

BOEM ENVIRONMENTAL STUDIES PROGRAM: ONGOING STUDIES

BOEM OCS Region: [Gulf of Mexico](#)

Planning Area: Gulfwide

Title: Gulf SERPENT: Establishing a Deepwater Plankton Observation System Using Industrial ROV's (GM-92-42-133)

Total Cost: \$351,939

Period of Performance: FY 2008-2013

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. While the time budgets of industrial ROV's vary by site and stage of the drilling process, experience working with the operators of these systems suggests that on average, approximately 40 percent of the time, the ROV's are operational, but not otherwise tasked in support of drilling.

The concept of using some of the operational standby time of industrial ROV's for scientific research was the genesis of the SERPENT project (Scientific Environmental ROV Partnership using Existing Industrial Technology) (<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 primary objective of this project is to establish a biological observatory network in the deepwater region of the northern Gulf of Mexico. This network will employ industrial Remotely Operated Vehicles (ROV's) to conduct regular video surveys of planktonic and nektonic organisms. Establishment of this network will provide a seasonal picture of the pelagic biodiversity in the deepwater region. The project will be linked with SERPENT* in-order to provide public outreach with Marine Advanced Technologies for Education (MATE) and LSU providing research experiences for undergraduate education. A secondary objective of the study is to document the settlement of hard and soft coral species and other epifauna on the deepwater platforms. This objective will be undertaken by adding ROV video examinations of the subsurface of the deepwater structures.

Methods: The total number of sites that are contributing data at any one time will likely fluctuate but a total of 10-15 locations are anticipated by the end of the first year. Several sampling methodologies have been developed:

Post-Riser Inspection Surveys - Surveys conducted when the ROV is available after work that has taken it to depth. An example of this would be after a riser inspection or inspection of the BOP. These surveys are designed to collect video of marine organisms between the bottom and surface. These surveys consist of a series of horizontal surveys at regular depths.

Dedicated Surveys - These are deployments of the ROV specifically to collect video data on organisms in the water-column. Such surveys can be conducted whenever the system is available but not otherwise tasked, and the ROV operators have time. During daytime, the best approach is to begin at 1000 feet and conduct horizontal transects at 500' intervals down to the bottom. At night they can begin at 100 feet and horizontal transects can be collected at 200' intervals down to about 1500 feet. At each depth interval, these surveys are the same as for the ascent surveys.

Opportunistic Surveys - Observation of marine life while conducting other work operations. For example: while conducting a riser inspection, you observe a jellyfish swimming near the riser. If time and operations permit, please record at least a minute of video of the organism including close-ups when practical. One easy way to accumulate these chance encounters is to label and keep a "Marine Life DVD" in the second burner and to record directly to the DVD whenever you encounter an animal during routine work operations. Information on the event can be annotated in the attached "Chance

Encounter” video log. Opportunistic surveys have proved to be particularly fruitful in terms of discoveries of new organisms and range extensions of known taxa.

Documentation of Colonization by Deepwater Corals - The general approach will be to conduct regular (monthly) observations of fixed structures associated with the platform, for which a datum of establishment can be determined. These structures will be surveyed with the ROV and any developing fouling organisms will be videotaped at close range. Such structures may include, but are not limited to, the subsea portions of the floating facility, anchor cables or tension legs, and bottom-mounted production equipment or the riser. Where feasible, settlement plates will be attached or suspended beneath selected facilities to document the recruitment of coralline species.

All video observations will be screened and separated into short clips, each containing a single species. These video data are archived to hard disks and DVDs. Still images from video clips are extracted. The date, time, location, and depth of the observation along with any other metadata such as water temperature are combined with a preliminary identification of the organism on to a standard data sheet used by the SERPENT Project. Detailed identifications result when the video clips are sent to individuals with particular taxonomic expertise on certain groups of organisms. Once organisms have been identified, representative video clips, stills and data are sent to the Serpent Project site for archiving and public dissemination. Once a sufficiently large number of observations of individual taxa can be accumulated, distributional patterns will be compiled based on depth, temperature, and geographic location. Using such an approach, this project will assemble a database of where and when planktonic organisms occur over a large region of the deepwater exploration and production zone in the Gulf of Mexico.

Products: Reports, imaging products, archived data sets, and peer-reviewed scientific publications.

Importance to BOEM: The BOEM will obtain information that will fill a large data gap for mid-water deep-sea animals in the Gulf of Mexico. This would be a good start in our understanding of mid-water biology of the deep Gulf. A recent EPA requirement for studies to assess the potential impacts of cooling water for power generation systems requires estimates of the relative abundances of organisms in the water column likely to be impacted by entrainment in cooling water intakes at offshore production and exploration facilities. This study will provide baseline data that could be used to assess such impacts. The resulting data will also 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 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.

Status: Awarded. Three years of observations completed. Identification posters in

preparation. A Gulf SERPENT highlights video was produced in 2009. A new high-resolution camera has been installed on an ROV. Industry vehicles have largely been busy with other duties in the past year but have begun to resume normal operations.

Interim Report Due: September 2010

Final Report Due: September 2013

Publications: Benfield, M.C., J.H. Caruso, and K.J. Sulak. 2009. [In situ observations of two manefishes \(Perciformes: Caristiidae\) in the mesopelagic zone of the northern Gulf of Mexico](#). Copeia 2009: 637-641.

[SERPENT Annual Report 2008](#)

Curry, R. A., Jones, D. O. B., Gates, A. R., Benfield, M. and Thompson, M., June 2009.

Benfield, M.C., B.A. Thompson, and J.H. Caruso. 2008. The second report of a sleeper shark (*Somniosus* (*Somniosus*) sp.) from the bathypelagic waters of the northern Gulf of Mexico. Bulletin of Marine Science 82(2):195-198.

Benfield, M.C. 2007. SERPENT: industry and academia team-up to explore marine life in the Gulf of Mexico deepwater region. Marine Technology Reporter, September 2007, 50:7, 28-37.

Gates, A.R., Jones, D.O.B., Benfield, M., Kaariainen, J.I. (2008) SERPENT Cruise Reports 2007. National Oceanography Centre, Southampton Cruise Reports Series No. 30. 158pp.

Affiliated WWW Sites: BOEM website: [SERPENT Spotlight](#)

International website: <http://www.serpentproject.com/>

[Slide Show](#)

BBC video: [Oar fish](#)

YouTube video: [Oar fish](#)

BBC video: [Mane fish](#)

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