Field	Study Information
Title	Building an eDNA Catalog of Deep Sea Organisms from Existing and Opportunistic Samples (NT-26-04)
Administered by	Marine Minerals Program (MMP)
BOEM Contact(s)	Paul Knorr (paul.knorr@boem.gov)
Procurement Type(s)	Interagency Agreement
Conducting Organization(s)	Smithsonian Institution
TBD	TBD
Performance Period	FY 2026–2031
Final Report Due	2031
Date Revised	February 5, 2025
Problem	The remote deepwater environments associated with critical mineral deposits are not adequately explored or characterized.
Intervention	Understanding of the distribution and co-occurrence of organisms endemic to these inaccessible environments can be improved by applying innovative environmental DNA (e-DNA) methods to existing archival specimens, as well as newly gathered materials.
Comparison	The e-DNA analysis of diverse deep-sea organisms can be used to populate a genomic catalogue of organisms. Future water samples can subsequently be tested for the presence of e-DNA, which can be identified using the genomic catalogue.
Outcome	Develop a genomic catalog pertinent to deep sea environments.
Context	All Regions, including the Territories, typically with water depths > 200 meters.

BOEM Information Need(s): Mapping, exploration, and characterization of the remote deepwater environments containing critical mineral (CM) deposits such as polymetallic nodules, ferromanganese crusts, and seafloor massive sulfides are costly and time-consuming (Aptim, 2023). To assess the potential impact of BOEM-regulated CM exploration and exploitation activities (30 CFR 580, 30 CFR 581, 30 CFR 582) on these environments, BOEM needs to assess the presence, distribution, and ecological relationships of deep-sea biota in areas of interest to CM resource development, regardless of adequate funding or availability of suitable research vessels.

Background: An environmental DNA (e-DNA) reference set useful to environmental analyses of CM activities can be derived from physical DNA analysis of existing specimens of newly acquired specimens (e.g., collected during upcoming field campaigns), and from BOEM deep-sea specimens currently curated by the Smithsonian Institution. Analyzing existing specimens can provide a cost- effective method to acquire the aforementioned information. This project would analyze existing specimens, as well as new specimens, to build a genomic catalogue. Future projects may then compare e-DNA from water samples against the genomic database to more easily identify organisms associated with CM

deposits. The project will dovetail with other field efforts funded by ESP as well as MMP (e.g., nodules offshore Hawaii, sulfide deposits in Alaska's western Aleutians (MM21-04), nodules on the Atlantic Blake Plateau (MM24-02)).

Objective(s): Set up an IAA with Smithsonian to perform DNA analysis on the existing and new BOEM deep-sea biological specimens, use the analytical results of sequencing to build a genomic library, and provide access to the library through an existing repository (e.g., the National Institute of Standards and Technology Marine Environmental Specimen Bank).

Methods: Analytical specifics will be developed by the PI, but would include:

- identifying relevant specimen(s) or samples from existing collections, from both the Smithsonian and other entities
- extracting DNA from these specimens
- conducting high-throughput sequencing and analysis to generate and correlate genetic data
- compiling the results into a genomic database
- submitting the results to an appropriate repository accessible by the public
- statistical analysis of assemblage or community patterns (e.g., analysis of similarities or principal component analysis)

Specific Research Question(s):

- Can existing specimens be used to populate a genomic catalog that is useful to BOEM for managing CM resources?

Current Status: N/A

Publications Completed: N/A

Affiliated WWW Sites: N/A

References:

Aptim Federal Services, LLC (Tampa, FL). 2023. Resource Evaluation of Critical and Hard Offshore Mineral Programmatic Reference (RE-CHOMPR). Sterling (VA): U.S. Department of the Interior, Bureau of Ocean Energy Management. Contract No.: 140M0121D0006; Order No.:140M0122F0027.