Environmental Studies Program: Ongoing Study

Study Area(s): All Planning Areas

Administered By: Headquarters

Title: Continued Archiving of Outer Continental Shelf Invertebrates by the Smithsonian Institution National Museum of Natural History (NSL #NT-14-01)

BOEM Information Need(s) to be Addressed: Continued archiving and long-term reliable curating of the vast collections of invertebrate specimens acquired through BOEM-sponsored projects are essential elements of biological quality assurance. This effort provides BOEM with the scientific credibility important to stakeholders' acceptance of decision making in the Offshore Energy and Minerals Program and addresses the intent of Congress through U.S. Code Section 59 calling for all collections by parties for the Government of the United States, when no longer needed for investigations in progress, to be deposited in the National Museum. Genomic tissue samples from OCS marine organisms ensures scientific quality of genetic based identification techniques that may be the future for OCS biological research. This BOEM-funded sample archiving program was also prominently highlighted during congressional testimony (July 27, 2010[1]) as an invaluable baseline information resource related to the Deepwater Horizon spill event in the Gulf of Mexico.

Total BOEM Cost: $2,080,000 **Period of Performance:** FY 2014–2019

Conducting Organization(s): Smithsonian Institution

BOEM Contact(s): Gregory Boland (gregory.boland@boem.gov)

Description:

Background: BOEM conducts biological projects in all Regions, including the Gulf of Mexico, Pacific, Atlantic and Alaska, in support of decision making related to the development of offshore energy and mineral resources. These projects frequently result in large collections of invertebrate biological specimens. Taxonomy is a critical component to the ecological interpretation of biological data. Archiving of the collections provides for taxonomic verification and for the future use of the collections. Genetic techniques are increasingly being used for taxonomic determinations in cases where morphologically based differentiation is unreliable or impractical, such as the determination of species taxonomy for larval life stages that do not have distinct morphological features. In this case, a tissue bank for DNA analysis serves as the next generation archive for invertebrate samples. The Smithsonian Institution's National Museum of Natural History (NMNH) is the Nation's most reliable and respected repository for biological collections, and runs the world leading Biorepository facility for non-human tissue samples. Early in the history of the BOEM Environmental Studies Program (ESP), it was recognized that extensive biological samples collected during BOEM environmental studies were invaluable to the relevant studies, but also to science in general. Since 1979, invertebrate specimens collected through the ESP have been

carefully maintained through the NMNH's archiving standards and made available to taxonomists around the world. This long-term archiving project has been described by senior NMNH staff as "a part of the fabric of invertebrate zoology." These ESP collections represent one of the most extensive collections of marine organisms from U.S. continental shelves and slopes in the facility, in terms of both geographic coverage and number of groups represented. Over the last 30 years, more than 220,000 specimen lots have been curated by the Smithsonian from a total of more than 350,000 lots received. Specimens from BOEM studies represent more than 20 percent of the total Smithsonian database, and in some species groups, BOEM samples represent the majority of the museum's collections. To date, over 400 species new to science have been identified in the BOEM collections. Recent and upcoming studies in the Pacific, Atlantic and Alaska will greatly increase the input of specimens for archival in the near future.

Genomic tissue samples are beginning to be added to the Biorepository facility concurrent with invertebrate specimen submissions from BOEM studies. However, a new focus with this study is a new genomic tissue sample collection goal to aggressively pursue a representative genomic tissue sample repository for all OCS marine organisms. This new collections focus will forge the way for future OCS research efforts that use genetic based specimen and environmental sample identification.

Objectives: The objectives of the study are to:

- Provide quality assurance for biological data generated through the BOEM Environmental Studies Program and the credibility of offshore energy and mineral resources decision-making.
- Preserve Federally-funded biological samples (including tissue genetics) and provide for their availability for scientific study into the future.
- Acquire genetic tissue samples representative of marine species from the BOEM OCS for preservation and future genetic research, using the NMNH Biorepository facility.

Methods: To accomplish the objectives of this project, it is required that contractors communicate with the NMNH to establish the specifications for the handling, storage, and shipping of invertebrate specimens collected through BOEM environmental studies within applicable contracts. These specifications were developed in coordination with the Smithsonian Institution to provide contractors with information required to ensure that the collected specimens are delivered to the NMNH in the best possible condition. The Smithsonian accepts the specimens, checks the condition of the samples and taxonomic identification, and makes them part of the national collections. Archiving of samples includes acquisition, administration, cataloging and curation, sorting and confirmation of identification. The collections are then maintained according to the strict guidelines of the NMNH and are made available to other researchers. Continuing recent initiatives, legacy samples from the Gulf of Mexico dating back to the mid to late 1800s will continue to be cataloged as appropriate. Also, utilization of the new NMNH tissue archival Biorepository will continue to be utilized where appropriate for all new biological collections. Continuing focus on the backlog of previously received samples

will be a priority, as well as continued efforts to incorporate collections from past studies, some located at academic institutions and others at the California Academy of Sciences.

The dedicated NMNH independent website for collections from BOEM-funded projects will be continued under this funding. This resource includes extensive information about individual project locations, dates, station data, and links to BOEM final reports. It also includes direct links to the online catalog database where individual records and images of specimens can be retrieved. Quarterly and annual reports from the NMNH to BOEM provide updates on the numbers of specimens accessioned into the NMNH collections, those remaining to be accessioned, and those on loan to taxonomists around the world.

Actively search for and acquire genomic tissue samples from marine organisms collected in the OCS that have been adequately curated and preserved for genomic analysis. The searching may focus on the literature of marine genetic scientific research, which may help identify laboratories and repositories where large numbers of tissue samples or tissue samples of marine organisms of particular interest may be acquired. Secure agreements for submitted genomic tissue samples to the NMNH Biorepository facility for long term preservation. The acquisitions will be strategic to meet genomic tissue sample collection goals, focusing on batch transfers of whole collections or splitting of existing samples from reputable sources. Maintain links to publications, other collections holdings, and genetic information for each genomic tissue sample. Develop strategy and share information NMNH Biorepository genomic tissue samples in collaboration with the Global Genome Biodiversity Network.

Current Status: The program has operated continuously for 38 years beginning in 1979. The current 2014–2019 contract has taken a more active role in expanding efforts to include specimen and tissue archiving from nation-wide recent and new BOEM studies. New emphasis has been directed to genomic tissue sample collection.

Final Report Due: Quarterly and Annual Reports are submitted to BOEM during each of the five contract years, but not published. Specimen archiving data and curation is posted to the web site and database on an ongoing basis (see web pages below).

Publications Completed:

Posters:

History of BOEM and NMNH-IZ Collaboration
http://invertebrates.si.edu/boem/reports/BOEM_History_full.pdf

Importance of Archived Programmatic Collections
http://invertebrates.si.edu/boem/reports/BOEM_Collections_full.pdf

Map of BOEM Collection Sites
http://invertebrates.si.edu/boem/reports/BOEM_Map_full.pdf

Affiliated WWW Sites:

https://marinecadastre.gov/espis/#/search/study/100073

http://invertebrates.si.edu/boem/boem.htm

Launch of BOEM Maps: A geospatial tour of 40 years of collections

Revised Date: June 14, 2017