

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

Title	Ecological Function and Recovery of Biological Communities within Sand Shoal Habitats within the Gulf of Mexico
Administered by	Headquarters/Gulf Region, Marine Minerals Program, Division of Environmental Sciences (Environmental Studies Program)
BOEM Contact(s)	Bridgette Duplantis, Bridgette.Duplantis@boem.gov
Procurement Type(s)	Cooperative Agreement
Performance Period	FY 2019–2021
Date Revised	January 29, 2018
PICOC Summary	
<i><u>Problem</u></i>	BOEM needs to observe prolonged biological, physical and chemical recovery of borrow areas located within Ship Shoal in order to understand the importance of dredged habitats to benthos, fish, and trophic structure/bioenergetics. Existing project-specific, post-construction monitoring is not of sufficient duration or temporal resolution to fully understand these sand complexes.
<i><u>Intervention</u></i>	This study proposes a collaborative effort to investigate the long-term recovery of benthic and fish communities following dredging sand resources within Ship Shoal in the Gulf of Mexico. Observations over an extended time frame will allow BOEM to identify the potential impacts of multiple sediment removal activities at Ship Shoal and determine the extent, nature, and process of disturbance and recovery.
<i><u>Comparison</u></i>	The duplication of the BOEM funded Canaveral Shoals study currently in progress (2013-2019) at Ship Shoal will expand our understanding of the recovery of sand shoals in different physical and biological environments. The study will include pre-disturbance and post-disturbance physical and biological sampling which will occur following a Before-After-Control-Impact (BACI) methodology.
<i><u>Outcome</u></i>	This study will deepen our understanding of the relationship of human disturbance to ecosystem services in offshore sand shoal habitats. Further, to determine if there are functional differences in borrow sites pre- and post-dredging by examining species distribution, diversity, habitat use, and population dynamics.
<i><u>Context</u></i>	The proposed study sites include the Ship Shoal borrow area and nearby control sites off Louisiana.

BOEM Information Need(s): This study proposes a new collaborative effort to investigate the long-term recovery of benthic and fish communities following dredging sand resources within Ship Shoal in the Gulf of Mexico. BOEM needs to observe prolonged biological, physical and chemical recovery of borrow areas located within Ship Shoal to understand the importance of dredged habitats to benthos, fish, and trophic structure/bioenergetics. Existing project-specific, post-construction monitoring is not of sufficient duration or temporal resolution to fully understand these sand complexes. Observations over an extended time frame will allow for BOEM to identify the potential impacts of multiple sediment removal activities at Ship Shoal and determine the extent, nature, and process of disturbance and recovery. Initial data from an ongoing project of this type off of Florida has led to some valuable information. This information on recovery is necessary for improved regional management of offshore habitat availability for prey and fish species.

This knowledge will improve effects analyses in National Environmental Policy Act (NEPA) documents and greatly focus and improve the outcomes of EFH consultations.

Background: The BOEM Marine Minerals Program is often involved with coastal restoration and construction projects that follow severe storms and accidental events such as Hurricane Katrina. Environmental monitoring may be a requirement for project proponents to access and use sand resources. However, because of the relative expense, monitoring is generally limited in scope and concluded within a year of project completion. Previous studies have indicated that the recovery time may be greater than 3 years particularly in borrow areas that are repetitively used, such as Ship Shoal (Byrnes, et al. 1999). In one of only two previous long term (5-10 years) studies, species composition in the borrow area still differed after 5 years (Turbeville and Marsh 1982). The benthic communities may exhibit biomass recovery within 3 months to 2.5 years, however their taxonomic composition can remain different for more than 3-5 years (Michel, et al. 2013). In the Fall of 2013, the MMP initiated a comprehensive borrow area recovery study on Canaveral Shoals, Florida (currently funded until Fall 2019). Since study initiation we have had some novel findings. For example, there are fewer residential fishes on cape-associated shoals than previous thought (i.e. spot and croaker). This information is extremely important when discussing the disturbance of a shoal and analysis of residential versus transient communities. This information is also critical for habitats dredged in regions such as the Gulf of Mexico. The duplication of the Canaveral Shoals study at Ship Shoal will expand our understanding of the recovery of sand shoals in different physical and biological environments.

Objectives: The objectives of this study are to examine the relationship of human disturbance to ecosystem services in offshore sand shoal habitats. Further, to determine if there are functional differences in borrow sites pre- and post-dredging by examining species distribution, diversity, habitat use, and population dynamics.

Methods: The proposed study sites include the Ship Shoal borrow area and nearby control sites off Louisiana. Pre-disturbance and post-disturbance physical and biological sampling will occur following a Before-After-Control-Impact (BACI) methodology. The methodological approach will match, as closely as possible, the sampling and analytical methods used in the ongoing Canaveral Shoals study for a three year period with consideration for longer term monitoring. BOEM has recently funded a new met-ocean permanent observation station in the vicinity of Ship Shoal that will provide important observations. A suite of data from previous monitoring is available including bathymetry, geological and geophysical data, fish and benthic assemblage data. Additional sampling regimes will include multibeam sonar, Acoustic Doppler Current Profiler (ADCP) wave/current measurements, sediment cores, benthic grabs, benthic community analysis, trawls, acoustic telemetry, seasonal and diel observations, gut content analysis, stable isotope analysis, etc. Data will be collected from different habitat settings at each site (side of shoal, shoal crest, shoal slipface, and offshore sites seaward and landward of the shoal sand body over multiple seasons during the day and night following a random stratified methodology. Observations will be analyzed via basic statistical procedures (e.g. determination of mean values, standard deviations, transformations of data, and comparisons of means) along with more complex statistical analyses and comparisons of community structure. These observations will also be integrated into an Ecosim model to assess the perturbation to the system.

Specific Research Question(s):

1. Are there functional differences between the borrow sites and control sites?
2. If so, do these differences correlate with biophysical differences (grain size, flow characteristics)?
3. What is the rate of recovery of benthic habitats and habitat use in a previously dredged borrow site on the OCS (to be examined through subsequent phases over a 7-10 year period)? And is this rate of recovery tied to any physical factors?
4. Do the reestablished sites fill the same trophic function as the original communities?
5. Are there regional differences in recovery (Gulf of Mexico vs Atlantic) and, if so, what is driving these differences?

References:

Byrnes, M. R., et al. Environmental Survey of Identified Sand Resource Areas Offshore Alabama: vol.I: Main Text, Vol.II: Appendices. OCS Report MMS 99-0052, U.S. Department of Interior Minerals Management Service, 1999.

Michel, J., A. C. Bejarano, C. H. Peterson, and C. Voss. Review of Biological and Biophysical Impacts from Dredging and Handling of Offshore Sand. OCS Report BOEM 2013-0119, Herndon, VA.: U.S. Department of Interior, Bureau of Ocean Energy Management, 2013.

Turbeville, D. B., and G. A. Marsh. Benthic Fauna of an Offshore Borrow Area in Broward County, Florida. Miscellaneous Report No. 82-1, U.S. Army Corps of Engineers Coastal Engineering Research Center, 1982.