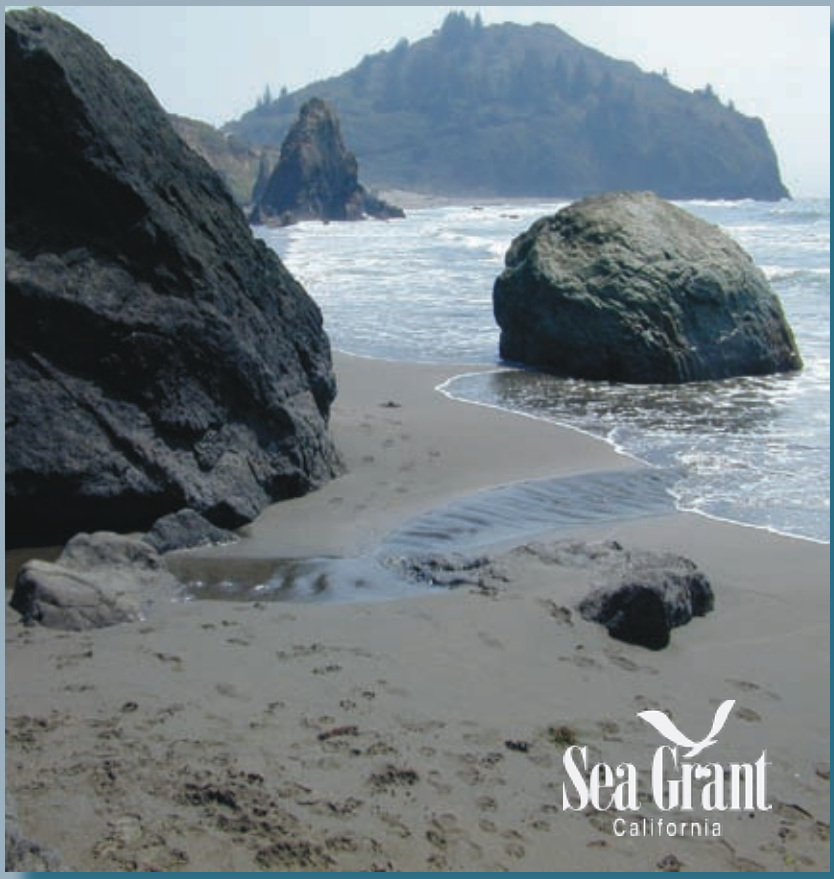
California Sea Grant

Program Directory 2008–2009



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Sea Grant is a unique partnership of public
and private sectors, combining
research, education,
and outreach for public service.
It is a national network of universities meeting
changing environmental and economic needs
of people in our coastal, ocean,
and Great Lakes regions.

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Message from the Director…

My message last year mentioned that these are exciting times for many of us engaged in coastal issues in California. That excitement continued through 2007 as new opportunities and challenges arose for California, a national leader in coastal policy, research and education. As you will discover in this directory, California Sea Grant remains deeply engaged in many groundbreaking activities within our state.

Progress continues on West Coast regional activities. The tri-state agreement among the governors of Washington, Oregon and California is moving forward with the development of an Action Plan. The four West Coast Sea Grant programs held more than a dozen workshops in 2007 to help identify the public view of the coastal research and information needs of the three states. This invaluable advice from our concerned citizens not only helps shape where the regional agreement is headed, but provides new guidance for the future direction of California Sea Grant. Further, the regional activities support the concept of a seamless research-outreach continuum described in my message of three years ago. That continuum now goes beyond California Sea Grant and embraces coastal research and outreach efforts on a regional basis.

The coastal challenges facing the state and region continue, although with a shifting emphasis. Whereas global climate change appeared as a long-term threat just a few years ago, alarmingly we are now facing these problems with increasing urgency. Issues such as sea-level rise, ocean acidification, changing precipitation patterns and species range adjustments require urgent research attention and answers. California Sea Grant has moved deeper into partnership with the state of California working with the Ocean Protection Council to fund critical research on these topics. Yet none of the traditional issues such as aquatic species invasions, water quality, coastal development, decline of fisheries and habitat loss have gone away. The need for focused research and outreach remains as strong as ever.

While addressing the issues mentioned above, the implementation of marine protected areas (MPAs) has taken on a new life this past year. California has moved forward at a rapid pace to designate a suite of new coastal MPAs. With the implementation of MPAs along the Central Coast of California in April 2007, the state is forging ahead to design a complete set of coastal MPAs to be implemented by 2012. Yet there remains much to learn about these MPAs. Do they achieve the desired objective of protecting ecosystem health? What is the impact of the displacement of the fishing fleet? Can we truly protect these locations so that they will not become merely “paper” MPAs? Again, California Sea Grant has been drawn into this process by partnering with the state to begin crucial work on the initial characterization of California’s Central Coast MPAs.

In the following pages you will find information on California Sea Grant’s increasingly complex mission. I encourage you to explore in depth many of these projects and activities. As such, I welcome you to join with California Sea Grant as we move forward.

Russell A. Moll
Director

Contents

Surfing at Capitola, California. Photo: Steve Lonhart, SIMoN/MBNMS

What is Sea Grant?

The National Sea Grant College Program, a network of 31 university-based programs, is dedicated to enhancing the understanding, conservation, and sustainable use of the nation's coastal and marine resources. It has facilities and staff in every coastal and Great Lakes state, with activities funded by the National Oceanic and Atmospheric Administration of the U.S. Department of Commerce. Matching funds come from the individual states, and additional support from a variety of private sources.

The Sea Grant programs of today focus on making this country a world leader in marine research and the sustainable development of marine and coastal resources. To this end, they produce and make available a wealth of information on these topics, from school curriculum materials to the most advanced scientific research.

California Sea Grant College Program, the largest of these 31 programs, draws on the talents of scientists and engineers at public and private universities throughout the state. It is administered by the University of California and is based at Scripps Institution of Oceanography in La Jolla.

California Sea Grant contributes to the growing body of knowledge about coastal and marine resources and helps solve contemporary marine-related problems through its sponsored research. It supports graduate education by funding trainees who work with marine scientists and engineers on a diversity of subject areas. Through its outreach and communications components, developments in information and technology are transferred to stakeholders. Our Extension personnel, in partnership with UC Cooperative Extension (UCCE), play a major role in the link between university, industry and the public.

The research funded is selected on the basis of competitive, peer-reviewed proposals and addresses a wide range of problems and opportunities. This Program Directory provides summaries of the projects funded in 2008 by California Sea Grant. Further information on any of these projects is available by contacting our offices, or visiting the program Web site—http://www.csgc.ucsd.edu.

Other Web Resources:

National Sea Grant Office	www.nsgo.seagrant.org/
National Sea Grant Library	nsgl.gso.uri.edu/
UC Digital Library	http://repositories.cdlib.org/csgc/

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Bodega Bay, California 94923

CAS California Academy of Sciences
San Francisco, California 94103

CASG California Sea Grant College Program
La Jolla, California 92093-0232

CDFG California Department of Fish and Game

CICESE Centro de Investigación Científica y de Educación Superior de Ensenada
Ensenada, Mexico

CPSLO California Polytechnic State University
San Luis Obispo, California 93407

CSGEP California Sea Grant Extension Program

CSULB California State University, Long Beach
Long Beach, California 90840

CSUMB California State University, Monterey Bay
Seaside, California 93955

FIAER Farallon Institute for Advanced Ecosystem Research
Petaluma, California 94975

HMS Hopkins Marine Station
Pacific Grove, California 93950

HSU Humboldt State University
Arcata, California 95521

IA Impact Assessment, Inc.
La Jolla, California 92037

MLML Moss Landing Marine Laboratories
Moss Landing, California 95039

NOAA National Oceanic and Atmospheric Administration
Washington, DC 20230

NMFS National Marine Fisheries Service
La Jolla, California 92037

RCUH Research Corp. of the University of Hawaii
Honolulu, Hawaii 96822

SAMS Scottish Association for Marine Science
Oban, Scotland

SIO Scripps Institution of Oceanography
La Jolla, California 92093

SDSU San Diego State University
San Diego, California 92182

SERC Smithsonian Environmental Research Center
Edgewater, Maryland 21037

SFSU San Francisco State University
San Francisco, California 94132

SJSU San José State University
San José, California 95192

SSU Sonoma State University
Rohnert Park, California 94928

SU Stanford University
Stanford, California 94305

SUNY-ESF State University of New York College of Environmental Science and Forestry
Syracuse, New York 13210

SWFSC Southwest Fisheries Science Center
Santa Cruz, California 95060

UCB University of California, Berkeley
Berkeley, California 94720

UCD University of California, Davis
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UCR University of California, Riverside
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UCSB University of California, Santa Barbara
Santa Barbara, California 93106

UCSC University of California, Santa Cruz
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UCSD University of California, San Diego
La Jolla, California 92093

USC University of Southern California
Los Angeles, California 90033

USGS U.S. Geological Survey
Reston, Virginia 20192

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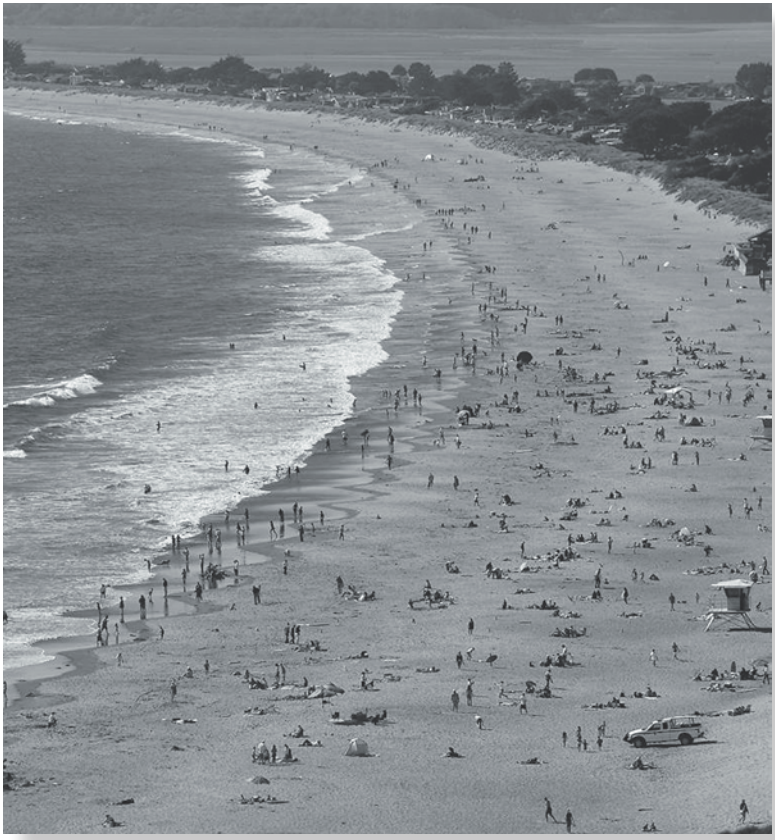
Seattle, Washington 98195

WSU Washington State University
Vancouver, Washington 98686



Tracking surf-zone dynamics at Huntington Beach. Photo: Dennis Darnell, SIO

- **Tracer Dispersion in the Surf Zone: Water Quality and Ecology**
  R/CZ-196 Feb. 06–Jan. 09
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  James Leichter, UCSD/SIO, 858.822.5330, jleichter@ucsd.edu
  Robert Guza, UCSD/SIO, 858.534.0585, rguza@ucsd.edu

Oceanographers continue to study the effects of waves, currents, bathymetry and cross-shore position on dispersion in the surf zone. In particular, they are studying the processes (e.g., shear waves and breaking waves) that dominate dispersion at different length scales, time scales and depth and distance from shore. The goal is to model the nonlinear interactions governing dispersion. They could then use real-time data, such as those collected by the Southern California Coastal Ocean Observing System (SCCOOS), to generate better, local forecasts of surf-zone processes. Dispersion contributes to some of the fine-scale patterns of phytoplankton and fish larvae abundance along the coast. An understanding of what determines the strength of nearshore dispersion and the ability to incorporate this knowledge into marine forecasts would represent a major step forward in the field of coastal oceanography. From a practical standpoint, it would advance oil-spill response planning, fisheries management and coastal water quality clean-up efforts.

- **Understanding Submarine Groundwater Discharge and Its Influence on Coastal Water Quality Along the California Coast**
  R/CZ-197 Feb. 06–Jan. 09
  Alexandria Boehm, SU, 650.724.9128, aboehm@stanford.edu
  Adina Paytan, UCSC, 831.459.1437, apaytan@ucsc.edu

In the summer and winter of the project's first year, scientists conducted field experiments at Stinson Beach in Marin County to quantify the flux of submarine groundwater from land to sea and to measure chemical and biological quantities associated with water quality—nutrients, fecal indicator bacteria and F^+ coliphage, an indicator of viral pollution. Results of the summer study show that the aquifer at Stinson Beach is contaminated with human waste. Fresh groundwater seems to be the source, as fecal and nutrient counts were observed to be highest when salinity levels were lowest; septic tanks may be contaminating groundwater. This year the scientists plan to conduct similar fieldwork in Santa Cruz to examine how different land-use patterns and local geology influence the composition of submarine groundwater and thus coastal water quality.

- **The Effects of Current Velocity and Creek Morphology on the Population Dynamics of Spionid Polychaetes in the Tijuana Estuary**
  R/CZ-199 Feb. 06–Jan. 09
  Brian Hentschel, SDSU, 619.594.0358, hentsche@sunstroke.sdsu.edu

Scientists are studying changes in the abundance, growth and reproduction of small worms (polychaetes in the family Spionidae) in response to different flows through channels and creeks at the NOAA Tijuana River National Estuarine Research Reserve. Findings will help identify creek sizes, shapes and flow regimes associated with ecosystem health. This information will be useful in deciding how and where to build tidal channels and creeks to restore marsh habitats. In the first year, scientists observed that worm population densities were highly variable in space and time. They also observed that creek velocities vary significantly from day to day and are driven more by local winds than expected. Researchers are now building structures that experimentally alter current velocities to quantitatively investigate whether worm populations are related directly to creek velocities.

- **The Role of Symbiotic Bacterial Metabolites in the Development of Toxic Phytoplankton Blooms**
  R/CONT-205 Feb. 08–Jan. 11
  Carl Carrano, SDSU, 619.594.5929, carrano@sciences.sdsu.edu
  Frithjof Kuepper, SAMS, 011.44.01631.559216, fck@sams.ac.uk
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Building on previous Sea Grant research, the chemists continue to explore the structure and iron-binding characteristics of siderophores produced by members of the *Marinobacter algicola* clade of the gamma-proteobacteria and others closely associated with *Gymnodinium catenatum*, *Alexandrium tamarense* and other harmful algal-bloom-producing dinoflagellates, as well as the ecologically more numerous alpha-proteobacteria.They will also determine whether phytoplankton use iron, made available by siderophores, to enhance their growth. Several possible hypotheses for how phytoplankton acquire this iron will be explored. The first phase of the project will focus on the continued isolation and structural and boron-binding characterization of new siderophores from bacteria associated with phytoplankton such as *G. catenatum*. They will also look at whether iron, derived from associated bacterial partners, can trigger rapid growth of dormant phytoplankton, in other words trigger harmful algal blooms.

- **Climate Change and Restoration Factors Affecting Fecal Pathogen Dynamics in Wetland Systems**
  R/CONT-206 Feb. 08–Jan. 11
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  Fred Watson, CSUMB, 831.582.4402, fred_watson@csumb.edu
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This project will employ both field and laboratory studies to better understand the consequences of climate change and wetland restoration on the fate and transport of fecal pathogens in coastal areas. The fieldwork will be conducted at the Molera wetland in Monterey County, built in 2005 by the researchers leading this project. Both field and laboratory studies will focus on understanding how water flows, vegetation, water temperature and salinity affect pathogen loads. The pathogens to be investigated include *Cryptosporidium parvum*, *Toxoplasma gondii* and *Giardia duodenalis*—all three can cause serious human disease. Findings from this project will advance the science of constructed wetland mitigation as a means of optimizing their natural cleansing ability. Research summaries will be posted on the NOAA Monterey Bay National Marine Sanctuary's SIMoN Web site. The researchers also plan on developing curricular material for schools.

- **Investigating the Limits of Native Oyster Recovery and Restoration**
  R/ENV-203 Feb. 07–Jan. 10
  Edwin Grosholz, UCD, 530.752.9151, tedgrosholz@ucdavis.edu
  Chela Zabin, SERC, 415.435.7128, zabinc@si.edu

Why does one oyster restoration project succeed while a seemingly identical one fails? This project seeks to answer the question using native oyster populations in San Francisco and Tomales Bays as case studies. To do this, scientists are studying spatial and temporal variability of oyster recruitment, measuring predation by Atlantic oyster drills and European green crabs, and quantifying effects of fouling organisms and "space competitors" like tunicates and sponges. The long-term viability of native oysters will also be examined.

- **Connectivity of West Coast Marine Sanctuaries: Tracking Sooty Shearwaters Throughout Dynamic Upwelling Ecosystems in the California Current System**
  R/ENV-204 Feb. 08–Jan. 11
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  Josh Adams, USGS/MLML, 831.771.4138, josh_adams@usgs.gov
  Erika McPhee-Shaw, MLML, 831.771.4470, eshaw@mlml.calstate.edu

The objective of this project is to characterize the response of sooty shearwaters to environmental variables that determine primary productivity, food-web structure and energy transfer within the California Current system. Specifically, researchers seek to understand conditions that attract the birds to upwelling retention zones. The theory is that these areas are rich in food for the birds—northern anchovy, Pacific sardine and juvenile rockfishes. In contrast, shearwaters are hypothesized to spend little time and thus show directed movement through upwelling areas where cold (9–11° C) waters are rapidly transported offshore. Point Sur and Cape Mendocino are two examples of places where upwelling is particularly intense.

Aerial view of the Bolsa Chica wetlands. Photo: NOAA

- **Nematode Community Analysis for Monitoring Meiofaunal Response to the Bolsa Chica Wetlands Restoration Project**
  R/ENV-207 Feb. 08–Jan. 10
  Paul De Ley, UCR, 951.827.2280, paul.deley@ucr.edu

As part of the Bolsa Chica Wetlands Restoration Project, the researcher will address the influence of tidal action and nutrient enrichment on nematode (roundworm) diversity and community structure. A comprehensive faunal list of all free-living (nonparasitic) nematodes at six representative locations in Bolsa Chica and at three control sites in the Santa Maria Estuary will be compiled. Besides filling a gap in what is known about these exceedingly abundant invertebrates (usually the dominant organism in marine sediments), the data will create a baseline from which changes in benthic community structure can be monitored and from which restoration success can, in part, be gauged.

- **Detecting, Localizing and Resolving Regime Shifts Along the California Coast**
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This project will utilize long-term temperature records to study regime changes and their relationship to coastal ecology and warming. The project has five main goals: (1) to describe how regime change occurs; (2) to search past climate records for as-of-yet unidentified regime shifts; (3) to determine the extent to which regime shifts contribute to warming; (4) to correlate sea surface temperature to ecosystem change, such as changes in the distribution and relative abundance of different types of plankton; and (5) to establish procedures for monitoring the coastal ocean to detect regime shifts and other abrupt processes in near real-time.

- **Collecting Sea Palms: Planning for Sustainable Use in a Variable Environment**
  R/CZ-200 Feb. 06–Jan. 09
  Karina Nielsen, SSU, 707.664.2962, karina.nielsen@sonoma.edu
  Carol Blanchette, UCSB, 805.893.5144, blanchet@lifesci.ucsb.edu

The sea palm (*Postelsia palmaeformis*) is an edible kelp collected from rocky intertidal areas of Northern California. This project looks at whether current collecting practices are sustainable, given the sea palm's growth and reproductive cycles. This year, scientists will conduct experiments to measure sea palm re-growth after harvesting. They will also analyze California Department of Fish and Game logbooks and voluntary reports for edible seaweed fisheries to look for meaningful trends in this relatively new, fast-growing industry. At the study's conclusion, scientists will make recommendations for developing a sustainable management plan. Results are also being communicated to undergraduates enrolled in a new course at Sonoma State University, "Communicating Ocean Sciences," and UC Santa Barbara's Marine Science Institute via its Outreach Center for Teaching Ocean Science and the Research Experience and Education Facility.

- **Determination of Red and White Abalone Age and Growth Using Bomb Radiocarbon Signal and Lead Dating**
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This project seeks to develop a technique for determining age, growth rates and longevity of red and white abalones from their shells. The technique under development uses radiocarbon markers from atomic bomb detonations in the 1950s and 1960s, as well as Pb-210 dating. These estimates will then be compared to those computed using traditional methods to deter-

mine, among other things, if large abalones are as old, or older than, predictions from growth models. Accurate lifespan data are crucial for developing state and federal abalone fishery management and recovery plans.

- **Two Decades of Fishing the Santa Barbara Channel: An Examination of Effort and Catch with Regard to Serial and Localized Depletions of Reef Fishes**
  R/FISH-203 Feb. 07–Jan. 09
  Milton Love, UCSB, 805.893.2935, love@lifesci.ucsb.edu

This project will mine a rare dataset, a detailed logbook kept by the owner of a commercial sportfishing boat. This owner took anglers to Santa Barbara reefs from 1979 to 2001 and painstakingly recorded their catches, the weather and reef habitat. Does this logbook show a pattern of serial depletions for rockfishes and lingcod and is it correlated with anglers' access to fishing areas? This will be explored; conclusions will be compared to results in peer-reviewed fisheries science publications.

- **Transport of Ghost Shrimp as Live Bait: Potential Effects on Impacted Southern California Populations**
  R/FISH-204 Feb. 08–Jan. 11
  Bruno Pernet, CSULB, 562.985.5378, bpernet@csulb.edu
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The bait industry in Southern California imports live ghost shrimp (*Neotrypaea californiensis*) from Oregon and Washington. The "delectable little shrimp" is used by recreational fishers to catch fish such as corbina, surf perch and halibut. Though the shrimp is native to Southern California, there are concerns that imported northern shrimp, which the researchers have recently shown is genetically identical to southern shrimp, might introduce non-native parasites, specifically the isopod *Ione cornuta*, which is present in appreciable numbers in imported shrimp. This project will examine whether this isopod's larvae are viable in southern waters. The researchers will also determine the poundage of live ghost shrimp (as well as other live bait species) imported into California annually.

(Right) *Neotrypaea californiensis* purchased at bait shop with parasitic isopod indicated by arrow. Photo: Bruno Pernet, CSULB

- **Exploring the Impact of Avian Predators on Central California Salmonids**
  R/FISH-205 Feb. 08–Jan. 11
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Recent tagging data suggest that birds such as the western gull feed on Central California juvenile salmon. Using out-migrating coho and steelhead smolt in Scott Creek and Wadell Creek as a case study, biologists will identify key avian predators, locate predation "hot spots" and monitor movements of passive integrated transponder (PIT) tagged smolts. They will also scan bird nests and roosts for PIT tags and collect stomach pellets to compute the contribution of salmon to the total diet. Because it is expected that avian predation can be significant

in some places, the final component of the project will explore the feasibility and effectiveness of bird-exclusion devices to reduce salmon predation.

- **Initial Steps Towards Evaluating Potential Disease Impacts of Propagated Marine Fish on Wild Stocks: A New Herpesvirus from White Seabass**
  R/AQ-127 Feb. 07–Jan. 10
  Ron Hedrick, UCD, 530.752.3411, rphedrick@ucdavis.edu
  Kristen Arkush, BML, 707.875.2062, kdarkush@ucdavis.edu
  Mark Okihiro, CDFG, 760.726.8170, ms.okihiro@att.net

Marine aquaculture can spread disease to wild stocks. In collaboration with a marine pathologist for the California Department of Fish and Game and the Hubbs-SeaWorld Research Institute in San Diego, scientists are studying aspects of "pathogen amplification," using a herpes-like virus in white seabass as a case study. It is hoped this work will establish criteria and tools for systematically evaluating disease risks for a growing list of marine fish slated for culture. In the first year of the project, scientists developed a diagnostic polymerase chain reaction test for the herpes-like virus. Testing of fish in the field has shown that the virus is relatively rare in wild fish. The results suggest that disease outbreaks in aquaculture facilities may indeed be a function of culturing conditions.

- **Seaweed Strain Selection and Preservation to Optimize Harvest Yields for Abalone Culture**
  R/AQ-128 Feb. 08–Jan. 11
  Michael H. Graham, MLML, 831.771.4481, mgraham@mlml.calstate.edu

In previous Sea Grant research, the biologist established the feasibility of using rope culture to grow two native red algae species in Monterey Harbor. The goal of this follow-up project is to make red algae culture not just feasible but commercially viable by lowering the cost of growing, harvesting and storing seaweed. With this goal, the biologist will conduct intra-clone out-plant selection experiments to develop strains of red algae (*Gracilaria* and *Gracilariopsis*) with high fragmentation survival, high protein content and high resistance to competition from epiphytes. Kelp selection experiments will be conducted to develop giant kelp (*Macrocystis*) and bull kelp (*Nereocystis*) strains with similar traits. In addition, the scientist will investigate low-cost preservation techniques that would allow seaweed to be stored for use as abalone feed during times when wild harvesting is limited or difficult. The project is being conducted in collaboration with the Monterey Abalone Company.

Monterey Abalone Company president Art Seavey holding up a *Gracilariopsis* outplant line. Photo: Michael Graham

- **Soft-Egg Syndrome in Farmed White Sturgeon**

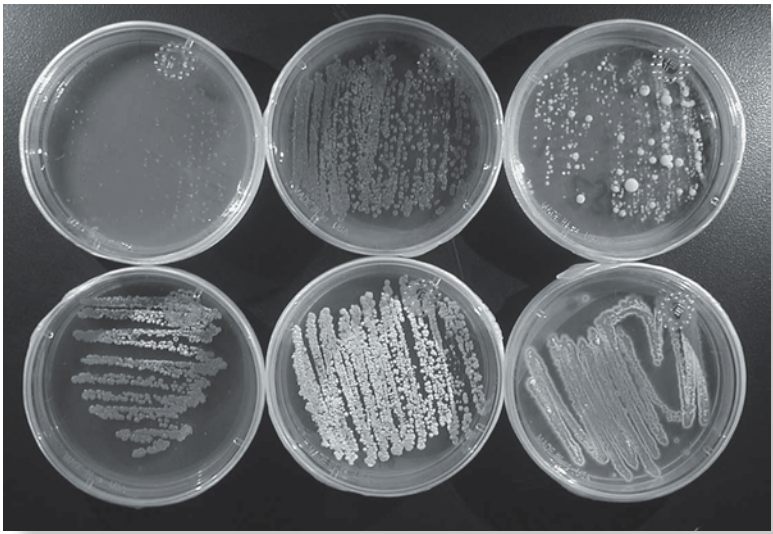
  R/AQ-129 Feb. 08–Jan. 11
  Kenji Murata, UCD, 530.752.9024, kmurata@ucdavis.edu
  Serge Doroshov, UCD, 530.752.7603, sidoroshov@ucdavis.edu
  Fred Conte, UCD, 530.752.7689, fsconte@ucdavis.edu

In the last two years, caviar producers in California have seen an inexplicable rise in the incidence of "soft" eggs—an undesirable caviar trait that is holding back an otherwise rapidly growing industry. The working hypothesis of this project is that soft-egg syndrome can be prevented by modifying a farm's husbandry techniques. To test this, scientists will measure the effects of water temperature, diet and stress (caused by handling and transporting fish) on egg-burst force, egg texture and incidence of ovarian follicular degeneration at harvest. The biologists will also compare the biochemical composition of the egg envelope and egg lysate, which contains cell debris and cellular fluid, for soft and firm eggs. Sterling Caviar and The Fishery are collaborating on this project.

- **Understanding Connectivity to Sustain and Manage Coastal Resources**

  R/ANS-209 Feb. 08–Jan. 11
  Lisa A. Levin, UCSD/SIO, 858.534.5108, llevin@ucsd.edu
  Linda L. Rasmussen, UCSD/SIO, 858.822.1816, llrasmussen@ucsd.edu

How can wildlife managers prevent introductions of invasive species with planktonic larvae or control their spread once they have become established? Biologists will investigate this topic for two invasive mussels (*Mytilus galloprovincialis* and *Musculista senhousia*) and a native species (*Mytilus californianus*). Other questions to be addressed: How far do larvae disperse from specific sites (i.e., new invasions or aquaculture facilities)? Will this dispersion stimulate hybridization or spread? How much larval exchange occurs between populations and is this exchange a likely vehicle for maintenance of population structure in rocky shore habitats? Can scientists identify common larval sources and sinks and quantify rates of self-seeding to more effectively manage coastal resources?



- **Biomedical Development of New Marine Microbial Resources**
  R/NMP-98 Feb. 07–Jan. 10
  Paul Jensen, UCSD/SIO, 858.534.7322, pjensen@ucsd.edu
  Bradley Moore, UCSD/SIO, 858.822.6650, bsmoore@ucsd.edu

In an effort to find new antibiotics and enzyme biocatalysts, chemists are probing the diversity of a promising class of deep-sea microbes in sediments off California. These microbes are considered promising because their land-based counterparts (actinomycetes) have been the source of dozens of antibiotics. Also being investigated is whether culture-independent methods and hydridization probes can improve the efficiency of natural product discovery. To this end, certain halogenating enzymes will be targeted for cloning and expression. Chlorine atoms will then be introduced into specific substrates using recombinant enzymes as biocatalysts, with the goal of enhancing or triggering antibiotic activity.

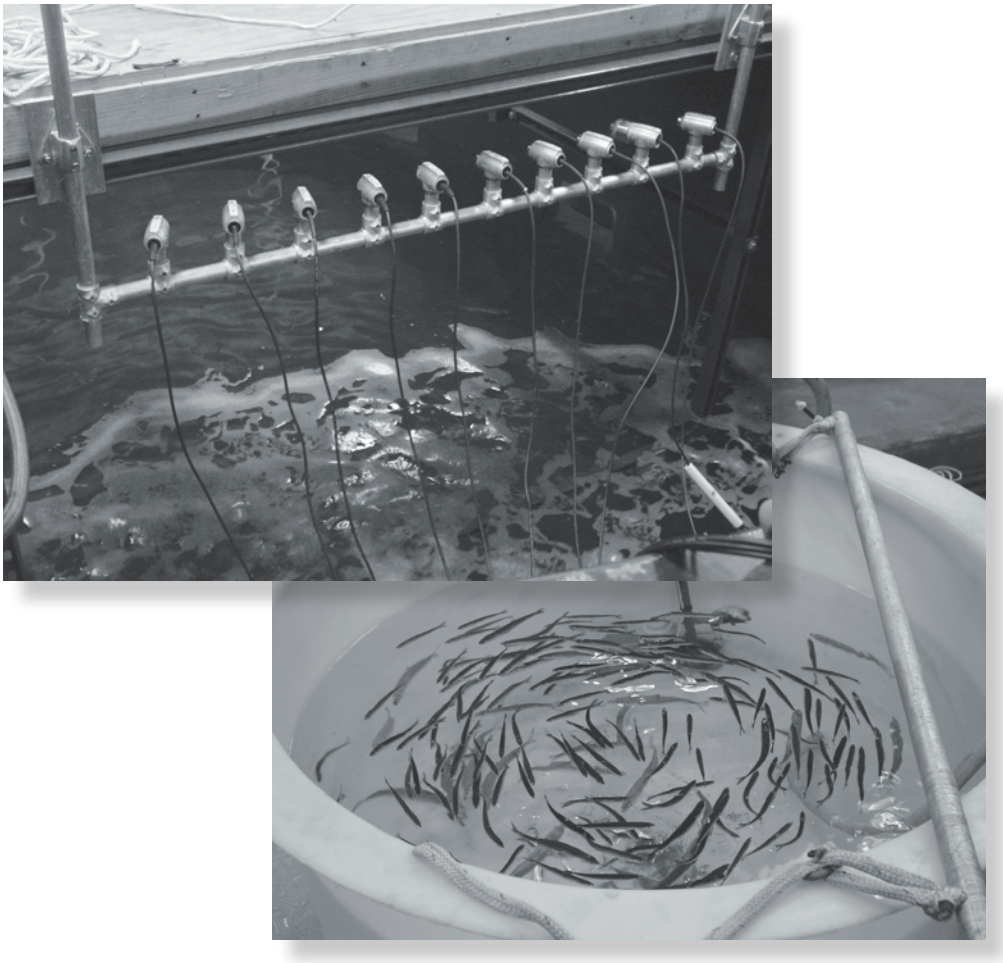
- **Harnessing the Pharmaceutical Potential of Marine Cyanobacteria**
  R/NMP-99 Feb. 08–Jan. 11
  William H. Gerwick, UCSD/SIO, 858.534.0578, wgerwick@ucsd.edu
  Lena G. Gerwick, UCSD/SIO, 858.534.0566, lgerwick@ucsd.edu

This project addresses a major obstacle in the development of new medicines from marine cyanobacteria—producing sufficient quantities of the compounds for necessary testing. The goal is to devise techniques for inducing and enhancing pharmaceutically interesting natural products from cultured marine cyanobacteria. The first phase of the research focuses on understanding gene expression for secondary metabolite pathways. This will be achieved using a reporter gene assay (beta-galactosidase) to determine regulatory DNA sequences for biosynthetic genes and to discover protein transcriptional activators of these regulatory domains. Once completed, the researchers will attempt to find new elicitors of natural products biosynthesis and then apply a combination of elicitor and transcriptional activator approaches

to scale-up compound production. The compounds can then be further tested for their anti-microbial and anticancer activities.

- **Sizing Fish with an Acoustic System**
  R/OE-40 Feb. 06–Jan. 09
  Jules Jaffe, UCSD/SIO, 858.534.6101, jjaffe@ucsd.edu

The goal of this project is to formulate a technique for inferring fish size and orientation from multi-angle sound reflection. To date, the scientists have performed experiments on different species of juvenile fish to measure how they scatter sound. They have shown that the use of several transmitters and receivers for measuring scattering patterns has many benefits over traditional techniques in which only one source and receiver are used. Specifically, it makes it possible to estimate the size, and to some extent, the shape of fish. Further development of the technology could be of use to aquaculture facilities in which visually inspecting fish is impossible due to cloudy water. In addition, the shape of the fish may provide some indication of health.



Coastal Community Development

- **Exposure of Santa Cruz Wharf Anglers to Domoic Acid**
  R/MA-45 Feb. 06–Feb. 09
  Mary Silver, UCSC, 831.459.2908, msilver@ucsc.edu
  Caroline Pomeroy, CSGEP, 831.763.8002, cmpomeroy@ucdavis.edu

Sport fish caught off the Santa Cruz Wharf have been shown to be contaminated with a toxin known as domoic acid, the causative agent of amnesic shellfish poisoning. This discovery raises concerns that certain groups of people may be consuming too much of the toxin. This project will characterize seafood catch and consumption statistics for wharf anglers to determine whether certain subpopulations are indeed at risk. Very little is known about anglers' exposure to marine toxins or how this varies across socioeconomic and cultural lines. In 2007, the Sea Grant trainee organized a team of volunteers, including UCSC undergraduates and local high school students, to catch fish from the wharf during a toxic bloom. The gut contents and domoic acid levels of these fish are now being analyzed.

Program Development

- **Program Development**
  M/NP-1
  R.A. Moll/CASG

Conditions in the marine sphere can change rapidly because of both human and natural causes, and problems that need immediate attention can arise unexpectedly. The program development project allows prompt support for short-term, marine-related research, outreach and education projects.

Special Competitions: Oyster Disease

- **Building Gene Expression-Based Predictors of Oyster Summer Mortality Syndrome**
  R/OD-1 Jun. 07–May 08
  Andrew Gracey, USC, 213.740.2288, gracey@usc.edu

Oyster summer mortality syndrome (SMS) is a devastating, unpredictable disease that has significant economic implications for the Pacific's bivalve culture businesses. Not much is known about what causes the disease, except that it is probably a combination of genetic, physiological and environmental factors. Also problematic, outbreaks are impossible to predict. This project seeks to identify functional genomic sequences (via DNA microassays) that are correlated with SMS. The goal is to develop a method for the early detection of the disease, which would enable growers to take proactive steps to mitigate losses. Specifically, the lead researcher of the project will characterize the gene expression patterns exhibited by oysters during the early stages of SMS and establish gene expression-based predictors of disease. The scientist will also identify the environmental conditions that increase susceptibility to SMS. Results will be tested at oyster beds throughout the nation.

CALFED Science Fellows Program

The CALFED Science Fellows Program was established to bring together junior scientists with CALFED Program agency scientists and senior research mentors in collaborative data analysis and research projects relevant to ecosystem management and water supply reliability questions, including analyses of the immense monitoring data collected and maintained by the implementing agencies. California Sea Grant administers the fellowship program.

- **Development of a Simulation Model of Juvenile Salmon Movement in the Sacramento-San Joaquin Delta**
  R/SF-7 Sept. 05–Aug. 08
  Annjanette Dodd, HSU, 707.733.9462, amd2@humboldt.edu

How do juvenile salmon move through the Sacramento-San Joaquin Delta? The goal of the project is to combine a hydrodynamic model of particle transport and a biological model of fish behavior to simulate the effects of water operations (e.g., reservoir release rates, pumping rates and other operations of the Delta Cross Channel gates) on juvenile salmon migration patterns. The strategy is to find the simplest model consistent with observational data, not to produce a "realistic" model of fish movement. In 2007, the CALFED Fellow used recently collected ultrasonic salmon tagging data to begin developing a particle-tracking model of fish movement through the Delta. The observational data have shown that juveniles as small as 3 and 4 inches in length do not behave as passive particles. This year, the researcher will begin modifying hydrodynamic models to include fish behavior. The results of the project will improve the ability to predict the effects of different flow regimes on fish.

- **Modeling Nutrient and Organic Carbon Loads and Sources in Central Valley Watersheds: Taking Existing Monitoring Data to the Next Stage**
  R/SF-8 Sept. 05–Aug. 08
  John Harrison, WSU, 360.546.9210, harrisoj@vancouver.wsu.edu

What are the relative contributions of various land-based sources of dissolved inorganic nitrogen and dissolved organic carbon to the Sacramento and San Joaquin River systems? How are river nitrogen and carbon concentrations, loads and sources likely to change as a function of climate, population growth, water demand, and land-use change in the next few decades? This project seeks to improve understanding of the links between land use, climate, and surface water quality.

- **The Application of Otolith Geochemistry to Determine Stock Structure, Survival and the Relative Impact of Water Exports on the "Threatened" Delta Smelt**
  R/SF-9 Sept. 05–Aug. 08
  James Hobbs, BML, 707.875.1973, jahobbs@ucdavis.edu

The delta smelt is a small fish found in only one ecosystem in the world: the brackish waters of the San Francisco Estuary. Unfortunately for its survival, about two-thirds of the state's fresh water is pumped from this same habitat. As a result, untold numbers of smelt larvae are sent through the extensive pumping systems of state and federal water projects. By studying the otolith geochemistry of adult smelt collected during a monitoring survey, the CALFED Fellow has shown that a majority of recruiting delta smelt originate in the North and Central West Delta, rather than the South Delta, where freshwater exports occur. Another important finding, low-salinity habitats in Suisun Bay provide critical nursery areas for juvenile smelt during wet years. The project's findings have already had a direct impact on the region's freshwater pumping schedules and has also invigorated interest in restoring the Cache slough area in the North Delta.

- **Determining the Factors Controlling Site Invasibility to *Lepidium latifolium***
  R/SF-10 Sept. 05–Aug. 08
  Margaret Andrew, UCD, 530.752.5092, meandrew@ucdavis.edu

To prevent the spread of the invasive perennial pepperweed (*Lepidium latifolium*), the CALFED Fellow is using hyperspectral HyMap remote-sensing data in combination with image-processing techniques to map the plant's distribution and identify environmental factors (e.g., temperature, precipitation, wind, stream flow and soil salinity) that may influence growth and reproduction. A recent success of the project has been the ability to map pepperweed at both Rush Ranch in Suisun Marsh, a very wet area, and the much drier Jepson Prairie in the Delta. The two sites present different spectral conditions for the detection of perennial pepperweed.

- **Effects of Water Temperature, Stream Flow and Flood Availability on the Growth, Survival and Movement of Central Valley Juvenile Steelhead (*Oncorhynchus mykiss*) with Implications for Water Management**
  R/SF-11 Sept. 05–Aug. 08
  Walter Heady, UCSC, 831.459.5783, heady@biology.ucsc.edu

The CALFED Fellow found that two man-made side channels on the lower Mokelumne River (LMR) provide rearing habitat for juvenile chinook and steelhead. Aquatic macro-invertebrate abundance and diversity was also enhanced. The fellow is now working in collaboration with the East Bay Municipal Utilities District and the California Urban Water Association on an acoustic telemetry project in the LMR. To date, he has tracked 65 tagged wild steelhead along standardized transects of the LMR using a handheld hydrophone. The ability to track individual fish is making it possible to study the habitat associations, site fidelity and movements of fish with different life histories (e.g., resident or anadromous).

- **Addressing Stakeholder Concerns: Pests and Pest Control in the Sacramento River Conservation Area**
  R/SF-12 Sept. 05–Aug. 08
  Suzanne Langridge, UCSC, 831.459.3902, sml@ucsc.edu

Could habitat restoration in the Sacramento River Valley increase the presence of pest birds in nearby orchards? This project examines the question of how restoring riparian habitats affects nearby farmers by studying birds at orchards and nearby restored areas along the Sacramento River. To date, it has been shown that the abundance of agricultural-pest birds (i.e., American crow,

Brewer's blackbird and European starling) is not affected by the presence or absence of nearby restored habitats. The density of insectivorous birds, however, was higher near remnant or restored riparian habitats. Once the results are finalized, the CALFED Fellow will share findings with farmers and other stakeholders.

- **Long-Term Geomorphic Effects of Dams on Rivers, Comprehensive and Comparative Approach**
  R/SF-13 Sept. 05–Aug. 08
  Toby Minear, UCB, 510.847.4454, tminear@berkeley.edu

Not all dams impact water flows and sediment transport equally. Results from this project have shown that in the Central Valley some dams have effectively frozen sediment transport downstream, in large part because dams have drastically reduced flood flows. Other dams continue to release flood flows, causing down-cutting of riverbeds. Continuing with this line of research, the CALFED Fellow is resurveying historical topographic maps and analyzing survey data from gauging stations to determine the amount of down-cutting that has occurred on several major rivers in the Central Valley.

- **Restoring Non-Equilibrium Riparian Communities in Disturbance-Altered Ecosystems: Implications for River Management and Climate Change**
  R/SF-14 Jan. 06–Dec. 08
  John Stella, SUNY-ESF, 315.470.4902, stella@esf.edu

The Fremont cottonwood stabilizes riverbanks, fixes carbon, produces woody debris, creates complex floodplain habitat for fish and wildlife and is, in short, an important component of the Central Valley's native riparian ecosystem. The objective of this project is to better understand the ecological factors influencing the health, growth and sustainability of these forests. The major discovery so far has been that along naturally meandering rivers, periodic channel cutoff events create "safe sites," which provide natural recruitment opportunities for cottonwoods. Data collected in the field last year will be used to develop a conceptual model for how these "safe sites" arise and evolve, and their importance in sustaining cottonwood forests. This research is intended to help policymakers and managers prioritize restoration efforts that can reverse the decline of cottonwood populations from habitat loss and changes in the region's natural hydrology.

- **Prey Selection of Larval and Juvenile Planktivorous Fish in the San Francisco Estuary**
  R/SF-15 Jan. 07–Dec. 08
  Lindsay Sullivan, SFSU, 415.435.7127, ljswr@sfsu.edu

Why has there been such a precipitous decline in populations of some plankton-eating fish species in San Francisco Bay? One theory is that the amount and type of food available to fishes has changed. To investigate whether this is indeed happening, this CALFED Fellow is conducting laboratory feeding experiments to quantify which species of copepods are the preferred foods of larval and juvenile fishes. Information on prey selection and the mechanisms that control it may help explain declines in plankton-eating fish species in the region, including the imperiled delta smelt. It will also improve scientists' understanding of how fish may respond to new predators, competitors or prey.

- **Temperature and Salinity Effects on the Physiology of White Sturgeon**
  R/SF-16 Jan. 07–Jan. 09
  Brian Sardella, UCD, 604.822.3378, basardella@ucdavis.edu

This CALFED Fellow is conducting experiments on white and green sturgeon to better understand the effects of water temperature and salinity on the animals' stress levels. In one experiment, the fellow calculated critical thermal maxima for green sturgeon at three different salinities; and through this work showed that salinity does indeed influence animals' thermal tolerance—something that has been speculated but not directly measured. In another experiment, he measured stress levels in fish exposed to a range of water temperatures and found that the animals are able to tolerate an amazing range of temperatures. Follow-up experiments will attempt to simulate the response of sturgeon to different climate scenarios for the delta. The fellow will also begin to identify the proteins that help the animals osmoregulate.

- **Role of Exotics as Ecosystem Engineers Affecting Estuarine Food Webs in Suisun Marsh**
  R/SF-17 Feb. 07–Feb. 09
  Christine Whitcraft, SFSU, 415.338.3704, cwhitcra@gmail.com

The focus of this project this year will be to measure a suite of abiotic and biotic variables in different habitat areas of Suisun Marsh invaded by *Lepidium latifolium* (perennial pepperweed). This is part of an effort to develop a comprehensive invasive species management plan for the reserve. Preliminary data suggest that within a wetland isolated from tidal creeks (the marsh-grassland transition zone), the presence of pepperweed has profound effects on abiotic soil properties and surrounding plant communities—notably, the plants increase soil humidity. The invasive plants have much less of an effect on these abiotic parameters in tidally inundated areas near the creek channel. The CALFED Fellow has been working with Solano Land Trust to evaluate eradication methods for different habitats and different herbicides. Preliminary results suggest that the type of herbicide applied and the timing of spraying are both important factors in determining eradication success.

- **The Impacts of Global Climate Change on Delta Fishes: Predicting Fish Abundance, Distribution and Community Changes**
  R/SF-18 Jun. 07–May 10
  Christa Woodley, UCD, 530.400.5871, cmwoodley@ucdavis.edu

Global warming is predicted to reduce rainfall, raise sea level and enhance evaporation in the San Francisco Bay-Delta region. This project looks at what this may mean for native and invasive fish species in the region in terms of their distribution, foraging opportunities, growth and reproduction. The CALFED Fellow is studying the physiological response of select species of fish to various scenarios of future climatic conditions. This research complements CALFED's Computational Assessments of Scenarios of Change for the Delta Ecosystem project, the objective of which is to understand how the regional ecosystem might respond to a few plausible scenarios of climate change.

- **Temporal and Spatial Patterns in Abundance and Production in Pelagic Organisms in the Low Salinity Zone (Suisun Marsh, Bay and Delta) of the San Francisco Estuary with Insight into Trophic Position and Impacts of Alien Invasive Species**
  R/SF-19 Feb. 08–Jan. 11
  Robert Schroeter, UCD, 530.219.9693, reschroeter@ucdavis.edu

Despite intensive efforts to identify factors contributing to dramatic species declines in the upper San Francisco Estuary, many of the underlying causes are still poorly understood. Taking advantage of multiple data sets, the CALFED Fellow is comparing habitats with extensive population declines (e.g., Suisun, Honker and Grizzly Bays and lower reaches of the Sacramento and San Joaquin Rivers) to those that have maintained relatively high species abundances (e.g., Suisun Marsh). One goal is to identify environmental conditions and biological factors that can explain discrepancies in species abundance between areas. As part of this investigation, the fellow will study the feeding ecology of several non-native invasive species (e.g., gelatinous zooplankton, caridean shrimp, various polychaetes and clams) that may be contributing to the observed decline of both zooplankton and fishes in the estuary.

- **Estimating Route-Specific Survival and Distribution of Juvenile Salmonids Migrating Through the Sacramento-San Joaquin River Delta**
  R/SF-20 Nov. 06–Oct. 09
  Russell Perry, UW, 541.380.1564, rperry@usgs.gov

A model developed for studying salmon on the Columbia River will be adapted to compute survival statistics for juvenile salmon migrating through the various river networks flowing into the Sacramento-San Joaquin Delta. The probability of a fish surviving passage through a specific dam or channel and more significantly, the proportion of a population subject to each route-specific survival rate, will be estimated. This information will allow quantitative assessments on the impact of water exports on juvenile salmon and on the proportion of a population subject to lower survival rates for a given management decision.

- **Heterotrophic Bacteria and the Food Web of the Low Salinity Zone and Salt Marsh Habitats of the San Francisco Estuary**
  R/SF-21 Nov. 06–Oct. 08
  Alexander Parker, SFSU, 415.338.3746, aeparker@sfsu.edu

This project is based on the premise that the sharp decline in phytoplankton abundance in the less salty areas of the San Francisco Estuary has likely increased the relative importance of bacterial carbon as a food source for higher trophic levels. To examine whether this is indeed true, the CALFED Fellow has been collecting field data that will allow him to compare phytoplankton and bacteria production and their respective roles in supporting the local food web. This past year, the fellow mapped the spatial and temporal patterns in phytoplankton and bacteria activity and abundance, and investigated factors influencing these patterns in restored vs. natural salt marshes.

- **Mercury Interactions with Algae: Effects on Mercury Bioavailability in the San Francisco Bay-Delta**
  R/SF-22 Jan. 07–Dec. 09
  Allison Luengen, UCSC, 631.632.8047, luengen@etox.ucsc.edu

Several fish species in the San Francisco Bay-Delta are contaminated with mercury. This project examines key processes hypothesized to be involved in mercury uptake in the food chain. The leading theory being explored is that mercury enters the food chain via phytoplankton and its accumulation by these organisms is influenced by the amount of dissolved organic material in the water column. The CALFED Fellow has recently shown that the presence of metals in the water column (e.g., Co, Cu, Hg, Mn, Ni, Pb and Zn) does not change the composition of resident phytoplankton. Luengen is currently growing phytoplankton in water samples with varying concentrations of dissolved organic material, to see if mercury levels in plankton can be related to levels of dissolved organic matter. The dissolved organic material, it should be noted, was taken from the San Francisco Bay-Delta. Findings may help regulators figure out ways to reduce mercury contamination in seafood and otherwise improve ecosystem health.

Mark Dettling, a PRBO Conservation Science biologist, checks a song sparrow nest along the San Joaquin River. Photo: Nat Seavy

- **Measuring and Predicting the Success of Riparian Restoration for Wildlife Populations**
  R/SF-23 Nov. 06–Oct. 09
  Nathaniel Seavy, PRBOCS/UCD, 415.868.0655 x311, nseavy@prbo.org

This project examines how bird populations respond to riparian habitat restoration and what can be done to improve bird conservation in restored areas. To this end, the CALFED Fellow has engaged in dialogs with River Partners and the Sonoma Ecology Center, as well as researchers at UC Davis and UC Berkeley to better identify the information that would most benefit managers. Seavy is developing seasonal fecundity models that can, among other things, enable evaluations of the relative effects of nest predators and brood parasites on bird reproduction. He is also analyzing data from field studies that involved capturing birds, placing a numbered band on their legs, and then recording the numbers that are recaptured in subsequent years. This information can then be used to calculate population growth rates in riparian habitats that have been restored.

- **Validation of a New Method for Population Assessment of Pacific Salmonids Using Genetic Markers**
  R/SF-24 Nov. 06–Oct. 09
  Anthony Clemento, UCSC, 831.420.3906, anthony.clemento@noaa.gov

The CALFED Fellow is attempting to develop a new method for tracing the parentage of Central Valley chinook. If successful, this virtual-tagging method would yield a powerful tool—one significantly better than current coded wire tags—for monitoring the effects of hatchery practices, water policy, climate change and fisheries management on salmonid populations. The fellow is in the process of developing the hundreds of single nucleotide polymorphism markers needed to effectively tag fish. In the fall of 2007, he began testing the method at a Central Valley salmon hatchery. The first step of this testing process was to genotype the brood stock. He will then collect some of their subsequent offspring and attempt to identify the parentage of each fish using nothing but the genetic markers under development, not a trivial task.

- **Modeling Physical Drivers and Age Structure of Cottonwood Forest Habitat: An Integrated Systems Approach**
  R/SF-25 Mar. 08–Feb. 11
  Alex Fremier, SUNY-ESF, 315.470.4902, fremier@gmail.com

The ultimate goal of this project is to improve the long-term prospects for restoring and protecting one of the signature species of the Central Valley's riparian ecosystem—the Fremont cottonwood. Toward this end, the CALFED Fellow will adapt a model of the physical processes driving river channel migration and cottonwood habitat creation along a 100-mile stretch of the Sacramento River from Red Bluff to Colusa. The Nature Conservancy, resource agencies and other stakeholders view this area as a prime site for conservation and restoration because the river still migrates naturally and is not confined by levees. If the modeling effort is successful, it will be used to generate predictions of how cottonwood forests will fare in the future under various physical states, including different climate scenarios, flow regimes and floodplain sedimentation rates. The results could help identify high-value habitat and plan corridor-wide conservation efforts.

- **Investigating the Lower Trophic Levels of Suisun Bay Food Web: A Biomarker-Specific Isotope Approach**
  R/SF-26 Sept. 07–Aug. 10
  Susan Lang, UCSD, 858.634.7094/206.920.6607, sqlang@ucsd.edu

Living organisms produce unique organic molecules that can survive in the environment long after the organism dies. This project is based on the premise that the isotopic composition of compounds unique to a wide range of primary producers will allow the CALFED Fellow to identify sources of organic carbon supporting zooplankton in Suisun Bay. For instance, the isotopes of chlorophyll may distinguish phytoplankton growing in the Sacramento River from those in the San Francisco Estuary, while "old" radiocarbon signatures would suggest an input from terrestrial carbon. If the novel biomarkers are effective, they will provide insights into the consequences of various water management options of relevance to pelagic species.

- **Endocrine Disruption in the Delta: Confirming Sites' Known Estrogenicity with Outplants, Histology, and Choriogenin Level Measurements**
  R/SF-27 Nov. 07–Oct. 10
  Susanne Brander, UCD, 707.875.1974, smbrander@ucdavis.edu

In parallel with an ongoing CALFED study of feminization in salmon in the Delta, this project will use the ubiquitous inland silverside fish (*Menidia beryllina*) as an indicator of endocrine disruptor contamination. By comparing the effects of endocrine disrupting compounds on silversides, salmon and Delta smelt, the CALFED Fellow seeks to identify specific chemicals causing the most harm to target species. She will also conduct "outplanting" experiments to compare the effects of contamination between sites to laboratory controls, part of an effort to understand the biochemical mechanisms of sublethal toxicity—how toxins are absorbed and how they affect fish physiology.

- **Tidal Wetland Vegetation Response to Climate Change in the San Francisco Bay-Delta**
  R/SF-28 Sept. 07–Aug. 10
  Lisa Schile, UCB, 415.378.2903/510.642.8322, lmschile@gmail.com

Global warming is elevating sea levels and altering precipitation patterns. For the San Francisco Bay-Delta, these trends are expected to lead to higher salinity and water levels. How will climate change affect wetland plants in the Bay-Delta? Which species will persist under changing condi-

tions, and where? To address these and other questions, the CALFED Fellow will map the current distribution of dominant plant species (e.g., California cordgrass, tule, bulrush, pickleweed and cattails) from the oceanic environment at the Golden Gate Bridge to the freshwater Delta. Schile will also conduct transplant and greenhouse experiments to establish plant tolerances to salinity and inundation. After these experiments are done, she and other CALFED-funded researchers will use GIS analyses to spatially model the predicted vegetation patterns in the estuary under different future climate scenarios. Her hypothesis is that freshwater marsh plants will die back because of climate change and that as a result, brackish marshes will dominate the Bay-Delta. Her findings will have implications for land-use decisions and restoration planning.

- **Nutrients and Benthic Invasion Dynamics in San Francisco Bay**
  R/SF-29 Sept. 07–Feb. 10
  Heidi Weiskel, UCD, 530.902.0878, hwweiskel@ucdavis.edu

The CALFED Fellow will lead one of the first efforts to examine the potentially critical relationship between nutrient pollution in the Bay-Delta and aquatic invasive species dynamics. A second, related topic is to understand the effects of biotic disturbances, in particular the effects of burrowing by the invasive Atlantic mud snail *(Ilyanassa obsoleta*) on benthic communities. The underlying hypothesis of the project (based on the findings of other researchers) is that nutrients change the composition of primary producers, favoring the proliferation of cyanobacteria over diatoms, which are the main food for the native snail (*Cerithidea californica*). By burrowing and feeding while burrowing, the Atlantic mud snail may be less vulnerable to changes in microalgae abundances associated with nutrient loading. In the first year of the project, the fellow will measure the effects of burrowing on chlorophyll levels, carbon-nitrogen ratios, grain size and microalgal assemblages in mudflats. A second experiment will, among other things, quantify the effects of elevated nutrients on non-native and native snail growth and reproduction. Subsequent experiments will test the effects of removing an older, established population of the Japanese mud snail (*Batillaria attramentaria*) in Tomales Bay on benthic communities and associated habitat. She will then compare these results to those from experiments with newly established populations in San Francisco Bay.

- **Environmental Water: Developing Indicators and Identifying Opportunities**
  R/SF-30 Jan. 08–Dec. 10
  Sara Hughes, UCSB, 805.893.5892, shughes@bren.ucsb.edu

Hughes is a doctoral student at the Bren School of Environmental Science and Management at UC Santa Barbara. She studies the human dimensions of resource management, in particular as it relates to water issues in California. In 2007, she used a Fulbright Postgraduate Award to study and evaluate water policies in Australia, at the University of South Australia's Centre for Comparative Water Policies and Laws in Adelaide. The region has suffered from almost a decade of severe drought and faces many of the same challenges as California, in terms of allocating water resources and balancing growth with conservation of biologically important riparian habitats. Hughes holds a Master of Science degree in Fisheries and Wildlife from Michigan State University's Center for Systems Integration and Sustainability (2006). Her thesis assessed the status of Michigan's groundwater policies. She has also been a field technician for the US Geological Survey's Biological Resources Division in Hawaii, where she collected data on local tropical bird populations. Her CALFED Fellowship will contribute to solutions to the water management challenges facing California and assist with efforts to recover at-risk fish species in the Delta.

California Ocean Protection Council

California's Ocean Protection Council (OPC), which was created in accordance with the 2004 California Ocean Protection Act, has awarded funds to California Sea Grant to administer peer-reviewed, scientific research to address OPC research priorities. The projects below were selected for 2008 funding.

- **Parasites as Indicators of Coastal Wetland Health**
  R/OPCENV-01 Feb. 07–Jan. 10
  Kevin Lafferty, USGS, 805.893.8778, lafferty@lifesci.ucsb.edu
  Armand Kuris, UCSB, 805.893.3998, kuris@lifesci.ucsb.edu

How healthy is that salt marsh? Count the parasites in common snails—the more parasites, the healthier the marsh. The working hypothesis of this project is that the number and diversity of trematode parasites in common snails encapsulate the predator-prey relationships present in a wetland. By extension, the absence of certain parasites means that a requisite host is missing from the area. Parasite counts could therefore help managers identify which animals are missing from a wetland habitat and then prioritize restoration to create habitats to attract these animals.

- **Evaluating Current Ocean Management Systems to Facilitate the Development of Ecosystem-Based Management**
  R/OPCENV-02 Feb. 07–Jan. 10
  Oran Young, UCSB, 805.893.8747, young@bren.ucsb.edu

This project is based on the premise that ocean health would be improved by streamlining and coordinating the complex web of regulations governing industries as diverse as shipping, fishing and coastal development. The goal of this project is to identify policies that are redundant and/or inefficient. To do this, the lead scientist is completing three major tasks: 1) to identify marine-related laws that overlap in function and space; 2) to identify inconsistencies in ocean management; and 3) to identify areas where agency and/or legal coordination can be improved. One by-product of this work will be the creation of a public database of California's coastal and marine laws.

- **Spiny Lobster Movement, Habitat Use and Abundance in Southern California: Bottom-Up and Top-Down Interactions in Kelp and Seagrass Habitats**
  R/OPCFISH-03 Feb. 07–Jan. 10
  Kevin Hovel, SDSU, 619.594.6322, hovel@sciences.sdsu.edu
  Christopher Lowe, CSULB, 562.985.4918, clowe@csulb.edu

Researchers continue to tag and acoustically track California spiny lobsters to better understand the animals' movement patterns and benthic habitats (e.g., kelp forests, surf grass and eelgrass beds). These data are being used, among other things, to identify the animals' home ranges and the influence of geological and biological features on their activity. In the first year of the project, biologists tagged 12 lobsters in San Diego and began SCUBA surveys to estimate lobster densities and community structures in different habitats.

- **Binational Studies Leading to Ecosystems-Based Management Strategy for the Common Thresher Shark and Other Fishery Resources in the Southern California Bight**
  R/OPCFISH-04 Feb. 07–Jan. 09
  Jeffrey Graham, UCSD/SIO, 858.534.8044, jgraham@ucsd.edu
  Oscar Sosa-Nishizaki, CICESE, 646.175.0500, ososa@cicese.mx
  Suzanne Kohin, NMFS, 858.546.7104, suzanne.kohin@noaa.gov

To gather the binational data needed to protect thresher sharks from overfishing, biologists recently established what amounts to a "mini-observer" program for the drift gillnet thresher shark fishery in Ensenada, Mexico. The project is part of an effort to assess the binational impact of fishing on shark populations in the Southern California Bight. To do this, biologists are also describing artisanal fisheries in Baja California. Among the other goals of the project is to identify essential habitat areas for juvenile threshers in Baja California. For sharks with native ranges beyond the waters of one nation, binational research of this kind is essential in establishing ecosystem-based shark management plans that can protect the long-term viability of these vulnerable species.

- **Assessing Changes in Life History Traits and Reproductive Function of California Sheephead Across its Range: Historical Comparisons and the Effects of Fishing**
  R/OPCFISH-05 Feb. 07–Jan. 09
  Jennifer Caselle, UCSB, 805.893.5144, caselle@lifesci.ucsb.edu
  Christopher Lowe, CSULB, 562.985.4918, clowe@csulb.edu
  Kelly Young, CSULB, 562.985.4859, kyoung@csulb.edu

The average California sheephead is smaller than it once was; females are reaching sexual maturity earlier, and they are transforming into males younger, and at odd times in the year. (Sheephead are sequentially hermaphroditic; they are born female and turn into males later in life.) In this project, researchers are investigating why fish size and reproductive structure has changed. The leading theory is that selective pressure from fishing and/or pollutants, especially estrogenic compounds, is to blame.

- **Ecology and Trophic Interactions of Jumbo Squid (*Dosidicus gigas*) in the California Current Ecosystem**
  R/OPC-06 Feb. 08–Jan. 11
  William F. Gilly, HMS/SU, 831.655.6219, lignje@leland.stanford.edu
  John Field, NOAA/SWFSC, 831.420.3907, John.Field@noaa.gov

As widely reported by the mass media, swarms of jumbo squid in 2007 invaded coastal waters in California, clogging fishing nets and eating untold numbers of hake, rockfish, sardine and

anchovy. The squid, which can weigh more than 100 pounds, also became a favorite target of sport fishers. To learn more about these new residents, biologists leading this project will count squid larvae in plankton, analyze squid stomach contents and track squid movements and foraging behaviors using pop-up tags. The information will help explain why the squid have expanded their range and what their impact on fisheries might be. One theory is that the squid are capitalizing on the loss of tunas and billfish that normally keep their numbers in check. Others speculate warming ocean waters are the cause. The squid's historic range is the equatorial eastern Pacific Ocean. Jumbo squid are Mexico's largest fishery by volume.

- **Tackling Ecological Complexity and Climate Change: Matches and Mismatches in the Seasonal Cycle of California's Marine Flora and Fauna**
  R/OPC-07 Feb. 08–Jan. 11
  William J. Sydeman, FIAER, 707.478.1381, wsydeman@comcast.net
  Steven J. Bograd, NOAA/NMFS, 831.648.8314, Steven.Bograd@noaa.gov

The researchers leading this study report that fish, fisheries and marine wildlife of the California Current large marine ecosystem are in a state of crisis and that because of this, there is an urgent need to understand the trophic interactions that regulate the number of top predators. The hypothesis is that matches and mismatches in predator needs and prey availability can explain the variable reproductive success of these animals. To test this, scientists will analyze existing physical and biological data and conduct field studies to create a comprehensive dataset for the period from 1997 to 2009. These data will then be used to study linkages between ocean upwelling, ocean circulation and trophic level productivity (primary, zooplankton, rockfish, seabird and salmon). The findings will have direct application for ecosystem-based fisheries management.

- **Long-Term Faunal Changes in California Nudibranchs: Climate Change and Local Ocean Health**
  R/OPC-08 Feb. 08–Jan. 11
  Jeffrey H.R Goddard, UCSB, 805.688.7041, goddard@lifesci.ucsb.edu
  John S. Pearse, UCSC, 831.648.9245, pearse@biology.ucsc.edu
  Terrence M. Gosliner, CAS, 415.321.8300, gosliner@calacademy.org

The premise of this project is that the abundance, diversity and geographic distribution of nudibranchs (brightly colored, short-lived mollusks) are useful indicators of broad-scale changes in coastal ocean conditions such as temperature and productivity. With this in mind, researchers will resurvey three rocky intertidal sites in Central California with historical records of nudibranch populations dating back to the 1930s. The goal is to examine the response of nudibranchs to warm and cold phases of the Pacific Decadal Oscillation (PDO) over the course of several PDO cycles. It is hoped that this analysis will make it possible to distinguish the cyclical effects of PDO cycles from the long-term trend associated with global warming. With their annual to subannual life-spans and planktonic larval dispersal, nudibranch community composition is hypothesized to reflect changing ocean climate at finer temporal scales than populations of longer-lived species.

Central Coast MPA Baseline Data Collection Project

This is a collaborative effort between the State Coastal Conservancy, Ocean Protection Council, California Department of Fish and Game (CDFG), and California Sea Grant Program. The following projects are collecting baseline data for the Central Coast Marine Protected Areas designated by the Fish and Game Commission under the Marine Life Protection Act.

- **Surveys of Shallow-Water Rocky Reef Communities**
  R/MPA-1 Jun. 07–May 08
  Mark Carr, UCSC, 831.459.3958, carr@biology.ucsc.edu

The researcher will quantify key attributes of species populations, communities and environmental variables associated with kelp forest ecosystems within and outside of the Central Coast MPAs. The survey design and sampling protocols have been modeled after the large-scale, long-term kelp forest monitoring program developed by the Partnership for Interdisciplinary Studies of Coastal Oceans (PISCO) and incorporated into the Cooperative Research and Assessment of Nearshore Ecosystems (CRANE) program. As in the CRANE program, this project uses divers to visually survey kelp forests for fishes, invertebrates and algae. The data will make it possible to study changes in fish and invertebrate abundance and diversity, as well as changes in the distribution and abundance of kelp itself.

- **Baseline Data Collection for Rocky Intertidal Marine Protected Areas in the Central Coast of California**
  R/MPA-2 Jun. 07–May 08
  Peter T. Raimondi, UCSC, 831.459.5674, raimondi@biology.ucsc.edu

The objective of the project is to survey rocky intertidal areas within and outside of MPAs. Sampling will be coordinated with the two largest rocky intertidal monitoring programs in the state—PISCO and Multi-Agency Rocky Intertidal Network (MARINe). The surveys will focus on documenting community structure of target species assemblages (e.g., mussels, barnacles and surfgrass) and abundances and sizes of key species (e.g., abalone, owl limpets and seastars). Biodiversity and species/habitat associations will also be measured. The data will make it possible to study changes in fish and invertebrate abundance and diversity, as well as changes in the distribution and abundance of kelp itself.

- **Baseline Surveys of Deep-Water Demersal Communities in and Near Central Coast MPAs**
  R/MPA-3 Jun. 07–May 08
  Richard M. Starr, CSGEP/MLML, 831.771.4442, starr@mlml.calstate.edu
  Mary M.Yoklavich, NOAA/SWFSC, 831.420.3940, mary.yoklavich@noaa.gov

This project will use a manned submersible to visually survey benthic communities in habitats deeper than can be effectively surveyed by divers or remotely operated vehicles. High-relief rocky habitats will be surveyed in three depth ranges: 30–100 meters, 100–200 meters, and 200–300 meters. Low-relief, soft-bottomed habitats, about which relatively little is known, will also be surveyed. Consistent with the other biologically oriented projects, the primary goal of this project is to collect data on deep-water habitat including fishes and macroinvertebrates, their relative abundances, sizes and trophic structures. When possible, long-term trends in species abundances, sizes and biomass will also be computed. Yet another goal is to identify biological hotspots within the MPAs, such as deep-water coral communities and fragile structure-forming invertebrates.

- **Collaborative Surveys of Nearshore Fishes in and Around Central Coast MPAs**
  R/MPA-4 Jun. 07–May 08
  Dean E. Wendt, CPSLO, 805.756.2988, dwendt@calpoly.edu
  Richard M. Starr, CSGEP/MLML, 831.771.4442, starr@mlml.calstate.edu

In this project, researchers are enlisting the expertise of commercial sportfishing vessel owners and recreational anglers to conduct hook-and-line surveys of nearshore rockfishes. Vessels will be departing out of ports in Half Moon Bay, Morro Bay, Monterey and Port San Luis to survey three sites in Marine Protected Areas (MPAs) and three reference sites outside MPAs. These sites are in waters deeper than divers can survey and shallower than the planned manned submersible surveys. Each of the six sites will be surveyed two days a month for three months. Nine to 15 anglers will be taken out to fish each time. The hook-and-line catch method complements underwater visual surveys and is especially useful in sampling mid-water and cryptic species. Besides helping to evaluate the effectiveness of the MPAs, the data will be of relevance to stock assessments of key species.

- **Socioeconomic Baseline Data Collection, Resource-Use Mapping and Rapid Social Assessment**
  R/MPA-5 Jun. 07–May 08
  John S. Petterson, IA, 858.459.0142, iaia.san.rr.com
  Edward W. Glazier, IA, 858.459.0142, iaia.san.rr.com

How will the Central Coast MPAs affect commercial fishers? Will open fishing areas become overly crowded? Will catches decline or improve over time? What is going to happen to prices? This project is collecting socioeconomic data that will allow managers to monitor the behavioral response of fishermen to different regulatory regimes and to answer these types of questions. Such information can be used to recognize and respond to unanticipated and/or unwanted fallout from the regulatory actions. The data collection process for this project involves analyzing CDFG catch records and interviewing between 300 and 600 commercial fishers about where they have historically fished, at what depths, when and for what species, with what gear, at what ex-vessel price, among other things. Recreational fishers and spearfishers will also be interviewed, as will “nonconsumptive” users, including kayakers, surfers and wildlife watchers to understand how MPAs are affecting them.

Education, Training & Public Information

- **Sea Grant Trainees**
  R/G-2
  R.A. Moll/CASG

Sea Grant's commitment to furthering marine-oriented education is met by the Sea Grant trainee project. Graduate students participate in research and work on problems relating to marine resources while fulfilling thesis requirements. This experience prepares them to enter positions in the academic community, government and industry.

- **California Sea Grant State Fellowship Program**
  E/G-9
  R.A. Moll/CASG

The program, modeled after the federal Knauss Marine Policy Fellowship, provides graduate students with training in the development and implementation of policy. Fellows are assigned to a state agency, legislative committee, or office concerned with marine resource issues.

- **John D. Isaacs Marine Undergraduate Research Assistant Program**
  E/UG-4
  R.A. Moll/CASG

This grants program provides undergraduate students with the opportunity to work closely with established marine scientists, develop their research skills, and better define their career goals in marine science. The program honors the memory of John D. Isaacs, a world-renowned figure in marine science.

- **Camp SEA Lab, Monterey**
  R/E-124PD
  Chris Hasegawa, CSUMB, 831.582.3796, chris_hasegawa@monterey.edu
  Laura Lienk, CSUMB, 831.582.3689, laura_lienk@csumb.edu

Science, Education, and Adventure are the focus as SEA Campers explore the wonders of the marine world from the top of the watershed to the bottom of the deep sea. Each day, the mysteries of the oceans are revealed through hands-on activities above, beside and below the water's surface. Residential and day camps are offered for students in grades 3–9. Outdoor School programs (both single day and three-day residential) grew in participation from 734 students in 2005–06 to 859 students in 2006–07, an increase of 17% (Outdoor School programs occur annually from late March through May). Sea Grant funds support the recruitment and housing of underrepresented youth from a variety of partner organizations, including California State University, Monterey Bay's Recruitment in Science Education (RISE) program, Boys and Girls Clubs, and Monterey Bay National Marine Sanctuary's MERITO program. Support also comes from the National Science Foundation and local businesses. For more information: http://www.campsealab.org/

California Sea Grant Committees

Sea Grant Advisory Board

This board represents the marine community of California and advises the vice president—research and graduate studies, University of California, and the director of the California Sea Grant College Program on research, education and outreach activities of the program.

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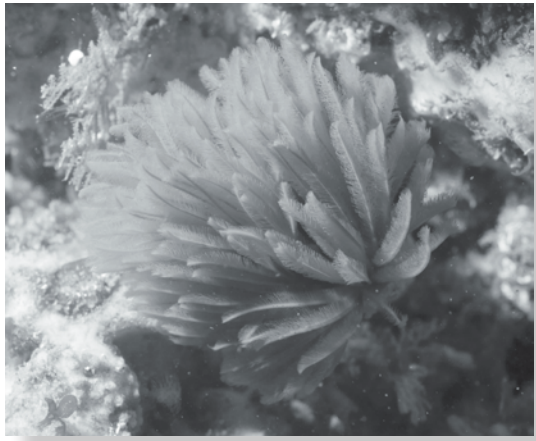

Resources Agency Sea Grant Advisory Panel

The state of California interacts with California Sea Grant through the Resources Agency Sea Grant Advisory Panel. The panel prioritizes California Sea Grant research in terms of the needs of the state.

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