Environmental Studies Program: Ongoing Study

Title	Impact of Non-linear Sedimentation on Dredge Area Benthic Ecosystem on Louisiana Shelf (GM-19-04-03)
Administered by	Gulf of Mexico OCS Region
BOEM Contact(s)	Barton Rogers (barton.rogers@boem.gov)
Procurement Type(s)	Cooperative Agreement
Conducting Organization(s)	Louisiana State University
Total BOEM Cost	$352,729
Performance Period	FY 2020–2023
Final Report Due	July 15, 2023
Date Revised	July 23, 2021
PICOC Summary	
Problem	BOEM makes decisions on the management of dredged, and surrounding areas, and thus needs more information on their evolution, potential impacts to infrastructure, and resources of concern.
Intervention	This study will use existing and new information to provide a new sedimentation, physical, biogeochemical, and benthic ecological understanding of mud-capped pits by using combined field observation, coring, data synthesis, and modeling methods.
Comparison	The overall goal of this study is to provide a comprehensive understanding of the contribution from non-linear sedimentation events (for this study, wave-supported fluid-mud) to dredged area infilling as well as its impacts on benthic ecology.
Outcome	Improved model resolution of dredged area infilling based upon non-linear events.
Context	The infilling of dredge pits in the northern GOM may be largely influenced by episodic effects such as high Mississippi River discharge in concert with large storm events.

BOEM Information Need(s): BOEM needs more information on wave-supported fluid muds from fluid-mud, wave, current, sediment, and other variables, as well as linear sedimentation rates associated with fluid-mud events. Additionally, BOEM needs information on sediment oxygen consumption, organic matter re-mineralization and nitrate, nitrogen dioxide, and ammonium when associated with fluid-mud events.

Background: Based on numerous studies, Nairn et al. (2005) proposed a conceptual diagram of dredged area infilling and margin erosion processes. However, a recent BOEM-supported observational study of the infilling rate reveals considerable discrepancy between model-predicted and observed values, which shed light on contributions from non-linear sedimentation processes such as those introduced by climate and weather events. In addition, ecosystem effects from sand dredging and the subsequent infilling has long been a focus of BOEM. For instance, three of the PIs (Drs. Xue, Xu, and Maiti) on this study are involved in an ongoing BOEM study aiming to understand the water quality and O^2 content in

the Caminada and Sandy Point dredging pits. However, the possible effect from non-linear sedimentary processes on either infilling or benthic ecology has never been addressed.

Objectives: Identify the effects of non-linear events on the infilling of OCS dredge areas, and describe the effects on benthic community composition, diversity, and production.

Methods: Collect the necessary geophysical data, sediment cores, and benthic fauna during summer months to build a reference for sediment and benthic ecology. Collect necessary sediment and benthic fauna at Raccoon Island Dredge Area and adjacent shelf waters in spring, fall, and winter, to capture effects of and recovery from fluid-mud events. Develop probability maps for wave-supported fluid-mud using the correlation among fluid-mud, wave, current, sediment, and other variables. Determine linear sedimentation rates associated with fluid-mud events. Quantify changes in sediment O^2 consumption, organic matter remineralization and NO^3, NO^2, NH^4 associated with fluid-mud events. Identify impacts of fluid-mud on benthic community composition using existing benthic ecological data/samples in the OCS region, benthic community composition data from the proposed study, and fluid-mud probability maps. Overlay fluid-mud distribution and benthic community composition maps with locations of dredge pits and oil/gas platforms to provide recommendations for BOEM's decision making (e.g., infilling rate, pit impact to surrounding benthic ecosystems, recovery trajectories, and monitoring recommendations).

Specific Research Question(s):

1. What are the effects on non-linear fluid-mud infill on benthic community composition using existing benthic ecological data/samples in the OCS region, benthic community composition data from the proposed study, and fluid-mud probability maps?
2. What are the impacts of both dredging and fluid-mud on the benthic community composition, diversity, and production, including changes over time and recovery from non-linear fluid-mud events?
3. What are the 3-dimesional fluid-mud relationships for the northern GOM shelf?

Current Status: The project is on track to be completed on schedule. This study started on July 16, 2020 and the kickoff meeting was held August 5, 2020. The goals, objectives, and study methodologies were presented at BOEM's Sand Management Working Group meeting on December 3, 2020. A data management plan coordination meeting was held on February 5, 2021 and the first semi-annual meeting was completed February 12, 2021 ahead of the first sampling cruise on March 12-14, 2021. The next cruise is planned for July 2021.

Publications Completed: None

Affiliated WWW Sites: None

References:

Nairn R, Johnson JA, Hardin D, Michel J. 2004. A biological and physical monitoring program to evaluate long-term impacts from sand dredging operations in the United States outer continental shelf. J Coastal Res. 20(1):126–137.

Nairn, RB, Lu Q, Langendyk, SK, Michel J. 2005. A study to address the Issue of seafloor stability and the impact on oil and gas infrastructure in the Gulf of Mexico. New Orleans (LA): U.S. Department of Interior, Minerals Management Service. 179 p. MMS 2005-043.