May 27, 2020

Michelle Morin  
Chief, Environmental Branch  
Office of Renewable Energy Programs  
Bureau of Ocean Energy Programs  
45600 Woodland Road, VAM-OREP  
Sterling, Virginia 20166

Re: Updated Recommendations for Mapping Fish Habitat

Dear Ms. Morin:

We appreciate your continued effort to work with us to facilitate a more efficient Essential Fish Habitat (EFH) consultation process for offshore wind development projects. We are attaching an updated version of our “Recommendations for Mapping Fish Habitat”, which were previously sent to you via email on January 31, 2020. This updated version does not change the recommended steps, but clarifies language where we have received repeated questions from developers. This document is intended to supplement the information in your existing guidelines with methodologies we recommend ensuring applicants provide adequate information for our EFH consultations that are consistent across all projects in our region. We hope this collaborative effort between our agencies will help ensure we receive sufficient information for our EFH consultations.

While the Bureau of Ocean Energy Management (BOEM) benthic survey guidelines provide methods for collecting benthic data across a lease area, we have found that these existing guidelines are not being applied consistently and do not ensure the collection of sufficient site specific data necessary for our consultations. Under your guidelines, technical requirements for side-scan sonar indicate that data obtained should be sufficient quality to permit the detection and evaluation of seafloor objects and features that are 0.5 – 1.0 meter in diameter within the survey area. Unfortunately, this resolution is insufficient for identifying certain types of complex habitats that are important for federally managed species. In addition, sampling is required at least every 1-2 kilometers across lease areas and along cable routes. While such spacing is useful for providing a general overview of habitat types found within project areas, it does not provide the necessary level of habitat information or allow for delineation of complex habitats that are critical for assessing project impacts to EFH. Targeted sampling based on the results of acoustic surveys processed at a resolution capable of detecting fine-scale habitat features is necessary to identify fully the extent of habitat types throughout the project impact area.
In addition to these recommended steps for habitat mapping, sufficient pre-application consultation and coordination will help ensure a more efficient EFH consultation. Specifically, we encourage BOEM and developers to meet with us early in the process, prior to conducting benthic surveys. Early pre-consultation meetings help everyone understand our resource concerns and information needs for the consultation process. Considering impacts to complex and sensitive habitats early in the process can help avoid and minimize project impacts at the early design phase. These early coordination efforts may also reduce the extent of additional information requests and streamline the EFH consultation process.

We appreciate your efforts to distribute our “Recommendations for Habitat Mapping” to developers and encourage early coordination with our agency. We have already seen improved early coordination as a result of your office sharing these recommendations. We value your continued coordination with us and look forward to continuing to work with you and your staff.

Sincerely,

Louis A. Chiarella
Assistant Regional Administrator for Habitat Conservation

cc: Brian Hooker, BOEM
    Thomas Nies, NEFMC
    Christopher Moore, MAFMC
    Lisa Havel, ASMFC
Recommendations for Mapping Fish Habitat
NMFS GARFO Habitat Conservation and Ecosystem Services Division

May 2020

The following information provides recommended steps for mapping fish habitat to ensure benthic habitat information collected for offshore development projects is sufficient for BOEM to meet requirements for the Essential Fish Habitat (EFH) consultation under the Magnuson Stevens Fishery Conservation and Management Act. This information is not intended to replace BOEM’s existing guidance, but rather to clarify and supplement guidance provided through BOEM Benthic Survey Guidelines (https://www.boem.gov/BOEM-Renewable-Benthic-Habitat-Guidelines/). We recommend BOEM and project developers meet with NMFS to discuss habitat mapping prior to conducting benthic survey work.

For the purposes of the EFH consultation, all benthic habitat types throughout the project area should be accurately delineated and mapped. Benthic substrates should be mapped through the use of acoustic data, sediment grain size analysis, and visual imagery. It is particularly important to identify and delineate complex, sensitive habitats that are more vulnerable to project impacts.

For the purposes of mapping fish habitat, complex habitats are defined as:

1) **Hard bottom substrates** (defined as Substrate Class Rock Substrate, and the three Substrate Groups Gravels, Gravel Mixes, Gravelly, and Shell in the attached Coastal and Marine Ecological Classification Standard (CMECS) modifier);
2) **Hard bottom substrates with epifauna or macroalgae cover**; and
3) **Vegetated habitats** (e.g. submerged aquatic vegetation and tidal wetlands).

The included **CMECS Modifiers** (pages 5-9) outlines how substrate types should be classified when analyzing grab samples and/or images.

**Benthic features defined as sand ripples, sand waves and ridges** should also be delineated in the project area. These features do not need to be mapped at the same minimum mapping unit or resolution as complex habitat.

Other important **biogenic habitats**, including soft bottom habitats with emergent fauna (e.g. corals, tube dwelling anemones and structure forming polychaetes) should be characterized and incorporated into the substrate maps as described below. These features should be characterized using benthic sampling and/or visual imagery.
While different habitat mapping technologies may be used, the following steps should be taken to provide the necessary information to inform the EFH consultation:

1. Landscape scale maps based on multibeam surveys of the entire lease area and proposed export cable corridors should be generated at a resolution of 0.25 to 0.5 m using both the multibeam bathymetry and backscatter. Sidescan sonar data should be collected at a sufficient density to be processed at a 0.1 m resolution or better. In all potential impact areas where acoustic data indicates that complex habitat may exist, the 0.1 m processed data should be used to more accurately differentiate and delineate these habitats.

At a minimum, acoustic data should be interpreted to delineate and distinguish: 1) soft bottom (i.e. mud and sand); 2) sand ripples and sand waves or ridges; and 3) large grained hard bottom (rock outcrop, cobbles and boulders).

Areas of potential complex habitat (see definition above) should be noted for further sampling and higher resolution acoustic analysis, for example areas where acoustic data suggest scattered boulders and cobbles (i.e. CMECS Substrate Groups Gravelly or Gravel Mixes), shell substrates, or high habitat heterogeneity occur.

2. The preliminary substrate identifications based on acoustic data should be used to identify appropriate locations to collect additional samples (e.g. benthic grabs, SPI profile/plan view imagery, video transects, and/or still imagery) in real-time or in follow-up surveys and should be used to identify areas that require a finer-scale delineation and mapping.

3. For areas of potential complex habitats (as defined above), sidescan data should be interpreted at a 0.1 m resolution or better, capable of detecting cobbles and boulders (as defined in the CMECS Modifiers starting on page 5). These areas should be indicated in maps with a scale sufficient to illustrate the seafloor structure and different types of habitat.

4. The minimum mapping unit for complex habitat that may be directly or indirectly impacted by the project should be 2,000 m² for homogeneous complex habitats. If two or more areas of complex habitat larger than 100 m² occur within a 2,000 m² area, the entire 2,000 m² area should be mapped as heterogeneous complex habitat. This allows for mapping of patchy complex habitats, such as areas of generally featureless bottom that contain small areas of complex habitat.

5. Benthic sampling (e.g. benthic grabs, SPI profile/plan view imagery, video transects, and/or still imagery) should be conducted in all substrate types identified from acoustic data. Benthic grabs and/or SPI Plan view should be conducted in the areas of potential project impacts to ground-truth soft sediment and small grained hard bottom substrates (pebble/granules). Video, SPI/PV imagery and/or still imagery should be conducted to groundtruth areas containing cobble and boulder.

In areas of complex habitat and/or areas of high substrate heterogeneity benthic sampling should be conducted at a rate higher than what is set forth in BOEM’s existing guidelines (1 sample every 1-2 km or 1-2 km²). To provide adequate sampling in areas of complex and
heterogeneous habitats, multiple stations should be sampled with a minimum of 3 replicate samples per station.

In areas with samples that have high densities of soft bottom emergent fauna (e.g. corals, tube dwelling anemones and structure forming polychaetes), additional targeted sampling should be done to clearly determine the extent of high density areas.

6. Substrate types identified through ground-truthing (benthic samples and/or images) should be classified using the modified CMECS substrate classifications. The classification of each grab sample and image should be noted and provided with the EFH Assessment. This can be provided both in table form and as points overlaid on substrate maps as described in #10 below.

7. When applying benthic sampling data to inform substrate mapping, it is not necessary to use the detailed CMECS classifications. Rather, for substrate mapping purposes, it is only necessary to differentiate the substrate as complex habitats (as defined above), Pebble/Granule, Sand, Mud, or as a combined substrate type that includes the appropriate Substrate Subgroups Pebble/Granule, Sand, Muddy Sand, and/or Sandy Mud.

8. Initial substrate delineations based solely on multibeam acoustic data should be revised to incorporate information from both ground-truthing sediment grab and/or image samples and interpretation of higher resolution sidescan data. Updated substrate maps incorporating all data sources should be provided.

9. Maps that show substrate types and benthic features should be provided at a landscape scale of 1:25,000, and complex habitat should be mapped at a larger scale (i.e. 1:1,000 or 1:5,000). Extensive areas of homogeneous substrate types may be mapped at a smaller scale (i.e. 1:50,000 or 1:100,000).

10. Biotic data should be obtained using grab samples and visual survey methods (e.g., video and still photos along transects, SPI profile and plan view images at individual stations). Maps showing the spatial distribution of biological habitat components and any associated sediment data should be provided as discrete data points on the final substrate maps. Biotic data should focus on identifying and describing the composition/abundance of structure-forming taxa that provide habitat (e.g., shelter, food) for associated fish and invertebrates. CMECS biotic classifications should be used to the extent practicable, but are not required, provided that the presence of structure forming and long lived epifauna, such as sponges, anemones, polychaetes, bryozoans, corals, tunicates and habitat forming bivalves (i.e. mussels, oysters), is evaluated.

For the EFH Assessment and benthic habitat classification, the methodology should describe how the data were used at each step in the process and include factors used in determining habitat classifications such as depth, surface reflectivity, expert opinion, visual verification, etc. Information for the EFH Assessment should include the habitat maps as well as information on the number of acres of each habitat type that may be disturbed, including the total areas of temporary and permanent impacts. The EFH Assessment should focus additional analysis on potential effects to complex habitats that may
be more vulnerable to permanent project impacts, as well as species and life stages that may be more vulnerable to project construction and operation. The narrative accompanying this information should specifically define any measures that are being taken to avoid, minimize, or mitigate impacts to sensitive benthic habitats present.

**The EFH Assessment should include the following mapping products:**

- Landscape/small scale maps (zoomed out) of all habitat types in the project area, including areas of complex habitat (Scale in the range 1:50,000 to 1:100,000);
- Large scale maps (zoomed in) that focus on complex habitat, based on finer resolution acoustic data and analysis and ground-truthed with grab samples and/or imagery (Scale in the range 1:1,000 to 1:5,000).
- Bathymetry, backscatter mosaic, and slope maps processed at 0.1 to 0.5 m, using continuous variables (displayed with color ramps)
Coastal and Marine Ecological Classification Standard (CMECS)
Substrate Classifications: Modifiers for EFH Assessments

Asterisks (*) indicate CMECS classifications that were modified by combining subclasses or subgroups, or where new classifications were added, in order to simplify classification for habitat delineation. See the Coastal and Marine Ecological Classification Standard, p. 104 and figure 7.2

Grain-size analyses of substrate sediments (grab samples or SPI) should be used to characterize: 1) Gravel Mixes and Gravelly substrate groups; and 2) all groups and subgroups in the Fine Unconsolidated Substrate subclass.

Seabed imagery (video, SPI/PV, still imagery) should be used to characterize: 1) Rock Substrates; 2) Gravels; and 3) the presence of cobble and/or boulder in Gravel Mixes and Gravelly substrate groups. Rock and Gravel substrates are often heterogeneous, therefore, multiple images or transect video should be used for classification. Seabed imagery should also be used to note the presence of bedforms (ripples, megaripples, and sand waves), which are defined based on wave-length and wave-height criteria in BOEM’s Guidelines for Providing Geophysical, Geotechnical, and Geohazard Information.

**Substrate Class: Rock Substrate:** Rock with particle sizes greater than or equal to 4,096 millimeters (mm) in any dimension that cover 50% or greater of the Geologic Substrate surface.

*Substrate Subclass: Bedrock/Megaclast*: Substrate with mostly continuous formations, or individual rocks of ≥ 4,096 mm, that cover 50% or more of the Geologic Substrate surface.

**Substrate Class: Unconsolidated Mineral Substrate:** Substrates with <50% cover of Rock Substrate (particles ≥ 4,096 mm in any dimension).

**Substrate Subclass: Coarse Unconsolidated Substrate:** Geologic Substrates with <50% cover of Rock Substrate (as defined above; Bedrock or Megaclast ≥4,096 mm in any dimension), and ≥ 5% Gravel (particles 2 mm to < 4,096 mm).

**Substrate Group: Gravels:** Geologic Substrate surface layer\(^1\) contains ≥ 80% gravel (particles >2 mm to < 4,096 mm diameter).

Larger sized Gravels are not sampled well using conventional grab samples. Seabed imagery should be used to quantify a percent cover estimate by Gravel type. The substrate should be classified by the sediment type with the highest percent cover. Gravel substrates are often heterogeneous, therefore, multiple images or transect video should be used for classification. Submit representative photos.

\(^1\) Substrate types should only be characterized from the layers of substrate that support the majority of multicellular life – the upper layer of hard substrate, or (typically) the upper 15 centimeters of soft substrate. (as defined in CMECS, page 98, available at: https://www.natureserve.org/sites/default/files/publications/files/cmecs_version_06-2012_final.pdf)
Substrate subgroup: Boulder - Geologic Substrate contains ≥80% Gravel, with a Gravel size of 256 mm to < 4,096 mm.

Substrate subgroup: Cobble - Geologic Substrate contains ≥80% Gravel, with a Gravel size of 64 mm to < 256 mm.

*Substrate subgroup: Pebble/Granule* - Geologic Substrate contains ≥ 80% Gravel, with a Gravel size of 2 mm to < 64 mm. The presence of cobble and/or boulder should be noted.

*Substrate subgroup: Gravel pavement* - Geologic Substrate contains ≥ 80% Gravel (Boulder, Cobble, and/or Pebble/Granule), with Gravel sizes from 2 mm- to <4,096 mm. If substrate is composed of Boulders, Cobbles, and/or Granule/Pebble that combined covers ≥80% of the substrate it should be reported as “Gravel pavement.”

The composition of Gravel pavements should be noted and described in the EFH Assessment. Specifically, the presence and relative abundance of 1) Boulder 2) Cobble and/or 3) Pebble/Granule should be described. Submit representative photos.

Substrate Group: Gravel Mixes – Geologic Substrate surface layer contains 30% to <80% Gravel (particles 2 mm to < 4,096 mm in diameter).

In this group and in the following three subgroups, the Gravel components must be specified (i.e., Boulders, Cobbles, and/or Granule/Pebble). Provide photos and grain size analyses of surficial sediments.

Substrate Subgroup: Sandy Gravel - Geologic Substrate is 30% to <80% Gravel, with Sand composing ≥90% of the remaining Sand-Mud mix.

Substrate Subgroup: Muddy Sandy Gravel - Geologic Substrate is 30% to <80% Gravel, with Sand composing 50% to ≥90% of the remaining Sand-Mud mix.

Substrate Subgroup: Muddy Gravel - Geologic Substrate is 30% to <80% Gravel, with Mud composing ≥50% of the remaining Sand-Mud mix.

Substrate Group: Gravelly – Geologic Substrate surface layer contains 5% to <30% Gravel (particles 2 mm to < 4,096 mm in diameter).

In this group and in the following three subgroups, the Gravel components must be specified (i.e., Boulders, Cobbles, and/or Granule/Pebble). Provide photos and grain-size analyses of substrate sediments.
**Substrate Subgroup: Gravelly Sand** - Geologic Substrate is 5% to <30% Gravel and the remaining Sand-Mud mix is ≥90% Sand)

**Substrate Subgroup: Gravelly Muddy Sand** - Geologic Substrate is 5% to <30% Gravel and the remaining Sand-Mud mix is <50% to ≥90% Sand)

**Substrate Subgroup: Gravelly Mud** - Geologic Substrate is 5% to <30% Gravel and the remaining Sand-Mud mix is ≥50% Mud)

**Substrate Subclass: Fine Unconsolidated Substrate** - Geologic Substrate surface layer contains less than 5% Gravel (particles 2 mm to < 4,096 mm in diameter).

**Substrate Group: Sand** - Geologic Substrate surface layer is composed of ≥90% Sand.

*Substrate subgroup: Very Coarse/Coarse Sand* - Geologic Substrate surface layer is composed of ≥90% Sand, with a median grain size of 0.5 mm to < 2 mm.

Substrate subgroup: Medium Sand - Geologic Substrate surface layer is composed of ≥90% Sand, with a median grain size of 0.25 mm to < 0.5 mm.

*Substrate subgroup: Fine/Very Sand* - Geologic Substrate surface layer is composed of ≥90% Sand, with a median grain size of 0.0625 mm to < 0.25 mm.

**Substrate Group: Muddy Sand** - Geologic Substrate surface layer contains 50% to <90% Sand and < 5% Gravel.

**Substrate Group: Sandy Mud** - Geologic Substrate surface layer contains 10% to <50% Sand and < 5% Gravel.

**Substrate Group: Mud** - Geologic Substrate surface layer contains ≥90% Mud and < 5% Gravel.

**Substrate Class: Shell Substrate**
Substrates where percent cover of Biogenic substrate (i.e. shell) exceeds percent cover of Geologic Substrate (i.e shell cover is greater than 50% of the substrate). Biogenic Substrate that is primarily composed of shells or shell particles. Most (but not all) shell-builders are mollusks.

**Substrate Subclass: Shell Reef Substrate** – Substrate that is dominated by living or non-living cemented, conglomerated, or otherwise self-adhered shell reefs, with a median particle size of 4,096 millimeters or greater in any dimension. Live reef building fauna may or may not be present.

**Substrate Group: Clam Reef Substrate** – Shell Reef that is primarily composed of cemented or conglomerated clam shells.
**Substrate Group: Crepidula Reef Substrate** – Shell Reef that is primarily composed of conglomerated Crepidula shells.

**Substrate Group: Mussel Reef Substrate** – Shell Reef that is primarily composed of self-adhered or conglomerated mussel shells.

**Substrate Group: Oyster Reef Substrate** – Shell Reef that is primarily composed of cemented or conglomerated oyster shells.

**Substrate Subclass: Shell Rubble** – Substrate that is dominated by living or non-living shells (any combination of clam, crepidula, mussel, and/or oysters) forming Rubble, with a median particle size of 64 millimeters to < 4,096 millimeters in any dimension (Cobbles and Boulders). Particles may be either loose, individual shells (whole or broken) or—particularly in the larger Rubble sizes—cemented, conglomerated, or otherwise attached so as to form Boulders of consolidated shell material.

**Substrate Subclass: Shell Hash** – Surface substrate layers are dominated by loose shell (any combination of clam, crepidula, mussel, and/or oysters) accumulations with a median particle size of 2 millimeters to < 64 millimeters (size of Granules and Pebbles). Shells may be broken or whole.

**Biological Information**

Biological information is necessary for habitat classification purposes and should be incorporated into the EFH Assessment. While CMECS biotic classifications may be used to the extent practicable, they are not required. For EFH consultations, the following biological information should be collected from grab samples and visual surveys at each station or along individual bottom transects: 1) presence and estimated percent cover of macroalgae, epifauna, and/or infauna/emergent taxa; 2) identification of taxa, in particular long-lived and habitat-forming species that are particularly vulnerable to project impacts (e.g. sponges, anemones, bryozoans, hydrozoans, corals, tunicates, and bivalves) should be noted. For each delineated area, species relative abundance and diversity should be characterized and described, including noting the presence of species that are vulnerable, rare, or dominant/common in terms of numbers and size. This information should be included in the EFH Assessment for all analyzed imagery. Habitat types should then be defined by incorporating the biotic data with the delineated geological substrate types and described in the EFH Assessment. Each imagery location should be noted on the delineated geological substrate maps and should be classified by the identified biological component of interest (e.g., presence of long-lived, soft-bodied, and/or common taxa).
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