

Endangered Species Act Information Needs for Offshore Wind Energy Projects in the U.S. Atlantic

Purpose and Overview

This document is designed to aid BOEM, other federal agencies, and lessees/project proponents preparing Biological Assessments for Endangered Species Act (ESA) section 7 consultations and any other documents (e.g., Construction and Operations Plans, National Environmental Policy Act documents) that consider effects of offshore wind energy related activities to listed species, their habitat, and any designated critical habitat in NMFS' Greater Atlantic Region (GAR) (Maine - Virginia) and Southeast Region (SER) (North Carolina – Florida's East Coast). Note, the SER also includes the Gulf of Mexico and U.S. Caribbean; however, this document does not apply to those locations.

This document provides an outline of the information and analysis needed to support a robust assessment of the effects of a proposed offshore wind energy project on ESA-listed species, their habitat, and designated critical habitat. This list is not project specific and may not capture all information needs for all projects. For any particular project, we expect the project description and effects analysis to be comprehensive and be based on the best commercial and scientific information available. We understand that site-specific information may not always be available; in those instances, the best reasonable substitute should be provided with an explanation for why any necessary assumptions are reasonable. We also recognize that quantitative analyses are not always possible; in those cases, qualitative assessments should be provided with a robust explanation of any underlying assumptions or data gaps.

Authority

The regulatory requirements for Biological Assessments and requests for consultation are described at 50 CFR Part 402. See also 84 FR 44976 (August 27, 2019).

General guidance on carrying out ESA Section 7 consultation in the **GAR** is available at: <https://www.fisheries.noaa.gov/new-england-mid-atlantic/consultations/section-7-consultation-technical-guidance-greater-atlantic>.

General guidance on carrying out ESA Section 7 consultation in the **SER** is available at: <https://www.fisheries.noaa.gov/southeast/endangered-species-conservation/esa-section-7-interagency-consultation-southeast-united-states>.

Contact Information

For information related to ESA listed species, critical habitat, or section 7 consultations, please contact:

Greater Atlantic Regional Fisheries Office, Protected Resources Division,
nmfs.gar.esa.section7@noaa.gov

Southeast Regional Fisheries Office, Protected Resources Division,
nmfs.ser.esa.consultations@noaa.gov

ESA Information Needs

- 1. Description of the proposed action: A complete description of all activities that will be carried out to support the construction, operation and maintenance, and decommissioning of the proposed project. This should include any planned surveys and/or monitoring activities.**
 - a. Under the ESA, “action” means all activities or programs of any kind authorized, funded, or carried out, in whole or in part, by Federal agencies in the United States or upon the high seas (50 CFR 402.02).
 - b. Under the ESA, *effects of the action* is defined as “all consequences to listed species or critical habitat that are caused by the proposed action, including the consequences of other activities that are caused by the proposed action. A consequence is caused by the proposed action if it would not occur but for the proposed action and it is reasonably certain to occur. Effects of the action may occur later in time and may include consequences occurring outside the immediate area involved in the action” (50 CFR 402.02).
 - c. Include all proposed federal actions (e.g., BOEM COP approval, USACE permits, EPA Clean Air Act permit, EPA NPDES permit, NMFS MMPA take authorizations); identify each action agency and its regulatory authorities (e.g., issuance of a permit by USACE pursuant to Section 10 of the Rivers and Harbors Act) and describe the permits or other authorizations that are proposed for issuance including any standard or special permit conditions.
 - d. Describe all project activities in detail, with an emphasis on those that may affect listed species or critical habitat. The detailed description should include the schedule, frequency, duration, location, and intensity of all activities, and describe how the activities are proposed to be carried out (see **Appendix A** for more detail).
 - e. Identify and describe all proposed measures that will be implemented to avoid, minimize, mitigate, monitor, or report on the effects of the proposed action. Identify which measures are proposed by the applicant and which measures are being proposed as conditions of project approval by one or more action agencies. Explain how, when, and where the measures will be carried out. Information should also be provided on the anticipated effectiveness of these measures to carry out the stated objective.
- 2. Identification of action area: A complete description of the area where project activities will occur, consistent with the ESA definition of the action area.**
 - a. Under the ESA, the “action area” is defined as: “all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action” (50 CFR 402.02).
 - b. For offshore wind energy projects, we expect the action area to include the following: the area where all project activities will occur; the surrounding areas

ensonified by project noise; all cable routes; the areas where pre- and post-construction surveys may take place; the vessel transit routes between the project area and the ports any project vessels may be using; and the routes used by vessels transporting manufactured components from any ports, including those in Europe, Gulf of Mexico, Canada, etc., inclusive of the portion of the ocean that will be transited by those vessels and the territorial sea of nations along the coast of foreign countries from which those vessels will originate.

- c. Include maps or figures illustrating the complete action area and any relevant components of the action area (e.g., cable route, lease area, etc.).
- 3. Description of the natural and anthropogenic characteristics (environmental conditions) of the action area:** Provide a complete description of the environmental conditions (e.g., depth, habitat features) and anthropogenic activities (e.g., fishing, shipping) that occur in the action area with a focus on the lease/project area.
- a. Identify and describe the natural and anthropogenic characteristics of the action area, including the water depth, atmospheric and oceanographic environment, nearshore and marine habitat features, soundscape, vessel usage/traffic including shipping lanes and fishing activity. If a smaller “project area” is identified, describe that area, providing more detailed information on habitat characteristics and other uses.
 - b. Include relevant seasonal, geographic, etc. information for each characteristic using the best available information.
- 4. Identification and description of critical habitat in the action area.**
- a. Identify any designated critical habitat that overlaps with the action area, as defined above. Use the following websites for information:
 - i. NMFS Species Directory, <https://www.fisheries.noaa.gov/species-directory/threatened-endangered>
 - ii. NMFS GARFO Section 7 Mapper, <https://www.fisheries.noaa.gov/new-england-mid-atlantic/consultations/section-7-species-critical-habitat-information-maps-greater>
 - iii. NMFS SERO Section 7 Mapper, <https://www.arcgis.com/home/item.html?id=b184635835e34f4d904c6fb741cfb00d>
 - b. Identify the physical and biological features of any designated critical habitat that occurs in the action area. These are described in the final rules designating the critical habitat.
- 5. Identification and description of ESA-listed species in the action area.**
- a. Identify the ESA-listed species that occur within the action area. Use the following websites for information:
 - i. NMFS Species Directory, <https://www.fisheries.noaa.gov/species-directory/threatened-endangered>
 - ii. NMFS GARFO Section 7 Mapper, <https://www.fisheries.noaa.gov/new-england-mid-atlantic/consultations/section-7-species-critical-habitat-information-maps-greater>

- iii. NMFS SERO Section 7 Mapper,
<https://www.arcgis.com/home/item.html?id=b184635835e34f4d904c6fb741cfb00d>
- b. Use the best available information to describe listed species distribution, abundance, and habitat use in the entire action area:
 - i. Describe how listed species habitat use varies across the action area (e.g., some species may occur in the lease area but not along the entirety of the cable corridor, include considerations of seasonality of use, if it is variable).
 - ii. Examples of data sources or relevant research include, but are not limited to, the following:
 1. Developer/Lessee site characterization surveys
 2. Atlantic Marine Assessment Program for Protected Species (AMAPPS), <https://www.fisheries.noaa.gov/new-england-mid-atlantic/population-assessments/atlantic-marine-assessment-program-protected>
 3. NOAA NEFSC Northeast Acoustic Marine Mammal Projects, <https://www.fisheries.noaa.gov/new-england-mid-atlantic/marine-mammal-acoustic-projects>
 4. Provincetown Center for Coastal Studies Right Whale Aerial Survey, <https://coastalstudies.org/right-whale-research/>
 5. MA/RI, MA Wind Energy Areas Marine Mammal and Sea Turtle Surveys, <https://www.masscec.com/resources/marine-mammal-and-sea-turtle-surveys>
 6. OBIS-SEAMAP, <http://seamap.env.duke.edu/>
 7. DOE Mid-Atlantic Baseline Studies, <http://www.briwildlife.org/mabs/>
 8. New York State Dept. of Conservation NY Bight Passive Acoustic Monitoring, Aerial, Shipboard Surveys, <https://www.dec.ny.gov/lands/113647.html>
https://remote.normandeau.com/nys_aer_overview.php
 9. Duke MGEL Density Models, <https://seamap.env.duke.edu/models/>
 10. NMFS GARFO Section 7 Mapper, <https://www.fisheries.noaa.gov/new-england-mid-atlantic/consultations/section-7-species-critical-habitat-information-maps-greater>
 11. NMFS SERO Section 7 Mapper, <https://www.arcgis.com/home/item.html?id=b184635835e34f4d904c6fb741cfb00d>
 12. Robots4Whales, <http://robots4whales.whoi.edu/>
 13. WhaleMap, <http://whalemap.org>
 14. Passive Acoustic Cetacean Map, <https://apps-nefsc.fisheries.noaa.gov/pacm/#/>

6. Effects of the Action on Listed Species: Information needed to support evaluation of project activities and anticipated affects to ESA-listed species including consideration of effects to their habitat/ecosystems. For each potential stressor listed in Appendix A, the following steps should be undertaken:

- a. Determine which ESA-listed species may be exposed to the effects/stressors of the action, including a description of the life-stage(s) and behaviors expected for exposed individuals (e.g., migrating adults, foraging juveniles).
- b. When possible, include a quantitative assessment of the number of individuals likely to be exposed to a particular stressor. When a quantitative assessment is not possible, a qualitative approach should be substituted (e.g., identification of the species and life stages likely to be exposed and the duration and intensity of that exposure).
- c. Describe the response and effects of the response to ESA-listed species. The effects analysis should clearly indicate the specific route of effect and which species the effect applies to.
- d. Make a determination¹ regarding the effects of the action on each listed species when added to conditions that would exist in the action area over time if the action did not occur². Include the rationale for reaching the determination:
 - i. Evaluate and describe the effects when *added to baseline*³ conditions (e.g., adding project vessel traffic to existing baseline vessel traffic and other relevant factors, not comparing the amount of additional traffic to baseline traffic).
 - ii. For each stressor/activity, determine if effects are expected to be: (a) discountable (extremely unlikely to occur), (b) insignificant (unable to meaningfully measure, detect, or evaluate), (c) wholly beneficial (positive effects without *any* negative effects), or (d) adverse (the appropriate conclusion if the effects are not discountable, insignificant or wholly beneficial). If the effects to a species are likely to be adverse and rise to the level of take, identify the type of “take” that you anticipate will occur. *Take* is defined in section 9 of the ESA as “to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or attempt to engage in any such conduct.” *Incidental take* “refers to takings that result from, but are not the purpose of, carrying out an otherwise lawful activity conducted by the Federal agency or applicant” (50 CFR 402.02). Where possible, estimate the type and amount of take that you anticipate.
 - iii. For each species in the action area, determine if the action as a whole is:
 1. Not Likely to Adversely Affect (NLAA). An NLAA determination is appropriate if all effects are: (a) extremely unlikely to occur, or (b) insignificant (unable to meaningfully measure, detect or evaluate), or (c) wholly beneficial (positive effects without *any* negative effects); or

¹ Note that you may reach different effects conclusions for the same activity/stressor for different species or species groups.

² In other words, analyze the effects of the action in the context of what else is going on in the action area over time, not in a vacuum. We would be happy to discuss this concept to assist in the analysis.

³ ‘Baseline conditions’ are created by the status of the species, the environmental baseline, and cumulative effects as defined under the ESA regulations at 50 C.F.R. 402.02.

2. Likely to Adversely Affect (LAA). LAA is the appropriate determination if effects are not extremely unlikely to occur, insignificant, or beneficial. If “take” is anticipated, an “LAA” conclusion is appropriate.
- 7. Effects of the Action on Designated Critical Habitat: Information needed to support evaluation of project activities and anticipated affects to designated critical habitat. For each potential stressor listed in Appendix A, the following should be analyzed and described:**
- a. Determine which effects/stressors may affect critical habitat in the action area.
 - b. Determine which areas of critical habitat may be exposed to the effects/stressors of the action including consideration of which physical and biological features may be exposed to effects of the action.
 - c. When possible, include a quantitative assessment (e.g. number of acres) of the exposure to a particular stressor. When a quantitative assessment is not possible, a qualitative approach must be substituted.
 - d. Describe the response of the exposure on critical habitat (i.e., how will the effects of that action to the physical and biological features in the action area affect the function of the habitat). The effects analysis should clearly indicate the specific route of effect and which critical habitat physical and biological feature the effect applies to.
 - e. Make a determination¹ regarding the effects of the action on critical habitat in the action area when added to conditions that would exist in the action area over time if the action did not occur² (e.g., when added to baseline³ conditions). Include the rationale for reaching the determination:
 - i. Evaluate and describe the effects when *added to baseline³* conditions (e.g., adding project vessel traffic to existing baseline vessel traffic and other relevant factors).
 - ii. For each stressor/activity, determine if effects when added to baseline conditions over time are expected to be: (a) discountable (extremely unlikely to occur), (b) insignificant (unable to meaningfully measure, detect, or evaluate), (c) wholly beneficial (positive effects without *any* negative effects), or (d) adverse (the appropriate conclusion if the effects are not discountable, insignificant or wholly beneficial).
 - iii. For critical habitat in the action area, determine if the action is:
 1. Not Likely to Adversely Affect (NLAA). NLAA is the appropriate conclusion if all effects are: (a) extremely unlikely to occur (“discountable”), or (b) insignificant (unable to meaningfully measure, detect or evaluate), or (c) wholly beneficial (positive effects without *any* negative effects); or
 2. Likely to Adversely Affect (LAA). LAA is the appropriate conclusion if all effects are not extremely unlikely to occur/discountable, insignificant, or beneficial.

Appendix A.

For all project phases, activities, and effect descriptions, include as much detail as possible including relevant project details, avoidance, mitigation, and minimization measures, reporting measures, and pre-and-post biological monitoring that are part of the proposed action. For each specific information need/effect listed, we have included specific aspects to include/consider/analyze. Some information needs/effects repeat themselves in different phases and thus we have only included new aspects to include/consider/analyze under subsequent phases but the initial aspects still pertain.

Construction

a. Air Emissions

- i. Describe air emissions from project equipment (e.g. vessels, wind turbine generator (WTG) installation equipment, noise mitigation systems), and evaluate and describe anticipated effects to listed species, their habitat, and any designated critical habitat.

b. Displacement/Shifts of other Activities

- i. Describe potential changes (if any) in use of the project area (lease area and cable route) especially, but also the entire action area, by non-wind related activities/users due to construction restrictions. Evaluate and describe how those changes may affect listed species, their habitat and any designated critical habitat (i.e., assess anticipated increased or decreased potential of vessel strike and/or interactions with fishing gear or other stressors due to displacement/shifts of vessel traffic and fishing activity). Evaluate and describe:
 - 1. Potential displacement or shifts of commercial and/or recreational fishing effort and/or vessel transit to/from the project area, details on which fisheries exist in the project area can be accessed via data request email: nmfs.gar.data.requests@noaa.gov
 - 2. Potential displacement or shifts of other activities (e.g., commercial shipping, recreational boaters, ferry services) to/from the project area
 - 3. Potential impact to listed species, their habitat and any designated critical habitat if commercial and recreational fisheries or other activities are displaced or shift to or from the project area.

c. Habitat Disturbance and Modifications

- i. For foundation and cable installation preparation, evaluate and describe potential loss of benthic resources, turbidity, effects on prey, type and amount of habitat disturbed/removed, and volume and type of material added. Evaluate and describe the effects from foundation and cable installation preparation to the physical and biological features of any critical habitat located in the foundation and cable installation preparation footprint.
- ii. For wind turbine foundations and scour protection, evaluate potential loss of benthic resources, turbidity, effects on prey, type and type and amount

- of habitat disturbed, and volume and type of material added. Evaluate and describe the effects from wind turbine foundations and scour protection to the physical and biological features of any critical habitat located in the wind turbine foundations and scour protection footprint.
- iii. For pre-cable lay grapnel run (if conducted), evaluate and describe effects to species (i.e., increased sedimentation/turbidity, loss or displacement of benthic resources) and assessment of any potential for entanglement of listed species. Evaluate and describe the effects from the pre-cable lay grapnel run to the physical and biological features of any critical habitat located in the pre-cable lay grapnel run footprint.
 - iv. For dredging operations, address potential for capture, impingement, and entrainment of listed species, evaluate and describe effects on turbidity, prey, and habitat. Provide information on dredge type (e.g., clamshell, hopper, hydraulic), volume (dredge amount is usually given in cubic yards; and the footprint is an area), type of material removed, and disposal methodology. Evaluate and describe the effects from dredging operations to the physical and biological features of any critical habitat located in the dredging footprint.
 - v. For cable installation, evaluate and describe potential loss of benthic resources, turbidity, effects on prey, type and amount of habitat disturbed, and any use of concrete mats or other protection. Evaluate and describe the effects from cable installation to the physical and biological features of any critical habitat located in the cable installation footprint.
 - vi. For any vessel anchoring or deployment of spuds, evaluate and describe effects to habitat (i.e., increased sedimentation/turbidity, loss or displacement of benthic resources) and assessment of any potential for entanglement. Also, evaluate and describe the effects from vessel anchoring/spudding to the physical and biological features of any critical habitat located in the anchoring/spudding footprint.

d. Intake and Discharge

- i. For any project infrastructure and vessels that have water intake, evaluate and describe any risk (i.e., frequency, volume, source, and impingement/entrainment) of intake and the effects of that intake to listed species, their habitat, prey, and any designated critical habitat.
- ii. For any project infrastructure and vessels that have water discharge, evaluate and describe any risk (i.e., frequency, volume, source) of discharge (including heated effluent) and the effects of that discharge to listed species, their habitat, prey, and any designated critical habitat.

e. Noise

- i. Include sound source levels and distance to isopleths of concern (see Acoustic Thresholds below) for all noise sources including, but not limited to: vessels, aircraft, cable installation, dredging, site assessment or other surveys, cofferdams and other support structures, foundation installation, and

detonation of unexploded ordinances (UXOs)/munitions and explosives of concern (MEC).

1. Information on source levels and the size of the area where noise will be above thresholds of concern (see Acoustic Thresholds below) should be quantified. Please specify assumptions associated with sound propagation in the environment.
 2. Information on pile installation should include: foundation type, number of piles, pile type (cofferdam, foundation, etc.), pile composition (e.g., steel), pile size/diameter, number of strikes per pile (for impact driving) or number of seconds per pile (for vibratory and directional drilling), number of piles installed per day, hammer energy, type of pile driving method (e.g., impact, vibratory, directional drilling), maximum number of hours per pile driving event, substrate and water depth in the pile installation area, daily and seasonal timing restrictions.
 3. Use best available information to model sound propagation whenever possible. For near-shore installation of smaller diameter piles, sheet piles, and cofferdams consider using NMFS' multi-species pile driving calculator (available at: <https://www.fisheries.noaa.gov/national/marine-mammal-protection/marine-mammal-acoustic-technical-guidance>).
- ii. Describe the species anticipated to be exposed to noise sources and evaluate and describe anticipated responses (e.g., mortality, injury, behavioral disturbance, noise-induced hearing loss) in consideration of baseline conditions. Clearly describe any avoidance, minimization, and monitoring measures included as part of the proposed action and identify which ones are anticipated to reduce exposure (either the number of individuals or the duration of exposure) or the response/consequences to the exposed individuals.
 1. Where possible, a quantitative assessment of the number of individuals likely to be exposed to noise that could result in mortality, injury, and/or behavioral disturbance/response must be provided. However, when that is not possible, a qualitative approach is acceptable.
 - iii. Include a complete description of any acoustic thresholds to be used in the analysis (see below for summary of NMFS acoustic thresholds for use in section 7 consultations).
 - iv. Evaluate and describe consequences of behavioral disruption (e.g., disruption of foraging) including impacts to individuals that are displaced from an ensonified area due to project noise (e.g., consider how displacement may affect interactions with fisheries, shipping lanes, etc.).
 - v. Evaluate and describe the effects of project noise to the physical and biological features of any critical habitat located within the ensonified area.

f. Pollutants, Spills, and Debris

- i. Describe risk (i.e., anticipated frequency, volume, and source) of chemical/pollutant releases/spills and oil spills and accidental release of man-made debris/trash from project infrastructure and vessels, and evaluate and describe anticipated effects to listed species, their habitat, and any designated critical habitat.
- ii. Include spill prevention and control plans and marine debris prevention plans as applicable.

g. Port Modification

- i. Describe any project-related port modifications (e.g., dredging, shoreside construction) and evaluate and describe any effects to listed species, their habitat, and any designated critical habitat, including consideration of habitat disturbance and modifications, noise, and vessel traffic, see **c.**, **e.** and **l.**, respectively.

h. Project Lighting

- i. Evaluate project lighting as a potential attractant or deterrent for listed species and their prey and address anticipated effects. Evaluate and describe the effects from project lighting to the physical and biological features of any critical habitat located in the project footprint.

i. Surveys/Monitoring

- i. Describe any geophysical and geotechnical surveys⁴ that may occur during construction, providing information on equipment to be used, sound source levels, distances to isopleths of interest. Address impacts on listed species, their habitat, and any designated critical habitat due to the surveys, including consideration of noise and vessel traffic from surveys, see **e.** and **l.**, respectively.
- ii. Describe any survey/monitoring activities for fisheries, habitat, protected species, or other biological resources that are planned over the life of the project that may affect protected species (inclusive of capture or collect even if released unharmed). Include relevant details including gear types and specifications, amount of gear, tow/soak times, timing, and duration. Identify any permits or authorizations that are associated with these surveys. Please note that additional information and/or coordination may be necessary to ensure appropriate consideration of protected species issues in such surveys.

j. Unexpected/Unanticipated Events

- i. Describe any unexpected/unanticipated events (e.g. vessel collision/allision, oil spill, tower collapse), and evaluate and describe any anticipated effects to listed species, their habitat, and any designated critical habitat, and explain the anticipated frequency of such events. This assessment should include consideration of extreme weather events such as hurricanes.

⁴ Offshore wind site assessment and data collection activities are assessed in a programmatic section 7 consultation, <https://www.fisheries.noaa.gov/new-england-mid-atlantic/consultations/section-7-take-reporting-programmatics-greater-atlantic#offshore-wind-site-assessment-and-site-characterization-activities-programmatic-consultation>

k. Unexploded Ordnances/Hazards

- i. Describe methods to be used if UXOs/MEC or other hazards are encountered during any site clearing/preparation or construction activities, and evaluate and describe any effects to listed species, their habitat, and any designated critical habitat from planned response actions. This should include information on the anticipated frequency of anticipated response (e.g., number of UXOs requiring response, detonation plans, etc.).
- ii. If detonation or discharge of UXO/MEC/hazardous materials is proposed, evaluate and describe effects of these activities on listed species, their habitat, and any designated critical habitat including consideration of exposure to noise/pressure, shrapnel, and pollutants or toxins. Include a complete description of any acoustic thresholds to be used in the analysis (see below for summary of NMFS acoustic thresholds for use in section 7 consultations).

I. Vessels

- i. Describe baseline vessel traffic in the area where project vessels will occur (i.e., vessel traffic in the area without the proposed action).
 1. To establish a baseline, include the three most recent years of the number of unique transits for all vessel types transiting the entire area where project activities will occur. Unique transits are considered an individual entry-exit of a vessel that overlaps the area where project activities will occur.
 2. Description should include vessel types, activity, size (length, beam, draft, deadweight tons), and operational speed (maximum and average).
- ii. Include details of number and types of project vessels to be used during construction, including size (length, beam, draft, deadweight tons) speed, and operational speed (maximum and average).
- iii. Include details on all ports planned for use and number of expected trips by vessel type to each port per month over the construction phase of the project.
- iv. Evaluate and describe the risk (i.e., potential, frequency, severity) of vessel strikes to listed species from project vessels during the construction phase. Clearly describe any avoidance, minimization, and monitoring measures included as part of the proposed action and describe how they are anticipated to reduce risk.
- v. Evaluate and describe the effects of vessel traffic during the construction phase to the physical and biological features of any critical habitat located in the vessel paths.
- vi. Describe any quieting measures to reduce vessel noise, if any.

Operations and Maintenance

a. Air Emissions

- i. Describe air emissions from Project equipment (e.g. vessels, WTGs, OSSs, aircraft) and evaluate and describe effects to listed species, their habitat, and any designated critical habitat.

b. Displacement and Shifts of other Activities

- i. Describe potential changes (if any) in use of the project area (lease area and cable route) by non-wind related activities/users due to presence of turbines and/or cables. Evaluate and describe how those changes may affect listed species, their habitat, and any designated critical habitat (i.e., assess anticipated increased or decreased potential of vessel strike and/or interactions with fishing gear or other stressors due to displacement/shifts of vessel traffic and fishing activity). Evaluate and describe:
 - i. Potential displacement or shifts of commercial and/or recreational fishing effort and/or vessel transit to/from the project area, details on which fisheries exist in the project area can be accessed via data request email: nmfs.gar.data.requests@noaa.gov
 - ii. Potential displacement or shifts of other activities (e.g., commercial shipping, recreational boaters, ferry services) to/from the project area
 - iii. Potential impact to listed species, their habitat, and any designated critical habitat if commercial and recreational fisheries or other activities are displaced or shift to or from the project area.

c. Habitat Disturbance and Modification

- i. Evaluate and describe the potential for displacement/disruption of listed species use of the project area and the consequences of any such displacement or disruption of use of the area.
- ii. Evaluate and describe the habitat conversion (e.g. scour, mats) and loss or addition of benthic resources, including potential reef effect and increase in fishing activity around structures.
- iii. Evaluate and describe the risk (i.e., potential, frequency, severity) of entanglement in project infrastructure to listed species.
- iv. Evaluate and describe the effects of the physical presence of project infrastructure on listed species movement through the project area.
- v. Evaluate and describe the effects of the physical presence of project infrastructure on regional and local oceanographic (e.g. wakes, stratification) and atmospheric conditions (e.g. reduced wind stress) and how that will affect listed species, including impacts on prey species, and critical habitat.
- vi. For any converter stations/substations, evaluate and describe any water withdrawal and potential of impingement and/or entrainment on listed species and prey. Evaluate and describe the effects from these operations to the physical and biological features of any critical habitat located in the water withdrawal footprint.
- vii. For any vessel anchoring or deployment of spuds, evaluate and describe effects to habitat (i.e., increased sedimentation/turbidity, loss or displacement of benthic resources) and assessment of any potential for entanglement. Also, evaluate and describe the effects from the vessel anchoring/spudding to the

- physical and biological features of any critical habitat located within the anchoring/spudding footprint.
- viii. Describe effects from electromagnetic fields and heat from inter-array and export cable to listed species, including impact on prey species and critical habitat.
- d. Intake and Discharge**
- i. See **d. (Construction)** above.
- e. Noise**
- i. See **e. (Construction)** above.
 - ii. Describe the anticipated operational noise from WTGs and the addition of that noise to the current oceanic soundscape, and evaluate and describe effects to listed species, their habitat, and any designated critical habitat (e.g., exposure and response to operational noise, vessel noise).
- f. Pollutants, Spills, and Debris**
- i. See **f. (Construction)** above.
 - ii. Describe the amount of fuels, oils, lubricants, etc. that will be contained in project infrastructure (e.g. WTGs and OSSs). Describe risk of chemical/pollutant releases/spills and oil spills.
- g. Project Lighting**
- i. See **h. (Construction)** above.
- h. Repair and Maintenance Activities**
- i. Describe repair and maintenance activities that may directly or indirectly affect listed species, their habitat, and any designated critical habitat and analyze those effects.
- i. Surveys/Monitoring**
- i. See **i. (Construction)** above.
 - ii. Describe impacts of wind farm presence to NMFS and other protected species surveys (e.g. aerial, shipboard) and evaluate and describe anticipated effects to listed species, their habitat, and any designated critical habitat.
- j. Unexpected/Unanticipated Events**
- i. See **j. (Construction)** above.
 - ii. Describe any unexpected/unanticipated events (e.g. failure of WTGs due to weather), and evaluate and describe any effects to listed species, their habitat, and any designated critical habitat, and explain the anticipated frequency of such events. This assessment should include consideration of extreme weather events such as hurricanes.
- k. Vessels**
- i. See **l. (Construction)** above.

- ii. Include details of number and types of vessels to be used during operations and maintenance, including size (length, beam, draft, deadweight tons), minimum and maximum speed, and operational speed (maximum and average).
- iii. Include details on ports planned for use and number of expected trips by vessel type to each port per month during the operations phase.
- iv. Evaluate and describe the risk (i.e., potential, frequency, severity) of vessel strikes to listed species from project vessels during the operational phase.
- v. Evaluate and describe the effects of vessel traffic during the operations and maintenance phase to the physical and biological features of any critical habitat located in the vessel paths.

Decommissioning

a. Air Emissions

- i. See **a. (Construction)** above.

b. Habitat Disturbance and Modifications

- i. Describe how the habitat will be altered due to decommissioning of the wind farm:
 - 1. Evaluate and describe the habitat conversion (e.g. loss of foundations, scour, mats) and how that will impact listed species, their habitat, and any designated critical habitat.
 - 2. For removal of structures, evaluate and describe impacts to benthic resources, turbidity, effects on prey, and amount of habitat disturbed and how that will impact listed species, their habitat, and any designated critical habitat. Describe if piles will be cut below the mudline or removed otherwise. Describe if scour protection will be removed.
 - 3. For dredging operations, provide information on location and frequency of dredging activities, dredge type, and volume and type of material removed. Address the likelihood of capture, impingement, entrainment of listed species; turbidity; effects on prey. Evaluate and describe the effects from dredging during decommissioning to the physical and biological features of any critical habitat located in the dredging footprint.
 - 4. Describe if inter-array and export cable will be removed. For cable removal, evaluate and describe impacts to benthic resources, turbidity, effects on prey, amount of habitat disturbed, and how that will impact listed species, their habitat, and any designated critical habitat. Also, evaluate and describe the effects from any decommissioning of inter-array and export cables to the physical and biological features of any critical habitat located in the footprint.

c. Intake and Discharge

- i. See **d. (Construction)** above.

d. Noise

- i. See e. (Construction) above.
 - ii. Describe noise levels associated with decommissioning activities (i.e. foundation, cable, pile, or scour removal), and evaluate and describe effects to listed species, their habitat, and any designated critical habitat.
- e. **Pollutant, Spill, and Debris**
- i. See f. (Construction) above.
- f. **Project Lighting**
- i. See h. (Construction) above.
- g. **Surveys/Monitoring**
- i. See i. (Construction) above.
- h. **Unexpected/Unanticipated Events**
- i. See j. (Construction) above.
- i. **Vessels**
- i. See l. (Construction) above.
 - ii. Include details of number and types of vessels to be used during operations and maintenance, including size (length, beam, draft, deadweight tons), minimum and maximum speed, and operational speed (maximum and average).
 - iii. Include details on ports planned for use and number of expected trips by vessel type to each port per month during the decommissioning phase.
 - iv. Evaluate and describe the risk (i.e., potential, frequency, severity) of vessel strikes to listed species from project vessels during the decommissioning phase.
 - v. Evaluate and describe the effects of vessel traffic during the decommissioning phase to the physical and biological features of any critical habitat in the vessel paths.

Acoustic Thresholds

The noise levels noted here are considered by NMFS as the best available for consideration of effects to ESA-listed species at this time. For dual metric thresholds for impulsive sounds: Use whichever results in the largest isopleth for calculating PTS onset. For additional details see: <https://www.fisheries.noaa.gov/national/marine-mammal-protection/marine-mammal-acoustic-technical-guidance>

- a. **ESA-listed Fish**
- i. Acoustic thresholds identifying the onset of behavioral disturbance for fishes. Note, NMFS has not established a “formal” threshold for behavior; this “threshold” is based on the best available information in the scientific literature.

Source Type	Threshold
All Sources	L_{RMS} 150 dB

- ii. Acoustic thresholds identifying the onset of physical injury for non-explosive impulsive sources for fishes (FHWG 2008).

Fish Size	Onset of Physical Injury (Received Level)
	Impulsive
Fishes \geq 2 g	$L_{p,0-pk,flat}$: 206 dB $L_{E,p,24h}$: 187 dB
Fishes $<$ 2 g	$L_{p,0-pk,flat}$: 206 dB $L_{E,p,24h}$: 183 dB

- iii. Acoustic thresholds identifying the onset of mortality and physical injury for underwater explosives for fishes (FHWG 2008, Popper et al. 2014).

Onset of Mortality (Received Level)	Onset of Physical Injury (Received Level)
$L_{p,0-pk,flat}$: 229 dB	$L_{p,0-pk,flat}$: 206 dB $L_{E,p,24h}$: 187 dB (\geq 2 g) $L_{E,p,24h}$: 183 dB ($<$ 2 g)

b. Sea Turtles

- i. Acoustic thresholds identifying the onset of behavioral disturbance for sea turtles (DoN 2017). Note, Data on behavioral reactions of sea turtles to sound sources is limited. However, in general, behavioral disturbance occurs around RMS 175 dB (O’Hara and Wilcox 1990; Moein et al. 1994; Lenhardt 2002; McCauley et al. 2000).

Source Type	Threshold
All Sources*	L_{RMS} 175 dB

* Currently, there are not enough data to derive separate thresholds for different source types.

- ii. Acoustic thresholds identifying the onset of Permanent Threshold Shift (PTS) for sea turtles (DoN 2017).

Hearing Group	PTS Onset Thresholds (Received Level)	
	Impulsive	Non-impulsive
Sea Turtles	$L_{p,0\text{-pk,flat}}: 232 \text{ dB}$ $L_{E,p, \text{TU},24\text{h}}: 204 \text{ dB}$	$L_{E,p, \text{TU},24\text{h}}: 220 \text{ dB}$

- iii. Acoustic thresholds identifying the onset of Temporary Threshold Shift (TTS) for sea turtles (DoN 2017).

Hearing Group	TTS Onset Thresholds (Received Level)	
	Impulsive	Non-impulsive
Sea Turtles	$L_{p,0\text{-pk,flat}}: 226 \text{ dB}$ $L_{E,p, \text{TU},24\text{h}}: 189 \text{ dB}$	$L_{E,p, \text{TU},24\text{h}}: 200 \text{ dB}$

- iv. Acoustic and pressure thresholds to predict the onset of PTS, tissue damage (i.e., lung and G.I. tract), and mortality for sea turtles from the use of underwater explosives (DoN 2017). Behavioral threshold applies here.

Hearing Group	Mortality (Severe lung injury)*	Slight Lung Injury*	G.I. Tract Injury
Sea Turtles	<i>Cell 1</i> Modified Goertner model; Equation 1	<i>Cell 2</i> Modified Goertner model; Equation 2	<i>Cell 3</i> $L_{\text{pk,flat}}: 237 \text{ dB}$

* Lung injury (severe and slight) thresholds are dependent on animal mass (Recommendation: Table C.9 from DoN 2017 based on adult and/or calf/pup mass by species).

Modified Goertner Equations for severe and slight lung injury (pascal-second)

$$\text{Equation 1: } 103M^{1/3}(1 + D/10.1)^{1/6} \text{ Pa-s}$$

$$\text{Equation 2: } 47.5M^{1/3}(1 + D/10.1)^{1/6} \text{ Pa-s}$$

M animal (adult and/or juvenile) mass (kg) (Table C.9 in DoN 2017)

D animal depth (meters)

Note: For a single detonation (within a 24-h period), NMFS relies on the TTS onset threshold to assess Level B harassment. For multiple detonations (within a 24-h period), NMFS relies on the RMS 175 dB behavioral sea turtle thresholds that is used for all sound sources.

c. ESA-listed Whales

- i. Marine mammal hearing groups (NMFS 2018).

Hearing Group	Generalized Hearing Range*
Low-frequency (LF) cetaceans (baleen whales)	7 Hz to 35 kHz
Mid-frequency (MF) cetaceans (toothed whales)	150 Hz to 160 kHz

* Represents the generalized hearing range for the entire group as a composite (i.e., all species within the group), where individual species' hearing ranges are typically not as broad. Generalized hearing range chosen based on ~65 dB threshold from normalized composite audiogram, with the exception for lower limits for LF cetaceans (Southall et al. 2007).

- ii. Acoustic thresholds identifying the onset of Permanent Threshold Shift (PTS) for marine mammals (NMFS 2018).

Hearing Group	PTS Onset Thresholds	
	Impulsive	Non-impulsive
Low-Frequency (LF) Cetaceans	$L_{p,0\text{-pk,flat}}: 219 \text{ dB}$ $L_{E,p, \text{LF},24\text{h}}: 183 \text{ dB}$	$L_{E,p, \text{LF},24\text{h}}: 199 \text{ dB}$
Mid-Frequency (MF) Cetaceans	$L_{p,0\text{-pk,flat}}: 230 \text{ dB}$ $L_{E,p, \text{MF},24\text{h}}: 185 \text{ dB}$	$L_{E,p, \text{MF},24\text{h}}: 198 \text{ dB}$

- iii. Acoustic thresholds identifying the onset of Temporary Threshold Shift (TTS) for marine mammals (NMFS 2018).

Hearing Group	TTS Onset Thresholds	
	Impulsive	Non-impulsive
Low-Frequency (LF) Cetaceans	$L_{p,0\text{-pk,flat}}: 213 \text{ dB}$ $L_{E,p, \text{LF},24\text{h}}: 168 \text{ dB}$	$L_{E,p, \text{LF},24\text{h}}: 179 \text{ dB}$
Mid-Frequency (MF) Cetaceans	$L_{p,0\text{-pk,flat}}: 224 \text{ dB}$ $L_{E,p, \text{MF},24\text{h}}: 170 \text{ dB}$	$L_{E,p, \text{MF},24\text{h}}: 178 \text{ dB}$

- iv. Acoustic thresholds identifying onset of behavioral disturbance for marine mammals (NOAA 2005).

Source Type	Threshold
Continuous	$L_{RMS} 120 \text{ dB}$
Non-explosive impulsive or intermittent	$L_{RMS} 160 \text{ dB}$

- v. Acoustic and pressure thresholds to predict the onset of behavioral harassment (multiple detonations) and TTS as well as PTS for marine mammals from the use of underwater explosives (NMFS 2018).

Hearing Group	PTS Impulsive Thresholds	TTS Impulsive Thresholds	Behavioral Threshold (multiple detonations)
Low-Frequency (LF) Cetaceans	$L_{\text{pk,flat}}$: 219 dB $L_{E,\text{LF},24h}$: 183 dB	$L_{\text{pk,flat}}$: 213 dB $L_{E,\text{LF},24h}$: 168 dB	$L_{E,\text{LF},24h}$: 163 dB
Mid-Frequency (MF) Cetaceans	$L_{\text{pk,flat}}$: 230 dB $L_{E,\text{MF},24h}$: 185 dB	$L_{\text{pk,flat}}$: 224 dB $L_{E,\text{MF},24h}$: 170 dB	$L_{E,\text{MF},24h}$: 165 dB

- vi. Acoustic and pressure thresholds to predict tissue damage (i.e., lung and G.I. tract) and mortality of marine mammals from explosives (DoN 2017).

Hearing Group	Mortality (Severe lung injury)*	Slight Lung Injury*	G.I. Tract Injury
All Marine Mammals	<i>Cell 1</i> Modified Goertner model; Equation 1	<i>Cell 2</i> Modified Goertner model; Equation 2	<i>Cell 3</i> $L_{\text{pk,flat}}$: 237 dB

* Lung injury (severe and slight) thresholds are dependent on animal mass (Recommendation: Table C.9 from DoN 2017 based on adult and/or calf/pup mass by species).

Modified Goertner Equations for severe and slight lung injury (pascal-second)

$$\text{Equation 1: } 103M^{1/3}(1 + D/10.1)^{1/6} \text{ Pa-s}$$

$$\text{Equation 2: } 47.5M^{1/3}(1 + D/10.1)^{1/6} \text{ Pa-s}$$

M animal (adult and/or juvenile) mass (kg) (Table C.9 in DoN 2017)
D animal depth (meters)

Note: For a single detonation (within a 24-h period), NMFS relies on the TTS onset threshold to assess Level B harassment. For multiple detonations (within a 24-h period), NMFS relies on a behavioral thresholds that is -5 dB from TTS onset (see Table above).

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