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STUDY TITLE: Deepwater Program: Northern Gulf of Mexico Continental Slope Habitats and Benthic Ecology

REPORT TITLE: Deepwater Program: Northern Gulf of Mexico Continental Slope Habitats and Benthic Ecology; Interim Report, Year 2

CONTRACT NUMBER: 1435-01-99-CT-30991

SPONSORING OCS REGION: Gulf of Mexico, OCS Region

APPLICABLE PLANNING AREA: Northern Gulf of Mexico

FISCAL YEARS OF THE PROJECT: 2000, 2001, 2002, 2003

COMPLETION DATE OF REPORT: December 2002

COSTS: 2000: $1,253,359 ; 2001: $1,178, 201 ; 2002: 1,105,657; 2003: $651,490; CUMULATIVE PROJECT COST: $4,188,707

PROJECT MANAGERS: Gilbert T. Rowe and Mahlon C. Kennicutt II

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KEYWORDS: Benthic Ecology, Northern Gulf of Mexico, Contaminants, Microbiota, Foraminifera, Meiofauna, Macrofauna, Demersal Fishes, Megafauna, Physical Oceanography, Hydrography, Geological Oceanography, Biogeochemistry, Geochemistry, Ecosystem Health, Ecosystem Modeling, Habitats, Zonation, and Carbon Limitation.

BACKGROUND: Increasing exploration and exploitation of fossil hydrocarbon resources in the deep-sea prompted the Minerals Management Service of the U.S. Department of the Interior to support an investigation of the structure and function of the assemblages of organisms that live in association with the sea floor in the deep-sea. The program, Deep Gulf of Mexico Benthos or DGoMB, is studying the northern Gulf of Mexico (GOM) continental slope from water depths of 300 meters on the upper continental slope out to greater than 3,000 meters water depth seaward of the base of the Sigsbee and Florida Escarpments. The study is focused on areas that are the most likely targets of future resource exploration and exploitation. However, to develop a Gulf-wide perspective of deep-sea communities, sampling in areas beyond those thought to be potential areas for exploration has been included in the study design. A major enhancement in the program is the extension of the transects onto the abyssal

plain of the central Gulf of Mexico through collaborative studies with Mexican scientists. This additional work effort will allow assessment of benthic community structure and function throughout the basin by sampling the deepest habitats in the region.

The program is designed to gain a better ability to predict variations in the structure and function of animal assemblages in relation to water depth, geographic location, time and overlying water mass. Biological studies are integrated with measurements of physical and chemical hydrographic parameters, sediment geochemical properties and geological characteristics that are known to influence benthic community distributions and dynamics. Eight (8) hypotheses are being tested on the basis of measures of benthic community structure.

It is hypothesized that community structure varies as a function of:

1. water depth,
2. geographic location (east vs west),
3. association with canyons,
4. association with mid-slope basins,
5. sea surface primary productivity,
6. proximity to hydrocarbon seeps,
7. time (seasonal and interannual scales), and
8. association with the base of escarpments

OBJECTIVES: The goals of the program are to:

- determine in greater detail the composition and structure of slope bottom biological communities and to infer relationships between biological patterns and major controlling processes and
- characterize the area as to its present “health” and function and compare and contrast the region with similar oceanic regions.

Specific program objectives are to:

- improve a conceptual model that served as the guide for the design and overall conduct of the study and to test specific hypotheses related to the models;
- compile and synthesize data from existing databases and on-going programs to interpret new results;
- conduct field collections to describe the distribution and structure of benthic communities on the continental slope of the GOM and to elucidate the functional interactions among them in known environmental settings;
- characterize the hydrographic structure and measure the dissolved and particulate water column nutrient concentrations, primary productivity, and chlorophyll *a* at the study sites;
- characterize the sediments at the study sites including grain size and hydrocarbon, metal, carbonate, and organic carbon concentrations;

- characterize the basic attributes of the benthic microbiota and biomass at the study sites;
- characterize the soft-bottom macro- and megafauna at the study sites;
- relate variations in benthic biota patterns to sedimentary processes and to the chemical and physical setting;
- define basic levels of animal and bacterial activity and production and describe interactions between and among benthic biota, the several ecological/biological compartments, and the abiotic environment; and
- compare and contrast the GOM benthic marine environment and communities with those in other basins of similar depth ranges and oceanic settings.

DESCRIPTION: The program is to be conducted over a 57-month period of performance. Major oceanographic cruises have been conducted, one in each of the first two years of the program and two in the third year. The final year of the program will be dedicated to completing sample analyses begun in the first three years, data management and interpretation, model refinement, and production of the Synthesis Report. The field surveys will document the biota, the abiotic character of the slope and the important biotic and abiotic forcing factors. Station selection criteria included consideration of anticipated zonation, water depth, distance from shore, abiotic variables, physiography and topography, geochemical environment, anthropogenic effects, and present and future leasing trends.

The four tasks of the program and their status:

TASK 1 - Re-examination of Existing Data and Field Study Design: Completed
TASK 2 - Field Sampling: Completed
TASK 3 - Sample and Data Processing and Analysis: Underway
TASK 4 - Data Interpretation, Synthesis and Reporting: To be Initiated

A major enhancement in the program is the extension of the transects onto the abyssal plain of the central Gulf of Mexico through collaborative studies with Mexican scientists. This additional work effort will allow assessment of benthic community structure and function throughout the basin by sampling on the deep Sigsbee Abyssal Plain within the Mexican Exclusive Economic Zone (EEZ).

SIGNIFICANT CONCLUSIONS: Based on the data being generated from the survey samples, detailed maps are being constructed which suggest the following:

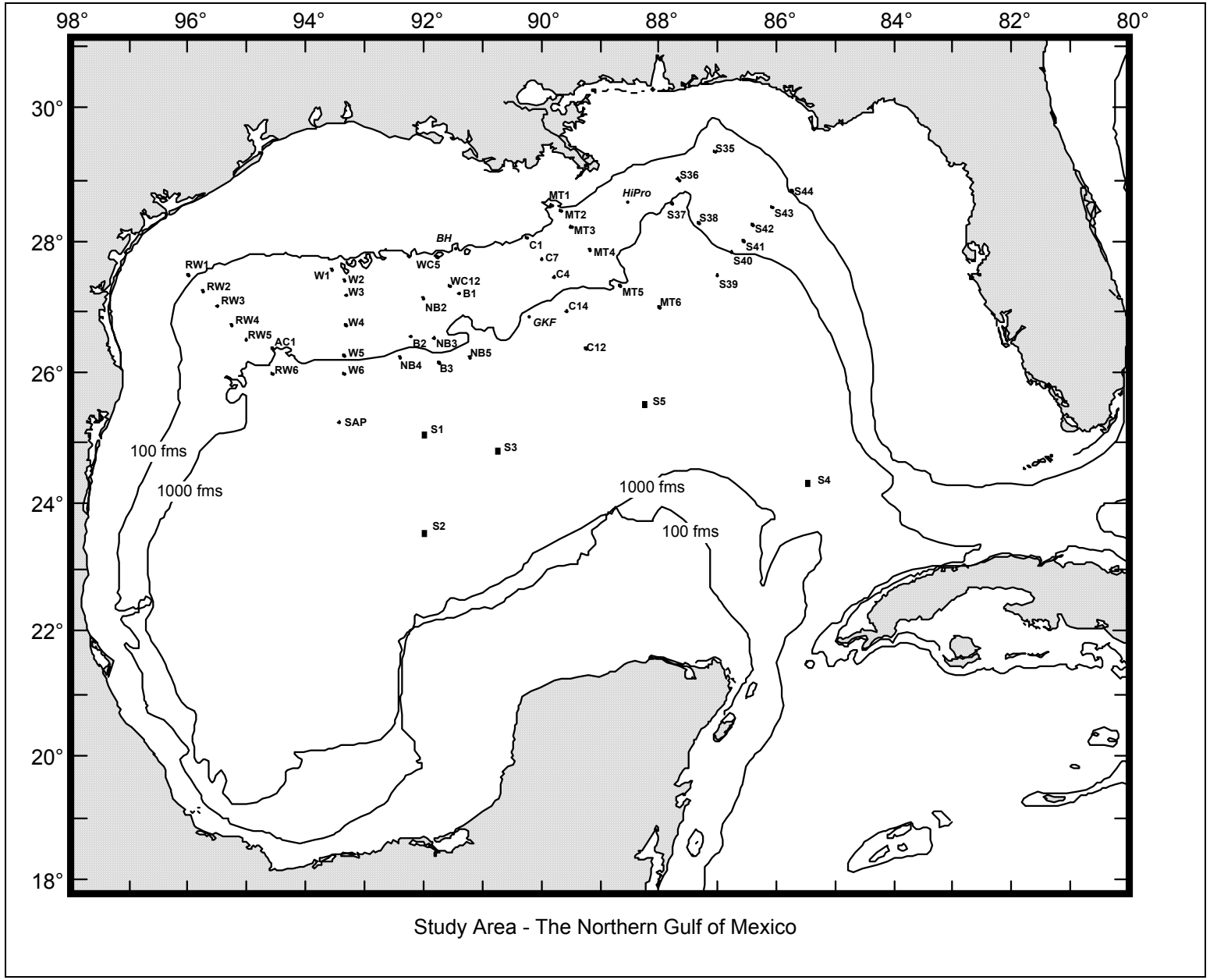
1. Biomass and density of each size or functional component decline with depth,
2. Diversity of each size or functional component reaches a maximum at intermediate depths,
3. Assemblages or re-current groups vary as a function of depth,
4. Maps of species (dominant) suggest that the Mississippi Trough and the DeSoto Canyon harbor unique assemblages of animals characterized by high densities and relatively low diversity, and

5. Total community metabolism, measured as sediment community oxygen demand, declines (log-normal) as a function of depth.

STUDY RESULTS: The study has resulted in large data sets describing the physics, geology, and biology of the sediment and near-sediment environments, at water depths ranging from 200 up to 3,700 meters. These data will be analyzed using multivariate statistical techniques, including but not limited to Principal Components Analysis and MANOVA. These analyses will allow the team to identify general trends related to environmental gradients and to test the eight (8) hypotheses listed above. The conceptual model will segue into a full-blown numerical simulation of food web dynamics, based on biomass and total oxygen consumption measured with a benthic lander at the 6 process sites. The internal transfers within the food web will be validated from the food web incubation tracer techniques.

STUDY PRODUCTS: This program will produce 57 Monthly Progress Reports, Two Interim Reports, One Final Synthesis Report, Multiple Peer Reviewed Publications, Five ITM Sessions, 6 Cruise Plans, 6 Cruise Reports, and Two Planning Meeting Reports.

*P.I.’s affiliation may be different than that listed for Project Manager(s).



Study Area - The Northern Gulf of Mexico

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