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DEEP-SEA RESEARCH
PART II

Preface

Ecosystems of the eastern boundary regions of the ocean basins, like those off California, Northwest Africa and Peru, are known for enhanced primary production and resulting large clupeid fisheries. In these eastern boundary regions, the basin-scale circulation brings the thermocline, pycnocline and nutricline close to the surface and often in contact with the mixed layer. Processes such as coastal upwelling then act to bring these cool and nutrient-rich waters to the surface. Photosynthesis is stimulated by the enhanced nutrient supply to sunlit waters, and food for supporting the ecosystem is generated. The source and fate of this primary production is variable, reflecting the dynamic physical character of eastern boundary systems. The physical and biological variability are most notable on mesoscale or subseasonal (upwelling events, jets and eddies), seasonal (spring transition, upwelling, winter) and interannual (El Niño) scales. Decadal and interdecadal oscillations are evident in the longer time series (Hayward, 1996; Ingraham Jr. et al., 1998) and the analysis of White et al. (1997) suggests that the Northeast Pacific, and the California Coast in particular, are regions of higher than average decadal and interdecadal variability. And of course, the shadow of global warming looms on the horizon, if not already underway. Considering these factors, and the planning and implementation of major multi-disciplinary programs along the West Coast of North America (GLOBEC, CoOP), we have assembled a series of papers dealing with the oceanography of California waters into a volume of Deep Sea Research II.

While the contributions to this volume are from the entire California coast, a great majority are from Central California. The geography of Central California adds to the complexity of the coastal circulation. Coastal mountain ranges serve to accelerate and steer winds, and this flow is interrupted by coastal valleys and associated sea breezes. Headlands (Pt. Reyes, Pt. Sur) are upwelling centers and anchor offshore flowing jets. Although the shelf is typically narrow, the Gulf of the Farallones has an extensive shelf. Finally, Monterey Submarine Canyon intersects the shelf, resulting in water 2 km deep just 10 miles from Monterey, with unique geology, biology, and physical processes. In 1987, our ability to study this region benefited from two important additions to the local scientific community. First, Mr. David Packard established the Monterey Bay Aquarium Research Institute, to pioneer new observational technologies and to study local waters. Second, due to the efforts of Dr. John Martin and Dr. Chris Mooers, the R/V Point Sur was assigned to Moss Landing Marine Laboratories, providing an all weather, multipurpose platform for modern oceanographic studies. These have greatly accelerated the collection and interpretation of data for Central California waters.

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Deep-Sea Research II issues are typically focused on single coordinated efforts; however, this issue compiles papers from multiple independent experiments. A second volume is already well underway. The first volume contains contributions from the CalCOFI program (Hayward and Venrick; Haury and Schulenberg; Ohman et al.), papers on sediment cores and sediment trap results taken in the Santa Barbara basin (Berger et al., Thunnell), from research efforts in Central California (Pilskaln et al., Rau et al., Robison et al., Service et al., Ramp et al., Silver et al., Buck and Thomsen, DeGranpre et al., Fiedler et al.); from EPA-sponsored studies in the Gulf of the Farallones (Steger et al., Nybakken et al.); and from ONR-sponsored studies in Northern California (Abbott and Letelier, Huyer et al., Batteen and Vance).

Physical studies include both modeling and observational studies. Batteen et al. use a high-resolution numerical model to distinguish the circulation pattern caused by winds from that associated with thermohaline forcing. Huyer et al. report results of high-resolution upper-ocean surveys of the California Current in summer 1993. Steger et al. use linear regression techniques to develop a model of tides in the Gulf of the Farallones. Ramp and Abbott describe the vertical structure of currents in water 84 m deep off Pt. Sur during spring, 1990.

Chemical studies include reports by DeGranpre et al. on high-frequency measurements of oxygen and carbon dioxide collected from the research platform FLIP and their use for estimating biological productivity. Haury and Schulenberg analyzed CalCOFI data for surface enrichment of nutrients and speculate on the processes responsible for their occurrence in time and space. Rau et al. collected time series of δ_{15}N from Monterey Bay and show that the range of values is similar to that observed globally. They suggest some of the variability can be explained by phytoplankton species composition.

The biological studies of Nybbaken et al., on benthic invertebrate megafauna and by Thomsen and Buck on primitive green nanoflagellates are bio-geographical and autoecological. Ohman et al. discuss the nature and importance of seasonal dormancy in several species of copepods. Robison et al. report on an ROV-derived time series of the abundance of a mid-water siphonophore and its relation to seasonal cycles in upper ocean production. Fiedler et al. describe the distribution of blue whales in relation to oceanographic conditions in the Channel Islands. Hayward and Venrick define three dynamical regimes in the CalCOFI area based on physical and biological structure. Abbott and Letelier and Service et al. explain variations of bio-optical properties collected from drifters and moorings, respectively, in terms of physical forcing. They pay particular attention to decorrelation scales of physical and biological properties.

Particle flux and paleoclimate papers include studies of marine snow in Monterey Bay, sediment trap studies in the Santa Barbara and analysis of sediment cores from the Santa Barbara basin. Pilskaln et al. report on mid-water (100–500 m) marine aggregate abundance and sinking rates measured from an ROV. Silver et al. discuss the composition of mid-water marine aggregate material and its relation to upper ocean phytoplanton abundance. Thunnell report on a three-year study of sediment trap data and show an inverse relation between the export ratio and primary production. Berger and Lange put forth hypothesis to explain why accumulations of

organic carbon and opal deposition declined in the Santa Barbara basin during the last glacial period while they tend to increase over much of the tropical ocean.

We hope this collection of papers will represent valuable reference material for anyone interested in the California Current System and eastern boundary processes.

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