

Part I

REPORTS, REVIEW, AND PUBLICATIONS

REPORT OF THE CALCOFI COMMITTEE

This year marks the fiftieth anniversary of the beginning of the seagoing operations and time series of sampling in the California Current that have become the hallmark of CalCOFI's research. In its five decades of collaborative work, CalCOFI has fielded over 300 coastal survey cruises, published over 6,000 documents and scholarly papers, spawned several new fields of research, and established benchmarks against which large-scale change may be evaluated. Methods of fishery and environmental research developed by CalCOFI scientists are used as standards worldwide. The marriage of federal, state, and university scientists in such a long-term endeavor is particularly successful for economically marshalling public resources.

This interagency approach to ocean measurement paid off in the ability to investigate the recent El Niño event. El Niño of 1998 (because it had been predicted) and the northward expansion of the growing population of California sardine stimulated increased temporal and spatial coverage of the California Current by CalCOFI cruises. In addition to the usual quarterly survey cruises in 1998, 48 extra ship days for 8 extra cruises were provided by UC ship funds; extra salaries for data collection and processing, and funds for supplies were made possible by a grant from the NOAA Office of Global Change. The data collected by the CalCOFI interagency consortium are summarized in Hayward et al. (this volume). Preliminary reports on the changes associated with the 1998 El Niño will be presented at the symposium of the 1999 CalCOFI Conference.

In 1999, CalCOFI returned to the less intense, quarterly sampling that has been its standard since 1985. However, studies of sardine spawning as far north as Monterey Bay have continued, with near-surface sampling of fish eggs and environmental properties. This sampling has given a much clearer picture than was previously available of the mesoscale spatial relations between spawning and the physical environment, and of differences between sardine and northern anchovy. The winter 1999 cruise was conducted on the Scripps Institution of Oceanography (SIO) RV *Roger Revelle*, whose large size and modern facilities permitted extensive participation by students conducting research independent of, but supported by, the CalCOFI time series of environmental

data. Work performed by our Mexican colleagues, partly a consequence of mentoring and collaboration by CalCOFI investigators over several decades, has begun to help us understand how the Gulf of California stocks of Pacific sardine contribute to the Pacific coast population (cf. de Anda-Montañez and Seijo, Lluch-Cota et al., and de Anda-Montañez et al., this volume).

The Pacific sardine resource off California has now surpassed one million tons and is considered fully recovered for the first time since the mid-1940s. At an interagency Pacific sardine workshop held in 1983, it was agreed that the sardine population would be considered fully recovered when it reached a million tons, when it occupied its historic range (Mexico to Canada), and when all historic age classes were represented in the population. All of these criteria have now been met, representing a real success story for Pacific sardines and fishery managers. The most recent stock assessment, conducted jointly by the California Department of Fish and Game (CDFG) and the National Marine Fisheries Service (NMFS), estimated 1.07 million metric tons in the area off California's coast (Ensenada, Mexico, to San Francisco) and up to 1.6 million metric tons coastwide (Ensenada to British Columbia). Since the onset of the recovery, the sardine population is estimated to have increased by 20% to 30% per year in the presence of a steady fishery. Egg and larval data collected by the CalCOFI program have been a crucial tool in measuring the sardine's recovery.

The market squid (*Loligo opalescens*) has been the basis of an important fishery in California since the 1850s. In the last decade, increases in catch and price have combined to make market squid the most valuable fishery in the state. The squid fishery is the largest unregulated open access fishery on the West Coast. At the CalCOFI market squid symposium held in 1997, researchers from around the world identified critical biological data necessary to manage the fishery (cf. Butler et al., and Lowry and Carretta, this volume). Recent funding from the squid permit fees contained in Senate Bill 364 (Sher, D-Palo Alto), passed by the California legislature in 1997, has enabled the CDFG to begin addressing research and assessment needs by forming a Market Squid Investigations Unit. Collaborative research contracts have been let to

SIO/NMFS and UCLA. Port sampling and field research activities have been implemented and will continue over the next several years.

One of the first products of the research is a paper (Butler et al., this volume) describing the age and growth of market squid from daily increments in statoliths. This study indicates that both male and female market squid can mature as early as 6 months and that longevity is less than one year. The short life span of this species partly explains the high productivity of the stock and how it can recover rapidly from environmental fluctuations such as the recent El Niño. This study will provide the necessary life-history parameters for developing a management plan. A CDFG report will be submitted to the legislature in 2001 on the status of the fishery and will provide recommendations for such a squid conservation and management plan.

The Pacific Fishery Management Council approved draft Amendment 8 to the Northern Anchovy Fishery Management Plan and has submitted the plan to the U.S. Secretary of Commerce for review. This action changes the name of the plan to the Coastal Pelagic Species Fishery Management Plan, and includes northern anchovy, Pacific sardine, Pacific mackerel, market squid, and jack mackerel. The new plan is designed to allow more responsive council action and establishes two categories of species management: "actively managed" and "monitored only." Actively managed species will be managed under a harvest guideline or quota; monitored only species will not be managed under a harvest guideline or quota. At the outset of the plan, Pacific sardine and Pacific (chub) mackerel will be actively managed, and the other three species will be monitored only. The plan contains a limited entry program applying south of 39°N latitude for finfish species only (market squid is not included). The new plan identifies essential fish habitat and overfishing thresholds as required by the Sustainable Fisheries Act and implements new harvest control rules for Pacific sardine and Pacific (chub) mackerel that retain a portion of the biomass as forage and provide a stable fishery.

Governor Wilson signed Assembly Bill 1241 (Keeley), the Marine Life Management Act of 1998, and Senate Bill 1336 (Thompson), the Rockfish Research Conservation and Management Act. This action will result in fundamental changes in how the CDFG approaches the management of several currently important, and newly emerging, fisheries, including the white seabass and nearshore finfish fisheries. The thrust of AB 1241 is to empower the Fish and Game Commission to regulate specified and emerging commercial fisheries that have been managed in the past through laws enacted by the legislature. The bill establishes a policy of fishery management based on sustainable use and directs that

management shall be through the development and implementation of fishery management plans (FMPs). The bill mandates that the CDFG do several things, including prepare a master plan by 1 September 2001 that describes the processes and resources required to prepare, adopt, and implement FMPs; prepare an FMP for the nearshore fishery, as defined in the bill, to be adopted by the commission on or before 1 January 2002; and bring FMPs established before 1 January 1999 into compliance with the provisions of the act on or before 1 January 2002. Governor Wilson's signing AB 1241 into law may prove to be historic in the management of California's marine resources.

The Marine Ecological Reserves Research Program (MERRP) study of production of planktonic fish eggs and larvae in nearshore waters continued in 1999 at the four southern California sites: Big Sycamore Canyon and Vandenberg Marine Ecological Reserves, and Anacapa and San Miguel Islands. In addition to the CUFES and bongo samplers used at these sites in 1998 (Watson et al., this volume), manta net sampling was added this year. The fortuitous timing of the study, which includes winter and summer surveys during the 1998 El Niño, a winter survey during the 1999 La Niña, and a scheduled summer 1999 survey, will allow comparison of nearshore ichthyoplankton production during these contrasting regimes. Preliminary examination of February 1999 samples suggests that compared with February 1998, planktonic shorefish egg abundance was lower at all sites except Vandenberg (where it was low in both years), but the abundance of rockfish (*Sebastes* spp.) larvae was much higher in 1999.

The rockfish genetics program has completed sequencing of the cytochrome *b* gene of almost all of the 70-plus species of rockfishes that occur along the west coast of North America. This has opened a new window of interesting research collaboration between the genetics group and the ichthyoplankton survey portion of the CalCOFI program. It is now possible to identify almost all of the rockfish larvae encountered in the CalCOFI survey. Recently William Watson brought in a common but unknown rockfish larva that turned out to be *Sebastes moseri*, a newly described species identified from a single adult specimen. The relatively common occurrence of these larvae in the CalCOFI collections indicates that the new species is abundant but not readily caught by traditional fishing gear. This discovery highlights the wealth of new information that can be obtained by the marriage of traditional and new methods of ocean observation within the context of the CalCOFI program.

In a related study, the genetics group has been examining population genetic structure in nearshore rockfishes. These studies are beginning to reveal significant

intraspecific genetic differences between northern, central, and southern California. These differences are almost certainly due to oceanographic barriers to larval dispersal (e.g., coastal jets and eddies). We hope that these genetic studies can give insights into long-term circulation patterns along the California coast.

The Southwest Fisheries Science Center's Coastal Fisheries Resources Division, together with the CDFG, has completed a stock assessment of cowcod (*Sebastes levis*) for the Pacific Fisheries Management Council. This stock assessment incorporated catch per angler hour (CPUE) from logbooks of commercial passenger fishing vessels (CPFVs); larval abundance from CalCOFI plankton surveys; and juvenile abundance from Orange County and Los Angeles City Sanitation Districts otter trawl surveys. The population model was tuned to these three indices and indicated that the cowcod population was only 10%–15% of its virgin biomass. Thus, under the Magnuson-Stevens Fishery Management Act, the cowcod is an overfished stock and will require a rebuilding plan.

Principal investigators Paul E. Smith, John R. Hunter, and H. Geoffrey Moser secured extra ship time and additional money from NOAA's Office of Oceanic and Atmospheric Research to improve the time resolution of fish reproduction during the onset and decline of the recent El Niño–Southern Oscillation (ENSO) event, December 1997 to December 1998. The complete fish reports can be seen in Hayward et al. in this issue. Briefly, the ENSO event was severe in the Southern California Bight. Egg pump surveys of the California Current off central California showed the presence of tropical species spawning extensively off southern California. Sardine spawning was detected as far north as Vancouver Island, British Columbia, Canada, the first reported sardine spawning north of the Columbia River in recent decades. Off southern California, sardine spawning was higher than the 1951–98 average. Hake spawning was barely detectable off southern California, and presumably the population spawned farther north than the current CalCOFI survey area. The populations of sardine, anchovy, and hake will continue to be monitored so that the effect of this ENSO event on the abundance and biomass of these species in their respective fisheries can be evaluated.

The biological-oceanographic survey cruises of IME-COCAL (Investigaciones Mexicanas de la Corriente de California) continued during the past year. Six cruises have been completed, and much progress has been made in processing and analyzing samples and data. This spring Tim Baumgartner hosted a workshop at CICESE, Ensenada, Mexico, that brought together research partners from CICESE, CICIMAR, and CalCOFI to discuss progress of the program, methods and technology,

collaborative projects, and funding. Martin Hernandez Rivas and coauthors from CICIMAR collaborated with William Watson, SWFSC, on a paper (in preparation) that describes the distribution and abundance of ichthyoplankton assemblages off Baja California based on initial IMECOCAL surveys.

Loren Haurly, of SIO's Marine Life Research Group (MLRG), retired from the University of California after a 32-year career. Loren spent most of his career examining the interactions of biology and physics as they affect zooplankton. According to colleagues, Loren broke new ground in exploring one major, nearly untouched, section of the Stommel diagram: he led the biological oceanographic community toward an understanding of important oceanic ecological questions that can be addressed only through long-term, large-scale data sets. Loren plans to continue to pursue such interests less formally in a freshwater setting—the Colorado River and Grand Canyon.

After 33 years of service to CalCOFI and 20 years engaged in some aspect or other of the production of *CalCOFI Reports* and the hosting of the annual meeting, George Hemingway plans to hand over those functions at year's end. George was the first CalCOFI coordinator and managing editor after the sunset of the enabling law for the Marine Research Committee of the State of California, replacing Herb Frey of the CDFG. In 1979, beginning with *CalCOFI Reports* volume 20, he implemented a peer review policy and editorial criteria that have turned this journal into the twelfth most cited fishery science journal, and the second-highest-ranked regional fishery journal in the world, according to data published by the Institute for Scientific Information.

The seagoing personnel of CDFG's Marine Region, SIO's MLRG, and the Southwest Fisheries Science Center's Coastal Division contributed, through their dedication and diligence, to the success of CalCOFI's field work. Amy Hays of the SWFSC deserves special thanks for making every one of the cruises in 1998. The CalCOFI Committee thanks the officers and crews of the research vessels that have served us well as platforms for our observations during the past year: the CDFG RV *Mako*, the NOAA ship *David Starr Jordan*, the University of California RVs *New Horizon*, *Roger Revelle*, and *Robert Gordon Sproull*.

We gratefully acknowledge the work of Mary Yoklavich in organizing the symposium of the 1998 conference and for selecting reviewers and editing the papers. We also thank the reviewers of the symposium on marine reserves: Giacomo Bernardi, Louis Botsford, Mark Carr, Churchill Grimes, Dennis Hedgecock, Mark Helvey, Sam Herrick, Ralph Larson, Alec MacCall, Janet Mason, Deborah McArdle, Tory O'Connell, Richard Parrish, Pat Reilly, James Seger, Rick Starr, Cindy Thomson,

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