

DEEPWATER PROGRAM: THE ARCHAEOLOGICAL AND BIOLOGICAL ANALYSIS OF WORLD WAR II SHIPWRECKS IN THE GULF OF MEXICO: A PILOT STUDY OF THE ARTIFICIAL REEF EFFECT IN DEEPWATER

The Archaeological and Biological Analysis of World War II Shipwrecks in the Gulf of Mexico: A Pilot Study of the Artificial Reef Effect in Deep Water.

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This study is intended to approach one basic question: do man-made artificial structures or objects, *i.e.*, shipwrecks, function as artificial reefs in deepwater? Although there is not yet a complete understanding of how artificial reefs function on the continental shelf, particularly in the photic zone above 100 m, it is generally accepted that artificial reefs can serve a positive function by the creation of new hard bottom habitat in areas where hard bottom is naturally lacking (most of the Gulf of Mexico). In the case of fish, artificial reefs can act both as attraction devices and as new habitat where new fish biomass is created and exported, meaning production. The fouling community growing on new hard bottom provided by artificial substrate is unquestionably new production for those organisms that require hard substrate. Although artificial structures alone do not add food or nutrients to the marine environment, the biofouling community may be very efficient in stripping both nutrients and suspended material from passing water and plankton and building a high standing stock community. The trophic linkages between the flux of organic material to deepwater fouling communities and potentially related fish communities have not been investigated. The ideal laboratory for this study exists in the Gulf of Mexico where 56 ships were sunk by German submarines during World War II, most within a few months of each other in 1942. Seven of these vessels, located during oil and gas surveys, were selected for this study because they represent a range of depths (from 400 feet to over 6,500 feet) and carried a variety of cargoes. In addition to the biological characterizations that will be conducted at each site, the vessels will be documented and studied as historic sites for nomination to the National Register of Historic Places. Click [here](#) for a two page color brochure of project.

Number of years: 2

Total Proposed Budget: \$350,000

Table of Partners:

MMS Gulf of Mexico Region	Governmental	Project management, contract inspection
NOAA Ocean Exploration	Governmental	18 days of research vessel time and remote operated vehicle
C&C Technologies	Industrial	Project coordination, development, validation, and production of products. Archaeological and historical research
University of West Florida	Academic	Marine Vertebrates
Dauphin Island Sea Lab	Academic	Deep sea corals
Droycon Bioconcepts	Industry	Microbiology
University of Alaska Fairbanks	Academic	Marine Invertebrates
The Past Foundation	NGO	Video documentary and internet production



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Partners for Research

The Minerals Management Service (MMS), in partnership with NOAA's Office of Ocean Exploration (OE) awarded a contract to C&C Technologies, Inc. to investigate the long-term effect of man-made structures on the deep-sea, and conversely, the effect of the environment on those structures. The contract was awarded under the auspices of the National Oceanographic Partnership Program (NOPP), with MMS providing \$350,000 towards research costs and OE providing 18 days of ship time, a deep submergence Remotely Operated Vehicle (ROV), and personnel for both.

In the Gulf of Mexico converting offshore oil and gas structures into artificial reefs on the continental shelf has been accepted as a benefit to fisheries; a total of 49 structures have been converted from a total of 383 structure removals between 1999 and June 2002. However, in the deeper waters beyond the shelf, additional information is needed as to the significance of a deep-sea artificial reef effect.

An Ideal Laboratory

The Gulf is an ideal laboratory for the study of the long term ecological role of man-made structures in deep water because of the presence of a number of steel-hulled ships that were casualties of World War II. Following the entry



Interior of the conning tower of the WWII German submarine U-166.

of the United States into the war in June 1941, American shipping was no longer exempt from attack and, on May 4, 1942, the 2,862-ton freighter *Norlindo* was sunk in the Gulf of Mexico. Another ship went down nearly every day in May. Twenty-four U-boats patrolled in the Gulf of Mexico between April 1942 and December 1943, sinking 56 ships and damaging 14. The Gulf represents one of the greatest concentrations of Allied vessels lost to German U-boats anywhere in the world. These casualties include oil tankers, cargo vessels, passenger ships, and fishing boats.

Partners in Deep Sea Research

- C&C Technologies, Inc.
- Droycon Bioconcepts
- Dauphin Island Sea Lab
- University of Alaska Fairbanks
- University of West Florida
- The PAST Foundation

Eighteen casualties of war subsequently have been located on the seafloor by the oil and gas industry as a result of remote sensing surveys required by MMS prior to exploration and development. Seven of these ships have been discovered on the approach to the Mississippi River off the coast of Louisiana in water depths ranging from 328 feet to 6,500 feet. Because of the range of water depths, representing different ecological niches, and the fact that all of the vessels were sunk within a few months of one another, they represent a unique opportunity to study the "artificial reef effect" in differing depths over the course of 60 years.

Research Methods

The study has two separate, but equally important objectives: an archaeological and historical objective and a biological objective. The archaeological objective is to document these seven wreck sites as historic properties that are significant to American history. The biological component of this study will approach one basic question, "*do man-made artificial structures or objects, i.e., shipwrecks, function*

as artificial reefs in deepwater?" which can be examined in terms of four major goals:

- Characterize the environment at each site and determine the biological effects of the shipwreck at selected sites.
- Determine the extent of physical and biological modification of sediments through the activity of microbes in the immediate vicinity of the wreck sites compared to sediment conditions distant from the sites.
- Document the spatial homogeneity of concretions and other biofouling communities on the wreck.
- Evaluate motile fish and invertebrate associations with the microbially-induced concretions, hard pans, and any other growth forms.



A team of biologists will study the "rusticles" that consume steel shipwrecks in deep water. Rusticles are the by-products of microbes that seem to thrive on iron and are slowly destroying such wrecks as the RMS *Titanic*.

An International Team of Scientists

The prime contractor for this study is C&C Technologies of Lafayette, Louisiana. C&C Technologies, a leader in the field of marine geophysical surveys, is also responsible for the discovery of many of the wrecks while under contract to the oil and gas industry and which are now the subject of this study. Most recently they were awarded a research grant from OE to conduct archaeological investigations at the site of the German submarine U-166, the fieldwork

for which was completed in October 2003. The present study will build on this successful project by adding additional sites and additional biological investigations. C&C will be joined by a team of world renowned scientists in the fields of microbiology and marine invertebrate and vertebrates. These include Dr. Roy Cullimore of Droycon Bioconcepts, whose previous research includes microbial analyses of the *Titanic* and the *Bismarck*. Dr. Cullimore is joined by Dr. William Schroeder, Senior Marine Scientist at the Dauphin Island Sea Lab, Alabama, and Dr. Thomas Shirley, Professor of Invertebrate Biology at the University of Alaska Fairbanks.

Education through Exploration

To, as Admiral James D. Watkins, Chairman, U.S. Commission on Ocean Policy has said, "capitalize on ocean exploration as an inspirational education tool," this study will also have a significant outreach and education component. A video documentary explaining the project will be overseen and produced by award-winning film maker Dr. Dennis Aig of the PAST Foundation whose credits include *The Horse Whisperer* and *A River Runs Through It*.

An Exciting Opportunity

This study represents the first time that MMS and NOAA's Office of Ocean Exploration have partnered through NOPP and it's anticipated that this effort will provide unprecedented insights into a number of topics, including:

- the potential for the long-term historic preservation of historic shipwrecks;
- global oil spill issues relating to the ongoing disintegration of World War II shipwrecks;
- the long term fate of man-made objects on the deepsea floor and, in particular, their potential role as artificial reefs; and, finally,
- using exploration to capture the public's imagination and appreciation of interdisciplinary oceanographic research.

