Environmental Studies Program: Ongoing Study

Field	Study Information
Title	Fine-scale dive profiles and activity patterns of sea turtles in the Gulf of Mexico (MM-19-03)
Administered by	Marine Minerals Program
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Procurement Type(s)	Interagency Agreement
Conducting Organization(s)	USGS
Total BOEM Cost	$665,000
Performance Period	FY 2019–2024
Final Report Due	April 2024
Date Revised	February 1, 2024
Problem	The current BOEM/USGS project (BOEM/USGS Inter-Agency Agreement M15PG00032) is collecting a robust data set on 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 for these imperiled species, especially at the sites of dredging operations.
Intervention	Acceleration data loggers (ADLs) can provide such fine-scale data, either directly from turtles upon recapture or by affixing a popoff 'package' that can be retrieved at-sea after a defined period of time on the animal. Depth-logging satellite tags can provide precise location data on individual movements and information on their use of various portions of the water column.
Comparison	Despite the impressive body of research available on sea turtle movements, there is still little known about their fine-scale activities and behavior. 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.
Outcome	This project will provide fine scale dive analysis to inform on in-water aggregations of sub-adult, juvenile and adult marine turtles as well as determination of fine scale movement and habitat use which will directly inform BOEM on management strategies throughout its programs and support other on-going BOEM studies.
Context	Western and Central GOM planning areas.

BOEM Information Need(s): Fine-scale information on dive profiles and activity patterns is lacking for sea turtles in Gulf of Mexico waters. Such information can provide key data on time spent per individual in various portions of the water column, including surface and bottom times. 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 mitigation operations. The results from the proposed research will provide detailed information on dive profiles and behavior of turtles within the water column. This information can also be summarized to calculate availability correction factors (ACFs) for species abundance estimation efforts.

This study will be conducted in collaboration with US Geological Survey (USGS) to fulfill expertise and permitting needs 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 relocation trawling projects is currently underway (BOEM/USGS Inter-Agency 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. Despite the impressive body of research available on sea turtle movements, there is still little known about their fine-scale activities and behavior. 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.

These high-resolution data can be used to identify and quantify specific behaviors (e.g., various types of swimming behavior based on their flipper-beat frequency and amplitude, stalling/gliding, rolling, resting, etc.) using fast-Fourier transforms, wavelet-analysis, and k-means clustering techniques. This project will provide fine scale dive analysis allowing investigation of in-water aggregations of sub-adult, juvenile and adult marine turtles as well as determination of fine scale movement and habitat use within the Northern Gulf of Mexico which will directly inform BOEM on management strategies throughout its programs and support other on-going BOEM studies.

Objectives: Expand upon ongoing research utilizing hopper dredge relocation trawling operations to opportunistically tag sea turtles to include using an ADL data logger embedded in a float with both a satellite tag and a VHF transmitter. Together, these data provide fine scale diving information to inform management decisions related to trawling and dredge operations. 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 tri-axial 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.

Specific Research Question(s): N/A

1. How can high-resolution data be used to identify and quantify specific behaviors (e.g., various types of swimming behavior based on their flipper-beat frequency and amplitude, stalling/gliding, rolling, resting, etc.) using fast-Fourier transforms, wavelet-analysis, and k-means clustering techniques?
2. How can fine scale dive analyses improve our understanding of in-water aggregations of sub-adult, juvenile and adult marine turtles?
3. Can such analyses determine fine scale movement and habitat use within the Northern Gulf of Mexico?

Current Status: Field work in Ship Shoal, LA and Sabine Bank, TX is complete. In the summer of 2022, ten ADL popoff packages and satellite tags were deployed on sea turtles captured via trawling at Ship Shoal, LA, with recovery of nine popoff packages. In the summer of 20023 eight unique turtles were captured via trawling and seven popoff ADL packages were deployed and recovered in Sabine Bank, TX. A no cost extension is pending to extend this contract one year.

Publications Completed: None

Affiliated WWW Sites:

https://www.doi.gov/sites/doi.gov/files/uploads/newswave-spring-summer2020.pdf

References: None