

BOEM ENVIRONMENTAL STUDIES PROGRAM: ONGOING STUDIES

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

Planning Area: Central and Western

Title: Exploration and Research of Northern Gulf of Mexico Deepwater Natural and Artificial Hard Bottom Habitats with Emphasis on Coral Communities: Reefs, Rigs and Wrecks (GM 08-03)

Total Cost:
\$4,388,421.00

Period of Performance: FY 2008-2012

Conducting Organization: TDI Brooks International Inc.

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Description:

Background: It is well known that there are many locations with significant areas of hard bottom in the deep Gulf of Mexico (GOM), particularly associated with faulting above the tops of salt diapirs. These hard bottom areas are in virtually all cases, created through biogenic precipitation of carbonate by chemosynthetic bacteria. Carbonate deposits can subsequently become exposed above surrounding slope sediments providing substantial substrate for attached animal communities to develop. These areas are well represented on 3D seismic surface amplitude anomaly geophysical maps used during the biological review process of potential impacts from proposed drilling operations or pipeline installations. Recent in-house analysis of industry 3D seismic seabed amplitude anomaly data has resulted in approximately 8,000 separate features that likely represent exposed carbonate hard bottom. An initial study has demonstrated the presence of numerous deepwater coral communities in the deep GOM but information is lacking for informed decisions regarding distribution and sensitivity to impacts.

The previous *Lophelia* deepwater coral study, *Characterization of Northern Gulf of Mexico Deepwater Hard Bottom Communities with Emphasis on Lophelia Coral* (Continental Shelf Associates, [MMS 2007-044](#)) was an important step in gaining knowledge of previously unknown sensitive biological features in the deep Gulf of Mexico. This study and final report is now available on the BOEM internet site linked above. Deepwater corals have become an increasingly significant habitat and area of study throughout the world with both intrinsic and socio-economic value.

Significant unanswered questions and new directions have become evident from the results of the initial study. Focused studies and process-oriented research are necessary to further develop an understanding of the distribution of deep coral habitats. Of particular significance is determining the probability of where high-density coral communities will be found on exposed hard bottom substrate. These objectives are a

part of this new study awarded in July of 2008.

As an additional aspect of hard bottom habitat, this new study has been expanded to include artificial reefs created by both oil and gas structures in deepwater as well as shipwrecks. Initially, a separate study named *Deepwater Artificial Reef Effect (DARE) II* (a follow up to the WWII shipwreck study; [MMS 2007-015](#)) was scheduled for a single year's field work to look at older deepwater platforms. This study now merges the DARE II objectives with the *Lophelia* II study that was been deferred from 2007 procurement to 2008.

It is generally accepted that artificial reefs can serve a positive function by the creation of new hard bottom habitats in areas where hard bottom is naturally lacking (most of the GOM). In the case of fish, artificial reefs can act both as attraction devices and as new habitats where new fish biomass is created and exported, meaning production. The fouling community growing on new hard bottoms provided by artificial substrate is unquestionably new production for those organisms that require hard substrate. The trophic linkages between the flux of organic material to deepwater fouling communities and potentially related fish communities are not well understood.

There are now numerous industry-related structures at water depths below 1,000 ft in the Gulf. Examples of extraordinary solid platforms include the Cognac and Bullwinkle platforms in 1,023 and 1,353 ft of water respectively. Bullwinkle has now been in place for 20 years and Cognac for 30 years. A third structure, the Pompano platform at a water depth of 1,430 ft in block VK 989 has already been documented to have *Lophelia* coral growth on parts of its structure and it was only nine years old at the time of those observations. In Green Canyon Block 184, an EA has already been completed for the removal of the Gulf's first tension leg platform at a water depth of 1,762 ft. The operator, ConocoPhillips requested that they be allowed to leave the massive template on the seabed. There is a good possibility that this structure is colonized by deepwater corals that are known to exist at the nearby chemosynthetic community Bush Hill in GC 185.

In the near future, decisions will be required for the removal of structures located in water depths beyond the continental shelf. Current guidelines outlined in 30 CFR Part 250.1728 allow the BOEM Regional Supervisor to approve alternate plans for removal of structures when the water depth is greater than 2,624 ft (800 m). Options for removal at shallower depths have previously relied on the concept that the structure left behind would serve as a positive fisheries enhancement or other beneficial environmental function. The BOEM now has a direct need for information that will help describe any significant ecological role (if any) that man-made structures may have in deepwater of the GOM. The completed study "*Archaeological and Biological Analysis of World War II Shipwrecks in the Gulf of Mexico: Artificial Reef Effect in Deepwater*" ([MMS 2007-015](#)) first approached this subject. This project looked specifically at older man-made structures represented by shipwrecks. Remarkable discoveries were made on some of the shipwrecks investigated during this project. One wreck was particularly significant, the *Gulfpenn* sunk in 1942, which provided a known recruitment time of 62 years. Numerous large colonies of *Lophelia* coral were discovered growing on the wreck

located at a depth of 1,820 ft.

Additional unexplored shipwreck sites were also added to this study as an additional stand-alone aspect. While some wreck sites have known extensive developments of deepwater coral, other unknown wreck sites determined from remote sensing will be visited for the first time. These other wrecks may have significant biological communities, but could also have national heritage importance. Their investigation has historically been difficult to accomplish as an independent project.

Objectives: The purpose of this study is to focus on remaining questions that will define environmental conditions that result in the observed distribution of significant high-density hard bottom communities that are sensitive to impacts from oil and gas development activities (especially extensive areas of *Lophelia* coral). The use of artificial reefs of all kinds including platforms and shipwrecks (man-made hard bottom) will be utilized to enhance the understanding of variables controlling zoogeography. The additional objectives of this combined study will be to further explore the basic question, “Do man-made artificial structures function as artificial reefs in deep water?” Additional objectives also include the investigation of previously unexplored shipwrecks of the deep Gulf as well as returning to previously visited WWII wrecks to recover ongoing experiments and obtain additional images and samples for genetic analysis.

Methods: Similar to the previous *Lophelia* I study, this project requires the use of submergence facilities, in this case, a remotely operated vehicle (ROV) rather than a submersible. Some complimentary elements of this project will also be conducted by investigators from various USGS locations resulting in cost sharing benefits for many investigators and broader approaches to additional ecological disciplines. This project is sponsored by the National Oceanographic Partnership Program (NOPP) and partnering with the National Oceanic and Atmospheric Administration’s Office of Ocean Exploration and Research (NOAA OER) for cost sharing of submergence and research vessel facilities used for most of the field sampling years.

Products: Written reports and maps detailing the distribution of observed deep-water hard bottom communities with special emphasis on coral communities, analyses of collected samples, synthesis of resulting data sets, and recommendations. Predictive methodologies will be proposed for evaluating the potential sensitive nature of hard bottom on the continental slope in other areas. Study results will include the evaluation of current mitigations and avoidance of chemosynthetic communities and consider typical avoidance of hard bottom areas appearing on 3D seismic surface anomaly geophysical maps.

Importance to BOEM: Sensitive biological features other than chemosynthetic communities in deep water are just beginning to be addressed by BOEM. There is still little known about the complexity and distribution of hard bottom communities in the deep Gulf that are not directly related to chemosynthetic communities.

Current Status: Field work for the project began 5 September 2008 with the first leg on the NOAA ship *Nancy Foster* leaving Galveston Texas. This leg was primarily dedicated

to the exploration of unknown shipwreck sites. The first unknown site visited turned out to be a remarkable discovery of a copper-clad sailing schooner likely dating to the early 1800's. The hull of the ship was exposed above the bottom as well as its intact copper sheathing. Another wreck site visited was confirmed to be the *Gulfoil*, a tanker that was sunk by a German U-boat during World War II in 1942. Similar to the *Gulfpenn*, another tanker sunk during WWII not far away and sunk just three days earlier; it was also covered with dense thickets of the deepwater coral *Lophelia*. This cruise leg had to take shelter in Pensacola due to Hurricane Ike but returned offshore for some additional work until two days before the second leg began on September 20. Luckily, the scheduled port of return was Gulfport Mississippi rather than Galveston. The second leg is dedicated to exploration and sampling of both known deepwater coral habitats as well as new unexplored hard bottom sites. This leg has had good success including the observation of a very large black coral tree at one site estimated to be at least 500 years old and over 5 feet tall at a depth of about 980 feet.

Separately funded collaborative cruises with the U.S. Geological Survey immediately followed the return of the second leg of the BOEM/USGS project. USGS did a variety of companion studies including the use of benthic landers and trawls using the same NOAA research vessel *Nancy Foster* at several of the same sites as well as a visit to a deep coral site in the eastern Gulf. This interagency collaboration will greatly enhance the overall success of both projects through sample and data exchange.

The second year of field work took place during two different cruises. The first cruise utilized the unique autonomous underwater vehicle (AUV) *Sentry* operated by the Woods Hole Oceanographic Institution. This cruise was dedicated to reconnaissance of a variety of stations, both natural hard bottom and archeology sites in order to focus future efforts using more expensive ships and ROVs. This cruise between 17 June and 1 July was also very successful. The *Sentry* AUV accomplished numerous remote sensing surveys as well as photo mosaics. One shipwreck was especially notable at a depth of over 7,000 feet, the deepest wreck site known in the Gulf of Mexico. The next cruise between 19 August and 12 September utilized the NOAA ship *Ron Brown* and the world-class ROV *Jason II* also from Woods Hole (both facilities provided by NOAA OER). The cruise mobilized in Key West Florida and also included stations located in the eastern Gulf and along the steep Florida Escarpment. During this 25-day cruise, a total of ten new sites were explored during twenty-one *Jason* dives looking for the occurrence of deepwater coral as well as to make collections for a variety of studies including genetic analyses and coral experiments in the laboratory. The NOAA Ocean Explorer web site listed below contains extensive details and imagery from this cruise.

An interim project planning meeting was held in Shepherdstown West Virginia February 17 and 18, 2010 to evaluate the status of the project thus far as well as plan for the final field sampling work later in 2010. Collaborating scientists from the U.S. Geological Survey also presented their results and plans for the completion of their project components. One additional cruise is planned for October 2010, also using the NOAA ship *Ron Brown* and the ROV *Jason II*. Additional work on deepwater platforms is also in the planning stages.

A third year of field work and the fourth cruise took place between October 14 and November 4 2010, again utilizing the exceptionally qualified NOAA research vessel *Ron Brown* and the Woods Hole ROV *Jason II* and again provided by NOAA Ocean Exploration and Research. A cruise report has not yet been completed, but the cruise was very successful. Although the project began long before the Deepwater Horizon oil spill, it has taken on a great deal of significance since that spill. Many of the stations investigated in this study were located within 20-30 miles of the Macando well in block MC 252. These provided exceptional baseline stations to revisit and look for impacts to deep coral habitats that were located directly below the oil on the surface of the gulf of Mexico for months.

A new site was chosen in close proximity (7 miles SW) to the Macando well to investigate potential impacts to hard bottom communities related to the accident. On the last day of the cruise, this site was visited using the *Jason II* ROV and a number of gorgonian corals were observed with dead or dying tissue. Final analysis results from samples of tissue and sediment are not yet available but will be published in a scientific journal as soon as possible. Details of the entire cruise and this final day of sampling are described on the NOAA Ocean Explorer site listed in the web sites below.

There is a continued possibility of extending the field sampling portion of this study into an additional year, 2012. Budget availability is in place from both NOAA OER and BOEM for field sampling of corals deepwater platforms. This aspect was one of the study components that was not logistically possible to accomplish using the NOAA vessels in 2009 and 2010.

Final deliverables will include a 20 minute educational video based in Google Oceans. A number of video clips from the project can also currently be viewed on YouTube by searching the term 'Lophelia II.'

Final Report Due: July 2012 (may be delayed if extra cruise occurs)

Publications: Wolff, Susan . 2008. Investigating Deepwater Reefs, Rigs and Wrecks – Biodiversity Hotspots. *Ocean News and Technology*, 15(5):38-39

Affiliated WWW Sites: <http://oceanexplorer.noaa.gov/explorations/08lophelia/welcome.html>
<http://oceanexplorer.noaa.gov/explorations/09lophelia/welcome.html>
<http://oceanexplorer.noaa.gov/explorations/10lophelia/welcome.html>

Link to companion Lophelia II-related deepwater coral studies conducted by USGS:
<http://fl.biology.usgs.gov/DISCOVRE/index.html>

Revised date: December 2011

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