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PROJECT MANAGERS: K. MacDonald, G. Robilliard, T. Winfield

AFFILIATION: Woodward-Clyde Consultants

ADDRESS: One Walnut Creek Center, 100 Pringle Avenue, Walnut Creek, CA 94596

PRINCIPAL INVESTIGATORS*: D. Gettleson, K. Haddad, S. Mahadevan, J. Rietman

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BACKGROUND: In anticipation of oil and gas exploration on the southwest Florida shelf, the U.S. Department of the Interior initiated a multi-year descriptive characterization of water column and benthic environments from this area. Biological, hydrographic, and geophysical surveys were completed during 1980 to 1981 and continued, with some modifications, from 1981 to 1982. This report details findings from the second study year and incorporates first year information into summary discussions of hydrography, substrates, and biotal zonation on the southwest Florida shelf.

OBJECTIVES: (1) To determine the potential impact of oil and gas offshore activities on live-bottom habitats and communities; (2) to produce habitat maps showing 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: During Year 1, five east-west transects were established to provide bathymetric and latitudinal coverage necessary to characterize the southwest Florida shelf environment. These transects were geophysically surveyed using recording fathometer, side-scan sonar, and subbottom profiler. During the same season (Fall 1980), photographic data obtained from a towed television/still camera system, were collected along the same transects. In Year 2 (Spring 1981), an additional north-south transect located in about 100 m water depth was geophysically and photographically surveyed.

During Year 1 (Fall 1980 and Spring 1981), hydrographic, sedimentary, and benthic biological samples were collected from 30 (1 km^2) stations (15 live bottom and 15 soft bottom) distributed along the five transects in 20 to 100 m water depth. Thirty fixed stations were sampled during Summer 1981 and Winter 1982. These included 21 first year stations and 9 new (five live bottom and four soft bottom) stations in depths of 100 to 200 m, bringing the total live-bottom and soft-bottom stations visited during both study years to 20 and 19, respectively. At soft-bottom stations, five replicate box core samples were collected for sediment and macroinfaunal samples; at live-bottom stations, three replicate triangle dredge hauls collected macroepifauna and macroalgae; and at all stations, otter trawls collected macroepifauna and fishes. Photographic data (videotapes and quantitative 35-mm slides) were also collected at all stations.

Sediment samples were analyzed for grain size, total carbonate, trace metals (Fall 1980 only), and hydrocarbons (Fall 1980 and Summer 1981 only). Hydrographic data and samples were analyzed to construct profiles of temperature, salinity, dissolved oxygen, transmissivity, light penetration, nutrients, chlorophyll a, and yellow substance (Year 1 only). Dredge and trawl data were reduced to taxonomic lists, rank order abundance tables, and species richness tables. Still photographs were analyzed using random dot overlays to estimate percent cover for total biota and particular identifiable biotic groups. Infaunal data were reduced as faunal density, diversity, equitability, evenness, and rank abundance. Species accumulation curves were used to evaluate sampling adequacy for all biological samples. Normal and inverse cluster analyses were used to group stations by species composition and abundances, then weighted discriminant analysis was utilized to relate groups to various environmental variables.

SIGNIFICANT CONCLUSIONS: Photographic observations discerned nine benthic biological assemblages (two soft bottom, and seven live bottom) distributed in three depth zones: 20 to 60 m, 60 to 90 m, and 90 to 200 m. Combined geophysical and visual data indicated the occurrence of six substrate types. Cluster analysis of live-bottom dredge and trawl data identified an onshore-offshore pattern consisting of a major mid-shelf group and two offshore groups. Soft-bottom stations also separated along the nearshore-offshore direction. Depth-related (and for infauna, sediment-related) trends in environmental variables were probably responsible for the observed biotic trends. The study area was pristine with respect to sediment trace metals and hydrocarbons.

STUDY RESULTS: Geophysical observations revealed that inner shelf (<40 m water depth) areas are covered by a thin veneer of sediment and interspersed with patch reefs, outcrops, and thinly covered hard bottom. At mid-shelf depths (70 to 90 m), thin sand covers a 5 to 20 m thick wedge of late Tertiary to Quaternary sediments. In 70 to 90 m depth, partially exposed outcrops occurred on a predominantly sand bottom. At the center transect (135 to 170 m water depth), exposed prominences of reef/rock protruded up to 3 m above a sand bottom.

Six primary substrates were identified from photographic surveys: sand/soft bottom, thin sand over hard substrate, rock outcrops/hard bottom, coralline algal nodule layer over sand, algal nodule pavement with *Agaricia* accumulations, and coarse rubble with attached crinoids. The first two substrate types accounted for nearly 90% of the total area surveyed. Generalized biotic assemblages distributed along three major depth zones were: Inner and Middle Shelf Sand Bottom Assemblage (20 to 90 m), Inner Shelf Live Bottom Assemblage I (20 to 27 m), Inner and Middle Shelf Live Bottom Assemblage II (25 to 75 m), Middle Shelf Algal Nodule Assemblage (62 to 108 m), *Agaricia* Coral Plate Assemblage (64 to 81 m), Outer Shelf Sand Bottom Assemblage (74 to 200 m), and Outer Shelf Low-Relief Live Bottom Assemblage (108 to 198 m).

Soft-bottom station infaunal sampling yielded 1,378 infaunal taxa. Taxonomic richness was highest at mid-shelf stations and lowest at offshore stations. Faunal densities ranged from 2,210 to 18,233 organisms m^{-2}. Cluster analysis and discriminant analysis of box core samples revealed nearshore-offshore gradients in species composition presumably related to depth and sediment grain size. A total of 667 macroepifaunal taxa were collected in soft-bottom otter trawls. Cluster analysis and discriminant analysis showed depth-related trends in species composition of trawl catches. Depth was the only discriminator of soft-bottom trawl data. Triangle dredge collections from live-bottom stations yielded 1,544 taxa. Species richness was highest at inshore (<50 m depth) stations. Trawl samples from live-bottom stations produced 1,148 taxa. Cluster analysis and weighted discriminant analysis of live-bottom dredge and trawl data showed depth-related (and possibly nutrient related) trends in species composition of epibiota. Quantitative slide analysis indicated epibiotal cover (mostly sponges and algae) was generally highest in the southwestern section of the study area.

With the exception of quartz clastics in the northeastern portion and fine-grained carbonate mud in the southeastern portion of the study area, sand-sized calcareous sediments predominated throughout the area. Sedimentary hydrocarbon levels were low and derived from biogenic sources. Sediment trace metal levels were low and showed a uniform distribution across the shelf.

Hydrographic parameters were more variable in surface waters than in deeper stratified layers. During summer, temperatures ranged from 30.6 to 12.6°C and from 24.5 to 14.0°C during winter. A thermocline was observed during spring and summer cruises. Salinity varied little (35 to 37 ppt) over the shelf. Transmissivity ranged from 96 to 87% in summer and 95 to 64% in winter. Dissolved oxygen exhibited no evident seasonal patterns and surface values ranged from 5.47 to 7.0 ml l^{-1}. Nutrient concentrations in

surface mixed layers were generally low but below the pycnocline nutrient concentrations increased. Offshore nutrients were generally higher than mid-shelf or inshore waters. Chlorophyll a concentrations ranged from <0.1 to 1.5 mg m^{-3} indicative of oligotrophic conditions.

STUDY PRODUCT: Woodward-Clyde Consultants and Continental Shelf Associates, Inc. 1984. Southwest Florida Shelf Ecosystems Study - Year 2. A final report for the U.S. Department of the Interior, Minerals Management Service Gulf of Mexico OCS Office, Metairie, LA. Volume 1: Executive Summary, Volume 2: Final Report I; Volume III: Final Report 2), Volume IV: Final Report 3), Volume V: Appendix A, Volume VI: Appendix B, Volume VII: Appendix C; Contract No. 14-12-0001-29144.

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