

STUDY TITLE: Monitoring: Assessment of Long-Term Changes in Biological Communities. Phase II.

REPORT TITLE: California OCS Phase II Monitoring Program: Yr-1 Annual Report

CONTRACT NUMBER(S): 14-12-0001-30262

SPONSORING OCS REGION: Pacific

APPLICABLE PLANNING AREA(S): All Pacific OCS Planning Areas

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COST(S): FY1986 = \$3,590,000; Total Estimated Cost = \$9,582,044

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KEY WORDS: Southern California OCS; Santa Maria Basin; oil and gas development and production; offshore monitoring; fates and effects of drilling discharges; long-term environmental effects; benthos; soft-bottom benthic assemblages; hard-bottom benthic assemblages; hydrocarbons; trace metals; sedimentology; mineralogy; sediment transport; currents; satellite imagery; bioturbation; larval settlement; flume studies.

BACKGROUND: The California Outer Continental Shelf (OCS) Phase II Monitoring Program is a five-year, multidisciplinary study designed to monitor potential environmental changes resulting from oil and gas development in the Santa Maria Basin region of the California OCS. Factors contributing to the decision to implement this particular study include: (1) the great potential for extensive production of oil and gas from this region of the California OCS; (2) the concern that development of, and production from, a major new oil field on the U. S. OCS may result in cumulative, long-term adverse impacts on the marine environment; and (3) the lack of previous oil and gas production activities, or other major anthropogenic influences in the area.

OBJECTIVES: (1) To detect and measure potential long-term (or short-term) changes in the marine environment in the vicinity of OCS oil and gas development and production activities; and (2) to determine whether changes observed in the marine environment during the monitoring period are caused by drilling and production-related activities or reflect natural processes.

**DESCRIPTION:** Specific parameters being addressed as part of the time-series monitoring effort consist of biological community indices and species abundances for hard-bottom and soft-bottom benthic assemblages; levels and distributions of trace metals and hydrocarbons in bottom sediments, suspended particulates, animal tissues, and pore waters; water currents and other physical oceanographic features; and various sedimentological properties (e.g., sediment grain size, total organic carbon and carbonate content, sediment shear strength, distribution of minerals types, and redox conditions). Synoptic measurements of these various parameters are taken to permit examination of biological changes in relation to concomitant chemical or physical changes linked to specific drilling events. Additional companion studies focus on benthic sediment-transport processes and animal-sediment-pollutant interactions.

The station design consists of a series of regional stations and two additional arrays of site-specific stations located in the vicinity of two existing, or planned, oil development/production platforms. The two site-specific sampling arrays provide an opportunity to examine potential nearfield impacts and possible impact gradients extending outward from point sources of platform discharge. One array is located in unconsolidated substrates offshore of Pt. Sal at the future site for Cities Service's (now Shell's) Platform Julius. The second array is located offshore of Pt. Arguello, within a region of hard-bottom features, in the vicinity of Chevron's Platform Hidalgo. Both arrays consist of a series of platform and comparison stations. Sampling began in October, 1986 and is scheduled to continue on a seasonal basis throughout the next five years. The Year-One Annual Report covers data collected on the first two cruises (October 1986 and January 1987).

**SIGNIFICANT CONCLUSIONS:** Results obtained during the first year of study provide a basis for beginning to understand environmental processes and relations that will be important in detecting and interpreting any subsequent impacts caused by oil and gas development and production activities in this region of the California OCS. Much of the predrilling chemical, physical, and biological data generated to date in this program demonstrate that impacts of discharges from oil and gas operations should be detectable, if they occur, and should be distinguishable from natural environmental variability.

**STUDY RESULTS:** The Santa Maria Basin supports a very rich and highly diverse benthic infauna. Numbers of species and abundances of both the macrofauna and meiofauna exceed previously reported values for the area. Both the macrofauna and meiofauna exhibit an apparent pattern of decreasing species abundance and diversity with increasing water depth.

Soft-bottom macrofaunal and meiofaunal assemblages occurring at different stations, at approximately the same depths, usually have similar faunal compositions. Cluster analysis of soft-bottom benthic communities (both macrofauna and meiofauna) clearly show a high degree of faunal homogeneity among stations within the Platform Julius site-specific array. These data indicate that this sampling array is located in an appropriate region for monitoring short and long-term impacts of oil development and production activities on the benthos.

Several species of attached epifauna identified on low-relief and high-relief substrates at stations around Platform Hidalgo appear to have high enough abundances to permit repeated sampling and statistical assessment of drilling and production impacts. Species suitable for monitoring at low-relief stations are the corals *Paracyathus stearnsii* and *Caryophyllia* sp(p.), the crinoid *Florometra serratissima*, and the ophiuroid *Ophiocantha diplasia*. Species suitable for monitoring at high-relief stations are the unidentified *Anemone* No. 25, and the corals *Desmophyllum crista-galli* and *Lophelia californica*.

Hydrocarbon and trace-metal distributions generally are uniformly low in sediments throughout the study area, and background levels do not reflect anthropogenic sources of contamination; therefore, the ability to detect drilling-related changes is good.

Pb-210 dating of sediment cores indicates that sediments in the study area are actively accumulating suspended particulate matter from the overlying water column, thus, they can be expected to accumulate solids from platform discharges. Estimated sedimentation rates at the Platform Julius site, based on Pb-210 dating, are in the range of 0.2 to 0.3 cm/year. Pb-210 profiles show a mixed surface sediment layer that extends to a depth of about 8 to 10 cm, indicating substantial vertical mixing of sediments.

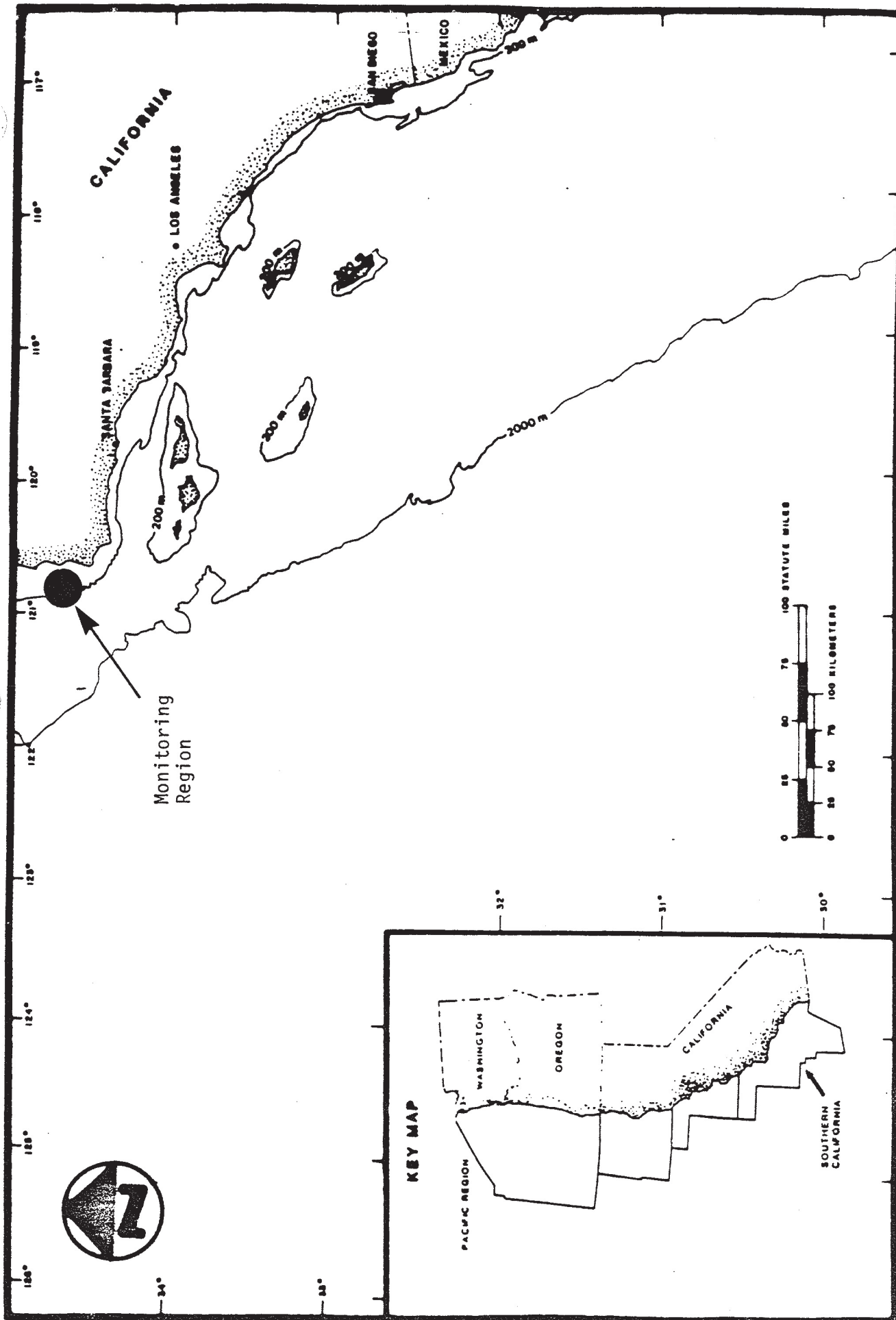
Current meter records confirm predictions of a mean along-shelf current flow in both an upcoast and downcoast direction. These patterns are interrupted periodically by cross-shelf flows, of up to several days duration, that are associated with traveling eddies seen in satellite images.

Several biological, physical and chemical parameters show clear signs of temporal variation between cruises. These results demonstrate the importance of conducting seasonal sampling before and after initiation of drilling activities, to provide the basis for differentiating between natural temporal variations in benthic community parameters and impacts due to drilling and production activities.

Companion laboratory studies (flume studies and substrate-choice experiments) on settling of larval invertebrates, performed on two species with contrasting life-history characteristics (*Capitella* sp. I and *Mercenaria mercenaria*), demonstrated differences in sediment preferences and selection capabilities. Presence of a layer of barite on sediment surfaces was also tested and found to have no effect on settlement of *Mercenaria* larvae. Initial experiments on settlement of these 2 species, and future work on settlement of other species, will be used to help interpret causes of potential drilling-related impacts on benthic communities observed during the time-series monitoring effort. In addition, studies will be performed to examine the degree to which activities of benthic organisms influence sediment and pollutant transport processes.

STUDY PRODUCT(S): Hyland, J. and J. Neff (eds.) 1988. California OCS Phase II Monitoring Program: Year-One Annual Report. Report prepared for U. S. Minerals Management Service, Pacific OCS Region, Los Angeles, CA. Contract No. 14-12-0001-30262. Volume I (MMS 87-0115) and Volume II (MMS 87-0116).

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Area in the Santa Maria Basin being monitored during the Long-Term Study.