

Environmental Studies Program: Studies Development Plan | FY 2019–2021

Title	Fine-scale dive profiles and activity patterns of sea turtles in the Gulf of Mexico
Administered by	Marine Minerals Program
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Procurement Type(s)	Inter-agency Agreement
Approx. Cost	\$500 (in thousands) (The U. S. Geological Survey will contribute in-kind with a value of \$250,000)
Performance Period	FY 2019–2021
Date Revised	January 29, 2018
PICOC Summary	
<i>Problem</i>	Fine-scale information pertaining to sea turtle behavior in the Gulf Mexico is lacking. These data are needed to inform site specific management decisions.
<i>Intervention</i>	Acceleration data loggers (ADL) will be embedded with a depth-logging satellite tag and VHF transmitter. This package will be placed on sea turtles at select locations within the Gulf of Mexico and will provide fine scale behavior data at various portions of the water column.
<i>Comparison</i>	<ol style="list-style-type: none"> 1) Fine-scale data vs. course depth data collection, 2) Utilization of new ADL technology, 3) Behavior comparisons among seasons, and 4) Geographic/Habitat-based differences in behavior.
<i>Outcome</i>	This project will provide fine scale dive analyses to inform in-water aggregations of sub-adult, juvenile, and adult marine turtles in the Gulf of Mexico. Fine scale movement and habitat use patterns will directly inform BOEM on management strategies throughout its programs and support other on-going BOEM studies.
<i>Context</i>	Gulf of Mexico OCS and adjacent coastal waters

BOEM Information Need(s): Fine-scale information on dive profiles and activity patterns is lacking for sea turtles in Gulf of Mexico waters. BOEM needs detailed information on dive profiles and behavior of turtles in the water column, and availability correction factors for species abundance estimation. Combining fine scale dive information with genetic analyses, population demographics, health and foraging studies will allow BOEM to address information gaps as identified through National Environmental Policy Act (NEPA) and Endangered Species Act (ESA) Section 7 consultations. These data would be used to inform management decisions related to Protected Species monitoring, decommissioning activities, and significant sediment resource extraction operations particularly in relation to assessing dredging entrainment risk and sea turtle relocation trawling mitigations. This study will be conducted in collaboration with US Geological Survey (USGS) as they possess the expertise and permits required from NMFS to collect biological samples and tag turtles.

Background: Deployment of satellite tags capable of logging dive data on turtles captured in sea turtle relocation trawling projects is currently underway (BOEM/USGS Interagency Agreement M15PG00032). The current BOEM/USGS project is collecting a robust data set on habitat-use and dive profiles of both immature and mature endangered Kemp's ridleys and threatened loggerheads of both sexes. However, there is a need to go beyond the relatively coarse depth-bin data summaries provided by satellite tags and calculate fine-scale dive profiles and activity budgets especially at the sites of dredging operations, which pose risk to sea turtles through entrainment by hopper dredges. Despite the impressive body of research available on sea turtle movements, there is still little known about their fine-scale activities and behavior that would inform the efficacy of trawling mitigations and assess the potential risk of lethal entrainment during dredging operations. Acceleration data loggers (ADLs) can provide such fine-scale data, either directly from turtles upon recapture or by affixing a pop-off 'package' that can be retrieved at-sea after a defined period of time on the animal. In particular, ADLs provide a means for assessing turtle behavior at a much finer scale than dive data alone allowing scientists to empirically measure body movements and orientation. Acceleration data are especially informative when viewed in the context of other ADL-recorded data (depth and temperature) as well as locational data from simultaneously attached satellite tags. Depth-logging satellite tags can provide precise location data on individual movements and use of various portions of the water column. However, ADLs provide a means for assessing turtle behavior at a much finer scale than dive data alone, specifically allowing scientists to empirically measure body movements and orientation.

Objectives: Expand upon ongoing research leveraging sea turtle relocation trawling associated with hopper dredge operations and site specific contracted trawl operations to tag sea turtles. Data collected will provide fine scale diving information to inform management decisions related to trawling and hopper dredge operations, particularly when evaluating dredge entrainment risk. The results would link three BOEM projects by providing detailed information on dive profiles and behavior of turtles within the water column as well as establish aerial correction factors (ACFs) to support other BOEM information needs (e.g., GOMMAPPS).

Methods: Once a sea turtle is captured during trawling, a satellite tag and ADL packages will be deployed and set to record triaxial acceleration at 30 Hz, depth at 1 Hz, and temperature at 0.033 Hz. ADLs will be paired with VHF transmitters and SPOT tags. These tags would be secured in a hydrodynamic, custom-made syntactic foam float. The ADL package will be secured to a nylon mesh base using monofilament or plastic cable ties and a galvanic timed release. After a set period of time, the galvanic release will dissolve in seawater, releasing the ADL package and allowing it to float to the surface for recovery. Released tags will be detected using a hand-held VHF receiver and a PTT-finder, and then retrieved by vessel. These high-resolution data can be used to identify and quantify specific behaviors using fast-Fourier transforms, wavelet-analysis, and k-means clustering techniques.

Specific Research Question(s): This project will answer questions related to:

- (1) In-water aggregations of sub-adult, juvenile and adult marine turtles;

- (2) Determine fine scale movement and habitat use within the Northern Gulf of Mexico;
- (3) Provide supporting data and analysis for other ongoing BOEM studies.