

## Environmental Studies Program: Studies Development Plan | FY 2020–2022

Title	Data Gap: Shipwrecks in the Mesophotic Zone and Their Benthic Communities
Administered by	Gulf of Mexico OCS Region
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Procurement Type(s)	Cooperative Agreement; Possible National Oceanographic Partnership Program (NOPP) Candidate
Performance Period	FY 2020–2024
Date Revised	February 22, 2019
PICOC Summary	Write one or two sentences for each of the following elements, as appropriate.
<i>Problem</i>	The mesophotic zone (40–150 m) represents one of the biggest data gaps in marine science at BOEM. The Bureau has a clear need to characterize shipwrecks and their ecological role to develop proper management and avoidance strategies based upon ranges of archaeological site preservation and ecological community structure in a high-energy environment.
<i>Intervention</i>	Four to six shipwreck and hardbottom sites will be selected for archaeological and biological characterization, documentation, and mapping using photogrammetry. This will allow for proper recordation of entire shipwreck sites as well as sessile benthic organisms inhabiting them. Where possible, motile species information will be captured.
<i>Comparison</i>	Different hull types (wood, steel, etc.) will be represented in the study sites to identify variability in shipwreck condition, material distribution, and site formation. Comparison of sessile benthic assemblages among shipwreck sites and on nearby natural reef habitats will be examined to identify factors contributing to community structure and habitat suitability.
<i>Outcome</i>	Study results will contribute to resolving a significant data gap for mitigating archaeological sites in high-energy environments. Also, characterization of biological assemblages inhabiting the <i>de facto</i> hardbottom habitat will improve our understanding of mesophotic community diversity and distribution on the Outer Continental Shelf (OCS). Study results will inform adaptive management strategies and mitigations that consider both the ecological role of shipwrecks and their archaeological importance.
<i>Context</i>	Shipwrecks and hardbottom in the Gulf of Mexico, between 40–150 meters.

**BOEM Information Need(s):** With limited data on sites in the mesophotic zone, including site patterning and essential defining characteristics, archaeologists are left with inadequate data to determine if avoidance measures intended to mitigate impacts to historic shipwrecks employed in these water depths are sufficient. Current archaeological mitigations and avoidance criteria only take into account archaeological remains, and not the potential impacts to the associated biological community. Impacts to the biological community may alter the environmental equilibrium of the archaeological site, significantly affecting its rate of degradation, stability, and eligibility to the National Register of Historic Places (NRHP).

The default shipwreck avoidance scheme of 300 meters was developed to protect sites that have had little to no documented debris fields in low-energy environments like the deep sea. The mesophotic zone, by contrast, is a high-energy environment both in terms of storm-induced wave activity and currents, but also from the relatively high rate of industry activity, high density of pipelines (and their movement), marine minerals activities, and frequent anchor deployments from operations under BOEM purview. Similarly, there is a data gap of benthic communities in the mesophotic zone, an area important to the information needs of BOEM. The program needs to prioritize multi-disciplinary scientific observations in the mesophotic zone to ensure the Agency's current mitigation strategies are appropriate. This information will directly inform pre-lease and programmatic National Environmental Policy Act (NEPA) analysis and post-lease mitigation applications and provide mission-critical site modeling that will directly inform Gulf of Mexico operations as well as forthcoming Atlantic management regimes.

**Background:** Few direct observations have been made of shipwreck sites and benthic habitats in the mesophotic zone of the Gulf of Mexico. To date, research on shipwrecks in the Gulf of Mexico has primarily focused on sites either in depths accessible by divers (<40 meters) or by remotely operated vehicles (ROVs) in depths > 200 meters, leaving a significant data gap.

### **Objectives:**

- This study will document and map four to six potential shipwreck targets and hardbottom sites in the mesophotic zone in order to identify diagnostic features for archaeological analysis, variability in overall site condition, material distribution, and site formation.
- There are 175 potential sites in BOEM's databases identified with side scan sonar within the mesophotic zone. The protocols for the mapping task will allow for the characterization of sessile benthic communities, including spatial distribution relative to the available wreck substrate.
- Comparison of sessile benthic assemblages with those found on natural reef habitats in similar environments (region, water depth, *etc.*) will be examined to identify factors contributing to community structure and habitat suitability for observed species. Ideally, shipwreck site selection will include diverse vessel ages and types in a range of water depths for comparison.
- The final report will include management and avoidance recommendations based on these analyses.

**Methods:** The specific methodology to achieve the objectives of this research will be developed by the cooperative parties as an integral part of this research. The video transect methodologies developed for photogrammetry mapping in deepwater will be applied at this depth range with modification to account for sediment turbidity at and near the seafloor. Modeling will be performed by BOEM staff in-house. Three-dimensional (3-D) models of the sites and ortho-rectified mosaics will be generated for each of the sites utilizing ROV-acquired high-definition video. This has been

successfully accomplished at deep-water sites like the Blake Ridge Shipwreck, 15377, and the Monterrey Shipwrecks. These models and maps will be made available to the public and scientific community via BOEM's website.

**Specific Research Question(s):**

1. What is the variability of observable shipwreck debris scatter within varieties of site types, conditions, and depths in the mesophotic zone?
2. Is the shipwreck eligible for listing in the NRHP?
3. What benthic species inhabit shipwreck sites in the mesophotic zone? What is the relative abundance and distribution of constituent species?
4. How do community structures found on shipwrecks compare and contrast with those observed on nearby natural hardbottom habitats?

**References:**