Broad-scale benthic habitat characterization of the 'Million Mound' province in the Southeast United States using submersibles, remotely operated vehicles, and AUVs

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Wiling to Attend Workshop? Yes

Target Names
Blake Plateau, Million Mounds, Stetson Banks, Savannah Banks

Geographic Areas of Interest within the North Atlantic Ocean
Southeast United States

Relevant Subject Areas
Geology, biology, habitat mapping

Description of Topic

One of the challenges for deep-sea exploration is the mismatch in coverage between acoustic surveys like multibeam, which can reveal very large areas of terrain, and visual surveys by AUV or ROV, which can reveal relatively small areas of the seafloor or water column. This white paper aims to address this challenge through a pilot study of coordinated, systematic explorations in the Million Mounds province, a large extent of mound features of the Southeast United States. The mound province lies within a marine protected area established by the South Atlantic Fishery Management Council in called the Coral Habitat Area of Particular Concern (C-HAPC, Fig 1). Previous observations, mostly from Johnson Sea-Link, along with a few dives on the most recent *Okeanos* cruise (EX1806) have verified that some of the mounds (those that were observed) are cold-water coral mounds. If the area is indeed covered in coral mounds, this would be one of the largest coral mound provinces in the world (E. Cordes, pers. comm.).

We propose to use multibeam data previously collected by the NOAA ship *Okeanos Explorer* (EX1403, EX1806) to guide a new series of systematic visual explorations by multiple assets. These coordinated explorations will yield a robust sample size of images and other data to permit extrapolation from small areas to larger areas. The pilot project will provide a case study and research design for broad scale habitat characterization, consistent with the goals of Seabed 2030. The proposal would deploy ROVs and AUVs in different ways, using a simple stratified, random design distributed over a large extent to determine whether there are gradients in coral cover and condition, such as latitudinal (north/south) gradients, related to mound orientation, or longitudinal (depth related, east/west) gradients in mound structure, coral cover, and associated species. This information would help to understand whether the mapped area is a more or less homogenous or heterogenous extent.

A second dilemma for broad scale habitat characterization is the choice of vehicle – ROV or AUV for a survey. AUVs can cover large areas, moving relatively quickly high over the bottom (~ 3 m), using down looking still cameras for visual samples. The video imagery collected with ROVs has more detail because it is typically closer to the bottom (~ 1-2 m), with forward-oblique and down-looking cameras. One solution is to use both of these platforms at the same time, and to deploy them simultaneously in a type of effort known as 'coordinated robotics' (Schmidt Ocean Institute, 2016). For example, two AUVs can fly parallel lines adjacent to an ROV transit line, at the same time, or offset in time. The end result would be a larger survey extent, and broader habitat characterization. If this effort were repeated in a systematic research design, the ability to characterize large areas would increase substantially.

Recent investigations have indicated that Coastal and Marine Ecological Classification Standard (CMECS) can be applied to image data to further enhance its value to the ocean research and management (Ruby, 2017; Etnoyer et al, 2018). CMECS is a comprehensive framework of common terminology developed for the classification of biological species, water column properties, and seafloor morphology as well as composition in all lacustrine and marine environments including the deep sea (Bassett et al, 2017). CMECS has been adopted by governmental agencies and other organizations since 2012. Because CMECS has seen wide adoption, annotating *Deep Discoverer* ROV video data and AUV imagery with CMECS compliant terminology would improve its accessibility and compatibility with other substrate classification approaches currently employed by the deep-sea research community. NOAA has developed image annotation tools (MADBAT) to codify data standards and an online data platform to share these data with the public. All imagery data from the proposed surveys would be codified using CMECS standards and distributed to the public through NOAA and BOEM websites.

References

Bassett, RD, M Finkbeiner, and PJ Etnoyer. 2017. Application of the Coastal and Marine Ecological Classification Standard (CMECS) to Deep-Sea Benthic Surveys in the Northeast Pacific: Lessons from Field Tests in 2015. NOAA Technical Memorandum NOS NCCOS 228, NOAA National Ocean Service, Charleston, SC 29412. 49 pp.

Etnoyer, PJ et al. (2018), Working with Video to Improve Deep-Sea Habitat Characterization, *Oceanography*, *31*:*1*, *Supp*, 64–67.

Ruby, C. (2017), Application of Coastal and Marine Ecological Classification Standard (CMECS) to remotely operated vehicle video data for enhanced geospatial analysis of deep sea environments. M.S. thesis, 266 pp., Mississippi State University.

Relevant Partnerships

NOAA National Centers for Environmental Information, Deep Sea Coral Research and Technology Program, NOAA National Centers for Coastal Ocean Science, Bureau of Ocean and Energy Management, DeepSEARCH

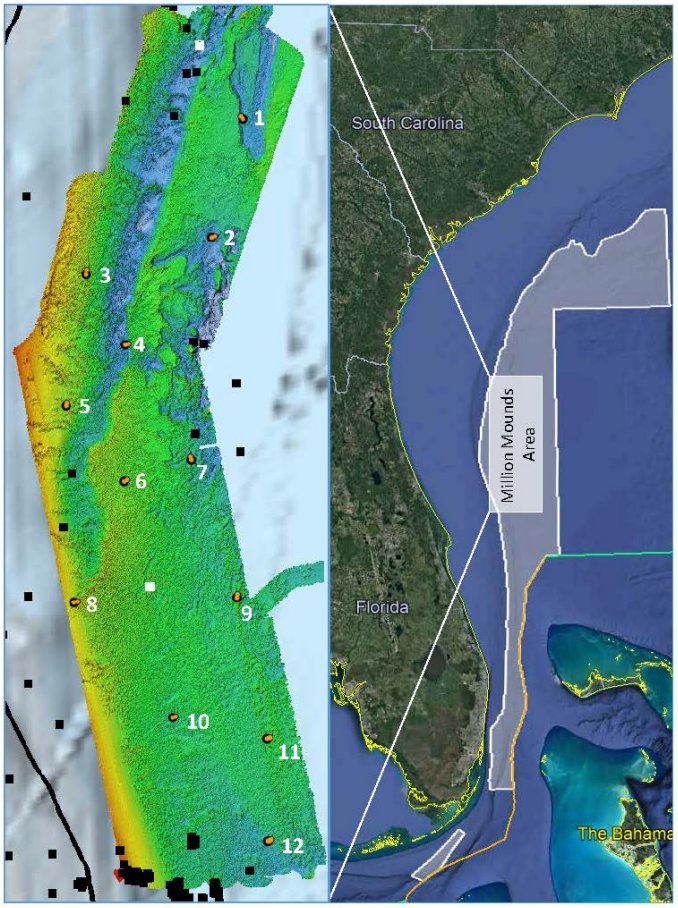

Figure 1: Location map of the Million Mounds province in the Southeast U.S. EEZ. The inset shows 30m resolution multibeam bathymetry collected by NOAA *Okeanos Explorer* during EX1403 and EX1806 expeditions. Black boxes represent the location of previous dives. White boxes represent the two ROV dives completed within the province during EX1806.

Proposed potential locations for future deep submergence dives are numbered 1-12 covering a diversity of depth, Gulf Stream current, and compass direction gradients. Dive site locations also sample a variety of geomorphological features (distinct mounds, ridge features, and mound/ridge complexes). Image created by Derek Sowers, NOAA OER.