

**STUDY TITLE:** South Texas OCS Baseline Monitoring: Biology and Chemistry, FY 1977

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**CONTRACT NUMBERS:** BLM: CT7-11; MMS: 14-12-0001-29131

**SPONSORING OCS REGION:** Gulf of Mexico

**APPLICABLE PLANNING AREAS:** Western Gulf of Mexico

**FISCAL YEAR OF PROJECT FUNDING:** 1977

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**COST:** FY 1976: \$2,307,225

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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 off the south Texas Outer Continental Shelf (OCS). The present report includes biological and chemical results from the third study year (1977).

**OBJECTIVES:** (1) To provide information for predicting the effects of OCS oil and gas development activities upon the components of the ecosystem; (2) to provide a description of the physical, chemical, geological, and biological components and their interactions against which subsequent changes or impacts could be compared; (3) to

identify critical parameters that should be incorporated into a monitoring program; and (4) to conduct experimental and other special studies as required to meet basic objectives.

**DESCRIPTION:** This third-year study continued to provide baseline information on pelagic and benthic environments of the STOCS. The study area encompassed the area from 960W Long, to the Texas coast on the west, and south to the Mexican border. Field sampling was conducted from January to December 1977. All laboratory analyses were completed by June 1978. Twenty-six 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 each of two carbonate banks (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 bank stations in the six months (March, June, July, August, November, and December) not included in the three seasonal sampling periods.

Water column parameters examined were temperature, salinity, depth, currents, Secchi depth, transmissivity, nutrients, low molecular weight (LMW) hydrocarbons, and high molecular weight (HMW) hydrocarbons. Water samples were collected using 30-1 Niskin bottles and 19-1 glass carboys (for LMW hydrocarbons). Phytoplankton were obtained using 30-1 Niskin bottles, and samples were analyzed for species densities, chlorophyll a, C14 productivity, and adenosine triphosphate (ATP). Macrozooplankton were collected using a 1-m, .250 mm mesh net, and microzooplankton with a 30-cm, .076 mm mesh Nansen net. Zooplankton samples were analyzed for species densities, biomass, trace metal body burden, and HMW hydrocarbon body burden. A 1- x 2-m rectangular mouth, 5-m (length) neuston net was used to collect neuston samples. Species densities and tarball concentrations were recorded for neuston samples. Benthic samples, collected with a 0.125 m<sup>3</sup> Smith-McIntyre grab sampler, provided sediments, microorganisms, meiofauna, and macroinfauna. Sediments were analyzed for texture (mean grain size, and percent sand, silt, and clay) and chemistry (delta C13, organic carbon, LMW hydrocarbons, and HMW hydrocarbons). Species abundances and total counts were recorded for microorganisms (bacteria and fungi). Species densities were recorded for meiofauna and macroinfauna. Invertebrate macroepifauna and demersal fishes were collected using a 10.7-m otter trawl; additional fish samples were obtained with hook and line. These samples were analyzed for species densities, trace metal body burdens, HMW hydrocarbon body burdens, and tissue histopathology. Biomass was also estimated for demersal fish catches.

**SIGNIFICANT CONCLUSIONS:** The third-year study revealed that spatial trends in invertebrate and fish distributions across the shelf were broadly related to depth and substrate. The STOCS was generally pristine with respect to hydrocarbon and trace metal occurrence in sediments, water column, and organisms. However, zooplankters exhibited definite hydrocarbon contamination, probably related to floating micro-tarballs. 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 switched from a predominantly vertical orientation in spring and summer months to a predominantly horizontal orientation in late fall and winter. Nitrate decreased to low values after spring and early summer phytoplankton blooms. Dissolved oxygen levels (4.3 to 6.0 ml l<sup>-1</sup>) 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 the limiting factor to productivity. Dissolved total hydrocarbons decreased with increasing station depth. LMW hydrocarbon concentrations in surface waters ranged from 44 to 578 nl l<sup>-1</sup> for methane; 1.9 to 10 nl l<sup>-1</sup> for ethene; 0.1 to 1.6 nl l<sup>-1</sup> for methane; 0.4 to 2.6 nl l<sup>-1</sup> for propene; and 0.2 to 1.3 nl l<sup>-1</sup> for propane.

Most HMW hydrocarbons in fishes and macroinvertebrates were biogenic in origin and characterized by a general lack of aromatic compounds. Fish and shrimp muscle had generally low, uniform, trace metal levels with few apparent geographical, seasonal, or interspecific trends.

Phytoplankton biomass parameters, particularly chlorophyll a, decreased in an offshore direction. Continuous measurement of chlorophyll a, temperature, and salinity along Transect II revealed freshwater intrusions into the STOCs area, an area upwelling event during February, and possible wind mixing in September due to Hurricane Anita. Zooplankton biomass, total density, and biomass generally decreased in an offshore direction. Copepods, mostly calanoids, comprised 50% of the total zooplankton catch though other groups (barnacle larvae, chaetognaths, cladocerans, molluscs, ostracods, and tunicates) were well represented. Neuston samples contained 104 decapod taxa comprised of 88 larval taxa and 16 non-larval taxa. Additional taxonomic groups collected in neuston nets included chaetognaths, cnidarians, ctenophores, echinoderms, foraminiferans, molluscs, nematodes, polychaetes, and tunicates. Approximately 50% of the zooplankton samples showed hydrocarbon contamination, and zooplankton exhibited the highest trace metal concentration of any group. Lead concentrations decreased offshore, and cadmium levels displayed a reverse trend. Nematodes were the numerical dominant and most speciose meiofaunal group. Nematode numbers increased significantly when sand equaled or exceeded 60%. Harpacticoid copepods, the second most numerous group, did not respond to this parameter. 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. A total of 59,220 individuals representing 667 infaunal species were collected. Polychaetes numerically dominated the collections. A total of 23,933 individuals representing 88 epifaunal species were collected. Three decapod crustaceans (*Trachypenaeus similis*, *Penaeus aztecus*, and *Sicyonia dorsalis*) comprised 60% of the total epifaunal catch by number. Nine distinct infaunal species groups were identified by cluster analysis. Epifaunal species clustered into eight species groups. Depth related species groupings, identified with cluster analysis, included inner shelf stations (10 to 49 m deep) and outer shelf stations (65 to 134 m deep). 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, and 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 1977 trawling efforts yielded a total of 132 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:** Flint, R. W. and C. W. Griffin. 1979. Environmental Studies, South Texas Outer Continental Shelf, Chemistry and Biology. A final report by the University of Texas Marine Science Institute for the U.S. Department of the Interior, Bureau of Land Management Gulf of Mexico OCS Office, New Orleans, LA. Vol. I (Chapters 1-10) - NTIS No. PB81-106718; Vol. II (Chapters 11-21) - NTIS No. PB81-106726; Vol. III (Appendices A-F); Vol. IV (Appendices G-I); Vol. V (Appendices J-M); Vol. VI (Appendices N-S); Vol. VII (Executive Summary) - NTIS No. PB81-106692. Contract No. 14-12-0001-29131.