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APPLICABLE PLANNING AREAS: Western Gulf of Mexico

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KEY WORDS: Western Gulf; Texas; baseline; biology; hydrography; sediment; macrofauna; infauna; epifauna; fish; neuston; zooplankton; hydrocarbons; tissue; trace metals; water column; nutrients; bacteria; phytoplankton; meiofauna; seasonality; histopathology; Hospital Rock; Southern Bank

BACKGROUND: In 1974, the U.S. Department of the Interior developed the Marine Environmental Studies Plan for the South Texas Outer Continental Shelf (STOCS) which commenced with a three-year benchmark investigation. The present report includes biological and chemical results from the second study year (1976).

OBJECTIVE: To assess the impacts of petroleum exploration and development and to expand the biological and chemical baseline efforts concerning the STOCS area.

DESCRIPTION: The study sought to establish baseline information on pelagic and benthic environments of the STOCS. The study area was bounded on the east by 96° W Long to the Texas coast on the west, Pass Cavallo to the north, and south to the

Mexican border. Field sampling was conducted from January to December 1976. All laboratory analyses were completed by February 1977. Sampling stations were situated along four transects perpendicular to the coastline ranging from 20 to 183 m of water. Four additional stations were located on two carbonate reefs (Hospital Rock and Southern Bank) in 72 to 82 m of water between Transects I and II. Stations were occupied during winter (January-February), spring (April-May), and fall (September-October). Samples were also collected from Transect II and the reef stations in the months (March, June, July, August, November, and December) not included in the three seasonal sampling periods.

Environmental variables examined included non-living and living characteristics of pelagic and benthic environments. Water column parameters included hydrography (temperature, salinity, depth, currents, Secchi depth, and transmissivity), nutrients (dissolved oxygen, nitrate, phosphate, and silicate), low molecular weight hydrocarbons, high molecular weight hydrocarbons, trace metals and reference elements (aluminum, cadmium, calcium, chromium, copper, iron, lead, nickel, vanadium, and zinc), phytoplankton, microorganisms, neuston, and zooplankton. Benthic samples were analyzed for sediment texture, sediment chemistry, microorganisms, meiofauna, macroinfauna, macroepifauna, and demersal fish. Gonadal and internal organ tissues from macrofaunal invertebrates and demersal fishes were examined for histopathologies. Water samples were collected using 30-l Niskin bottles, except water samples for low molecular weight hydrocarbons were collected with 19-l glass carboys. Zooplankton were collected using a 1-m, .250 mm mesh net; microplankton were collected with a 30-cm, .076 mm mesh Nansen net; neuston were collected with a 1 x 2 m, rectangular mouth, 5-m long net. Meiofauna, macroinfauna, shelled microzoobenthos, and sediments were collected with a Smith-McIntyre grab sampler (0.125 m^3). Fishes and macroepifauna were collected using a 10.7-m otter trawl. Other fish samples were obtained with hook and line. Loran-A and Lorac were used for positioning and station relocation.

All data, except histopathology, were entered into a data base file for storage, retrieval, and numerical manipulation. Statistical analyses included univariate, bivariate, and multivariate procedures.

SIGNIFICANT CONCLUSIONS: The STOCS area is generally pristine with respect to hydrocarbon and trace metal occurrences in the water column, sediments, and organisms. However, zooplankters exhibited definite hydrocarbon contamination, probably related to floating micro-tarballs. The second-year study revealed that trends in invertebrate and fish distribution across the shelf were broadly related to depth and substrate. Histopathologies in fishes and invertebrates were caused by naturally occurring symbionts.

STUDY RESULTS: Separate hydrographic climates were identified, with nearshore and offshore areas being most distinct. Temperature-salinity gradients switch from a predominantly vertical orientation in spring and summer months to a predominantly horizontal orientation in late fall and winter. Dissolved oxygen levels in the upper 60 m of the water column responded more to physical factors (temperature and salinity) than

productivity. Nutrient concentrations were generally low with nitrate being the limiting factor to productivity. Silicate and phosphate levels were depleted during the spring productivity increase, but were regenerated by fall.

Low molecular weight hydrocarbon (e.g., propene, ethene) concentrations in the water column were variable. Evidence of bottom seepage of methane was detected at some stations. Most low molecular weight hydrocarbons detected during the study were naturally occurring.

Trace metal concentrations in epifauna, zooplankton, and macronekton were low. Variability in trace metal data was considerable, and insufficient sample replication precluded statistical detection of small changes in metal concentrations.

Zooplankton samples showed considerable hydrocarbon contamination presumably associated with floating micro-tarballs. Water column levels of particulate and dissolved hydrocarbons were similar, and concentrations of both decreased in an offshore direction. Most high molecular weight hydrocarbons in fishes and macroinvertebrates were biogenic in origin and characterized by a general lack of aromatic compounds.

Phytoplankton biomass parameters, particularly chlorophyll a, decreased in an offshore direction. Depth profiles of chlorophyll a often displayed subsurface maxima. Phytoplankton species composition was variable and low diversity values were associated with blooms of *Skeletonema costatum*, *Nitzschia delicatissima*, or *Leptocylindrus danicus*. Interrelationships among Secchi depth, phytoplankton abundances, and chlorophyll a were evident. Zooplankton numbers and biomass were variable in time and space. Copepods, mostly calanoids, comprised 60% of the total zooplankton catch, although other groups (barnacle larvae, chaetognaths, cladocerans, molluscs, ostracods, and tunicates) were well represented. Seasonal variation in abundance differed for each zooplankton group. Neuston samples contained mostly decapod (85 taxa) and fish (110 taxa) developmental stages. Additional taxonomic groups collected in neuston nets included chaetognaths, cnidarians, ctenophores, echinoderms, foraminiferans, molluscs, nematodes, polychaetes, and tunicates. Neuston biomass values showed trends with season, geography, and floating tar dry weight.

Nematodes were the numerically dominant and most speciose meiofaunal group. Nematode numbers increased significantly with increase in the sand fraction of sediment. Harpacticoid copepods were also associated with this parameter and presumably with available organic carbon content. The harpacticoid/nematode ratio in soft sediments may be a good indicator of environmental degradation or recovery. Macroinfauna and epifauna were distributed in three habitats based on location and sediment: shallow muddy sands and mid-depth transitional sediments; deep silty clays; and deep muddy sands. Depth related species groupings identified with cluster analysis included inner shelf stations (10 to 49 m) and outer shelf stations (65 to 134 m). Demersal fishes also displayed depth related groupings in cluster analyses, with seasonal and temperature effects also influencing the results. Inner shelf locations exhibited low fish species diversity throughout the year, while mid-shelf stations

displayed high diversity values throughout the year. A greater number of fishes were caught during night trawls than during day trawls. The 1976 trawling efforts yielded a total of 128 fish species.

Histopathological analysis of epifaunal invertebrates revealed that molluscs had the highest incidence and variety of symbionts in their internal organs, followed by crabs and shrimps. No evidence of histopathology was found in echinoderms. Of the fishes examined, vermilion snapper (*Rhomboplites aurorubens*) displayed the highest percentage of lesions in internal organs. The lesions, caused mostly by protozoan and helminth parasites, caused varying degrees of localized necrosis in infected tissues. The incidence of gonadal pathology was generally low.

STUDY PRODUCTS: University of Texas Marine Science Institute. 1977. Environmental Studies, South Texas Outer Continental Shelf, Biology and Chemistry. A final report to the U.S. Department of the Interior, Bureau of Land Management, Washington, D.C. Vol. I (Final Report, Chapters 1-8) - NTIS No. PB292346; Vol. II (Final Report, Chapters 9-18) - NTIS No. PB292347; Vol. III (Appendices A-D); Vol. IV (Appendices E-K); Vol. V (Appendices L-N); Vol. VI (Appendices O-P). Contract No. 14-12-0001-29126.

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