Environmental Studies Program: Ongoing Study

Title	Spatial & Acoustic Ecology of Pelagic Megavertebrates (NT-17-02)
Administered by	Headquarters
BOEM Contact(s)	Jacob Levenson (jacob.levenson@boem.gov)
Procurement Type(s)	Cooperative Agreement
Conducting Organization(s)	University of North Carolina Wilmington
Total BOEM Cost	$2,300,000
Performance Period	FY 2017-2022
Final Report Due	January 2022
Date Revised	August 27, 2021
PICOC Summary	
Problem	Little information is available on the acoustic behavior of Deep-diving, acoustically sensitive cetaceans (*e.g.*, beaked whales) for passive acoustic monitoring
Intervention	Conduct acoustic ecology studies of deep diving cetaceans of the U.S. OCS
Comparison	Current modeled distribution
Outcome	Improved density maps of deep diving whale distribution of the US OCS and baseline PAM data for deep diving species off the Mid-Atlantic.
Context	US OCS

BOEM Information Need(s): Regulatory drivers such as the Marine Mammal Protection Act, Endangered Species Act, and Magnuson-Stevens Fishery Conservation and Management Act require BOEM to consider the impacts of regulated activities on protected and managed species. BOEM is required to design and implement mitigation measures to reduce or eliminate impacts from regulated activities on protected and managed species, which is challenging due to a lack of data on infrequently observed, cryptic species. Deep-diving, acoustically sensitive cetaceans (*e.g.*, beaked whales) and poorly sampled species, such as sei whales, are just such creatures, and they inhabit the shelf and shelf-break waters of virtually every area BOEM manages. The lack of information about their diving behavior and acoustic ecology creates a high degree of variability in their detection probabilities and the analysis of data from passive acoustic monitoring (PAM), which is one of BOEM's primary mitigation and monitoring tools. Verifying cue rates (*i.e.*, a key for PAM analyses) for understudied marine mammals in diverse behavioral states and habitats is thus key in reinforcing BOEM passive acoustic studies nationally. BOEM requires robust, current data to (1) fully analyze and disclose the potential for significant impact from OCS activities at the programmatic and site-specific level pursuant to NEPA, (2) to enable us with the ability to ensure that a species is not jeopardized by an activity or that critical habitat is not adversely modified by that activity pursuant to the ESA, (3) to minimize incidental take of marine mammals stemming from BOEM-permitted activities, thus meeting not only the small numbers and negligible impact requirement under the MMPA but also making every effort to maintain the health and stability of marine mammals and their ecosystem, and (4) to fulfill assessment and consultation requirements under the with other federal agencies. This study will ensure BOEM acoustic monitoring, a vital cross programmatic tool, is based on the best available science.

Background: Detection probability, the likelihood of a species being detected in a given survey method, is a pervasive challenge to the application of marine mammal field data. Acoustic and visual surveys are heavily relied upon by BOEM and partners to estimate species abundances for impact analysis. In some species, such as the sei whale, acoustic behavior is calculated by very infrequent observations, leading to a significant amount of uncertainty in these lesser observed species. Furthermore, understanding the depth ranges and behavioral states at which marine mammals are vocalizing can provide important behavioral information and help interpret PAM datasets.

Numerous studies suggest cetaceans, particularly deep-divers such as beaked and sperm whales, may be disturbed or injured by intense sound sources. Several species of cetaceans occur in each of the program areas whose acoustic behavior, particularly cue rates, as it relates to habitat usage is poorly understood.

Traditional survey methods for cetaceans include shipboard or aerial surveys. However, these are not sufficient for deep diving cetaceans due to their cryptic nature and offshore distribution. Variations in detectability result in significant data gaps in the distribution/occurrence of these species, which impairs BOEM's abilities to assess the potential impacts of acoustic disturbance from BOEM-regulated activities. This study will improve our understanding and application of the detection probabilities of these deep diving animals.

This study will support accuracy improvements to future as well as existing efforts such as Atlantic and Gulf of Mexico Marine Assessment Program for Protected Species (AMAPPS/GoMMAPPS). In doing so this study will provide necessary information for planning and compliance with environmental regulations.

Objectives: The objectives of this study are to: a) Describe site behavioral and acoustic ecology of understudied cetaceans where significant data gaps in cue rates exist; b) Describe acoustic, behavioral, and foraging ecologies of pelagic deep diving cetaceans; c) Update uncertainty analysis for OCS cryptic species to inform planning and mitigation design; d) Verify and/or establish cue rates to inform accurate density modeling of data deficient marine mammal species applicable to multiple BOEM programs and regions for impact analysis.

Methods: Due to the costs associated with traditional vessel survey time, this study will use an integrated, multi-platform approach for obtaining data that will be crucial for BOEM decision-making processes. This project will utilize two primary, proven methods: (1) Vessel mobile passive acoustic monitoring (PAM) and (2) Animal tagging. To maximize cost effectiveness, this project will initially use mobile (*i.e.*, tag, vessel and AUV-based) PAM, which, in addition to providing key data of its own, will also supplement existing Navy/NOAA fixed archival PAM units supported by the AMAPPS project. Together these techniques will accomplish at least three goals: i) record, classify and localize cetacean calls; ii) collect and verify cue rates using acoustic tagging combined with visual behavioral observation and towed PAM; iii) aid in validating acoustic propagation models by having multiple receiving nodes operating simultaneously. Utilizing a state of the art sailing vessel designed specifically for surveys (visual and acoustic) will allow many days at sea (90/year), which will provide robust temporal and spatial coverage. Also, importantly, vessel and AUV-based PAM will provide ground truth and guidance for the PAM buoys (*e.g.*, vocalization rates), which are nationally critical for long-term use of PAM techniques for mitigation and monitoring of industrial activity. Electronic tags such as satellite linked position tags and 3-D accelerometer/acoustic tags will also be used to augment remote study of targeted species to provide a better understanding of habitat use and movement in relation to acoustic

behavior. Such tagging strategies have provided superb data for a variety of marine mammal species and the techniques and technologies are readily available so can be easily and cost effectively deployed.

Specific Research Question(s): What are the acoustic behaviors of deep diving cetaceans needed for effective PAM implementation?

Current Status: Two of three cruises completed, a final cruise has been delayed due to covid and will take place fall 2021.

Publications Completed:

Gero S, Clabaugh A, Levenson JJ, Holmberg J, Zetterlind V. 2018. Incorporating Citizen Science into Environmental Assessment Workshop Report. 54 p. OCS Study BOEM 2019-065. Obligation No.: M17AC00013.

Pabst DA, Nowacek DP. 2019. Report of the marine mammal passive acoustics and spatial ecology (MAPS) research planning meeting May 9–10, 2018. 76 p. OCS Study BOEM 2019-058. Obligation No.: M17AC00013.

Affiliated WWW Sites:

https://sites.duke.edu/oceansmart/research/

https://www.northcarolina.edu/news/uncw-researchers-participate-in-international-marine-mammal-project/