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MEMORANDUM

Date: July 30, 2015

To: Ecosystems and Ocean Planning Committee

From: Jessica Coakley, Staff

Subject: Improving How the Council Addresses Anthropogenic (Human) Activities that Impact Fish Habitat

As part of the Council's Habitat Pilot Project, we are examining ways to improve the process of addressing anthropogenic activities that impact fish habitat. This includes discussions of both non-fishing and fishing impacts.

To focus this discussion for the Committee at this August 2015 Meeting, the Habitat Project Team has worked with the Fisheries Leadership and Sustainability Forum to prepare background documents focused on several anthropogenic activities, and have developed associated draft policy documents for consideration. The development of written Council policy on these kinds of activities will allow the Council to comment more quickly and effectively on activities and projects proposed in the Mid-Atlantic region, and enable the Council to work more effectively in addressing fish habitat issues in the ecosystem context within our region. Our partners, including NOAA Fisheries have indicated that this would be beneficial when they comment on projects within the region to cite Council positions.

The Ecosystem and Ocean Planning Advisory Panel (AP) met on July 21, 2015 and their input was solicited on these draft policy documents. The group was only able to review some of the material due to time constraints. Written comments were taken on the materials that they did not have the time to fully discuss (i.e., Marine Transport, Coastal Development, and Fishing Impacts Draft Policy). We are planning to schedule another AP meeting after this Committee meeting, to provide another opportunity for more detailed AP input on these issues.

In addition, the Council's Habitat Pilot Project is focused on the development of goals and objectives for addressing fish habitat issues and improving how important fish habitat areas are identified and prioritized. To support discussion this fall and into 2016 on this subject, a report entitled, "Regional Use of the Habitat Area of Particular Concern (HAPC) Designation" was prepared and is enclosed for review. This report was developed to support future discussions on how the Council could make better use of these HAPC provisions (such as prioritizing multi-species habitat areas), and other approaches that enhance our ability to address fish habitat issues in the larger ecosystem and ocean planning context.

All of the following materials are available in the online briefing book materials. Some of the materials are included in hard copy (as noted).

Development of Council Policy on Non-Fishing and Fishing Activities

1. Improving How the Council Addresses Anthropogenic (Human) Activities that Impact Fish Habitat
2. Introduction and Methods **(online only)**
3. General Policies on Non-Fishing Activities and Projects – Draft Council Policy
4. Liquefied Natural Gas
    a. Liquefied Natural Gas Background Document **(online only)**
    b. Liquefied Natural Gas – Draft Council Policy
5. Offshore Wind Energy
    a. Offshore Wind Background Document **(online only)**
    b. Offshore Wind – Draft Council Policy
6. Offshore Oil
    a. Offshore Oil Background Document **(online only)**
    b. Offshore Oil – Draft Council Policy
7. Marine Transport
    a. Marine Transport Background Document **(online only)**
    b. Marine Transport – Draft Council Policy
8. Coastal Development
    a. Coastal Development Background Document **(online only)**
    b. Coastal Development – Draft Council Policy
9. Habitat Impacts from Fishing
    a. Fishing Background Document **(online only)**
    b. Fishing – Draft Council Policy
10. Advisory Panel Meeting Summary and Written Comments

Prioritizing Fish Habitat Areas **(online only)**

11. Regional Use of the Habitat Area of Particular Concern (HAPC) Designation
    a. Final Report
    b. List of HAPCs

Additional Reference Materials **(online only)**

1. Impacts to Marine Fisheries Habitat from Non-fishing Activities in the Northeastern United States, NOAA Fisheries
2. Living Shorelines: From Barriers to Opportunities, Restore America's Estuaries
3. Offshore Wind Best Management Practices Workshop, MAFMC
4. Offshore Wind Energy Development Site Assessment and Characterization: Evaluation of the Current Status and European Experience, Bureau of Ocean Energy Management (BOEM)
5. MAFMC Comments to Delaware Coastal Programs on Proposed Geophysical Seismic Surveys
6. MAFMC Comments to BOEM on the 2017-2022 Proposed Oil and Gas Leasing Program

<u>DRAFT - Improving How the Council Addresses Anthropogenic (Human) Activities that Impact Fish Habitat</u>

<u>Non-fishing Impacts</u>

As a policy entity, how can the Council best communicate its concerns about non-fishing activities in our region over which fisheries managers have no regulatory authority?

How do we make the current NOAA Fisheries Habitat Division consultation process on projects proposed in the Mid-Atlantic region more effective?

Can we improve the current process so we stay informed of activities/projects that may impact habitat, so the Council has the opportunity to comment?

A few comment letters a year are developed on an ad hoc basis, and often require Committee and Council agenda time. Is there a way the comment process can be made more effective?

Possible Approaches:

<u>Step 1</u> – Identify and Document Council Positions on Fish Habitat Issues (Draft Policy)

- Written policy informs NOAA Fisheries and other partners and agencies of Council position on issues
- Allows for more rapid development of Council comments on issues
- Allows Council members and staff to engage more effectively with partners and identify opportunities to address fish habitat issues that are important, in a more timely manner
- Allows for the opportunity to look across species and plans and try to address these issues more comprehensively/holistically

<u>Step 2</u> – Identify Projects of Concern in the Mid-Atlantic Region

- Enter into an agreement with NOAA Fisheries to be notified of projects that meet certain criteria
- Create criteria to filter the thousands of projects into the few the Council might want to respond to

<u>Step 3</u> - Expedite the Council Process to Develop Comments on Projects

- Have staff develop comment letters consistent with the Council policy
- Expedite the approval process - Committee chair, Council chair, or ED sign off if letter is consistent with Council written policy

<u>Fishing Impacts</u>

Does the Council have positions with respect to fishing activity that impacts habitat, to be addressed in the larger Ecosystem Approach to Fisheries Management (EAFM) context as opposed to just fishery plan by plan?

Impacts to Fish Habitat from Anthropogenic Activities: Introduction and Methods

Prepared by the Fisheries Leadership & Sustainability Forum for the Mid-Atlantic Fishery Management Council

I. Introduction

To support the Mid-Atlantic Fishery Management Council's (MAFMC) consideration of habitat impacts from anthropogenic activities, the Fisheries Forum prepared a set of background documents, which aim to:

- Provide a high level understanding of anthropogenic activities identified as priorities by the Oversight Team;
- Describe potential impacts to habitat that may result from these activities; and
- Identify overlap between potential habitat impacts and the habitats important to MAFMC managed species.

This document describes the methods used to develop background documents on the following six activities:

- Liquefied Natural Gas (LNG)
- Wind Energy
- Offshore Oil
- Marine Transport
- Coastal Development
- Fishing

II. Document Contents and Structure

Given the different nature of habitat impacts resulting from fishing activities compared to non-fishing anthropogenic activities, separate approaches were taken in drafting these two different sub-categories of background documents.

<u>Fishing</u>

I. Introduction – explains the purpose and organization of the document, and introduces important habitat concepts used throughout the document.
II. Gear Profiles – provides an overview of each fishing gear configuration, how it's used in the Mid-Atlantic region, and its potential impacts to habitat.
III. Potential Impacts in the MAFMC Context – provides a ranking of gears as low, moderate or high impacts, and explores the relative impact given the proportion of effort each gear represents within a fishery (see "Methods" below).
IV. Discussion – highlights nuances and considerations that influence the extent and severity of habitat impacts from fishing activities.
V. References

Non-Fishing Activities

Background documents for energy development (LNG, wind and oil), marine transport and coastal development are structured according to the following outline:

I. Activity Overview – provides a succinct introduction to the activity, permitting authorities, and the extent to which the activity is or could occur in the Mid-Atlantic region.
II. Habitat Impacts by Habitat Type – describes potential impacts to habitat, organized by habitat type (see "Methods" below).
III. Potential Impacts to MAFMC Managed Stocks – highlights MAFMC stocks and habitat types that may be impacted by each activity. This information is also presented in table format (see "Methods" below).
IV. Indirect Impacts – describes impacts to the survival and productivity of fish stocks and potential interactions with other coastal or marine activities.
V. References

III. Methods

All six background documents synthesize and organize existing information on anthropogenic activities and their potential impacts to important fish habitat. Primary source documents include:

- National Oceanic and Atmospheric Administration (NOAA) Technical Memorandum 209, "Impacts to Marine Fisheries Habitat from Nonfishing Activities in the Northeastern United States"
- New England Fishery Management Council's "Omnibus Essential Fish Habitat Amendment 2 Draft Environmental Impact Statement. Appendix G: Non-Fishing Impacts to Essential Fish Habitat"
- NOAA Technical Memorandum 181 "Characterization of the Fishing Practices and Marine Benthic Ecosystems of the Northeast U.S. Shelf, and an Evaluation of the Potential Effects of Fishing on Essential Fish Habitat"

Experts involved in fisheries management, habitat conservation and the essential fish habitat (EFH) consultation process also provided valuable insights. A complete list of references and sources is included with each background document.

The following methods were used to aggregate and synthesize information from multiple sources and draw insights about potential impacts to habitat.

Fishing

Expert judgment

In addition to several technical and peer-reviewed resources, information was also drawn from sources that leverage expert judgment. To distinguish between these different informational resources, footnotes are used to identify the source of specific insights.

Heat map of habitat impacts

To provide a visual comparison of habitat impacts across gear types, fishing gears were assigned a ranking of low (green), moderate (yellow) or high (orange). These rankings are a qualitative simplification of the information summarized in each gear profile, which is rooted in expert judgment, peer-reviewed published research, observational studies, and gray literature. Rankings reflect relative potentials for habitat impacts, recognizing that the actual impacts to habitat are a function of how, when and where the gear is used.

Effort-based indexing

Gear types used within each fishery are assigned a relative effort categorization, using landings estimates generated by MAFMC staff and NOAA Fisheries trip report logbook data:

- Majority – gears accounting for greater than 50% of landings
- Minority – gears accounting for less than 50% of landings
- Minimal – gears accounting for less than 5% of landings

Fishing gears responsible for minimal landings in a fishery are assigned a lower habitat impact ranking, reflecting a lower potential for habitat impacts.

<u>Non-Fishing Activities</u>

Habitat categorization

The potential for intersections between habitat impacts and habitats important for Mid-Atlantic stocks is assessed using a simplified set of habitat types and attributes. This allows for direct comparisons between MAFMC's EFH and habitat areas of particular concern (HAPC) descriptions, and habitat descriptions in reference documents. These attributes include distance from shore, depth in the water column, and substrate type.

<u>Distance from shore</u>: Three categories are used to describe habitat in terms of distance from shore. While estuaries are subset of nearshore habitat, this specific habitat type is included to recognize the importance of estuarine environments and their susceptibility to impacts. Nearshore and offshore are not strictly defined in terms of specific distance from shore but are general categorizations used for this specific purpose.

- Estuarine – includes habitats such as estuaries, intertidal flats, submerged and exposed vegetative zones, etc.
- Nearshore – includes habitats close to shore, including inshore, coastal, and state waters, etc.
- Offshore – includes habitats far from shore, including outer continental shelf, federal waters, etc.

<u>Water column:</u> Three categories are used to describe different habitat types relative to their distribution within the water column.

- Pelagic – includes the upper water column, mid-water column or entire water column. This designation is inclusive of pelagic habitats not specifically referenced as demersal or benthic. This designation is also inclusive of nearshore and offshore habitats, though is less relevant for estuarine environments.
- Demersal – specific to the lower water column. The use of demersal waters is implicit for habitats that expand the entire water column, and is an added distinction for habitat in the lower portion of the water column.
- Benthic – includes general and specific bottom habitats, the delineation of which is expanded through the third set of categorizations below.

Benthic substrate/structure: Benthic habitats are further categorized based upon the type of substrate or structure present.

- Submerged aquatic vegetation (SAV) – includes submerged vegetation such as eelgrass etc.
- Structured – includes a range of natural or manmade structured habitat such as rock, boulder piles, shell, oyster reefs, etc.
- Soft – includes soft substrates such as sand, silt, clay, mud, etc.

MAFMC EFH and HAPC table

EFH and HAPC for each species and life stage are "tagged" according the nine habitat types described above, based on information described or clearly implied by text descriptions from MAFMC and NOAA Fisheries source documents. These tags are not mutually exclusive; EFH for a single species may include habitat types in each category. This approach documents all habitat attributes identified as EFH or HAPC, intentionally allowing for overlap and avoiding distinction in the relative amounts of each habitat type used by each species or life stage.

Visualizing EFH and HAPC designations in this table (below) reinforces that Mid-Atlantic species have a strong association with nearshore habitats, and some or all life stages occur throughout state and federal waters. Additionally, many managed species are estuarine-dependent for several life stages. While only a few species are specifically benthic dwelling, there is a strong connection between MAFMC stocks and the demersal and benthic environment.

Potential for adverse impacts

Impacts to each habitat type are drawn from the source documents and summarized in Section II of each background document. Each habitat type is the characterized as having: a) potential for adverse impacts; b) low potential for adverse impacts; or c) no potential for adverse impacts, for each specific activity. These characterizations are identified through color-coding in the table within each background document. Overlaps between the habitat types potentially impacted and habitat types identified as EFH or HAPC for each species and life stage are identified.

Assumptions

The methods described above purposefully simplify and generalize habitat types and the relationship between these activities and MAFMC species for the purpose of identifying potential overlap. Given that these activities were explored from a hypothetical perspective (rather than with respect to a specific project proposal), an inclusive rather than exclusive approach was taken. Several of the activities explored are not occurring in the Mid-Atlantic region at this time. Thus all potential configurations of each activity are explored to provide the Oversight Team with an understanding of the full suite of impacts that may potentially result from this development.

	Distribution			Water Column			Benthic Substrate/Structure		
	Estuary	Nearshore (state waters)	Offshore	Pelagic (upper/mid/ entire column)	Demersal (lower water column)	Benthic (seafloor substrate)	SAV	Structured (e.g. shell, manmade)	Soft (sand, silt)
MAFMC Species									
Atlantic Mackerel									
Eggs	x	x	x	x					
Larvae	x	x	x	x					
Juveniles	x	x	x	x					
Adults	x	x	x	x					
Black Sea Bass									
Eggs	x	x	x	x					
Larvae	x	x	x	x	x	x		x	
Juveniles	x	x	x		x	x	x	x	x
Adults	x	x	x		x	x		x	x
Atlantic Bluefish									
Eggs		x	x	x					
Larvae		x	x	x					
Juveniles	x	x	x	x					
Adults	x	x	x	x					
Butterfish									
Eggs	x	x	x	x					
Larvae	x	x	x	x					
Juveniles	x	x	x	x					
Adults	x	x	x	x					
Shortfin Squid (*Illex*)									
Eggs			x	x					
Pre-Recruits			x	x					
Recruits		x	x	x					
Longfin Squid (*Loligo*)									
Eggs	x	x	x		x	x	x	x	x
Pre-Recruits	x	x	x	x					
Recruits	x	x	x	x	x	x	x	x	x
Ocean Quahogs									
Juveniles		x	x			x			x
Adults		x	x			x			x
Scup									
Eggs	x	x							
Larvae	x	x							
Juveniles	x	x	x		x	x	x	x	x
Adults	x	x	x		x	x			
Spiny Dogfish									
Juveniles		x	x	x	x				
Sub-Adults		x	x	x	x				
Adults		x	x	x	x				
Summer Flounder									
Eggs		x	x	x					
Larvae	x	x	x	x					
Juveniles	x	x	x		x	x	x		x
Adults	x	x	x		x	x	x		x
HAPC	x						x		
Atlantic Surfclams									
Juveniles		x	x			x			x
Adults		x	x			x			x
Golden Tilefish									
Eggs			x	x					
Larvae			x	x					
Juveniles			x		x	x		x	x
Adults			x		x	x		x	x
HAPC			x			x		x	x

Habitat Table References

Atlantic Bluefish

MAFMC. 1999. "Amendment 1 to the Bluefish Fishery Management Plan." Dover, DE. 408 p. + append.

Shepherd, G. and D. Packer. 2006. "Essential Fish Habitat Source Document: Bluefish, *Pomatomus saltatrix*, Life History and Habitat Characteristics." NOAA Technical Memorandum, NMFS-NE-198.

Atlantic Mackerel

MAFMC. 2011. "Amendment 11 to the Atlantic Mackerel, Squid, and Butterfish Fishery Management Plan." Dover, DE. 559 p. + append.

Studholme A. et al. 1999. "Essential Fish Habitat Source Document: Atlantic Mackerel, *Scomber scombrus*, Life History and Habitat Characteristics." NOAA Technical Memorandum, NMFS NE 141; 35 p.

Atlantic Surfclams

Cargnelli, L. et al. 1999a. "Essential Fish Habitat Source Document: Atlantic Surfclam, *Spisula solidissima*, Life History and Habitat Characteristics." NOAA Technical Memorandum, NMFS-NE-142.

MAFMC. 2003. "Amendment 13 to the Atlantic Surfclam and Ocean Quahog Fishery Management Plan." Dover, DE. 344 p. + append.

Black Sea Bass

Drohan, A., J. Manderson, and D. Packer. 2007. "Essential Fish Habitat Source Document: Black Sea Bass, *Centropristis striata*, Life History and Habitat Characteristics, 2nd Edition." NOAA Technical Memorandum, NMFS NE 200; 68 p.

MAFMC. 2002. "Amendment 13 to the Summer Flounder, Scup, and Black Sea Bass Fishery Management Plan." Dover, DE. 552 p. + append.

Steimle, F. et al. 1999. "Essential Fish Habitat Source Document: Black Sea Bass, *Centropristis striata*, Life History and Habitat Characteristics." NOAA Technical Memorandum, NMFS NE 143; 42 p.

Butterfish

Cross, J. et al. 1999. "Essential Fish Habitat Source Document: Butterfish, *Peprilus triacanthus*, Life History and Habitat Characteristics." NOAA Technical Memorandum, NMFS NE 145; 42 p.

MAFMC. 2011. "Amendment 11 to the Atlantic Mackerel, Squid, and Butterfish Fishery Management Plan." Dover, DE. 559 p. + append.

Golden Tilefish
MAFMC. 2009. "Amendment 1 to the Tilefish Fishery Management Plan." Dover, DE. 496 p. + append.

Steimle, F. et al. 1999. "Essential Fish Habitat Source Document: Tilefish, *Lopholatilus chamaeleonticeps*, Life History and Habitat Characteristics." NOAA Technical Memorandum, NMFS-NE-152.

Longfin Squid (*Loligo*)
Cargnelli, L. et al. 1999. "Essential Fish Habitat Source Document: Longfin Inshore Squid, *Loligo pealeii*, Life History and Habitat Characteristics." NOAA Technical Memorandum, NMFS NE 146; 27 p.

Jacobson, L. 2005. "Essential Fish Habitat Source Document: Longfin Inshore Squid, *Loligo pealeii*, Life History and Habitat Characteristics, 2nd Edition." NOAA Technical Memorandum, NMFS NE 193; 42 p.

MAFMC. 2011. "Amendment 11 to the Atlantic Mackerel, Squid, and Butterfish Fishery Management Plan." Dover, DE. 559 p. + append.

Ocean Quahogs
Cargnelli, L. et al. 1999b. "Essential Fish Habitat Source Document: Ocean Quahog, *Arctica islandica*, Life History and Habitat Characteristics." NOAA Technical Memorandum, NMFS-NE-148.

MAFMC. 2003. "Amendment 13 to the Atlantic Surfclam and Ocean Quahog Fishery Management Plan." Dover, DE. 344 p. + append.

Scup
MAFMC. 2002. "Amendment 13 to the Summer Flounder, Scup, and Black Sea Bass Fishery Management Plan." Dover, DE. 552 p. + append.

Steimle, F. et al. 1999. "Essential Fish Habitat Source Document: Scup, *Stenotomus chrysops*, Life History and Habitat Characteristics." NOAA Technical Memorandum, NMFS-NE-149.

Shortfin Squid (*Illex*)
Cargnelli, L., S. Griesbach, and C. Zetlin. 1999. "Essential Fish Habitat Source Document: Northern Shortfin Squid, *Illex illecebrosus*, Life History and Habitat Characteristics." NOAA Technical Memorandum, NMFS NE 147; 21 p.

Hendrickson, L. and E. Holmes. 2004. "Essential Fish Habitat Source Document: Northern Shortfin Squid, *Illex illecebrosus*, Life History and Habitat Characteristics, 2nd Edition." NOAA Technical Memorandum, NMFS NE 191; 36 p.

MAFMC. 2011. “Amendment 11 to the Atlantic Mackerel, Squid, and Butterfish Fishery Management Plan.” Dover, DE. 559 p. + append.

Spiny Dogfish
MAFMC. 2014. “Amendment 3 to the Spiny Dogfish Fishery Management Plan.” Dover, DE. 106 p. + append.

Stehlik, L. 2007. “Essential Fish Habitat Source Document: Spiny Dogfish, *Squalus acanthias*, Life History and Habitat Characteristics.” NOAA Technical Memorandum, NMFS-NE-203.

Summer Flounder
MAFMC. 2002. “Amendment 13 to the Summer Flounder, Scup, and Black Sea Bass Fishery Management Plan.” Dover, DE. 552 p. + append.

Packer, D. et al. 1999. “Essential Fish Habitat Source Document: Summer Flounder, *Paralichthys dentatus*, Life History and Habitat Characteristics.” NOAA Technical Memorandum, NMFS-NE-151.

Draft Council Fisheries Habitat Policies - Preamble

Fish require healthy surroundings to survive and reproduce. Habitat for a fish is the environment which supports it; this includes the benthic habitat, water column habitat, and ecological connections and linkages that occur throughout. Fish habitat plays an essential role in the reproduction, growth, and sustainability of commercial and recreational fisheries and supports the biodiversity on which these ecosystems depend.

Human activities have significantly altered coastal and marine habitat over time. Fish habitat continues to be degraded or lost due to a variety of factors, including coastal development, land-based pollution, fishing gear impacts, invasive species, dams and other blockages that restrict access for migratory fish species, and reduction in the amount and delivery of freshwater to estuaries. In addition, climate change and the demand for new sources of energy have the potential to cause wide-ranging impacts on fish habitat. Given the continuing trend for coastal development, the pressures on coastal and marine habitat will only increase. Most of the Council's managed resources have strong nearshore and coastal linkages to habitat, and in many cases the nearshore and offshore environment for these managed resources is one continuum.

Once habitat is damaged or lost it is difficult and costly to recover. The Council is limited in its ability to address all these threats to fish habitat, as the Council only has authority to manage its fisheries. However, by more clearly articulating the Council's positions on human activities within our region, the Council can more effectively comment and collaborate with partners and other agencies in trying to address these threats. As such the Council has developed the following policies on anthropogenic (human) activities to respond and support healthy fish habitat for our managed resources. The development of Council policy on these issues should enhance our ability to respond to nearshore and offshore activities in our region, and engage with our partners is addressing these issue more effectively.

The following four principles guided the development of these policies:

1. An ecosystem approach, which includes consideration of long-term health of essential habitat, and its linkages within the ecosystem, is fundamental to the sustainable use of all of our marine resources.

2. To ensure healthy and productive marine ecosystems, it is imperative that human use impacts in sensitive habitats be considered in deciding the appropriateness of all human uses that impact marine and coastal areas, including but not limited to fisheries management.

3. Sustainable use that safeguards ecological processes is a priority of decision making in the marine and coastal environments.

4. Not all areas require equal levels of protection, as not all areas are equally ecologically or biologically significant or vulnerable to particular stressors.

General Policies on Non-Fishing Activities and Projects – Draft Council Policy

Engage Early - Early consultation with agencies is critical to support planning for monitoring and data collections to evaluate impacts.

Early Communication - Early communication between project developers and the fishing industry(s) and other stakeholders is a critical component of conflict avoidance and mitigation. This should consider the full range of regional fishing interests. The coexistence of development activities and fishing activities should be a requirement.

Sustained Communication – There should be sustained communication about project activities with stakeholders (i.e., vessel presence, activities, etc.).

Before and After Environmental Monitoring - To inform consideration of impacts, monitoring habitat and biological/ecological conditions in the project areas before , during, and after development and operations, is necessary to understand better understanding of the potential and realized impacts. Establish an environmental baseline before construction begins, and a timeline that specifies when and what type of information is collected.

Before and After Economic Monitoring - Economic baselines should be established to evaluate impacts to fisheries, fisheries infrastructure, and fishing communities.

Monitoring Data - Project monitoring information should be reviewed for any unanticipated adverse impacts, such that remediation or mitigation measures can be considered. Monitoring data should be archived in NOAA's National Centers for Environmental Information (NCEI), regional portals, or other long-term archiving process for potential future use such as:
https://www.ncei.noaa.gov/ or http://midatlanticocean.org/data-portal/

Research - Increasing investment in research and monitoring should provide a better understanding of expected impacts and support improvements in the consultation process. Dedicated funding to support habitat research, inventorying habitat, and research of impacts to habitat from project activities should be prioritized.

Timing Restrictions - Project activities (exploration, construction, and operations) should be conducted when the fewest species, least vulnerable species, and least vulnerable life stages are present. Appropriate work windows should be established based on multi-season pre-construction biological sampling in the affected area.

Activities Restrictions – Development/activities should not occur in sensitive areas and those already prohibited to fishing. This includes discrete canyon and broad areas on the Outer Continental Shelf identified for deep sea coral protection. [note 400-500 fathom comment for Ctte.]

Buffers - If activities with significant adverse impacts on sensitive habitat species or life stages are to be conducted, protective buffers that prevent the adverse effects should be used.

Exclusion Zones - Guidelines should be established that specify when, where, and how marine exclusion zones can be established for project development and activities.

Decommissioning of Projects/Platforms - Decommissioning options for platforms (such as those used in liquefied natural gas, oil, and wind production to the extent the activities occur in the region) should be developed, but projects should re-consult with appropriate agencies when preparing to decommission. This provides the opportunity for consideration of best decommissioning methods; original decommissioning options may be decades old and may not make use of best available technologies. It also allows for consideration of platforms to remain for alternative uses (e.g., oil platforms decommissioned for use as artificial reefs in the Gulf of Mexico).

Contaminants - Ensure the use of contaminants (toxic chemicals) which can adversely affect the aquatic environment/marine biota are below impact levels. Avoid the use of biocides (e.g., aluminum, copper, chlorine compounds) to prevent fouling; less damaging antifouling alternatives should be implemented to avoid the leaching of these contaminants into the environment.

Eutrophication - Eutrophication of estuaries and nearshore waters in the Mid-Atlantic adversely impacts fisheries and essential fish habitat. Thus the Council supports policies, projects, and investments that reduce point and non-point sources of eutrophication and opposes land use practices and other activities that exacerbate eutrophication.

Effective Footprint - For all human activities and projects that the Council may comment on, the immediate structural footprint of the activity must be consider. Beyond that, the effective footprint of the activity should also be considered. For example, wind facilities have a footprint associated with the actual wind turbine structures, moreover, they have an effective footprint in that they may influence currents, which can influence bottom structure (sand) through scouring and pelagic water column habitat important for eggs of squid and other species. Similarly, outside the structural footprint of LNG plants, the plants may have security buffers implemented by the Department of Homeland Security, which may limit navigation and access the fishing grounds. The effective footprint of a particular activity or project may be significantly larger than the structural footprint, thus the impact to habitat and fishing grounds may be much larger than they might seem when just considering the structural footprint of the project or activity.

Activity Corridors – Coastal and ocean development activities should be restricted to certain corridors; greater effort should be made in identifying these areas for planning purposes.

Liquefied Natural Gas
Anthropogenic Activity Background Document

I. Activity Overview

Liquefied Natural Gas (LNG) is super-cooled methane gas, converted into liquid form. In this energy-dense state, LNG takes up significantly less space than gaseous methane, providing for more efficient transport over long distances. The process for transporting LNG requires specialized facilities to convert methane between gaseous and liquid states and connect to distribution pathways, large ships to move the liquefied gas, and large ports to accommodate these vessels.

Shipping

LNG is shipped between facilities in very large double-hulled cryogenic tanker ships, which may be received in shoreside or offshore ports. For shoreside ports, maintenance dredging is often required to maintain the depth and width of shipping channels and port facilities to accommodate the draft of these vessels. Offshore ports are sited in deepwater and do not require dredging.

Infrastructure

Specialized LNG facilities are necessary to support the import and export of LNG, which can be located onshore or offshore. Both configurations require shoreside infrastructure to support distribution. Onshore plants are sited in close proximity to the ports receiving the transport vessels, and transfer LNG to the plant for regasification. The construction of onshore LNG plants and associated upland facilities and pipelines can involve a number of coastal development activities, such as dredging, filling, and shoreline stabilization. The U.S. Department of the Interior's Federal Energy Resources Commission (FERC) permits the development of LNG facilities onshore; additional state and federal permits may also be required.

LNG can also be received at offshore facilities. The construction of offshore receiving ports includes the installation and maintenance of a receiving facility and pipelines to either transport LNG to shoreside facilities and distribution networks, or connect to existing pipelines. The U.S. Coast Guard is in charge of permitting offshore receiving facilities in federal waters.

Within LNG facilities, specialized equipment is necessary to conduct the liquefaction and regasification processes. Currently, all plants in the Mid-Atlantic region are configured to regasify imported LNG. Regasification can be conducted by closed-cycle and open-cycle processes. Closed-cycle facilities rely on a mixture of water and chemicals to warm and gasify the super-cooled LNG and to cool machinery within the facility; open-cycle facilities rely on the intake of large amounts of seawater to perform these functions. LNG received offshore is regasified in submerged buoys that connect the vessel to the offshore facility; gaseous methane is then piped to shore and connected to onshore distribution pipelines.

Activity in the Mid-Atlantic Region

LNG is an important, marketable product that supplies fuel for heating in the Northeast. The Mid-Atlantic region currently has the most existing LNG-associated facilities and development of any part of the U.S. All existing onshore LNG facilities in the Mid-Atlantic are closed-loop import facilities, though a few combined import and export facility configurations are currently proposed for construction. At this time, all transport vessels dock in existing nearshore ports. With its large populations centers and increasing demand for energy for heating, the region will continue to import LNG in the near future as a result of the increasing availability of relatively cheap natural gas reserves around the world. In addition, increasing domestic production of natural gas may prompt the construction and re-configuration of facilities to export LNG in the future. Recently, FERC authorized construction and operation of a facility on Chesapeake Bay to liquefy and export LNG from the Marcellus shale formation in the Northeast.

National Oceanic and Atmospheric Administration (NOAA) Fisheries Habitat Conservation Division staff are actively engaged in the consultation process with federal partners before and during permitting of LNG activities. In addition to providing comments through Essential Fish Habitat (EFH) consultation, and the National Environmental Protection Act (NEPA) process undertaken by FERC and the U.S. Department of the Interior's Bureau of Ocean and Energy Management (BOEM), NOAA Fisheries also engages early to suggest alterations to the siting and design of potential LNG developments to minimize habitat impacts.

II. Habitat Impacts from LNG by Habitat Type

LNG activities can potentially impact all habitat types, though most impacts are believed to be site-specific. Impacts to marine habitat are described below, organized by distribution and depth of habitat types.

Distribution (Nearshore (Including Estuarine)/Offshore)

a) Nearshore

The construction of onshore plants and associated upland infrastructure can lead to habitat destruction and conversion through dredging and filling shoreline habitat, installation of structures such as piles and foundations, and shoreline stabilization and hardening. Changes in runoff, sedimentation and siltation can also occur as a result. Once operational, LNG facilitates may impact habitat, water quality and species behavior through the discharge of seawater, debris and contaminants. Open-cycle LNG plants located in nearshore, confined water bodies can disrupt hydrology and ecosystem function through changes in salinity and temperature resulting from the intake and discharge of large volumes of water. These facilities can also impinge and entrain fish eggs and larvae and impact species survival, behavior and physiology (see Indirect Impacts).

Vessels used to transport LNG between onshore facilities may necessitate dredging to establish and maintain shipping channels. The ballast water exchange of these vessels may have similar impingement and entrainment effects and impact water quality through the release of contaminants into the nearshore environment.

The use of offshore receiving facilities can have additional impacts on the nearshore environment. The construction of pipelines linking to onshore LNG plants can lead to habitat destruction and conversion, suspension of sediments including contaminated sediments, and alteration of sediment movement and water flows around pipes. Construction and maintenance barges may also impact habitat through anchoring, use of seawater for cooling and ballast, and expelling debris. Biocides like copper and aluminum compounds are used to coat pipeline surfaces to prevent the growth of marine organisms. These compounds can leach into surrounding waters and accumulate in substrates, potentially exposing organisms living or feeding on the bottom to toxins (see Indirect Impacts).

Estuarine
In addition to the impacts listed above, LNG plant construction and operation can impact estuarine habitats by damaging emergent vegetation and wetland habitat like eelgrass and microalgae beds as a result of dredging, siltation and changes in hydrology and temperature. Shoreline hardening and installation of stabilization structures for onshore facilities can also have direct impacts on vegetation, mudflats, salt marshes and other nursery areas critical to certain species and life stages.

b) Offshore
Where LNG is received offshore, the construction of offshore ports can result in habitat conversion or destruction and suspension of sediment as a result of driving piles or other means of attaching the ports to the seafloor. The use of construction and maintenance barges, and installation and maintenance of pipelines, may also impact offshore benthic habitat as described below.

<u>Depth (Pelagic/Demersal/Benthic)</u>

a) Pelagic
Pelagic environments may be impacted by LNG activities through the exchange of ballast water and noise impacts from construction, operation and maintenance activities (see Indirect Impacts). In shallow pelagic waters, sedimentation and runoff may reduce water quality.

b) Demersal
Nearshore and offshore demersal environments can be impacted by the suspension and resuspension of sediments caused by dredging, construction of facilities and pipelines, laying cables, and moving vessels in confined areas. The resulting increase in turbidity can result in temporary physical impacts to demersal species and changes in light

penetrability. Toxicity impacts from resuspension of contaminated sediment and leaching of biocides from coated pipelines may also occur.

c) Benthic
In addition to construction and maintenance activities associated with offshore ports, the large scale dredging of shipping channels to accommodate LNG vessels can also have permanent and temporary impacts. Impacts from dredging result from the direct removal of substrate, relocation of substrate through plowing, trenching and side casting, and disposition of dredged materials. These activities can result in direct loss of habitat, conversion of substrate and habitat types, and changes in bathymetry and sedimentation. These impacts may result in a net decrease of habitat availability and changes in the distribution of species for all or some life stages, including spawning locations for species with substrate-specific spawning behaviors.

<u>Benthic Substrate (Submerged Aquatic Vegetation/Structured/Soft)</u>

a) Submerged Aquatic Vegetation
In addition to direct impacts from construction, shoreline hardening and dredging, submerged aquatic vegetation (SAV) may also be indirectly impacted by changes in sedimentation, siltation, water quality, and hydrology.

b) Structured
While the extent of construction, dredging and pipeline installation occurring in structured habitat (hard bottom, shell and manmade substrate) may be less than that in soft bottom substrates, these activities can damage and convert structured habitats, which typically take longer to recover than soft substrates.

c) Soft
The construction of offshore ports and pipelines, and dredging of shipping channels are most likely to occur in soft bottom habitat such as sand and silt. In addition to direct habitat impacts from these activities, soft bottom habitats may also be exposed to changes in substrate type, bathymetry, and sediment location and flows.

III. Potential Impacts of LNG to MAFMC Managed Stocks

Depending on the configuration, location, and scale of LNG activities, all Mid-Atlantic Fishery Management Council (MAFMC) managed stocks have the potential to be impacted to some degree. Given the existing configuration of LNG activity in the region, the majority of impacts are expected to occur close to shore, and result from onshore infrastructure construction and operation, and shipping channel/port dredging. Thus, nearshore, estuarine, demersal and benthic habitats (particularly SAV and soft bottoms) are most likely to be harmed or disrupted. Offshore, pelagic and structured benthic habitats are less likely to be impacted, unless offshore receiving facilities are considered in the Mid-Atlantic. The use of offshore receiving ports would also increase impacts to nearshore and benthic habitats from the construction and maintenance of pipelines used to transport LNG from offshore terminals to onshore facilities.

The following table lists the habitat types designated as EFH and Habitat Areas of Particular Concern (HAPC) for the different life stages of MAFMC managed stocks *(*see *Impacts to Fish Habitat from Anthropogenic Activities: Introduction and Methods)*. Cells highlighted in orange indicate an overlay between the habitat type used and the potential for the habitat type to be adversely impacted by LNG activities; cells highlighted in yellow indicate a lower potential for impacts. Aside from specific life stages of shortfin squid (*Illex*) squid and golden tilefish, there is overlap between habitat use and potential impacts for all species and life stages from LNG development. Areas designated as HAPC for summer flounder may be particularly vulnerable to impacts from LNG development.

Visual Overlay of Potential Impacts from LNG Activities and MAFMC Species' EFH/HAPC

Legend

Orange = potential for adverse impacts

Yellow = low potential for adverse impacts

Green = no potential for adverse impacts

MAFMC Species	Distribution			Water Column			Benthic Substrate/Structure		
	Estuary	Nearshore (state waters)	Offshore	Pelagic (upper/mid/ entire column)	Demersal (lower water column)	Benthic (seafloor substrate)	SAV	Structured (e.g. shell, manmade)	Soft (sand, silt)
Atlantic Mackerel									
Eggs	x	x	x	x					
Larvae	x	x	x	x					
Juveniles	x	x	x	x					
Adults	x	x	x	x					
Black Sea Bass									
Eggs	x	x	x	x					
Larvae	x	x	x	x	x	x		x	
Juveniles	x	x	x		x	x	x	x	x
Adults	x	x	x		x	x		x	x
Atlantic Bluefish									
Eggs		x	x	x					
Larvae		x	x	x					
Juveniles	x	x	x	x					
Adults	x	x	x	x					
Butterfish									
Eggs	x	x	x	x					
Larvae	x	x	x	x					
Juveniles	x	x	x	x					
Adults	x	x	x	x					
Shortfin Squid (*Illex*)									
Eggs			x	x					
Pre-Recruits			x	x					
Recruits		x	x	x					
Longfin Squid (*Loligo*)									
Eggs	x	x	x		x	x	x	x	x
Pre-Recruits	x	x	x	x					
Recruits	x	x	x	x	x	x	x	x	x
Ocean Quahogs									
Juveniles		x	x			x			x
Adults		x	x			x			x
Scup									
Eggs	x	x							
Larvae	x	x							
Juveniles	x	x	x		x	x	x	x	x
Adults	x	x	x		x	x			
Spiny Dogfish									
Juveniles		x	x	x	x				
Sub-Adults		x	x	x	x				
Adults		x	x	x	x				
Summer Flounder									
Eggs		x	x	x					
Larvae	x	x	x	x					
Juveniles	x	x	x		x	x	x		x
Adults	x	x	x		x	x	x		x
HAPC	x						x		
Atlantic Surfclams									
Juveniles		x	x			x			x
Adults		x	x			x			x
Golden Tilefish									
Eggs			x	x					
Larvae			x	x					
Juveniles			x		x	x		x	x
Adults			x		x	x		x	x
HAPC			x			x		x	x

IV. Indirect Impacts

In its liquid state, methane can be highly explosive when it comes in contact with water. As a result, the U.S. Coast Guard may utilize exclusion zones to ensure LNG port safety. These exclusion zones could displace fishing effort to other areas and increase congestion of shipping traffic around these zones. In addition to the habitat impacts described above, activities associated with LNG can also have impacts on the survival and productivity of marine species:

a) Noise

Construction, operation and shipping activities associated with LNG can cause underwater noise, vibrations and changes in pressure, which can damage marine life and disrupt behavior, such as avoidance of areas with loud or persistent noise. Larvae and juvenile fish are most susceptible to underwater noise impacts, particularly where it occurs in estuaries. Marine mammals may also be impacted through damage to hearing organs, disruptions in communication and echolocation, and changes in behavior and migration patterns.

b) Impingement and Entrainment

Open-cycle LNG facilities utilize seawater for warming and cooling, and can entrain (capture) and impinge (press against intake screens) marine species, including fish eggs, larvae and juveniles, as well as phyto- and zoo-plankton. Closed-cycle facilities use small volumes of seawater to start and stop the regasification process, thus the impacts are less significant. Offshore ports used for regasification and vessels used in transporting LNG also intake and expel seawater, which can result in similar impacts. Impingement and entrainment associated with LNG activities has been linked to high mortality with eggs and larvae of several species in New England waters.

c) Impacts to Species Survivability

LNG facilities may disrupt the temperature, salinity, and quality of surrounding waters, which can reduce the fitness of marine organisms by altering respiration, metabolism, reproduction, growth, and behavior. Benthic and demersal species may also be exposed to toxins from biocides used to coat LNG pipelines that become resuspended in demersal waters; exposure to biocides such as copper at low concentrations has been shown to impact the survival of herring eggs and larvae. In the event of a spill or leak, LNG may be introduced into the surrounding waters, potentially exposing marine organisms to hydrocarbons. In such cases, acute impacts to marine organisms can be reasonably expected, though there is limited information available on these impacts.

d) Invasive Species

Ballast water exchange occurring during the loading and offloading of LNG from tankers in inshore and offshore facilities can introduce non-native and invasive species. Invasive species pose a large threat to fisheries, habitat, and community structure and dynamics. Invasive species can lower the fitness of organisms, reduce genetic diversity, and introduce exotic diseases.

V. References

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Liquefied Natural Gas (LNG) – Draft Council Policy

1. LNG facilities should utilize a closed loop system and the best commercially available technology to reduce potential impacts from impingement and entrainment of living marine resources, and thermal and salinity impacts to the aquatic environment.

2. Strategies should be implemented to diffuse heating or cooling in any effluent. Alteration of the temperature regimes of the receiving waters, could cause a change in species assemblages and ecosystem function.

3. LNG facilities that use surface waters for regasification and engine cooling purposes should be sited away from areas of high biological productivity (e.g., estuaries).

4. The expansion of existing LNG facilities or repurposing of existing industrial sites and/or the shipping of LNG into ports which already have been developed and have existing deep water facilities would decrease the need for additional dredging.

5. The construction of new onshore LNG infrastructure often requires shoreline hardening and stabilization. Preference should be given to the use of softer shoreline stabilization methods

6. The construction of new onshore LNG infrastructure often requires the installation of pipelines. Pipelines should not be constructed through sensitive fish habitat such as shellfish beds, fish spawning and/or nursery habitat areas, submerged aquatic vegetation (SAV), or hard/structured habitat. Pipeline construction should use the most up to date technology including monitoring to reduce impacts.

7. Some onshore impacts can be avoided through the construction and use of offshore, deep water LNG ports; however, offshore facilities must transport LNG from offshore terminals to onshore facilities and may have other offshore impacts.

8. LNG facilities siting and activities should minimize conflicts with other users groups including recreational and commercial fisheries.

9. LNG facilities and pipelines should avoid areas with important and/or sensitive fish habitats.

10. Install monitoring and leak detection systems at natural gas production and transportation facilities.

11. Ensure gas production and transportation facilities have developed and implemented adequate gas spill response plans and protocols, which include the identification of sensitive marine habitats, including ensuring response equipment is available

12. Ensure that ballast water exchanges and discharges from all vessel involved are closely monitored to prevent the discharge of debris, contaminated ballast water, and invasive species.

Mid-Atlantic Managed Species with at least 1 Life Stage with the Potential to be Adversely Impacted by LNG Development and Operations

Atlantic mackerel
Black sea bass
Atlantic bluefish
Butterfish
Longfin squid (*Loligo*)
Ocean quahogs
Scup
Spiny dogfish
Summer flounder
Atlantic surfclams

Aside from specific life stages of shortfin squid (*Illex*) and golden tilefish, there is overlap between habitat use and potential impacts for all species and life stages from LNG development and operations. Areas designated as habitat areas of particular concern (HAPC) for summer flounder may be particularly vulnerable to impacts from LNG development.

Offshore Wind Energy
Anthropogenic Activity Background Document

I. Activity Overview

Offshore wind projects leverage strong, steady winds over the ocean to rotate turbine blades, driving attached generators to create electricity. Turbines can be mounted on fixed piles or floating devices, and the resulting structures can stand several hundred feet above the surface of the water. Each turbine, whether fixed or floating, must be connected to an electric service platform that collects and relays the electricity to shore, and serves as a base for maintenance activities. Together, the collection of wind turbines and a service platform form a “wind farm,” which can consist of just a few or many dozen turbines with a very large project footprint. Specialized, high voltage cables are used to transmit the generated electricity from the service platform to an onshore substation that connects to the existing power grid. While generally termed “offshore wind energy,” projects can be sited in both nearshore and offshore waters. The U.S. Department of the Interior’s Bureau of Ocean Energy Management (BOEM) leases areas to be considered for siting wind energy projects, and the U.S. Army Corps of Engineers (Corps) permits offshore wind projects in state waters. The U.S. Coast Guard oversees lighting and traffic patterns at wind farms to reduce potential navigation hazards.

<u>Construction and Operation</u>

There are several considerations that inform siting of offshore wind farms including wind speed, size of turbines, distance from shore, and depth of water. Larger turbines are more efficient at harnessing energy at a given wind speed; however, they require larger, sturdier piles to support their span. Floating turbines, which employ turbines mounted on floating devices and anchored to the seafloor with cables, can allow wind farms to be sited further from shore and in deep water. However, given current technological limitations with floating turbines and driving piles in deep water, wind farms are most likely to be comprised of fixed turbines and sited in shallow waters less than one-hundred and fifty feet deep.

To construct fixed turbines, construction barges equipped with percussive or gravity hammers drive piles up to 100 feet into the seabed in mostly sandy habitats. Crushed rock or concrete mattresses are placed on the seafloor at the base of the piles to stabilize them against the forces of waves, high winds and ice floes, and to prevent currents from scouring sediment. Cranes onboard the barges are used to mount turbines and a service platform onto the piles. The piles, turbines, and electric service platforms are all assembled onshore and moved to the project site on construction barges for installation.

<u>Electricity Transmission</u>

To collect and distribute the electricity generated at a wind farm, a network of expensive transmission cables must be laid to connect each turbine to the service platform, and the service platform to an onshore power substation. The cables are laid in trenches on the seafloor that are excavated by jetting, trenching, or plowing tools and then buried to protect them from damage or disturbance. The amount of cable required to network a wind farm is related to the spacing between turbines, distance from shore, and the number and type of seafloor obstacles that the cables must be routed around or through. In instances where re-routing cables is impractical, they may be placed on the substrate and buried with concrete mattresses; explosives can also be used to remove benthic obstacles, though this is less common. Throughout the life cycle of a wind farm, transmission cables must occasionally be unearthed and inspected for damage and eventually removed during decommissioning.

Activity in the Mid-Atlantic Region

The Mid-Atlantic region is densely populated with extensive development along the shoreline. High energy demand and lack of space for onshore coastal wind farms make it an attractive area to develop offshore wind projects. While there are currently no operational wind farms in Mid-Atlantic waters, BOEM has worked with states and stakeholders to identify offshore leasing areas for wind development under a program called “Smart from the Start.” Under this program, National Oceanic and Atmospheric Administration (NOAA) Fisheries Habitat Conservation Division staff are actively involved in the pre-consultation phase to help identify potential concerns and impacts to Essential Fish Habitat (EFH) and Habitat Areas of Particular Concern (HAPC). These insights can prompt states and BOEM to modify the areas identified for potential wind energy development. Offshore wind energy sites have been identified off of Virginia, Maryland, New Jersey, Delaware, and New York, and there are several proposals to develop wind farms in both nearshore and offshore waters. Given technological limitations and the abundance of shallow sandy areas suitable for installing fixed turbines, there are currently no proposals for building floating turbines in the Mid-Atlantic.

II. Habitat Impacts from Offshore Wind by Habitat Type

Development of offshore wind farms has the potential to impact all marine habitat types. Impacts from construction activities are likely to be temporary, while impacts from operation and transmission may occur over longer timeframes. Specific impacts to habitat types are described below, organized by distribution and depth.

Distribution (Nearshore (Including Estuarine)/Offshore)

a) Nearshore

Each construction and transmission-related activity associated with developing wind farms has the potential to impact nearshore habitats. The percussive or gravity hammers used to drive piles into the seabed can directly damage benthic habitats by crushing, removing, converting, or suspending substrates. These hammers vibrate and emit sound waves, which can travel great distances and alter fish and marine mammal behavior, damage hearing and communication organs, and decrease survival near the project site (see Indirect Impacts). Placing crushed rock or concrete mattresses at the base of piles can also directly destroy, convert, or bury substrates. These scour-preventing defenses, along with the vertical structure of the piles themselves, can introduce artificial habitat and also alter species behavior (see Indirect Impacts). Construction barges used to install piles, turbines, service platforms, and transmission cables may drag their anchors along the seafloor, which can directly destroy or damage benthic habitats and suspend sediment. Strong cables and anchors placed on the seafloor to keep floating piles in place could also cause similar benthic habitat impacts.

Regardless of where wind farms are sited, cables connecting service platforms to onshore substations must pass through nearshore habitats. After trenches are excavated, cables are positioned and laid inside the trenches by construction barges and covered with the displaced sediment. These activities can directly destroy, damage, bury, or convert benthic substrate. The resulting suspended sediments can increase sedimentation, siltation and turbidity. When cables are unearthed for inspection and eventual decommissioning, these impacts may occur again. Electricity-bearing transmission cables also create electromagnetic fields around cables, which can alter species behavior (see Indirect Impacts).

Estuarine
In addition to the impacts described above, piles in confined water bodies like estuaries can disrupt tidal patterns and alter the flow of currents, sediments, and nutrients. This disruption can impact the distribution of eggs, larvae, and juveniles of many species that rely on these areas as nurseries. These impacts vary with the size, number and configuration of piles. Laying cables in shallow estuaries can disrupt littoral sediment and freshwater inflow, cause faster draining at low tide, and increase saltwater intrusion at high tide; these changes can lead to net loss of salt-intolerant plants and organic matter and cause soil erosion and siltation. In addition, these activities can resuspend contaminated sediments, which cannot easily disperse in shallow waters and may alter the behavior and survival of eggs, larvae, and juvenile fish and shellfish.

b) Offshore
For wind projects sited in offshore waters, the construction and transmission-related impacts described above can also be expected in offshore habitats. As fixed deepwater pile and floating turbine technologies continue to evolve, wind farms may increasingly be sited in deeper offshore waters.

<u>Depth (Pelagic/Demersal/Benthic)</u>

a) Pelagic
Spilled chemicals such as lubricants have the potential to reduce water quality and increase toxicity throughout the water column. Reduced water quality can lead to direct mortality and have sublethal effects on fish and other species by altering behaviors such as feeding, growth, migration, and reproduction. The physical presence of piles and turbines may also impact species behavior throughout the water column (see Indirect Impacts).

b) Demersal
Construction of wind farms and laying transmission cables can suspend sediments, including contaminated sediments, which increases turbidity and causes sedimentation in demersal waters. Suspended particles and contaminants may temporarily degrade the habitability of surrounding waters, decrease long-term survival, and alter the behavior of demersal species.

c) Benthic
Benthic habitats will likely be subject to the most damaging impacts from the construction and operation of wind farms. Installing piles and laying networks of transmission cables can destroy, damage, convert, and disturb all benthic habitat types. The anchors of construction barges and floating turbines may also cause similar impacts by sliding along the seafloor. A considerable amount of cable is required to connect turbines to service platforms and platforms to onshore substations, resulting in a large footprint on benthic impact. The presence of piles themselves are likely to cause currents to speed up as they move around them, leading to scouring of sediment around their bases. Scour unearths and removes benthic sediment in plumes, leaving holes on the seafloor that can alter community dynamics through habitat and species removal. Resuspended contaminated sediments eventually settle to the seafloor and can persist over long timeframes, degrading the habitability of benthic substrates and exposing organisms that live on or feed near the seafloor to toxins. In addition, the presence of transmission cables in benthic substrates can alter or inhibit benthic species' migrations, especially for invertebrates living in sediments.

Benthic Substrate (Submerged Aquatic Vegetation/Structured/Soft)

a) Submerged Aquatic Vegetation
In addition to the general benthic impacts described above, sedimentation, siltation and turbidity from construction activities can bury submerged aquatic vegetation (SAV) with fine particles and decrease sunlight penetration, which results in decreased productivity of SAV habitats. SAV is particularly sensitive to reduced water quality from pollutants and resuspended contaminated sediments, which can poison existing SAV and prevent future growth in the surrounding substrate. If cables are sited through SAV, these habitats could be directly destroyed by excavation and burial, and contribute to increased turbidity and sedimentation.

b) Structured
Offshore wind farms are unlikely to be sited on structured habitats such as gravel, shell beds, or cobble; however, destruction and damage from excavation and cable burial may result if transmission cables need to be routed through these habitats. Where cables are unable to be buried to standard depths, concrete mattresses may be used to cover cables passing through hard bottom habitats, resulting in similar impacts. In some cases, explosives may be used to permanently remove large hard bottom obstacles. The force of explosives can directly destroy and permanently remove hard structured habitat, alter nearby habitats, and increase sedimentation and turbidity as the result of suspended sediments. Structured habitats may also be crushed, removed or disturbed by driving piles in adjacent habitats or dragging construction barge anchors.

c) Soft
Soft bottom habitats such as sand, silt, and clay are particularly vulnerable to sediment impacts due to the small, relatively light particles that typify them. Construction activities near the seafloor may create small disturbances that can remove sediment altogether or cause plumes of sediment to be resuspended, leading to sedimentation and burial of existing benthic habitat.

Trenching and burying transmission cables can alter habitat complexity and quality by removing or exposing sediment, smoothing out existing seafloor depressions, and creating new contours through the effects of scour.

III. Potential Impacts of Offshore Wind to MAFMC Managed Stocks

Considering the full potential of wind farm configurations and siting options, all habitats utilized by Mid-Atlantic Fishery Management Council (MAFMC) species could potentially be impacted to some extent by offshore wind development. Given technological limitations and the structure of current proposals, offshore wind developments in the near term are likely to be sited close to shore and utilize fixed turbine technology. Thus, impacts from construction and transmission activities will occur in nearshore, shallow water, and will be mostly benthic or demersal in nature. Offshore wind development activities are most likely to occur in soft bottom habitat given the ease of construction in this substrate. SAV and estuarine habitats are particularly vulnerable to transmission-related construction, and may incur significant impacts if activities occur in those areas. If wind farms are sited in deeper offshore water in the future, the impacts described above will likely extend to benthic and demersal habitats offshore.

The following table lists the habitat types designated as EFH and HAPC for the different life stages of MAFMC managed stocks *(*see *Impacts to Fish Habitat from Anthropogenic Activities: Introduction and Methods)*. Cells highlighted in orange indicate an overlay between the habitat type used and the potential for the habitat type to be adversely impacted by offshore wind activities; cells highlighted in yellow indicate a lower potential for adverse impacts.

MAFMC species that depend on nearshore, benthic habitats during at least one life stage have the most potential to be impacted by wind development projects. In the Mid-Atlantic, soft, sandy substrate is the dominant benthic habitat type. Given that wind farms tend to be sited in soft substrates, there are very large areas of the Mid-Atlantic region where wind development could potentially take place. Of the six species that utilize nearshore, benthic habitat, soft bottom substrate is an essential habitat for at least one life stage. The overlap between potential areas of development and the common use of soft bottom habitat may increase the likelihood of impacts to some of these species. With their strong dependence on soft bottom substrates, ocean quahogs and Atlantic surfclams may be particularly vulnerable to impacts from offshore wind development. If transmission cables are routed through estuarine habitats, additional species may be impacted considering the sensitivity and importance of that habitat to early life stages of many stocks. Golden tilefish are the only MAFMC managed species not likely to be impacted directly by wind development activities due to their reliance on very deep, offshore habitats.

Visual Overlay of Potential Impacts from Offshore Wind and MAFMC Species' EFH/HAPC

Legend	Distribution			Water Column			Benthic Substrate/Structure		
Orange = potential for adverse impacts **Yellow** = low potential for adverse impacts **Green** = no potential for adverse impacts	Estuary	Nearshore (state waters)	Offshore	Pelagic (upper/mid/ entire column)	Demersal (lower water column)	Benthic (seafloor substrate)	SAV	Structured (e.g. shell, manmade)	Soft (sand, silt)
MAFMC Species									
Atlantic Mackerel									
Eggs	x	x	x	x					
Larvae	x	x	x	x					
Juveniles	x	x	x	x					
Adults	x	x	x	x					
Black Sea Bass									
Eggs	x	x	x	x					
Larvae	x	x	x	x	x	x		x	
Juveniles	x	x	x		x	x	x	x	x
Adults	x	x	x		x	x		x	x
Atlantic Bluefish									
Eggs		x	x	x					
Larvae		x	x	x					
Juveniles	x	x	x	x					
Adults	x	x	x	x					
Butterfish									
Eggs	x	x	x	x					
Larvae	x	x	x	x					
Juveniles	x	x	x	x					
Adults	x	x	x	x					
Shortfin Squid (*Illex*)									
Eggs			x	x					
Pre-Recruits			x	x					
Recruits		x	x	x					
Longfin Squid (*Loligo*)									
Eggs	x	x	x		x	x	x	x	x
Pre-Recruits	x	x	x	x					
Recruits	x	x	x	x	x	x	x	x	x
Ocean Quahogs									
Juveniles		x	x			x			x
Adults		x	x			x			x
Scup									
Eggs	x	x							
Larvae	x	x							
Juveniles	x	x	x		x	x	x	x	x
Adults	x	x	x		x	x			
Spiny Dogfish									
Juveniles		x	x	x	x				
Sub-Adults		x	x	x	x				
Adults		x	x	x	x				
Summer Flounder									
Eggs		x	x	x					
Larvae	x	x	x	x					
Juveniles	x	x	x		x	x	x		x
Adults	x	x	x		x	x	x		x
HAPC	x						x		
Atlantic Surfclams									
Juveniles		x	x			x			x
Adults		x	x			x			x
Golden Tilefish									
Eggs			x	x					
Larvae			x	x					
Juveniles			x		x	x		x	x
Adults			x		x	x		x	x
HAPC			x			x		x	x

IV. Indirect Impacts

In addition to the habitat impacts described above, offshore wind development may result in indirect impacts, such as potentially excluding fishing vessels and shifting fishing effort away from wind farms, introducing potential hazards to navigation, and increasing mortality of seabirds through collisions with turbines. Offshore wind may also have impacts on the survival and productivity of marine species over various timeframes. Construction activities may cause temporary, site-specific impacts on fish and marine mammal species, depending on the specific number and configuration of turbines and transmission cables. Other impacts from operation and transmission activities are likely to occur over the life of a wind farm, such as:

a) Underwater Sound

Pile driving hammers emit harmful sound waves that create concussive forces and cause pressure changes that can temporarily or permanently damage hearing organs and cause disorientation. These sounds can alter feeding and migration behaviors and reduce hearing, communication and echolocation effectiveness in marine mammals and fish. Persistent sound from spinning turbines over the lifespan of a wind farm can also deter or attract some species. For example, salmon and cod are capable of detecting sound generated by operating wind turbines from several miles away, which could lead to long-term avoidance of those areas.

b) Electromagnetic Fields

Transmission cables bearing high-voltage electricity loads create electromagnetic fields around them. Electromagnetic fields can be detected by anadromous and elasmobranch species such as salmon and sharks, and may potentially alter their distribution, behavior, feeding and migration, potentially changing community dynamics near wind farms.

c) Artificial Habitat Creation

Piles, scour preventing structures, and floating turbines can create artificial habitat or act as Fish Aggregating Devices (FADs) throughout the water column. The introduction of new habitat may be beneficial to fish species, though it is not known if they increase local fish production or simply act as an aggregation point for existing fish. The attraction or avoidance caused by offshore wind infrastructure may also alter predator-prey relationships, disrupt species dominance, and modify local mortality rates by supplying ambush sites for predators and refuge for prey. The presence of this infrastructure can also impede migratory pathways for many species of marine mammals, fish, and invertebrates over a portion of the ocean.

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Wind Energy – Draft Council Policy

1. Wind facilities siting and activities should minimize conflicts with other users groups including recreational and commercial fisheries.

2. Project developers should engage/work early with the Council and other site user groups to address access issues (e.g., project/operations exclusion zones), such as maritime passage, fishing, and other associated hazards (e.g., homeland security).

3. Transmission cables should not be placed through sensitive fish habitat such as shellfish beds, fish spawning and/or nursery habitat areas, submerged aquatic vegetation (SAV), or hard/structured habitat.

4. The Council recommends best available technology to install transmission cables to reduce potential impacts. This may include horizontal directional drilling to avoid impacts to sensitive habitats (e.g., salt marshes and intertidal mudflats).

5. Transmission cables should be buried to an adequate depth to reduce conflicts with other ocean uses including fishing. Cables should be:

    a. Monitored after installation to ensure bathymetry is restored, and after large storm/meteorological events to ensure cables remain buried.

6. Project proposals should evaluate the expected impacts from scour and sedimentation beyond the footprint of the wind facilities. These should consider changes in currents. These scour impacts should be minimized to the extent possible.

7. Make contingency plans and response equipment available to respond to spills associated with wind service platforms.

8. Impacts to aquatic species from the persistent electromagnetic fields around transmission cables are not well studied at this time. Future work and monitoring on this subject is warranted.

9. Short-term and long term impacts from sound during surveys, construction (e.g., pile driving, hammers) and operations (e.g., spinning turbines) on the environment/ecosystem should be evaluated and minimized.

10. If safe fishing operations are to be conducted in areas where wind farms may disrupt radar operation, it is essential that either adequate mitigation solutions be found or projects be modified to reduce its impact on radar technology.

Additional information on wind best management practices can be found in: MAFMC, 2014. Proceedings from a workshop on Offshore Wind Best Management Practices. 16 p. Available from: Mid-Atlantic Fishery Management Council, 800 North State Street, Suite 201, Dover, DE 19901, or online at http://www.mafmc.org

Mid-Atlantic Managed Species with at least 1 Life Stage with the Potential to be Adversely Impacted by LNG Development and Operations

Atlantic mackerel
Black sea bass
Atlantic bluefish
Butterfish
Shortfin squid (*Illex*)
Longfin squid (*Loligo*)
Ocean quahogs
Scup
Spiny dogfish
Summer flounder
Atlantic surfclams

With their strong dependence on soft bottom substrates, ocean quahogs and Atlantic surfclams may be particularly vulnerable to impacts from offshore wind development. If transmission cables are routed through estuarine habitats, additional species may be impacted considering the sensitivity and importance of that habitat to early life stages of many stocks. Golden tilefish are the only MAFMC managed species not likely to be impacted directly by wind development activities due to their reliance on very deep, offshore habitats.

Offshore Oil
Anthropogenic Activity Background Document

I. Activity Overview

Offshore oil development is a multi-phase process that includes exploration, construction, extraction, transmission, and decommissioning over the lifetime of a project. Oil exploration begins with conducting surveys and completing exploratory drilling to locate oil reserves trapped in subsea sediments on the continental shelf. Once surveys are completed and oil is located, specialized drilling vessels and equipment are used to drill through sediments below the seafloor to release and extract the target crude oil and associated liquid hydrocarbons from undersea reservoirs. A platform and associated production infrastructure, collectively called a "rig," is then installed on the surface of the ocean by barges to replace the drilling infrastructure. The platform houses the crew, machinery, and facilities used to pump the crude oil to the surface through pipes for separation, cleaning, and storage. Once separated from other materials, crude oil is pumped onshore to refinery or distribution facilities through pipelines buried on the seafloor. After wells stop producing oil, the rigs and pipelines are decommissioned and removed piece by piece for onshore disposal. Some decommissioned rigs can be used as artificial reef habitat under "rigs to reefs" programs administered by coastal states. The U.S. Department of the Interior's Bureau of Ocean Energy Management (BOEM) utilizes a five-year planning framework to identify potential drilling sites. BOEM then implements a multi-stage parcel leasing and environmental review process that regulates oil exploration and production activities in designated areas on the continental shelf.

The development and extraction of offshore oil is complex. This document is organized around activity subsections to facilitate an exploration of the habitat impacts associated with each phase of this process, and identify the risks and unintended consequences of oil development. The four subsections include: 1) surveying and exploration, 2) drilling, construction and extraction, 3) decommissioning; and 4) oil spills.

1. <u>Surveying and Exploration</u>
Producers use seismic and acoustic surveying equipment such as air guns towed behind vessels to locate oil reserves by refracting sound waves off of the seafloor. Remote sensing technologies that use underwater imaging can also help producers locate subsurface fractures in rock that may contain oil reserves. These survey techniques may require placing sensors on the seafloor to provide additional geological information on sediment composition and density before drilling begins. These activities have the potential to impact marine species and habitats with underwater sound and direct contact with the seafloor.

2. <u>Drilling, Construction and Extraction</u>
a) Exploratory and Production Drilling
Once surveys are completed, specialized drilling equipment is used to drill exploratory wells and sediment cores to determine the specific composition of the hydrocarbons under the seafloor. Special drill ships, semi-submersible vessels, or "jackup rigs," can all be used to drill wells over

10,000 feet deep. Jackup rigs are the most commonly used drilling vessels and must be towed by barges or tugboats to a drill site. These rigs use extendable legs that rest on the seafloor to prop the rig up above the surface of the ocean. To begin drilling, vessels lower slender sections of steel pipe with an attached drill bit, called a “drill string,” through their hulls until the drill bit contacts the seafloor. A drilling collar allows the rig to drill at all angles from the vessel through a process known as directional drilling; this technology allows a single drill rig to tap several lateral reserves, and can avoid the need to drill through sensitive habitats.

Steel pipe casings are placed around the drill string to protect it from damage and leaks during operation. As the drill bit rotates and bores into sediments, lubricating and cooling fluids known as “drilling muds” circulate through the casings to keep the drill bit functioning properly in the borehole. Drilling muds can be water-based, oil-based, or entirely synthetic and may incorporate chemicals such as hydrocarbons. As the drilling depth increases, metal casings are placed just below the seafloor and filled with concrete to help stabilize the borehole. These casings also keep unwanted natural gas, hydrocarbons, and hot, saline, metal-filled seawater mixtures called “produced waters” trapped in subsea sediments from flowing through the casings back to the surface. The drilling muds, crushed rock cuttings created during drilling, and produced waters are pumped to the surface for cleaning and then re-circulated back to the drill bit in a continuous cycle. Eventually, these drilling fluids and cuttings must be cleaned and discarded. The U.S. Environmental Protection Agency (EPA) regulates the discharge of these materials from casings in a process known as “shunting.” Under Clean Water Act regulations, the EPA typically requires producers to clean and dispose of the slurry of fluids and cuttings onshore, or to pump them back into subsea sediments to avoid dispersion in the water column and prevent the release of toxins that may occur if discarded at the surface platform. Occasionally, drilling gear may contact natural fractures or create new ones in rock formations. These events, called “frac-outs,” can potentially release drilling muds, produced waters, and hydrocarbons from subsea reservoirs, which can reduce water quality and introduce toxins into surrounding waters.

After drilling is completed, another casing pipe incorporating several pressure release valves is lowered down into the well to allow the oil to flow to the surface platform. The drill string is then retrieved by the jackup rig and disassembled for future use. A large metal “blowout preventer” is installed on the casing just below the surface platform to control natural pressure releases that may occur during normal operations. In the event of large, uncontrollable pressure releases called “blowouts,” rams on the blowout preventer can sever the pipe casing shut to prevent large-scale oil releases and explosions.

b) Platform and Pipeline Installation

After the drill rig retrieves the drill string, the rig is towed away by barges and replaced with a production platform. While there are many designs for semi-submersible and floating platforms, most platforms are attached to the seafloor by steel-coated piles and anchored cable systems. Production platforms can be quite large to provide space for maintenance machinery, oil-processing equipment, living quarters for a small permanent crew, and other resources. They are built onshore as modules and barged to the site; this modular structure also allows for easy disassembly at the end of the project's lifespan.

Pipelines must be installed to connect the platform to onshore infrastructure, including refineries and distribution networks. The pipes can measure up to five feet in diameter and must be buried at least three feet below the seafloor or covered with three feet of rock when sited in water less than 200 feet deep. Where pipelines approach nearshore navigation corridors, they must be buried at least ten feet deep according to U.S. Army Corps of Engineers (Corps) permitting regulations. Installing pipes from the project site to shore can potentially have a very large footprint on the seafloor, and cause significant benthic impacts depending on the installation methods used.

Trench excavation methods for burying pipelines include mechanical plowing, pressurized hydraulic jetting, and dredging techniques. Where hard-bottom substrates obstruct pipeline pathways, explosives may be used to clear a path, which can cause significant damage to benthic habitats. Once laid on the seafloor, pipes are flushed with pressurized liquids that may contain biocides and other chemicals to test for leaks and durability in a process known as hydrostatic pressure testing. The construction vessels and excavation equipment required to lay pipelines can necessitate construction corridors up to a half-mile wide. During the consultation process, National Oceanic and Atmospheric Administration (NOAA) Fisheries Habitat Conservation Division staff provide input on pipeline siting, excavation, and installation methods to avoid impacts to sensitive benthic habitats resulting from these activities.

c) Operations

Once pipelines are in place, production begins when a series of small explosive charges are set off at the base of the well to allow oil to flow to the surface platform. The platform separates target crude oil from other compounds like natural gas and seawater, and then transfers oil into pipelines to be transported to shore for distribution. To support ongoing oil production, supply vessels routinely ferry crew and supplies back and forth from shore. Over the decades-long lifespan of a rig, chemicals and debris from operation, maintenance, and repair activities can be released into surrounding waters. This can impact water quality and result in the accumulation of toxins such as hydrocarbons in substrates.

3. <u>Decommissioning</u>

BOEM requires that within five years of ceasing production, rigs and all associated infrastructure be removed and the site be restored to pre-project conditions. This breakdown and cleanup process uses large construction barges and cranes to plug the well with cement and collect piles and rig components for onshore disposal under EPA rules. Abrasive cutting tools and explosives can be used to remove piles, pipes and the structure of the well at least fifteen feet below the seafloor. The tanks, platform processing equipment, and pipelines must all be flushed to remove oil and chemical residue, and all rig structure must be cleaned of any growth. After decommissioning is complete, pipelines may be left in place as long as they will not interfere with navigation or fishing operations in the future.

Decommissioned rigs may be disassembled, salvaged, and disposed of onshore. Rigs may be sunk in place, or a portion of the rig structure may be severed to leave 85 feet of clearance for vessels. Explosives may be used to sever rig legs from the seafloor when abrasive or other mechanical means are not feasible. Once all project-related structure is removed, producers employ bottom trawls to remove any debris lost overboard during operations. Surveys and diver or Remotely Operated Vehicle (ROV) verification are required to ensure proper cleaning and removal of any hazards to navigation. Through "rigs to reefs" partnership programs, some of the rig structures such as rig legs and piles may be used to create artificial habitat for fish and other species. Most rigs decommissioned for this purpose are moved to designated artificial reefing sites in state waters, though rig operators and owners may also work with state and other partners to leave rigs at the project site.

4. Oil Spills

Oil spills have the potential to severely impact all habitat types and species across ecosystems. Oil can be accidentally leaked or spilled during any stage of exploration, construction, production, shipping, or decommissioning activities. Spills can range in volume from small operational discharges of produced waters to major disasters such as the *Deepwater Horizon* blowout that spilled millions of barrels of crude oil into the Gulf of Mexico. Crude oil and its associated hydrocarbons can move great distances after a spill, reduce water and habitat quality across all depths and distances from shore, and may be toxic to all living organisms that come in contact with it. While unlikely, large spills have the potential to cause the most widespread and lasting impacts on habitat from oil development activities (see Oil Spill Appendix).

Activity in the Mid-Atlantic Region

Under BOEM's five-year planning and leasing framework, no offshore oil exploration or development is planned in the Mid-Atlantic region through 2017. However, with its large population centers, existing infrastructure for shipping, processing, and refining crude oil, and political movement to expand domestic production, oil development is likely in the region's future. The Mid-Atlantic Regional Planning Board coordinates energy-leasing activities in the region along with the U.S. Department of Interior and states, and may recommend sites for leasing during the 2017-2022 planning cycle.

II. Habitat Impacts of Oil Development by Habitat Type

While the activity is generally known as "offshore" oil development, it can occur in both nearshore and offshore waters and impact all habitat types. Impacts from drilling, pipeline-associated activities, and decommissioning are generally localized and primarily impact benthic substrates. However, given the scope of activities and phases involved, the ability to extract and pipe oil far from shore, and the long duration of operations, offshore oil development may result in a very large footprint of impact. The total footprint of impact is related to the different temporal and spatial natures of each phase of offshore oil development and extraction. For example, surveying may occur for a short time over a large area, while drilling and extraction may extend over a long period of time over a small area. While rare, oil spills have the greatest potential to cause significant impacts across all habitat types and impacts may persist over long timeframes (see Oil Spill Appendix). The following analysis considers all potential habitat impacts of offshore oil development and does not assess the likelihood of oil development in state and federal waters.

Distribution (Nearshore (Including Estuarine)/Offshore)

a) Nearshore
All habitat types in nearshore waters have the potential to be impacted by oil development. Construction and drilling activities such as driving piles with vibrating or percussive hammers, anchoring platforms, and extending the legs of jackup rigs all have the potential to crush, bury, or disturb benthic habitats in nearshore waters. Construction barges and drilling vessels may sweep anchors and cables along the seafloor across wide areas and cause similar impacts, though to a lesser extent. Excavating and burying pipelines can remove and convert nearshore habitats. Even when platforms are sited far offshore, pipelines must still be routed through nearshore areas. Explosives may be used to permanently remove hard substrates in the path of pipelines, and can cause significant damage to benthic habitats. In nearshore, shallow waters, pipeline-associated activities can exacerbate shoreline erosion, cause steep cliffs of sediment called escarpments to form, and increase sedimentation, altering nearshore communities (see Indirect Impacts). Shunting produced waters, drilling muds, and cuttings on the seafloor can also result in the accumulation and alteration of benthic substrates. All of these activities may increase sedimentation and turbidity, and may resuspend contaminated sediments and toxins that can reduce water quality and impact species that rely on nearshore habitats.

Rig decommissioning activities can cause impacts by disturbing the habitats near rigs, platforms, and pipelines. Moving and sinking rigs to serve as artificial habitat can alter benthic habitat and impact species behavior (see Indirect Impacts). In the event of a spill, waves, wind, currents, and tidal action tend to transport and accumulate spilled oil nearshore. These forces drive oil into interstitial spaces between sediment on beaches and tidal areas, which can cause significant water quality impacts and expose coastal vegetation and the many life stages of species that rely on these areas for habitat to toxins. Over the long term, oil accumulation may decrease coastal vegetation and habitability of sediments in shallow, nearshore waters (see Oil Spill Appendix).

Estuarine
Trenching for pipelines in estuarine habitat can cause marshes to drain more rapidly during low tides or periods of low precipitation, and interrupt freshwater and littoral sediment inflow. Altering these processes can allow increased saltwater intrusion in low salinity areas at high tides, killing saltwater-intolerant plants and submerged aquatic vegetation (SAV). These activities may also cause soil erosion, sedimentation, and increased turbidity. Resuspended contaminated sediments cannot disperse in estuaries due to their tidal influence and low water volumes. The presence of pipelines in estuaries may disrupt current flow, lead to adjacent scour and erosion, and cause escarpments to form on coastal dunes or marshes. These alterations

can lead to mortality and reduced productivity of coastal vegetation and fragmentation of coastal wetlands.

If oil exploration activities occur nearshore, shunting produced waters and drilling muds near estuaries has the potential to reduce water quality through the introduction of toxins and disruption of salinity gradients, which can reduce habitat suitability for eggs, larvae, and juvenile fish and shellfish. Given the enclosed nature of estuaries, spilled oil can accumulate and persist over long timeframes, which can cause SAV die-offs and long term exposure of resident organisms to toxins. During cleanup activities, trampling and cutting salt marshes can have long-lasting impacts on estuarine habitat productivity.

b) Offshore
Oil development projects sited far from shore can result in the same impacts associated with drilling, platform construction, laying pipelines, and decommissioning as described above. The further from shore a project is sited, the more pipeline must be laid in offshore benthic habitats. Wind and currents can transport spilled oil far offshore after a spill, potentially reducing offshore water quality and impacting marine communities over a large area of the ocean (see Indirect Impacts).

<u>Depth (Pelagic/Demersal/Benthic)</u>

a) Pelagic
Under some circumstances, drilling muds and produced waters can be shunted at the surface near the production platform rather than in sediments below the seafloor. This can reduce pelagic water quality by releasing toxins and increasing the dispersion area of contaminated materials throughout the water column. Chemicals (e.g. biocides) that leach from piles and other in-water structures may also reduce pelagic water quality and introduce toxins. Conducting seismic and acoustic surveys, drilling, driving piles, using explosives, and decommissioning activities emit sound waves that can travel long distances in pelagic waters and cause direct mortality or behavioral changes in marine species (see Indirect Impacts).

b) Demersal
Drilling, construction, and decommissioning activities near the seafloor can disturb and resuspend sediments, causing increased turbidity and sedimentation in demersal waters. Shunted fluids, cuttings, and suspended contaminated sediments near the seafloor may reduce water quality by releasing metals, pesticides, chemicals, and other toxins such as hydrocarbons into surrounding waters, altering habitat suitability and potentially causing lethal and sublethal impacts on demersal and benthic organisms (see Indirect Impacts).

c) Benthic
Drilling, construction, pipeline installation, and decommissioning activities physically contact the seafloor and can directly destroy benthic habitats. Drilling, driving piles, and excavating trenches for pipelines can crush, remove, bury, or convert benthic habitats and suspend sediments. The suspension of sediments can increase turbidity, which causes sedimentation,

alters existing substrates, and can expose new substrates with different chemical and physical properties. Suspended contaminated sediments eventually accumulate on the seafloor, reducing benthic habitat quality and potentially impacting organisms that live or feed there (see Indirect Impacts). The legs of rigs and piles may also disrupt currents and cause scour, which removes and exposes benthic sediments, alters habitat complexity, and can change species behavior (see Indirect Impacts). Excavating sediments to lay and bury pipelines can reduce benthic habitat suitability and complexity by altering seafloor contours and smoothing depressions and mounds; these activities can have a large footprint of benthic impact. When buried improperly, in nearshore substrates, or adjacent to undersea cliffs, pipelines have the potential to cause scour and may lead to formation of escarpments, leading to erosion and long-term sedimentation.

During decommissioning, barge anchors, explosives, and mechanical cutting tools can also directly destroy, remove, alter or suspend unconsolidated benthic sediments. Trawling the project area after decommissioning may damage or alter benthic substrates, and impact benthic species survival and behavior (see Indirect Impacts). In the event of a spill, oil and its associated hydrocarbons stick to sediments suspended in the water column, causing them to sink and eventually settle to the seafloor through the process known as adsorption. As a result, oil accumulates in benthic sediments, introducing toxins and reducing the suitability of substrate for growth of aquatic vegetation and causing lethal and sublethal impacts to organisms feeding or living on the seafloor (see Indirect Impacts).

Benthic Substrate (Submerged Aquatic Vegetation/Structured/Soft)

a) Submerged Aquatic Vegetation
Depending on project siting, construction and pipeline-associated activities can disturb the seafloor, erode and suspend sediments and contaminants, and cause scour, which increases turbidity and sedimentation. The resulting turbidity can bury or smother SAV, cause siltation, and reduce sunlight penetration, which decreases survival and productivity of SAV habitats and can exacerbate shoreline erosion. Suspended contaminated sediments may resettle on benthic substrates where SAV grows, reducing habitat quality and potential growth in the future. SAV is particularly at risk to impacts from exposure to toxins in oil. In the event of a spill, oil tends to accumulate in shallow, nearshore waters where SAV grows, and can cause die-offs or permanently impair growth if the spill occurs during spring growing seasons (see Oil Spill Appendix).

b) Structured
It is unlikely that drilling and rig construction activities will occur in areas with structured habitats such as shell beds, gravel, or other hard-bottom substrates. If projects are sited in or near these areas in the future, benthic impacts can be expected as described above. Structured habitats, however, may be subject to significant impacts from the use of explosives to remove hard bottom barriers in the path of pipelines and from barge anchors sliding on the seafloor. These activities can permanently remove and alter structured habitat and reduce sources of habitat complexity such as boulder or cobble mounds.

c) Soft
Construction and decommissioning activities are likely to occur on soft-bottom substrates like mud, clay, and silt, which are susceptible to disturbance and resuspension. These processes can remove, convert, bury, or expose substrates and increase turbidity, causing sedimentation and siltation. Turbidity can pose additional problems during an oil spill. Oil adsorption is particularly likely on suspended clay due to its physical and chemical properties, which can expose benthic organisms contacting or feeding in these soft substrates to toxins and cause contamination over decades (see Indirect Impacts).

III. Potential Impacts of Offshore Oil to MAFMC Managed Stocks

Considering all potential configurations and siting options for hypothetical offshore oil developments in the Mid-Atlantic, each habitat used by Mid-Atlantic Fishery Management Council (MAFMC) species could be impacted to some extent. Given the necessity of laying pipelines to connect rigs with onshore infrastructure, nearshore habitats will be impacted regardless of where rigs are sited. Impacts from construction, extraction, and decommissioning activities are most likely benthic or demersal in nature. SAV and estuarine habitats are particularly vulnerable to these impacts, and may incur significant impacts if pipelines are laid in these areas. Oil spills have the potential to severely impact all habitats across timescales of decades.

The following table lists the habitat types designated as Essential Fish Habitat (EFH) and Habitat Areas of Particular Concern (HAPC) for the different life stages of MAFMC managed species (see *Impacts to Fish Habitat from Anthropogenic Activities: Introduction and Methods*). Cells highlighted in orange indicate an overlay between the habitat used and the potential for the habitat type to be adversely impacted by offshore oil activities; cells highlighted in yellow indicate a lower potential for adverse impacts.

If oil exploration and development projects are permitted in the Mid-Atlantic region, federally managed species that depend on nearshore, benthic habitats during at least one life stage have the most potential to be impacted. Should pipelines be routed through sensitive estuarine habitats, additional species may be impacted due to their importance to early life stages of many stocks. Golden tilefish eggs and larvae and shortfin squid (*Illex*) eggs and pre-recruits are the only MAFMC managed species not likely to be impacted directly by offshore oil development activities and regular operations due to their reliance on offshore, pelagic habitats. However, in the event of an oil spill, every life stage of each MAFMC species has the potential to be significantly impacted through direct mortality, reductions in water quality, and disruption of food chains and ecological functions by exposure to toxins (see Oil Spill Appendix).

Visual Overlay of Potential Impacts from Offshore Oil and MAFMC Species' EFH/HAPC

Legend

Orange = potential for adverse impacts

Yellow = low potential for adverse impacts

Green = no potential for adverse impacts

MAFMC Species	Distribution: Estuary	Distribution: Nearshore (state waters)	Distribution: Offshore	Water Column: Pelagic (upper/mid/ entire column)	Water Column: Demersal (lower water column)	Water Column: Benthic (seafloor substrate)	Benthic Substrate/Structure: SAV	Benthic Substrate/Structure: Structured (e.g. shell, manmade)	Benthic Substrate/Structure: Soft (sand, silt)
Atlantic Mackerel									
Eggs	x	x	x	x					
Larvae	x	x	x	x					
Juveniles	x	x	x	x					
Adults	x	x	x	x					
Black Sea Bass									
Eggs	x	x	x	x					
Larvae	x	x	x	x	x	x		x	
Juveniles	x	x	x		x	x	x	x	x
Adults	x	x	x		x	x		x	x
Atlantic Bluefish									
Eggs		x	x	x					
Larvae		x	x	x					
Juveniles	x	x	x	x					
Adults	x	x	x	x					
Butterfish									
Eggs	x	x	x	x					
Larvae	x	x	x	x					
Juveniles	x	x	x	x					
Adults	x	x	x	x					
Shortfin Squid (*Illex*)									
Eggs			x	x					
Pre-Recruits			x	x					
Recruits		x	x	x					
Longfin Squid (*Loligo*)									
Eggs	x	x	x		x	x	x	x	x
Pre-Recruits	x	x	x	x					
Recruits	x	x	x	x	x	x	x	x	x
Ocean Quahogs									
Juveniles		x	x			x			x
Adults		x	x			x			x
Scup									
Eggs	x	x							
Larvae	x	x							
Juveniles	x	x	x		x	x	x	x	x
Adults	x	x	x		x	x			
Spiny Dogfish									
Juveniles		x	x	x	x				
Sub-Adults		x	x	x	x				
Adults		x	x	x	x				
Summer Flounder									
Eggs		x	x	x					
Larvae	x	x	x	x					
Juveniles	x	x	x		x	x	x		x
Adults	x	x	x		x	x	x		x
HAPC	x						x		
Atlantic Surfclams									
Juveniles		x	x			x			x
Adults		x	x			x			x
Golden Tilefish									
Eggs			x	x					
Larvae			x	x					
Juveniles			x		x	x		x	x
Adults			x		x	x		x	x
HAPC			x			x		x	x

IV. Indirect Impacts

In addition to the habitat impacts described above, exploration, drilling, construction, extraction, and transport activities associated with oil development may cause indirect and non-habitat impacts to the marine environment. While some impacts such as reduced water quality are likely temporary and occur mostly near rigs, impacts from oil spills can be widespread and last for decades. Oil development can cause significant impacts to species, such as complex changes to species behavior and responses to altered environments.

a) Underwater Sound

Air guns used in acoustic surveys, drilling wells, driving piles, and utilizing explosives to remove hard substrates can emit harmful sound waves and result in sudden changes in pressure. These sound and pressure changes can cause direct mortality, damage hearing and communication organs, and alter behaviors such as swimming, migration, and foraging in marine mammals and fish. Sound impacts are exacerbated among species that have swim bladders and those that are attracted to rigs. Sound waves can also travel great distances in water, and may reduce the communication and navigation effectiveness of marine mammals far from the source of the sound. Timing windows that restrict survey and construction activities may be implemented to mitigate these impacts.

b) Water Quality

Water quality can be impacted by discharging drilling muds and produced waters, releasing debris, waste, fuel and lubricants from production platforms and associated vessels, and leaching chemicals from in-water structures. Contaminants can disperse over wide areas up to 1,000 meters away from discharge sites and eventually accumulate in substrates and the tissue of marine species. This can cause direct mortality as well as physiological and behavioral changes in fish and invertebrates.

c) Species Behavior and Fitness

Oil development activities can impact species productivity and fitness through sedimentation, turbidity, and siltation. These mechanisms may suffocate and bury eggs with fine sediments, reduce growth and survival of fish and shellfish, disrupt migration and spawning effectiveness, impact physiological processes, and alter species behavior through attraction or avoidance. Activities associated with trenching and burying pipelines may reduce habitat complexity through smoothing, removing depressions and irregularities, and filling areas with sediment. These activities can also displace burrowing organisms, alter benthic species migrations, and disrupt community dynamics by changing available substrates.

d) Decommissioning and Artificial Habitat

The presence of underwater rig structures can have positive and negative impacts on marine species. Rigs and their associated infrastructure can introduce new structured habitat and create artificial reefs. While this may contribute to productivity, it can alter avoidance or attraction behaviors, provide ambush sites for predators and refuge structure for prey, and disrupt community dynamics by changing species dominance in an area. In addition, this infrastructure may impede and disrupt migratory pathways and alter behaviors such as feeding in marine mammals, fish, and invertebrates.

Each decommissioning option can destroy existing artificial habitat throughout the water column through destruction, removal, and alteration. Cleaning and trawling activities directly remove debris near project sites that may have become de facto artificial habitat during the lifespan of the rig. Decommissioning can also create new artificial habitat in rigs to reefs program areas that may be beneficial to some species over long timeframes; research is needed to understand if these projects increase local fish production or simply aggregate existing fish from nearby areas.

e) Spills

While unlikely, oil spills have the most potential of any aspect of offshore oil development to significantly impact MAFMC habitats and species. Oil may be spilled during any stage of the drilling and extraction process, such as during "frac-outs," blowouts or spills during shipping and may have significant, long-term impacts. Oil is highly toxic, carcinogenic, and mutagenic and is likely to cause lethal and sublethal impacts such as reduced fitness and physiological and behavioral changes in all species that come in contact with it such as seabirds, marine mammals, fish, invertebrates, and others (see Oil Spill Appendix).

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VI. Oil Spill Appendix

This appendix is intended to build on and capture additional insights from our research to help the MAFMC understand the specific mechanisms and threats to habitats and species that may result from oil spills. It supplements the basic habitat impacts description in the "Oil Spills" section of the document, explains sources of impacts, and puts boundaries on the wide range and severity of potential mechanisms and impacts a spill can have on the marine environment.

Sources

Oil leaks and spills can occur at any stage of the offshore oil development process. Spilled oil can enter marine waters after shipping accidents and collisions, pipeline leaks or ruptures, severe storm events, and blowouts at wells. While large blowouts and catastrophic shipping accidents have the potential to spill large volumes of oil, these events are rare. Over 90% of spilled oil by volume enters marine waters from small, daily operational discharges of produced waters, drilling muds, leaks in pipelines or tankers, and natural pressure releases at wells.

Spill Mechanics

Crude and refined oil is composed of many kinds of hydrocarbons with different chemical and physical properties that can be toxic to marine organisms, depending upon the pathway, severity, and duration of exposure. After a spill or leak, oil floats along the surface of the ocean and can be transported great distances by the forces of wind, waves, currents, and tides. Sunlight can multiply the toxicity of some light hydrocarbon compounds and increase their uptake into living organisms near the ocean's surface, such as plankton. This enhanced toxicity can disrupt ecosystem dynamics by directly impacting plankton at the base of the food chain.

Some oil compounds become more soluble in seawater over time through the degrading forces of waves and wind, and can become suspended and partially dissolve throughout the water column. As these water-oil globules dissolve, a portion of hydrocarbons are broken down by microbes, while the rest introduce toxins and reduce water quality that can impact the entire pelagic community. Wave and wind action over time also increase adsorption of oil onto suspended sediments in the surrounding water, causing it to sink and eventually settle on benthic substrates, contaminating them over decades. The more suspended sediments are present in the water column after a spill, the more oil can be transported to the seafloor and held on benthic sediments. Heavier hydrocarbon components of oil tend to sink more quickly and are lipophilic: they are readily incorporated into the fatty tissues of organisms feeding on and contacting the seafloor.

Water Quality Impacts

Oil and its associated hydrocarbons build up in benthic sediments and can reduce the suitability of habitat for organisms living or feeding near the seafloor, including living habitat (e.g. SAV). Contaminated sediments may also cause direct mortality and sublethal impacts such as reduced fitness in fish and invertebrates that come in contact with them, especially at early life stages.

Species Impacts

Exposure to hydrocarbons can have significant impacts on species ranging from direct mortality to disruption of physiology, metabolism, and feeding and reproduction behaviors. Oil components can be mutagenic, carcinogenic, or both to many species even at low levels of exposure. The wide range of likely sublethal impacts to species from exposure to toxins in hydrocarbons can include, but are not limited to: deformities in eggs and larvae, abnormalities such as altered organ development, diseases of the liver and spleen, altered skin pigmentation, impaired feeding, growth, reproductive efficiency, and recruitment, altered blood and hormone chemistry, increased susceptibility to diseases and infections, and altered behaviors such as lowered return rates of migratory species to spawning grounds and avoidance of areas. In addition, the lipophilic properties of hydrocarbon compounds can cause sublethal impacts such as altered fitness, physiology, and behavior in species and their predators.

Oil can impact all species that come in contact with it, especially seabirds, marine mammals, and fish because it sticks to feathers, skin, and scales easily, is very difficult to remove, and disrupts basic life functions such as respiration and feeding. Early life stages of species that are frequently found in estuaries and sheltered inshore waters are at especially high risk of incurring impacts from exposure to toxins in oil because it cannot disperse easily in enclosed areas. Generally, eggs and larvae are more susceptible to impacts from exposure to oil toxins than juveniles and adults. Eggs, larvae, and other plankton are generally vulnerable to oil impacts because they are often found in high concentrations, cannot actively relocate to avoid oiled areas, and oil absorbs quickly into their small bodies. Impacts to these life stages and plankton can disrupt the prey base of an ecosystem and flow up the food chain to alter pelagic communities and ecosystem dynamics beyond the area directly affected by oiling.

Cleanup Impacts

Impacts to habitats and species can be exacerbated by oil removal and cleanup activities. Oil can be removed from marine waters through burning or skimming activities on the ocean’s surface, dispersal with chemicals, scrubbing sediments using sorbents, direct removal by trenching, and natural degradation by microbes. Each of these options can have significant impacts on species and habitats. While the specific impacts of burning oil from the surface are unclear, chemical dispersants are known to reduce water quality and introduce toxins into living habitats such as SAV. They can cause similar impacts to species as oil itself, such as direct mortality, reduced fitness, survival, egg fertilization, and other sublethal impacts over long timeframes. Spill cleanup activities can suspend contaminated sediments and exacerbate the adsorption of oil and chemical dispersants, transporting more oil to benthic substrates where it is harder to remove. Spill cleanup activity in coastal areas can lead to trampling and cutting of salt marshes and nearshore vegetation, which can severely damage these habitats and lead to die-offs, sedimentation, and reduced productivity. Lastly, vessels involved in cleanup activities can discharge, spill, leak, or spread bilge water, collected hydrocarbons, and dispersants that increase organisms’ exposure to toxins and reduce water quality on a small scale.

Offshore Oil – Draft Council Policy

1. Offshore oil exploration and development is not consistent with our vision for sustainable fisheries.

2. Alternative energy is more consistent with the Council's visions for sustainable fisheries. [Not consensus: some advisors for and against this statement]

If offshore energy development moves forward:

3. Wind facilities siting and activities should minimize conflicts with other users groups including recreational and commercial fisheries. For recreational fisheries, this should include some coordination across regions to address Highly Migratory Species fishing tournaments.

4. Onshore facilities associated with exploration and production (e.g., pipelines, roads, bridges, and other structures) should not be constructed through sensitive fish habitat such as shellfish beds, fish spawning and/or nursery habitat areas, submerged aquatic vegetation (SAV), or hard/structured habitat.

5. The expansion of existing onshore oil/refining facilities and/or the shipping of oil into ports which already have been developed and have existing deep water facilities would decrease the need for additional dredging.

6. Use methods to transport oil and gas that eliminate the need for handling in sensitive fishery habitats.

7. Offshore oil development should not occur in sensitive areas and those already prohibited to fishing. This includes discrete canyon and broad areas on the Outer Continental Shelf identified for deep sea coral protection.

8. The Council supports the best commercially available technology to reduce potential impacts. This may include horizontal directional drilling to avoid impacts to sensitive habitats.

9. Monitoring and leak detection systems should be used at oil extraction, production, and transportation facilities, to prevent oil from entering the environment.

10. The disposal of chemicals/contaminants used in petroleum development should be rigorously regulated. Avoid the discharge of produced waters, drilling muds, and cuttings into the marine and estuarine environments. Re-inject produced waters into the oil formation, whenever possible, and develop a frack-out plan [what about capping of materials?].

11. The adverse impacts from discharges of chemicals, produced waters, drilling muds, and cuttings into the environment should be evaluated and prevented, including physical and chemical effects on pelagic and benthic species and communities.

12. Potential adverse impacts to marine resources from oil spill clean-up operations should be weighed against the anticipated adverse effects of the oil spill itself. The use of chemical dispersants in nearshore areas where sensitive habitats are present should be avoided.

13. Ensure oil production and transportation facilities have developed and implemented adequate oil spill response plans and protocols, which include the identification of sensitive marine habitats such as shellfish beds, fish spawning and/or nursery habitat areas, submerged aquatic vegetation (SAV), or hard/structured habitat, and approaches to track movement of spills.

14. Short-term and long term impacts from sound during exploration, construction, and operation on the environment/ecosystem (including marine mammals, sea turtles, fish populations, and associated fisheries) should be evaluated and minimized using time and area restrictions (see general policy comments).

Mid-Atlantic Managed Species with at least 1 Life Stage with the Potential to be Adversely Impacted by Offshore Oil Development and Operations

Atlantic mackerel
Black sea bass
Atlantic bluefish
Butterfish
Shortfin squid (Illex)
Longfin squid (Loligo)
Ocean quahogs
Scup
Spiny dogfish
Summer flounder
Atlantic surfclams
Golden tilefish

Council managed species that depend on nearshore, benthic habitats during at least one life stage have the most potential to be impacted. Should pipelines be routed through sensitive estuarine habitats, additional species may be impacted due to their importance to early life stages of many stocks. Golden tilefish eggs and larvae and shortfin squid (*Illex*) eggs and pre-recruits are the only MAFMC managed species not likely to be impacted directly by offshore oil development activities and regular operations due to their reliance on offshore, pelagic habitats. However, in the event of an oil spill, every life stage of each MAFMC species has the potential to be significantly impacted.

Marine Transport
Anthropogenic Activity Background Document

I. Activity Overview

To facilitate the use of marine waters for transport, fishing and recreation, coastal infrastructure is necessary to dock, receive and launch vessels and their associated goods and/or services. Ports and marinas are constructed and maintained along with nearshore shipping channels and harbors to facilitate access. The physical structures vary greatly in size and scale, from backyard docks used to launch personal vessels, to marinas that house many small boats or yachts, to commercial port facilities that accommodate large passenger and cargo vessels and facilitate the loading, unloading and storage of cargo. Similarly, harbors and shipping channels range in depth and breadth to accommodate the associated vessel traffic. Marine transport development activities will continue to grow in the future to keep up with the expansion of global trade and shipping needs.

<u>Construction and Maintenance of Ports and Marinas</u>
Depending on the size and function of the port or marina, the physical infrastructure may be affixed to the shore or seafloor, or float on the surface of the water. Larger structures are often constructed by driving piles into the seafloor to support the raised infrastructure. Over-water, floating structures, such as piers, barges, booms, rafts and mooring buoys have less direct contact with the seafloor, but may still contact benthic habitat through installed guide piles, anchors, and chains.

Port facilities, and to a lesser extent marinas, have often been constructed by filling wetlands or shallow water habitat to create upland areas for associated infrastructure. Bulkheads or seawalls can be constructed to contain the fill, provide a straight upland edge for wharf structures, and a platform for equipment operations and material transfer. In some cases, underwater explosives may be used in the construction of marine transport and hardening structures. The construction of associated onshore facilities, such as cargo handling and storage space, fueling areas, washing and repair facilities, and boat storage may also replace shoreline habitat with impervious surfaces. Marinas, mostly used for recreational boating, are smaller than ports and require less upland infrastructure. Once in place, ports and marinas require periodic maintenance that may involve applying sealants, removing algal buildup, and repairing damaged or weathered structures. The scale of the construction and maintenance activities depends on the size and types of vessels that are expected to use the port or marina.

In addition to ports and marinas, infrastructure is commonly constructed on private property to facilitate access and use of marine and coastal waterways, such as backyard docks and small vessel moorings. These projects have a smaller total footprint and fewer impacts to marine habitat than the commercial activates described above. However, the size and number of these small projects in a given area could potentially result in significant cumulative impacts that degrade coastal habitats.

Dredging of Harbors and Shipping Channels

Dredging is a major component of marine transport activities. To facilitate the construction of ports and marinas, nearshore areas may need to be dredged to create harbors that serve as turning basins, anchorages and berthing docks for different sizes and types of vessels. The dredging of sediments from intertidal and subtidal habitats is often necessary to create shipping channels that facilitate vessel traffic into and out of ports and marinas. Harbors and shipping channels also require routine dredging or "maintenance" dredging to remove accumulated sediments and maintain established depth and width profiles. Maintenance dredging occurs frequently, but "improvement" dredging, which creates new shipping channels or expands the operating profiles of existing channels, has increased along with the demand to accommodate larger capacity commercial cargo vessels.

Dredging uses hydraulic or mechanical equipment; the type of equipment used depends on the characteristics of the sediments to be removed and the type of sediment disposal required. Hydraulic dredging removes a slurry of water and sediment, which is pumped through a pipeline onto a barge or a hopper bin for off-site disposal, or directly to a confined disposal site onshore. Mechanical dredging uses a clamshell dredge, which is suspended from a crane, to grab and deposit the sediments onto a barge for transport. Depending on the chemical and biological profile of the sediments, the dredged material can be placed in confined disposal facilities, open-water disposal sites, or be used for secondary uses. Dredged materials can be repurposed to support a number of beneficial activities, such as restoring sensitive habitats and stabilizing eroded shorelines. The impacts to the environment from a navigational dredging project can have cumulative effects on benthic communities and are proportional to the location and scale of the activities, length of time it takes to complete the project, frequency of maintenance dredging, and resilience of the benthic habitat and associated communities.

Activity in the Mid-Atlantic Region

Marine transport infrastructure is well developed in the Mid-Atlantic region, and thus the majority of proposed marine transport projects are for maintenance dredging. As the Panama Canal expansion is underway, ports will need deeper shipping channels to accommodate larger vessels, improve efficiency, remain competitive, and expand or protect their market share. Projects for deepening and widening of existing ports are larger in scope than maintenance dredging. Port deepening projects have occurred or are underway in New York Harbor, the Delaware River, Baltimore, and Norfolk. National Oceanic and Atmospheric Administration (NOAA) Fisheries Habitat Conservation Division staff are involved during the consultation process for permitting marine transport activities. All types of marine transport projects go through a federal permitting process led by the U.S. Army Corps of Engineers (Corps), who has permitting authority for navigational improvements and construction in navigable waters and oversees dredged material placement. In addition to NOAA Fisheries Habitat Conservation Division staff, the Corps consults with other federal agencies such as the U.S. Environmental Protection Agency and the U.S. Fish and Wildlife Service as needed for project proposals. The permitting process can be quite complex depending on the size of the projects and the engagement of local governments and port authorities.

II. Habitat Impacts from Marine Transport by Habitat Type

Marine transport activities occur solely in nearshore waters, though they may impact a number of different habitat types. The severity of impact is proportional to the size and duration of construction, maintenance or dredging project. Of all the marine transport activities, dredging and filling are likely to cause the most significant impacts to marine habitat. While filling aquatic habitat with sediment is currently a less common practice, fill may be proposed to expand a port's upland area to gain additional storage space. Potential habitat impacts from marine transport activities are described below, organized by distribution and depth of habitat types.

Distribution (Nearshore (Including Estuarine)/Offshore)

a) Nearshore

The construction and maintenance activities that facilitate marine transport all occur in the nearshore environment, thus habitat impacts will be concentrated in the coastal zone. The construction, expansion and maintenance of ports and marinas and associated activities such as dredging, filling and shoreline hardening can result in direct habitat destruction and conversion, altered habitat function, increased sedimentation, and decreased water quality. Dredging in particular can result in disruptions to physical and biochemical habitat properties and reduce the suitability of benthic habitat. The scale and severity of habitat impacts depends on the size, type and configuration of the port or marina, the size and frequency of vessel traffic, the type of habitat on which they are sited, and the timing and frequency of dredging.

The construction and expansion of ports and marinas can result in direct habitat destruction or damage as a result of placing hardened support structures in the water, such as piles or concrete docks. Anchors and guide piles associated with floating structures may also damage nearshore benthic habitat, though to a lesser degree. Filling nearshore habitat to create uplands for port and marina facilities and hardening of adjacent shorelines with erosion control structures such as bulkheads, seawalls or jetties can also result in direct habitat loss, particularly of nearshore benthic habitats. Construction activities may resuspend sediments, including contaminated sediments, increase turbidity, and reduce localized water quality. If underwater explosives are used to construct bulkheads, seawalls and concrete docks, habitat destruction and suspension of sediments can be amplified. Explosives can also impact the survival and behavior of fish (see Indirect Impacts).

Once in place, marine transport infrastructure may continue to impact nearshore habitats. The presence of ports and marinas over the surface of the water can change light regimes of the habitats below, impacting primary production and the behavior of fish species (see Indirect Impacts). In-water structures and shoreline hardening structures can change tidal and current patterns, which may alter longshore sediment transport processes, nearshore beach building processes, and nearshore organism assemblages and their associated food webs. The presence of these structures in the water column can also create new habitat for sessile organisms and alter the surrounding benthic substrate (see Indirect Impacts).

Marine transport infrastructure and associated activities may have significant impacts on water quality. Contaminants such as oil, fuel, chemicals (e.g. paint and solvents), and metals (e.g. mercury and lead) can be released directly into the water during construction and maintenance activities and through incidental spills. Wooden piles and treated concrete can also leach chemicals into the water column and expose organisms to toxins (see Indirect Impacts). As a result of decreased tidal and current flows from in-water structures, contaminants may become trapped in nearshore waters and sediments, thus concentrating toxins, and creating areas of low dissolved oxygen and algal blooms (see Indirect Impacts). Shoreline hardening structures and associated shoreside development that often accompanies marine transport projects can increase the footprint of impervious surfaces and lead to more stormwater runoff. An increase in runoff can exacerbate water quality degradation through increasing suspended sediments and introducing land-based contaminants such as petroleum hydrocarbons, metals, pesticides and fertilizers into coastal waters.

The construction, expansion and maintenance of harbors and shipping channels can have significant and long-term impacts on the nearshore environment, particularly where frequent maintenance dredging is required. Both mechanical and hydraulic dredging may directly destroy, convert and disturb habitat, particularly in nearshore and estuarine areas. Through removing and displacing benthic substrates, sediments are suspended in the water, which can result in increased sedimentation, turbidity and resuspension of contaminants into the water column. Dredging may also alter the physical and biochemical properties of benthic habitat through changing depth profiles and current circulation patterns.

Estuarine

Marine transport activities can be particularly detrimental in estuarine areas. Direct habitat destruction and conversion from construction, maintenance, dredging and shoreline filling and hardening can eliminate critical intertidal and wetland habitats and the ecological functions they provide to many life stages of marine organisms. Impacts associated with sedimentation, siltation, turbidity and stormwater runoff can decrease the productivity of estuarine habitats and exacerbate water quality impacts.

b) Offshore
The habitat impacts from marine transport activities are concentrated in the nearshore environment, and are not expected to result in any impacts to offshore habitat.

<u>Depth (Pelagic/Demersal/Benthic)</u>

a) Pelagic
In-water structures such as piles may reduce water quality by impacting water circulation and leaching biocides and other chemicals. Large over water structures can cause pelagic shading, which affects fish behavior. Vertical structures may introduce habitat for new shellfish communities to develop (see Indirect Impacts). Though these impacts span the water column, they are likely to be concentrated in nearshore, pelagic waters.

b) Demersal
Construction and maintenance activities associated with marine transport, particularly dredging, can suspend sediments in the water column. The resulting sedimentation, siltation and turbidity can cause temporary physical and behavioral impacts to benthic species. The resuspension of contaminated sediments can also degrade benthic habitats and decrease the fitness of benthic organisms (see Indirect Impacts). If required, the use of underwater explosives may exacerbate the spatial extent and duration of these sediment impacts.

c) Benthic
The construction of ports, marinas and shoreline hardening structures can result in direct loss and conversion of benthic habitat. The placement of in-water structures such as piles, concrete docks, bulkheads, jetties and breakwaters can alter tidal and current patterns, thus impacting the distribution and flow of benthic sediments. These structures can hinder natural sediment transport, cause scour of surrounding sediment, or increase the suspension and resettlement of sediment. Benthic organisms may be buried or exposed as a result of these changes in sediment flows. Shellfish communities that settle on introduced structures such as piles can create shell deposits on the surrounding seafloor, changing the composition of the benthic substrate and shifting the benthic community structure to species associated with shell habitat.

Dredging can have significant detrimental impacts to benthic habitat, though the extent of damage depends on the type of benthic substrate, the frequency and scale of disturbance, and the ability of the affected habitat and associated species to recover. Through the physical removal and destruction of benthic substrate, dredging is likely to result in decreased biomass and species diversity (see Indirect Impacts). Dredging of shipping channels can change the physical contours and depth profile of the seafloor. Deepening channels can reduce light penetration and lower water temperatures, which may influence biochemical processes and reduce productivity. When channels become significantly deeper than surrounding areas, natural mixing can decrease, resulting in anoxic or hypoxic water conditions. Altered circulation patterns around dredging projects may change sediment composition from sand or shell substrate to fine particles. This shift may increase the suspension of sediments, reduce the viability of shellfish beds and aquatic vegetation, and negatively impact the survival of species during critical life stages (see Indirect Impacts).

Marine transport activities, particularly dredging of shipping channels, can suspend sediment in the water column. Reductions in pervious surfaces around marinas and ports can also increase stormwater runoff and the direct flow of silt and sediment into adjacent waterways. The resulting increase in sedimentation and siltation can bury benthic organisms, decrease the productivity of submerged vegetation and plankton, and change the structure and/or complexity of benthic habitat. Contaminants in suspended sediments and stormwater runoff can be toxic to benthic organisms and degrade the habitability of nearby areas (see Indirect Impacts).

Benthic Substrate (Submerged Aquatic Vegetation/Structured/Soft)

a) Submerged Aquatic Vegetation
Marine transport activities may directly replace submerged aquatic vegetation (SAV) habitat with hardened structures, or deepen areas to depths that have insufficient light to support SAV, resulting in a loss of the critical ecological functions this habitat provides. In addition to directly burying SAV beds, increased sedimentation, siltation and turbidity that result from construction and dredging can decrease primary productivity through reduced light penetration and reduce dissolved oxygen levels. The placement of structures over the water can also alter light regimes by casting shadows. Shading impacts are greatest directly below structures, but reductions in primary productivity can extend to nearby areas as shadows change from the presence and movement of vessels and docks. Development of shoreside infrastructure associated with marine transport may also increase stormwater runoff, exacerbating sedimentation and siltation impacts and causing eutrophication of SAV beds through nutrient loading.

b) Structured
Structured habitat is less likely to be impacted by marine transport activities since the majority of these activities are taking place in established ports or shipping channels, where structured habitat is not found. Marine transport activities in shipping channels may however affect nearby structured habitat by increased sedimentation burying or converting structured habitat as particles settle.

c) Soft
Marine transport activities, especially dredging, can cause damage to soft bottom habitats through the direct removal and relocation of sediment. Dredging in intertidal mud and sand flats can result in a loss of critical ecological function. Dredging may also change the flow of soft substrate, and alter the contours of soft benthic habitat. Altered circulation patterns may change the nature of soft bottom habitat from coarse sand to

finer particle sediments, which can affect benthic community composition. Finer, more organic particles are also more likely to bind with contaminants than coarse particles, which can leader to greater accumulation in sediments (see Indirect Impacts).

III. Potential Impacts of Marine Transport to MAFMC Managed Stocks

Depending on the scale, duration, location and specific activities involved, nearly all habitat types used by Mid-Atlantic Fishery Management Council (MAFMC) stocks have the potential to be impacted to some degree from marine transport projects. Given that most current projects are for maintenance dredging of ports and shipping channels, benthic habitats in nearshore or estuarine areas are most likely to be impacted. Marine transport activities occur strictly nearshore, and thus no impacts are expected to offshore habitats. Impacts to the pelagic environment are likely less destructive than those to benthic and demersal habitats due to the distribution of dredging impacts.

The following table lists the habitat types designated as Essential Fish Habitat (EFH) and Habitat Areas of Particular Concern (HAPC) for the different life stages of MAFMC managed stocks (see *Impacts to Fish Habitat from Anthropogenic Activities: Introduction and Methods*). Cells highlighted in orange indicate an overlay between the habitat type used and the potential for the habitat type to be adversely impacted by marine transport activities; cells highlighted in yellow indicate a lower potential for adverse impacts; cells highlighted in green are unlikely to be impacted.

Given the intersection of where marine transport activities occur and the dependence of MAFMC stocks on the nearshore environment, many MAFMC managed species may potentially be impacted. Benthic habitats used by some or all life stages of black sea bass, longfin squid (*Loligo*), ocean quahogs, scup, summer flounder, and Atlantic surfclams are more likely to be exposed to impacts from marine transport activities, especially dredging. Pelagic habitats, which are important for Atlantic mackerel, Atlantic bluefish, butterfish, and shortfin squid (*Illex*) recruits, are less likely to be impacted by marine transport activities. If marine transport activities take place in estuarine or SAV habitats, the impacts could be severe; they are important for the majority of MAFMC species and are designated as HAPC for summer flounder. Shortfin squid (*Illex*) (eggs and pre-recruits) and golden tilefish (all life stages) are the only MAFMC stocks that are not linked to the nearshore environment and do not have the potential to be impacted by these activities.

Visual Overlay of Potential Impacts from Marine Transport and MAFMC Species' EFH/HAPC

Legend
- **Orange** = potential for adverse impacts
- **Yellow** = low potential for adverse impacts
- **Green** = no potential for adverse impacts

MAFMC Species	Distribution			Water Column			Benthic Substrate/Structure		
	Estuary	Nearshore (state waters)	Offshore	Pelagic (upper/mid/ entire column)	Demersal (lower water column)	Benthic (seafloor substrate)	SAV	Structured (e.g. shell, manmade)	Soft (sand, silt)
Atlantic Mackerel									
Eggs	x	x	x	x					
Larvae	x	x	x	x					
Juveniles	x	x	x	x					
Adults	x	x	x	x					
Black Sea Bass									
Eggs	x	x	x	x					
Larvae	x	x	x	x	x	x		x	
Juveniles	x	x	x		x	x	x	x	x
Adults	x	x	x		x	x		x	x
Atlantic Bluefish									
Eggs		x	x	x					
Larvae		x	x	x					
Juveniles	x	x	x	x					
Adults	x	x	x	x					
Butterfish									
Eggs	x	x	x	x					
Larvae	x	x	x	x					
Juveniles	x	x	x	x					
Adults	x	x	x	x					
Shortfin Squid (*Illex*)									
Eggs			x	x					
Pre-Recruits			x	x					
Recruits		x	x	x					
Longfin Squid (*Loligo*)									
Eggs	x	x	x		x	x	x	x	x
Pre-Recruits	x	x	x	x					
Recruits	x	x	x	x	x	x	x	x	x
Ocean Quahogs									
Juveniles		x	x			x			x
Adults		x	x			x			x
Scup									
Eggs	x	x							
Larvae	x	x							
Juveniles	x	x	x		x	x	x	x	x
Adults	x	x	x		x	x			
Spiny Dogfish									
Juveniles		x	x	x	x				
Sub-Adults		x	x	x	x				
Adults		x	x	x	x				
Summer Flounder									
Eggs		x	x	x					
Larvae	x	x	x	x					
Juveniles	x	x	x		x	x	x		x
Adults	x	x	x		x	x	x		x
HAPC	x						x		
Atlantic Surfclams									
Juveniles		x	x			x			x
Adults		x	x			x			x
Golden Tilefish									
Eggs			x	x					
Larvae			x	x					
Juveniles			x		x	x		x	x
Adults			x		x	x		x	x
HAPC			x			x		x	x

IV. Indirect Impacts

In addition to the habitat impacts described above, activities associated with marine transport can have impacts on the survival and productivity of marine species.

a) Contaminants

The release of contaminants during port and marina construction and maintenance activities, suspension of contaminated sediments from dredging, increased stormwater runoff from impervious surfaces, and leaching from chemically treated wood piles and docks can expose marine species to toxins. Organisms can suffer from tissue damage, changes in hormone regulation, and disturbances to cellular and immune function if exposed to toxins. Chronic exposure to contaminants can cause bioaccumulation in fish species and relay impacts through food webs. Contaminants commonly released during port and marina activities include oil, fuel, chemicals (e.g. paint, detergents, and solvents), and metals (e.g. copper, zinc, arsenic, mercury, lead, nickel, and cadmium).

b) Benthic Community Structure

Changes in habitat caused by marine transport activities can alter the distribution of invertebrates and fish, expose or bury sessile organisms, and change predator-prey interactions. Changes in water quality and primary productivity can also alter plant and animal assemblages and shift nearshore food webs. Dredging can alter the physical and chemical properties of habitat, including sediment composition, and disrupt communities of native species. This may cause a shift in the types of benthic organisms that re-colonize dredged areas and could provide opportunities for invasive species to spread. In-water structures such as shoreline hardening structures, vertical piles, and docks may create artificial habitat for sessile organisms or cause shading underwater, which can alter nearby community structure and local productivity.

c) Survival and Productivity

Marine transport activities can impact the survival and productivity of marine species at the individual and stock level. Dredging activities are particularly harmful to marine species and can result in large reductions in benthic species diversity, the total number of individuals, and overall biomass. Eggs and larvae can be entrained and harmed in dredging equipment. Turbidity, sedimentation and siltation can reduce primary productivity and dissolved oxygen levels, thus reducing food availability and creating anoxic conditions. High levels of suspended sediment can also hinder the respiration of fish and invertebrates, diminish the effectiveness of sight feeders, and reduce the growth and survival of filter feeders. Light regimes changed by over-water structures may inhibit feeding, schooling and migratory behaviors that are driven by visual cues. Changes in sedimentation and current patterns can also have population level impacts by inhibiting the dispersal, settlement and recruitment of eggs and larvae, burying eggs, and impacting juvenile predation rates. If underwater explosives are used to construct port or marina infrastructure, the shock wave can directly impact fish behavior.

d) Invasive Species

Marine transport activities can introduce invasive species through the exchange of ballast water from large commercial vessels, and the presence of fouling organisms on vessel hulls. Invasive species can alter nearshore habitats and threaten the survival and productivity of native marine species.

V. References

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2. National Oceanic and Atmospheric Administration. 2008. "Impacts to Marine Fisheries Habitat from Nonfishing Activities in the Northeastern United States." NOAA Technical Memorandum NMFS-NE-209. 339p.
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4. Atlantic States Marine Fisheries Commission. 2013. "Harbor Deepening: Potential Habitat and Natural Resource Issues." 12p. Web: <http://www.asmfc.org/files/Meetings/Winter2013/ISFMPPolicyBoardSupplemental.pdf>. Accessed December 19, 2015.
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Marine Transport – Draft Council Policy

General

1. Dredging should be conducted only when necessary. Activities that would require dredging (e.g., piers and marinas) should be located in deep water or designed to alleviate the need for frequent maintenance dredging.

2. Identify sources of erosion in the watershed that may be contributing to excessive sedimentation. Implement appropriate management techniques to ensure that actions are taken to curtail those causes.

3. The expansion of existing ports which have already been developed and have existing deep water facilities would decrease the need for additional dredging.

4. Dredging should not be conducted through sensitive fish habitat such as shellfish beds and submerged aquatic vegetation (SAV). While major navigation channels in the Mid-Atlantic are unlikely to contain SAV, smaller channels and docks are of particular concern.

5. Avoid placing maritime infrastructure close to SAV, estuarine/salt marshes, shellfish beds, and other sensitive habitat areas.

6. Use seasonal restrictions and spatial buffers on dredging to limit negative impacts during fish spawning, egg development, young-of-year development, and migration periods, and to avoid secondary impacts to sensitive habitat areas such as SAV.

7. Use silt curtains to reduce impacts of suspended sediments on adjacent benthic resources.

8. Avoid dredging in fine sediments to reduce turbidity plumes and the release of nutrients and contaminants, which tend to bind to fine particles.

9. Consider using settling basins to act as sediment traps to prevent/slow sediment accretion in the navigational channel. This reduces the need for frequent maintenance dredging of the entire channel.

10. Consider the effects of increased boat traffic to an area when assessing a new dredging project or expanding existing channels. Increases in the size and scale of boat traffic may result in increased maintenance dredging and produce secondary impacts, such as shoreline erosion, sedimentation, and turbidity.

11. Guidelines or requirements (state/federal) for over water structures should be employed. The height, width, construction materials, and orientation of over-water structures can influence the shade footprint and result in shading impacts to SAV or alternation of the aquatic/benthic ecosystem. This footprint should be minimized.

12. Ensure that sediments are tested for contaminants and meet or exceed US EPA requirements and standards prior to dredging and disposal.

13. Consider beneficial uses for uncontaminated sediments when practicable and feasible. Priority should be given to beneficial uses of material that contributes to habitat restoration and enhancement, landscape ecology approaches, and includes pre- and post-disposal surveys.

14. Best management practices for ballast water exchange and/or treatment should be employed to reduce the risk of ecological impacts from invasive aquatic species.

Operation and Maintenance of Ports and Marinas

1. Ensure that a non-point source (NPS) pollution and stormwater management plan are integrated into the maintenance and operation of a port or marina. Management practices should be tailored to the specific issues of each port or marina.

2. Encourage marinas to participate in NOAA/US EPA's Coastal NPS Program and the Clean Marina Initiative. http://coast.noaa.gov/czm/pollutioncontrol/

3. Ensure gas production and transportation facilities have developed and implemented adequate gas spill response plans and protocols, which include the identification of sensitive marine habitats.

4. Promote the use of oil-absorbing materials in the bilge areas of all boats with inboard engines and proper disposal of materials produced and used by the operation, and maintenance of boats, to limit the entry of solid and contaminated waste into surface waters.

5. Recommend that facilities provide a containment and filtering/treatment system for vessel wash down wastewater.

6. Promote the use of pumpout facilities and restrooms at marinas and ports to reduce the release of sewage into surface waters.

7. Prevent the disposal of fish waste or other nutrient laden material in marina or port basins through the use of public education, signage, and by providing alternate fish waste management practices.

8. Encourage the removal of unnecessary impervious surfaces surrounding the port or marina facility, and maintain a buffer zone between the aquatic zone and upland facilities.

9. Ensure that facilities have designated/enclosed areas for boat maintenance activities (e.g., painting, engine repair) and provide for appropriate storage, transfer, containment, and disposal facilities for harmful liquid material (e.g., solvents, antifreeze, and paints), to prevent chemicals from reaching the aquatic zone.

10. Recommend the use of concrete, untreated wood, or steel dock materials to avoid the leaching of contaminants associated with wood preservatives.

11. Recommend anchoring techniques and mooring designs that avoid scouring the bottom habitat from anchor chains. For example, anchors that do not require chains (e.g., helical anchors) or moorings that use subsurface floats to prevent anchor chains from dragging the bottom are some designs that should be considered.

Mid-Atlantic Managed Species with at least 1 Life Stage with the Potential to be Adversely Impacted by Marine Transport Activities

Atlantic mackerel
Black sea bass
Atlantic bluefish
Butterfish
Shortfin squid (*Illex*)
Longfin squid (*Loligo*)
Ocean quahogs
Scup
Spiny dogfish
Summer flounder
Atlantic surfclams

Benthic habitats used by some or all life stages of black sea bass, longfin squid (*Loligo*), ocean quahogs, scup, summer flounder, and Atlantic surfclams are more likely to be exposed to impacts from marine transport activities, especially dredging. Pelagic habitats, which are important for Atlantic mackerel, Atlantic bluefish, butterfish, and shortfin squid (*Illex*) recruits, are less likely to be impacted by marine transport activities. If marine transport activities take place in estuarine or SAV habitats, the impacts could be severe; they are important for the majority of MAFMC species and are designated as HAPC for summer flounder. Shortfin squid (*Illex*) (eggs and pre-recruits) and golden tilefish (all life stages) are the only MAFMC stocks that are not linked to the nearshore environment and do not have the potential to be impacted by these activities.

Coastal Development
Anthropogenic Activity Background Document

I. Activity Overview

Coastal development encompasses a broad suite of activities that alter nearshore environments to accommodate a variety of human uses. These activities may be conducted to support trade and transport, such as dredging of shipping channels. They can also involve the expansion of shoreside infrastructure or residential and commercial development, such as filling wetlands and other nearshore habitats with fill materials such as crushed rock, sand, or soil, and grading to prepare and stabilize a site prior to construction. Other coastal development activities aim to buffer eroding shorelines and adjacent property through hardening with seawalls and jetties, or protect low-lying areas by constructing flood control structures. While the actual purpose of each particular activity may vary, coastal development activities generally involve removing or altering existing habitat and/or introducing new structures. These functional similarities result in similar impacts to habitat, and thus a number of activities are discussed within this document. To help illustrate the range of coastal development activities, four general categories are described below: 1) dredging and disposal, 2) sand mining and beach nourishment, 3) coastal infill, and 4) shoreline protection.

<u>1. Dredging and Disposal</u>

Dredging generally involves removing sediment from one area and moving it to another location. Dredging may be done to prepare an area for construction, but is most frequently conducted to support navigation. Navigational dredging occurs regularly in nearshore and estuarine waters to establish and maintain harbors, ports, marinas, and shipping channels to accommodate the ever-growing size of transport vessels. Once sediments are dredged from the seafloor, they are disposed of at confined disposal facilities, open-water sites, or used for secondary activities such as fill for construction activities, landfill cover, beach nourishment or habitat restoration. The extent of dredging and disposal activities depends on the amount of navigational dredging required to accommodate vessels that use or may use the harbor, port, or marina. Additionally, manmade residential lagoon communities require dredging to maintain access to individual homeowners docks. While individual dredging projects can be relatively small and localized, the combined footprint of dredging projects can be quite large: several hundred million cubic yards of sediment is dredged from navigation channels and ports annually to maintain and improve our nation's navigation system.

Navigational dredging is conducted to maintain or improve marine transport channels. Improvement dredging removes previously undisturbed sediments to create new navigation channels or increase the width, depth, and scope of channels. Maintenance dredging is more common, and is used to maintain the established profiles of existing channels by removing deposited sediments that accumulate over time. Both can be conducted using hydraulic or mechanical equipment, depending on the characteristics of the sediments and the type of disposal required. Hydraulic dredging, which is typically used for larger maintenance dredging projects, uses a hopper dredge or cutterhead pipeline dredge to remove loosely compacted materials from the seafloor by drawing the sediment through a pipeline onto a barge, hopper bin, or directly to another area. Mechanical dredging uses a clamshell or dipper dredge suspended from a crane to grab loose or hard, compacted materials off the seafloor and deposit the sediments onto a barge for transport. This technique is often used for smaller projects in confined areas, such as preparing a small site for construction. In addition to these two dredging methods, specialized equipment may also be used to remove storm debris from navigable waterways.

Once materials are dredged, they are transported to designated disposal areas by barges or pipelines. Depending on the grain size and contamination level of the dredged material, it can be disposed of in confined disposal facilities located on dry land or less commonly in open water sites. The selection of a disposal option balances environmental considerations, technical feasibility, and cost. Contaminated sediments must be treated, mixed with other materials, and disposed of in confined facilities. Non-contaminated sediments can be disposed at open-water sites and designated areas on the continental shelf that have historically been used for this purpose. Dredged materials may also be repurposed for secondary uses, such as creating or restoring wetlands, stabilizing eroding shorelines, or to serve as agricultural fertilizer, landfill cover, or construction materials (see Wetland and Estuarine Alteration Appendix).

2. Sand Mining and Beach Nourishment

Sand Mining

Sand mining uses hydraulic dredging techniques to collect sand deposits from the ocean floor. Mined sand is used for beach nourishment, pre-construction fill, as an ingredient in construction material such as concrete, and to protect sensitive habitats, such as nesting areas for sea turtles and birds. The vast majority of sand mined in U.S. waters is used to nourish eroded beaches. This activity often occurs on targeted sandy shoals and/or ridges in shallow nearshore waters, especially in navigation channels and existing mine sites historically used for this purpose. Dredging barges use hydraulic pressurized jets to fluidize sediments and draw them up a hose, like a vacuum, into large hoppers on their decks. The collected sand is then barged directly to shore or transported in pipelines.

Beach Nourishment

Beaches are dynamic interfaces of land and sea that provide recreation and tourism in coastal cities. To counter erosion and natural migration of sand, beach nourishment uses mined sand to replenish and provide protection to beaches and property from flood damage, storm surge, sea level rise, and other erosive forces. Sand that matches the grain size and properties of target beaches is dredged from specific mine sites on the seafloor, and is either placed directly on beaches or on offshore shoals for natural transport onto beaches by waves and currents. Typically, hydraulic dredging barges pump sand directly onto beach faces through flexible pipelines held on the seafloor by a pipe sled. Once ashore, bulldozers spread the sand to attain the desired slope and gradient and to create dunes on target beaches to protect coastal properties. The size of a nourishment project depends on the size of the beach, and can range from a few acres to hundreds of acres requiring over one million cubic yards of sediment.

Acceptable sand is sourced as close to shore as possible to reduce transportation and operation costs; therefore, beach nourishment activities mostly occur in shallow nearshore waters.

Beach nourishment is considered a “soft” shoreline armoring approach that protects beaches and landward property and provides larger, wider areas for increased recreation and tourism opportunities. This shoreline protection approach is generally less intensive and damaging to habitats and organisms than “hard” armoring techniques, such as installing seawalls. While intended to reduce erosion on dynamic coastlines, nourishment may actually exacerbate erosion if the grain size and composition of the nourishing sediments do not match those of the target beach. As a result, most nourished beaches must be nourished every few years or on a routine basis, locking the site into an ongoing, expensive cycle and exposing habitats to recurrent and cumulative impacts. Through state-federal cost sharing arrangements, the U.S. Army Corps of Engineers (Corps) commits to supporting and maintaining projects over 50-year timeframes.

3. Coastal Infill

Coastal development activities frequently require filling wetlands or shallow water habitat to create upland areas for residential and commercial development, and any associated infrastructure. However, most projects in the Mid-Atlantic are relatively small-scale and expand on current development, such as filling for utility lines, residential housing, roads, or commercial development. Before undertaking a new coastal development project, pre-construction preparation and stabilization work at the project site is often required, which may include repairing existing infrastructure such as docks and marinas, and employing shoreline hardening techniques. Typically, nearshore or estuarine areas are filled with hard substrates, shorelines may be graded to facilitate construction activities, or structures such as rebar or piles are installed to provide foundational support for coastal construction projects. For example, dredging out intertidal areas to clear sediment and riparian debris or filling portions of wetlands with layers of dirt and crushed rock may be necessary before road, dike, or bridge construction may begin in a coastal area. Hard structures such as concrete mattresses may also be installed to create a strong foundation before construction can begin. Shoreline hardening structures, such as bulkheads or seawalls, can also be constructed to contain fill and provide a straight upland edge for waterfront structures. These activities may all cause impacts to habitat and are considered a necessary component of many coastal development activities.

4. Shoreline Protection

Shoreline protection involves installing a variety of hardened structures at the land-sea interface to stabilize dynamic shorelines, prevent erosion, and provide buffers to protect shoreside property from flooding. Different structures serve different purposes, and can incorporate hard, structural stabilization components including concrete, wood and rock, soft components such as sediments and natural vegetation, or both. These armoring structures generally alter erosion and sediment deposition patterns, break waves or dissipate their energy, and reduce storm surge flood levels. The range of shoreline protection structures includes employing large “hard” structures such as seawalls and bulkheads, jetties, groins, or breakwaters, as well as “soft” structures such as sand, shellfish beds, and coastal vegetation (see Living Shorelines Appendix). Shoreline protection structures can also include flood control structures such as dikes, floodgates, and tide gates. Although shoreline protection structures destroy nearshore habitat, these structures can also create habitat for some species of fish and invertebrates.

Structural “hard” techniques are best suited for environments with large waves, a large fetch (the cross shore distance along open water over which wind blows to generate waves), steep slope and an open coast. Hardening structures such as bulkheads and seawalls, jetties and groins, revetments, and breakwaters are used to reduce wave, tide, and wind energy and erosion on shorelines. These structures can range in size from smaller bulkheads to protect personal property to larger projects such as seawalls that can be over 10 miles long. Construction of these structures typically involves large excavators, dump trucks, or barges to transport and install the hardening materials (stone, riprap, and wood).

Bulkheads, seawalls, and revetments are hard, vertical structures placed parallel to the shoreline that retain sediments and intercept wave energy. Bulkheads are usually made of wood, steel sheet piles, or concrete and are smaller than seawalls, which are typically concrete. These structures are designed to withstand the full force of waves and prevent storm surge flooding. Construction of both structures can require driving support piles or rebar into the seafloor and possibly dredging intertidal areas to clear out sediment and riparian debris. Revetments are made of layered rock or rock-like materials (i.e. riprap) placed over the seaward-facing slope of a shoreline. They are designed to break waves more gradually than bulkheads or seawalls and hold land and sediments behind the rocks in place.

Jetties and groins are structures designed to prevent beach erosion and break waves. They run perpendicular to the beach and extend out into the water, trapping sand on the updrift side and causing a loss of sediment on the downdrift side of the structure. Groins are smaller structures designed to stabilize sandy beaches, while jetties are larger structures built around tidal inlets to stabilize their location. Both jetties and groins are typically made of rock or concrete rubble, logs, or metal sheet piles placed on the seafloor near the beach or inlet.

In contrast, breakwaters are built in shallow water, parallel to the shoreline to break waves and reduce shoreline erosion. Breakwaters encourage sediment accretion behind the structure and also provide some storm surge flood level reduction. They can be constructed with poured concrete, wood, or rocks, and may be attached to the seafloor or shore. Living reefs, such as oysters or mussel beds, can also be incorporated into breakwaters in low wave energy environments. These “soft” shoreline protection approaches known as “living shorelines” retain some natural characteristics of existing nearshore habitat, and may incorporate native vegetation or sand to reduce coastal erosion (see Living Shorelines Appendix).

Selecting an erosion control strategy is site-dependent, and the best approach depends on existing conditions of the site, including the wave energy, bathymetry, fetch, composition of the adjacent shoreline, and purpose of the structure. Resiliency, effectiveness, and affordability also help determine an appropriate shoreline protection approach. Ironically, these structures can cause further erosion by starving downcurrent areas of sediment, increasing scour adjacent to hardening structures, and preventing natural migration of habitat. For example, coastal wetlands and beaches naturally migrate landward in response to sea level rise, but may be constrained by shoreline hardening activities.

Flood control structures are used predominantly in estuaries and constructed in low-lying, enclosed areas to direct water away from flood prone areas or prevent tidal and storm surge from flooding upland areas. Dikes are elevated earthen or concrete embankments constructed along tidally influenced channels in estuaries. Tide gates and floodgates are typically made of metal or wood and are mounted on dikes in front of a waterway to prevent upstream flooding of estuarine waters. Both types of flood control structures are adjustable and usually left open to avoid interfering with existing flows or species' migrations. Floodgates are larger than tide gates and they are usually closed before and during storms. Tide gates are typically used on smaller bodies of water and can be set to allow a certain amount of tidal flow or one-way movement of water out of an estuary. Ditches, or dug out canals, can also be used to divert water flow away from low-lying, flood prone areas. To achieve the desired flood protection, several structures are often used in combination.

Permitting

In general, the Corps plays the lead role in permitting the suite of coastal development activities discussed above, especially where dredging and filling are involved or activities take place near navigable waterways. The Corps typically works in coordination with the coastal state in which the activity is undertaken since many states have their own special rules governing development in wetlands and beach nourishment. Permitting for dredging requires additional coordination: the Corps permits dredging and disposal activities, while the U.S. Environmental Protection Agency (EPA) provides oversight and authorization for determining suitability of dredged sediments for specific disposal options. Together, they consult with the National Oceanic and Atmospheric Administration (NOAA) Fisheries Habitat Conservation Division staff and the U.S. Fish and Wildlife Service on siting dredging and disposal activities and any actions that involve the placement of structures or fill in navigable waterways. Construction or maintenance of shoreline and flood control structures requires specialized permits from the Corps and associated state. Large projects with the potential for significant impacts are permitted individually, while general permits are commonly used for projects with minimal adverse impacts. For sand mining and beach nourishment, the U.S. Department of the Interior's Bureau of Ocean Energy Management (BOEM) is tasked with setting and implementing regulations to oversee sand mining in federal waters, and utilizes a comprehensive sand source evaluation program in partnership with states.

Activity in the Mid-Atlantic Region

The Mid-Atlantic is a densely populated region, and the demand for coastal development activities will continue to grow to keep pace with increasing inland development. These activities do not occur in isolation, but can comprise different aspects of a larger coastal development activity and occur simultaneously along the coastline. In addition, the effects of climate change, such as sea level rise and the potential for more frequent and intense storms, will likely increase utilization of the full suite of shoreline protection techniques in the Mid-Atlantic region. For example, a higher demand for shoreline protection structures has been seen following the event known as "Superstorm Sandy." With the expansion of existing infrastructure and construction of new shoreline protection structures, there is a corresponding increase in the need for filling nearshore areas. As property owners, cities, and states repair damaged hardening structures in the wake of the storm, they are generally trying to incorporate living shorelines and shoreline vegetation to buffer storm effects in the future (see Living Shorelines Appendix).

While beach nourishment has been common along the Atlantic coast since the 1960s, proposals for siting new sand mine sites offshore have been steadily increasing to keep up with the frequency and intensity of powerful eroding storms. Most Mid-Atlantic states have existing beach nourishment policies in place to regulate sand mining locations and operations. NOAA Fisheries Habitat Conservation Division staff are working with the Corps to help replenish eroded areas hard hit by Superstorm Sandy through beach nourishment, though suitable nearshore mine sites are becoming depleted. The Corps, BOEM, and states are looking to expand sand mining activities to offshore sand banks and shoals in deeper federal waters on the outer continental shelf.

As the Panama Canal continues to expand to allow passage for larger capacity vessels, U.S. ports will need deeper shipping channels to accommodate larger vessels. As a result, there are a number of improvement dredging projects in the Mid-Atlantic region that are intended to deepen and widen existing ports and shipping channels. Major port deepening projects have occurred or are underway in New York Harbor, the Delaware River, in Baltimore, and in Norfolk. While maintenance dredging occurs more frequently, expansion dredging projects at existing ports are larger in scope and may cause more widespread and significant impacts to habitat. Most of the resulting dredged material is disposed of on land or in nearshore waters, though there are offshore open ocean disposal sites off the coasts of Virginia and New Jersey.

II. Habitat Impacts from Coastal Development by Habitat Type

Coastal development activities occur almost exclusively in nearshore waters and may impact a number of different habitat types. Nearshore benthic habitats are especially likely to incur impacts given that all activities involve taking natural habitat out of the environment (e.g. dredging and sand mining) or placing something in or on natural habitat (e.g. shoreline protection structures). Different coastal development activities have different footprints, spanning small coastal infill projects on personal property to miles of beach nourishment. While the scale of projects varies greatly, coastal development activities may alter important coastal processes, reduce habitat complexity and cause fragmentation, thus reducing the productivity and suitability of habitats. The severity of specific impacts that result from these activities are proportional to the scale and location of the activities and the resilience of the impacted habitat and its associated communities. Compared to other anthropogenic activities such as energy development, coastal development activities are widespread and frequent across the Mid-Atlantic shoreline and may have significant cumulative impacts.

Distribution (Nearshore (Including Estuarine)/Offshore)

a) Nearshore

Coastal development activities may directly destroy, convert and disturb habitat, particularly in nearshore and estuarine areas. Many of the coastal development activities involve constructing a physical barrier in the habitat, including shoreline hardening structures or coastal infill, which can alter the flow of currents, sediments and nutrients. These impacts will ultimately reduce the complexity and functionality of habitat. For example, the suite of coastal activities, especially shoreline hardening and coastal infill, can remove high diversity shoreline vegetation and woody debris, which play an important ecological role. Additionally, these barriers can cause fragmentation of valuable shallow coastal habitats, such as salt marshes, and inhibit the natural migration of these habitats landward in response to sea level rise.

Coastal development activities can impact benthic habitats by altering seafloor topography. These activities can also change the hydrological flows from the shore to the ocean and also within the nearshore waters. Activities that decrease shoreline vegetation and increase impervious surfaces from coastal construction can increase the flow of sediments and nutrients into the nearshore environment, which can result in eutrophication and decreased dissolved oxygen (see Indirect Impacts). Additionally, in-water structures and fill can change tidal and current patterns, which may alter longshore sediment transport processes, nearshore beach building processes, and nearshore organism assemblages and associated food webs. The presence of these structures in the water column can also create new habitat for sessile organisms and alter surrounding benthic substrate (see Indirect Impacts).

Coastal development activities can reduce localized water quality. Removing and displacing substrates can resuspend sediments in the water, resulting in increased turbidity and sedimentation, burial of nearshore substrates, and resuspension of contaminants into the water column. Many of these activities, especially the disposal of dredged material and beach nourishment, can create sediment plumes, which can reduce sunlight penetration and impact nearshore primary productivity. Treated wood and concrete, used to construct nearshore infrastructure and shoreline hardening structures, can leach chemicals into the water column and expose organisms to toxins (see Indirect Impacts). Coastal infrastructure and shoreline hardening structures can also increase the footprint of impervious surfaces and increase stormwater runoff. This can exacerbate water quality degradation through increasing suspended sediments and introducing land-based contaminants such as petroleum hydrocarbons, metals, pesticides and fertilizers into coastal waters, creating algal blooms and areas of low dissolved oxygen. Additionally, as a result of decreased tidal and current flows from the presence of in-water structures, these contaminants may become trapped in nearshore waters and sediments, thus concentrating toxins (see Indirect Impacts).

Estuarine

Coastal development activities can be particularly detrimental in estuarine areas. As previously mentioned, the majority of activities occur in nearshore, estuarine habitat, and some activities occur exclusively in these habitats, including installation of flood control structures and disposal of dredged material used for estuarine habitat restoration projects. Direct habitat destruction and conversion from these activities can eliminate critical shallow water and wetland habitats and the valuable ecological functions they provide to many life stages of marine organisms. Impacts associated with increased sedimentation, siltation, turbidity and stormwater runoff can decrease the productivity of estuarine habitats and exacerbate water quality impacts. Many of these activities construct barriers in estuarine habitats that reduce the natural water flushing and cause shading, which can alter temperature regimes, increase salinity, reduce dissolved oxygen levels, and concentrate contaminants (see Wetland and Estuarine Alteration Appendix).

b) Offshore

The habitat impacts from coastal development activities are concentrated in the nearshore environment, and any impacts to offshore habitats are likely to be minimal. However, if dredged material is disposed of in offshore open ocean disposal sites, or if sand mining sites are located offshore, impacts from substrate removal, burial, turbidity, and settling of particles can be expected in the offshore environment.

Depth (Pelagic/Demersal/Benthic)

a) Pelagic

Coastal development activities, including dredging and disposal of dredged material, filling, and constructing in-water structures may reduce water quality by impeding water circulation and increasing sedimentation and turbidity. Large over-water structures can cause shading throughout the water column, which may impact the behavior of fish and other species. Structures may leach biocides and other chemicals into the water column. Constructing in-water structures introduces habitat for new shellfish communities to develop (see Indirect Impacts). Though these impacts span the water column, they are likely to be concentrated in nearshore waters.

b) Demersal

Coastal development activities, particularly dredging, disposal, and beach nourishment can suspend sediments in the water column. Dredging may also result in entrainment of dermersal and benthic organisms, larvae, and eggs (see Indirect Impacts). The resuspension of contaminated sediments can degrade benthic habitats and decrease water quality. The resulting turbidity, sedimentation and siltation can cause temporary physical and behavioral impacts to demersal species, such as decreasing the fitness of organisms contacting or feeding on the seafloor or causing avoidance (see Indirect Impacts).

c) Benthic

Coastal development activities can result in direct loss and conversion of benthic habitat through the physical removal or destruction of substrates. Benthic habitat can also be disturbed by temporary construction activities such as using equipment that can compress, scrape or smooth the seafloor. Conversion of benthic habitat may occur as suspended sediments settle over substrate, new substrate is exposed from dredging or construction activities, or in-water structures introduce new vertical habitat for shellfish, which can change surrounding substrate composition. These activities may also alter benthic habitat by filling depressions, reducing gradients of shoals and ridges, and compressing sediments, which can destroy important mound and burrow habitats for organisms. Benthic habitat loss and conversion can result in decreased biomass and species diversity (see Indirect Impacts).

Some activities, especially dredging and sand mining, can change the physical contours and depth profile of the seafloor. Altered circulation patterns around dredging projects may change sediment composition from sand or shell-dominated substrate to fine particles. This shift may increase the suspension of sediments, reduce the viability of shellfish beds and aquatic vegetation, and negatively impact the survival of species during critical life stages (see Indirect Impacts). Additionally, the disposal of dredged materials and placement of in-water structures and fill can alter tidal and current patterns, thus impacting the distribution and flow of benthic sediments. These structures can hinder natural sediment transport, cause scour of surrounding sediment, or increase the suspension and resettlement of sediment. Benthic organisms may be buried or exposed as a result of these changes.

Coastal development activities, particularly dredging, disposal and beach nourishment can suspend sediment in the water column and impact water quality. Coastal development construction activities may cause reductions in pervious surfaces around onshore infrastructure, increasing stormwater runoff and direct flow of silt and sediment into adjacent waterways. The resulting increase in sedimentation and siltation can bury benthic organisms, decrease the productivity of plankton and submerged vegetation, and change the structure of benthic habitat. Contaminants in suspended sediments and stormwater runoff may expose benthic organisms to toxins and degrade the habitability of nearby areas (see Indirect Impacts).

<u>Benthic Substrate (Submerged Aquatic Vegetation/Structured/Soft)</u>

a) Submerged Aquatic Vegetation

Coastal development activities may directly replace submerged aquatic vegetation (SAV) habitat with fill or hardened structures. Some activities can also deepen areas to depths that reduce sufficient light to support SAV, resulting in a loss of the critical ecological functions this habitat provides (see Wetland and Estuarine Alteration Appendix). In general, these activities are not likely to occur directly on SAV beds, but the temporal nature of SAV make it difficult to map and therefore it is vulnerable to unintended impacts from nearby activities. Shoreline hardening structures or fill can fragment SAV beds, impede natural migration necessary to survive sea level rise, and alter the flow of sediments and nutrients needed for vegetation growth. The placement of structures over the water can also alter light regimes by casting shadows and shading, thus reducing primary productivity of these habitats. Similarly, increased sedimentation, siltation and turbidity that result from coastal development activities can directly bury SAV beds, decrease primary productivity through reduced light penetration, and reduce dissolved oxygen levels. Development of shoreside infrastructure may also increase stormwater runoff, exacerbating sedimentation and siltation impacts, increasing contaminant levels and causing eutrophication of SAV beds through nutrient loading.

b) Structured
Structured habitat is less likely to be directly impacted by coastal development activities than other substrates, since the majority of these activities take place in areas where structured habitat is not found. Coastal development activities may, however, affect nearby structured habitat by increased sedimentation, which may bury or disturb structured habitat as particles settle.

c) Soft
Coastal development activities are likely to occur in soft bottom habitats, and are likely to cause impacts through the direct removal and/or relocation of sediment. Dredging and filling activities in intertidal mud and sand flats can result in a loss of critical ecological function. Activities may also change the flow of soft sediments and alter the contours of soft benthic habitat. Altered circulation patterns may change the nature of soft bottom habitat from coarse sand to fine particle sediments, which can affect benthic community composition. Fine organic particles are also more likely to bind with contaminants than coarse particles, which can lead to greater accumulation in sediments and expose species to toxins (see Indirect Impacts).

Activity-Specific Habitat Impacts

Dredging and Disposal
Dredging and disposal generally occurs nearshore, though there are some offshore sites used for disposal and sand mining. In these instances, similar impacts expected to occur in nearshore habitats are also likely to occur offshore. The direct disruption and conversion of substrates may fill depressions or smooth the seafloor, remove vertical topography, and decrease suitability of substrates for burrowing organisms (see Indirect Impacts). Through removal and placement of sediment, these activities can change benthic contours and increase turbidity throughout the water column near dredging sites, during transportation (especially with mechanical dredges), and at the disposal sites. As a result, substrate composition in or near dredging or disposal sites may be altered as surface textures and grain size may not match with the surrounding substrate.

Dredging and disposal can also disrupt currents and sediment transport, and may temporarily cause scour and sediment plumes to form up to thousands of feet downcurrent of project sites. The deepening of channels during dredging may also reduce water quality by reducing temperature, oxygen, and sunlight penetration in these areas, and potentially lead to poor mixing, which can result in hypoxic or anoxic conditions. Dredging in certain areas may not only increase water depth, but also potentially wave heights, leading to more shoreline erosion. In addition, these activities can resuspend nutrients and sediments, including contaminated sediments, and cause eutrophication.

Sand Mining and Beach Nourishment
In addition to the general impacts discussed above resulting from dredging and disposal of dredged material, sand mining in particular may change the characteristics of soft substrates. By burying adjacent habitats through sedimentation and siltation, uncovering new sediments,

and leaving behind substrates with lower sand and higher silt content and poorly-sorted particles, these habitats can be altered for a long time. If sand mining sites continue to expand into offshore waters in the future, offshore sand shoals known as "relic shoals," which are static and do not receive new sediments from the nearshore sediment transport system, may be permanently removed. These shoals can act as important migratory markers, feeding, and spawning locations for various species and fishing grounds (see Indirect Impacts).

Beach nourishment can add soft sediments to the nearshore sediment transport system with different properties than the existing substrates, which may increase erosion and turbidity adjacent to and downcurrent from target beaches. Increased turbidity on target beaches is usually temporary, but if mud, silt, and clay are accidentally introduced onto target beaches with the sand, the increase in turbidity and reduction in habitat suitability in the intertidal zone can persist and impact species behavior.

Coastal Infill and Shoreline Protection

These activities exclusively take place in nearshore, estuarine and intertidal areas, and generally replace soft sediments with hard structures, which can fragment and alter habitat function. By placing structures in the path of currents, tides, and mixing zones of fresh and saltwater, these activities alter sediment and nutrient flows, causing accretion, scour, and exacerbating erosion, which may cause subsidence of nearby marsh and wetland habitats (see Wetland and Estuarine Alteration Appendix). In addition, these fill-associated structures can inhibit longshore sediment transport and beach formation, alter dune size, and impede nearshore benthic habitat migration. Flood control structures such as dikes, floodgates, and tide gates are placed exclusively in estuaries and may also disrupt currents, sediment, and nutrient flow and create barriers to species migrations (see Wetland and Estuarine Alteration Appendix).

III. Potential Impacts of Coastal Development to MAFMC Managed Stocks

Depending on the scale, duration, location and specific coastal development activities involved, all habitat types have the potential to be impacted to some degree. Coastal development activities occur almost exclusively nearshore, and thus impacts are likely to be concentrated along the land-sea interface and in waters close to shore. Given that most projects involve the removal of sediments (e.g., dredging and sand mining) or the placement of sediments or structures (e.g., coastal infill and shoreline hardening), benthic habitats within nearshore or estuarine areas will be most significantly impacted. Impacts to offshore and pelagic environments are both less likely, and potentially less severe.

The following tables list the habitat types designated as Essential Fish Habitat (EFH) and Habitat Areas of Particular Concern (HAPC) for the different life stages of Mid-Atlantic Fishery Management Council (MAFMC) managed stocks (see *Impacts to Fish Habitat from Anthropogenic Activities: Introduction and Methods*). Cells highlighted in orange indicate an overlay between the habitat type used and the potential for the habitat type to be adversely impacted by coastal development activities; cells highlighted in yellow indicate a lower potential for adverse impacts; cells highlighted in green are unlikely to be impacted.

To illustrate the similarities and differences in how coastal development activities may impact important fish habitat, a table has been created for each of the four general categories: dredging and disposal, sand mining and beach nourishment, coastal infill, and shoreline hardening. For all four activities, nearshore and estuarine environments may be subject to impacts. While shoreline hardening and coastal infill occur exclusively nearshore, the disposal of dredged material and sand mining may occur offshore, and thus offshore habitat may be exposed to impacts. Impacts to pelagic waters from all four activities are likely to be temporary and less significant than impacts to demersal or benthic habitats. Among benthic habitats, soft substrates and SAV habitats are more likely to be impacted than structured habitats.

Given the intersection of where most coastal development activities occur and the general dependence of MAFMC stocks on nearshore habitats, almost all MAFMC managed species may potentially be impacted. Where coastal development activities take place in estuarine habitats, such as installing flood control structures, the impacts could be severe. Estuaries are important for the majority of MAFMC species and are designated as Habitat Areas of Particular Concern (HAPC) for summer flounder (see Wetland and Estuarine Alteration Appendix). Benthic habitats important for some or all life stages of black sea bass, longfin squid (*Loligo*), ocean quahogs, scup, summer flounder, and Atlantic surfclams are more likely to be exposed to impacts from coastal development activities, especially dredging and disposal, sand mining and beach nourishment. Pelagic habitats, such as those used by Atlantic mackerel, Atlantic bluefish, spiny dogfish, and butterfish may have less exposure to impacts. Golden tilefish (all life stages) are the only MAFMC stock not linked to the nearshore environment; due to the deep nature of their offshore habitat, they are not likely to be impacted by these activities. Shortfin squid (*Illex*) eggs and pre-recruits are unlikely to be impacted by coastal infill and shoreline protection activities due to their reliance on offshore pelagic habitats; however, they may be impacted if dredged material is disposed of offshore, and are more likely to be impacted during sand mining on offshore shoals. Sand mining may also remove or alter sand ridges and/or shoals that are particularly important for both juvenile and adult Atlantic surfclams and ocean quahogs, and may be important migratory markers and feeding areas for Atlantic bluefish, scup, and summer flounder.

Visual Overlay of Potential Impacts from Dredging and Disposal and MAFMC Species' EFH/HAPC

Legend

Orange = potential for adverse impacts

Yellow = low potential for adverse impacts

Green = no potential for adverse impacts

MAFMC Species	Distribution			Water Column			Benthic Substrate/Structure		
	Estuary	Nearshore (state waters)	Offshore	Pelagic (upper/mid/ entire column)	Demersal (lower water column)	Benthic (seafloor substrate)	SAV	Structured (e.g. shell, manmade)	Soft (sand, silt)
Atlantic Mackerel									
Eggs	x	x	x	x					
Larvae	x	x	x	x					
Juveniles	x	x	x	x					
Adults	x	x	x	x					
Black Sea Bass									
Eggs	x	x	x	x					
Larvae	x	x	x	x	x	x		x	
Juveniles	x	x	x		x	x	x	x	x
Adults	x	x	x		x	x		x	x
Atlantic Bluefish									
Eggs		x	x	x					
Larvae		x	x	x					
Juveniles	x	x	x	x					
Adults	x	x	x	x					
Butterfish									
Eggs	x	x	x	x					
Larvae	x	x	x	x					
Juveniles	x	x	x	x					
Adults	x	x	x	x					
Shortfin Squid (*Illex*)									
Eggs			x	x					
Pre-Recruits			x	x					
Recruits		x	x	x					
Longfin Squid (*Loligo*)									
Eggs	x	x	x		x	x	x	x	x
Pre-Recruits	x	x	x	x					
Recruits	x	x	x	x	x	x	x	x	x
Ocean Quahogs									
Juveniles		x	x			x			x
Adults		x	x			x			x
Scup									
Eggs	x	x							
Larvae	x	x							
Juveniles	x	x	x		x	x	x	x	x
Adults	x	x	x		x	x			
Spiny Dogfish									
Juveniles		x	x	x	x				
Sub-Adults		x	x	x	x				
Adults		x	x	x	x				
Summer Flounder									
Eggs		x	x	x					
Larvae	x	x	x	x					
Juveniles	x	x	x		x	x	x		x
Adults	x	x	x		x	x	x		x
HAPC	x						x		
Atlantic Surfclams									
Juveniles		x	x			x			x
Adults		x	x			x			x
Golden Tilefish									
Eggs			x	x					
Larvae			x	x					
Juveniles			x		x	x		x	x
Adults			x		x	x		x	x
HAPC			x			x		x	x

Visual Overlay of Potential Impacts from Sand Mining/Beach Nourishment and MAFMC Species' EFH/HAPC

Legend	Distribution			Water Column			Benthic Substrate/Structure		
Orange = potential for adverse impacts									
Yellow = low potential for adverse impacts **Green** = no potential for adverse impacts	Estuary	Nearshore (state waters)	Offshore	Pelagic (upper/mid/ entire column)	Demersal (lower water column)	Benthic (seafloor substrate)	SAV	Structured (e.g. shell, manmade)	Soft (sand, silt)
MAFMC Species									
Atlantic Mackerel									
Eggs	x	x	x	x					
Larvae	x	x	x	x					
Juveniles	x	x	x	x					
Adults	x	x	x	x					
Black Sea Bass									
Eggs	x	x	x	x					
Larvae	x	x	x	x	x	x		x	
Juveniles	x	x	x		x	x	x	x	x
Adults	x	x	x		x	x		x	x
Atlantic Bluefish									
Eggs		x	x	x					
Larvae		x	x	x					
Juveniles	x	x	x	x					
Adults	x	x	x	x					
Butterfish									
Eggs	x	x	x	x					
Larvae	x	x	x	x					
Juveniles	x	x	x	x					
Adults	x	x	x	x					
Shortfin Squid (*Illex*)									
Eggs			x	x					
Pre-Recruits			x	x					
Recruits		x	x	x					
Longfin Squid (*Loligo*)									
Eggs	x	x	x		x	x	x	x	x
Pre-Recruits	x	x	x	x					
Recruits	x	x	x	x	x	x	x	x	x
Ocean Quahogs									
Juveniles		x	x			x			x
Adults		x	x			x			x
Scup									
Eggs	x	x							
Larvae	x	x							
Juveniles	x	x	x		x	x	x	x	x
Adults	x	x	x		x	x			
Spiny Dogfish									
Juveniles		x	x	x	x				
Sub-Adults		x	x	x	x				
Adults		x	x	x	x				
Summer Flounder									
Eggs		x	x	x					
Larvae	x	x	x	x					
Juveniles	x	x	x		x	x	x		x
Adults	x	x	x		x	x	x		x
HAPC	x						x		
Atlantic Surfclams									
Juveniles		x	x			x			x
Adults		x	x			x			x
Golden Tilefish									
Eggs			x	x					
Larvae			x	x					
Juveniles			x		x	x		x	x
Adults			x		x	x		x	x
HAPC			x			x		x	x

Visual Overlay of Potential Impacts from Coastal Infill and MAFMC Species' EFH/HAPC

Legend	Distribution			Water Column			Benthic Substrate/Structure		
Orange = potential for adverse impacts; **Yellow** = low potential for adverse impacts; **Green** = no potential for adverse impacts	Estuary	Nearshore (state waters)	Offshore	Pelagic (upper/mid/ entire column)	Demersal (lower water column)	Benthic (seafloor substrate)	SAV	Structured (e.g. shell, manmade)	Soft (sand, silt)
MAFMC Species									
Atlantic Mackerel									
Eggs	x	x	x	x					
Larvae	x	x	x	x					
Juveniles	x	x	x	x					
Adults	x	x	x	x					
Black Sea Bass									
Eggs	x	x	x	x					
Larvae	x	x	x	x	x	x		x	
Juveniles	x	x	x		x	x	x	x	x
Adults	x	x	x		x	x		x	x
Atlantic Bluefish									
Eggs		x	x	x					
Larvae		x	x	x					
Juveniles	x	x	x	x					
Adults	x	x	x	x					
Butterfish									
Eggs	x	x	x	x					
Larvae	x	x	x	x					
Juveniles	x	x	x	x					
Adults	x	x	x	x					
Shortfin Squid (*Illex*)									
Eggs			x	x					
Pre-Recruits			x	x					
Recruits		x	x	x					
Longfin Squid (*Loligo*)									
Eggs	x	x	x		x	x	x	x	x
Pre-Recruits	x	x	x	x					
Recruits	x	x	x	x	x	x	x	x	x
Ocean Quahogs									
Juveniles		x	x			x			x
Adults		x	x			x			x
Scup									
Eggs	x	x							
Larvae	x	x							
Juveniles	x	x	x		x	x	x	x	x
Adults	x	x	x		x	x			
Spiny Dogfish									
Juveniles		x	x	x	x				
Sub-Adults		x	x	x	x				
Adults		x	x	x	x				
Summer Flounder									
Eggs		x	x	x					
Larvae	x	x	x	x					
Juveniles	x	x	x		x	x	x		x
Adults	x	x	x		x	x	x		x
HAPC	x						x		
Atlantic Surfclams									
Juveniles		x	x			x			x
Adults		x	x			x			x
Golden Tilefish									
Eggs			x	x					
Larvae			x	x					
Juveniles			x		x	x		x	x
Adults			x		x	x		x	x
HAPC			x			x		x	x

Visual Overlay of Potential Impacts from Shoreline Protection and MAFMC Species' EFH/HAPC

Legend	Distribution			Water Column			Benthic Substrate/Structure		
Orange = potential for adverse impacts; **Yellow** = low potential for adverse impacts; **Green** = no potential for adverse impacts	Estuary	Nearshore (state waters)	Offshore	Pelagic (upper/mid/ entire column)	Demersal (lower water column)	Benthic (seafloor substrate)	SAV	Structured (e.g. shell, manmade)	Soft (sand, silt)
MAFMC Species									
Atlantic Mackerel									
Eggs	x	x	x	x					
Larvae	x	x	x	x					
Juveniles	x	x	x	x					
Adults	x	x	x	x					
Black Sea Bass									
Eggs	x	x	x	x					
Larvae	x	x	x	x	x	x		x	
Juveniles	x	x	x		x	x	x	x	x
Adults	x	x	x		x	x		x	x
Atlantic Bluefish									
Eggs		x	x	x					
Larvae		x	x	x					
Juveniles	x	x	x	x					
Adults	x	x	x	x					
Butterfish									
Eggs	x	x	x	x					
Larvae	x	x	x	x					
Juveniles	x	x	x	x					
Adults	x	x	x	x					
Shortfin Squid (*Illex*)									
Eggs			x	x					
Pre-Recruits			x	x					
Recruits		x	x	x					
Longfin Squid (*Loligo*)									
Eggs	x	x	x		x	x	x	x	x
Pre-Recruits	x	x	x	x					
Recruits	x	x	x	x	x	x	x	x	x
Ocean Quahogs									
Juveniles		x	x			x			x
Adults		x	x			x			x
Scup									
Eggs	x	x							
Larvae	x	x							
Juveniles	x	x	x		x	x	x	x	x
Adults	x	x	x		x	x			
Spiny Dogfish									
Juveniles		x	x	x	x				
Sub-Adults		x	x	x	x				
Adults		x	x	x	x				
Summer Flounder									
Eggs		x	x	x					
Larvae	x	x	x	x					
Juveniles	x	x	x		x	x	x		x
Adults	x	x	x		x	x	x		x
HAPC	x						x		
Atlantic Surfclams									
Juveniles		x	x			x			x
Adults		x	x			x			x
Golden Tilefish									
Eggs			x	x					
Larvae			x	x					
Juveniles			x		x	x		x	x
Adults			x		x	x		x	x
HAPC			x			x		x	x

IV. Indirect Impacts

In addition to the habitat impacts described above, coastal development activities can have impacts on the survival, productivity, community structure and behaviors of marine species.

a) Survival and Productivity

Coastal development activities can impact species at both the individual and stock level. Dredging and disposal activities may be particularly harmful to species by causing removal, burial, and entrainment, which can cause direct mortality to species, especially at early life stages. These activities also increase turbidity, sedimentation and siltation, which can reduce the development and survival of eggs and larvae, hinder respiration and metabolism, and inhibit light penetration through the water column, reducing primary productivity. Suspended sediments may bury and smother species, alter growth rates and survival, and cause gill abrasion in fish species. In-water structures may also create barriers that disrupt current flows, which can alter distribution and recruitment of eggs and larvae, and limit the amount of food and nutrients available to organisms.

b) Behavior Changes

Changes in habitat from coastal development activities can remove important nursery, refuge, forage, and spawning areas, which may alter species behavior. Sand mining on targeted offshore sand shoals and/or ridges in particular can remove navigation points that may limit or obstruct species migrations. Increased turbidity and sedimentation can disrupt the foraging patterns and reduce the success of sight- and filter-feeders, alter swimming and spawning behavior, and cause attraction or avoidance at individual and population levels. Dredging and disposal and flood control structures, such as floodgates or tide gates, may also impede passage of diadromous species into and out of upstream areas and may limit spawning by cutting off access to spawning grounds.

c) Water Quality

These activities can introduce contaminants into the water column and resuspend contaminated sediments, which can expose organisms to toxins that may alter species' behavior, physiology, and survival. In-water structures can leach chemicals including metals into surrounding waters, and may also resuspend and concentrate existing contaminants by altering currents and reducing flushing. Chronic exposure to contaminants can cause bioaccumulation in species and compound impacts throughout food webs. Channel deepening and alteration can alter temperature regimes and change nutrient flows, which can reduce the dissolved oxygen content of the water and lead to anoxic or hypoxic conditions and decrease primary productivity.

d) Community Structure Shifts

Coastal development activities can directly remove or displace organisms, decreasing the overall abundance, biomass, and diversity of a community. Installing in-water infrastructure such as shoreline hardening structures may alter habitat suitability, and change the distribution of invertebrates, shellfish, and fish, which can lead to changes to predator-prey interactions and food webs. Similarly, removing or disrupting substrates can alter their chemical and physical properties, disrupting species abundance and dominance in an area. Changing hydrological processes, reducing water quality, and removing or altering high-diversity or highly productive areas, such as wetlands, may also disrupt community structure and dynamics. Introducing new structures into nearshore waters may serve beneficial purposes by offering species new habitats to colonize or use as refuge areas. However, original species assemblages may never return to disturbed areas, and the disturbance may provide opportunities for the spread of invasive species. Secondary uses of fill, such as wetland restoration and beach nourishment, may also change communities by altering the suitability and occupancy of restored habitat.

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VI. Wetland and Estuarine Alteration Appendix

This appendix builds on and captures additional insights from our research to help the MAFMC understand the important ecological roles wetland and estuarine habitats play in the marine ecosystem and the threats that coastal development activities in the Mid-Atlantic may pose. It supplements the basic habitat impacts description in the "Estuarine" section of the document by explaining mechanisms of impacts, discussing the ecosystem services these habitats provide, and exploring increasingly common restoration and mitigation activities.

Sources of Impacts

Many of the coastal development activities described above occur in or near estuaries, including coastal infill, installing shoreline protection structures, dredging and disposal of dredged materials, including secondary fill uses such as saltmarsh and wetland restoration. The installation and operation of flood control structures such as floodgates, tide gates, and dikes occur exclusively in these habitats because they lie at the interface of fresh and saltwater. In addition to direct habitat losses resulting from these anthropogenic activities, the Mid-Atlantic also loses portions of these habitats through subsidence and erosion due to unique geological factors. As the coast becomes more crowded in this region, coastal development encroaches on estuaries and wetlands and can cause impacts from various fill-related activities. In fact, many coastal habitats of the Mid-Atlantic region have already incurred cumulative impacts of overlapping coastal development activities, urbanization, sediment contamination and the significant loss of wetlands over time.

Loss of Ecosystem Services

Estuaries and wetlands provide several important ecosystem services, including buffering storm surges and floods, filtering surrounding waters, and protecting shallow, highly productive waters. These habitats act as natural vegetative coastal barriers that absorb storm surge and provide storage capacity to reduce flooding. As conduits from rivers to the ocean, these habitats also help to maintain salinity, temperature, oxygenation, and stratification of brackish waters to maximize primary productivity in some areas, and facilitate transport and mixing of littoral sediments, nutrients, and freshwater in others. In addition, vegetation in estuaries and wetlands supports water quality by filtering out contaminants, excess nutrients, turbidity, and toxins from groundwater, stormwater, and riverine sources. Most importantly, these habitats support high primary productivity and provide important nursery, feeding, and spawning habitat for many species of invertebrates, fish, and seabirds.

Activities such as filling in or near these habitats can reduce these important ecosystem functions through direct habitat destruction, reduction of habitat complexity and fragmentation. Many of these activities construct barriers in estuarine habitats that reduce natural tidal flushing, which can increase salinity, reduce dissolved oxygen levels, and concentrate contaminants. Installation of structures can also alter temperature regimes in estuaries and wetlands by causing a loss of vegetation, which can increase water temperatures. Conversely, these structures may also shade the water column, lowering adjacent water temperatures and reducing habitat suitability. Alteration of estuaries or wetlands has the potential to release and resuspend contaminated sediments, which can disrupt nutrient availability for SAV and coastal vegetation and reduce overall ecosystem productivity. If these habitats are replaced with impervious surfaces, erosion and runoff may increase, resulting in decreased water quality and increased turbidity and sedimentation.

Importance to MAFMC species

Estuaries and wetlands are particularly important to MAFMC stocks; seven of the twelve species depend on estuaries as EFH for at least one life stage, and estuaries comprise a portion of HAPC for summer flounder. In addition, many other species such as invertebrates, anadromous fish (including forage species such as herring), shellfish, and seabirds also rely on estuaries and wetlands as important habitat and contribute to the total productivity of regional fisheries.

Wetland Mitigation and Restoration

The cultural attitude has shifted in Mid-Atlantic following Superstorm Sandy as residents have realized the important ecological functions that estuaries and wetlands provide; there are no longer many large wetland alteration or filling projects in the region. Instead, smaller projects with relatively small footprints of impact are more common, mostly for road, bridge, and home development and are sited to avoid impacts to these sensitive habitats. Although these projects are relatively small, their combined impacts decrease the habitat's overall functionality. Where impacts are unavoidable, NOAA Fisheries Habitat Conservation Division staff and the Corps usually require compensatory mitigation to ensure that there is no net loss of wetlands. Mitigation may be "in-kind" meaning that the same habitat type impacted is restored or created in another location; mitigation may also restore a different habitat type than is impacted if it provides greater function and value. Mitigated or restored wetlands do not have the same ecological function as naturally occurring wetlands. As a result, compensatory mitigation ratios are usually greater than 2:1. The specific ration for each project is informed by a number of factors, such as the specific habitat loss, mitigation methods and likelihood of success.

Secondary Uses of Dredged Materials

To support wetland and estuarine mitigation and restoration projects, dredged materials from coastal development activities may be used for secondary purposes, such as creating beneficial habitat or restoring or enhancing existing habitats. Examples of these approaches include increasing the height of eroded saltmarsh or wetland areas by adding sediment to subsiding areas to counteract the effects of sea level rise. By strategically placing layers of dredged material to bring degraded substrates to the intertidal level or constructing wave barriers, vegetation can be allowed to re-grow and restore damaged areas and stabilize eroding shorelines. The Mid-Atlantic region is considering using these restoration techniques, but is proceeding with caution to avoid unintended adverse effects to existing marsh habitat. Dredged material can foster accretion of sediments and lead to the development and growth of intertidal flats, native coastal vegetation and SAV beds, and shellfish reefs over time, which can further support the productivity and ecological functions of these areas.

VII. Living Shorelines Appendix

This appendix is intended to capture insights gleaned from our research to help the MAFMC understand the range of "living" shoreline protection techniques and their advantages in terms of less severe or lasting impacts to habitats compared with "hard" alternatives such as seawalls, breakwaters, and jetties.

Range of Living Shoreline Alternatives

"Living shorelines" encompass a range of shoreline protection and stabilization techniques and structures that can leverage natural vegetation along with other "soft" stabilization elements such as sand. They may also include "hard" engineered shoreline structures such as rockpiles or breakwaters, or utilize hybrid approaches that leverage aspects of both soft and hard structures. Living shorelines help to stabilize and reduce erosion along protected shorelines such as estuaries, bays, and sheltered tributaries, while preserving and supplementing aspects of the nearshore habitat's natural appearance and function. Living shorelines can take many forms and come in many sizes, ranging from nourished beaches and vegetated dunes, to engineered shorelines in small bays that incorporate natural marsh habitat and coir fiber logs, rock or oyster shell to help hold existing and planted vegetation in place. Various configurations can also leverage both man-made and natural structures, including engineered rock revetments and sills to protect existing vegetation, living oyster or mussel reefs and rock breakwaters to buffer coastlines and upland areas from small waves, and vegetation edging with erosion control blankets to hold sediment in place near marshes and wetlands.

Applications and Limitations

Living shorelines are not well suited for high-energy wave environments or areas subject to frequent flooding or high storm surge, as these actions are likely to inundate and damage living vegetative buffers. Rather, living shorelines are best suited for coastlines with low to moderate wave energy, smaller waves and fetch, and gently sloping shores. These erosion control and shoreline stabilization alternatives have advantages over traditional "hard" protection and stabilization techniques, and are becoming more popular along the Atlantic coast as a result. The vegetated buffers of living shorelines reduce the volume, contaminant capacity, and turbidity effects of upland runoff, improve water quality in adjacent marine waters, dissipate wave energy effectively without exacerbating erosion like seawalls or bulkheads, and may also create wetland habitat for many species. As natural and planted vegetation is protected over time and becomes established along a living shoreline, it can create important habitat for fish, invertebrates, and seabirds. In the post-Superstorm Sandy Mid-Atlantic region, states and municipalities are becoming more interested in these approaches as affordable and effective shoreline stabilization and erosion control management tools.

Living shorelines have benefits over traditional "hard" shoreline protection methods, but NOAA Fisheries Habitat Conservation Division staff must consider the habitat that exists where the living shoreline is proposed and if developing a living shoreline would be a trade up in habitat value. Areas of existing SAV, shellfish, or hard bottom habitat may not be appropriate for a living shoreline since these natural habitats are considered more valuable habitat.

<u>Coastal Development – Draft Council Policy</u>

General

1. Avoid coastal development in sensitive benthic habitat such as submerged aquatic vegetation, wetlands, complex bottom, and other priority fish habitats.

2. Preserve coastal upland buffers between buildings/infrastructure and wetlands and sand dunes, to allow for the inland migration of habitats as sea levels rise.

3. Preference should be given to the use of softer or "living" shoreline stabilization methods for coastal development, which can offer an alternative form of erosion control, with less severe habitat impacts than "hard" shoreline stabilization methods (e.g., concrete bulkheads and seawalls, concrete or rock revetments).

4. Projects should consider efforts to preserve and enhance fishery habitat to offset impacts (e.g., provide for nursery habitats and marsh areas through soft/living shoreline methods, removing barriers to natural fish passage).

5. Avoid installing new water control structures in wetlands and streams.

6. Use seasonal restrictions and spatial buffers on coastal development activities to limit negative impacts during fish spawning, egg development, young-of-year development, and migration periods, and to avoid secondary impacts to sensitive habitat areas.

Dredge Material Disposal

1. Ensure that all options for disposal of dredged materials are comprehensively assessed. The consideration of upland alternatives for dredged material disposal sites should be evaluated before wetland or offshore sites are considered.

2. Consider beneficial uses for uncontaminated sediments when practicable and feasible. Priority should be given to beneficial uses of material that contributes to habitat restoration and enhancement, landscape ecology approaches, and includes pre- and post-disposal surveys.

3. Avoid dredged material disposal activities in areas containing sensitive or unique benthic habitats.

Beach Nourishment

1. Avoid sand mining in areas containing sensitive marine benthic habitats (e.g., spawning and feeding sites, hard bottom, cobble/gravel substrate, shellfish beds).

2. Avoid mining sand from sandy ridges, lumps, shoals, and rises that are named on maps. The naming of these is often the result of the area being an important fishing ground.

3. Existing sand borrow sites should be used to the extent possible. Mining sand from new areas introduces additional impacts.

4. Conduct beach nourishment during the winter and early spring, when productivity for benthic infauna is at a minimum.

5. Use seasonal restrictions and spatial buffers on sand mining to limit negative impacts during fish spawning, egg development, young-of-year development, and migration periods, and to avoid secondary impacts to sensitive habitat areas such as SAV.

6. Preserve, enhance, or create beach dune and native dune vegetation in order to provide natural beach habitat and reduce the need for nourishment.

7. Each beach renourishment activity should be treated as a new activity (i.e., subject to review and comment); including those identified under a programmatic EA or EIS.

8. Bathymetric and biological monitoring (pre- and post-) to assess recovery in beach borrow and renourishment areas should be required.

9. Assess the effect of noise from mining operations on the feeding, reproduction, and migratory behavior of marine mammals and finfish.

Wetland Dredging and Filling

1. Dredging and filling within wetlands should be avoided to the maximum extent practicable.

2. Do not dispose of dredge material in wetlands.

3. Ensure that filling materials meet or exceed applicable state and/or federal water quality standards.

4. Identify and characterize fishery habitat functions/services in the project areas prior to any dredge and fill activities.

Mid-Atlantic Managed Species with at least 1 Life Stage with the Potential to be Adversely Impacted by Coastal Development Issues

Atlantic mackerel
Black sea bass
Atlantic bluefish
Butterfish
Shortfin squid (*Illex*)
Longfin squid (*Loligo*)
Ocean quahogs
Scup
Spiny dogfish
Summer flounder
Atlantic surfclams

Given the intersection of where most coastal development activities occur and the general dependence of MAFMC stocks on nearshore habitats, almost all MAFMC managed species may potentially be impacted. Golden tilefish (all life stages) are the only MAFMC stock not linked to the nearshore environment; due to the deep nature of their offshore habitat, they are not likely to be impacted by these activities.

Habitat Impacts from Fishing
Anthropogenic Activity Background Document

Contents

I. Introduction

Purpose

This document is intended to provide the Mid-Atlantic Fishery Management Council (MAFMC) and their advisors with a high-level overview of the likely habitat impacts from fishing gears employed in their managed fisheries. It is not intended to be comprehensive, but rather a synthesis of information, presented in summary form. The goals of this report are to summarize existing information about habitat impacts likely to occur from employing specific fishing gears and to compliment the background documents on impacts from non-fishing anthropogenic activities on essential fish habitat (EFH).

Habitat Context

Several fishing gears are used to carry out federally managed fisheries under the jurisdiction of the MAFMC, each of which may impact habitat differently. In general, habitat impacts from fishing gears are a function of the area, duration, and severity of the gear's contact with the seafloor. Bottom-tending gears are likely to impact habitat to some extent, while pelagic gears are unlikely to have direct habitat impacts since they do not contact the seafloor.[1, 2] Fishing gears may impact benthic habitats by crushing, moving or converting substrates, and

[1] New England Fishery Management Council Habitat Plan Development Team. January 2011. "Omnibus Fish Habitat Amendment 2 Environmental Impact Statement Appendix D: The Swept Area Seabed Impact (SASI) Approach: A Tool for Analyzing the Effects of Fishing on Essential Fish Habitat." 257p. p.19.
[2] Grabowski, John et al. 2014. "Assessing the Vulnerability of Marine Benthos to Fishing Gear Impacts." Reviews in Fisheries Science & Aquaculture, 22:2, 142-155.

suspending sediments as they contact or move along the seafloor. In addition, gears can alter habitat complexity by filling, smoothing, or removing burrows and seafloor depressions, creating new benthic contours, and changing the composition or abundance of benthic organisms.

Marine habitats are generally made up of biological and geological components.

- ***Biological habitat components*** include organisms that provide physical structure that can increase growth, survival, and productivity such as oyster reefs and structure-forming invertebrates.
- ***Geological habitat components*** include nonliving structures where organisms can seek shelter and feed, such as burrows, depressions, and mounds.

Fishing gears may impact biological and geological habitat components differently. For example, biological habitats growing among the substrate may be scraped off and removed through contact with the mainline of a fishing gear, while the surrounding geological habitats like boulder or cobble formations can remain relatively undisturbed.

Habitats can be categorized as high-energy or low-energy.

- ***High-energy habitats*** typically occur in shallow water less than two hundred feet deep and are characterized by high wave or current energy that can move substrates.
- ***Low-energy habitats*** are typically found in deeper water (greater than two hundred feet) and are characterized by relatively low energy currents that only suspend and move very fine sediments.

Each habitat has different susceptibilities to specific impacts. ***Susceptibility*** is a function of several factors, such as how long geological features take to recover to pre-disturbance conditions, and how quickly organisms re-colonize the sediment or are replaced by new ones. A gear type may also impact the same habitat type in different ways when it is deployed across locations due to differing susceptibility factors. A habitat type in a low-energy environment with little exchange of currents, nutrients, and sediments may be more vulnerable to lasting impacts from fishing gears due to their long recovery times compared to the same habitat type found in high-energy environments.[3] For example, once toppled, a gravel pile found in a low-energy environment may never re-form on the seafloor, where the same gravel pile may be re-formed due to the forces of waves and currents over time in a high-energy environment.

In addition, the recovery times of different habitat components may be very different. Some biological habitats, such as colonies formed by sea pens and bryozoans may be able to recover relatively quickly from disturbances, while longer-lived, deepwater corals may take much longer to recover. According to expert judgment, gravel, cobble, and boulder substrates are most susceptible among geological habitat types to impacts from fishing gear because they do not recover as quickly as others.[4]

[3] New England Fishery Management Council Habitat Plan Development Team. 2011.
[4] *Ibid*.

In evaluating how likely each gear type is to adversely impact bottom habitats, this report references these terms and concepts to reflect peer reviewed observational studies and expert judgment insights.

Document Organization

This document is organized into three main sections **(**see *Impacts to Fish Habitat from Anthropogenic Activities: Introduction and Methods***)**. Alphabetized gear profiles provide a general overview of each gear type and how it is used in to capture MAFMC managed species. We include information about the general impacts the gear may have on habitat, and then discuss how likely these impacts are based on how the gear is used in the region. To facilitate comparisons across gear types, two tables are presented to show how gears are scored in terms of low, moderate or high impacts, and the relative overall impact given the proportion of effort each gear represents within a fishery. In the final section, we offer a discussion of the relative impacts of gears used in the Mid-Atlantic region, and the factors that influence the severity of habitat impacts.

Resources

To compile this report, a number of source documents were used:

- 2011 New England Fishery Management Council's comprehensive Essential Fish Habitat Amendment 2;
- 2004 National Oceanic and Atmospheric Administration's National Marine Fisheries Service (NOAA Fisheries) Technical Memorandum 181;
- 2002 Northeast Fisheries Science Center's Essential Fish Habitat Steering Committee workshop on fishing gear effects in the Northeast region; and
- Reference materials provided by the Oversight Team.

In addition to sharing valuable guidance and insights, Council staff and the Oversight Team provided:

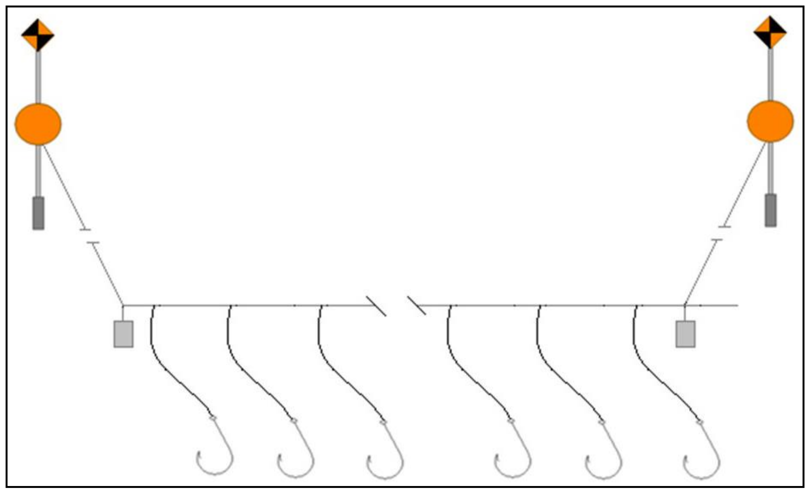
- A list of gear types commonly used in the Mid-Atlantic managed fisheries;
- NOAA Fisheries trip report logbook landings data to provide proxies of the relative effort of each gear type deployed;
- Swept Area Seabed Impacts (SASI) model insights and accompanying habitat vulnerability assessment information; and
- Supplemental or updated information on specific gear types such as hydraulic clam dredges.

All resources are listed in section V. References, and footnotes are used in this document to indicate where information is based on expert judgment or modeling assumptions and not peer reviewed literature.

II. Gear Profiles

Bottom Longlines

Bottom longlines consist of a strong stainless steel or galvanized wire mainline with many short clip-on leaders, called gangions, which connect baited hooks to the mainline. Weights are attached along and at both ends of the mainline to keep the gear and baited hooks on the seafloor. Each mainline can be over 20 miles long with hundreds of attached gangions; mainlines can be fished individually or connected to additional mainlines and fished in tandem. The hooks are hand-baited by the crew and attached to the mainline several feet apart. As the mainline is deployed from vessels, ropes are used to connect each end of the mainline to buoys on the surface to mark their location for retrieval. Bottom longlines are set in stationary, zigzag patterns along the seafloor to target demersal species and are kept in place by the weights, which prevent them from drifting freely in currents. After soaking for several hours or days, the line is retrieved with the assistance of a revolving drum onboard the fishing vessel, and the hooked fish are collected from the gangions as they come to the surface.[5]



In the Mid-Atlantic region, bottom longlines are fished in offshore, deepwater habitats on the continental shelf to target golden tilefish and represent the majority of catch in the fishery. Bottom loglines have the potential to impact benthic habitat types in these areas by scraping and sliding the mainline or weights along the seafloor during deployment or retrieval. Direct contact of the gear on benthic substrates can destroy, damage, bury or convert benthic habitats, and disrupt sediments. Bottom longlines are likely to have low, temporary impacts to mud, sand and gravel habitats, but may cause permanent impacts to sensitive biological structures like deepwater corals and the specific hard bottom clay structures preferred by golden tilefish.[6] Some experts have considered the targeted harvest of golden tilefish to have habitat impacts since they play an important role in forming and maintaining burrows near canyons; reductions

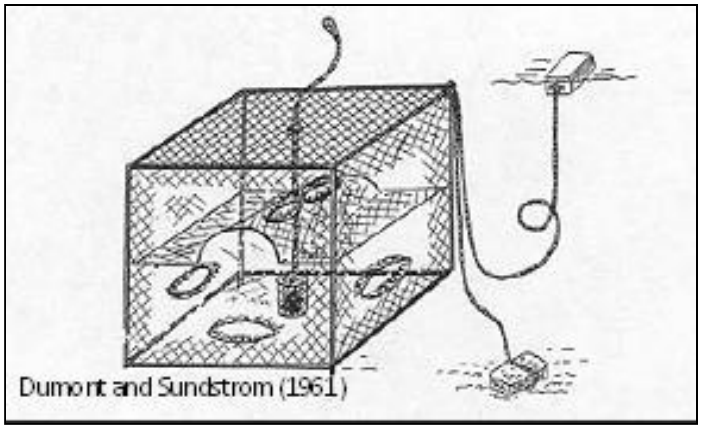
[5] Image source: NOAA Fisheries Southeast Fisheries Science Center, 2015. Web: http://www.sefsc.noaa.gov/labs/mississippi/images/longline_gear_illustration.jpg.

[6] Northeast Region Essential Fish Habitat Steering Committee. 2002. Workshop on the Effects of Fishing Gear on Marine Habitats off the Northeastern United States, October 23-25, 2001, Boston, Massachusetts. Northeast Fisheries Science Center Reference Document 02-01; 86 p. p. 32.

in tilefish populations can reduce the availability of burrows for lobsters and crabs.[7] There is a slight chance the gear can also disturb or damage attached benthic epifauna, such as sea pens that may be attached to hard bottom substrates, while leaving the substrate itself relatively undisturbed. Overall, the habitat impacts from bottom longlines are likely to be low.

Fish Pots

Fish pots are portable, rigid cages enclosed in mesh netting that are set on the seafloor to catch demersal and benthic fish and invertebrates. The cages and their funnel-shaped openings vary in size and shape, and may be fished with or without bait to attract target species. The size of the mesh netting may be adjusted to retain desirable species, while allowing undersized and/or non-target species to escape. Fish pots are either set individually with their own buoys to mark their locations, or in strings of up to 25 pots that are linked together by ropes. They are designed to be portable enough so that they may be set and retrieved multiple times in a day.[8]

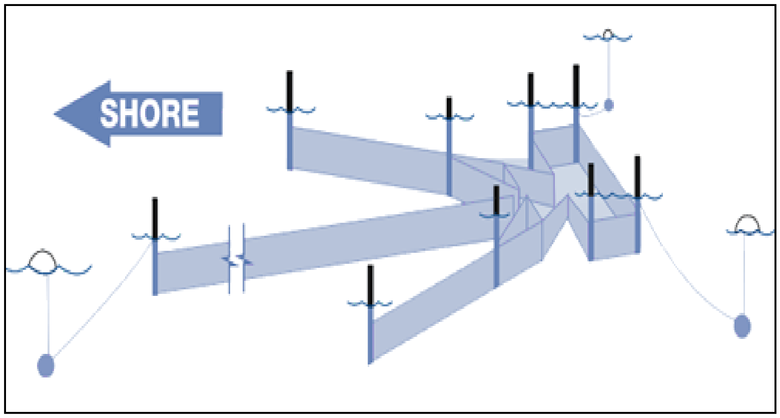


Fish pots account for a minority of landings in the black sea bass fishery and minimal landings of butterfish and scup in these fisheries. A modified pot called a "scup trap", or "floating trap", is used to catch scup. It should be noted that the term pot and trap are frequently used interchangeably for a similar type of fishing gear design. In federal waters, pots and traps are typically a gear similar to that described above.

Fish pots, which are fished similarly to lobster pots, can be deployed on any benthic substrate and thus have the potential to impact all benthic habitat types. The direct placement of fish pots, deployment and retrieval activities, and movement of pots along the seafloor in strong currents may compress, smooth, disturb or convert benthic habitat. These impacts are a function of the total footprint of the pots, damage caused by the mainline, the total number of pots fished on a string, and the number of times each pot is hauled.[9] While biological habitat may be vulnerable to damage and smoothing from traps, complex hard bottom habitats with abundant structural biota are considered to be the most vulnerable to alteration from pot fishing. However, these areas are generally avoided by pot fishers due to problems with getting the string tangled on the seafloor.[10] Due to the temporary presence and small footprint of this

[7] Northeast Region Essential Fish Habitat Steering Committee. 2002. p. 32.
[8] Dumont and Sundstrom, 1961. Web: http://www.nmfs.noaa.gov/pr/interactions/gear/traps_pots2.gif.
[9] Northeast Region Essential Fish Habitat Steering Committee. 2002. p. 29.
[10] *Ibid*.

gear type, habitat impacts on biological and physical structure are likely to be low on mud, sand, and gravel substrates.[11]



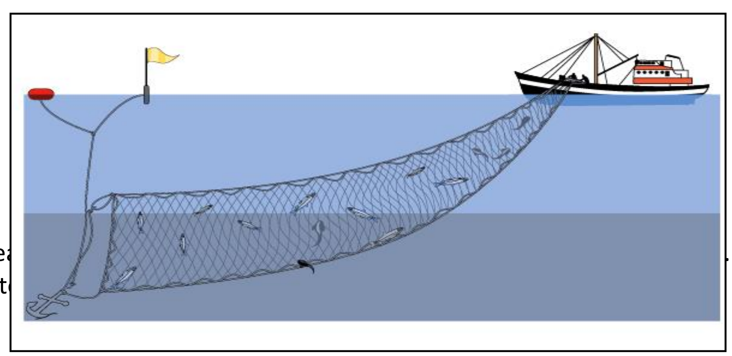
Fish Traps

Fish traps are large-scale net mazes set out seasonally to intercept and corral migrating fish. Fished passively, the gear utilizes the seafloor and the water's surface as vertical boundaries, and walls of netting as horizontal boundaries to lead fish into the trap. Leader ropes or fencing are used to guide fish through a narrow funnel section of netting and into the heart of the trap. The trap's netting is buoyed at the surface and fixed to the seafloor with anchors or ropes attached to cleats to maintain the vertical profile and keep fish within the net. Fish traps rely on inherent schooling behaviors to attract more fish into the trap and keep them together until they can be harvested. They are often installed in set locations annually for weeks at a time in shallow, nearshore waters.[12]

Fish traps account for a minority of black sea bass landings and minimal landings of butterfish and scup in these fisheries. Fish traps have been on the decline in this region, but remain in some places such as Rhode Island, and are used to target species like scup. Given the location where traps are fished, nearshore, benthic habitats are most likely to be impacted. Anchoring the nets to the seafloor and any movement of these weights along the bottom during periods of strong currents or wave energy can disturb compress, convert, or suspend benthic substrate. Similar to fish pots, the impacts of this gear are likely to be low on mud, sand, and gravel substrates due to their relatively small contact with the seafloor and predictable locations.[13]

Gill Nets

Gill nets are rectangular nets used to entangle fish around their gills as they swim by. They utilize translucent walls of monofilament nylon netting that are set across currents and fished vertically. A buoyant floatline along the top portion of the net and a heavy leadline along the bottom keep the net in place, and



[11] *Ibid.*

[12] Image Source: University of Minnesota Se[illegible] .

[13] Northeast Region Essential Fish Habitat St[illegible]

maintain the spread of the mesh while fishing. Gill nets may be fished at any depth in the water column depending upon their configuration and the desired species; they are versatile and can be fished in nearshore estuarine waters as well as offshore and over the continental shelf.[14]

Pelagic Gill Nets

Pelagic gill nets do not contact the seafloor; some are fished in midwater depths, while others are deployed just above the seafloor.

Sink Gill Nets

Sink or bottom gill nets rely on leadlines running along their length or anchors spaced along the net to hold them in position along the seafloor. They are typically about 300 feet long and 12 feet high, and are fished in strings of three to four nets at a time on a school of fish or particular bottom feature.

> *Stake Gill Nets*
>
> In shallow, inshore waters, stakes can be used to fasten sink gill nets to the seafloor to fish across tidal currents. Stakes are driven into the sediment along the span of the net; the stakes remain in place while the net can easily be lifted, checked, and re-set.

In the Mid-Atlantic region, gill nets account for the majority of Atlantic bluefish landings, and sink gill nets account for the majority of landings in the spiny dogfish fishery. While pelagic gill nets do not contact the seafloor and are likely to have minimal habitat impacts, sink gill nets can directly contact and impact benthic habitats with leadlines and anchors. Disturbances may occur while setting and retrieving gear, and by the movement of weights along the seafloor with heavy currents or wave action. Stake gill nets can create additional impacts by driving stakes into the sediment, impacting benthic habitat and causing scour. Sink and stake gill nets are likely to have low impacts in sand, mud, and gravel habitats.[15] Sink gill nets deployed in deep water on the continental slope could permanently impact hard bottom clay structures or deepwater corals.[16] While gill nets can be selective by matching mesh size to the desired target species, bycatch concerns have prompted some states in the region to restrict their use.[17]

[14] Image Source: Encyclopedia Brittanica, Inc. 2010. Web: http://media.web.britannica.com/eb-media/15/144915-004-ED578F04.gif.

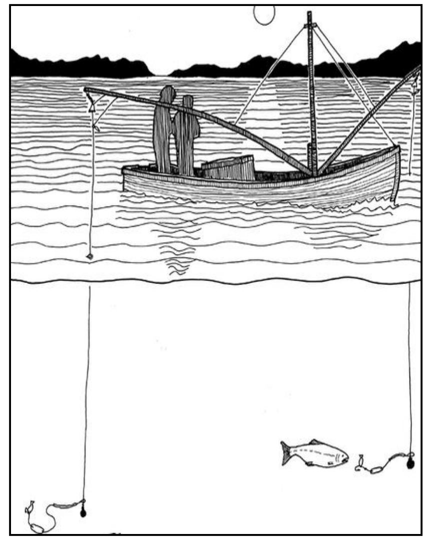
[15] Northeast Region Essential Fish Habitat Steering Committee. 2002. p. 32.

[16] *Ibid*.

[17] New England Fishery Management Council Habitat Plan Development Team. 2011. p. 57.

Hook and Line

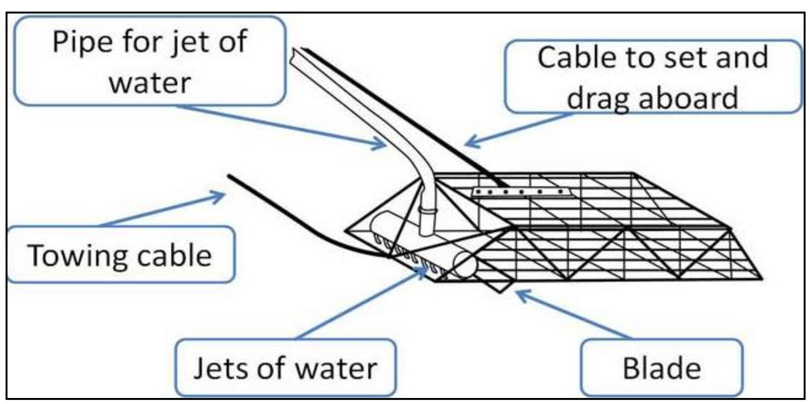
Hook and line gear consists of a line with an attached lure or baited hook. The bait or lure can drift in the water column or sink to the bottom by attaching weights to the line. Typically, one hook or lure is tied to each line to catch a single fish, but umbrella rigs allow several baited hooks or lures to be fished from a single line. Fish are hooked in the mouth and held until the bite is detected and they can be retrieved. Lines may either be set and retrieved by hand (hand-lining), with rod and reel, or by electric or hydraulic retrieval machines that are mounted to the vessels, which allow small crews to simultaneously fish and retrieve several lines.[18]



In the Mid-Atlantic region, hook and line gear is used in the commercial sector to catch a minority share of Atlantic bluefish and spiny dogfish. Jigging machines mounted on fishing boats can also been used to jerk unbaited, snagging lures through the water column to catch squid, though this practice is uncommon in the Mid-Atlantic. Rod and reel gear is used extensively in the recreational sector to target all MAFMC managed species with the exception of Atlantic surfclams and ocean quahogs. In general, hook and line gear is unlikely to cause benthic habitat impacts due to the small, temporary footprint of weighted hooks and lures contacting the seafloor.

Hydraulic Clam Dredges

A hydraulic clam dredge resembles a metal cage that is towed behind a vessel along the seafloor to collect clams. The dredges measure about 12 feet wide and 22 feet long, and incorporate narrow, pressurized jets along their leading edge that force water into the sediment to create turbulence and dislodge clams and other invertebrates. A hose from the fishing vessel attaches to the front of the dredge and supplies the force for the operating jets to stir up sediment and pull the dredge forward and several inches down into the sediment. This action helps to unearth clams from sand and sandy-mud or sandy-gravel mixed substrates. A horizontal metal cutting bar rides at an angle behind the jets to catch and direct the dislodged clams up and into the cage behind it for



[18] Image Source: The Fish Project, 2011. Web: http://thefishproject.weebly.com/uploads/9/4/7/1/9471530/4342638.png?544.

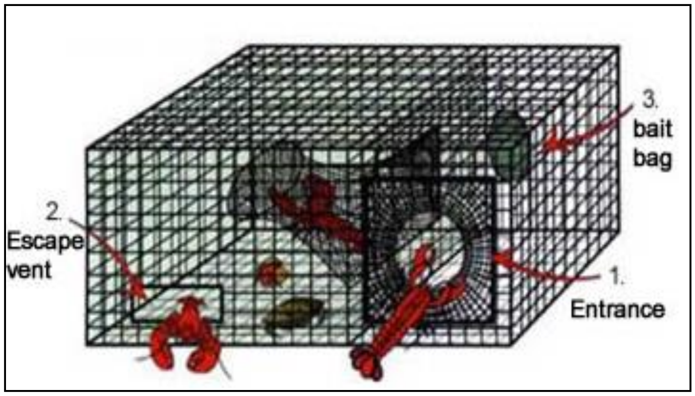
collection. The cage allows sediment, invertebrates, and undersized clams to pass through without being retained. The dredge is typically towed at about 2.5 knots for 15 minutes and gradually slows down as the cage fills with clams, at which point the dredge is pulled back to the surface with a winch.[19]

In the Mid-Atlantic and New England regions, hydraulic clam dredges are used commercially to collect the majority of both ocean quahogs and Atlantic surfclams. Hydraulic dredges are commonly fished in fine-grain sandy substrates, and can also be used in large-grain sand, and mixed mud/sand/gravel substrates. The pressurized jets do not function properly in hard bottom habitats or in areas with seagrass; hydraulic clam dredges are excluded from shallow waters where SAV grows due to their vulnerability to impacts.[20] Hydraulic clam dredges are likely to significantly impact biological and geological benthic structures and habitat by removing substrates through the trenching action of the dredge and suspending sediments with pressurized jets.[21] These activities may bury existing or uncover new substrates in the wake of the dredge and change the nature of the benthic habitat. The weight and force applied by the dredge and pressurized jets can reduce habitat complexity by removing existing structure and burrows, creating unnatural mounds, and filling interstitial spaces between sediments. In addition to habitat impacts, hydraulic clam dredges are likely to dislodge many species of invertebrates in their wake, which can temporarily increase predation and reduce overall species abundance in localized areas. According to expert judgment, hydraulic clam dredges have the highest potential to cause significant, lasting habitat damage of any fishing gear type.[22] However, since they are used in relatively small areas across the Mid-Atlantic and New England, their total potential to impact benthic habitat is not as great as bottom trawls or scallop dredges, which are used much more commonly and have a greater total footprint of impact.[23]

[19] Image Source: University of Padova, 2011. Web: http://chioggia.scienze.unipd.it/DB/immagini/Hydraulic-dredges-1.jpg.
[20] Northeast Region Essential Fish Habitat Steering Committee. 2002. p. 14.
[21] Northeast Region Essential Fish Habitat Steering Committee. 2002. p. 15.
[22] New England Fishery Management Council Habitat Plan Development Team. 2011. p. 107.
[23] Northeast Region Essential Fish Habitat Steering Committee. 2002. p. 14.

Lobster Pots

Lobster pots are rectangular, wire-mesh cages coated in plastic that contain bait to attract and trap lobsters on the seafloor. Lobster pots incorporate long, sloping tunnel entrances on two sides to allow lobsters to enter the pot, and escape vents on the other sides to allow undersized lobsters to escape. Where the benthic substrate is hard and uneven, single pots are often deployed with individual buoys; strands of up to 100 pots connected by floating or sinking mainlines may be used where the benthic substrate is smooth and soft. When fished in rough, offshore waters, larger and heavier lobster pots are deployed. After soaking for several days, the mainlines and pots are pulled aboard small vessels and the live lobsters are collected.[24]

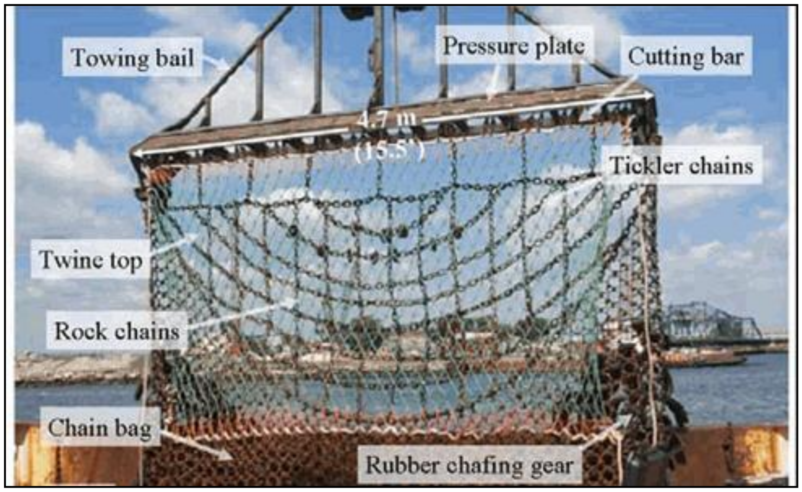


While lobster pots are specifically designed to catch lobsters, a minimal portion of MAFMC managed black sea bass landings is caught as bycatch. Lobster pots are versatile and can be set both nearshore and offshore on any benthic substrate. Benthic habitats can be negatively impacted by the weight of the pots crushing, compressing, or disturbing the benthic substrates and causing scour of sediments. When fished in a string, lobster pots and their attached mainlines may drag along the seafloor during deployment and retrieval, potentially increasing the area impacted. The use of floating mainlines can minimize these impacts; however, pots with floating mainlines need to be carefully placed away from migration corridors to avoid entangling whales. In general, the benthic impacts from a single lobster pot are likely small due to their limited footprint and temporary presence on the seafloor. However, repeatedly deploying pots or strands of pots in the same areas may result in cumulative impacts, especially in areas with high structural complexity.[25] For example, biological benthic habitat and seafloor depressions may be vulnerable to damage and smoothing over by repeatedly soaking trap gear in these areas.[26] However, as this gear is not commonly used in the Mid-Atlantic, they have low potential to significantly impact benthic habitat.

[24] Image Source: Lobster Traps Organization, 2014. Web: http://www.lobstertraps.org/img/lobster-trap-diagram.jpg.
[25] Northeast Region Essential Fish Habitat Steering Committee. 2002. p. 28.
[26] New England Fishery Management Council Habitat Plan Development Team. 2011.

Scallop Dredges

Scallop dredges are metal bags towed behind vessels used to dislodge and collect scallops from substrates on the seafloor. The bag is about 15 feet wide and the bottom is made up of many heavy metal interlocking rings, like chainmail, called chafing gear; the rings are sized to retain legal scallops and allow undersized scallops, other invertebrates, and sediments to fall back through them to the seafloor. A metal cutting bar on the leading edge of the dredge moves horizontally just above the surface of the sediment, creating turbulence that forces the scallops up off the seafloor and into the bag behind it. Protective metal "shoes" in front of the cutting bar help the dredge ride smoothly over uneven substrates and avoid damage from collisions with hard obstacles on the seafloor. A series of chains behind the cutting bar help direct scallops up and into the bag, while keeping sediment and undesired species out. Scallop dredges can be deployed singularly or in tandem and are typically towed between four and five knots to keep the cutting bar working efficiently. While typically towed over mostly smooth substrates, heavier, sturdier dredges can be used to fish over hard substrates. Depending upon the substrate type and density of scallops on the seafloor, tows can last from ten minutes to one hour.[27]



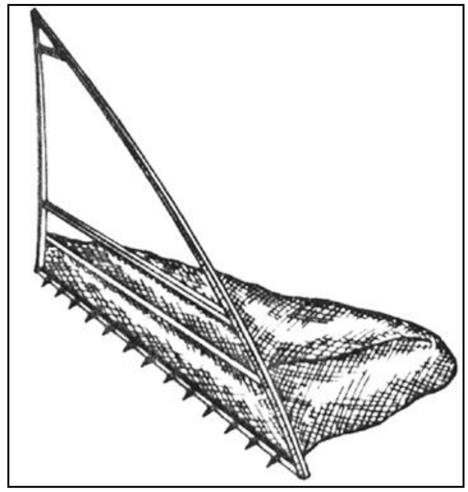
While scallop dredges are used commercially to target scallops, a minimal portion of summer flounder landings is also caught as bycatch. They can impact benthic habitats to varying degrees based on the width of the dredge, the speed at which it is towed, and the characteristics of the substrates present. The shoes, chafing rings, and chains are all designed to drag along the seafloor and are likely to cause significant impacts on benthic habitats in the path of the dredge through crushing, compressing, or damaging structures and suspending substrates. Scallop dredges can also remove biological and geological habitat altogether, displace sediments, reduce habitat complexity by smoothing over or filling seafloor depressions created by the scallops, and destroy or damage emergent and attached benthic epifauna such as colonial polychaetes.[28] These impacts may reduce abundance of some invertebrates and food quantity and quality of the surrounding benthic substrate.[29] In mixed substrate habitats such as gravel, the metal chafing rings can significantly alter the first few inches of benthic substrate by

[27] Image Source: Goudey, 1999. Web: http://www.scienceteacherprogram.org/images/CComer11-2.gif.
[28] Northeast Region Essential Fish Habitat Steering Committee. 2002. p. 18.
[29] Northeast Region Essential Fish Habitat Steering Committee. 2002. p 20.

creating shallow trenches and suspending sediments, including contaminated sediments.[30] The likely habitat impacts from scallop dredges are similar to those of trawl gear, though scallop dredges cannot be fished as deeply and thus have a smaller potential impact footprint due to much shorter tow times.

Toothed Clam Dredges

Toothed clam dredges are metal cages that are towed along the seafloor by small vessels to rake clams out of the sediment. Fished primarily in sand and sandy mud substrates, the cages ride on skis to help them slide easily over obstacles and uneven bottom on the seafloor. Toothed clam dredges incorporate long, angled metal tines, or "teeth," on their leading edge to rake through benthic substrates, which dislodges sediment, clams, and invertebrates. Once dislodged, the clams are forced upward and into the cage for collection. The cage design incorporates spaces in the bottom to allow undersized clams, other non-target invertebrates, and sediment to pass through and fall back to the seafloor. After each tow, the dredge is pulled back to the vessel by a winch to collect the remaining clams.[31]

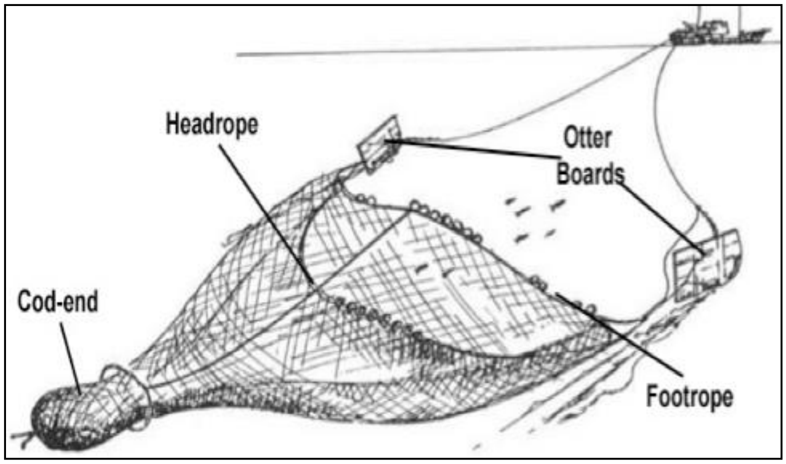


Toothed clam dredges are a secondary gear used to target ocean quahogs and Atlantic surfclams, and are predominantly used from southern New England northward. These dredges account for minimal landings in each fishery. The size of the dredge and speed of the tow dictate the degree to which benthic habitats are impacted by toothed clam dredges. While in contact with the seafloor, the skis can compress, convert, or damage benthic habitats and may smooth over biological depressions or collapse existing burrows, reducing habitat complexity. The dredge's teeth rake the benthic sediments to a depth of about six inches, which can destroy, damage, or disturb benthic habitats and create small furrows in their wake. The dredge can also dislodge invertebrates, which can attract predators and increase predation in areas following a tow. Therefore, toothed clam dredges are likely to have significant impacts on benthic habitats.

[30] *Ibid*.
[31] Image Source: FAO, 2003. Web: http://www.fao.org/docrep/field/003/AB874E/AB874E18.gif.

Trawls

Trawling consists of a single vessel or pair of vessels towing a long, tube-like net through the water at a desired depth that funnels and captures species of fish and invertebrates. Large, heavy wooden or metal panels called "otter boards" or simply "doors" are attached to the sides of the net by wire ground cables and bridles. The towing cable, or "warp," attaches each of the doors to the vessel, which create tension and drag on the water to help drive them down and apart to keep the net mouth wide open. For trawls that fish on the seafloor, the doors are equipped with metal "shoes" on their front and underside to protect them from damage as they bounce off rocks and hard substrate on the seafloor, and to create clouds of silt at the edges of the net mouth to herd fish inside. The trawl nets themselves, also called "trawls," are widest at the mouth and gradually get narrower toward the back of the bag, called the "codend," where fish are concentrated and eventually collected when the gear is hauled back to the vessel. A buoyant floatline runs across the top of the trawl net and a heavy leadline or footrope runs along the bottom portion of the net mouth, called the sweep, to apply vertical forces to keep the net open during a tow.[32]



Trawl gear is versatile: the speed of the vessel, size of the net and its mesh, and configuration of the ropes and chains can all be changed based on the desired depth and species to be fished. Including cables, sweeps and spread of the net between doors, the static footprint of trawl gear can span several hundred feet. Tows can last as long as six hours and at a typical speed of about three knots, can cover a distance of 20 miles and have 0.75 square miles of bottom contact.[33]

Midwater Trawls

Midwater trawls are towed by one or a pair of vessels and rely on a series of funneling ropes and engine noise to herd schooling fish toward the net and are commonly used in the Mid-Atlantic region to fish the middle of the water column. If fish congregate in deep water, heavy balls of chains can be attached to midwater trawl gear to allow it to fish deeper, and allow it to occasionally contact the seafloor.

[32] Image Source: NOAA Fisheries NEFSC, 2012. Web: http://www.nefsc.noaa.gov/psb/bycatch/typical_trawl.jpg.
[33] Mirarchi, F. 1998. "Bottom Trawling on Soft Substrates." p. 80-84 in: *Effects of Fishing Gear on the Seafloor of New England*. E.M. Dorsey and J. Pederson (eds.). MIT Sea Grant Publication. 98-4, 160 pp.

Bottom Otter Trawls
In contrast, bottom otter trawls are designed to sweep along or just above the seafloor to catch various benthic and demersal species of fish and invertebrates, and are the most common type of trawl gear used in the region. Bottom trawlers can adjust the speed of the vessel, the length of the warp, and the weight of the gear through the use of chain sweeps and "rollers" to suspend the net just off the bottom to target demersal species like scup or squid, or may use heavier chain sweeps that keep the net in constant contact with the seafloor to target flatfish such as summer flounder.

Raised Footrope
Some bottom trawl gear is designed specifically to employ a raised footrope to help reduce bottom contact and benthic groundfish species while targeting demersal species that hold just off the bottom like squid or butterfish. In areas of rough or uneven seafloor, bottom trawls can be outfitted with many small, rubber circles called "cookies" near the underside of the net mouth to help them roll smoothly over bottom contours: these are often called "roller" sweeps.

Rockhopper
Recently, larger, heavier "rockhopper" sweeps have been developed that utilize a series of fixed rollers along the bottom of the net. These help minimize damage to the seafloor from dragging gear on the bottom, and keep the net from catching on obstructions as it moves along the seafloor.

In the Mid-Atlantic fisheries, each trawl configuration is utilized to target federally managed species. Small mesh single or paired midwater trawls are used to catch the majority of Atlantic mackerel and herring when the fishery is operating at high capacity, and a small portion of shortfin squid (*Illex*) landings. Bottom otter trawls are responsible for the majority of shortfin squid (*Illex*) and longfin squid (*Loligo*) landings, a minority share of spiny dogfish landings, and minimal golden tilefish landings. Raised footrope trawls are mostly used to target spiny dogfish and account for a minority of landings in that fishery while avoiding benthic groundfish species. Rockhopper bottom trawls account for the majority of landings in the summer flounder, scup, butterfish, and black sea bass fisheries, and also the majority of Atlantic mackerel landings when the fishery is operating below capacity.[34]

Habitat impacts from trawling are generally related to the type and configuration of the gear, its relative weight in the water, the amount of the seafloor contacted, and the length of the tow. Pelagic or midwater trawls rarely contact the seafloor; therefore they are less likely to cause significant habitat impacts compared to bottom otter trawls. Significant impacts to habitat result from towing gear along the seafloor, including doors, ground cables and bridles, footrope, sweep portion of the net mouth, and any associated rollers or cookies on bottom-tending trawl

[34] When operating at full capacity, midwater trawls account for the majority of Atlantic mackerel catch; rockhopper bottom trawls currently take the majority of Atlantic mackerel as the fishery operating at a low level.

gear. As a result, negative impacts to all benthic habitat types including mud, clay, sand, gravel, rock, or mixed substrates are highly likely. Bottom trawling gear can directly damage, convert, or destroy biological and geological benthic habitats such as structures formed by organisms and mounds of substrate through crushing, burying, and disturbing substrates.[35] The weight of the doors, shoes, and rollers scraping on benthic substrates can reduce habitat complexity by smoothing and filling burrows and depressions on the seafloor, suspend sediments due to turbulence in its wake, and significantly reduce species abundance in areas by redistributing and removing sediments.[36] The sum of these mechanisms can decrease and disrupt overall ecosystem productivity and function. In certain areas such as deepwater mud, clay, and gravel, these impacts may permanently reduce the suitability of habitats for species. For example, trawling may knock over or remove gravel, cobble, or boulder mounds that do not re-form.[37]

Bottom trawls are likely to impact benthic habitats over a single tow; repeated trawling over the same areas of seafloor can exacerbate impacts, have cumulative effects on habitats and benthic communities, and impact a greater portion of the seafloor.[38, 39] Due to their widespread, varied use across the region and large footprint on the seafloor, bottom otter trawls in their various configurations are likely to cause the most widespread habitat impacts of any gear type used in the Mid-Atlantic.[40] The use of rockhopper trawl gear in particular, which is mostly coated in plastic and can be up to 80% lighter than other bottom trawl gears, may be able to reduce the severity and duration of some of these impacts, however.

III. Potential Habitat Impacts in the MAFMC Context

Two tables are presented below to visually represent a comparison of potential habitat impacts across gear types. They are designed as a heat map to give a sense of which targeted fisheries use these gears and which gears are likely to cause the most significant impacts on habitats in the Mid-Atlantic region. Gears are scored and color-coded as low, moderate or high potential impacts based on the information summarized in each gear profile, which is rooted in expert judgment, peer-reviewed published research, observational studies, and some gray literature (Table 1). These rankings are not intended to be technical or absolute, and represent relative rankings across gears. The actualized habitat impacts resulting from the use of each gear will depend on its specific configuration, where it is used, and the specific types of habitat present.

[35] Northeast Region Essential Fish Habitat Steering Committee. 2002. p. 24-25.
[36] Northeast Region Essential Fish Habitat Steering Committee. 2002. p. 25.
[37] *Ibid*.
[38] *Ibid*.
[39] Northeast Region Essential Fish Habitat Steering Committee. 2002. p. 23.
[40] New England Fishery Management Council Habitat Plan Development Team. 2011.

In Table 1, each fixed gear including bottom longlines, pots, and traps, are scored as having low habitat impacts. Mobile gears such as bottom otter trawls and dredges that tow or drag equipment along the seafloor can crush, remove, and bury and suspend sediments, reducing habitat complexity and leaving altered substrates in their wake; these gears are scored as having high potential for habitat impacts.

Table 1. Heat Map of Habitat Impacts by Gear Type

Gear Type	Potential Habitat Impacts	Targeted MAFMC Fisheries
Bottom Longline [41]	Low	Golden Tilefish
Fish Pot	Low	Black Sea Bass, Butterfish, Scup
Fish Trap	Low	Black Sea Bass, Butterfish, Scup
Pelagic Gill Net	Low	Atlantic Bluefish
Hook and Line	Low	Atlantic Bluefish, Spiny Dogfish; potentially all species except Atlantic Surfclams and Ocean Quahogs may be caught by recreational sector using hook and line gear
Lobster Pot	Low	Black Sea Bass
Single or Paired Midwater Trawl [42]	Low	Atlantic Mackerel, Shortfin Squid (*Illex*)
Sink Gill Net	Moderate	Spiny Dogfish
Bottom Otter Trawl	High	Summer Flounder, Scup, Black Sea Bass, Spiny Dogfish, Golden Tilefish, Atlantic Mackerel, Butterfish, Longfin Squid (*Loligo*) and Shortfin Squid (*Illex*)
Hydraulic Clam Dredge	High	Atlantic Surfclam, Ocean Quahog
Scallop Dredge	High	Summer Flounder (as bycatch)
Toothed Clam Dredge	High	Atlantic Surfclam, Ocean Quahog

[41] Bottom longlines generally have low impacts on habitat, but may cause permanent damage to rare, sensitive habitat types such as deepwater coral and hard clay.
[42] Midwater trawl is usually the dominant gear type used to catch Atlantic mackerel. However, the fishery is operating at low levels and bottom otter trawls account for the majority of the catch at this time.

Table 2 includes landings information from personal communication with MAFMC staff and NOAA Fisheries trip report logbook data as a proxy for effort of each gear type in the Mid-Atlantic region. The likely habitat impacts of each gear in Table 1 are presented in the center column, while the effort-indexed impact potential is scored in the far right column. Gears accounting for greater than 50% of landings in a fishery are coded as “Majority” gears, whereas gears accounting for less than 50% of landings are coded as “Minority” gears. Where a gear accounts for less than 5% of fishery landings, it falls under a “Minimal” category. In these cases, the previous coding of the minimal gear from Table 1 is downgraded to reflect a lower likelihood of habitat impacts. For example, bottom trawls account for minimal landings in the golden tilefish fishery, and therefore are scored down from high to moderate impacts. The Atlantic bluefish fishery is the only Mid-Atlantic fishery generally prosecuted with gears that are likely to have low habitat impacts, while the golden tilefish fishery uses gears that are likely to cause low and moderate impacts, respectively. Every other MAFMC-managed fishery utilizes some gears that have the potential to cause high habitat impacts.

Table 2: Heat Map of Habitat Impacts by MAFMC Fisheries, indexed by Gears and Landings [43]

MAFMC Fishery	Gears Used	Potential Habitat Impacts	% of Landings	Effort-Indexed Impact Potential
Atlantic Mackerel [44]	Bottom Trawl	High	Majority	High
	Midwater Trawl	Moderate	Minority	Moderate
	Other [45]	N/A	Minimal	N/A
Atlantic Surfclams	Hydraulic Clam Dredge	High	Majority	High
	Toothed Clam Dredge	Low	Minority	Low
Black Sea Bass	Bottom Trawl	High	Majority	High
	Fish Pot and Fish Trap	Low	Minority	Low
	Lobster Pot	Low	Minimal	Low
	Other	N/A	Minority	N/A
Atlantic Bluefish	Pelagic Gill Net	Low	Majority	Low
	Hook and Line	Low	Minority	Low
	Other	N/A	Minimal	N/A
Butterfish	Bottom Trawl	High	Majority	High
	Fish Pot and Fish Trap	Low	Minimal	Low
	Other	N/A	Minority	N/A
Golden Tilefish	Longline	Low	Majority	Low
	Bottom Trawl	High	Minimal	Moderate
Shortfin Squid (*Illex*)	Bottom Trawl	High	Majority	High
	Midwater Trawl	Moderate	Minimal	Low
Longfin Squid (*Loligo*)	Bottom Trawl	High	Majority	High
	Other	N/A	Minimal	N/A
Ocean Quahogs	Hydraulic Clam Dredge	High	Majority	High
	Toothed Clam Dredge	Low	Minority	Low
Scup	Bottom Trawl	High	Majority	High
	Fish Pot and Fish Trap	Low	Minimal	Low
	Other	N/A	Minimal	N/A
Spiny Dogfish	Sink Gill Net	Moderate	Majority	Moderate
	Bottom Otter Trawl	High	Minority	High
	Hook and Line	Low	Minority	Low
	Other	N/A	Minimal	N/A
Summer Flounder	Bottom Trawl	High	Majority	High
	Scallop Dredge	Low	Minimal	Low
	Other	N/A	Minimal	N/A

[43] Landings information comes from personal communication with MAFMC staff and NOAA Fisheries trip report logbook data and is presented here to give relative impressions of the most important gears used in a fishery.
[44] The dominant gear in the Atlantic mackerel fishery changes from bottom to midwater trawl as noted above.
[45] "Other" denotes specific gear type information was not available.

IV. Discussion

Some important nuances emerged from this research that can inform discussions around habitat impacts from fishing gears. The total impact of the different gear types on habitat in the Mid-Atlantic region is related to several factors such as configuration of the gear, area fished, total effort, and seasonality. Some gears described above are used to catch MAFMC managed species, but are mainly used within state waters, such as staked gill nets and toothed clam dredges. At first glance, some gears seem to have low impacts on habitat on an individual tow or soak basis, but the cumulative impacts of repeatedly deploying gears such as lobster pots over time may be quite significant to habitat on a region-wide scale. For example, the total impact of the widespread use of hook and line gear by the recreational sector in the region may be substantial. Simple adjustments to how the gear is deployed, such as reducing soak times for certain fixed gears like bottom longlines or pots could reduce impacts to habitat by reducing the amount of time they contact the seafloor.

Fishing gear impacts on habitat are a function of both the single and cumulative use of each gear type used in the region. Scallop dredges, hydraulic and toothed clam dredges, and bottom otter trawls are the most likely gears to cause significant habitat impacts.[46] These relatively heavy gears are towed or dragged along the seafloor and purposefully create turbulence to suspend sediment and organisms, and therefore are likely to impact habitats over long timeframes of months to years. Fixed gears, such as lobster pots, fish traps and fish pots, and bottom longlines are the least likely to cause significant, long-term habitat impacts due to their relatively small and temporary footprint on the seafloor.[47] Gears that do not contact the seafloor such as floating gill nets are unlikely to impact benthic habitats. Over a single tow, scallop dredges, hydraulic clam dredges and bottom trawls may have the highest potential to impact habitat. However, when taking into account the width of the gear, towing speed and area towed, and the size of the fleet using each gear, bottom otter trawls are likely to cause the most significant impacts to habitat across the region.

[36] Northeast Region Essential Fish Habitat Steering Committee. 2002. p. 41
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Fishing Impacts – Draft Council Policy

This policy applies to managing the impact of fishing on sensitive habitat areas. [Advisors recommended moving this first section to the Preamble of all the policy documents]

1. An ecosystem approach, which includes consideration of benthic communities and habitat, and their linkages within the ecosystem, is fundamental to the sustainable use of our marine resources.

2. To ensure healthy and productive marine ecosystems, it is imperative that the impacts of fishing in sensitive benthic habitats be considered in fisheries management decision making.

3. Sustainable use that safeguards ecological processes is a priority of fisheries management decision making.

4. Not all benthic areas require equal levels of protection, as not all areas are equally ecologically or biologically significant or vulnerable to particular stressors.

To support these overarching directives, the areas within the Council's fisheries management jurisdiction are defined as two types:

A ***historically fished area*** is a marine ecosystem area where there is a history of fishing; this may include ongoing fishing activity.

A ***frontier fishing area*** is an area of the marine ecosystem where there is no history of fishing. In the Mid-Atlantic this includes deep areas of the Outer Continental Shelf.

There is a higher level of scientific uncertainty about benthic habitat and its associated communities in frontier fishing areas than within historical fishing areas. Within the Council's "Deep sea coral zones", areas where corals have been observed or where they are likely to occur, fishermen will be prohibited from using bottom-tending fishing gear such as trawls, dredges, bottom longlines, and traps. Large swaths of the area in these coral zones are frontier fishing areas.

Frontier Fishing Areas Policy

5. The Council will evaluate the expansion of existing or new fisheries or new fishing gears into frontier fishing areas for potential impacts to benthic habitats, and determine the sensitivity of these areas to the proposed fishing activity.

Historically Fished Areas Policy

6. The Council will identify benthic areas and high productivity areas that may be more at risk than others within historically fished areas, and prioritize the work and fisheries management actions that may be required to mitigate or avoid harm. This will include consideration of the cumulative impacts of all fisheries and fisheries gears on Mid-Atlantic fish benthic habitat through fishing gear impact analyses.

7. Evaluate the effectiveness of existing fisheries management measure for minimizing fish habitat impacts, and determine whether changes are required.

8. Implement management measures across fishery management plans that may reduce impacts on benthic habitat. For example, efficiencies in the fisheries such as trip limits, or other existing measures impact the time gear may spend on the seabed.

Fishing Gear Use (applies to all fishing areas)

9. Measures which avoid or reduce the potential for lost gear, or “ghost gear”, should be considered in fishery management plans, where practicable.

10. Fishing gear modifications or substitutions which reduce the impacts on benthic habitats should be considered in fishery management plans, where practicable.

Meeting Summary

Ecosystems and Ocean Planning Advisory Panel Meeting

July 21, 2015

Advisors: Frederick Akers (GEHWA), Bonnie Brady (LICFA), Gregory DiDomenico (GSSA), Monty Hawkins, Roman Jesien (MD Coastal Bays), Meghan Lapp (Seafreeze, Ltd.), Carl LoBue (TNC), Pam Lyons Gromen (Wild Oceans), Peter Moore (MARACOOS), Steven Ross (UNCW), Brad Sewell (NRDC), David Wallace (Wallace&Assoc.), Judith Weis (Rutgers), John Williamson (Ocean Conservancy)

Invited Habitat Experts: Sarah Cooksey (DNREC- Delaware Coastal Programs), Karen Greene (NOAA Fisheries Habitat Conservation Division (HCD)), Brian Hooker (BOEM), Terra Lederhouse (NOAA Fisheries HCD), Jake Levenson (BOEM), Catherine McCall (MDDNR - Maryland Chesapeake & Coastal Service), Howard Townsend (NOAA Fisheries HCD – Chesapeake Bay Office)

Staff and Council Members: Jessica Coakley (Staff), Warren Elliott (Council/Committee Chair)

Others: Megan Driscoll (National Aquarium), Lauren Latchford (NOAA Fisheries HCD), Andrew Rubin (NOAA Fisheries HMS)

Summary

The Ecosystems and Ocean Planning Advisory Panel (AP) met to discuss the draft policy documents to solicit some early input on these materials for the Ecosystems and Ocean Planning Committee. A number of subject matter experts on coastal and ocean development issues related to fish habitat were invited to attend the meeting to help support a more detailed discussion with the advisors.

The discussions were extensive and thorough, and as a result the advisors were only able to review about half of the material; the draft General Policies, Liquefied Natural Gas, Wind Energy, and Offshore Oil at length, and very briefly Fishing Impacts. Advisors were asked to provide any written comments on subjects they did not have the opportunity to discuss at the meeting (provided after this summary); staff are planning to schedule another AP meeting after the Committee meets in August 2015.

To the extent possible, comments at the meeting were directly integrated into the policy drafts while being discussed. They were on the screen and being editing in real time. The summary that follows here touches on general topics that were discussed and/or those comments that have not been addressed in the documents.

The group discussed the purpose of these policy documents and where they fit within the Council process (i.e., plans, consultations, larger context?) to reduce impacts on fish habitat. The group discussed the EFH consultation process and coastal zone management tools within our region in some detail. Advisors emphasized that both fisheries management and habitat restoration should be important parts of addressing fish habitat in our region. It was also noted that while future planning and enhancement are important, we need to take steps to prevent habitat degradation so it doesn't continue.

Advisors discussed the proposed ways to improve the process by being notified of projects in our regions by NOAA Fisheries and how to identify which types of projects the Council might be interesting in based on scale of project, habitat type it occurs in, or activity type (proposed agreement with NMFS plus filter). The advisors intended to revisit this discussion at the end of the meeting but did not have time.

The advisors recommended the development of a “preamble” to these policy documents framing the issue and the context for development of the draft policies to reduce impacts on fish habitat. A draft preamble has been included based on their advice.

For all the policy documents, it was suggested that the list of species impacted by each activity be moved to the front of each policy document (as opposed to the end), and that it should document prey species and other management species that could potentially be impacted by these kinds of activities.

The group discussed the importance of habitat information and research, and put forward the idea of developing habitat research plans. These could potentially be integrated into the Council’s research plan. These could be species specific, across all plans; and could include the kind of data collection that would benefit habitat knowledge (e.g., bathymetry (multi-beam mapping), habitat mapping, links to productivity, etc.). NOAA HCD noted that identifying habitat research items is part of the essential fish habitat review process [currently planned for 2016].

There was some discussion of the Regional Planning Body and their role in this process. It was suggested that the RPB is intended to address some of the cumulative impact and larger scale planning issues that were raised (i.e., development corridors, wind energy cable connector, etc.). The group discussed how it may fit in this process.

Having projects engage early in the consultation process and establishing appropriate monitoring of projects were a common discussion theme. Some suggested the project developer should pay, but in some cases other agencies may pay for some of the monitoring. It was suggested it depends on each project and what is required, so there was not a draft policy relative to who pays for sampling.

The group then moved through each of the policy documents. As noted above, extensive real-time editing was done with the advisors to directly incorporate the bulk of their comments in the drafts. Some additional issues were raised specific to the individual policies:

The issue of compensatory mitigation for fishing gear/vessel impacts was raised. In the case of the oil and gas industry, there are compensatory mitigation funds set aside to pay for damage to fishing gear and/or vessels, etc. Compensatory mitigation could apply to other activities within the region such as wind. It was suggested that the Council should approach legislators to have a similar kind of fund established for wind energy, or consider including this in their habitat policies.

The issue of oil and gas dispersant use and what the policy should be on this subject was raised. There were opinions on whether they should be used, and lessons learned from the gulf. This may be an issue the Council want to comment on/revisit. Advisors also noted that the Atlantic coast is not equipped to deal with oil and gas spill response effectively, and preparedness is an issue in our region.

Several advisors raised the issue of eutrophication and water quality both in the meeting and in their written comments. While a general policy was added about point and non-point sources of pollution, this may be an area the Council want to expand or consider further development.

In general policies, the issue of whether it was worthwhile to have projects reconsult when it is time to decommission a project was met with extensive discussion. The policy statement suggests that because it may be decades before decommission projects, projects should reconsult on their options as there may be better technologies available for removal or to consider alternative uses (i.e., artificial reefs). Advisors were clearly mixed on the outcome and whether rigs and platforms should be left in the water.

Advisors noted that there were several policies under wind and LNG that probably apply to both, and should either be cross referenced or integrated into each of those documents. Likewise, effort should be made to look across all the policies for better consistency in language describing sensitive habitat types.

Another general comment was that nearshore and offshore impacts from these activities may be different, and should be better reflected in the policy documents.

Lastly, the group touched briefly on the fishing impacts policies and agreed that that subject required more extensive discussion; perhaps even its own meeting.

Written Comments received from Advisors and Invited Experts on the Materials (as of July 30, 2015):

Comments from advisor Carl LoBue:

Recommendations – Coastal Development

There should be a water quality section in the coastal development section.

Loss of seagrass meadows, deteriorating salt marshes, harmful and toxic algae blooms, hypoxic dead zones, coastal acidification, and fish kills are all symptoms of excessive nutrient loading called Eutrophication. These symptoms are wide spread and are impacting critically important bays, harbors, estuaries, and rivers through the mid-Atlantic. The magnitude of the contribution of different sources of nutrients vary from watershed to watershed. However they are always derived from a combination of the following 1) human waste water from antiquated and improperly sited sewage treatment outfalls, or sewage that is not treated to standards that are appropriate for the area, 2) over reliance on septic systems that contaminates groundwater that ultimately feeds to rivers, bays, harbors, estuaries, nearshore waters, 3) sloppy agriculture (overuse of fertilizers or inadequate resource recovery from animal waste), and 4) nitro oxide atmospheric pollution from the burning of dirty fuels without enough emissions controls.

The steady deterioration of riverine, estuarine, and nearshore nursery areas in the Mid-Atlantic is arguably the biggest long-term threat to Mid-Atlantic and Atlantic Coast fisheries resources. The Council really needs to make some statements about this, it needs to specifically acknowledge this connection, and then make statements that are specific enough so that it will be abundantly clear that the Council supports efforts, policies and investments targeted to reverse these problems and does not support policies and projects that will make the situation worse.

I think this could probably be done with a small number of well written bullets.

In an ideal world, federal agencies (NOAA, EPA, Department of Ag, Energy, Transportation etc…) would be in alignment with improving water quality for both people and nature – some strong connections made by the Council can help to remind people that the nations and the regions recreational and commercial fishing industries rely on clean water too. Right now those statements are missing from these draft policies.

Beach Nourishment

Carefully reconsider the cost effectiveness and efficacy of investments in traditional beach nourishment projects and consider alternatives investments such as non-structural responses and relocation of vulnerable infrastructure out of harm's way in light of forecasts of future coastal storms and long-term sea level rise.

Wetland Dredging and Filling

Modify #2, to read something, "with the exception of the beneficial re-use of dredged materials for wetland restoration….

Recommendations - Shipping

In the ports and marinas section, I recommend a short bullet on 'encouraging proper short and long-term plaining for forecasted future extreme events and sea level rise.'

Reason 1) Many marinas were caught off guard by Sandy and the result was storage of gas, oil, paints at many marinas was not in a place it should have been if people thought more carefully about what was coming, a lot of what was stored in the flood zone ended up going into the bays and harbors –

Reason 2) Investments in infrastructure related to ports and shipping should include and plan around forecasts for sea level rise and coastal storms – it's simply a smart cost effective thing to do.

Fishing Gear:

I think the top 4 statements could be modified and included to represent an umbrella for ALL of the Council policy recommendations

1. An ecosystem approach, which includes consideration of long-term health of essential habitat, and its linkages within the ecosystem, is fundamental to the sustainable use of all of our marine resources.

2. To ensure healthy and productive marine ecosystems, it is imperative that human use impacts in sensitive habitats be considered in deciding the appropriateness of all human uses that impact marine and coastal areas, including but not limited to fisheries management..

3. Sustainable use that safeguards ecological processes is a priority of decision making in the marine and coastal environments.

4. Not all areas require equal levels of protection, as not all areas are equally ecologically or biologically significant or vulnerable to particular stressors.

Additional on fishing gear: I am not without opinions on the issue of impacts of fishing, and fishing methods – but worry that this is a very serious issue that requires much more deliberate conversation that this simple review allows time for, and thus I will hold my comments to this until future conversations.

Thank you so much for considering my comments and suggestions

Comments from advisor Judith Weis:

I would like to see consideration in the Coastal Development section of pollutants coming in from agricultural areas and urban areas - from point sources (e.g. sewage treatment plants) and runoff of fertilizers, etc.

These inputs impair water quality and can have major deleterious effects on fishery species that utilize estuaries or coastal habitats. (We have published about how snapper bluefish are affected by living in a polluted estuary.)

Please change "toxins" whenever it appears in the background documents and/or recommendations to "contaminants" or "toxicants." I explained that "toxins" technically refers to chemicals made by living things, like jellyfish venom, snake venom etc.

Comments from advisor John Williamson:

What seems to be missing from the Offshore Wind Energy background document is a sense of the scale of wind projects. The Walney 1, Walney 2 and West of Duddon Sands projects, taken together, are typical of the current generation of offshore wind projects in Europe. (BTW, the developer, DONG Energy, is in process of buying lease-rights in the Massachusetts WEA.) The scale of these projects is large enough that they shape the environment around them – going way beyond isolated impacts implied by the background document. Therefore, policy needs to consider the cumulative impacts of a wind farm in a much greater area than the immediate footprint of the windfarm alone. Estimates from UK fishermen are that the effected environment is 2.5X to 3X larger than the footprint – that is anecdotal from three different “stakeholder” sources. Policy needs to consider redirection of tidal flows, prevailing currents, sediment transport and settlement “downstream” from construction activities, and sensitive habitats which might be affected outside the OWF.

Taken together the three projects (which are now in operation) cover about 50 square nautical miles (my calculation). The inter-array and export cables, depicted on the charts, cover approximately 140 nautical miles. The act of burying this cable to a depth of 6’ will require disturbance of over 500,000 cubic yards of substrate material (again, my calculation). Foundations and assembly of 350 wind towers create additional potential for sediment disturbance. The stone riprap at the base of each tower (to control scour), cumulatively for 350 towers, introduces about a third of a square mile of benthic structure to the area.

It might also be noted that OWF technology is evolving rapidly and much larger projects are already in early permitting stages in the EU. Additionally, construction methods are evolving to allow projects in greater depths of water (currently depths to 150’). Floating turbine technology is anticipated within the next three to five years which will allow projects in much deeper water at less cost (towers/turbines can be assembled ashore and towed to final location).

What we have seen so far on offshore wind projects have been very small-scale – 2 or 3 turbines off of VA and 5 turbines off of RI. But I think it is likely that we will see much larger projects coming off the drawing boards in the next 3 to 4 years. As I noted, DONG Energy is in process of buying one of the leases BOEM granted last year in the Massachusetts area – DONG is the major developer in Europe and they don’t build small projects.

Attached is recently published information on offshore noise pollution which you might find interesting. It looks at the effects on cod. There is no similar information on noise impacts on black sea bass or fluke

– that “experiment” has yet to be done. But when recreational fishermen are getting excited about the reef-effects of offshore wind farms, they may be in for a surprise. It’s new territory. (If the attachment is not readable, the URL: http://phys.org/news/2015-07-highlights-noise-threat-atlantic-cod.html)

Comments from advisor Meghan Lapp:

I have been reading through the AP briefing materials for next week, and I have a few corrections to make to the descriptions of fishing gear in the “Habitat Impacts from Fishing Anthropogenic Activity Background Document”, as well as a few other statements I found problematic. I built commercial fishing trawls for almost 5 years, so I am very familiar with the types of gear involved.

On the Bottom Otter Trawls section describing types of footropes, there are a few incorrect statements. It says “In areas of rough or uneven seafloor, bottom trawls can be outfitted with many small rubber cookies near the underside of the net mouth to help them roll smoothly over bottom contours: these are often called ‘roller sweeps’.” Firstly, the vast majority of trawls in the Mid Atlantic are fitted with what is called a cookie sweep.(No nets are framed by bare wire on the underside by a bare wire footrope/sweep.) Some may have raised footropes with chains that tickle the bottom, or chains that are covered in cookies, but the majority of nets are framed along the bottom mouth with a sweep made from wire covered in rubber cookies with an occasional lead weight (because the rig is so light otherwise it would never touch the bottom). The cookies protect the wire from damage. This is what is known as a cookie sweep. It is not used on “rough uneven sea floor”, it is used on sand and smooth bottom areas. Also, it is not called a roller sweep. A roller sweep is an entirely different type of gear, a sweep made of a wire covered with large rubber cylinders designed to get over very rocky areas. I have never heard of them ever being used in the Mid Atlantic region, because the vast majority of bottom in the Mid Atlantic region is smooth and sandy bottom. I have only heard of them being used in rocky areas more towards the Gulf of Maine, and they are rarely used any more. So, the term “roller sweep” should be removed and the correct definition of a cookie sweep should be entered into the document.

Rockhopper sweeps do not incorporate rollers. A rockhopper is not a roller. It is essentially a very large rubber cookie. They vary in size and are rarely used in the Mid Atlantic region, again usually because they are used in rocky bottom. They are used to “hop” over rocks, hence the term rockhopper. But there is really no need to use them in the Mid Atlantic, because the bottom doesn’t contain very many rocky areas. Occasionally vessels will use “small” rockhoppers (10-12 inch) in certain places in the Mid Atlantic, so it could be included in the document. But it is not extremely common; most of the time cookie sweeps are used.

On page 15 of the document it says that rockhopper gear is mostly covered in plastic, which I have never heard of. Cookies, rockhoppers, and rollers are all made of rubber.

I am a bit disturbed by the statement also on page 15 that says, after describing bottom trawl impact, that bottom trawls can “decrease and disrupt overall ecosystem productivity and function.” Recent studies have shown that bottom trawling can actually have negligible effect on soft (sand and mud) bottom with no effect on invertebrate species, all while actually and increasing fish productivity: http://www.opc.ca.gov/2015/02/fishery-bulletin-ecological-effects-of-bottom-trawling-on-fish-habitat-along-the-central-california-outer-continental-shelf-lindholm-et-al/ and see also http://rspb.royalsocietypublishing.org/content/280/1769/20131883. These are more recent studies and documents than what are quoted as sources in the document, and they are peer reviewed. So, I would suggest revising that section if possible.

Page 2 states implies that depths greater than 200 feet are not impacted by wave or current energy. However, there is not much evidence to support this. Significant bottom currents have been studied and observed at up to 300-1500 meters, with resulting siltation and sediment transport inn deepwater cayons of 1500 meter depths. See http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3266243/. This is just one study, but it actually points out that storms transporting clay sediments at these depths may actually be necessary for deepwater ecosystems. Other studies exist, however, and oil companies in the past have expressed concerns over hurricanes in the Gulf of Mexico uncovering buried pipelines due to the damage a hurricane can cause the seafloor at a depth of 300ft. Characterizing areas deeper than 200 feet as "low energy" seems a bit of a stretch.

Anyway, I don't know if any of this can be incorporated into the documents before the meeting, but I thought in any event I would let you know.

Comments from advisors Meghan Lapp, Greg DiDomenico, Robert Ruhle, Peter Moore, and Bonnie Brady:

Ecosystems and Ocean Planning Committee Members,

After consultation with several Ecosystem and Ocean Planning AP members, including Greg DiDomenico, Bonnie Brady, Meghan Lapp, Robert Ruhle and Peter Moore we respectfully request that the EOP Committee should take no action on creating a policy regarding fishing impacts.

Due to concerns with the Draft Policy presented at the Ecosystems and Ocean Planning AP meeting, and no opportunity to discuss that document in order to provide AP input, we feel strongly that it is premature to develop a Council policy to address fishing impacts.

We therefore request that no action be taken on this policy at the August meeting and future actions on this policy statement should be postponed.

Thank you for your consideration,

Meghan Lapp, Fisheries Liaison, Seafreeze Ltd.

Greg DiDomenico. Garden State Seafood Association

Robert Ruhle, F/V Darana R

Peter Moore, Industry Liaison

Bonnie Brady, Long Island Commercial Fishing Association

Comments from invited expert Catherine McCall (MDDNR - Maryland Chesapeake & Coastal Service):

Thanks for this continued opportunity to provide feedback. I am passing along a few thoughts for consideration as your discussions move forward.

Best,

Catherine

Marine Transport

- General Item 2 - suggest a rephrase from "sources of erosion" to "sediment load sources" as sediment may not just be from erosion

- General Item 6 - suggest a strike of "such as SAV" at the end as the committee may not want to limit just to this habitat

- One item for consideration could be evaluation of nearby port/transport facilities to evaluate the need for expansion/alteration of a particular facility

- One item for committee consideration could be a policy statement addressing the addition or incorporation of public/fishing access into smaller transport projects where appropriate. With a changing landscape for working waterfronts, the consideration of benefit not only for marine transport communities but also for the fishing community could provide access opportunities. This would be project specific.

- Question for consideration - what type(s) of marine transport would this apply to? Would it be activities related to both non-fishing and fishing transport projects? For instance, is it to address project proposals just for non-fishing commercial ports, or would it also apply to fishing harbor alterations?

Coastal Development

- Generally, the committee may want to consider how they consider landscape-level and/or cumulative impacts to fisheries habitat and resources and how that issue is reflected in response to project application reviews. There is significant dialogue in Maryland about how impervious surface affects fisheries resources. If the concern is at the landscape level, the committee may want to consider how to articulate the cumulative impacts of project review level in individual project applications. For instance, is it impervious surface limits, consideration of placement of infrastructure, etc.? Some of this may depend upon thresholds for location, scope of projects.

Fishing Impacts

- Throughout many of the other draft council policies, there was discussion about fishing activities' relationship with other uses (e.g. fishing activity amongst turbine arrays). The committee may want to consider how they might articulate how they could consider fishing activity changes related to other uses or in response to other activity/industry changes.

Comments from invited expert Karen Greene (NOAA Fisheries HCD):

Coastal Development - Draft Council Policy

General

1. Avoid coastal development in sensitive aquatic habitat such as submerged aquatic vegetation, wetlands, complex bottom, shellfish beds, and other priority fish habitats.

This is the difficulty with the term “coastal development.” It is quite broad. Water dependent activities such as marinas, ports, beach nourishment, docks, bridges, etc. should not be placed in sensitive aquatic habitats, but non-water dependent development like commercial and residential development and some infrastructure should not be placed in any aquatic habitat.

4. Restore, create, enhance, and preserve. This is generally the order of preference.

Preservation is the last option since it does not provide new or improved habitat to offset a loss from development.

Dredge Material Disposal

1. Ensure that all options for disposal of dredged materials are comprehensively assessed. The consideration of upland alternatives for dredged material disposal sites should be evaluated before wetland or offshore sites are considered.

There are a few EPA-designated offshore disposal sites that have been in uses form many years. These should be used before new disposal sites are considered. Also, aquatic disposal in the estuaries should be avoided.

2. Consider beneficial uses for uncontaminated sediments when practicable and feasible. Priority should be given to beneficial uses of material that contributes to [fish] habitat restoration and enhancement, landscape ecology approaches, and includes pre- and post-disposal surveys.

Should specify fish habitat otherwise we wind up losing aquatic habitat for the creation of bird islands.

Wetland Dredging and Filling

2. Do not dispose of dredge material in wetlands.

This somewhat repeats item one. Could say that dredged material should not be placed in wetlands unless the placement is specifically designed to restore or to enhance the fishery habitat of the wetlands.

Marine Transport

8. Avoid dredging in fine sediments to reduce turbidity plumes and the release of nutrients and contaminants, which tend to bind to fine particles.

Often it is the fine sediments that accumulate in the channels and need to be dredged. It may be better to say that when dredging fine grained sediments, use best management practices and dredging equipment (i.e., adjust lift speeds, use an environmental bucket or hydraulic dredge, avoid barge overflow) to minimize turbidity plumes.

Comments received from advisor Brad Sewell:

General Policies on Non-Fishing Activities and Projects – Draft Council Policy

Engage Early - Early consultation with Council, stakeholder community, (etc.) by agencies is critical to inform planning for activities and projects to best minimize and avoid impact to fish and wildlife, and to design effective monitoring plans and data collections to evaluate impacts. This should include establishing both environmental and economic baselines for impacts analysis and monitoring.

Before and After Monitoring - To inform consideration of impacts, monitoring habitat and biological/ecological conditions in the project areas before, during, and after development and operations, is necessary to provide a better understanding of the potential and realized impacts. Should have established environmental monitoring protocol, baseline data, etc. (Look to wind energy workshop for language.)

Monitoring Data - Project monitoring information should be reviewed for any unanticipated adverse impacts, such that remediation or mitigation measures can be considered. Monitoring data should be archived in NOAA's National Centers for Environmental Information (NCEI) or other long-term archiving process for potential future use. https://www.ncei.noaa.gov/ Should add data to MARCO Portal, MARACOOS,

Research - Increasing investment in research and monitoring should provide a better understanding of expected impacts and support improvements in the consultation process. Dedicated funding to support habitat research, monitoring. Research of impacts to habitat from project activities should be prioritized.

Surveys – Given the great harm to ocean fish and wildlife from seismic surveys, surveys should only occur in areas available for leasing, should avoid duplication by industry, should account for cumulative impacts, and should be subject to highly precautionary limits on the amounts of annual and concurrent survey activities.

Development should not occur in or through sensitive areas and those areas already prohibited to fishing. This includes discrete canyon and broad areas on the Outer Continental Shelf identified for deep sea coral protection. Proposal to change to: "Activities that impact benthic habitat in deep sea coral zones should be restricted."

Timing Restrictions - Project activities (exploration, construction, and operations) should be conducted when the fewest species, least vulnerable species, and least vulnerable life stages are present. Appropriate work windows should be established based on multi-season pre-construction biological sampling in the affected area.

Note that MAFMC doesn't have a 5 year habitat research plan – maybe they could address this as well.

If an activity with adverse effects on sensitive habitats, species or life stages is to be conducted, protective buffers that prevent adverse effects should be used.

Decommissioning of Projects/Platforms - Decommissioning options for platforms (such as those used in liquefied natural gas, oil, and wind production, to the extent that such activities occur within the region) should be developed, but projects should re-consult with appropriate agencies when preparing to decommission. This provides the opportunity for consideration of best decommissioning methods; original decommissioning options may be decades old and may not make use of best available technologies. It also allows for consideration of platforms to remain for alternative uses (e.g., oil platforms decommissioned for use as artificial reefs in the Gulf of Mexico).

Chemicals - Ensure that the use of chemicals does not adversely affect marine biota or aquatic environment. Avoid the use of biocides (e.g., aluminum, copper, chlorine compounds) to prevent fouling; less damaging antifouling alternatives should be implemented to avoid the leaching of these chemicals into the environment.

In the Event of an Accident/Event – Should an accident occur, scientists should be given timely access to the response zone so that they can conduct independent scientific research during and after an event.

Enforcement – Regulators should consistently track all environmental protection and mitigation measures required of operators, and should ensure swift enforcement when measures are not being met.

Transparency in Reporting – All accidents and events, as well as any violations of environmental protection and mitigation measures, should be reported and published in a format and location easily accessible to the public. Periodically, summary reports should be made published in order for the public to gain a comprehensive picture of the impacts of non-fishing activities and projects.

Offshore Oil – Draft Council Policy

1. Offshore oil exploration and development is not consistent with our vision for sustainable fisheries in the region.

2. If oil and gas exploration and development do advance in the region, the Council urges the highest level of precaution in all activities in order to reduce the impacts that will occur to marine, coastal and human environments.

3. The selection of leasing areas should be informed by a full understanding of the potential impacts of oil and gas exploration and development on the marine, coastal and human environments and economies of the Mid-Atlantic.

4. Pre and post-development ecological monitoring should be undertaken to understand further the impacts of oil and gas activities and to facilitate corrective measures in the event of environmental impacts to ocean fish and wildlife.

5. Onshore facilities associated with exploration and production (e.g., pipelines, roads, bridges, and other structures) should not be constructed on/through sensitive fish habitat (e.g., salt marsh, mud flats, shellfish beds, and submerged aquatic vegetation (SAV)).

6. The expansion of existing onshore oil/refining facilities and/or the shipping of oil into ports which already have been developed and have existing deep water facilities would decrease the need for additional dredging, and should be prioritized over new development

7. Use methods to transport oil and gas that eliminate the need for handling in sensitive fishery habitats.

8. Offshore oil development should not occur in sensitive areas and those already prohibited to fishing. This includes discrete canyon and broad areas on the Outer Continental Shelf identified for deep sea coral protection.

9. If sited near sensitive habitat, the Council insists on the use of best available technology to reduce potential impacts. This may include horizontal directional drilling to avoid impacts to sensitive habitats.

10. Monitoring and leak detection systems should be used at oil extraction, production, and transportation facilities, to prevent oil from entering the environment.

11. The disposal of chemicals used in petroleum development should be rigorously regulated. Avoid the discharge of produced waters, drilling muds, and cuttings into the marine and estuarine environments. Re-inject produced waters into the oil formation, whenever possible, and develop a frack-out plan (what about capping of materials?).

12. The adverse impacts from discharges of chemicals, produced waters, drilling muds, and cuttings into the environment should be evaluated and prevented when they occur, including physical and chemical effects on pelagic and benthic species and communities.

13. Potential adverse impacts to marine resources from oil spill clean-up operations should be weighed against the anticipated adverse effects of the oil spill itself. The use of chemical dispersants near sensitive habitats should be avoided.

    Note that currents can take spills from the area and should ensure that plan for areas oil is transported to and impacts on nursery areas.

14. Ensure oil and gas exploration, production and transportation facilities have developed adequate oil spill response plans and protocols and have the training, resources and capacity to implement them in the event of an oil spill. Oil spill response plans should include the identification of sensitive marine habitats, the location and timing of sensitive life stages, important dispersal and/or migratory corridors, and should be updated on a regular basis, with input by the Council.

15. Regulators must ensure industry maintains readily deployable resources for rescue, response and containment events that are proven to be effective in the Mid-Atlantic region.

16. Short-term and long term impacts from sound during exploration, construction, and operations on the environment/ecosystem should be evaluated and minimized. Time and area restrictions on seismic survey activities should be designed to minimize impacts on marine mammals and sea turtles, as well as minimize the impacts on fish populations and fisheries. Careful, seasonal planning of seismic surveys should be undertaken to avoid duplicative surveys and reduce any potential impacts to the resources and fisheries under our jurisdiction. Seismic surveys could consider restricting their activities to the winter months when there is less potential for disruption to fisheries. (See 4/13/15 MAFMC Comments to Delaware Coastal Programs on Proposed Geophysical Seismic Surveys, pg 3).

    Note that seismic surveys can have impact on HMS recreational fishing tournaments.

Regional Use of the Habitat Area of Particular Concern (HAPC) Designation

Prepared by the Fisheries Leadership & Sustainability Forum for the Mid-Atlantic Fishery Management Council

June 2015

Contents

Acronyms

AP	Advisory Panel
CEBA	Comprehensive Ecosystem-Based Amendment (South Atlantic)
CHAPC	Coral Habitat Area of Particular Concern (Gulf of Mexico, South Atlantic)
COP	Council Operating Procedures
DEIS	Draft Environmental Impact Statement
EA	Environmental Assessment
EFH	Essential Fish Habitat
EIS	Environmental Impact Statement
EEZ	Exclusive Economic Zone
EFHRC	EFH Review Committee (Pacific)
ESA	Endangered Species Act
FEP	Fishery Ecosystem Plan
GRA	Gear Restricted Area
HAPC	Habitat Area of Particular Concern
HCD	Habitat Conservation Division
HMS	Highly Migratory Species
ICCAT	International Commission for the Conservation of Atlantic Tunas
MPA	Marine Protected Area
MSA	Magnuson-Stevens Act
NMS	National Marine Sanctuary
PDT	Plan Development Team
RCA	Rockfish Conservation Areas (Pacific)
RFP	Request for Proposals
SAFE	Stock Assessment and Fisheries Evaluation Report
SSC	Scientific and Statistical Committee
SAV	Submerged Aquatic Vegetation
USACE	United States Army Corps of Engineers
WPSAR	Western Pacific Stock Assessment Review

Part I. Introduction and Regional Synthesis

1. Introduction

Habitat Areas of Particular Concern (HAPCs), a subset of Essential Fish Habitat (EFH), are habitat types and/or geographic areas identified by the eight regional fishery management councils and NOAA Fisheries as priorities for habitat conservation, management, and research. The HAPC designation is a versatile habitat conservation tool that has been applied in a variety of ways and for diverse purposes across management regions.

This report summarizes the approaches of the eight regional fishery management councils and NOAA Fisheries Highly Migratory Species Management Division to designating HAPCs. Part I provides a synthesis of regional similarities and differences, as well as questions, insights, and lessons learned over nearly two decades of experience. Part II includes nine short profiles describing the process, purpose, and rationale for each region's approach to designating HAPCs, and regional factors that influenced the approaches used.

This report was developed to support the Mid-Atlantic Fishery Management Council's consideration of HAPCs as a strategy for supporting effective habitat conservation and ecosystem resilience in the Mid-Atlantic region. The regional profiles and synthesis are intended to serve as a resource for the broader federal fisheries management community, and were developed with extensive input and feedback from council and NOAA Fisheries staff.

Background

The 1996 reauthorization of the Magnuson-Stevens Act (MSA) recognized the loss of marine and estuarine habitat as a long-term threat to the viability of U.S. fisheries, and emphasized habitat conservation as an important component to conservation and management. The MSA defines EFH as "waters and substrate necessary to fish for spawning, breeding, feeding or growth to maturity" (16 U.S.C. 1802 § 3(10)). Fishery management plans (FMPs) must describe and identify EFH, minimize adverse impacts from fishing to the extent practicable, and identify actions to encourage habitat conservation and enhancement.

The HAPC designation is described in the implementing regulations of the EFH provisions (50 CFR § 600.815). Councils are encouraged to identify habitat types or areas within EFH as HAPCs, based on one or more of the following considerations:

- (i) The importance of the ecological function provided by the habitat
- (ii) The extent to which the habitat is sensitive to human-induced environmental degradation
- (iii) Whether, and to what extent, development activities are, or will be, stressing the habitat type

(iv) The rarity of the habitat type

The HAPC designation does not confer any specific habitat protections, but can focus habitat conservation efforts through several pathways. Councils may take HAPCs into consideration when minimizing adverse impacts from fishing, for example, through restrictions on where and when fishing activity may occur. HAPCs also enable councils and NOAA Fisheries to communicate habitat conservation priorities to non-fishing ocean users. While NOAA Fisheries and the councils lack the authority to regulate non-fishing activities, Federal agencies must consult with NOAA Fisheries when authorizing, funding, or undertaking activities that may adversely impact EFH (16 U.S.C. 1855 §305(b)(2)). Within the EFH consultation process, HAPCs encourage increased scrutiny and more rigorous conservation recommendations for reducing adverse impacts to fish habitat. Finally, HAPCs can serve as a tool for focusing habitat research and monitoring efforts.

Regional HAPC designations

Nearly twenty years have passed since the EFH provisions were adopted through the reauthorized MSA. During that time, councils have taken diverse approaches to designating HAPCs. The following synthesis and regional profiles illustrate this diversity, focusing on:

- The timing, frequency, process, and roles and responsibilities involved in designating HAPCs;
- The purposes for designating HAPCs, the size, extent, and location of the habitat areas and/or types identified, and regional interpretations of the four HAPC considerations;
- The role of HAPCs in the EFH consultation process; and
- Perspectives on effective use of the HAPC designation, including the role of councils in supporting habitat conservation, the evolution of HAPC as a policy tool, and advances in habitat science.

Clarifications

The following notes are included to clarify frequently asked questions and regional differences.

- The 2000 lawsuit, *American Oceans Campaign v. Daley*, determined that there was inadequate environmental analysis of fishery management plan amendments implementing the EFH provisions of the 1996 MSA in five of the eight council regions (Gulf of Mexico, New England, Caribbean, Pacific, and North Pacific). (The South Atlantic, Mid-Atlantic, and Western Pacific Councils had not yet completed their analyses of habitat impacts from fishing, and were not included in the lawsuit.) Each region was required to prepare a new Environmental Assessment or Environmental Impact Statement for their EFH amendment. In some regions this requirement resulted in an EIS completed several years later than a plan amendment. In the process of completing the required EIS, some regions also made changes to HAPCs that were subsequently adopted through new plan amendments.

- Two councils, the Gulf of Mexico and South Atlantic, identified “Habitat Areas of Particular Concern” under a joint Coral FMP that pre-dates the 1996 reauthorization of the MSA and adoption of the EFH provisions. Additional explanation is provided in these two profiles. In the South Atlantic profile the term “EFH-HAPC” is used to indicate HAPCs identified pursuant to MSA habitat authorities.
- The term “HAPC” is considered singular where it applies to a habitat type, a single location, or a set of locations considered a single HAPC designation. The term HAPCs is used in the plural to refer to multiple HAPCs as habitat types or locations, and to refer to the designation as described in the implementing regulations of the EFH provisions (50 CFR 600.815).

2. Procedural similarities and differences

Since the EFH provisions were first introduced through the 1996 reauthorization of the MSA, councils have adopted different processes and timelines to bring their FMPs into compliance. Regional use of the HAPC designation has evolved alongside these processes, resulting in procedural differences between regions. Many councils emphasize the importance of having a clearly defined process for designating HAPCs, and that this process may evolve over time.

Timing and frequency: HAPCs are nearly always identified as part of the EFH identification and review process. All eight councils completed an initial round of amendments in the late 1990s to bring their FMPs into compliance with the 1996 MSA. Since that point, the number, frequency, and timing of EFH reviews and actions has varied by region. The implementing regulations of the EFH provisions state that a complete review of all EFH information should be conducted as recommended by the Secretary, but at least once every five years (50 CFR 600.815 (a)(10)). The EFH review process and amendment process, if the council determines that action is needed, can involve a lengthy timeline. As a result the actual time elapsed between EFH reviews is often longer than five years. Several councils have completed multiple rounds of EFH reviews, though in some cases these reviews have not resulted in FMP amendments or changes to HAPCs. Other councils are still in the process of completing their first EFH reviews for one or more FMPs.

Amendment process: As a subset of EFH, HAPCs are specific to managed species or species complexes, and are designated through amendments to one or more FMPs. Most councils initially completed a single amendment (termed an omnibus, generic, or comprehensive amendment) to comply with the EFH provisions of the 1996 MSA. Some councils have continued to conduct EFH reviews and update FMPs on a comprehensive basis while others now take an FMP-specific approach.

Roles and responsibilities: The division of habitat conservation roles and responsibilities among council and NOAA Fisheries staff varies by region. The composition and role of advisory bodies, plan teams, technical teams, academics and outside experts, contractors, and other groups also varies. These differences reflect regional processes for compiling and synthesizing habitat information, conducting EFH reviews, designating HAPCs, and communicating about habitat conservation issues.

Information inputs: The information inputs used to designate and describe HAPCs vary by region. These differences may reflect a region's EFH review and/or HAPC designation process, the information that is available, and the time and resources that council and NOAA Fisheries staff are able to devote. Inputs may include a wide variety of internal and external data sources, published literature, expert opinion, industry and public input, and in a few instances targeted research.

Public participation: Several councils provide formal opportunities for the public, including NOAA Fisheries, to participate in the designation of HAPCs via a nomination or proposal process. These processes increase the range of information sources, expertise, and perspectives involved in identifying HAPCs, and may also enhance transparency and stakeholder buy-in. Developing and refining these opportunities for public participation has been a learning process. Councils have considered the timing of proposal cycles, the consistency and quality of information inputs, and processes for evaluating the merits of different proposals.

Monitoring: Long-term monitoring of HAPCs is challenging due to resource limitations, the extent, number, and/or location of HAPCs, and especially the absence of specific and measurable HAPC objectives. There are no examples of long-term monitoring of HAPCs relative to specific goals and objectives. There are limited examples of research conducted to assess impacts and damage to HAPCs over time, and to characterize community composition within HAPCs.

3. Identifying HAPCs: Decisions and design considerations

Councils have considerable flexibility to designate HAPCs. Designating HAPCs requires a council to construct a scientifically based statement about the value of a habitat area or type, and how it may be impacted by fishing and non-fishing activities. The four HAPC considerations of ecological function, sensitivity, exposure to development stress, and rarity. provide a framework for articulating this statement of value in consistent terms. However, designating HAPCs is not necessarily a process of determining the habitat areas or types that are most important to a fishery or region. Each management region's use of the HAPC designation also reflects regional context, priorities, concerns, and perspectives on the effective and appropriate use of HAPCs as a tool for habitat conservation.

Level of HAPC designation

HAPCs are usually designated for a specific fishery or species complex and FMP, though this depends on a region's approach to reviewing and designating EFH and HAPCs. In regions that address EFH and HAPC on a fishery by fishery basis, HAPCs are clearly identified within the context of a single fishery and FMP. In regions that perform comprehensive EFH reviews and amendments, HAPCs may or may not be as clearly affiliated with specific fisheries and FMPs. For example, in the South Atlantic, habitat types and sites may be designated separately as HAPC for multiple species complexes. In New England, proposed HAPCs[1] are described in terms of their value to managed fisheries and their overlap with EFH, but are not necessarily identified as HAPC for a specific fishery.

There are fewer examples of HAPCs identified for individual species and/or purposes. Some councils manage species specific FMPs (e.g., Mid-Atlantic golden tilefish), which may result in the designation of species-specific HAPCs. In other cases, HAPCs may be targeted toward a species of high importance due to economic value, stock status, or research needs. Finally, a council may utilize species-specific habitat information, such as confirmed spawning activity, to justify the value of a HAPC to multiple species.

Regional Examples

- The South Atlantic Council designated habitat types (e.g., pelagic *Sargassum*) and discrete sites (e.g., areas of hard bottom such as the Big Rock and the Charleston Bump) as HAPC for multiple species complexes.
- The New England Council prioritized designating HAPCs that include juvenile cod EFH.
- The Caribbean Council designated reef fish spawning site HAPCs for the Reef Fish FMP, based on confirmed spawning activity by individual species (e.g. red hind).

Definition and application of HAPC considerations

Councils take similar approaches to defining and interpreting the four HAPC considerations of ecological function, sensitivity, exposure to development stress, and rarity, drawing from ecological theory, peer-reviewed literature, and other information sources. Most councils provide a qualitative description of which considerations a HAPC meets, and why. The level of detail included in these descriptions varies, depending on the amount of information available. Sometimes there is an explicit statement of which of the four considerations are met, or this information may be organized into a table. In other cases the four HAPC considerations may be addressed implicitly, for example through a description of a HAPC's ecological importance. The four HAPC considerations are most often used to frame statements about the value of a habitat type or area, rather than to rank or compare potential or existing HAPCs.

Of the four HAPC considerations, ecological importance is the most frequently invoked. While ecological importance is not explicitly stated as the basis for identifying every single HAPC, it is usually implicit. The considerations of sensitivity and exposure to

[1] Omnibus Habitat Amendment 2 preferred alternatives (NEFMC 2014)

development stress are related. Together they describe the susceptibility of a habitat area or type to impacts from anthropogenic activities, and the time horizon and likelihood of impacts. For example, each region that contains coral/hardbottom habitat recognizes this habitat type as sensitive to degradation. Whether areas of coral/hardbottom habitat are currently or likely to be stressed by development depends on where the habitat is located, and current and potential development activities occurring in the region.

The fourth HAPC consideration of rarity is prioritized differently across regions, and can be difficult to define. One reason is that rarity depends on scale, and what is considered rare at a small scale (e.g. a patch of SAV or coral habitat) may not be considered rare at a larger scale. The geography and size of a management region influence the interpretation of rarity as well. Rarity can also be a function of past and current exposure to anthropogenic activity. For example, submerged aquatic vegetation (SAV) is recognized as important habitat in several regions, but may be less abundant and therefore more rare in areas more heavily impacted by coastal development. Finally, rarity is not necessarily an indication of ecological importance.

Regional Examples

- The North Pacific Council ranks proposed HAPCs on a scale of zero to three for each HAPC consideration, and combines these scores with a data certainty factor to screen proposals for further consideration by the Council. All HAPCs must meet the "rarity" consideration. For a potential HAPC to rank high (scored a 3) for rarity, it must occur in discrete areas within a single Alaska region (Gulf of Alaska, Bering Sea, Aleutian Islands, and Arctic).
- The North Pacific and New England Councils developed additional considerations and priorities that HAPCs must meet, in order to help further focus the HAPC identification process.
- The New England Council is proposing an extensive inshore HAPC for juvenile cod, defined as a depth contour 0-20m, due to the sensitivity and exposure of nearshore areas to a wide range of anthropogenic stressors.
- The Western Pacific Council determined that justification of ecological importance should be considered the primary criteria for screening potential HAPCs, and that sensitivity, susceptibility, and rarity should be considered secondary considerations that can strengthen the HAPC designation.

Habitat types and sites as HAPCs

NOAA Fisheries has encouraged shifting from designating habitat types as HAPCs towards identifying discrete, geographically defined sites. While some councils designate site-specific HAPCs, others continue to identify a combination of types and sites. There are different perspectives on whether a HAPC must be a defined location, in order to serve as a meaningful habitat conservation tool for addressing fishing or non-fishing impacts. Regions that primarily or exclusively designate discrete sites as HAPCs include the North Pacific, New England, Gulf of Mexico, and the Caribbean. The NOAA Fisheries Highly Migratory Species Management Division also identifies discrete sites as HAPCs. Regions that continue to designate both habitat types and sites as HAPCs include the South Atlantic, Pacific, Mid-Atlantic, and Western Pacific.

A region may designate habitat types as HAPCs due to information limitations. Designating habitat types as HAPCs can also be a deliberate and strategic statement that this habitat is important, wherever it is found. Some important habitat types are dynamic, and vary in location and extent over time. Examples include living habitat types such as seagrass or SAV, and habitat types defined by chemical or physical parameters such as temperature and salinity. While the approximate location of these dynamic habitat types can be mapped, tracking their location over time is often not feasible due to resource limitations. Designating habitat types as HAPCs can shift the burden of proof to consulting agencies in the EFH consultation process, by requiring these agencies determine whether a habitat type is found in an area and thus may be adversely affected by a proposed development activity.

There can be overlap among habitat types and sites designated as HAPCs within a region. For example, habitat types and locations may be designated as HAPC in conjunction to better approximate the location of an important habitat type, or ensure that a habitat type is acknowledged throughout an area where it occurs. A habitat type such as SAV may also occur within another habitat type, such as estuaries, or within a discrete location identified as HAPC. It is not clear whether this overlap strengthens the HAPC designation.

Regional Examples

- The North Pacific's HAPC proposal process, and the Pacific's EFH/HAPC Request for Proposals, specify that HAPCs must include geographic coordinates.
- The Pacific exclusively identified habitat types rather than sites as HAPCs for salmon, including dynamic features such as thermal refugia.
- The South Atlantic identified coral and hardbottom habitat types as HAPCs, and also identified discrete areas where these habitat types are known to occur.

Location of HAPCs

Some regions primarily designate HAPCs in state and/or territorial or Commonwealth waters, while other regions designate HAPCs offshore in federal waters. This distinction reflects different perspectives on the most effective use of the HAPC designation: addressing fishing impacts in federal waters, which councils can regulate, or addressing non-fishing impacts outside of council authority. EFH for most species encompasses both state and federal waters, but the majority of development activities requiring EFH consultations occur in state waters. Where HAPCs are located inshore, their utility as a habitat conservation tool is primarily to address non-fishing impacts through the EFH consultation process. Where HAPCs are located offshore in federal waters, they may intersect with non-fishing activities but more often address current or potential habitat impacts from fishing.

Designating HAPCs in state waters may also reflect other factors including the life history of managed species, the availability of information to document habitat importance, physical features like bathymetry, the types of fishing gear used in a region, and the overlay of HAPCs with sites recognized under other authorities (e.g., National Marine Sanctuaries). The North Pacific and Gulf of Mexico regions designate HAPCs primarily in federal waters, while other regions also designate HAPCs in state waters.

Regional Examples

- In the Gulf of Mexico, all HAPCs are located in federal waters.
- Nearly all Caribbean HAPCs are located in state waters, and may include inland habitat (e.g., state forests).
- HAPCs for anadromous salmon species in New England and the Pacific region include inland freshwater habitat.

HAPCs and fishing restrictions

HAPCs are an administrative designation that do not imply or confer any restrictions on fishing activity. In practice, HAPCs may overlap or be associated with a wide range of habitat protection measures including seasonal or year-round closures, gear restrictions, and prohibitions on anchoring. These measures are most often implemented to minimize adverse impacts of fishing, but in some cases are adopted for other purposes and through separate council actions.

The relationship between HAPCs and restrictions on fishing activity is complicated and challenging to communicate. Stakeholders may conflate HAPCs with closures, and with other designations like Marine Protected Areas (MPAs). Many councils make a deliberate effort to communicate that HAPC designations do not directly translate to restrictions on fishing, and that HAPCs are designated for purposes such as addressing non-fishing impacts and focusing research priorities. This misperception may change as stakeholders become more familiar with the process and outcomes of designating HAPCs.

Regional Examples

- The North Pacific identified areas of skate egg concentrations as HAPCs but did not adopt any gear restrictions for these areas. The Council requested that these sites be monitored and information be included in the Ecosystem chapter of the Council's Stock Assessment and Fisheries Evaluation (SAFE) report.
- In the Mid-Atlantic region, HAPC for golden tilefish corresponds to gear restricted areas (GRAs) closed to bottom trawling.
- The Caribbean Council designated reef fish spawning site HAPCs that were already subject to seasonal spawning closures.

Overlap of HAPCs with other designations
Many HAPCs correspond with areas protected under other designations and authorities, such as National Marine Sanctuaries, Marine Reserves, and State and National parks. Sometimes this overlap is intentional, and a council may choose to designate sites as HAPCs because they are already recognized for their ecological value. In other cases, part or all of these sites may be designated as a HAPC with more specific regard to the four HAPC considerations. The objectives and purpose for recognizing sites of ecological value under other authorities may be complementary to fishery management objectives, but are still different. One concern is that overlap between HAPCs and other designations may perpetuate the tendency to equate HAPCs with protected area designations that are often associated with fishing restrictions.

HAPCs and deep sea corals
A small number of councils have designated deep sea corals as HAPCs. The HAPC designation pre-dates the deep sea coral discretionary authority, which was introduced in the 2006 reauthorization of the MSA (16 U.S.C. 1853 § 303 (b)(2)). Some regions continue to use the HAPC designation to recognize deep sea corals, while others are currently considering whether to use the HAPC designation or deep sea coral discretionary authority.

4. HAPC and EFH consultations

The HAPC designation can be a mechanism for councils to communicate their habitat conservation priorities beyond the scope of councils' jurisdiction and regulatory authority. Under the EFH provisions of the MSA, a federal agency authorizing, funding, or undertaking an activity that may adversely impact EFH must consult with NOAA Fisheries. HAPCs may be directly leveraged in the consultation process and support a more focused examination of non-fishing impacts to important fish habitat.

EFH consultation process
Through the EFH consultation process, the consulting agency (termed the action agency) authorizing, funding, or undertaking an activity that may adversely impact EFH is responsible for notifying NOAA Fisheries and assessing the activity's potential impacts to EFH (16 U.S.C. 1855 §305(b)(2)). NOAA Fisheries determines whether a consultation is required, and if so, responds with any necessary conservation recommendations for the action agency to avoid, minimize, mitigate, or offset adverse impacts to EFH. The action agency must provide a detailed written response to NOAA Fisheries, including an explanation for any conservation recommendations that are not adopted.

NOAA Fisheries Habitat Conservation Division (HCD) staff are responsible for overseeing the agency's role in the EFH consultation process.[2] Across council regions,

[2]In the NOAA Fisheries West Coast Region, staff within the four Area Offices oversee the agency's role in the EFH consultation process and are hereafter included in reference to HCD staff.

the majority of consultations are with the U.S. Army Corps of Engineers (USACE) for development activities occurring in the nearshore zone (e.g., inlet dredging). Consultations for activities in federal waters (e.g., consultations with the Bureau of Ocean and Energy Management for offshore wind energy development) are less frequent and tend to involve larger-scale projects. While the consultation process is based upon a formal framework, timeline, and division of responsibilities, NOAA Fisheries HCD staff are able to engage in an iterative dialogue and information-sharing process with the action agency.

Role of HAPCs in EFH consultations

The presence of HAPCs may influence the process as well as the outcomes of EFH consultations. Given the high volume of EFH consultations annually, NOAA Fisheries HCD staff may optimize limited staff time and resources by prioritizing consultations that involve adverse impacts to HAPCs. Staff may also engage in a more rigorous consultation process, and provide the action agency with more stringent conservation recommendations. Some regions have deliberately designated (or are considering designating) HAPCs specifically for the value they bring to the EFH consultation process. For example, a council may designate HAPCs in nearshore areas that are likely to be impacted by development.

There are different regional perspectives on whether HAPCs are an effective mechanism for councils to address the habitat impacts of non-fishing activities, and whether the HAPC designation influences the prioritization and outcome of EFH consultations. The role of HAPCs in the EFH consultation process can depend on the following factors.

<u>Documenting and communicating value</u>: Designating a habitat type or site as a HAPC can be a meaningful statement in its own right, and enable councils to communicate their habitat conservation priorities in specific terms. However, this is only a starting point. Through the EFH consultation process, NOAA Fisheries HCD staff must construct a strong and scientifically founded statement about the value of habitat to managed stocks, and describe how this habitat would be adversely impacted by the proposed activity. The treatment of HAPCs in the EFH consultation process may be influenced by how clearly their value to a managed species can be articulated and documented in FMPs, peer-reviewed literature and other sources.

<u>Regional context:</u> There are different perspectives on whether HAPCs support prioritization of EFH consultations, and whether consultations involving HAPCs result in more stringent conservation recommendations. The extent to which HAPCs are invoked in EFH consultations depends on the overlay of several regional factors:

- The types, location, distribution, and intensity of development activities;
- The life histories and distribution of managed species, and whether EFH/HAPC is identified in nearshore and estuarine habitat; and
- Whether HAPCs are located in areas impacted by non-fishing activities.

In some regions such as the South Atlantic, where there are extensive HAPCs in nearshore waters as well as considerable coastal development, information about HAPCs is frequently drawn into the EFH consultation process. By contrast, in regions like the Gulf of Mexico or North Pacific, HAPCs are primarily offshore and less frequently overlap with EFH consultations. In the case of Pacific salmon species listed under the Endangered Species Act (ESA), the habitat types designated as HAPCs are frequently impacted by development activities, but the critical habitat designation under the ESA authority carries more weight.

Adoption of conservation recommendations: It is difficult to determine whether EFH consultations involving HAPCs result in more favorable outcomes, in terms of adverse impacts avoided. The habitat conservation recommendations generated by NOAA Fisheries are non-binding and not enforceable. Due to the high volume of EFH consultations, limited time and resources, and lack of monitoring by action agencies, NOAA Fisheries cannot track whether and to what extent conservation recommendations are followed over time.

Council involvement: Councils may comment and make recommendations to state and Federal agencies regarding projects that, in the council's view, may impact EFH and/or HAPC (16 U.S.C. 1855 §305 (b)(3)). In theory these comments could reinforce and add weight to NOAA Fisheries' conservation recommendations. As with NOAA Fisheries' conservation recommendations, it is difficult to demonstrate how council recommendations translate to outcomes. Direct council involvement in EFH consultations is limited. Councils may stay apprised of large development projects and EFH consultations through formal processes, such as updates at a council meeting, as well as through informal and ongoing communication between council and NOAA Fisheries staff.

Education and relationship building: The EFH consultation process involves ongoing communication between action agencies and NOAA Fisheries HCD staff. HAPCs can help focus these discussions and serve as an educational tool. Whether the action agency is a frequent participant in EFH consultation process (e.g., USACE) or is less familiar with the consultation process, HAPCs can frame discussions about the habitat impacts of an activity in more specific terms. An understanding of EFH and HAPC and how both may be impacted by development activities can also enable action agencies to take proactive measures to minimize impacts prior to the consultation phase of a project.

5. Looking ahead: Perspectives on effective use of the HAPC designation

HAPCs and the council role in habitat conservation

The most significant challenge to habitat conservation is demonstrating effectiveness in terms of maintaining or enhancing fishery productivity. Regional use of the HAPC designation can reflect very different perspectives on the role of councils in supporting habitat conservation, and the outcomes that can be achieved by leveraging existing habitat authorities. The HAPC designation may be leveraged in the EFH consultation process, but whether consultations involving HAPCs lead to more favorable habitat conservation outcomes is unclear. It is also not possible to demonstrate that designating HAPCs translates to population level benefits for fish stocks.

What constitutes "effective" use of the HAPC designation depends on a council's expectations and rationale for designating HAPCs. While successful habitat conservation is challenging to demonstrate, councils have several opportunities to optimize the value of HAPCs as a habitat conservation tool.

- Councils can identify a clear purpose and objectives for designating HAPCs. What matters is not just "what is a HAPC" and the scientific basis for why, but how habitat conservation is linked to specific fishery management objectives.
- Councils can take a more comprehensive approach to designating HAPCs, by considering the intersections between managed fisheries, their habitat requirements, and current and potential fishing and non-fishing activities.
- Councils can leverage the HAPC designation process and outcomes as an educational tool and process for communicating with fishery stakeholders and other ocean users about the value of habitat to federally managed fisheries.

HAPC as a policy tool

Since the 1996 reauthorization of the MSA, councils have overseen multiple rounds of EFH reviews and HAPC designation processes. Through these iterations, councils have gained experience and also identified questions and considerations that will shape use of the HAPC designation in the future.

<u>Ideal size and number of HAPCs</u>: Where HAPCs are used as a tool for communicating habitat priorities, more and/or larger HAPCs can make a strong statement about the value of a habitat type or area. Within the EFH consultation process, more and/or larger HAPCs could also provide more flexibility for NOAA Fisheries to leverage the HAPC designation on a case by case basis, depending on the proposed activity and potential impacts. However, the value of the HAPC designation as a habitat conservation tool derives from its narrower focus. More selective use of HAPCs may preserve that value. More widespread use of HAPCs may also increase management complexity, particularly if they are associated with restrictions on fishing activity.

<u>Time horizons</u>: A related consideration is whether HAPCs are a long-term or permanent designation, or should change in response to new information and priorities. From a long term perspective, the scientific basis for HAPC designations can be strengthened over time with additional information. However, councils are also identifying HAPCs that take into consideration current priorities, concerns, and information needs, which may change over time. The four HAPC considerations of ecological function, sensitivity, exposure to development stress, and rarity, allow for HAPC to reflect the long-term value of habitat areas and types, as well as changing concerns and development pressures.

Growth of development activities: The scale and diversity of development activities are growing in most regions, and increasing the potential for adverse impacts to important fish habitat. There can be significant growth of development activities between EFH reviews, particularly when development of council actions causes the timeline for EFH reviews to extend beyond five years. These changes reinforce the value of HAPCs as a tool for communicating habitat conservation priorities beyond the fisheries realm, as well as the importance of looking ahead to emerging ocean and coastal uses.

Implications of evolving habitat science and environmental change

As a tool for habitat conservation, HAPCs are grounded in habitat science. The value of the HAPC designation—whether to focus research, address fishing impacts, or communicate habitat conservation priorities—derives from the amount and the quality of information linking habitat with managed fisheries. As habitat and ecosystem science evolve, councils will continue to consider whether HAPCs are best used to recognize inherent habitat value, or whether HAPCs should be outcome oriented.

Broadening the definition of habitat: Councils are exploring the HAPC designation to recognize a wider range of habitat attributes. Habitat is defined in terms of the biological, chemical, and physical parameters of the water column and substrate. By definition, EFH recognizes habitat needed for immediate survival and to support life processes including reproduction and foraging. There are already examples of HAPCs tied to salinity and temperature profiles. As habitat science continues to advance, so will the question of whether HAPC is the appropriate tool to recognize attributes and forms of habitat such as artificial structures, oceanographic features such as currents and upwellings, and dynamic conditions, and if so, what purpose the HAPC designation would serve.

Connecting habitat conservation with fishery productivity:
The connection between habitat conservation and fishery productivity is a challenge but also a developing opportunity for the use of HAPCs. The basis for designating HAPCs can range from simple presence/absence of a species, to more complex associations with habitat characteristics such as substrate type, depth, and temperature. Critical life processes and life stages may be highly correlated with a particular area or habitat type, yet the habitat characteristics defining this association may not be well understood. Future advances in habitat science should improve the ability to frame habitat conservation in terms of enhanced fishery productivity and conversely, habitat loss or degradation in terms of lost productivity.

Responding to climate change: Climate change introduces additional complexity by altering properties of the marine environment, and impacting fishery productivity and distribution. Even as the understanding of habitat and fishery productivity develops, marine habitat itself is changing. These changes will raise the questions of whether HAPCs continue to serve their intended purpose, and how climate change could or should be reflected in a region's interpretation of the four HAPC considerations.

Part II. Regional Profiles

1. New England

Summary of current approach
The New England Fishery Management Council first identified one area as a Habitat Area of Particular Concern (HAPC) for juvenile cod, and another for Atlantic salmon, through an omnibus amendment in 1998. The Council is nearing the completion of a second omnibus habitat amendment (Omnibus Amendment 2) which will designate additional HAPCs. This amendment was first initiated in 2004 as an Essential Fish Habitat (EFH) 5-year review and evolved into a more comprehensive evaluation of spatial management approaches to habitat conservation.

The Council's preferred HAPC alternatives were identified through a public proposal process and approved for inclusion in Omnibus Amendment 2 in 2007. The proposed HAPCs include multi-purpose HAPCs, areas of juvenile cod EFH, and seamounts and canyons on the outer continental shelf. One HAPC is an extensive inshore area of juvenile cod EFH defined as a depth contour from 0-20 m, designated primarily to inform the EFH consultation process and focus attention on coastal and nearshore development activities. Although some HAPCs may overlap with area closures or gear restrictions, the Council clearly communicates that the designation of HAPCs is a separate decision. The Council has identified a set of preferred alternatives for HAPC and anticipates taking final action on Omnibus Habitat Amendment 2 in 2015.

History and evolution
The Council first identified two spatially defined HAPCs through an omnibus amendment in 1998. The Northern Edge Cod HAPC covers approximately 187 nm^2 on the northeastern edge of Georges Bank. This area was identified as a HAPC for juvenile cod due to the important role of cobble and gravel substrate in supporting survival of post-settlement juvenile cod, as well as the vulnerability of this habitat to adverse impacts from mobile fishing gear. This HAPC was designated within the boundaries of an existing closure, Closed Area II, which has been closed since December 1994 to various gears capable of catching groundfish. Amendment 13 to the Northeast Multispecies Fishery Management Plan (2003) designated a habitat area closed to mobile bottom-tending gear, the Closed Area II Habitat Closure Area, which has the same boundaries as the HAPC. The Council also identified 11 rivers in Maine as a HAPC. The rivers systems included in this HAPC support the last remaining populations of Atlantic salmon and are susceptible to impacts from a wide range of anthropogenic activities.

The Council anticipates completing Omnibus Habitat Amendment 2 in 2015. This amendment was initiated to comply with the EFH review requirement, and evolved to include a more comprehensive review of existing and potential spatial management measures, including existing groundfish closures and habitat closures. Two goals added later in the process were to enhance groundfish fishery productivity, and maximize societal net benefits from groundfish stocks while addressing current management needs.

The timeline for developing this amendment was extended for several reasons, including the 2006 reauthorization of the Magnuson-Stevens Act (MSA) and introduction of the deep sea coral discretionary provision, as well as the Habitat Plan Development Team's (PDT) development of a model[3] to optimize the process of minimizing adverse impacts of fishing across gear types, fisheries, and areas.

The Council's current preferred alternatives for identifying HAPCs are the same alternatives that were reviewed and selected in 2007. Between 2004 and 2005, the Council solicited proposals for HAPCs from the public. Proposals were reviewed by the Council's EFH Technical Team (which later became the Habitat PDT) and Habitat Oversight Committee, following a HAPC designation and selection process described in a NEFMC Habitat Annual Review Report prepared in 2000 by Council staff (NEFMC 2000). The Council solicited HAPC proposals according to the following considerations (NEFMC 2014):

1. Improve fisheries management in the EEZ;
2. Include EFH designations for more than one Council-managed species in order to maximize the benefit of the designations;
3. Include juvenile cod EFH; and
4. Meet more than one of the EFH Final Rule HAPC criteria.

The Council approved 16 potential HAPCs for inclusion in the Draft Environmental Impact Statement (DEIS) for EFH Omnibus Amendment 2. While there may be overlap between these HAPCs and existing or potential closures and gear restrictions, the HAPC designation is intended to be an administrative designation to focus council attention and the consultation process, and will not directly confer any protective measures. The Council's current preferred alternatives include maintaining the existing Atlantic salmon and juvenile cod HAPCs, adding several HAPCs that overlap with juvenile cod EFH, and designating two seamounts and a number of canyons on the outer continental shelf. Three of the HAPCs in the Gulf of Maine and on Georges Bank would designate areas with a diversity of habitat types that provide EFH for a variety of managed species. In several cases the extent and/or depth of these proposed HAPCs is limited by the extent of EFH, which in the northeast region is based on fishery-independent surveys of distribution and abundance for each managed species.

Shelf HAPCs

In addition to the existing Northern Edge Juvenile Cod HAPC, the Council's preferred alternative would designate an additional four continental shelf HAPCs that meet most or all of the Council's additional HAPC considerations as stated above. Each of these sites is also noted for its ecological importance, and meets two to three of the HAPC considerations. Two of these proposed HAPCs currently overlap with existing habitat and/or groundfish closures, although the extent of overlap will ultimately depend on the spatial management measures adopted through Omnibus Amendment 2.

[3] Swept Area Seabed Impact Model (SASI). See Omnibus Habitat Amendment 2, Appendix D: The Swept Area Seabed Impact approach: a tool for analyzing the effects of fishing on Essential Fish Habitat. (NEFMC 2014)

The proposed Inshore Juvenile Cod HAPC is notable for its spatial extent and deliberate focus on non-fishing activities. This HAPC was initially approved by the Council in 1999 for inclusion in a subsequent amendment. Defined as inshore areas in the Gulf of Maine and southern New England from 0-20 m depth, this represents a nearly continuous stretch of inshore waters from Maine to Rhode Island. This HAPC is ecologically important and was designated primarily due to the sensitivity and ongoing exposure of nearshore areas to a wide range of anthropogenic stressors posing chemical, physical, and biological threats.[4]

Canyons and seamounts
The Council's preferred alternatives for Omnibus Amendment 2 also include designating two seamounts and 16 offshore canyons as HAPCs. The proposed seamounts are noted for their ecological importance, sensitivity, and rarity, though are not anticipated to be exposed to any development stresses. They overlap with EFH for a single species, deep-sea red crab. The canyons proposed as HAPCs would be designated individually or together as a single HAPC. Each site meets all four HAPC considerations, including potential exposure to anthropogenic activities (e.g., transmission lines for energy resources). The extent of both seamount and canyon HAPCs is limited by depth to which EFH has been designated (2000 m for seamounts, and 1500 m for canyons). The Council is participating in a Memorandum of Understanding Regarding the Management of Deep Sea Corals, adopted to support coordination and information-sharing with the Mid-Atlantic and South Atlantic Fishery Management Councils. Whether the Council retains seamounts and canyons as HAPCs in its final preferred alternatives, and/or utilizes the MSA deep sea coral discretionary provision, remains to be determined.

2. Mid-Atlantic

Summary of current approach
The Mid-Atlantic Fishery Management Council has made limited use of the Habitat Area of Particular Concern (HAPC) designation to date, in part due to limited information linking habitat to production (Montañez, pers. comm.). The Council identifies Essential Fish Habitat (EFH) and HAPCs on a Fishery Management Plan (FMP)-specific basis, and has identified HAPC for summer flounder and golden tilefish. Both HAPCs are described as habitat types rather than discrete areas, although the golden tilefish HAPC is a habitat type where it occurs within a defined area. The golden tilefish HAPC has corresponding gear restricted areas where bottom trawling is prohibited.

History and evolution

Summer flounder
The Council identified HAPC for summer flounder through Amendment 12 to the Summer Flounder, Scup, and Black Seabass FMP in 1998. HAPC is identified on the

[4] The sources and impacts of these stressors to Atlantic cod EFH by life history stage are described in Table 3 in Vol. 3 of Omnibus Habitat Amendment 2 (NEFMC 2014).

basis of its ecological importance for shelter and feeding, and is not mapped but defined in text as follows (MAFMC 1998):

> "All native species of macroalgae, seagrasses, and freshwater and tidal macrophytes in any size bed, as well as loose aggregations, within adult and juvenile summer flounder EFH is HAPC. If native species of submerged aquatic vegetation (SAV) are eliminated then exotic species should be protected because of functional value, however, all efforts should be made to restore native species."

As most summer flounder HAPC occurs in state waters there are no associated protections. However, the Council notes that designating SAV as HAPC may allow their recommendations to carry additional weight in the context of EFH consultations.

Golden tilefish
HAPC was first identified for golden tilefish in the original Golden Tilefish FMP, completed in 1999. At that time, golden tilefish were overfished and landings were concentrated in a small area. The Council designated HAPC as substrate between the 250 and 1200-foot isobaths in two statistical areas that accounted for approximately 90% of landings. While these areas were identified in terms of three of the four HAPC considerations (rarity, ecological function, and sensitivity) the Council's stated intent was essentially to classify these areas as HAPC because they represented areas of tilefish concentration. No habitat protections were associated with HAPC at the time, but the FMP clearly stated that these areas could be candidates for protection in the future given additional information about the impacts of mobile bottom gear.

Amendment 1 to the Golden Tilefish FMP, implemented in 2009, modified the description of EFH and defined a subset of areas in which HAPC is known to occur. The revised EFH description, informed by a literature review and expert analysis, identified EFH as semi-lithified clay substrates within a preferred temperature range, which generally correspond to a depth contour of 100 to 300m.[5] HAPC is further defined as clay outcrop/pueblo[6] habitats within four canyon areas (Norfolk, Veatch, Lydonia, and Oceanographer canyons), within the same depth contour identified as EFH. This habitat type is recognized for its ecological function as well as sensitivity to degradation. The council considered identifying additional canyon areas where clay outcroppings could occur, but chose to limit HAPC to the four canyons where it was documented to occur through submersible video surveys. Should the presence of clay outcroppings be confirmed in other canyons, these areas would be likely HAPC candidates in the future (Montañez, pers. comm.).

While golden tilefish HAPC does not directly confer any habitat protections, it is protected through an overlay of gear closures that generally correspond to the areas where HAPC may exist. Golden tilefish HAPC is a habitat type within geographically

[5] Substrate type and temperature are stronger indicators of EFH than depth, however these parameters correspond to depth contours utilized for mapping purposes (Montañez, pers.comm.)
[6] Tilefish create vertical and horizontal burrows in clay substrate that are also referred to as "pueblo habitat" (MAFMC 2008)

defined areas and a specified depth contour, although the precise location of the habitat types considered HAPC within these areas is not known. The clay outcropping/pueblo habitats identified as HAPC are highly vulnerable to bottom-tending mobile gear, including otter trawls. Amendment 1 establishes a series of gear restricted areas (GRAs) closed to bottom trawling, within and adjacent to the four canyons where HAPC is known to occur. For enforcement purposes, the GRAs are defined by straight line boundaries rather than in terms of the depth contour used to define EFH and HAPC.

The Council is currently considering alternatives for protecting deep sea corals, and developed of a Memorandum of Understanding Regarding the Management of Deep Sea Corals to support coordination and information sharing with the Mid-Atlantic and South Atlantic Fishery Management Councils. Whereas the South Atlantic and New England Councils have designated or are considering designating deep sea corals as HAPCs, the Mid-Atlantic is protecting these areas using the deep sea coral discretionary provision of the Magnuson-Stevens Act (MSA).

3. South Atlantic

Summary of current approach

The South Atlantic Fishery Management Council recognizes two different types of Habitat Areas of Particular Concern (HAPCs). The Council has two different pathways for identifying Coral Habitat Areas of Particular Concern (CHAPCs), and Essential Fish Habitat-Habitat Areas of Particular Concern (EFH-HAPCs), pursuant to the EFH provisions of the Magnuson-Stevens Act (MSA). The two designations serve different purposes. CHAPCs, a designation which pre-dates the EFH provisions of the MSA, directly eliminate or minimize the impact of fishing and fishing gear on coral, coral reefs, and live/hard bottom habitat. EFH-HAPCs are established to highlight the value of habitat to species or species complexes in the context of a specific fishery management plan (FMP), and address the impacts of non-fishing activities on those habitats and managed species during the EFH consultation process. Coral reefs and hard bottom habitat may therefore be recognized as CHAPCs in their own right, and also as EFH-HAPCs as habitat for other managed species. All CHAPCs are now also designated as EFH-HAPCs.

The majority of the region's EFH-HAPCs were initially identified via the Council's 1998 Habitat Plan and Comprehensive Amendment. Additional EFH-HAPCs were identified for corals and snapper-grouper species through recent Comprehensive Ecosystem-Based Amendments. Many habitat types and areas are identified as HAPC for multiple species and FMPs. The Council utilized both the CHAPCs and EFH-HAPC designations to protect deepwater coral ecosystems in the region.

History and evolution

The Council designated the first CHAPC, the Oculina Bank, under a joint South Atlantic and Gulf of Mexico Coral FMP implemented in 1984.[7] This use of the term "HAPC" pre-dates the EFH provisions of the MSA, and the four EFH considerations of ecological function, sensitivity, exposure to development stress, and rarity. The Coral FMP identified a separate set of four CHAPC considerations (SAFMC and GMFMC 1982)[8]

- Ecological value (e.g. outstanding examples of a species, rare species, unusual or unique biological relationships or ecological conditions)
- Research (history of study or areas of research interest)
- Exploitation (economically important or susceptible to anthropogenic activities)
- Recreation (high use or high value)

Coral HAPCs must meet at least one of these criteria, and are intended to be geographically representative of the South Atlantic region. The Oculina Bank was recognized as a CHAPC for its fragile, slow-growing *Oculina* corals, which support diverse deepwater ecosystems. While the use of mobile bottom gear was banned at that time, continued fishing activity led to extensive damage and impacts to fish communities. In 1994 this area was designated the Experimental Oculina Research Reserve under the Snapper Grouper FMP and closed to bottom fishing for species in the snapper grouper complex for the next 10 years, and in 1995 was closed to bottom anchoring by fishing vessels.

In 1998, the Council developed a Habitat Plan and a Comprehensive EFH Amendment to address EFH requirements for South Atlantic FMPs. The Habitat Plan identified both habitat types and sites as EFH-HAPCs for most of the Council's FMPs, and utilizes a separate process and set of criteria for identifying CHAPCs.

EFH-HAPCs for FMPs

The 1998 Comprehensive EFH Amendment identified EFH-HAPCs for most of the Council's current FMPs. The South Atlantic identified EFH on the basis of an extensive literature review, with EFH generally corresponding to the availability of Level 1 or 2 habitat data[9], and HAPC informed by the availability of higher-tier data (Wilber, pers.comm.) Habitat types and sites designated EFH-HAPCs under the EFH provisions are ranked high, medium, or low across the four HAPC considerations.

The South Atlantic designated HAPCs on a fishery and FMP-specific basis. The council identified specific areas as HAPCs (e.g. known areas of offshore hard bottom), as well as habitat types (e.g. mangrove habitat), features (e.g. coastal inlets) and HAPCs tied to habitat designations at the state level (e.g. state-designated nursery habitats of particular importance to shrimp). The combination of HAPC sites and types varies by FMP, and a

[7] The joint South Atlantic and Gulf of Mexico Coral FMP was separated into two regional FMPs in 1994

[8] Summary; see Table 11, p. 76 of the Habitat Plan (SAFMC 1998)

[9] The EFH Final Rule describes a 4-tier approach to organizing the information used to describe and identify EFH. Level 3 indicates that growth, reproduction, or survival rates are available; Level 4 indicates that production rates by habitat are available. (50 CFR § 600.815)

particular area or habitat type is often identified as a HAPC for multiple FMPs. The EFH-HAPCs identified under this amendment are not associated with any protective measures. The Council established the Dolphin and Wahoo FMP and designated EFH and EFH-HAPCs for these species in 2004.

Coral HAPCs

The Habitat Plan and Comprehensive EFH Amendment recognize the importance of coral and hardbottom habitats in multiple ways. The Council draws a clear distinction between EFH-HAPCs identified according to the four considerations of ecological function, sensitivity, exposure to development stress, and rarity, and CHAPCs identified according to the four considerations described in the 1984 Coral FMP. EFH-HAPCs are intended to recognize habitat types and areas of special significance to managed species, and CHAPCs are intended to focus regulatory and enforcement measures.

Corals are managed under the Coral, Coral Reef, and Live/Hardbottom Habitat FMP, and also serve as important habitat for other managed species. Coral areas may be co-designated as CHAPCs, and as area or habitat-based EFH-HAPCs in the context of the Snapper-Grouper and/or Coral FMPs. The overlay of area-based CHAPCs with area or habitat type-based EFH-HAPCs reflect that coral and hardbottom habitats are important wherever they occur, and that coral and hardbottom habitats are not contiguous, but part of interrelated habitat types (including sand and substrate) that provide important habitat functions. Reefs and corals rank “high” in terms of ecological function, sensitivity, and rarity as EFH-HAPC for snapper-grouper, and rankings vary for the individual sites.

Comprehensive Ecosystem-Based Amendments

Since the initial Habitat Plan and Comprehensive EFH Amendment, there have been several updates to HAPCs in the South Atlantic region. The original Habitat Plan, which served as the source document for EFH descriptions, evolved into a Fishery Ecosystem Plan that serves as a source document and basis for Comprehensive Ecosystem-Based Amendments (CEBAs). Changes to CHAPCs and EFH-HAPCs have been implemented through this process, with participation from the Coral and Habitat Committees, Coral and Habitat Advisory Panels, fishermen and other experts.

CEBA 1 designated areas of deep sea corals as CHAPCs as a largely proactive effort to protect corals and associated species from potential fishing impacts. These areas were recognized as CHAPCs but not as EFH-HAPCs, and thus not conferred the standing of HAPCs designated under the EFH provisions of the MSA. The use of damaging bottom gear, anchoring by fishing vessels, and possession of managed coral species is prohibited. CEBA 1 also established allowable golden crab fishing areas and shrimp fishery access areas within two of these HAPCs, to allow these small and specialized fisheries to operate within specific boundaries that correspond to historical fishing areas.

Comprehensive Ecosystem-Based Amendment 2 (CEBA 2), implemented in 2012, designated additional EFH-HAPCs for the Snapper Grouper FMP and new deepwater CHAPC under the Coral, Coral Reef, and Live/Hard Bottom Habitat FMP. CEBA 2 designated a network of eight deepwater Snapper Grouper Marine Protected Areas

(MPAs) as EFH-HAPCs for the snapper-grouper complex. These MPAs were previously established through a 2009 amendment to the Snapper Grouper FMP to support the management of snapper grouper species, many of which are long-lived and possess complex life histories. Fishing for all species in the snapper-grouper complex is prohibited in these areas. CEBA 2 also designated the deepwater CHAPCs established under CEBA 1 as EFH-HAPCs. In addition, new EFH-HAPC was established for golden and blueline tilefish. These actions in combination were intended to reinforce the Council's ability to protect these important areas from fishing impacts, and to support enhanced EFH consultations.

The South Atlantic Council is also a party to a Memorandum of Understanding among the three East Coast councils to help coordinate the protection of deep sea corals.

4. Caribbean

Summary of current approach

The Caribbean Fishery Management Council identified a large number of discrete sites as Habitat Areas of Particular Concern (HAPCs) under its Reef Fish and Coral Fishery Management Plans (FMPs). The U.S. Caribbean region has limited life history and habitat distribution information, and current HAPC sites were proposed by the Council's Scientific and Statistical Committee (SSC) and Habitat Advisory Panel and adopted through a Comprehensive Amendment in 2005. HAPCs are identified under the Reef Fish and Coral FMPs and include a set of known spawning sites in federal waters, which are protected through seasonal spawning closures and gear restrictions, and areas of mangrove, seagrass, and coral habitat in state waters. Many of the HAPCs in state waters correspond to areas identified as parks and reserves at the federal level and/or by the Commonwealth of Puerto Rico or territory of the U.S. Virgin Islands, and are recognized for their ecological value to a broad range of managed and protected species.

History and evolution

The Council's Generic Essential Fish Habitat (EFH) Amendment, completed in 1998, designated habitat types as HAPC, including estuarine habitats (wetlands, salt marshes, and mangroves) and marine habitats (water column, seagrass, non-vegetated bottom-sand, mud-, algal plains and coral reefs). Hind Bank, off the coast of St. Thomas, was the only discrete area identified as a HAPC. Hind Bank corresponds with a no-take marine conservation district adopted through an Amendment to the Coral FMP in order to protect corals within a spawning aggregation site of red hind. Anchoring is also prohibited in this area. All habitats were generally recognized for their ecological function and value to Caribbean fisheries. At the time, EFH for Federally managed Caribbean species was identified and described based on the distribution of corals and a limited number of managed species, and the Generic Amendment notes that additional life history information would be necessary to identify both EFH and HAPCs.

In 2004, the Caribbean completed an Environmental Impact Statement (EIS) for the 1998 Generic Amendment, and identified changes to HAPC that were subsequently adopted through a 2005 Comprehensive Amendment to Caribbean FMPs. This EIS was prepared by a contractor who explored metrics for describing, evaluating, and then mapping potential HAPC sites in terms of the four HAPC considerations. Because there was insufficient information to support this approach in the Caribbean, HAPCs were instead proposed by an expert panel consisting of the Council's SSC and Habitat Advisory Panel. The Comprehensive Amendment designated more than 40 additional HAPCs, primarily discrete locations, off the coasts of Puerto Rico, St. Thomas, and St. John. The HAPCs identified in the Comprehensive Amendment fall into the three categories described below. The first two categories of HAPCs are more closely aligned with reef fish management and were adopted under the Reef Fish FMP. The third category of HAPCs was adopted under the Coral FMP.

Reef Fish Spawning Site HAPCs (Reef Fish FMP)

Eight confirmed reef fish spawning locations are identified as HAPCs under the Reef Fish FMP. While these areas were identified on the basis of spawning activity, they are presumed to contain coral and live/hard bottom habitats, and therefore recognized for ecological function as well as sensitivity to degradation. One of these areas, Hind Bank, was previously identified in 1998 as HAPC and protected as a no-take reserve under the Coral FMP. A well-known grouper spawning aggregation, El Seco in Vieques, is identified as a HAPC but is completely within state waters. The remaining six were already subject to seasonal spawning closures. In addition, the Generic Amendment prohibited fishing with bottom-tending gear including pots and traps, nets and bottom longlines in these areas as part of a suite of measures to minimize adverse impacts to habitat from fishing. Anchoring is prohibited in two of the HAPCs and the requirement for an anchor retrieval system is in place for the others.

Additional Reef Fish HAPCs (Reef Fish FMP)

An additional 18 HAPCs are identified as areas of ecological importance to reef fish species under the Reef Fish FMP, primarily due to the presence of valuable estuarine, mangrove, and seagrass habitat. All sites are in state waters, and many were already recognized as parks or reserves at the federal and/or territorial or Commonwealth level, for example as a National Estuarine Research Reserve, National Wildlife Refuge, Natural Reserve, State Forest, Wildlife Sanctuary, or other designation. Most of these HAPCs are discrete sites. Some areas of seagrass beds in Puerto Rico waters are recognized as a habitat type within a defined location, since they are not precisely mapped and may vary over time. Areas within the U.S. Virgin Islands have specific restrictions on fishing activities.

All of these HAPCs are recognized for their ecological importance to the reef fish complex, and most are also considered sensitive and/or likely to be stressed by development activities. Although these sites are identified as HAPCs under the Reef Fish FMP, they are also recognized as areas of importance to other federally managed species including spiny lobster, queen conch, and corals, as well as protected species of marine mammals and sea turtles. The primary function of these habitats is as nursery and feeding grounds.

Coral HAPCs (Coral FMP)
An additional 19 HAPCs are identified as areas of ecological importance under the Coral FMP. Many of these sites are also recognized for their sensitivity and potential to be stressed by development. As a group, these HAPCs share similarities with HAPCs identified under the Reef Fish FMP, though were considered most closely aligned with the Coral FMP. All sites are in state waters, and many are also recognized as reserves and parks at the federal and/or territorial/Commonwealth levels. As with the Reef Fish HAPCs, these sites are recognized as benefitting other federally managed and protected species. These HAPC sites contain corals and are in some cases identified at a scale (e.g., state forest) that includes a variety of other habitat types such as mangroves, seagrass beds, and coastal wetlands. Most of these have a restriction on fishing activities and prohibit anchoring, especially in areas contiguous to federal waters such as the Buck Island Reef National Monument.

Recent efforts
A review of EFH and HAPC designations was completed by a contractor in 2011. The report concluded that a comprehensive EFH amendment was not justified, but noted that additional HAPC designations could be considered by expert recommendation. The Caribbean Council has also contracted work to characterize EFH and HAPCs through the NOAA Coral Reef Conservation Program.

5. Gulf of Mexico

Summary of current approach
The Gulf of Mexico Fishery Management Council initially identified habitat types as well as specific sites as Habitat Areas of Particular Concern (HAPCs) in 1998, and replaced these with a set of discrete sites in 2005. The Council identified 18 areas as HAPCs. All are spatially defined areas in federal waters, and were designated primarily for the purpose of protecting coral and hard bottom habitat. Several of these areas are also designated as Marine Reserves, Marine Protected Areas, National Monuments, and National Marine Sanctuaries. Half of these areas include protection from adverse fishing impacts. Some areas had existing protections, and additional restrictions on anchoring and allowable gear types were adopted in conjunction with, though not as a direct result of, the Council's identification of these areas as HAPCs. The Council conducted an Essential Fish Habitat (EFH) review in 2010 and did not identify additional HAPCs. The Council is currently considering whether to add deep sea corals as coral HAPCs, or recognize these areas using the deep sea coral discretionary provision of the Magnuson-Stevens Act (MSA).

History and evolution

The Council first identified two sites as HAPCs under the Coral Fishery Management Plan (FMP) in 1984.[10] The Council's 1998 Generic Amendment to implement the EFH provisions of the 1996 MSA identified three habitat types (broadly defined in terms of intertidal and estuarine habitats, offshore areas of high habitat value and diversity or vertical relief, and ecologically important areas adjacent to human development activities)[11] with the intent of soliciting recommendations for specific sites from the Council, Advisory Panels, state and federal agencies, and academia. This amendment also identified nine specific sites that met at least one or more of the HAPC considerations, and included two Marine Sanctuaries, three National Estuarine Research Reserve sites, and one National Monument.

The Council later completed an Environmental Impact Statement (EIS) for this amendment, and in 2005 completed a Generic Amendment that replaces these HAPCs with a set of 18 spatially discrete sites. The 2005 Generic Amendment explored metrics for describing, evaluating, and then mapping potential HAPC sites in terms of the four HAPC considerations. Several concepts were proposed for designating HAPCs in terms of ecological importance, including spawning sites, nursery grounds, and migratory routes. Lacking the information to reasonably delineate areas based on those concepts, the Council chose an approach that would utilize expert opinion with regard to all four HAPC considerations.

Ultimately the Council focused its use of HAPCs on areas of living coral reef and hard bottom habitat. Many of these areas were already recognized by the Council and subject to protective measures including closures and gear restrictions. The 2005 amendment confirmed the status of these areas as HAPCs, and prohibited anchoring and the use of bottom-tending gear on these and additional sites. While these restrictions apply to areas that are HAPCs, they were adopted concurrently and did not directly result from the HAPC designation. The coral reef and hard bottom sites recognized as HAPCs meet one or more of the four EFH considerations.

The Council completed an EFH 5-year review in 2010, which did not result in any changes to HAPCs. Staff reviewed existing HAPC designations and considered whether sites should be added or removed based on a literature review and consultation with experts. Some additional sites were identified as potential HAPCs, in response to new information about the habitat, species associations, and the growth of non-fishing activities. The report noted that no studies have been conducted to evaluate the effectiveness of existing HAPCs, but that the designation has helped focus the Council's review of projects that may impact these areas, and that many of these sites have been protected. The final 2010 EFH report concluded that a comprehensive EFH amendment

[10] The Gulf Council identified 2 areas (Flower Garden Banks and Florida Middle Grounds) as "Habitat Area of Particular Concern" under a joint South Atlantic and Gulf of Mexico Coral FMP implemented in 1984. The use of this term pre-dates the EFH provisions of the 1996 MSA. HAPCs were identified with regard to a set of four considerations (see South Atlantic profile). These areas were designated as HAPCs under the EFH provisions in 2005.

[11] Summary; see section 7.3 of Generic Amendment 1 (GMFMC 1998).

was not needed but that EFH descriptions could be updated on a FMP basis, and that additional HAPC designation could be considered at this time.

The Council is currently considering options for protecting deep sea corals, either as HAPCs under the EFH provisions, or using the deep sea coral discretionary authority of the Magnuson-Stevens Act (MSA). In December 2014 a Coral Working Group convened by the Council recommended that the council designate discrete areas as Coral HAPCs, rather than as deep sea coral areas, and recommended restrictions on bottom-tending gear and anchoring.

6. Western Pacific

Summary of current approach

The Western Pacific Regional Fishery Management Council's use of the Habitat Area of Particular Concern (HAPC) designation reflects the region's place-based approach to managing geographically isolated island regions, which include the State of Hawai'i, the territories of Guam and American Samoa, the Commonwealth of the Northern Mariana Islands, and eight remote island areas. Limited habitat information is available for most of the Western Pacific's regions and managed species, and HAPCs are primarily defined in terms of habitat types. Recently the Council and NOAA Fisheries Pacific Islands Regional Office have engaged in an effort to refine the identification of geographically defined HAPCs for Hawaiian Archipelago Bottomfish, in a process that provided the Council's most recent interpretation of the four HAPC considerations. HAPCs do not confer any specific habitat protections in the Western Pacific region, but in many cases existing coral reef species complex HAPCs intentionally correspond to the boundaries of previously established Marine Protected Areas (MPAs) and long term monitoring sites.

History and evolution

The Western Pacific Regional Fishery Management Council initially identified HAPCs in 2001, in the context of species-specific Fishery Management Plans (FMPs) for Bottomfish and Seamount Groundfish, Crustaceans, Pelagics, Precious Corals, and Coral Reef Ecosystems. HAPCs included some discrete sites, but were primarily described in terms of habitat types (e.g., water column, escarpments, and slopes) within defined depth contours. The HAPCs identified under the Coral Reef Ecosystem Fishery Ecosystem Plan include more than 50 sites. All sites meet at least one of the four HAPC considerations and existing protective status is considered as a factor. Although these HAPCs are place-based, the implementing amendment notes that additional life history information would be needed to refine the location of these HAPCs and link them to individual species and life history stages. In 2009, the Council reorganized its FMPs into a set of place-based Fishery Ecosystem Plans (FEPs). The existing EFH and HAPC descriptions were carried forward into five separate FEPs for American Samoa, the Mariana Archipelago, the Hawaiian Archipelago, the Pacific Remote Island area, and Pacific Pelagics.

Hawaiian Archipelago Bottomfish and Seamount Groundfish HAPCs

The Council is nearing the end of a process to update EFH and HAPC designations for Bottomfish and Seamount groundfish in the Hawaiian Archipelago, where bathymetric mapping and additional fishery-independent sampling and research can support more precise identification of HAPC sites. The availability of this information is due in part to the Council's identification of bottomfish as a priority for the investment of research resources, in order to evaluate the efficacy of state bottomfish restricted fishing areas.

Bottomfish HAPC is currently defined as all slopes and escarpments from 40-280m, plus three known sites of juvenile habitat. In 2008, the NOAA Fisheries Pacific Islands Regional Office contracted with the University of Hawai'i to review and update existing information. One product of this review was a HAPC Justification Report, which proposes and describes the rationale for identifying a set of HAPC sites.

The 2010 HAPC Justification Report identified16 geographically discrete HAPC candidate sites, proposing that existing HAPCs are not sufficient to inform environmental impact statements or focus research or protective measures. Each of the proposed HAPCs meets at least one of the four HAPC considerations. Most are identified on the basis of ecological importance, and none are identified as susceptible to development. The three relevant HAPC considerations are described in the context of bottomfish EFH (Kelley et al., 2010):

> "Rarity was based on the presence of unusual physical or biological characteristics in the context of [the] current state of knowledge of bottomfish habitats."
>
> "…Ecological importance was evaluated with respect to modeled larval dispersal characteristics or the presence of critical life history stages (i.e., juveniles and spawning adults)."
>
> "Sensitivity was evaluated with respect to the habitat's vulnerability to disturbance from either fishing or non-fishing activities, [including] risk of significantly depleting the targeted bottomfish species or presence of substantial invertebrate beds (i.e., corals or sponges) that could be impacted by fishing gear and anchors."

The report includes presence/absence data for key bottomfish species in each of the proposed sites, and includes additional justification for each site noting factors such as genetic continuity and connectivity between areas, enforceability, and the potential for fishing effort displaced from Papahānaumokuākea National Monument, where commercial fishing for bottomfish was recently phased out. Many of the proposed sites are identified as candidates for additional research. No specific protections are recommended, although some sites overlap with bottomfish restricted fishing areas adopted by the Hawai'i Department of Land and Natural Resources, in which fishing for bottomfish is prohibited.

The HAPC Justification Report was then reviewed by the Western Pacific Stock Assessment Review (WPSAR) bottomfish working group, which recommended reducing the number of candidate sites from 16 to seven. The working group concluded that HAPCs should be based upon survey information, catch data, and evidence of nursery grounds, and that other factors considered in the HAPC report such as impacts of fishing gear and connectivity were not well supported with scientific evidence. The group also determined that ecological importance should be considered the primary basis for identifying a HAPC, with the other three HAPC considerations serving a secondary role.

In 2012 the Council approved the WPSAR bottomfish working group’s recommendations regarding bottomfish HAPC, and also recommended designating seamount groundfish HAPC to coincide with seamount groundfish EFH at Hancock Seamount. The Council anticipates that the amendment to the Hawaii Archipelago Fishery Ecosystem Plan to update EFH and HAPC designations will be approved in 2015.

7. Pacific

Summary of current approach

The Pacific Fishery Management Council’s identification of Habitat Areas of Particular Concern (HAPCs) is notable for a sustained focus on important habitat types, as well as for the prominent role of public participation in the latest Groundfish Essential Fish Habitat (EFH) review process. The Council first identified several habitat types as well as several discrete areas as HAPCs for Pacific Coast Groundfish in 2005. The Council completed a review of EFH for the Pacific Coast Groundfish Fishery Management Plan (FMP) in 2014, using a process outlined in the Council’s Operating Procedures (COP). This process provided for significant stakeholder participation through the formation of an EFH Review Committee, and a proposal process that enabled stakeholders to suggest modifications to EFH and HAPCs. The Council will begin the FMP amendment process in April 2015. The Council also recently completed an EFH review for Pacific salmon, and identified five habitat types as HAPCs. The habitat types identified as HAPCs for both groundfish and salmon are not all mapped, and may vary in location and extent. This approach to designating HAPCs acknowledges the importance of these habitat types wherever they occur.

History and evolution

Groundfish

The Pacific Fishery Management Council first described EFH for groundfish in 1998, but did not identify HAPCs at this time. Amendment 19 to the Groundfish FMP implemented in 2006 identified habitat types as well as specific “areas of interest” as HAPCs. The four habitat types identified as HAPCs include estuaries, canopy-forming kelp, seagrass, and rocky reefs. Each habitat type meets two of the four HAPC considerations (ecological importance and sensitivity to human-induced environmental degradation), and estuaries are also identified as stressed by development. All four habitat types were mapped to provide approximate locations using available data at the time, but are also defined in terms of their text descriptions such that these habitat types constitute HAPC wherever they are found to exist. The distribution of kelp and seagrass habitat can vary over time, and mapping data was incomplete for kelp and seagrass as well as for rocky reefs. A fifth habitat type, representing a series of 13 oil rigs in southern California, was proposed as a

HAPC but disapproved when NOAA Fisheries concluded that there was insufficient evidence to link oil rigs with the four HAPC considerations.

Amendment 19 also identified several “areas of interest” as HAPCs due to their unique geological and ecological characteristics. These include several seamounts and banks, Monterey Canyon, areas of the Channel Islands National Marine Sanctuary, and state waters off the coast of Washington. In some cases there may be overlap between habitat types (e.g., estuaries and seagrass) or between a habitat type and a discrete area (e.g., kelp canopy and Washington State waters). While groundfish HAPCs are not directly associated with protective measures, they may overlap with closures and restrictions on some or all forms of bottom contact fishing gear, adopted to minimize adverse impacts to EFH. HAPCs may also overlap with areas that are protected under other authorities, such as National Marine Sanctuaries.

Amendment 19 also describes a process that would allow organizations or individuals to petition the Council at any time to modify or eliminate an existing HAPC, or consider adopting a new one. The Council subsequently developed a formalized Process for Essential Fish Habitat Review and Modification, which is described in the Council’s Operating Procedures (COP 22). COP 22 establishes the membership and operating guidelines for an EFH Review Committee (EFHRC), and a process for reviewing groundfish EFH and HAPCs. COP 22 was revised in 2011 to specify that potential HAPCs would be identified through the periodic EFH review process, rather than an ongoing basis.

The process outlined in COP 22 is now guiding the Council’s groundfish EFH review process, which was initiated in December 2010 and carried out in three phases. In Phase 1, the EFHRC reviewed new information and NOAA Fisheries provided a synthesis report to the Council. In Phase 2 the Council provided evaluation of the new information, and initiated a request for proposals for potential changes to EFH and HAPC. Phase 3 of this process will involve identifying the issues to be addressed, developing and analyzing alternatives, and taking final action.

A total of three proposals identified five potential new HAPCs. The proposed HAPCs are located within National Marine Sanctuaries on the continental shelf and contain hard and soft substrates that support juvenile and adult groundfish species, as well as observed biogenic habitat. All are identified as candidates on the basis of ecological function and rarity, and some are also identified as sensitive to anthropogenic impacts. In a 2014 report to the Council, the EFHRC recommended updating a map of the HAPC habitat types identified in 2006, and that the Council consider designating the five proposed sites identified through the proposal process as HAPCs.

The Council anticipates initiating a plan amendment (or other appropriate regulatory process) to update the EFH provisions of the Groundfish FMP, including HAPC designations, in 2015. The Council has also been considering changes to its Rockfish Conservation Areas (RCA), which are groundfish closures aimed at reducing overfishing and species conservation, and in some cases directly overlap with EFH restrictions.

Given that the prohibitions (fishing restrictions in specified areas) and effects (protection of benthic habitat from federally managed fishing activities) are very similar under both EFH and RCA restrictions, the Council is considering these issues simultaneously (Griffin, pers.comm.)

Salmon
A new set of HAPCs for Pacific salmon was implemented via final rule in early 2015. The Council first convened a Pacific Coast Salmon EFH Oversight Panel in 2009 to review available information and recommend revisions to salmon EFH and HAPCs. The Oversight Panel, composed of Council and NOAA Fisheries staff and experts, recommended designating five habitat types as HAPCs, which the Council adopted via Amendment 18 to the Salmon FMP.

The habitat types identified as HAPCs for Pacific salmon reflect the distinctive habitat needs of anadromous species and include complex channels and floodplain habitat, thermal refugia (areas of cooler water, which are critical to salmon survival), spawning habitat, estuaries, and marine and estuarine submerged aquatic vegetation. All five HAPC types are located in state waters or inland, and are identified to support the EFH consultation process. These habitat types are already acknowledged for their importance as critical habitat for ESA listed species, and the HAPC designation itself is not anticipated to substantially influence EFH conservation recommendations. Each of the habitat types is described in terms of ecological importance, sensitivity, and exposure to development stress. None of the habitat types are inherently rare, but are becoming less prevalent due to habitat loss and coastal and inland development. Of the five habitat types only estuaries are well mapped. Others are identified by text descriptions that refer to a broad range of habitat parameters including substrate type and also properties such as temperature, salinity, flow, and dissolved oxygen content.

8. North Pacific

Summary of current approach
The North Pacific Fishery Management Council utilizes a highly structured and inclusive process for identifying and reviewing potential Habitat Areas of Particular Concern (HAPCs). The Council identifies priorities for candidate HAPCs based on input from the stock assessment process, and issues a request for proposals from the public, including stakeholders as well as management partners including NOAA Fisheries. These proposals are reviewed and ranked according to the four HAPC considerations as well as a data certainty factor. Proposed HAPCs must meet at least two of the four considerations, including rarity.

The Council originally identified habitat types as HAPCs before adopting a place-based approach and proposal process, which was revised in 2010 and is now aligned with the 5-year Essential Fish Habitat (EFH) review cycle. Through two iterations of this proposal process, the Council identified seamounts and coral areas as HAPCs and adopted restrictions on the use of bottom fishing gear, and most recently identified areas of skate egg concentration as HAPCs in order to focus monitoring and additional research.

History and evolution
The North Pacific Fishery Management Council first identified three habitat types as HAPCs in 1998 (NPFMC 2012)[12]:

- Areas with living substrates in shallow waters (e.g., eelgrass, kelp, mussel beds);
- Areas with living substrates in deep waters (e.g., sponges, corals, anemones)
- Freshwater areas used by anadromous fish (e.g. migration, spawning, and rearing areas)

Living substrates in shallow waters were recognized as important habitat for multiple council-managed species. Living substrates were recognized for their value to groundfish, and freshwater areas for their value to Pacific salmon and other anadromous species such as smelt.

At that time, the Council also solicited proposals for additional HAPCs and options for minimizing adverse impacts from fishing. This process generated recommendations for additional HAPC locations and habitat types, as well as two proposals for minimizing adverse impacts. In response, the Council initiated the development of a plan amendment. This process resulted in two significant outcomes. First, a proposal by the Council to classify HAPC biota as prohibited species ultimately resulted in the State of Alaska prohibiting a fishery for these species in the EEZ, utilizing a state-specific provision (§ 306 (a)(3)) of the Magnuson-Stevens Act (MSA). Second, the Council chose to proceed instead with the development of a more comprehensive and inclusive process for HAPC identification and protection.

As part of the development of a 2005 an Environmental Impact Statement (EIS) to address the 1998 EFH Fishery Management Plan (FMP) amendments, the Council rescinded the original habitat type HAPC designations, and outlined a site-based HAPC proposal and review process. Through this process, the Council issues a request for HAPC nominations, and sets priorities based on input from the stock assessment process. Proposed sites must meet the HAPC consideration of rarity, plus at least one more of the four considerations. Proposals are then reviewed by Council staff and plan teams, at which point the Council can select proposals for further analysis.

This process was proposed to occur on a three-year cycle. The first round was initiated in 2003, and the Council identified two priority areas (NMFS 2005)

1. Seamounts in the Exclusive Economic Zone (EEZ), named on National Oceanic and Atmospheric Administration (NOAA) charts, that provide important habitat for managed species

[12] A detailed history of the North Pacific's approach to the HAPC designation is provided in sections 2.1 and 2.2 of the 2012 HAPC EA (NPFMC 2012)

2. Largely undisturbed, high-relief, long-lived hard coral beds, with particular emphasis on those located in the Aleutian Islands, which provide habitat for life stages of rockfish or other important managed species.

Nominations were also to be based on the best available scientific information and include the following features:

1. Sites must have likely or documented presence of FMP rockfish species
2. Sites must be largely undisturbed and occur outside core fishing areas.

As a result of this process the Council identified Alaska Seamount Habitat Protection Areas, Gulf of Alaska Coral Habitat Protection Areas, and the Bowers Ridge Habitat Conservation Zone. Gear restrictions adopted as part of the HAPC designation process prohibit the use of some or all forms of bottom contact fishing gear in most of these areas. These HAPCs and gear restrictions were adopted in 2006 via amendments to the Crab and Groundfish FMPs.

Following the first HAPC proposal cycle in 2003, the Council considered additional HAPC priorities but did not initiate a new proposal cycle. In 2010, the Council adopted revisions to the HAPC proposal process addressing consistency in the information included in proposals, and the definition of HAPC criteria and how these are applied to candidate sites.

The Council's 2010 HAPC Process Document describes the Council's current approach, the information that must be included in a HAPC proposal, and a scoring process for ranking candidate HAPCs on a level from 0 to 3 across the four HAPC considerations. This document also establishes a data certainty factor, which describes the level of information used to describe the candidate HAPC from 1 (habitat information does not exist; identified by inference or proxy) to 3 (site-specific habitat information is available). The data certainty factor is not necessarily used to eliminate potential HAPCs; for example, it could be used to help identify research priorities or areas where NOAA Fisheries could contribute additional information. Proposals are received and reviewed by staff, plan teams, and the Council's Scientific and Statistical Committee (SSC), Advisory Panel (AP), and Enforcement and Ecosystem Committee. At this point the Council can choose to accept and analyze a candidate site for HAPC designation, identify a site or a topic as an area for further research, or reject the proposal.

The Council also chose in 2010 to align the HAPC process with EFH 5-year reviews (rather than the three-year cycle initially proposed), and initiated a new Request for Proposals (RFP) with areas of skate egg concentration identified as a priority. This RFP resulted in a proposal from the NOAA Fisheries Alaska Fisheries Science Center to consider six areas of skate egg concentrations. All six areas were subsequently identified as HAPC. The Council considered but did not adopt any gear restrictions, and requested that these sites be monitored and information be included in the Ecosystem chapter of the Council's Stock Assessment and Fisheries Evaluation (SAFE) report.

9. Atlantic Highly Migratory Species

Summary of current approach
Atlantic Highly Migratory Species (HMS) are managed internationally through the International Commission for the Conservation of Atlantic Tunas (ICCAT), and domestically in the U.S. under the Magnuson-Stevens Act (MSA) through a fishery management plan (FMP) administered by NOAA Fisheries.[13] The role of MSA habitat authorities is unique in the management context of highly mobile pelagic species. NOAA Fisheries has identified areas of nearshore habitat in the Mid-Atlantic region as habitat areas of particular concern (HAPC) for sandbar sharks, and a large area of offshore habitat in the Gulf of Mexico as HAPC for bluefin tuna. Both HAPCs focus on areas of ecological importance for spawning and early life stages. While neither HAPC is directly associated with fishing restrictions, there is no targeted fishery for either species in the regions where the HAPCs have been identified. NOAA Fisheries is currently conducting an EFH 5-year review that may result in the designation of additional HAPCs.

History and evolution

Overview of HMS management
Atlantic HMS, including Atlantic tunas, swordfish, sharks, and billfishes, are managed domestically and internationally, and span multiple U.S. regional fishery management council jurisdictions. In the U.S., the Consolidated Atlantic Highly Migratory Species Fishery Management Plan[14] is administered by NOAA Fisheries under the Secretarial authority of the MSA. This FMP is developed and implemented by NOAA Fisheries with input from an advisory panel that includes commercial, recreational, scientific, and environmental stakeholders, as well as representatives from East Coast fishery management bodies (state, interstate, and international). The HMS Advisory Panel provides input and advice on the development of FMP amendments but is not a voting body. Management alternatives are developed and selected by NOAA Fisheries. The Atlantic HMS FMP is subject to the same requirements as all federally managed FMPs, including the requirement to describe and identify Essential Fish Habitat (EFH). NOAA Fisheries can thus also identify HAPCs for HMS.

HMS utilize pelagic habitat throughout the U.S. Exclusive Economic Zone (EEZ), from inshore and continental shelf areas to the open ocean. EFH is currently defined according to geographic text descriptions and probability boundaries created by analyzing point

[13] Cooperative management of Atlantic tuna, swordfish, and billfish stocks is coordinated by the International Commission for the Conservation of Atlantic Tunas (ICCAT), with conservation and management recommendations implemented in the U.S. under the authority of the Magnuson-Stevens Act and Atlantic Tunas Convention Act. The conservation and management of Atlantic sharks is conducted solely under the Magnuson –Stevens Act. See section 1.1 of the 2006 Consolidated Atlantic Highly Migratory Species Fishery Management Plan for a description of HMS management history and process (NMFS 2006).
[14] Two separate FMPs for Atlantic Tunas, Swordfish, and Sharks; and Atlantic Billfish, were merged into a single Consolidated Atlantic Highly Migratory Species Fishery Management Plan in 2006.

data in a Geographic Information System established by species and life history stage, when sufficient information is available. Most HMS fishing takes place in the water column and impacts to EFH are considered negligible. While EFH for HMS is primarily offshore, a wide array of non-fishing impacts in the coastal zone are recognized as potentially impacting HMS EFH, and more recently some stakeholders have raised concerns related to aquaculture and seismic testing (Cooper, pers.comm). Nearshore waters are also particularly important to some shark species for mating, pupping, and nursery habitat.

The contribution of habitat conservation to sustainable management of HMS using MSA habitat authorities is different than for many other federally managed species, because HMS are managed by the U.S. only in federal waters, which may comprise a small portion of their total range. While management of some species is coordinated internationally, other HMS (including sharks) are only managed domestically. The role of habitat conservation and the potential to identify HAPCs for HMS may change in the future as offshore non-fishing activities become more prevalent, the association of HMS with nearshore habitat and structure is better understood, and/or as assessments and management measures shift from the complex to the species level (Cooper, pers.comm.).

Sandbar shark HAPC
EFH was first identified and described for Atlantic tunas, swordfish, and sharks in 1999. This FMP identified HAPC for sandbar sharks as follows (NMFS 1999):

> "Important nursery and pupping grounds…in shallow areas and the mouth of Great Bay, NJ, lower and middle Delaware Bay, lower Chesapeake Bay, MD and near the Outer Banks, NC, in areas of Pamlico Sound adjacent to Hatteras and Ocracoke Islands and offshore those islands."

At the time, sandbar sharks were identified as one of the most commercially important shark species in the shark fishery of the southeastern U.S. In 2002, sandbar sharks were determined to be experiencing overfishing, and an amendment to the FMP established a time/area closure off the coast of North Carolina to protect pupping and nursery areas for both sandbar sharks and dusky sharks (a prohibited species). This area was identified for a time/area closure due to high catch rates of neonate and juveniles of both species, and encompasses the area identified as HAPC for sandbar sharks. A 2011 assessment determined that sandbar sharks were overfished but that overfishing is not occurring. Sandbar sharks can not be commercially or recreationally retained.

Bluefin tuna HAPC
NOAA Fisheries conducted an EFH review and amendment to the 2006 Consolidated HMS FMP in 2009, and a HAPC for spawning bluefin tuna was suggested by two conservation and research organizations during the scoping process. The bluefin tuna HAPC is defined as a broad area of the western Gulf of Mexico, from the 100 m depth contour seaward to the boundary of the EEZ. This area is identified as the only known spawning location for western Atlantic bluefin tuna. While there are no restrictions on fishing directly associated with the identification of this area as HAPC, there is no

targeted fishery for bluefin tuna in the Gulf of Mexico, and incidental landings in the Gulf of Mexico are limited.

EFH 5-year review

NOAA Fisheries is currently conducting a 5-year EFH review for all HMS species. A draft review completed in March 2015 identified new information that could support the designation of new HAPC sites, including nursery areas for lemon sharks off southeastern Florida and Mississippi, nursery areas for sand tiger sharks in Delaware Bay and near Cape Cod, and potential spawning sites (inferred from larval distribution research) in the Florida Straits, Gulf of Mexico, and U.S. Caribbean. In the final 5-year review document NOAA Fisheries will determine if modifications to HMS EFH are warranted and if an amendment to the FMP is necessary.

References and Additional Resources

New England

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Atlantic Highly Migratory Species

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NMFS. 2015. Draft Essential Fish Habitat 5-Year Review for Atlantic Highly Migratory Species. Silver Spring, MD. 127 p.

Personal communication with Peter Cooper, Fishery Management Specialist, Highly Migratory Species Management Division, NOAA Fisheries. February 9, 2015.

Current and Proposed Habitat Areas of Particular Concern (HAPCs)
Compiled May 2015

This document includes information about existing and proposed Habitat Areas of Particular Concern (HAPCs), including discrete sites and habitat types, identified by the eight regional fishery management councils and NMFS Highly Migratory Species Division. This is accurate and up to date to the best of our knowledge, but should be used as a starting point for further investigation rather than a comprehensive reference. This document was compiled intended as a supplement to the report, "Regional Use of the Habitat Area of Particular Concern (HAPC) Designation," prepared by the Fisheries Leadership & Sustainability Forum for the Mid-Atlantic Fishery Management Council. This report includes additional detail about each region's use of the HAPC provision.

In this document, HAPCs are organized by region, with references to implementing actions and additional resources (primarily amendments and EISs) which may include maps, coordinates, depth contours, overlay with habitat protections and gear restrictions, and justification for HAPC designation with regard to the 4 HAPCs considerations (ecological function, sensitivity, exposure to development stress, and rarity).

Additional notes:

- This document does not include HAPC designations that were later rescinded or replaced. This information is included in the HAPC report.
- This document may include some references to numbers of HAPC sites where this information is clearly numbered or referenced in supporting documents. However, there is not a total number of HAPCs provided by region or in sum. The number of HAPCs per region may be difficult to identify, as demonstrated by the following examples:
    - A single habitat type identified as HAPC may include references to specific locations and examples (e.g., all ___ including the following locations…)
    - A set of discrete locations (e.g. seamounts, rivers) may be considered one HAPC or multiple
- In most cases the date (year) given for each implementing amendment refers to the date of the final amendment. In some cases the date of final rule is provided.
- Several regions are in the process of identifying HAPCs (New England, Western Pacific, Atlantic HMS, Pacific)
- In most regions the most useful reference for additional information about existing HAPCs (coordinates, maps, etc.) is the most recent, although in some cases additional information about the rationale for identifying HAPCs requires revisiting original amendments and/or EISs.
- In some regions HAPC is clearly identified within the context of a specific FMP; in others HAPC may include EFH for multiple species/complexes and/or is not clearly associated with a single FMP

New England Fishery Management Council

Current HAPCs
Implementing action: Omnibus EFH Amendment 1 (1998)

- Atlantic Salmon HAPC: 11 rivers in Maine, including: Dennys, Machias, East Machias, Pleasant, Narraguagus, Ducktrap, Sheepscot, Kennebec, Penobscot, St. Croix, Tunk Stream
- Northern Edge Juvenile Cod HAPC

HAPC Candidates (2015)
Current preferred alternatives (in addition to existing HAPCs)

- Inshore Juvenile Cod HAPC (inshore areas of the Gulf of Maine and Southern New England, 0-20 m)
- Great South Channel Juvenile Cod HAPC
- Cashes Ledge HAPC
- Jeffreys Ledge/Stellwagen Bank HAPC
- Bear and Retriever Seamounts HAPC
- Canyon HAPCs
  - Heezen Canyon
  - Lydonia, Gilbert, & Oceanographer Canyons
  - Hydrographer Canyon
  - Veatch Canyon
  - Alvin & Atlantis Canyons
  - Hudson Canyon
  - Toms, Middle Toms & Hendrickson Canyons
  - Wilmington Canyon
  - Baltimore Canyon
  - Washington Canyon
  - Norfolk Canyon

Reference: See Omnibus Amendment 1 for coordinates, references to HAPC considerations, maps, etc. for all current and proposed HAPCs
http://www.nefmc.org/library/omnibus-habitat-amendment-2

Mid-Atlantic Fishery Management Council

Summer Flounder HAPC
Implementing action: Amendment 12 to the Summer Flounder, Scup, and Black Seabass FMP (1998)
http://static1.squarespace.com/static/511cdc7fe4b00307a2628ac6/t/53e3ac8ce4b0b6a302b8dea3/1407429772601/SFSCBSB_Amend_12.pdf

"All native species of macroalgae, seagrasses, and freshwater and tidal macrophytes in any size bed, as well as loose aggregations, within adult and juvenile summer flounder EFH is HAPC. If native species of submerged aquatic vegetation (SAV) are eliminated then exotic species should be protected because of functional value, however, all efforts should be made to restore native species."

Golden Tilefish HAPC
Implementing action: Amendment 1 to the Tilefish FMP (2009)
http://static1.squarespace.com/static/511cdc7fe4b00307a2628ac6/t/5362971ce4b03e512f44ad00/1398970140914/Tilefish_Amend_1_Vol_1.pdf

Portions of Norfolk, Veatch, Lydonia, and Oceanographer canyons within the depth range within the same depth contour identified as EFH; known to have clay outcrop/pueblo habitats

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South Atlantic Fishery Management Council
See profile for more information about the distinction between Coral HAPCs and EFH-HAPCs.

Oculina Bank HAPC and satellite sites #1 and #2 (implementing action?)
Originally designated as a Coral HAPC, later expanded and satellite sites added.

Comprehensive EFH Amendment (1998)
http://www.safmc.net/ecosystem/EcosystemManagement/HabitatProtection/SAFMCHabitatPlan
The following list does not include species for which HAPC was initially identified, but were removed from federal management, including red drum and spiny lobster

Coral, coral reef, and live bottom HAPCs
- 10-Fathom Ledge
- Big Rock
- The Point
- Hurl Rocks
- Charleston Bump
- Gray's Reef National Marine Sanctuary
- *Phragmatopoma* (worm reef) reefs off the central east coast of Florida
- *Oculina* Banks off the east coast of Florida from Ft. Pierce to Cape Canaveral
- Nearshore (0-4 m, 0-12 ft) hard bottom off the east coast of Florida from Cape Canaveral to Broward County
- Offshore (5-30 m, 15-90 ft) hard bottom off the east coast of Florida from Palm Beach County to Fowey Rocks
- Biscayne Bay, Florida
- Biscayne National Park, Florida
- Florida Keys National Marine Sanctuary

Coastal Migratory Pelagics HAPCs

- Sandy shoals of Cape Lookout, Cape Fear, and Cape Hatteras from shore to the ends of the respective shoals, but shoreward of the Gulf Stream
- The Point
- Ten-Fathom Ledge
- Big Rock
- Charleston Bump
- Hurl Rocks
- The Point off Jupiter Inlet
- *Phragmatopoma* (worm reef) reefs off the central east coast of Florida
- Nearshore hard bottom south of Cape Canaveral
- The Hump off Islamorada, Florida
- The Marathon Hump off Marathon, Florida
- The “Wall” off of the Florida Keys
- Pelagic *Sargassum*
- Atlantic coast estuaries with high numbers of Spanish mackerel and cobia based on abundance data from the ELMR program including Bogue Sound, New River, and Broad River

Snapper-Grouper HAPCs

- Medium to high profile offshore hard bottoms where spawning normally occurs
- Localities of known or likely periodic spawning aggregations
- Nearshore hardbottom areas
- The Point
- Ten Fathom Ledge
- Big Rock
- Charleston Bump
- Mangrove habitat
- Seagrass habitat
- Oyster/shell habitat
- All coastal inlets
- All state-designated nursery habitats of particular importance to snapper-grouper
- Pelagic and benthic *Sargassum*
- Hoyt Hills for wreckfish
- The *Oculina* Bank Habitat Area of Particular Concern
- All hermatypic coral habitats and reefs
- Manganese outcroppings on the Blake Plateau
- SAFMC designated Artificial Reef Special Management Zones

Penaeid Shrimp HAPCs

- All coastal inlets
- All state-designated nursery habitats of particular importance to shrimp
- State-identified overwintering areas

Dolphin-Wahoo HAPC
Dolphin-Wahoo FMP, 2003
http://www.safmc.net/Library/pdf/DolphinWahooFMP.pdf

- The Point
- Ten-Fathom Ledge
- Big Rock
- Charleston Bump
- Georgetown Hole
- The Point off Jupiter Inlet
- The Hump off Islamorada, Florida
- The Marathon Hump off Marathon, Florida
- The "Wall" off of the Florida Keys
- Pelagic *Sargassum*

Comprehensive Ecosystem-Based Amendment 1 (2009)
http://safmc.net/Library/pdf/CE-BA1%20FINAL%20%28Oct%202009%29.pdf

Establishes deepwater coral HAPCs as Coral HAPCs (CHAPCs). Note that these are HAPCs according to criteria specified under the Coral FMP, and not the HAPC considerations identified under the EFH Final Rule (referred to as EFH-HAPCs). Deepwater coral HAPCs were later designated EFH-HAPCs through CEBA2 in 2012.

- Cape Lookout Lophelia Banks
- Cape Fear Lophelia Banks
- Stetson Reefs, Savannah and East Florida Lithoherms, and Miami Terrace
- Pourtales Terrace
- Blake Ridge Diapir Methane Seep

Comprehensive Ecosystem-Based Amendment 2 (2012)
http://www.safmc.net/Library/pdf/CE-BA%202_July%2015,%202011_Final.pdf

Deepwater Marine Protected Area HAPCs (Snapper-Grouper)
- Snowy Grouper Wreck MPA
- Northern South Carolina MPA
- Edisto MPA
- Charleston Deep Artificial Reef MPA
- Georgia MPA
- North Florida MPA
- St. Lucie Hump MPA
- East Hump MPA

Golden tilefish:
- Irregular bottom comprised of troughs and terraces intermingled with sand, mud, or shell hash bottom

- Mud-clay bottoms in depths of 150-300 m

Blueline tilefish:

- Irregular bottom habitats along the shelf edge in 45-65 m depth, shelf break
- Upper slope along the 100fm contour (150-225 m)
- Hardbottom habitats characterized as rock overhangs, rock outcrops, manganese phosphorite rock slab formations, or rocky reefs in the South Atlantic Bight; and the Georgetown Hole (Charleston Lumps) off Georgetown, South Carolina

CEBA2 also amends the Coral FMP to designate deep-water Coral HAPCs as EFH-HAPCs.

Caribbean Fishery Management Council

Implementing action: Comprehensive Amendment to the Fishery Management Plans of the U.S. Caribbean to Address Required Provisions of the Magnuson-Stevens Fishery Conservation and Management Act, 2005
http://caribbeanfmc.com/fmp_sfa_amendment.html

Other **r**eferences

- Final Environmental Impact Statement (text, tables and figures, appendices) (2004): http://caribbeanfmc.com/fmp_efh_feis.html
- EFH 5-Year Review (2011): (scroll to bottom for links to Volume I (text) and Volume II (figures and tables)) http://caribbeanfmc.com/fmp_efh.html

Reef Fish HAPCs: Confirmed spawning locations

Puerto Rico (4):

- Tourmaline Bank
- Abrir La Sierra Bank
- Bajo de Sico
- Vieques El Sico

St. Croix: (2):

- Mutton snapper spawning aggregation area
- East of St. Croix (Lang Bank)

St. John (2):

- Hind Bank Marine Conservation District
- Grammanik Bank

Reef Fish HAPCs: Areas of ecological importance to Caribbean reef species

Puerto Rico (11):

- Hacienda la Esperanza, Manatí
- Bajuras and Tiburones, Isabela
- Cabezas de San Juan, Fajardo
- JOBANNERR, Jobos Bay
- Bioluminescent Bays, Vieques
- Boquerón State Forest
- Pantano Cibuco, Vega Baja
- Piñones State Forest
- Río Espiritu Santo, Río Grande
- Seagrass beds of Culebra Island (nine sites designated as Resource Category 1 and two additional sites)
- Northwest Vieques seagrass west of Mosquito Pier, Vieques

St. Thomas (2):

- Southeastern St. Thomas, including Cas Cay, the Mangrove Lagoon and St. James Marine Reserves and Wildlife Sanctuaries
- Saba Island/Perseverance Bay, including Flat Key and Black Point Reef

St. Croix (5):

- Salt River Bay National Historic Park and Ecological Preserve and Marine Reserve and Wildlife Sanctuary
- Altona Lagoon
- Great Pond
- South Shore Industrial Area
- Sandy Point National Wildlife Refuge

Coral HAPCs: Areas of ecological importance to Caribbean coral species

Puerto Rico (13 total):

- Luis Peña Channel, Culebra
- Mona/Monito
- La Parguera, Lajas
- Caja de Muertos, Ponce
- Tourmaline Reef
- Guánica State Forest
- Punta Petrona, Santa Isabel
- Ceiba State Forest
- La Cordillera, Fajardo
- Guayama Reefs
- Steps and Tres Palmas, Rincon
- Los Corchos Reef, Culebra
- Desecheo Reefs, Desecheo

St. Croix (6 total):

- St. Croix Coral Reef Area of Particular Concern, including the East End Marine Park
- Buck Island Reef National Monument
- South Shore Industrial Area Patch Reef and Deep Reef System
- Frederiksted Reef System
- Cane Bay
- Green Cay Wildlife Refuge

Gulf of Mexico Fishery Management Council

Implementing action: Generic Amendment 3 for Addressing Essential Fish Habitat Requirements, Habitat Areas of Particular Concern, and Adverse Effects of Fishing in the Fishery Management Plans of the Gulf of Mexico, 2005

All EFH and HAPC actions are listed here:
http://www.gulfcouncil.org/fishery_management_plans/essential_fish_habitat.php

Current HAPCs

- Florida Middle Grounds
- Madison-Swanson Marine Reserve
- Tortugas North and South Ecological Reserves
- Pulley Ridge
- East and West Flower Garden Banks
- Stetson Bank
- Sonnier Bank
- MacNeil
- 29 Fathom Bank
- Rankin Bright Bank
- Geyer Bank
- McGrail Bank
- Bouma Bank
- Rezak Sidner Bank
- Alderice Bank
- Jakkula Bank

Atlantic Highly Migratory Species

Current HAPCs: Areas identified for two species; candidate HAPCs proposed for evaluation in 2015 EFH 5-Year Review

Sandbar shark HAPC (1999)
Implementing action: Final Fishery Management Plan for Atlantic Tunas, Swordfish, and Sharks (1999)
http://www.nmfs.noaa.gov/sfa/hms/documents/fmp/tss_fmp/index.html

Sandbar shark HAPC: “Important nursery and pupping grounds have been identified in shallow areas and the mouth of Great Bay, NJ, lower and middle Delaware Bay, lower Chesapeake Bay, MD and near the Outer Banks, NC, in areas of Pamlico Sound adjacent to Hatteras and Ocracoke Islands and offshore those islands.”

See figure 5.51 of Amendment 1 to the Consolidated Atlantic HMS FMP (2006) for map. Also figure 14.1 of 5-Year Review (2015)

Spawning bluefin tuna HAPC (2009)
Implementing action: Amendment 1 to the 2006 Consolidated HMS Fishery Management Plan: Essential Fish Habitat (2009)
http://www.nmfs.noaa.gov/sfa/hms/documents/fmp/am1/index.html

Spawning bluefin tuna HAPC: “West of 86 degrees W longitude and seaward of the 100m isobaths, extending from the 100m isobaths to the EEZ.”

See figure 2.4 of Amendment 1 for map; also Figure 14.2 of 5-Year Review (2015)

HAPC candidates (2015)
Draft Essential Fish Habitat 5-Year Review for Atlantic Highly Migratory Species
http://www.nmfs.noaa.gov/sfa/hms/documents/2015_draft_efh_review.pdf

Recommendations for evaluation (see p. 108)

- Lemon sharks: “high density lemon shark nursery within the Cape Canaveral – Jupiter Inlet region of southeastern Florida, and off Chandeleur Sound, Mississippi.”
- Sand tiger sharks: “important nursery grounds in Delaware Bay and the Cape Cod region”
- Billfishes: “Larval distribution of billfishes (blue and white marlin, sailfish, roundscale spearfish, and longbill spearfish) is the subject of ongoing research within the Florida Straits, Gulf of Mexico, and the U.S. Caribbean, suggesting that these areas could be considered primary spawning grounds for billfishes.”

Western Pacific Fishery Management Council

Implementing actions: see FMPs
*HAPC was originally identified in the context of species FMPs. In 2009 the Council developed five new fishery ecosystem plans (American Samoa FEP, Mariana Archipelago FEP, Hawaii Archipelago FEP, Pacific Remote Island Area FEP, Pacific Pelagic FEP); EFH and HAPC descriptions were carried forward

Current HAPCs:

- Pelagics: Water column down to 1000m that lies above seamounts and banks
- Bottomfish: All escarpments and slopes between 40-280m and three known areas of juvenile opakapaka habitat

- Precious corals: Makapuu, Westpac, and Brooks Bank beds, and the Auau Channel
- Crustaceans: All banks within the Northwestern Hawaiian Islands with summits less than 30m
- Coral reef ecosystem: All MPAs identified in the FMP, all PRIA, many specific areas of coral reef habitat

Coral reef ecosystem HAPCs
Implementing action: Fishery Management Plan for Coral Reef Ecosystems of the Western Pacific Region, 2001
http://www.wpcouncil.org/coralreef/Coral%20Reef%20FMP.html

See Table 6.6 for list of HAPCs, evaluation against HAPC considerations, and existing protected status

Northwestern Hawaiian Islands
- All substrate 0-10 fm
- Laysan: all substrate 0-50 fm
- Midway: all substrate 0-50 fm
- FFS: All substrate 0-50 fm

Main Hawaiian Islands:
- Kaula Rock (entire bank)
- Niihau (Lehua Island)
- Kauai (Kaliu Point)
- Oahu: Pupukea MLCD, Shark's Cove MLCD, Waikiki MLCD, Makapuu Head/Tide Pool Reef Area, Kaneohe Bay, Kaena Point, Kahe Reef
- Maui: Molokini, Olowalo Reef Area, Honolua-Mokuleia Bay MLCD, Ahihiki Kinau Natural Area Reserve
- Molokai (south shore reefs)
- Lanai: Halope Bay, Manele Bay, Five Needles
- Hawaii: Lapakahi Bay State Park MLCD, Pauko Bay and Reef MLCD, Kealakekua, Waiaiea Bay MLCD, Kawaihae Harbor-Old Kona Airport MLCD
- All long-term research sites
- All CRAMP sites

American Samoa
- Fagatele Bay
- Larsen Bay
- Steps Point
- Pago Pago (North Coast of Tutuila, National Park of American Samoa)
- Aunuu Island
- Rose Atoll
- South Coast Ofu (marine areas)
- Aua Transect – Pago Pago harbor, oldest coral reef transect

- Tau Island

Guam
- Cocos Lagoon
- Orote Point Ecological Reserve Area
- Haputo Point Ecological Reserve Area
- Ritidian Point
- Jade Shoals

CMNI
- Saipan (Saipan Lagoon)

US Pacific Remote Islands
- Wake Atoll
- Johnston Atoll
- Palmyra Atoll
- Kingman Reef
- Howland Island
- Baker Island
- Jarvis Island

HAPC candidates: Hawai'i Archipelago Bottomfish and Seamount Groundfish
Draft Amendment to the Hawai'i Archipelago Fishery Ecosystem Plan. Revised Descriptions and Identification of Essential Fish Habitat and Habitat Areas of Particular Concern for Bottom and Seamount Groundfish of the Hawaiian Archipelago.
http://www.wpcouncil.org/wp-content/uploads/2012/06/154CM_Action-Item_HI-BF-EFH.pdf

As recommended by the Western Pacific Stock Assessment Review (WPSAR) bottomfish working group and approved by the Council in 2012; final action anticipated in 2015.
- Kaena Point, Oahu
- Keneohe Bay, Oahu
- Makapuu Point, Oahu
- Penguin Bank
- Pailolo Channel
- North Kahoolawe
- Hilo, Hawaii

The Council also recommended designating seamount groundfish HAPC to coincide with seamount groundfish EFH at Hancock Seamount.

Coordinates, area, maps, and additional description provided in 2010 HAPC Justification Report and 2011 review and report by the WPSAR bottomfish working group, as well as in the draft amendment.

Pacific Fishery Management Council

Pacific Coast Groundfish HAPCs
Implementing action: Amendment 19 to the Pacific Coast Groundfish Fishery Management Plan (2005)
http://www.pcouncil.org/groundfish/fishery-management-plan/fmp-amendment-19/

Habitat type HAPCs:

- Estuaries
- Canopy kelp
- Seagrass
- Rocky reefs

HAPC sites: ("areas of interest")

- Off of Washington: All waters and sea bottom in state waters shoreward from the three nautical mile boundary of the territorial sea shoreward to MHHW
- Off of Oregon: Daisy Bank/Nelson Island, Thompson Seamount, President Jackson Seamount
- Off of California: all seamounts, including Gumdrop Seamount, Pioneer Seamount, Guide Seamount, Taney Seamount, Davidson Seamount, and San Juan Seamount; Mendocino Ridge, Cordell Bank, Monterey Canyon; specific areas in the Federal waters of the Channel Island National Marine Sanctuary; specific areas of the Cowcod Conservation Areas

HAPC candidates
Review of Pacific Coast Groundfish Essential Fish Habitat. Phase 2 Report to the Pacific Fishery Management Council. (2014)
http://www.pcouncil.org/wp-content/uploads/D2b_EFHRC_RPT_PHASE2_MAR2014BB.pdf

- California (4): Point Sur Platform, La Cruz Canyon, Fanny Shoal to Rittenburg Bank, Cochrane Bank
- Washington (1): Olympic 2

"The five proposed HAPCs identify areas that include known hard substrate and soft substrate, observed adult and juvenile groundfish species and observed biogenic habitat." Phase II report, p. 28

Salmon HAPCs
Implementing action: Amendment 18 to the Pacific Coast Salmon Plan (2015 final rule)

Reference: Appendix A to the Pacific Coast Salmon FMP: Identification and Description of Essential Fish Habitat, Adverse Impacts, and Recommended Conservation Measures for Salmon
http://www.pcouncil.org/wp-content/uploads/Salmon_EFH_Appendix_A_FINAL_September-25.pdf

Current HAPC habitat types (5):

- Complex channels and floodplain habitats
- Thermal refugia
- Spawning habitat
- Estuaries
- Marine and estuarine SAV

Note: "With the exception of estuaries, none of these HAPCs have been comprehensively mapped, and some may vary in location and extent over time. For these reasons, the mapped extent of these areas is only a first approximation of their location." Appendix A p. 6

North Pacific Fishery Management Council

HAPCs identified in 2006
Implementing action: Amendments 65/65/12/7/8 to the BSAI Groundfish FMP, GOA Groundfish FMP, BSAI Crab FMP, Scallop FMP, and Salmon FMP

Alaska Seamount Habitat Protection Areas: Dickens, Denson, Brown, Welker, Dall, Quinn, Giacomini, Kodiak, Odessey, Patton, Chirikof & Marchand, Sirius, Derickson, Unimak, and Bowers Seamounts

Bowers Ridge Habitat Conservation Zone: Bowers Ridge, Ulm Plateau

Gulf of Alaska Coral Habitat Protection Areas: Cape Ommaney 1, Fairweather FS1, Fairweather FS2, Fairweather FN1, Fairweather FN2

http://alaskafisheries.noaa.gov/analyses/efh/HAPCea0406.pdf

Skate Egg HAPCs
Implementing action: Amendment 104 to the Fishery Management Plan for Groundfish of the Bering Sea and Aleutian Islands (2015 final rule)

Includes 6 areas of skate egg concentration: Bering 1, Bering 2, Bristol, Pribilof, Zhemchung, Pervenets

Reference (includes table with coordinates):
https://alaskafisheries.noaa.gov/sustainablefisheries/amds/amd104/bsai104fmptext.pdf

Additional information (total area, coordinates):
http://www.npfmc.org/wp-content/PDFdocuments/conservation_issues/HAPC/SkateHAPC_InitRev312.pdf

Additional Reference Materials (Web Links)

1. Impacts to Marine Fisheries Habitat from Nonfishing Activities in the Northeastern United States, NOAA Fisheries
2. Living Shorelines: From Barriers to Opportunities, Restore America's Estuaries
3. Offshore Wind Best Management Practices Workshop, MAFMC
4. Offshore Wind Energy Development Site Assessment and Characterization: Evaluation of the Current Status and European Experience, Bureau of Ocean Energy Management (BOEM)
5. MAFMC Comments to Delaware Coastal Programs on Proposed Geophysical Seismic Surveys
6. MAFMC Comments to BOEM on the 2017-2022 Proposed Oil and Gas Leasing Program