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

Title	California Deepwater Investigations and Groundtruthing (Cal DIG) II
Administered by	Pacific OCS Region
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Procurement Type(s)	Inter-agency Agreement with USGS and/or NOAA
Approx. Cost	$1,250 (in thousands)
Performance Period	FY 2019–2022
Date Revised	March 2, 2018
PICOC Summary	
Problem	Seafloor habitats and the commercially important fish and invertebrates that utilize these habitats could be affected by leasing activities offshore California.
Intervention	The solution is to understand what types of habitats exist near potential BOEM activities and how fish and invertebrate species utilize these habitats based on correlations to selected species and abundances.
Comparison	We will select areas that give us the broadest range and variability in habitats that could exist within a geographic area relevant to BOEM renewable energy activities.
Outcome	Benthic communities and commercially important species will be identified and correlated with specific features, habitats, and environmental conditions.
Context	There are two potential domains: northern California OCS and south-central California OCS. One domain will be chosen by accessing data currently being collected, existing model outputs, and where the potential for leasing is highest.

BOEM Information Need(s): BOEM needs basic, regional data on the geology and biological community structure and use of the seafloor in many parts of the California OCS. The offshore of California has proven to be a region of competitive interest for the development of energy on the OCS. BOEM and the State of California are currently identifying potential lease areas after receiving notification of interest from several commercial companies for floating wind renewable energy development. The south-central area has been the primary target because an obsolete power plant at Morro Bay retains a connection to the California electrical grid. In addition, this area has been proposed as an area for new OCS oil and gas leasing, and currently has active oil production from OCS leases. Northern California is also of interest because it has the strongest wind resources in the state and a need for a local power source.

The seafloor in the two areas of potential development offshore California are focused on 300–1,100 m depths and contain seafloor areas which are valuable to commercial fisheries, unique coral and chemosynthetic seeps, and potentially other sensitive areas, which BOEM will need to consider in its decisions regarding leasing. Results from this study will provide a regional understanding of sensitive areas and use by selected fish and invertebrate species. That regional context is needed to evaluate future applicants'

site-specific surveys. This research will enhance understanding of the structure and function of significant biological communities and help BOEM define and delineate unique sea-floor areas offshore California. Biologically based habitat use and characterization information will aid both renewable and conventional energy needs through National Environmental Policy Act (NEPA) documents and supporting consultation and analysis requirements under the Magnuson-Stevens Fishery Conservation and Management Act, Endangered Species Act, and the National Historic Preservation Act.

Background: Fish associations with habitat, and specifically corals, give mixed responses dependent on species and locations (Tissot et al. 2006, Auster 2005, Hourigan et al. 2017). For much of the shelf off of California, this habitat has also been impacted by bottom trawling, with some of that area then conserved over ten years ago (Hixon and Tissot 2007, Lindholm et al. 2015). Few visual surveys are available for the proposed areas of interest. The Long Term Ecological Research project has supported and supplemented the longstanding California Cooperative Oceanic Fisheries Investigations surveys in the southern portion of the proposed area focusing offshore Point Conception on mid and surface water oceanography and biological sampling. Inshore, the State of California has supported video surveys to evaluate the effects of Marine Protected Areas (Ortiz and Tissot 2008; Starr et al. 2008). Surveys to the south and in National Marine Sanctuaries in the general bathymetric range of 300-1,000 m documented diverse and sensitive habitat types including statistically significant populations of high-relief hard bottom substrates, hard and soft deep-water corals (Greene et al. 2003), and canyon-wall areas with a high diversity habitats (Hixon, Tissot and Pearcy 1991). Fisheries landings and 300 m resolution soundings data suggest similar canyons and features that support corals and high diversity exist in the area of interest.

BOEM and the U.S. Geological Survey (USGS) initiated geophysical surveys in the area of south-central California (20−35 mi offshore, 500−1,200 m water depth). That effort will assess regional hazards and create habitat maps by collecting regional bathymetry (10 m resolution) and reflectivity of the seabed, as well as ground truth-related sampling. Cal DIG I data are necessary and will be used to direct subsequent biological surveys for this proposed study. To the north, USGS is collecting geophysical data that will be needed to select habitat type for visual transect surveys. The deep water environment offshore California is large and one cruise cannot yield the final answer to the question of seafloor use and ecology by commercially important fishes. However, the currently funded acquisition of sensor data, along with commitments to partner from USGS, NOAA, and MBARI make this the ideal time to define habitats and link those habitats with fish use and abundance, for an area that will inform BOEM decisions.

Objectives: The purpose of this study is to provide BOEM with a regional-level characterization and relative use of seafloor (benthic) habitats to selected fish and invertebrate communities in anticipation of commercial energy installations.

1) Identify and map major geologic features and habitats of the seafloor.

2) Identify the distribution and abundance of benthic communities and selected commercially important fish and invertebrate species, which could include areas of fish refugia, deep-water coral communities, chemosynthetic areas, and historic properties (shipwrecks).

3) Assess relative habitat use and sensitivity of selected areas by comparing food-web ecology, coral age-structure, and genetic diversity across depths and environmental gradients.

Methods: BOEM and the State of California management will prioritize from multiple target areas discovered in Cal DIG I or USGS current mapping surveys. Biological and limited physical sampling are planned focusing primarily on remotely operated vehicles (ROVs) capable of performing high-definition visual surveys of roughly 20 days at sea and sampling at depths of 300–1,100 m. Physical measurements at the seafloor will include temperature, bottom sediment type, grain size, and currents, if possible. Multiple survey transects will be conducted to quantify invertebrate and demersal fish assemblages with the surficial geology (Blanchard et al. 2008). The ROV or submersible will also collect limited samples of coral and sponge species for taxonomic, genetic identification, isotopic testing, and submission to the Smithsonian Institution under an existing BOEM Agreement. Invertebrates in soft-bottom areas will be collected by grabs to identify rare or unique species assemblages. To the extent possible, archaeological investigation(s) will be conducted on potential historic shipwrecks encountered during the Cal DIG I surveys. Shipwreck encounters are a possibility because this was, and is, a frequent route to San Francisco from points south.

Substantial work is anticipated to process, analyze, and interpret collected data. Video will be viewed multiple times to quantify biological species, unique seafloor features, and possible historic properties. Species will be identified to appropriate taxonomic units and analyzed using statistical and multivariate analyses. A subset of species groups will inform CMECs Biota mapping classifications and existing habitat suitability models to create geospatial maps. End products will include community and distribution analysis of invertebrates and fishes, geospatial maps of biological habitats across the whole region, and identification of unique seafloor features. The contractor will produce a final written report that summarizes the analysis and interpretation as well as provide associated maps and databases.

Specific Research Question(s):

1) What are the major features and habitats of the seafloor relative to OCS leasing areas?

2) How do benthic communities and selected commercially important fishes utilize the seafloor habitat?

3) What is the relative connectivity of selected sea-floor associated communities and start to assess their vulnerability to disturbance?

References:

Auster, P.J. 2005. Are deep-water corals important habitats for fishes? In A. Freiwald and J.M. Roberts (eds.), *Cold-Water Corals and Ecosystems*, Springer, p.747-760.

Blanchard, J.L., D.L. Maxwell, and S. Jennings. 2008. Power of monitoring surveys to detect abundance trends in depleted populations: the effects of density-dependent habitat use, patchiness, and climate change. *ICES Journal of Marine Science*, Volume 65, Issue 1, 1 January 2008, p.111–120.

Greene, H.G., J.J. Bizzarro, D.M. Erdey, H. Lopez, L. Murai, S. Watt, and J. Tilden. 2003. Essential fish habitat characterization and mapping of California continental margin. *Moss Landing Marine Laboratories Technical Publication Series No.* 2003-01, 29 p.

Hixon, M.A. and B.N. Tissot. 2007. Comparison of trawled vs. untrawled mud seafloor assemblages of fishes and macroinvertebrates at Coquille Bank, Oregon. J. Exp. Mar. Biol. Ecol. 344: 23-34.

Hixon, M.A., B.N. Tissot, and W.G. Pearcy. 1991. Fish assemblages of rocky banks of the Pacific northwest, Heceta, Coquille, and Daisy Banks. U.S. Department of the Interior, Minerals Management Service. OCS Study MMS 91-0052, 410 p.

Hourigan T.F., P.J. Etnoyer, and S.D. Cairns. 2017. The State of Deep-Sea Coral and Sponge Ecosystems of the United States. NOAA Technical Memorandum NMFS-OHC-4. Silver Spring, MD. 467 p.

Huff, D.D., M.M. Yoklavich, M.S. Love, D.L. Watters, F. Chai, and S.T. Lindley. 2013. Environmental factors that influence the distribution, size, and biotic relationships of the Christmas tree coral Antipathes dendrochristos in the Southern California Bight. *Marine Ecology Progress Series*, Vol. 494: 159-177.

Lindholm, J., M. Gleason., D. Kline, L. Clary, S. Rienecke, A. Cramer, and M.Los Huertos. 2015. Ecological effects of bottom trawling on the structural attributes of fish habitat in unconsolidated sediments along the central California outer continental shelf. *Fisheries Bulletin,* 113: 82-96.

Ortiz D. M. and B.N. Tissot. 2008. Ontogenetic patterns of habitat use by reef-fish in a Marine Protected Area network: a multi-scaled remote sensing and *in situ* approach. *Marine Ecology Progress Series,* Vol. 365 (August 18 2008), p.217-232.

Starr, R., M. Yoklavich, and B. Tissot. 2008. Monitoring MPAs in deep water off central California: 2007 IMPACT submersible baseline survey. *California Sea Grant College Program Publication* No. T-067. 21 p.

Tissot, B.N., M.M. Yoklavich, M.S. Love, K. York, and M. Amend. 2006. Benthic invertebrates that form habitat structures on deep banks off southern California, with special reference to deep sea coral. *Fisheries Bulletin,* 104:167-181.