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APPLICABLE PLANNING AREAS: Eastern Gulf of Mexico

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BACKGROUND: In 1974, the U.S. Department of the Interior initiated comprehensive marine environmental surveys of the Outer Continental Shelf (OCS) off Mississippi, Alabama, and Florida (MAFLA). Data were collected for three years to establish a baseline from which to evaluate effects of oil and gas activities in the MAFLA region. This report comprises the final year (1977/1978) results and overall program synthesis.

OBJECTIVES: (1) To determine concentrations of high molecular weight hydrocarbons and selected trace metals in the water column, sediments, and selected benthic macrofauna; (2) to continue seasonal studies of benthic infauna, meiofauna, and foraminifera; (3) to continue histopathological studies to determine tissue conditions of

selected benthic macrofauna; and (4) to collect samples and conduct analysis supportive of benchmark data interpretation.

DESCRIPTION: The study area was the MAFLA OCS in the eastern Gulf of Mexico, bounded by 81°30' to 89°W long, and 25°30' and 30°15'N lat. Four cruises were carried out during 1977/1978: August-September 1977, October-November 1977, and February 1978. Sample depths ranged from 10 to 200 m.

Temperature and salinity were recorded using salinity/temperature/depth systems, water samplers, and reversing thermometers. Transmissometers and photometers were used to detect water clarity and light penetration. A box corer (21.3 x 30.5 x 43.2 cm) was used to obtain sediment samples 600 cm^2 in surface area and of 40 cm depth. A 10-m semi-balloon trawl and a rectangular dredge (97 cm x 41 cm) were used to collect macroepifauna and demersal fishes. Forty-nine box core stations and 17 dredge and trawl samples were taken along eight transects. Sediment samples were analyzed for grain size, percent carbonate, clay mineralogy, total organic carbon (TOC), adenosine triphosphate, hydrocarbons, trace metals, foraminifera, meiofauna, and macrofauna. Macroepifauna, zooplankton, and demersal fishes were identified and then analyzed for hydrocarbons and trace metals [with and without barium (Ba) and vanadium (V)] using gas chromatography, atomic absorption spectrophotometry, and neutron activation analysis, respectively. Water samples were analyzed for suspended sediment mineralogy, particulates, trace metals (with and without Ba and V), particulate hydrocarbons, dissolved hydrocarbons, particulate organic carbon, dissolved organic carbon, and salinity. Tissue samples were analyzed from various macroepifaunal groups using standard histological techniques.

Data from the MAFLA surveys were subjected to various univariate and multivariate statistical analyses. Descriptive statistics were obtained, then multivariate techniques (cluster analysis, principal components analysis, stepwise discriminant analysis, and canonical analysis) were used. A suite of resemblance measures and diversity indices were used to determine species associations and community parameters.

SIGNIFICANT CONCLUSIONS: Ecological, histophathological, and histochemical evidence indicated that the MAFLA area was pristine and healthy. In many parts of the MAFLA region, sediments were essentially free of any detectable petrogenic or anthropogenic hydrocarbons, and the water column showed only biogenic sources. Sediment and water column trace metal levels were low and reflected animal tissue levels.

STUDY RESULTS: The Mississippi River and Loop Current are major oceanographic influences in the MAFLA area. The Loop current is variable, causes short-term changes in vertical temperatures, and transports tropical larvae and trace metals into the area. The water column is often stratified in the northern portion of the study area and more variable over the west Florida shelf. The shelf off Mississippi and Alabama is dominated by fine sediments with low carbonate content. The Mississippi River is the major source of these fine sediments. The west Florida shelf has little active

sedimentation with predominantly carbonate sand offshore and quartz inshore. The two sediments intermix in the vicinity of Cape San Blas.

MAFLA area sediments were grouped into three geochemical provinces based upon hydrocarbon source. No evidence of anthropogenic or petrogenic hydrocarbons was found in nearshore area (<50 m) of the west Florida shelf. Deeper sections were characterized by accumulations of fine sediments and high TOC. The Alabama-Mississippi shelf showed traces of petrogenic content.

Trace metal pollution was not detected for any station. Metals analyzed were representative of possible pollutants associated with crude oil and offshore construction activities. Sediment trace metals increased offshore and to the northwest. Regression analysis indicated that the effects of independent variables on concentrating trace metals was % fines > TOC > $CaCO_3$. Trace metals in demersal fishes were related to bioavailable trace metals in sediments. Dusky flounder (*Syacium papillosum*) had trace metal concentrations related to ambient sediment concentrations. Generally, trace metal values were low in the water column, sediments, and animal tissues.

Foraminiferans increased in abundance offshore and to the north resulting in a positive correlation with fine sediments. Sources of stress were apparently natural (salinity, temperature, or sedimentology). Meiofauna exhibited an extremely patchy spatial and seasonal distribution throughout the MAFLA area. Abundances were moderately correlated with sediments. Taxonomic problems made meiofauna poor indicators of environmental stress. Species diversity and density of infaunal species (60% polychaetes) decreased offshore and to the west. Macroepifauna also followed the pattern of decreasing diversity in an offshore direction. A total of 292 fish species were collected. Pattern analyses revealed fish species groups to be aligned along the 40-m, 100-m, and 200-m isobaths. About 400 taxa of zooplankton were recorded from the MAFLA area. Oceanic, slope, and shelf species interchanged on the west Florida shelf but no coastal species were collected.

No occurrences of pathology were found. The MAFLA area was considered generally healthy and an excellent region for conducting monitoring studies before, during, and after oil and gas exploration and development activities.

STUDY PRODUCTS: Dames and Moore. 1979. The Mississippi, Alabama, Florida, Outer Continental Shelf Baseline Environmental Survey MAFLA 1977/1978. A final report to the U.S. Department of the Interior, Bureau of Land Management Gulf of Mexico OCS Office, New Orleans, LA. Vol. IA (Program Sythesis Report) - NTIS No. PB294-277: Vol. IB (Executive Summary Report) - NTIS No. PB294-228; Vol. IIA (Compendium of Work Element Reports) - NTIS No. PB299-686; Vol. IIB (Compendium of Work Element Reports) - NTIS PB299-687. Contract No. AA550-CT7-34.

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