BOEM ENVIRONMENTAL STUDIES PROGRAM: ONGOING STUDIES

Region: Gulf of Mexico, OCS

Title: Gulf SERPENT: Continuing and Expanding a Deepwater Biological Observation System in the Northern Gulf of Mexico (GM-09-01-16)

Planning Area(s): Gulf wide

Total Cost: $261,267 **Period of Performance:** FY 2013-2016

Conducting Organization: Coastal Marine Institute, Louisiana State University

BOEM Contact: Dave Moran

Description:

Background: The pelagic waters seaward of the 200 m isobath remain a poorly studied region of the oceans in general and the Gulf of Mexico in particular. Oceanographic expeditions largely depend upon research vessels and the number of suitable ships in the UNOLS (University-National Oceanographic Laboratory System) fleet is limited. At best we are capable of gaining brief access to these regions for periods of a few days. Studying organisms in the water column or on the bottom frequently utilizes remotely operated vehicles (ROV's) or manned submersibles. The factor constraining access to these environments is primarily the cost of mounting research cruises to these areas and the general paucity of available manned and unmanned submersibles to investigate these deep regions of our oceans. Thus the principal obstacle to furthering biological oceanographic research in the deepwater regions is one of access to capable ships and ROV systems.

Deepwater drilling and production operations usually employ industrial ROV systems. These commercially produced ROV's are sophisticated vehicles capable of operating to depths of over 1000 m while equipped with manipulator arms, cameras, lights and other sensors (e.g. temperature, pressure, current velocity). The number of industrial ROV systems in operation by the petroleum industry far eclipses the handful operated by the academic fleet. Moreover, these systems are located on semisubmersible rigs and drillships that remain in one location for months at a time. Unlike the oceanographic community, deepwater energy exploration provides the potential for extended access to poorly studied regions of the ocean combined with appropriate ROV systems for deep sea exploration. Having appropriate ROV systems in place at locations of interest is of little scientific value if there is not time for them to conduct research.

The concept of using some of the operational standby time of industrial ROV's for scientific research was the genesis of the SERPENT project (**S**cientific **E**nvironmental **R**OV **P**artnership using **E**xisting I**n**dustrial **T**echnology) (http://www.serpentproject.com/) based at the National Oceanographic Institute in Southampton, UK. SERPENT works to bring scientists and industrial partners together to explore the oceans with ROV's and other industrial technology.

There are SERPENT Project partnerships in operation at almost all the major deepwater exploration and production centers around the world.

Objectives: The new phase of Gulf SERPENT (2013-2016) will expand its research to include benthic megafauna as well as water column macro/megaplankton and micronekton/nekton. For both water column and benthos, the project is designed to determine: (10 what organisms are present; (2) their depth distributions; (3) geographic distribution; (4) their relative abundances; and (5) seasonality.

Methods/Analyses: Gulf SEWRPENT is different because it does not require the presence of biological oceanographers during the majority of data collection. Industrial personnel conduct surveys and collect data. This reduces the cost of the project to both BOEM and industry while actively involving ROV personnel in data collection. At the onset of operations at each deepwater site, we send one or two personnel out to the vessel to familiarize HSE, drilling/subsea, and ROV personnel with the goals and operation of the project. ROV pilots are trained in conducting Gulf SERPENT surveys and in the recognition of marine organisms of interest. A repeat visit is scheduled following crew-change to ensure that all ROV personnel assigned to that system are familiar with the project. Once the training has been conducted, ROV pilots undertake surveys on a regular, time-available basis and the data are sent back to LSU for analysis. Follow-on trips by LSU personnel are only required when there is a change in personnel offshore or if we detect issues with the quality of data being collected.

Water column surveys consist of a series of horizontal transects flown at depths ranging from 150 m to the seabed at vertical intervals of 150 m. Surveys are flown into the prevailing current for 10 minutes flying at constant altitude, heading, and velocity. Lighting is on at standard settings (determined during initial site visits) and the color camera is aimed straight ahead. Video data are recorded to DVD or HDD (depending on the type of system). At the end of each transect, the ROV turns back to the cage or TMS and attempts to get good quality close-up images of representative organisms to assist with taxonomic identification.

Relative abundance can be calculated as numbers min^{-1}. Observations are sorted into short clips for each type of organism encountered and they are stored along with the metadata associated with each observation. However, numerical density (numbers m^2) cannot be determined in the absence of quantitative information about the dimensions of the field of view. With current technology that would require a high-powered laser system to be integrated into the ROV's electronics, which would not be feasible for most of the sites.

The design of seafloor surveys employs 24 100 m-long transects in a radial design with three parallel transect in six directions offset by bearing s of 30 degrees. This design can be completed in less than 6 h. The width of the field of view can be computed from information about the camera's angular field of view or with a pair of scaling lasers. The design can test the hypothesis that there are differences in abundance as a function of direction from a blow-out preventer.

Products: Taxonomically (preliminarily) identified digital images of all deep water forms observed yearly including locations and depth of collection will be obtained. BOEM has the

right to use and reproduce these photographs freely without any copyrights providing GulfSERPENT, LSU, and the contracting oil company are named in the photo credit.

Quarterly reports on the progress of the project will be submitted.

A final report including all organisms, photographs and locations (maps) of organisms collected (including depth) at the end of the funding period will be submitted.

The presentation of results at all ITM (Information Transfer Meetings) that occur within the agreement period will be made.

Importance to BOEM: The BOEM will obtain information that will fill a large data gap for mid-water and water bottom deep-sea animals in the Gulf of Mexico. This would be a good start in our understanding of mid-water, demersal, and benthic biology of the deep Gulf. The resulting data will be valuable for National Environmental Policy Act documents including lease sale Environmental Impact Statements. The stakeholders of the Gulf of Mexico Region (the States of Texas and Louisiana, and the industry) will benefit through increased knowledge of a little known portion of the Gulf of Mexico, the deepwater pelagic, demersal, and benthic region. Also, information regarding the colonization of deepwater surfaces by organisms including corals will provide significant information regarding the deepwater artificial reef effect. Many more structures will be decommissioned in coming years and significantly more in deepwater.

Current Status: Awarded.

Final Report Due: February 29, 2016

Publications: None

Affiliated WWW Sites: BOEM Website: SERPENT Spotlight

International website: http://www.serpentproject.ocm/

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