Field	Study Information
Title	Benthic Habitat Mapping and Characterization in the Pacific Outer Continental Shelf Region (PC-26-03)
Administered by	Pacific OCS Region
BOEM Contact(s)	Jennifer Le (jennifer.le@boem.gov)
Procurement Type(s)	Interagency Agreement
Conducting Organization(s)	U.S. Geological Survey (USGS)
Total BOEM Cost	TBD
Performance Period	FY 2026–2028
Final Report Due	TBD
Date Revised	August 20, 2025
Problem	Collaborative field efforts among government agencies and others result in large amounts of multibeam mapping, underwater visual surveys, and sample collections. However, these data can remain uninterpreted and unusable.
Intervention	Perform benthic habitat characterization of existing mapping and ground-truth data using the Coastal and Marine Ecological Classification Standard (CMECS).
Comparison	This study would provide high-quality, reliable data to subject matter experts (SMEs) and decision-makers. It would also add value to BOEM investments in data collections.
Outcome	High-resolution benthic habitat maps, delineation of sensitive and/or unique habitats (as defined by BOEM).
Context	Pacific OCS Region, specifically Central and/or Western Pacific

BOEM Information Need(s): BOEM needs high-resolution benthic habitat characterization to inform environmental analyses at multiple stages of the mineral development process. The National Environmental Policy Act (NEPA) requires Federal agencies to use high-quality, reliable data and resources in their environmental documents. The same information is often helpful during consultations, such as those required under the Magnuson-Stevens Fishery Conservation and Management Act. Study results would provide high-resolution benthic habitat maps with existing mapping and ground-truth data. Accurate and contemporary information about seafloor geomorphology and substrate composition are necessary for potential offshore mineral development and associated environmental review documents. For example, impact analyses and mitigation measures consider sensitive and/or unique habitat within and adjacent to areas of potential effect. Additionally, there may be an opportunity to supplement the NOAA National Centers for Coastal & Ocean Sciences efforts, given those analyses are only as robust as the data layers of which they are comprised. This study is responsive to an FY25 stakeholder input letter that emphasizes the need to interpret the multitudes of data that have been collected but sit unused.

Background: Given recent directives, such as Executive Order (EO) 14285 (*Unleashing America's Offshore Critical Minerals and Resources*), EO 14154 (*Unleashing American Energy*), and Secretarial Order 3417 (*Addressing the National Energy Emergency*), U.S. government agencies are and have been collaborating on expeditions in the Central and Western Pacific where there is high potential for mineral deposits. These collaborative field efforts have resulted in large amounts of high-resolution multibeam echosounder (MBES) mapping, underwater visual surveys collected by remotely-operated and/or autonomous underwater vehicles (ROVs/AUVs), and sample collections in the Pacific Region. However, much of these high-quality data and information are not yet interpreted for use by SMEs and decision-makers.

MBES use active acoustics to ascertain ocean depth (bathymetry) and relative seafloor hardness (acoustic backscatter). These two components can be used to evaluate seafloor morphology and sediment composition. A third component of MBES data (water column data) can be indicative of chemosynthetic communities, e.g., by detecting rising methane gas bubbles from a seep. These acoustic data can generate abiotic, physical habitat maps, but are limited by resolution (tens of meters or more from ship-based MBES in the deep ocean) and complexities of ecosystem interactions. Environmental sampling data can be used to ground-truth acoustic maps, as well as characterize benthic habitats. Ground-truth data can include seabed imagery and physical samples (e.g., sediment cores) to determine surficial sediments and document benthic fauna.

CMECS is a method of defining ecological units in the marine environment with a standardized format and common terminology. The CMECS framework consists of two settings (biogeographic and aquatic) and four components (water column, geoform, substrate, and biotic) within which are a nested hierarchy of subcomponents and classes that define ecological units with increasing specificity. CMECS is flexible and scalable, with the ability to incorporate additional classification information as needed. It is the U.S. national standard and is endorsed by the Federal Geographic Data Committee.

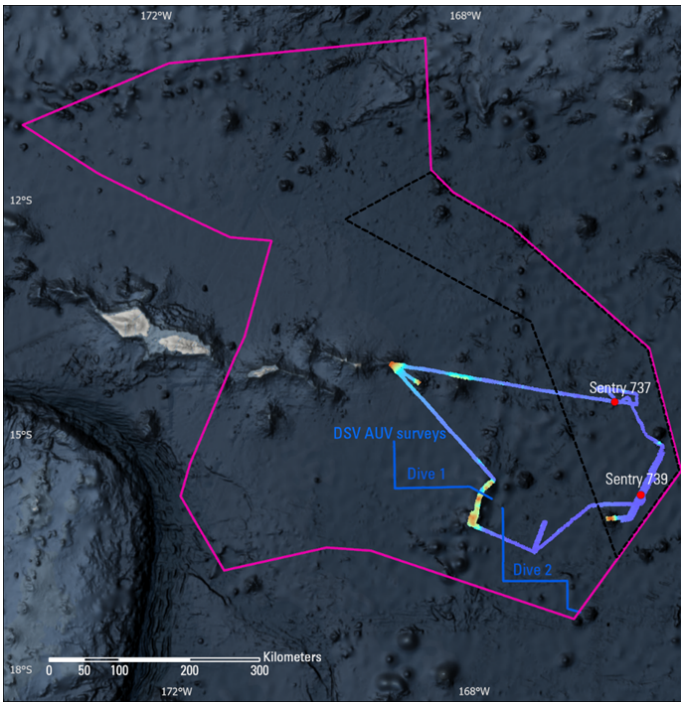
Previous BOEM studies have demonstrated the use of CMECS to derive spatially explicit benthic habitat maps from acoustic and ground-truth data. BOEM funded a CMECS study to characterize benthic habitats in the Gulf of Mexico (Benthic Community Characterization at BOEM "No Activity Zones" (GM-22-06)). In 2017, BOEM funded a multi-year collaborative study with USGS to assess seafloor character and map habitats in the vicinity of Morro Bay (Cochrane et al., 2022). The proposed study would employ CMECS classification for easy integration with other seafloor classification products that have been produced.

Objective(s): This study aims to:

- Assess potential benthic habitat using existing data with a geographic information system (GIS) and CMECS schema; and
- Delineate geoform, substrate, and (if possible) biotic components of the seafloor.

Methods: During Phase 1 of this study, USGS would evaluate geoform and substrate CMECS components from existing high-resolution multibeam data (bathymetry, backscatter), subbottom (if available), imagery and/or physical sample collections, and create geospatial data products (i.e., map layers) of these components. During the study timeline, additional datasets may become available for more detailed analyses. A possible Phase 2 of this study would supplement Phase 1 analysis with these additional datasets, which may include biotope assessment if it could be performed with statistical robustness.

Offshore American Samoa, the E/V *Nautilus* completed a mapping expedition with AUV *Sentry* in fall 2024 (Figure 1). There was also an AUV survey conducted in the region by Deep Sea Vison. Additional field efforts offshore American Samoa are planned for summer 2026 on NOAA Ship *Okeanos Explorer* and potentially fall 2026 on NOAA Ship *Ron Brown*. Although there is currently a dearth of ship-based MBES surveys offshore American Samoa, ship transit data could supplement preliminary assessment of seafloor geoforms to help refine target areas for further exploration; subsequent field efforts in this area would increase MBES survey density and contribute new data for additional analyses.



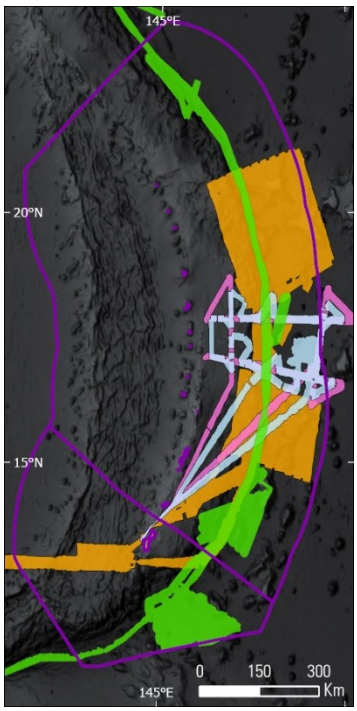


Figure 1. (Left) American Samoa EEZ and locations of 2024 survey efforts on E/V Nautilus (color bathymetry) and AUV Sentry, as well as AUV surveys by Deep Sea Vision. The BOEM RFI area is shown in black dotted outline.
Figure 2. (Right) Map of Guam and CNMI EEZs showing coverage of pre-existing multibeam survey footprints in areas of interest for minerals characterization.

Offshore Guam and the Commonwealth of the Northern Mariana Islands (CNMI), the E/V *Nautilus* completed an expedition with AUV *Orpheus* in spring 2025; there may be opportunity to revisit in summer 2026. Guam and CNMI have existing MBES survey data (e.g., PD20MT01, SU10-1, MGL1205, MGL1204) that could readily be used for the analyses proposed for this project (Figure 2). Expeditions are also planned for deep water areas south of Hawai'i (R/V *Kilo Moana* in fall 2025) and around Howland, Baker, and Wake Islands. BOEM would identify areas of interest within the Pacific OCS, such as priorities identified pursuant to EO 14285, in consultation with USGS to verify information needs and ensure data are available to perform analysis requested.

Specific Research Question(s):

1. What are the seafloor morphology and substrate composition in the target deep-water area(s)?
2. Is there evidence of sensitive and/or unique benthic habitats?
3. If so, what is the extent of the habitat?

Current Status: N/A

Publications Completed: N/A

Affiliated WWW Sites: N/A

References:

Cochrane GR, Kuhnz LA, Gilbane L, Dartnell P, Walton MAL, Paull CK. 2022. California Deepwater Investigations and Groundtruthing (Cal DIG) I, volume 3—Benthic habitat characterization offshore Morro Bay, California: U.S. Geological Survey Open-File Report 2022–1035, 18 p., https://doi.org/10.3133/ofr20221035

Cochrane, G.R., 2024, California State Waters Map Series—Benthic habitat characterization in the region offshore Humboldt Bay, California: U.S. Geological Survey Open-File Report 2024–1047, 16 p., https://doi.org/10.3133/ofr20241047