New England Fishery Management Council
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DRAFT MEMORANDUM

DATE: April 9, 2015

TO: Tom Nies, Executive Director

FROM: Scallop PDT

SUBJECT: **Input for responses to public comments received on Habitat Omnibus Amendment 2 related to potential impacts on scallop resource and fishery**

In February 2014, the Council selected some preferred alternatives for Omnibus Habitat Amendment 2. The Draft Environmental Impact Statement and amendment document was out for public comment from October 10, 2014 through January 8, 2015. In total, 195 individual, group, or organizational comments were submitted. In addition, five different petitions and form letters were circulated by various groups and submitted directly by individuals, or by the organizer on their behalf.

Several issues were raised during the public comment period related to potential impacts on the scallop resource and fishery. The Scallop PDT was asked to review eight specific issues raised in the public comments to assist with potential responses and additional analyses for the final EIS. Other comments related to the scallop fishery and resource were received that are better addressed by the Habitat Plan Development Team, so the Scallop PDT did not address them. For example, the potential impacts of scallop dredges on the lobster resource and fishery and potential effects of scallop dredging on the benthic environment and species abundance and diversity compared to natural disturbances.

This memo summarizes the discussion and additional analyses prepared by the Scallop PDT for the Council to consider when it prepares responses and takes final action. The eight specific issues are highlighted individually below with responses from the Scallop PDT.

This memo was presented to the Habitat Committee on March 23, 2015 in Portland, ME. Since that meeting several additions have been made based on questions and input at the meeting.

1. **Commenters suggested that DEIS analysis does not adequately assess the potentially negative impacts of habitat closures under consideration throughout the Gulf of Maine on federal NGOM scallop vessels. Majority of the economic analyses are through calendar year 2012, and some scallop fishing areas have increased activity in 2013 and 2014, so the potential impacts are underestimated.**

Scallop PDT Response:
The overall economic analysis in the DEIS is comprised of four main parts: 1) VTR reports to identify the magnitude and composition of fishing revenues in areas currently open to fishing but being considered for area management in this action; 2) spatial data from VMS to refine estimates; 3) revenue being generated from areas under consideration by recreational fleets; and 4) observer data adjacent to closed areas to assess potential effort shifts. There is some discussion in the DEIS that several EFH closed areas are expected to have distributional effects, especially for vessels that are home ported near inshore closed areas, and the DEIS includes information by vessel size. However, the Scallop PDT discussed that the analyses of impacts on the scallop fishery could be improved if fishing effort location was further divided by permit category (LA, LAGC IFQ and NGOM), updated with more recent years to address comments about the GOM specifically, and mapped at a finer scale to identify if there are areas fished within a habitat management area.

The Scallop PDT has updated some of the fishing effort maps to include FY2013 and 2014. Three maps have been generated using VTR data since VMS data have not been processed after 2012; one with FY2010-2012, one with FY2013, and one with FY2014. The reported locations from all VTR trips on LAGC NGOM vessels have been summarized by ten minute squares. Darker squares indicate more trips, and all areas not highlighted represent fishing locations with fewer than three unique vessels (Figure 1 -
Figure 3). Overall, effort has increased on Platt's Bank in recent years. While effort seems to have decreased in other habitat management area alternatives in the GOM (Machias and Eastern Maine areas) some of these areas are fished by a small number of vessels so data are confidential and are not shown. In general, as stated in the DEIS, the potential impacts of the areas under consideration in the GOM are not substantial when considering the scallop fishery overall, but for a small number of vessels homeported in discrete areas, particularly in Maine, some of the options could have more negative impacts on current and future fishing opportunities, particularly if scallop stocks continue to recover in the GOM.

Although the proposed habitat management areas are all in Federal waters, there are important scallop fishing grounds within adjacent Maine state waters. The primary fishing area within state waters is adjacent to Washington County, Maine (downeast region near Canadian border) (Figure 4). About 75% of total state water landings have been coming from that area (Figure 5). Cobscook Bay is within Washington County and that is where the majority of state water scallop fishing occurs. State water landings are beginning to increase in recent years in Hancock County as well, one county to the west of Washington County, which represents 12.4% of the total state landings in 2014. The Machias HMA is adjacent to coastal waters off Washington County and both the small and large Eastern Maine HMAs are adjacent to Hancock county. As scallop stocks hopefully continue to recover in the GOM it is possible that more fishing effort will spill over into federal waters. Therefore, options that close these areas to scallop dredge gear could have potential effects on future fishing opportunities for NGOM vessels if stocks recover within some habitat management areas in the region.

Finally, there is an area near the EEZ off the coast of Maine that is fished by both US and Canadian fishermen, otherwise known as the grey zone (Figure 6). The level of fishing activity by Canadian scallop vessels in that area is uncertain. There is no quota management in that area because it is a disputed territory; therefore it is fished on and off during the year by Canadian scallop fleets (full and mid bay vessels from both Nova Scotia and New Brunswick) when other areas run out of quota (Trisha Cheney, ME DMR, *personal communication*). Since some of the areas in the GOM are fished more sporadically and by a relatively small number of vessels the Scallop PDT has plotted all available survey data to identify potential areas that may have been, or may become areas with more scallop fishing effort in the future to better assess potential impacts of EFH closures. All survey data from both federal and state surveys have been combined between 1963 and 2014 (Figure 6 and Figure 7). All station locations with more than one scallop have been plotted, as well as station locations with no scallops (x). Some of the larger scallop tows in the Eastern Maine habitat area for example were from NMFS trawl surveys in the 1990s, and the very large tows on Fippennies Ledge within Cashes Ledge closed area were on the NMFS dredge survey in the 1980s.

Figure 1 – Binned VTR fishing location (ten minute squares) for all NGOM trips in FY2010-2012. Note: Ten minute squares are colored only when three or more vessels fished during this time period. Areas not colored represent 0-3 vessels. The colored areas, therefore, represent the most intensively utilized areas in the NGOM management zone.

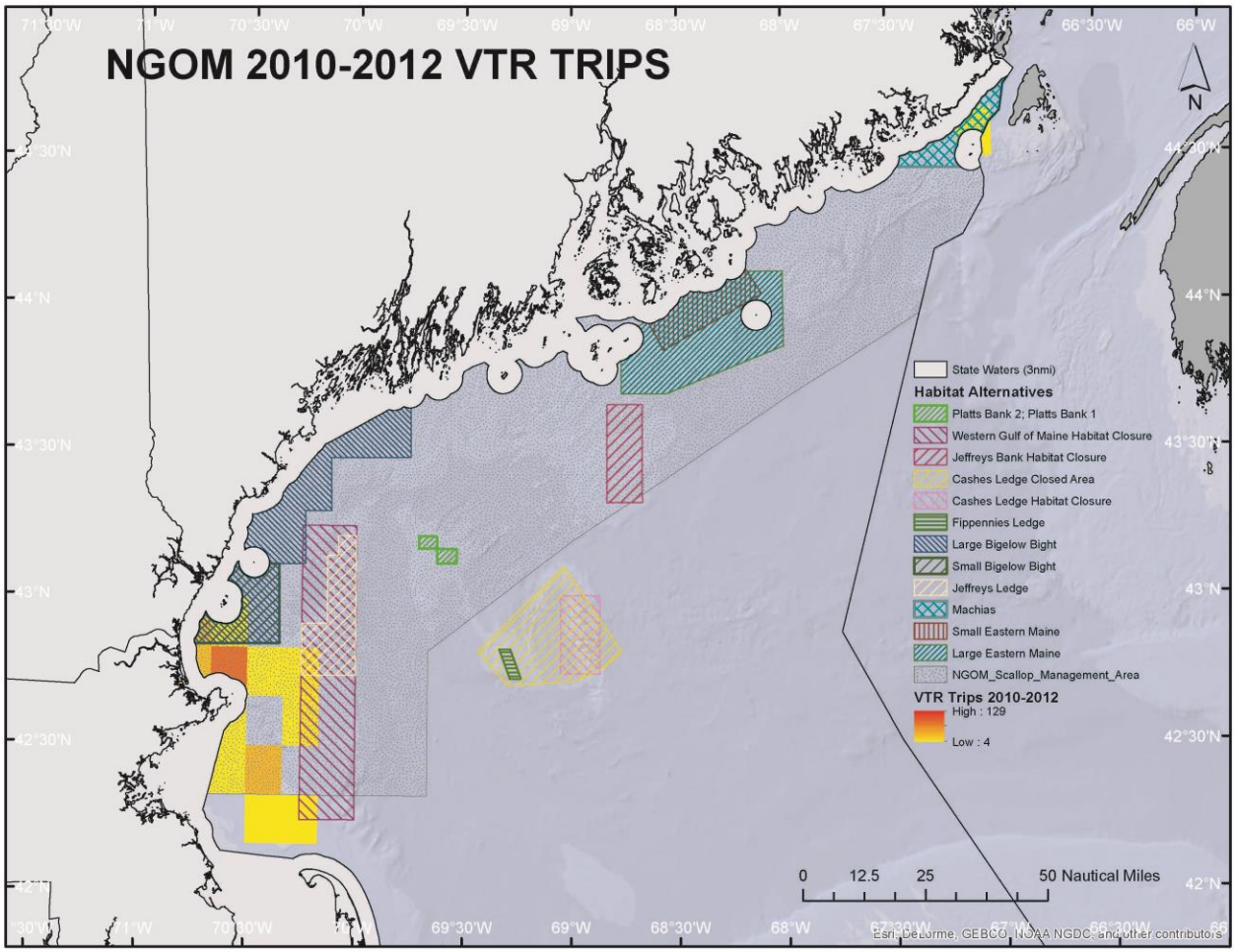


Figure 2 – Binned VTR fishing location (ten minute squares) for all NGOM trips in FY2013. Note: Ten minute squares are colored only when three or more vessels fished during this time period. Areas not colored represent 0-3 vessels. The colored areas, therefore, represent the most intensively utilized areas in the NGOM management zone.

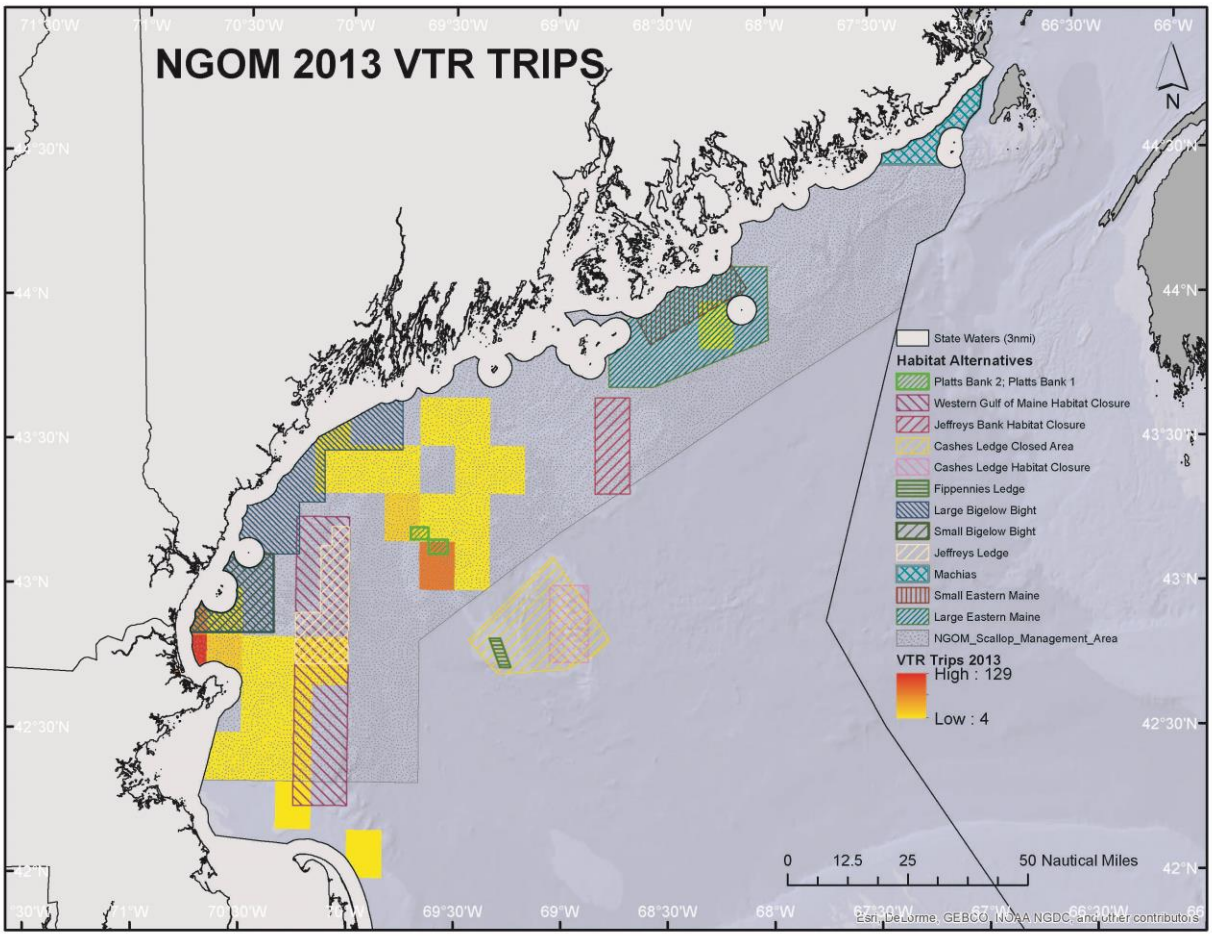


Figure 3 – Binned VTR fishing location (ten minute squares) for all NGOM trips in FY2014. Note: Ten minute squares are colored only when three or more vessels fished during this time period. Areas not colored represent 0-3 vessels. The colored areas, therefore, represent the most intensively utilized areas in the NGOM management zone.

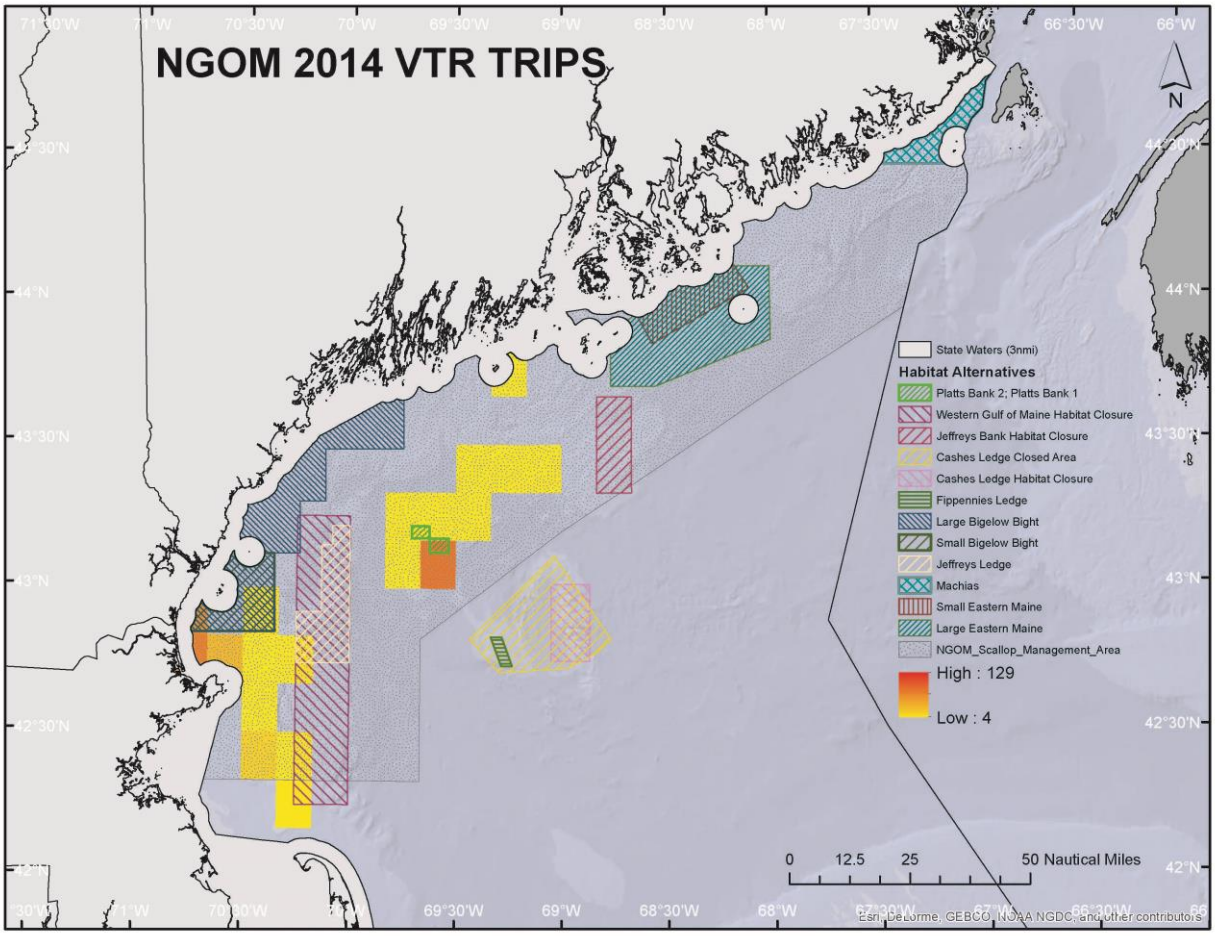


Figure 4 – Counties in the state of Maine

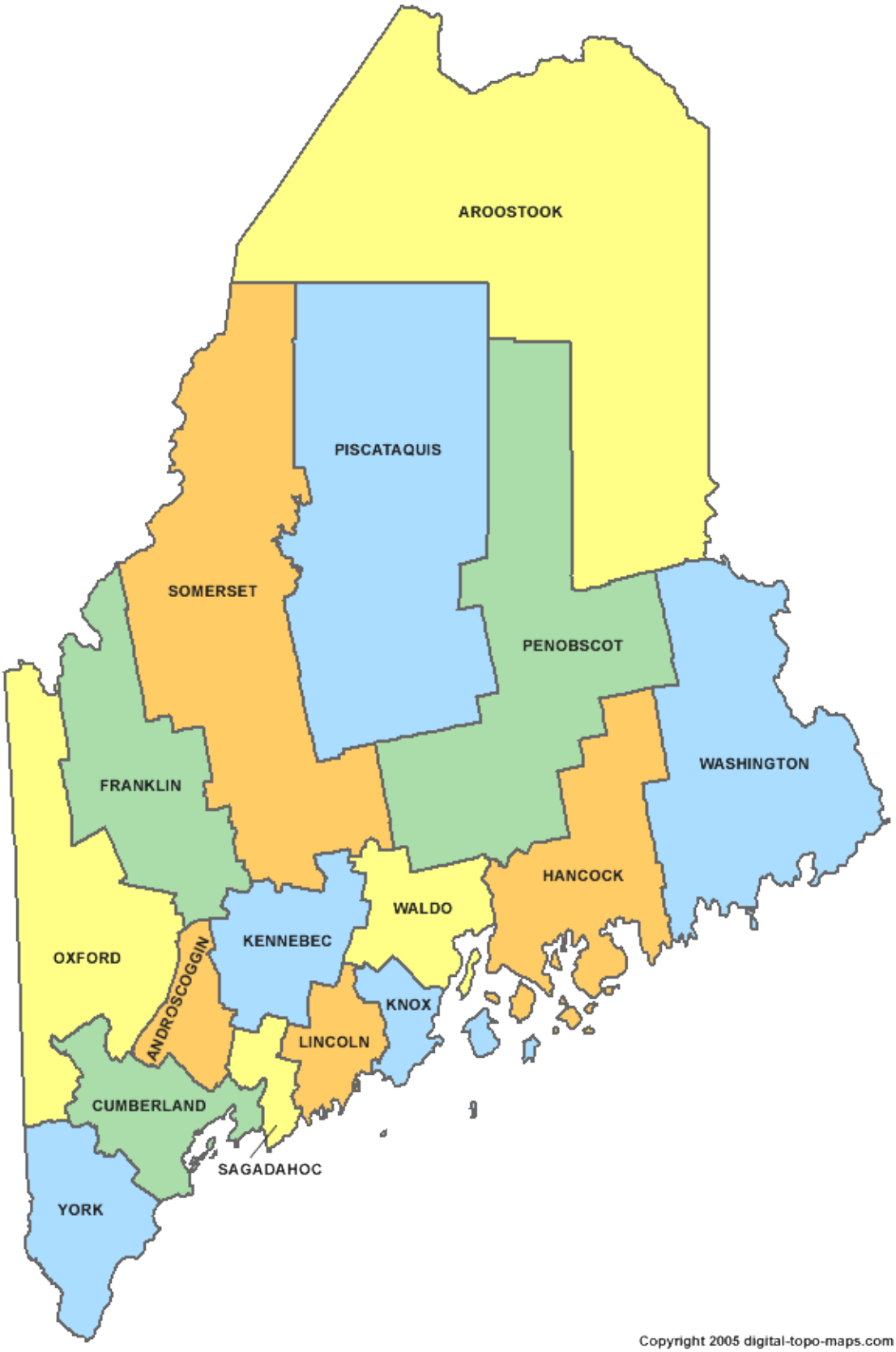


Figure 5 – Total landings from state waters in Maine by county

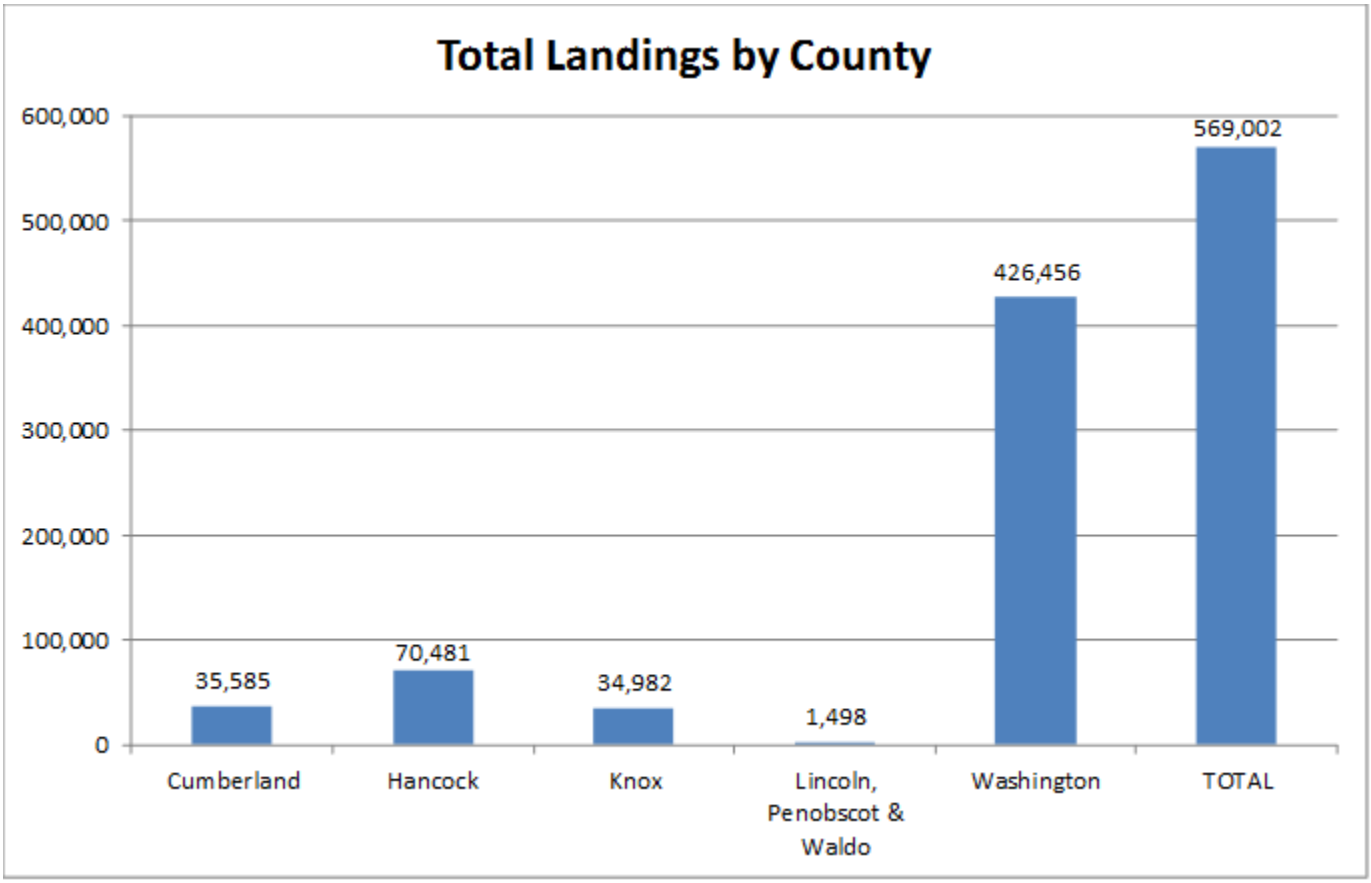


Figure 6 – Number of sea scallop catch from all available survey data (both federal and state)

Key: x = no scallop catch on survey tow

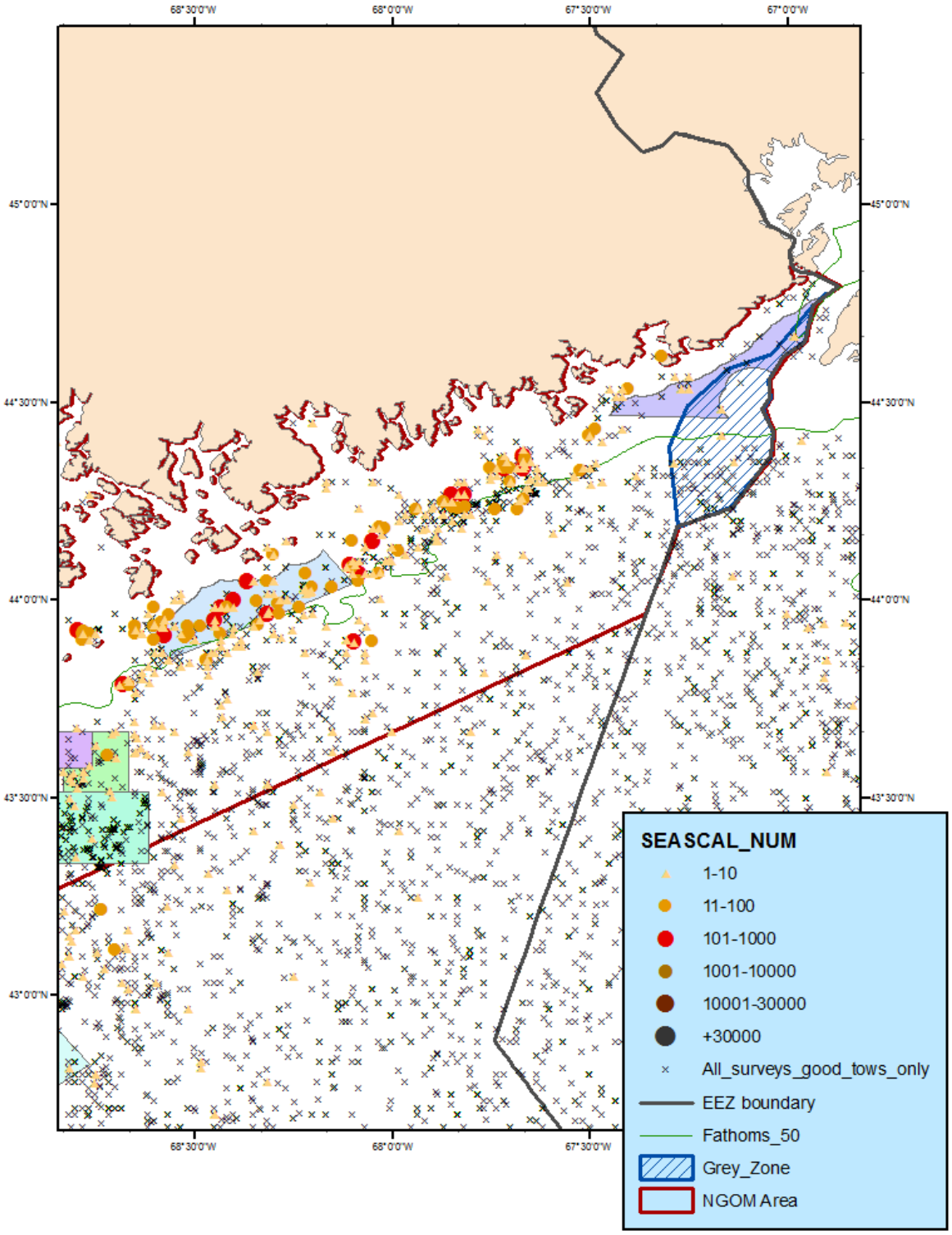
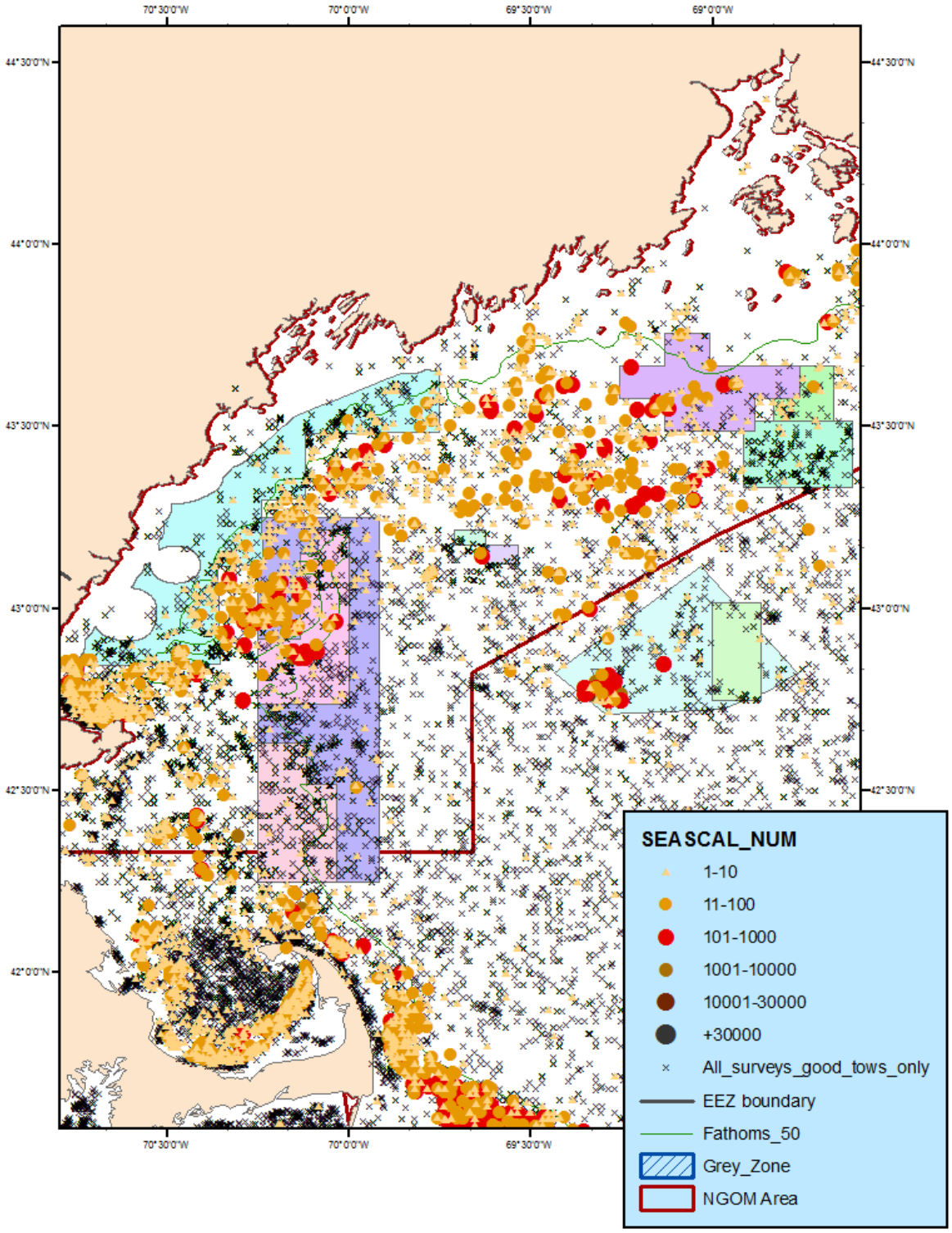


Figure 7 – Number of sea scallop catch from all available survey data (both federal and state)

Key: x = no scallop catch on survey tow



2. **NGOM scallop area boundary should be reconsidered, and Fippennies should be opened to scalloping. This could alleviate pressure on groundfish. Should consider a rotational management plan for Fippennies Ledge, Platts Bank, and Jeffreys Ledge.**

Scallop PDT Response:
The NGOM boundary was selected in Amendment 11 to the Scallop FMP based on the boundary of the scallop dredge exemption area, previously approved under the Groundfish FMP. To allow scallop dredging on a LAGC vessel in areas outside of a dredge exemption area would require a change under the Groundfish FMP. The Council could consider this as a future work priority, but it is currently not on the list of issues for 2015, and the boundary could not be modified in this action, OHA2. If a boundary change is considered in a future action, there are several surveys of portions of federal waters within the Gulf of Maine that could potentially be used to identify alternative boundaries (i.e. SMAST video survey and NEFSC trawl survey). The PDT noted that if an area rotation program is considered in the future it may not be to the same scale as the program on GB and the MA. There is a relatively high cost in terms of surveys, analyses, monitoring for the area rotation program on GB and the MA, but corresponding fishery yields are much higher. Therefore given the overall lower scallop yield of the GOM, a rotational program in federal waters of the GOM may be designed differently.

3. **Commenters expressed concerns that some of the inshore habitat closure alternatives could have distributional impacts on segments of the limited access general category fishery. Specifically, the northern portions of Alternative 3 in the Great South Channel and the Cox Area 1 (larger southern area). In addition, if EFH areas change and do not become scallop access areas, LAGC vessels are not able to fish outside of dredge exemption areas. The latter issue could apply if the existing Nantucket Lightship and Closed Area I habitat closures are modified or removed.**

Scallop PDT Response:
For the most part, the analysis of fishery impacts in the DEIS is on a fleetwide basis. The DEIS notes that some closure alternatives will impact vessels differently, and the economic analyses are broken down by vessel size, but the potential for distributional effects between the LAGC and LA fleets is not discussed in detail. The Scallop PDT has updated some analyses using fishing effort data to further evaluate the impacts of closed areas on the LA and LAGC fisheries separately. Specific attention was given to the areas of concern mentioned in public comments, Alternative 3 in the Channel (Great South Channel East HMA) and Cox Area 1. Trips were binned into ten minute squares, and areas with less than three unique vessels or less than ten trips per TMS are not shown for LA map (and less than 17 trips for LAGC map). It should be noted that using VTR data to represent fishing locations for longer trips is problematic, since the area fished is likely much larger than one ten minute square. However, VMS data are not available for FY2013 and 2014 at this time. Consistent with the analyses in the DEIS, these analyses show that some portions of habitat alternatives under consideration do overlap with areas fished. Note that not all of the habitat management alternatives are shown; only a subset so the maps are not too cluttered. These plots show that some portions of habitat closure alternatives overlap with LAGC scallop fishing effort, and some do not. LA effort is plotted as well for the same years.

Similar to the comment above, a LAGC vessel is not allowed to fish for scallops with a dredge in areas outside of a scallop dredge exemption area. Figure 9 below shows the current scallop

dredge exemption areas. If any areas that are currently closed as EFH closures open as a result of this action, LAGC dredge vessels would not be permitted to fish in those areas unless the area is modified to a scallop access area. LAGC dredge vessels can fish with a dredge within a scallop access area, even if it is outside of a dredge exemption area.

Figure 8 – FY2010-2014 scallop fishing locations from all LAGC IFQ trips (top) and LA trips (bottom), VTR location binned by ten minute square. Note: Ten minute squares are colored only when three or more vessels fished during this time period. Areas not colored represent 0-3 vessels. The colored areas, therefore, represent the most intensively utilized areas in the NGOM management zone. As there are no dredge exemption areas east of Closed Area I, trips mapped in that location are assumed to be reporting errors.

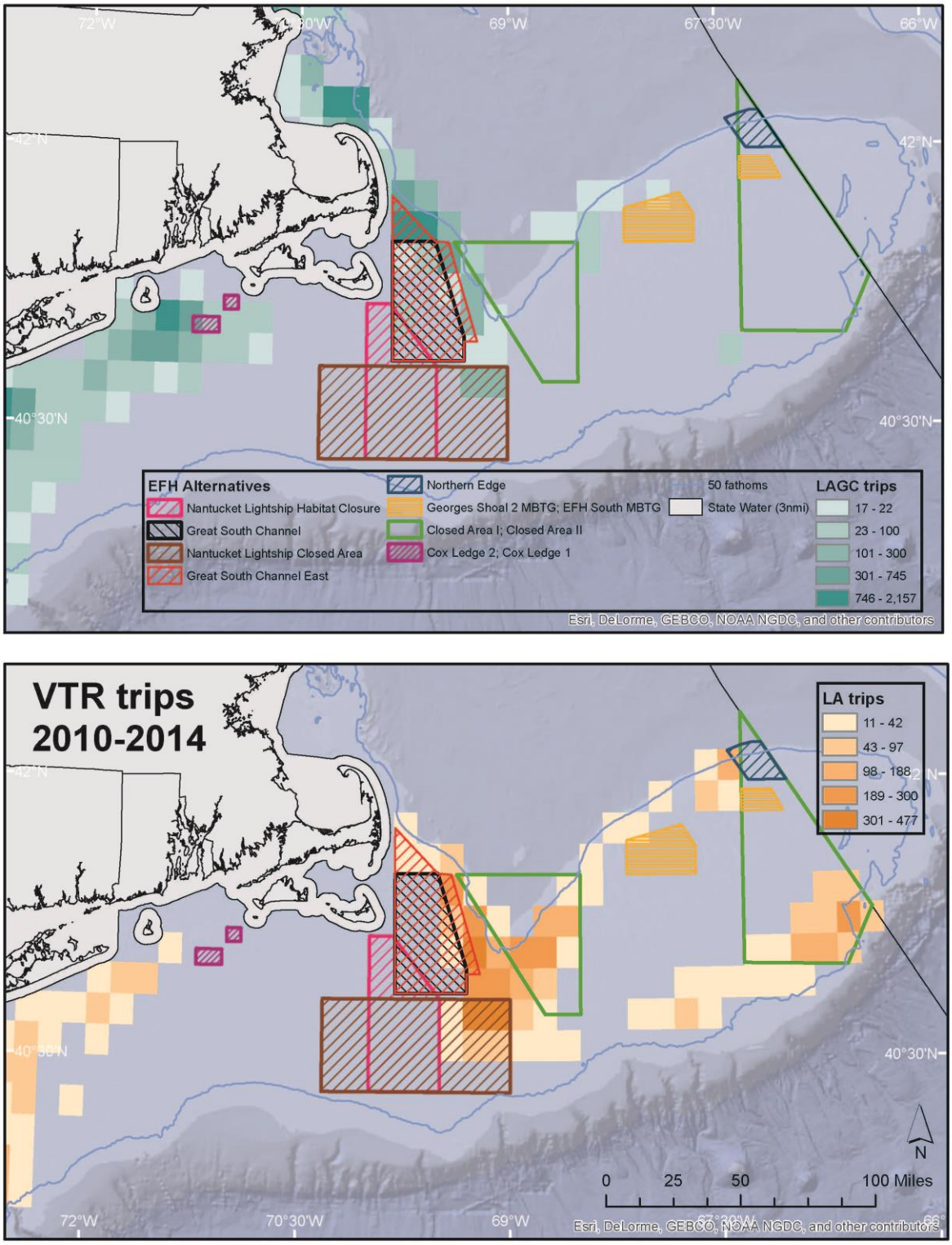
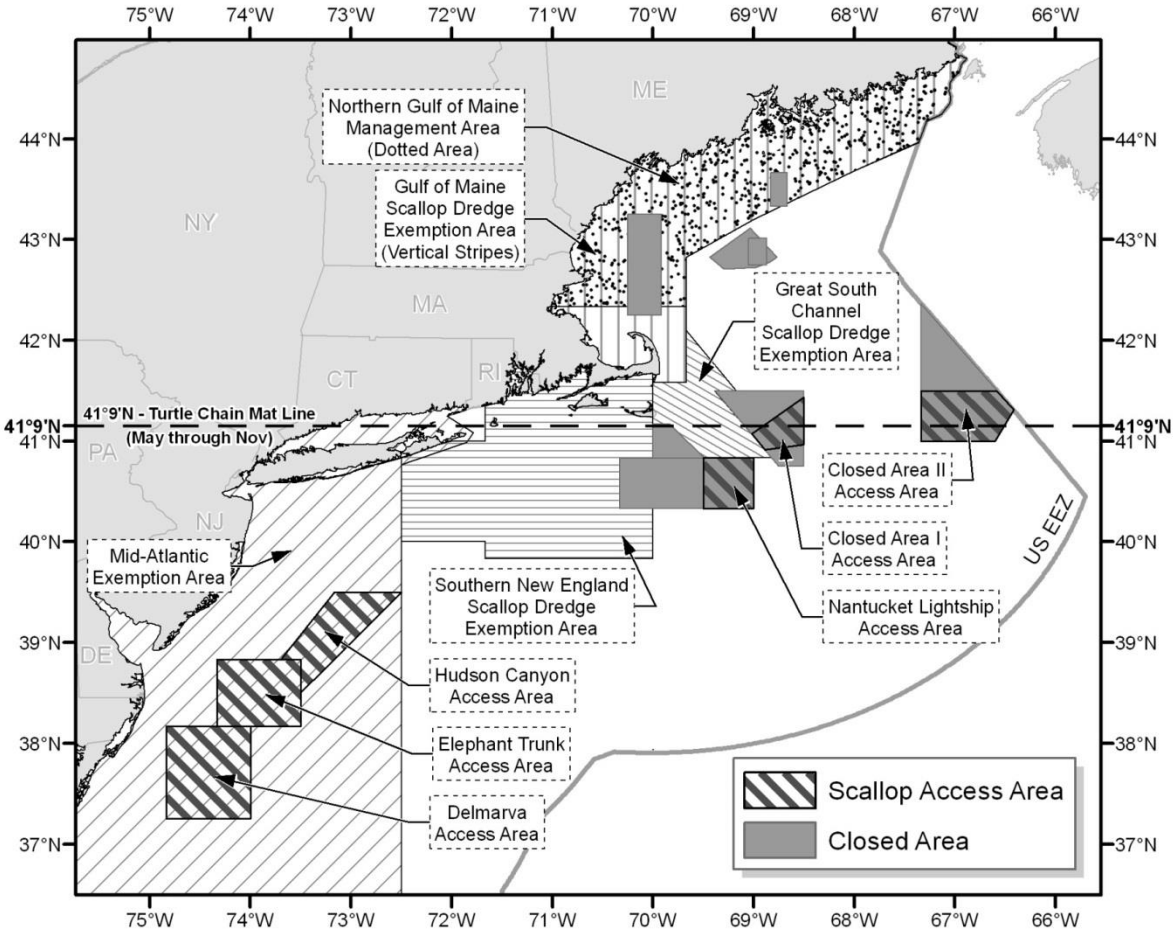


Figure 9 – Scallop dredge exemption areas implemented under the Groundfish FMP



Gulf of Maine Scallop Dredge Exemption Area (SDEA)–
Groundfish FW 21 (Feb 1997)
Rationale for only possessing scallops: Eliminates any incentive not to minimize the catch of regulated multispecies

Great South Channel Scallop Dredge Exemption Area –
RA Authority (August 2006), based on industry request (requested October 2005)
Same rationale as other SDEAs

Southern New England Scallop Dredge Exemption Area –
Groundfish Amendment 13 (April 2004)
Same rationale as other SDEAs

Mid-Atlantic Exemption Area –
Fisheries that occur in the Mid-Atlantic Regulated Mesh Area (West of 72°30') are exempted from needing to establish an exempted fishery (i.e., you can fish in this area with a trawl and not be on a multispecies trip or on a DAS, etc).

4. **GARFO commented that the Council has not yet weighed in on whether it supports the scallop EFH designation as updated in 2011 to include additional sources of survey data.**

Scallop PDT Response:
The PDT reviewed the No Action EFH Designation (Figure 10), as well as the proposed EFH designation (Figure 11). The proposed EFH map was updated by the Habitat PDT to include additional surveys, such as trawl surveys, while the No Action map includes the NMFS dredge survey only. While the Habitat Committee requested inclusion of these additional data sources, the updated map was never explicitly identified as the preferred alternative by the Committee or Council. Overall, the Scallop PDT agrees that using more data sources to produce an updated EFH designation map is preferable; specifically, the NMFS dredge survey does not capture the distribution of scallops in the Gulf of Maine, so the NMFS trawl survey data were included on the map. However, the updated EFH text definition is less specific than the No Action text EFH designation. For example, references to specific depth ranges, salinity preferences, and temperature range have been removed. The Scallop PDT discussed that the proposed map could be used to identify a larger extent of where scallops are found, but the updated EFH designation text could be made more specific to help identify the areas within the larger area that may be more "essential "to the species. (No Action text is below).

The PDT discussed that in the GOM for example, over 90% of all the scallops observed in the state scallop survey were found within the 6-45 meter depth range. And within federal waters in the GOM, a survey has been completed in discrete areas and 90% of the scallops observed from that survey were found within the 66-85 meter depth range.

The proposed map encompasses more area, which seems counter to identifying areas that are "essential". However, an EFH designation gives NMFS the authority to review and potentially make conservation recommendations for projects that could have negative impacts on the scallop resource and fishery if proposed in an area that is designated as EFH. Therefore, a larger EFH designation area could have indirect beneficial impacts to the fishery and resource, compared to the No Action EFH designation map that covers less area. The Scallop PDT discussed that the EFH text definition could be updated to include more specific information about ecosystem requirements, and the PDT recommends including the No Action language for detailed info about depth, temperature, and salinity, as well as additional information about depth preferences in the GOM as provided above. The Habitat PDT agreed with this when they discussed the issue at a recent meeting.

No Action EFH Definition: Atlantic sea scallop (*Placopecten magellanicus*)
No action essential fish habitat for Atlantic sea scallops is described as those areas of the coastal and offshore waters (out to the offshore U.S. boundary of the exclusive economic zone) that are designated on the map below in the accompanying table and meet the following conditions:

Eggs: Bottom habitats in the Gulf of Maine, Georges Bank, southern New England and the Mid-Atlantic south to the Virginia-North Carolina border as depicted on the map below. Eggs are heavier than seawater and remain on the seafloor until they develop into the first free-swimming larval stage. Generally, sea scallop eggs are thought to occur where water temperatures are below 17° C. Spawning occurs from May through October, with peaks in May and June in the Mid-Atlantic area and in September and October on Georges Bank and in the Gulf of Maine.

Larvae: Pelagic waters and bottom habitats with a substrate of gravelly sand, shell fragments, and pebbles, or on various red algae, hydroids, amphipod tubes and bryozoans in the Gulf of Maine, Georges Bank, southern New England and the Mid-Atlantic south to the Virginia-North Carolina border as depicted on the map below. Generally, the following conditions exist where sea scallop larvae are found: sea surface temperatures below 18° C and salinities between 16.9‰ and 30‰.

Juveniles: Bottom habitats with a substrate of cobble, shells, and silt in the Gulf of Maine, Georges Bank, southern New England and the Mid-Atlantic south to the Virginia-North Carolina border that support the highest densities of sea scallops as depicted on the map below. Generally, the following conditions exist where most sea scallop juveniles are found: water temperatures below 15° C, and water depths from 18 - 110 meters.

Adults: Bottom habitats with a substrate of cobble, shells, coarse/gravelly sand, and sand in the Gulf of Maine, Georges Bank, southern New England and the middle Atlantic south to the Virginia-North Carolina border that support the highest densities of sea scallops as depicted on the map below. Generally, the following conditions exist where most sea scallop adults are found: water temperatures below 21° C, water depths from 18 - 110 meters, and salinities above 16.5‰.

Spawning Adults: Bottom habitats with a substrate of cobble, shells, coarse/gravelly sand, and sand in the Gulf of Maine, Georges Bank, southern New England and the Mid-Atlantic south to the Virginia-North Carolina border that support the highest densities of sea scallops as depicted on the map below. Generally, the following conditions exist where spawning sea scallop adults are found: water temperatures below 16° C, depths from 18 - 110 meters, and salinities above 16.5‰. Spawning occurs from May through October, with peaks in May and June in the Mid-Atlantic area and in September and October on Georges Bank and in the Gulf of Maine.

Figure 10 – Current EFH designation for sea scallops (No Action)

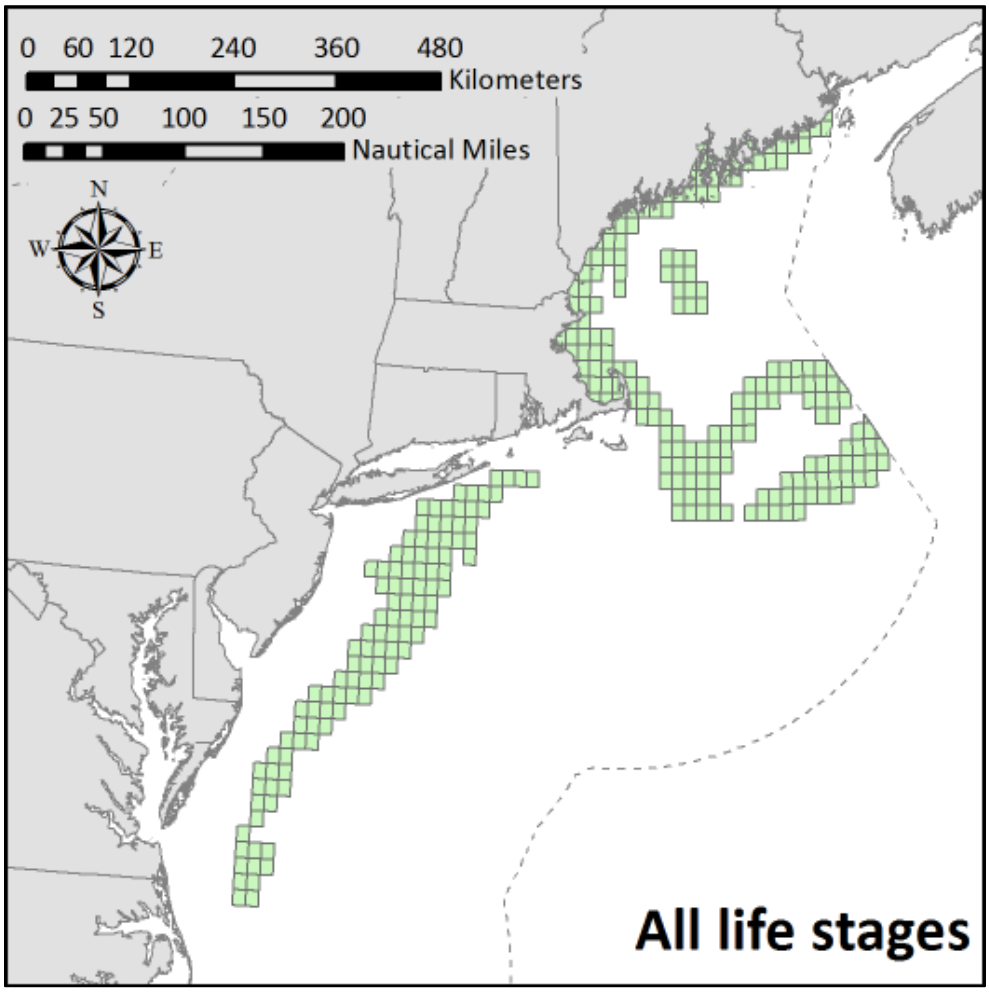
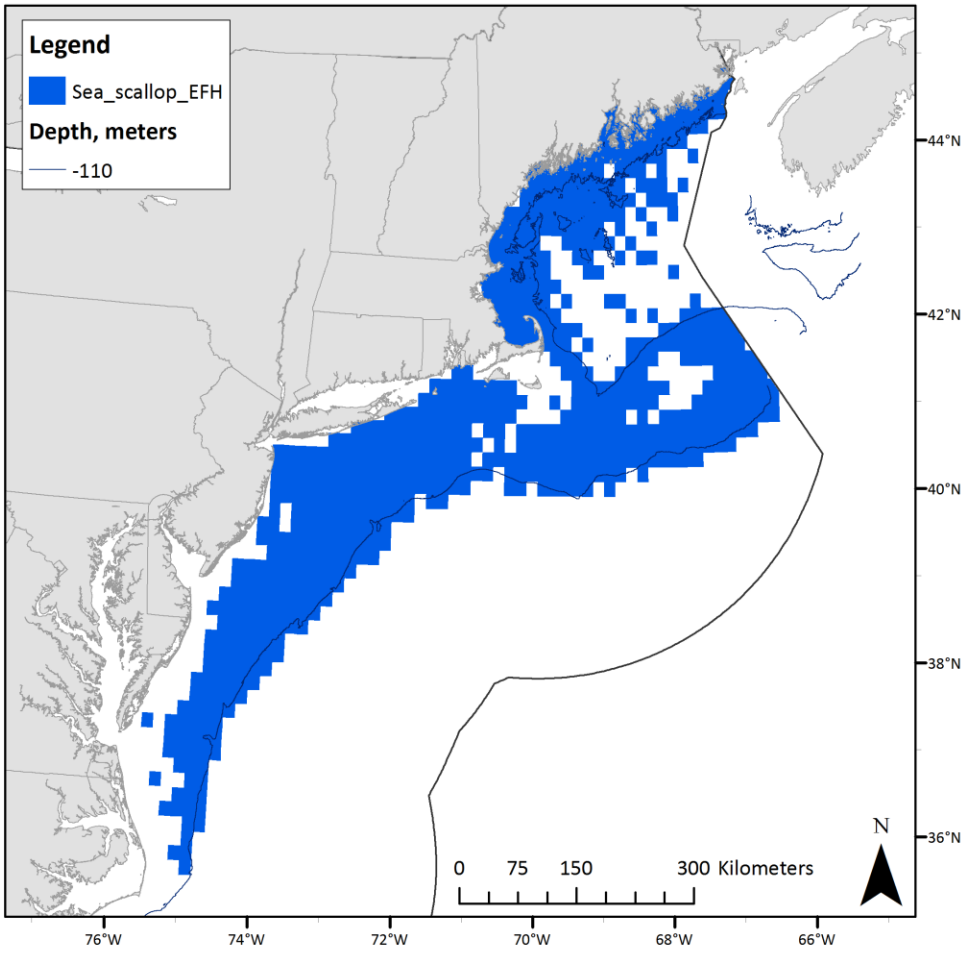


Figure 11 – Proposed EFH designation for sea scallops (preferred)



5. **GARFO commented that the DEIS analysis of benefits associated with reopening areas currently closed to the scallop fishery is inadequate.**

Scallop PDT Response:

Section 4.6.4.2 evaluates the potential impacts of the habitat management alternatives on the scallop fishery by region. There is reference to potentially low positive to positive impacts on the scallop fishery for some of the alternatives that open areas that have been closed to the scallop fishery. Table 140 includes an estimate of long and short term yields for habitat alternatives, including estimates for some areas that could reopen to the scallop fishery. These analyses provide a direct way to evaluate scallop yield estimates per area. The short term impacts of these alternatives are evaluated by taking an estimate of 2013 biomass from the NEFSC dredge survey only. Note that the PDT generally uses a combined estimate from all available surveys (NEFSC, VIMS, SMAST, Arnie's Fishery), but in this case it was only feasible to use the NEFSC dredge survey because individual estimates needed to be done on a finer scale for each of the individual habitat management area alternatives. In some cases there were not sufficient survey dredge tows in a certain area in 2013 to produce a reliable biomass estimate;

therefore, tows from previous years were combined (2008-2013) and an average biomass was used for the 2013 estimate. This produced a more reliable and stable estimate of biomass compared to a single year with limited dredge tows. For the northern edge (CA2 NA) two dedicated dredge surveys were conducted in that area in 2012 and 2013 by VIMS with RSA funding; therefore, for that area only those years were combined, but for the rest of the areas an average of the last six years was used for the 2013 biomass estimate. The short-term yield is calculated by applying Fmsy to the exploitable portion of the biomass per area, not total biomass. The long-term yield is calculated by applying Fmsy to the long term biomass estimate per area.

For example, CA1NA has an estimate of 1,452 mt in short term yield and 42 mt (median) to 601 mt (mean) annual yield in the long term. Therefore, there will be positive impacts to the fishery if this area is reopened, especially in the first year based on estimates of current biomass. After larger scallops have been harvested from the area, the long term benefits of that area are estimated to be lower (42-601 mt annual catch in the long term versus almost 1,500 mt in the short term). The habitat closure in NL is not a major scallop area, so both the short and long term benefits of that area are small (28 mt in the short term and 3-552 mt in the long term). The mean estimate is much higher than the median because it is driven by several large tows that have occurred in that area but are not persistent over time. In general the center of NL has not been a very productive area for scallops; however, recent recruitment on GB has been higher than average and large sets of small scallops have been present in this area as well as most of the southern flank of GB.

When the values in Table 140 were carefully considered in the review of the DEIS it was noted that the 2013 estimate of biomass for habitat alternative 8 on GB was very high. This alternative was developed later in the process at the Council meeting when the final range of alternatives was approved for public hearings, after Table 140 was first developed. When the table was updated to include Alternative 8 the original biomass estimate only used 2013 survey tows, instead of the method used for calculating 2013 biomass for the other areas (average of 2008-2013). That has now been corrected so the method used for estimating current biomass in the areas is consistent, and that estimate went from 16,448 mt to about 13,000 mt. Therefore, the short-term yield estimate from the area also declines since the total biomass and total exploitable biomass is lower. The 2013 biomass value based on the last six years instead of just one single year is more stable and likely more reliable. No other values in Table 140 need to be corrected, just the 2013 biomass estimate and associated short-term yield. These analyses will be corrected in the FEIS.

When considering the potential benefits of opening areas that have been closed to the scallop fishery it is important to keep in mind that allocations in the scallop fishery are complex. There is an overall catch limit or ACL, but there is no overall TAC and fishery allocations are set well below the ACL to take into account uncertainty and fishing target principles of area rotation. Therefore, if areas convert from closed to open as a result of this action, the potential yield in those areas will not automatically convert to available catch. Under area rotation there are both spatial limits on fishing mortality as well as overall fishing mortality limits that are much lower.

To express how these closures impact fishery allocations under area rotation, the DEIS also includes an analysis of both the short and long term impacts of how these various habitat closed areas would be integrated into the overall scallop area rotation program, and not just one area at a time (Section 4.6.4.2.1.2.2). For example, several runs were completed that assess how modifications to closed areas would affect fishing mortality and landings overall. Run 2, for

example, includes no habitat management areas, while Run 1 is No Action (current habitat management areas) and Run 3 includes several new habitat management areas under consideration. In summary, in terms of short term benefits, Run 3 has the highest projected landings for FY2015 (about 23,000 mt), followed by Run 2, no habitat management closures (about 22,000mt), compared to Run 1 at about 19,000 mt (No Action habitat management alternatives) (Table 141, Table 142, Table 143). The increase in landings in Run 3 is a result of some closed areas opening to the scallop fishery; about 4,000 mt higher than No Action but only 1,000 mt higher than Run 2 with no habitat closures. Run 2 does not have higher landings than Run 3 (with closures) because of constraints built into the fishing target principles under area rotation, further explained on page 652 and 653 of Volume III of the DEIS. Therefore, in terms of short term economic impacts, the No Action (Run1) has the lowest revenues and economic benefits, Run 3 (modified EFH closed areas) has the highest, followed by Run 2 (no habitat closed areas).

In the long term, No Action (Run 1) provides the highest long-term biomass (Figure 59), but Run 2 (no habitat closures) provides the highest long-term landings and associated economic benefits (Figure 58, Table 146, Tables 157-160). This is because lower landings under Run 2 in the short and medium term (especially in years 2015-2017) generate higher yield over the long-term. Estimated landings and total economic benefits net of No Action (current EFH closed areas) are higher in both 2015 and the long term (2015-2037) for both No Action (Run 2: no EFH closures) and Run 3 (modified EFH closures) (Table 143, and Tables 157-160). About 107 million pounds higher for Run 2 (2015-2037) and about 65 million pounds higher for Run 3 compared to No Action (Table 143) and $722 million dollars for Run 2 and $458 million dollars for Run 3 compared to No Action (using 3% discount rate). These potential benefits are high of course, but it does need to be taken into consideration that even though a $56-$67 million dollar difference in short term total economic benefits is a lot of money (Table 157 and 158, 2015 fishing year), amounting to over 10% of the total economic benefits from the fishery that was estimated to range from about $450 to $500 million in the short-term. More detail of these positive economic impacts can be repeated in the overall practicability analyses, but the DEIS does include a relatively detailed summary of the potential benefits to the scallop fishery of reopening areas, especially in the short term.

6. **Commenter suggested that DEIS analysis does not adequately consider how scallop stocks and scallop management will be adversely affected if major scallop beds are left out of the rotational management scheme. Analysis should consider impacts to economics, management, yield per recruit, and recruitment. Another commenter suggested that the Northern Edge in particular contains a large proportion of total scallop larvae for Georges Bank and that needs to be taken into consideration before opening the area to fishing.**

Scallop PDT Response:
The PDT discussed that the analysis in the DEIS does evaluate how long term closed areas can have **negative** impacts on area rotation program. The DEIS includes two separate analyses prepared by the Scallop PDT to illustrate the potential impacts of long term closures. First an estimate of yield per area was calculated by multiplying the mean and median recruitment in each area by the maximum yield per recruit. Second, separate projection runs were completed with various areas closed and open to simulate how modifications to closures would affect the overall area rotation program, not just one area at a time. The FEIS could arguably summarize

these analyses more clearly, but the PDT disagrees that the DEIS does not adequately consider impacts of closures on scallop stocks and scallop management.

Table 140 provides an estimate of long-term and short-term yield estimates for various habitat management alternatives. For example, the annual yield that could be produced from the northern part of Closed Area II that is currently not accessible to the scallop fishery ranges between 536 mt (median) and 1,254 mt (mean). If that area was open to the scallop fishery it could provide about 500-1,300 mt annually, or 1.1- 2.9 million pounds, if fished at optimal fishing mortality for that specific area. However, total catch for the scallop fishery is controlled by an overall catch limit from all areas; therefore, the second analysis completed evaluates how closures could affect the total catch for the fishery, not just one area at a time.

Section 4.6.2.1.2.2 summarizes the model based analysis, which simulates changes in fishing activity as a result of closures, making assumptions about displaced effort and incorporating overall constraints on the fishery based on fishing targets used in the FMP. In the short term, the model results suggest that some modification of closures (Run 3) and no closures (Run 2) have higher economic benefits than status quo closures (Run 1). However, the run with the lowest estimate of area swept, a proxy for potential impacts on the seabed, is the run with no closures (Run 2). In the long run, landings are higher for the run with no closures and total area swept is lower.

Another comment was made that the DEIS does not adequately address that long-term closures may have potentially **positive** impacts on the resource and fishery because they contain large proportions of total scallop larvae. The PDT agrees that the status quo habitat closures, especially "Closed Area II NA", which includes the northern edge or No Action EFH closed area within CAII contains a relatively large proportion of total scallop spawning stock biomass, as does the other No Action EFH closed areas ("CAI NA" and "NL NA"), which are highlighted in green in Table 1. For example, using 2014 biomass estimates, total biomass for the Georges Bank and Mid-Atlantic Bight combined is estimated to be about 143,000 mt and 67,000 mt exploitable biomass (red area in Table 1). "Closed Area II No Access" has a total biomass estimate of about 7,000 mt and 5,600 mt of exploitable biomass, note that the majority of biomass in that area is exploitable. That area has approximately 8% of total exploitable biomass and 5% of total biomass.

In addition "Closed Area I No Access" also has a relatively high estimate of exploitable biomass that would be available to the fishery if that area reopened under this action. However, the biomass estimate for that area is more uncertain because the biomass estimates vary quite a bit from each survey (i.e. 2,163 mt from NEFSC dredge survey, 5,115 mt from SMAST survey, and 21,378 mt from Habcam survey). When these results were reviewed by the Scallop PDT earlier this year concerns were expressed about these estimates and the biomass estimate for this area is probably overestimated. Finally, Nantucket Lightship No Access may also open to the scallop fishery, but the majority of those scallops are small and their survival is uncertain, note only about 600 mt of exploitable biomass in that area. Overall, these potentially positive economic impacts on the scallop fishery from areas reopening are described in Section 4.6.4.2.1.2.2, as part of Run 2. Therefore, the current EFH closed areas do contain a relatively large proportion of total scallop larvae, and that may be having positive impacts on the resource overall if recruitment has increased as a result of the closures, but the impacts of long-term closed areas on increased recruitment overall are still uncertain.

There has been research on transport of scallop larvae on GB and the potential benefit of closed areas as population replenishment sources[1]; however, the survival after settlement in open areas is still uncertain and variable. For sessile species like scallops, permanently closed areas can enhance fishery yields only if recruitment outside the closures increases sufficiently to a level that more than compensates for the loss of yields from the closures (Hilborn et al., 2004). Some work has been done in this region on the subject of evaluating whether closed areas have contributed to increased biomass and recruitment success, but the results are not black and white.

Hart and Rago 2006 evaluated whether the closures on GB impacted recruitment on GB overall. They found that mean recruitment on GB did increase after the closures, but it was not significant. However, strong recruitment was observed downstream of the Hudson Canyon rotational access area. Their analysis used all federal scallop survey data from 1979 through 2005. During the years after the GB closures (1994), mean recruitment did not significantly increase; and mean recruitment was similar inside and outside of closed areas suggesting that dredging did not have a significant effect on settlement success; i.e., the area effect was not significant. However, in more recent years (after 2005) there have been very high recruitment levels on GB. It is possible that with more data points the increase in mean recruitment on GB may now be significant, but the analyses done for the 2006 paper have not been updated.

Hart 2006 focused on whether marine reserves increase fishery yields, specifically highly productive and fecund sea scallops on GB versus canary rockfish, a long-lived, low productivity species prone to recruitment overfishing. Models were developed to identify yield as a function of fishing mortality and closure fraction for the two species. The results suggest that closed areas can increase overall yield, but only when spawning stock biomass is low, fishing mortalities are greater than Fmsy, and with low closure fractions. Currently on GB the spawning stock biomass of scallops is relatively high and fishing mortality is below Fmsy; therefore, the potential benefits of area closures to increase total scallop yield may be limited. Furthermore, the PDT discussed that above a certain point, additional biomass may not contribute additional recruitment success. Georges Bank in particular is a mixed larval pool increasing movement of larvae around the Bank, which could lead to saturation at lower biomass levels.

Another issue that comes into play when evaluating the potential benefits of closed areas and recruitment success is density dependence. It is possible that biomass in open areas may contribute less in terms of fertilization success because animals are more spread out. Scallops are typically more concentrated in closed areas; therefore, if recruitment success is density dependent for sea scallops, closed areas could increase overall yield by improving recruitment success (Smith and Rago, 2004).

Smith and Rago 2004 considered spatial aspects of growth and reproduction for development of reference points for sea scallops. The paper explains that the renewal process, or relationship between stock size and recruitment, involves poorly understood aspects of reproductive biology and difficult to quantify processes governing successful fertilization and survival. There

[1] The PDT reviewed several papers on scallop larval transport (Davies et al 2014, Gilbert et al 2010, Tian et al 2009). There are three main scallop aggregations on GB: northeast peak (NEP), southern flank (SF), and great south channel (GSC). The NEP contains the highest abundance of adult scallops and acts as a significant larval source for other aggregations. The GSC is the most retentive, and the NEP and SF are not retentive and rely on larvae from other aggregations. Dispersal and connectivity are driven by physical processes such as tidal mixing, along shelf currents, and wind; as well as biological processes such as growth, mortality and behavior (Tremblay et al 1994, Tian et al 2009, and Gilbert 2010). There can be great variation in all of these parameters.

probably is some linkage, but it was not certain in 2004, and it is still not certain today. In addition, there are numerous environmental effects as well, and large year classes may be driven more by favorable environmental effects than population size. The paper also points out that closures cannot increase yield from increased egg production from closures if the magnitude of fishing effort in the remaining open areas increases. If closures cause effort to displace and increase in open areas, gains in yield can be compromised. Overall, the research suggests that concentrating effort in lower productivity areas may be an effective way to reduce recruitment variability, improve yield, and ensure that the reproductive capacity of the resource remains high.

In conclusion, the impacts of closed areas on increased spawning success and scallop yield are currently uncertain. If there is no spawning advantage from scallops in high density closed areas, then there is a net loss in yield from long term closures. But if there are areas that increase fertilization success and contribute to increased recruitment overall in open areas, then closures of these areas may be beneficial and increase overall scallop yield. With a greater understanding of these important linkages it is possible, and potentially a very good idea, for the Council to consider specific closures to increase scallop recruitment in a future scallop action. While some of the current and/or proposed habitat closures may have beneficial impacts on scallop biomass and recruitment, it should be noted that increased scallop yield is not the primary goal of the Omnibus Habitat Amendment.

Table 1 – 2014 biomass estimates with standard errors (total and exploitable biomass from each survey method and combined)

		DREDGE			SMAST			HABCAM			TOTALS	
Area	Bms	SE	Ebms	Bms	SE	Ebms	Bms	SE	Bms	SE	Ebms
Delmarva	4707	778	2080	9626	1093	3935	10598	3665	8310	2253	3488
Elephant Trunk	16392	3426	8067	24799	2909	12938	36154	3469	25782	3278	13147
HCS	5805	1206	3044	7381	1021	3143	18041	5050	10409	3055	4884
Virginia	279	79	3	NS	NS	NS			279	79	3
NYB	6822	1656	4140	3609	495	2119	12756	613	10618	1059	6371
Long Island	11966	816	8438	10269	950	6402	14305	508	12950	780	8643
NYB Ext	1766	332	757	6900	867	4013	*		*		*
Block Island	939	206	535	1372	671	521	*		*		*
Mid-Atlantic Total	**48676**	**4167**	**27064**	**63956**	**3612**	**33071**	**91854**	**20577**	**68348**	**5186**	**36536**
CL-I NA	2163	649	1854	5115	3004	3091	21378	5917	9984	3850	6783
CL-1 Acc	333	59	246	962	375	190	*		*		*
CL-2 NA	8989	3190	7061	5550	2054	4191	7087	524	7209	2211	5579
CL-2 Acc	7848	2462	3642	8197	2570	929	9835	95	8627	2055	2458
NLS-NA	2240	1142	675	5211	4650	677			3726	3386	676
NLS-Acc	1637	327	854	30052	6534	3091	3231	626	11640	3794	1449
GSch	17689	1875	9485	11134	7849	4949	15994	4870	14939	5442	7481
SEP	15434	9833	2862	7026	1359	2476	16038	1223	12833	5775	3050
NEP	7752	9302	3837	5863	1483	2259	4330	394	5982	5443	2678
Georges Bank Total	**64085**	**14311**	**30516**	**79110**	**12246**	**21853**	**77893**	**19008**	**74938**	**11294**	**30154**
TOTALS	**112761**	**14906**	**57580**	**143066**	**12767**	**54924**	**159149**	**28013**	**143286**	**12428**	**66690**
* Included in other areas											

7. **Commenter pointed out that there are potentially positive effects of removing older animals; i.e. to provide more room for growth of younger scallops, which improves the beds and the fishery overall.**

Scallop PDT Response:
The PDT does not agree with this comment. There is no evidence that removing larger scallops has positive effects on smaller scallops. In fact, scallop larvae need hard substrate to attach to for settlement success. If there is limited hard substrate in sandy areas for example, larvae can attach to larger scallops instead. This has been documented in video surveys on Georges Bank. Larger scallops also produce more larvae than smaller scallops, and if scallops are density dependent, there may be beneficial impacts on spawning success if scallops are more concentrated and closer together (MacDonald and Thomspon, 1985)

There is no evidence that crowding impacts growth. The NEFSC has a large database of aged scallops; growth is calculated by measuring the distance between rings on the shell. If growth was impacted negatively by crowding in closed areas, the distance between rings would be smaller than in open areas. But the opposite was found, growth is faster in closed areas and higher density portions of closed areas do not grow slower than less dense portions of closed areas (Hart and Chute, 2009).

As for food, small scallops eat smaller sized phytoplankton; larger scallops are filtering out larger food in the water column. Overall, scallops are not found in very high densities; one scallop per square meter is considered dense. The most concentrated areas like the cod HAPC has densities of about one scallop per square meter on average, with more dense patches throughout. Even at those relatively high densities, scallops are not removing large portions of food from the water column. Therefore, growth is not food limited, even in high density areas.

One issue that does seem to be density dependent is mortality from predators. When scallops are concentrated mortality from predators is increased, especially when scallops are small. There have been seeding experiments in Canada that evaluated mortality at different density levels, and mortality was higher for juvenile scallops in higher densities. (Barbeau et al, 1996).

8. **Commenters pointed out that the success of the scallop fishery depends on rotational management, and area closures can lead to die-offs of scallops.**

Scallop PDT Response:
Scallops will eventually die in long term closures because they are relatively sessile and will not move large distances into areas where they might be subject to fishing mortality, especially as they age. If increasing scallop yield was the only goal of fisheries management in the Northeast, then large long term closures may not be the ideal tool. However, there are other goals of closures in this region and those need to be weighed against changes in scallop yield. There may be some benefits to the scallop resource from area closures if total recruitment increases, but there are costs as well from the yield lost within the closed area. The costs and benefits of these closures are evaluated from many perspectives with the DEIS and the Council will need to make a policy decision about how to balance the various benefits and costs.

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