

STUDY TITLE: 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

REPORT TITLE: Archaeological and Biological Analysis of World War II Shipwrecks in the Gulf of Mexico: Artificial Reef Effect in Deep Water

CONTRACT NUMBER: 01-03-CT-73095 (M03PC00001)

SPONSORING OCS REGION: Gulf of Mexico

APPLICABLE PLANNING AREA: Northern Gulf of Mexico

FISCAL YEARS OF PROJECT FUNDING: 2004; 2005

COMPLETION DATE OF REPORT: April 2007

COSTS: FY 2004: \$297,527; FY 2005: \$145,352; FY 2006: \$28,776; **CUMULATIVE PROJECT COST:** \$471,655

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KEY WORDS: Gulf of Mexico; shipwrecks, artificial reef, archaeology; biology; maps; survey; Deep-water, World War II

BACKGROUND: During World War II German U-boats wreaked havoc on merchant shipping along the coastal waters of the United States. The Gulf of Mexico represents one of the greatest concentrations of Allied vessels lost to German U-boats worldwide. These casualties include oil tankers, cargo vessels, passenger ships, and fishing boats. Because these vessels have been on the seafloor for over 50 years, and because of the significant role played by them and their crews in an important period of American and world history, they are likely eligible for inclusion in the National Register of Historic Places. At present, the remains of 18 of these vessels have been identified in Federal waters as a result of oil industry surveys required by the United States Department of the Interior, Minerals Management Service (MMS). In addition, the only German U-boat known to have sunk in the Gulf, the *U-166*, was discovered in 2001 seventy-two kilometers off the mouth of the Mississippi River. Taken together, these wrecks represent an important historical resource documenting a crucial period in American history. The sites preserve information vital to the understanding of the U-boat war in the Gulf of Mexico and its impact on the course of the world conflict. In addition, they represent artificial habitats that were located to the seafloor at well-documented dates of

a similar time period. Therefore, these wreck sites offer a unique opportunity to study the “artificial reef effect” of man-made structures in deepwater.

OBJECTIVES: Archaeological Objectives: (1a) positively identify each vessel casualty and establish its type and date of construction, nationality, ownership (past and present), use history, mission and cargo at time of loss; (2a) determine each vessel’s past and present condition and state of preservation, assess any environmental impacts caused by the wreck, and make observations relating to its rate of deterioration and future research potential; (3a) determine the horizontal extent of the debris field surrounding each casualty; (4a) analyze imagery and historical documentation to determine potential eligibility to the National Register of Historic Places; (5a) assess the impacts of bio-fouling communities to these shipwrecks to determine the stability of these sites; (6a) for vessels determined to be potentially eligible, prepare a National Register nomination form. Biological Objectives: (1b) characterize the environment at each site (e.g. water depth, bottom sediment type, currents, etc.); (2b) determine the biological effects of shipwreck artificial reefs at selected sites, to include detailed imagery surveys of shipwreck sites at a variety of scales; (3b) determine the extent of physical and biological modification of sediments in the immediate area of wreck sites compared to sediment conditions at sites distant from wreck areas. Sampling will include sediment coring close to and distant from wrecks to determine any “artificial reef effect;” (4b) conduct limited sampling of fauna attached to hard substrate for taxonomic and other potential analyses such as isotope studies; (5b) analyze imagery and sample collection to address spatial heterogeneity of any fouling community and motile fish and invertebrate association with wrecks.

DESCRIPTION: This multidisciplinary study was to focus on the biological and archaeological aspects of seven of these World War II era shipwrecks in the north-central portion of the Gulf of Mexico. Six of the shipwrecks were lost as a direct result of wartime activity between early May and late July in 1942. The seventh vessel, the steam yacht *Anona*, was lost from accident in 1944 after all the U-boats had left the Gulf of Mexico (The *Anona* was not investigated during the 2004 fieldwork, because of storm activity in the Gulf at the time of the field investigations). All seven shipwrecks were discovered during Oil and Gas surveys and reported to the MMS as a result of Federal regulations. Water depths at the investigation sites range from 87 m to 1,964 m. Six of the shipwreck sites were investigated over an 18-day period using a Remote Operated Vehicle (ROV) to determine site boundaries, National Register potential, preservation state and stability, and the potential for man-made structures or objects to function as artificial reefs in deepwater. Survey control was maintained during the project using the latest marine survey technology. Also a significant educational outreach component was implemented along with the scientific and historical components of the project.

SIGNIFICANT CONCLUSIONS: The influence of the shipwrecks was evident in the kinds and numbers of epifaunal invertebrates associated with hard substrate, as the abundance and species richness decreased with distance from the shipwrecks at all depths. The abundance of sedimentary meiofauna decreased dramatically with depth, most likely linked to decreases in particulate organic matter derived from surface water production. Species richness of micromollusks, particularly gastropods, decreased

abruptly with depth. Many of the distinctive macroinvertebrates also had pronounced bathymetric distributional patterns, being found only at the deeper sites, and not necessarily associated with the shipwrecks. Venus flytrap anemones were conspicuous and abundant members of the epifaunal community on the wrecks. Azooxanthellate hard and soft corals (Scleractinia, Antipatharia, and Gorgonacea) were associated with shipwrecks, but only at the shallowest three shipwrecks. The dense *Lophelia* colonies associated with the *Gulfpenn* may have been among the more dramatic biocenoses in the study. The complex matrix of living and dead branches of corals increase habitat complexity; the absence of these corals in deeper depths undoubtedly resulted in a loss of habitat complexity and some associated macroinvertebrates, as has been noted in *Lophelia* reefs in the northeast Atlantic. These deep coral habitats associated with the shipwrecks permitted one of the deeper studies of true reef fishes in the northern Gulf. Reef fish assemblages did not occur at the deeper wreck sites, and the composition of the fish communities were similar among the deeper shipwreck sites, both near and away from the wrecks.

Each wreck site was assessed for its potential eligibility to be placed on the National Register of Historic Places (NRHP) and a National Register nomination form was completed for each potentially eligible site. After reviewing the archaeological and historical data, it was decided that each site was potentially eligible for the NRHP under Criterion "A" association with events that have made a significant contribution to the broad patterns of our history. It was also determined that all the sites were also potentially eligible under Criterion "D" as archaeological sites. Additionally, the *Anona* and the *U-166* sites were also deemed potentially eligible under Criterion "C" as representative examples of distinctive architecture, in this case ship type. Furthermore, an examination of debris distribution data from this study revealed the trend that site size increases proportionately with depth. This observation allows for a preliminary formula to calculate the expected boundary size for shipwreck sites, which can be used to set avoidance criteria or plan site surveys.

STUDY RESULTS: More than 300 hours of video footage was collected along with, physical samples of microbial, invertebrate, and vertebrate specimens, and twenty-six sediment cores for laboratory analysis. The horizontal extent of each site including associated visible artifact scatter (debris field) was mapped for each shipwreck and a preliminary model was developed for estimating the size of specific types of deepwater shipwreck sites discovered in the future. The condition, state of preservation, and rate of deterioration was assessed and documented. The impact of bio-fouling communities on these shipwrecks was also examined. The sediment core analysis indicated the shipwrecks have currently caused negligible or no lasting detectable chemical impact to the environment.

STUDY PRODUCTS: C & C Technologies, Inc. 2007. Archaeological and biological analysis of World War II shipwrecks in the Gulf of Mexico: Artificial reef effect in deepwater. Final report for the U.S. Dept. of the Interior, Minerals Management Service Gulf of Mexico OCS Region, Metairie, LA. Contract No. 0103CT73095. MMS OCS Study 2007-015. 387 pp.

C & C Technologies, Inc. prepared National Register nomination forms for all seven shipwreck sites included in the study.

The PAST Foundation set up a project website, which included information about the history of the wrecks, general background about U-boat activity in the Gulf of Mexico, information about the science being conducted at the sites and the scientists conducting the work. An important aspect of the website was to put the website visitor “on the boat,” by including daily updates from the research team. These updates took the form of written journals, or narratives, describing each day’s activities, and were written daily by a different member of the project team. These narratives were supplemented by still images and, on every other day, by a short but professional quality video clip produced onboard by the PAST Foundation Documentary Unit.

<http://www.pastfoundation.org/DeepWrecks/>

The PAST Foundation/Hunter Neil and Montana State University is preparing five short films for the study and a wreck site highlights reel.

*P.I.’s affiliation may be different than that listed for Project Managers.

