

Part I

REPORTS, REVIEW, AND PUBLICATIONS

REPORT OF THE CALCOFI COMMITTEE

PACOOS

Development of the Pacific Coast Ocean Observing System (PaCOOS), formerly called PaCOS, continues. The PaCOOS mission is to provide ocean information for the sustained use of the California Current large marine ecosystem under a changing climate. A science planning meeting was held in September 2003, followed in May 2004 by a Board of Governors meeting, during which a draft PaCOOS general science plan (initiated at the September meeting) was reviewed and the framework for a PaCOOS charter and memorandum of understanding was developed. The Board of Governors consists of one representative from each of twelve organizations, including two NOAA Fishery Centers, NOAA National Marine Sanctuary program, the three state conservation agencies, four universities, and two foundations. When implemented, CalCOFI shall become the southern component of a coastwide PaCOOS sentinel-species observing system. The geographic observational requirement of PaCOOS is the U.S. EEZ off the coasts of California, Oregon, and Washington, with links to comparable ecosystem observations of the California Current in México and Canada.

Data integration planning has also begun with initial funding from the National Marine Fisheries Service. Development of a Web-based searchable database that integrates physical and biological data is progressing. The software infrastructure to read both data sets is being developed for the region currently surveyed by CalCOFI. This will be expanded to incorporate data from partners along the coast such as from stations now occupied to the north by Monterey Bay Aquarium Research Institute (MBARI). We foresee the Web site's role broadening from a CalCOFI-specific information source to a portal for querying coastal relational databases and promoting ecosystem research. The Web address is <http://calcofi-las.ucsd.edu>

CALCOFI

Cruises

The CalCOFI program completed its fifty-fourth year, with four quarterly cruises during which were the

usual seabird casts and plankton tows using the Bongo (oblique plankton tow fitted with an Optical Particle Counter), Manta (nueston), and Pairovet (vertical) nets. Measures of primary productivity, weather, sea birds, and marine mammals were also quantified. In spring 2003, the RV *Roger Revelle* completed its cruise of the 67 standard CalCOFI stations, and the RV *David Starr Jordan* completed an additional 42 stations, "boxing" the CalCOFI pattern in the south and then transiting north to San Francisco; this cruise included a one-day coastal survey off Imperial Beach with John Largier. In addition to the CalCOFI cruise station surveys, work continues on a number of ancillary research projects involving phytoplankton, HPLC, zooplankton, trace metals, seabirds, and marine mammals, as well as studies using the optical plankton counter, Continuous Underway Fish Egg Sampler, Acoustic Doppler Current Profiler, EK-500 scientific sounder, and bio-optics.

CalCOFI Web Site Overhaul

As the CalCOFI program synchronizes with other coastal observation programs, the interest in the CalCOFI Web site (www.calcofi.org) continues to grow rapidly. In the last 6 months, visitors from over 40 countries have accessed the site. Originally designed for general cruise information and as a hydrographic data archive, the Web site is expanding, offering new data products and oceanographic sampling and analysis information.

The 54-year data set is in a period of transition as vigorous efforts are being made to convert the data tables into a Web-based queryable relational database. Currently, the relational hydrographic database is available globally to users as a downloadable file, and a Web-based query interface is being developed.

This conversion of the tabulated data to relational database is the first step in facilitating the interlinking of related databases on the Internet. Our Live Access Server (LAS) project currently under development will dynamically link CalCOFI hydrographic data to biological databases and ancillary data products. Using a single Web-based query form, researchers will be able to extract and download interrelated data types from any of the linked databases.

Central California CalCOFI surveys

A collaboration between MBARI, the Naval Postgraduate School (NPS), the University of California, Santa Cruz (UCSC), and NOAA/NMFS has led to continued quarterly occupations of historical CalCOFI lines off central California. Line 67 was occupied quarterly from 1988 to 1991 and has been since 1997 in response to the 1997–98 El Niño. On the basis of discussions started with ACCEO and more recently with PaCOOS, it was decided to continue this important series. Continuous-mooring time series in the inner portion of line 67 (see <http://www.mbari.org/oasis/>) and more frequent ship surveys (once every three weeks or monthly; see <http://www.mbari.org/bog/projects/centralcal/summary/tsummary.htm>, and <http://cimt.ucsc.edu/research.html>), as well as AUV surveys, complement the larger scale but less frequent line 67 cruises.

During winter and spring, regular southern California CalCOFI surveys are extended into central California. Researchers from MBARI, NPS, and UCSC join the cruises for the lines north of line 77 and collect and analyze samples for chlorophyll and nutrients. Conductivity, temperature, and depth casts are extended to 1,000 m along line 67, and time-permitting station spacing is reduced to 10 nmi in the inshore portion of this line. In the summer and fall, dedicated 4–6-day cruises are carried out by MBARI, NPS, and UCSC scientists. To date these cruises have primarily occupied line 67, but in the future they are expected to occupy line 60 (off San Francisco) as well. These cruises include the typical CalCOFI measurements as well as other ancillary measurements (see <http://www.mbari.org/bog/Projects/secret/default.htm> for details). Measurements of the partial pressure of carbon dioxide in the atmosphere and the sea surface have recently been added to the regular and central California CalCOFI surveys. Funds from the Monterey Bay National Marine Sanctuary, Sanctuary Integrated Monitoring Network (SIMoN) have allowed the hiring of a postdoctoral researcher at MBARI. One of the tasks of this researcher will be to integrate the results of the central California surveys with those in southern California.

IMECOCAL

For highlights of the work in Baja California, Mexico, please visit IMECOCAL's Web site: <http://imecocal.cicese.mx/>.

SIO HIGHLIGHTS

PaCOOS's potential and three new research programs have brightened the outlook for CalCOFI at SIO this year in the aftermath of severe budget cuts two years ago. In a cooperative agreement that included continued in-

terim support from NOAA (to replace operating funds lost in university budget cuts) SIO has agreed to begin coordinating and developing areas essential to the future of the PaCOOS program. These fall into two main categories: augmented development of an integrated data management system (presently being initiated by SWFSC and SIO personnel under the guidance of Dr. Christian Reiss at SWFSC); and initiation of technical training and cross-calibration of procedures, making use of the availability of RV *Roger Revelle* for the fall CalCOFI cruise. In a step toward achieving this goal, we are now posting our procedures on the SIO/CalCOFI Web site: www.calcofi.org/newhome/cruises/sample_analysis.htm.

SIO director Charles Kennel has offered office space and administrative infrastructure for the PaCOOS executive officer. This would facilitate interaction between PaCOOS and other large programs based at SIO (such as the Southern California Coastal Ocean Observing System, SCCOOS, and the Center for Biodiversity and Conservation) and allow access to a well-developed public-outreach program.

Three long-term research programs have received funding to use routine CalCOFI cruises as research platforms and provide new dimensions to our observations. SCCOOS will support an additional transect on each CalCOFI cruise. This will take place on the return leg; stations along this transect will be inshore of our shoreward routine stations and will consist of continuous measurements and CTD casts. In addition, SCCOOS will provide funds for the development of bio-optical approaches to measuring primary productivity.

Professor John Hildebrand has received funding from CNO-N45 and ONR to make quantitative visual and acoustic surveys of marine mammals on CalCOFI cruises 2004–2007. These surveys will supplement data he will collect through the deployment of long-term acoustic monitoring devices moored at six stations within the CalCOFI survey area.

Professor Mark Ohman, aided by several SIO scientists, has obtained funding from the Long-Term Ecological Research (LTER) Program of the National Science Foundation. These funds will allow the CalCOFI measurements to be routinely supplemented with measurements of iron concentration and particulate and dissolved organic material, as well as samples of the smaller size classes of plankton. (Many of these techniques have already been tried out on CalCOFI cruises.) LTER funds also provide for "special purpose" cruises to investigate hypotheses generated by the CalCOFI data. There will be a biophysical modeling component, a data management component, and an outreach program. The LTER funding begins in September 2004. It is awarded in 6-year increments, with the possibility of *n* renewals. In Ohman's words, "Here's hoping for a very large *n*."

CDFG HIGHLIGHTS

The Marine Protected Areas (MPAs) mandate focused primarily on implementing the Marine Life Protection Act (MLPA) and MPAs established in the Channel Islands National Marine Sanctuary in 2003. Though the MLPA working group process was informally halted for the calendar year, staff developed various scenarios for continuing implementation and reviewed the status of existing MPAs. The Channel Islands MPA network was implemented in April 2003, and staff focused efforts on developing a monitoring strategy and participating in ongoing monitoring efforts. Progress was made toward a long-term monitoring plan for the MPAs, and preliminary data from inside and outside these MPAs were collected.

CDFG has been collaborating with partner groups to assess fish and invertebrate populations in both shallow (< 20m) and deeper water rocky reef habitats in California. The team uses divers in shallow habitats and remotely operated vehicles (ROVs) in deeper water. Methodology studies have been the focus this year; the team is developing cost-effective methods for measuring the survey area using ROVs as well as determining the area and number of samples needed to measure changes in fish populations. Preliminary sampling focusing on the Channel Islands MPA has been conducted with The Nature Conservancy, the Channel Islands National Marine Sanctuary, and Marine Applied Research and Exploration.

The Squid Fishery Management Plan is being revised to include additional management options at the request of the Fish and Game Commission. Adoption is proposed for late 2004. The Pacific Fishery Management Council revised the reallocation of unharvested sardine in 2003. The new framework includes geographic boundary changes, the reallocation date in the year, the percentage of unharvested sardine to be reallocated, and coastwide allocation after 1 December.

In 2003, the Commission modified sea urchin fishery regulations, eliminating minimum landing requirements, adopting equal work days in northern and southern California, creating a preference system for experienced fishers in the permitting process, and allowing data collection on commercial vessels. Funding continued for studies of sea urchin recruitment. This was the second year of the experimental tanner crab fishery, which landed more than 90 metric tons. The fishery is male only, with a minimum legal size of 5 in. (carapace width), and occurs on the north coast in deep water (> 300 fathoms).

There was a northerly offshore shift in the salmon population in 2003 that contributed to a full season for the commercial fishery in Fort Bragg. The California recreational fishery survey program assumed the lead for

sampling recreational ocean salmon. Samplers recorded numbers of fish and catch per angler information and collected adipose clip salmon heads for coded wire tag recovery. Coho salmon continue to be seen off California, but their origin is unknown (Oregon or California).

The Aquatic Nuisance Species component tracked emerging aquatic nuisance species statewide and began to develop a plan for minimizing the spread of the invasive brown seaweed, *Undaria pinnatifida*. Work that will involve research, surveillance, and outreach began under a \$2.2 million grant from the State Water Resources Control Board for *Caulerpa* eradication.

The Shellfish Disease component continued to monitor the geographic distribution of the causative agent of withering syndrome and initiated an intertidal gastropod sampling effort to determine whether the South African sabellid polychaete has become established at any location statewide. Research continued on the development of an oral oxytetracycline-based treatment regimen for withering syndrome in cultured abalone, and on susceptibility of the federally endangered white abalone to the disease. The Fish Disease component continued certification of white sea bass for release from the hatchery to netpens and from netpens to the environment; it also conducted research on diseases at all life stages.

NOAA HIGHLIGHTS

The newest member of the CalCOFI Committee is Dr. Roger Hewitt, who recently assumed John Hunter's role as Director of the Fisheries Resources Division at the Southwest Fisheries Science Center and as the NMFS representative on the Committee. Roger came to the Center in the early 1970s and worked with Paul Smith and Ruben Lasker on interpretation of ichthyoplankton distribution patterns. For several years he was a regular at CalCOFI Conferences, publishing a dozen papers in *CalCOFI Reports* and in one of the *CalCOFI Atlases*. He was involved with the development of the egg production method and for several years coordinated production of the annual estimate of anchovy biomass using the technique. He also developed procedures for describing the mortality and dispersal of fish larvae; developed methods for using SONAR to map epi-pelagic fish schools and estimate their biomass; conducted field experiments to determine sources of mortality on young fish, acoustic properties of fish schools, and inshore fish production; developed models that described the influence of various processes on the survival of young fish; and studied the efficiency of ichthyoplankton sampling methods and recommended improvements. In the late 1980s he modeled the shipboard sampling regime for the U.S. Antarctic Marine Living Resources (U.S. AMLR) program after CalCOFI. He spent 16 field sea-

sons in the Antarctic while working with the U.S. AMLR program, monitoring the krill-centric ecosystem, developing fishery management options, and providing advice to the U.S. delegation to the Convention for the Conservation of Antarctic Marine Living Resources. Roger reports that he is glad to return home to CalCOFI but also notes that he was never far away. We in the committee welcome him back and look forward to many years of working with him.

The winter and spring CalCOFI cruises took place this year in January–February and in April. In 2002 these cruises were extended northward to include line 60. SIO participates to line 77, and MBARI continues the oceanographic work on the five northern lines. During the April 2004 spring cruise the majority of sardine eggs found with the Continuous Underway Fish Egg Sampler were north of line 77 and were still being collected in large numbers on line 60. This egg distribution is quite different from previous cruises and indicates a northward shift of the sardine population.

Beginning in February 2004 the City of Los Angeles Department of Public Works resumed sampling (under contract to SWFSC) along four inshore survey lines that had been sampled by the Los Angeles County Museum during the Ichthyoplankton Coastal and Harbor Survey (ICHS) in the late 1970s to mid-1980s. Stations are located at the 8 m, 15 m, 22 m, 36 m, and 75 m isobaths on each line, following the ICHS design. An integrated, quantitative water-column sample is collected at each station with a CalCOFI bongo net, comparable to the sampling during ICHS and CalCOFI surveys. Sampling is quarterly, in conjunction with CalCOFI surveys. Sample analysis has not yet begun, but ichthyoplankton and squid paralarvae will be sorted from the samples, identified to the lowest practical taxon, counted, and quantitative abundance estimates generated. The survey currently is scheduled for six quarterly cruises.

KUDOS

The seagoing personnel of SIO's Integrative Oceanography Division, the SWFSC's Fisheries Research Division, and CDFG's Marine Region all contributed through their dedication, expertise, and diligence, making the CalCOFI program possible. The CalCOFI Committee thanks the officers and crew of the research vessels SIO RV *New Horizon*, SIO RV *Roger Revelle*, and the NOAA RV *David Starr Jordan*—they have served us well in 2003. We are indebted to them all, as we are to our sea-going crew, including Dimitry Abramenkoff, Ron Dodson, Dave Griffith, Amy Hays, Sue Manion, Sherry McCann, Fernando Raimirez, Jennifer Sheldon, Jim Wilkinson, and Dave Wolgast. Ralf Goericke has served again this year as the coordinator of the sea-going work, and the committee extends to him our gratitude.

The Committee would like to thank James Wilkinson this year again for his continued dedication as our Web master. Thanks to him, the CalCOFI Data Reports 0211 and 0302 are now online. The library of annual *CalCOFI Reports* is available online in a searchable PDF format thanks to Kevin Hill. The CalCOFI hydrographic data set is also available in Microsoft Access 2000 for 1949–2002. The database includes all hydrographic data published in the biannual Data Report.

The Committee would like to thank Robert N. Lea of CDFG, who served once again in 2003 on the editorial board of the *CalCOFI Report*. We would also like to thank Maura Leos of CDFG, who served as CalCOFI conference registrar in 2003, for all her help and expertise coordinating the conference, running the audio-visual equipment, and attending to the needs of the conference participants.

The CalCOFI Committee:

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