

Environmental Studies Program: Ongoing Study

Title	Behavioral Response of Sea Turtles from Controlled Exposures to a Mobile Impulsive Sound Source (AT-20-04)
Administered by	Office of Renewable Energy Programs
BOEM Contact(s)	Kyle Baker (kyle.baker@boem.gov)
Procurement Type(s)	Contract
Conducting Organization(s)	Coonamessett Farm Foundation
Total BOEM Cost	\$296,968
Performance Period	FY 2020–2024
Final Report Due	September, 2024
Date Revised	August 8, 2023
PICOC Summary	
<i><u>Problem</u></i>	Low-frequency impulsive sounds produced during surveys and construction associated with BOEM programs can impact the behavior of sea turtles. Despite the frequent occurrence of these activities in the Renewable Energy, Conventional Energy, and Marine Minerals Programs, little is known of the impact to sea turtles.
<i><u>Intervention</u></i>	Conduct a controlled exposure experiment to measure the behavioral response of turtles exposed to impulsive sound sources.
<i><u>Comparison</u></i>	The behavior of field-tagged sea turtles in ambient noise conditions will be compared to tagged turtles exposed to impulsive sound sources.
<i><u>Outcome</u></i>	The study will assist BOEM’s understanding sea turtle behaviors at different sound exposure levels to inform analyses, monitoring needs, and future applications around survey and construction activities authorized by BOEM programs.
<i><u>Context</u></i>	The field study will be conducted in the Mid-Atlantic.

BOEM Information Need(s): The November 2018 Wildlife and Offshore Wind workshop identified field studies to understand the impacts from the impulsive sounds produced from pile driving as a priority research and monitoring issue. The impacts to sea turtles from pile driving of oil and gas foundations survey equipment across all BOEM program areas have also been an impact of concern but are not well understood. Nationwide, BOEM needs information on the responses of sea turtles to impulsive sounds to inform environmental analyses, consultations, and inform geographic and seasonal considerations for leasing decisions, and inform mitigation and monitoring needs. This information will inform future siting of lease areas in sea turtle habitats, information needs, and inform research and monitoring programs associated with offshore leasing activities

Background: Sea turtles generally hear 50 Hz to 2 kHz sounds (Dow Piniak et al. 2012; Ketten and Bartol 2006; Lavender et al. 2014; Lenhardt et al. 1996; Lenhardt 1994; Martin et al. 2012; Moein 1994; O'Hara and Wilcox 1990) that overlaps with frequencies produced by pile driving and survey equipment (e.g., boomers, sparkers, airguns, sub-bottom profilers) that produce low-frequency impulsive sounds (BOEM 2018; Crocker and Fratantonio 2016). There are some laboratory studies showing some avoidance

responses to impulsive sounds (DeRuiter and Larbi Doukara 2012; McCauley et al. 2000; Moein 1995; O'Hara and Kania 1981)) as well as field observations suggesting behavioral and avoidance responses may occur. Recently, tags have been developed that can data log the received levels of sound received by a turtle and the associated behaviors during those exposures (Tyson et al. 2017). This study is designed to obtain acoustic and behavioral data from controlled exposure experiments to underwater noise. The current level of information is incomplete and inadequate to determine the relationship between exposure level and behavioral responses in sea turtles. Typically, loggerhead turtles are most commonly studied species due to their availability in high numbers, but opportunistic tagging of other species would also provide much needed information on inter-species variability. Field studies are needed to better understand the impacts to sea turtles that are otherwise not available. Behavioral data could be compared to controls and behavioral data from turtles from other tagging studies (Patel et al. 2016; Smolowitz et al. 2015) if the geographic areas are comparable.

Objectives: The overall purpose of the study is to determine the relationship between behavioral responses to impulsive underwater sounds and exposure level in sea turtles.

Methods: Sea turtles will be field-captured in coordination with the National Marine Fisheries Service and tagged with an audio and animal motion data logging tag. CFF will conduct the controlled exposures in the field. Tags will be used to record animal motion (e.g., position, speed, and depth) and sound exposure simultaneously. Animal motion will be logged under ambient ocean noise conditions and during controlled exposures to impulsive sound sources. The tagging response of turtles will be obtained under control conditions by focally following turtles and retrieval of the tag during single day deployments. A burn wire release and floatation system will allow the tag to be released at a specified time and a VHF beacon can be used to aid in recovery to ensure behavioral data obtained from the recovered tag. Impulsive sound sources below 2,000 Hz will be mobile source will be deployed from a vessel. Empirical data will be analyzed and variable responses of sea turtles determined for different exposure conditions (e.g., sound pressure level). A final report, sample .wav files, and video of representative study methods and field activities will be submitted to BOEM for scientific, educational, and outreach opportunities.

Specific Research Question(s):

1. How do sea turtles behaviorally respond to controlled exposures to impulsive sound sources?
2. How do sea turtles behaviorally respond to sound exposure at different sound pressure levels?
3. What is naturally occurring sea turtle behavior in the study area (this could vary significantly between different regions)?
4. What is the tagging response of sea turtles in the study area?

Current Status: Calibration of the sound source was completed in Summer 2022. COVID-related delays and the unusual absence of turtles in Cape Cod Bay resulted in no controlled exposures in 2022. Field work is underway for the summer/fall 2023.

Publications Completed: None

Affiliated WWW Sites: None

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