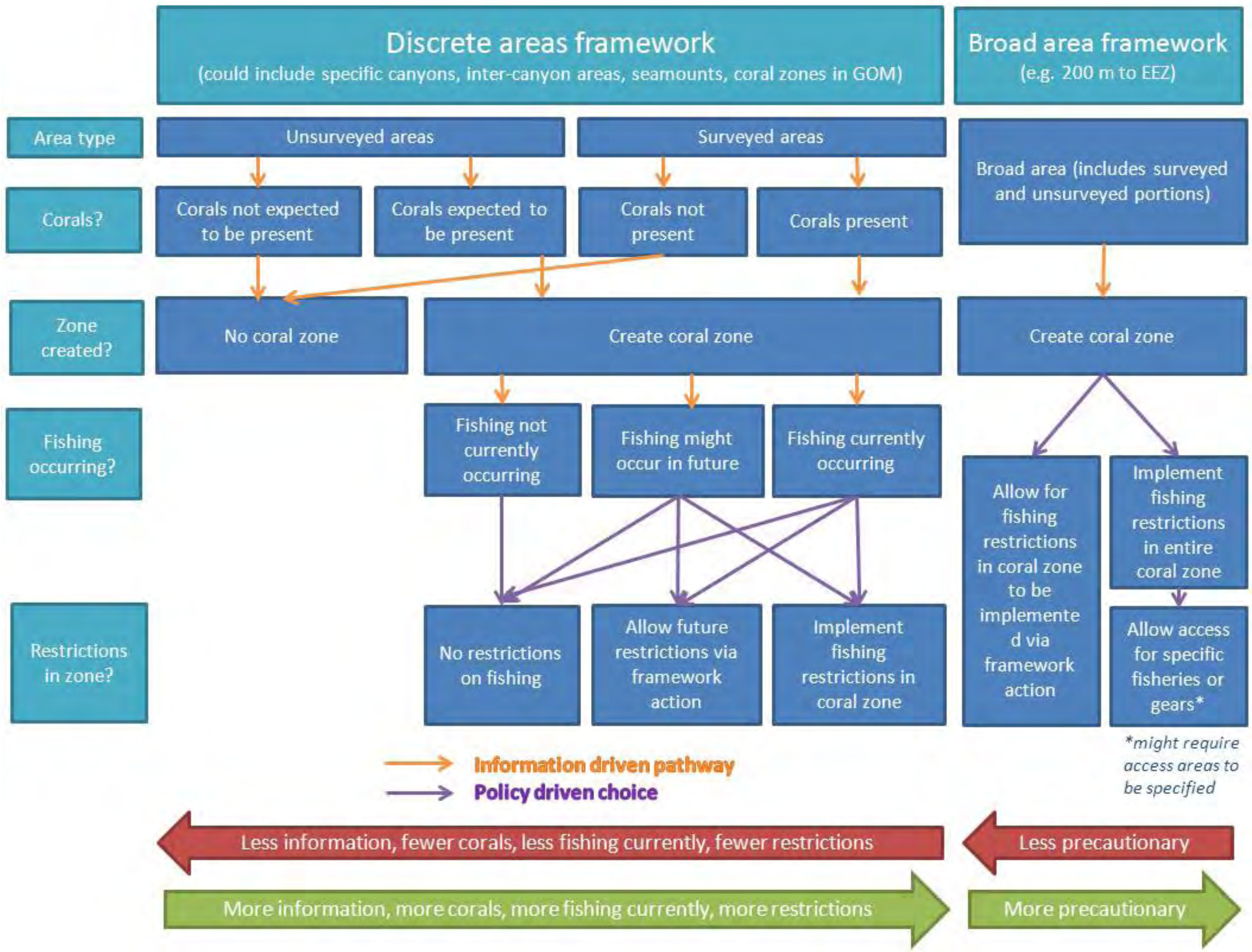
- Coral zones can include additional area beyond the locations of deep-sea corals if necessary to ensure the effectiveness of protection measures, which may include the following:
    - Restrictions on time/location of fishing within zones,
    - Limiting fishing to specific vessel types or vessels fishing 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.

Strategy for deep-sea coral zone designation and protection of corals therein: The PDT proposes the following strategy (Figure 6) for designation of coral zones and development of management measures for those zones. These two frameworks could be used separately or combined. The final strategy selected by the Committee and Council will likely not include all the pathways in the flowchart, and will depend on the degree of precaution desired, given uncertainty in both coral location and fishing effort data inputs to the process.

Figure 6 - Possible strategy for designation of deep-sea coral zones and development of associated management measures



The 'discrete areas' framework is intended to designate and implement fishing restrictions for narrowly defined coral zones, including discrete ares of the GOM, single canyons or a few adjacent canyons and the areas in-between, and seamounts. The discrete areas suggested below either have documented presence of corals, or have similar slope and sediment characteristics to areas with document corals, such that their presence can reasonably be inferred. Fishing restrictions might be implemented differently for zones with documented corals, vs. zones designated based on inferred coral presence. In addition, fishing restrictions might be implemented according to current fishing distributions, or in a more precautionary manner. These choices depend on the Committee's willingness to take precautionary action where corals are inferred vs. documented, and where fishing effort might occur in the future vs. where it is occurring now. For example, designating a coral zone based on documented presence of corals and then restricting fishing activity currently occurring in the areas is less precautionary than designating a coral zone based on inferred presence of corals and then closing the area to certain types of fishing to prevent expansion of fishing into that zone. Other scenarios also exist: documented corals but no fishing occurring, and inferred corals with fishing currently occurring. In between restricting fishing and not placing any restrictions on fishing is the option of making future restrictions on fishing a frameworkable action.

The 'broad areas' framework, as currently understood by the PDT, would focus on designating a coral zone in an area outside the boundaries of currently occurring fishing effort. The Committee could then take a precautionary approach, and close this area to any current as well as future expansion of fishing, or could leave the area unrestricted but allow measures to be implemented in the future via framework provisions. The former has been termed the 'freeze the footprint' approach.

Section 2.1 below lists the discrete and broad coral zones as recommended by the PDT, and includes any supporting information and analyses collected to date. Section 2.2 outlines options for fishing restrictions in those zones, including an overview of where fishing is currently occurring. Once the range of zones and potential restrictions has been narrowed down, more extensive fishing effort and fishery impact analyses will be completed.

2.1 Alternatives to define Deep-Sea Coral Zones

Potential deep-sea coral zones are listed below, organized into the following categories: broad zone, discrete zone corals known, discrete zone corals inferred. A brief description is provided for each zone, including location, depth, substrate, coral surveys, and coral presence. Presence of corals was determined based on a variety of data sets (Table 7). Generally, these data sets show presence of corals only, vs. presence/absence and/or presence/absence with abundance information. The records vary in age from the 1850s through present. Unlike the more widely known trawl surveys, which provide broad spatial coverage, the various coral surveys tend to be narrowly focused/of limited spatial extent. These datasets were compiled and audited by the US Geological Survey and NOAA's Deep-Sea Coral Research and Technology Program (DSCRTP), with the assistance of the NEFSC and others (the compiled database is referred to as the USGS Cold-Water Coral Geographic Database (CoWCoG)).

Table 7 – Deep-sea coral data sources for the Northeast Region

Data set	**Citation**
Deichmann, 1936	Deichmann, Elisabeth, 1936, The Alcyonaria of the western part of the Atlantic Ocean: Memoirs of the Museum of Comparative Zoology at Harvard College, v. 53, 317 p.
Hecker et al., 1980	Hecker, Barbara, Blechschmidt, Gretchen, and Gibson, Patricia, 1980, Epifaunal zonation and community structure in three mid- and north Atlantic canyons—final report for the canyon assessment study in the mid- and north Atlantic areas of the U.S. outer continental shelf: U.S. Department of the Interior, Bureau of Land Management Monograph, 139 p.
NEFSC HUDMAP[1]	Records from 2001, 2002, and 2004 video samples taken near the head of Hudson Canyon between 100-200 m depth. Corals sampled include sea pens and the stony coral *Dasmosmilia lymani*.
NEFSC Sea Pens[1]	Records of sea pens compiled from various sources, including submersible surveys, trawl surveys, and towed camera surveys. Data collected between 1956 and 1984.
NES CR Dives	These data summarize dives locations of samples collected during NOAA Ocean Explorer "Mountains in the Sea" cruises to the New England seamounts during 2003 and 2004.
Smithsonian	Records off all coral types from various research vessel surveys conducted from 1873 through present. Surveys conducted in GOM as well as along shelf/slope break on Georges Bank and in Mid-Atlantic Bight.
Theroux and Wigley	Theroux, Roger B. and Wigley, Roland L., 1998, Quantitative composition and distribution of the macrobenthic invertebrate fauna of the continental shelf ecosystems of the northeastern United States
US Fish Commission	Records for *Dasmosmilia lymani* off NJ/VA; collected in the 1880s
VIMS for BLM/MMS	Mostly *Dasmosmilia lymani* records; fewer records of *Stylatula elegans, Isozoanthus* sp.; records from mid-late 1970s; collected for Minerals Management Service by Virginia Institute of Marine Science
Watling and Auster, 2005	Watling, L., and Auster, P. J., 2005, Distribution of deepwater Alcyonacea off the northeast coast of the United States, *in* Freiwald, Andre, and Roberts, J. M., eds., 2005, Cold-water corals and ecosystems:ß Springer-Verlag, Berlin, p. 279-296.
Watling et al, 2003	Watling, L., Auster, P.J., Babb, I., Skinder, C., and Hecker, B., 2003, A geographic database of deepwater alcyonaceans of the northeastern U.S. continental shelf and slope: Groton, National Undersea Research Center, University of Connecticut, Version 1.0 CD-ROM.
Yale University Peabody Museum Collection	Yale University Peabody Museum Collection, Yale Invertebrate Zoology—Online Catalog: accessed July 2007 at http://peabody.research.yale.edu/COLLECTIONS/iz/

2.1.1 Broad coral zone on the shelf-slope

This alternative would designate the entire shelf-slope area between some depth and the EEZ as a deep-sea coral zone. At the 9/27/10 committee meeting, a minimum depth of 200 m was proposed. The rationale was that 200 m is deeper than most fishing effort, such that coral protection efforts would have a relatively small impact on current fishing. Taking the boundary of the zone to the EEZ, rather than to a specific depth (e.g. 2000 m) was viewed a precautionary approach.

Based on literature review, seven of the 16 regional stony coral species occur shallower than 200 m. Of the nine known soft coral species in the region, depth range information was available for seven. All of these have observed minimum depths greater than 200 m (depth ranges were not specified for *Gersemia rubiformis* or *Clavularia modesta*). Of the 21 gorgonian species known in the region, depth ranges were specified for 13. Of these, only one species, *Primnoa resedaeformis*, is known to occur shallower than 200 m. Thus, a minimum depth of 200 m is sufficiently shallow to protect most species known in the region, however, a variety of stony corals are known to occur between 100-200 m.

Based on an examination of observer data, a deeper threshold might be more appropriate. Table 8 summarizes the depth of fishing by gear type, in both meters and fathoms. For dredges, gillnets, and longlines, 200 m appears to be an appropriate depth that would exclude all or nearly all fishing using these gears. However, trawls and lobster traps are used in deeper waters; for these gears, a depth of 300 m would exclude nearly all fishing. Note that once Amendment 3 to the Deep-Sea Red Crab FMP goes into effect, fishing for red crabs by limited access red crab vessels will only be permitted to occur deeper that 400 m, so this fishery is prosecuted entirely within any likely broad shelf-slope coral zone. Also, lobstering activities cannot be restricted by NEFMC.

This type of coral zone would likely extend from the boundary of the EEZ along the southern flank of Georges Bank to the

Table 8 - Depth of observed tows/sets by gear type, 2002-2009

Gear type and code(s)	Sample size	95th percentile depth meters (fathoms)	99th percentile depth meters (fathoms)
Trawl (includes 050 – fish, 052 -scallop, 055 – lobster trawl, 058 – shrimp, 059 – other spp)	106,634	227 (124)	267 (146)
Dredge, scallop (132)	55,104	77 (42)	82 (45)
Dredge, hydraulic (386)	975	66 (36)	137 75
Gillnet (100 – fixed or anchored sink)	27,338	128 (70)	188 (103)
Longline, bottom (010)	4,166	161 (88)	208 (114)
Trap, lobster (200 - nk, 201 - wood, 202 – wire)	270	237 (130)	302 (165)

2.1.2 Discrete zones with known presence of corals

The following are individual areas with documented deep-sea corals that are suggested as coral zones.

2.1.2.1 Mount Desert Rock DSC Zone

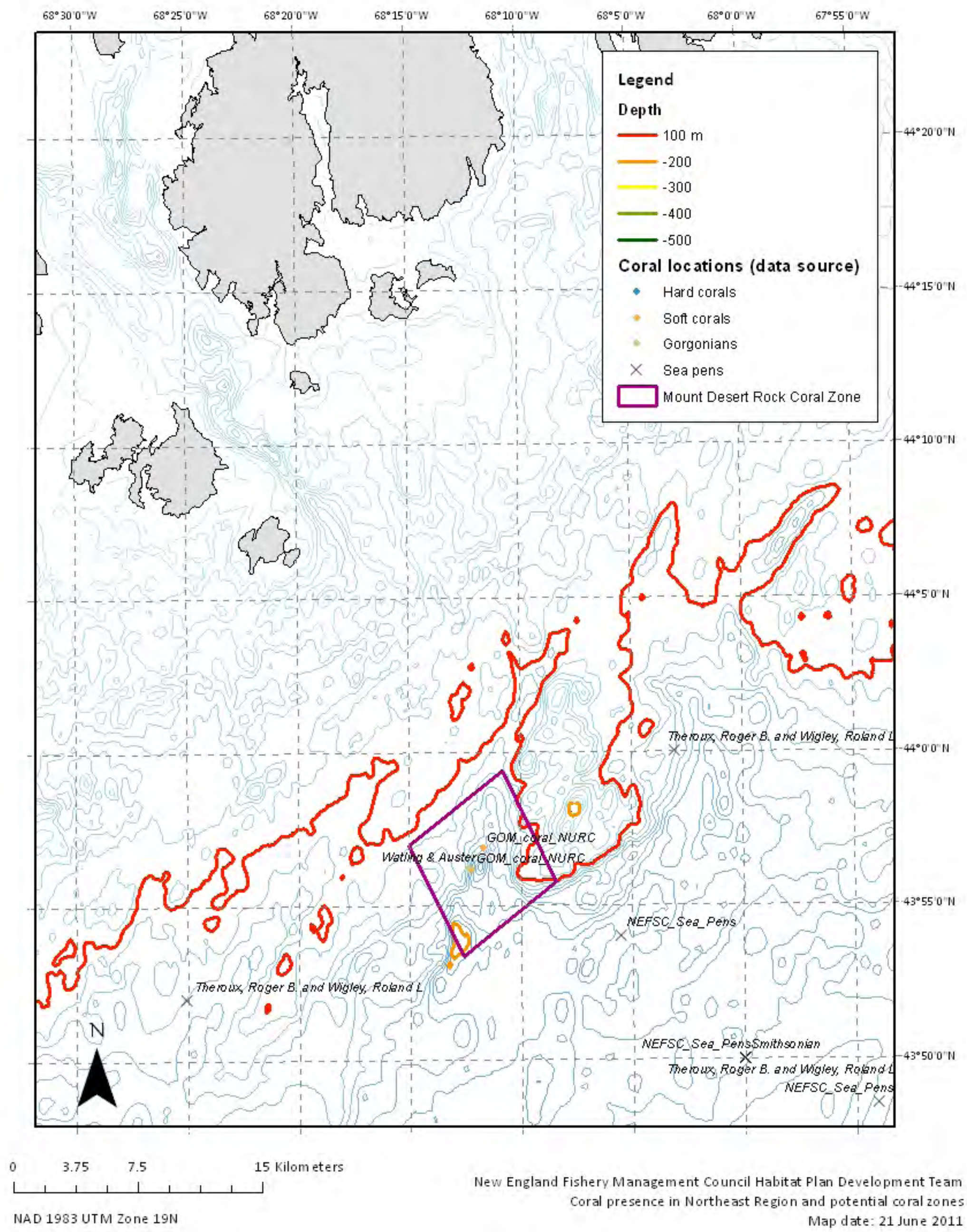
The proposed Mount Desert Rock Deep-Sea Coral Zone () is located approximately 30 km offshore of Mt Desert Island, Maine in waters that vary in depth between 100-200 m. The suggested area is approximately 52 km^2.

This site is proposed based on ROV (remotely operated vehicle) video observations and sample collections at two stations around Mount Desert Rock made during a research cruise in 2002. Colonies of red tree coral *Primnoa resedaeformis* were found on steep surfaces in this area, with dense and diverse habitat-forming sponges found throughout the dive transects (dive details Watling and Auster, unpublished). We infer that corals are likely to be distributed in areas of similar geology and experiencing similar oceanographic conditions around these sites, and based on this inference produced the straight-line boundary shown in the figure.

Based on observations elsewhere in the Gulf of Maine proper, this is one of only several unique sites that are known to support this species (Watling and Auster 2005). Corals have been shown to provide habitat for Acadian redfish and cusk (Auster 2005, Husebo et al. 2002) as well as prey species such as pandalid shrimp. Given our general lack of understanding of population connectivity of deep sea corals in general (Thoma et al. 2009), conserving corals in this environmental setting can aid in a risk-averse approach to sustaining genetic diversity across the wider region.

Figure 7 - Deep-sea corals observed in Mount Desert Rock area.

Map 12 – Mount Desert Rock Deep-Sea Coral Zone



2.1.2.2 Western Jordan Basin DSC Zone

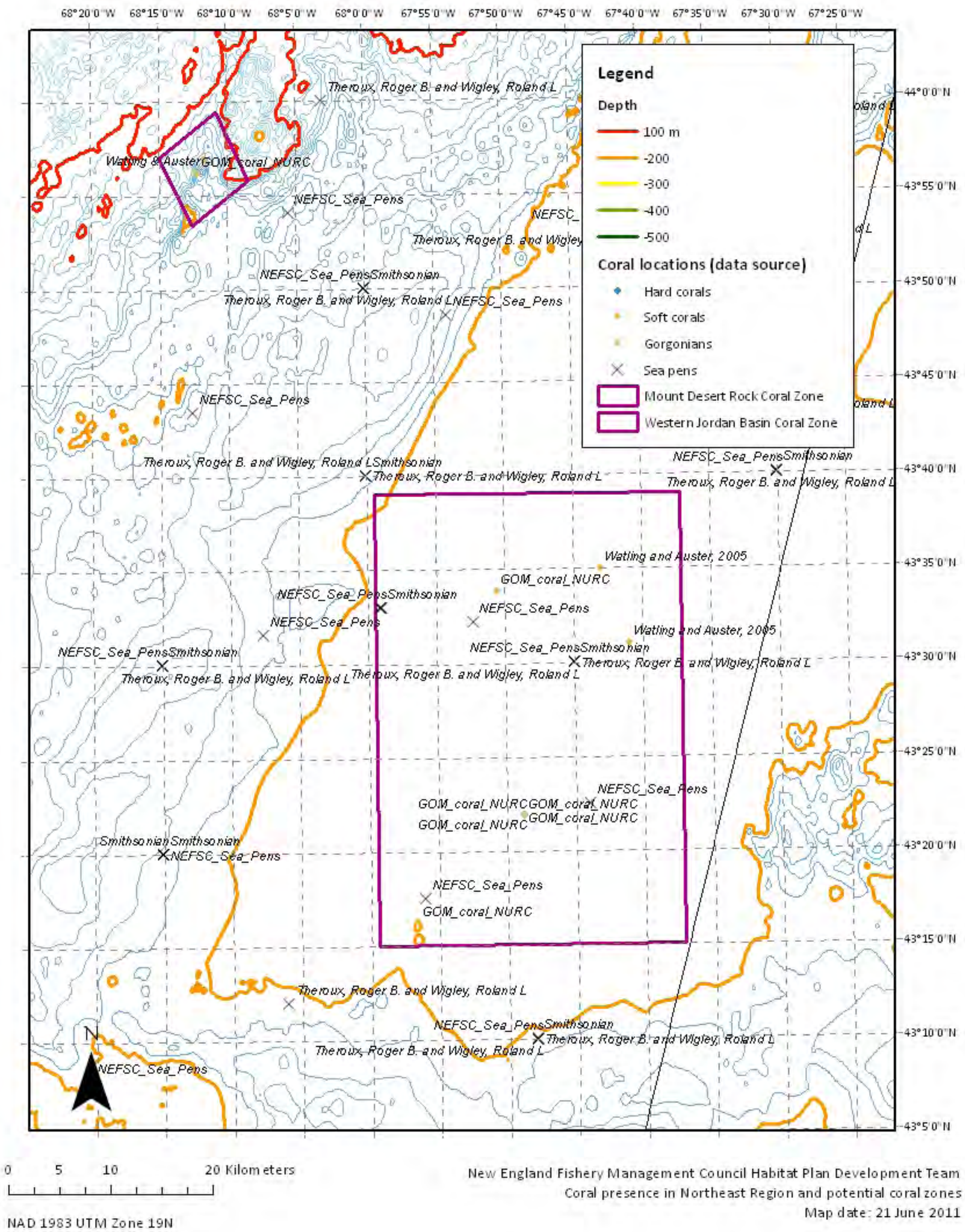
The proposed Western Jordan Basin Deep-Sea Coral Zone () is located in Jordan Basin in the eastern Gulf of Maine. Water depths in the area range between 200-250 m. The suggested area is approximately 1300 km^2.

This site is proposed based on ROV (remotely operated vehicle) video observations and sample collections at four stations during research cruises in 2002 and 2003, as well as samples cataloged in the CoWCoG coral database that come from Watling & Auster

(2005). While bathymetric charts indicate relatively moderate topographic complexity, observations and limited multibeam records indicate steep rock patches emerging from surrounding fine grain sediments. These patches of hard substratum support *Paragorgia arborea*, both pink and white forms, *Primnoa resedaeformis*, and a species of *Paramuricea*. Observed hard substratum communities were dominated by corals, and provided habitat for Acadian redfish and cusk (Auster 2005) as well as pandalid shrimp, an important prey taxa for species of economic importance. Thoma et al. (2009) found that *Paramuricea* in the Gulf of Maine and along the continental margin were genetically similar but different from specimens elsewhere in the North Atlantic basin, and may represent a unique species. As above, conserving corals in this environmental setting can aid in a risk-averse approach to sustaining genetic diversity of this taxa across the wider region.

Figure 8 - Deep-sea corals observed in Jordan Basin.

Map 13 – Western Jordan Basin Deep-Sea Coral Zone



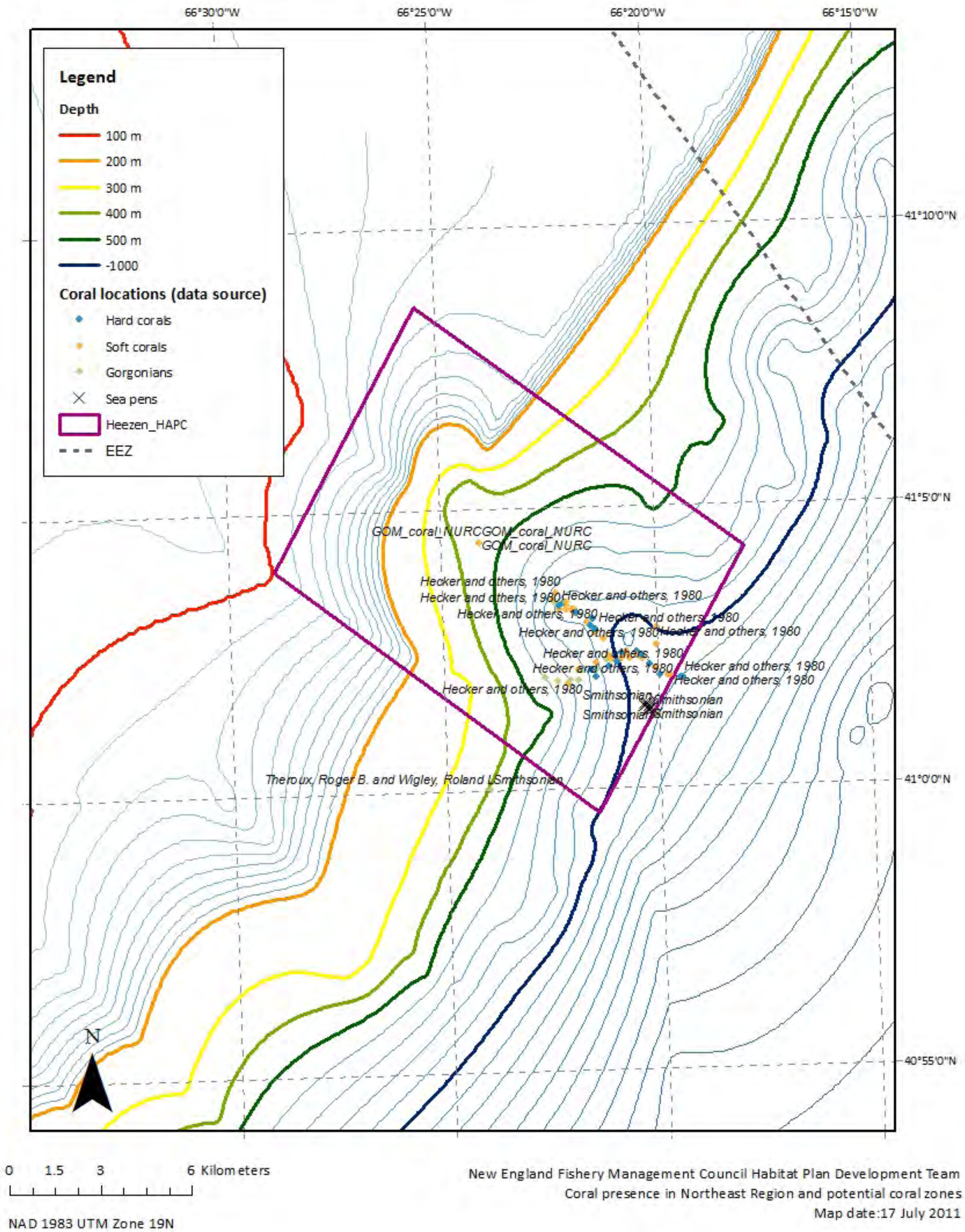
2.1.2.3 Heezen Canyon DSC Zone

Heezen Canyon has been surveyed for corals and corals were present (Hecker and Blechschmidt (1980); Hecker et al. (1980); Opresko (1980); NE database including Smithsonian database).

Coral types include **Stony**: *Desmophyllum dianthus, Flabellum alabastrum*; **Soft**: *Anthomastus agassizii, Anthomastus grandiflorus, Clavularia rudis, Capnella florida, Gersemia* *fruticosa*; **Gorgonians**: *Acanella arbuscula, Paramuricea grandis*; **Sea pens**: *Anthoptilum grandiflorum, Halipteris* (=Balticina) *finmarchica, Kophobelemnon stelliferum*.

Depths of coral observations are as follows: *Gersemia fruticosa* between 600-1200 m. The gorgonian *Acanella arbuscula* and the soft coral *Anthomastus grandiflorus*, both found on soft substrates, occurred at 850-1050 m; the gorgonian *Paramuricea grandis* was common from 1450-1500 m; the soft coral *Anthomastus agassizii* and the stony coral *Desmophyllum dianthus* were found from 1150-1500; *Desmophyllum dianthus* was also found from 1500-1550 m. *Clavularia rudis*: axis of Canyon at 1100 m; *Capnella florida* axis of Heezon Canyon from 1100-1200 m. *Anthoptilum grandiflorum*: six on wall of Heezen Canyon between 850-1050 m. *Halipteris* (=*Balticina*) *finmarchica* between 900-2200 m; *Kophobelemnon stelliferum* between 1300-1600 m.

Map 14 – Heezen Canyon Deep-Sea Coral Zone



2.1.2.4 Lydonia/Gilbert/Oceanographer Canyons DSC Zone

All three of these canyons have been surveyed for corals and corals were found.

Lydonia: Suveys include Hecker et al. (1980, 1983); Hecker and Blechschmidt (1980); Opresko (1980); NE database including Smithsonian database

Coral types include: **Stony**: *Dasmosmilia lymani, Desmophyllum dianthus, Solenosmilia variabilis, Javania cailleti;* **Soft**: *Anthomastus agassizii, Clavularia rudis, Capnella florida, Capnella glomerata*; **Gorgonians**: *Paragorgia arborea, Primnoa resedaeformis, Acanthogorgia armata, Anthothela grandiflora, Acanella arbuscula, Paramuricea grandis*; **Sea pens**: *Anthoptilum murrayi*, *Kophobelemnon stelliferum*, *Pennatula aculeata*, *Pennatula grandis, Distichoptilum gracile, Stylatula elegans*. Smithsonian also lists *Lophelia pertusa* (**stony**), *Keratoisis* sp. (**gorgonian**), *Scleroptilum grandiflorum* (**sea pen**).

Depths of coral observations are as follows: *Clavularia rudis*: 900 m. *Capnella florida*: 350-1500 m; most common farther up east axis between 500-700 m. *Capnella glomerata*: several individuals found at 200 m and 562 m. *Acanthogorgia armata*: 400-1299 m. *Paragorgia arborea*: 300-900 m. *Paramuricea grandis*: 400-1349 m. *Primnoa resedaeformis*: 560 m. *Paramuricea grandis*: deeper part of the axis at > 800 m. *Anthothela grandiflora*: 450-1149 m. *Paramuricea grandis*: 400-1349 m. *Pennatula grandis*: Alvin dive 1263 covered lower east wall, axis, and west wall of canyon between 933-1145 m; *P. grandis* found on floor of canyon axis. (Hecker et al. 1983). *Distichoptilum gracile*: soft substrates, especially on east wall and axis (Hecker et al. 1983); 1100-1800 m (Opresko 1980). Hecker et al. (1983) noted in Canyon (p. 34) below 990 m (p 40); especially 1000-1500 m (p. 42) or about 1300-1500 (p. 45). East wall dominant between 1200-1500 m (p. 48). In the axis reaches higher densities, with a peak of 0.7-0.9 individuals/m 2 at 1600 m, than on either of the walls (< 0.2 individuals/m2) (p. 48). Also Alvin 1265 lower west wall 900-1080 m on soft substrate a few are found (p. 130). Alvin 1263, dive covered the lower east wall, axis, and west wall of the canyon between 933-1145 m; found on floor of canyon axis (p. 131). Alvin 1267 axis and east wall 1317-1520 m, silty floor. Also above the cliffs in silt covered tributaries with small clay out crops (p. 131). Alvin 1268 axis at 2003 m (p. 132). Alvin 1264 lower west wall of silt between 2177-2190 m, plus silty axis… throughout this region it's a dominant (p. 133). *Kophobelemnon stelliferum*: 700-800 m (Opresko 1980). *Pennatula aculeata*: quite common near head of Canyon between 400-600 m, soft substrates in the shallow axis and on the west wall (Hecker and Blechschmidt 1980); high concentrations between 300-450 or 550 m in silty axis (Hecker et al. 1983.); 350-1375 (Opresko 1980). Hecker et al (1983) notes Alvin 1039 dive, a depression in axis at about 400 m, silty; *P. aculeata* dominates (p. 127). Alvin 1040: axis and east wall 170-440 m; sea pen totally dominates flat, silty axis (p. 128). Alvin 1037: axis and lower west wall 330-550 m; dominant in course-grained axis (p. 128). *Distichoptilum gracile*: 1100-1800 m (Opresko 1980); below 990 m, esp. 1000-1500 m; dominant on east wall 1200-1500 m, higher densities in axis at 1600 m (Hecker et al. 1983). *Stylatula elegans*: one specimen found at about 600 m (Opresko 1980).

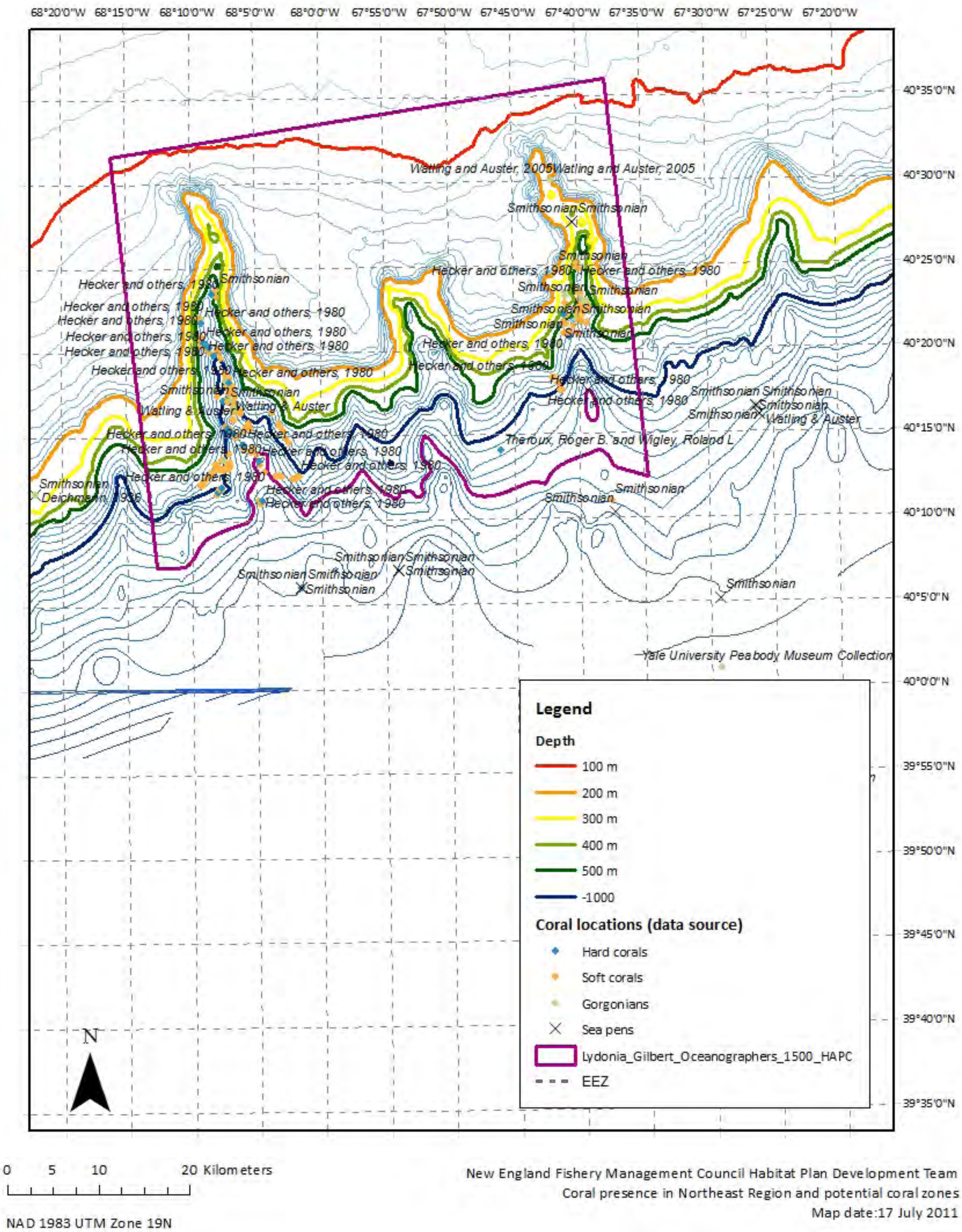
Gilbert: Surveyed by Thoma et al. (2009) – no other records. Isididae: *Acanella* was found at Lat.: 40.1104, Long.: –67.8807; depth = 2097 m

Oceanographer: Suveyed by Hecker et al. (1980); Hecker and Blechschmidt (1980); Opresko (1980); Thoma et al. (2009); Valentine et al. (1980); NE database including Smithsonian database.

Coral types include **Stony**: *Desmophyllum dianthus, Lophelia pertusa (?), Flabellum alabastrum, Javania cailleti;* **Soft**: *Anthomastus agassizii, Anthomastus grandiflorus, Clavularia rudis, Capnella florida*; **Gorgonians**: *Paragorgia arborea, Primnoa resedaeformis, Acanthogorgia armata, Anthothela grandiflora, Acanella arbuscula, Paramuricea grandis, Thouarella grasshoffi*; **Sea pens**: *Pennatula aculeata, Distichoptilum gracile*.

Depths of coral observations are as follows: *Desmophyllum dianthus*: boulders and outcrops 650-1600 m; found throughout axis between 1500-1600 m (Hecker and Blechschmidt 1980). *Lophelia pertusa*: west wall of at 1100 m, dead rubble also found on wall at depths from 700-1300 m. *Flabellum alabastrum*: soft substrate. *Javania cailleti*: axis between 935-1220 m. *Anthomastus agassizii*: on boulders and outcrops from 1057-1326 m; Valentine et al. (1980) found them in a zone of greatest abundance from 1100-1860 m; Hecker and Blechschmidt (1980) found them mostly from 950-1350 m on glacial erratics, outcrops, coral rubble. *Anthomastus grandiflorus*: "in the northern canyons found from 700-1500 m." *Clavularia rudis*: 750 and 900 m. *Acanthogorgia armata*: boulders or outcrops between 400-1299 m; from 650-950 m (Hecker and Blechschmidt 1980; Hecker et al. 1980). *Acanella arbuscula*: 1046-1191 m; found by Hecker and Blechschmidt (1980) mostly from 950-1350 m. *Paragorgia arborea*: 300-1100 m; large colonies in the axis above 1000 m. *Primnoa resedaeformis*: zone of greatest abundance from 300-1099 m (Valentine et al. 1980). *Paramuricea grandis*: on wall and axis of on boulders and outcrops between 400-1349 m; Thoma et al (2009) 814, 1078 m; Valentine et al. (1980) observed greatest abundance from 1100-1860 m; Hecker and Blechschmidt (1980) observed they were dominant from 950-1350 m. *Pennatula aculeatea*: 1700-1799 m deep part of axis (Opresko 1980). *Distichoptilum gracile*: soft substrates, lower east wall and in the axis (Hecker et al 1980); 1100-1800 m (Opresko 1980).

Map 15 – Lydonia/Gilbert/Oceanographer Canyon Deep-Sea Coral Zone



2.1.2.5 Toms/Middle Toms/Hendrickson Canyons DSC Zone

Toms and Hendrickson Canyons have been surveyed for corals and corals were found.

<u>Toms Canyon:</u> Surveyed by Hecker and Blechschmidt (1980); Hecker et al. (1983). NE database including Smithsonian database.

Coral types include: Hecker et al. (1983) surveyed a slope area in the Mid-Atlantic: Slope II, bounded by Toms Canyon to the south and Meys Canyon to the north. They may have sampled on the slope near the canyon and found corals there, but not within the canyon. Hecker and Blechschmidt (1980) report corals in the head of the canyon. **Stony**: *Dasmosmilia lymani, Desmophyllum dianthus, Solenosmilia variabilis, Flabellum sp.* on slope bounded by Toms Canyon to the south and Meys Canyon to the north; **Soft**: *Anthomastus agassizii* on slope bounded by Toms Canyon to south and Meys Canyon to north, near head of Canyon, *Anthomastus grandiflorus* seen near Toms Canyon, *Gersemia fruticosa* seen near head of Canyon; **Gorgonians**: *Acanella arbuscula, Paramuricea grandis* on slope bounded by Toms Canyon to south and Meys Canyon to north; **Sea pens**: *Kophobelemnon stelliferum, Distichoptilum gracile, Stylatula elegans* on slope bounded by Toms Canyon to south and Meys Canyon to north. Smithsonian database: *Pennatula aculeata*, *Pennatula grandis, Scleroptilum grandiflorum, Virgularia.*

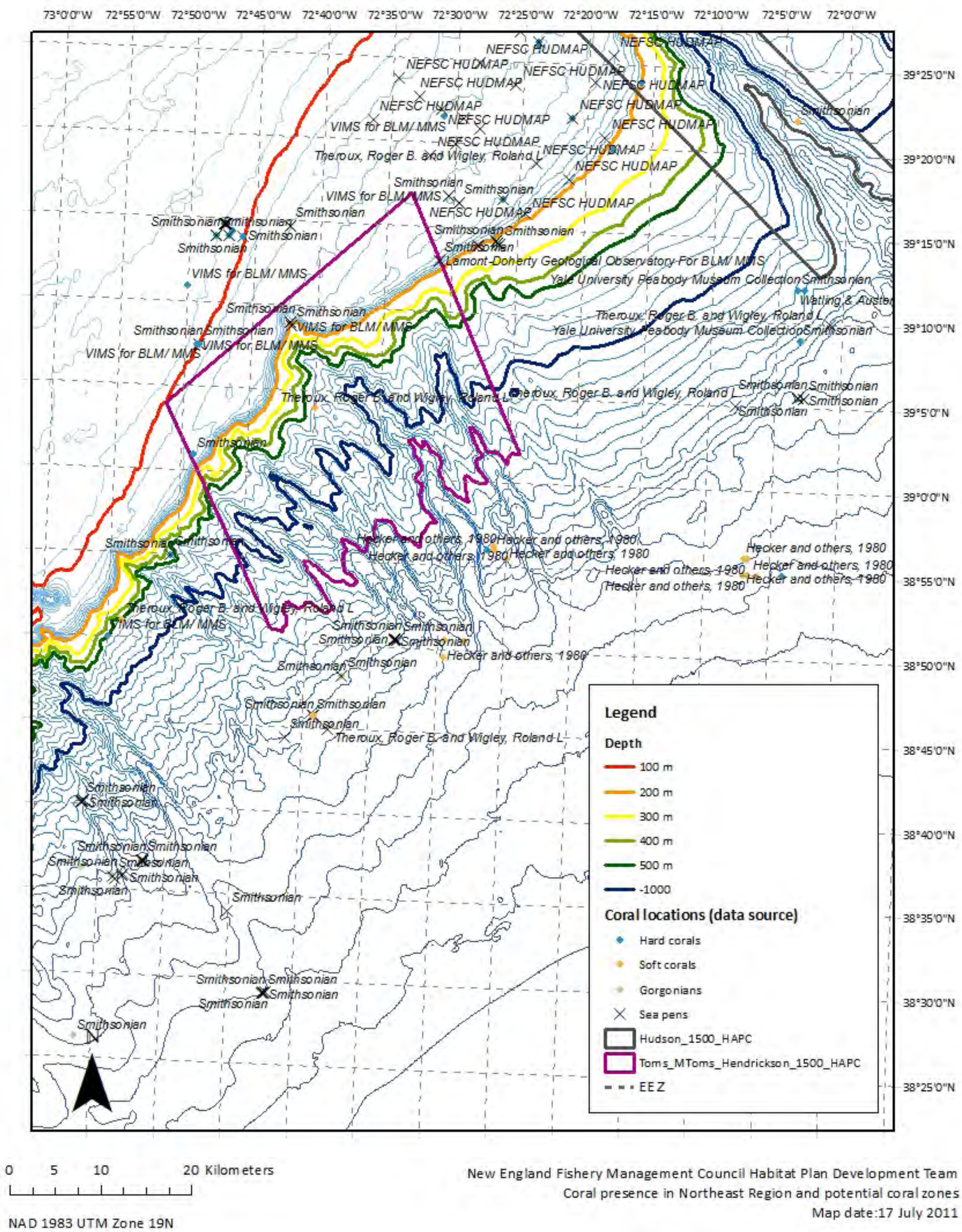
Depths of coral observations are as follows: *Stylatula elegans* on slope bounded by Toms Canyon to south and Meys Canyon to north: high densities found 100-300 m. *Kophobelemnon stelliferum* on slope bounded by Toms Canyon to south and Meys Canyon to north: found mostly between 1460-1540 m, substrate muddy with some gravel.

<u>Hendrickson Canyon:</u> Surveyed by Hecker et al. (1983).

Coral types include: **Sea pens**: *Distichoptilum gracile* Slope II in Hendrickson Canyon, *Stylatula elegans* slope landward of Hendrickson Canyon, *Kophobelemnon stelliferum* Slope Area II steep silty slope of Hendrickson Canyon silty axis and lower wall (Hecker et al. 1983).

Depths of coral observations are as follows: Distichoptilum gracile Slope II in Hendrickson Canyon (Hecker et al. 1983) 640 -1640 m and also common in "zone 4" between 1460-1540 m and "zone 5" between 1510-2290, also listed in Hecker et al (1983) from Slope Area II Alvin dive 1118 -- steep silty slope of Hendrickson Canyon between 1300-1350 m and also silty axis and lower wall 1350-1430 (p. 126) and deep axis, on hard substrate (p. 127); *Stylatula elegans* Slope II dive JSL 1082 -- slope landward of Hendrickson Canyon 145-220 m (Hecker et al 1983); *Kophobelemnon stelliferum* Slope Area II Alvin dive 1118 -- steep silty slope of Hendrickson Canyon silty axis and lower wall 1350-1430 (Hecker et al. 1983).

Map 16 – Toms/Middle Toms/Hendrickson Canyon Deep-Sea Coral Zone



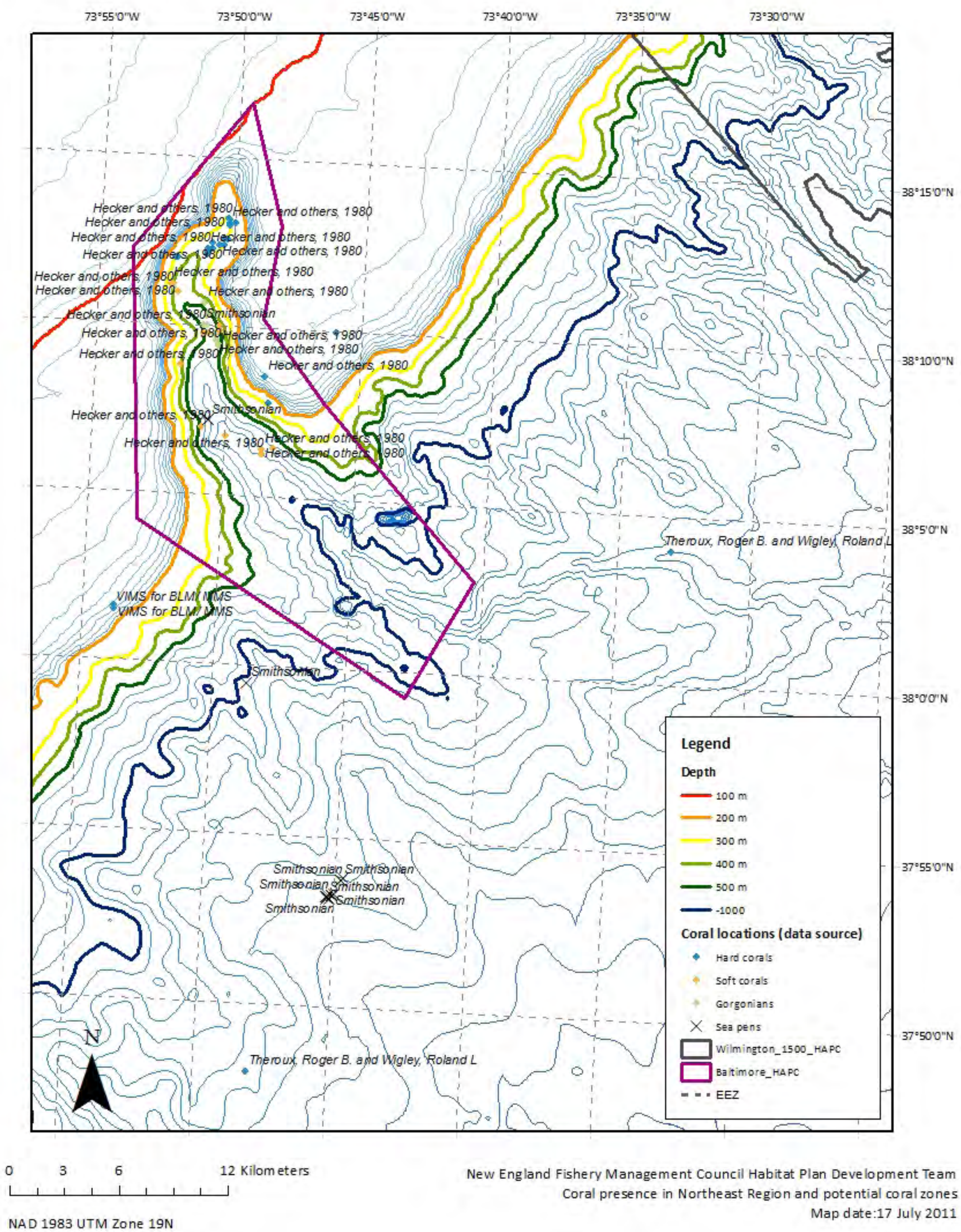
2.1.2.6 Baltimore Canyon DSC Zone

Baltimore Canyon has been surveyed for corals and corals were present (Hecker et al. (1980, 1983); Opresko (1980); NE database).

Observed species included **Stony**: *Dasmosmilia lymani* near head of Canyon , *Flabellum alabastrum* found on slope south of Canyon, *Desmophyllum dianthus;* **Soft**: *Anthomastus agassizii?*, *Anthomastus grandiflorus, Capnella florida*; **Gorgonians**: *Acanella arbuscula* on slope just south of Canyon, *Paragorgia arborea, Primnoa resedaeformis, Acanthogorgia armata*, *Anthothela grandiflora*; **Sea pens**: *Kophobelemnon stelliferum* common on slope north of Baltimore Canyon (Opresko 1980), *Distichoptilum gracile, Stylatula elegans*. An additional sea pen, *Virgularia mirabilis* (Müller, 1776), was mentioned in Hecker and Blechschmidt (1980): "Seven specimens of this sea pen were seen on the slope between Baltimore and Norfolk Canyons at depths from 1500 to 1800 meters." It has been recorded in Europe and is said to occur in the western Atlantic, but this is the only mention of this species in these waters that we have been able to find.

Depths of these observations were as follows: *Acanthogorgia armata* found at 350 m, *Paragorgia arborea* axis of Canyon at 400 m and 500 m, *Primnoa resedaeformis* 450 m, *Kophobelemnon stelliferum* common on slope north of Canyon between 1550-1800 m and also at 200 m north of Canyon (Opresko 1980), *Stylatula elegans* at about 150-300 m. *Distichoptilum gracile* 1190-2040 m and north flank dominant between 1500-1700 m. Hecker et al (1983) -- Baltimore Canyon zone 4, 1190-1690 m, and zone 5, 1610-2040 (p. 87). North flank dominant between 1500-1700 m (p. 98). Baltimore Canyon Alvin dive 1108: axis and south wall in the vicinity where it curves to the east. Lower south wall from 1140-1400 m consists of a steep consolidated clay slope with a silty sediment veneer (p. 123). Alvin 1107: dive explored axis and lower wall near mouth of canyon from 1790-1940 m; floor of axis covered by silty sediment with a hummocky topography, found in the axis and lower north wall (p. 123).

Map 17 – Baltimore Canyon Deep-Sea Coral Zone



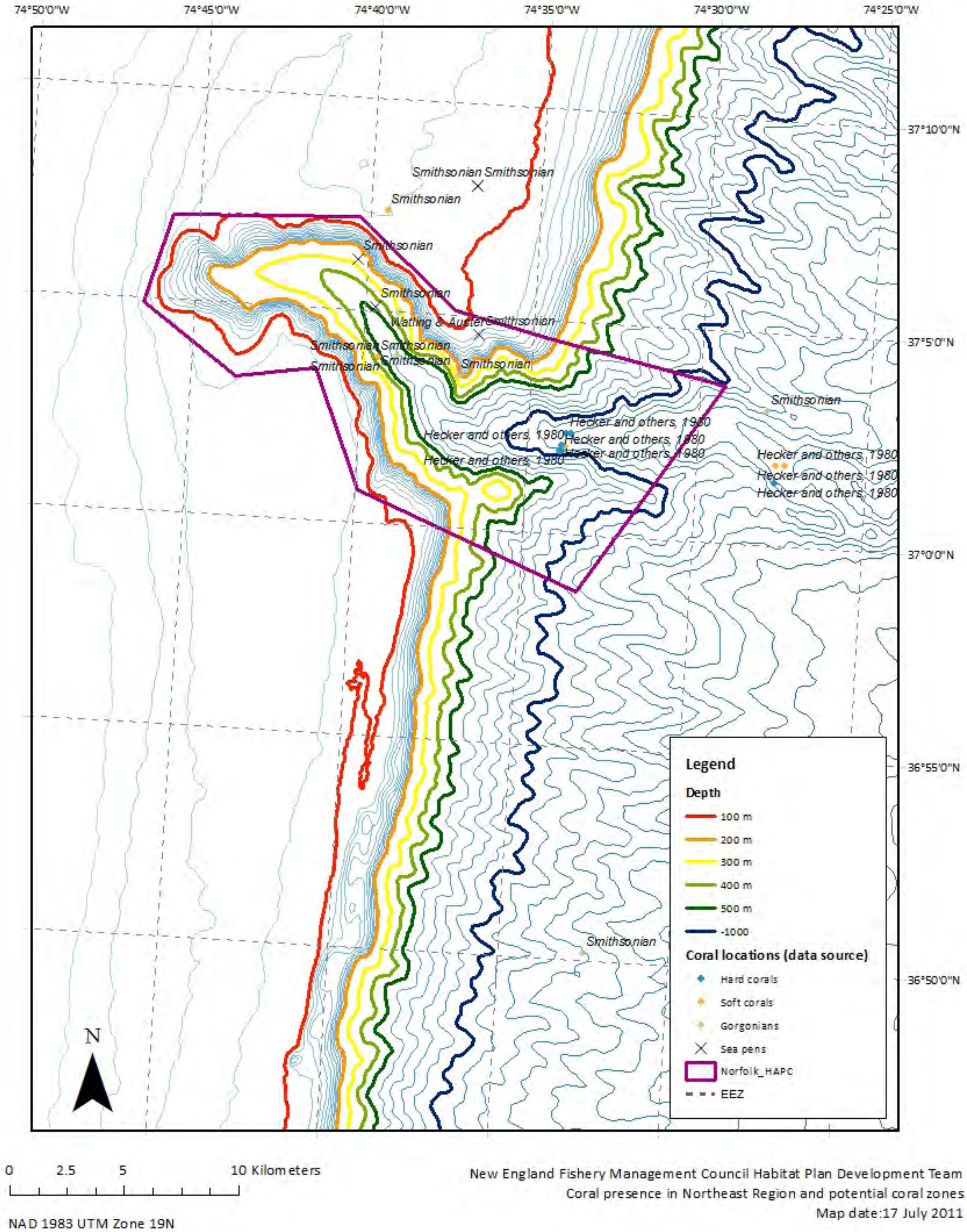
2.1.2.7 Norfolk Canyon DSC Zone

Norfolk Canyon has been surveyed for corals and corals were present (Hecker and Blechschmidt (1980); Opresko (1980); Malahoff et al. (1982). NE database including Smithsonian database).

Observed species included **Stony**: *Desmophyllum dianthus* occasionally on axis of Canyon, *Flabellum alabastrum* found in deeper parts of the continental slope south of Canyon and in axis of Canyon on soft substrate; **Soft**: *Anthomastus grandiflorus* axis of Canyon, *Gersemia fruticosa* at the mouth of Canyon; **Gorgonians**: *Paragorgia arborea, Primnoa resedaeformis, Acanthogorgia armata* occasionally in axis of Canyon on exposed outcrops; **Sea pens**: *Pennatula aculeata*. Smithsonian database: note records for *Gersemia rubiformis*, *Acanella* sp., *Stylatula* cf. *diadema* Bayer, 1959.

Depths of these observations were as follows: *Desmophyllum dianthus* hard substrate at 1050-1250 m, *Flabellum* sp. high concentrations at 1300-1350 m (Hecker and Blechschmidt 1980), *Anthomastus grandiflorus* between 2150-2350 m, *Acanthogorgia armata* hard substrate at 1050-1250 m (Hecker and Blechschmidt 1980), *Paragorgia arborea* 400-600 m, *Primnoa resedaeformis* 400 m, *Pennatula aculeata* exceptionally high concentrations 2150-2300 m in axis of Canyon (Opresko 1980).

Map 18 – Norfolk Canyon Deep-Sea Coral Zone



2.1.2.8 Bear Seamount DSC Zone

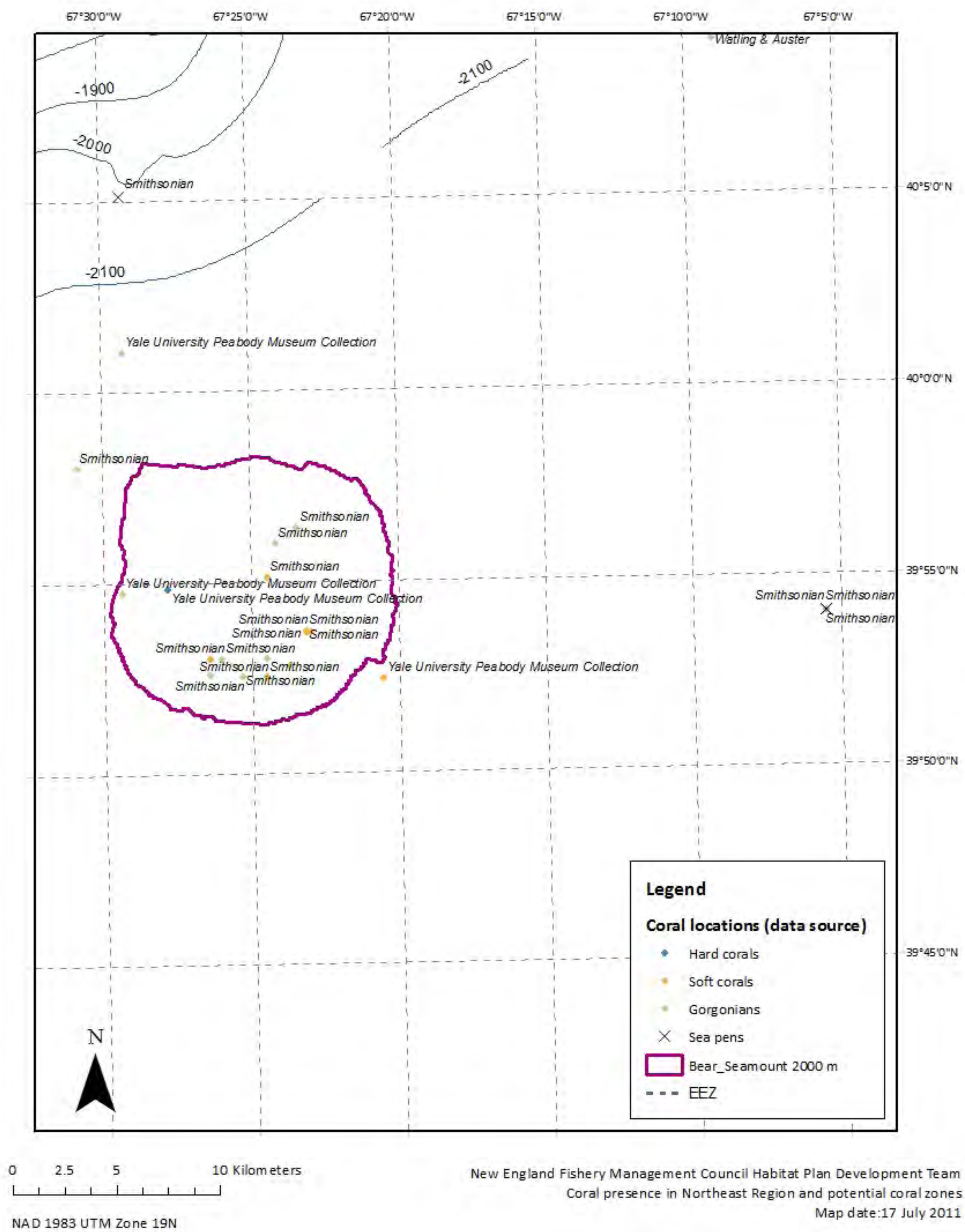
Bear Seamount has been surveyed for corals and corals were present (Moore et al. (2003, 2004); Brugler (2005); Cairns (2006, 2007), Mosher and Watling (2009), Thoma et al.

(2009); Deep Atlantic Stepping Stones Science Team/IFE/URI/NOAA. NE database including Smithsonian database).

Observed species included **Stony**: *Vaughanella margaritata, Caryophyllia ambrosia ambrosia*, *Lophelia pertusa, Desmophyllum dianthus, Solenosmilia variabilis Enallopsammia rostrata, Flabellum alabastrum;* **Soft**: *Anthomastus agassizii*; **Gorgonians**: *Chrysogorgia* sp., *Metallogorgia melanotrichos*, *Radicipes gracilis*, *Lepidisis caryophyllia*?, *Paragorgia arborea?, Swiftia casta?, Primnoa resedaeformis??*, *Thouarella grasshoffi Calyptrophora antilla* (39°53’42”N, 66°23’07”W), *Paramuricea* sp., *Keratoisis* sp.; **Sea pens**: *Pennatula aculeata;* **Black**: *Bathypathes* (Schizopathidae), *Leiopathes* sp. Smithsonian database: *Parantipathes tetrasticha* listed on summit of Bear Seamount; listed in ITIS in the family Antipathidae; Clavulariidae listed on Bear summit.

Depths of these observations were as follows: *Bathypathes* (Schizopathidae) 1195–1402 and 1843–1888 m, *Leiopathes* sp. 1643 m, *Chrysogorgia* sp. 1559 and 1994–2031, *Metallogorgia melanotrichos* 1491, 1559 (Mosher and Watling 2009) and 1559, 1639 (Thoma et al. 2009), *Radicipes gracilis* 1431–1464 and 1428–1650, *Paramuricea* sp. 1378–1431, *Calyptrophora antilla* 1684 m; Smithsonian database: *Parantipathes tetrasticha* 1165 m.

Map 19 – Bear Seamount Deep-Sea Coral Zone



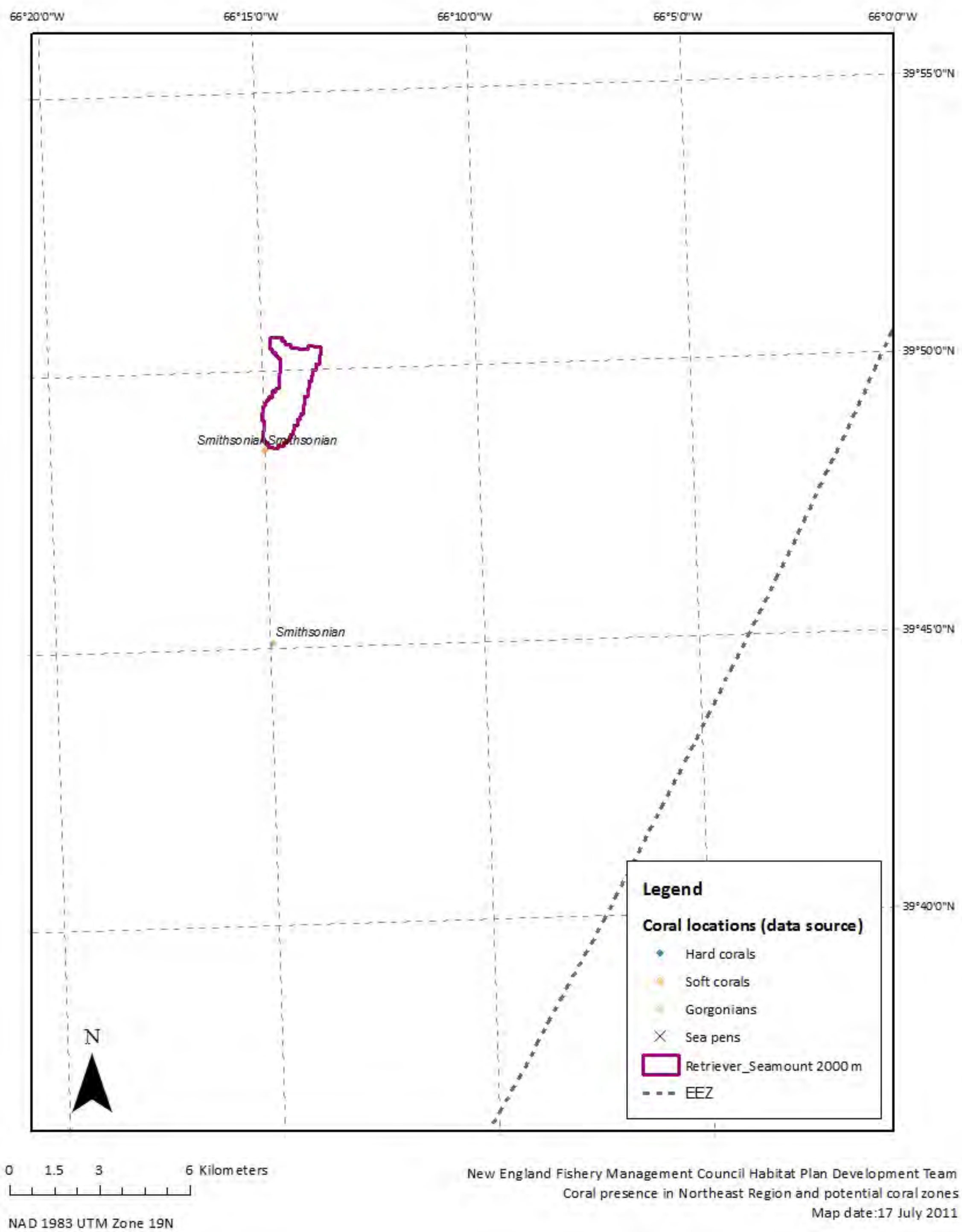
2.1.2.9 Retriever Seamount DSC Zone

Retriever Seamount has been surveyed for corals and corals were present (Cairns (2007), Mosher and Watling (2009), Thoma et al. (2009)).

Observed species included **Gorgonians**: *Chrysogorgia* sp., *Metallogorgia melanotrichos*, *Acanella arbuscula, Parastenella atlantica* (39°48.5454'N, 66 ° 14.9883'W), *Paranarella watlingi* (39 °48.0754'N, 66°14.9408'W), *Paramuricea* sp.; **Black**: *Bathypathes* (Schizopathidae), *Parantipathes* (Schizopathidae).

Depths of these observations were as follows: *Bathypathes* (Schizopathidae) 1983 m, *Parantipathes* (Schizopathidae) 2045 m, *Chrysogorgia* sp. 3860 m, *Metallogorgia melanotrichos* 1983, 2012, *Acanella arbuscula* 2035, 2040, *Paramuricea* sp. 1981, 1984, 1985, 2040 m, *Parastenella atlantica* 1984 m, *Paranarella watlingi* 3855 m.

Map 20 – Retriever Seamount Deep-Sea Coral Zone



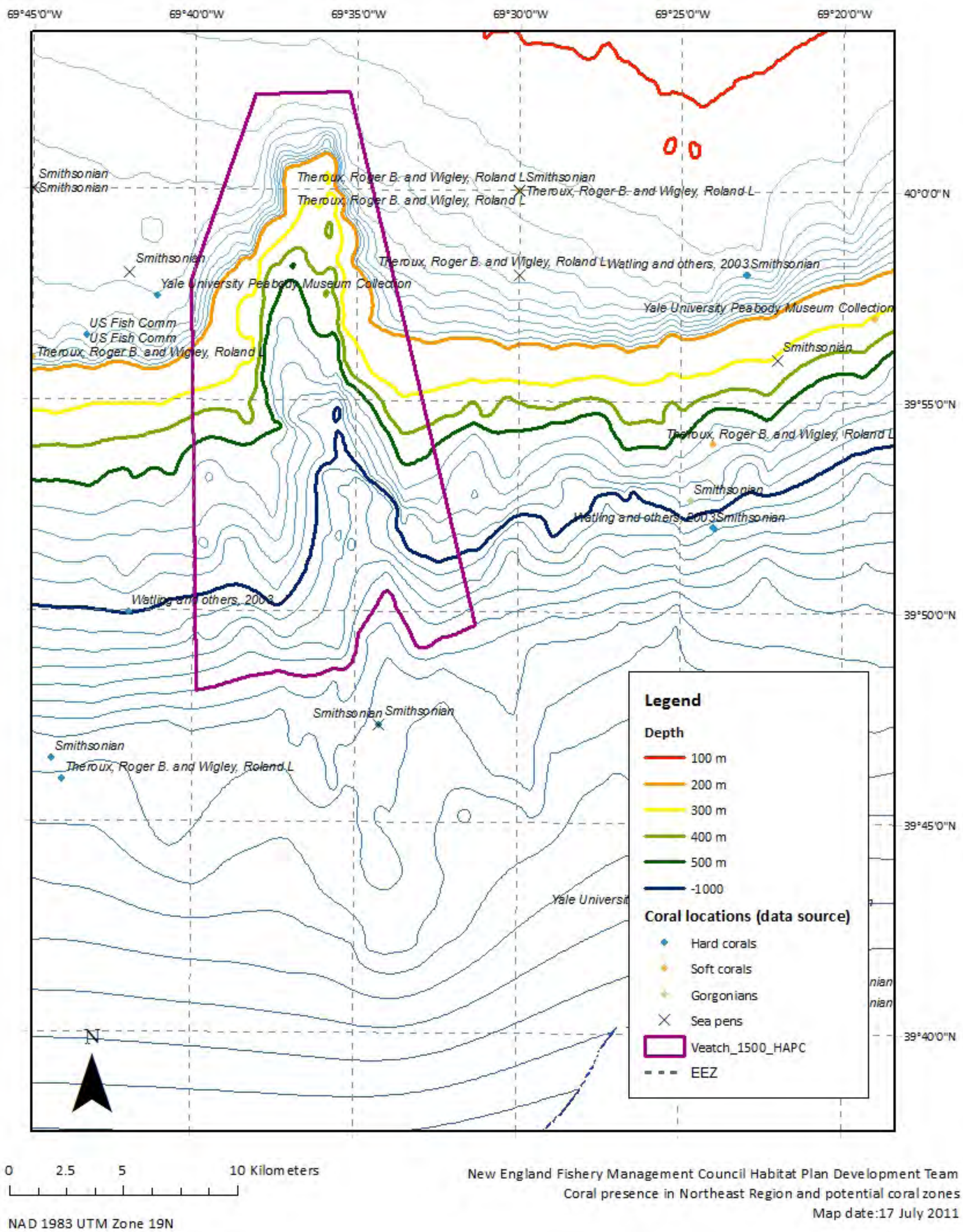
2.1.3 Discrete zones with inferred presence of corals

The following individual areas to which corals can reasonably be inferred are also suggested as coral zones.

2.1.3.1 Veatch Canyon DSC Zone

Hecker et al. (1983) surveyed an area called Slope III, a 25 mile wide section of the continental slope on the southwestern edge of Georges Bank, between Veatch and Hydrographer Canyons; they found corals there, but there doesn't appear to be any literature identifying corals within the canyon. Should be a map in Hecker and Blechschmidt (1980). See also: http://www.nrdc.org/water/oceans/priority/recheck.asp. See also Hydrographer Canyon/Slope III from Hecker et al (1983).

Map 21 – Veatch Canyon Deep-Sea Coral Zone

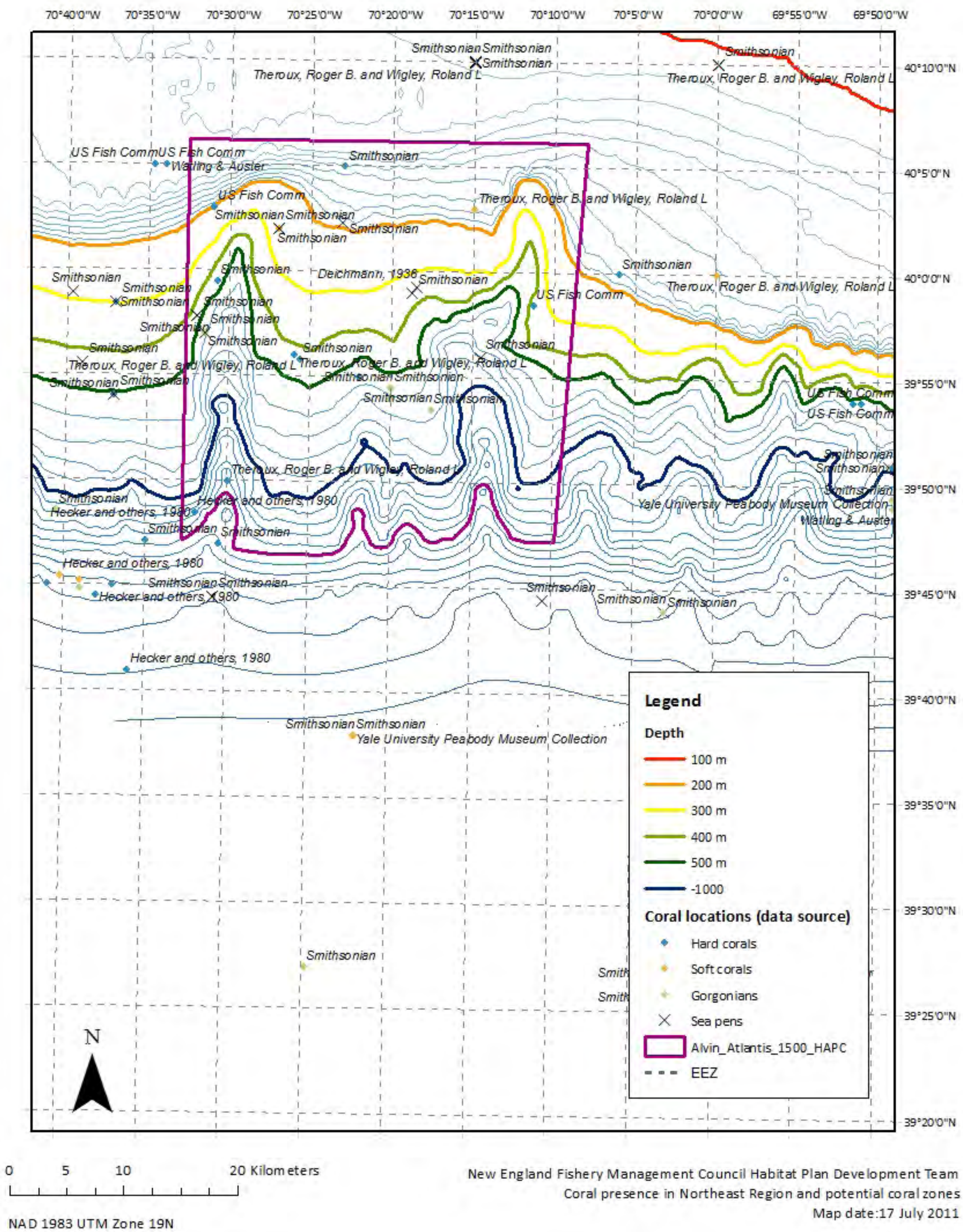


2.1.3.2 Alvin/Atlantis Canyon DSC Zone

<u>Alvin Canyon:</u> Hecker and Blechschmidt (1980) appear to have found corals on the slope near the canyon, but did not sample within the canyon. **Stony**: *Flabellum alabastrum* seen on deep continental slope near Canyon; **Soft**: *Anthomastus agassizii* on deep continental slope near Canyon; **Gorgonians**: *Acanthogorgia armata*, *Acanella arbuscula, Paramuricea grandis* seen on deep continental slope near Canyon

Atlantis Canyon: No literature found at present that documents the presence of corals within the canyon. Sea pens: Anthoptilum grandiflorum: three near Canyon, Halipteris (=Balticina) finmarchica: found near Canyon. *Anthoptilum grandiflorum*: three at 2150 m near Canyon (Opresko 1980). *Halipteris* (=*Balticina*) *finmarchica*: found near Canyon between 900-2200 m (Opresko 1980).

Map 22 – Alvin/Atlantis Canyon Deep-Sea Coral Zone



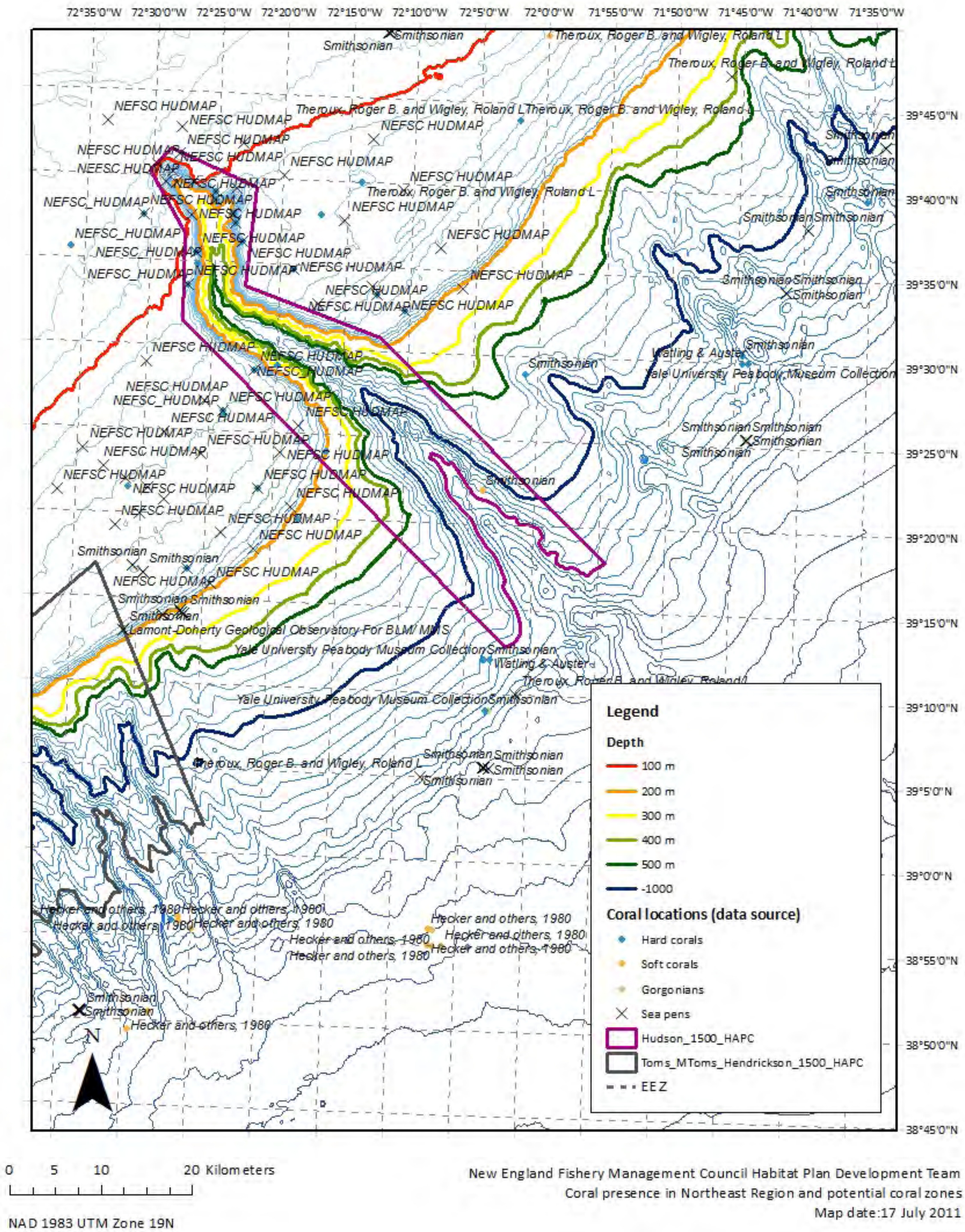
2.1.3.3 Hudson Canyon DSC Zone

Surveys: Hecker and Blechschmidt (1980); see also website listed in next column. Shelf at head of canyon: V. Guida (unpublished data, NMFS James J. Howard Marine Sciences Lab, Highlands, NJ). NE database including Smithsonian database.

Types of corals present: There appears to have been some submersible dives in the canyon over the years, but the only confirmation of corals within the Canyon at present comes from Hecker and Blechschmidt (1980): "*Eunephthya* [= *Gersemia*] *fructicosa* and sea pens were found in the deeper portion of the canyon" (page A-39). "Abundant populations of large individuals of *Eunephthya fruticosa* were found only in the deeper part of Hudson Canyon" (page A-45). See also: http://www.nrdc.org/water/oceans/priority/recheck.asp. **Stony**: *Dasmosmilia lymani* continental shelf between Baltimore and Hudson Canyons, and on the shelf south of Hudson Canyon and in the head of Hudson Canyon, *Desmophyllum dianthus* on an outcrop near Canyon; **Soft**: *Anthomastus agassizii* may be found on hard substrates near the canyon, *Anthomastus grandiflorus* seen near Hudson Canyon, *Gersemia fruticosa* near and in deep portion of Canyon; **Gorgonians**: *Acanthogorgia armata* found on an outcrop near Canyon, several individuals that may be *Chrysogorgia agassizii* found in the vicinity of Canyon, *Paramuricea grandis* seen from Corsair Canyon to near Hudson Canyon on hard substrates; **Sea pens**: *Benthoptilum sertum* New Jersey near Hudson 39.58333N, 71.31250W, *Funinculina armata*, *Stylatula elegans* near head of canyon.

Depths at which corals were found: *Dasmosmilia lymani* between 100-200 m on the shelf south of Hudson Canyon and in the head of Canyon, *Gersemia fruticosa* near and in deep portion of Canyon around 2250-2500 m, *Paramuricea grandis* seen from Corsair Canyon to near Hudson Canyon from 700-2200 m on hard substrates, *Chrysogorgia* agassizii were found at 2150 m in the vicinity of Canyon. *Benthoptilum sertum* New Jersey near Hudson, 1962 m.

Map 23 – Hudson Canyon Deep-Sea Coral Zone



2.1.3.4 Hydrographer Canyon DSC Zone

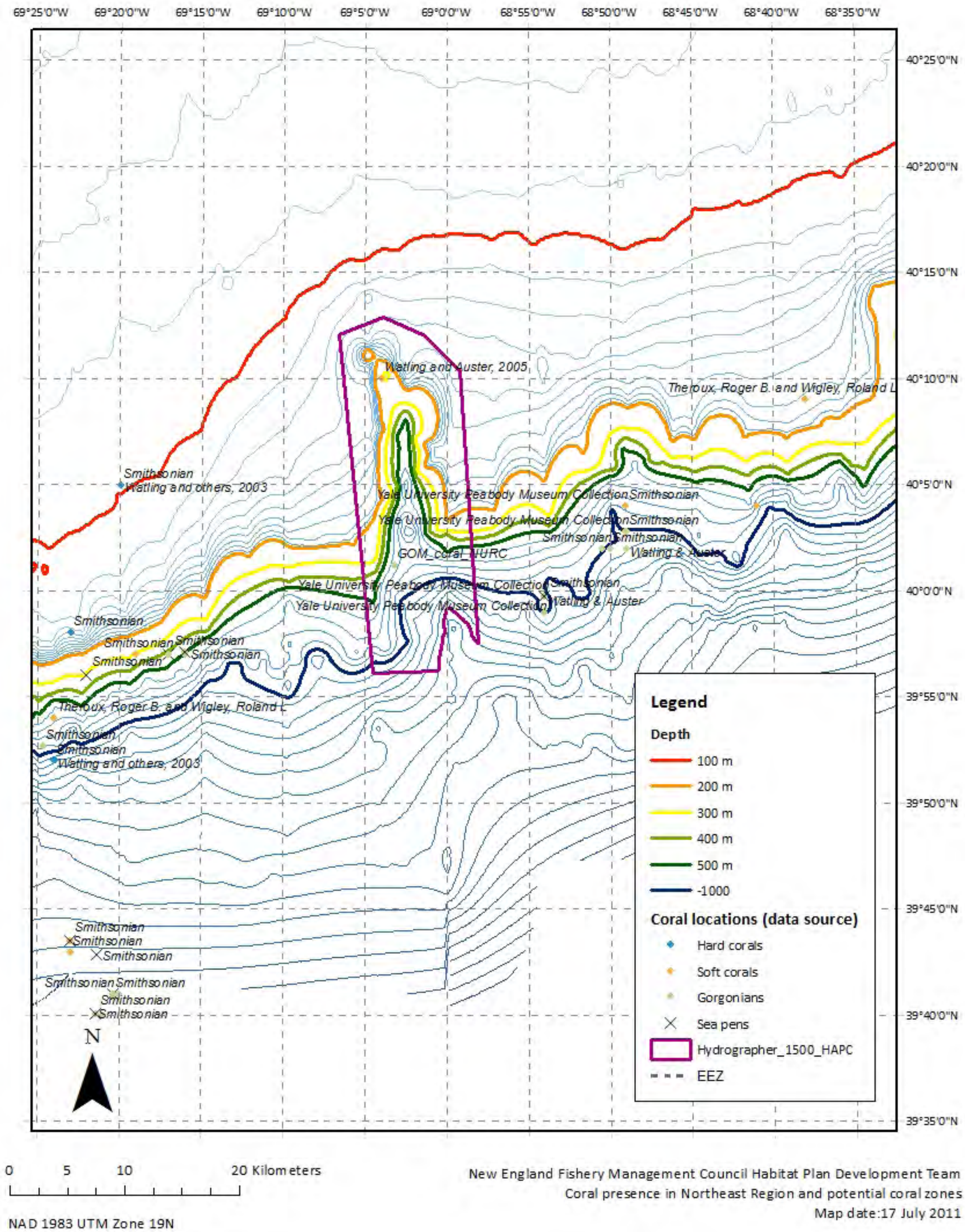
Surveys: Hecker and Blechschmidt (1980); Hecker et al. (1983); see also websites below. NE database lists 2 records: “GOM coral NURC” from “Hydrographer Canyon” 1991, and “Watling/

Auster (2005)… discussed in Theroux/Wigley 1998" from "Continental Shelf off of New England."

Coral types observed: Hecker et al. (1983) surveyed an area called Slope III, a 25 mile wide section of the continental slope on the southwestern edge of Georges Bank, between Veatch and Hydrographer Canyons; they found corals there, but there doesn't appear to be any literature identifying corals within the canyon. See also: http://www.nrdc.org/water/oceans/priority/recheck.asp . Indeed, it appears that submersible dives have found no corals there. Maps in Hecker and Blechschmidt (1980) show that a camera was lowered into the canyon. (fig. A-1), but no corals are recorded. For recent surveys, see: http://data.nurp.noaa.gov/nurp03/REsum.asp?Project_No=NAGL-01-04A "Preliminary Scientific Results: Two dives were made in the submersible Alvin. One found corals on rock outcrops in Oceanographer Canyon; the other did not find corals, but instead found high numbers of deep sea red crabs and flounders on mud slopes in Hydrographer Canyon. The presence of mud at Hydrographer Canyon apparently precludes the presence of corals. However, we also did not see other octocorals, such as the umbellulids, that also favor muddy bottoms." And finally, see: <http://oceanexplorer.noaa.gov/explorations/deepeast01/logs/sep14/sep14.html>. "Dr. Barbara Hecker had predicted that we would not find the same community in Hydrographer Canyon as was found in Oceanographer Canyon. Corals, she suggested, would not be well represented here because they need a rocky substrate. As the science team reviewed video footage, a rich community was revealed. Numerous individuals representing many different species were observed. Dr. Hecker's prediction was correct, however; no corals were found." From Hecker et al. (1983) Slope III, a 25 mile wide section of the continental slope on the southwestern edge of Georges Bank, between Veatch and Hydrographer Canyons – **Stony**: *Dasmosmilia lymani, Desmophyllum dianthus*. **Soft**: *Anthomastus agassizii*. **Gorgonians**: *Paramuricea grandis*; **Sea pens**: *Kophobelemnon stelliferum*, *Distichoptilum gracile*. NE Database lists 2 **Gorgonians**: GOM coral NURC = *Paragorgia arborea*; Theroux/Wigley 1998 = *Primnoa* sp.

Depths of coral observations: *Primnoa* sp. between 200-300 m; *Paragorgia arborea* between 600-700 m.

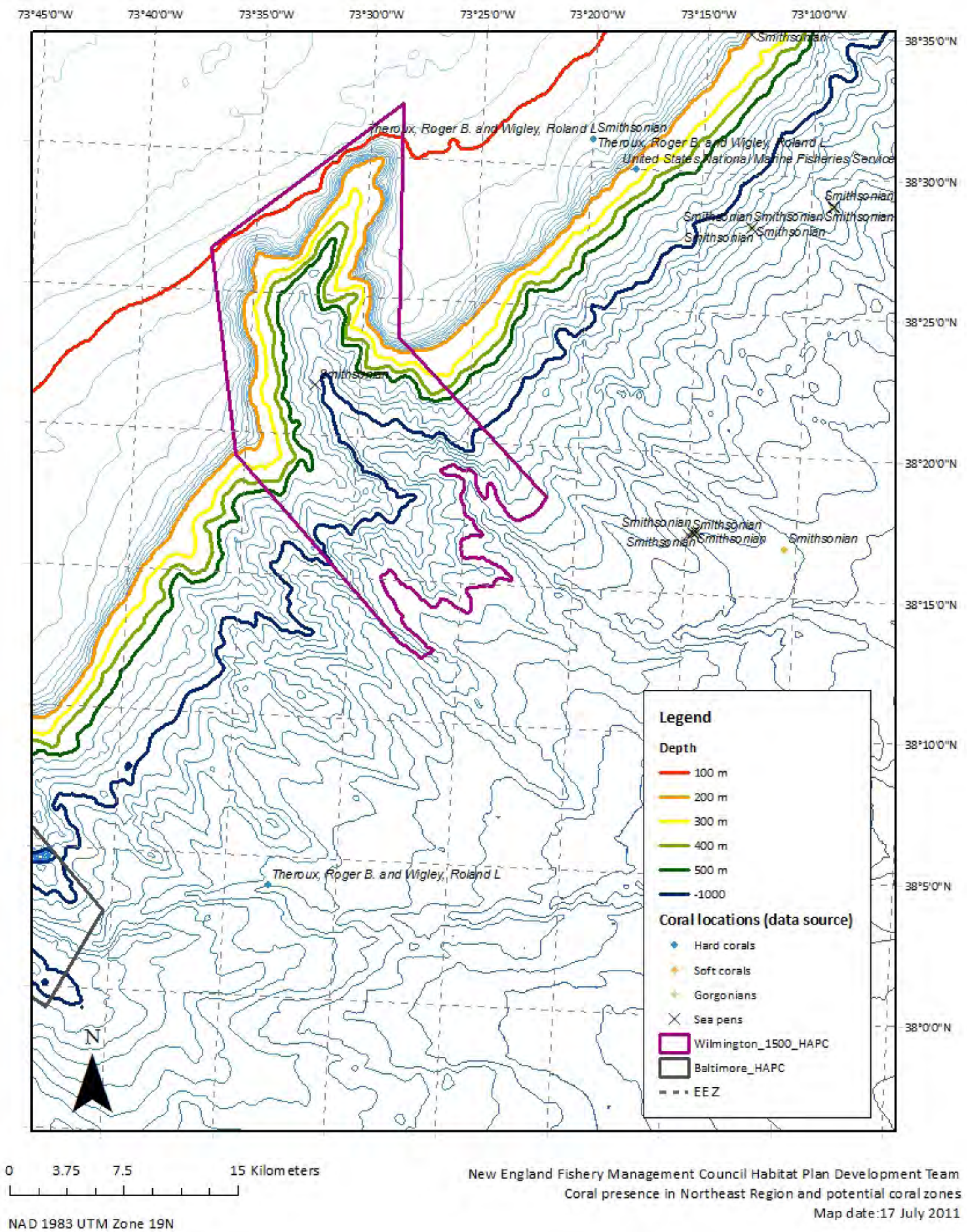
Map 24 – Hydrographer Canyon Deep-Sea Coral Zone



2.1.3.5 Wilmington Canyon DSC Zone

No literature found at present that documents the presence of corals. See also: http://www.nrdc.org/water/oceans/priority/recheck.asp. Single Smithsonian record of *Pennatula aculeata*.

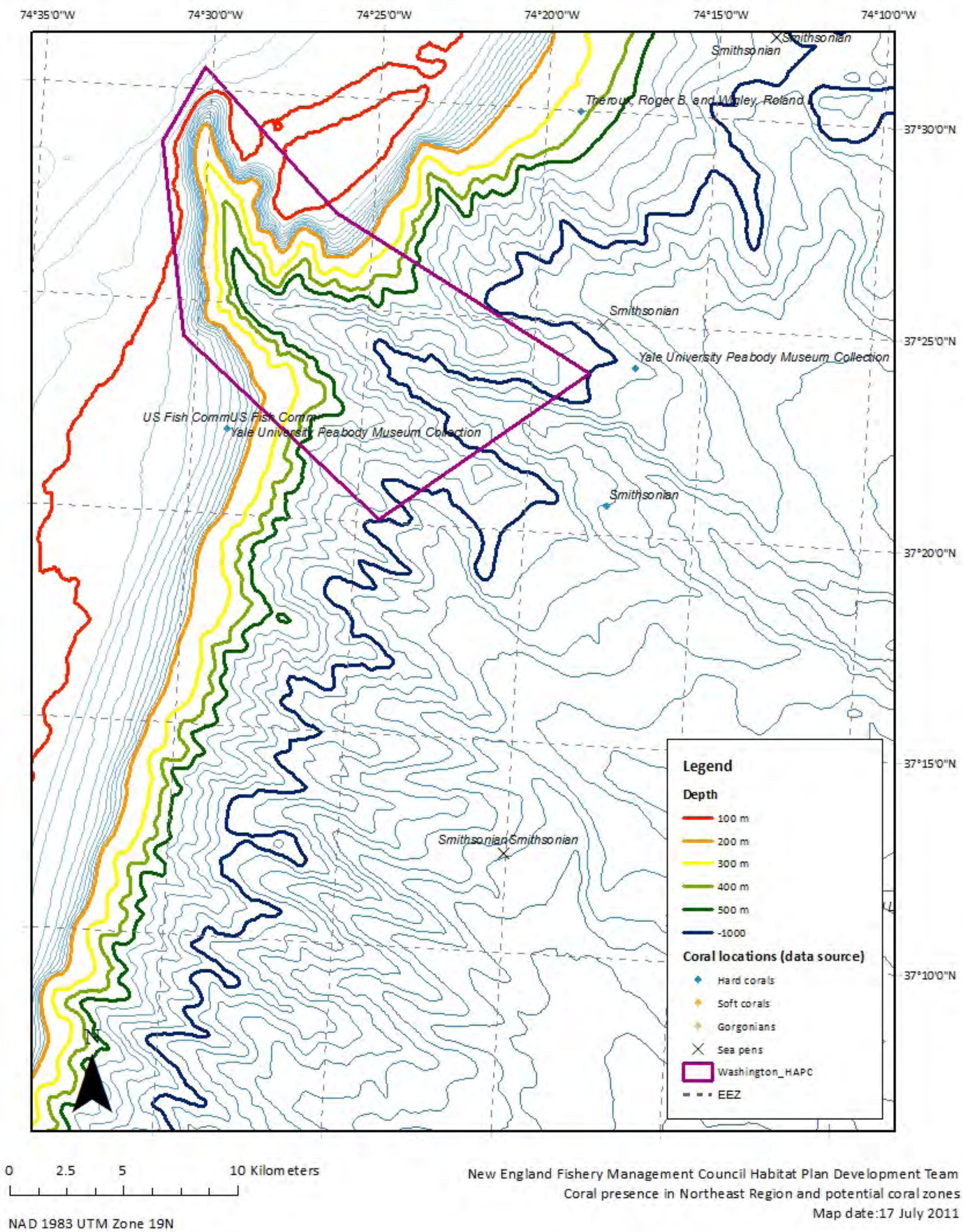
Map 25 – Wilmington Canyon Deep-Sea Coral Zone



2.1.3.6 Washington Canyon DSC Zone

No literature found at present that documents the presence of corals.

Map 26 – Washington Canyon Deep-Sea Coral Zone



2.2 Management measures for deep-sea coral zones

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

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

2.2.1 Gear restrictions and/or prohibitions

The following range of alternatives would protect deep-sea corals via restrictions and/or prohibitions on various types of commercial and/or recreational fishing within deep-sea coral zones. Note that the language for these alternatives was changed from 'prohibitions' to 'restrictions and/or prohibitions' at the 1/6/11 Habitat Committee meeting.

2.2.1.1 No Action Alternative

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

2.2.1.2 Alternatives for a broad shelf-slope coral zone

2.2.1.2.1 Restrict and/or prohibit all fishing in a broad coral zone

Depending on the depth at which a broad coral zone is defined, and whether all or most fishing effort is excluded at this depth, this would represent a freeze the footprint alternative. As discussed above, a starting depth of approximately 300 meters defines a coral zone that emcompasses very little current fishing effort, with the exception of the deep-sea red crab fishery.

2.2.1.2.2 Restrict and/or prohibit all fishing in a broad coral zone but allow for access by certain fisheries

This alternative would close a broad coral zone to all fishing, with exceptions for specific fisheries/gear types.[2] Access could be granted in specific areas only, or for all vessels in a particular fishery, or using a particular gear type. Given that the deep-sea red crab fishery occurs entirely within a likely broad coral zone, this fishery would be an appropriate candidate for exemption/access.

2.2.1.3 Alternatives for discrete coral zones

2.2.1.3.1 Restrict and/or prohibit on mobile bottom tending gears in specified coral zones

This alternative would restrict and/or prohibit mobile bottom-tending fishing gear operations in deep-sea coral zones.

2.2.1.3.2 Restrict and/or prohibit commercial bottom-tending gears in specified coral zones

This alternative would restrict and/or prohibit commercial bottom-tending fishing gear operations in deep-sea coral zones.

2.2.1.3.3 Restrict and/or prohibit commercial fishing gears in specified coral zones

This alternative would restrict and/or prohibit commercial fishing gear operations in deep-sea coral zones.

2.2.1.3.4 Restrict and/or prohibit all fishing gears in specified coral zones

This alternative would restrict and/or prohibit commercial and recreational fishing gear operations in deep-sea coral zones.

2.2.1.4 Allow restrictions and/or prohibitions to be implemented via framework action in coral zones

At their 1/6/11 meeting, the habitat committee added this alternative, which would make restrictions on fishing in coral zones frameworkable. Specifically, in areas where deep-sea corals have not been documented, gear restrictions or prohibitions would not be put

[2] Such an access program could be developed following the South Atlantic Fishery Management Council (SAFMC) example. The SAFMC finalized 'Comprehensive Ecosystem-Based Amendment 1 for the South Atlantic Region (CE-BA 1)' in October 2009, which was implemented by NMFS effective July 22, 2010 (see SAFMC 2009 and Federal Register Vol. 75 No. 119, pp 35330-35335). This action designated Deepwater Coral Habitat Areas of Particular Concern (CHAPCs) and created Shrimp Fishery Access Areas (SFAA) and Allowable Golden Crab Fishing Areas within the CHAPCs.

in place until research documents presence/absence, and if possible relative densities, of deep-sea corals. Following completion of this research, implementation of gear restrictions or prohibitions could be implemented via framework action.

2.3 Deep-sea coral research recommendations

2.3.1 Fully document all coral catch in NEFSC survey data

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

2.3.2 Fully document all coral bycatch during observed fishing trips

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

2.3.3 Additional focused coral surveys

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

2.3.4 Create coral guide to support collection of data during research trips and fishing trips

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