

STUDY TITLE: Southern California Bight Baseline, Year I.

REPORT TITLE: Southern California Baseline Study Intertidal and Benthic 1975-76 (Year I), Vol. III, Report 2.4 - Benthic Macrofauna; Report 2.5 - Benthic Microfauna.

CONTRACT NUMBER(S): BLM: CT5-52; MMS: 14-12-0001-29079.

SPONSORING OCS REGION: Pacific.

APPLICABLE PLANNING AREA(S): Southern California.

FISCAL YEAR(S) OF PROJECT FUNDING: 1975; 1976.

COMPLETION DATE OF REPORT: March 1978.

COST(S): FY 1975: \$3,802,641; FY 1976: \$127,623; CUMULATIVE PROJECT COST: \$3,930,264.

PROJECT MANAGER(S): R. Callahan.

AFFILIATION: Science Applications, Inc.

ADDRESS: P.O. Box 2351, 1200 Prospect Street, La Jolla, California 92037.

PRINCIPAL INVESTIGATOR(S)*: R. Douglas, K. Fauchald, G. Jones.

KEY WORDS: Southern California; Southern California Bight; Tanner-Cortes Banks; baseline; biology; benthos; infauna; foraminifera; sediment; faunal zones; distribution; grain size.

BACKGROUND: Prior to leasing of the Southern California OCS, an extensive program of environmental studies was conducted by the U.S. Department of the Interior. The benthic faunal studies conducted as part of this program were among the largest ever undertaken in this area. Unlike previous studies in the area, the present benthic investigations studied the biota of every major habitat of the Southern California Bight. Of most importance, the study intensively surveyed the fauna of the slope--heretofore poorly sampled--and outer island shelves, banks, and ridges--almost unknown to science and sampled extensively for the first time.

OBJECTIVES: (1) To determine the abundance, composition, diversity, and general health of the benthic macrofauna of the Southern California Bight prior to oil and gas development in the area; (2) To document the occurrence, distribution, standing crop, and diversity of Foraminifera; (3) To describe Foraminifera communities and define their boundaries; (4) To correlate Foraminifera distribution with the physical environment; and (5) To assess the value of Foraminifera as indicators of man-induced alterations in the environment.

DESCRIPTION: Benthic macrofauna were collected at 546 stations in 11 high density sampling areas (372 NM²). The sampling areas were divided into 1-NM² areas. An additional 231 stations were located outside the high density sampling areas (HDSAs). Station depths ranged from 7 to 1,886 m. A total of 711 box core samples [using a 0.06 m² USNEL box corer (20 x 30 cm)] and 145 trawl and/or dredge samples (using a 1.8-m beam trawl or rock dredge) were collected. Specimens were identified to the lowest practical taxonomic classification and described using the following methods of sample analysis. Data were analyzed using classification techniques; rankings of numerically dominant taxa; diversity, evenness, dominance indices; and plotting subroutines.

A total of 268 Foraminifera samples were collected using a box corer or Van Veen grab sampler. Samples were taken from the top centimeter of the core and 12 to 15 cm below the top of the core. Samples were preserved on board ship after staining with Rose Bengal and later sieved in the laboratory through a 230 mesh (62.5 um) screen. Estimates of standing crop and species diversity were made by counting live (i.e., those Foraminifera which were stained by the Rose Bengal) and dead organisms.

SIGNIFICANT CONCLUSIONS: Benthic macrofauna and Foraminifera community assemblages in the Southern California Bight have been described. The macrofaunal were grouped into four assemblages that were influenced by geographic location as well as physical factors such as depth and sediment characteristics. Five Foraminifera communities were also identified. Distribution of these communities was also largely influenced by depth-related gradients in sediment and water quality.

STUDY RESULTS: The benthic data presented in the report allowed for a description of the faunal species present in the study area, but not spatial and temporal descriptions of the faunal communities.

The 11 HDSAs were grouped into the mainland shelf HDSAs, island shelf HDSAs, open water HDSAs, and an anomalous area (Tanner-Cortes Banks). Mainland shelf HDSA benthic assemblages conformed to bathymetry. Three faunal zones (shallow water, intermediate, and deep water) were recognized. The numbers of species and specimens were inversely proportional to depth. In general, standing crops were lower in deep water than at shallow and intermediate depths. Faunal patterns were less distinct in the island shelf HDSAs. Faunal distributions correlated with bathymetry at the San Miguel Island HDSA and substrate type at the Santa Rosa Island HDSA (which had a limited depth range). Species richness, abundance, and standing crops were high throughout the areas. At the San Miguel Island HDSA, standing crops were highest in deeper offshore areas. The open water HDSAs showed varying results. No distinct faunal associations were observed in the Santa Catalina Island HDSA except along the northern margin of the area where standing crops were low. The Santa Cruz Basin HDSA fauna could be grouped into shallow water, slope, and basin associations. The fauna of the Santa Rosa Ridge HDSA were similar to the shallow water fauna of the Santa Cruz Basin HDSA. The Tanner Bank HDSA fauna were similar to the slope fauna of the Santa Cruz Basin HDSA. Discontinuous faunal distribution patterns and complex substrate types characterized the Tanner-Cortes Banks HDSA. However, clear distinctions existed between the fauna of the bank tops and that of the troughs between the banks. In spite of the species differences, species richness, population density, and standing crops were similar.

Echinoderms were distributed in four depth zones: <100 m, 100 to 250 m, 300 to 1,000 m, and >1,000 m. In water less than 100 m deep, the brittle star Amphiodia urtica dominated on fine sediments and Amphipholis sp. was dominant or codominant where shell debris was present. Sea urchins were dominant from 100 to 300 m depth. The brittle stars Ophiomusium jolliensis and Asteronyx longifissus and the starfish Myxoderma platyacanthum were dominant at depths between 500 and 1,000 m. Basin floors greater than 1,000 m deep had a fauna dominated by the brittle stars Ophiura leptocleria, Ophiophthalmus normani, and Ophiacantha sp. and the holothuroid Scotoplanes sp. Only two crustacean zones were recognized in shallow (<300 m) and deep waters. The shallow water fauna formed two groups associated with soft silts and clays or gravel and boulders. At greater than 300 m depth, crustacean numbers were uniform but species numbers were low. For molluscs, three distinct patterns were identified for soft bottoms. These included a sand associated fauna in very shallow water, a silt and clay assemblage at depths of less than 50 m, and a fauna dominated by Cyclocardia ventricosa in 50 to 100 m depth. Polychaete zones were established in shallow water (one associated with sand and another with silt and clay) on the slope between 200 and 500 m, and in the basins at depths exceeding 1,000 m.

Five Foraminifera communities were identified in the study area using cluster analysis. Four of these communities are predominantly found in shallow waters (<15 m) of the mainland and insular shelf and the offshore banks and ridges. A fifth community is found in deepwater environments below the shelf edge. Characterizations of faunal patterns using standing crop, live/dead ratios, and species diversity proved to be less useful than expected. Of these factors, however, standing crop appeared to be the most useful in faunal/environmental relationships. Species diversity patterns indicated higher than average number of species around sewage outfalls and similar numbers of species in areas with and without oil seeps. The standing crop, diversity, and composition of the fauna appear to be strongly influenced by temporal changes.

Faunal distributions are correlated with depth-related gradients in sediment and water quality (particularly salinity and oxygen). These dependencies make the Foraminifera sensitive indicators of water and sediment quality. The Foraminifera communities were discriminated in terms of six variables that define water and sediment quality: temperature, salinity, oxygen, mean grain size, percent carbonate, and percent organic carbon of the sediments.

STUDY PRODUCT(S): Fauchald, K. and G. Jones. 1978. Benthic Macrofauna. In: Southern California Baseline Study Intertidal and Benthic 1975-1976 (Year I), Vol. III, Report 2.4. A final report by Science Applications, Inc. for the U.S. Department of the Interior, Bureau of Land Management Pacific OCS Office, Los Angeles, CA. NTIS No. PB83-149799. Contract No. 08550-CT5-52. 416 pp. + Addendum (Taxonomic Findings).

Douglas, R. G., C. Walch, and G. Blake. 1978. Benthic Macrofauna. In: Southern California Baseline Study Intertidal and Benthic 1975-1976 (Year I), Vol. III, Report 2.5. A final report by Science Applications, Inc. for the U.S. Department of the Interior, Bureau of Land Management Pacific OCS Office, Los Angeles, CA. NTIS No. PB83-149799. Contract No. 08550-CT5-52. 358 pp.

*P.I.'s affiliation may be different than that listed for Project Manager(s).