

Part I

## REPORTS, REVIEW, AND PUBLICATIONS

### REPORT OF THE CALCOFI COMMITTEE

#### CALCOFI FIELD SEASON

The 2004 CalCOFI field season was highlighted by four successful quarterly cruises that included additional projects beyond the existing CalCOFI survey structure. As was the case in 2003, the spring survey was conducted aboard multiple vessels enabling more extensive coverage of the Pacific sardine (*Sardinops sagax*) spawning range. In addition, the SWFSC was able to charter the fishing vessel *Frosti* to sample adult sardines within the survey region with guidance from the NOAA ship *David Starr Jordan* and the R/V *New Horizon* from SIO. The F/V *Frosti* completed nineteen surface trawls in which fourteen were positive for adult or juvenile sardine. Aboard the R/V *New Horizon*, CalCOFI began a partnership during the April survey with researchers from the LTER group at SIO. Measurements of trace metals, dissolved and particulate organic carbon, and particulate calcium are now added to the extensive suite of CalCOFI measurements. A new project measuring recorded marine mammal acoustics, led by Dr. John Hildebrand of GRD and MPL at SIO, also began during the spring survey.

Coastal sea surface temperatures (SST) remained seasonally average from the beginning of the year through March of 2004. April displayed positive anomalies of SST in the northern region while the Southern California Bight remained within seasonal averages. In May, positive SST anomalies were observed throughout most of the coastal areas from the Mexican border up to the Gulf of Alaska. These positive SST anomalies persisted through October with the largest anomalies seen in August at approximately +2.5°C. Illustrating the effect of these positive anomalies, the usual Baja California resident, the Humboldt or Jumbo squid (*Dosidicus gigas*), was collected as far north as the Gulf of Alaska.

During the March–April survey, both the R/V *New Horizon* and the NOAA ship *David Starr Jordan* collected very few Pacific sardine eggs in the Southern California Bight. The majority of the sardine eggs were collected north of Point Conception with the bulk of the egg distribution centered on Monterey Bay. While the absolute numbers of Pacific sardine eggs collected were significantly less than those seen in previous years, Northern anchovy eggs were distributed farther off-

shore and farther north (north of Point Conception) than previous years.

#### CALCOFI ICHTHYOPLANKTON

The 2004 CalCOFI ichthyoplankton database has been completed and a data report prepared. Interesting trends in the data include continuing declines in larval incidence and abundance of Pacific sardines off southern California (CalCOFI lines 77–93); incidence peaked in 1998 and abundance in 1999, and by 2004 both had declined to their lowest level since 1984. Although the winter and spring surveys indicated increased incidence and abundance off central California (CalCOFI lines 60–73) from 2003–04, it was not enough to offset the decline in the combined areas. Average larval abundance of northern anchovy peaked off southern California in 1987 and subsequently declined substantially, but at an increasingly slower rate in recent years. In 2004 it increased slightly. Preliminary examination of the winter and spring 2005 CalCOFI samples suggests that larval anchovy abundance may be higher again this year, which might be interpreted as the beginning of an anchovy resurgence, although it is too early to know.

#### PACOOS

Participants of the 2001 CalCOFI Conference recommended the development of a comprehensive observing system for the entire pelagic ecosystem of the California Current, built upon the foundation of the CalCOFI survey program, but expanded to cover the entire system by adding new partners. This was a tough time (2001–02) to begin planning such a project since the existence of CalCOFI surveys was threatened and the GLOBEC plankton-based hydrographic surveys in Oregon and Washington, an important potential partner, were soon to be discontinued. In 2005, however, the system envisioned by the 2001 conferees may soon become a reality under a consortium known as PaCOOS, Pacific Coast Ocean Observing System. The CalCOFI survey program has been stabilized, and the survey lines in Oregon and Washington have been continued under PaCOOS. Central California survey lines discontinued by CalCOFI in the 1980s are now regularly occupied

on a quarterly basis under a cooperative relationship established between NOAA and the Monterey Bay Aquarium Research Institute, the Navy Post Graduate School, and the University of California, Santa Cruz. A historic gap in marine observations on the Pacific Coast occurring in northern California may soon be filled as well. A NOAA fisheries position was recently filled at Humboldt State University (HSU) to aid HSU in implementing PaCOOS surveys in northern California. When HSU begins their part of the work, the coast-wide ecosystem observing system, based on plankton-based hydrographic surveys as envisioned in 2001, will be established. Other PaCOOS events in 2005 included: adding two additional NOAA organizations to the Board of Governors (NESDIS and OAR), thereby strengthening the participation of NOAA in PaCOOS; initiation of long-term planning of data integration and access; and planning of a coast-wide demonstration project focusing on climate and the dynamics of the coast-wide stocks of sardine, hake, and euphausiids.

#### MOLECULAR ROCKFISH LARVAL IDENTIFICATION

Russell Vetter and staff at SWFSC have continued to make genetic identification of fish eggs and larvae a priority. To this end, John Hyde (Scripps Institution of Oceanography) has been developing genetic markers for the identification of *Sebastes* larvae. In conjunction with Cynthia Taylor (Scripps Institution of Oceanography), all of the *Sebastes* spp. collected during the 1999 CalCOFI cruises have been processed. Using the new molecular method, the number of identifiable species has increased from five to 28 with only 2% of the larvae remaining unidentifiable to the species level. Interestingly, the samples are dominated by two species, *S. hopkinsi* and *S. ensifer*, which together comprise >60% of the larvae.

#### COAST-WIDE SARDINE SURVEY

A Baja California to British Columbia coast-wide survey was first proposed at the 2000 Trilateral Sardine Forum (TSF) held 29 November–1 December in Ensenada, Baja California, Mexico. The initial goal of this survey was to obtain estimates of total biomass of Pacific sardines off of the American continent from northern Baja California to British Columbia. Routine biomass estimates conducted in April off California and Mexico and those made off the Pacific Northwest in July may be double counting sardines as they are a migratory species. A synoptic survey would prevent such double counting and was proposed again at the 2004 TSF on 18 November 2004 in La Jolla, California. The data from this coast-wide survey can be used to evaluate not only Pacific sardines but also other pelagic fish populations off the western American continent. Genetic

samples and age-length distribution can be used to infer movement patterns and stock structure.

Our current proposal specifies a coast-wide (U.S. EEZ off the states of California, Oregon, and Washington), near-synoptic (two-ship) survey of Pacific sardines to be conducted during April 2006. Tentative plans also include complementary surveys by Mexican and Canadian scientists of waters off northern Baja California and southern British Columbia. The objectives of the surveys will be to describe the spatial distribution of eggs, larvae, and adults, obtain measurements of egg production and adult fecundity required for an estimate of spawning biomass, and to collect environmental data that may be useful for describing spawning habitat. The survey design will consist of regularly spaced stations along a series of inshore/offshore transects following an extended CalCOFI pattern. Primary station observations will include: a) pelagic trawl samples of adult fish; b) plankton net samples of eggs, larvae, and zooplankton; and c) vertical profiles of temperature, salinity, oxygen, and chlorophyll. Primary transect observations will include: a) continuous egg pump samples; b) continuous multi-frequency acoustic samples of adult fish; and c) continuous measurements of sea-surface and meteorological conditions. Other observation protocols may be added as time, space, and personnel allow.

The data collected on this coast-wide survey will serve a variety of purposes. Egg data collected from CUFES and temperature data can be used to examine the spatial distribution of eggs of pelagic species with sea surface temperatures. Preliminary estimates of biomass of Pacific sardines can be computed based on data from trawl and acoustic surveys. Spawning biomass, as well as size and age distribution of Pacific sardines off Mexico, the U.S., and maybe British Columbia, can be obtained from egg and larval data plus adult reproductive specimens from the trawls. Estimates of absolute total biomass and spawning biomass of Pacific sardines would greatly benefit the stock assessment. Spatial distributions of eggs, larvae, and adult populations, together with oceanographic conditions, would contribute to a better understanding of population dynamics. The size distribution, if different between inshore and offshore, could be used to estimate availability to the fisheries in the stock assessment. Finally, determining stock structure through genetics is essential for updating fishery management strategies.

#### SIO HIGHLIGHTS

CalCOFI cruises are near capacity with ancillary programs, several of which were initiated this year. All of these programs broaden our understanding of the ecosystem far beyond that provided by the CalCOFI time-series itself.

Professor John Hildebrand of Scripps Institution of Oceanography has received four-year funding from ONR to make quantitative observations of cetaceans in the CalCOFI region, both with moored acoustic recorders and acoustic and visual observations from CalCOFI ships. The intent is to relate cetacean location to mesoscale oceanographic features. This is a graduate student project, and shipboard observations began on the April 2004 cruise.

Funding from the Southern California Coastal Ocean Observing System (SCCOOS) allows CalCOFI to extend surveys toward the coast. Since the July 2004 cruise, seven inshore stations (20 m depth) have been occupied, one at the end of each cardinal line and one midway between. Data from these stations will provide a bridge between the offshore observations of CalCOFI and the nearshore observations of SCCOOS. SCCOOS funding is also supporting the development of a bio-optical approach to estimating primary productivity.

CalCOFI 0411, on the R/V *Roger Revelle*, marked the initiation of research of the California Current Ecosystem/Long-Term Ecological Research Program. Funded by NSF in five-year, renewable increments, this program has three interdependent components: time-series observations (CalCOFI), experimental process cruises, and modeling studies. CCE/LTER adds several new measurements to the regular CalCOFI cruises.

Recently, a Moore Foundation award was received by Mark Ohman and Russ Davis to enhance the resolution of the quarterly surveys with two new instruments. Autonomous ocean gliders along two CalCOFI lines would “fly” continuously, providing ecological information from the upper ocean between cruises. Spatial augmentation during cruises will be provided with a shipboard free-fall Moving Vessel Profiler that will provide nearly continuous spatial coverage of the upper ocean between stations. These two instruments will significantly improve our ability to resolve changes in hydrographic structure and plankton communities. Deployment is expected to begin this fall (2005).

As always, the quarterly cruises serve as research platforms for graduate student research. Two ongoing student projects in addition to the whale project are a study of dissolved organic carbon cycling and a study of the utilization of iron and nitrate by phytoplankton in the Southern California Bight.

In anticipation of the Pacific Coast Ocean Observing System (PaCOOS), Scripps has continued to advance our data processing procedures with the final goal of a quasi-autonomous computer-based system that maintains our traditional high standards of data quality. This will make CalCOFI data more quickly available and more easily communicated. All cruises from 2004 are currently available online at <[www.calcofi.org/newhome/data/data.htm](http://www.calcofi.org/newhome/data/data.htm)>.

A strategic effort in preparation for PaCOOS has been the development of a “white paper” that provides a comprehensive review and summary of the vast and disparate data now collected by CalCOFI at Scripps and a plan for an information management approach that will facilitate integration of the CalCOFI dataset into the larger PaCOOS system. CalCOFI provides a spectrum of the data-management challenges that will need to be addressed by PaCOOS, and it is anticipated that identifying, articulating, and addressing these collaboratively on the CalCOFI scale will inform the development of the more complex federated system.

## CDFG HIGHLIGHTS

The Marine Life Protection Act (MLPA) was reinvigorated with the combined efforts of the CDFG and the Resources Agency coupled with private donations through the Resources Legacy Fund Foundation (RLFF). This new initiative will build on the progress and lessons learned in the earlier efforts. In 2004, the MLPA initiative named an eight-member Blue Ribbon Task Force (BRTF) to serve as the principle body for making recommendations to the Department of Fish and Game Commission. In support of the task force, a Science Advisory Team was named that included distinguished marine biologists, oceanographers, and socioeconomic professionals from the West Coast. A steering committee populated by CDFG staff and task force staff hired on through the RLFF also aids the task force. In 2005, the BRTF will define a region along the central coast to serve as the first stage of Marine Protected Area (MPA) implementation in California as mandated in the MLPA. Once the central coast region is defined and accepted by the CDFG Commission, a Central Coast Regional Stakeholder Group will be named to represent major marine interests in the region. This group will work with a sub-team from the Science Advisory Team to draft alternative MPA network proposals. This first phase of establishing a network of MPAs along the central coast is slated to be complete by mid-2006 with the rest of the state completed in stages until the final completion date in 2011. More information can be found on the MLPA initiative process at <[www.dfg.ca.gov/mrd/mlpa/index.html](http://www.dfg.ca.gov/mrd/mlpa/index.html)>.

In the legislature, FGC 8494 was passed in 2004 and requires that any vessel using bottom trawl gear in state-managed halibut fisheries shall possess a halibut bottom trawl permit. It also specifies a minimum landing requirement and qualifying period, transfer guidelines, and fee levels.

Each year, the Commission adopts state regulations that conform to the federal regulations for commercial and recreational ocean salmon and commercial and recreational groundfish. There are also annual regulations cycles for

commercial herring and herring roe on kelp. Additional Commission 2004 regulation changes were for bag limits for rockfishes, cabezon and greenlings fishery closures, restricted access fishery for spot prawn, retention of black rockfish, spot prawn trawl conversion program, lingcod season, size and bag limits, cabezon total allowable catch and cumulative trip limits, nearshore fishery trap gear limitations, use of dip nets in the commercial nearshore fishery, and marine protected areas.

Implementation of the Nearshore Fishery Management Plan (NFMP) focused on efforts to increase our knowledge of plan species through formal stock assessments, refining methods for monitoring landings, implementing the restricted access program, and determining the amount of appropriate habitat for plan species in existing Marine Protected Areas (MPAs). UCSC, CDFG, and NMFS staff completed the first-ever, peer-reviewed stock assessment for California sheephead (*Semicossyphus pulcher*), a state-managed, protogynous hermaphroditic species that occurs primarily south of Point Conception. When this unusual life history characteristic is accounted for in the assessment model, and biomass of both mature males and females is considered, the stock is determined to be at 31% of the unfished level. Managers developed management measures (e.g., seasons, trip limits, etc.) for nearshore species for 2005–06 that provided more fishing opportunities, while protecting overfished species, using information from stock assessments and constituent input. The Restricted Access program has been fully implemented and permit appeals have been completed. The first year of the full-restricted access program has experienced an attrition rate of about seven percent in the number of permittees fishing for the shallow nearshore species (cabezon, California sheephead, greenlings, California scorpionfish, and black-and-yellow, China, gopher, grass, and kelp rockfishes). The Deeper Nearshore Species Fishery Permit was first required in 2003 to take black, blue, brown, calico, copper, olive, quillback, and treefish rockfishes and has had an attrition rate of nine percent. Knowledge of appropriate habitat in existing MPAs will further efforts to base management on methods using fish densities in reference areas as described in the NFMP. Cataloguing of appropriate habitat has been initially directed toward southern California nearshore areas and will expand northward in 2005.

The Fish and Game Commission adopted the Market Squid Fishery Management Plan (MSFMP) in 2004, which went into effect in March 2005. The MSFMP was drafted to be flexible enough to adapt to changes in both the environment and economic conditions yet ensure for the long-term sustainability of squid populations. Key elements within the plan include: 1) seasonal catch limits; 2) maintaining an active monitoring program; 3) week-

end closures; 4) gear restrictions requiring light shields and wattage limits during fishing; 5) a restricted access program; and 6) establishing a seabird closure in the Gulf of the Farallones National Marine Sanctuary. This plan outlines how management decisions will be made while allowing for adaptive management to stochastic fishery conditions. In addition, the Commission can react quickly to volatility within the fishery without the need for plan amendments, which can slow response time. It will also provide the Commission specific guidelines for making management decisions.

The Department completed analysis of the Tanner crab experimental fishery and produced a summary report including recommendations for management of an emerging fishery. The report included biomass estimates and harvest guidelines for the emerging fishery. After the sale of the Stornetta property in northern California, an assessment was completed comparing abalone/invertebrate resources there with those at Moat Creek in spring 2004. Commercial sea urchin management continued with the market sampling and logbooks programs and production of an annual fishery report. The spot prawn trawl to trap conversion program was completed in 2004.

The Cooperative Research and Assessment of Nearshore Ecosystems (CRANE) group, with funding from the California Impact Assistance Program, completed surveys of fish and invertebrates at 68 kelp bed sites from Monterey to San Diego and at the Channel Islands in the summer of 2004. We are now compiling the survey data and historical data, some of which goes back to the 1970s. We expect to have a descriptive report of the data and a manuscript for submission in 2006.

In the past two years, we have been developing protocols using Remotely Operated Vehicles (ROV) to quantitatively measure fish populations in areas beyond diver depths. We are now using our methods to collect data for the Channel Islands MPA Monitoring Program. In November 2003 and May 2004 we did exploratory surveys of 14 sites, and in September 2004 we quantitatively surveyed five sites. We are now seeking funding for a survey of 10 additional sites in the summer of 2005.

Aerial surveys of kelp bed canopy on the mainland coast and the Channel Islands were completed in the summers of 2002 through 2004, and a survey is planned for 2005. The 2002 and 2003 data are posted on the CDFG web site. Data from 2004 will be posted in September 2005.

The Ocean Salmon Project (OSP) estimates ocean salmon harvest and fishing effort by major port and half-month periods. In addition, the program collects 20% of the catch to estimate the coded-wire-tagged (CWT) salmon contribution rates to California ocean salmon fisheries. In 2004, the ocean salmon fisheries were closer

to shore than in 2003 and were centered on the San Francisco port area (60% of all estimated landings). Estimated commercial landings were similar to 2003 (approx. 500,800 salmon), but the recreational landings estimates almost doubled from the 2003 estimates (approx. 220,200 salmon). The estimated recreational harvest was greater than the effort (approx. 215,700 angler days fished) in 2004. OSP collected and processed heads from approximately 17,000 adipose fin-clipped salmon for CWT's.

A joint NMFS and CDFG nearshore groundfish log-book program was initiated in 2004. Nearshore fishers, industry representatives, and agency personnel collaborated during a workshop to plan the voluntary program. A pilot study was initiated in phases starting with one port in each of the four management regions (Crescent City, Fort Bragg, Morro Bay, and Santa Barbara). Invitations were sent to all nearshore fishery permit holders inviting them to participate in the program.

The Aquaculture, Disease, and Aquatic Nuisance Species mandate continued efforts in 2004 to assure eradication of the invasive algae *Caulerpa taxifolia* from two California lagoons and eradication of the abalone-infesting sabellid polychaete from abalone farms and display facilities throughout the state. Disease control at the Ocean Resources Enhancement Program's white sea bass hatchery allowed the release of over 240,000 juveniles, a new record number, this year.

## KUDOS

The seagoing personnel of the SWFSC's Fisheries Resources Division, SIO's Integrative Oceanography Division, and CDFG's Marine Region all contributed, through their dedication and diligence, to the success of CalCOFI's quarterly fieldwork. 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 NOAA Ship *David Starr Jordan*, the F/V *Frosti*, and the University of California's R/Vs *New Horizon* and *Roger Revelle*.

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