ACCESS NUMBER: 29142

STUDY TITLE: Southwest Florida Shelf Ecosystems Study - Year I

REPORT TITLE: Southwest Florida Shelf Ecosystems Study, Year I, Executive Summary, Final Report, Appendix A: Methodology, and Appendix B: Supporting Data

CONTRACT NUMBERS: BLM: CT0-50; MMS: 14-12-0001-29142

SPONSORING OCS REGION: Gulf of Mexico

APPLICABLE PLANNING AREA: Eastern Gulf of Mexico

FISCAL YEAR OF PROJECT FUNDING: 1980

COMPLETION DATE OF REPORT: April 1983

COST: FY 1980: $1,338,285

CUMULATIVE PROJECT COST: $1,338,285

PROJECT MANAGER: K. Mac Donald

AFFILIATION: Woodward-Clyde Consultants

ADDRESS: 3489 Kurtz Street, San Diego, California 92110

PRINCIPAL INVESTIGATORS*: D. Gettleson, K. Mac Donald

KEY WORDS: Eastern Gulf; Florida Shelf; biology; benchmark; infauna; epifauna; benthos; hydrography; geology; benthic photographs; videotapes; hydrocarbons; trace metals; sediment; hard-bottom; community; maps; nutrients; grain size; seasonality; faunal zones

BACKGROUND: The Minerals Management Service plans to lease offshore tracts in the Eastern Gulf of Mexico every two years as outlined in its Five-Year Outer Continental Shelf (OCS) Oil and Gas Lease Schedule. The southwest Florida continental shelf consists of sandy soft-bottom areas and hard-bottom (live-bottom) areas which have not been adequately characterized. The distributions of these bottom types and associated biota and their significance in the shelf benthic and water column ecosystem is not well known. This study was conducted to describe the southwest Florida shelf ecology with an emphasis on mapping the benthic environment.

OBJECTIVES: (1) To determine the potential impact of OCS oil and gas offshore activities on live-bottom habitats and communities of the southwest Florida shelf ecosystem; (2) to produce habitat maps that show the location and distribution of various bottom substrates; and (3) to broadly classify the biological zonation across and

along the shelf, projecting the percent of the area covered by live/reef bottoms and the amount covered by each type of live/reef bottom.

DESCRIPTION: Various geophysical, hydrographic, and biological characteristics were studied along five east-west transects across the southwest Florida shelf. Geophysical data, consisting of bathymetric, subbottom profile, and side-scan sonar data, were collected along each transect from 40- to 200-m water depths. Underwater television videotapes and 35-mm color still photographs were collected along these transects from 20- to 100-m water depths.

Thirty (15 soft-bottom and 15 hard-bottom) stations were selected, based on preliminary analyses of underwater television videotapes and still photographs, along the five transects between depths of 20 and 100 m. The stations were visited during the Fall of 1980 (October-November) and the Spring of 1981 (April-May). Hydrographic profiles of temperature, salinity, dissolved oxygen, transmissivity, light penetration, yellow substance, nutrients, and chlorophyll a data were made at each station during two cruises. Five replicate macroinfauna, sediment grain size, and total carbonate samples and two replicate hydrocarbon and trace metal samples were collected with a modified Reineck box core sampler at each soft-bottom station. A 30-ft otter trawl was used to collect epibiota samples at both soft-bottom and hard-bottom stations. A Kahlsico triangle dredge was utilized to collect three replicate dredge samples at each hard-bottom station. Underwater television and 35-mm still camera photographic data were also collected to characterize each station. To assess epibiota coverage within live-bottom areas, a quantitative slide analysis was conducted where several photographic slides from each station were evaluated. By determining the biota or substrate beneath 100 random dots superimposed on each slide, percent coverage was determined.

SIGNIFICANT CONCLUSIONS: Nine major biological assemblages, two associated with soft sediments and seven associated with hard substrates (live-bottom), were identified from the underwater television and still camera observations made between 20- and 100-m water depths. Comparisons of substrate mapping using geophysical data and visual observations indicated that there was not a one-to-one correspondence between the two methods and a combination of the two data sets was necessary to yield the most complete and accurate substrate descriptions. Clustering of trawl and dredge data, interpretation of quantitative slide analyses, and television observations revealed three epibiotal zones: (1) an Inner Shelf Zone; (2) an Inshore Middle Shelf Zone; and (3) an Offshore Middle Shelf Zone. Additional data, collected during two seasons, characterized the seasonal nature of the oceanographic conditions of the region, as well as the differing sediment characteristics within the region studied.

STUDY RESULTS: The southwest Florida shelf was divided into three depth zones for the purposes of this study: (1) Inner Shelf, 0- to 40-m water depths; (2) Middle Shelf, 40- to 100-m water depths; and (3) Outer Shelf, 100- to 200-m water depths. Geophysical data disclosed that the Inner Shelf was characterized by a thin sand layer over bedrock with small localized areas of outcrops on the four northernmost transects and a thicker layer of fine grained sediment in the southern part of the study area. The Middle Shelf

was composed of a thin sand layer overlying a 5- to 20-m thick wedge of late Tertiary to Quaternary sediments inshore of the 70-m depth contour. From the 70- to 90-m depth, partially exposed reef-like structures were dominated by sand covered bottom with scattered areas of outcrops. At the 135- to 170-m water depth on the center transect, exposed prominences of reef rock/dead coral protruded up to 3 m above a sand covered bottom.

Visual observations (videotapes and still photographs) were used to assess both the substrate types and the composition of the associated benthic communities. Five substrate types were delineated: (1) sand bottom/soft bottom; (2) thin sand over hard substrate; (3) rock outcrops/hard bottom; (4) coralline algal nodule layer over sand; and (5) algal nodule pavement with *Agaricia* coral accumulations. The first two substrate categories accounted for nearly 90% of the total. Turbidity fronts apparently related to resuspension of bottom sediments, and seafloor depressions from 1 to 25 m in diameter and up to 2 m deep were also observed with the television/still camera system. The depressions may represent buried karst features or underwater springs.

Hydrographic data were collected at the 30 shelf stations during fall and spring. Fall data showed the results of wind induced mixing and water surface cooling with the mixed layer extending to about 40- to 60-m water depths. A high level of nutrients indicated that the Loop Current or winds may have induced upwelling of deeper waters into the near-bottom environment. Spring cruise data showed salinities mixed from surface to bottom, generally high dissolved oxygen values down to the bottom, and nutrient levels low with subsurface maxima indicating possible Loop Current water intrusion onto the shelf. Extremely low yellow substance concentrations and few fluctuations in salinity indicated little influence on the shelf waters by Everglades runoff.

Grain size and carbonate analyses of soft-bottom sediment samples delineated three distinct sediment types; an insoluble quartz clastics facies found in the northeastern part of the study area, a fine-grained carbonate mud northwest of Key West, and a carbonate sand throughout the rest of the study area. Surficial sediment hydrocarbon analyses showed a low-level background concentration of primarily marine biogenic hydrocarbons, with traces of petrogenic and/or terrigenous hydrocarbons at six stations. Concentration levels of nine trace metals (barium, cadmium, chromium, copper, iron, nickel, lead, vanadium, and zinc) were low and showed uniform distribution across the shelf.

Analyses of soft-bottom trawl samples indicated little seasonal species variation. Clustering of trawl data showed distinct bathymetric distribution patterns of epibiota, but little latitudinal variation. There was a high taxonomic richness for the macroinfauna with 1,033 taxa identified. Deeper water stations (>60 m) exhibited higher taxonomic richness than the inner shelf stations, while total infaunal density was inversely related to depth with deeper stations displaying lower faunal densities. Faunal similarity analyses disclosed an offshore (60- to 90-m depths) macroinfaunal zone dominated by the polychaete *Synelmis albini*; less distinct nearshore (20 m) and middle shelf (50 m) station groupings were also identified.

Quantitative slide analyses of each hard-bottom station indicated low percent coverages of biota were found at a majority of the stations. Highest percent biotal cover was found in the southwestern section of the study area where coralline algae, the green alga *Anadyomene menziesii*, and the hard coral genus *Agaricia* occurred in relatively high abundance. Dredge and trawl sample collections revealed a number of undescribed species including 28 sponges, 4 molluscs, 1 ophiuroid, and 3 fishes, as well as numerous geographical range extensions. In addition, a number of relict molluscs, previously known only from Pliocene and Pleistocene deposits, were collected and may represent an upper Neogene relict pocket that survived the Pleistocene glacial sea level fluctuations.

STUDY PRODUCTS: Woodward-Clyde Consultants and Continental Shelf Associates, Inc. 1983. Southwest Florida Shelf Ecosystems Study - Year I. A final report for the U.S. Department of the Interior, Minerals Management Service Gulf of Mexico OCS Office, Metairie, LA. Vol. I - NTIS No. PB84-113273; Vol. II - NTIS No. PB84-113281; Vol. III - NTIS No. PB84-113299; Vol. IV - NTIS No. PB84-113307. Contract No. 14-12-0001-29142. 921 pp.

Four Cruise Reports: February 10, 1981, April 3, 1981, April 25, 1981, and July 20, 1981. A Marine Habitat Atlas: 2 volumes, January 15, 1983.

*P.I.'s affiliation may be different than that listed for Project Managers.