Environmental Studies Program: Ongoing Study

Title	Optimization of Towed Passive Acoustic Monitoring (PAM) Array Design and Performance (AT-19-02)
Administered by	Office of Renewable Energy Programs
BOEM Contact(s)	Stanley Labak, stanley.labak@boem.gov Brian Zelenke, brian.zelenke@boem.gov
Principal Investigators(s)	Mary Jo Barkaski Aaron Thode
Conducting Organizations(s)	CSA Ocean Sciences
Total BOEM Cost	$196,155
Performance Period	FY 2019–2020
Final Report Due	November 20. 2020
Date Revised	October 24, 2019
PICOC Summary	
Problem	Routinely, the Bureau of Ocean Energy Management (BOEM) is required to assess the efficacy of towed PAM arrays as mitigation tools. Currently, there is no methodology to accomplish this.
Intervention	BOEM proposes the development of an algorithm that can assess the efficacy and localization accuracy of a proposed PAM towed array design for various marine mammal vocalization frequencies and waveforms.
Comparison	This output resulting from the algorithm can then be queried to predict the animal localization accuracy for various range and bearing combinations from the array in order to assess their efficacy for various species and mitigation ranges.
Outcome	The utility of any proposed towed PAM array can therefore be given from any scenario.
Context	This algorithm should be generally applicable anywhere towed PAM arrays are employed, including shallow water.

BOEM Information Need(s): BOEM's Office of Renewable Energy Programs is required by the Endangered Species Act, Marine Mammal Protection Act, and the National Environmental Policy Act to assess the potential and apply appropriate mitigation for the protection of marine mammals. PAM has become a widely used mitigation in order to detect marine mammal species and ensure they remain outside of protective exclusion zones during the use of active sound sources, in order to prevent injury to these protected species. To date there are no data readily available that assess the localization accuracy of towed PAM array configurations. BOEM therefore has no way of determining how effective the localizing abilities of the arrays proposed by developers for mitigation purposes are for the various types of calls produced by the marine mammal species that occur in the Atlantic. Determining effective mitigations

that balance protection of marine mammals with the development of offshore renewable energy requires an understanding of the localizing accuracy of towed PAM arrays.

Background: PAM is a growing technology that is used worldwide to detect vocalizing marine mammals in order to mitigate for potential acoustic impacts to these protected species. Since PAM is not limited by visibility constraints, this mitigation technique can be used at night and in bad weather when visual observations are not possible. Developers in the renewable energy industry have routinely requested and have been approved to conduct 24-hour High Resolution Geophysical (HRG) surveys. Round-the-clock operations are important to the industry considering the tremendous mobilization and operational costs associated with these surveys. Towed PAM is one of the mitigations proposed to be used during nighttime operations to not only detect vocalizing marine mammals, but to help ensure that animals remain outside of the exclusion zone.

In order to do this the towed PAM array must be able to localize on the position of the marine mammal's vocalization in order to determine the distance that the marine mammal is from the sound source. This would then enable the PAM operator to determine the proper mitigation action required, for example, to shut down the sound source or not. Currently, there are no readily available data or methods which can assess the accuracy of the localization abilities of towed PAM arrays.

Objectives:

- The first objective of this study is to examine and understand the critical parameters for designing a towed PAM array.

- The second objective is to develop an algorithm and identify the metrics, which will allow for optimization of the towed PAM array design. An understanding of the localization accuracies of various towed PAM arrays will provide BOEM with the necessary information to determine whether towed PAM array mitigations, as proposed by Lessees, will comply with lease stipulations for responsible renewable energy development.

Methods: Establish and verify an algorithm, which facilitates the evaluation of efficacy of a specified set of the physical parameters for a towed PAM array (*e.g.*, array length, hydrophone spacing, number of hydrophones, *etc*.) in order to allow optimization and selection of an appropriate towed PAM array configuration for marine mammal mitigation purposes. The algorithm should incorporate the characteristics of multiple marine mammal species vocalizations, including, but not limited to, frequency, source level, repetition rate, and directionality—as well as array operational parameters including, but not limited to, tow depth, speed, and water depth.

Specific Research Question(s): Can the algorithm provide BOEM a tool which can be directly used to assess the efficacy of towed PAM arrays for any given scenario?

Current Status: A kick-off meeting was held on October 7, 2019.

Publications Completed: None.

Affiliated WWW Sites: None.

References: None.