Sea Grant California

Sea Grant News

FALL 2010

Coastal Science Serving California

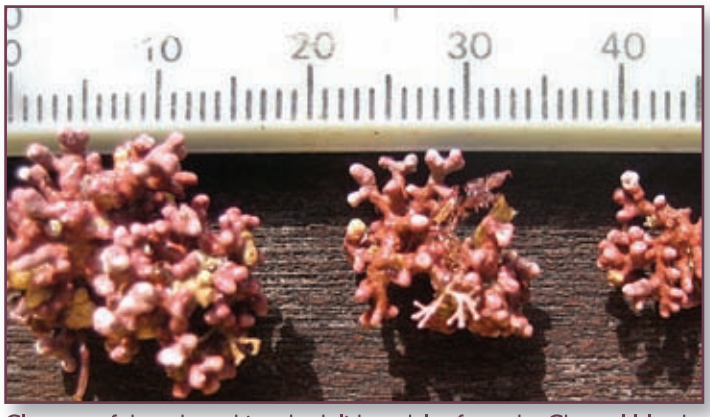
Funding for 17 New Projects Announced

LA JOLLA – California Sea Grant has awarded funding to 17 marine research projects to further the program's expertise along new avenues of scientific inquiry.

In total, about $550,000 was awarded to the yearlong projects, including traineeships for 13 graduate student researchers.

"We are excited to see some new faces in the Sea Grant fold and some new research approaches," says California Sea Grant Assistant Director Shauna Oh.

Some of the new names – people who have never before received California Sea Grant research funds – include **Diana Steller**, a marine biologist at Moss Landing Marine Laboratories who will be studying red coralline algae nodules around the Channel Islands.



S. Sankaran/MLML

Close up of three branching rhodolith nodules from the Channel Islands.

Not your typical slimy algal goo, these algae (called rhodoliths) tricked even the first scientists into thinking they were corals – because they build an intricate, calcium-based outer covering and can transform sandy areas into a complex three-dimensional reef habitat.

"It's so cool," says Steller, an avid diver and head of Moss Landing's research diving program. "It's like we found a whole new habitat to explore right out our door."

Another new addition to the Sea Grant portfolio is **Jesse Dillon**, a professor in microbiology at Cal State Long Beach. Dillon's area of expertise is extremophiles: microbes that thrive in unlikely corners of the planet – polar ice, deep-sea vents and hyper-saline marshes.

"The Sea Grant award gives us seed money to demonstrate the efficacy of stable isotope probing in characterizing microbial food webs in salt marshes," Dillon says. Translation: The method will tell scientists who is eating whom, at the microbial level.

The mud-loving, salt-tolerant microbes are important to society at large because of their potentially huge role in removing carbon from the air and putting it in the ground. "Our grant was written in the context of rising sea levels and whether wetland loss might measurably affect global carbon cycling," Dillon says. "That is the big picture."

Wei-Chun Chin, an assistant engineering professor at UC Merced, is yet another Sea Grant first-timer, funded to study the physiology of toxin-producing marine algae, in particular the intracellular chemical signaling processes that trigger toxin release.

"In animal cells, calcium ions trigger the release of hormones," Chin explains. "I want to verify if the same signaling mechanism occurs in harmful algae."

continued on page 2 …

Sea Grant researchers will examine whether the removal of invasive cordgrass (right) is a net plus or minus for primary productivity in Humboldt Bay.

L. Lagarde/HSU

INSIDE …

… continued from page 1

J. Dillon/CSU Long Beach

Sea Grant researchers will be studying microbes in marsh sediments (above) as part of a broader effort to study global carbon cycling.

Xiaochun Wang, a computer modeler with the Joint Institute for Regional Earth System Science and Engineering at UCLA, is yet another newcomer, funded to develop the ability to forecast upwelling intensities along the California coast 48 hours in advance. High-frequency radar data, 2D surface current observations, as well as single-point temperature and salinity measurements, will be used to truth-check the forecasts.

J. Ruvalcaba/MLML

A sea hare forages on foliose red algae intertwined within a rhodolith bed. Rhodolith beds are increasingly being recognized as an important component of California's marine ecology.

Alison Purcell, an assistant professor in environmental sciences at Humboldt State University, is also receiving her first Sea Grant award. She will be investigating the pros and cons of eradicating the invasive cordgrass *Spartina densiflora* in tidal marshes of Humboldt Bay. In particular, she hopes to establish whether cordgrass removal increases or decreases total net primary productivity in the marshes.

Other grant recipients and their projects are:

Lihini Aluwihare, Scripps, UC San Diego, analyzing mussel populations for levels of brominated compounds

Alexandria Boehm, Stanford University, characterizing fecal bacteria and their sources in beach sand

Laurence Breaker, Moss Landing Marine Laboratories, exploring links between warming and species assemblages in coastal Central California waters

David Ebert, Moss Landing Marine Laboratories, comparing gopher rockfish diets inside and outside marine protected areas

William Gerwick, Scripps, UC San Diego, investigating the pharmaceutical potential of marine cyanobacteria

Scott Hamilton, Marine Science Institute, UC Santa Barbara, comparing sheephead reproductive behaviors inside and outside marine reserves

Kevin Hovel, San Diego State University, studying trophic interactions on Southern California's rocky reefs

Raphael Kudela, UC Santa Cruz, detecting cyanobacteria blooms using solid phase adsorption techniques

Hunter Lenihan, Marine Science Institute, UC Santa Barbara, developing fishery management models for the spiny lobster

Lisa Levin, Scripps, UC San Diego, creating proxies for evaluating invertebrates' exposure to pH and oxygen

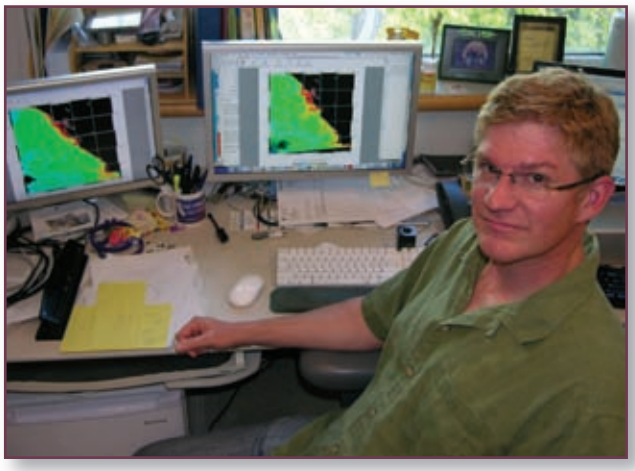
Bernie May, UC Davis, analyzing parentage of farmed white sturgeon (raised for meat and caviar)

Chris Vulpe, UC Berkeley, monitoring water quality through gene expression in small fish

Erin Loury, a Sea Grant trainee with David Ebert, tags a gopher rockfish in the Point Lobos State Marine Reserve.

C. Brooks/MLML

Forecasting TOXIC ALGAL BLOOMS in California


T. Stevens/UCSC

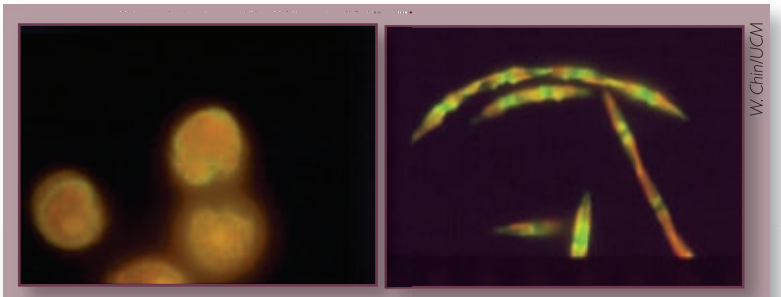
Raphael Kudela, ocean sciences professor at UC Santa Cruz.

SANTA CRUZ, CA – After years of studying and monitoring harmful algal blooms in California's coastal waters, a team of researchers are ready to begin forecasting when toxin-producing algae will strike next.

UC Santa Cruz ocean sciences professor Raphael Kudela is leading the project, recently awarded a $720,000 grant from the Ocean Protection Council and California Sea Grant.

The first predictions will be for diatoms of the genus Pseudo-nitzschia, which produce domoic acid, the neurotoxin that builds up in shellfish and small fishes and can cause amnesic shellfish poisoning. Although state monitoring and quarantines protect consumers from tainted seafood, seabirds and marine mammals often are poisoned and can suffer massive die-offs.

UC Santa Cruz researchers and the California Department of Public Health (CDPH) have already built and validated a computer model for predicting the environmental conditions in Monterey Bay favorable to Pseudo-nitzschia. A similar model exists for coastal waters off Santa Barbara.


W. Chin/UCM

Fluorescence microscopic images of the harmful algae *Alexandrium fundyense* (left), which produces the toxin responsible for paralytic shellfish poisoning and *Pseudo-nitzschia multiseries* (right), which produces the toxin causing amnesic shellfish poisoning.

Kudela's team will expand these existing models to cover the entire coast and develop forecasting capabilities for the algae that produce saxitoxins, responsible for paralytic shellfish poisoning. His collaborators include scientists at CDPH, UCLA, Jet Propulsion Laboratory, University of Southern California, Southern California Coastal Water Research Project, and Central and Northern California Ocean Observing System.

"We are at the point now where we'd like to take these research projects and turn them into something that's useful for the state and the public," Kudela explains. "We aim to develop a web-based tool to provide real-time updates for state agencies and wildlife managers. It will give them a heads up so they know what to expect and how to prioritize their monitoring efforts."

An unusual event this winter underscores the potential for modeling to improve protection of public health. The annual quarantine on recreational shellfish harvesting had just been lifted when the model for Monterey Bay showed a new episode of domoic acid production.

"Right after the annual closure was lifted, the model actually picked up an unusual event where the mussels got toxic again," Kudela says. "We alerted the state and they closed harvesting again. So that's where we're headed, and ultimately we'll have a web site where you can go and get that kind of information."

Modeling may also help explain shifts in where and when algal blooms are occurring.

This summer both Monterey Bay and the Santa Barbara area experienced an atypically prolonged bloom of Pseudo-nitzschia, with toxin levels exceeding the regulatory limit.

"Santa Barbara has become a real hot spot and it never used to be," he says. "We are seeing bigger blooms, blooms at unusual times of the year, and in places we haven't seen them before."

A Fish Feed without Fishmeal

Removing Fish Oil Next

In preliminary feeding trials, Sea Grant scientists have been able to remove all of the fishmeal from the diets of cultured white seabass.

The early success has far-ranging implications for raising high-value marine species without putting pressure on wild stocks of forage fishes ground up to make fishmeal.

In a series of experiments, led by Mark Drawbridge of the Hubbs-SeaWorld Research Institute, fishmeal was replaced with a mix of high-quality poultry by-products, concentrated corn protein, spirulina and chicken liver meal.

Not only did seabass survive on several versions of the fishmeal-free diet, they seemed to thrive on it, posting faster growth rates, higher survival rates and better rates of food conversion. In short, the new diet appears to have measurable benefits over the current commercial one.

Various types of prepared fish food. Some may look familiar to aquarists.

Pinpin/Wikipedia Commons

Cost is a factor in all this, and it has not yet been calculated what the price point of the new feed would be. As a research project, the first step was to show the feasibility of rearing healthy carnivores without fishmeal. As this has now been done for white seabass, the next step will be to try to remove fish oil from its diet, a challenge which may prove more difficult than finding alternatives to fish protein.

The scientists are also working on reducing fishmeal in feeds for California yellowtail, which Mexico, among other nations, would like to commercially culture offshore. For this species, researchers have been able to drop the fishmeal content from 62 percent to 20 percent, and even to as low as 10 percent. Promisingly, fish on the 20-percent fishmeal feed were observed to outperform those on the 62-percent feed.

B. Aalto/UCD

Fellowship recipient Emilius Aalto even spends his leisure time on the coast.

NOAA Awards Population Dynamics Fellowships

As part of a national effort to bring science to the fore of fisheries management, NOAA Fisheries/Sea Grant has awarded Population Dynamics Fellowships to two outstanding California graduate students. They are: Emilius Aalto, a doctoral student in ecology at UC Davis, who will work on developing population models for analyzing rockfish stocks with research mentor Mary Yoklavich, head of the Habitat Ecology Team at NOAA's Southwest Fisheries Science Center in Santa Cruz, and Valeria Brown, a doctoral student in applied mathematics at UC Santa Cruz, who will evaluate salmon stock assessment models, with Michael Mohr, leader of the Salmon Assessment Team at the Southwest Fisheries Science Center. For more information on the fellowship and other educational opportunities at Sea Grant visit: http://www.csgc.ucsd.edu/EDUCATION/

Z. Sigler/UCSC

Valeria Brown takes a dead fish out of the water on a volunteer trip with the Sacramento River Carcass Survey.

Beach Wildlife Needs Wrack, Ecologists Say

D. Hubbard/UCSB

Saltbrush (above) is an example of a native coastal strand plant that traps and holds sand that would otherwise be blown away by the wind.

The California least tern, an endangered subspecies of the least tern, nests in coastal sands.

R. Hagerty/USFWS

By some estimates, beaches, through tourism and recreation, generate more than $80 billion annually to the California economy. That's a lot of bucks, and a lot of people at the beach.

Due to the sheer crush of humanity on the coast, communities often decide to mechanically rake and groom high-use beaches to remove litter and seaweed, also known as wrack.

In the face of rising sea levels and continued population growth, coastal managers on both coasts have begun asking scientists to help them understand how to best protect and conserve coastal dune and beach strand ecosystems.

In previously reported research, California Sea Grant researchers documented the impact of raking and grooming on shorebirds and invertebrates, and offered guidance on practices for protecting the California grunion, which deposits its eggs in beach sand.

More recently, UC Santa Barbara researchers Jenny Dugan and David Hubbard documented an absence of native plants at groomed beaches in Southern California, and the subsequent implications for sand transport. The roots of plants and piles of wrack can hold and catch sand that otherwise might be blown away by the wind. The details of their findings were published in the journal *Estuaries and Coasts*.

In light of the research, Santa Barbara County cut back on its beach grooming activities, allowing native coastal strand plants and animals to recover. The ecologists' findings have also caught the eye of Nancy Douglass, a biologist who monitors shorebirds for the Florida Fish and Wildlife Conservation Commission.

In their journal article, Dugan and Hubbard suggest that managers consider designating "islands" of beach habitat at which no grooming is allowed year-round at beaches where grooming currently occurs and where there is an interest in conservation and restoration. This strategy may be a more effective tool for conservation than seasonal or other types of modified grooming, they say.

Summertime Oyster Deaths, Why?

USC biologist Andrew Gracey has identified 60 genes in Pacific oysters that make the delectable bivalves more susceptible to "summer mortality syndrome."

The expression patterns of these genes can be used to predict mortality rates weeks before the oysters actually perish.

Though the cause of disease is still not fully understood, Gracey's project, funded through a special nationwide competition for oyster disease research, shows that water temperatures above 36 degrees Celsius lead to higher mortality rates, as does prolonged exposure to air.

At shellfish farms, Pacific oysters (*Crassostrea gigas* – the only oyster species afflicted by the syndrome) are typically kept submerged and are fed to speed growth. Faster growth, however, could actually be a contributor to disease outbreaks, Gracey says, as smaller oysters are less likely to come down with the sydrome. Because of this, growers often harvest Pacific oysters before they are fully mature, to prevent losses that can, in extreme cases, exceed 50 percent.

Gracey hopes to one day be able to breed a disease-resistant Pacific oyster, which shellfish growers could harvest at full size. The economic implications would be staggering for the $96-million-a-year domestic oyster aquaculture industry.

"The overall goal is to help farmers alleviate the affects of oyster disease and secondly to understand the physiology of the disease," Gracey says.

M. Chaney/USC

Hemolymph testing technique being conducted on an oyster.

M. Chaney/USC

The inside of a Pacific oyster.

Reducing Pathogen Pollution from Coastal Dairies

M. Lennox/UC Davis

A vegetative buffer strip below a dairy reduces pathogen pollution in runoff.

In light of Sea Grant research findings, a dozen coastal dairies in Northern California have voluntarily adopted some "best management practices" to reduce pathogen pollution into the Tomales Bay watershed.

The farm practices shown to improve water quality include: planting vegetative buffer strips of barley and rye grasses around high-use lots; mulching lots with straw; removing manure from the ground prior to rainfall; planting seeds in the ground, and bringing cows indoors during part of the rainy winter season.

UC Davis veterinarian Rob Atwill, a specialist in waterborne infectious diseases, and colleagues have shown that a 10 meter-wide buffer strip around lots holding less than 2-month old calves can decrease Giardia loads in runoff by a factor of 10 (i.e., from almost 10,000 cysts per second to less than 1,000 cysts per second). Cryptosporidium contamination can also be significantly reduced with buffer strips and straw mulching.

Fecal coliform bacteria were removed from runoff by moving cattle indoors during the rainy season; locating high-use areas on level ground (to reduce flows into tributaries); mulching with straw and applying seeds, and planting buffer strips around lots.

Findings have relevance to the Tomales Bay Pathogen Total Maximum Daily Load and subsequent Conditional Waiver for Grazing Lands in the Tomales Bay Watershed, which establishes ambient water-quality standards for fecal coliform bacteria to protect public health. The regulations also call for implementing management practices to reduce pathogen pollution into the bay, which is a regional center of shellfish aquaculture.

To read more about this project, visit: http://www.csgc.ucsd.edu/BOOKSTORE/project_profiles_10.html

John D. Isaacs Undergraduate Research

A. Garcia/UCSB

Gabriela Navas in the Hechinger laboratory.

For Gabriela Navas, an undergraduate senior and biology major at UC Santa Barbara, an average day in the lab is spent among a multitude of minute New Zealand mud snails.

Navas ensures that the snails, a non-native species, are receiving correct amounts of air and food, performs dissections, and checks for disease. Her work is part of a larger effort, led by UCSB researcher Ryan Hechinger, to find a biological control for halting the snail's march into yet more of the nation's rivers and creeks.

"I really enjoy research and this was a new facet of research to explore," says Navas, who was one of five students awarded $2,500 in summer research support in 2010, through the John D. Isaacs Marine Undergraduate Research Assistant Program.

This program was established in 2006 in memory of John D. Isaacs, a former Scripps Institution of Oceanography professor and an influential scientist in the world of marine biology, to provide undergraduates an opportunity to contribute to California Sea Grant research.

Navas, who was born in Lüneburg, Germany, has been working in the Hechinger laboratory for two years. She plans to apply for graduate school this year to pursue a master's degree in marine biology.

Minh Khuc in the Gerwick laboratory.
E. Trentacoste/UCSD

The other four recipients of the Isaacs award are:

Minh Khuc, a fifth-year human biology major at UCSD, who has been assisting Scripps professor William Gerwick and his team for more than a year on a project to turn algae into biofuels.

David Ortiz-Suslow, a junior at UCSD, who worked with Scripps professor Peter Franks, analyzing phytoplankton species in water samples collected from Imperial Beach.

Erick Ruiz Cadena, a third-year student at San Diego Mesa Community College, who assisted Scripps professor Paul Dayton on a wetland restoration project in Southern California.

Lyndsay Trimble, a senior at San Diego State University, who worked with SDSU professor Carl Carrano, on a project to better understand algal blooms.

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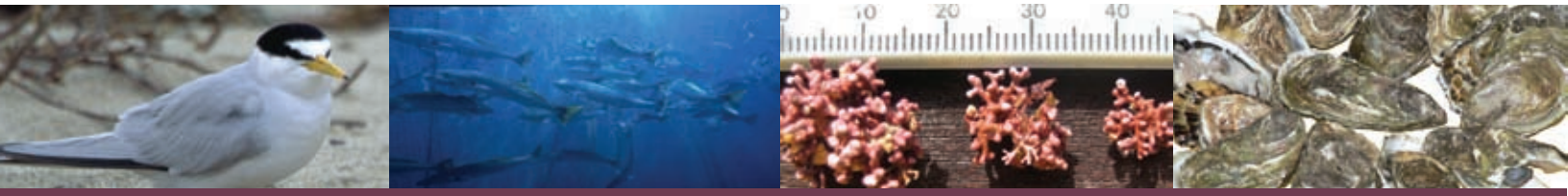

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Managing Data-Poor Fisheries: Case Studies, Models & Solutions

California Sea Grant Extension and California Department of Fish and Game (CDFG) jointly held a workshop in late 2008 to review and discuss new approaches for managing fisheries when available data are insufficient for single species or ecosystem-based management. The workshop included advance distribution of a series of draft manuscripts and presentations from invited national and international experts. The proceedings are now available as a CD. Cost: $10 (plus postage and sales tax) through the California Sea Grant Bookstore at http://anrcatalog.ucdavis.edu/SeaGrant.