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BACKGROUND: The primary goal of this study is to describe the existing ecosystem and interrelate dominate natural processes in a way that can be used to understand the impact of man's activities in the area, especially as it relates to petroleum exploration and development. This relatively small area is important to the adjacent states because of multiple use by marine transportation, dredged material disposal, commercial fishing recreational fishing and energy-related industries. Competition for the space and resources and the effect on other resource uses requires an understanding of this system for its effective management. Petroleum activities represent one of the more important resource uses in terms of economic and environmental impact along central Gulf Outer Continental Shelf (OCS) area.

OBJECTIVES: (1) To biologically characterize the topographic features located on the outer shelf of the study area; (2) to describe the sediments and transition areas of the region; (3) to determine the seafloor topography and how it affects sediment distribution; (4) to evaluate the presence or absence of biologically productive areas on hard bottoms in the Mobile and northern Viosca Knoll leasing area; (5) to study circulation patterns and driving forces, especially due to the Loop Current, around the De Soto Canyon, including meteorology, hydrography, currents, sea state, and freshwater discharge; (6) to study the occurrence and extent of the nepheloid layer; (7) to investigate the extent and significance of hypoxia on the shelf; (8) to study the fates of pollutants associated with shelf activities, especially petroleum exploration/production; (9) to define shelf benthic communities with emphasis on near-slope environments and habitats not previously described; and (10) to analyze trophic relationships among biotic components of the shelf ecosystem with emphases on energy transfer within and between pelagic and benthic components.

DESCRIPTION: Biological, physical, chemical, and geological characteristics were studied along three north-south transects across the continental shelf of Mississippi and Alabama. Four Stations in depths of approximately 50, 100, 150, and 200 m were sampled along each of these transects. Side-scan, ROV, and underwater color photographs and video data were collected around topographic features in the study area.

Three cruises were conducted in the study area: (March 1987, September 1987, March 1988). Six sediment samples at each of the stations were analyzed for trace metals, hydrocarbons, macroinfauna, and grain size. Two samples collected with a 40 foot otter trawl were studied for demersal fish and macropifauna. Physical oceanography data originates from three moored current meter arrays positioned in the central portion of the study area parallel and between transects M and D (Figure 1). Hydrographic data were collected at these moored arrays and at each of the 12 stations. Hydrographic data consists of CTD, transmissivity, dissolved oxygen and nutrients. Satellite imagery data were collected from the Advanced Very High Resolution Radiometers (AVHRR) to monitor the position of the Loop Current and mesoscale features in the Gulf. Topographic features were geologically characterized using subbottom profiling and side scan sonar equipment to generate mosaics and bathymetric maps. Biological characterization used data collected by ROV, rock dredge, and video and still photographs, and hook-and-line to describe habitat and biotic zonation. All these data and food habit analyses are integrated to characterized the study area.

STUDY RESULTS: Subbottom profile records indicate that the shelf edge is built upon delta-front forset beds truncated by erosion during the last low stand of sea level in the Pleistocene. Holocene sediments to 15 m thick cap the erosional surface. Topographic features of primary interest to this study were constructed on top of these sediments. The Holocene sediments are thickest in the central part of the survey area, indicating a small delta lobe was deposited in that area.

Three types of topographic features were mapped: (1) pinnacles, probable formed by coral-algal assemblages: (2) linear ridges perhaps lithified coastal dunes; and (3) enigmatic features. The pinnacles are features with heights of 2-15 m and widths of 2-200 m. Some larger features have flat tops, but most large pinnacles are ragged suggesting they may be conglomerates of smaller pinnacle features. Pinnacle features were scattered over the survey area, but were concentrated around 40 fathoms (73m). This line is believed to be related to a stillstand during the recent post-glacial rise in sea level.

Physical oceanography studies during March 1987 cruise indicate surface temperatures increased seaward from 15^0C in shallow water to 18^0C over the shelf slope. Isotherms followed the trend of the isobaths. Hydrographic data from March 1988 indicates a filament from a Loop Current eddy entered the study area between Stations C4 and M4 and wrapped clockwise to the northeast. The filament contained water with higher temperature, salinity and water mass characteristics, occurred in the southeast part of the study area.

The satellite component of the physical oceanography investigation positioned fronts associated with the Loop Current, warm core eddy, warm intrusions reaching into the region from the top of the Loop, warm intrusions from the Loop, and a cold ridge extending southward from the study area.

Sediments in the study area analyzed from high molecular weight hydrocarbons contain a mixture of biological and petroleum hydrocarbons. Biological hydrocarbons are predominantly plat biowaxes (n-C_{23} -nC_{33}), possibly with a minor planktonic input (n-C_{15} -n-C_{19}). Petroleum hydrocarbons are present as polynuclear aromatic compounds (PAH), a complete suite of N-alkanes, and an unresolved complex mixture. Sediment PAHs on the shelf are about six times lower that PAHs analyzed in sediments from adjacent bays. High hydrocarbon concentrations are generally at the seaward ends of the transects between the 100 and 200 m isobaths with the stations closest to the delta containing the highest concentration of hydrocarbons.

Sediment trace metal analyses from the 12 transect stations varied in iron and trace metal content. The variations seem to be the result of natural variability in grain size and mineralogy. Deep water sediments were enriched in iron and trace metals compared to shallow water sediments, but all were typical of unpolluted Gulf of Mexico shelf sediment. A few samples from transect C (near the Mississippi River) seem to be enriched in barium by about a factor of two over what would be expected but there were few other indications of trace metal pollution in the area. Manganese concentrations were only about half of that expected based on the iron concentration for many samples. This shows the sediments are biochemically active and capable of solubilizing manganese and perhaps other metals.

Polychaetes were the dominate macroinfauna taxon, both in numbers of species and numbers of individuals. Unlike many assemblages in the western Gulf of Mexico, no species appeared to dominate the community. There were no discernible patterns of

diversity or abundance that could be attributed to inshore-offshore or east-west gradients. This lack of dominance and patterns is expected to change as data from additional cruises are analyzed.

Trawls for macrofauna composition and abundance indicates that the largest numbers of species were collected at 100 m and the largest numbers of individuals were collected at 150 and 200 m.

The demersal fish study identified 2,839 specimens representing 98 species and 37 families of fishes from 11 samples collected on cruise O. Fishes were not caught at two stations (M4 and D3) and a replicate was made at one station.

The 100 M station along each transect yielded the highest number of individuals while the 20 m station along each transect yielded the highest number of species. An average of 374 individuals representing an average of 17 species were captured at 100 m along each transect and an average of 288 individuals representing 21 species were captured at 20 m along each transect. The 200 m station along each transect yielded the fewest number of individuals and species of fishes. An average of 83 individuals representing an average of 10 species were captured at 200 m.

STUDY PRODUCTS: Brooks, J.M. and C.P. Giammona, eds. 1988. Mississippi-Alabama Marine Ecosystem Study Annual Report, Year 1. Volume I: Technical Narrative. OCS Study/MMS 88-0071.

Brooks, J.M. and C.P. Giammona, eds. 1988. Mississippi-Alabama Marine Ecosystem Study Annual Report, Year 1. Volume II: Appendices. OCS Study/MMS 88-0072.

Additional products: six bi-monthly reports, eight cruise reports, and four presentations.

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