ACCESS NUMBER: 29106

STUDY TITLE: Ecological Communities of OCS Slope and Adjacent Regimes of Northern Gulf of Mexico

REPORT TITLE: The Ecological Communities of the Continental Slope and Adjacent Regimes of the Northern Gulf of Mexico, Executive Summary and Text, Photographic Atlas and Appendices

CONTRACT NUMBERS: BLM: CT1-12; MMS: 14-12-0001-29106

SPONSORING OCS REGION: Gulf of Mexico

APPLICABLE PLANNING AREAS: Eastern Gulf of Mexico; Central Gulf of Mexico; Western Gulf of Mexico

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KEY WORDS: Eastern Gulf; Central Gulf; Western Gulf; DeSoto Canyon; Sigsbee Abyssal Plain; biology; benthos; epifauna; infauna; benthic photographs; sediment; slope; rise; abyssal plain; abundance; distribution; fish; faunal zones; modeling; maps; bibliography; community

BACKGROUND: This report dealing with the deepwater ecological communities of the Gulf of Mexico was based upon collection of the macroinfauna and megaepifauna made from 1964 to 1973 aboard Texas A&M University's (TAMU) ship the R/V ALAMINOS. The research was sponsored by various organizations including TAMU, the Office of Naval Research, the National Science Foundation, the Atomic Energy Commission, the Bureau of Land Management, and others.

OBJECTIVES: (1) To describe and discuss the ecological nature and distribution of the macroepibenthic assemblages that occur in the northern Gulf of Mexico; (2) to provide photographic documentation of the nature of the benthic environment within which these assemblages exist, including portrayal of some constituent species that exist within

bathymetric zones; (3) to describe, after analyzing available data generated by the present study and found in extant literature, the important gaps in the knowledge of the area, its assemblages, and functioning of the deep ecosystem and then suggest study approaches to reduce these gaps; and (4) to provide an assessment of the significance of the potential impacts on the deep macrobenthic communities by oil and gas exploration and production.

DESCRIPTION: Macro- and megaepifauna were collected using five types of dredges including a Menzies dredge, a plow dredge, a scoop dredge, a 3-m gape skimmer dredge, and a 2-m gape skimmer dredge. A 20-m otter trawl net was also used. A Campbell grab collecting 0.62 m^2 surface area and a Phleger corer were used to collect the macroinfauna and sediment samples, respectively. Two different cameras were used to collect photographic data: a 35-mm underwater multi-exposure model (Alpine Geophysical Associates, Model 314) and a 70-mm Shipek Deep-Sea Camera (Hydro Products Model PC-700). Both cameras were equipped with a 200 watt-second strobe and were focused at approximately 1.5 m. The study area extended from 25°N lat northward to approximately the 150-m isobath and from the east wall of the DeSoto Canyon and the easternmost extension of the Mississippi Fan to the Sigsbee Abyssal Plain and up the slope to the shelf break south of Brownsville, Texas. A total of 193 stations were sampled in water depths of 81 to 3,801 m from 1964 to 1973. Specimens were sorted and preserved in formalin in the field, transferred to laboratories at TAMU, and then sent to taxonomic specialists for identifications. Clustering, applied to faunal similarity indices for each 50-m depth interval, was used to construct a dendrogram to delineate faunal breaks across the slope, rise, and abyssal plain.

SIGNIFICANT CONCLUSIONS: Relative abundances and distributions of various groups of macroepifauna including echinoderms, crustaceans, fishes, gastropods, cephalopods, sponges, coelenterates, bryozoans, brachiopods, and sipunculids, and infauna consisting of polychaetes, bivalves, and scaphopods were discussed. Five faunal zones were recognized to occur from the shelf to the abyss in the northern Gulf of Mexico, conforming reasonably well to zones described for the northwest Atlantic Ocean. The DeSoto Canyon, Mississippi Trough, and Alaminos Canyon were three canyon systems recommended for future studies.

STUDY RESULTS: The Shelf/Slope Transition Zone assemblage (150 to 450 m) was dominated by demersal fishes, asteroids, and brachyurans with gastropod molluscs and polychaetes also well represented. The Archibenthal Zone assemblage (475 to 950 m) was dominated by demersal fishes, asteroids, and gastropod molluscs with holothuroids increasing in number and brachyurans declining drastically. The Upper Abyssal Zone assemblage (975 to 2,250 m) showed a continuing decrease in demersal fishes and brachyurans, a major increase in the number of species of large holothuroids, and a peak in the number of sponge and gastropod species. The Mesoabyssal Zone (2,275 to 3,200 m) was characterized by large declines in all major species groups. The Lower Abyssal Zone assemblage (3,225 to 3,850 m) had the lowest species richness of all the zones but also possessed a benthic species assemblage not occurring elsewhere in the

Gulf. Key species from each of these zones were determined based upon frequency of appearance in samples and numbers collected per trawl.

A deep ecosystem model was proposed consisting of three distinct layers: the euphotic zone extending from the surface to a depth of about 60 m, the aphotic zone extending from the euphotic zone to within a meter of the bottom, and the seafloor with an approximately 1-m thick contiguous water layer. Each of these three functionally distinct layers was further broken down into a five-reservoir food chain. Sources of matter and energy for the ecosystem come not only from the primary productivity of the phytoplankton being passed down the food chain but also from dissolved organic matter, deadfalls of animal carcasses, fallout of terrestrial and shallow marine plants, transport of animals and organically rich sediments in slumps and turbidity flows, and active foraging of demersal fishes and large benthic crustaceans in the midwater region.

Various potential hazards to the deep Gulf ecosystem were discussed and included various types of chemical pollution including oil spills, increased terrestrial sediment deposition, and bottom sediment slumping. Guidelines were proposed for avoiding significant impacts upon the ecosystem by petroleum activities. Major information deficiencies of the deep Gulf of Mexico were also summarized and included measurements of the organic content of the sediments and water column, dissolved oxygen levels within 1 m of the bottom and Eh values in adjacent sediments, the residence time of waters in the Gulf, levels of dissolved metals and various organic pollutants in sediment pore water, information on currents occurring on the continental slope and abyssal plain, the effects of slumping and turbidity flows on the fauna, studies on the deepwater microbiology, comparisons of meiofaunal and macrofaunal abundances from the same areas, and studies of benthopelagic organisms which are capable of transferring major amounts of organic matter between the pelagic and benthic environments.

STUDY PRODUCTS: Pequegnat, W. E. 1983. The Ecological Communities of the Continental Slope and Adjacent Regimes of the Northern Gulf of Mexico. A final report by TerEco Corporation for the U.S. Department of the Interior, Minerals Management Service Gulf of Mexico OCS Office, Metairie, LA. Vol. I - NTIS No. PB84-113406; Vol. II - NTIS No. PB84-113398. Contract No. AA851-CT1-12. 715 pp.

The report also contained three appendices: Appendix A, consisting of an atlas of bottom photographs depicting some of the biological components, physiography, and surficial sediments of the five described faunal zones; Appendix B, containing a listing of collected species; and Appendix C, presenting an annotated bibliography of publications dealing with the oceanography of the Gulf of Mexico.