California Sea Grant

Program Directory

2004–2005

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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…

As I reflect on this past year and the events that have transpired in 2003, one truism stands out: "We live in interesting times." Who could have predicted the challenges and pace of change that confront our society, especially in California? The culmination of the year was a sweeping political reform that ushered in a new governor and administration under unique circumstances. Many new people are now in positions of leadership throughout the state with a new approach to solving our problems and helping us reach fresh heights.

While we are in the process of adjusting to this change in state leadership, we are wise to step back and realize that many of the same issues that confronted past leaders will endure. The challenges of a highly diverse coast with large urban centers and rich resources continue to characterize California. The multiple demands on our precious coastal resources continue to rise. As someone said to me the other day, much of our way of life in California is predicated on a high-quality coastline. The needs in marine coastal research and outreach loom larger than ever as do the importance of helping persons in leadership make the best possible informed decisions.

Accordingly, I believe the relevance for a program such as California Sea Grant continues to grow. In a fast-paced world filled with surprising events each day, there is, more than ever, a need for credible information. This is a central tenet of the California Sea Grant mission—to support research and education on our marine environment. At the same time, if we are to have a vibrant and resilient economy and yet conduct commerce in an environmentally responsible manner, we must seek to further our knowledge and understanding of where we live and work.

Russell A. Moll
Director

The projects and activities described in this directory are the most recent contributions by California Sea Grant to that knowledge base. I encourage you to learn about these and begin or continue a dialogue with us on how to work together. I welcome you to join with California Sea Grant as we move forward in the future.

Contents

From National Marine Sanctuary education coordinators' "Kids Gallery." Drawing by Erik (age 8) and photo by Kip Evans

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 2004 by California Sea Grant. Further information on any of these projects is available by contacting our offices, or visiting the program website—http://www-csgc.ucsd.edu.

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Vermillion rockfish (*Sebastes miniatus*).

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ABP	Aqua Bounty Pacific, Inc. San Diego, California 92123
BML	Bodega Marine Laboratory Bodega Bay, California 94923
CIMRI	Channel Island Marine Resource Institute Port Hueneme, California 93041
CPSU	California Polytechnic State University San Luis Obispo, California 93407
CSGEP	California Sea Grant Extension Program
CSUF	California State University, Fresno Fresno, California 93740
CSULB	California State University, Long Beach Long Beach, California 90840
CSUMB	California State University, Monterey Bay Seaside, California 93933
HMS	Hopkins Marine Station Pacific Grove, California 93950
HSU	Humboldt State University Arcata, California 95521
MBARI	Monterey Bay Aquarium Research Institute Moss Landing, California 95039-9644
MLML	Moss Landing Marine Laboratories Moss Landing, California 95039
NOAAF	NOAA Fisheries Silver Spring, Maryland 20910
PRBOCS	PRBO Conservation Science Stinson Beach, California 94970
PU	Pepperdine University Malibu, California 90263
SIO	Scripps Institution of Oceanography La Jolla, California 92093
SDSU	San Diego State University San Diego, California 92182

SJSU San José State University
San José, California 95192

SU Stanford University
Palo Alto, California 94305

SWFSC Southwest Fisheries Science Center
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TRNERR Tijuana River National Estuarine Research Reserve
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UCSC University of California, Santa Cruz
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From National Marine Sanctuary education coordinators' "Kids Gallery." Drawing by Alonzo (age 11) and photo by Kip Evans

Coastal Ocean Research

Satellite photo of San Francisco Bay showing sediment flow.

- **Observation of Physical Fluxes Between an Estuary and the Ocean**

  R/CZ-170 Mar. 01–Feb. 04
  Mark Stacey, UCB, 510.642.6776, mstacey@socrates.berkeley.edu; Thomas Powell, UCB, 510.642.7455, zackp@socrates.berkeley.edu

In this project, scientists are studying the relative importance of tidal currents, winds, freshwater flows and water densities in driving fluxes of salt, heat and suspended solids in San Francisco Bay. What is being learned will shed light on the connections between the biological and physical processes in the estuary and will assist with efforts to understand those processes that transport contaminated sediments from land to sea.

- **Exploring the 1990s: Investigation into Factors Controlling Siliceous Microplankton Distribution in the Santa Barbara Channel**

  R/CZ-172 Mar. 01–Feb. 04
  Elizabeth Venrick, UCSD/SIO, 858.534.2068, evenrick@ucsd.edu; Carina Lange, UCSD/SIO, 858.534.4605, clange@ucsd.edu

The purpose of this project is to examine the degree to which radiolarian and diatom skeletons in ocean sediments can be used to make inferences about past ocean climate. Of particular interest is to understand why and how changes in ocean temperatures and currents affect siliceous microorganism production in the Santa Barbara Channel.

- **Dynamics and Ecosystem Threats of Bidirectional Cordgrass Hybridization in San Francisco Bay**

  R/CZ-176 Mar. 01–Feb. 05
  Donald Strong, UCD/BML, 707.875.2022, drstrong@ucdavis.edu

Hybrid cordgrasses threaten to invade every restored wetland in South San Francisco Bay. These hybrids, crosses between native cordgrasses and exotic *Spartina alterniflora*, are destroying tidal mud flats that serve as important feeding areas for wetland birds. Uncontrolled, these hybrids could exterminate native cordgrasses and frustrate wetlands restoration projects. This research seeks to explain why non-native hybrids out-compete indigenous species. The findings will be used to improve eradication strategies. Preliminary results suggest that hybrids release vastly more pollen than native grasses, preventing pure species from reproducing. Agencies are now removing upstream sources of pollen before attempting to eradicate downstream patches of hybrids.

- **The San Diego–La Jolla Ecological Reserve: Implications for the Design and Management of Marine Reserves**

  R/CZ-177 Mar. 01–Feb. 04
  Paul Dayton, UCSD/SIO, 858.534.6740, pdayton@ucsd.edu; Enric Sala, UCSD/SIO, 858.534.9899, esala@ucsd.edu

The scientists are collecting field data at the San Diego-La Jolla Ecological Reserve that will help in designing and managing marine reserves. One goal of the project is to identify the sources, mortality and survival rates of key kelp forest animals. Volunteer divers are helping scientists gather field data. The results of this project will

assist in meeting a state legislative mandate to establish a network of reserves along the coast.

- **Bacterial and Protozoal Contamination of Nearshore Marine Environments in California, with Ecologically Sustainable Management Recommendations**

  R/CZ-180 Mar. 02–Feb. 05
  Rob Atwill, UCD, 559.688.1731, ratwill@vmtrc.ucdavis.edu; Patricia Conrad, UCD, 530.752.7210, paconrad@ucdavis.edu

Scientists have collected and begun testing 1,200 mussels for the presence of *Cryptosporidium*, a waterborne parasite that lives in the intestines of animals and people. The parasite has been detected in "high-risk" areas in Morro Bay and Elkhorn Slough, an indication that the coastal waters and shellfish are being contaminated by fecal waste. The scientists have been working with five ranches and dairies near Tomales Bay, a major oyster-growing center, to develop ways of reducing contamination in runoff. The farms have since mulched and planted vegetative buffers around their properties to absorb and filter runoff before it enters the bay. This year, scientists will test farm runoff to measure how these simple, cost-effective practices reduce pathogen pollution. They will also begin genotyping isolates of *Cryptosporidium* to help identify sources of fecal pollution.

- **Climatological and Near-Real-Time Satellite-Observed Ocean Fronts along the California Coast**

  R/CZ-181 Mar. 02–Feb. 05
  William Broenkow, MLML, 831.771.4457, broenkow@mlml.calstate.edu; Laurence Breaker, MLML, 831.771.4498, lbreaker@mlml.calstate.edu

Using satellite images of sea-surface temperature, scientists are mapping the positions of major fronts off the California coast. Fronts are narrow bands across which water velocity, temperature and salinity rapidly change. Phytoplankton and fish tend to congregate near these fronts. In maps compiled in 2002, fronts were plotted monthly using data from the GOES-10 satellite, averaged over a 30-day period. This year, the scientists plan to shorten the averaging period to 10 days to reduce "smearing" caused by daily and weekly changes in ocean sea-surface temperature. This 10-day average will produce a more representative "snapshot" of the ocean. They also plan to "truth-check" satellite-derived images

with direct observations of ocean temperature collected during CalCOFI cruises.

- **Nitromusk Compounds: Are They Bio-Available and Do They Compromise Toxin Defense Systems?**

  R/CZ-182 Mar. 02–Feb. 05
  David Epel, SU/HMS, 831.655.6226, depel@stanford.edu; Richard Luthy, SU, 650.725.9170, luthy@stanford.edu

Synthetic musks added to perfumes, detergents and fabric softeners can accumulate in freshwater organisms. The purpose of this research is to characterize the degree of contamination in saltwater organisms and marine sediments. The scientists will also look at how, or if, these compounds impair an organism's cellular defense system. The techniques developed in this project will help evaluate the effects of chronic, low-level pollution on marine life and shed light on the sediment chemistry of marine pollutants. Such information can be useful for setting appropriate water-quality standards.

- **Effects of the San Diego–La Jolla Marine Reserve on the Abundance, Diversity, and Population Structure of Reef Fishes**

  R/CZ-183 Mar. 02–Feb. 05
  Philip Hastings, UCSD/SIO, 858.822.2913, phastings@ucsd.edu; Paul Dayton, UCSD/SIO, 858.534.6740, pdayton@ucsd.edu

Do small, no-take marine reserves enhance fish populations? In this project, scientists are answering the question by conducting a series of fish surveys in and

around the San Diego-La Jolla Ecological Reserve. Their counts are being compared to those from adjacent similar habitats where fishing is allowed. In addition, the researchers are looking at effects of the reserve on recruitment, population structure and fish size. They are also compiling historical records of fish abundance, size and diversity to reconstruct a scientifically accurate characterization of marine life in the past. The historical data and the current survey work will help scientists monitor changes in marine ecosystems over time and design reserves to meet specific conservation goals.

- **Diablo Canyon Archaeology: Trans-Holocene Faunal Exploitation Along the Central California Coast**

  R/CZ-187 Mar. 04–Feb. 06
  Terry Jones, CPSU, 805.756.2523, tljones@calpoly.edu

The scientist will radiometrically date and speciate a collection of bone and shell fragments excavated near the San Luis Obispo power plant. The goal is to reconstruct what may be one of the longest records of coastal resource use in all of western, continental North America. Particular attention will be paid to trends, patterns and changes in the assemblages of species hunted over time. Some 10,000 years of exploitation may be represented. One species of particular interest is the sea otter, which the Chumash Indians hunted for their pelts. Another is abalone. The lead investigator is interested in whether otter abundances were in decline long before the Spanish arrived in the 18th century and what the answer implies for the sustainable management of marine species today.

- **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

A GPS-tracked drifter developed in an earlier Sea Grant project will be used to study processes that control the dispersion and eddy-transport of passive tracers in the surf zone. The collected observational data, as well as the statistical methods used to analyze the data, will answer fundamental questions about advection and diffusion in the surf zone. The work has direct applications to tracking the transport of pollutants, larvae and fine sediments along the coast. What is learned may also add greater detail and new dimensions to existing coastal circulation models, used, among other things, to forecast surface wave heights along the coast.

- **Eelgrass Community Response to Grazing by an Aggressive Herbivore: An Experimental Approach**

  R/CZ-189 Mar. 04–Feb. 06
  Frank Shaughnessy, HSU, 707.826.4133, fjs3@humboldt.edu; Jeffrey Black, HSU, 707.826.3439, jmb7002@humboldt.edu

This study seeks to determine whether, or the degree to which, migrating brant geese are depleting eelgrass beds in Humboldt Bay. These beds are among the most extensive left in California and are important feeding grounds for geese. The scientists hypothesize that moderate grazing actually maximizes eelgrass growth. A similar relationship between grazing and grass growth is observed in terrestrial ecosystems. The scientists will test this hypothesis and then examine the indirect effects of grazing on abundances of shrimp and juvenile Dungeness crab, both of which are commercially important species.

Tamarisk (*Tamarix ramosissima*) in bloom.

- **The Invasion and Impacts of Tamarisk in Tijuana Estuary Salt Marshes and Ecosystem Recovery After Its Eradication**

  R/CZ-190 Mar. 04–Feb. 06
  Drew Talley, UCD, 530.752.2843, dmtalley@ucdavis.edu; Jeffrey Crooks, TRNERR, 619.575.3613, jcrooks@tijuanaestuary.com; Lisa Levin, UCSD/SIO, 858.534.3579, llevin@ucsd.edu

The purpose of this project is to document the history, extent and ecological impacts of tamarisk—an invasive

non-native tree that has a high tolerance to salt—in the Tijuana estuary. As part of this work, the scientists will evaluate the effectiveness of an ongoing tamarisk eradication program supported by the Coastal Conservancy and the U.S. Fish and Wildlife Service, and they will evaluate the ability of biological communities to recover after tamarisk is removed. They will also conduct stable-isotope studies to monitor changes in food-web dynamics associated with the tamarisk invasion. The proliferation of tamarisk at the Tijuana River National Estuarine Research Reserve is destroying riparian habitat and salt marsh. Some of these areas are designated critical habitat for federally protected endangered species.

- **Using the 83-Year Record of Sea Surface Temperature at Pacific Grove, California as a Proxy for Selected Offshore Chemical and Biological Parameters**

  R/CZ-191 Mar. 04–Feb. 06
  Laurence Breaker, MLML, 831.771.4498, lbreaker@mlml.calstate.edu

This project investigates whether an 83-year record of sea-surface temperature at Hopkins Marine Station—one of the longest continuous records of sea-surface temperature on the U.S. West Coast—can serve as a proxy for other physical, chemical and biological parameters that are more difficult, costly and time-consuming to measure directly. The scientist theorizes that offshore measurements of temperature, salinity, dissolved carbon dioxide, nitrate and phosphate in Monterey Bay and the California Current co-vary with temperature changes recorded at the marine station. If this is shown to be true, scientists could use the temperature record to predict these parameters at locations where there are few direct measurements.

Aquaculture Research and Development

- **Creation of a Molluscan Cell Line**

  R/A-119 Mar. 02–Feb. 05
  Jane Burns, UCSD, 619.543.5326, jcburns@ucsd.edu; Ronald Hedrick, UCD, 530.752.3411, rphedrick@ucdavis.edu

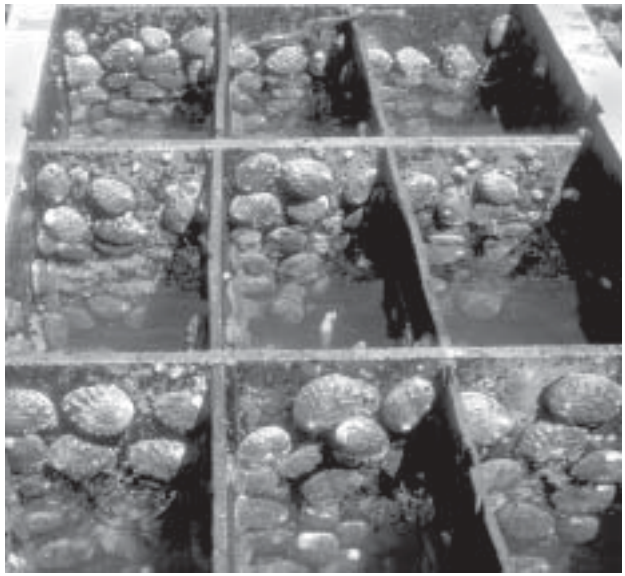
Researchers are working on developing a molluscan cell line—a continuously dividing cell similar to a cancer cell. Such a cell line would be of immediate benefit in diagnosing, detecting and culturing shellfish pathogens. To make the cell line, the scientists are looking closely at the pathology of neoplastic cells, which proliferate like cancer cells. The scientists have shown that neoplastic cells transplanted into a healthy mussel infect and eventually kill their host. They are seeking to more fully understand the mechanism by which these transplanted neoplastic cells cause disease. The research is being conducted in collaboration with a shellfish biologist at the California Department of Fish and Game and also with a pathologist at UCSD's medical school to facilitate the transfer of medical techniques to shellfish research.

- **Meiosis in Tetraploid Pacific Oysters, Their Triploid Mothers, and Diploid Grandmothers**

  R/A-120 Mar. 02–Feb. 05

  Dennis Hedgecock, UCD/BML, 707.875.2075, dehedgecock@ucdavis.edu

Most of the oysters cultured along the West Coast have three sets of chromosomes in each cell. Triploid oysters are preferred over normal diploid ones because they grow quickly and are marketable year-round. They are also sterile. The purpose of this project is to understand meiosis in tetraploid males, which are crossed with normal diploid females to make commercial triploid seed. The work has applications in maintaining healthy oyster brood stocks and in developing techniques that will make it possible to breed oysters for desired commercial traits.



- **Pharmacokinetics and Efficacy of Oxytetracycline in RLP-Infected Abalone**

  R/A-122 Mar. 04–Feb. 06

  Ronald Tjeerdema, UCD, 530.754.5192, rstjeerdema@ucdavis.edu; James Moore, BML, 707.875.2067, jimmoore@ucdavis.edu; Mark Viant, UCD, 530.752.2473; mrviant@ucdavis.edu; Carolyn Friedman, UW, 206.543.9519, carolynf@u.washington.edu

The FDA-approved antibiotic oxytetracycline has proven effective at treating withering syndrome. But, although the drug clears from an abalone's foot muscle quickly, preliminary studies suggest it takes months to leave its digestive system. The goal of this project is to understand why there is such a discrepancy. The answer is of interest to the state's abalone farmers, who want to ensure consumers that their products are drug-free. The research also has direct applications for government shellfish biologists interested in rebuilding wild abalone stocks by "seeding" depleted beds with captive-bred abalone.

- **Acoustic Method for Fish Counting and Fish Sizing in Tanks**

  R/A-123 Mar. 04–Feb. 05

  Philippe Roux, UCSD/SIO, 858.822.3155, philippe@mpl.ucsd.edu; William Kuperman, UCSD/SIO, 858.534.7990, wak@mpl.ucsd.edu

Scientists are building a prototype acoustic device that can rapidly count the number and measure the size of fish in an aquarium, tank or pond. This inexpensive, simple and fast device will improve fish farmers' capacity to plan harvests, monitor fish densities and control feeding rates—all potential cost-saving measures. The project also has an educational component: The scientists will create an interactive exhibit at the Birch Aquarium in La Jolla called, "How Many Fish?" at which visitors will be asked to guess the number of fish in a tank. They can then use the new sonar device to obtain an estimate of the actual number.

Fisheries Research and Development

- **Pelagic Fish-Egg Abundance and Mortality Estimation by CUFES and Real-Time Machine Vision**

  R/F-180 Mar. 00–Feb. 04
  David Checkley, UCSD/SIO, 858.534.4228, dcheckley@ucsd.edu; Mohan Trivedi, UCSD 858.822.0075, mtrivedi@ucsd.edu

In this project, scientists continue their efforts to automate a manual fish-egg counter, the Continuous Underwater Fish Egg Sampler (CUFES). As part of this effort, scientists are developing computer algorithms that can recognize anchovy, sardine, mackerel and menhaden eggs in video images of water samples. A long-term goal is to be able to count sardine eggs accurately enough to estimate the size of the stock's biomass and the distribution of spawning adults.

- **Migratory Movements of Pacific Bluefin Tuna off California**

  R/F-189 Mar. 02–Feb. 04
  Barbara Block, SU/HMS, 831.655.6236, bblock@leland.stanford.edu; Charles Farwell, MBARI, 831.648.4826, cfarwell@mbayaq.org

In this project, 3- and 4-year-old bluefin tuna are being tagged and tracked off California. The goal is to reconstruct the spacial and temporal structure of the Pacific bluefin population and its migratory patterns across the Pacific and along the coast. A second goal is to examine whether bluefin congregate along oceanic fronts, areas in which there are abrupt changes in water temperature and salinity. The key questions being addressed are: How long do bluefin reside in waters off California? When do the fish arrive from the Eastern Pacific? When do they return to the Western Pacific to spawn? This basic biological information offers a scientific framework for the future management of this economically important species within the Exclusive Economic Zones of the United States and Mexico. Approximately 85 bluefin will be tagged.

- **Conservation Genetics of California Abalone: Developing Tools for Management**

  R/F-189 Mar. 02–Feb. 04
  Ronald Burton, UCSD/SIO, 858.822.5784, rburton@ucsd.edu

This project's goal is to develop genetic markers that will enable scientists to distinguish wild from cultured abalone. The markers will make it possible for biologists to monitor changes in the genetic variability of supplemented or translocated populations and in this way prevent abalone recovery plans from inadvertently eroding the genetic diversity of remnant wild stocks.

- **Pattern and Association in Pelagic Zooplankton and Fish and Their Use in Resource Assessment**

  R/F-191 Mar. 02–Feb. 05
  David Checkley, UCSD/SIO, 858.534.4228, dcheckley@ucsd.edu; John Hunter, SWFSC, 858.546.7127, john.hunter@noaa.gov

For reasons that are not completely understood, sardine and anchovy landings fluctuate dramatically with changes in ocean temperature associated with events such as El Niño. There is a need to more clearly determine how water properties influence the distribution and abundance of fish eggs and larvae. A related objective is to investi-

gate whether the distribution and abundance of zooplankton is somehow a controlling factor in determining where fish spawn. To date, scientists have been collecting data, primarily plankton counts collected by optical devices, and are analyzing data on zooplankton and fish abundance collected by ship-board sonar. The project is being conducted in collaboration with NOAA Fisheries and has immediate applications in forecasting stock size and the effects of harvesting on stock size as a function of changing oceanic conditions.

- **Developing New Management Techniques for the Pelagic Gillnet Fishery in the Southern California Bight**

  R/F-193 Mar. 04–Feb. 06
  Jeffrey Graham, UCSD/SIO, 858.534.8044, jgraham@ucsd.edu

Scientists will acoustically track the fine-scale movements and habits of mako and thresher sharks in the Southern California Bight, an important nursery area for young sharks. Commercial and recreational fishers target these shark species. They are also inadvertently caught in drift gill nets. Biologists have expressed concerns that shark by-catch in the Bight, particularly of juvenile sharks, might have profound consequences for the fishery's long-term viability. The data that will be gathered during this study can be used to reduce by-catch and will assist NOAA Fisheries in implementing its new Highly Migratory Fisheries Management Plan.

- **Establishing a DNA Sequence Database for the Marine Fish Fauna of California**

  R/F-194 Mar. 04–Feb. 06
  Philip Hastings, UCSD/SIO, 858.822.2913, phastings@ucsd.edu; Ronald Burton, UCSD/SIO, 858.822.5784, rburton@ucsd.edu

The goal of this project is to develop a mitochondrial gene database for all marine fish species in California. The database will allow scientists to identify species from their eggs and larvae, as well as from headed, gutted or filleted fish specimens. The database will be archived at GenBank and made available to the public in a searchable, on-line format. The database will make it possible for scientists to analyze gut contents of marine animals and seabirds, thus improving marine food web studies. The database will also benefit law enforcement by providing a means of distinguishing legal and illegal takes.

The common murre (*Uria aalge*).

- **Marine Bird–Fishery Interactions in California: Modeling Prey Consumption and By-Catch Relationships**

  R/F-195 Mar. 04–Feb. 06
  William Sydeman, PRBOCS, 415.868.1221, wjsydeman@prbo.org; Nadav Nur, PRBO, 415.868.1221, nadavnur@prbo.org

Using 30 years of data collected around the Farallon Islands, ornithologists are studying the dietary habits of a diving seabird called the murre. The goal is to determine how much food, in aggregate, is required to sustain murre populations. The murre—the Northern Hemis-phere's counterpart to the penguin—feeds on krill as well as squid, juvenile rockfish, juvenile hake and juvenile salmon, all of which are fished commercially. The work will help state and federal agencies meet mandates to implement fisheries management plans that maintain sufficient reserves for sustaining the full richness and vibrancy of marine ecosystems.

- **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

Once a valuable fishery, white abalone in 2002 became the first marine invertebrate placed on the federal Endangered Species list. This project seeks to gather basic natural history, genetic and disease susceptibility data that will serve as the scientific underpinning for developing and implementing a recovery plan. Specific goals include: conducting field surveys to determine how many white abalone are left in Southern California and where they live, collecting brood stocks for captive breeding programs, and conducting lab experiments to find how temperature and feeding regimes influence key stages in the animal's life history. The scientists will also study the susceptibility of white abalone to withering syndrome and evaluate treatment protocols suitable for captive-rearing programs. The work will help ensure that released abalone will not infect remnant wild populations.

New Marine Products Research and Development

- **The Biomedical Potential of California Marine Organisms**

  R/MP-87 Mar. 00–Feb. 04
  William Fenical, UCSD/SIO, 858.534.2133, wfenical@ucsd.edu

The biomedical potential of soft-bodied, sessile, marine invertebrates (e.g., sponges, tunicates, and nudibranchs) native to temperate waters of California will be assessed. About 86 marine specimens have been collected from the Channel Islands. Extracts from these organisms are being tested for their biomedical potential in treating cancer, AIDS and infectious diseases. Crude methanol extracts have been screened in cytotoxicity, HIV-1 integrase, antibacterial and anti-fungal assays. Four sponges and a tunicate are now candidates for further study. Bristol-Myers Squibb has expressed interest in the cytotoxic material isolated from these native species.

- **Marine Natural Materials: Novel Biological Elastomers from Marine Invertebrates**

  R/MP-91 Mar. 01–Feb. 04
  Robert Shadwick UCSD/SIO, 858.534.7973, rshadwick@ucsd.edu; Herbert Waite, UCSB, 805.893.2817, waite@lifesci.ucsb.edu

The scientists have characterized the mechanical properties of protein polymers in the egg capsules of a common marine snail. The capsule material has been

shown to have similarities to both elastin and collagen, meaning that the material is both strong and flexible. This bimodal character is not rare in nature. Notable, however, was the discovery that the egg capsule material could be stretched and re-stretched repeatedly like a spring. The scientists are now interested in understanding the physical processes within a snail's foot that cross-link proteins to make polymers.

- **Novel, Post-Translationally Modified Peptide Antibiotics from Solitary Tunicates ("Sea Squirts")**

  R/MP-93 Mar. 01–Feb. 04
  Robert Lehrer, UCLA, 310.825.5340, rlehrer@mednet.ucla.edu; Steven Taylor, Amylin Pharmaceuticals, 858.458.8550, staylor@amylin.com; Victor Vacquier, UCSD/SIO, 858.534.4803, vvacquier@ucsd.edu

In the search for new antibiotics, scientists are characterizing peptides extracted from sea squirts (*Styela clava*, *S. plicata* and *Ciona intestinalis*) commonly found growing on docks and marinas in Southern California. These peptides have been shown to have broad-spectrum antimicrobial activity, especially against methicillin-resistant *Staphylococci*. The scientists are also studying the mechanisms by which these peptides kill microorganisms. This type of investigation is essential in efforts to use natural compounds as templates for designing new medicines.

The seaweed *plocamium* is characterized by its fine, delicate branching.

- **Molecular Approaches in Marine Pharmacology**

  R/MP-94 Mar. 02–Feb. 05
  Alison Butler, UCSB, 805.893.8178, butler@chem.ucsb.edu

Seaweeds contain halogenated compounds that might treat inflammation, bacterial infections and even cancer. Their therapeutic potential could be explored more aggressively if the compounds could be synthesized instead of being extracted from seaweeds. In this project, the scientist is trying to develop biotechnological methods that would enable production of these compounds using the same biochemical machinery as seaweeds themselves. So far, the gene that codes for the production of a key enzyme involved in halogenation has been cloned. This gene was then inserted into bacteria to produce halogenated terpene compounds. The scientist will now work to put the enzyme into synthetic algal membranes to try to increase yields of halogenated compounds.

- **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

Marine sponges produce tiny, intricate silicon dioxide structures called spicules. In previous Sea Grant research, the lead investigator of this project discovered that the principal protein responsible for directing silicon dioxide nanofabrication—the process of building at the molecular or atomic scale—also directs the nanofabri-cation of titanium dioxide. Titanium dioxide is extremely efficient at converting light to electricity and thus has wide use in electronics. A major goal of this project is to characterize the molecular mechanisms by which the protein silicatein controls the nanostructure of titanium dioxide.The results of the work will be shared with DuPont, Dow Corning Corporation and Amgen Inc. to assist in the design of new semiconductors, optoelectronic and medical devices.

- **Antibiotic Drug Discovery from the New Marine Actinomycete 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 of this project recently discovered a new genus of bacteria living in deep-sea sediments. These marine actinomycetes, which the scientist named *Marinomyces*, have been shown to be effective at killing drug-resistant strains of bacteria. This discovery was not a total surprise since terrestrial actinomycetes have inspired the development of about 100 commercially available therapeutic drugs in the last 75 years. The project goal is to find new species of *Marinomyces* and to develop culturing techniques needed to investigate metabolites produced by these bacteria. The overarching purpose of the project is to assess the biomedical potential of these bacteria, particularly as sources of new anticancer and antimicrobial medicines.

Ocean Engineering and Instrumentation

- **Mitigation of Coastal Bluff Instability in San Diego County, California**

  R/OE-37 Mar. 01–Feb. 04
  Scott Ashford, UCSD, 858.822.0431,
  sashford@ucsd.edu

To prevent property damage along the coast, engineers often build sea walls, jetties, or place revetment along the backside of a beach. The technical merit, cost and environmental impacts of a variety of erosion-control and bluff-stabilization strategies in northern San Diego County is being evaluated. This analysis will lead to a set of recommendations on how to best minimize bluff collapses in densely populated coastal areas. The GIS mapping and soft-copy photogrammetry techniques used in this project have broad applications in measuring coastal erosion rates all along the West Coast.

Marine Affairs

- **Empirical Evaluation of Regional Scale Marine Reserves and the Groundfish Trawl Fishery with Geographical Information Systems, Analysis of Covariance and Bioeconomic Modeling**

  R/MA-42 Mar. 02–Feb. 05
  Michael Dalton, CSUMB, 831.582.3024, michael_dalton@csumb.edu; Stephen Ralston, NOAAF, 831.420.3949, steve.ralston@noaa.gov

To better understand how marine reserves might impact the state's groundfish trawl fleet, scientists are modeling the effects of the Rockfish Conservation Area established in 2002. To date, scientists have shown that fishing effort has shifted and intensified in open areas. The next step is to be able to spatially quantify and predict shifts in fishing effort. Ultimately, the scientists hope to incorporate economic data into the model and predict the interplay of reserves and traditional catch-and-control regulations on both fishermen and fish. The model could then help fisheries managers decide what kinds of regulations should be put in place in open areas if reserves are established. Much of the data that is being used in this study comes from fishers' log books and landings tickets.

- **Market Channels and Value Added to Fish Landed at Monterey Bay Area Ports**

  R/MA-43 Mar. 03–Feb. 04
  Caroline Pomeroy, UCSC, 831.459.5614, cpomeroy@ucsc.edu; Michael Dalton, CSUMB, 831.582.3024, michael_dalton@csumb.edu

The objectives of this project are to 1) document the production and distribution of fish landed in the Monterey Bay ports of Moss Landing, Monterey and Santa Cruz, 2) describe the spatial organization of processing, and 3) estimate the value added to these fish products in Monterey and Santa Cruz counties. This type of economic analysis will help fisheries managers weigh potential impacts of regulatory decisions on the fishing industry and communities that depend on fishing.

- **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, landings of ground fish on the West Coast plummeted, prompting the Secretary of Commerce to declare a disaster in the fishery. Just a decade earlier, the fishery was considered a success story. What went wrong? The purpose of this project is to examine the historical record, including documents of the Pacific Fishery Management Council and California Department of Fish and Game, and to then reconstruct the factors that influenced the management of the fishery. The story of what happened has the potential to help scientists develop more effective fisheries policies. It will also shed light on how fisheries policy is developed in the face of uncertainty.

Rapid Response

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

Because conditions in the marine sphere can change rapidly as a result of both human and natural causes, 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 as needs arise.

Special Competitions

Aquatic Nuisance Species

- **West Coast Ballast Outreach Project**

  A/EA-3 Oct. 01–Aug. 04
  Jodi Cassell, CSGEP, 650.871.7559, jlcassell@ucdavis.edu; Karen McDowell, WCBOP, 510.622.2398, kdhart@ucdavis.edu

The California Sea Grant Extension Program began the West Coast Ballast Outreach Project in 1999 to address concerns that ballast water discharges could be introducing foreign marine species into the state's coastal and estuarine ecosystems. The program continues with its goal of reducing the risk of invasions from ballast water through a committed partnership with those maritime industries that might bear the brunt of regulatory actions on ballast water discharges. The program will continue to coordinate activities pertaining to the management of ballast water on the West Coast and will continue to educate stakeholders and increase awareness of ballast water issues. By pooling resources and promoting industry participation, the program ultimately hopes to help industry find solutions for dealing with aquatic nuisance species in ballast water.

- **Physiological Adaptation and Invasion Success: A Comparison of Native and Invasive Species of Bay Mussels (*Mytilus trossulus* and *M. gallo-provincialis*) in the Central California Hybrid Zone**

  R/CZ-179 Oct. 01–Sept. 04
  George Somero/SU, HMS

What makes some exotic species such successful invaders, capable of out-competing all native species? The project seeks to address the question for two species of mussels, a native one and an exotic one from the Mediterranean Sea. Though the two look identical and would thus on first blush seem to have similar fitness levels, the exotic species has almost completely displaced native mussels from San Diego to Monterey Bay. North of Monterey, interestingly, the native mussel maintains a healthy presence, at least in some areas. In this project, marine biologists are trying to pinpoint the environmental conditions, principally water temperature and salinity, that seem to be favoring the survival of the indigenous species in northern waters. So far, the hypothesis is that the native mussels are more adept at surviving seasonal deluges of fresh water from rain and runoff, and for this reason, salinity concentrations along the coast may explain the observed ranges of the two species.

- **Controlling *Undaria* and Invasive Kelps Through Management of the Gametophyte**

  R/CZ-184 July 03–June 05
  David Chapman, UCSB, 805.893.7545, chapman@lifesci.ucsb.edu

Undaria pinnatifida is a brown macroalgae originally endemic to Japan, where it is harvested for "wakame," an ingredient in miso soup. *Undaria* was discovered in Los Angeles Harbor in 2000 and in Santa Barbara and Monterey harbors in 2001. Biologists fear that unchecked, the kelp could displace native kelp beds and nearshore marine communities. A goal of this project is to detail how the kelp reproduces. Of particular interest is to determine the extent to which gametophytes persist as perennials through parthenogenetic (a type of asexual) self-replication. The potential for *Undaria* to hybridize with native kelps is another unanswered, important question. Only after these basic questions are answered can biologists begin to characterize the ecological risks of an expanded *Undaria* invasion and develop strategies for containment.

- **Determination of Chinese Mitten Crab, *Eriocheir sinensis*, Year Class Strength Through Investigation of Their Reproductive Life History**

  R/CZ-185 July 03–June 05
  Brian Tsukimura, CSUF, 559.278.4244, briant@csufresno.edu; Fred Schreiber, CSUF, 559.278.2001, fred_schreiber@csufresno.edu

Chinese mitten crabs—so named for their furry claws—were first found in San Francisco Bay in 1992. Since then, they have spread throughout the estuary. In this project, scientists will study the degree to which water temperature and other environmental parameters affect mitten crab reproduction. To do this, the researchers will test the thermal tolerances of young mitten crabs, as well as assess year-class strength as a function of water temperature. Another question to be answered is the degree to which environmental conditions, such as temperature, stimulate development and reproduction. The data that will be collected will be used to make recommendations on how to monitor and control mitten crabs in the Bay-Delta and elsewhere.

Chinese mitten crabs clogging a fish salvage system.

- **A Multi-State Approach to Understanding the Invasion Ecology of Exotic Crayfish in Northern and Southern California**

  R/CZ-186 July 03–June 05
  Lee Kats, PU, 310.506.4310, lee.kats@pepperdine.edu; Jay Brewster, PU, 310.506.4259, jay.brewster@pepperdine.edu

Two exotic species of crayfish have been introduced to California and are now endangering the survival of native crayfish and amphibians. One is the signal crayfish, *Pacifasticus leniusculus*, which was introduced to Northern California through bait buckets. The other is the East Coast red swamp crayfish, *Procambarus clarkii*, which was introduced to Southern California via bait buckets and aquaculture. A goal of this project is to look at environmental and man-made factors influencing the species' spread. Another is to evaluate whether the species are depressing native crayfish populations. The scientists will also examine whether physical barriers (e.g., waterfalls and culverts) can slow the exotics. The last aspect of the project is to examine how communities recover after exotic crayfish have been removed.

Marine Environmental Biotechnology Program

- **Use of cDNA Microarrays to Isolate Differentially Expressed Genes in White Spot Virus Infected Shrimp (*Penaeus stylirostris*)**

  R/A-121 June 03–May 05
  Arun Dhar, SDSU, 619.594.4356, adhar@sciences.sdsu.edu; Kurt Klimpel, 858.467.6424, kklimpel@aquabounty.com; Robert Bullis, 410.730.8600, rbullis@advancedbionutrition.com; Lee Roy McClenaghan, 619.594.3751, lmcclena@sciences.sdsu.edu

The continued prosperity of the global shrimp aquaculture industry is hindered by disease. A leading one is caused by the white spot virus. Between 1992 and 1998, shrimp farms lost an estimated $4 billion to $6 billion in product from white spot disease. The goal of this project is to use cDNA microarray analysis to compare gene expression profiles in hemocytes and hepatopancreas tissues of healthy and infected shrimp. The scientists will then isolate and characterize differentially expressed genes. It is hoped the research will lead to a better understanding of the molecular mechanisms of viral pathogenesis in shrimp, and more generally in invertebrates, and that what is learned will further efforts to advance shrimp aquaculture.

Education

- **Sea Grant Trainees**

  E/G-2
  R.A. Moll/UC-SG

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.

Trainee Scott Rapoport (Shadwick R/MP-91) injecting a neural extract that causes whelks to lay eggs.

- **California Sea Grant State Fellowship Program**

  E/G-9
  R.A. Moll/UC-SG

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

- **John D. Isaacs Memorial Sea Grant Scholarship**

  E/UG-4
  R.A. Moll/UC-SG

The John D. Isaacs Memorial Sea Grant Scholarship was established in 1981 to recognize excellence in research by high school students, to encourage interest in marine science at the high school level, and to encourage pursuit of scholastic excellence in higher education. Each year a California high school junior or senior, who presents an outstanding marine science project at the California State Science Fair, receives a scholarship to study at a college or university in California.

The winner in 2003 was Marwa Kaisey, a senior at La Jolla High School. Kaisey is using her scholarship to attend UCLA, where she plans to major in either biology or marine biology.

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.

Russell J. Schmitt
Chair, Sea Grant Advisory Board
University of California
Director, Coastal Research Center
Santa Barbara, CA

To be announced
Resources Agency of California
Sacramento, CA

Steven Aceti
Executive Director
California Coastal Coalition
Encinitas, CA

John Briscoe
Stoel Rives LLP
San Francisco, CA

Andrew Cameron
California Institute of Technology
Director
Center for Computational & Regulatory Genomics
Pasadena, CA

Gary N. Cherr
Bodega Marine Laboratory
Bodega Bay, CA

Linda Fernandez
University of California
Department of Environmental Sciences
Riverside, CA

Garry Griggs
University of California
Director, Insitute of Marine Sciences
Santa Cruz, CA

David Hankin
Humboldt State University
Department of Fisheries
Arcata, CA

To be announced
California Environnmental Protection Agency
Sacramento, CA

Helen Ingram
University of California
Irvine, CA

Geraldine Knatz
Managing Director
Port of Long Beach
Long Beach, CA

Justin Malan
Executive Director
California Aquaculture Association
Carmichael, CA

Diane Pleschner-Steele
President
DB Pleschner & Associates
Buellton, CA

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Boalt Hall School of Law
Berkeley, CA

Lisa R. Shaffer
University of California
Director, International Relations
San Diego, CA

Howard Wayne
former member, California State Assembly
San Diego, CA

Kate Wing
Ocean Program
Natural Resources Defense Council
San Francisco, CA

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.

To be announced
Chair, Resources Agency
Sacramento, CA

Gary Bane
Vice President
Nauticos
Santa Barbara, CA

Peter Douglas
Executive Director
California Coastal Commission
San Francisco, CA

Linda Duguay
Director
University of Southern California Sea Grant Program
Los Angeles, CA

Reinhard E. Flick
University of California
Center for Coastal Studies
San Diego, CA

Margy Gassel
Research Scientist
Office of Environmental Health Hazard Assessment
Oakland, CA

Eric Knaggs
Marine Region
California Department of Fish and Game
Monterey, CA

Justin Malan
Executive Director
California Aquaculture Association
Carmichael, CA

Bruce McPherson
California State Senate
Sacramento, CA

Tony Michaels
University of Southern California
Director, Wrigley Institute for Environmental Studies
Los Angeles, CA

Carlton Moore
Interim Administrator
Spill Prevention & Response Division
California Department of Fish and Game
Sacramento, CA

Timothy J. Mulligan
Humboldt State University
Department of Fisheries Biology
Arcata, CA

Francis Palmer
Chief
Ocean Standards Unit
State Water Resources Control Board
Sacramento, CA

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Executive Director
California Fisheries & Seafood Institute
Sacramento, CA

Dwight E. Sanders
Chief
Environmental Planning and Management
State Lands Commission
Sacramento, CA

Susan Williams
Director
Bodega Marine Laboratory
Bodega Bay, CA

Darryl Young
Director
Department of Conservation
Sacramento, CA

Index of Researchers

Research Institutions

Since 1968, California Sea Grant has supported a unique combination of marine research, education, and outreach activities at a number of universities and marine laboratories. These institutions have included:

Arizona State University
Bodega Marine Laboratory
California Academy of Sciences
California Institute of Technology
California Maritime Academy
California Polytechnic State University, San Luis Opispo
California State Polytechnic University, Pomona
California State University, Chico
California State University, Fresno
California State University, Fullerton
California State University, Hayward
California State University, Long Beach
California State University, Los Angeles
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California State University, Northridge
California State University, San Marcos
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Carnegie Institute of Washington
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College of the Redwoods
Cornell University
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San Francisco State University
San José State University
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Southern California Ocean Studies Consortium
Southwest Fisheries Science Center
Stanford University
State University of New York at Buffalo
Tijuana River National Estuarine Research Reserve

Research Institutions (continued)

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