CALIFORNIA SEA GRANT

PROGRAM DIRECTORY
2015

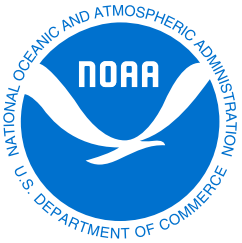
CALIFORNIA SEA GRANT COLLEGE PROGRAM

Scripps Institution of Oceanography
University of California, San Diego
9500 Gilman Drive #0232
La Jolla CA 92093-0232
(858) 534-4440
https://caseagrant.ucsd.edu/

This document was supported by the National Sea Grant College Program of the U.S. Department of Commerce's National Oceanic and Atmospheric Administration, by the University of California, U.S. Fish and Wildlife Service, the California Natural Resources Agency, the California Ocean Protection Council and the Delta Science Program. This publication was produced under NOAA grant number NA14OAR4170075, project number C/P-1 through the California Sea Grant College Program. The views expressed herein do not necessarily reflect the views of any of those organizations.

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.

Cover image: East end of Santa Cruz Island. Robert Schwemmer, NOAA.



Introduction

Federal Funding Sources

Strategic Focus Areas (Core Funding)
- Healthy Coastal and Marine Ecosystems
- Resilient Coastal Communities
- Safe and Sustainable Fisheries and Seafood Supply

West Coast Sea Grant Regional Social Science Research
National Sea Grant Aquaculture Research Program
U.S. Army Corps of Engineers

State Funding Sources

California Ocean Protection Council
South Coast MPA Baseline Program
North Coast MPA Baseline Program
Collaborative Fisheries Research West

Fellowships

Delta Science Fellows Program
NOAA Fisheries/Sea Grant Fellowships
Knauss Sea Grant Fellows
California Sea Grant State Fellows

More Information

credit: NOAA National Ocean Service

INTRODUCTION

The National Sea Grant College Program, a network of 33 university-based programs, is dedicated to enhancing the understanding, conservation, and sustainable use of the nation's coastal and marine resources. It has facilities and staff in every coastal and Great Lakes state, with activities funded by the National Oceanic and Atmospheric Administration of the U.S. Department of Commerce. Matching funds come from the individual states, and additional support from a variety of private sources.

The Sea Grant programs of today focus on making this country a world leader in marine research and the sustainable use 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 draws on the talents of scientists and engineers at public and private universities throughout the state. It is administered by Scripps Institution of Oceanography in La Jolla, a part of the University of California San Diego.

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. Its 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 funded in 2015 by California Sea Grant. Further information on any of these projects is available by contacting our offices, or visiting the program Web site—https://caseagrant.ucsd.edu/

MESSAGE FROM THE DIRECTOR

On behalf of the staff of California Sea Grant, I am proud to present our 2015 Program Directory. Listed herein is a brief summary of each currently active research project and research fellowship that our program supports in partnership with various federal and state agencies.

The projects highlighted in this program directory complement other work supported by CASG, most notably that performed by our state-wide network of Extension specialists and approximately 20 policy fellows, who work in various California-based agencies and Washington D.C., to apply scientific knowledge to solve practical problems related to our coastal environments. I encourage you to visit our website for a more detailed view of our program.

We have experienced notable changes over the past year. First, our Communications program has been re-staffed and modernized after the departure or retirement of several long-tenured, valued employees. Second, our treasured Associate Director, Dr. Shauna Oh, has left after 13 years at Sea Grant to assume a wonderful professional opportunity. From adversity comes opportunity, and 2015 will see the addition of a new Director of Extension and a Research Coordinator to grow our capacity to connect cutting-edge coastal science with California's stakeholders. The recent and forthcoming changes in our staff will allow us to explore new approaches and seize new opportunities in the years ahead.

- Dr. Jim Eckman, California Sea Grant Director

OUR VISION

The California Sea Grant College Program envisions a future in which people live in balance with coastal and marine resources, noting that the well being of California is closely tied to its human and natural resources. We envision an educated and engaged public that makes decisions based on sound, scientific information, resulting in sustainable, thriving human and natural communities.

OUR MISSION

CASG's mission is to provide integrated research, extension, outreach, and education to help Californians balance diverse coastal and marine interests and adapt to changing conditions and needs. We accomplish this by collaborating with a network of local, state, tribal, regional, national and international partners. California is large and diverse both geographically and in terms of its population. In addition to more than 37 million residents, California draws millions of visitors and tourists from around the world each year.

STRATEGIC FOCUS AREAS - CORE FUNDING

Healthy Coastal and Marine Ecosystems

Submarine Groundwater Discharge in North Monterey Bay—The Fuel Sustaining the Algal Incubator

R/CONT-218; May 2012–Apr. 2015*

Adina Paytan, UC Santa Cruz, 831.459.1437, apaytan@ucsc.edu

Andrew Fisher, Raphael Kudela, Christopher Edwards, UC Santa Cruz

John Ryan, Monterey Bay Aquarium Research Institute, 831.775.1978, ryjo@mbari.org

Peter Swerzenski, U.S. Geological Survey, 210.554.2420, pswarzen@usgs.gov

Northern Monterey Bay is subject to recurrent diatom and dinoflagellate blooms. Theories as to why these blooms occur in Northern Monterey Bay include the creation of retention zones within the inner shelf, which accumulate nutrients and phytoplankton, and pumping of nutrient-rich deep water from Monterey Canyon onto the inner shelf. The scientists of this project propose that submarine groundwater discharge is a yet unidentified source of nutrients to Monterey Bay that may contribute to sustaining the phytoplankton in the coastal area. Preliminary results indicate that submarine groundwater discharge is continuous throughout the year, adding nutrients into Northern Monterey Bay, and mixing models of nutrients and radium isotopes show the greatest influence of submarine groundwater discharge on the bay is in the nearshore, with nutrient-rich deep water influencing areas of the continental shelf further from shore. An incubation experiment with Monterey Bay seawater and phytoplankton populations showed additions of local groundwater elicited a positive growth response from diatoms, further strengthening the theory that submarine groundwater discharge plays a role in phytoplankton ecology of Northern Monterey Bay.

Climate and the Santa Barbara Basin Fish Assemblage in the Last Two Millennia: Management Implications

R/HMCE-01 Feb. 2014 - Jan. 2016

David Checkley, UC San Diego/Scripps Institution of Oceanography, 858.534.4228, dcheckley@ucsd.edu

Marine fish population sizes may vary over periods of months to decades in response to natural ocean cycles, which inevitably favor some species over others. Superimposed on these natural cycles are a host of man-made stressors, such as fishing and anthropogenic climate change, which may also cause further swings in fish population sizes. This project seeks to reconstruct patterns of fish abundances in the Santa Barbara Channel over a 2,000 year period predating modern human activity to tease apart the processes most affecting fish populations currently. The raw material for this reconstruction will be layered sequences of otoliths (ear-bone-like structures) in sediment cores extracted from the seafloor below the Santa Barbara Basin. The shape, size, and elemental composition of these otoliths, along with assumptions about their deposition rates, will be used to estimate fish biomasses over time and in relation to ocean climate. Data collected from this study will be shared with fishery managers and policy makers. Researchers will also produce an online key for identifying the region's marine fishes from their otoliths.

Importance Estuarine Acidification (EA) for Commercial Oyster Production and Native Oyster Restoration

R/HMCE-02 Apr. 2014 - Jan. 2016

Edwin Grosholz, UC Davis, 530.752.9151, tedgrosholz@ucdavis.edu

Ann Russell, UC Davis, 530.400.4362, adrussell@ucdavis.edu

Though the ocean is expected to become more acidic on average over the next several decades, it is not clear whether climate change will have the same effect on California's estuaries, since these waterways are highly influenced by local freshwater in-flows and upwelling dynamics. In this project, Tomales Bay will be used as a test bed for studying the relative importance of pH, salinity, plants and mixing on oyster populations. This will be achieved through targeted water sampling of key environments in the bay and through outplanting and resampling of young oysters to document rates of shell calcification, growth and survival. Sampling will be conducted on daily cycles to document the effects of plants on water characteristics and on seasonal cycles to document the effects of the region's Mediterranean climate. There will also be episodic sampling during major events such as large ocean storms or heavy rains. The data that will be collected during the project will allow scientists to explain whether pH or other factors are more important in explaining patterns observed in the field. Findings will be shared with native oyster

restoration groups and local shellfish producers at annual stakeholder meetings to be convened by the researchers, and through outreach materials, to be produced through the cooperative extension program of UC Agriculture and Natural Resources.

Context and Scale of Seagrass Effects on Estuarine Acidification: An Academic-Industry Partnership to Explore Mitigation Potential

R/HMCE-03 Feb. 2014 - Jan. 2016

Tessa Hill, UC Davis, 530.752.0179, tmhill@ucdavis.edu

Brian Gaylord, UC Davis, Bodega Marine Laboratory, 707.875.1940, bpgaylord@ucdavis.edu

Eric Sanford, UC Davis, Bodega Marine Laboratory, 707.875.2040, edsanford@ucdavis.edu

Could seagrass meadows be a natural, local remedy for ocean acidification? This project explores the idea by documenting pH, alkalinity and other properties of seawater at seagrass meadows and control sites in Tomales Bay, a major shellfish-growing center in the state. Three major questions will be addressed: 1) To what extent does carbonate chemistry within the bay vary because of geomorphology and hydrology? 2) To what degree do seagrasses, by up-taking and releasing carbon dioxide, alter local carbonate chemistry? And, 3) Do results support the idea of using expanded seagrasses to locally buffer carbonate chemistry and hence offset ocean acidification? Results from this project will be shared with stakeholder groups at yearly workshops, convened by the project's lead investigator, and may provide crucial information to help protect the region's shellfish farms from climate change. The project is a collaboration with the Hog Island Oyster Company.

Ocean Forcing of San Francisco Bay: Intrusion of Upwelled Water

R/HMCE-04 Feb. 2014 – Dec. 2015

John Largier, UC Davis, Bodega Marine Laboratory, 707.875.1930, jlargier@ucdavis.edu

This project examines the degree to which the intrusion of deep, upwelled water into San Francisco Bay affects the bay's nitrate, oxygen and pH levels and thus contributes to eutrophication, hypoxia and acidification. The research, which will combine new and existing field data, will address basic questions about when and why upwelled water is sometimes but not always delivered into the bay; the origins of this dense water; its reach into the bay and the processes (e.g. tidal flows) that enhance or minimize mixing of water masses. Findings will be shared with state and local agencies involved with reducing nutrient pollution into the bay and understanding and preparing for climate change.

credit: Robert Schwemmer, NOAA

Geochemistry, Physics, and Ecology of an Intermittent Estuary on the California Coast: A Multi-Disciplinary Investigation into an Annual Organism Die-off

R/HMCE-05 Feb. 2014 – Jan. 2016

Céline Pallud, UC Berkeley, 510.642.6359, cpallud@berkeley.edu

Stephanie Carlson, UC Berkeley, 510.643.5438, smcarlson@berkeley.edu

Mark Stacey, UC Berkeley, 510.642.6776, mstacey@berkeley.edu

Almost every year since 1995, Pescadero Estuary in San Mateo County has experienced mysterious die-offs of fish, including federally protected steelhead trout. These fish kills always occur after the sandbar across the lagoon mouth has been breached (due to the build-up of freshwater behind it) and the lagoon becomes opened to tidal flushing. Why would tidal flushing kill fish? It is speculated that the initial outflow of stagnant freshwater stirs up sulfur-containing sediments on the bottom, which, by changing the water's sulfur chemistry, cause a potentially lethal drop in the water's dissolved oxygen content. This project seeks to test these ideas by quantifying sulfur cycling in the estuary, as it opens and closes and its marshlands are flooded and drained. The scientists will also characterize the physical dynamics of the estuary during open and closed states and during transitions from each. The project's third objective is to characterize how changes in geochemical and physical water conditions influence fish movement patterns, especially how fish attempt to escape anoxic (suffocating) conditions. For this component of the project, fish will be acoustically tagged and tracked with an existing array of receivers. Findings, which will be shared at two workshops for decision-makers, may help identify restoration activities that could reduce fish kills in the estuary and protect habitat quality for the commercially important Dungeness crab fishery. The project is a partnership with NOAA Fisheries and state and federal agencies participating in the Pescadero Estuary Science Panel.

The Effect of Sea Otter Re-establishment in Southern California on the Remnant Populations and Recovery of Black Abalone, An Endangered Species

R/HMCE-06 Feb. 2014 – Jan. 2016

Peter Raimondi, UC Santa Cruz, 831.459.5674, raimondi@ucsc.edu

The black abalone is a long-lived intertidal marine snail listed as endangered under the federal Endangered Species Act. The southern sea otter is a voracious marine mammal that adores abalone, is also federally protected and, with the termination of the "otter-free" management zone, is now allowed to expand its range naturally into Southern California. Broadly, this project seeks to evaluate the potential impact of the otter's free-ranging status on black abalone populations at the four northern Channel Islands (Anacapa, Santa Cruz, Santa Rosa and San Miguel). These offshore islands are within the otter's new foraging territory and are believed to be home to more than half of all abalone in Southern California. In the project's first year, biologists will begin conducting field surveys to map the locations and sizes of black abalone, as well as the numbers of animals residing within deep, rocky crevices beyond arms reach of otters. The quality of black abalone habitat will also be evaluated and mapped. In the project's final stages, researchers will assess the proportion and location of abalone populations vulnerable to otter predation. Results will be rendered into GIS-compatible formats essential to developing mitigation and management strategies for two recovering, protected species.

The Spread and Ecological Consequences of the Invasive Seaweed, *Sargassum horneri*

R/HMCE-07 Feb. 2014 – Jan. 2016

Daniel Reed, UC Santa Barbara, Marine Science Institute, 805.893.8363, reed@lifesci.ucsb.edu

Sally Holbrook, UC Santa Barbara, Marine Science Institute, 805.893.3956, Holbrook@lifesci.ucsb.edu

Carolynn Culver, CA Sea Grant Extension, Marine Science Institute, 805.893.4530, cculver@ucsd.edu

Sargassum horneri is a large, annual, brown alga native to shallow reefs of Japan and Korea that was first discovered in the eastern Pacific Ocean in Long Beach Harbor in 2003. Since then, the alga has become invasive in shallow rocky reef habitats from Santa Cruz Island in the Channel Islands archipelago to Isla Natividad in Baja California, Mexico. Though not yet rigorously documented, some biologists have expressed concerns that the algae may be displacing giant kelp, the keystone species for California's kelp forests, in some areas. To better evaluate it's potential threat to these ecosystems, scientists will lead dive surveys and conduct experiments around the Channel Islands to identify the physical and biological characteristics of nearshore habitats that encourage the invader's proliferation. They will also attempt to document what, if any, effects the non-native seaweed has on native kelp communities' structure and diversity. Marine protected areas around the Channel Islands may slow the invader's spread. Yet another goal of this project is to examine if this is true and, if so, the mechanisms by which this biotic resistance is conferred. Results from the project will be shared with NOAA Fisheries, which has funded research on eradicating the alga, and the Channel Islands National Marine Sanctuary, which has identified *S. horneri* as an invasive species of great concern. To educate the broader public, researchers will help create exhibits for the Outreach Center for Teaching Ocean Science at UC Santa Barbara, and the Channel Islands Boating Center.

Interactive effects of acidification and hypoxia and adaptive potential in red abalone

R/HCME-10 Nov. 2014-Oct. 2015

Andrew Whitehead, UC Davis, 530.754.8982, awhitehead@ucdavis.edu

Eric Sanford, UC Davis, 707.875.2040, edsanford@ucdavis.edu

Laura Rogers-Bennett, UC Davis, 707.875.2035, rogersbennett@ucdavis.edu

Anthropogenic climate change is likely to impact fitness and persistence of marine species in complex ways that are difficult to predict. Though occurrence of hypoxia and pH are linked under scenarios of global climate change, little research has been published on ocean acidification effects on animal physiology that also includes the interactive effects of genetic variation, adaptive potential, and simultaneous exposure to hypoxia. This project will test for interactive effects of acidification and hypoxia during sensitive early life stages of an ecologically and economically important marine mollusc (red abalone, Haliotis rufescens), as well as identify and characterize genetic variation associated with variable sensitivities to these stressors. Specifically, researchers will examine the effects of chronic and acute exposures on development; the impact of local evolution to varied ocean OA/hypoxia conditions on abalone sensitivity; and identify genetic markers predictive of variable sensitivity to climate stress. The project may result in genomic tools that facilitate screening of individuals and populations for variation that may be adaptive to future environments, allowing genome-enabled conservation and management of red abalone.

Impacts of Ocean Acidification on Larval Anchovies, *Engraulis mordax*

R/HCME-12 Feb. 2015 – Jan. 2016

Ronald Burton, UC San Diego/Scripps Institution of Oceanography, 858.822.5784, rburton@ucsd.edu

The physiological and behavioral effects of ocean acidification (OA) on the early life stages of marine fish are largely unknown. Because any negative effects of OA on eggs and larvae can greatly impact fisheries productivity and ecosystem function, gaining a mechanistic understanding of OA effects is a key research priority. The primary goal of this study is to determine potential direct effects of OA on a key species in the California Current Ecosystem, the northern anchovy. The scientists will collect northern anchovy eggs from San Diego and Cape Mendocino – two areas with varied seawater pCO2 and spawning seasons. The eggs will be exposed to varied treatments of pCO2 concentration prior to analysis of gene expression and larval behavior. A mechanistic understanding of OA response may provide a general understanding of how fish larvae acclimate to this stress. Comparisons between two populations that naturally experience different levels of OA may provide evidence for rapid evolutionary adaptation to environmental change.

Global Change Ecophysiology of egg masses and juveniles of the kelp forest fish, *Scorpaenichthys marmoratus*

R/HCME-13 Feb. 2015 – Jan. 2016

Gretchen Hofmann, UC Santa Barbara, 805.893.6175, hofmann@lifesci.ucsb.edu

Coastal regions such as the California Current Large Marine Ecosystem are predicted to be highly vulnerable to ocean acidification in the future, and the resident biota face a complex physical environment where hypoxia and low pH co-occur within kelp forests. This project examines the organism-environment interactions of early life stages of cabezon (*Scorpaenichthys marmoratus*), a common benthic marine fish, to environmentally relevant levels of pCO2, oxygen and temperature in California kelp forests. The first stage of this project will deploy sensors to document conditions within kelp forests of the Santa Barbara Channel Region. The second stage will collect cabezon egg masses to rear in the laboratory under varied pCO2, oxygen and temperature based on sensor measurements. Eggs and larva will then be tracked their growth, metabolic rate, aerobic scope, temperature tolerance and survivorship through early life stages. The study will illuminate the physiological capacities of these early stage fish as related to the current abiotic conditions in kelp forests and how present-day genotypes might tolerate future conditions that are projected for the next decade.

Predicting the Impact of Ocean Acidification on Copper Toxicity to Marine Invertebrates

R/HCME-14 Feb. 2015 – Jan. 2016

Andrew Gracey, University of Southern California, 213.740.2288, gracey@usc.edu

Copper pollution of marine environments has been identified as a persistent problem in urban areas of Southern California. Regulations for copper contamination in Southern California's harbors must be considered in the context of a changing global ocean, particularly its combined effect with ocean acidification. Mytilus is the most sensitive genus to copper toxicity as well as an ecologically and economically important native organism in Southern California. This project will monitor the survival, development, and gene expression of mussel larvae of the genus Mytilus in response to both defined and field-collected copper-contaminated water samples, under pH conditions that simulate present day, 2050, and 2100 predicted levels. The project objective is to predict the effect that ocean acidification will have on the sensitivity of marine invertebrates to copper contamination.

Insulin-like growth factor I (IGF-I) as a physiological biomarker for growth rate and nutritional status of fishes in Marine Protected Areas (MPAs)

R/HCME-15 Feb. 2015 – Jan. 2016

Sean Lema, Cal Poly San Luis Obispo, 805.756.2802, slema@calpoly.edu

Brian Beckman, NOAA Fisheries, 206.860.3461, brian.beckman@noaa.gov

Dean Wendt, Cal Poly San Luis Obispo, 805.756.2988, dwendt@calpoly.edu

Modeling approaches suggest that changes in species abundance and density within MPAs can be complex and may alter the dynamics of individual somatic growth rates. Individual growth rates within and outside of MPAs must be quantified to gain a more complete picture of how the management protections of MPAs affect overall abundance, biomass and individual growth – traits that in turn impact population dynamics like recruitment and mortality. This project will evaluate the efficacy of measuring plasma concentrations of the hormone insulin-like growth factor-1 (IGF-I) as a non-lethal, physiological approach for quantifying growth rate and nutritional status of marine fishes. First, the scientists will test the validity of IGF-I as a growth biomarker in laboratory-reared juvenile black rockfish. The researchers will then sample wild black rockfish and lingcod within and outside of two MPAs (Point Buchon and Piedras Blancas) to determine if there is variation in plasma IGF-I concentrations based on habitat protection status. If successful, this method may provide a new, cost-effective approach for assessing the growth rate of individuals in wild populations that is superior to the current capture-mark-recapture method.

Examination of phenotypic plasticity of native *Spartina foliosa* populations in San Francisco Bay for tidal marsh restoration, endangered species support and adaptation to sea level rise

R/HCME-16 Feb. 2015 – Jan. 2016

Donald Strong, UC Davis, 707.875.2022, drstrong@ucdavis.edu

Patricia Foschi, SF State University, tfoschi@sfsu.edu

The invasive plant *Spartina alterniflora* (Atlantic smooth cordgrass) and its hybrids with native *S. foliosa* (Pacific cordgrass) have invaded over 170 marshes in the San Francisco Bay as of 2013. Past control efforts have extirpated both native and non-native *Spartina* from many marshes and been associated with decline in the endangered clapper rail, halting control efforts. This study will examine the effects of habitat components (elevation and inundation, substrate, marsh vegetation) and genotypes on *S. foliosa* phenotypes in the hopes of identifying a strain of *S. foliosa* most suited to habitat restoration efforts. Working with samples from eleven *S. foliosa* populations transplanted to controlled garden and greenhouse environments, the researchers will monitor plant performance and phenotypes before testing for a genetic basis for performance differences. The anticipated outcome is to identify the genotype of native *S. foliosa* that grows most rapidly and produces the most viable seed over the greatest range of environmental parameters.

STRATEGIC FOCUS AREAS - CORE FUNDING

Resilient Coastal Communities

Beach Evolution on Scales from Storms to Years

R/RCC-01 Feb. 2012–Mar. 2015

Robert Guza, UC San Diego/Scripps Institution of Oceanography, 858.534.0585, rguza@ucsd.edu

William O'Reilly, UC San Diego/Scripps Institution of Oceanography, 858.534.6258, woreilly@ucsd.edu

The physical oceanographers leading this project have been monitoring sand movement at three beaches in San Diego County that received beach nourishment in 2012 through a $28-million regional beach sand project. This monitoring has highlighted the dramatic variability in how beaches may respond to wintertime waves: Sand at Cardiff State Beach and Solona Beach, for example, was transported to offshore waters (depths of 4-12 meters) during the 2012-13 winter season, while at Imperial Beach, much of the added sand remained above mean sea level and was transported several kilometers south, reaching the Tijuana River mouth 8 months later. The scientists have extended their Sea Grant project in order to continue monitoring beach sand movement, and they are also developing numerical models for sand transport. The ultimate goal of the project is to better understand how our sandy beaches respond to waves over time scale ranging from individual storms to decades-long storm patterns. The project is a collaboration with the U.S. Army Corps of Engineers and the California Department of Parks and Recreation.

Spatial Redistribution of Fishing Effort: Identifying Drivers and Testing Model Predictions for Informing Expectations in Marine Spatial Planning

R/RCC-03 Feb. 2014 – Jan. 2016

Crow White, Cal Poly San Luis Obispo, 805.756.2954, cwhite31@calpoly.edu

Steven Gaines, UC Santa Barbara, 805.893.7363, gaines@bren.ucsb.edu

credit: California Sea Grant

Do marine reserves reduce fishermen's catches or simply displace where fish are caught? Is "spill-over" real and can it be documented from catch records? This project seeks to identify, test and quantify factors that have redistributed fishing effort (where fishing is occurring and how intensely) around the Northern Channel Islands since the region's marine protected areas (MPAs) went into effect in 2003. In the project's first year, researchers will mine data from existing socio-economic reports, developed by the environmental consulting firm Ecotrust, based on extensive interviews with local fishermen. This analysis will be used to formulate hypotheses about fishermen's responses to the MPAs. Examples of the types of hypotheses that will be considered include: MPAs remove rather than redistribute fishing effort and MPAs induce fishermen to "fish the line" to take advantage of "spill-over" from no-fishing areas. In the second year, researchers will compile empirical data to test the hypotheses developed in the project's first stage. This empirical data will be drawn from multiple datasets, including aerial monitoring of fishing vessel type and location, fish biodiversity, benthic habitat and kelp forest cover, weather conditions and other relevant spatial information across the islands, before and after the MPAs' establishment. Findings will be used to develop models for forecasting potential impacts of other MPAs in redistributing fishing effort and/or changing the amount or quality of fish caught by fishermen. The team will share their results with marine scientists and managers at two local meetings, and their findings will also be presented at the five-year review of the North Central coast's MPAs in 2015. Ecotrust, a partner on the project, will communicate the results with California fishermen.

Statewide High-Resolution Assessment of California Coastal Cliff Erosion and Retreat

R/RCC-04 Feb. 2014 – Jan. 2016

Adam Young, UC San Diego/Scripps Institution of Oceanography, 858.822.3378, adyoung@ucsd.edu

In this project, the scientist will lead an effort to measure and map recent coastal cliff erosion and retreat along most of the California coast, using aerial laser survey data collected in 1998, 2002 and 2010. Recent hot spots of erosion will be identified and examined for any spatial erosion patterns relating to bluff composition, coastal settings and other factors such as coastal armoring and wave exposure. The scientist will assess whether there have been changes in erosion rates over time by comparing laser-based contemporary cliff retreat rates to published long-term historical ones. Results will provide a baseline for future coastal erosion studies and may shed light on the future of, and processes shaping, California's coastline.

STRATEGIC FOCUS AREAS - CORE FUNDING

Safe and Sustainable Fisheries and Seafood Supply

Determining the Genetic and Molecular Bases of Oyster Resistance to an Oyster-killing virus, Ostreid herpesvirus 1

R/SSFS-01 Feb. 2014 - Jan. 2016

Dennis Hedgecock, University of Southern California, 213.821.2091, dhedge@usc.edu

Carolyn Friedman, University of Washington, 206.543.9519, carolynf@u.washington.edu

Pacific oysters worldwide have suffered mass mortalities from the oyster herpes virus (Ostreid herpes virus 1). In Tomales Bay in Northern California, a major shellfish growing center in the state, the virus has doubled summertime mortality rates of oysters over their 18-month culture cycle. As a waterborne pathogen activated by warmer water temperatures, all the state's shellfish growing areas are potentially at risk should the virus spread from its current location in Tomales Bay and Drake's Estero. The goal of this project is to protect and improve Pacific oyster farming in Tomales Bay and other parts of the state by providing a detailed understanding of the genetic, cellular and physiological mechanisms of heritable resistance to the herpes virus infection. In the project's first year, the scientists will conduct field trials to identify oyster families with differential susceptibility to the oyster-virus infection. A second set of experiments will then examine the heritability of disease resistance from these families and whether it translates into higher survivorship and yield in the field. Assuming that it does, the researcher will employ gene-mapping and gene-expression profiling techniques to localize and identify genes and biomarkers for disease resistance. Maps of these genes will then be compared to genetic profiles of oyster families that have previously produced offspring with high rates of survivorship in Tomales Bay. Ideally, findings will advance the seed industry's ability to selectively breed high-yield oysters with genetic resistance to the virus. This project is a collaboration with the University of Washington in Seattle, Hog Island Oyster Company, Taylor Shellfish Farms and California Department of Fish and Wildlife.

credit: Rick Starr, California Sea Grant Extension

Developing a Climate Change-Tolerant Urchin Fishery

R/SSFS-02 Feb. 2015 – Jan. 2016

Lisa Levin, UC San Diego/Scripps Institution of Oceanography, 858.534.3579, llevin@ucsd.edu

Echinoderms are important benthic fauna ecologically, and California's Strongylocentrotus franciscanus (red urchin) and S. purpuratus (purple urchin), are important commercial exports for distributors in the Southern California Bight, prized for their roe. However, laboratory experiments suggest that low pH (simulating future ocean acidification) can have a negative effect on fertilization, larval development, and gene expression for these species, whereas a different species, S. fragilis (pink urchin), is abundant in deep-margin, soft-bottom environments characterized by low oxygen and low pH. In light of ocean acidification, this project seeks to determine the suitability of S. fragilis as a future fishery species. For wild populations of S. fragilis in the Southern CA Bight, the researchers will model population spatial distribution and estimate density; evaluate morphological and gonadal traits across abiotic gradients; characterize seasonal patterns for gonad index; and determine if gonad traits of S. fragilis match current industry standards for S. franciscanus and S. purpuratus. Results will be used to advise future consideration and management of an S. fragilis fishery.

Juvenile Life History and Adult Return as a Function of Juvenile Rearing Location for Coho Salmon in the Shasta River, CA

R/SSFS-03 Feb. 2015 – Jan. 2016

Darren Ward, Humboldt State University, 707.826.3344, darren.ward@humboldt.edu

California's remnant coho salmon populations are listed on the state and federal Endangered Species Acts and have been the focus of considerable investment in the form of population monitoring and restoration efforts. Water withdrawal for irrigation and widespread habitat alteration certainly contributed to the decline of coho salmon in the Shasta River, but the primary constraints on current population growth remain unknown. The scientists will use tagging surveys and – if proven effective – otolith signatures, to 1) Measure differences in juvenile coho life history from two different natal habitats in the Shasta River; 2) Characterize site use for fish with an early-emigrant life history that leave the Shasta River as young-of-the-year; and 3) Determine whether early emigrants that do not rear at the natal site as juveniles contribute to the population of returning adults. Results will contribute toward understanding population dynamics and identifying effective recovery actions for Shasta River coho salmon.

Development of Sustainable Tuna Aquaculture in the United States Using Yellowfin Tuna as a Model

R/AQ-133; Feb. 2012–Jan. 2015

Mark Drawbridge, Hubbs-SeaWorld Research Institute, 619.226.3943, mdrawbr@hswri.org

Dan Margulies, Inter-American Tropical Tuna Commission, 858.546.7120, dmargulies@iattc.org

Rearing fish during their larval stage is often the most difficult part of developing a new species for culture; however, for yellowfin tuna, this common difficulty is further complicated by the absence of a domestic population of breeding fish. Instead of setting up breeding tanks locally, which is expensive and logistically complex, researchers have been airfreighting tuna eggs and larvae from the Inter-American Tropical Tuna Commission's facility at the Achotines Laboratory in Panama (one of the few research facilities in the world designed specifically to study the early-life history of tropical tunas) to their aquaculture facility at Hubbs-SeaWorld Research Institute in San Diego. The survivorship of these animals, though, has been so low that it has been basically impossible to carry out the necessary research on their early life history requirements (e.g., nutritional requirements). The first main goal of this project is to identify what is causing low survivorship among airfreighted fish and to fix the sources of harm, if feasible. In recent trials, project researchers found that larval survival in control groups retained in Panama and not subject to the stress of bagging for shipment survived better than those placed in bags for simulated shipments, which in turn survived better than those actually airfreighted. Survival upon arrival after 24 hour shipments was often high but mortality increased dramatically thereafter among all groups even before first feeding. Even control groups stocked directly into culture tanks (without bagging) failed to survive to a juvenile stage, suggesting that the quality of the larvae was impaired to start with or culture conditions were not optimized. Proliferation of bacteria during the shipping period was identified as a key impediment to success that was minimized by shipping eggs rather than larvae, sterilizing the water before adding it to the bags, and adding antimicrobial compounds to the water in the bags prior to shipment.

Maximizing the Values of Offshore Aquaculture Development in the Context of Multiple Ocean Uses

R/AQ-134; Sep. 2012–Mar. 2015*

Sarah Lester, UC Santa Barbara, 805.893.5175, lester@msi.ucsb.edu

Steven Gaines, UC Santa Barbara, 805.893.7363, gaines@bren.ucsb.edu

Christopher Costello, UC Santa Barbara, 805.893.5802, costello@bren.ucsb.edu

Libe Washburn, UC Santa Barbara, 805.893.7367, washburn@icess.ucsb.edu

The state of California is in the process of establishing a management framework for permitting and regulating open-ocean aquaculture. To assist in the planning process, this project seeks to model and evaluate the industry's economic and environmental tradeoffs. The team has modeled three offshore aquaculture development scenarios: 1) finfish in net pen cages, based on striped bass, 2) shellfish on longlines, based on Mediterranean mussels, and 3) kelp on longlines, based on sugar kelp. The model will examine the effects of these on: 1) the California halibut fishery, 2) water quality and the seafloor environment, and 3) visual impact from operations that may be visible from the coast. The team is running the finfish scenario in Aquamodel, a proprietary software model developed by colleagues at USC, and is exploring how to model disease dynamics so as to be able to evaluate the risk of disease transmission to wild fish. The final step of the project, which is currently underway, is to combine all of the model components to evaluate the tradeoffs from different spatial patterns of aquaculture development on the other uses and values in the marine environment. The project is based on a similar one, led by the UC Santa Barbara's Sustainable Fisheries Group, in which the impacts of offshore energy were analyzed. The hoped for outcome of this project, scientists say, is to significantly reduce conflict over and impacts from fish farming and thereby increase its value and compatibility with other ocean uses.

FEDERAL FUNDING SOURCES

West Coast Sea Grant Regional Social Science Research

Toward Resilience and Sustainable Seafood Supply: Assessing Direct Marketing Approaches for the West Coast Fishing Communities

R/SOC-02 Feb. 2012–Mar. 2015

Barbara Walker, UCSB, 805.893.3576, walker@research.ucsb.edu

Caroline Pomeroy, CASGEP, 831.459.4173, cpomeroy@ucsd.edu

Carolynn Culver, CASGEP, 805.893.4530, cculver@ucsd.ed

Kimberly Selkoe, UCSB, 805.966.1677, selko@nceas.ucsb.edu

The "locavore" movement is helping America's farmers. Could it also help our fishermen? Social scientists, in collaboration with marine scientists, commercial fishermen and the West Coast Sea Grant programs, are exploring whether and how direct marketing might benefit West Coast fishermen and fishing communities. In the project's first phase, researchers have been studying direct marketing programs (e.g., off-the-boat sales, web-based sales, and community supported fishery programs) in North and South Carolina and Washington to identify key factors necessary for success, as well as the social and economic implications of direct marketing arrangements to fishery participants and consumers. What is learned will be used to craft a direct marketing assessment toolkit to help fishing communities avoid costly mistakes and other pitfalls that can beset direct marketing programs. More specifically, the toolkit will help communities recognize the full range of potential direct marketing approaches and from these identify ones most applicable to their local catches and consumer preferences. The toolkit will be tested in California Sea Grant 2014 Program Directory 34 West Coast fishing communities struggling to organize or develop broadly successful direct marketing programs. In the project's final stage, the team will convene outreach seminars to disseminate the toolkit and share study results with West Coast fishing communities.

Scaling Up Cost-Effective Community Engagement in Coastal Resource Management

R/SOC-04 Feb. 2014- Jan. 2016

Julia Parrish, University of Washington, 206.221.5787, jparrish@uw.edu

Shawn Rowe, Oregon Sea Grant, 541.867.0190, shawn.rowe@oregonstate.edu

Heidi Ballard, UC-Davis, 530.754.6255, hballard@ucdavis.edu

Citizen science offers unique opportunities to build public engagement, community capacity, and relevance for science, while addressing major environmental and resource issues in timely, cost-efficient fashion. Effective programs enhance science learning, long-term public involvement, and the knowledge needed to collect accurate data. This project will gauge the essential elements of a rigorous, successful coastal citizen science program quantitatively and qualitatively, using individual demographics, organizational, community, and regional predictors, and focus group evaluations. Its focus will be COASST, a coastal observation and seabird survey team that operates along the West Coast and into Alaska.

The Environmental and Economic Impacts of Moorage Marinas on the West Coast

R/SOC-05 Feb. 2014- Jan. 2016

Christine Bae, University of Washington, 206.543.4190, cbae@uw.edu

James Moore, University of Southern California, 213.740.0595, jmoore@usc.edu

Recreational marinas are growing rapidly on the West Coast but fall outside usual planning, economic, and environmental research disciplines. This interdisciplinary study will calculate the net economic impacts of moorage marinas in Southern California and Western Washington and investigate environmental externalities. It will use GIS to correlate marina locations and NOAA Mussel Watch data on pollution and other impacts back to 1986. The economic and environmental impacts will then be compared for baseline and alternative scenarios, helping regulators and coastal communities develop smart, well-informed marina policies.

National Sea Grant Aquaculture Research Program

Sustainable Marine Aquaculture in the Southern California Bight: A Case Study on Environmental and Regulatory Confidence

R/AQ-136; Sept. 2014 – Aug. 2016

Paul Olin, Sea Grant Extension Specialist, 707.565.3449, polin@ucsd.edu

Jack Rensel, System Science Applications, Inc. 360.631.6538, jackrensel@att.net

Kenneth Riley, JHT, Inc. 252.728.8750, rileyk@ecu.edu

James Morris, NOAA-NOS, 252.515.0214, james.morris@noaa.gov

Jerry Schubel, Aquarium of the Pacific, 562.951.1608, jschubel@lbaop.org

Dale Kiefer, University of Southern California, 213.740.5814, kiefer@physics.usc.edu

Diane Windham, NOAA, 916.930.3619, Diane.Windham@noaa.gov

Randy Lovell, CDFW, 916.445.2008, Randy.Lovell@wildlife.ca.gov

Aquaculture is an increasingly integral source of seafood in the marketplace, providing more than half of seafood imports that comprise more than 90 percent of domestic U.S. seafood consumption. The offshore waters of the Southern California Bight (SCB) U.S. have extraordinary potential for development of marine aquaculture. This project will, (1) Conduct a stakeholder workshop to evaluate the current status of offshore marine aquaculture in the region and inform environmental modeling; (2) Use multiple modeling platforms to assess the environmental response to establishment of offshore fish farm operations; (3) Host a stakeholder workshop to report results; and (4) Prepare communication tools to convey the outcomes of the Southern California Aquaculture Forum and the resulting recommendations. The results of this project will contribute significantly to the spatial planning efforts underway for the SCB; and the interactive tools and data produced will ensure that a full range of marine aquaculture uses and complimentary activities are included in regional marine spatial plans. A well-defined and phased communications plan will help coastal managers and stakeholders make timely and confident decisions about making space for marine aquaculture in the coastal ocean.

U.S. Army Corps of Engineers

Monitoring Recovery of Endangered Coho Salmon in Russian River

A/EA-AR-05; Ongoing

Paul Olin, Sea Grant Extension Specialist, 707.565.3449, polin@ucsd.edu

Partners:
US Army Corps of Engineers;
California Department of Fish and Wildlife;
National Fish and Wildlife Foundation;
National Marine Fisheries Service;
Sonoma County Water Agency;
Soyotome Resource Conservation District;
Trout Unlimited;
University of California, Berkeley

The Russian River Coho Salmon Captive Broodstock Recovery Program is a broad coalition involving the U.S. Army Corp of Engineers, California Department of Fish and Wildlife, National Marine Fisheries Service, Sonoma County Water Agency, California Sea Grant, UC Cooperative Extension, and hundreds of private landowners joining together to re-establish self-sustaining runs of coho salmon in the Russian River basin.

The Department of Fish and Wildlife and Army Corps manages the hatchery component at the Don Clausen Warm Springs Hatchery, while UCCE and California Sea Grant scientists are responsible for monitoring juvenile and adult salmon in the wild, following their release. SGEP Advisor Paul Olin and staff operate an ongoing monitoring program for coho salmon in the Russian River basin to document in-stream survival of juvenile coho salmon, outmigration of smolts, and returns of adult fish. Efforts are primarily focused on monitoring for the Russian River Coho Salmon Captive Broodstock Program and activities are concentrated on historic coho salmon streams in the southern portion of the watershed in western Sonoma County.

STATE FUNDING SOURCES

California Ocean Protection Council

Forecasts and Projections of Environmental and Anthropogenic Impacts on Harmful Algal Blooms in Coastal Ecosystems

R/OPCCONT-12; Dec. 2010–Mar. 2015*

Raphael Kudela, UC Santa Cruz, 831.459.3290, kudela@ucsc.edu

Burt Jones, University of Southern California, 213.740.5765, bjones@usc.edu

David A. Caron, University of Southern California, 213.740.0203, dcaron@usc.edu

Yi Chao, UCLA, 818.354.8168, yi.chao@jpl.nasa.gov

In coastal waters around the globe, harmful algal blooms are becoming more intense and more frequent, endangering both human health and wildlife. In California, one of the most problematic harmful marine algal toxins is domoic acid, which has caused mass deaths of sea lions and seabirds and is commonly detected in fish caught by anglers. This project focuses on more fully understanding how certain kinds of harmful algal blooms form and spread off California, the goal being to forecast these potentially serious public health threats. The major effort to date has been to combine and expand existing domoic-acid forecasting models for the Santa Barbara Channel and Monterrey Bay, using new monitoring and NASA remote sensing data, as well as numerical model fields. A similar but much simplified modeling effort is underway for Alexandrium catenella, which produces the toxin that causes paralytic shellfish poisoning. In 2013, researchers sought to identify the relative importance's of surface seawater temperatures, surface salinities, micronutrient concentrations and their ratios, ocean color, freshwater inputs and upwelling indices in "driving" bloom formation and toxin production. This information will be used to determine the number of regional models that need to be "stitched" together to accurately predict blooms off all of California. The California Department of Public Health and the California Program for Regional Enhanced Monitoring of PhycoToxins are providing data needed to develop and validate the model. In addition to the modeling work, OPC funding provides support for continued collection of field data and for the development of several outreach tools, including various web portals to aggregate all of California's harmful algal bloom projects, present bloom forecasts to managers and health officials, and to help implement a coordinated response network.

Integrating the MLMA and MLPA—Developing New Ways to Manage California's Nearshore Fisheries Using Catch Data from Marine Protected Area Monitoring

R/OPCFISH-13 Feb. 2012–Feb. 2015*

Dean Wendt, Cal Poly San Luis Obispo, 805.756.2988, dwendt@calpoly.edu

Rick Starr, CA Sea Grant Extension, 831.771.4442, rickstarr@ucsd.edu

This project explores the ability to use MPA monitoring data, collected by volunteer anglers, for improving fisheries management, particularly for fisheries that are "data poor" (i.e., have limited data). OPC funding provides support to continue angler research surveys for an additional two years, after which time there will be a seven-year record of catch data (e.g., fish abundances and sizes, among other things) within four Central Coast MPAs and associated reference sites. With these data, researchers will assess effects of the MPAs on key nearshore species, in terms of fish sizes, abundance, species composition and, in some cases, fish growth and movements. In addition to these MPA monitoring objectives, researchers will use the fishery-independent dataset to populate ("run") five new fishery models for setting catch limits. Output from these models will be analyzed and compared to catch limits calculated through traditional stock assessment models. "A management strategy evaluation" will examine the models' performances through time and under various control rules, including bio-economic modeling to forecast long-term costs and benefits of different management actions. There will also be an effort to begin to resolve the "mismatch" in spatial scales at which stocks are assessed and fishing pressure applied. When such a disconnect occurs, it can lead to local depletions or under-utilizations of stocks. The highly localized angler survey data may shed light on how to manage stocks at the community level and/or most relevant spatial scales. Results and recommendations will be shared with state resource managers and the public.

credit: Deborah Seiler, California Sea Grant

STATE FUNDING SOURCES

South Coast MPA Baseline Program

Citizen-Scientist Monitoring of Rocky Reefs and Kelp Forests: Creating a Baseline for the South Coast MPAs

R/MPA-21; Sep. 2011–Jun. 2015*

Jan Freiwald, Reef Check Foundation, 831.345.8167, jfreiwald@reefcheck.org

Gregor Hodgson, Reef Check Foundation, 310.230.2371, ghodgson@reefcheck.org

Volunteers are core to this project, but these are not just any volunteers. All are skilled divers who have been trained and certified through the non-profit Reef Check program to conduct scientific surveys of rocky reef and kelp forest ecosystems. This unusual citizen-science monitoring program has been collecting data in California since 2006, and for the baseline monitoring project is being tailored to document and compare ecosystems inside and outside the new MPAs. In the first two years of baseline monitoring, divers completed 105 surveys in the study region. Each survey consists of eighteen 30-meter transects, along which divers count and estimate lengths of key fishes (35 species), invertebrates (32 species) and algae (9 species). Reef Check scientists have also trained or re-certified more than 250 divers each year state-wide, creating invaluable human capital for continued MPA monitoring and support for marine conservation. These divers have continued to monitor Reef Check's site in the south coast study region after the baseline monitoring was completed. Long-term monitoring data from 2006 to 2014 are available for these and all other Reef Check sites at Reef Check's new online data portal at: data.reefcheck.org. These data will be presented in the final report of the project that is being developed over the third year of the baseline monitoring program.

Baseline Characterization and Monitoring of Rocky Intertidal Ecosystems for MPAs in the South Coast Region

R/MPA-22; Sep. 2011–Jun. 2015*

Carol Blanchette, UC Santa Barbara, 805.893.5144, blanchette@msi.ucsb.edu

Peter Raimondi, UC Santa Cruz, 831.459.5674, raimondi@biology.ucsc.edu

Jennifer Burnaford, Cal State University, Fullerton, 657.278.2382, jburnaford@fullerton.edu

Jayson Smith, Cal State University, Fullerton, 657.278.4233, jasmith@fullerton.edu

Julie Bursek, NOAA/Channel Islands National Marine Sanctuary, 805.382.6141, julie.bursek@noaa.gov

Tide pools and other rocky-intertidal habitats are the focus of this project. These habitats are being described and compared inside and outside the South Coast MPAs based on invertebrate and algal biodiversity surveys and counts of target species. The survey methods replicate those developed for the West Coast by scientists with the Multi-agency Rocky Intertidal Network (MARINe). In the project's first year, scientists completed baseline biodiversity surveys and target-species sampling at 22 sites. Target-species sampling was continued at these sites during the project's second year. In the project's final year, researchers will analyze, document and describe the patterns, statuses and trends of rocky intertidal ecosystems and species along the South Coast. Additionally, researchers will co-host a workshop with staff from the LiMPETS program to train teachers on the baseline research and revised protocols for characterizing abundances of key species over time. Details on the protocols for the biodiversity and target-species surveys are available at the Pacific Rocky Intertidal Monitoring: Trends and Synthesis website at the University of California, Santa Cruz.

Integrative Assessment of Baseline Ecological and Socioeconomic Conditions and Initial Changes within the South Coast MPA Region

R/MPA-23; Sep. 2011–Jun. 2015*

Jennifer Caselle, UC Santa Barbara, 805.893.5144, caselle@msi.ucsb.edu

Carol Blanchette, UC Santa Barbara, 805.893.5144, blanchette@msi.ucsb.edu

Management of natural resources to meet a wide array of goals – ranging from conservation of biodiversity to enhancing economic yields of harvested species – is a challenging task and requires a broad vision of humans as integral parts of natural ecosystems. The 1999 California Marine Life Protection Act (MLPA) led to the establishment of a network of Marine Protected Areas (MPAs) across the state. The MLPA requires monitoring to measure MPA performance relative to the goals of the Act and inform adaptive management. Meeting the requirements of the MLPA means taking an ecosystems approach to monitoring that encompasses species, populations, habitats and humans. Although many ma-


credit: NOAA

rine habitats have been extensively studied in southern California (e.g. kelp forest, rocky intertidal), studies of how these habitats are linked via species (e.g. birds, fish) that utilize multiple habitats within the ecosystem are rare. California's South Coast region has the highest concentration of MPAs along the entire CA coast, encompassing both mainland and island coastal regions, for which a large body of both ecosystem monitoring data and contextual data exist (e.g. oceanographic and water quality data, remotely sensed data, habitat maps). However, many of these datasets have yet to be analyzed outside of the context for which they were originally created or combined into synthetic measures of ecosystem health. This project seeks to coordinate and integrate the individual projects making up the South Coast Baseline MPA program to address ecosystem level questions. Through webinars and workshops, the PIs have worked with the South coast baseline group to produce integrative products including datasets and scientific papers. A special issue of integrative papers is expected in 2015.

Sandy Beach Ecosystems: Baseline Characterization and Evaluation of Monitoring Metrics for MPAs along the South Coast of California

R/MPA-24; Sep. 2011–Jun. 2015*

Jenifer Dugan, UC Santa Barbara, 805.893.2675, j_dugan@lifesci.ucsb.edu

Henry Page, UC Santa Barbara, 805.893.2675, page@lifesci.ucsb.edu

Karina Nielsen, Sonoma State University, 707.664.2962, karina.nielsen@sonoma.edu

Julie Bursek, NOAA/Channel Islands National Marine Sanctuary, 805.382.6141, julie.bursek@noaa.gov

Sandy beach ecosystems are the focus of this baseline monitoring study. Metrics for assessing beach ecosystem function and health include: 1) kelp-wrack coverage and composition; 2) marine bird, pinniped and macroinvertebrate abundances and 3) population abundances, biomasses and sizes of target species, including sand crabs, Pismo clams, talitrid amphipods and wrack-associated invertebrates. Human activities at the beach are being documented, and scientists are partnering with citizen-science nonprofits to develop and test protocols for training volunteers to help collect long-term beach monitoring information. In addition to the survey work, researchers are studying the ecological importance of beaches to other coastal and nearshore ecosystems, and in 2013 published findings suggesting that two tiny burrowing crustaceans closely related to the roly poly have, in the last century, vanished from most beaches in the South Coast study region. Scientists said the trend is alarming because these animals are considered indicators of beach ecosystem health. In the project's final year, researchers will complete monthly surveys of South Coast study beaches, analyze their data and conduct a joint workshop for teachers on refining LiMPETS protocols for sandy beaches.

California Spiny Lobsters and South Coast MPAs: A Partnership to Quantify Baseline Levels of Abundance, Size Structure, Habitat Use and Movement

R/MPA-25; Sep. 2011–Jun. 2015*

Kevin Hovel, San Diego State University, 619.594.6322, hovel@sciences.sdsu.edu

Ed Parnell, UC San Diego/Scripps Institution of Oceanography, 858.822.2701, eparnell@ucsd.edu

Samantha Harrod, San Diego Oceans Foundation, 619.523.1903, sam@sdof.org

In this project, researchers are estimating spiny lobster densities within six South Coast MPAs and adjacent reference sites and will relate these estimates to bottom features, such as rocky crevices and understory algae. Commercial lobster fishermen tagged and recaptured lobsters to study "spillover" from closed to open areas, lobster movements and home ranges. Spatially explicit landings data (catch records by location) are also being compiled to calculate catch-per-unit effort inside and outside the MPAs before and after they went into effect. The six MPAs and adjacent reference sites are: (1) Point Vicente State Marine Conservation Area (SMCA); (2) Laguna Beach State Marine Reserve (SMR); (3) Swami's Beach SMCA; (4) Matlahuayl SMR; (5) South La Jolla SMR; and (6) Cabrillo SMR. Spiny lobsters support a popular recreational and valuable commercial fishery, are a key part of the southern California kelp forest ecosystem, and are a priority species for state managers. Results from this project will help assess the fishery's stability to current harvesting practices and may be included in the spiny lobster fishery management plan now under development.

Baseline Characterization and Monitoring of the MPAs along the South Coast: ROV Surveys of the Subtidal (20–500 m)

R/MPA-26; Sep. 2011–Jun. 2015*

James Lindholm, Cal State University, Monterey Bay, 831.582.4662, jlindholm@csumb.edu

Dirk Rosen, Marine Applied Research & Exploration, 510.232.1541, dirk@maregroup.org

Researchers are using a remotely operated vehicle to capture video and still images of life in deep-water habitats, including submarine canyons. From the images, they are documenting the numbers and kinds of fishes and larger invertebrates and their association with bottom features. In the project's first year the following sites were surveyed: (1) Point Vicente SMCA and Abalone Cove State Marine Reserve (SMR) off Palos Verdes; (2) the two Farnsworth Bank SMCAs off Catalina Island; and (3) San Diego-Scripps Coastal SMCA and Matlahuayl SMR. With additional support from private donors, the ROV was also "flown" about a half-meter above the seabed through four other marine protected areas near Laguna Beach and Newport Beach in Orange County. In the project's second year, the original three sites were resurveyed along with three new sites off San Clemente Island, with support from the US Navy. The final baseline characterization includes summary descriptions of benthic ecosystems, habitat characteristics and species assemblages in the South Coast MPAs and reference sites.

Kelp and Shallow-Reef Ecosystems: Baseline Data and Long-Term Trends Using Historical Data for the South Coast

R/MPA-27; Sep. 2011–Jun. 2015*

Daniel Pondella, Occidental College, 323.259.2955, pondella@oxy.edu

Jennifer Caselle, UC Santa Barbara, 805.893.5144, caselle@msi.ucsb.edu

Jeremy Claisse, Occidental College, 323.259.2618, claisse@oxy.edu

Our approach to creating a baseline characterization of kelp and shallow (less than 30-meters depth) rock ecosystems in the South Coast Study Region involved (1) new surveys of targeted elements of kelp forest and rocky reef ecosystems using SCUBA and (2) analyses of existing historical datasets on rocky reef ecosystems. To characterize kelp forests inside and outside of the recently established MPAs of the Southern California Bight, we used visual SCUBA surveys to assess habitat characteristics of the rocky substrate and the major players in the kelp forest community, including fishes, mobile and sessile invertebrates, and algae. Depending on the morphology and lifestyle of each species, abundance was estimated using swath surveys that count individuals within a defined area, or uniform point contact surveys that estimate the percent cover of colonial and other species for which distinguishing individuals is challenging. These baseline surveys allow us to understand the initial condition of the kelp forest communities inside and outside of MPAs at the time of MPA implementation and will provide a valuable reference point for interpreting any changes to these communities in the future. The scope of what is being accomplished is unprecedented for a habitat in a single study region associated with the MLPA and its implementation in California. The SCSR consists of as much coastline (1197.2 km) as the rest of the state. In addition, this spatial challenge extends to the number of MPAs: 41 of 50 MPAs in the SCSR have rocky reefs and excluding special closures (15 MPAs), this is nearly half of the MPAs in California (N = 109). We systematically surveyed 94 of the 122 nearshore rocky reefs in the SCSR. This synoptic baseline survey was conducted at 75 individual sites in 2011 and 88 sites in 2012. In addition, we incorporate two similar 'historical' data sets from 59 sites in 2004 and 79 sites in 2008.

Use of Estuarine, Intertidal and Subtidal Habitats by Seabirds within the MLPA South Coast Study Region

R/MPA-28; Jun. 2011–Jun. 2015*

Dan Robinette, Point Blue Conservation Science, 805.735.7300, drobinette@prbo.org

Jaime Jahncke, Point Blue Conservation Science, 707.781.2555, ext. 335, jjahncke@prbo.org

In this project, ornithologists are evaluating whether the new MPAs are adequately protecting seabirds, specifically pelagic cormorants, Brandt's cormorants, Western gulls, black oyster-catchers, pigeon guillemots, California least terns and California brown pelicans. They are compiling and analyzing existing records of seabird populations prior to the establishment of the South Coast MPAs and conducting new bird surveys at key sites. In the project's first two years, scientists monitored seabird breeding colonies, rooting sites and foraging rates on Santa Cruz Island, in La Jolla (where there is also a Brandt's cormorant colony), at Cabrillo National Monument on Point Loma in San Diego and along the Palos Verdes peninsula in Los Angeles. The MPAs and special closures were established, in part, to protect roosting and breeding seabirds from passing ships, fishing lines and other human activities. As a result, scientists will be looking for evidence that the new regulations are reducing seabird behaviors like nest abandonment that indicate disturbance. During the 2012 field surveys, researchers observed high mortalities of least tern chicks. Fecal samples suggest the reproductive failure was caused by a lack of 1-year-old Northern anchovy and young rockfishes near the bird's breeding colonies. The scientists report that 2013 appears to be a mixed year for least tern chicks, with some colonies doing better than others. Analyses of least tern fecal pellets and other seabird monitoring data will be conducted this fall and next year. Findings from this project will be used to enhance and encourage science-based approaches to seabird conservation.

Establishing Consumptive and Nonconsumptive Human Use Baseline Indicators for MPAs in the South Coast of California

R/MPA-29; May 2012–Jun. 2015*

Kristen Sheeran, Ecotrust Fisheries, 503.467.0811, ksheeran@ecotrust.org

Charles S. Steinback, Ecotrust Fisheries, 503.467.0758, charles@ecotrust.org

People are the focus of this baseline-monitoring project. In particular, social scientists leading this project are documenting human behavior at the coast. They will observe what, where and how often, and how much people spend for three sectors of the ocean economy: (1) private recreation, which includes activities such clamming, beach walking, diving, photography, surfing and birding; (2) commercial fishing, and (3) commercial passenger fishing vessels (aka "party boats") that may take people out fishing or whale watching. The core outcome of the project will be a series of standardized, fully documented, and quantitative socioeconomic data sets and maps. These will be used to establish an initial snapshot of human-use "indicators" for the South Coast MPAs and to assess initial changes in how people enjoy the water and commercially fish along the coast. Scientists will also attempt to identify key socioeconomic metrics and a modeling framework for understanding cause-and-effect relationships between ecosystem features, human-use patterns and MPAs.

Nearshore Substrate Mapping and Change Analysis Using Historical and Contemporary Multi-Spectral Aerial Imagery

R/MPA-30; Sep. 2011–Jun. 2015*

Jan Svejkovsky, Ocean Imaging, 858.792.8529, jan@oceani.com

Scientists with San Diego-based Ocean Imaging Corp. are mapping intertidal and, to a lesser extent, subtidal habitats in the South Coast study region, using multi-spectral images collected in the red, green, blue and near infrared bands. These imaging data are being combined with bathymetric maps, produced using LiDAR data collected by Fugro EarthData for a California Coastal Conservancy-funded project. The result is the ability to map sandy beaches, surf-grass meadows, kelp canopies, algae-covered rocks and bare-rock habitats at 1-meter resolutions. In the project's final year, raw image data files (calibrated and mosaicked) and GIS-compatible substrate classification files, among other metadata packages, will be made publicly available the MPA Monitoring Enterprise's data server and on DVD.

STATE FUNDING SOURCES

North Coast MPA Baseline Program

Characterization and Indicators of Oceanographic Conditions

R/MPA-31; Feb. 2014 – Jan. 2017

Eric Bjorkstedt, Humboldt State University and NOAA Southwest Fisheries Science Center, eric.bjorkstedt@noaa.gov

Brian Tissot, Humboldt State University

John Largier, Bodega Marine Laboratory, UC Davis

William Sydeman, Farallon Institute for Advanced Ecosystem Research

Marisol Garcia-Reyes, Farallon Institute for Advanced Ecosystem Research

Spatial patterns and temporal variability in water temperatures, currents and other oceanographic conditions play an important role in the dynamics and structure of marine populations and ecosystems. This project seeks to assemble and synthesize a variety of in-situ and remote-sensing ocean and atmospheric data to depict ocean conditions along the North Coast relevant to understanding the processes that drive the region's biological variability. The resulting data products will characterize ocean conditions for the 20-year period leading up to the implementation of the MPAs and will be updated as baseline field studies are conducted. Results from this work will provide context for comprehensive analyses of baseline and future MPA monitoring and are critically important for helping researchers determine whether observed biological patterns are due to differences in fishing pressure or natural variability in fish populations.

Baseline Characterization of Nearshore Rocky Reefs and Kelp Forests

R/MPA-32; Feb. 2014- Jan. 2017

Sean Craig, Humboldt State University, sean.craig@humboldt.edu

Ryan Jenkinson, Humboldt State University

Adam Wagschal, H.T. Harvey & Associates

This project will use data collected by professional research divers to describe and assess ecological conditions within the region's nearshore rocky reefs and kelp forests. Key metrics for assessing ecological status include documenting the density of macroinvertebrates, macroalgae, and benthic fishes; the size structure and density of red abalone and red sea urchins; the percent cover of sessile and colonial invertebrates and algae, and substrate type and reef structure. Except for the abalone and urchin focused surveys, the design and protocols for sampling and collecting data follow those established by the Partnership for Interdisciplinary Studies of Coastal Oceans for long-term MPA monitoring of kelp forests. The eight sites that will be surveyed during the project include four MPAs (Pyramid Point State Marine Conservation Area (SMCA), Double Cone SMCA, Ten Mile State Marine Reserve (SMR) and Pt. Cabrillo SMR) and four reference sites. This project is a collaboration with commercial urchin divers.

Baseline Characterization of Rocky Intertidal Ecosystems

R/MPA-33; Feb. 2014 – Jan. 2017

Sean Craig, Humboldt State University, sean.craig@humboldt.edu

Andrew Kinziger, Humboldt State University

Joe Tyburczy, California Sea Grant Extension, Eureka, CA

Ivano Aiello, Moss Landing Marine Laboratories, San Jose State University Research Foundation

Peter Raimondi, UC Santa Cruz

Rosa Laucci, Smith River Rancheria

The main objective of this project is to produce a quantitative baseline characterization of the region's rocky intertidal invertebrates and algae, following biodiversity and target-species survey methods developed by the Partnership for Interdisciplinary Studies of Coastal Oceans (PISCO) and Multi-Agency Rocky Intertidal Network (MARINe). Researchers will also provide quantitative comparisons between rocky intertidal ecosystems within four MPAs (Pyramid Point State Marine Conservation Area (SMCA), Double Cone SMCA, Ten Mile State Marine Reserve and MacKerricher SMCA) and associated reference sites. According to scientists, about 25-30 fish species (notably, marine sculpins) inhabit tide-pools in the northeast Pacific. Researchers will explore this unique ecological attribute of the North Coast by documenting fish biodiversities in these habitats. In the project's final year, scientists plan to integrate their baseline assessments of rocky intertidal ecosystems with other components of the baseline monitoring program to help inform the role and design of future MPA monitoring and evaluation. They will also analyze the newly collected data in conjunction with existing PISCO data to look for species that could be used as indicators of rocky intertidal ecosystem health. This project is a collaboration among academic scientists and North Coast tribes.

Citizen-scientist Monitoring of Rocky Reefs and Kelp Forests: Creating a Baseline for California's North Coast MPAs

R/MPA-34; Feb. 2014 – Jan. 2017

Jan Freiwald, Reef Check California, jfreiwald@reefcheck.org

Gregor Hodgson, Reef Check Foundation

Reef Check is a non-profit, citizen-science conservation organization that teaches and certifies experienced divers to survey species found in rocky reefs and kelp forests along California. Its volunteers have contributed to baseline monitoring of MPAs throughout California since 2006. In the past, four monitoring sites have been surveyed along the North Coast Study Region (NCSR), an effort that will now expand to 11 sites. Volunteers will survey sites inside and outside the new MPAs for two years, documenting abundances of about 70 rocky reef indicator species. In the third year, data will be analyzed to characterize reef ecosystems in NCSR and document any initial changes inside the MPAs. In addition to the baseline characterizations of rocky reef and kelp forest ecosystems, Reef Check engages and educates the public about the value of and need for science-based marine management. By training volunteers as citizen scientist and involving them in the baseline monitoring the program builds capacity for long-term MPA monitoring and continued stakeholder involvement. Reef Check scientists will integrate Reef Check's survey data with other baseline monitoring projects to produce a more complete assessment of the region's nearshore ecosystems and to provide recommendations for improving long-term monitoring, management and community involvement with marine ecosystems in California.

Baseline Characterization of Seabirds

R/MPA-35; Feb. 2014 – Jan. 2017

Richard Golightly, Humboldt State University,
richard.golightly@humboldt.edu

Daniel Barton, Humboldt State University

Phil Capitolo, Institute of Marine Sciences, UC Santa Cruz

W. Breck Tyler, Institute of Marine Sciences, UC Santa Cruz

Daniel Robinette, Point Blue Conservation Science

Jaime Jahncke, Point Blue Conservation Science

Seabirds are the focus of this project. Scientists will quantify their numbers and locations along the North Coast, as well as their reproductive rates, diet and related interannual variance at select colonies to identify how these important marine predators are being affected by the new MPAs, human disturbance and ever-changing ocean conditions. Species of interest include the common murre, Brandt's cormorant, double-crested cormorant, pelagic cormorant, Western gull and pigeon guillemot. The project's four main objectives are to: 1) provide a region-wide census of seabird breeding populations through aerial surveys of their breeding colonies; 2) document trends in seabird breeding population sizes at two sites using existing photographs of birds taken from 1996-2013; 3) assess seabird diets and reproductive success at Castle Rock, the largest seabird colony in the region; and 4) document foraging and roosting of key seabird species, as well as incidences of breeding and roosting seabirds being disturbed by human activities. The resulting baseline characterization will serve as a foundation for assessing initial and long-term responses of seabirds to their environment and the new MPAs. The project is a collaboration among academic scientists, federal wildlife officials, citizen scientists, a private research center and an environmental consulting company.

Baseline Characterization of Human Uses and the Socioeconomic Dimensions of MPAs

R/MPA-36; Feb. 2014 – Jan. 2017

Steven Hackett, Humboldt State University,
steven.hackett@humboldt.edu

Laurie Richmond, Humboldt State University

Cheryl Chen, Point 97

Charles Steinback, Point 97

What is the current socioeconomic status of North Coast fishing communities? How have commercial fishermen perceived and been affected by the new MPAs? How have the no-fishing zones shifted their fishing effort? Have their catches gone up or down and can recent trends in species targeted and their landings be attributed to the new regulations? These are among the types of questions that will be addressed in this socioeconomic study, a collaboration with local fishermen and the California Department of Fish and Wildlife. The project's main goals are to 1) to establish a baseline socioeconomic characterization of the North Coast fishing communities including demographics, historical context, fishing patterns, perceptions of management, and economic involvement, and 2) to assess where fishermen were fishing before and after the MPAs went into effect in 2012 and related socioeconomic implications of these shifts in fishing effort and resulting catches. The data for this analysis will come from survey interviews with over 150 commercial and charter fishermen, focus group discussions with fishermen in each of the five major ports and analysis of logbook and landings records. Among the outcomes from this project will be "heat maps" showing coastal areas of high importance to commercial fishermen before and after the MPAs' implementation. The lead scientists and fishermen will also look to develop recommendations for long-term socioeconomic monitoring. Results of this study will provide a better understanding of the status of the region's fishing communities against which future MPA impacts and benefits can be measured. To facilitate meaningful collaboration with the fishing community, this project has incorporated a fisherman's advisory council of representatives from each of the major ports to guide us in study design, data collection, and data interpretation.

Baseline Characterization of Nearshore Fish Communities Associated with Rocky Reef Habitats

R/MPA-37; Feb. 2014 – Jan. 2017

Timothy Mulligan, Humboldt State University, tjm2@humboldt.edu

Dave Hankin, Humboldt State University

Joe Tyburczy, California Sea Grant Extension

Drew Barrett, Humboldt State University

In this collaborative fisheries research project, scientists will partner with charter boat fishing captains and volunteer anglers to characterize the baseline status of nearshore rocky reef fish assemblages in four of the region's MPAs (Pyramid Point State Marine Conservation Area, South Cape Mendocino State Marine Reserve (SMR), Sea Lion Gulch SMR and Ten Mile SMR) and reference sites. This quantitative baseline data will describe the diversity, abundance, size structure and movement patterns of rocky reef fishes caught inside and outside of MPAs. The project will geographically expand upon an existing 2-year (2010-2011) data set on North Coast rocky reef fishes, enabling comparisons of fish communities before and after the MPAs went into effect in 2012. Unlike the earlier volunteer angler fish surveys, fish that are caught will be tagged and released at depth to enable studies of fish movement patterns across MPA boundaries. Researchers hope that by engaging local fishing communities in the research, they may establish a foundation for long-term collaborative monitoring and community involvement in marine resource management. Data from this project will complement other datasets collected by the other baseline monitoring projects to help evaluate placement, monitoring and overall effectiveness of the region's MPAs.

Baseline Characterization of Sandy Beach and Surf-Zone Ecosystems

R/MPA-38 Feb. 2014- Jan. 2017

Karina Nielsen, San Francisco State University, knielsen@sfsu.edu

Sean Craig, Humboldt State University

Timothy Mulligan, Humboldt State University

Jenifer Dugan, Marine Science Institute, UC Santa Cruz

Rosa Laucci, Smith River Rancheria

The goal of this project is to provide the first comprehensive baseline characterization of the region's sandy beach and adjacent surf-zone ecosystems. This characterization will be based on multiple surveys of sites within and outside of the newly established MPAs. Beach surveys will focus on documenting the biological diversity of intertidal invertebrates, including sand crabs and talitrid amphipods (sandhoppers) that are eaten by shorebirds and surf-zone fishes. Scientists will count numbers and kinds of birds and document the presence of wrack (piles of seaweed that wash up on the shore, providing food and habitat for many beach invertebrates). Human activities will also be recorded at the study beaches. The surf-zone surveys will focus on estimating abundances of surf-zone fishes, including night smelt and surfperch, both of which are important for recreational and commercial beach fishermen and for traditional tribal and subsistence practices. A limited number of fishes caught at the reference sites will be dissected to document their reproductive condition and stomach contents, from which diet is inferred. In the last year of the project, researchers will perform data analyses to identify key trophic links among beach and surf-zone organisms within the context of the North Coast's physical setting. This will provide the foundation for an evaluation of the baseline ecological status and functioning of the region's sandy-beach and surf-zone ecosystems. They also hope to identify candidate "indicator" species that could be used for long-term monitoring of sandy beach and surf-zone ecosystem health. This project is a collaboration among academic scientists, North Coast tribes, commercial and recreational fishermen and citizen scientists.

Traditional Ecological Knowledge of Keystone Marine Species and Ecosystems

R/MPA-39; Feb. 2014 – Jan. 2017

Megan Rocha, Smith River Rancheria, megan.m.rocha@gmail.com

Hawk Rosales, InterTribal Sinkyone Wilderness Council

Rachel Sundberg, Cher-Ae Heights Indian Community of the Trinidad Rancheria

Thomas Torma, Wiyot Tribe

Traditional ecological knowledge (TEK) can be defined as the cumulative body of scientific knowledge passed through cultural transmission by indigenous peoples over many generations. TEK is what informs customary management of natural resources by indigenous peoples, and it can be a highly credible means of understanding ecological features and species, and identifying areas of concern and related threats. The main goal of this project is to draw on tribal knowledge to enhance the baseline characterizations of six species that are both ecologically and culturally important within the beach, intertidal, kelp and mid-depth rock ecosystems. The method for acquiring this information will include a review of archival ethnographies and interviewing citizens from the participating Tribes who are culturally knowledgeable and/or active harvesters. Interviewees will be queried about their perceptions and knowledge of ecosystems and keystone species (such as sea lettuce, clams, abalone and mussels) that may be indicators of MPA performance. They will also be asked about their perceptions of the new "Tribal take" state regulations. The interviews will include short map-based interviews with focus groups and long, oral history interviews. Data collection will occur during the first two years of the project. To aid in standardization, Ecotrust will develop a data survey tool and assist in data analysis in the project's final year. This project's approach seeks to recognize and support the political and cultural sovereignty of each participating Tribe and its community's intellectual property,

while maintaining consistency in the research methodology and data collection across the region. Smith River Rancheria is leading this project in partnership with the Intertribal Sinkyone Wilderness Council, a consortium of ten federally recognized Tribes, the Cher-Ae Heights Indian Community of the Trinidad Rancheria, and the Wiyot Tribe.

Baseline Characterization of Estuarine Ecosystems

R/MPA-40; Feb. 2014 – Jan. 2017

Frank Shaughnessy, Humboldt State University, fjs3@humboldt.edu

Timothy Mulligan, Humboldt State University

John Largier, Bodega Marine Laboratory, UC Davis

Adam Wagschal, H.T. Harvey & Associates

Stephen Kullmann, Wiyot Tribe

The North Coast has 16 major estuaries that support a wide diversity of plant and animal life, including salmon and other commercially important species. The focus of this project is to describe and evaluate the ecological status of representative and under-studied estuaries in the region by surveying plants, invertebrates and fishes in tidal mudflats and eelgrass beds of four estuaries – three within MPAs (Humboldt Bay, Big River and Ten Mile River) and the Mad River Estuary. Field surveys will be conducted multiple times a year for two years to better document seasonal and interannual variability in species abundances and diversity, as well as changes in the sizes of focal species, such as bivalves, eelgrass, and black rockfish, among others. Estuarine ecosystems are largely driven by a complex set of interacting physical variables, including freshwater flows, seasonal closures of lagoon mouths and ocean water properties related to winds and upwelling. Information about these "abiotic" variables will be distilled to describe the "contextual conditions" in each estuary. During the analysis phase of their project, scientists will identify baseline and contextual metrics that might allow for future evaluation of MPA performance. This project is a collaboration among academic scientists, North Coast tribes, and ecological consultants.

Baseline Characterization and Monitoring of the MPAs along the North Coast: ROV Surveys of the Subtidal

R/MPA-41; Feb. 2014 – Jan. 2017

Andrew Lauermann, Marine Applied Research & Exploration, andy@maregroup.org

Richard Starr, Moss Landing Marine Laboratories

Dirk Rosen, Marine Applied Research & Exploration

Researchers will use a remotely operated vehicle (ROV) to capture video and still images of seafloor communities from 20- to 500-meters depth along the North Coast, with an emphasis on characterizing species and habitat features within mid-depth rock, soft-bottom subtidal and deep ecosystems. These ecosystems sustain some of the state's vibrant commercial and recreational fisheries. The images collected along these "visual strip transects" will be used to identify and count fishes and macroinvertebrates and document physical features of the seafloor. They will also provide a permanent archival record of sea floor communities that can be used for a variety of purposes, in addition to baseline analyses, such as public education or future reanalysis using refined techniques. Follow this project on Twitter.

STATE FUNDING SOURCES

Collaborative Fisheries Research West (CFRW)

Integrating Collaborative Data Collection with Management: A Lobster Fishery Test Case

R/OPCCFRW-2; Jul. 2012–Mar 2015

Carolynn Culver, CA Sea Grant Extension, 805.893.4530, cculver@ucsd.edu

Stephen Schroeter, UC Santa Barbara, 760.438.5953, schroete@lifesci.ucsb.edu

Caroline Pomeroy, CA Sea Grant Extension, 831.459.4173, cpomeroy@ucsd.edu

Doug Neilson, CA Dept of Fish & Wildlife, 858.467.4229, dneilson@dfg.ca.gov

Could commercial fishermen help gather and interpret data for long-term, cost-effective fisheries management? This project addresses this question for the California spiny lobster fishery, building on an pilot at-sea sampling program for the southern rock crab fishery that was developed by the project's lead scientists. During the project's first year, lobster fishermen, scientists and managers worked together to develop and test protocols for collecting different types of data while fishermen conducted their commercial fishing operations. The team analyzed the collected data to identify the types of data most needed for management such as data that capture variations among fishing locations. They then developed a sampling regime that both ensures scientific rigor and minimizes the burden on the program's fishing partners. For the past two years, fishermen have continued to collect data and work with project scientists and managers to interpret the data, which are being used to inform development of the Lobster Fishery Management Plan. In addition, the fishermen, scientists and managers involved in the project have been discussing ideas for storing and sharing data, and for continuing the program over the long term. To help identify some options, the lead scientists have been gathering information on other similar fishermen-based data collection programs. Ultimately, the group will share results of their lobster data collection efforts, including evaluation of the program's long-term feasibility.

Collaborative Fisheries Research to Build Socioeconomic Essential Fishery Information: A Test Case

R/OPCCFRW-7MG; Apr. 2013–Mar. 2015

Caroline Pomeroy, CA Sea Grant Extension, 831.459.4173, cpomeroy@ucsd.edu

Monica Galligan, CA State University, Monterey Bay, 831.582.4743, mgalligan@csumb.edu

Paul Reilly, CA Department of Fish & Wildlife, 831.649.2879, Paul.Reilly@wildlife.ca.gov

Carolynn Culver, CA Sea Grant Extension, 805.893.4530, cculver@ucsd.edu

A California Sea Grant Coastal Specialist is leading a socioeconomic study of the commercial fishery for California halibut in partnership with the commercial fishing community, state fisheries managers, and Sea Grant colleagues. The project's focus is on the human system — the players, places and processes — that interact with the fishery's ecological system. The project team is collecting and analyzing information from the literature, fishery landings data, and individuals knowledgeable of the fishery to develop a well-grounded description of the fishery and its dynamics over the past 15 years. Together they are identifying factors that explain variability and change in the fishery over time. Their initial results will be vetted and refined with a larger group of participants in the commercial California halibut fishery before the final results are made public. The team also is developing and evaluating a collaborative process for documenting, evaluating and predicting change in the fishery's human system that can be adapted for use in other fisheries. A final summary report will be posted on the California Sea Grant and California Department of Fish and Wildlife websites.

Cooperative tagging and tracking of yellowtail to assess recruitment and residency in the Southern California Bight

R/OPCCFRW-9MG; July 2013 – December 2015*

Stuart Sandin, UC San Diego/Scripps Institution of Oceanography, 858.534.4150, ssandin@ucsd.edu

Noah Ben-Adereta, UC San Diego/Scripps Institution of Oceanography, 858.248.0884, nbenader@ucsd.edu

Yellowtail are a highly sought after trophy fish, whose basic life history characteristics are poorly understood. To enable sustainable, long-term management of the popular sport fishery, this project seeks to gather quantitative movement pattern data on this economically important species', with an emphasis on its movements around several of the region's new marine protected areas. The tagging and tracking data that will be gathered in this project collaboratively with anglers will focus on two main questions: 1) whether there is a resident year-round "home guard" yellowtail population in San Diego, and 2) whether these fish are successfully spawning locally. The data will help researchers interpret spatial patterns of catch inferred from historical angler catch records and provide a robust dataset for future management decisions. In addition, the project's findings will set a precedent for the study of movements and interactions of highly mobile species within California's new marine reserves.

Crowd Sourcing Essential Fishery Information for California halibut

R/OPCCFRW-11MG; Aug. 2013 – February 2015*

Lia Protopapadakis, Santa Monica Bay Restoration Foundation, 310.216.9826, lprotopapadakis@santamonicabay.org

Steve Santen and Bob Godfrey, Marina Del Rey Anglers

Kim Penttila, California Department of Fish and Wildlife

The goal of this project is to collect Essential Fishery Information from sport-caught California halibut (Paralichthys californicus). This data will contribute to improved sex-specific growth curves for the species and will aid in estimating sex-specific gear selectivity. The team will work directly with recreational fishermen and will charter a commercial passenger fishing vessel to gather additional data. Using a newly-developed, non-lethal method for determining the gender of a landed halibut, collaborators will also measure and weigh sub-legal fish. Legal-sized fish will also be measured and their otoliths (bone-like ear structures) will be collected to estimate their ages. Building on this work, the team plans to develop a citizen-science program using a web-based reporting platform for Santa Monica Bay and eventually throughout the species' range in California.

credit: Rick Starr, California Sea Grant Extension

Collaborative Research on Night Smelt

R/OPCCFRW-13MG; Feb. 2014 – March 2015*

Drew Barrett, HSU, drew_bar@msn.com

Adam Wagschal, H.T. Harvey & Associates

Mike Zamboni, Commercial Fisherman

The specific objectives of this research project are to form a collaboration between commercial fishermen, resource managers, and marine fisheries ecologists, to: 1) document locations of spawning events and characterize spawning habitat, 2) gather basic life history information on the spawning population of night smelt including measurements of sex, age, length, weight, and 3) examine bycatch in the commercial night smelt fishery landings. The commercial night smelt harvest typically occurs between January and August.

FELLOWSHIPS

Delta Science Fellows Program

Beginning in 2003, the Delta Science Fellows Program (previously known as the CALFED Science Fellows Program) has paired graduate students and postdoctoral researchers with Bay-Delta agency scientists and senior research mentors. Fellows work on collaborative data analysis and research projects applicable to the California Bay-Delta system under the mentorship of both agency and academic scientists. The program's goals are to invest in knowledge that will fundamentally advance the understanding of the complex environments and systems within the Bay-Delta system, to aid policy-makers and managers, and to train the next generation of research scientists for water issues in California. The funded projects for 2015 are listed below.

Modeling Wetland Plant Cover to Assess Ecosystems and Bird Habitats

R/SF-52; Oct. 2012–Jun. 2015*

Iryna Dronova, University of California, Berkeley, 734.272.3876, idronova@berkeley.edu

Imagine farmers growing crops not for food but to sequester carbon dioxide. Under the state's cap-and-trade program, such scenarios are possible, though there are many details to hash out – not the least of which is putting hard numbers to the carbon-credit value of different types of vegetation. In research that may help in this effort, the Delta Science Fellow is attempting to develop a method for calculating vegetative cover ("leaf area index") in key wetlands of the Sacramento- San Joaquin River Delta, using NASA Landsat satellite images. Her work to date has focused on collecting fish-eye images and light-intensity readings of plant communities at freshwater marshes on Twitchell Island and Sherman Island and tidal wetlands at Suisun Marsh. From these data, she is able to calculate local estimates of leaf area index. At present, these field estimates of leaf area index are being compared to Landsat satellite-based metrics for the same areas, and preliminary results indicate significant correlations between field and satellite estimations. Once the techniques for estimating LAI from satellite data are refined, scientists will be able to use the Landsat images to reconstruct vegetative cover and density over a 30-year period for the entire delta. This reconstruction will facilitate an ongoing NASA-funded study to quantify net carbon fluxes in wetlands in the delta. Other applications of the project include being able to better monitor trends in wetland bird habitat quality and recovery trajectories for various habitat restoration projects.

Research mentor: Peng Gong, Department of Environmental Science, Policy, and Management, UC Berkeley Community mentor: Kristin Byrd, USGS Western Geographic Science Center

The Loss of Marshes in the Delta, Has It Changed the Base of the Food Web?

R/SF-54; Mar. 2013–Jun. 2015*

Emily Howe, UW, 206.384.2059, ehowe2@uw.edu

Has habitat loss altered the base of the food web in the Sacramento-San Joaquin River Delta? This project seeks to test the hypothesis that the primary source of carbon (energy) at the base of the food web has shifted from plant detritus to phytoplankton, as wetlands and their marsh plants have been destroyed. As a result, the food chain has become structured around pelagic food web dynamics and is yet one more symptom of ecosystem degradation. To investigate these ideas, the Delta Science Fellow is using stable isotope and fatty acid biomarkers to: 1) identify the origin, transport and fate of organic debris in the delta and Suisun Bay, and 2) investigate the role of this debris in supporting key invertebrate prey organisms in tidal marshes and other shallow-water ecosystems. Ultimately, she would like to evaluate implications of freshwater discharges on these processes and investigate the connection between marsh ecosystems and aquatic food webs. Findings will be of relevance to wetland restoration planning.

Research mentor: Charles Simenstad, School of Aquatic and Fisheries Sciences, College of Ocean and Fishery Sciences, University of Washington

Community mentor: Robin Stewart, USGS, Menlo Park; and Steve Culberson, US Fish and Wildlife Service

Salinity Tolerances and Biomarkers of Salt Stress in Longfin and Delta Smelt

R/SF-55; Jan. 2013–June 2015

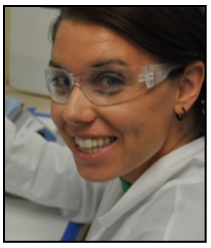
Brittany Kammerer, UC Davis, (206) 940.7537, bdkammerer@ucdavis.edu

This project seeks to identify salinity tolerances of two listed fish species – longfin smelt and delta smelt. Experiments focused on newly hatched and post-45-day-old smelt. The work shows that both smelt species, at this age, are able to survive and grow in salty waters. The Delta Science Fellow also conducted experiments on adult delta smelt. These experiments looked at how changes in water salinity might affect delta smelt's responses and physiology, in order to determine if salinity toler-

ance influences their presence in the low salinity zone (<6ppt), where fluctuations are common. Part of this project is to identify biomarkers through fluorescent staining of gill cells and acclimatory responses of salinities from ≤6 ppt to 10 ppt. Physiological responses and biomarkers may provide scientists and managers a means to monitor species' exposures to different water salinities. Results from this project may further what is known about the species' life history requirements, particularly the timing and speed at which smelt can transition from fresh to saline conditions.

Research mentor: Swee Teh, UC Davis

Community mentor: Randall Baxter, California Department of Fish & Wildlife



Understanding the Impacts of Climate Change on Delta Smelt

R/SF-56; Sep. 2012–Aug. 2015*

Lisa Komoroske, UC Davis, 716.912.4656, lmkomoroske@ucdavis.edu

Climate change is expected to change both water temperature and salinity regimes in the San Francisco Estuary-Delta. This project examines potential consequences of climate change to the endangered delta smelt at multiple biological scales. In the project's first year, laboratory experiments were conducted to determine the species' thermal and salinity tolerances and physiological responses to warm and salty waters. Interestingly, delta smelt had lower temperature tolerance with age, and were able to survive across a broad range of salinities. The Fellow has developed a microarray for the delta smelt's "transcriptome," the small percent of the genome that is involved in making proteins. This lab-on-a-chip was then used to document normal levels of gene expression and how they change as water temperatures and salinities approach tolerance thresholds. Results indicate that coordinated expression changes in a large number of genes serve to respond to salinity and temperature stress, and that delta smelt experience sublethal stress well below their tolerance limits. Examining different life stages of Delta Smelt and comparing their responses to water temperatures in the Delta, Komoroske and her colleagues discovered that juvenile smelt are likely to be the stage most vulnerable to climate change. This is in part because Delta Smelt often have a one year life cycle, and the juveniles are the stage that occur in the late summer and early fall when water temperatures are highest. This research has been published in Conservation Physiology (Komoroske et al., 2014), and the Fellow is now collaborating with the U.S. Geological Survey to understand what this means for delta smelt future habitat suitability in the Delta under different climate change scenarios. Overall, the Fellow's work will shed light on how, or whether, climate change might alter fish habitat quality and in this way help managers prioritize conservation strategies.

Research mentor: Nann A. Fangue, Wildlife, Fish and Conservation Biology, UC Davis

Community mentor: Gonzalo Castillo, U.S. Fish & Wildlife Service

How Hydrologic and Geomorphological Processes in Gravel-Bed Rivers Sustain Chinook Salmon Spawning Habitat During Managed Flow Regimes

R/SF-59; Oct. 2013 – Sept. 2015

Erin Bray, post-doctoral researcher, UC Santa Barbara and UC Berkeley, ebray@bren.ucsb.edu, 805.618.8851

Chinook salmon begin and end their lives in the gravel-bottomed upland reaches of rivers, and it is believed that suitable habitat for salmon eggs occurs along stretches of gravel with good groundwater and surface-water exchange. A main goal of this project is to figure out how to predict the locations of where this exchange occurs. To do this, the fellow will study the effects of stream-flow releases and sediment characteristics on flows between river channels and groundwater aquifers. Among the questions that will be addressed in the projects early stages are: How does the geometry of gravel bars vary between natural, flow-altered and engineered gravel bars? What are the hydrologic implications of the observed geometry of gravel bars? And, what is the form and function of bend-bar morphology in terms of infiltration and seepage patterns, as it relates to suitable salmon spawning habitat? Findings are of relevance to identifying ways to restore spawning habitat for Chinook salmon through actions, such as gravel augmentation and altered managed flows.

Research mentor: Thomas Dunne, UC Santa Barbara

Community mentor: Erin Rice, U.S. Bureau of Reclamation

Using Genomics to Explore the Physiological Effects of Elevated Water Temperature on Bay-Delta Fish

R/SF-60; Sept. 2013 - Aug. 2015

Kenneth Jeffries, post-doctoral researcher, UCDavis, kenmjeffries@gmail.com, 530.752.4680

Scientists expect that climate change will increase San Francisco Bay's water temperatures, potentially degrading habitat for species with preferences for cooler conditions. In the project's first year, the fellow plans to document the thermal tolerances of three fish species in the bay: delta smelt, longfin smelt and inland silverside. Both smelt species are native fishes experiencing dramatic population declines, while the inland silverside is an abundant, exotic species with a high tolerance for a range of environmental

conditions. In the project's second stage, the fellow will attempt to identify the genes activated by thermal stress and will use these genes to develop an assay for assessing thermal stress levels in wild fish that might not have any outward signs of physiological distress (such as lower growth rates). Findings from this project will help identify species-specific biomarkers of thermal stress for long-term ecosystem management under climate change scenarios.

Research mentor: Richard Connon and Nann Fangue, UC Davis

Community mentor: Ted Sommer, Department of Water Resources, California Natural Resources Agency

Scaling of the Portfolio Effect in Central Valley Chinook Salmon: Trends and Implications

R/SF-61; Jul. 2014 – Dec. 2015

Anna Sturrock, post-doctoral researcher, UC Berkeley, a.sturrock@berkeley.edu, 510.423.2210

Is bigger always better? Recently published research suggests that bigger out-migrating young salmon are more likely to survive poor ocean conditions than smaller salmon of about the same age. But, does this size advantage hold true for all salmon populations under all freshwater conditions? The fellow will explore this question for juvenile Chinook salmon in the Central Valley. Abundance and size data from juveniles exiting their natal rivers and caught in traps will be analyzed and compared with size-at-outmigration reconstructions of adults that returned to their natal rivers to spawn, to see who really survives. The reconstructions will be based on analyses of otoliths (earbone-like structures) collected during salmon carcass surveys. Strontium isotope signatures in the otoliths will be used to determine where a fish was born, its size upon leaving its natal stream and upon entering the ocean. Scientists will compare patterns across a range of spatial and temporal scales (rivers, basins, runs, years and hydrologic regimes) to explore the importance of size-selective mortality and life-history diversity for juvenile salmon in the Central Valley. Results will be evaluated in the context of the portfolio effect, which argues that maintaining multiple and diverse salmon stocks will dampen boom-bust cycles in adult salmon returns and increase population persistence.

Research mentor: Stephanie Carlson, University of California Berkeley

Community mentor: Rachel Johnson, National Marine Fisheries Service

Testing the Interactions Between Invasive Perennial Pepper Weed and Ecosystem Function in Tidal Marshes of the San Francisco Bay-Delta

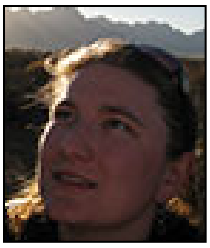
R/SF-63; Sept. 2013 - Aug. 2015

Rachel Wigginton, doctoral student, UC Davis, rdwigginton@ucdavis.edu, 714.394.2792

This project will explore the ecological role and impact of a highly aggressive, non-native plant in the mustard family, known as perennial pepper weed (Lepidium latifolium). Native to Europe and Central Asia, the noxious weed has invaded sensitive tidal wetlands of the San Francisco Bay-Delta and Suisun March, elbowing out native marsh plants, including the endangered endemic soft-bird's beak. The core of the project will be a series of field-manipulation experiments, in which pepper weed densities are varied in plots with naturally occurring native plant communities to evaluate the weed's ecological consequences at various stages of invasion. Experiments will seek to quantify the weed's impact on carbon storage, marsh plant productivity and food webs at sites with different salinity exposures. Findings may provide important insights into cost-effective control strategies for the weed and their implications for marsh restoration.

Research mentor: Ted Grosholz, UC Davis

Community mentor: Brenda Grewell, USDA



Optimizing Salt Marsh Harvest Mouse Conservation Through an Investigation of Demography, Habitat Use and Multi-Species Management

R/SF-64; Sept. 2013 – Oct. 2015

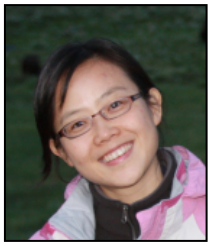
Katherine Smith, doctoral student, UC Davis, ratsmith@ucdavis.edu, 530.400.7729

The salt marsh harvest mouse (Reithrodontomys raviventris) is the world's only land mammal found exclusively within coastal marshes. Amazingly adapted to coastal living, the small mammal can swim (yes, swim), drink salt water, and climb pickleweed to evade high tide. This project explores novel approaches to helping the endangered species thrive within San Francisco Bay's small, highly fragmented marshes, further threatened by sea level rise. To do this, the fellow is live-trapping, radio-collaring and monitoring the mice at six sites within Suisun Marsh monthly. Three of the study sites are managed to enhance duck hunting. The other three sites are natural tidal wetlands. A main goal of the project is to establish population sizes of the mice at the six study sites and to figure out where mice go when the managed wetlands are flooded to create duck ponds for hunters. Her work will document much needed basic biological information on the species, such as its home range size, longevity, feeding habits and reproductive cycles. Finding may illuminate ways to rebuild mice

populations, protect coastal wetlands and enhance duck populations, as other research has suggested that larger mice populations can reduce predation on duck eggs and chicks.

Research mentor: Doug Kelt, UC Davis

Community mentors: Steve Culberson and Michael Chotkowski, U.S. Fish and Wildlife Service, and Laureen Barthman-Thompson, California Department of Fish and Wildlife



How do Shallow-Water Habitats Work? Using Smart Drifters to Understand How Flow and Geomorphology Interact to Establish High-Quality Habitats

R/SF-65; Sept. 2013 - Aug. 2015

Qingfang Wu, post-doctoral researcher, UC Berkeley, qingfangwu@berkeley.edu, 510.387.0078

A UC Berkeley research team has built a fleet of floating robots that can be deployed in estuaries and rivers to track water movements and monitor various aspects of water quality. The drifters, officially called the Floating Sensor Network, are equipped with sensors that measure position (GPS), water turbidity, chlorophyll, salinity, and water temperature. For this project, the fleet of mobile sensors will be deployed in the Liberty Island wetland to better understand processes that affect phytoplankton abundances and the transport of phytoplankton produced in wetlands to open-water (pelagic) food webs. Understanding how tidal flows affect mixing and dispersion of water properties and phytoplankton is also a major focus of the project. The project's three main objectives are to: 1) quantify effects of shallow-water flows through wetlands on water cloudiness (turbidity), chlorophyll (a measure of phytoplankton abundance), salinity and water temperature; 2) correlate drifter trajectories (i.e., water movements) to phytoplankton abundances, and 3) identify wetland features that encourage the transport of phytoplankton into the San Francisco Bay-Delta's open waters. Findings should help identify wetland designs that would be most effective at creating habitats to support the pelagic food web.

Research Mentor: Alexandre Bayen, University of California Berkeley

Community mentors: Brian Bergamaschi, Research Chemist, USGS and Tamara Kraus, Soil Scientist, USGS

Using Hyperspectral Remote Sensing to Map Methylmercury Concentrations in the San Francisco Bay-Delta

R/SFJPL-66; Jan. 2014 - Dec. 2015

Cédric G. Fichot, post-doctoral researcher, Caltech, cgfichot@gmail.com, 706.254.1629

Sediment-bound mercury in the foothills of the Sierras – the legacy of the Gold Rush – is an ongoing source of the toxic heavy metal in the San Francisco Bay-Delta. This project seeks to demonstrate the ability to estimate surface concentrations of mercury's toxic bioavailable form (methylmercury) based on the optical properties of methylmercury-containing organic material, as measured by NASA's Portable Remote Imaging Spectrometer (PRISM) sensor, developed by NASA's Jet Propulsion Laboratory. The fundamental premise of the research is that methylmercury, when bound to organic material in the water column, will have a uniquely defining spectral fingerprint. For this project, the PRISM sensor will be mounted on an airplane and flown over the Bay-Delta multiple times to obtain data on water color (reflectance) at 1- to 2-meter resolutions. The precise number of flights will depend on funding; however, the goal is to survey the region seasonally, before and after large rainfall events, and over a tidal cycle. The fellow will develop an algorithm for estimating methylmercury concentrations and will test and validate it with direct field measurements. If the algorithm proves reliable, the fellow will use the reflectance data to monitor the effects of wetland restoration, periodic flooding of rice fields and precipitation on methylmercury concentrations. The remote sensing data will also be used to quantify the photochemical degradation of methylmercury.

Research mentor: Michelle Gierach, NASA's Jet Propulsion Laboratory

Community mentors: Brian Bergamaschi and Michael Sauer, U.S. Geological Survey

Using Advanced Radar Remote Sensing Techniques to Measure Subsidence and Levee Instability in the Sacramento-San Joaquin Delta

R/SFJPL-67; Sept. 2013 - Aug. 2015

Priyanka Sharma, Postdoctoral Researcher, Jet Propulsion Laboratory/California Institute of Technology, priyanka.sharma@jpl.nasa.gov

Nearly a quarter of California's fresh water supply flows through the Sacramento-San Joaquin Delta, an area comprised of tidal marshland and reclaimed land in the form of approx. 60 islands surrounded by 1700 km of levees. Maintaining the integrity of the Delta levee system is critical to protecting the state's primary water supply and the overall economic and environmental health of the region. Land subsidence within the Delta poses a serious challenge to maintaining the delicate ecosystem and integrity of the water supply. Land subsidence behind the levees increases the stress from the water in the channels and can lead to levee failure or cause water seepage. The focus of this study is to determine the cumulative subsidence and subsidence rates and investigate subsidence along levees across the Sacramento-San Joaquin Delta.

We use data from NASA's Uninhabited Aerial Vehicle Synthetic Aperture Radar (UAVSAR), collected at 40-day average interval from July 2009 through the current day. UAVSAR is an L-band SAR designed for differential interferometry (InSAR) and has sufficient resolution (~7 m product ground resolution) to resolve the levees from the surrounding area. The results of this project will be of value to both risk management associated with maintaining the levees in the area and to long-term plans for providing a more reliable water supply for California.

Research mentor: Dr. Cathleen E. Jones, NASA Jet Propulsion Laboratory

Community mentor: Joel Dudas, California Department of Water Resources

Seismic Deformation Potential of Peaty Organic Soils Underlying Delta Levees

R/SFDWR-68; Sept. 2013 – Aug. 2015

Ali Shafiee, doctoral student, UCLA, ashafiee@ucla.edu, 858.210.2029

The Delta Science Fellow leading this project will study the post-earthquake volume change (settlement) of peaty soils. Peaty soils are associated with wetlands and contain high amounts of partially decomposed plant debris. These soils underlie many of the region's earthen levees and their deformation potential is an important factor in seismic hazard assessment. Though the engineering community is well aware of this mechanism's importance, most previous studies have focused on understanding the post-seismic response of "traditional" soils such as clay and sand. This project will fill a much needed gap in the ability to evaluate levee stability following the next "big one" by looking more closely at peaty soil dynamics. In the project's first year, the fellow will conduct laboratory tests on peaty soil samples gathered from Sherman Island, the site of a field-scale model levee test in 2011 and 2012, to measure their seismic deformation potential and cyclic deformation potential. The fellow will utilize a digitally controlled simple shear device, recently modified to perform cyclic shearing under realistic field conditions during and after an earthquake. These modifications will greatly enable relevant soil testing. Findings will further refine and improve seismic hazard assessment within the geologic context of the delta.

Research mentor: Scott Brandenberg, UCLA

Community mentor: Curtis Schmutte, professional engineer and consultant

2015 NMFS—Sea Grant Fellowship Program in Population and Ecosystem Dynamics & Marine Resource and Economics

NOAA Fisheries and the National Sea Grant Office jointly offer Graduate Fellowships in Population Dynamics and Marine Resource Economics. Fellows - all doctoral students - are selected through a national competition to study topics of relevance to fisheries management under the guidance of NOAA Fisheries scientists. Research conducted during the fellowships is consistent with NOAA's mission to "protect, restore and manage the use of coastal and ocean resources through ecosystem-based management." The funded projects for 2015 are listed below.

Propagation of Environmental Variability Across Trophic Levels: How Biological and Ecological Factors Influence Sensitivity of Communities to Climate and Fishing

E/PD-10; Jun. 2012–May 2015*

Lewis Barnett, UC Davis, 530.665.0019, labarnett@ucdavis.edu

Climate change may exacerbate year-to-year fluctuations in fish stock sizes, and if this occurs, managers will be faced with new challenges. This project aims to identify management techniques that might "undo" some of these climate-related effects and thus dampen swings in fish population sizes and protect the structure of natural food webs. In work to date, the fellow has been identifying data sources for a model that will be used to simulate the effects of climate change on fish stocks. He and his colleagues are especially interested in understanding how climate-driven variability in the size of one fish stock will affect stock sizes at higher and lower levels of the food chain. The case study for the model's development will look at interactions between hake (whiting), forage fishes (anchovies, herring and sardines) and krill.

Development of a Novel Nested Patch Occupancy Model Applied to River Network Data

E/PD-11; Jun. 2013-May 2016

Lynn Waterhouse, SIO/UCSD, lwaterho@ucsd.edu

Efforts are underway to rebuild Chinook salmon and steelhead populations in the Columbia River basin in Washington through hatchery and habitat-restoration programs.

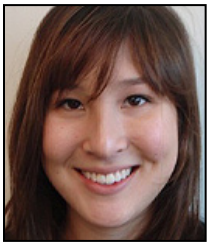
To assist with these recovery efforts, groups have been tagging and tracking millions of salmon and steelhead through the elaborate Pacific Northwest river system, with a technology similar to pet microchipping, known in science circles as passive integrated transponder (PIT) tags. This project seeks to "get more" from existing PIT-tagging data, using advanced mathematical and statistical methods. The goals include being able to improve methods for modeling fish movement patterns through river systems and for estimating the numbers of fish returning to specific river areas. This type of information will help scientists identify, or further verify, habitat areas that should be prioritized for restoration. Other benefits of the project include being able to potentially optimize the deployment of in-river fish detection stations – to lower project costs and reduce the number of fish that need to be implanted with tags. This would have the added benefit of reducing tagging-related fish mortalities. Though the model is being applied to salmon and steelhead in the Columbia River basin, the method under development may be adapted to other species in other river systems.

Quantifying the interactive effects of ocean acidification, temperature change, and fishing behavior on population dynamics and management decisions

E/PD-12; Jun. 2014-May 2016

Allison Dedrick, UC Davis,
agdedrick@ucdavis.edu

Ocean acidification (OA) and changing temperatures could alter the spatial distribution and sustainability of marine invertebrate populations, including for commercially and ecologically important species. Larvae in particular are vulnerable to OA and temperature changes and are the primary mode of connectivity among population patches of sedentary adults. The Fellow will use spatial and bioeconomic modeling to predict the interactions of OA, temperature and fishing for two populations: the commercially fished Atlantic sea scallop (Placopecten magellanicus) on the east coast and the recreationally fished red abalone (Haliotis rufescens) on the west coast. By incorporating fishing and bioeconomic data into a population model, the Fellow will be able to produce a range of possibilities of how these effects might play out in real-world fisheries, helping to direct future data collection or management decisions.



Developing a new ecosystem-based management approach: using ecosystem models to calculate a better estimate of population scale for single-species models

E/PD-13; Jun. 2014-May 2017

Laura Urbisci, UC Santa Barbara,
lurbisci@bren.ucsb.edu

The single-species models used to manage quotas for individual fishery stocks rely heavily on estimates of population "scale" (abundance). For apex predators such as tunas, sharks and swordfish, estimates of virgin stock biomass are difficult to generate because their population scale is heavily dependent on the state of the ecosystem, including prey availability, primary production and environmental factors. Apex predators are also more susceptible to overfishing. The Fellow will compare the results of two population models for common thresher sharks (Alopias vulpinus), a migratory apex predator with considerable uncertainty in their stock status. The first model will be a traditional fisheries single-species dynamic model. The Fellow will then develop a second model that includes non-traditional data and ecological processes. Comparing the two models will identify the key drivers of population dynamics, strengths and shortcomings for each approach. The Fellow will also identify methods to utilize ecosystem-level data to generate more robust estimates of population scale for use in single species stock assessment.

Quantifying the roles of environmental variability and the portfolio effect in the population dynamics of the Sacramento River Fall Chinook salmon stock

E/PD-14; Jun. 2014-May 2016

Lauren Yamane, UC Davis,
layamane@ucdavis.edu

In 2007, low returns of Sacramento River Fall run Chinook (SRFC) to spawning grounds prompted the closure of the state's largest salmon fishery. Examination into the cause of low escapement suggested that although the proximate cause was poor ocean conditions, the ultimate cause was diminished genetic and life history diversity among the populations comprising the stock. The Fellow will evaluate how much increased life history diversity could have reduced variability at the aggregate stock level through a maximized portfolio effect and whether that would have prevented closure of the SRFC fishery. She will also explore an alternative mechanism of greater stock variability through a strengthened cohort resonance effect. The cohort resonance effect quantifies population sensitivity to a varying environment and is magnified by decreased survival from fishing. By modeling and comparing the impact of these effects on overall stock variability, the Fellow will develop a better understanding of the underlying mechanisms and management actions that have the potential to stabilize the SFRC stock and other fisheries under changing environmental conditions.

Efficiency Costs of Restrictions in Tradable Permit Programs: Analysis of the Alaskan Halibut and Sablefish Individual Fishing Quota System

E/MRE-7; Jun. 2012–May 2015*

Kailin Kroetz, UC Davis, 603.219.6933, kkroetz@ucdavis.edu

The Alaskan halibut and sablefish fishery is currently managed under a "catch-shares" program, known as an individual transferable quota (ITQ). Loosely speaking, ITQs grant quota holders "rights" to catch a certain amount of fish and to buy and sell quota, much as stocks are traded. To meet certain social goals, however, ITQs are not purely free-market-based and are often established with restrictions on who can trade with whom and own quota. With the halibut/sablefish fishery, for example, smaller vessels must maintain a certain amount of the total quota, and there are limits to corporate ownership and consolidation. Though these rules keep more boats on the water, they also decrease the fishery's economic efficiency. The goal of this project is to develop a model that can quantify the costs of these inefficiencies for the halibut and other ITQ fisheries. In the project's first year, a preliminary model was developed and is now being fine-tuned. Results from this project are relevant to fishery managers and can be used to inform the design of new catch-shares programs.

Forecasts and Adaptation of Tuna Fisheries in Response to El Niño Southern Oscillation

E/MRE-8; Jun. 2014-May 2016

Jeffrey Shrader, UCSD, jgshrade@ucsd.edu

Because of the sensitivity of tuna fisheries to temperature, medium and long-term climate changes create potential challenges for future catch and fishery sustainability. Moreover, since many tuna fisheries operate on the high seas, individual actions by captains and fishermen are the primary method for mitigating damages from these environmental processes. An effective way to reduce damages from these environmental risks might be to provide harvesters with information about potential damages, allowing them to adapt to the risky processes by adopting behaviors that mitigate those risks. Using data from the North Pacific albacore fishery and Western and Central Pacific purse-seine tuna fishery, the Fellow will estimate the degree to which adaptation reduces damages from medium-term climate fluctuations caused by El Niño/Southern Oscillation (ENSO). He will, (1) estimate the extent that ENSO forecasts reduce fishery damages; (2) Calculate the value of forecasts; (3) Investigate the behavioral changes of fishermen in response to forecasts; and (4) Model whether behavior changes are a result of self-learning or forecasts. The project will ultimately shed light on how adaptation is achieved, the degree to which adaptation can reduce damages from environmental processes, and the potential for providing centralized climate information to engender adaptation.

2015 Knauss Sea Grant Fellows

The federal Knauss Marine Policy Fellowship Program matches highly qualified graduate students with hosts in the legislative branch, the executive branch, or appropriate associations/institutions located in the Washington, DC area for a one-year paid fellowship.

Amy Bowman – NOAA Fisheries' Office of Science and Technology (US DOC, NOAA)

Eliot Crafton – U.S. Representative Lois Capps - California (US DOC, NOAA)

2015 California Sea Grant State Fellows

Modeled after the highly successful Knauss Marine Policy Fellowship Program, the State Fellows Program provides an opportunity to acquire "on the job" experience in the planning and implementation of marine and coastal resource policies and programs in the state of California. The program matches graduate students and recent graduates with "hosts" in state or federal agencies in California for a one-year paid fellowship.

Alisan Amrhein – CA Department of Fish and Wildlife Marine Region

Annalisa Batanides – NOAA Fisheries West Coast Region, Aquaculture

Jocelyn Christie – CA Coastal Conservancy South Coast Program

Lauren Garske – CA Coastal Commission

Maya Haden – NOAA Sentinel Site

Morgan Ivens-Duran – CA Ocean Protection Council #2

Daniel Livsey – Delta Science Program, Science Plan

Brenna Mahoney – CA Coastal Conservancy Climate

Jonathan "Toffer" MacKay – CA Department of Fish and Wildlife Aquaculture Program

Elena Perez – CA Coastal Commission

Heather Perry – San Francisco Bay Conservation and Development Commission

Nicole Russell – CA State Lands Commission

Nick Sadrpour – CA Ocean Protection Council

Kim Tenggardjaja – State Water Resource Control Board, Division of Water Quality

Morgan Visalli – NOAA Channel Islands National Marine Sanctuary Resource Protection Program

Sean Windell – Delta Science Program Interagency Ecological Program

TBD - Delta Science Program Independent Science Board

CALIFORNIA SEA GRANT COMMITTEES

SEA GRANT ADVISORY BOARD

This board represents the marine community of California and advises the director of the California Sea Grant College Program on research, education and outreach activities of the program.

- Jim Eckman - Sea Grant Director
- Jim Harvey - Moss Landing Marine Lab Director
- Diane Pleschner-Steele - California Wetfish Producers Director
- Toby Garfield - NOAA Southwest Fisheries Director
- Steve Weisberg - Southern California Coastal Water Research Project
- Randy Lovell - California Department of Fish and Wildlife Aquaculture Coordinator
- Douglas Bartlett - Scripps Institution of Oceanography Professor
- Amber Mace - California Council on Science and Technology Deputy Director
- Andy Cameron - Cal Tech Senior Research Associate in Biology
- Gary Griggs - UCSC Institute of Marine Sciences Director
- Gary Cherr - UC Davis Bodega Marine Laboratory Director
- Craig Shuman - California Department of Fish and Wildlife

RESOURCES AGENCY SEA GRANT ADVISORY PANEL

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

- Charles Lester - Executive Director, California Coastal Commission
- Clif Davenport - Senior Engineering Geologist
- Debbie Aseltine-Neilson - Senior Marine Biologist Specialist, California Department of Fish and Wildlife
- Dirk Rosen - Executive Director, Marine Applied Research & Exploration (MARE)
- Jennifer DeLeon - Senior Environmental Scientist, Division of Environmental Planning and Management, State Lands Commission
- Jim Moffett - Professor of Biological Sciences, Earth Sciences and Civil and Environmental Engineering, University of Southern California
- Katcho Achadjian - Assembly Member, California Assembly District 35
- Lesley Ewing - Senior Coastal Engineer, California Coastal Commission
- Margy Gassel - Scientist, Office of Environmental Health Hazard Assessment
- Mariela Paz Carpio-Obeso - Ocean Standards Unit Chief, State Water Resources Control Board
- Mark Johnsson - Geologist, California Coastal Commission
- Nann A. Fangue - University of California, Davis, Department of Wildlife, Fish and Conservation Biology
- Robert Brodberg - Chief, Fish & Water Quality Evaluation, Office of Environmental Health Hazard Assessment
- Ron Flick - University of California, San Diego, Scripps Institution of Oceanography
- Steven N. Murray - Professor, Biology, California State University, Fullerton
- Susan Hansch - Chief Deputy Director, California Coastal Commission

CALIFORNIA SEA GRANT PERSONNEL

ADMINISTRATION

James E. Eckman, Director
p: (858) 534-4440
jeckman@ucsd.edu

Rose Madson, Business Manager
p: (858) 534-4601
rmadson@ucsd.edu

Roberto Chavez, Programmer/Analyst
p: (858) 534-4441
rachavez@ucsd.edu

Carol Bailey-Sumber, Proposal/Grants Analyst
p: (858) 534-7855
cbsumber@ucsd.edu

Tisha Salas, Fund Manager
p: (858) 534-0577
lsalas@ucsd.edu

Herminia Villalpando, Fund Manager
p: (858) 534-4442
hvillalpando@ucsd.edu

COMMUNICATIONS

Deborah Seiler, Communications Coordinator
p: (858) 246-1661
dseiler@ucsd.edu

Caitlin Coomber, Marketing Communications Specialist
p: (858) 534-0580
ccoomber@ucsd.edu

EXTENSION SPECIALISTS

Rick Starr
Moss Landing Marine Laboratories
8272 Moss Landing Road
Moss Landing, CA 95039
p: (831) 771-4442
rickstarr@ucsd.edu, starr@mlml.calstate.edu

Carolynn Culver
Marine Science Institute, University of California, Santa Barbara, CA 93106-6150
p: (805) 893-4530
cculver@ucsd.edu

Monique Myers
Marine Science Institute, University of California, Santa Barbara, CA 93106-6150
p: (805) 680-4141
mrmyers@ucsd.edu

Paul Olin
133 Aviation Blvd. #109, Santa Rosa, CA 95403
p: (707) 565-3449
polin@ucsd.edu

Jennifer O'Leary
Department of Biology, California Polytechnic University, San Luis Obispo, CA 93407
p: (805) 756-5389
joleary@ucsd.edu

Carrie Pomeroy
UCSC Center for Ocean Health, 100 Shaffer Road, Santa Cruz, CA 96060
p: (831) 459-4173
cpomeroy@ucsd.edu

Theresa Sinicrope Talley
Scripps Institution of Oceanography, University of California San Diego, La Jolla, CA 92093-0232
p: (858) 534-4600
tstalley@ucsd.edu

Joe Tyburczy
2 Commercial St. #4, Eureka, CA 95501
p: (707) 443-8369
jtyburczy@ucsd.edu