

Environmental Studies Program: Studies Development Plan | FY 2023–2024

Title	Qualitative Risk Assessment Approach Refining Acoustic Processes and to Explore the Inclusion of Cumulative Effect Analysis for Offshore Windfarm Construction and Operations (NT-23-06)
Administered by	Office of Environmental Programs
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Procurement Type(s)	Contract
Conducting Organization(s)	TBD
Total BOEM Cost	TBD
Performance Period	FY 2023–2026
Final Report Due	TBD
Date Revised	May 4, 2022
PICOC Summary	-
<i><u>Problem</u></i>	Offshore renewable energy development produces high levels of intermittent, impulsive noise and persistent noise due to vessel use and turbine operations. Current numerical approaches typically look at discrete examples of acoustic stressor impacts alone. These analyses have not been able to quantitatively assess and integrate the overall impact of acoustic and non-acoustic stressors. This integration is needed for qualitatively assessing cumulative effects.
<i><u>Intervention</u></i>	This proposed study would provide valuable insights on refining the fidelity and robustness of the current acoustic risk assessment approaches and identify potential methodologies to expand these approaches to also include non-acoustic stressors. This is all with a goal of quantitatively addressing cumulative effects for offshore windfarm activities.
<i><u>Comparison</u></i>	There are two BOEM-funded studies that have produced reports that use a risk assessment framework to quantify the aggregate acoustic risk for seismic and windfarm activities in the Gulf of Mexico (GOM) and off New England (BOEM reports BOEM-2021-022 and BOEM 2021-081, respectively). These studies were proof of concept evaluations for the risk assessment approach for specific acoustic sources. This study is the next natural step to refinement of those efforts and to expand them beyond just acoustic stressors.
<i><u>Outcome</u></i>	The study would establish methodologies and tools for beginning to quantify the cumulative effects of risk from multiple stressors using expert elicitation and allow comparisons of various alternatives and mitigation factors in National Environmental Policy Act (NEPA) documents and in regional activity planning.
<i><u>Context</u></i>	Nationwide relevance for developing a quantitative tool to assess cumulative effect, specifically for offshore wind farms but theoretically for all BOEM-regulated activities

BOEM Information Need(s): BOEM NEPA and Endangered Species Act (ESA) consultation documents (including environmental impact statements [EISs], Construction and Operations Plans, etc.) analyze the

impacts of offshore energy and construction activities, including installation of large wind turbine structures. Part of the requirements of NEPA and ESA regulatory documents include analyses of the cumulative effects of the proposed activity, which up to now has been primarily qualitative. However, with the ever-increasing complexity of the knowledge and quantification of the various stressors (both acoustic and non-acoustic) it has become obvious there is a growing need to quantitatively examine the cumulative effects of BOEM activities. Additionally, this work will potentially facilitate the evaluation of the various options available to BOEM, other regulators, and project planners and managers.

Background: In 2013, an expert working group (EWG) consisting of biologists, engineers, and underwater acousticians began working together (with the support of BP and Shell) on a systematic framework to evaluate potential effects of specific acoustic exposures on marine mammals. The objective was to develop a structured process that included logical elements of previous assessment methods that applied noise exposure predictions to estimate potential effects on hearing and behavior, but increasingly integrated relevant biological and ecological variables in predicting the probability of such potential effects and interpreting their significance. The framework was deliberately structured in a stepwise manner including elements (*e.g.*, level A and B takes) consistent with current U.S. regulatory assessment methods, but with additional stages that explicitly included biologically and ecologically meaningful contexts by which to interpret potential responses and that at least began to consider chronic influences. Notable aspects of the resulting framework included:

- Inclusion of ecologically relevant methods for predicting animal distribution.
- Incorporation of variance in animal density estimates.
- Integration of behavioral aversion in animal movement models.
- Integration of population consequences of disturbance (PCOD) approaches to evaluate potential effects relative to exposure magnitude and duration.
- Development of risk assessment methods that include biologically and environmentally relevant aspects of the context of exposure.

The original scope was intentionally narrow, focusing on relatively short-term, small-scale potential effects of discrete exposures (acute) on marine mammals from seismic airgun surveys in the GOM. The EWG framework built on a sequence of advances made in noise exposure criteria, PCOD modeling/framework, and environmental assessment and represented a significant step in evolving from relatively simplistic assessment methods to more sophisticated approaches that consider biological, environmental, and contextual covariates. However, the need to move beyond this acute paradigm to address aggregate exposures from multiple similar seismic activities and long-term, large-scale potential effects of chronic noise (*e.g.*, masking effects) was identified as a critical evolution. Also, the utilization of expert elicitation was identified as a method of circumventing the obstacles that Population Consequences of Acoustic Disturbance (PCAD) and PCoD (National Academies 2005, 2017; Pirotta 2018) approaches required scientific input from numerous, diverse, complex, and slowly funded and executed scientific studies that may not be available in the near future.

With BOEM and National Marine Fisheries Service (NMFS) funding, this work continued and a risk assessment framework for seismic activities was developed for aggregate activities and also for chronic activities in the GOM (report BOEM 2021-022). Additionally, the framework was adapted to examine offshore wind farm activities for multiple projects in both their construction and operational phases. This work will concentrate on offshore wind projects for this study, but in general, the techniques and approaches could be applied to other impact sources. This study enabled the user to understand and

manage many of the temporal and spatial variables involved, enabling decisionmakers to minimize their potential impacts. Two variations of the risk framework were used in the Gulf geological and geophysical EIS process. NMFS sponsored a specific study to examine the masking of marine mammal activities by seismic surveys. This was not directly included in the EIS, but it facilitated NMFS's decisions on it. The second application introduced the concept and approach to the larger audience, and it was included in the EIS. As a new technique, it was not strictly relied on in the decision process, but it was used to assist the NMFS decision process.

Objectives: The objectives of this study are to:

- Expand the capabilities of the current windfarm risk framework by implementing improved temporal, spatial and environmental layering used in the framework (e.g., allowing expansion beyond the existing layers to items like prey species data or non-acoustic environmental factors), implement means to quantify the uncertainty and data gaps of critical local parameters (e.g., upwelling, runoff, etc.), and identify operational methods to allow the comparisons of results (initially, this will be used to examine results from multiple scenarios for an acoustic stressor, but it will also be expanded in the next bullet to include multiple stressor results),
- Expand the current aggregate acoustic framework to incorporate non-acoustic stressors into the current framework to quantify the cumulative effects for BOEM-regulated activities, and
- Develop a tool that is both useable and tunable for determining cumulative effects for BOEM-regulated activities.

Methods: The study would convene a team of experts in acoustics, marine biology, acoustic impact analysis, acoustic modeling, statistics, oceanography and the equivalent types of experts in other appropriate fields to first review what approaches and risk assessment framework developments are already available, and then refine and expand those approaches to meet the objectives. Integral to this effort is the building of the necessary databases and models/algorithms to examine, test, and evaluate the approaches identified and ultimately to build a tool, which is capable of assisting non-expert users to evaluate the risk for their specific scenario(s).

Specific Research Question(s):

- Identify and evaluate the numerous variables necessary to improve the acoustic risk assessment process and their volatility. What are they and how sensitive is a risk assessment framework to them?
- Identify the most important potential contributors to both acoustic and combined acoustic/non-acoustic cumulative effects. What are these contributors, how should they be "weighted," and what gaps exist in trying to incorporate them into a combined risk assessment framework?
- Identify an approach to building a tool that can assist the regulator in assessing cumulative risk. Then build the tool. What is the technical basis for this tool and what does an operator need to be aware of to use it effectively?

Current Status: N/A

Publications Completed: N/A

Affiliated WWW Sites: N/A

References:

Pirotta E, Booth CG, Costa DP, et al. Understanding the population consequences of disturbance. *Ecol Evol*. 2018;8:9934–9946. 10.1002/ece3.4458

National Academies. 2005. Marine mammal populations and ocean noise; determining when noise causes biologically significant effects. Washington (DC): The National Academy Press.

National Academies. 2017. Approaches to understanding the cumulative effects of stressors on marine mammals. Washington (DC): The National Academies Press.

Southall B, Ellison W, Clark C, Tollit D, Amaral J. 2021. Marine mammal risk assessment for Gulf of Mexico G&G activities. Sterling (VA): U.S. Department of the Interior, Bureau of Ocean Energy Management. 99 p. Report No.: OCS Study BOEM 2021-022.

Southall B, Ellison W, Clark C, Tollit D, Amaral J. 2021. Marine mammal risk assessment for New England offshore windfarm construction and operational scenarios. Sterling (VA): U.S. Department of the Interior, Bureau of Ocean Energy Management. 104 p. Report No.: OCS Study BOEM 2021-080.