

STUDY TITLE: South Texas OCS Baseline Study, Plankton, Fisheries, and Physical Oceanography

REPORT TITLE: Environmental Studies of the South Texas Outer Continental Shelf, 1975. Volume I: Plankton and Fisheries, Volume II: Physical Oceanography, and Volume III: Addendum to Volume I: Plankton and Fisheries

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BACKGROUND: The U.S. Department of the Interior (USDOI) was authorized to initiate a national Outer Continental Shelf (OCS) environmental studies program in 1974. As oil and gas activities were projected for the Gulf of Mexico off south Texas, the USDOI implemented a program to develop precise and relevant baseline data upon which future management decisions could be made. This study provided data and information on hydrology, plankton, crustaceans, pelagic and bottom fishes, and recreational fisheries for the south Texas coastal and OCS areas.

OBJECTIVES: (1) To identify zooplankton and determine their seasonal and areal distribution and abundance, with specific emphasis on shrimp larvae and ichthyoplankton; (2) to analyze historical data on bottom fishes and shrimps, and newly generated information on pelagic and recreationally important fishes; (3) to assess pelagic and recreational fish species through available data, hydroacoustical surveys,

periodic gill net sampling, and a creel survey; (4) to estimate for daytime onshore and offshore fisheries, the seasonal and total fishing effort by recreational fishermen, catch per unit effort for the dominant species caught in each fishery, and the approximate value of these fisheries to the local economy; and (5) to derive a comprehensive picture of physical oceanographic conditions off the south Texas coast from analysis of available historical hydrographic, water movement, and meteorological data.

DESCRIPTION: Zooplankton samples collected from four stations off south Texas for a three-year period (1963-1965) were analyzed to document zooplankton variability. Subsamples were sorted into major taxonomic groups. Copepods were most intensively studied. Between February and December 1965, monthly cruises were conducted for plankton sampling at 20 stations. In the laboratory, each sample was microscopically examined and all planktonic stages of penaeids were removed and sorted into developmental stages, identified to genus, and counted. Data reported were for *Penaeus* larvae only, a grouping of the young of the white, pink, and brown shrimps. A series of 12 stations along four transects extending from coastal to OCS waters were occupied from December 1974 through September 1975 on a quarterly day/night basis. All fish eggs and larvae were removed from aliquot samples, counted, measured, and classified to the lowest possible taxon. Paired bongo net plankton samplers were used to collect king and Spanish mackerel larvae from May through September 1975 at 16 stations along four transects perpendicular to the coast off Port Aransas. *Scomberomorus* larvae were sorted, counted, and measured. Numerous scombrid eggs were encountered but none could be definitely identified as *Scomberomorus* eggs. Geometric and arithmetic mean catches of penaeid shrimp were compiled from data previously obtained and used as indices of shrimp abundance. Annual commercial shrimp catches and the value of these catches were also reported as other indices of shrimp abundance. Total commercial landings of finfishes, blue crabs, and squid were derived from Texas landings information. Gill nets were used to obtain supplementary data for assessment of near-surface pelagic fishes; other methods used in the pelagic fish survey included recreational fish surveys and hydroacoustical surveys. Fishes caught in gill nets were identified, counted, and measured. Recreational field surveys were conducted through direct observation of the number of fishing units (boats or people) and personal interview to determine length of time fished to obtain catch results. Data concerning the sport fishery for billfishes were collected by interviewing anglers and boat captains. Two sonar surveys (August and December) were conducted along 14 transect lines in the area extending from Brownsville northward to Matagorda Bay and from nearshore to the shelf break. Data concerning the ichthyofauna of the 7- to 110-m isobaths were obtained in 1962-1964. Samples were taken on a monthly basis using a 14-m flat trawl equipped with rollers. The numbers and weights of each species were analyzed.

SIGNIFICANT CONCLUSIONS: Zooplankton abundance increased seaward and showed a marked temporal variation. Larval *Penaeus* shrimp occurred throughout the study area with spring and fall abundance peaks. Large catches of fish eggs and larvae indicated highly productive and major spawning areas. Commercial shrimping and recreational sport fishing have a definite economic impact on the study area.

Oceanographic data revealed a complex surface current system greatly influenced by prevailing winds and density structure.

STUDY RESULTS: Zooplankton abundance was seasonally variable; variation was most pronounced at shallow stations. Three-year zooplankton abundance data showed a gradual decrease seaward. Copepods were most abundant comprising 70% by number and a total of 118 species. *Penaeus* larvae occurred throughout the study area, but highest concentrations occurred in middle continental shelf waters. In shallow depths (7.3 to 13.7 m), larvae occurred between April and October with a spring and fall peak period closely coinciding with the white shrimp spawning season. In intermediate depths (22.9 to 82.3 m), larvae occurred generally throughout the year but there were two periods of increased abundance; one in spring and the other in fall or early winter. It was hypothesized that these peaks can be related to spawning activities of brown shrimp. During the ichthyoplankton survey, 49 families, 84 genera, and 50 species were identified. Anchovies, gobies, and codlets accounted for 57% of the larvae. Based on the number of eggs collected, late summer and early fall appear to be the dominant spawning times for fishes in the study area. Greatest numbers of king mackerel larvae were taken in September in deepwater (32 to 36 m). Spanish mackerel larvae occurred in greatest numbers in May in shallow waters (13 m or less). Extremely large catches of fish eggs and larvae indicate that these waters are highly productive and serve as a major spawning area for fishes. Groundfish data indicated that a diverse ichthyofauna occurs at depths of 7 to 100 m. Fourteen identified families made up approximately 97% of the biomass and 96% of the number of fishes; Lutjanidae (snappers) contributed over 30% of the biomass and 20% of the specimens. Twelve species of penaeid shrimp occurred in the study area, however, only three (i.e., brown, white, and pink shrimps) were harvested commercially. The brown shrimp was the most abundant species with greatest concentration at water depths between 23 to 28 m; white and pink shrimps occurred generally in water depths less than 23 m. Between 1970-1974, commercial shrimp landings from the study area ranged from 4.4 to 7.3 million pounds (heads off) with a value of 5.7 to 13 million dollars. Data analysis revealed that pelagic schooling fishes included five families and 17 species. Highest number (27) of schools occurred in August and the lowest number (7) occurred in December. Sports fishermen caught 32 species during approximately 344,455 man-days of fishing. King mackerel, crevalle jack, red snapper, and sand seatrout numerically dominated the catches. These catches, projected and coupled with yearly landings of billfish from 1972-1975, were worth approximately 3.9 to 7.4 million dollars. Spatial and temporal variability of physical oceanographic data were high. Shelf water temperatures during winter were characterized by vertical homogeneity and a strong lateral gradient. In summer, strong vertical stratification and lateral homogeneity occurred. An onshore/offshore salinity gradient was present in most seasons due to freshwater outflow. Drifters, ship drift reports, and current meter records revealed a complex surface current structure with seasonal reversals. The interaction of prevailing winds and density structure is important for open-shelf flow in all seasons.

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