

Technical Summary: NSL AT-16-10

Study Title NSL AT-16-10	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
Report Title	Data synthesis and predictive modeling of deep-sea coral and hardbottom habitats offshore of the Southeastern US: guiding efficient discovery and protection of sensitive benthic areas
Report Number(s) (OCS Study)	BOEM 2022-038
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Sponsoring OCS Region or Office	Gulf of Mexico
Applicable Planning Area(s)	Straits of Florida, South Atlantic, Mid-Atlantic
Fiscal Year(s) of Study Funding	FY 2016: \$165,000
Costs by Fiscal Year	FY 2016: \$165,000, FY 2017: \$170,000, FY2018: \$215,000, FY 2019: \$0, FY 2020: \$0, FY 2021: \$0
Cumulative Project Cost	\$550,000
Project Manager(s)	John Christensen
Affiliation of Project Manager(s)	US Department of Commerce, National Oceanic and Atmospheric Administration, National Ocean Service, National Centers for Coastal Ocean Science, Marine Spatial Ecology Division, Biogeography Branch
Address of Project Manager(s)	1305 East-West Hwy, SSMC-4, N/SCI-1, Silver Spring, MD 20910
Principal Investigator(s)	Matthew Poti, John Christensen
Keywords	benthic, invertebrates, deep-sea corals, cold-water corals, deepwater corals, hardbottom, continental shelf, continental slope, Atlantic margin, spatial predictive modeling, predictive habitat modeling, occupancy models

ABSTRACT: This study compiled records of the observed occurrence and developed models and maps of the predicted occurrence of deep-sea corals and hardbottom habitats offshore of the southeastern US. A database of presence-absence observations of deep-sea corals with associated measures of sampling effort and bottom type was compiled from 20 datasets containing data collected during underwater visual surveys conducted between 2001 and 2018. These observations were integrated with spatial environmental predictors depicting depth and seafloor topography, substrate, oceanography, and latitude-longitude in statistical models (occupancy models) to predict and map the occurrence of 24 taxa of deep-sea corals and hardbottom habitats across the study area. The maps identify areas where these organisms and habitats are more likely and less likely to occur. A map of predicted genus richness was produced for the 23 genera of deep-sea corals included in the study. Information from the presence-absence database

and maps of predicted occurrence and genus richness can inform and support environmental risk assessments, environmental impact statements, and other decision documents related to the review of proposed offshore energy development in the region.

BACKGROUND: The Bureau of Ocean Energy Management (BOEM) oversees the responsible development of offshore energy and mineral resources on the US Outer Continental Shelf (OCS). Offshore energy projects often include activities that may physically disturb the seafloor and could negatively affect benthic biota. BOEM identified a need for information on the spatial distributions of sensitive benthic habitats, including deep-sea corals and hardbottom areas capable of supporting diverse benthic communities, offshore of the southeastern US within the Atlantic OCS region. Many deep-sea corals form complex 3D structures that can increase local biodiversity by providing microhabitats for use by other species (e.g., fishes, crustaceans, echinoderms). Areas with exposed hardbottom provide available surface for attachment of sessile invertebrates like deep-sea corals and may also be associated with greater diversity and abundance of large fish on the continental shelf offshore of the southeastern US. Information on the spatial distributions of deep-sea corals and hardbottom habitats is needed to assess the potential impacts of activities that may disturb the seafloor and to develop mitigation measures to avoid or minimize these impacts.

OBJECTIVES: The study had two main objectives: (1) compile a database of presence-absence observations of deep-sea corals with associated measures of sampling effort and bottom type from available data collected by underwater visual surveys; (2) develop predictive models that relate the occurrence (presence-absence) of deep-sea corals and hardbottom habitats to spatial environmental predictors to predict and map their potential spatial distributions offshore of the southeastern US.

METHODS: A database of deep-sea coral occurrences (presence-absence) with associated measures of sampling effort (i.e., area observed by a survey segment) and bottom type was compiled from 20 available datasets containing data from underwater visual surveys conducted between 2001 and 2018. Spatially-explicit hierarchical occupancy models were used to relate records of deep-sea coral and hardbottom habitat occurrence from the database to spatial environmental predictors characterizing the seafloor, oceanography, and latitude-longitude of the study area to predict and map the estimated occurrence of 24 taxa of deep-sea corals and hardbottom habitats across the study area. The models attempted to account for imperfect detection and thus standardize estimates of occurrence across taxa. Variability in model predictions was mapped to provide a measure of the level of confidence in the model predictions.

RESULTS: Maps of the observed and predicted occurrence across the study area are presented for 24 taxa of deep-sea corals and for hardbottom habitats. A map of the predicted genus richness (i.e., the number of genera expected at each grid cell) is also presented. Corresponding maps of the coefficient of variation of model predictions provide a measure of the variability, or uncertainty, associated with the model predictions at each grid cell. Measures are presented to assess model fit and model performance for each taxon. Plots of the estimated detection and occupancy probability are presented to assess how well the models may have distinguished detection probability from occupancy probability. Plots of the marginal effects of each environmental predictor on the predicted occurrence for each taxon are also presented to examine potential relationships between the predicted occurrence and each individual environment predictor.

CONCLUSIONS: Multi-taxon occupancy models offer a novel framework for estimating the spatial distributions and biodiversity of deep-sea corals and hardbottom habitats using presence-absence data. The maps and data products developed for this study can be used to inform planning for ocean activities such as offshore energy development as well as to guide future visual surveys of deep-sea habitats by identifying priority areas for ground-truthing and for filling data gaps.

STUDY PRODUCT(S):

BOEM study report: Poti M, Goyert HF, Salgado EJ, Bassett R, Coyne M, Winship AJ, Etnoyer PJ, Hourigan TF, Coleman H, Christensen J. 2021. Data synthesis and predictive modeling of deep-sea coral and hardbottom habitats offshore of the southeastern US: guiding efficient discovery and protection of sensitive benthic areas. New Orleans (LA): US Department of the Interior, Bureau of Ocean Energy Management. 260 p. Report No.: BOEM 2022-038. Contract No.: M16PG00010.

MAP OF STUDY AREA: Figure 1 of the study report for OCS Study BOEM 2021-xxx.

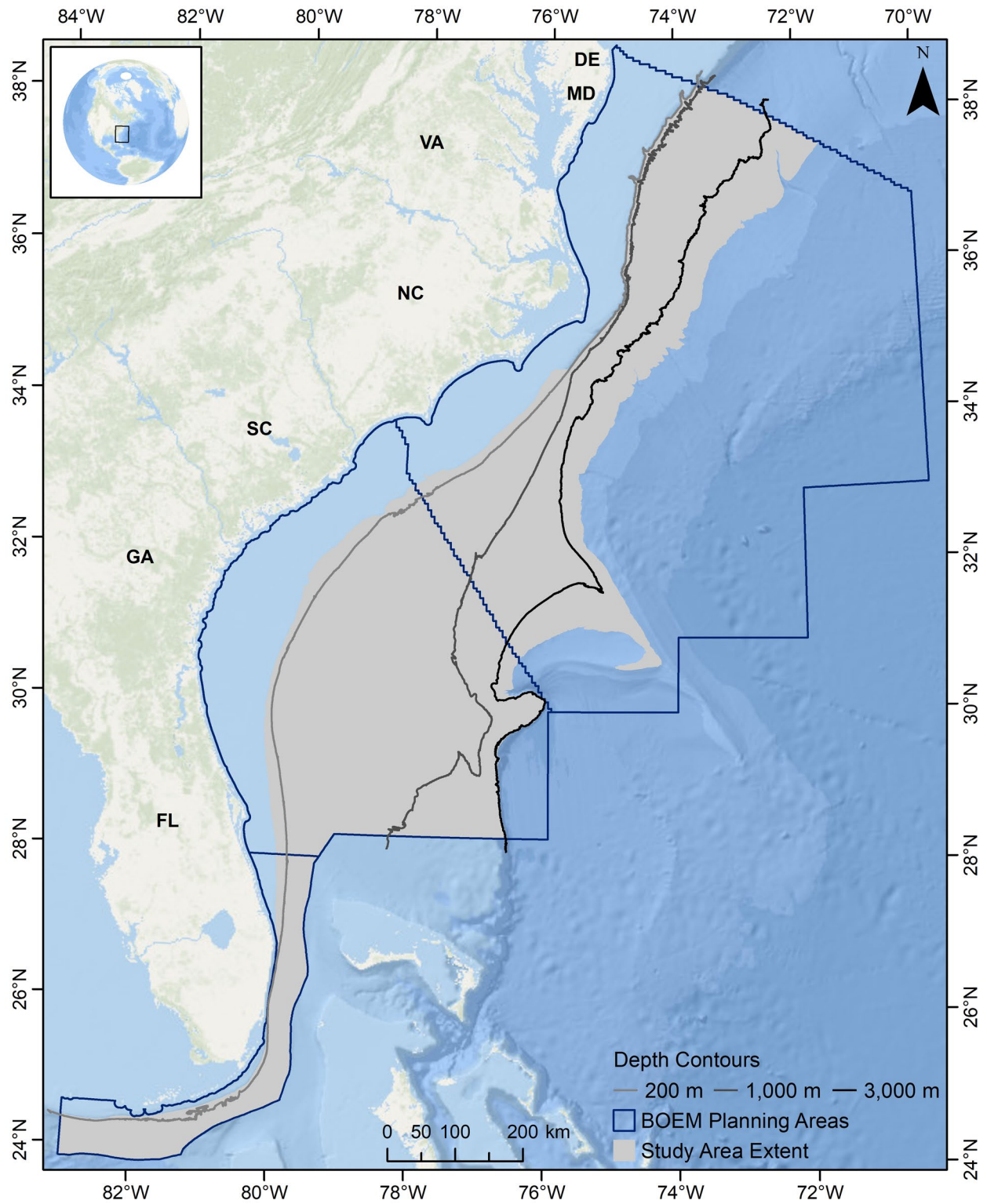


Figure 1. Study area.

The study area included waters from 50–3,500 m depth within the BOEM Straits of Florida, South Atlantic, and Mid-Atlantic Planning Areas.