

## Environmental Studies Program: Ongoing Study

Title	Data Synthesis and Advanced Predictive Modeling of Deep Coral and Hardbottom Habitats in the Southeast Atlantic: Guiding Efficient Discovery and Protection of Sensitive Benthic Areas (AT-16-10)
Administered by	GOM OCS Region
BOEM Contact(s)	Michelle Nannen ( <a href="mailto:michelle.nannen@boem.gov">michelle.nannen@boem.gov</a> )
Procurement Type(s)	Inter-agency Agreement
Conducting Organization(s)	The National Oceanographic and Atmospheric Administration (NOAA), National Ocean Service (NOS), National Centers for Coastal Ocean Science (NCCOS)
Total BOEM Cost	\$550,000
Performance Period	FY 2021–2022
Final Report Due	September 25, 2020
Date Revised	August 11, 2021
PICOC Summary	
<i><u>Problem</u></i>	Deepwater sensitive benthic biological habitats may be affected by potential OCS energy activities.
<i><u>Intervention</u></i>	This study aims to predict the distribution of deepwater sensitive benthic biological habitats in the Mid and South Atlantic OCS so that proper mitigations may be developed to prevent impacts to these habitats from potential OCS energy activities.
<i><u>Comparison</u></i>	Presence / absence data from existing datasets will be used to create a model that will predict the potential location of other deepwater benthic communities.
<i><u>Outcome</u></i>	The model will be used to predict potential locations of sensitive deepwater benthic communities for use in Atlantic OCS energy permitting and associated conditions of approval (i.e., distancing requirements for bottom disturbing activities) for that permit.
<i><u>Context</u></i>	The study's geographic location in the Mid and South Atlantic Planning Areas.

**BOEM Information Need(s):** Knowledge of the distribution of sensitive benthic biological habitats in deep water is necessary for management of potential energy development in the Atlantic region. Such information is needed to define mitigations and avoid impacts to sensitive benthic habitats such as hardbottom areas and coral communities. While the area south of Cape Hatteras contains some of the most substantial deepwater coral habitat in U.S. waters, the vast majority of this region remains unexplored and unmapped by modern acoustic or seismic techniques. Further work is required to locate and characterize sensitive benthic habitats to guide possible BOEM actions and assessments in this region. Yet, deep coral communities are patchy, and hardbottom habitats are rare, so unguided field exploration is risky, costly, and potentially ineffective. To efficiently and effectively map and explore sensitive benthic habitats over a region as vast as the Mid/South Atlantic OCS, it is necessary to develop the best possible predictive models of deepwater coral and hardbottom, and use those models to prioritize mapping and exploration. Improved models will result in better databases on known coral and hardbottom habitats, reduced cost and increased success of mapping/exploration, and comprehensive

region-wide maps of sensitive benthic habitats. Such baseline habitat information is an important focus for BOEM studies in the Mid and South Atlantic, informing Essential Fish Habitat consultations, development of mitigation measures for potential energy activities, and NEPA sections on benthic communities.

**Background:** A variety of sensitive deepwater habitats have been discovered in the Mid and South Atlantic OCS, including deepwater coral communities and hardbottom that support important demersal fish species such as the snapper-grouper complex. Numerous sites have been investigated in the recent past and are summarized in NOAA's Deep Sea Coral Research and Technology Program (DSCRTP) 2012 Report to Congress. Though the 2009-2011 DSCRTP effort was intensive in some areas (primarily off Florida) and documented unique and extensive coral/hardbottom habitats, this work left vast expanses of potential habitat from North Carolina to Georgia unexplored and unmapped. Recent predictive habitat modeling led by the NOAA National Centers for Coastal Ocean Science (NCCOS) used historical presence-only data to generate maps of potential deepwater coral habitat that have helped prioritize and guide field mapping and exploration efforts in the U.S. Atlantic and Gulf of Mexico. Although helpful, these first-generation presence-only models are limited in resolution and accuracy compared to improved models possible when modern, precisely geolocated data on presence-absence, abundance, density, size, diversity, and other data are available on benthic communities. Therefore, BOEM has engaged NCCOS to synthesize data and develop improved deepwater benthic models for the Gulf of Mexico (Project 'Deepwater Coral and Chemosynthetic Atlas and Modeling Program: Gulf of Mexico' which began in in FY15), and NOAA Fisheries has engaged NCCOS to develop similar model improvements for the Northeastern U.S. (Northeast Coral and Sponge Initiative, which began in FY13). To date, the Southeast (SE) US has lacked funding to move beyond presence-only models of deepwater coral and habitat to make more accurate, high-resolution predictions of probability, abundance, and quality of benthic habitat in that large and complex region. Currently, there are no planned efforts to improve the presence-only models for the SE, leaving a large gap in anticipated state-of-the art predictive maps of benthic communities. That gap coincides with BOEM's information needs in the Mid and South Atlantic OCS. BOEM and NOAA's interest in improving data syntheses and models to guide more efficient mapping and exploration, combined with the challenge of efficiently exploring the vast Mid and South Atlantic OCS, make this proposal timely and important for BOEM and NOAA information needs.

**Objectives:** The goal of this study is to produce region-wide high-resolution predictive spatial models and maps of the probability, abundance, density, and quality (e.g., locations of highly-developed, diverse, or extensive "hotspots" of coral and/or hardbottom that are especially sensitive and important). This objective will be achieved in three stages: 1) Review of all recent, precisely geolocated bottom imagery recording not just presence but absence, abundance, size, and diversity/complexity of deepwater coral and hardbottom communities. This will result in a major improvement over the currently available presence-only summaries of exploration efforts in the region. 2) Develop predictive models that use these new data types and newly available mapping and oceanographic data to more precisely predict important areas to map and explore for discovery of sensitive deepwater coral and hardbottom areas. 3) Incorporate anticipated new mapping and exploration efforts into updated models of coral and hardbottom to provide a comprehensive, ground-truthed regional picture of the distribution, extent, abundance, and relative importance/sensitivity of these habitats.

**Methods:** All available benthic imagery and related data, as well as new mapping and oceanographic data, will be reviewed and processed by experts at NCCOS's Deep Coral Ecology Lab, in collaboration with original data collectors, to build a database of precisely geolocated presence/absence, abundance,

size, and diversity/complexity data on deepwater coral and hardbottom communities. Using these newly available types of data, more advanced predictive models based on machine-learning algorithms (generalized additive models applied in the context of ensemble boosting) will be developed by spatial statisticians and benthic ecologists at NCCOS's Biogeography Branch. Models will be used to produce maps and GIS products, including measures of accuracy and certainty, that will be made available to guide exploration and mapping efforts as well as immediate decision-making needs. Anticipated collection of new mapping and exploration data will then be incorporated into models to both improve and ground-truth. The result will be a comprehensive, well validated region-wide map detailing characteristics of sensitive benthic habitats.

**Specific Research Question(s):** This study aims to predict the distribution of deepwater sensitive benthic biological habitats in the Mid and South Atlantic OCS so that proper mitigations may be developed to prevent impacts to these habitats from potential OCS energy activities.

**Current Status:** The inventory of existing datasets of deepwater coral and hardbottom presence and absence in the SE Atlantic has been completed and the datasets have been analyzed and annotated. The database has undergone QA/QC. A region-wide high-resolution predictive spatial model and maps for deepwater coral and hardbottom in the SE Atlantic has been created using this data and outputs from initial runs are being reviewed.

**Publications Completed:** None

**Affiliated WWW Sites:** <https://marinecadastre.gov/espis/#/search/study/100144>.

#### **References:**

- U.S. Department of Commerce. National Oceanographic and Atmospheric Administration. 2012. Deep Sea Coral Research and Technology Program 2012 Report to Congress. Internet website: [ftp://ftp.library.noaa.gov/noaa\\_documents.lib/NMFS/CRCP/Reports/deep-sea-corals\\_report-to-congress\\_2010-2011.pdf](ftp://ftp.library.noaa.gov/noaa_documents.lib/NMFS/CRCP/Reports/deep-sea-corals_report-to-congress_2010-2011.pdf).
- U.S. Department of Commerce. National Oceanographic and Atmospheric Administration. 2013. Northeast Deep Sea Coral and Sponge Initiative. Internet website: <https://deepseacoraldata.noaa.gov/fieldwork-studies/ne-fieldwork-fy13-15>.
- U.S. Department of the Interior. Bureau of Ocean Energy Management. 2014. Environmental Studies Program: Studies Development Plan FY 2015-2017. Deepwater Coral and Chemosynthetic Atlas and Modeling Program: Gulf of Mexico. Internet website: <https://www.boem.gov/GM-15-06/>.