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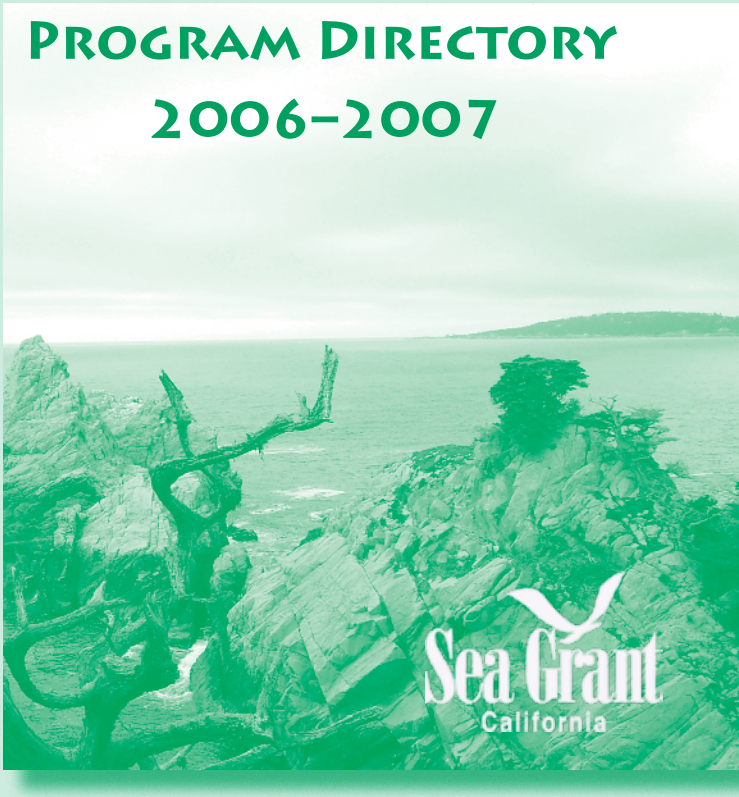
CALIFORNIA SEA GRANT

PROGRAM DIRECTORY 2006–2007



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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…

California Sea Grant engages in a delicate balancing act by considering national ocean priorities and applying those to state needs. This balancing act is one pursued by each of the 30 Sea Grant Programs in the U.S. In some years national priorities tend to take center stage while in others local and state needs are preeminent.

This past year was one of unusual opportunity where both national ocean issues and the California coastal environment required equal attention. The release of the reports of the U.S. Commission on Ocean Policy and the Pew Oceans Commission brought much needed national attention to the plight of our oceans and the way we govern them.

Not to be outdone, the Resources Agency of the State of California created stunning news of its own. Following upon a workshop held in Santa Cruz in November 2004, California created the California Ocean Information, Research and Outreach Strategy. California Sea Grant was instrumental in both events by serving as a co-sponsor of the workshop and providing substantial input to the newly formed strategy. In yet another landmark event, the California Ocean Protection Council was created and in an instant the state became the national leader in ocean policy and research.

These events have shaped our program and will continue to influence it for years to come. In true partnership fashion, California Sea Grant and the state of California are working together to address the many needs of the state. Once again, the primary mission of California Sea Grant—to support research and education on our marine environment—has become increasingly relevant. Thus the research and outreach projects described in this directory have been greatly shaped by events of the past year, particularly those from California. You will see new focused research to study the issues of marine protected areas through a special allocation of state funds to California Sea Grant. In addition, you will find outreach and research projects that cover a broad swath of issues of critical importance in California and the nation.

In closing, let me repeat the same message I have shared with you the past five years. I encourage you to explore in more depth the projects and activities described in the pages that follow. As such, I welcome you to join with California Sea Grant as we move forward.

Russell A. Moll
Director

Contents

What is Sea Grant?

The National Sea Grant College Program, a network of 30 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 principally 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 30 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 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 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 being funded in 2006 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/
News Media Center	www.seagrantnews.org/
National Sea Grant Library	nsgl.gso.uri.edu/

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Santa Rosa Creek, upstream from Santa Rosa, Bay Area Delta Bioregion. Photo ©North Coast Regional Water Quality Control Board

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CSGEP	California Sea Grant Extension Program
CSULB	California State University, Long Beach Long Beach, California 90840
HMS	Hopkins Marine Station Pacific Grove, California 93950
HSU	Humboldt State University Arcata, California 95521
H-SWRI	Hubbs-SeaWorld Research Institute San Diego, California 92109
MLML	Moss Landing Marine Laboratories Moss Landing, California 95039
ODFW	Oregon Department Fish & Wildlife Salem, Oregon 97303
PRBOCS	PRBO Conservation Science Stinson Beach, California 94970
PU	Pepperdine University Malibu, California 90263
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
SFSU	San Francisco State University San Francisco, California 94132
SSU	Sonoma State University Rohnert Park, California 94928
SU	Stanford University Stanford, California 94305
UBC	University of British Columbia Vancouver, Canada

UCB	University of California, Berkeley Berkeley, California 94720
UCD	University of California, Davis Davis, California 95616
UCLA	University of California, Los Angeles Los Angeles, California 90095
UCSB	University of California, Santa Barbara Santa Barbara, California 93106
UCSC	University of California, Santa Cruz Santa Cruz, California 95064
UCSD	University of California, San Diego La Jolla, California 92093
USD	University of San Diego San Diego, California 92110
UW	University of Washington Seattle, Washington 98195
WSU	Washington State University Vancouver, Washington 98686

Coastal Ocean Research

- **Horizontal Dispersion of Passive Tracers in the Surf Zone**
  R/CZ-188 Mar. 04–Feb. 07
  Falk Feddersen, UCSD/SIO, 858.534.4345, falk@coast.ucsd.edu; Robert Guza, UCSD/SIO, 858.534.0585, rguza@ucsd.edu

This project seeks to understand diffusion and advection of passive tracers in the surf zone, using field data gathered by drifters and current meters. Statistical analyses of these data will answer fundamental questions about processes dispersing pollutants, pathogens and planktonic larvae near the shore. In the first year of the project, scientists completed field experiments at Black's Beach in La Jolla, California and have processed the raw data to compute, among other things, GPS-corrected drifter trajectories, and wave and current statistics. Analyses of the drifter data have also provided the basis for new estimates of eddy diffusion. The field experiments demonstrate that diffusion in the surf zone is not isotropic and depends on the heights of incoming waves, and surf zone diffusion is estimated to be twice as intense as that just seaward of breaking waves. In the coming year, drifter data from field experiments will be compared to simulated data from a numerical model.

- **Foraging Ecology of the California Sea Lion: Diet, Diving Behavior, Foraging Locations, and Predation Impacts on Fishery Resources**
  R/CZ-192 Mar. 05–Feb. 07
  Daniel Costa, UCSC, 851.459.2786, costa@biology.ucsc.edu

The foraging and diving behaviors and at-sea distribution of California sea lions (*Zalophus californianus*) are being investigated to better evaluate the effects of these

marine mammals on salmonids and other fishes. In this effort, sea lions in the Channel Islands National Marine Sanctuary are being tagged and tracked by satellite. The diverse and complex array of data collected by the tags are plotted using a groundbreaking behavioral visualization system known as MAMVIS, developed at the Sea Mammal Research Unit at the University of St. Andrews in Scotland. Feeding studies are also ongoing. The end result of the study will be one of the most comprehensive evaluations of the consequences of a growing pinniped population on fishery resources. Reports and publications resulting from this work will be shared with West Coast resource managers, conservationists and the fishing industry.

- **Modeling Water and Sediment Quality in the Coastal Ocean**
  R/CZ-193 Mar. 05–Feb. 08
  Keith Stolzenbach, UCLA, 310.206.7624, stolzenb@ucla.edu, James McWilliams, UCLA, 310.206.2829, jcm@atmos.ucla.edu

In an earlier Sea Grant project, the researchers developed a Regional Ocean Modeling System to forecast the three-dimensional variability in physical oceanographic and biological parameters along the entire U.S. West Coast. They are now in the process of extending this model so it is capable of forecasting environmental events on finer spatial and temporal scales in the coastal zone. The model is programmed to simulate–and eventually predict–three important water and sediment quality issues in Santa Monica Bay and over the San Pedro Shelf: 1) the transport of sewage discharged offshore, 2) the fate of storm water discharged from rivers and storm drains and, 3) the transport of coastal sediments. The investigators are conducting and planning related research for the EPA, U.S. Army Corps of Engineers, State Water Resources Control Board and the sanitation districts of the City of Los Angeles, Los Angeles County and Orange County.

- **Anthropogenic Impacts on Rocky Intertidal Mollusks in Southern California: Compiling Historical Baseline and Quantifying the Extent of the Problem**
  R/CZ-194 Mar. 05–Feb. 07
  Kaustuv Roy, UCSD, 858.822.0559, kroy@ucsd.edu

Do you ever wonder what the shore looked like a century ago? Many would be shocked at the changes that have accompanied exponential coastal population growth.

This project looks at processes to determine spatial and temporal distributions of biological diversity in Southern California's rocky intertidal habitats. The goal is to identify the human role in the degradation of these habitats. It is hoped that new information will help protect what is close to being lost. This year, the biologist will continue to build an historical database of rocky intertidal molluscan species and will use the expanded database to test the hypothesis that human activities on the shore have reduced, and continue to reduce, the body sizes of intertidal species. Preliminary research has shown that the sizes of marine snails in Southern California have decreased in all but one study site, the Cabrillo National Monument in San Diego, a strictly enforced marine reserve.

- **California Beach Health: Evaluation of Grunion as an Indicator Species**
  R/CZ-195 Mar. 05–Feb. 08
  Karen Martin, PU, 310.506.4808,
  kmartin@pepperdine.edu

The scientist monitors the spawning population of California grunion from San Diego to Monterey Bay as part of an effort to evaluate the effects of human activities on sandy beaches. The analysis involves estimating the number of adult grunion during "runs," collecting incubating eggs and examining embryos for developmental abnormalities. These data will be compared to a number of potential environmental stressors such as beach grooming, beach use, pollution, fishing and other factors. The goal is to determine whether grunion can be used to assess environmental conditions at sandy beaches.

- **Tracer Dispersion in the Surf Zone: Water Quality and Ecology**
  R/CZ-196 Mar. 06–Feb. 09
  Falk Feddersen, UCSD/SIO, 858.534.4345, falk@coast.ucsd.edu; James Leichter, UCSD/SIO, 858.822.5330, jleichter@ucsd.edu; Robert Guza, UCSD/SIO, 858.534.0585, rguza@ucsd.edu

Although the physical processes that disperse and mix tracers in the surf zone have strong implications for the distribution and abundance of marine life, for the location and richness of their habitats, and for the fate of pollutants, basic questions remain unanswered about the length-scales, time-scales and diffusion associated with dispersion. Building on previous Sea Grant research, the scientists will continue to study dispersion in the surf zone. Research questions to be addressed include, understanding the effects of waves, bathymetry and cross-shore position on dispersion, and identifying the processes (e.g., shear waves and wave breaking) dominating dispersion at different length scales and cross-shore locations. In the first year, output from numerical simulations of tracer-release experiments will be used to develop dye-release strategies for real field experiments at Huntington Beach, an urban location in Orange County that has been plagued by beach closures. Field experiments will involve using a jet ski as a mobile sampling platform for measuring dye, phytoplankton and temperature in the surf zone. These observations will be combined with data from the Southern California Ocean Observing System to produce nearly synoptic maps of temperature and concentrations of dye and chlorophyll.

- **Understanding Submarine Groundwater Discharge and Its Influence on Coastal Water Quality Along the California Coast**
  R/CZ-197 Mar. 06–Feb. 09
  Alexandria Boehm, SU, 650.724.9128, aboehm@stanford.edu; Adina Paytan, SU, 650.724.4073, apaytan@stanford.edu

Studies on the East Coast and Gulf States have shown that discharges of submarine groundwater can contribute to poor coastal water quality, however parallel studies have yet to be conducted in California—in part because of the perception that California runs a water deficit and hence must not have huge stores of subterranean fresh water. The researchers will use a radium isotope to trace fluxes of fresh and saline submarine groundwater into coastal waters. The broad goal is to assess the impact of submarine groundwater on coastal water quality and to identify the processes that modulate these flows (e.g., tides, rainfall and ocean waves). To do this, researchers will conduct field experiments in Santa Cruz and Bolinas to examine how land use and geology influence nutrient levels, metal loads and fecal coliform counts in groundwater discharges. They will also investigate the degree to which potentially harmful human pathogens in groundwater are removed by percolating through sediments. The scientists hypothesize that groundwater discharges are as much a source of coastal water pollution as surface runoff. Among the project's many implications, findings will help health officials and coastal communities identify sources of bacterial contamination on beaches.

- **The Role of Symbiotic Bacterial Metabolites in the Development of Toxic Phytoplankton Blooms**
  R/CZ-198 Mar. 06–Feb. 08
  Carl Carrano, SDSU, 619.594.5929, carrano@sciences.sdsu.edu; Frithjof Kuepper, SAMS, 011.44.01631.559216, fck@sams.ac.uk; David Green, SAMS, 011.44.01631.559354, dgreen@sams.ac.uk

With the occurrence of harmful algal blooms on the rise, scientists now have a great interest in understanding the life histories of toxic dinoflagellates and the processes that give rise to their sudden population explosions. In this project, scientists will test whether symbiotic marine bacteria produce metabolites that support the nutrition and growth of two toxic dinoflagellates. In particular, they are interested in whether symbionts produce iron-binding compounds (siderophores) that either directly or indirectly assist dinoflagellates in iron acquisition. Iron is an important nutrient for ocean life and a limiting factor for primary productivity. This project will test the hypothesis

that bacterial symbionts can regulate the supply of iron to plankton. It will also examine a newly discovered group of bacterial metabolites that contain boron. It is possible these “boronophores” regulate boron uptake. The extent to which siderophores and boronophores control nutrients and hence growth has direct application to efforts to understand coastal conditions and processes leading to the formation of harmful algal blooms.

- **The Effects of Current Velocity and Creek Morphology on the Population Dynamics of Spionid Polychaetes in the Tijuana Estuary**
  R/CZ-199 Mar. 06–Feb. 09
  Brian Hentschel, SDSU, 619.594.0358,
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In the past two decades, strategies for restoring rare and degraded salt marshes in Southern California have progressed from simple trial and error to “adaptive restoration and management” in which restoration projects are integrated with scientific research. In recent years, ecologists have begun to examine the importance of building networks of tidal channels and small creeks through marshes. Although there is a consensus that water flow through channels and creeks influences marsh plants and animals in many ways, few studies have directly tested the consequences of different creek types and current speeds on key estuarine invertebrates. The goal of this project is to examine the effects of tidal creek flows in the Tijuana River National Estuarine Research Reserve on several species of worms (polychaetes in the family Spionidae) that colonize restored and disturbed marshes and alter their feeding behaviors in response to changes in water flow. Because these worms play many important roles in marsh ecosystems, including serving as food for many fishes and birds, results from this project will enhance the success of future marsh-restoration projects by identifying the influence of different creek sizes, shapes and flow regimes on ecosystem health.

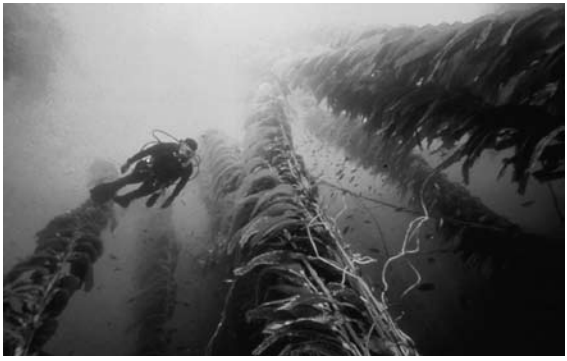
- **Collecting Sea Palms: Planning for Sustainable Use in a Variable Environment**
  R/CZ-200 Mar. 06–Feb. 09
  Karina Nielsen, SSU, 707.664.2962, karina.nielsen@sonoma.edu; Carol Blanchette, UCSB, 805.893.5144, blanchet@lifesci.ucsb.edu

This project will examine the biology of the California sea palm (*Postelsia palmaeformis*), an intertidal, cold-water kelp that resembles a small palm tree and whose edible fronds are likened to low-fat, mineral rich noodles. Sea palms are just one of a handful of edible seaweeds harvested in California and sold dried at health food stores, Asian markets, and more recently through the Internet. Because the demand for seaweeds has risen significantly in recent years, and because little is known about their basic natural history, some biologists worry that sea palms in Mendocino County, where 2 to 3 tons were harvested in 2001, may be vulnerable to overexploitation. Researchers will study the biological effects of different harvesting practices on sea palm reproduction, growth and abundance. They will also explore the extent to which the kelp's growth patterns vary with latitude. In collaboration with the California Department of Fish and Game, researchers will analyze seaweed harvest data and use new biological information to evaluate whether current regulations are ensuring a sustainable resource. Results of this project will also be communicated to undergraduates enrolled in a new course at Sonoma State University, "Communicating Ocean Sciences" and through UC Santa Barbara's Marine Science Institute via its Outreach Center for Teaching Ocean Science and the Research Experience and Education Facility.

- **Flow Dynamics in Kelp Forests: Implications for Conditions and Survival**
  R/CZ-201 Mar. 06–Feb. 08
  Matthew Edwards, SDSU, 619.594.7049, edwards@sciences.sdsu.edu

The surface canopy of California's giant kelp forest sometimes deteriorates substantially during prolonged periods of unusually high water temperatures and low nutrient levels. The objective of this project is to examine a process that may alleviate seasonal declines in growth rates and kelp health. In particular, biologists will examine whether ocean waves interact with kelp "fronds" to generate a vertical flow along the main stem-like structure. They will study whether vertical motions interact with the thermocline by bringing cold, nutrient-rich bottom waters to the surface. If this occurs, they will examine the degree to which kelp benefit from the extra nutrients. A variety of field experiments will be conducted in the kelp beds off

Point Loma and La Jolla in San Diego to examine flow dynamics and its biological implications. An example of the type of work planned: biologists will place inorganic fertilizer at the base of kelp plants to see whether it results in higher nutrient uptake relative to nearby kelp plants. Besides adding to the basic understanding of kelp forest ecosystems, this research will give insights into how to artificially fertilize giant kelp beds during extended periods of low nutrient levels.



- **Krill and Krill Predators: Ecosystem-Based Management in the Gulf of the Farallones-Cordell Bank Krill Production Domain**
  R/CZ-202 Mar. 06–Feb. 09
  William Sydeman, PRBOCS, 415.868.1221, wjsydeman@prbo.org; Jaime Jahncke, PRBOCS, 415.868.1221, jjahncke@prbo.org; John Largier, BML, 707.875.1930, jllargier@ucdavis.edu

Euphausiid crustaceans (krill) are a critical source of carbon in marine food webs, providing food for hake, Chinook and Coho salmon, rockfishes, seabirds and large whales. Yet, despite their ecological importance, little is known about euphausiid spatial and temporal distribution, abundance and reproductive dynamics. This project will examine the relationship between seasonal changes in physical oceanographic conditions and the distribution and abundance *Euphausiid pacifica* and *Thysanoessa spinifera* in the Gulf of the Farallones-Cordell Bank region. A series of research cruises will help scientists test the hypothesis that coastward advection of cold, salty bottom water during intense upwelling pushes the more oceanic species, such as *E. pacifica*, onto waters on the continental shelf where they become an abundant, early-season food source for predators. As upwelling relaxes, *T. spinifera* (a coastal species) increases in its relative abundance. Findings from this project have many applications, an important one being the potential to assist with an ecosystem-based approach to fisheries management.

Aquaculture Research and Development

- **Understanding the Pathogenesis of *Streptococcus iniae* Infection in Fish and Development of an Effective Vaccine for Use in Aquaculture**
  R/A-124 Mar. 05–Feb. 08
  Victor Nizet, UCSD, 858.534.7408, vnizet@ucsd.edu

Streptococcus iniae (SI) causes a fatal meningoencephalitis in commercially important fish species, including striped bass, tilapia and salmon. The lead investigator has identified several SI genes required for fish virulence and has subsequently developed a preliminary vaccine that uses live attenuated mutants. In the second year of this project, the scientist will continue to develop this vaccine, working closely with a commercial seabass farm. Some specific aims: to finish virulence gene characterization in the full panel of attenuated mutants; to use directed mutagenesis to delete key virulence genes; and, to conduct large-scale vaccination trials with selected deletion mutants. The U.S. aquaculture industry stands to benefit greatly if a cost-effective, commercially available vaccine can be developed.

- **Integrated Culture of Seaweeds and Red Abalone in Monterey Harbor**
  R/A-125 Mar. 06–Feb. 08
  Michael Graham, MLML, 831.771.4481, mgraham@mlml.calstate.edu

The ultimate goal of this project is to develop an operational seaweed-culturing plan for the Monterey Abalone Company, a medium-sized abalone farm in Monterey

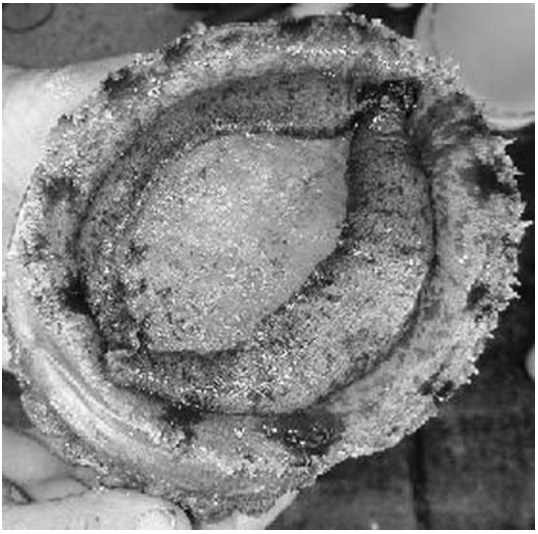
Harbor, which currently feeds their abalones kelp harvested from nearby beds. Scientists will continue to experiment with several techniques for growing different species of red algae and kelp on ropes hung inside and outside Monterey Harbor. The idea is to determine how to grow as much seaweed as needed as fast as possible and in the smallest possible space. They will also study the effects of different diets on abalone shell color and growth rates and will determine the amount of seaweed needed to sustain the farm's 36,000-abalone-per-year production level. The ability to grow seaweeds for cultured abalone will benefit both the aquaculture industry and alleviate pressure on wild beds. California Sea Grant Extension Program plans to adapt research findings into a "user-friendly" manual for industry.

- **Enhancement of Growth Rates and Swimming Performance in Juvenile Marine Finfish in Aquaculture**
  R/A-126 Mar. 06–Feb. 08
  Mary Sue Lowery, USD, 619.260.4078, slowery@sandiego.edu; Kevin Kelley, CSULB, 562.985.4294, kmkelley@csulb.edu; Mark Drawbridge, H-SWRI, 619.226.3943, mdrawbridge@hswri.org

Many of the benefits of exercise on human health appear to translate to fish. In preliminary experiments, researchers have shown that white seabass reared in raceways with moderately strong flows grow faster than their more sedentary counterparts in low-flow environments. The goal of this project is to quantify the effects of sustained exercise on stress and growth rates in select species of hatchery-reared juvenile marine finfish. It is hypothesized that exercise reduces stress (as measured by

blood cortisol levels) in cultured finfish and modulates key physiological processes involved in muscle growth (such as levels of growth hormone and production of insulin-like growth factor). Findings from the project will be used to build and test new raceways for rearing finfish. As part of the project's outreach component, middle and high school girls participating in the BE WiSE (Better Education for Women in Science and Engineering) program in San Diego will participate in a series of educational lectures, tours and experiments relating to this research and to aquaculture and marine science in general.

Fisheries Research and Development



- **Restoration of the Endangered White Abalone, *Haliotis sorenseni*: Resource Assessment, Genetics, Disease, and Culture of Captive Abalone**

  R/F-196 Mar. 04–Feb. 07
  Ronald Burton, UCSD/SIO, 858.822.5784, rburton@ucsd.edu; Carolyn Friedman, UW, 206.543.9519, carolynf@u.washington.edu

The goal of this collaborative project is to obtain information needed to plan and implement a recovery program for white abalone populations in California. To do this, scientists have developed genetic markers for identifying white abalone, and they have evaluated the degree of genetic variation in natural populations and broodstock. In further work, they will conduct lab experiments to study the influence of temperature and feeding regimes on key stages of the animal's life history. They also will study the susceptibility of white abalone to withering syndrome and evaluate treatment protocols suitable for captive-rearing programs. Findings will help ensure that released abalone will not infect remnant wild populations.

- **Enhancement of Fertilization Success in Abalone: Increasing Effectiveness of Transplanting and Outplanting Recovery Strategies**
  R/F-197 Mar. 05–Feb. 08
  Richard Zimmer, UCLA, 310.206.4981, z@biology.ucla.edu; Cheryl Ann Zimmer, UCLA, 310.825.8561, cazimmer@obee.ucla.edu

In many areas of California, the density of sexually mature abalone is too sparse to support successful fertilization. Numerous natural abalone populations may be unable to recover despite conservation efforts and strict fisheries regulations. The biologists seek to determine the optimal adult density, spacing and sex ratio to maximize fertilization for a given flow regime. Their research involves laboratory studies of the kinetics of abalone fertilization in laminar sheer flows, and field experiments are being conducted to test laboratory predictions. Findings will help government biologists identify natural abalone populations that probably are not reproducing. It will also help them identify coastal areas whose hydrodynamics are suited for transplanting or outplanting adults.

- **Life History Studies of California Chondrichthyans: Determining Essential Biological Information for Effective Management of Bycatch Fisheries**
  R/F-199 Mar. 05–Feb. 07
  Dave Ebert, MLML, 831.771.4427, debert@mlml.calstate.edu; Greg Cailliet, MLML, 831.771.4432, cailliet@mlml.calstate.edu

In recent years, landings of chondrichthyans (including sharks, rays, and chimaeras) in California have risen to an all time high—both as targeted takes and bycatch. The increase in exploitation is alarming, however, because it is occurring in the absence of basic biological information on these animals. In an effort to prevent overharvesting,

biologists are collecting baseline information on the age, growth, reproduction, feeding, and distribution of species common in the bycatch from West Coast groundfishing. In addition, caudal thorns from skates are being investigated as a novel technique for aging these fish. Skates will also be tagged and recaptured to study movement patterns, estimate growth rates and validate age estimates. This kind of basic life history information can help ensure the sustainable management of chondrichthyans in California and elsewhere.

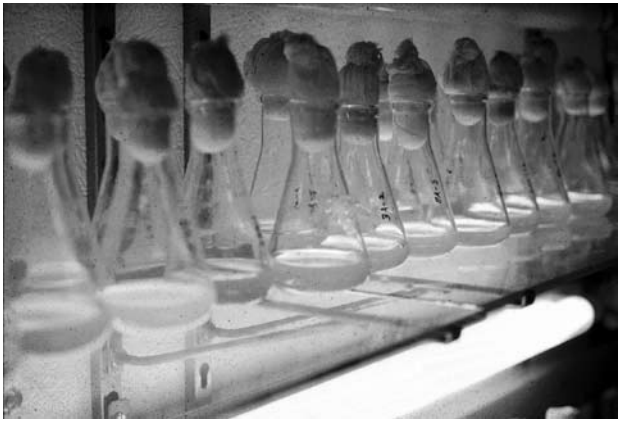
- **Assessing Withering Syndrome Resistance in California Black Abalone: Implications for Conservation and Restoration**
  R/F-200 Mar. 06–Feb. 08
  Hunter Lenihan, UCSB, 805.893.8629, lenihan@bren.ucsb.edu; Carolyn Friedman, UW, 206.543.9519, carolynf@u.washington.edu; Glenn VanBlaricom, UW, 206.543.6475, glennvb@u.washington.edu; Kevin Lafferty, UCSB, 805.893.8993, lafferty@lifesci.ucsb.edu

Although black abalone may be in danger of extinction in California, a lack of basic biological information on this once abundant intertidal specie is frustrating conservation efforts. Some scientists believe restoration—vis-à-vis "outplanting" of cultured abalone into the wild—is desperately needed since surviving abalone are now too sparse to reseed depleted areas. While in theory promising, restocking is not currently an option because techniques for rearing black abalone have not yet been developed. Compounding the situation, the lethal disease, withering syndrome (WS), is spreading northward, perhaps because ocean waters have warmed slightly in recent decades. This project seeks to answer some of the major questions thwarting conservation efforts: For example, are surviving black abalone resistant to WS and is this a heritable trait? And what are the best methods for spawning WS-resistant black abalone? Although the primary focus of this research is in its application to black abalone conservation, the findings will have immediate benefits for the state's abalone aquaculture industry, which is constantly seeking ways for preventing the introduction and spread of disease. The Abalone Farm, Inc. is a collaborator on this project.

- **Determination of Red and White Abalone Age and Growth Using Bomb Radiocarbon Signal and Lead Dating**
  R/F-201 Mar. 06–Feb. 08
  Greg Cailliet, MLML, 831.771.4432, cailliet@mlml.calstate.edu; Allen Andrews, MLML, 831.771.4460, andrews@mlml.calstate.edu

The goal of this project is to develop a reliable technique for determining and validating age and growth rates of red and white abalone. To do this, researchers will use radiocarbon markers produced during tests of atomic bombs in the 1950s and 1960s, as well as Pb-210 dating, from a series of abalone shells to estimate age, growth and longevity. These estimates will be compared to those computed using traditional methods to determine, among other things, if large abalones are as old, or older than, the prediction of growth models. This basic biological information is crucial for developing recovery plans for these invertebrates. If, for example, abalone life spans exceed previous estimates of 30 to 40 years, conservation efforts might be directed away from protecting smaller, younger individuals to ones that protect larger, older individuals. The research will benefit state and federal biologists involved in the conservation and management of California abalone populations.

New Marine Products Research and Development



- **Marine Bio-Nanotechnology: High-Performance Materials from Sponge Silicatein**
  R/MP-95 Mar. 04–Feb. 07
  Daniel Morse, UCSB, 805.893.8982,
  d_morse@lifesci.ucsb.edu

Living organisms synthesize remarkably strong and architecturally controlled mineralized composite materials with a precision of nanoscale fabrication often exceeding capabilities of modern engineering. In this project, researchers are elucidating the molecular mechanisms controlling the formation of intricate silicon dioxide structures called spicules in marine sponges. In earlier work, the primary protein responsible for directing the synthesis of crystalline forms of several kinds of semiconducting materials was isolated. Previously these compounds could be made only at very high temperatures (nearly a thousand degrees). This protein, which they named silicatein, operates at room temperatures and in the absence of caustic chemicals. In their most recent work, they have used gene cloning, special high-magnification electron microscopes and X-ray analyses to reveal the fine structure of silicatein. These findings are further helping to harness the protein (and components of the protein that can be anchored on silicon chips and other electronically useful platforms) to make valuable high-performance semiconductors and solar energy converters. Dow Corning Corporation, the world's largest manufacturer of silicon-based materials, has provided matching support for this work.

- **Antibiotic Drug Discovery from the New Marine Actinomycete-like Genus *Marinomyces***
  R/MP-96 Mar. 04–Feb. 07
  William Fenical, UCSD/SIO, 858.534.2133, wfenical@ucsd.edu; Paul Jensen, UCSD/SIO, 858.534.7322, pjensen@ucsd.edu

The lead investigator recently discovered a new genus of bacteria living in deep-sea sediments. These bacteria are remarkably similar to actinomycetes—soil bacteria that have been the source of dozens of antibiotics, including streptomycin, erythromycin and the tetracyclines. Tests have shown that 35 percent of these new species produce compounds with a high level of antibiotic activity. Fully 80 percent produce molecules that inhibit colon cancer. More importantly, chemical analyses have shown the presence of never-before-seen molecules. During the course of this Sea Grant project, chemists will continue to develop culturing techniques for these bacteria. They will also continue to search for new species of marinomyces and to assay their metabolites for antimicrobial and anticancer activity.

- **Studies on the Rapid Self-Assembly of Elastic Tensile Fibers From a Natural Protein Polymer Found in Marine Snails**
  R/MP-97 Mar. 05–Feb. 08
  Herbert Waite, UCSB, 805.893.2817, waite@lifesci.ucsb.edu; Robert Shadwick, UBC, 604.827.3149, shadwick@zoology.ubc.ca

The egg capsules of marine whelk snails contain a protein polymer that can “self-assemble” and “self-heal.” Building on previous California Sea Grant research, biologists will characterize the molecular basis for the protein’s novel elastic properties. They will also complete ongoing amino acid sequencing of the protein and cDNA, to begin the process of designing peptides with commercial potential. Fabrication of new tensile materials has broad industrial and biomedical applications such as improving materials for artificial tendons and ligaments.

Ocean Engineering

- **Relationship Between Bluff Erosion and Beach Sand Supply for the Oceanside Littoral Cell**
  R/OE-39 Mar. 06–Feb. 08
  Scott Ashford, UCSD, 805.822.0431, sashford@ucsd.edu; Neal Driscoll, UCSD, 858.822.5026, ndriscoll@ucsd.edu

In previous California Sea Grant research, the lead investigator showed that material eroded from coastal bluffs is a major source of beach sand in northern San Diego County. Following on this research, scientists will now try to quantify the volume of beach sand coming from coastal bluffs. Two independent techniques will be employed to address this question. One will be based on comparing ground-based laser scans of coastal bluffs before and after bluff failures. The other will use mineralogical analyses of sediments to track the origins, migration and fate of sand in the beach zone. The findings from this research will assist communities in deciding how to protect and maintain sandy beaches and will give insights into whether, or if, sea walls and other hard structures exacerbate bluff erosion in nearby unprotected areas. A better understanding of these processes may help coastal communities decide when, how or if to spend millions of dollars on beach nourishment projects.

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

In this project, researchers are investigating the feasibility of measuring fish size and swimming orientation with a

multi-static sonar system. They will also explore the degree to which the pattern of reflected sound can be used to speciate fish. The prototype system to be developed will include a single acoustic transmitter with multiple receivers located at different angles. With this system, the researchers will perform scattering experiments on live fish to measure multi-static reflection patterns. Inferences on fish size and morphology and swim bladder size and shape will then be compared to 3D surface topography maps created using a computed tomography (CT) system at the UCSD School of Medicine. The idea is to develop signal processing and imaging techniques that would make it possible to measure fish size and orientation and to use CT scans as a way to continuously check the accuracy of sound-based inferences. If researchers can develop such techniques, it would significantly advance efforts to use bioacoustic data as a basis for estimating fish stock size.

Marine Affairs

- **A Historical Analysis of the Collapse of Pacific Groundfish: U.S. Fisheries Science, Development and Management, 1945–1995**
  R/MA-44 Mar. 04–Feb. 07
  Naomi Oreskes, UCSD, 858.534.4695, noreskes@ucsd.edu

In 2000, the West Coast ground fish fishery collapsed, prompting the Secretary of Commerce to declare the fishery a disaster. Just a decade earlier, the fishery was considered a success story. What went wrong? Historians are examining documents, including those from the Pacific Fishery Management Council and the California Department of Fish and Game, to reconstruct a history of the factors that influenced the fishery's management. This analysis aims to help scientists develop more effective fisheries policies. It will also shed light on how policy is developed in the face of uncertainty. In the first year, archival records at the Food and Agriculture Organization of the United Nations in Rome were examined to understand more fully the rationale for adopting the concept of "maximum sustainable yield" as the basis for fisheries policy. Initial analyses of these documents, as well as those from the U.S. State Department, show that one of the issues driving the policy was conflict between Latin American countries and American tuna boats.

- **Exposure of Santa Cruz Wharf Anglers to Domoic Acid**
  R/MA-45 Mar. 06–Feb. 08
  Mary Silver, UCSC, 831.459.2908, msilver@ucsc.edu; Caroline Pomeroy, CSGEP, 831.763.8002, cmpomeroy@ucdavis.edu

Although commercially sold fish and shellfish are tested for levels of domoic acid, similar safeguards for protecting public health are not in place for recreationally caught fish. In fact, little is known about anglers' exposure to marine toxins or how this exposure varies among different socioeconomic groups. The goal of this project is to begin to quantify the levels of algal toxins consumed by different sub-populations of anglers. Behind the study is a concern that some groups may be consuming levels of toxins exceeding federal safety limits. Because a statewide study is beyond the scope of this project at this time, this study will focus on domoic acid levels measured in fish caught at the Santa Cruz wharf. It will pair these data with patterns of fish consumption by anglers at the wharf to

estimate total toxic loads. The Santa Cruz wharf is among the most heavily fished areas in Northern California, and it sits squarely within Monterey Bay, an area where domoic acid outbreaks have occurred in the past, causing die-offs of birds and marine mammals. This study will determine whether people are also at risk.

Rapid Response

- **Rapid Response**
  R.A. Moll/UC-SG

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 rapid response project allows prompt support for short-term, marine-related research, outreach, and education projects.

Marine Life Protection Act

The 1999 Marine Life Protection Act mandated that the state design and manage an improved network of marine protected areas to, among other things, protect marine life and habitats, marine ecosystems and marine natural heritage. The following research projects address topics of relevance to the act, and are being funded by the California Department of Fish and Game (CDFG) and administered by California Sea Grant and USC Sea Grant.

- **Temporal Variation in Fish Communities off Santa Cruz Island, California**
  R/MLPA-01 Mar. 05–Feb. 06
  Ralph Larson, SFSU, 415.338.1027, rlars@sfsu.edu

This project is evaluating long-term changes in Southern California fish populations by extending an existing data series collected at Santa Cruz Island between the early 1970s and 1996. Preliminary analysis of the data showed that warming of ocean waters and loss of kelp was associated with changes in fish populations. It now appears that ocean temperatures in the region have returned to a cooler climate regime. Biologists are taking advantage of this temperature shift and, using underwater videography, are resampling sites around Santa Cruz Island. This fieldwork documents the effects of cooler water and presence (or absence) of kelp on fish populations. The investigator is collaborating directly with the Channel Islands National Park. Findings will be of relevance to the CDFG's nearshore fishery management plans.

- **The Effects of Habitat Composition, Quality, and Breaks on Home Ranges of Exploited Nearshore Reef Fishes**
  R/MLPA-02 Jan. 05–Dec. 07
  Christopher Lowe, CSULB, 562.985.4918, clowe@csulb.edu; Jennifer Caselle, UCSB, 805.893.5144, caselle@lifesci.ucsb.edu

By acoustically tagging and tracking fishes, biologists seek to determine the home ranges and fine-scale habitat preferences of adult ocean whitefish and barred sand bass in the Catalina Marine Science Center Marine Life Refuge. The relationship between habitat quality and home range size is being investigated using tracking data and benthic habitat maps. Fish are being translocated to adjacent areas to test their fidelity to home ranges and to assess the degree to which different species (e.g., kelp bass, sand bass, whitefish and sheephead) will cross expanses of

sand to return to their original home range. Findings have application in designing marine reserves of sufficient size and habitat quality to ensure the protection of reproductive adults. The research will also assist in identifying essential fish habitats for nearshore reef fishes.

- **Using Life History Characteristics to Determine Optimum Placement of Marine Reserves**
  R/MLPA-03 Mar. 05–Feb. 07
  Steven Berkeley, UCSC, 831.459.3530, stevenab@cats.ucsc.edu; Steve Parker, ODFW, 541.867.0300, steve.parker@oregon.state.edu

Researchers are identifying those species of West Coast groundfish most likely to benefit from the establishment of marine reserves. The lead investigator has recently shown that older black rockfish (*Sebastes melanops*) spawn earlier in the year than younger ones. The larvae from older females have also been shown to be more likely to survive. Because marine reserves can potentially protect larger, older individuals, it is critical to identify those species, such as black rockfish, that exhibit age-related patterns in reproductive output and larval quality. The identification of these species can help resource managers select sites for marine reserves and identify essential fish habitats.

- **Shelter Use, Movement, and Home Range of Spiny Lobsters in San Diego County**
  R/MLPA-04 Jan. 05–Dec. 06
  Kevin Hovel, SDSU, 619.594.6322, hovel@sciences.sdsu.edu; Christopher Lowe, CSULB, 562.985.4918, clowe@csulb.edu

California spiny lobsters are an important predator within kelp forests and rocky shorelines in Southern California and also a valuable commercial and recreational fishery. About 500,000 pounds, worth an estimated $5 million, are landed annually. This project addresses one of the priorities of the Marine Life Protection Act: to assess the home ranges of recreationally and commercially exploited mobile invertebrate species. Through surveys and sonic tagging, biologists are investigating how the size, type and distribution of sheltering areas influence lobster density, movement and home range in the Point Loma kelp forest, a prime lobster fishing area in San Diego County. Findings will be shared with the California Department of Fish and Game.

CALFED Science Fellows Program

The California Bay-Delta Authority (CALFED) Program is a collaborative effort of more than 20 state and federal agencies with management or regulatory responsibilities for the San Francisco Bay-Delta system. Its four objectives are to improve ecosystem quality, water supply reliability, water quality and levee system integrity. The CALFED Science Fellows Program has been established to bring world-class science to all program elements to help achieve overall CALFED goals. California Sea Grant administers the following research projects toward those ends.

- **Impacts of Inundation Regime, Floodplain Vegetation, and Burrowing Animals on the Incorporation of Carbon into Floodplain Soils**
  R/SF-1 July 03–June 06
  Sandra Clinton, UCB, 510.643.9294,
  sclinton@uclink.berkeley.edu

Floodplains on the lower reaches of the Consumes River—the last undammed river on the western slope of the Sierra Nevadas—are home to some of the largest stands of riparian forest left in the Central Valley. Because of the land's ecological value, efforts are underway to convert former farmland to wilderness areas. Scientists are studying the processes influencing the fertility of soils in the region. Of interest is whether algae contribute to soil fertility and if so, to identify processes that transport algae to floodplain soils. Another topic of interest is to identify what kinds of invertebrate communities are associated with different types of riparian meadows and forests and whether the presence of certain invertebrates enhances soil fertility.

- **Sediment Supply and Marsh Development in San Francisco Estuary**
  R/SF-3 Sept. 03–Aug. 06
  Frances Malamud-Roam, UCB, 510.643.1631,
  fmalamud@eps.berkeley.edu

Researchers have developed a set of geochemical "fingerprints" (using trace elements and strontium isotope signatures) that allow them to identify sources of sediments in tidal marshes of the northern San Francisco Estuary. Dams and water diversions have reduced sediment loads, making downstream habitats vulnerable to inundation caused by rising sea level. This project seeks to quantify the proportion of sediments coming from local creeks and streams versus those from the larger watershed associated with the Sacramento and San Joaquin rivers. To date,

researchers have analyzed four sediment cores collected from a relatively small marsh along Novato Creek in Marin. The data suggest that 1) inland sites receive more of their sediments from the local creek than the bayward sites and, 2) the sediments on the surface of the marsh are more closely correlated with sediments from Napa River than with sediments passing through the Sacramento-San Joaquin Delta. In the next year, researchers will, among other things, complete a "mixing" model to quantify the fraction of sediments derived from various end-member sources for a series of sediment cores taken from different marshes. The findings will provide a quantitative evaluation of the feasibility of marsh restoration projects in the region, as well as an assessment of how the estuary tidal marshes may fare under rapidly rising global sea level.

- **An Investigation of Floodplain Habitat for California's Native Fish Species**
  R/SF-4 July 03–Nov. 06
  Jeff Opperman, UCD, 530.754.9141, jjopperman@ucdavis.edu

The lead scientist on this project recently wrote a draft report for CALFED, in which the general principles of floodplain geomorphology, hydrology, and ecology for the Central Valley were reviewed. A second document will review the historical extent and losses of floodplains, describe restoration approaches in the valley and elsewhere and discuss potential implications of climate change on floodplain hydrology and ecology. The scientist and collaborators have developed a technique for identifying floodplains inundated by ecologically important flows and have used the technique to document the rarity of this type of habitat in California. More recently, the scientist has been studying growth rates of juvenile Chinook that were raised in either floodplain or riverine habitats of the Consumes River Preserve. Results show that fish grown in floodplains grow faster than those raised in the river. Subsequent analyses will compare the mercury content of these fish.

- **Protistan Microzooplankton in the Suisun Bay Food Web: Source or Sink?**
  R/SF-5 Aug. 03–July 06
  Gretchen Rollwagen Bollens, WSU, 360.546.9115, rollboll@vancouver.wsu.edu

This project seeks to assess the trophic role of small zooplankton ("microzooplankton") in Suisun Bay in the northern San Francisco Estuary—as grazers of algae and prey for larger zooplankton. Of particular interest are the effects of microzooplankton on the productivity of the lower plank-

tonic food web and the transfer of energy to higher trophic levels such as fish. To do this, researchers are measuring the distribution, abundance, taxonomic composition and feeding rates of both microzooplankton and larger zooplankton. Feeding experiments have shown that grazing rates of microzooplankton are sometimes ten times that of phytoplankton, suggesting that microzooplankton exert strong control of algal abundance. Moreover, in concurrent feeding experiments in which both algae and microzooplankton were presented to larger zooplankton predators, microzooplankton were often the preferred prey compared to algal taxa. These results indicate that microzooplankton are important in transferring phytoplankton carbon to higher trophic levels.

- **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

By combining a hydrodynamic model of particle transport with one on fish behavior, scientists will attempt to simulate the responses of juvenile salmon to changes in reservoir release rates, pumping rates, operations of the Delta Cross Channel gates and other processes that can influence water flows. The broad idea is to understand how water operations influence migration patterns of juvenile salmon and to use this information to protect as many salmon as possible from potentially harmful water policies. To validate the model, output from multiple simulations will be compared to real observations. These comparisons will allow scientists to identify model hypotheses that best replicate observed patterns of fish movement. The final product will be a tool that scientists can use to compare the effects of various water management options on fish migration patterns. Results will be shared with CALFED managers and others interested in salmon and wildlife conservation.

- **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, UCD, 530.752.1450,
  jharrison@ucdavis.edu

Concentrations of the nutrients nitrate and phosphorous exceed national guidelines in many of the San Joaquin River's tributaries, contributing to low dissolved-oxygen levels and a rise in the incidence of algal blooms. In the river's lower reaches, low oxygen levels create a barrier

for migrating salmon. High nutrient and dissolved organic carbon concentrations in water destined for public consumption also pose public health issues. The objective of this research is to use existing data and computer models to quantify the fluxes, sources and controls of nitrate, phosphate, and organic carbon throughout the Sacramento and San Joaquin river systems. Some of the specific research questions to be addressed include: 1) What are relative contributions of various land-based sources of dissolved organic carbon and nutrients? 2) How can the ability to predict sources and fluxes of nutrients be improved? 3) How will changes in climate, population growth and increased water demand influence water quality? Findings will be used to improve water quality for ecosystems as well as public health.

- **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, UCD, 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. Unfortunate 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 lost each year to the extensive pumping systems of state and federal water projects. Efforts to protect the smelt are failing, as smelt numbers continue to fall—and fell dramatically in 2004. In this project, a scientist will analyze otolith geochemical signatures in adult fish (otoliths are bony structures in a fish's ear) to identify those larval nursery habitats contributing most to the adult population. They will also examine whether adult survival rates correlate with fast growth rates. In addition, the role of water temperature on the productivity and spatial distribution of juvenile smelt will be studied. This work will overlap with ongoing research on the population ecology of smelt, including the effects of contaminants, feeding success and reproductive fitness on their numbers. Findings from these projects will hopefully reverse the species' downward spiral.

- **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

Perennial pepperweed (*Lepidium latifolium*) is a noxious weed that grows in the San Francisco Bay-Delta system. To prevent its spread and otherwise improve the manage-

ment of this potentially destructive non-native plant, scientists will use remote sensing to map the plant's distribution and identify environmental factors (e.g., temperature, precipitation, wind, stream flow and soil salinity) that may influence its growth and reproduction. Statistical analyses of this data will make it possible to generate maps showing areas most vulnerable to infestation. This information can serve as an early detection system for subsequent eradication programs and assist in efforts to protect native habitats from encroaching invasive plants.

- **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

With field studies, laboratory experiments and computer modeling, researchers will study the factors influencing growth, survival and movement of juvenile steelhead in certain portions of the Central Valley. Steelhead in the study area are protected by the federal Endangered Species Act; and population declines clearly are linked to water diversions and dams in the region. This project thus focuses on two priority topics for CALFED: 1) the links between water operations and biological resources and, 2) ecological processes and their relationship to water management and key species. It is anticipated that what is learned will help with government goals of doubling populations of naturally produced salmonids, restoring altered habitats and providing water flows to protect early stages of steelhead. Findings will also help in understanding environmental ramifications of water diversions and the Delta Cross Channel on juvenile steelhead trout.

- **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

In the Sacramento River valley, some farmers have expressed concerns about the potential for restored riparian forests to increase the numbers of agricultural pests. To quantify the degree to which these concerns are valid, researchers will examine the quantities and distribution of serious agricultural pests—weeds, insects and mammals—and document their movement from restored riparian areas to farm lands. They will also study similar questions for enemies of pests, the idea being that farm yields might

actually benefit from the presence of restored habitats, if these habitats become refuges for pest enemies. Scientists will share findings with farmers and other stakeholders in the region to better ground public perception of the costs and benefits of restoration.

- **Long-term Geomorphic Effects of Dams on Rivers in the Central Valley of California: A Comprehensive and Comparative Approach**
  R/SF-13 Sept. 05–Aug. 08
  Toby Minear, UCB, 510.847.4454, tminear@berkeley.edu

Large dams disrupt the natural flow and sediment supply in rivers, changing both the geomorphology and ecology of rivers. Not all dams are alike, however. Dam design and operation, reservoir size and the natural state of the watershed all influence the character and extent to which a dam alters its surroundings. The goal of this project is to compare the effects of dams on 16 major tributaries in the Central Valley. The scientist will study changes in magnitude and frequency of geomorphic processes associated with dams and document how differences in their operation and design influence these changes. Understanding the effects of dams on the shape and sediment composition of river channels is another topic of interest. Findings will shed light on where and how to concentrate restoration efforts and have the potential to increase the ecological effectiveness of restoration projects while decreasing their costs.

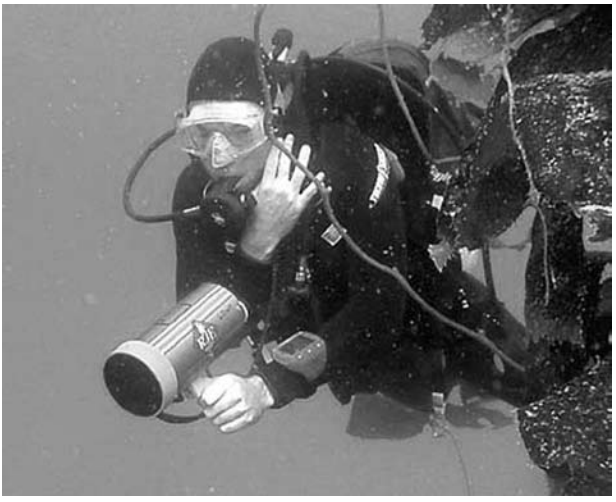
- **Restoring Non-Equilibrium Riparian Communities in Disturbance-Altered Ecosystems: Implications for River Management and Climate Change**
  R/SF-14 Jan. 06–Dec. 08
  John Stella, UCB, 510.643.2450,
  stella@nature.berkeley.edu

The large, fast-growing Fremont cottonwood is a dominant species in riparian habitats of the Central Valley. The trees stabilize riverbanks, fix carbon, produce woody debris and create complex habitat for fish and wildlife. Scientists will examine the consequences of water operations on cottonwood population structure and life-history characteristics. They will test three hypotheses: 1) Fremont cottonwood populations are declining throughout the Central Valley because of habitat loss and inappropriate hydrology, 2) Tree growth and stand condition are largely determined by sufficient water, the availability of which varies with climate, location and severity of hydrologic alteration and, 3) Cottonwood physiological function varies with water availability. Findings from this project will assist in restoring riparian habitats in an ecosystem continuously stressed by human activity.

Education

- **Sea Grant Trainees**
  E/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 State Fellowship 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.

California Sea Grant Committees

Sea Grant Advisory Board

This board represents the marine community of California and advises the president of the 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 agency.

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Index of Researchers/Fellows