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BACKGROUND: The South Texas Outer Continental Shelf (STOCS) is a region that has oil and gas potential. The U.S. Department of the Interior (USDOI) required complete environmental characterizations of oil and gas lease areas for making appropriate management choices. These reports present the results of field studies in the STOCS area conducted by a consortium of investigators contracted by the USDOI.

OBJECTIVES: (1) To provide information for predicting effects of OCS oil and gas activities on components of the ecosystem; (2) to provide a description of the physical, chemical, geological, and biological components and 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 identify and conduct experimental and problem-oriented studies as required to meet the basic objectives.

DESCRIPTION: The study area was bounded by 96°W long on the east, the Matagorda Bay complex on the north, the Texas coastline on the west, and the Mexico-U.S. international border on the south.

In 1975, samples were collected from 18 stations located along three transects during three biological-meteorological seasons: winter (December-February), spring (April-May), and fall (September-October). Thirteen additional stations were sampled during the second and third years of the study. Navigation for water column cruises was LORAN-A, while benthic stations were located using LORAN-C systems.

Water samples were collected with Nansen or Niskin bottles. Salinity and temperature were recorded using a Plessey Model 9060 salinity/temperature/depth measuring system or conductivity/temperature/depth metering system. Sediment samples were taken by gravity core. Smith-McIntyre grabs were used to collect fungi, macroinfauna, meiofauna, and sediment. Macroepifauna and demersal fishes were collected with box otter trawls (10.7 m width) towed for 15 min. Neuston was sampled with a 2.0 x 1.0 m frame net with 0.505-mm mesh. Zooplankton were collected using a 1-m diameter Nitex net (0.233-mm mesh) equipped with a digital flow meter. Low and high molecular weight hydrocarbons from sediments, organisms, and water column were analyzed using gas chromatography. Crustaceans, fishes, molluscs, and zooplankton were examined for high molecular weight hydrocarbons. Trace metals (cadmium, chromium, copper, iron, lead, nickel, and zinc) were analyzed by flame atomic absorption spectroscopy. Aluminum, calcium, and vanadium were measured in zooplankton samples by neutron activation analysis.

Water column levels of light extinction, chlorophyll a, phaeopigments, adenosine triphosphate, transmissometry, and phytoplankton abundance were measured using standard techniques.

Data were assembled for subsequent statistical and numerical analyses which included cluster analysis, multiple discriminant analysis, linear and nonlinear regression, and various descriptive statistics.

SIGNIFICANT CONCLUSIONS: STOCS biotic communities were characterized as moderately diverse and ecologically pristine. Depth and substrate type were predominant environmental variables controlling distribution and abundance of benthic invertebrates and fishes. Contaminations by trace metals and hydrocarbons were relatively nonexistent in the water column, sediments, and organisms. Aromatic hydrocarbons detected in zooplankton were from offshore tanker expulsion.

STUDY RESULTS: Low molecular weight hydrocarbons were derived from natural sources. High methane levels were associated with the thermocline during stratified periods. Biogenic ethene (ethylene) and propene (propylene) were associated with high productivity levels. Sediment methane was of microbial origin. The STOCS area was

found to be relatively pristine with respect to petrogeneous hydrocarbons. Zooplankton samples displayed increasing levels of petroleum hydrocarbons during the study. Micro-tarballs discharged from tanker traffic were thought to be the cause of this contamination. Macroepifauna and fishes did not contain appreciable amounts of high molecular weight hydrocarbons; spatial and temporal trends were not evident, suggesting that hydrocarbon pools were stable. No significant trace metal concentrations were detected in zooplankton, fishes (gill, liver, muscle), or shrimps (hepatopancreas and muscle). Some nearshore species displayed seasonal fluctuations of aluminum. Phytoplankton biomass and activity decreased offshore and from north to south. Phytoplankton species associations were irregular in space and time. Positive correlations existed between species counts, chlorophyll a, carbon-14 uptake, and secchi depth. Neuston assemblages were diverse and variable; most taxa exhibited pronounced seasonal abundance cycles with peaks in spring and summer. Onshore-offshore variation occurred in some taxa, particularly the larval decapods. No significant correlations were found between neuston biomass and environmental variables. Copepods formed depth-related clusters according to species composition. Most filamentous fungi found in STOCS sediments were terrestrial imperfect fungi. Peak abundance in the fall sediment was directly correlated with total organic carbon at each site. Over half of the fungal species tested could assimilate crude oil to overcome carbon limitation. Benthic bacterial populations decreased with increasing depth. Hydrocarbon degrading bacteria were an indigeneous component of the benthic bacterial community throughout the year and their abundance was correlated with sediment alkane content. A total of 786 meiofaunal samples were analyzed. Nematodes were the most abundant of the true meiofauna, while polychaetes were the most abundant of the temporary meiofauna. Benthic infaunal and epifaunal invertebrates were represented by 973 taxa from 14 phyla. The numerically dominant phyla were Annelida, Arthropoda, Echinodermata, Mollusca, Nemertinea, and Sipuncula. Polychaetes accounted for 40% of the total species richness, while crustaceans and molluscs contributed 34 and 18%, respectively. Infaunal distribution was primarily associated with depth and sediment characteristics. Epifaunal distribution was primarily depth related. No significant temporal variations were evident in benthic invertebrate communities. Over 160 fish species were collected; 57 species were represented by an excess of 100 individuals and 22 species were collected in excess of 1,000 individuals. Common species included *Syacium gunteri, Diplectrum bivittatum, Serranus atrobranchus*, and *Trachurus lathami*. Cluster analysis revealed depth-related groupings of fishes. Discriminant analysis separated the depth-related groups with respect to a combination of mean grain size, percent silt composition, and bottom salinity.

STUDY PRODUCTS: Flint, R. W. and N. N. Rabalais. 1980. Environmental Studies, South Texas Outer Continental Shelf, 1975-1977. Vol. I, Ecosystem Description. 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. NTIS No. PB80-181506 (PC/A16). Contract No. AA551-CT8-51. 213 pp + app.

Benavides, R. A., R. W. Flint, and R. Godbout. 1980. Environmental Studies South Texas Outer Continental Shelf, 1975-1977. Vol. II, Data Management. 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. NTIS No. PB80-181514 (PC/A15). Contract No. AA551-CT8-51. 98 pp + app.

Flint, R. W. and N. N. Rabalais. 1980. Environmental Studies, South Texas Outer Continental Shelf, 1975-1977. Vol. III, Study Area Final Reports. 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. NTIS No. PB80-181522 (PC/A99). Contract No. AA551-CT8-51. 648 pp.

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