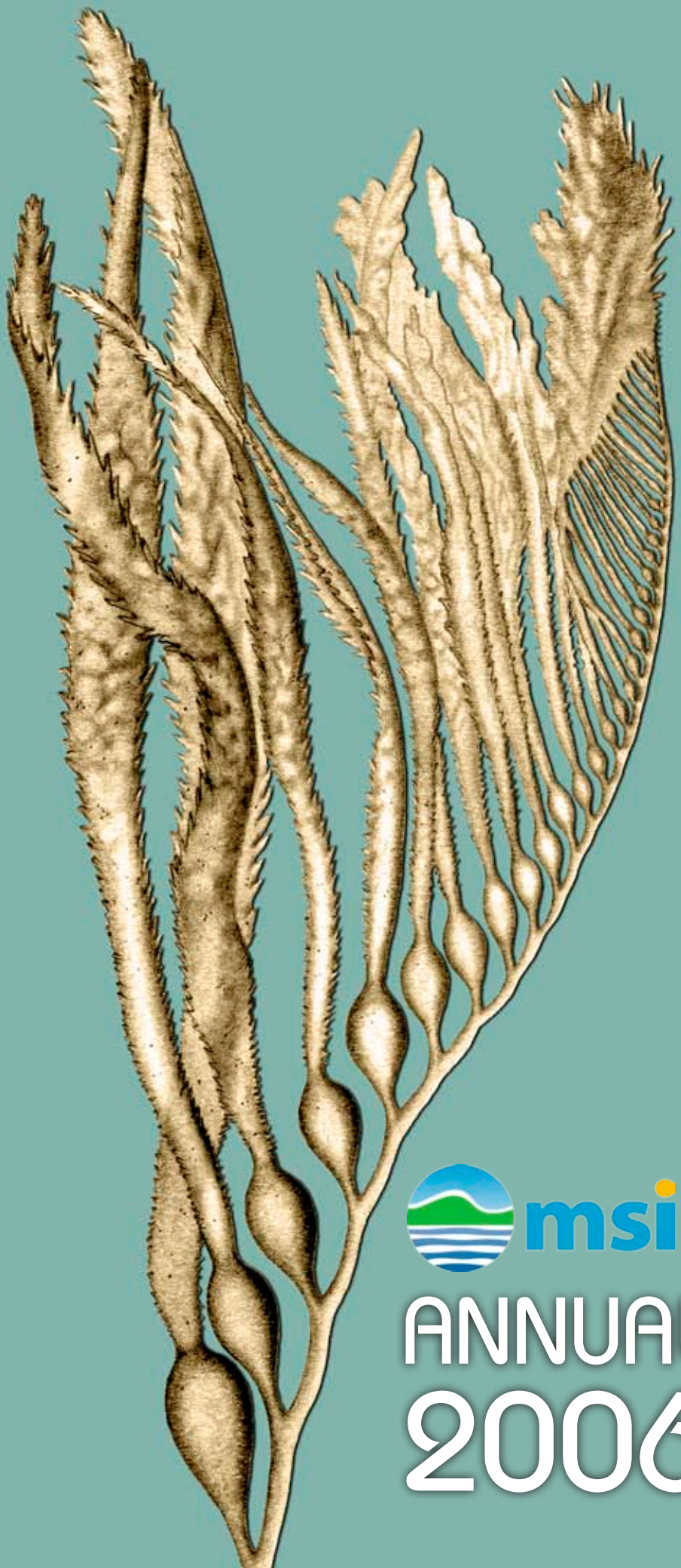

msi

ANNUAL REPORT 2006-2007

MARINE SCIENCE INSTITUTE

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Director's Statement

Director's Statement

Two years ago I wrote what I thought would be my last Director's statement for MSI. At that time our Director, Steve Gaines, was returning after serving as Acting Vice Chancellor for Research. As fate would have it, after one short year Steve Gaines has been called upon to serve as the acting Dean of the College of Mathematical, Life and Physical Sciences and I have returned as Acting Director of MSI. It is a pleasure to be back and to witness MSI's continued success and growth.

MSI's continues to attract highly creative and entrepreneurial researchers. One of our key assets is the Marine Science Research building which we have used strategically to support our researchers and to provide research space for multidisciplinary research programs led by MSI investigators. This strategy has been tremendously successful with much of MSI's recent growth has been from large multi-investigator research efforts that unite marine biology and engineering, marine science and nanotechnology and marine science with marine management. The interdisciplinary nature of the research at MSI is exemplified by the diversity of scientific disciplines represented by our investigators. At any one time researchers from 12 or more campus departments are conducting research through MSI and the addition of visiting scholars from national and international institutions adds to this mix. This diversity is one of our greatest strengths. It arises spontaneously from the cross-disciplinary research environment that exists at UCSB in general and that we strive to foster at MSI.

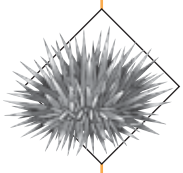
The success of our investigators has fueled the rapid growth of MSI in recent years. The total research dollars administered by MSI continues to grow and is approaching $100 million dollars with over $20 million in new grants received during each of the last two fiscal years. MSI now administers a record 289 awards. Our administrative staff continues to meet the challenges of our growth and provide superb service to our researchers. Without their dedication, MSI would not be the successful enterprise that it is. I would like to thank our staff, on behalf of all MSI investigators, for the excellent job that they do for MSI and for UCSB.

To give you a feel for the research conducted at MSI during the past year I will present a few highlights. Choosing these examples from the hundreds of research publications by MSI investigators is a daunting task and it is impossible to capture the total impact of MSI on marine science with just a handful of examples. My hope is that these will at least provide a flavor for the diversity of research being conducted through MSI. Todd Oakley, a faculty member in EEMB and MSI member, in collaboration with members of UCSB's Neuroscience Research Institute discovered significant clues into the origin of the nervous system through a comparative study of the genome of a marine sponge and higher animals that were published in PLose ONE, a public Library of Science Journal. MCDB faculty member and MSI member Kathy Foltz led a group that was part of an international consortium that sequenced and annotated the genome of the California purple sea urchin, Strongylocentrotus purpuratus. The new genome sequence is the first to be accompanied by a comprehensive analysis of when and where the genes are expressed. The results were published in the journal Science. MSI member Hunter Lenihan from the Bren School has been a leader in building and solidifying CALobster. The mission of CALobster is to advance research and education partnerships between fishermen, scientists, resource agencies, and environmental groups dedicated to generating democratic forms of resource management for California's lobster fishery. USGS researcher and MSI member, Kevin Lafferty, EEMB professor Armand Kuris and colleagues published their discovery that parasites have the potential to greatly alter marine food web structure in the Proceedings of the National Academy of Sciences. In particular, parasites in the Carpinteria Salt marsh greatly increase the connectance within the food web. Past food webs that have not included parasites may have resulted in a distorted view of the way food webs work in nature. Finally, last years report in Science by MSI Associate Research Geophysicist Doug Wilson and

colleagues describing their successful recovery of the first samples of gabbro from the upper crust of the Earth by drilling through the sea floor was chosen by Discover Magazine as one of the top eight publications in earth science for 2006, and finally the results of the NCEAS Working Group "Linking marine biodiversity to ecosystem functions and services" were published in Science and made an enormous media splash. The press release by the NSF announcing these findings has become the most downloaded press release from NSF's website of all time.

I look forward to the coming year and the continued success of MSI. It is a pleasure to serve MSI once more. My thanks to everyone whose efforts and talents make MSI such a vibrant institution.

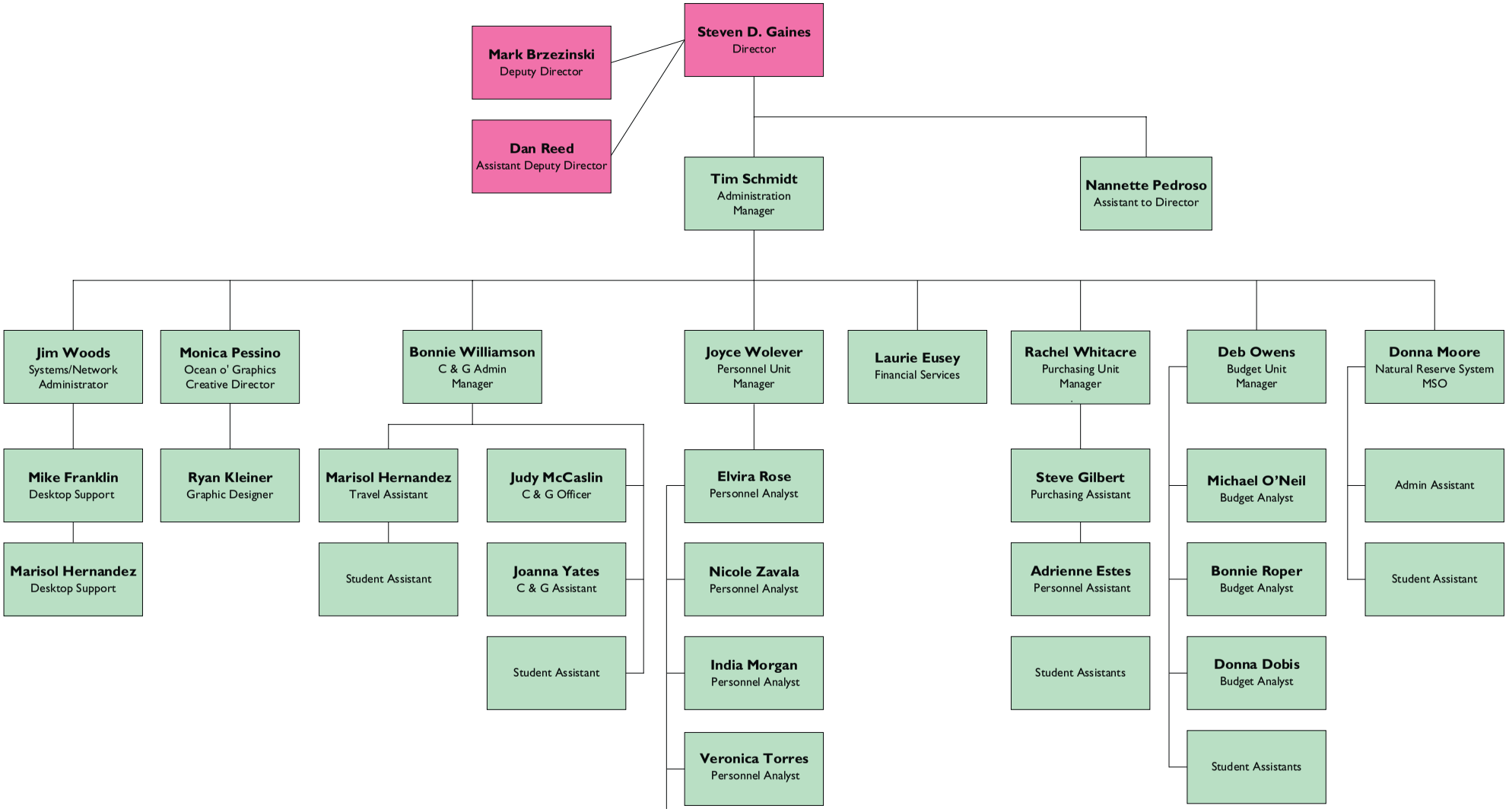
Mark Brzezinski
Deputy Director



Organizational Charts

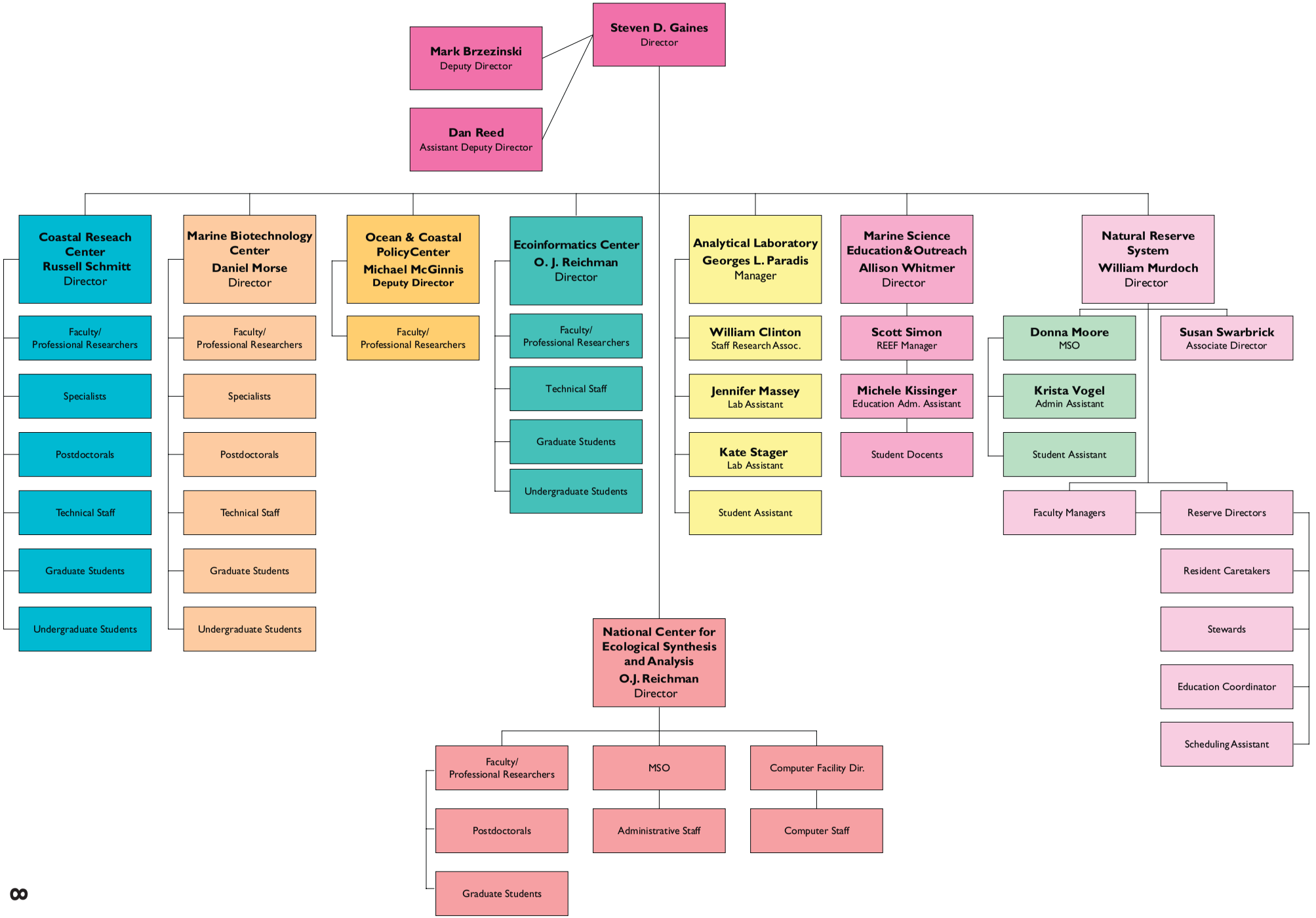
MARINE SCIENCE INSTITUTE

2006–2007 ORGANIZATIONAL CHART



MARINE SCIENCE INSTITUTE

2006–2007 ORGANIZATIONAL CHART



Other Projects & Activities

Seminars, Workshops, Conferences, and Meetings

The Marine Science Institute continues to support various seminars, workshops, conferences and meetings. During the 2006-2007 fiscal year 141 events took place, in which a wide range of marine science topics were highlighted.

Dates	Coordinator	Topic
June 25-July 1, 2006	Daniel Reed Carol Blanchette Allison Whitmer	7th International Temperate Reef Symposium
June 27-July 24, 2006	John Alroy Charles Marshall* Arnold Miller*	Paleobiology Database (Hosted by NCEAS) Working Group
July 1-3, 2006	Steven Gaines	Mellon Consortium
July 8-21, 2006	Evgeny Zilov* Marianne Moore* Stephanie Hampton	The 60-year data set of plankton dynamics in Lake Baikal: Examining facets of the jewel of Siberia Working Group
July 10-13, 2006	Charles Mitchell* Alison Power*	The roles of natural enemies and mutualists in plant invasions Working Group
July 25-27, 2006	Matthew Jones	Ecoinformatics Meeting
July 31-August 2, 2006	Matthew Jones Mark Schildhauer James Beach* Bertram Ludaescher* William Michener*	Science Environment for Ecological Knowledge (SEEK) (Hosted by NCEAS) Working Group
August 9, 2006	O.J. Reichman	Reception for NCEAS Alumni at the Ecological Society of America Meeting
September 5-7, 2006	O.J. Reichman Stephanie Hampton	NCEAS Science Advisory Board Meeting
September 7, 2006	EcoLunch Seminar Series	Walt Carlson: An empirical test of competition and keystone predation theory: A quest for the holy grail of relevant plant traits (Seminar)
September 8-10, 2006	John Alroy Charles Marshall* Arnold Miller*	Paleobiology Database (Hosted by NCEAS) Working Group
September 11-12, 2006	John Alroy Charles Marshall* Arnold Miller*	Paleobiology Database (Hosted by NCEAS) Working Group

* Non-UCSB personnel

September 13-17, 2006	Fiorenza Micheli* Andrew Rosenberg*	A synthetic approach to the science of ecosystem-based management of coastal marine ecosystems (EBM) Working Group
September 14, 2006	EcoLunch Seminar Series	Anne Salomon: Top down control leads to the alteration of a coastal ecosystem in Alaska (Seminar)
September 18-22. 2006	John Gamon* Faiz Rahman*	SpecNet Working Group
September 21, 2006	EcoLunch Seminar Series	Erica Fleishman: Using Science to Inform Conservation and Resource Management at NCEAS (Seminar)
September 25-27, 2006	Dov Sax* Steven Gaines Jay Stachowicz*	Exotic species: A source of insight into ecology, evolution, and biogeography Working Group
September 26, 2006	Jim Reichman	NCEAS welcome and update meeting
September 28, 2006	EcoLunch Seminar Series	Marjorie Brooks: Anthropogenic Stressors and Aquatic Ecosystems in the Colorado Rocky Mountains (Seminar)
October 2-6, 2006	John Drake* Bill Langford*	Machine learning for the environment Working Group
October 2-4, 2006	Steve Gaines	PISCO Advisory Committee Meeting
October 5, 2006	EcoLunch Seminar Series	Jonathan Chase: Community Assembly in Time and Space (Seminar)
October 4-7, 2006	Allison Whitmer	PISCO All Scientists Meeting
October 6-8, 2006	Nicholas Gotelli* Robert Colwell* Carsten Rahbek*	Synthetic macroecological models of species diversity Working Group
October 9-11, 2006	Steve Gaines	Science of Marine Reserves Meeting
October 12, 2006	Alison Whitmer	OCTOS Teachers Meeting
October 12, 2006	EcoLunch Seminar Series	Jim Lovvorn: Conserving a Top Predator by Studying a Marine Ecosystem (Seminar)
October 13-17, 2006	Daniel Doak* James Estes* Tim Wootton* Terrie Williams*	Conservation planning for ecosystem functioning: Testing predictions of ecological effectiveness for marine predators (EBM) Working Group
October 13-17, 2006	Robert Orth* William Dennison*	Global trajectories of seagrasses: Establishing a quantitative basis for seagrass conservation and restoration Working Group
October 17, 2006	Steve Gaines	CEQI: Coastal Environmental Quality Initiative Meeting
October 17, 2006	Stephanie Hampton	NCEAS Postdoctoral Training Workshop

* Non-UCSB personnel

October 19, 2006	EcoLunch Seminar Series	Pablo Marquet: Exorcizing Ecological Complexity: Towards an Ecology Based on First Principles (Seminar)
October 23-30, 2006	Brian McGill* Rampal Etienne* John Gray* Jessica Green*	Tools and fresh approaches for species abundance distributions Working Group
October 23-28. 2006	Mark Urban Mathew Leibold*	Evolutionary and ecological sorting in space Working Group
October 24, 2006	Allison Whitmer	LTER Science Task Force Advisory Committee Meeting
October 26, 2006	EcoLunch Seminar Series	Brian Enquist: A General Scaling Model for the Diversity of Plant Growth, Form, Function and Functional Trait Spectra (Seminar)
October 31- November 6, 2006	Jonathan Shurin* Helmut Hillebrand* Daniel Gruner*	Comparing trophic structure across ecosystems Working Group
November 1-3, 2006	O. Reichman	Knowledge and capacity-building to support ecosystem-based management (EBM) for sustainable coastal-marine systems Working Group
November 2, 2006	EcoLunch Seminar Series	Ransom Myers: The Global Loss of Top Predators in the Ocean: Consequences of a World Without Sharks, Tuna and Great Fish (Seminar)
November 2-5, 2006	Julia Koricheva* Jessica Gurevitch*	Meta-analysis in ecology: Lessons, challenges and future Working Group
November 6-9, 2006	Evan Preisser* Daniel Bolnick*	When, and how much, does fear matter? Quantitatively assessing the impact of predator intimidation of prey on community dynamics Working Group
November 9, 2006	EcoLunch Seminar Series	Dan Bolnick: A Rose is a Rose is a Rose, but is a Stickleback a Stickleback? (Seminar)
November 14-16, 2006	Russell Schmitt Sally Holbrook	Moorea Coral Reef LTER All Scientists Meeting
November 17-20. 2006	Patrick Christie* Richard Pollnac*	Governance feasibility of marine ecosystem-based management: A comparative analysis (EBM) Working Group
November 16, 2006	EcoLunch Seminar Series	Becky Thurber: Metagenomics as a Method for Investigating the Physiology and Ecology of Coral-Microbe Interactions (Seminar)
November 28, 2006	O.J. Reichman	Reception to honor NSF renewal

* Non-UCSB personnel

November 30, 2006	EcoLunch Seminar Series	Jake Goheen: MacArthur-Wilson and Community Equilibria: Testing for Local Saturation of Species Richness Using Long-term Data (Seminar)
December 4-6, 2006	Christopher Field* Josep Canadell*	Vulnerability of carbon in permafrost: Pool size and potential effects on the climate system Working Group
December 7, 2006	Allison Whitmer	OCTOS Teachers Group Meeting
December 7, 2006	EcoLunch Seminar Series	Marissa Baskett: Rapid Evolution, Community Shifts, and Marine Conservation (Seminar)
December 8-9, 2006	Stephanie Hampton	ESA Data Centers Workshop
December 11-15, 2006	Matthew Jones Mark Schildhauer James Beach* Bertram Ludaescher* William Michener*	Science Environment for Ecological Knowledge (SEEK) (Hosted by NCEAS) Working Group
December 14, 2006	EcoLunch Seminar Series	Mick Kronman: Critical Thinking in Marine Resource Management (Seminar)
January 8-10, 2007	Peter Kareiva	EPA Risk Analysis Working Group
January 11-12, 2007	Erica Fleishman	Steering committee, Wild Salmon Ecosystems Working Group
January 11-14, 2007	Kim Cuddington James Byers*	Habitat modification in conservation problems: Modeling invasive ecosystem engineers Working Group
January 11, 2007	EcoLunch Seminar Series	John Lambrinos: Patterns of Ecosystem Recovery Following Removal of an Invasive Wetland Grass (Seminar)
January 12-16, 2007	Robert Orth* William Dennison*	Global trajectories of seagrasses: Establishing a quantitative basis for seagrass conservation and restoration Working Group
January 18, 2007	EcoLunch Seminar Series	Neo Martinez: Dynamics of Complex Ecological Networks: Can Basic Understanding be Applied? (Seminar)
January 22, 2007	Steve Gaines	Sustainable Fisheries Project Meeting
January 22-26, 2007	Elise Granek* Evamaria Koch* Edward Barbier* David Stoms Shankar Aswani-Canela	Measuring ecological, economic and social values of coastal habitats to inform ecosystem-based management of land-sea (EBM) Working Group
January 24, 2007	Erica Fleishman Christopher Costello	Steering committee Sustainable Fisheries Project Meeting

* Non-UCSB personnel

January 25, 2007	EcoLunch Seminar Series	Sally Hacker: Differing Consequences of Ecosystem Engineering Invaders: Significance of Impact and Community Context to Restoration Potential (Seminar)
January 25-26, 2007	Erica Fleishman	Ecosystem-based Management Advisory Board Meeting
January 25, 2007	EcoLunch Seminar Series	Sally Hacker: Differing Consequences of Ecosystem Engineering Invaders: Significance of Impact and Community Context to Restoration Potential (Seminar)
January 25-26, 2007	Erica Fleishman	Ecosystem-based Management Advisory Board Meeting
January 25, 2007	Allison Whitmer	Los Angeles Conservation Corps Science on Saturday Meeting
January 27-30, 2007	Fiorenza Micheli Andrew Rosenberg	A synthetic approach to the science of ecosystem-based management of coastal marine ecosystems (EBM) Working Group
January 27, 2007	Allison Whitmer	OCTOS Teachers Group Meeting
January 30-31, 2007	Christopher Costello	Working Group, Matching property rights institutions with fishery characteristics Working Group
January 31-February 4, 2007	Helen Regan* Sahotra Sarkar	Making decisions on complex environmental problems Working Group
January 31-February 2, 2007	Ben Halpern	Ranking and mapping human threats and impacts to marine ecosystems in the California current Working Group
February 1, 2007	EcoLunch Seminar Series	Mark Burgman: Uncertainty and Robust Decision Analysis for Bayes Nets: Managing Competing Environmental Demands (Seminar)
February 1-2, 2007	Stephanie Hampton	Waters Network Modeling Committee Meeting
February 5-7, 2007	Stephanie Hampton	Environmental Law Institute EBM Mengerink Meeting
February 8-11, 2007	Gail Osherenko Elliott Norse* Larry Crowder* Oran Young Satie Airame	Ecosystem-based management for the oceans: The role of zoning Working Group
February 8, 2007	EcoLunch Seminar Series	Larry Crowder: Rethinking the Management of Oceanic Pelagic Organisms: Forging a Future for Sea Turtles (Seminar)

* Non-UCSB personnel

February 12-18, 2007	Diane Davidson* William Fagan*	Ecological stoichiometry and the spatial distributions and temporal dynamics of arthropods Working Group
February 14-15, 2007	Matthew Jones Bertram Ludaescher* Ilkay Altintas* Eric Seabloom* Deborah Estrin* James Gallagher* Mark Schildhauer	Management and analysis of environmental observatory data using the Kepler scientific workflow system Working Group
February 15, 2007	EcoLunch Seminar Series	Brad Stenger: Ongoing Ecology Communication: Nature, Journalism, and the Web (Seminar)
February 21-22, 2007	Juliann Aukema Erica Fleishman	Steering committee, economic impacts of non-native forest pests and pathogens in North America Meeting
February 22, 2007	EcoLunch Seminar Series	Mark Urban: Making the Connection: Species Interactions, Space, and Evolution in Temporary Pond Communities (Seminar) Group
February 27-March 1, 2007	Erica Fleishman	Wild salmon ecosystems Working
February 28, 2007	Robert Warner	PISCO Research Activities Panel Meeting
March 1, 2007	EcoLunch Seminar Series	Francis Juanes: Atlantic Salmon Conservation: Life History Flexibility, Genetic Variability and Climate Change (Seminar)
March 2-4, 2007	Russell J. Schmitt Sally Holbrook	Moorea Coral Reef LTER Food Web Working Group
March 2-4, 2007	Sally Holbrook Russell J. Schmitt	Moorea Coral Reef LTER Biological-Physical Oceanography Coupling Working Group
March 3-8, 2007	Jim Reichman Stephanie Hampton	NCEAS Scientific Advisory Board Meeting
March 6, 2007	Allison Whitmer	OCTOS Teachers Group Meeting
March 6-7, 2007	Matthew Jones Mark Schildhauer James Beach* Bertram Ludaescher* William Michener*	Science Environment for Ecological Knowledge (SEEK) (Hosted by NCEAS) Working Group
March 8, 2007	EcoLunch Seminar Series	Phil Levin: Ecosystem Management of What? Ecology, Truth and Politics in the California Current (Seminar)
March 9-12, 2007	Daniel Doak* James Estes* Tim Wootton* Terrie Williams*	Conservation planning for ecosystem functioning: Testing predictions of ecological effectiveness for marine predators (EBM) Working Group

* Non-UCSB personnel

March 12-16, 2007	Carlos Carroll* Erica Fleishman*	Landscape and population connectivity Working Group
March 15-16, 2007	Qianlai Zhuang* Jerry Melillo* Ronald Prinn* A. David McGuire*	Toward an adequate quantification of CH4 emissions from land ecosystems: Integrating field and in-situ observations, satellite data, and modeling Working Group
March 15, 2007	EcoLunch Seminar Series	Jerry Melillo: Will Warming Increase or Decrease Carbon Storage in Temperate Forest Ecosystems? (Seminar)
March 18-19, 2007	Stephanie Hampton	Physiological Synthesis Center Meeting
March 19-23, 2007	Aaron King* Pej Rohani*	Unifying approaches to statistical inference in ecology Working Group
March 22, 2007	EcoLunch Seminar Series	Stephen Ellner: Cryptic Population Dynamics: Rapid Evolution can Mask Trophic Interactions (Seminar)
March 23-35, 2007	Susan Swarbrick	Field trip to Sedgwick Reserve for the Los Angles Conservation Corps Science on Saturday program
March 24, 2007	Russell J. Schmitt	Moorea Coral Reef LTER Working Group Meetings
March 26-30, 2007	Peter Kareiva* Taylor Ricketts* Gretchen Daily* Stephen Polasky*	Conservation priorities: Can we have our biodiversity and ecosystem services too? Meeting
March 27, 2007	Jim Reichman	Retirement Reception for Gail Stichler
March 29, 2007	EcoLunch Seminar Series	Juliann Aukema: Dispersal and Spatial Distribution of the Desert Mistletoe, Phorandendron californicum, at Multiple Scales: Patterns, Processes and Mechanisms (Seminar)
April 4-7, 2007	Gary Mittelbach* Howard Cornell* Dr Douglas Schemske*	Gradients in biodiversity and speciation Working Group
April 4-6, 2007	Matthew Jones Mark Schildhauer James Beach* Bertram Ludaescher* William Michener*	Science Environment for Ecological Knowledge (SEEK) (Hosted by NCEAS) Working Group
April 5, 2007	EcoLunch Seminar Series	Gary Mittlebach: Evolution of the Latitudinal Diversity Gradient (Seminar)
April 10, 2007	EcoLunch Seminar Series	Egbert Leigh: Neutral Theory: A Historical Perspective (Seminar)

* Non-UCSB personnel

April 11-13, 2007	Peter Leavitt*	Ecological variability of lakes in time: Integrated insights from paleolimnology and long-term ecological research Meeting
April 12-14, 2007	Gail Osherenko	CLIOTOPS workshop: The Challenge of Change: Managing for Sustainability of Oceanic Top Predator Species
April 18-23, 2007	Jason Hoeksema* Nancy Johnson* James Umbanhowar*	Bridging the gap between theory and practice in mycorrhizal management (Extended) Working Group
April 19, 2007	EcoLunch Seminar Series	Ben Halpern: Mapping the Global Impact of Human Activities on Marine Ecosystems (Seminar)
April 20, 2007	Patricia Halpin	Santa Barbara County Science Fair
April 23-27	Peter Kareiva* Taylor Ricketts* Gretchen Daily* Stephen Polasky	Conservation priorities: Can we have our biodiversity and ecosystem services too? Working Group
April 24, 2007	Patricia Halpin	OCTOS Teachers Group Meeting
April 25, 2007	Margaret Connors	Kids Do Ecology Poster Day Meeting
April 26, 2007	EcoLunch Seminar Series	David Marsh: Optimal (or at least not completely terrible) Population Monitoring (Seminar)
April 26-27, 2007	Ben Halpern	Ranking and mapping human threats and impacts to marine ecosystems in the California current Working Group
April 28-May 1, 2007	Julia Koricheva* Jessica Gurevitch*	Meta-analysis in ecology: Lessons, challenges and future Working Group
April 30-May 4, 2007	Jonathan Shurin* Helmut Hillebrand* Daniel Gruner*	Comparing trophic structure across ecosystems (Extended) Working Group
May 2-3, 2007	Erica Fleishman	Analysis and Conservation Prioritization of Landscape Connectivity in Nevada Working Group
May 3, 2007	EcoLunch Seminar Series	Stuart Sandin: What Have we Lost from Coral Reefs? Using Ecological Insights to Manage an Imperiled Ecosystem (Seminar)
May 4-8, 2007	Mark Urban Mathew Leibold*	Evolutionary and ecological sorting in space Working Group
May 9, 2007	O.J. Reichman	Advantages and Opportunities of NCEAS Research Efforts

* Non-UCSB personnel

May 10, 2007	EcoLunch Seminar Series	Brad Cardinale: Effects of Biodiversity on the Functioning of Ecosystems: One Summary of, and Vision for a Paradigm (Seminar)
May 14-20, 2007	Chris Wilcox* C. Josh Donlan*	Exploring compensatory mitigation and markets as mechanisms for resolving fisheries bycatch: Biodiversity conservation conflicts Working Group
May 17, 2007	EcoLunch Seminar Series	Peter Leavitt: Degradation and Destabilization of Lake Ecosystems by Anthropogenic Nitrogen: A New Paradigm for Future Lake Eutrophication (Seminar)
May 24, 2007	EcoLunch Seminar Series	Jim Reichman: The Impact of Subterranean Herbivorous Rodents on Soils and Plant Communities (Seminar)
May 24-25, 2007	Frank Davis J. Michael Scott*	Planning meeting for a distributed graduate seminar to analyze state wildlife action plans Meeting
May 31, 2007	EcoLunch Seminar Series	Jonathan Davies: The Phylogenetic and Geographic Distribution of Extinction Risk in the Flowering Plants of the Cape of South Africa (Seminar)
May 31, 2007	Jocelyn Ondre	Jeremy Prince: Sustainable Fisheries Group Seminar Workshop
June 1, 2007	Satie Airame	PISCO Science Communication
June 2-10, 2007	John Drake* Bill Langford*	Machine learning for the environment Working Group
June 4-8, 2007	Juliann Aukema Erica Fleishman O. Reichman	Economic impacts of non-native forest pests and pathogens in North America (TNC) Working Group
June 5, 2007	Dan Reed	Santa Barbara Coastal LTER Annual Meeting and Poster Presentations
June 5, 2007	Patricia Halpin	OCTOS Teachers Group Meeting
June 7, 2007	EcoLunch Seminar Series	Stephen Katz: 60 Years of Environmental Monitoring in the Worlds Largest Lake: Measuring the Rotational Velocity of the Planet and other Climate Teleconnections with a Thermometer in Lake Baikal (Seminar)
June 13-14, 2007	Stephanie Hampton	Informatics Training
June 14, 2007	EcoLunch Seminar Series	Amber Budden: The US Postdoc Experience and the Role of the National Postdoctoral Association (Seminar)

* Non-UCSB personnel

June 18-21, 2007	Fiorenza Micheli* Andrew Rosenberg*	A synthetic approach to the science of ecosystem-based management of coastal marine ecosystems (EBM) Working Group
June 18, 2007	EcoLunch Seminar Series	Ken Weiss: Altered Oceans (Seminar)
June 20-22, 2007	Erica Fleishman	Linking Packard's ecosystem-based management initiatives (Packard) Working Group
June 22-23, 2007	Satie Airame	Science of Marine Reserves Meeting
June 25-27, 2007	Patrick Christie* Richard Pollnac*	Governance feasibility of marine ecosystem-based management: A comparative analysis (EBM) Working Group
June 26-July 27, 2007	John Alroy Charles Marshall* Arnold Miller*	Paleobiology Database (Hosted by NCEAS) Working Group

Coastal Research Center

The Coastal Research Center is an organizational unit within the Marine Science Institute at UCSB. The central theme of the Center is to develop scientific knowledge to gain a more complete understanding of coastal and island ecosystems, which is necessary for sound management of the natural resources within coastal and island regions. The Center links academic scientists from a wide variety of disciplines, enhancing the ability to address marine environmental issues.

While CRC scientists work in marine environments throughout the world, much effort is focused on coastal reefs found in the Santa Barbara Channel region and the coral reefs surrounding the island of Moorea, French Polynesia. These two locations provide excellent model systems for the scientific exploration of a wide range of marine issues and scientists at UCSB have long valued these environments as natural laboratories for scientific study. Both areas are enjoyed by those seeking recreation, support important local fisheries and are faced with growing conflicts amongst different user groups as human population pressures increase, a trend that is common for many marine environments. The nearshore marine environments of California and the islands of French Polynesia are used increasingly as a disposal site for waste products. Renewed exploitation of oil and natural gas reserves has augmented the number of conflicting demands placed upon the Channel resources, while issues related to global climate change have increased concerns about the sustainability of coral reef ecosystems. Local issues related to the sustainability of commercial and sport fisheries in both regions mirror global concerns regarding management of exploited stocks. The cumulative effects of human activities on the natural resources of both of these regions are just beginning to be understood. It is imperative that we learn how to balance the multiple uses of nearshore ocean waters in an environmentally sound manner. Lessons learned by scientists in the Coastal Research Center have wide implications for understanding and resolving present and future problems, and will help local, regional and national regulators develop better management policies.

Development of sound management plans for areas such as the Santa Barbara Channel or the islands of French Polynesia is hampered by scientific uncertainty about the consequences of human activities. To understand and predict natural and anthropogenic disturbances, synthesis of new and existing knowledge of many scientific aspects of coastal marine systems - including biology, ecology, genetics, geology, chemistry and oceanography - will be necessary. Further, the development of new approaches and the use of emerging technologies are needed to resolve fundamental questions, some of which have remained unanswered for many years. Only with these advances will it be possible to make reliable predictions about the consequences of various activities, to develop the ability to restore degraded habitats and conserve valuable resources, and to foster development of environmentally sound policies for use of coastal or island regions in general.

The Center has four major objectives:

- To act as a center for production and integration of basic scientific information to more fully understand coastal and island ecosystems and their natural and exploited populations.
- To evaluate and predict effects of human activities on the marine environment, and to develop measures to ameliorate lost or degraded natural resources.
- To train students in basic research on marine environmental issues that may be applicable to decision-makers.
- To facilitate and promote interdisciplinary research initiatives.

Faculty/Professional Research Participants: 2006-2007

Russell J. Schmitt, Director and Professor of Biology

Alice Alldredge, Professor of Biological Oceanography

Giacomo Bernardi, Professor of Molecular Ecology (UCSC)

Andrew Brooks, Associate Project Scientist

Mark Brzezinski, Professor of Biology

Alison Butler, Professor of Chemistry

Bradley Cardinale, Assistant Professor of Biology

Craig Carlson, Associate Professor of Biology

Robert C. Carpenter, Professor of Biology (CSU-Northridge)

Joseph H. Connell, Research Professor of Zoology

Jenifer E. Dugan, Associate Research Biologist

Peter J. Edmunds, Professor of Biology (CSU-Northridge)

John M. Engle, Associate Research Biologist

A. Russell Flegal, Professor of Environmental Toxicology (UCSC)

Steven D. Gaines, Professor of Biology

Ruth D. Gates, Assistant Research Biologist (University of Hawaii)

Scott Hodges, Professor of Biology

Gretchen Hofmann, Associate Professor of Biology

Sally J. Holbrook, Professor of Biology

Evelyn Hu, Professor of Electrical and Computer Engineering

Ronald Iltis, Professor of Electrical and Computer Engineering

Robert Jacobs, Professor of Biology

Ryan Kastner, Assistant Professor of Electrical and Computer Engineering

Michael I. Latz, Research Biologist, (Scripps -UCSD)

David Lea, Professor of Geology

Hua Lee, Professor of Electrical and Computer Engineering

James J. Leichter, Associate Professor of Oceanography, (Scripps -UCSD)

Hunter Lenihan, Associate Professor of Environmental Science

Milton Love, Research Biologist

Sally MacIntyre, Professor of Limnology and Oceanography

Stéphane Maritorena, Associate Researcher

John Melack, Professor of Biology

Daniel Morse, Professor of Biology

Erik Muller, Assistant Research Biologist

Roger M. Nisbet, Professor of Biology

Henry M. Page, Associate Research Biologist

Daniel C. Reed, Research Biologist

Stephen C. Schroeter, Research Biologist

Hannah Stewart, Postdoctoral Researcher (Un. Washington)

Allan Stewart-Oaten, Professor of Biology

David Valentine, Assistant Professor of Geological Sciences

Libe Washburn, Professor of Geography

Allison Whitmer, Assistant Dean (Georgetown University)

Susan Williams, Professor of Environmental Science and Policy (UCD)

Leslie Wilson, Professor of Biology

EcoInformatics Center

Extensive research directed toward identifying and understanding the natural world has been conducted, leading to the acquisition of monumental amounts of data. Yet, due to the ways in which these data are managed, virtually none of it is readily available to researchers, including those who gathered it, after a very short period of time. The lack of ready access to information is not surprising for data collected by past generations of scientists, but access is typically impossible even for information garnered within the lifetime of the youngest ecologist, or even within the last five years. In fact, it will be true tomorrow for data gathered today. The unfortunate circumstance is that despite many years and dollars spent in pursuit of useful information about the environment, preservation and reuse of that data has not been a priority. As a consequence, environmental data are distributed widely across institutions, essentially unstandardized in content and format, and typically undocumented. As a result, ecologists are now limited not only by a lack of information, but also by an inability to access the vast amount of data that has been collected.

The EcoInformatics Center (EIC) was established in July 2003 to address this situation by making what is already known about the environment available to potential users, from students and scientists to resource managers, regional planners, and policy makers. The EIC involves both the technical and human aspects of data acquisition, sharing, and utilization.

The EIC resides under the Marine Science Institute and is a partner Center to the National Center for Ecological Analysis and Synthesis (NCEAS). Approaches developed at NCEAS are being used to identify, develop, and test emerging concepts, technologies, and software.

The Mission of the EIC is to:

- Develop and employ cutting edge technology to generate an Ecological Information Access System to locate and utilize the dispersed and heterogeneous information that characterizes data pertinent to ecological and environmental issues.
- Extend core data-access capability to develop and distribute contemporary information tools for scientists, students, conservationists, resource managers, policy makers, and planners.

To accomplish this mission, the EIC is composed of the following elements:

1. Research on tools to promote data acquisition, distributed access, and long term storage and archiving.
2. Analyses of the cultural and sociological aspects of information sharing
3. Training of students and scientists in the use of data management tools

Information is the raw material of knowledge. The research enterprise is designed to generate information – data – and facilitate its incorporation into higher order understanding and true knowledge of the system under consideration. Information has accumulated in a somewhat haphazard way for centuries. In certain focused areas, such as medicine, basic information has been turned into operational outcomes (diagnoses, treatments, pharmaceuticals) that have benefited humans. However, the geometric increase in information, and its availability in machine form, has made the amount of accessible information overwhelming; unfortunately it has not led to a commensurate increase in knowledge in most fields.

This is particularly true for ecological information, which is important for advancing the basic understanding of natural systems and for making wise management and policy decisions about natural resources. Within the universe of information, ecological data may be as dispersed and heterogeneous as any of interest to scientists and other users. Decisions commonly rely on integrating data as diverse as climatological records, spatial distributions of individuals, changes in biodiversity over space and time, responses of species to experimental manipulations, genetic structure of populations, patterns of human alterations of ecosystems, and much more. The scope of information needed to understand ecological systems is enormous.

Ecological information is inherently diverse, and it grows more diverse each day as new types of relevant information emerge. As a result, a database designed for today would be exceedingly complex, and it would be outdated long before it could ever be developed. Thus, the environment needs a different data management model that provides generic access to information in place of a uniform database structure. Rather than standardizing inputs and outputs, the solution lies in an approach analogous to the Internet that standardizes how information is characterized (through metadata, or information about the data itself). Information, once characterized with metadata, can be made accessible in context-dependent ways that are both comprehensive and efficient. The key tools are an efficient, flexible, and standardized way to describe ecological information, and a powerful information searching capability.

The primary faculty and research scientists associated with the Center include:

Dr. Richard Appelbaum, Department of Sociology and Director, Institute for Social, Behavioral, and Economic Research
Dr. Steven Gaines, Department of Ecology, Evolution, and Marine Biology and Director, Marine Science Institute
Mr. Matthew Jones, Director of Informatics Research and Development, National Center for Ecological Analysis and Synthesis
Mr. Chris Jones, Information Systems Coordinator, Marine Science Institute
Dr. Dan Reed, Research Biologist, Marine Science Institute
Dr. O. J. Reichman, Department of Ecology, Evolution, and Marine Biology and Director, National Center for Ecological Analysis and Synthesis
Dr. Mark Schildhauer, Director of Computing, National Center for Ecological Analysis and Synthesis
Dr. Robert Warner, Department of Ecology, Evolution, and Marine Biology

Accomplishments

Participants in the EIC have been successful on several fronts this year, including advances in software technologies, new awards that will permit continued advances in informatics (see Table 1), and publications raising awareness of informatics issues within the ecological community.

Data and metadata management continues to be a principal emphasis of the software engineering effort at the EIC. Researchers there have created several applications for managing data, including the Metacat metadata and data storage system. This year the EIC has released two new versions of Metacat, which is being used broadly to manage data at UCSB, within the US environmental sciences community, and at international institutions. The Metacat system has become the principal mechanism for data sharing across the 26 sites of the Long Term Ecological Research Network (LTER), and the EIC continues to collaborate with the LTER Network Office to ensure that a national federation of data is available to all researchers. This collaboration is formalized as the Knowledge Network for Biocomplexity (KNB), where a single web-based portal has been established for accessing data from hundreds of ecological field stations throughout the US. The KNB portal grew in 2007 to now contain over 15,000 ecological data sets (Figure 1), many of which are from Metacat systems that have been deployed by two MSI research programs, PISCO and the Santa Barbara Coastal LTER (SBC).

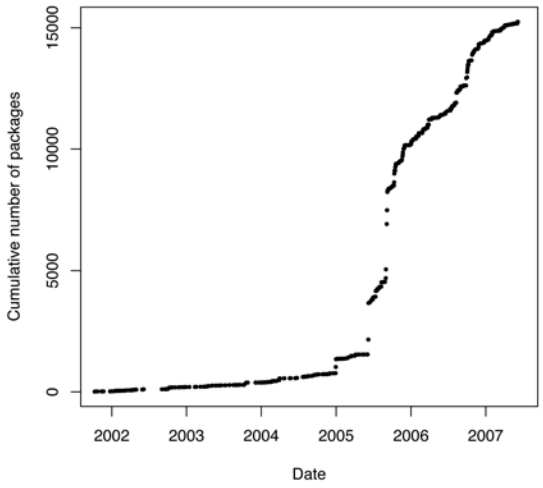


Figure 1: Cumulative number of data packages available from the Knowledge Network for Biocomplexity (KNB) over time. Each data package contains raw ecological data and descriptive documentation that supports proper interpretation and use of the data. Data are contributed from NCEAS, the LTER Network, PISCO, the Organization of Biological Field Stations (OBFS), the UC Natural

In addition to the US collaborators, the EIC has been working with international partners in South Africa, Taiwan, and elsewhere to establish an international network of data providers. The EIC collaboration with Kruger National Park in South Africa has been expanded this year to include other parks in the South African National Parks system and in the South African Environmental Observation Network (SAEON). Software infrastructure is currently being deployed in these new locations, and will include research focused on both savanna and marine systems. These activities are supported by a new award from the Andrew W. Mellon Foundation.

Analysis and modeling of ecological data is the second major emphasis area for the EIC. Research on systems for streamlining the analysis and modeling process and integrating national data archives such as the KNB is ongoing at the EIC. As part of the Science Environment for Ecological Knowledge (SEEK) project, researchers at the EIC are pioneering a new approach to analysis and modeling called 'scientific workflows' through the creation of a software tool called Kepler (Figure 2). Kepler simplifies the effort required to analyze and model scientific data by using a visual representation of these processes. These representations, or "scientific workflows," display the flow of data among discrete analysis and modeling components. We have released several versions of Kepler during 2007, and it is being used and extended by many science disciplines, including ecology, molecular biology, chemistry, geology, astronomy, and many others. The Kepler Project is a collaboration among many institutions, including UCSB, UC Davis, UC San Diego, UC Berkley, University of New Mexico, and many others.

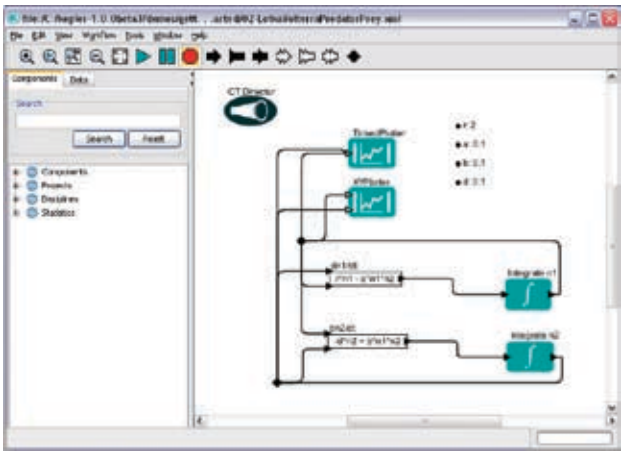


Figure 2: The Kepler scientific workflow system showing the Lotka-Volterra predator-prey model. Each component in a scientific workflow is an independent and re-usable analysis or modeling procedure. Kepler supports components written in many prominent analysis environments, such as R and Matlab, and is e

These advances in the software infrastructure available to the environmental sciences community have been accomplished through the existing research grants to participants in the EIC. Five new extramurally funded awards in 2007 will allow EIC work to continue and to be expanded into new areas (Table 1).

Kepler CORE. One of these awards is for Kepler CORE, a new initiative that aims to transform the current Kepler software system from a research prototype to production-grade software. This collaborative initiative brings together the investigators that are driving development from UC Santa Barbara, UC Davis, and UC San Diego in order to produce a new product that is more robust and stable. This new release of Kepler will be an open-source, non-proprietary product that is easily extensible to support analysis and modeling by different fields of science, including ecology and environmental science.

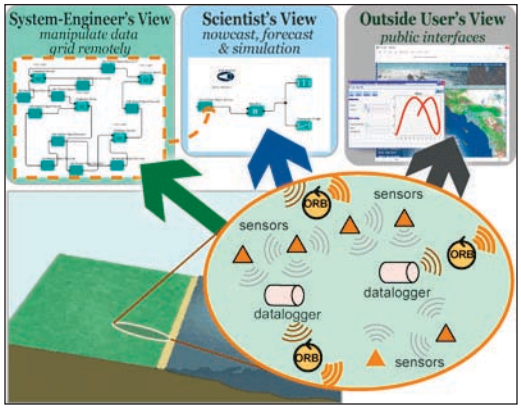


Figure 3: The REAP project uses the Kepler system to support a) sensor network management for system engineers, b) analysis and modeling

REAP. Another of these awards, the Real-time Environment for Analytical Processing (REAP) project, focuses on the infrastructure needed to integrate emerging sensor networks that are being deployed widely in ecology and environmental science. REAP aims to support the sensor networks deployed in both the National Ecological Observatory Network (NEON) and the Ocean Observing Initiative (OOI)

by extending the Kepler system to support direct feeds of sensor data. REAP is being designed as a series of extensions to Kepler that allow scientists to search for sensor data, access the data streams directly within the workflow environment, and then to analyze the sensor data stream in conjunction with data from archives like the Knowledge Network for Biocomplexity. The system is being designed to support a wide variety of common sensor hardware and software, including equipment from vendors such as Campbell Scientific and National Instruments, as well as a variety of open platforms such as TinyOS. In addition to scientific data access, researchers on REAP are developing sensor monitoring and control software that allows a systems engineer to simulate, design, deploy, monitor, and control a sensor network from within the workflow environment. The design of all of these software systems in REAP is being guided by the needs of two use cases. The first focuses on large scale processing and integration of Sea Surface Temperature fields as used in oceanography, and the second on the modeling of terrestrial host-pathogen dynamics within grassland systems.

Table 1: Current research awards for informatics at NCEAS and the EIC.

Funding Source	Year Funded	Description
NSF	2002	Science Environment for Ecological Knowledge (SEEK)
SanParks	2005	Analysis Tools for Thresholds of Potential Concern
SanParks	2005	Spatial Data extensions for Kruger National Park
NSF	2006	Management and Analysis of Environmental Observatory Data Using the Kepler Scientific Workflow System (REAP)
NSF	2007	A Workshop for Advancing a Unified Model for Observational Data in the Ecological and Environmental Sciences
Mellon	2007	Data Management and Analysis Tools Supporting Adaptive Management in South African Parks
Mellon	2007	Deploying Information Management Tools and Increasing Analytical Capabilities of Scientists
NSF	2007	Development of Kepler / CORE – A Comprehensive, Open, Reliable, and Extensible Scientific Workflow Infrastructure
NSF	2007	Faculty Institutes for Reforming Science Teaching (FIRST)

Kruger and SANParks. In addition to these projects that create software for basic research, the EIC obtained new Mellon Foundation support to build systems that facilitate adaptive management of South African ecosystems through quantitative analysis and modeling. In these projects, researchers are using the Kepler system as a bridge between scientists that create quantitative models for understanding system function and managers who use those quantitative metrics, termed Thresholds of Potential Concern (TPCs), to make management decisions about South African parks. Thus, the workflow tool represents a communication mechanism between the two worlds of science and management.

Semantics projects. In addition, the EIC has continued to pursue other informatics projects, including the development of a mechanism for modeling the semantics of scientific observations in order to support improved search capabilities and semi-automated data integration. We ran a national workshop for **'Advancing a Unified Model for Observational Data'**. This emphasis on semantics has led to further work on classifying ecological and environmental concepts for use in improving science teaching (**FIRST project**). This work on semantics is fundamental to continued advances in the informatics field that benefit ecology, and researchers at the EIC have submitted two additional new proposals to extend work in this area.

Finally, researchers at the EIC have been active in outreach through publications and scientific conferences. Some of the publications have increased awareness of the need for informatics research and infrastructure that benefits ecology. For example, Jones et al (2006) published a review that broadly describes the informatics needs within ecology and Madin et al. (in press) published an overview of the needs for semantic data modeling in ecology.

Future directions

EIC accomplishments during 2007 have led to significant increases in both the availability of ecological data and the availability of software that is useful for managing and analyzing that data. Nevertheless, significant work is still needed in order to support the needs of researchers. Although we've had some success at building the KNB data archiving network, many scientists still resist sharing data broadly, often due to resource limitations and sometimes due to perceived threats associated with data sharing. The EIC plans to continue promoting the benefits of data sharing to enable scientific advances in ecology while simultaneously improving software systems that lower the effort needed for scientists to share data. One way in which these benefits will be achieved is through advances in analytical systems like Kepler that can directly access data from the KNB and other data networks.

Recent Publications

Jones M B, Schildhauer M, Reichman O J, and Bowers S. 2006. The new bioinformatics: integrating ecological data from the gene to the biosphere. Annual Review of Ecology, Evolution, and Systematics. 2006. 37:519–544.

Ludäscher B., Altintas I., Berkley C., Higgins D., Jaeger-Frank E., Jones M., Lee E., Tao J., Zhao Y. 2006. Scientific Workflow Management and the Kepler System. Special Issue: Workflow in Grid Systems. Concurrency and Computation: Practice & Experience 18(10): 1039-1065.

Madin, Joshua, Shawn Bowers, Mark Schildhauer, Serguei Krivov, Deana Pennington, and Ferdindo Villa. In press. An ontology for describing and synthesizing ecological observation data. Ecol. Informatics.

Pennington D, D Higgins, AT Peterson, MB Jones, B Ludaescher, S Bowers. 2007. "Ecological Niche Modeling Using the Kepler Workflow System", pp 91-108 in Taylor, I.J.; Deelman, E.; Gannon, D.B.; Shields, M. (Eds.), "Workflows for e-Science: Scientific Workflows for Grids", 530 p., Springer. ISBN: 978-1-84628-519-6.

Marine Biotechnology Center

UCSB is recognized internationally for its leadership in Marine Biotechnology. This exciting field uses the latest breakthroughs in modern molecular biology, genetic engineering and cell science to solve basic problems in marine resource biology; to improve the production of medical, chemical, food, and energy resources from the ocean; and to develop new products and industries based on more efficient use of the ocean's resources.

The Marine Biotechnology Center is unique in the University of California system. It helps coordinate fifteen different research programs in this area at UCSB, and helps obtain funding for the vitally needed practical training of advanced students and professionals to help meet the future needs and changing requirements of the nation's marine and biotechnology industries. Close interactions with California's biotechnology, aquaculture and pharmaceutical industries provide new products and highly trained scientific personnel to the industrial sector, and provide support from industry for research and training in the University. The state-of-the-art Marine Biotechnology Laboratory Building - the first such facility of its kind in the United States - provides facilities needed to accommodate the rapid growth of research and teaching in Marine Biotechnology on the campus.

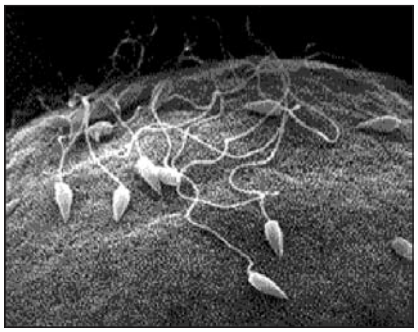
Research and training in Marine Biotechnology are focused at UCSB in three inter-related areas: (1) the development of new methods and approaches from molecular and cellular biology to investigate the basic mechanisms controlling life in the oceans and its responses to environmental change; (2) the development of new industries, resources and products from the oceans; and (3) the use of marine organisms as models for biomedical research. Recent progress in these areas is summarized below.

UCSB scientists are using the tools of biotechnology to unravel the ocean's mysteries in environments as diverse as the Antarctic, tropical seas and reefs, the great ocean depths, and California's resource-rich coastline. These investigations include pioneering studies of the molecular mechanisms of photosynthesis and carbon dioxide fixation by the ocean's phytoplankton, effects on these processes caused by the depletion of ozone in the Antarctic atmosphere, and effects of global warming, pollution and other environmental changes. UCSB scientists and students have discovered receptor molecules and chemical signals that control life in the ocean. The discovery of these signals, and of the receptors, transducing molecules and genes that respond to these signals, has shed new light on the underlying processes regulating the reproduction, development and growth of species ranging from tropical corals to valuable marine resources (urchins and abalones) in California waters and around the world.

Researchers in the Marine Biotechnology Center are developing the tools and techniques of molecular and cellular biology to better understand the biodiversity of marine organisms, and how they affect, and are affected by, physical, chemical and geochemical oceanic processes. Marine biota, particularly the microscopic plankton, are dominant mediators of geochemical change on Earth, yet the genetic diversity, abundance and function of these microorganisms in complex communities is still not completely understood. Researchers at the Marine Biotechnology Center are developing new ways to monitor these microscopic communities, and are discovering previously unsuspected diversity and population structure in globally distributed marine microbial populations. These studies are helping to reveal the influence of microorganisms on global biological and geochemical cycles, and are also providing the tools and baseline data necessary for realistically assessing the impacts of man-made and naturally occurring environmental change. In addition, the recognition of previously unrecognized marine biodiversity is providing a rich resource for new development of biotechnological products and processes. Several teams are involved in an international effort to annotate the genome of the California purple sea urchin, an organism that serves as an excellent biomedical model system as well as being an integral component of the marine benthic community. Sea urchin genome consortium members at UCSB are helping to develop bioinformatic and functional genomic technologies that can be applied to genomic analyses of other marine organisms as well.

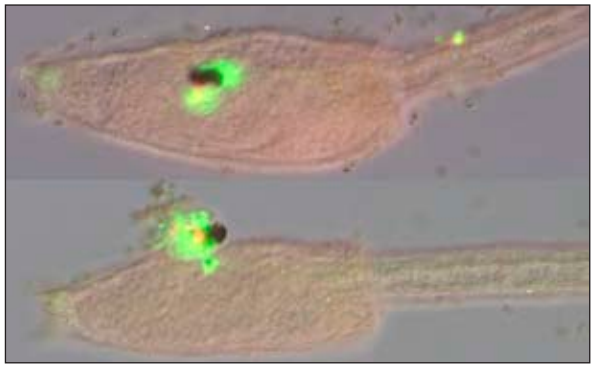
Research at UCSB in the development of new products and industries from marine resources has led to the discovery of promising new diagnostic and therapeutic agents for diseases including cancer, arthritis, epilepsy and Alzheimer's disease, and the development of powerful new enzyme catalysts, novel bioadhesives, and marine microorganisms capable of degrading and detoxifying chlorinated hydrocarbons and other pollutants. Members of the Marine Biotechnology Center are working with researchers in Chemistry, Physics and Engineering through UCSB's new Army-supported Institute for Collaborative Biotechnologies, and through the NSF-sponsored National Materials Research Laboratory, the California NanoSystems Institute, NIH's Bioengineering Consortium Program, and NASA's Biomolecular Materials program to develop valuable new materials based on the structures made by marine organisms which exhibit exceptional strength, resiliency, hardness and enhanced electrical and optical performance. With the help of the marine biotechnologists' skills in genetic and protein analysis and engineering, and close collaborations with colleagues in Chemistry, Physics and Engineering, the fundamental molecular structures and mechanisms underlying the enhanced performance of these natural materials made by marine organisms are being revealed, and translated into practical engineering solutions for the development of novel advanced materials. Teams are working with experts in the Department of Electrical and Computer Engineering to harness the mechanisms of low-temperature catalysis and molecular recognition of proteins that direct biomineralization in marine organisms to help direct the nanoscale fabrication of ultra-small crystals used for magnetic information storage and semiconductors, to help reduce the size and defect-density of electronic components, and to make new photovoltaic materials with improved efficiency to harness the sun's energy. A new generation of tough, water resistant adhesives and coatings has been inspired by sessile intertidal invertebrates, and the fangs and beaks of marine polychaetes and squids are the pointing the way to new lightweight polymeric materials with the hardness and wear resistance usually associated with ceramics. Research aimed at practical applications with economic value also has led to improvements in the economic efficiency and yield of cultivation of valuable marine fish, shellfish and plants grown for food and pharmaceuticals. These findings have led directly to the growth of new and "environmentally friendly" industries in Santa Barbara that now are producing abalones, urchins and marine algae using innovations in aquaculture technology developed at UCSB.

Research using marine organisms as model systems for biomedical research has led to a host of new and far-reaching discoveries at UCSB. Many marine invertebrates, because of their relatively simple design, and the ease of their maintenance and analysis in the laboratory, have provided a rich source of new information and serve as desirable, non-mammalian models for research. A major area of emphasis is in regard to the genetic control of normal development and of tumor formation. Professor Kathleen Foltz and her students make use of marine model systems to investigate fundamental questions of reproductive biology and early development. They discovered that the molecular recognition processes controlling oocyte maturation and fertilization are highly conserved across species; information gained from studying the eggs and embryos of many marine invertebrates (such as sea urchins, sea stars and sea squirts) can be applied to other animals, including mammals. This research group has been actively involved in the Genome Sequencing Project for the California Purple Sea Urchin, Strongylocentrotus purpuratus. Their team is part of an international consortium, coordinated through the Human Genome Sequencing Center at Baylor College of Medicine, that has completed the first echinoderm genome sequence. The information gained from this genome project is being used to identify and understand the gene networks that regulate early development, and to investigate the evolutionary underpinnings of animal development. The Foltz research team is using the genomic information to describe the egg "proteome" – the identification of all of the proteins present in the egg – and to study their regulation in the first few minutes of fertilization and during early development. Using a functional proteomics approach, nearly 250 sea urchin egg proteins that undergo modifications at fertilization have been identified. Most of these proteins are conserved in mammals and thus may provide insight into fertility and contraception.



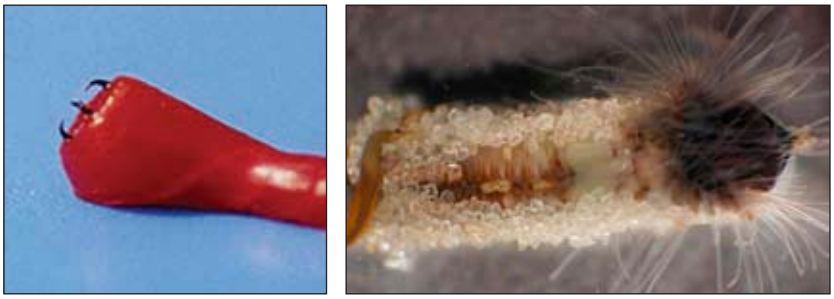
High-magnification electron micrograph of sea urchin sperm fertilizing an egg.

Professor William Smith and his students are pioneers in the study of chordate developmental biology using the ascidian ("sea squirt") as a model organism. Ascidians are invertebrate members of the chordate phylum, and are the closest living relatives of the vertebrates. However, despite their kinship with the vertebrates, the ascidians have many features that are more like those found in invertebrate model organisms such as nematodes and insects, including a small genome, and a simple embryo that develops according to an invariant cell lineage. Professor Smith and his group have used two locally abundant species of ascidians to identify the genes that regulate fundamental process of embryogenesis. To help them with this identification, they've isolated mutants that disrupt the development of various tissues including the nervous system and notochord (a tissue found all chordates that serves as a developmental "scaffold"). These mutants have allowed them identify genes that code for proteins required for the normal development of the brain and other neuronal structures. For example, in embryos bearing the mutation bugeye the anterior neural tube fails to close - thus providing a model for one of the most common types of human birth defects (see figure below). Their detailed genetic and developmental studies thus provide new insight to chordate developmental mechanisms in a novel model organism. Their studies thus have established a tractable, simple marine animal model that is yielding remarkable insights into the molecular, genetic and cellular mechanisms that regulate tissue morphogenesis and assembly.



Heads of ascidian tadpole larvae. The top larva shows normal development, while the larva in the bottom carries the recessive mutation bugeye. The larvae have been stained with an antibody against the brain protein arrestin (green).

In addition, marine model systems have shed light on the mechanisms that nerve cells use to produce, store release and respond to chemical messengers and how the resulting regulation of these cells results in information processing, storage and memory. Many of these discoveries have had direct implications for human and other mammalian research. Professor J. Herbert Waite's laboratory studies the specialized teeth, fangs, beaks, spines, and claws of marine invertebrates that equip these animals for feeding, defense, and predation. Their studies in marine polychaetes, squids and snail egg capsules are providing insights into alternative strategies for making robust, tough, lightweight, and self-healing materials.



Close-up photograph of a sandcastle worm building its tube home by cementing together sandgrains with Dopa containing proteins (right)

Another important area of research is water resistant adhesion. Water is the nemesis of practical adhesive bonding, yet the rocky intertidal seashore is home to a host of organisms that spend their lives attached to solid surfaces surrounded and assaulted by water and waves. Professor Waite and his students discovered that the amino acid known as Dopa is a key to the remarkable underwater adhesion in mussels and sandcastle worms. In related studies, discoveries first made at UCSB on the biological mechanisms controlling the nanofabrication and toughness of the abalone shell have now been extended by Professor Paul Hansma and his students to human bone, with profound implications for diseases such as osteoporosis and arthritis.

Faculty/Professional Researcher Participants
Mark A. Brzezinski, Professor of Marine Biology
Alison Butler, Professor of Chemistry and Biochemistry
Craig A. Carlson, Associate Professor, Ecology, Evolution and Marine Biology
Bradley F. Chmelka, Professor of Chemical Engineering
Steven DenBaars, Professor of Electrical and Computer Engineering
Evelyn Hu, Director of the California NanoSystems Institute and Professor of Electrical and Computer Engineering
Kathleen R. Foltz, Professor of Molecular, Cellular and Developmental Biology
Paul K. Hansma, Professor of Physics
Kevin F. Lafferty, Research Biologist
Robert Jacobs, Professor of Pharmacology
Aileen N.C. Morse, Research Biologist
Daniel E. Morse, Director, Professor of Molecular Genetics and Biochemistry
William Smith, Professor of Molecular, Cellular and Developmental Biology
Galen D. Stucky, Professor of Chemistry and Biochemistry; Professor of Materials
Matthew Tirrell, Dean of the College of Engineering and Professor of Chemical Engineering
J. Herbert Waite, Professor of Molecular, Cellular and Developmental Biology
Leslie Wilson, Professor of Molecular, Cellular and Developmental Biology

National Center for Ecological Analysis and Synthesis

The National Center for Ecological Analysis and Synthesis (NCEAS) was created in May 1995 with funding from NSF, the State of California, and UCSB. The Center focuses on the use of collaborative and synthetic approaches to solve fundamental ecological and environmental problems, and emphasizes application of up-to-date analytical and informatics tools to existing data sets and the development of new modeling approaches. NCEAS is associated with the Marine Science Institute and is located in downtown Santa Barbara.

NCEAS staffing includes the Director (O. J. Reichman), Deputy Director (Stephanie Hampton), Director of Computing (Mark Schildhauer) and fourteen full- and part-time personnel, including nine administrative and five technical support staff.

The Science Advisory Board (SAB) of 19 eminent ecologists met September 6-7, 2006 and March 7-8, 2007 to review proposals and provide guidance on the Center's mission and research directions. In addition, the Ecosystem-based Management (EBM) Advisory board met on January 25-26, 2007.

Research activities focus on working groups, sabbatical fellows, postdoctoral associates, distributed graduate seminars and graduate student internships. During the 2006-2007 fiscal year, NCEAS hosted 10 meetings and 56 working group meetings, involving a total of 1184 visits by 836 different scientists. In addition, the Center hosted 10 Center Fellows (sabbatical visitors), 13 postdoctoral fellows, 8 graduate student interns and 3 undergraduate interns.

Several research areas have emerged as part of NCEAS activities, including analysis of large scale processes, complex population dynamics, ecological community dynamics, analysis of broad biogeographical patterns, development of new analytical and statistical methods, projects related to resource management, and ecological informatics. Several projects have involved areas outside the core of ecology, such as human cultural diversity, evolutionary and security strategies, and urban ecology.

The Conservation and Resource Management Program at NCEAS has grown. For example, the Packard Foundation's continuing Ecosystem-Based Management (EBM) project involves the analysis and synthesis of existing data and development of new tools to address gaps in knowledge critical to successful implementation of ecosystem-based management. The Moore Foundation has supported several marine conservation projects, the Paul G. Allen Family Foundation has sponsored Working Groups focused on sustainable fisheries, and NCEAS began working with the U.S. Fish and Wildlife Service to analyze and synthesize data relevant to fish declines in the San Francisco Bay Estuary. The Nature Conservancy supports Working Groups and a postdoctoral associate focused on non-native pests and pathogens.

NCEAS has become a leader in developing collaborations and technical solutions to overcome obstacles related to the dispersed and heterogeneous nature of ecological data. The Center has been involved with many collaborators to develop generic data access tools for more efficient and powerful analysis of ecological data by a broad user community, from student and resource managers to scientists. These ecoinformatics tools are reaching maturity and are being deployed in a number of settings; information about these tools can be found online at http://www.nceas.ucsb.edu/ecoinformatics.

Outreach efforts have focused on development of online ecological databases and information, and on a distributed graduate student research seminar. NCEAS' community outreach program, Kids Do Ecology (KDE), is intended to enhance student appreciation of ecology and the scientific process; 10 local classrooms of 5th graders and their teachers were mentored by NCEAS resident scientists this year. In addition, the Center hosted 38 Ecolunch seminars this past year, given by resident and visiting scientists, that are open to the community.

NCEAS relies almost exclusively on the Internet to disseminate Center-related information and findings, in addition to the usual peer-reviewed publications. The Center receives e-mail at nceas@nceas.ucsb.edu, and our World Wide Web URL is http://www.nceas.ucsb.edu. The NCEAS home page provides interactive access to a large array of information, including summaries of current and pending research, descriptions of computing resources at NCEAS and elsewhere, funding and employment opportunities at NCEAS, ecological data archives, and NCEAS reports and publications.

NCEAS ECO LUNCHES
7/1/2006 – 6/30/2007

	September 7, 2006Walter Carson, University of Pittsburgh
	An empirical test of competition and keystone predation theory: a quest for the holy grail of relevant plant traits
September 14, 2006	**Anne Salomon, University of California Santa Barbara**
	Top-down control leads to the alteration of a coastal ecosystem in Alaska
September 21, 2006	**Erica Fleishman, NCEAS**
	Using science to inform conservation and resource management at NCEAS…and in the Great Basin
September 28, 2006	**Marjorie Brooks, NCEAS**
	Effect of sunlight on metal bioavailability in Rocky Mountain Streams
October 5, 2006	**Jonathan Chase, Washington University**
	Community assembly in time and space
October 12, 2006	**James Lovvorn, University of Wyoming and NCEAS**
	Conserving a top predator by studying a marine ecosystem
October 19, 2006	**Pablo Marquet, Pontificia Universidad Catolica de Chile**
	Exorcizing ecological complexity: towards an ecology based on first principles
October 26, 2006	**Brian Enquist, University of Arizona**
	A general scaling model for the diversity of plant growth, form, function and functional trait spectra
November 2, 2006	**Ransom Myers, Dalhousie University**
	The global loss of top predators in the ocean: consequences of a world without sharks, tuna and great fish
November 9, 2006	**Dan Bolnick, University of Texas at Austin**
	A rose is a rose is a rose, but is a stickleback a stickleback?
November 16, 2006	**Becky Vega Thurber, San Diego State University**
	Metagenomics as a method for investigating the physiology and ecology of coral-microbe interactions
November 30, 2006	**Jake Goheen, University of Florida**
	MacArthur-Wilson and community equilibria: testing for local saturation of species richness using long-term data
December 7, 2006	**Marissa Baskett, NCEAS**
	Rapid evolution, community shifts, and marine conservation
December 14, 2006	**Mick Kronman, Santa Barbara Harbor Operations Manager**
	Critical thinking in marine resource management
January 11, 2007	**John Lambrinos, Oregon State University**
	Patterns of ecosystem recovery following the removal of an invasive wetland grass

January 18, 2007	**Neo Martinez, Pacific Ecoinformatics and Computational Ecology Lab, NCEAS** *Dynamics of complex ecological networks: Can basic understanding be applied?*
January 25, 2007	**Sally Hacker, Oregon State University** *Differing consequences of ecosystem engineering invaders: significance of impact and community context to restoration potential*
February 1, 2007	**Mark Burgman, University of Melbourne** *Uncertainty and robust decision analysis for Bayes nets: managing competing environmental demands*
February 8, 2007	**Larry Crowder, Duke University** *Rethinking the management of oceanic pelagic organisms: Forging a future for sea turtles*
February 15, 2007	**Brad Stenger, Wired Magazine** *Ongoing Ecology Communication: Nature, Journalism, and the Web*
February 22, 2007	**Mark Urban, NCEAS** *Making the connection: species interactions, space, and evolution in temporary pond communities*
March 1, 2007	**Francis Juanes, University of Massachusetts and NCEAS** *Atlantic salmon conservation: life history flexibility, genetic variability and climate change*
March 8, 2007	**Phil Levin, NOAA and NCEAS SAB** *Ecosystem management of what? Ecology, truth and politics in the California Current*
March 15, 2007	**Jerry Melillo, Marine Biological Laboratory, Woods Hole** *Will warming increase or decrease carbon storage in temperate forest ecosystems?*
March 22, 2007	**Stephen Ellner, Cornell University** *Cryptic population dynamics: rapid evolution can mask trophic interactions*
March 29, 2007	**Juliann Aukema, NCEAS** *Dispersal and spatial distribution of the desert mistletoe, Phoradendron californicum, at multiple scales: patterns, processes and mechanisms*
April 5, 2007	**Gary Mittelbach, Michigan State University, Kellogg Biological Station** *Evolution of the latitudinal diversity gradient*
April 10, 2007	**Egbert Leigh, Smithsonian Tropical Research Institute** *Neutral theory: A historical perspective*
April 19, 2007	**Ben Halpern, NCEAS** *Mapping the global impact of human activities on marine ecosystems*
April 26, 2007	**David Marsh, Washington and Lee University, NCEAS** *Optimal (or at least not completely terrible) Population Monitoring*
May 3, 2007	**Stuart Sandin, Scripps Institute of Oceanography** *What have we lost from coral reefs? Using ecological insights to manage an imperiled ecosystem*
May 10, 2007	**Brad Cardinale, UCSB** *Effects of biodiversity on the functioning of ecosystems: one summary of, and vision for a paradigm*
May 17, 2007	**Peter Leavitt, University of Regina and NCEAS** *Degradation and destabilization of lake ecosystems by anthropogenic nitrogen: A new paradigm for future lake eutrophication*
May 24, 2007	**Jim Reichman, NCEAS**

	The impact of subterranean herbivorous rodents on soils and plant communities
May 31, 2007	**T. Jonathan Davies, NCEAS** *The phylogenetic and geographic distribution of extinction risk in the flowering plants of the Cape of South Africa*
June 7, 2007	**Steve Katz, NOAA Northwest Fisheries Science Center** *60 years of environmental monitoring in the worlds largest lake: measuring the rotational velocity of the planet and other climate teleconnections with a thermometer in Lake Baikal*
June 14, 2007	**Amber Budden, NCEAS** *The US Postdoc Experience an the Role of the National Postdoctoral Association*
June 18, 2007	**Ken Weiss, Los Angeles Times** *Altered Oceans*

Date	Number of Participants	Coordinator	Topic
June 27- July 24, 2006	16	John Alroy Charles Marshall Arnold Mille	Paleobiology Database (Hosted by NCEAS) Working Group
July 8-21, 2006	9	Evgeny Zilov Marianne Moore Stephanie Hampton	The 60-year data set of plankton dynamics in Lake Baikal: Examining facets of the jewel of Siberia Working Group
July 10-13, 2006	8	Charles Mitchell Alison Power	The roles of natural enemies and mutualists in plant invasions Working Group
July 31-August 2, 2006	6	Matthew Jones Mark Schildhauer James Beach Bertram Ludaescher William Michener	Science Environment for Ecological Knowledge (SEEK) (Hosted by NCEAS) Working Group
September 8-10, 2006	11	John Alroy Charles Marshall Arnold Miller	Paleobiology Database (Hosted by NCEAS) Working Group
September 11-12, 2006	10	John Alroy Charles Marshall Arnold Miller	Paleobiology Database (Hosted by NCEAS) Working Group
September 13-17, 2006	18	Fiorenza Micheli Andrew Rosenberg	A synthetic approach to the science of ecosystem-based management of coastal marine ecosystems (EBM) Working Group
September 18-22. 2006	16	John Gamon Faiz Rahman	SpecNet Working Group
September 25-27, 2006	13	Dov Sax Steven Gaines Jay Stachowicz	Exotic species: A source of insight into ecology, evolution, and biogeography Working Group

October 2-6, 2006	13	John Drake Bill Langford	Machine learning for the environment Working Group
October 6-8, 2006	13	Nicholas Gotelli Robert Colwell Carsten Rahbek	Synthetic macroecological models of species diversity Working Group
October 13-17, 2006	12	Daniel Doak James Estes Tim Wootton Terrie Williams	Conservation planning for ecosystem functioning: Testing predictions of ecological effectiveness for marine predators (EBM) Working Group
October 13-17, 2006	12	Robert Orth William Dennison	Global trajectories of seagrasses: Establishing a quantitative basis for seagrass conservation and restoration Working Group
October 23-30, 2006	16	Brian McGill Rampal Etienne John Gray Jessica Green	Tools and fresh approaches for species abundance distributions Working Group
October 23-28. 2006	13	Mark Urban Mathew Leibold	Evolutionary and ecological sorting in space Working Group
October 31- November 6, 2006	16	Jonathan Shurin Helmut Hillebrand Daniel Gruner	Comparing trophic structure across ecosystems Working Group
November 2-5, 2006	13	Julia Koricheva Jessica Gurevitch	Meta-analysis in ecology: Lessons, challenges and future Working Group
November 6-9, 2006	14	Evan Preisser Daniel Bolnick	When, and how much, does fear matter? Quantitatively assessing the impact of predator intimidation of prey on community dynamics Working Group
November 17-20. 2006	14	Patrick Christie Richard Pollnac	Governance feasibility of marine ecosystem-based management: A comparative analysis (EBM) Working Group
December 4-6, 2006	14	Christopher Field Josep Canadell	Vulnerability of carbon in permafrost: Pool size and potential effects on the climate system Working Group
December 8-9, 2006	31	Stephanie Hampton	ESA Data Centers Workshop (Hosted by NCEAS) Meeting
December 11-15, 2006	32	Matthew Jones Mark Schildhauer James Beach Bertram Ludaescher William Michener	Science Environment for Ecological Knowledge (SEEK) Hosted by NCEAS) Working Group
January 8-10, 2007	17	Peter Kareiva	EPA Risk Analysis Working Group
January 11-12, 2007	6	Erica Fleishman	Steering committee, Wild Salmon Ecosystems Working Group

January 11-14, 2007	7	Kim Cuddington James Byers	Habitat modification in conservation problems: Modeling invasive ecosystem engineers Working Group
January 12-16, 2007	13	Robert Orth William Dennison	Global trajectories of seagrasses: Establishing a quantitative basis for seagrass conservation and restoration Working Group
January 22-26, 2007	14	Elise Granek Evamaria Koch Edward Barbier David Stoms Shankar Aswani-Canela	Measuring ecological, economic and social values of coastal habitats to inform ecosystem-based management of land-sea (EBM) Working Group
January 24, 2007	11	Erica Fleishman Christopher Costello	Steering committee Sustainable Fisheries Project Working Group
January 27-30, 2007	14	Fiorenza Micheli Andrew Rosenberg	A synthetic approach to the science of ecosystem-based management of coastal marine ecosystems (EBM) Working Group
January 30-31, 2007	21	Christopher Costello	Working Group, Matching property rights institutions with fishery characteristics Working Group
January 31- February 4, 2007	11	Helen Regan Sahotra Sarkar	Making decisions on complex environmental problems Working Group
January 31- February 2, 2007	6	Ben Halpern	Ranking and mapping human threats and impacts to marine ecosystems in the California current Working Group
February 1-2, 2007	3	Stephanie Hampton	Waters Network Modeling Committee (Hosted by NCEAS) Meeting
February 5-7, 2007	18	Stephanie Hampton	Environmental Law Institute EBM Mengerink (Hosted by NCEAS) Meeting
February 8-11, 2007	13	Gail Osherenko Elliott Norse Larry Crowder Oran Young Satie Airame	Ecosystem-based management for the oceans: The role of zoning Working Group
February 12-16, 2007	7	Diane Davidson William Fagan	Ecological stoichiometry and the spatial distributions and temporal dynamics of arthropods Working Group
February 14-15, 2007	12	Matthew Jones Bertram Ludaescher Ilkay Altintas Eric Seabloom Deborah Estrin James Gallagher Mark Schildhauer	Management and analysis of environmental observatory data using the Kepler scientific workflow system Working Group

February 21-22, 2007	11	Juliann Aukema Erica Fleishman	Steering committee, economic impacts of non-native forest pests and pathogens in North America Meeting
February 27- March 1, 2007	35	Erica Fleishman	Wild salmon ecosystems Working Group
March 6-7, 2007	6	Matthew Jones Mark Schildhauer James Beach Bertram Ludaescher William Michener	Science Environment for Ecological Knowledge (SEEK) (Hosted by NCEAS) Working Group
March 9-12, 2007	12	Daniel Doak James Estes Tim Wootton Terrie Williams	Conservation planning for ecosystem functioning: Testing predictions of ecological effectiveness for marine predators (EBM) Working Group
March 12-16, 2007	15	Carlos Carroll Erica Fleishman	Landscape and population connectivity Working Group
March 15-16, 2007	22	Qianlai Zhuang Jerry Melillo Ronald Prinn	Toward an adequate quantification of CH4 emissions from land ecosystems: Integrating field and in-situ A. David McGuire observations, satellite data, and modeling Working Group
March 18, 2007	18	Stephanie Hampton	Physiological Synthesis Center (Hosted by NCEAS) Meeting
March 19-23, 2007	14	Aaron King Pej Rohani	Unifying approaches to statistical inference in ecology Working Group
March 26-30, 2007	6	Peter Kareiva Taylor Ricketts Gretchen Daily Stephen Polasky	Conservation priorities: Can we have our biodiversity and ecosystem services too? Meeting
April 4-7, 2007	9	Gary Mittelbach Howard Cornell Dr Douglas Schemske	Gradients in biodiversity and speciation Working Group
April 4-6, 2007	6	Matthew Jones Mark Schildhauer James Beach Bertram Ludaescher William Michener	Science Environment for Ecological Knowledge (SEEK) (Hosted by NCEAS) Working Group
April 11-13, 2007	9	Peter Leavitt	Ecological variability of lakes in time: Integrated insights from paleolimnology and long-term ecological research Meeting
April 18-23, 2007	13	Jason Hoeksema Nancy Johnson James Umbanhowar	Bridging the gap between theory and practice in mycorrhizal management (Extended) Working Group

April 23-27, 2007	27	Peter Kareiva Taylor Ricketts Gretchen Daily Stephen Polasky	Conservation priorities: Can we have our biodiversity and ecosystem services too? Working Group
April 25, 2007	~45	Margaret Connors	Kids Do Ecology Poster Day Meeting
April 26-27, 2007	12	Ben Halpern	Ranking and mapping human threats and impacts to marine ecosystems in the California current Working Group
April 28-May 1, 2007	12	Julia Koricheva Jessica Gurevitch	Meta-analysis in ecology: Lessons, challenges and future Working Group
April 30-May 4, 2007	15	Jonathan Shurin Helmut Hillebrand Daniel Gruner	Comparing trophic structure across ecosystems (Extended) Working Group
May 2-3, 2007	18	Erica Fleishman	Analysis and Conservation Prioritization of Landscape Connectivity in Nevada Working Group
May 4-8, 2007	12	Mark Urban Mathew Leibold	Evolutionary and ecological sorting in space Working Group
May 14-20, 2007	17	Chris Wilcox C. Josh Donlan	Exploring compensatory mitigation and markets as mechanisms for resolving fisheries bycatch: Biodiversity conservation conflicts Working Group
May 24-25, 2007	22	Frank Davis J. Michael Scott	Planning meeting for a distributed graduate seminar to analyze state wildlife action plans Meeting
June 2-10, 2007	13	John Drake Bill Langford	Machine learning for the environment Working Group
June 4-8, 2007	14	Juliann Aukema Erica Fleishman O. Reichman	Economic impacts of non-native forest pests and pathogens in North America (TNC) Working Group
June 13-14, 2007	~20	Stephanie Hampton	Informatics Training Meeting
June 18-21, 2007	12	Fiorenza Micheli Andrew Rosenberg	A synthetic approach to the science of ecosystem-based management of coastal marine ecosystems (EBM) Working Group
June 20-22, 2007	45	Erica Fleishman	Linking Packard's ecosystem-based management initiatives (Packard) Working Group
June 25-27, 2007	14	Patrick Christie Richard Pollnac	Governance feasibility of marine ecosystem-based management: A comparative analysis (EBM) Working Group
June 26-July 27, 2007	17	John Alroy Charles Marshall Arnold Miller	Paleobiology Database (Hosted by NCEAS) Working Group

Ocean and Coastal Policy Center

Ocean and coastal policy issues are becoming increasingly important in California, nationally, and internationally. The University of California, Santa Barbara is in a key position to make significant contributions in research and policy analyses of local, state, national, and international ocean management issues.

The need for programmatic attention on ocean and coastal policy in California has never been greater. California has one of the longest and most valuable coastlines in the nation. Offshore California, significant development of offshore resources takes place and the ocean and coastal zone are used, with increasing frequency, by a wide range of users - including offshore oil and gas extraction, recreation, marine transportation, fishing, and marine research. Offshore oil development and the attendant multiple-use controversies, in particular, have dramatized the need for better methods of ocean policy planning.

The Ocean and Coastal Policy Center (OCPC) is oriented toward problem-solving of significant coastal and ocean policy issues. Work at the center is interdisciplinary, involving perspectives from the different social science disciplines (broadly defined as political science, economics, law, history, anthropology, sociology, geography and aspects of environmental studies) and from the natural and physical sciences. In addition to interdisciplinary research, the Center engages in applied projects which directly relate research to specific marine policy problems. The OCPC is one of the few centers in California focusing on these issues.

Major themes of the center include:

- Coastal watershed management and ecosystem planning
- California marine and coastal policy
- Aquatic and marine biodiversity conservation policymaking
- Studies in ecological restoration

The OCPC has received support from the National Science Foundation, U.S. Department of the Interior, and other governmental agencies. The Center has also produced a "White Paper Series" that includes several essays devoted to ecological and policy-related activities of the Southern California Bight and associated coastal watersheds and wetlands. The special series is available on the center's webpage.

Academic Participants
Michael McGinnis, Deputy Director
Keith Clarke, Professor of Geography
Gail Osherenko, Research Scientist
Robert Wilkinson, Director, Water Policy Program
Oran Young, Professor of Environmental Science and Management

UC Natural Reserve System

The mission of the UC Natural Reserve System is to contribute to the understanding and wise management of the Earth and its natural systems by supporting university-level teaching, research, and public service at protected natural areas throughout California.

The University of California administers 35 natural reserves throughout the state which serve as outdoor classrooms and research laboratories for faculty, researchers, and college students in the field sciences and humanities. Community groups and K-12 classes also benefit from the reserve system through field trips and outreach programs. The reserves are natural areas that represent the ecological diversity of California. Most of the major habitats of California are included in the NRS. Each reserve is managed by a UC campus. UC Santa Barbara oversees seven of these reserve sites with habitats as diverse as coastal wetlands, coastal dunes, rocky intertidal, oak woodlands, grasslands, Monterey pine forest, island marine and terrestrial environments, and the mountain and Great Basin environments of the eastern Sierra. Unlike wilderness areas that are available for recreation, the University reserves are devoted entirely to teaching and research. The reserves serve as "living laboratories," where researchers, teachers, and students can pose questions of the natural world that can only be answered by studying the natural environment.

- **Carpinteria Salt Marsh Reserve** is a significant coastal wetland reserve located 20 miles east of UCSB. It consists of 120 acres of south coast estuary, mudflats, beach and intertidal habitats, providing areas for studies on wildlife and fisheries biology, botany, and ornithology (site of several endangered species).

Reserve Staff
Andrew J. Brooks. Reserve Director
William Rice, Faculty Advisor

- **Coal Oil Point Natural Reserve** is located on the West Campus of UCSB and is composed of 158 acres of vulnerable and valuable coastal dunes, coastal terrace, south coastal estuarine lagoon, vernal pools, mudflats, beach and rocky intertidal habitats. This reserve is an ideal location for studies of migratory shorebirds and waterfowl, estuarine plants and animals, water quality and the impacts of human activities on coastal environments. Because of its close proximity to the main campus, the Coal Oil Point Natural Reserve provides a unique and accessible research and teaching resource.

Reserve Staff
Cristina Sandoval, Resident Reserve Director
Carla D'Antonio, Faculty Advisor

- **Kenneth S. Norris Rancho Marino Reserve** lies along the Cambria coast. This 500 acre reserve offers access to giant kelp forests, as well as rocky shore, coastal terrace grassland, soft chaparral, and Monterey pine forest. Overnight facilities available.

Reserve Staff
Don Canestro, Resident Reserve Director
Steven Gaines, Faculty Advisor

- **Santa Cruz Island Reserve** comprises 46,020 acres of the largest and most topographically diverse of Southern California's offshore islands. It is located 24 miles offshore from Santa Barbara and facilitates research and teaching at all the northern Channel Islands, especially Santa Cruz Island. The reserve provides housing, laboratories, collections, information, and transportation for research and teaching on and around the island, and a GIS/database center.

Reserve Staff
Lyndal Laughrin, Resident Reserve Director
Sally J. Holbrook, Faculty Advisor

- **Sedgwick Reserve** is located less than one hour from the UCSB campus and is an excellent natural study area for classes in biology, botany, zoology, geography, geology, anthropology, agroecology, and environmental studies. Situated in the Santa Ynez Valley, the 5,860 acre reserve includes coast live oak forest, blue oak woodland, valley oak savannah, Ceanothus chaparral, coastal sage scrub, grassland, and willow riparian forest, plus a variety of wetland types, including vernal pools. The reserve's large size and environmental heterogeneity provide an exceptional opportunity for teaching and research on biodiversity and landscape ecology. The extensive repetition of small drainages, distinct geologic and soil regimes (including large areas of unique serpentines), and complete drainage systems make the site uniquely suitable for replicated experimental studies. At least one significant Chumash archeological site is located on the property.

Reserve Staff
Katherine McCurdy, Resident Reserve Director
Joshua Schimel, Faculty Advisor

- **The Valentine Eastern Sierra Reserve** has two field sites in the Mammoth Lakes area, SNARL and Valentine Camp.

  The Sierra Nevada Aquatic Research Laboratory (SNARL) is located on 51 acres of the eastern slope of the Sierra Nevada and is an ideal base for field research throughout the ecologically and geologically diverse eastern Sierra and Owens Valley. The reserve offers modern housing, including dormitory accommodations for short and long-term use by researchers and classes. Office space and laboratory facilities, including wet labs, controlled-environment rooms, chemistry and radio-isotope labs, and experimental stream channels, as well as meeting and classroom facilities, are offered on a year-around basis. An extensive GIS database, a library, and a computer/communications center are also available.

  Valentine Camp encompasses 152 acres and contains one of the region's few pristine montane meadows. It provides varied habitats, including coniferous forest, chaparral, and sagebrush plains in which to conduct observational and experimental studies. The considerable ecological diversity within the reserve makes it an excellent teaching resource. The facilities include housing and laboratories which are open in the summer and early fall and, on a limited basis, in the winter. A system of foot trails provides access to all of the site's major habitats.

Reserve Staff
Daniel R. Dawson, Resident Reserve Director
John M. Melack, Faculty Advisor
Leslie Dawson, K-12 Education Coordinator

UCSB Natural Reserve System Administration
William W. Murdoch, Director
Susan L. Swarbrick, Associate Director
Donna Moore, MSO

Analytical Laboratory

The MSI Analytical Lab is a professionally managed chemical analysis facility, with the objectives of improving the quality and efficiency of marine-related research efforts, and of providing advanced capabilities for new and expanded research programs. Originally established in 1977 to serve the needs of UCSB marine researchers, the facility is now recognized campus wide as well as nationally as a resource for high-quality analytical services, with a regular user base of over 50 faculty and professional researchers. The major capabilities of the Lab include metals analysis by Inductively Coupled Plasma Mass Spectroscopy, Flame Atomic Absorption Spectroscopy (AAS), and Furnace AAS; bulk elemental analysis of carbon, hydrogen and nitrogen (CHN) by combustion; stable isotope ratio determination of light isotopes (C, N, O, H, S) in biological and geological materials using both continuous-flow and dual inlet Isotope Ratio Mass Spectrometry; and automated determination of nutrients in natural waters using a 5-channel Flow Injection Analyzer. Most of the Lab's current instrumentation was obtained with extramural funding from grants acquired by the Lab manager in conjunction with interested faculty and researchers. The Lab operation is supported largely through user fees. There are currently five full time and three part time staff employed by the Analytical Laboratory. Please visit our Web site at www.msi.ucsb.edu/Analab/index.html for more information.

OceansAlive!
MSI Education and Outreach

It has been another busy year for MSI's Education and Outreach Program, OceansAlive! Between The Science Fair Mentorship Program, The REEF, our new Mobile REEF outreach visits to schools, community events and on-campus programs, OceansAlive! has provided marine science and environmental education to over 20,000 children and adults! This has been accomplished through the continued development of collaborations with a number of campus, local, state and national organizations and institutions, including the Science Fair Mentorship Program, which hosts the annual SB County Schools Science Fair at UCSB.

Science Fair Mentorship Program: Through OceansAlive! MSI has worked in collaboration with a number of UCSB departments that include the California NanoSystems Institute (CNSI), the Materials Research Lab (MRL), Physics and EEMB to provide 120 local junior high, middle school and high school students with UCSB undergraduate and graduate student mentors for science fair projects. These secondary school students then compete at the local level with the opportunity to progress to the state and national levels.

The Research Experience & Education Facility, better known as The REEF has been extremely busy this year. This has included visits from primary and secondary schools from as far north as King City in Monterey Co., to San Diego in southern California, and as far east as Las Vegas, Nevada! This year over 8,300 K-12 students visited The REEF (Figure 1). The REEF also serves as a marine lab for many colleges including Cal Lutheran Thousand Oaks, CSU Channel Islands, and UCSB. At UCSB, The REEF serves as an interdisciplinary adjunct lab for Geology 4 (Intro to Oceanography), EEMB 3 (Intro Biology), EEMB 106 (Biology of Fishes), Writing 2 and Writing 109 ST. It also serves UCSB outreach and summer programs. This year had over on-campus 3,400 visitors from over 30 different academic departments and outreach programs.

This year The REEF once again supported international programs, including middle school students from Taiwan as part of the Yuan-Lin Cultural Exchange Program and Engineering Graduate students from Osaka University, Japan!

Other 2006/2007 collaborations include:

- Further development with the NOAA Channel Islands National Marine Sanctuary (CINMS) and implementation LiMPETS Monitoring site at Campus Point that support CINMS Education and Outreach and will be linked with visits to The REEF.
- The SBC-LTER Watershed Education Program collaborated again with the Office of Academic Preparation and Equal Opportunity (APEO), and the Los Angeles Conservation Corps' (LACC) Clean and Green Program to bring 60 middle school students from inner-city LA to UCSB for a one-week residential research experience.
- The American Association of University Women (AAUW) Tech Trek Program brings 120 girls from around the country to participate in a week-long, immersive, on-campus experience in science and academics. MSI has continued supporting Tech Trek by providing real-time, hands-on marine science education and research.

The Young Marine Scientist Program
2006-2007

The goal of the Young Marine Scientists Program (YMS) is to familiarize students and their teachers with scientific and social aspects of the marine ecosystems. Science and its research are presented as everyday common sense investigative activities, which we all utilize for survival. Thus, every surviving creature is in a sense a scientist, and the scientific method of investigation is a process of logical problem solving and critical thinking, used to solve sophisticated research questions.

The YMS program provides research opportunities to university undergraduate students, pre-professional student-teachers, K-12 teachers and their students, as well as parents and siblings of those who join the Young Scientists. The YMS students bring their experiences to the entire household, classroom and school. Hands-on/Minds-on activities, and creative, practical materials, have been developed for teaching science, aimed at appealing to every participant's natural fascination with the marine environment, and Nature, through all disciplines. Important YMS goals are to make samples of recent university research accessible to teachers in the community in order to encourage inquiry and research with their students.

As part of her UCSB Community Service and Campus Outreach to the K-12 education system, Dr. Polne-Fuller directs the YMS, working with UCSB undergraduate students, UCSB student teachers, local K-12 teachers and students of all ages. She expanded on the development of marine science curricula, original lesson plans, and creative activities and research projects for elementary and secondary classrooms. Dr. Polne-Fuller's classroom tools include current cutting-edge research and discoveries, as well as science stories she has written, and original marine and land focused poems and music to enrich and integrate with the teaching of science. During this year, she worked with middle school science teachers through the Gevirtz Research Center at UCSB, teaching and guiding the preparation of science units, and the development of creative, original teaching materials. This year Dr. Polne-Fuller worked with several summer youth programs, hosted groups of junior and senior high school science teachers in the Tri-County Districts. She worked with the JASON Project teacher training program, and the outreach education unit of the Santa Barbara Maritime Museum.

CAMPUS TEACHING AND EDUCATION WORK

UCSB Undergraduate Students:

- **Undergraduate Research** - Dr. Polne-Fuller worked with UCSB undergraduate students studying the toxicity of low alcohol on living cells.
- **Welcoming Freshman Group** - Hosted groups of freshman students at the lab, sharing research projects and potential future involvement.
- **Welcoming Freshman Summer Start students** - Participated in the Freshmen Summer Start Program lunch-hours to answer questions and share experiences about higher education, influences of college life, and maintaining a once-strong personal value system.

- **Research Mentorship Program (RMP):** Celebrating its 14th anniversary, Dr. Polne-Fuller continues to teach and direct a UCSB Summer Session program for excelling high school students (Interdisciplinary 93S and 93SL, Research Mentorship Program 2007). This year, 9 MSI researchers served as mentors in this program, where 62 outstanding high school students from across the USA participated and presented a high quality Research Symposium on July 31st and August 1st, 2007, at the Bren School Conference Room.

- **Shoreline Preservation ES-20:** Co-taught the course she developed entitled "Shoreline and Watershed Preservation Issues: From Watersheds to the Channel Islands," providing undergraduate students from campus-wide departments with hands-on views of environmental research taking place at UCSB, and developing an awareness of pending environmental issues affecting UCSB and the surrounding communities .

- **Created and co-taught "The Saturday with Scientists Program":** this weekend program hosts large numbers of high school students from under-served high schools. Buses bring about 100 high school students, counselors and teachers to spend a Saturday at UCSB visiting labs, experiencing research tools, and learning about the professional lives of researchers in a wide range of disciplines. The students come from a wide variety of under-served high schools, some among the UCSB Partnership Schools, and others from the vaster area of Inner City Los Angeles, and East and Central LA. The day-long program ends with a visit to the touch tanks maintained by the Marine Science Institute and the Department of Biological Sciences.

DONORS:

- Always open to hosting individuals and small groups of donors and their families and friends who are interested in quality education for teachers and children.

RESEARCH and PRESENTATIONS for pre-college groups:

- Grunion Midnight Field Trips – Organized two guided Grunion Greeting Midnight Beach Walks for donors and their families.
- Guided Visits to the Monarch Butterflies sites – for UCSB donor groups and families, and visiting groups from the LA area.
- Guided Beach Walks and activities for the American Women in Science Association.
- Participated in the Chancellor's Back To School Night – hosting donors and the Chancellor's advisory Group guests.

Awards Administered

Awards Administered

American Assn for the Advancement of Science

C. White, B. Kendall
SB060039 10/13/2005-10/12/2008 $39,000
Population Connectivity and the Management of Coastal Fishery Species across the California-Mexico International Border

American Assn for the Advancement of Science Subtotal $39,000

Andrew W. Mellon Foundation

M. Schildhauer, M. Jones, O. Reichman
SB070042 9/22/2006-9/22/2009 $250,000
Data Management and Analysis Tools Supporting Adaptive Management in South African Parks

Andrew W. Mellon Foundation Subtotal $250,000

California Coastal Conservancy

E. Fleishman, O. Reichman
06-135 5/1/2007-3/15/2009 $78,738
Non-market Ecological Valuation of Coastal Marine Resources in California

Cal Coastal Conservancy Subtotal $78,738

California Department of Fish and Game

J. Dugan, H. Page
P0675003 7/1/2006-6/30/2007 $29,999
Restoration Approach for Sandy Beaches Impacted by an Oil Spill and Cleanup Activities

R. Jellison
S0660040 9/13/2006-11/30/2006 $9,500
Hot Creek Stressor Identification

R. Jellison, D. Herbst
P0460003 7/1/2006-12/31/2006 $35,133
Biological Stressor Identification at Hot Creek Fish Hatchery

Cal RA Department of Fish and Game Subtotal $74,632

Cal State Lands Commission

I. Leifer
C2006-050 7/10/2006-9/30/2007 $10,000
Goleta Slough Seep Study

Cal State Lands Commission Subtotal $10,000

California Artificial Reef Enhancement

M. S. Love
SB020084 6/1/2006-6/30/2007 $170,000
The Ecological Role of Natural Reefs and Oil and Gas Production Platforms on Rocky Reef Fishes in Southern California

M. S. Love
SB020084 7/1/2007-12/31/2008 $147,873
The Ecological Role of Natural Reefs and Oil and Gas Production Platforms on Rocky Reef Fishes in Southern California

California Artificial Reef Enhancement Subtotal **$317,873**

California Regional Water Quality Control Board

05-179-160-0 1/1/2007-3/31/2009 $100,000
Assessment of the Influence of Sediment on Benthic Stream Communities and Development of Guidance for Sediment TMDLs: Proposed Research Outline for TMDL Study

California Regional Water Quality Control Board Subtotal **$100,000**

California Sea Urchin Commission

S. Schroeter
SB070019 7/1/2006-12/31/2006 $5,000
Studies of Sea Urchins Settlement in Southern and Northern California

S. Schroeter
SB070019 1/1/2007-12/31/2007 $15,445
Studies of Sea Urchins Settlement in Southern and Northern California

California Sea Urchin Commission Subtotal **$20,445**

Channel Islands National Park

H. Page, J. Dugan
J8C07060004 9/18/2006-1/31/2008 $9,999
An Investigation of the Responses of Benthic Invertebrate Species to Marine Protected Areas in the Channel Islands National Park

Channel Islands National Park Subtotal **$9,999**

David and Lucile Packard Foundation

O. Reichman, S. Andelman
2004-27169 6/20/2006-3/31/2008 $584,025
Knowledge and Capacity-Building to Support Ecosystem-Based Management for Sustainable Coastal-Marine Systems

David and Lucile Packard Foundation Subtotal **$584,025**

Dersu & Associates

T. Dudley
SB070110 4/1/2007-8/31/2007 $15,750
Nam Theun Wetland Restoration Ecological Study

Dersu & Associates Subtotal **$15,750**

Environmental Defense Fund

M. Love
SB070008 8/1/2006-1/31/2007 $10,767
Facilitating Cooperative Partnerships in Support of Sustainable Fishing

Environmental Defense Fund Subtotal **$10,767**

Foundation for Research Science and Technology

N. Shears, S. Gaines
UCAL0601 10/1/2006-1/1/2007 $13,270
The Effect of Marine Reserves on Recruitment, Exploited Species and Fishing

N. Shears, S. Gaines
UCAL0601 1/1/2007-3/31/2007 $13,270
The Effect of Marine Reserves on Recruitment, Exploited Species and Fishing

N. Shears, S. Gaines
UCAL0601 4/1/2007-6/30/2007 $13,270
The Effect of Marine Reserves on Recruitment, Exploited Species and Fishing

Foundation for Research Science and Technology Subtotal **$39,810**

Gordon and Betty Moore Foundation

B. Halpern, O. Reichman
1314 12/13/2006-6/1/2008 $190,616
Ranking and Mapping Human Threats and Impacts to Marine Ecosystems in the California Current

O. Reichman
1203 10/1/2006-5/15/2007 $85,826
Wild Salmon Ecosystems

Gordon and Betty Moore Foundation Subtotal **$276,442**

Luce Foundation

S. Gaines, J. Melack, O. Reichman, A. Alldredge, O. Chadwick, B. Luyendyk
SB070105 7/1/2007-6/30/2011 $450,000
The Luce Environmental Science to Solutions Initiative

Luce Foundation Subtotal **$450,000**

Marine Biological Laboratory

D. Morse
27343 1/1/2007-8/31/2007 $11,647
Biomolecular Mechanism, Cloning, Sequencing and Analysis of Adaptive Reflectin cDNAs and Proteins

D. Morse
27343 8/1/2005-8/31/2007 $11,353
Biomolecular Mechanism, Cloning, Sequencing and Analysis of Adaptive Reflectin cDNAs and Proteins

Marine Biological Laboratory Subtotal **$23,000**

Methanogenesis Corporation (Canada)

D. Valentine
SB070096 4/1/2007-3/31/2008 $270,000
Methane from Deep Coal: Enrichment, Isolation and Characterization of Subsurface Methanogenic Communities

Methanogenesis Corporation (Canada) Subtotal **$270,000**

Michigan State University

M. Jones, M. Schildhauer
61-2582CA SB 1/1/2007-12/31/2007 $82,082
Faculty Institutes for Reforming Science Teaching - FIRST III

Michigan State University Subtotal **$82,082**

National Aeronautics and Space Administration

C. Anderson, D. Siegel
NNG04GQ34H 9/1/2006-8/31/2007 $24,000
A Model for Remotely Detecting the Dynamics and Toxicity Of Pseudo-nitzchia Blooms in the Santa Barbara Channel

I. Leifer, D. Roberts, B. Luyendyk
0-NACP05-0030 12/1/2006-11/30/2007 $189,545
Remote-Sensing Methane Emissions: Field-Validation with Seepage from Marine, urban, and Submerged City Sources

National Aeronautics and Space Administration Subtotal **$213,545**

National Geographic Society

R. Warner
8079-06 9/7/2006-9/7/2007 $18,000
Unexpected Indirect Consequences of Predator Removal on Coral Reef Community Structure

National Geographic Society Subtotal **$18,000**

National Marine Fisheries Service

O. Reichman
SB070079 9/15/2006-3/31/2007 $3,000
Multivariate Statistical Analysis Workshop

National Marine Fisheries Service Subtotal **$3,000**

National Science Foundation

J. Alroy
EAR-0545059 3/1/2007-2/28/2008 $0
Collaborative Research: The Paleobiology Database: an International, Web-based Community Project to Assemble, Disseminate, and Analyze Paleontological Data, Renewal

S. Andelman
DEB-0443453 9/1/2006-8/31/2007 $99,735
RCN: Biodiversity Conservation in Dynamic Landscapes (BCDL) Network

S. Andelman
DEB-0443453 9/1/2007-8/31/2008 $99,712
RCN: Biodiversity Conservation in Dynamic Landscapes (BCDL) Network

M. Brzezinski
0648130 7/1/2007-6/30/2010 $672,641
Silica cycling and the role of diatoms in the North Pacific Subtropical Gyre

B. Cardinale
DEB-0614428 10/1/2006-9/30/2008 $275,000
Effects of Algal Diversity on the Productivity of Streams: Does Diversity Play a Greater Role in Variable vs Constant

C. Carlson
MCB-0237725 4/1/2007-3/31/2008 $112,970
Collaborative Research: Linking Microbial Discovery to Biogeochemical Processes in an Oligotrophic Oceanic Microbial Observatory

G. Hofmann
ANT-0440799 5/1/2007-4/30/2008 $114,591
Towards an Understanding of Protein Homeostatis in Cold-adapted Antarctic Fish

M. Jones, M. Schildhauer
DBI-0619060 10/1/2006-5/31/2009 $1,956,203
Management and Analysis of Environmental Observatory Data Using the Kepler Scientific Workflow System

J. Kennett, L. Becker
ATM-0713769 3/15/2007-2/29/2008 $53,073
SGER: Investigations of a Likely Extraterrestrial Impact at 12.9 ka: Possible Cause of Younger Dryas Cooling, North American Mammal Mass Extinction and Demise of Clovis People

A. M. Kuris, K. D. Lafferty
NSF EF-0224565 6/1/2007-5/31/2008 $9,000
Anthropogenic Effects on Host-Trematode Dynamics

D. Lea
OCE-0602362 9/1/2006-8/31/2007 $105,833
Collaborative Research: Establishment of a Climate Type-Section for the Tropical Atlantic from Cariaco Basin Sediments

J. Levine
DEB-035608 7/1/2007-12/31/2007 $42,655
Environmental Variation, Dormancy, and Rare Plant Persistence in Invaded Habitats

J. Levine
DEB-035608 7/1/2007-12/31/2007 $6,000
Environmental Variation, Dormancy, and Rare Plant Persistence in Invaded Habitats

S. MacIntyre
DEB-0640953 3/1/2007-3/31/2008 $421,624
Turbulent Mixing, Internal Waves, and Intrusions: Temporal and Spatial Variability of Resource Supply and Metabolic Activity in Lakes, Renewal

T. Oakley
DEB-0643840 4/1/2007-3/31/2008 $120,000
CAREER: Exploring Congruence of Fossil and Molecular Estimates of Macroevolutionary Divergence Times in Ostracoda (Crustacea)

T. Oakley, D. Plachetzki
DEB-0710406 7/1/2007-6/30/2009 $12,000
DISSERTATION RESEARCH: Tracing the Origins and History of Animal Phototransduction using Phylogenetic Approachs

D. C. Reed, S. D. Cooper, S. D. Gaines, S. J. Holbrook, J. M. Melack
NSF OCE 9982105 4/1/2006-3/31/2008 $12,000
LTER: Land/Ocean Interactions and the Dynamics of Kelp Forest Communities

D. C. Reed, S. D. Cooper, S. D. Gaines, S. J. Holbrook, J. M. Melack
NSF OCE 9982105 4/1/2006-3/31/2008 $34,999
LTER: Land/Ocean Interactions and the Dynamics of Kelp Forest Communities

D. Reed, S. Gaines, J. Melack, D. Siegel, S. Holbrook
0620276 12/1/2006-11/30/2007 $820,000
LTER: Land/Ocean Interactions and the Dynamics of Kelp Forest Communities, Renewal

O. Reichman
DEB 0553768 10/1/2006-9/30/2011 $3,418,276
NCEAS: National Center for Ecological Analysis and Synthesis, Renewal

O. Reichman, J. Orrock
DEB-0444217 3/1/2007-8/31/2007 $5,420
CRB: The Role of Apparent Competition and Patch Geometry in Mediating the Invasion and Restoration of Grassland Communities

O. J. Reichman, M. P. Schildhauer, M. Jones
NSF EF-0225676 10/1/2006-9/30/2008 $321,927
ITR Collaborative Research: Enabling the Science Environment for Ecological Knowledge

W. R. Rice
NSF DEB-0128780 6/1/2007-1/31/2008 $5,000
Gender-Specific Fitness and Intersexual Developmental Conflict in a Drosophila Model System

D. Valentine
0447395 4/1/2007-3/31/2008 $122,437
CAREER: Microbial Geochemistry of Natural Marine Gas Seeps - A Research and Education Plan

D. Valentine
MCB-0604191 9/1/2006-8/31/2009 $328,492
MIP: Interactions between Archaea, Bacteria and their Viruses in the Anoxic Sediments of a Modern Evaporative Basin: Salton Sea, CA

National Science Foundation Subtotal **$9,169,588**

Oregon State University

S. Gaines, S. Airame
F0468A-A 8/22/2006-11/30/2007 $136,241
New Advances in the Science of Marine Reserves, second editions of: The Science of Marine Reserves

S. Gaines, R. Warner, L. Washburn, G. Hofmann
F0395A-C 4/1/2007-3/31/2008 $673,408
Partnership for Interdisciplinary Studies of Coastal Oceans (PISCO), Renewal

S. Gaines, R. Warner, L. Washburn, G. Hofmann
F0395A-C 4/1/2007-3/31/2008 $910,052
Partnership for Interdisciplinary Studies of Coastal Oceans (PISCO), Renewal

Oregon State University Subtotal **$1,719,701**

Paul G. Allen Charitable Foundation

S. Gaines, C. Costello, O. Reichman, J. Melack
8637 5/1/2007-5/1/2009 $2,000,000
Sustainable Fisheries Project

Paul G. Allen Charitable Foundation Subtotal **$2,000,000**

Princeton University

D. E. Morse, P. Hansma, G. D. Stucky, J. Waite
00000532 8/19/2006-8/18/2007 $315,000
Synthetic Self-Healing Structural Materials

Princeton University Subtotal **$315,000**

Resources Legacy Fund Foundation

W. McClintock, S. Gaines
2005-0072M 8/1/2006-9/30/2006 $22,563
Hardware and Support Enhancements to the Marine Life Protection Act Initiative Geographic Information System

W. McClintock, S. Gaines
2005-0072M 10/1/2006-9/30/2007 $24,870
Hardware and Support Enhancements to the Marine Life Protection Act Initiative Geographic Information System

Resources Legacy Fund Foundation Subtotal **$47,433**

Shoreline Preservation Fund – Associated Students UCSB

T. Dudley
WIN07-04 3/1/2007-12/31/2007 $7,261
Sustainable Control of Invasive Arundo donax Along the UCSB Coastal Zone

J. Dugan
WIN07-10 4/15/2007-12/31/2007 $10,500
Developing and Testing Invasive Plant Control for Isla Vista's Vernal Pools

A. Whitmer
Fall 06-02 12/1/2006-6/30/2007 $6,120
REEF Aquarist and Mobile REEF Internship Program, Renewal

Shoreline Preservation Fund - Associated Students UCSB Subtotal **$23,881**

South African National Parks

M. Jones
SB070033 8/28/2006-7/31/2007 $78,900
Analysis Tools for Thresholds of Potential Concern

South African National Parks Subtotal **$78,900**

The Nature Conservancy

O. Reichman
CR0002-64689 7/1/2006-6/30/2007 $30,000
A Workshop on Global Climate Change and Adaptation of Conservation Priorities

O. Reichman
SB070032 8/15/2006-8/14/2007 $240,377
The Economic Impact of Non-native Forest Pests and Pathogens in North America

The Nature Conservancy Subtotal **$270,377**

The New Media Studio

C. Blanchette, A. Whitmer, V. Herrity
NNN04AA02A 2/1/2007-1/31/2008 $51,810
Adding Ocean Science Content and Embedded Assessment Tool Capabilities to the Satellite Observations in Science Education (SOSE) REASoN Project

The New Media Studio Subtotal **$51,810**

UC Berkeley

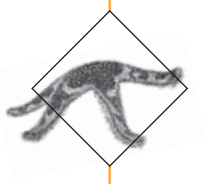
R. A. Knapp
MCSA3624 6/1/2006-6/30/2007 $60,796
Amphibian Disease Dynamics in a Fragmented Landscape

UC Berkeley Subtotal **$60,796**

UC Biotechnology Research and Education Program

J. Waite
2007-02 7/1/2007-6/30/2008 $50,000
Self-Healing Bio-Inspired Polymers: Structure and Mechanics

UC Biotechnology Research and Education Program Subtotal **$50,000**



UC Davis

T. Dudley
2006-34439-17024 9/1/2006-8/31/2007 $60,012
Ecological Basis for Biological Control of giant reed (Arundo donax) in California

UC Davis Subtotal **$60,012**

UC Genetic Resources Conservation Program

A. Lambert, T. Dudley
SB070054 7/1/2006-6/30/2007 $1,900
Conservation of Native Phragmites australis in California

UC Genetic Resources Conservation Program Subtotal **$1,900**

UC Mexus

G. Hofmann
SB070049 9/1/2006-2/29/2008 $15,500
Stress Temperatures and Sea Urchin Metamorphosis Along Latitudinal and Depth Gradients

UC Mexus Subtotal **$15,500**

UC Office of the President

G. Hofmann, M. Zippay
SB07129 7/1/2007-6/30/2008 $30,000
Examining the Impacts of Climate Change on Marine Organisms: Effects of Ocean Acidification on Larval Marine Snails of Coastal California

S. Holbrook, K. Arkema
06TCEQI080036 7/1/2006-6/30/2007 $30,000
The Ability of Kelp Forests to Filter Nearshore Water and Impact Water Quality

A. Kuris
06-000531-01 7/1/2006-6/30/2007 $45,073
Establishing Connectivity of Invasive Populations: A Precursor to Prioritization and Implementation of Eradication Efforts

R. Schmitt, S. Holbrook
6773 5/1/2007-6/30/2008 $15,000
The Conservation Technology Initiative

R. Warner, J. Caselle
06CEQI070034 7/1/2006-6/30/2007 $106,312
Assessing the Assessment: New Models for Informing the Design of Monitoring and Evaluation Programs for Kelp Forest Ecosystems in California's MPAs

L. Yang, J. Levine
SB070021 9/1/2006-8/31/2007 $38,536
The Ecology of Rare Events: Resource Pulses in Space and Time

L. Yang, J. Levine
SB070021 9/1/2006-8/31/2007 $5,840
The Ecology of Rare Events: Resource Pulses in Space and Time

UC Office of the President Subtotal **$270,761**

UC San Diego

L. Washburn
0478.01SB 2/1/2005-12/31/2006 $191,685
Short-Medium Range Resolution/Long Range HF Radars-Task A.1

L. Washburn
0478.01SB 2/1/2005-6/30/2007 $90,000
Short-Medium Range Resolution/Long Range HF Radars-Task A.1

L. Washburn
0478.01SB 1/1/2007-9/30/2007 $187,541
Short-Medium Range Resolution/Long Range HF Radars-Task A.1

L. Washburn
0478.03SB 2/1/2005-12/31/2006 $10,828
Two Bight-Scale Sections Using an Underway CTD-Task C.1

L. Washburn
0478.03SB 1/1/2007-9/30/2007 $10,997
Two Bight-Scale Sections Using an Underway CTD-Task C.1

UC San Diego Subtotal **$491,051**

UC Sea Grant

J. Caselle
R/OPCFISH-05-S-1/2 2/1/2007-3/31/2008 $46,296
Assessing Changes in Life History Traits and Reproductive Function of CA Sheephead Across its Range: Historical Comparisons and the Effects of Fishing

J. Caselle
R/OPCFISH-05UG-F-1/1 6/1/2007-9/30/2007 $2,500
Assessing Changes in Life History Traits and Reproductive Function of CA Sheephead Across Its Range: Historical Comparisons and the Effects of Fishing

A. Kuris, K. Lafferty
R/OPCENV-01-S-1/3 2/1/2007-3/31/2008 $48,536
Parasites as Indicators of Coastal Wetland Health

A. Kuris, K. Lafferty
R/OPCENV-01-TR-1/3 2/1/2007-3/31/2008 $17,645
Parasites as Indicators of Coastal Wetland Health

H. Lenihan
R/F-200A-S-1/2 9/1/2006-12/31/2007 $1,000
Assessing Withering Syndrome Resistance in California Black Abalone: Implications for Conservation and Restoration

H. Lenihan, K. Lafferty
R/F-200A-F-1/2 3/1/2006-2/28/2007 $12,849
Assessing Withering Syndrome Resistance in California Black Abalone: Implications for Conservation and Restoration

H. Lenihan, K. Lafferty
R/F-200A-TR-1/2 3/1/2006-3/31/2008 $28,293
Assessing Withering Syndrome Resistance in California Black Abalone: Implications for Conservation and Restoration

H. Lenihan, K. Lafferty
R/F-20DA-TR-2/2 3/1/2007-2/28/2008 $29,719
Assessing Withering syndrome Resistance in California Black Abalone: Implications for Conservation and Restoration, Renewal

M. Love
R/FISH-203-TR-1/2 2/1/2007-1/31/2008 $29,719
Two Decades of Fishing the Santa Barbara Channel: An Examination of Effort and Catch with Regard to Serial and Localized Depletions of Reef Fishes

D. Morse
R-MP-95-F-3/3 3/1/2006-2/28/2007 $93,555
Marine Bio-Nanotechnology: High-Performance Materials from Sponge Silicatein, Renewal

D. Morse
R-MP-95-F-3/3 3/1/2006-2/28/2007 $16,101
Marine Bio-Nanotechnology: High-Performance Materials from Sponge Silicatein, Renewal

D. Morse
R/MP-95-TR-3/3 3/1/2006-2/28/2007 $12,191
Marine Bio-Nanotechnology: High-Performance Materials from Sponge Silicatein, Renewal

J. Waite
R/MP-97B-TR-2/3 3/1/2006-2/28/2007 $28,855
Studies on the Rapid Self-Assembly of Elastic Tensile Fibers from Natural Protein Polymer Found in Marine Snails, Renewal

J. Waite
R/MP-97B-F-2/3 3/1/2006-2/28/2007 $49,241
Studies on the Rapid Self-Assembly of Elastic Tensile Fibers from Natural Protein Polymer Found in Marine Snails, Renewal

J. Waite
R/MP-97B-S-1/3 3/1/2005-5/31/2007 $2,000
Studies on the Rapid Self-Assembly of Elastic Tensile Fibers from a Natural Protein Polymer found in Marine Snails

J. Waite
R/MP-97-TR-3/3 3/1/2007-2/28/2008 $29,909
Studies on the Rapid Self-Assembly of Elastic Tensile Fibers from Natural Protein Polymer Found in Marine Snails, Renewal

J. Waite
R/MP-97B-S-2/3 9/1/2006-12/31/2007 $1,000
Studies on the Rapid Self-Assembly of Elastic Tensile Fibers from a Natural Protein Polymer Found in Marine Snails, Renewal

O. Young
R/OPCENV-02-S-1/2 2/1/2007-3/31/2008 $5,983
Facilitating Ecosystem-Based Management Through a Quantitative Evaluation of Ocean Management Systems Interplay

O. Young
R/OPCENV-02-TR-1/2 2/1/2007-3/31/2008 $20,570
Facilitating Ecosystem-Based Management Through a Quantitative Evaluation of Ocean Management Systems Interplay

UC Sea Grant Subtotal **$475,962**

UC Toxic Substances Research and Teaching Program

P. Holden
SB070091 11/1/2006-9/30/2007 $26,000
Fate and Effects of TiO2 Nanoparticles on Planktonic, Aerosilized, and Biofilm P. putida Bacteria

UC Toxic Substances Research and Teaching Program Subtotal **$26,000**

University of Queensland

A. Morse
SB060101 12/1/2006-11/30/2007 $67,444
Coral Reef Targeted Research and Capacity Building for Management

A. Morse
SB060101 1/27/2006-11/30/2009 $18,681
Coral Reef Targeted Research and Capacity Building for Management

University of Queensland Subtotal **$86,125**

University of Southern California

C. Nicholson
083262 2/1/2006-1/31/2007 $25,000
Continuing to Build and Evaluate the SCEC 3D Community Fault Model, Renewal

G. Osherenko, K. Clarke
112446 3/1/2006-2/28/2007 $13,238
California's Coastal Zone Management Program: Retaining Agricultural Land in the Face of Urban Growth, Renewal

University of Southern California Subtotal **$38,238**

US Department of Agriculture

T. Dudley
2006-35302-16641 12/15/2006-12/14/2007 $152,500
Regional Targeting of Biological Control Agents Against Saltcedar (Tamarix spp.) in North America

US Department of Agriculture Subtotal **$152,500**

US Department of Commerce

J. Caselle, L. Washburn
NCND6021-6-00021 9/3/2006-8/31/2007 $14,010
Maintenance of PISCO_CINMS Moorings in the Channel Islands National Marine Sanctuary, Renewal

A. Whitmer
NA06NOS4290203 9/1/2006-8/31/2007 $50,000
Mobile REEF Program: A Vehicle for Scientific Literacy

US Department of Commerce Subtotal **$64,010**

US Department of Energy

P. Holden
DE-FG02-05ER63949 11/15/2006-11/14/2007 $86,070
Stabilization of Plutonium in Subsurface Environments via Microbial Reduction and Biofilm Formation

US Department of Energy Subtotal **$86,070**

US Department of the Army

D. Morse
W911NF-06-1-0285 7/1/2006-11/30/2006 $85,000
Biomolecular Mechanism, Cloning, Sequencing and Analysis of Adaptive Reflectin cDNAs and Proteins from Squid

D. Morse
W911NF-06-1-0285 12/1/2006-11/30/2007 $200,000
Biomolecular Mechanism, Cloning, Sequencing and Analysis of Adaptive Reflectin cDNAs and Proteins from Squid

US Department of the Army Subtotal **$285,000**

US Environmental Protection Agency

S. Henkel, G. Hofmann
FP-91654401 9/19/2006-9/18/2007 $10,838
2005 EPA Science to Achieve Results (STAR) Fellowship for Graduate Environmental Study Molecular Techniques for Predicting Invasion Potential: Comparisons Among Native and Invasive Kelp Species

S. Henkel, G. Hofmann
FP-91654401 9/19/2006-9/18/2007 $2,747
2005 EPA Science to Achieve Results (STAR) Fellowship for Graduate Environmental Study Molecular Techniques for Predicting Invasion Potential: Comparisons Among Native and Invasive Kelp Species

S. Henkel, G. Hofmann
FP-91654401 9/19/2007-9/18/2008 $2,747
2005 EPA Science to Achieve Results (STAR) Fellowship for Graduate Environmental Study Molecular Techniques for Predicting Invasion Potential: Comparisons Among Native and Invasive Kelp Species

US Environmental Protection Agency Subtotal **$16,332**

US Fish & Wildlife Service

E. Fleishman
813327J002 6/6/2007-6/5/2008 $385,781
Integration analysis, and synthesis of results from Evaluation of a Pelagic Organism Decline (POD) in the Upper San Francisco Estuary

US Fish & Wildlife Service Subtotal **$385,781**

USDC – National Oceanic & Atmospheric Administration

S. Gaines
NCNS3000-6-00546 7/14/2006-7/13/2007 $22,400
Graduate Training Support

S. Gaines
NA05NOS4291158 5/1/2005-4/30/2010 $2,670,204
Ocean Science Education Building, Phase I

R. Haymon, K. Macdonald
NA04OAR600049 5/1/2006-4/30/2008 $69,672
Exploring Hydrothermal System Response to Magma Supply & Crustal Thickness Gradients Along the Galapagos Spreading Center, 89.5°-94°W

USDC - National Oceanic & Atmospheric Administration Subtotal **$2,762,276**

USDI – Minerals Management Service

I. Leifer, B. Luyendyk
M07AC13149 2/5/2007-9/30/2007 $10,000
Volume and Chemistry of Natural Petroleum Seeps in the Santa Barbara Channel and Southern Santa Maria Basin

I. Leifer, B. Luyendyk
M07AC13149 10/1/2007-9/30/2009 $62,157
Volume and Chemistry of Natural Petroleum Seeps in the Santa Barbara Channel and Southern Santa Maria Basin

M. Love
1435-01-05-CA-39315 8/5/2005-8/4/2009 $35,000
Reproductive Ecology and Body Burden of Resident Fish Prior to Decommissioning

M. Love
1435-01-05-CA-39322 10/1/2006-8/31/2008 $150,000
Fish Assemblages Associated with Platforms and Natural Reefs in Areas Where Data Are Non-Existent or Limited

H. M. Page, J. E. Dugan, M. S. Love, H. Lenihan
Task 85339 MMS-31063 10/1/2005-3/30/2007 $7,500
Ecological Performance and Trophic Links: Comparisons Among Platforms and Natural Reefs for Selected Fish and their Prey

USDI - Minerals Management Service Subtotal **$264,657**

USDI – National Park Service

J. Caselle
J8C07050004 7/1/2006-6/30/2008 $40,651
Establish Baseline Ecological Conditions of Newly Established Marine Reserves at the Channel Islands

J. Engle
J807060010 9/29/2006-3/1/2008 $9,976
Interim Funding of Four San Diego County Rocky Intertidal Monitoring Sites

R. Knapp
J8C07050005 7/1/2007-6/30/2008 $35,935
Reintroduce Yellow-legged Frogs to Fishless Lakes in Yosemite National Park

USDI - National Park Service Subtotal **$86,562**

Virginia Institute of Marine Science

L. B. Quetin, R. M. Ross
518606/1247 10/1/2006-9/30/2008 $192,000
LTER: Palmer Antarctica LTER: Climate Change, Ecosystem Migration and Teleconnections in an Ice-Dominated Environment

L. B. Quetin, R. M. Ross
518606/1247 10/1/2006-9/30/2008 $12,000
LTER: Palmer Antarctica LTER: Climate Change, Ecosystem Migration and Teleconnections in an Ice-Dominated Environment

Virginia Institute of Marine Science Subtotal **$204,000**

WetLabs, Inc.

J. Case
SB060041 1/11/2006-7/31/2006 $10,000
An Underwater Bioluminescence Assessment Tool (U-BAT)

J. Case
SB070041 8/29/2006-2/29/2008 $115,681
An Underwater Bioluminescence Assessment Tool (U-BAT), Phase II, Renewal

WetLabs, Inc. Subtotal **$125,681**

Wilburforce Foundation

E. Fleishman, O. Reichman
UNIVE0611 12/1/2006-11/30/2007 $25,000
New Tools for Incorporating Landscape and Population Connectivity into Conservation Planning

Wilburforce Foundation Subtotal **$25,000**

Wildlife Conservation Board

C. Sandoval, S. Swarbrick
WC-6046PP 2/15/2007-4/15/2010 $261,000
Restoration of the Devereux Slough margin on Coal Oil Point Reserve

Wildlife Conservation Board Subtotal **$261,000**

Wildlife Conservation Society

E. Fleishman
SB07121 2/1/2007-8/31/2007 $103,673
Linking Packard's Regional EBM Initiatives

Wildlife Conservation Society Subtotal **$103,673**

Research Summaries
(Contracts/Grants Administered)
July 2006 – June 2007

John Alroy **9/1/2000-8/31/2006** **$1,520,615**
Harvard University, SB020042

The Co-Evolution of Biodiversity and the Environment Through Geologic Time

The UCSB investigator and UCSB's National Center for Ecological Analysis and Synthesis will provide computational resources, meeting facilities and project coordination for a five-institution, multidisciplinary collaborative research endeavor. Major scientific objectives include building a comprehensive locality-level paleoecological database of Phanerozoic marine and terrestrial organisms; linking these data with geochemical time series to be provided by one of the other co-investigators; developing web-based database management and analysis software; building a web site that will provide public access to the database; and performing statistical analyses that will make corrections for sampling artifacts and quantify intrinsic biotic dynamics, extrinsic environmental forcings of biotic dynamics, and the effects of geographic scale, biogeography, and paleoenvironment on our view of the Earth's evolutionary history.

John Alroy **4/15/2006-2/28/2008** **$200,000**
National Science Foundation, EAR-0545059

Collaborative Research: The Paleobiology Database: an International, Web-based Community Project to Assemble, Disseminate, and Analyze Paleontological Data

The Paleobiology Database is leading the discipline of paleontology into the 21st century by digitizing the global literature on fossils and spearheading research programs that are of broad interest throughout the biological and Earth sciences. Its work over the next five years will document major evolutionary innovations, mass extinctions, and the impact of global change on the biosphere. The Database is an international, distributed effort that covers every taxonomic group, geographic region, and time interval, and brings together 116 Ph.D.s from 73 institutions in 14 countries. It incorporates a wide variety of data types, including taxonomy and both the contents and contexts of fossil collections. The Database is at the forefront of efforts to integrate databases through collaboration with other organizations such as GBIF, MorphoBank, and CHRONOS and use of up-to-date standards and protocols. The Database's effort to translate the literature into digital form will permanently level the playing field for researchers from around the world. The Database has compiled information on 36,923 fossil collections and 66,506 taxa since its inception in 2000, and serves as a repository for multiple independent research consortia. Researchers in six scientific working groups will cover such specific topics as global Phanerozoic diversity and the interplay of diversity and biogeography, local-scale diversity, climate and ecomorphological convergence, and large-scale trends in body size and preservational factors.

Sandy Andelman **9/1/2002-9/30/2006** **$30,000**
Andrew W. Mellon Foundation, SB030037

Using a Knowledge Network to Expand NCEAS-South Africa Collaboration: Scale-Dependence in the Relationship Between Biodiversity and Ecosystem Function

The National Center for Ecological Analysis and Synthesis (NCEAS) is involved in several large projects designed to develop software tools to facilitate remote access and management of ecological data. Ecological data are profoundly heterogeneous and highly distributed, making them difficult to locate and assimilate. To test the tools as they are developed, and to involve the ecological community in the design and refinement of the tools, NCEAS has employed a distributed graduate seminar approach that has been used at the Center to address other topics. In this approach, graduate seminars are conducted simultaneously at multiple universities around the country. All participating universities collaborate remotely to address a common central research theme, but each individual seminar also focuses on a form of that question targeting its own local geographic area. At the end of

the semester, some of the students and faculty from each seminar come to NCEAS to conduct a grand synthesis of the information and ideas that emerged from each individual seminar. This has many benefits as both a pedagogical and intellectual instrument.

Sandy Andelman **2/1/2004-1/31/2007** **$37,000**
Andrew W. Mellon Foundation, SB040051

A Unified Framework for Management and Dissemination of Heterogeneous Data and Metadata from Kruger National Park

The Kruger National Park (KNP) is renowned for long-term ecological datasets generated from plant and animal monitoring programs. Some of these data comprise time series spanning more than five decades. Several major thematic layers, such as vegetation cover, plant composition, vertebrate herbivore counts, fire records, and the concomitant rainfall and hydrology are maintained in geo-referenced databases. In addition, the several hundred research projects registered in the Park generate further data, which also are catalogued. The potential benefits of these data for advancing ecological knowledge are significant, but have not been fully realized. The National Center for Ecological Analysis and Synthesis (NCEAS) is engaged in several major informatics research initiatives, and is developing tools for access, management and analysis of heterogeneous ecological data. To facilitate use of these tools by ecologists, and to obtain input into the evolution of the tools, NCEAS is coordinating a distributed graduate seminar series involving the use of new informatics tools and methods at multiple universities. With funding from the Mellon Foundation, NCEAS has expanded this distributed research and training model to involve collaboration with scientists from Kruger and elsewhere in South Africa.

Sandy Andelman **9/1/2005-8/31/2007** **$196,837**
National Science Foundation, DEB-0443453

RCN: Biodiversity Conservation in Dynamic Landscapes (BCDL) Network

Developing the conceptual foundations for biodiversity conservation in a dynamic and uncertain world requires understanding of the linkages among the dynamics of species, ecological systems, economic activities, and land-use change. Despite recognition of the need for this integration and common objectives, research in each of these areas commonly proceeds independently. This is a three-year interdisciplinary program of collaboration directed towards coordinating research in ecology, economics, policy, land-use, and operations research needed to catalyze the development of an interdisciplinary conceptual framework for biodiversity conservation. The BCDL Network addresses a fundamental limitation of current biodiversity conservation approaches and will bridge the gap between conservation theory and practice. The Network will provide interdisciplinary training opportunities for graduate students and early career scientists and is committed to increasing participation in the Network by under-represented communities.

Clarissa Anderson **9/1/2004-8/31/2007** **$72,000**
David Siegel
National Aeronautics and Space Administration, NNG04GQ34H

A Model for Remotely Detecting the Dynamics and Toxicity Of Pseudo-nitzchia Blooms in the Santa Barbara Channel

Environmental controls of harmful algal blooms are variable at the regional level and not always anthropogenic. In the Santa Barbara Channel the highest concentrations of the toxic diatom group, Pseudo-nitzschia, coincide with periods of strong upwelling and minimal run-off from land. This project addresses bloom dynamics and toxicity of Pseudo-nitschia using the existing framework of the NASA supported Plumes and Blooms project and the SBC-LTER research site. These programs will provide many of the physical, chemical, and biological parameters necessary to parameterize bloom formation and toxin production. In situ data will be incorporated into a predictive model that assesses toxic bloom probabilities for this site. The model will be applied to the remote estimation of blooms using satellite ocean color (MODIS-Aqua & SeaWiFS), sea surface temperature (AVHRR), and high frequency radar determinations of surface currents to develop predictive tools for the onset and toxicity of Pseudo-nitzschia bloom dynamics.

Carol Blanchette **2/1/2005-1/31/2008** **$158,665**
Alison Whitmer
Vishna Herrity
The New Media Studio, NNN04AA02A

Adding Ocean Science Content and Embedded Assessment Tool Capabilities to the Satellite Observations in Science Education (SOSE) REASoN Project

The investigators will develop a curricular module focusing on ocean science, and a java-based software and learning evaluation tool designed to be integrated into the data access and visualization toolbox of the NASA SOSE REASoN project. The ocean science curricular module (Patterns and Processes in the Ocean) will be designed as a reusable content object (RCO) to be integrated into the SOSE internet-based toolbox. This will provide an incredibly valuable test to the "re-usability" of the RCE framework being developed through the SOSE project. This RCO will be based on NASA ocean-related datasets from several sources and will incorporate data-rich topics that span large scales in time and space. The primary data of interest are ocean temperature (SST), ocean color (chlorophyll), ocean winds and sea surface height. These datasets are perfect for illustrating and exploring physical relationships driving patterns and processes in the oceans across large scales in space ant time. This module will allow students to explore relationships among many physical and biological variables and begin to understand the physical processes influencing the distribution of organisms throughout the oceans.

Mark Brzezinski **4/1/2004-3/31/2008** **$594,338**
National Science Foundation, OCE-0350576

Testing the Utility of Natural Variations in Isotopes of Si as a Proxy for Silica Production in the Sea

In the mid 1990's it was discovered that diatoms fractionate isotopes of silicon during silicon biomineralization opening the possibility of using natural variations in isotopes of silicon in dissolved Si and in diatom frustules as a tool for assessing silica production in both the past and present day ocean. Diatoms with their silica ballast are key vectors of organic matter out of the euphotic zone. Their obligate need for Si means that their contribution to primary productivity and the biological carbon pump can be controlled by the availability of silicic acid in ocean surface waters. Natural variations in isotopes of Si in diatoms and silicic acid offer a possible means of assessing relative silicic acid use on longer time scales and larger spatial scales than any other technique currently available. This project proposes to continue evaluating and calibrating the ∂30 Si proxy.

Mark Brzezinski **12/1/2003-11/30/2007** **$155,755**
Oregon State University, OSU S0793A-G

Plankton Dynamics and Carbon Cycling in the Equatorial Pacific Ocean: Control by Fe, Si, and Grazing

In collaboration with investigators at Oregon State University, as part of a grant from the NSF Biocomplexity Program, the UCSB PI will participate on two cruises to the Equatorial Pacific Ocean. Dr. Brzezinski's primary responsibility is to make measurements of silica dissolution rates. UCSB's research team will also assist in measuring silicic acid concentration, biogenic silica concentration and silica production rates. Additionally, the UCSB researchers will participate in K-12 outreach workshops related to this project in Oregon and Maine.

Brian Campbell **9/1/2003-8/30/2006** **$72,000**
David Valentine
National Aeronautics and Space Administration, NGT5-50468

Hydrogen Isotope Systematics of Lipid Biomarkers from Sulfate-Reducing Bacteria

This graduate student research project will examine hydrogen isotope fractionation by sulfate-reducing bacteria (SRB). One objective is to understand deuterium/hydrogen (D/H) systematics in SRB. Pure cultures of SRB will be grown in media of varying _D/ lipids and metabolites will be monitored for D/H response. Another objective is to develop lipid biomarker proxies for anoxia.

Compound-specific _D analyses will be conducted on lipid biomarkers from oxic and anoxic environments (e.g., Black Sea). A viable proxy (associating anoxia with _D of a particular compound) could place constraints on redox conditions of Proterozoic oceans, thereby contributing to the understanding of biological-planetary interactions.

Bradley Cardinale **10/1/2006-9/30/2008** **$275,000**
National Science Foundation, DEB-0614428

Effects of Algal Diversity on the Productivity of Streams: Does Diversity Play a Greater Role in Variable vs. Constant

Ecologists have long studied how the productivity of ecosystems limits species diversity, but the converse question of how diversity controls production has recently emerged as a prominent topic of research. In part, this question has been prompted by accelerating rates of extinction and invasion that reduce and homogenize species pools, requiring a better understanding of the ecological consequences of diversity loss. Studies to date have advanced knowledge of how, when and why species diversity can affect primary production. However, these studies have been limited in scope, focused mostly on randomly assembled communities of grassland species placed together in experimental units that are spatially homogeneous and isolated from external processes such as disturbance and dispersal. In fact, it seems that most studies have worked hard to eliminate forms of spatial and temporal heterogeneity that might increase experimental 'noise'. These forms of heterogeneity are potentially the same ones that maintain diversity in the first place, and theory suggests they are necessary for species to express niche differences that affect resource capture and production. Recent models even argue that diversity per se will only influence productivity in a variable environment where taxa have full opportunity to express niche differences. The PI seeks to add heterogeneity back into the study of diversity-function relationships by examining how key aspects of spatial and temporal variation moderate the impacts of species diversity on primary production. He will take an empirical approach focusing on stream periphyton (benthic algae) as a model system. Periphyton are useful as a model because the diversity and composition of algae in streams are known to be structured by spatial heterogeneity in flow, and by patchy disturbances that intermittently scour substrates.

Craig Carlson **4/1/2003-3/31/2008** **$592,198**
National Science Foundation, MCB-0237725

Collaborative Research: Linking Microbial Discovery to Biogeochemical Processes in an Oligotrophic Oceanic Microbial Observatory

This renewal project focuses on microorganisms that live in the ocean surface layer (0-300 m), one of the largest habitats on earth. Microorganisms in the ocean surface layer play an integral role in carbon transport from the atmosphere to the deep ocean. Small perturbations in the metabolism of DOC by microorganisms could strongly impact the balance between oceanic and atmospheric Co2. Thus, the microbial processes that determine DOM production, consumption and distribution in the oceans are important to the global carbon cycle. A relatively small set of microbial groups dominates the ocean surface. Most of these organisms have never been cultured for study in scientific laboratories. The goal of this project is to understand the cell biology and biogeochemical activities of the major bacterioplankton groups by applying new high throughput technologies for cell culturing, and studying the metabolism of these organisms in nature and their interactions with organic matter in the oceans. This effort will be focused on the Bermuda Atlantic Time-series Study (BATS) site, a subtropical gyre characterized by winter time convective overturn, spring phytoplankton blooms, and regular patterns of DOC cycling.

Craig Carlson **7/1/2004-6/30/2007** **$342,038**
National Science Foundation, OCE-0425615

The Effect of Mesoscale Eddy Perturbations on Microbial Processes and Community Structure in the Sargasso Sea

This is a companion project to the "EDDIES" (EDdy Dynamics, mixing Export, and Species composition) project funded by NSF Biological, Chemical and Physical Oceanography. This

interdisciplinary field program was initiated in the Sargasso Sea during the summers of 2004 and 2005. Recent evidence suggests that mesoscale eddies are an important nutrient transport mechanism in the oligotrophic waters of the main subtropical gyres. Numerical simulations and satellite-based statistical estimates indicate that the magnitude of the eddy-driven nutrient flux could be sufficient to balance geochemical estimates of new production. Relatively few direct observations of this process are available, owing to the spatial and temporal intermittency of the events that drive it. Available data demonstrate that isopycnal displacements associated with certain types of eddies can transport nutrients into the euphotic zone, resulting in the accumulation of chlorophyll in overlying waters. Preliminary data indicate that coincident with the passage of a cyclonic eddy at the BATS site, bacterial production rates were significantly enhanced relative to the monthly mean values. However, the extent of the prokaryotic heterotrophic response and their impact on coupled biogeochemical cycles and export has yet to be elucidated. The principal investigator will sample parameters relevant to heterotrophic prokaryotes across mesoscale eddies documenting how these parameters vary inside the eddy through time and space (horizontal and vertical) relative to outside ("control") waters.

Craig Carlson **1/1/2003-12/31/2006** **$246,537**
University of Miami, UNIV MIAMI SB030082

Collaborative Research: Global Ocean Repeat Hydrography, Carbon, and Tracer Measurements

Dissolved organic matter (DOM), represents one of the largest exchangeable carbon reservoirs on earth. The global dissolved organic carbon (DOC) pool is estimated to be 685 Pg C (Pg = 1015 g C; Hansell and Carlson, 1998a), a value comparable to the mass of inorganic C in the atmosphere. Small perturbations in the production or sink therms of the oceanic DOC pool could strongly impact the balance between oceanic and atmosphericCO2. In this global ocean repeat hydrograph, carbon and tracer program, D. Hansell (University of Miami) and C. Carlson of UCSB will be responsible for at sea sampling and analyses of dissolved organic carbon (DOC) and nitrogen (DON) measurements. This program includes 17 legs of 10 cruises conducted in various ocean basins from 2003 - 2008.

Craig Carlson **9/1/2002-8/31/2007** **$253,359**
Virginia Institute of Marine Science, 519207/1248

Quantification and Modeling of DOC and DON Release in Marine Systems: A Study of Increasing Trophic Complexity

This project complements and expands the PI's ongoing work examining interactions between microbial communities and bioavailability of DOM. He will be responsible for measurements of the microbial dynamics community and selected characterization of the DOM pool. He will provide expertise towards the microbial dynamics and processing of organic matter, and will be responsible for measuring microbial biomass and production in both experimental and field work. Other tasks for the UCSB PI are to oversee the experimental design of the bioavailability study and bacterial growth efficiency experiments; to measure bulk DOM (DOC and DON) concentrations for the oceanic component of the project and for bioavailability studies; to characterize the dissolved combined neutral sugars and dissolved free amino acids in the field and in experimental studies using HPLC technologies; and to participate in data reduction and analysis and publication of papers and reports.

James Case **12/1/2004-10/31/2007** **$240,000**
US Department of the Navy, N00014-05-1-0046

Coastal Bioluminescence: A Collaboration Dealing with Sources, Population Dynamics and Instrumentation

The goal of this project is to complete a major line of ONR-supported research that received its initial impetus in 1983. As a result of his involvement as a member of the BIDS committee reporting to the Submarine Security Division of the Johns Hopkins Applied Physics Laboratory, the PI developed ideas leading to this line of research. For several years BIDS regularly reviewed ASW/SSN Security field tests dealing with bioluminescence related to submarine security and detection, followed development of an airborne system for detecting submarines at operational depths from their

bioluminescence, and evaluated reports of related work by researchers from other sources, primarily the USSR. The PI's work has focused on development of an adequate bioluminescence detector to reliably sample the bioluminescent biota in the open sea to depths relevant to the Navy.

James Case **8/1/2005-7/31/2006** **$40,000**
WetLabs, Inc., SB060041

An Underwater Bioluminescence Assessment Tool (U-BAT)

This is part of a project that is funded by the Office of Naval Research under the Small Business Technology Transfer Program (STTR) with the lead institution WET Labs, Philomath, OR, a long-established developer and manufacturer of oceanographic equipment. WET Labs will lead in the development of numerous improvements to a profiling bioluminescence sensing instrument that was created by the Principal Investigator's group at UCSB with ONR support. The instrument will be further developed, tested and integrated into a general bio-optics instrument package.

James Case **8/29/2006-2/29/2008** **$115,681**
WetLabs, Inc., SB070041

An Underwater Bioluminescence Assessment Tool (U-BAT), Phase II

This is part of a Phase II proposal to the Office of Naval Research under the Small Business Technology Transfer Program (STTR) with the lead institution WET Labs, Philomath, OR, a long established developer and manufacturer of oceanographic equipment. WET Labs will lead development of numerous improvements to a profiling bioluminescence sensing instrument developed by Dr. Case's group at UCSB with ONR support. The Case Laboratory at UCSB has developed and extensively field-tested, with ONR support, three generations of a profiling bioluminescence sensing instrument that will be further developed, tested and integrated with WET Labs lead, into a general bio-optics instrument package. UCSB's phase II efforts in the project will include assistance with the following: 1) Final Underwater Bioluminescence Assessment Tool (UBAT) design. 2) Final prototype design and review. 3) Final design and development of the new combined bioluminescence and IOP sensor and software. 4) Final design review to ensure all technology was transferred accurately and meets MBBP-03 design characteristics. 5) Calibration and validation tests of the combined bioluminescence and IOP sensor in the UCSB laboratory marine optics facility. 6) Review of data collected in laboratory and field, including the efforts of other investigators on prototype tests, with analysis and recommendations. 7) Recommendation toward final UBAT definition.

Jennifer Caselle **2/1/2007-3/31/2008** **$85,197**
UC Sea Grant, R/OPCFISH-05-S-1/2

Assessing Changes in Life History Traits and Reproductive Function of CA Sheephead Across its Range: Historical Comparisons and the Effects of Fishing

The overall goal of this project is to address many of the data deficiencies identified during the recent stock assessment of California sheephead in order to allow managers to reduce uncertainties in the assessment and to better assist resource management of this key component of the nearshore ecosystem. In addition, the PI will provide a unique test of specific predictions from life history theory on the effects of size- and sex- selective harvesting on a temperate sex-changing fishery species. Specific questions to be addressed are: 1) What are the current levels of life history characteristics (growth rates, age and length at maturity, age and length at sex change, sex ratio) and how do these characteristics vary across the species range? 2) What is the current reproductive output and potential across the species range? 3) How have life history characteristics and reproductive output changed through time, and can this be related to shifts in and types of fishing pressure, shifts in environmental parameters (e.g., ENSO, PDO), and/or changes in population density? The basic approach is to undertake a comprehensive and current examination of spatial variation in age, growth, density and reproductive function.

Jennifer Caselle **9/3/2006-8/31/2007** **$14,010**
Libe Washburn
US Department of Commerce, NCND6021-6-00021

Maintenance of PISCO_CINMS Moorings in the Channel Islands National Marine Sanctuary

Near-island instrumentation, customized for particular locations, provides information necessary to understand and track water mass movements that affect recruitment of key species to coastal habitats. Inter-annual and shorter-term upwelling and relaxation events have been shown to drive recruitment and movement of certain fish species. It is also likely that these events affect other resources, including keystone species. How specific events function to affect living resources depends on the timing of reproduction and behavior of the various life stages of the animals and plants. Some rockfish species with larval phases offshore in the upper water column, for example, may only recruit to coastal habitats when upwelling drivers allow relaxation, and offshore surface waters approach shore. Rockfish with deeper larvae would be held offshore during such times, and move towards shore only when upwelling resumes. Understanding these dynamics provides a measure of predictive capacity for managers and could help explain anomalies. It also allows managers to make informed decisions with regard to placement and size selection of reserves designed to protect or restore particular resources, as well as explain changes in populations, trophic structure, and forcing functions and processes (e.g., seasonal and longer-term cycles of reproduction dispersal, and recruitment). To provide CINMS with data on water mass movements, six SEA stations were established in 2004 around the Channel Islands and customized to address the information needs of individual areas.

Jennifer Caselle **7/1/2005-6/30/2008** **$172,791**
USDI - National Park Service, J8C07050004

Establish Baseline Ecological Conditions of Newly Established Marine Reserves at the Channel Islands

The State of California has recently approved a network of marine reserves that closes over 20% of Channel Islands National Park (CINP) waters to harvest. Both commercial and recreational interests have exploited fish, invertebrates and algae for many years; and there is evidence these activities have had large-scale impacts on marine ecosystems. Traditional fisheries management (season, bag, and size limits, permits) has failed to adequately protect marine resources. Establishment of no-harvest zones is a needed action for restoring ecosystem health. This is the largest network of marine reserves in the U.S. and provides the best opportunity to demonstrate the conservation value of no-harvest zones. This project expands the CINP's existing kelp forest monitoring program through establishment of up to sixteen new fixed sites and will monitor existing sites to ensure adequate inside/outside reserve baseline data to properly evaluate the effectiveness of the new marine reserves. The project will be conducted in cooperation with UCSB's Partnership for Integrated Studies for Coastal Oceans (PISCO) subtidal monitoring program to collect fish abundance and size estimates at the monitoring locations.

James Childress **8/15/2003-7/31/2007** **$248,007**
National Science Foundation, NSF OCE-0240982

Collaborative Research: Site Evaluations and Background Studies of Interactions Among Fluid Chemistry, Physiology, and Community Ecology for Ridge 2000 Lau Basin Integrated Studies

Two cruises to the East Lau Spreading Center (ELSC) are proposed to evaluate sites for selection as the Integrated Study Site (ISS) bull's eye for the Ridge 2000 program and to carry out studies necessary for further interdisciplinary research in this area. In addition to exploration and biological mapping, the sites will be carefully evaluated in terms of the relation between the chemistry of the diffuse flow vents and the macrobiology. This is especially important to do at this time because the only available water chemistry data for this region is from high temperature vents and indicates that Zn is very high and sulfide and methane are very low; this is not consistent with the abundant

communities of sulfide and perhaps methane-oxidizing symbioses reported in diffuse flow. This work is complementary to, and will follow upon, the first two major ISS evaluation cruises outlined in the Implementation Plan for the site.

Ellen Damschen **11/1/2005-10/31/2007** **$10,000**
Steven Gaines
National Science Foundation, SB060070

Biological Informatics Postdoctoral Fellowship

The purpose of this project is to conduct a first test of large-scale habitat configuration effects on species diversity and composition over time in kelp forests using rare long-term datasets from the Santa Barbara Channel. The investigator seeks to determine the effects of the spatial arrangement of habitat in kelp forests on community composition and species abundances and distributions in order to provide a differential tool that can be used to assess the importance of connectivity and patch shape for species with different life history traits at two different scales. Objectives include: determining if the degree of patchiness at two different spatial scales has increased over time due to human-induced impacts (e.g., urchins, pollution, climate variability); quantifying suitable habitat for kelp and determining if the area, isolation, and shape of available substrate affects kelp colonization and turnover; and determining if kelp forest patchiness affects the distribution and abundance of marine species and whether life history traits (reproductive mode, planktonic larval duration, vagility) can predict species responses.

Daniel Dawson **7/12/2002-11/30/2006** **$50,000**
US Department of Agriculture, USDA02DG11050464-022

Fuel Reduction, Product Utilization, and Low-Impact Forest Management in an Ecological Reserve at the Urban/Wildland Interface

Valentine Eastern Sierra Reserve, an ecological reserve and research station owned and operated by the University of California, is located at the urban/wildland interface between the town of Mammoth Lakes and the Inyo National Forest. Wildfire has been suppressed on the Reserve for approximately 150 years. Research shows that fire average recurrence intervals before that time were as frequent as nine years. Very high loading of fuel has accumulated, and the forest is in a very unhealthy condition with excessive stand density. The University has been engaged in a low level of forest management and fuel reduction since 1997 and has employed as a consultant Dr. John Tappeiner, former Chief Silvaculturist of Region Five of the USFS. Dr. Tappeiner has identified a desired future condition for the forest and outlined the management steps necessary to achieve it. Reserve personnel will work with him to prepare a Timber Harvest Plan to meet the requirements of the CA Forest Practices Act. The project will require significant reduction in stand density and methods to remove stems and slash from the forest without compromising the ecological integrity of the Reserve.

Tom Dudley **4/1/2007-8/31/2007** **$15,750**
Dersu & Associates, SB070110

Nam Theun Wetland Restoration Ecological Study

A large hydropower dam will be constructed on one of the main tributaries to the Mekong River, the Nam Theun River, on the Nakai Plateau in central Laos. The Nam Theun 2 dam project is projected to flood approximately 340 km2 of the plateau. This region has an incredibly high biodiversity, and habitat in the reservoir footprint is used by many endangered and rare animals. Very little is known about the ecology of wetlands in this region, although it has been identified as an area of international significance. The primary objectives of this initial stage of the study are to document natural wetland ecosystem biodiversity, processes, and functions before the dam is built, help guide development of a conceptual wetland restoration plan to be implemented as part of the dam construction, and establish long-term monitoring sites for evaluation of restoration success.

Tom Dudley **3/1/2007-12/31/2007** **$7,261**
Shoreline Preservation Fund - Associated Students UCSB, WIN07-04

Sustainable Control of Invasive Arundo donax Along the UCSB Coastal Zone

A student researcher, Yoshi Tamagawa, will evaluate the distribution of the invasive reed, Arundo donax, in riparian and shoreline habitats adjacent to the UCSB campus. He will also evaluate the distribution of an herbivorous wasp in these areas - this wasp has potential to reduce the growth and invasiveness of Arundo. In common garden experiments at the UCSB greenhouses at More Mesa, the student will evaluate the damage to Arundo caused by wasp feeding relative to uninfested plants. Information from this study will directly benefit the UCSB community by identifying populations of Arundo around campus that may interfere with current campus restoration projects. Evaluating the impact of wasps on Arundo will enable researchers to determine whether these wasps will be effective for permanent control of Arundo populations in this area.

Tom Dudley **9/1/2006-8/31/2007** **$60,012**
UC Davis, 2006-34439-17024

Ecological Basis for Biological Control of giant reed (Arundo donax) in California

Giant reed (Arundo donax) may be the most destructive invader of California riparian areas. Classical biological control is a cost-effective and environmentally benign alternative to traditional control methods. Candidate agents have been identified, but their eventual release is predicated upon evidence that damage is substantial, and greater than that potentially caused by herbivores already present in North America. It is also important to establish monitoring programs so that efficacy can be evaluated when and if releases take place. The PI and postdoc will characterize vegetation at two spatial scales for the Santa Clara River riparian ecosystem as a baseline for future evaluation of field effectiveness of Arundo biocontrol, and recovery of desired vegetation and associated wildlife. Associated woody and understory plants will be surveyed, and plant growth parameters will be compared with those found in the European range of origin. They will also characterize the herbivore complex already present on giant reed in North America, in particular a recently discovered stem-boring wasp in Ventura County, to evaluate the potential for augmentation biocontrol as an alternative to introduction of non-native natural enemies. They will create an internet-based outreach program for the dissemination of information critical for the control and management of Arundo populations, both regionally and nationally.

Tom Dudley **12/15/2005-12/14/2007** **$305,000**
US Department of Agriculture, 2006-35302-16641

Regional Targeting of Biological Control Agents Against Saltcedar (Tamarix spp.) in North America

This research is designed to enhance the effectiveness of biological control of saltcedar (Tamarix spp.) where this noxious weed infests floodplain ecosystems throughout the western U.S. An approved biological control agent from north-central Asia (Chrysomelidae: Diorhabda elongata from 44.1°N) has been released in experimental sites in eight western states, but establishment in most has been weak or absent. Poor establishment appears to be related to developmental asynchrony with environmental conditions, especially photoperiod, and secondarily to host plant genotype, across the wide range of latitudes where it has been tested. A second biotype or genetic form of Diorhabda from the Mediterranean region (35.1°N) has now been released at four sites, with moderate to poor establishment. Eight biotypes of Diorhabda are currently maintained from other latitudes in Eurasia and northern Africa, and these have been tested to ensure safety for subsequent release. However, before widespread releases of these insects can take place, the responses of the geographical biotypes to field conditions must be tested, including host genotype, climate, and especially photoperiod, across a representative range of infested ecosystems. The PI will conduct field tests across three North-South latitudinal gradients in Pacific western, arid interior and mid-continent locations, and will simultaneously characterize the full range of developmental responses of the Diorhabda biotypes to photoperiod and temperature under controlled conditions.

Tom Dudley **11/30/2005-9/30/2010** **$100,000**
US Fish & Wildlife Service, 81440-5-G021

Biological Control of Invasive Giant Reed (Arundo donax) in the Santa Clara River Watershed

Giant reed (Arundo donax) may be the most destructive invasive plant infesting southern California riparian areas, including the Santa Clara River. Because traditional control methods are very costly and incur substantial collateral damage, the PI seeks to develop biological control as a cost-effective and environmentally benign means to reduce Arundo infestations using imported natural enemies that specialize on these plants in their Eurasian regions of origin. The ultimate objective of this project is to suppress the growth and reduce the abundance of Arundo in infested riparian ecosystems, thereby eliminating competition with native woody and understory species and facilitating ecological recovery of the Santa Clara River ecosystem and riparian associated wildlife. This ecosystem provides an excellent test location, but the program is directed towards subsequent implementation throughout southern California and other infested ecosystems of North America. The overall objective is to identify and evaluate herbivorous insects and plant-infecting fungi with the following specific goals: 1) quantify level of damage to the target plant, including plant mortality; 2) verify that agents do not feed on nor infect native and economically important plants; 3) evaluate potential for large-scale rearing, transport and introduction into infested field locations.

Jenifer Dugan **7/1/2005-9/30/2006** **$15,558**
Cal RA Department of Fish and Game, P0575002

Investigation of the Depuration of Petroleum Hydrocarbons by Sand Crabs

An average of 75% of the world's open coast shorelines are sandy beaches. This high prevalence means that sandy beaches are likely to receive the majority of contamination from a spill or other impact associated with coastal and offshore oil and gas activities. The sand crab, Emerita analoga, occurs intertidally on almost every type and length of ocean beach and is often the dominant macrofaunal species. This species has been shown to exhibit sensitive and plastic life history responses to environmental variation and anthropogenic impacts. Populations of E. anologa have been used as bioindicators and are bioaccumulators of metals and hydrocarbons. The main study objective of this project is to determine the sand crab's ability to depurate petroleum hydrocarbons and to determine the relative half life (T1/2) of PAHs in sand crabs. This information will enhance the understanding and interpretation of tissue burdens of petroleum hydrocarbons in this widespread intertidal species.

Jenifer Dugan **7/1/2006-6/30/2007** **$29,999**
Henry Page
Cal RA Department of Fish and Game, P0675003

Restoration Approach for Sandy Beaches Impacted by an Oil Spill and Cleanup Activities

Exposed sandy beaches comprise three-quarters of the world's open coast shorelines and are valued for human recreation and as habitat and resources for wildlife. This prevalence means beaches are often the primary coastal habitats affected by oil spills and cleanup activities. Agencies, such as the OSPR and the National Oceanic and Atmospheric Administration, are under increasing pressure to develop environmentally sensitive, cost-effective strategies to respond to, clean up and restore beaches impacted by an oil spill. Macroinvertebrate communities inhabiting sandy beaches depend almost entirely upon allocthonous inputs of carbon and organic material. For California beaches, stranded marine macrophytes (macroalgae, sea grasses) from rocky reefs represent a major subsidy that supports a diverse and productive portion of beach food webs. Changes in the supply and accumulation of macrophyte wrack have significant bottom-up effects on this ecosystem, altering the biodiversity, structure, composition and dynamics of the macroinvertebrate community, and consequently the availability of prey to higher trophic levels, such as shorebirds and fishes. Results from groomed beaches suggest that removal of rack significantly reduces not only wrack cover, but the species richness, abundance and biomass of intertidal macroinvertebrates, prey availability to shorebirds and the cover of dune vegetation on sandy beaches. This study will provide the first experimental investigation of the potential ecological recovery of a beach affected by an oil spill and cleanup activities.

Jenifer Dugan **12/1/2005-3/31/2007** **$5,978**
Shoreline Preservation Fund - Associated Students UCSB, Fall 05-07

Investigating the Ecological Impacts of Coastal Armoring on Sandy Beaches

The ecological effects of seawalls on sandy beaches are little studied and poorly understood. As a consequence of this lack of knowledge, potential ecological impacts of seawalls are not generally considered in decisions regarding seawalls. As sea level rises and coastal erosion accelerates, the need to understand the ecological consequences of coastal armoring on sandy beach ecosystems is increasingly urgent. Results from the PI's ongoing SPF project provide compelling evidence that seawalls are associated with measurable and significant ecological impacts to sandy beaches. This project will continue the investigation of the ecological effects of seawalls on sandy beaches located between Gaviota and Hope Ranch on the coast of Santa Barbara County.

Jenifer Dugan **2/16/2006-12/31/2006** **$15,000**
SRS Technologies, MSD-06-PR-0980

Assessing Habitat and Prey Resources for Western Snowy Plovers on Exposed Sandy Beaches of Vandenberg Air Force Base

Sandy beaches comprise three-quarters of the world's shorelines, including much of the California coast. Exposed sandy beaches compose 43% of the mainland coast of Santa Barbara County and are thus likely to receive the majority of contamination from a spill, leak, or other impact associated with human activities. Recently, the primary sites affected by a number of significant oil spills in central and southern California have been sandy beaches (Avila Beach, Guadalupe Dunes, Surf Beach and Huntington Beach). Despite their importance as a major component of the coast, recipients of ocean and land-based pollutants, and ecological, recreational and economic resources, beaches are the least understood and studied intertidal habitat on the California coast. The PI will produce a detailed description of the intertidal and supralittoral sandy beach habitat used by Western Snowy Plover for nesting and rearing chicks on Vandenberg Air Force Base exposed sandy beaches. The resulting report will include recommendations for incorporating prey and habitat measurements into the snowy plover monitoring program for VAFB.

Jenifer Dugan **4/1/2006-11/30/2007** **$9,999**
UC Sea Grant, R/CZ-PD121-F-1/1

Balancing Human Health Needs with Sustainable Harvest of Marine Resources for Biomedical Use: The Case of the Giant Keyhole Limpet

This study represents the first step in a proactive approach to a unique resource management issue: sustainable harvest of a marine animal that is the only source of a natural product important to the pharmaceutical industry. Basic information on the life history and population biology of this species does not exist and is critically needed for development of an effective management program that addresses the need for a sustainable harvest for biomedical use. The Investigators will gather and analyze basic information on the distribution, abundance and size structure of an important and potentially valuable marine species, Megathura crenulata, in a variety of habitats, both natural and artificial. They will also investigate key aspects of the reproductive biology of M. crenulata from selected habitats. This study will provide resource managers with information that will aid in the development of strategies for sustainable use and management of a marine species that is the only known source of potentially valuable biomedical products for human health, yet has life history characteristics that confer high vulnerability to overfishing. The study results will also support the pharmaceutical industry by providing information critically needed to achieve continued availability of a natural product important for development and commercialization of several promising pharmaceutical drugs with the potential to improve human health.

Jenifer Dugan **9/15/2005-9/14/2006** **$5,000**
USDI - Minerals Management Service, 0205P025828

Development of Response Protocols for Oil Spills in Sandy Intertidal Habitats

The investigator will collaborate with agencies and other scientists to develop protocols for rapid

baseline assessments that can be used in responding to oil spills on sandy beaches. These protocols will be suitable for use before oil arrives to a shoreline and will assist in assessment of injury to shorelines. The research involves review of existing information on sandy beach sampling protocols. The PI will identify a set of protocols that are potentially adaptable for rapid assessment use, as well as areas of uncertainty, data gaps and research needs for this effort. Finally, a set of potentially useful methods for the design of protocol tests will be prioritized, with a resulting subset for use in assessing the quality of habitat and diversity of resources on sandy beaches immediately preceding an oil spill.

Jenifer Dugan **9/6/2000-6/29/2007** **$259,724**
USDI - Minerals Management Service, Task 17610 MMS-31063

Joint UCSB-MMS OCS Student Internship Program

The purpose is to develop a sustained student internship program involving the joint cooperation of the MMS-Pacific Outer Continental Shelf (POCS) regional office, the UC MMS Coastal Marine Institute, and the Environmental Studies Program at UC Santa Barbara. This program provides the MMS-POCS regional office with qualified student interns who have a demonstrated interest in POCS-identified issues and offers the students an opportunity for work experience in the processes by which the MMS-POCS office manages offshore resources. Overall objectives are to increase the number of students exposed directly to CMI-funded research projects, to generally strengthen discourse between the UC and MMS, to provide students with a forum for presenting and discussing their research interests as they relate to the interests of MMS, and to keep the MMS-POCS staff abreast of marine research at UCSB and the progress of CMI projects, as well as to expose them to topics of particular interest.

Jessica Dutton **7/1/2004-6/30/2007** **$50,000**
Gretchen Hofmann
UC Toxic Substances Research and Teaching Program, SB040104

Interspecific Stress Expression in a Native/Invasive Pair: Independent and Additive Effects of Temperature and Chemical Exposure in the Invasive Mussel Mytilus galloprovincialis and its native Cogener Mytilus trossulus

Chemical pollution has become a significant characteristic shaping many coastal habitats and communities and likely exerts a selective force upon organisms therein by redefining the parameters of physiological stress for those areas. It has been suggested that invasive organisms may be successful at infiltrating new environments in some part due to relatively robust stress tolerance capabilities. This suggestion can be tested by comparing the relative physiological responses to cumulative environmental stressors in a native and invasive species pair, the bay mussels Mytilus trossulus and M. galloprovincialis respectively. By examining field and laboratory relationships between contaminant exposure, biological uptake, thermotolerance capabilities and physiological stress in the two species, this study will elucidate some of the physiological differences that may have helped M. galloprovincialis successfully invade the west coast of the United States and elsewhere. This research should contribute to our understanding about the role of environmental pollution in biological invasions, and will also reveal much about the relative merits of the two study organisms as sentinel species for monitoring purposes.

John Engle **5/30/2002-12/31/2007** **$160,957**
UC Santa Cruz, UCSC 14350102CA85144

Coordination of Database Development, Protocol Standardization, and Regional Activities Between Minerals Management Service and Others in the Multi-Agency Rocky Intertidal Monitoring Network

The UCSB portion of the multi-campus Minerals Management Service (MMS) program, "Shoreline Assessment of Changes in the Rocky Intertidal in the Southern California Bight," consists of coordination of database development and maintenance, protocol standardization, and other regional activities between MMS and the additional agency members of the Multi-Agency Rocky Intertidal Network (MARINE). The program includes principal investigators from UC Santa Cruz, UC Los

Angeles, UC Santa Barbara, and California State University, Fullerton. The primary Cooperative Agreement is arranged between MMS and UCSC, with subcontracts extended to the other California institutions.

John Engle **9/29/2006-3/1/2008** **$9,976**
USDI - National Park Service, J807060010

Interim Funding of Four San Diego County Rocky Intertidal Monitoring Sites

Limited field data entry (slide scoring, data entry with no analysis) is needed for the results from the spring 2006 rocky intertidal monitoring event for sites near and within Cabrillo National Monument. Dr. John Engle and his staff will provide the slide scoring and data entry at UCSB's laboratories from October through December 2006 for four sites. Park staff will provide the slide scoring and data entry at Cabrillo NM for the three sites within the park's administration. The electronic format of this data is critical in order for UCSB, the National Park Service, and other regional members of the Multi-Agency Rocky Intertidal Network (MARINe) to use this information and compare local data within a regional context. Data will be contributed to the MARINe database by both groups by June 2007. Data will be reviewed and included in park management documents following the entry into the MARINe database.

Erica Fleishman **5/1/2007-3/15/2009** **78,738**
O. James Reichman
Cal Coastal Conservancy, 06-135

Non-market Ecological Valuation of Coastal Marine Resources in California

The National Center for Ecological Analysis and Synthesis (NCEAS) will evaluate and synthesize methods for deriving the value of ecosystem services that are provided by coastal marine resources in California. The working groups convened by NCEAS will

- compile a lexicon related to valuation of ecosystem services
- create a preliminary list of services in coastal marine California that are expedient and tractable to value
- evaluate and synthesize methods for deriving the value of ecosystem services
- consider the extent to which surrogate measures of market or non-market values can be developed and implemented
- assess the uncertainty in direct or indirect measurements of ecosystem services and discuss how those uncertainties might affect management options or decisions
- calculate the value of at least one of the services provided and define the potential uncertainties associated with that value

To accomplish these tasks, NCEAS will convene approximately three workshops and working groups of economists and ecologists with appropriate expertise. Tasks will be supported by a graduate assistant and by NCEAS staff. NCEAS will work closely with OPC to ensure that deliverables include not only complete documentation of activities conducted at NCEAS and associated inferences, but summary products that are suitable for decision-makers and the educated public.

Erica Fleishman **6/6/2007-6/5/2008** **$385,781**
US Fish & Wildlife Service, 813327J002

Integration analysis, and synthesis of results from Evaluation of a Pelagic Organism Decline (POD) in the Upper San Francisco Estuary

The Interagency Ecological Program (IEP) for the San Francisco Bay/Sacramento-San Joaquin Estuary consists of nine member agencies: three State (Department of Water Resources, Department of Fish and Game, and State Water Resources Control Board), and six Federal (Fish and Wildlife Service, Bureau of Reclamation, Geological Survey, Army Corps of Engineers, National Marine Fisheries Service, and Environmental Protection Agency) and also includes a non-government organization

(The San Francisco Estuarine Institute) among its program partners. Working together, the mission of the IEP partners is to develop a better understanding of the estuary's ecology and the effects of the State Water Project (SWP) and Federal Central Valley Project (CVP) operations on the physical, chemical, and biological conditions of the San Francisco Bay - Delta estuary. To accomplish its goals, IEP members conduct and sponsor a large number of long-term monitoring surveys as well as shorter term studies. The overall goal for the proposed work with NCEAS (including but not limited to working groups) is to conduct and/or guide the integration, analysis, and synthesis of Pelagic Organism Decline (POD) and other relevant data and information in a more efficient, sophisticated, unbiased, and synergistic manner than would be possible with local resources alone. The focus of the NCEAS working group (and other activities as appropriate) is identification of and testing of hypotheses about POD trends, individual and interacting stressor(s) associated with the observed POD trends, the linkages among these stressors, and the mechanistic pathways leading to the observed trends. The degree of uncertainty associated with any conclusions will also be clearly identified.

Erica Fleishman **5/15/2007-5/30/2008** **$94,500**
US Forest Service, 05-JV-11221682-21

Response of Birds, Butterflies, and their Habitats to Management of Wildland Fuels and Fire Regimes

Resource agencies across the Intermountain West are concerned with the response of bird communities and individual species of birds to fire and fire management. Understanding the response of cavity-nesting birds is especially important because the quality of habitat for many species is affected by fire. In addition, cavity-nesting species often are designated as Management Indicator Species or Sensitive Species. The PI will address local data gaps on the distribution and abundance of birds, including species identified as Sensitive or priorities by USFS and Nevada Partners in Flight, and the response of those species and their habitats to management of wildland fuels and fire regimes. Birds, butterflies, and vegetation will be sampled using established techniques that detect species presence reliably and permit assessment of distributional trends across space and time. Results of the collaborative project will be summarized and reported in several forms, including publication in peer-reviewed scientific journals and USFS General Technical Reports. Electronic databases and associated metadata also will be developed.

Erica Fleishman **4/27/2007-4/30/2008** **$100,000**
Wilburforce Foundation, UCSB0703

Analysis and Conservation Prioritization of Landscape Connectivity in Nevada

The PI will develop a rigorous scientific assessment of landscape connectivity from the perspective of multiple system components that can be used to inform management and policy in Nevada. The Southern Nevada Public Land Management Act and the Lincoln County Conservation, Recreation and Development Act are examples of specific, current opportunities to use science to prioritize land acquisition and allocation of multiple land use. This study will examine natural and, especially, anthropogenic drivers that may affect connectivity for riparian systems, sagebrush steppe, and pronghorn. This process, and its application to management and policy, will be enhanced by participation of a multidisciplinary group of approximately twenty scientists and practitioners who are dedicating their time and expertise to the effort. It is anticipated that products of geospatial analyses will be used by scientists, land managers, policy makers, and other stakeholders to explore alternative scenarios of land use, climate change, and management options in Nevada.

Erica Fleishman **12/1/2006-11/30/2007** **$25,000**
O. James Reichman
Wilburforce Foundation, UNIVE0611

New Tools for Incorporating Landscape and Population Connectivity into Conservation Planning

Conservation area design (CAD) is being used by many landscape-scale conservation efforts in western North America to establish geographic priorities and to raise awareness within the scientific, practitioner, and lay communities of the importance of critical areas. CAD techniques can identify

important locations, but it is generally acknowledged that these techniques currently cannot evaluate factors that allow species and their resources to persist over time. These factors include land-cover connectivity and the resilience of reserve networks to ecological processes such as fire. Several new methods for CAD are emerging that have the potential to improve greatly on past methods. These new methods are unfamiliar to most practitioners, and no comparative evaluation of their usefulness in different contexts exists. The National Center for Ecological Analysis and Synthesis (NCEAS) will host a meeting of approximately 10-12 scientists who are conducting some of the most innovative research on incorporating connectivity and ecological processes into conservation planning. The meeting will be held at NCEAS' facilities in Santa Barbara, California.

Erica Fleishman **2/1/2007-8/31/2007** **$103,673**
Wildlife Conservation Society, SB07121

Linking Packard's Regional EBM Initiatives

Seven Regional Initiatives (RIs) supported by the David and Lucile Packard Foundation are working to integrate physical, natural, and social science activities to help design practical, transparent, and politically feasible management frameworks that advance coastal-marine sustainability - a process that has been termed "ecosystem-based management" (EBM). NCEAS and FOS will work with these seven projects to help them both define and improve the EBM work at their specific sites, and to bring them together to learn from one another in a learning network. There also is an opportunity to build capacity for data analysis, synthesis, and sharing into the individual projects and the network. As a first stage in this process, investigators will hold an initial meeting of the projects that can serve as a pilot test to see if a long-term learning network makes sense. NCEAS will help to introduce the project teams to concepts and tools related to data documentation, access, analysis, and synthesis and to determine what support and training in these areas would be required as part of the longer-term work.

Kathleen Foltz **9/1/2004-8/31/2007** **$375,000**
National Science Foundation, IOB-0415581

Understanding the Fertilization Signalsome

The activation of the quiescent egg during fertilization is the remarkable first step in the development of a new organism. Despite a long history of descriptions of the process, surprisingly little is known about the molecular details of fertilization in any system. In the eggs of all multicellular animals studied to date, a rise in intracellular calcium plays a key role in egg activation. The PI will conduct experiments designed to test hypotheses about the molecular mechanisms of the very early events of egg activation to examine how the rise in calcium is mediated and what triggers opening of calcium gates in the egg's endoplasmic reticulum. These studies are conducted on echinoderms (sea urchin and starfish), the best-understood model system currently in place for dissecting the egg activation pathway. Eggs (especially the highly synchronous echinoderm eggs) offer an exciting example of digital signaling, based on protein-protein interactions, that toggle the cell from "off" to "on" in seconds. Understanding the details of fertilization will provide insight into the general phenomenon of signal transduction as well.

Steven Gaines **6/20/2003-12/31/2007** **$360,000**
Andrew W. Mellon Foundation, SB030115

Linking Community Ecology and Biogeography: The Causes of Large-scale Variation in Marine Ecosystems

This continuation of previous research funded by the Mellon Foundation will focus on the biogeography of species interactions. Three complementary types of studies will examine the issues of how multispecies interactions are altered by oceanographic and geographic processes. 1. New models of species interactions targeted specifically at the large life history variation in the ocean: predator prey, competition, facilitation, parasitism and disease. 2. Coordinated experiments on the dynamics and consequences of species interactions at geographical scales, with repeated experiments at strategic locations to test hypotheses derived from modeling efforts. 3. Geographical sampling of the abundance and dynamics of key interacting pairs to examine if the large scale patterns are

consistent with model and experimental predictions. These types of studies are especially crucial to make any thoughtful advances in the design of marine reserve networks as effective means of ecosystem wide management.

Steven Gaines **1/1/2006-6/30/2007** **$163,707**
Cal RA Department of Fish and Game, P0570008

GIS and Analytical Support for the Marine Life Protection Act

The purpose of the project is to enable the Department of Fish and Game (Department) to meet the requirements of the Marine Life Protection Act (MLPA) by providing support for the Master Plan Team and a Regional Constituent Working Group, in the development of recommendations for a range of alternatives, and a preferred alternative for a network component of Marine Protected Areas (MPAs). The Department requires contracted services to provide scientific consultation, analyses and support for development of the draft Master Plan through the Regional Working Group Process; logistical support for the Master Plan Team; now called the Science Advisory Team (SAT); and map, document and data preparation. The UCSB research team will provide broad scientific and technical consultation, analyses and support focused on marine resources, habitats, and biological and physical processes and factors relating to possible MPA design and citing alternatives generated during the Working Group Process and subsequent to that until a preferred alternative of Central Coast MPAs is adopted by the Commission. UCSB will also provide logistical and communications support for the SAT to facilitate its advisory role to the Regional Working Groups and the Department. Finally, services will be provided to support hardware and software systems used to host the MLPA Initiative database, web-maps and decision support tools.

Steven Gaines **2/15/2002-8/31/2006** **$892,340**
Carol Blanchette
Mark Schildhauer
Christopher Jones
Matthew B. Jones
National Science Foundation, NSF DBI01-31178

Capturing Data in the Field: An Application Framework for Easily Creating Custom Data and Metadata Entry Forms on Handheld and Desktop Computers

The investigators will develop a set of software tools that will enable researchers to easily and powerfully configure custom data capture applications for use on handheld devices in the field, and desktop PCs in the lab. These applications will simultaneously enable researchers to provide critical, structured metadata necessary for their work to participate in a distributed "Knowledge Network for Biocomplexity," while also providing immediate benefit in terms of permitting greater ease, accuracy and efficiency in capturing original data in the field. This work is fully compatible with approaches involved in the Knowledge Network for Biocomplexity, while significantly extending the scope of those efforts by attempting to address informatics issues at their source: the point of data capture in the field. These tools should have broad applicability throughout the discipline, with potential ramifications to any context where researchers need to rapidly and easily develop customized data collection forms for handheld computers, with the added benefit that the resultant data sets will adhere to existing standards for metadata documentation and sound data set design.

Steven Gaines **6/1/2004-5/31/2007** **$26,172**
National Science Foundation, OISE-0402589

International: Dissertation Enhancement: Marine Population Connectivity Across the US/ Mexican Border: A Genetic Approach to Dispersal Dynamics in Kelp Bass

As fisheries around the world continue to crash, there is an urgent need to better understand the population dynamics of marine species. Empirical knowledge of population dynamics in the sea is basic at best, largely due to the challenge of studying the pelagic larval phase that provides the link between generations and across locations. The question of the scale and variability of larval dispersal, and consequently the degree of connectivity among populations, remains largely unanswered. Successful fisheries management will depend on knowing accurate scales of population

connectivity and the effects of flow dynamics on these scales through time and space. While efforts to incorporate complex flow and realistic propagule dispersion into analytical models of connectivity are progressing rapidly, empirical approaches to measuring marine larval dispersal patterns lag behind. This thesis project takes a genetic approach called genotype assignment (GA) to estimate dispersal patterns in the kelp bass Paralabrax clathratus. GA is a statistical clustering technique that can identify source populations of individuals based on multilocus genotype data.

Steven Gaines **1/1/2005-12/31/2009** **$5,217,999**
Robert Warner
Libe Washburn
Gretchen Hofmann
Oregon State University, F0395A-C

Partnership for Interdisciplinary Studies of Coastal Oceans (PISCO)

The Partnership for Interdisciplinary Studies of Coastal Oceans (PISCO) is a collaboration of scientists at four universities - Oregon State University, University of California at Santa Cruz, University of California at Santa Barbara, and Stanford University - with the goals of understanding the dynamics of the ocean ecosystem along the U.S. west coast, producing a new generation of scientists trained in interdisciplinary collaborative approaches, and sharing knowledge for science-based decisions regarding coastal and marine management and stewardship. Over the next five years, PISCO will address major scientific, technological, and cultural challenges to provide the information and tools that are essential for effective management and conservation of the ocean. Ultimately, PISCO will help society to enjoy the many benefits of intact, functioning marine ecosystems, including abundant ocean wildlife, sustainable commercial and recreational fisheries, and vibrant coastal economies.

Steven Gaines **8/22/2006-11/30/2007** **$136,241**
Satie Airame
Oregon State University, F0468A-A

New Advances in the Science of Marine Reserves, second editions of: The Science of Marine Reserves

The investigators will update the scientific information and expand the distribution and effective use of "The Science of Marine Reserves" booklet that was originally produced in 2002. The first edition was intended for use within the United States and has been very effective in sharing information about marine reserves with non-technical audiences. The booklets have contributed directly to the establishment of marine reserves in the U.S. However, since 2001 over 300 new papers on the science of marine reserves have been published. There is now a need to update the booklet. Two updated versions will be produced, one for U.S. audiences and a second (in English) for the international community. In addition to the two booklets, the processes used to develop the new materials will result in a stronger community of scientists that is familiar with the latest findings, ready to share that knowledge with users and decision-makers, and primed to advance the science of marine reserves through further research. The use of scientific advisors in intended to provide rigorous peer review in the development of content and to entrain a broad group of scientists in the distribution and use of the booklet.

Steven Gaines **5/1/2006-5/1/2009** **$4,000,000**
Christopher Costello
O. James Reichman
John Melack
Paul G. Allen Charitable Foundation, 8637

Sustainable Fisheries Project

Confidence in our ability to manage ocean fisheries is at an all-time low. Over-fishing has been determined to be the most important alteration of the oceans in the past millennium. The range of causes for the declines in US marine fisheries is large and diverse, but the global breadth of the problem points to a widespread failure of management systems as the critical root of the problem.

Fishery dynamics result from the interplay among physical oceanography, biological interactions, economic activities, and regulatory decisions. Yet, the standard management framework for fisheries meshes poorly with this inherent complexity. One of the largest problems is that market incentives create behaviors that are typically at odds with sustainable practices. Open access to fisheries favors overcapitalization and a race to fish that serves neither fish nor fishermen well. In many cases, more effective management strategies involving dedicated access privileges are known, but the pathway to implementation is unclear. In collaboration with Environmental Defense, three entities at the University of California, Santa Barbara will catalyze the reform of fisheries by coupling ecological analysis, economic models, and investment tools to help align positive ecological outcomes with fishermen's incentives. A Sustainable Fisheries Fund will be developed to support reform efforts. The UCSB entities include the Donald Bren School of Environmental Science and Management, the Marine Science Institute, and the National Center for Ecological Analysis and Synthesis. The project will implement these tools and strategies with significant investment from public and private sources.

Steven Gaines **12/1/2005-11/30/2007** **$326,372**
Resources Legacy Fund Foundation, 20050137M

MLPA Initiative Evaluation Tool

The purpose of this project is to develop a decision support tool for use by the Science Advisory Team for the Marine Life Protection Act (MLPA) Initiative, a public-private partnership between the Resources Agency, the Department of Fish and Game and the Resources Legacy Fund Foundation.

Steven Gaines **9/1/2003-8/31/2006** **$150,000**
The Pew Charitable Trusts, SB030106

A New Conceptual Framework for Marine Reserve Networks

Even when legislation mandates a science-based process in policy-making, science frequently gets marginalized. Two problems commonly limit the role of science: 1) existing science often does not support clear answers, and even when it does, 2) scientists are often unwilling to be advocates for the science. If the underlying science is poorly developed, science will either be silent altogether on key issues, or scientists will interpret the limited information in conflicting ways. In either case, science is unlikely to play any substantive role in decision-making. In addition, even where science supports clear choices, the message is often not communicated forcefully and effectively. Scientists scrupulously guard their perceived objectivity. As a result, their fear of being tarnished with the advocate label often leaves the science to advocate for itself. The investigator's approach is to reduce these bottlenecks to the effective integration of conservation science into policy decisions. His strategy, developed as a result of his involvement with the Channel Islands marine reserve process in California, includes measures to: anticipate key questions, respond opportunistically to new challenges, promote collaborative efforts, share the science, and advocate for science.

Steven Gaines **7/1/2005-8/31/2007** **$369,391**
UC Office of the President, 05 T CEQI 08 0076

Population Connectivity of Coastal Fishery Species across the California-Mexico International Border

This project focuses on understanding the interconnections between populations of fishery species on either side of the international border with Mexico. Despite the fact that California is moving quickly toward promoting sustainable harvest through ecosystem-based management approaches in its own waters, there has been little consideration of the role of other regions in supplying individuals. Fish and invertebrates do not recognize international borders. Past research suggests that many southern California species peak in abundance south of the Mexican border, and indirect evidence suggests that ocean currents may cause a significant number of marine communities in California to depend on larval re-seeding from Baja, Mexico. Without consideration of the role of cross-border connectivity, the State of California's efforts to create sustainable harvests will be misinformed and likely unsuccessful. In order to understand the extent of larval exchange between California and Mexico, the PI will use new advances in genetic technology on a suite of model species to determine the rates and direction of gene flow across the international border, the spatial

scales of larval dispersal along the coastline, and, when possible, the source locations of individuals recruiting to populations in California. Synthesis of these results will enable the research group to test and quantify the hypothesized dependence of California on breeding populations in Mexico for new recruits. The research covers a broad taxonomic assemblage of five fish and invertebrate fishery species having similar biogeographic and life history traits that suggest population connectivity across the international border. These species also represent a host of other sub-tropically associated species in California, thereby extending the implications of the results to cover a wide array of species of economic and conservation importance to California.

Steven Gaines **7/1/2005-6/30/2007** **$10,000**
US Geological Survey, USGS 0527WS001

Channel Islands Field Station Marine Ecology Cooperative Agreement, Task 1

This contract from the USGS Biological Resources Division provides a Field Station at UCSB for research on marine species and their ecosystems. The UCSB investigator will direct studies on problems affecting marine ecosystem patterns and processes in the Channel Islands and along the Pacific Coast of California.

Steven Gaines **7/14/2006-7/13/2007** **$22,400**
USDC - National Oceanic & Atmospheric Administration, NCNS3000-6-00546

Graduate Training Support

This award provides graduate student support for Christine Addison, a graduate student working with Drs. Steven Gaines and Carol Blanchette.

Steven Gaines **5/1/2005-4/30/2010** **$6,495,699**
USDC - National Oceanic & Atmospheric Administration, NA05NOS4291158

Ocean Science Education Building, Phase I

As a collaboration between the Channel Islands National Marine Sanctuary (CINMS) and the University of California, Santa Barbara (UCSB) the Ocean Science Education Center will be a state-of-the-art educational facility that connects invited participants to the CINMS and the Marine Science Institute at UCSB through compelling, hands-on programming. The facility will function as both an Outreach Center for Teaching Ocean Science (OCTOS) and the primary administrative office for operation of the sanctuary (CINMS). The combination will be a unique learning center that brings together science process, environmental policy, and the human connection by focusing on the special marine ecosystem of the Channel Islands. A goal of the project is for the building to be designed and constructed to a gold LEED standard, serving as a demonstration for sustainable design.

Jeffrey Goddard **11/1/2005-10/31/2006** **$1,500**
UC MEXUS, SG 05/10-07

Developmental mode in benthic opisthobranch molluscs from the eastern tropical Pacific

Compared to the northeast Pacific Ocean, few data exist on the early life histories and mode of development of opisthobranch molluscs, or sea slugs, from the eastern tropical Pacific. As part of a basin-wide, biogeographic comparison of developmental mode in this taxon from the Pacific Ocean, the PI and Mexican collaborator will document egg size and mode of development in shallow-water, benthic opisthobranchs from Bahia de Banderas on the tropical Pacific coast of Mexico.

Jeffrey Goddard **6/22/2004-12/22/2006** **$50,000**
Milton Love
USDI - Minerals Management Service, 1435-01-04-CA-34806

Benthic Invertebrate Communities on Shell Mounds Beneath Oil and Gas Platforms in the Santa Barbara Channel and Santa Maria Basin

The Minerals Management Service (MMS) defines decommissioning as the process of ending oil,

gas, or sulfur operations and returning the lease or pipeline right-of-way to a condition that meets regulatory requirements. As part of this process MMS conducts detailed environmental reviews of any proposed decommissioning projects to evaluate the impacts from platform removal on local and regional invertebrate populations. Assessing habitat quality bears upon platform decommissioning issues, as questions about habitat and the ecological role of Pacific OCS platforms are still unresolved. For example, removing platforms also removes useful habitat, kills numerous associated shellfish, and may have adverse impacts on regional populations of some species on the Pacific OCS. The primary goal of this study is to quantitatively investigate and characterize the macro-invertebrate community on shell mounds under currently operating platforms. The research may be able to detect geographic, bathymetric and temporal variability in abundance and composition of the invertebrate communities.

Benjamin Halpern **12/13/2006-6/1/2008** **$207,091**
O. James Reichman
Gordon and Betty Moore Foundation, 1314, 1523

Ranking and Mapping Human Threats and Impacts to Marine Ecosystems in the California Current

Coastal and nearshore marine ecosystems are heavily threatened by human activities on land and at sea, yet surprisingly little is known about the distribution of threats and their differential impacts among ecosystems. The California Current has received a large amount of attention from conservationists and resource managers trying to develop spatial management plans, and recent political developments linking state-level efforts will only increase this interest, creating an urgent need for rigorous, comprehensive, and spatially-explicit threat and impact assessment for marine ecosystems. This research will produce a high-resolution map of human impacts to marine ecosystems for the California Current and will leverage the large amount of experience and resources developed over the past two years to produce similar maps at a global scale, based on higher-quality regional data. The PI will 1) use an expert survey tool developed and vetted for the global threats process to survey traditional and non-traditional experts from Baja to Washington, 2) gather and synthesize high-quality, high-resolution data for the Current that will supplement or replace the global data for the region, 3) use a variety of novel modeling approaches to combine these data into synthetic threat impact maps, and then 4) bring together decision theory experts to develop approaches for translating our results into decision support tools. All of these products will be made available for free on an interactive mapping website, and ongoing involvement in and connection to existing outreach efforts and policy processes will be used to help translate the products into future policy and management decision-making.

Benjamin Halpern **4/1/2006-12/31/2006** **$5,000**
Steven Gaines
The Nature Conservancy, CR00016

Threat Analysis for Marine Ecosystems of the North Pacific

The UCSB PIs will provide a threats analysis for marine ecosystems in the Nature Conservancy's Pacific Region from Alaska to Baja, Mexico and assist in organizing a workshop to receive expert input on these threats, and strategies to address them. The Nature Conservancy is in the process of identifying priorities for marine conservation around the globe over the next ten years. Part of this work involves identifying the major threats that affect marine ecosystems and habitats with marine realms (e.g., temperate N. Pacific, polar N. Pacific) and Major Habitat Types or biomes (e.g., continental shelves, bays, estuaries and coastal waters). Specifically, the UCSB investigators will pull out the threats assessment and rankings for marine ecosystems of the Temperate and Polar realms in the two major biomes (Coastal Waters, Continental Shelves) of TNC's Pacific Region. This assessment will cover the geographical area from Alaska to Baja, Mexico. The information/report will include a brief narrative describing the most threatened marine ecosystems and the highest ranking threats.

Benjamin Halpern **4/1/2005-8/1/2006** **$53,405**
Sandy Andelman
The Nature Conservancy, SB050084

Predicting Community-level Responses to Marine Reserve Protection: The Causes of Food Web Stability

The Nature Conservancy is providing additional support for Dr. Benjamin Halpern, recently appointed Program Manager for the Packard Foundation-funded project on "Ecosystem-based Management of Coastal-Marine Systems," housed at the National Center for Ecological Analysis and Synthesis (NCEAS). This award enhances four distinct projects that are all directly or closely related to Dr. Halpern's post-doctoral research project, including funding for graduate and undergraduate student interns, as well as incidental costs for data access and travel expenses. These projects have the potential for broad impact on marine conservation and marine ecology.

Rachel Haymon **5/1/2004-4/30/2008** **$229,028**
Ken Macdonald
National Science Foundation, 0324668

Collaborative Research: Hydrothermal System Response to Magma Supply and Crustal Thickness Gradients along the Galapagos Spreading Center, 89.5°-94° W

A field experiment is proposed along the Galapagos Spreading Center (GSC) to investigate the response of the hydrothermal-geological-biological system along the ridge crest to large, hotspot-induced, along-strike gradients in magma supply and crustal thickness/structure. Unlike the East Pacific Rise (EPR) and other mid-ocean ridges (MOR's) where variations in magma supply along strike are much debated, the GSC is known to exhibit increases in magma supply and crustal thickness toward the center of the Galapagos mantle plume (GMP) influence at 91.5°W. The GSC is thus an ideal natural experiment for which the observations have yet to be made, on how magma supply and crustal thickness affect the nature, abundance, and distribution of ridge crest hydrothermal activity, and interactions between hydrothermal, volcanic, tectonic, and biological processes.

Rachel Haymon **5/1/2004-4/30/2008** **$436,815**
Ken Macdonald
USDC - National Oceanic & Atmospheric Administration, NA04OAR600049

Exploring Hydrothermal System Response to Magma Supply & Crustal Thickness Gradients Along the Galapagos Spreading Center, 89.5°-94°W

A field experiment is proposed along the Galapagos Spreading Center (GSC) to explore the response of the hydrothermal-geological-biological system along the ridge crest to large, hotspot-induced, along-strike gradients in magma supply and crustal thickness/structure. Unlike the East Pacific Rise (EPR) and other mid-ocean ridges (MOR's) where variations in magma supply along strike are much debated, the GSC is known to exhibit increases in magma supply and crustal thickness/structure toward the center of the Galapagos mantle plume (GMP) influence at 91.5°W. However, almost no hydrothermal exploration of the GSC has been done. The GSC is thus an ideal natural experiment, for which the observations have yet to be made, on how magma supply and crustal thickness affect the nature, abundance, and distribution of ridge crest hydrothermal activity, and interactions between hydrothermal, volcanic, tectonic, and biological processes.

Sarah Henkel **9/19/2005-9/18/2007** **$28,569**
Gretchen Hofmann
US Environmental Protection Agency, FP-91654401

2005 EPA Science to Achieve Results (STAR) Fellowship for Graduate Environmental Study Molecular Techniques for Predicting Invasion Potential: Comparisons Among Native and Invasive Kelp Species

Kelps, an important group of seaweeds, are significant members of marine communities, holding

scenic, recreational, economic, and environmental value. This research focuses on the invasive Asian kelp, Undaria pinnatifida, and how it is capable of spreading. Invasive species can disrupt food webs and have economic impacts. The fellow will examine how temperature tolerance play a role in invasions and range expansions. An established measure of temperature tolerance is the production of heat shock proteins (Hsps). This project will study Hsps and how they are involved in invasion and spread. Knowledge of the potential for Undaria to spread is important for prevention as well as control of this invader.

David Herbst **7/1/2005-9/30/2006** **$31,810**
Cal RA Department of Fish and Game, P0580088

Stream Condition Inventory and Macroinvertebrate Bioassessment of Stream-Reaches in Grazed and Presently Ungrazed Portions of the Golden Trout Wilderness

The U.S. Forest Service has teamed with CalTrout/Orvis and the California Department of Fish and Game to support this independent and objective study to assess stream condition and trend and their links to grazing in the Golden Trout Wilderness. The objectives are 1) To compare grazed and ungrazed areas to determine if there is a difference in "rate of change toward improved riparian habitat conditions" in the riparian meadow environment and in the stream/aquatic environment; 2) To compare grazed and ungrazed areas to determine if there is a difference in "rate of change in erosion features"; and 3) Based on 1 and 2, to determine whether maintaining grazing on the rested allotments could have achieved adequate progress toward the desired conditions.

David Herbst **10/15/2004-3/31/2007** **$160,000**
California Regional Water Quality Control Board, 04-157-256-0

Bioindicators of Water and Habitat Quality in Streams of the Lahontan Region-Eastern Sierra

The objectives of this project are to provide baseline and trend monitoring information to assist the California Regional Water Quality Control Board in determining the ambient quality of the Lahontan Region's waters. The work consists on: 1) collecting data on instream assemblages of benthic macroinvertebrates and algae throughout the Lahontan Region, including data on the geomorphic features and associated physical habitat of stream systems; 2) compiling and evaluating existing data to facilitate the development and/or refinement of impairment thresholds, tolerance values, and indices of biological integrity; and 3) providing technical assistance regarding bioassessment.

David Herbst **12/1/2005-3/31/2009** **$484,000**
California Regional Water Quality Control Board, 05-179-160-0

Assessment of the Influence of Sediment on Benthic Stream Communities and Development of Guidance for Sediment TMDLs: Proposed Research Outline for TMDL Study

Sediment is one of the most prevalent, non-point source pollutants impacting water quality in streams nationwide and in California. Statewide, 30.5 percent of stream miles listed as impaired under the Clean Water Act in 2002 were listed for sediment, and sediment was cited more than any other pollutant impairing streams. Assessing, managing, and restoring water bodies affected by a non-point source pollutant such as sediment is one of the most difficult challenges faced by researchers and water quality managers. The Principal Investigator will develop and refine tools to assist Regional Water Boards throughout the State of California in developing TMDLs for sediment. His work will consist of: a) characterizing benthic communities and instream physical habitat in watersheds representing a range of sediment loading, including those with excessive sedimentation from anthropogenic sources and those representing a minimally-disturbed or "reference" condition; b) conducting sediment dose experiments on benthic communities using stream mesocosms; c) conducting sediment dose experiments on selected macroinvertebrate taxa using laboratory microcosms; and d) integrating the findings to create new tools to assist the Regional Water Boards in developing sediment TMDLs.

David Herbst **5/1/2006-3/31/2009** **$420,111**
California Regional Water Quality Control Board, 05-280-160-0

Bioassessment Comparability within Watershed Networks: Spatial and Temporal Components of Variation, and Development of Reference Site Selection Criteria

The objectives of this project are to develop and refine tools to assist the Regional Water Quality Control Board, Lahontan Region (RWQCB) and the State Water Resources Control Board (SWRCB) in assessing the quality of wadeable streams and rivers. The project will consist of: 1) characterizing benthic communities and instream physical habitat at selected stream reaches, and developing/ refining tools for the application of bioassessments; 2) integrating historic bioassessment data into a format compatible with the SWRCB's Surface Water Ambient Monitoring Program (SWAMP) database; 3) working with SWAMP staff to promote consistency in bioassessment methods and to develop and refine quality assurance procedures for bioassessment in California; and 4) preparing results (manuscripts) for submittal to peer-reviewed scientific journals.

David Herbst **9/14/2005-9/14/2010** **$120,000**
Scott Cooper
US Department of Agriculture, 05-JV-11272164-082

Aquatic Invertebrate Research for Kings River Experimental Watershed

Headwater streams provide the strongest connection between the landscape and networks of flowing water. This is where flows originate and where the interface of earth and water, and biogeochemical processes influence the entire watershed. The objective of this research study is to set a multi-year baseline for future studies of integrated watershed effects of fire and logging practices in the Kings River Experimental Watershed (Sierra National Forest). This component of that baseline is to establish annual, seasonal, and habitat-specific conditions describing the diversity and structure of benthic invertebrate communities in ten separate headwater catchments that will serve as treatment and control groups for future project activities, and for two additional study sites below confluences of the treatment headwater drainages where the integrative changes associated with the upstream watershed may be discerned. This continues the development of a data set that the investigators have established over the period from 1999 to 2004.

Gretchen Hofmann **5/1/2005-4/30/2008** **$535,623**
National Science Foundation, ANT-0440799

Towards an Understanding of Protein Homeostatis in Cold-adapted Antarctic Fish

The central objective of this project is to examine the process of protein homeostasis in the cells of Antarctic notothenioid fishes. Prior results suggested that proteins in Antarctic fish may be subject to a great deal of misfolding at the subzero temperatures typical of Antarctic coastal waters. The two main observations that will define this new set of experiments are: 1) the observation that a normally stress-inducible molecular chaperone, Hsp70, has been recruited into constitutive expression, and 2) in pilot experiments, high levels of ubiquitinated proteins have been measured in tissue of two Antarctic species. The planned experiments will continue with a comparative approach using temperate New Zealand notothenioid fishes to highlight the differences in Antarctic fish physiology. Specific aims include use of ubiquitin conjugate analysis to measure the levels of damaged proteins in cells of Antarctic fishes; estimation of the efficiency of protein synthesis in cold-adapted Antarctic fish cells by measuring the levels of defective ribosomal products (DRiPs); measurement of relative 26S proteasome activity in cells of Antarctic fishes; and assessment of the nature of cold-adapted gene expression in Antarctic fish as compared to their temperate New Zealand relatives.

Gretchen Hofmann **7/15/2004-6/30/2007** **$368,534**
National Science Foundation, OCE-0425107

Finding the Genes that Matter: Profiling Gene Expression in Strongylocentrotid Sea Urchins with Different Biogeographic and Temperature Distributions

The goal of this project is: 1) to test the hypothesis that temperature contributes to setting species distribution patterns in marine ecosystems and 2) to employ genomic approaches and other

molecular techniques to assess changes in gene expression in congeneric sea urchins that are adapted to different temperatures and have different biogeographical distributions in nature. The project uses four congeneric species of temperate sea urchin (genus Strongylocentrotus) as study organisms: S. purpuratus, S. Droebachiensis, S. franciscanus, and S. pallidus. Gene expression profiles will be assessed in order to address how the differentially thermally adapted sea urchin species respond to ecologically relevant temperatures at the genomic level. The strategy for the genomics approach entails using DNA macroarrays to screen for differentially expressed genes that will then be analyzed using other genomics techniques -- DNA microarrays and real time PCR.

Gretchen Hofmann **9/1/2006-2/29/2008** **$15,500**
UC MEXUS, SB070049

Stress Temperatures and Sea Urchin Metamorphosis Along Latitudinal and Depth Gradients

The goal of this project is to combine the expertise of two science groups - one at UABC (Dr. E. Carpizo) and another at UCSB (Dr. G. Hofmann) - in order to assess the survival of larvae and embryos of marine invertebrates in the context of global climate change. Combining invertebrate zoology, marine ecology and genomics, these studies will contribute to an understanding of how economically important marine organisms may respond to changes in ocean temperature, and further how these impacts might be distributed across the natural range of these organisms that spans the border of the Pacific coast from the U.S. to Mexico. Finally, this project will have an elevated training profile as students and postdocs will play a primary role in conducting and communicating the resulting science. It is hoped that this initial collaboration will become the platform for long-term collaborations, and that the UC-MEXUS funds awarded will serve as "seed" funding to obtain additional external grant support for applied marine ecology between the U.S. and Mexico.

Sally Holbrook **7/1/2006-6/30/2007** **$30,000**
Katie Arkema
UC Office of the President, 06TCEQI080036

The Ability of Kelp Forests to Filter Nearshore Water and Impact Water Quality

For both economic and ecological reasons, kelp forests are one of the most important marine ecosystems in California. One significant, yet largely unexplored function of kelp forests is their ability to concentrate and process suspended materials. Primary producers take up nitrate as water passes through the forest, and invertebrates and fishes consume particulate organic carbon in the form of plankton, propagules and microbes. How kelp forests alter concentrations of waterborne subsidies and sequester these materials into nearshore food webs is fundamental to understanding both the ecosystem function of kelp forests and the impact they have on coastal water quality in California. This study will investigate the role of kelp forests in altering the concentrations and pathways of materials in California nearshore waters. Kelp forests support dense assemblages of suspension feeders that may function as natural filters. However, scientists have not explored whether filter-feeding invertebrates in kelp forests have impacts on water quality similar to those of filter feeders in bays and estuaries. Investigating the ability of kelp forest invertebrates to filter nearshore waters will also be informative for understanding how entire kelp forest ecosystems "process" waterborne materials (nitrate, pollutants, fish and invertebrate larvae). While much is known about particular species of interest that inhabit kelp forests and how these species interact with each other, very little is known about the ecosystem function of entire kelp beds and how they serve as "processing units" for waterborne substances.

Patricia Holden **6/15/2004-6/30/2007** **$338,938**
City of Santa Barbara, 21429

DNA-Based Source Tracking of Human Fecal Material: A Proposal to the City of Santa Barbara

The overarching goal of this research is to determine the presence and potential origins of human waste in creaks, extending into the surf zone at the coastal ocean, in Santa Barbara. The geographical focus of this study will be in three areas: 1) old Mission creak from Bohnett Park into the new Mission Creek concretized channel, 2) mid and lower Mission Creek extending to the ocean and

including the lagoon, 3) lower Arroyo Burro Creek with an emphasis on lagoon and beach processes. The work will be conducted in two phases. Phase I will determine the efficacy of two DNA-based tests for discerning human from animal fecal material in environmental matrices. Phase II will apply the demonstrated assays to understanding the origins and fates of human fecal material in the study areas.

Patricia Holden **9/1/2003-8/31/2006** **$100,000**
UC Irvine, UCI-2003-1374

Dynamics of Point and Non-point Source Fecal Pollution from an Urban Watershed in Southern California

A growing number of the nation's rivers, estuaries, and coastlines are impaired for fecal indicator bacteria (FIB). This problem is particularly acute in southern California, where the shedding of FIB and pathogens from urbanized watersheds routinely triggers swimming advisories at coastal and inland freshwater beaches, and the closure of shellfish harvesting areas in estuarine and coastal systems. Identification and mitigation of FIB pollution is complicated by the many human and non-human non-point sources of these organisms, and the complex and interrelated physicochemical, transport and ecological processes that control their spatial and temporal distributions in watersheds. This project funds field measurements and modeling studies aimed at understanding how storms affect FIB sources, ecology, and transport within several sub-drainages of the Santa Ana River watershed in southern California.

Patricia Holden **11/1/2006-9/30/2007** **$26,000**
UC Toxic Substances Research and Teaching Program, SB070091

Fate and Effects of TiO2 Nanoparticles on Planktonic, Aerosolized, and Biofilm P. putida Bacteria

Bacteria are the most abundant organisms on earth and are the major catalysts for reactions in nuclear cycling and biodegradation. Most bacteria grow as biofilms which consist of cells and surrounding exopolymeric substance (EPS) made of polysaccharides, DNA, protein, and sorbed exogenous materials including metals. However, bacteria are also free-living in planktonic systems, and they can be aerosolized and transported long distances in the atmosphere. Currently, there is little understanding of the effects of nanoparticulate metals to bacteria. This research is aimed towards gaining new insights into interactions between bacteria and engineered nanoparticles, with an overall goal of providing fundamental insights into this new area of research. The project will involve gathering baseline information concerning the fate and effects of nanoparticles to bacteria. Because it is most relevant to the ecological performance of bacteria in the environment, the research will focus initially on physiological, dose-response assays that, coupled with the knowledge of nanoparticle characteristics, will reveal relationships between toxicity responses and particle type, size and other characteristics such as charge or functionalization. First, physiological responses will be catalogued and measured, and other experiments at the level of protein production and gene transcription will follow.

Patricia Holden **11/15/2004-11/14/2007** **$250,648**
US Department of Energy, DE-FG02-05ER63949

Stabilization of Plutonium in Subsurface Environments via Microbial Reduction and Biofilm Formation

Actinide contamination of subsurface sediments and groundwaters at DOE sites that have varying geochemistry and hydrology is a long-term problem. The investigator's hypothesis is that plutonium (Pu) solubility, speciation and resultant (im)mobilization are susceptible to both metal reduction and biofilm formation by common, well-studied subsurface bacteria. To prove this hypothesis, the PI will study enzymatic metal reduction, bacterial accumulation, and mineral sorption/desorption processes by examining the Pu-bacteria and Pu-mineral-bacteria interactions. Because Pu has complicated geochemistry and a range of oxidation states that are relevant to subsurface and vadose environments, this research will focus on both anaerobic and aerobic mechanisms. The objective of the project is to understand how biotransformation and biogeochemical processes known to affect the behavior of major redox-active transition metals, Fe and Mn, can affect the mobility of Pu in the

environment. Results will fill significant gaps in the scientific basis for monitored natural attenuation and in situ stabilization of widespread and problematic radionuclide contamination.

Patricia Holden **7/1/2004-6/30/2007** **$332,099**
US Environmental Protection Agency, RD-83171201

Transformation of Biologically-Conjugated CdSe Quantum Dots Released into Water and Biofilms

Semiconductor nanocrystals (quantum dots) differ in important ways from bulk semiconductor materials. Their increased band gap means that they function as strong oxidizing and/or reducing agents, and their small size allows them to pass into living cells. Conjugation of biomolecules to the crystal surface can alter any or all of these properties. In preliminary experiments, the investigators have observed that nucleobase-conjugated CdSe quantum dots were actively taken up by soil and water bacteria (for example, Bacillus subtilis and Escherichia coli). Effects on microbial viability attributed to the presence of the quantum dots included slower doubling times, heavy metal sequestration, and "blebbing" of metals into the environment. The PIs aim to quantify these effects using a variety of biologically-conjugated quantum dots and an assortment of microbial species, monitoring the process of quantum dot uptake and breakdown and characterizing the breakdown products that result from bacterial metabolism of these particles.

Robert Jellison **5/1/2005-12/31/2006** **$89,448**
David Herbst
Cal RA Department of Fish and Game, P0460003

Biological Stressor Identification at Hot Creek Fish Hatchery

The investigators will assist the California Department of Fish and Game (DFG) to develop a workplan to investigate impacts of Hot Creek Hatchery discharge on downstream water quality. The UCSB PI will lead the research team of two DFG scientists and two UCSB scientists. Based on review of the bioassessment survey reports, the team will perform the following tasks: 1) description of biological impairment; 2) listing of candidate causes; 3) workplan to address the data gaps and how to fill them; 4) draft characterization of causes and final written report.

Robert Jellison **9/13/2006-11/30/2006** **$9,500**
Cal RA Department of Fish and Game, S0660040

Hot Creek Stressor Identification

The PI will implement the tasks outlined in the Hot Creek Stressor ID Team Work Plan as follows: 1) Conduct ANOVA/multiple regression analysis of data from 2002-2005 to examine the relationship between local physical characteristics and the three indicator taxa. 2) Perform depth stratified benthic macroinvertebrate sampling, contingent on results of ANOVA. If the results are inconclusive, conduct benthic macroinvertebrate sampling at sites purposefully selected to provide a range of depth (and velocity) characteristics in the various reaches of Hot and Mammoth Creeks above and below the hatchery. Dominant taxa will be identified and enumerated. 3) Macrophyte density in the various reaches will be quantified through appropriate random sampling, drying and weighing. 4) On up to two dates, sequential time series water samples will be collected and analyzed from sources and downstream locations before and during the period of cleaning operations. The samples will be analyzed to assess nutrient sources and potential water quality changes associated with daily hatchery operations as well as cleaning operations. 5) Conduct a preliminary stable isotopic (13C, 15N) analysis of selected samples to determine if hatchery feed, macrophytes and sediments immediately up and downstream of the hatchery are sufficiently distinct to detect their relative contribution. If preliminary samples show sufficiently distinct isotopic signatures, the PI will analyze stable isotopes of sediment samples collected during the August 2005 bioassessment monitoring, as well as freshly-collected macrophytes, to investigate the relative contribution of springbrook versus hatchery nutrient sources.

Robert Jellison **1/15/1997-6/30/2008** **$1,397,427**
John Melack
Los Angeles Department of Water and Power, LADWP 8062

Monitoring of Limnology and Plankton in Mono Lake

Mono Lake is a large, hypersaline, highly productive alkaline lake lying just east of the Sierra Nevada. In addition to its recreational, scenic, and water resource values, it contains large populations of an endemic brine shrimp and the alkali fly, which are important food sources for migrating birds. Although saline lakes are common throughout the world and provide important ecological resources for many species, they are much less studied than freshwater ecosystems. Limnological monitoring conducted from 1982-1996 represents one of the longest continuous studies of any hypersaline lake. Rapid lake level rise in 1995 resulted in the onset of meromixis (persistent salinity stratification) and disruption of internal nutrient cycles. This monitoring program will assess whether long-term changes are occurring and if the hypothesized benefits of higher lake levels will take place.

Robert Jellison **4/1/2007-3/31/2008** **$140,163**
David Herbst
US Fish & Wildlife Service, 842407J0007

Assess Responses of Lahontan Cutthroat Trout Prey Items to Changing Hydrological Regimes and Salinity in Walker Lake, Nevada

This research project will assess the responses of tui chub, benthis macroinvertebrates, and zooplankton to changing salinity and hydrological regimes over a 5-year period. The project contains four major components: 1) an expanded limnological monitoring program conducted in cooperation with all members of the Walker Lake Fishery Improvement Team (Service, Nevada Department of Wildlife, Walker River Paiute Tribe) with a primary focus on zooplankton dynamics, all of which will be integrated with ongoing monitoring conducted by the Nevada Division of Wildlife, 2) the first quantitative assessment of benthic macroinvertebrates in Walker Lake and implementation of an appropriate and efficient long-term benthic bioassessment monitoring program, 3) hydroacoustic surveys of the tui chub population allowing estimates of both population size and inter-annual variability in recruitment, and 4) mapping and monitoring of changes in the lakewide distribution of macrophytes.

Matthew B. Jones **1/1/2007-12/31/2007** **$82,082**
Mark Schildhauer
Michigan State University, 61-2582CA SB

Faculty Institutes for Reforming Science Teaching - FIRST III

The National Center for Ecological Analysis and Synthesis (NCEAS) will participate in this construction of the Faculty Institutes for Reforming Science Teaching (FIRST) database. NCEAS personnel have nearly a decade of experience developing formal metadata standards for ecological data and implementing software applications and database servers for distributed storage and querying of ecological data and metadata. Rather than embark on a completely independent development effort, the FIRST project will adopt existing technological approaches where these are relevant, thereby gaining compatibility with the generic solutions developed within the Knowledge Network for Biocomplexity (KNB) and the emerging approaches from the Science Environment for Ecological Knowledge (SEEK). UCSB's PIs and staff will work with other project scientists with the definition and construction of the appropriate extensions of the Ecological Metadata Language (EML) to create an "Educational Metadata Language" that will powerfully describe a variety of assessment instruments for the sciences.

Matthew B. Jones **10/1/2006-5/31/2009** **$1,956,203**
Mark Schildhauer
National Science Foundation, DBI-0619060

Management and Analysis of Environmental Observatory Data Using the Kepler Scientific Workflow System

National initiatives such as the National Ecological Observatory Network (NEON) and the Ocean Observatories Initiative (OOI) have highlighted the need for improvements in cyberinfractructure supporting environmental observatories. Although previous initiatives have focused on data acquisition and archiving, scientists also need cyberinfrastructure that supports integration of data acquired from different instruments, and modeling and analysis of archived and real-time data sources. In addition to scientists, resource managers and the public need access to data, modeling results, and analysis outcomes. This four-year project will advance cyberinfrastructure by combining, for the first time, scientific workflow systems with dynamic real-time data grids associated with multiple sensor networks. The project goal is to provide scientists with an analysis and modeling tool that can easily integrate distributed heterogeneous data streams for use in simulation and forecast models. This near real-time environment for analytical processing will provide an open-source, extensible and customizable framework for designing and executing scientific models that consume data streams from sensor networks. Project investigators will combine the real-time data grid being constructed through other projects (ROADNet, CENS ESS, OPeNDAP, EcoGrid) with the scientific workflow system Kepler. These open-source software frameworks represent considerable prior investments. Kepler will be extended to meet the needs of scientists that analyze and model observatory data, systems engineers that create and maintain observatory sensor networks, and the public that accesses data and results from observatories.

Matthew B. Jones **8/28/2006-7/31/2007** **$78,900**
South African National Parks, SB070033

Analysis Tools for Thresholds of Potential Concern

UCSB will perform software engineering activities to create software products to be used by Kruger National Park for the management of scientific data. One software engineer will be devoted to this project. The engineers at the National Center for Ecological Analysis and Synthesis will elicit software specifications from personnel at Kruger National Par, design and prototype the following software products: 1) creation of R scripts for Threshold of Potential Concern (TPC) Analyses; 2) creation of Scientific workflow for TPC Analyses; and 3) a Web-based interface for executing these TPC analyses.

James Kennett **3/15/2007-2/29/2008** **$53,073**
Luann Becker
National Science Foundation, ATM-0713769

SGER: Investigations of a Likely Extraterrestrial Impact at 12.9 ka: Possible Cause of Younger Dryas Cooling, North American Mammal Mass Extinction and Demise of Clovis People

This research will investigate the untested and novel hypothesis of a major extraterrestrial impact (comet) over North America at ~12.9 ka near the end of the Pleistocene. The principal investigators are working with several scientists (notably Richard Firestone of Lawrence Berkeley Laboratory and Alan West, consulting earth scientist, Scottsdale, Arizona) on developing and testing a potentially important and far-reaching hypothesis that a major extraterrestrial (ET) impact event over North America triggered the abrupt onset of Younger Dryas cooling, caused the well-known massive extinction of North American mammals (such as mammoths, camels, horses, groundsloths, etc.), and terminated the Paleolithic Clovis culture. The initial evidence suggests that all of these events occurred together abruptly, thus challenging popular existing hypotheses for the Younger Dryas cooling and the massive extinction event by human overkill. Remarkably, this major ET impact event has remained undiscovered until now; yet this singular event may explain several outstanding and unexplained problems: the abrupt triggering of Younger Dryas cooling, the massive megafaunal extinctions and a critical early human cultural change throughout North America. The new hypothesis for testing posits that Younger Dryas cooling was triggered by an impact on or near the Laurentide Ice Sheet causing destabilization, melting and resulting massive flooding to the northern Atlantic and Arctic that in turn affected ocean circulation and climate change.

James Kennett **2/15/2003-12/31/2007** **$330,000**
National Science Foundation, NSF OCE-0242041

Abrupt Climatic Transitions: Surface to Deep-water Response from High-resolution Sediment Records, Santa Barbara, California

Understanding mechanisms behind abrupt climate change during the late Quaternary remains a major challenge in Earth Sciences. The oceans clearly have played a major role in such change, although specific components of the ocean system have responded and contributed differently. While differences in timing between these responses appear to be small (as brief as decades), the sequencing of change is key in understanding processes and forcing mechanisms of climate change. Unfortunately, few areas in the world contain records of sufficient temporal resolution to resolve such change on the short time scales at which these remarkable climatic shifts occurred. One such area is Santa Barbara Basin, providing one of the highest resolution marine records of late Quaternary climate change at the required decadal resolution.

James Kennett **8/1/2003-7/31/2006** **$215,980**
David Lea
National Science Foundation, OCE-0320723

Acquisition of an Automated Light Gas Stable Isotope Mass Spectrometer for Dedicated Carbonate Analysis

Stable isotope variations in both marine and terrestrial carbonates are the backbone of paleoclimatic and paleoceanographic research. Oxygen isotopic variations track ocean and atmosphere temperatures, sea level/glacial history, and other environmental parameters. Carbon isotopic variations track biogeochemical cycles, land-sea reservoir changes, and CO2 and CH4 exchange between the ocean and atmosphere. Stable isotopic stratigraphy is also central to global correlation. A major question in the earth and ocean sciences today is the character and cause of climate change and abrupt warmings in the recent geological past. UCSB has established an enviable reputation for research in this area over the past 15 years. This grant provides a major upgrade of stable isotope instrumentation to modern standards through the acquisition of a Finnigan MAT 253 coupled to a "Kiel" automatic carbonate preparation device, with 37% matching support from the campus.

James Kennett **7/1/2006-6/30/2007** **$132,326**
Dorothy Pak
Craig Nicholson
Christopher Sorlien
National Science Foundation, OCE-0623148

Extending the High-Resolution Global Climate Record in Santa Barbara Basin: Evaluating Climate Change Potential

The investigators will conduct a series of pilot investigations to determine the effective potential of recovered piston cores for ultra high-resolution paleoceanographic and paleoclimatic investigations of the late Quaternary. They will refine the integrative stratigraphy and conduct orbital and millennial-scale stable isotopic and Mg/Ca investigations of selected intervals (windows) to establish the utility of these proxies in the sequence. This work will further the understanding of abrupt climate change and millennial-scale late Quaternary climate behavior prior to 160 ka, and of factors that can destabilize climate and potentially cause abrupt climate change, a current societal concern given global warming and possible future climatic instability. Ongoing development of the integrative stratigraphy will provide a quantitative basis for modeling the basin-wide response to climate change, and the interaction between climate, tectonics and sea-level fluctuations. The dated high-resolution seismic stratigraphy and development of 3D structure models will also provide input into the history of crustal deformation, structural models for oblique faulting and folding, and earthquake, submarine slope-stability and tsunami hazards along coastal California.

James Kennett **10/1/2003-9/14/2007** **$450,826**
US Department of Energy, DE-FG02-03ER63696

Effects of Oceanic Disposal of Carbon Dioxide on Benthic Microfauna: Foraminfera as Indicators of Dissolution and Ecosystem Health

Carbon dioxide (CO2) sequestration is currently being considered as a mechanism for reducing the release of carbon dioxide to the atmosphere. Because direct infection of CO2 at the seafloor provides certain advantages to other disposal venues, a crucial part of investigating oceanic CO2 sequestration is to determine the biological and geochemical effects on the benthic realm. Work is ongoing to determine the effects of dissolving carbon dioxide hydrate on benthic megafauna. However, little work has been conducted to quantify the effects of CO2 sequestration on microorganisms in surface sediments. The investigator will conduct a number of studies on foraminifera, a well-known group of diverse protists that are typically abundant, and sometimes dominant, in marine sediments. Many foraminifera precipitate shells composed of calcium carbonate, making them an ideal indicator to assess the effects of dissolving CO2 hydrate, which increases pCO2 levels and also decreases pH in the surrounding waters. Because of their shell composition, significant proportions of foraminifera are dependent on a stable, relatively high pH. Foraminifera live both epifaunally at the sediment/water interface as well as burrowing infaunally, and thus can be used to determine the extent of environmental change both on and within the sediments.

Roland Knapp **6/1/2002-6/30/2007** **$405,950**
UC Berkeley, MCSA3624

Amphibian Disease Dynamics in a Fragmented Landscape

The UCSB investigator will be primarily responsible for two aspects of the overall research project awarded to Dr. Briggs at UCB: 1) conducting field surveys of mountain yellow-legged from (Rana muscosa) populations to describe the pattern of spread by chytrid fungus and the effect of chytridiomycosis on frog population dynamics and age structure, and 2) building a statistical model to predict the landscape-scale distribution of chytrid fungus infections as a function of habitat variables and contaminant concentrations. These aspects of chytrid fungus infections remain poorly understood but are critical to predicting the dynamics of this disease. To conduct field surveys, the UCSB investigator will lead a three-person crew into remote backcountry locations, assist with and oversee data collection, ensure compliance with a quality-control protocol, and maintain crew safety. He will also be responsible for entry of these data into a database, and for statistical analysis of collected data. He will use a series of statistical techniques, including regression trees, generalized additive models, and autologistic regression to describe the factors associated with chytrid infections and to develop a predictive model of these infections.

Roland Knapp **7/1/2005-6/30/2008** **$66,616**
USDI - National Park Service, J8C07050005

Reintroduce Yellow-legged Frogs to Fishless Lakes in Yosemite National Park

Yosemite National Park recently proposed reintroductions of the declining mountain yellow-legged frog (Rana muscosa) into lakes in six basins. Eight lakes were chosen for reintroduction based on the results of a recent survey of amphibian populations in all lentic water bodies in the park. These lakes currently lack R. muscosa and nonnative trout populations, contain suitable habitat for R. muscosa, and have remnant R. muscosa populations within 5 km that are large enough to serve as source populations for the reintroductions. The lack of R. muscosa at the reintroduction sites is likely a consequence of historic populations going extinct, perhaps because of trout introductions or disease outbreaks. The effect of predation by introduced trout in causing the extinction of R. muscosa populations in the Sierra Nevada is well-documented. The amphibian disease, chytridiomycosis, is caused by the fungal pathogen, Batrachochytrium dendrobatidis, and was recently implicated as a major cause of R. muscosa population extinctions in the southern Sierra Nevada. Recent evidence indicates that B. dendrobatidis is widespread in R. muscosa populations in Yosemite National Park. The objective of this research is to: 1) determine the presence/absence of B. dendrobatidis in all proposed R. muscosa source populations and in alternative source populations located nearby, 2)

use source populations free of B. dendrobatidis to conduct as many of the eight originally-proposed reintroductions as possible, and 3) monitor population sizes and disease status of the R. muscosa populations for at least two years following reintroduction.

Roland Knapp **9/1/2005-8/31/2006** **$10,000**
Utah State University, 051861001

Evaluation of Reference Site Classification Schemes, Probability-based Survey Designs, Biological Indicators, Biotic Tolerance Values, and the Comparability of Different Sampling Methods for Western Lakes and Ponds

The products obtained from this project will provide a sound empirical basis on which state and federal agencies in the western United States and elsewhere can build effective biological monitoring and assessment programs. This is a collaborative effort between Utah State University; aquatic biologists working for the states of Utah, California, and Washington; and the Bureau of Land Management. The research address five questions critical to establishing scientifically defensible programs of biological assessment in lake ecosystems: 1) Which environmental factors are most useful in defining reference conditions for western lakes, and how can these factors be used to classify or model natural differences in biotic potential among lakes? 2) What probabilistic sampling design can most effectively be applied to western lakes? 3) How effective are three general types of assemblage-wide biological indicators (multimetric indices, RIVPACS, and biotic indices based on tolerances) in assessing the biological integrity of western lakes? 4) Can stressor-specific tolerance values for benthic lake taxa assist in diagnosing causes of biotic degradation? 5) How comparable are the data obtained from different methods commonly used to sample benthic invertebrate assemblages in lakes and ponds?

Armand Kuris **6/1/2002-5/31/2008** **$2,238,400**
Kevin Lafferty
National Science Foundation, NSF EF-0224565

Anthropogenic Effects on Host-Trematode Dynamics

Disease interacts with the environment in a variety of ways. This is particularly true for diseases with complex life cycles. A basic understanding of the way that parasites with complex life cycles interact with man-made changes to the environment will help to anticipate future changes in such diseases. This project will use a variety of experimental, observational and theoretical approaches to develop a comprehensive and synthetic understanding of the interactions between man-made environmental change, parasite communities, and the extent to which these changes affect host communities. Salt marshes are a useful model ecosystem to address the role of diseases, since these wetlands are subject to a wide range of man-made impacts and support a diverse community of trematode worm parasites. Examples of changes that can affect parasite communities include losses to biodiversity, pollution, introduced species and climate change. The effects of these impacts are not likely to be the same for all diseases. Because some parasitic diseases can alter the community of hosts that they infect (such as by altering the flow of energy through an ecosystem or by changing predator-prey relationships) there may be complex feedback between changes in the environment, diseases and ecosystems.

Armand Kuris **7/1/2006-6/30/2007** **$45,073**
UC Office of the President, 06-000531-01

Establishing Connectivity of Invasive Populations: A Precursor to Prioritization and Implementation of Eradication Efforts

The UCSB PI will direct the parasitological component of this collaborative project and play a major role in the coordination of the policies deriving from the synthesis of this research. He will also supervise the UCSB graduate student and the parasitological components of the workshops and tutorials.

Armand Kuris **12/1/2005-3/31/2007** **$9,999**
Kevin Lafferty
UC Sea Grant, P/CZ-119PD-F-1/1

Large-Scale Survey of a Potentially Inexpensive Ecological Indicator

The objective is to quantify the diversity and abundance of the California horn snail trematode community in 35 California coastal wetlands, from Drake's Estero to Tijuana Estuary. This will provide baseline data to use the trematodes as ecological indicators to assess wetland condition. The PIs will perform analysis on the data, comparing the trematode communities to wetland condition (e.g., amount of surrounding development and management history). By providing baseline data for most California estuarine wetlands, it will be possible to use these data for benchmarks and comparisons to assess the several important restoration and remediation projects that are presently being initiated. This technology adds a significant and quantifiable component to other related assessment technologies because it very directly addresses the trophic functioning of these ecosystems in response to perturbations including pollution and impact of exotic species.

Armand Kuris **2/1/2007-3/31/2008** **$66,181**
Kevin Lafferty
UC Sea Grant, R/OPCENV-01

Parasites as Indicators of Coastal Wetland Health

The overall objective of this project is to complete the development and assessment of the use of larval trematode parasites in snails as a cost-effective and integrative tool for characterizing wetland biodiversity and ecosystem function. To finish the development of these parasites as a tool for managers to assess wetlands, it is necessary to take several more steps to validate the basic science of the approach and transfer the technique to end-users. The specific objectives are: 1) To determine how well trematodes indicate assemblages of fishes and benthic invertebrates (at the scale of entire habitats and wetlands); 2) To confirm which animals are indicated by trematodes (i.e., which hosts are used by the trematodes) throughout their geographic range; 3) To examine the extent the trematode tool integrates time to provide information on longer-term trends in wetland condition (compared to the information provided by standard surveys); 4) To establish the most efficient sampling strategy to calibrate the tool and combine it with standard assessment techniques to characterize a wetland; 5) To communicate to and instruct managers and stake-holders in the use of the trematode bioindicator tool; 6) To work with established wetland educational programs to incorporate the knowledge and study of the ecologically important trematode parasites into their educational endeavors.

Adam Lambert **7/1/2006-6/30/2007** **$1,900**
Tom Dudley
UC Genetic Resources Conservation Program, SB070054

Conservation of Native Phragmites australis in California

Common reed, Phragmites australis (Cav.) is a perennial grass native to North America. In the past century, it has increased in distribution and abundance across North America, especially along the Atlantic Coast. This expansion is attributed to anthropogenic changes in wetland ecosystems that facilitate P. australis dispersal and to the introduction of European genotypes into the eastern United States. Phragmites australis expansion has deleterious effects on wetland ecosystems, leading to various control efforts against the invasive biotypes. However, these control efforts can impact non-target plants, including native P. australis populations. Currently, there are insufficient data on the distribution of native haplotypes in the United States to effectively control exotic populations without harming native ones. This is especially the case in California, where most P. australis populations are undocumented. In the most recent invasive plant inventory of California, P. australis remained unscored as native/exotic because of a lack of information on its genetic distribution. Locating and positively identifying native P. australis populations, and creating a publicly available GIS database. will ensure the conservation of this species in California.

Lyndal Laughrin **3/1/2005-9/15/2006** **$5,000**
Susan Swarbrick
Martin V. & Martha K. Smith Foundation, 05002

Solving Invasive Plant Problems Through Habitat Restoration: A Teacher-Student Workshop

A teacher-student workshop held on Santa Cruz Island at UCSB's Santa Cruz Island Reserve (SCIR) field station will focus on the problems of invasive exotic plant species on the California Channel Islands. The ability to target and solve major ecological problems is rarely addressed directly by high school science teachers in California schools. Many leading scientists now consider the spread of exotic species into natural ecosystems to be the "number one" threat faced by natural environments in Mediterranean regions. The workshop will give teachers and students from Ventura high schools the opportunity to study the issues related to the spread of exotic plants and to learn effective methods for addressing the problems in a combination of classroom activities and hands-on field training. Teachers and students will participate in restoration activities that will demonstrate the implementation of a variety of techniques utilized in the fast-growing field of environmental restoration.

David Lea **7/15/2003-6/30/2007** **$275,732**
National Science Foundation, NSF OCE-0317611

High Resolution Mg/Ca-Based Sea Surface Temperature Records from Cariaco Basin Ocean Drilling Program Hole 1002C

The objective of this research is to generate high resolution Mg/CA-based sea surface temperature (SST) records from Cariaco Basin sediments spanning the last 450 thousand years (ky) before present (BP). The Cariaco Basin is well known as a repository of tropical paleoclimate records (Peterson et al., 2000b). Its location on the northern Venezuelan shelf, within the region of influence of the intertropical convergence zone, the high sedimentation rate of the basin (0.3 to >1 mm/y), the excellent preservation of carbonate microfossils, and the occurrence of annually laminated, unbioturbated sequences for the Holocene as well as long periodic intervals over the last half million years, all contribute to making the Cariaco Basin one of the premier tropical climate archives in the oceans. Results from this study promise to advance understanding of the climate impact of the tropics on millennial time scales, with relevance to understanding global climate change on both glacial - interglacial time scales as well as on human time scales.

David Lea **6/15/2005-5/31/2008** **$304,003**
National Science Foundation, OCE-0502609

Testing the Tropical Greenhouse Forcing Hypothesis Using a Halmahera Proxy SST Record

This project will test a new hypothesis: tropical ocean temperature variability over the last several hundred thousand years is dominantly driven by changes in greenhouse forcing (the tropical greenhouse forcing hypothesis). This hypothesis will be tested by developing a new proxy sea surface temperature (SST) record from a site in the western equatorial Pacific warm pool lying just east of Halmahera, Indonesia. A high sedimentation rate core (~15 cm/ky) from this site taken by collaborators from Tongji University in Shanghai, China will be targeted for development of a ~30-140 y resolution proxy SST record. SSTs will be reconstructed using the Mg content of the surface-dwelling planktonic foraminifera Globigerinoides ruber, a methodology that has been validated in many different settings and timescales throughout the tropics. Results from this study will advance independent determinations of climate sensitivity from paleoclimatic data. Climate sensitivity is considered the most significant uncertainty in global climate change predictions.

David Lea **9/1/2006-8/31/2007** **$105,833**
National Science Foundation, OCE-0602362

Collaborative Research: Establishment of a Climate Type-Section for the Tropical Atlantic from Cariaco Basin Sediments

Scientists' understanding of the nature of late Pleistocene climate variability has changed

dramatically during the last decade. It is now known that the climate system can undergo large amplitude fluctuations on much shorter timescales than previously thought, an observation that has important implications for future climate change. The systematic and methodic examination of polar ice cores serves as a model for interdisciplinary studies of past climate change. The investigators for this project seek to emulate the strategies used by their ice core colleagues, although there are few marine sediment sections that can be sampled at a comparable resolution. The high deposition rate, frequently varved sediments accumulating in Cariaco Basin, a deep depression along the northern margin of Venezuela, represent a climate archive that can be sampled at a resolution similar to that employed in ice core studies. This project is a multidiciplinary study involving individuals from the University of Miami (L. Peterson), the University of Akron (D. Black), the University of South Carolina (R. Thunell) and the UC Santa Barbara PI, David Lea. The PIs will make paired planktonic foraminiferal Mg/Ca and d16O measurements in order to reconstruct climate variability on multiple time scales. The climate records produced from this study will serve as a template for late Pleistocene tropical climate variability, and thus provide a low latitude counterpart for the ice core climate records.

Ira Leifer **4/1/2004-8/31/2007** **$80,000**
American Chemical Society, PRF 40726-AC8

A Turbine Seep-Tent Network to Study Hydrocarbon Migration

Hydrocarbon migration in a fracture network presents an extremely challenging problem with significant implications to issues such as reservoir recharge and seep contribution to global climate. Since non-destructive, in-situ studies are difficult, great uncertainties remain. Marine seeps provide a unique opportunity to study this migration process as the seabed is a transecting surface through the network, and measuring gas flux is simpler as bubbles locate seepage. Close to UCSB lies one of the most active seep fields in the world. Thanks to numerous current and past research projects, a historical picture of seepage has been built up over the last decade. Deployment of a 40-unit turbine-seep tent network will measure spatio-temporal variations in seep flux in two disparate active seepage areas. Turbines are spun by rising bubbles; measuring flux and calibration showed insensitivity to bubble size and a fast (0.25s) response. Data analysis will discriminate between factors controlling hydrocarbon flux, including temperature, hydrostatic (tides, swell, barometric), and tar in the fractures. Deployment at two separate seeps will test the hypothesis that seeps respond to small earthquakes. Also tested is whether larger seeps are less oily, a conclusion based on a limited data set from the Gulf of Mexico. This research will also allow discrimination between the mechanisms behind ejections and blowouts.

Ira Leifer **8/1/2005-7/31/2006** **$7,000**
Cal State Lands Commission, C2005-016

Quantifying the Amount and Composition of Seepage from the Playa Del Rey Freshwater Marsh

The project goal is to determine the seep gas emissions from the Ballona Freshwater Marsh. Seepage has been observed at two sites in six to eight feet of water. Seepage rates will be measured with two turbine seep tents. If flow rates are too low to be measured by the turbines, then turbine tents will be capped with a collar and jar, and the time rate of filling will be measured. Flow rates will be measured for a full day to confirm that seepage rates are representative. A third tent will be placed on the marsh bed in an area of no seepage and a background bubble flux measured. Gas samples will be collected from the tents for analysis by Zymax. Chemical analyses specified will include BTEX, H2S, CO and CO2, He, H2, Ar, O2, N2, and the n-alkanes 1-5. Del C13 for CO2, CH4, and ethane will also be performed and Del D for CH4.

Ira Leifer **4/1/2006-9/30/2007** **$200,000**
Bruce Luyendyk
Cal State Lands Commission, C2005-041

UCSB Coal Oil Point Seep Studies

This research study will quantify aspects of natural marine oil and gas seepage from the Coal Oil Point seep field with respect to spatial and temporal emission rates. Specifically, this study will

provide the spatial distribution of gas seepage fluxes and estimates of oil seepage as well as provide initial baseline data for studies that address seasonal and inter-annual variability. The study also develops approaches to allow cost benefit analysis of mitigation strategies based on field data. Results of this study are key towards the larger goal of developing appropriate and cost-effective mitigation strategies. A multi-pronged approach includes seasonal and inter-annual sonar seepage mapping studies; turbine tent deployment and flux monitoring; sea-surface oil slick capture study, seabed oil-tent deployment and flux monitoring; and oil slick trajectory study.

Ira Leifer **7/10/2006-9/30/2007** **$10,000**
Cal State Lands Commission, C2006-050

Goleta Slough Seep Study

The project goal is to determine the source of the gas emissions from the Goleta slough (gas reservoir, biological, natural seepage, air) in order to ensure that mitigation efforts will not lead to increased gas emissions and/or present a hazard. Gas samples will be collected from other seeps in the vicinity of the slough for comparison. Samples will be analyzed for relevant gases including CO and CO2, He, H2, Ar, O2, N2, and the n-alkanes methane through pentane. Del C13 will also be measured for CH4 and ethane. Other analysis may be requested depending upon a review of the storage field gas and well-head gas compositions.

Ira Leifer **12/1/2006-11/30/2007** **$189,545**
Dar Roberts
Bruce Luyendyk
National Aeronautics and Space Administration, 0-NACP05-0030

Remote-Sensing Methane Emissions: Field-Validation with Seepage from Marine, urban, and Submerged City Sources

Although CH4 is at least 20 times more potent to greenhouse warming than CO2, its sources are poorly constrained. Remote sensing can improve atmospheric CH4 budgets by allowing measurements at multiple scales with standardized measures and repeat sampling. However, improvements in spatial resolution are necessary to validate satellite-derived CH4 measurements of sources with sub-regional scale variability. Equally important, is the lack of ground-referenced data. The PIs propose that marine hydrocarbon seeps can ground reference remote sensing CH4 data determining limitations and abilities of current and next generation remote sensing platforms. Marine hydrocarbon seeps provide an ideal natural laboratory for this validation, due to the sea surface's relative spectral uniformity, the locality of the seeps, their clear identification (visual and sonar), the wide diversity of source strengths and intensity, and the freedom of movement (no obstacles) on the sea surface. The goal of this project is to identify the feasibility and limitations of current (AVIRIS) and next generation, remote-sensing technology for detection and quantification of CH4 fluxes. This study uses the wide range of seep strengths and intensities in the Coal Oil Point (COP) seep field as ground-reference data. The technique will be ground-referenced in an urban aqueous seep, the La Brea Tar Pits, and then applied to AVIRIS images acquired during the flooding of New Orleans.

Ira Leifer **2/5/2007-9/30/2007** **$10,000**
Bruce Luyendyk
USDI - Minerals Management Service, M07AC13149

Volume and Chemistry of Natural Petroleum Seeps in the Santa Barbara Channel and Southern Santa Maria Basin

Understanding the impact of oil slicks on coastal communities requires quantitative evaluation of tar on the beaches, the most visible impact of oil from the Coal Oil Point seeps on human activities, as well as protected environmental areas. The PIs will conduct a series of slick tracking studies, spanning a range of seasons, weather and oceanographic conditions, and water temperatures. Studies will be in conjunction with beach tar surveys, and oil samples will be collected from the tracked slicks and the beach for analysis by USGS. Surveys will also focus on slicks from a range of seeps in the seep field, and any spill of opportunity. For each daylong slick study, data analysis will include numerical GNOME modeling to improve modeling of slick advection and chemical

evolution. Beach tar surveys will be conducted weekly throughout the study, with additional studies before and after rain events, and with several periods of daily surveys spanning one week at several times during the year. These surveys will have as their core, the existing detailed survey grid centered at Coal Oil Point, but will also survey a larger length of beach (~ 2 km) through a coarse grid focused on the swash zone. For these studies, image-processing techniques to evaluate beach tar will be developed.

Hunter Lenihan **6/4/2007-5/31/2008** **$11,384**
Channel Islands Marine Resource Institute, SB080003

The Effect of Environmental Conditions on the Early Life Stages of the White Abalone (Haliotis sorenseni) and Experimental Outplanting of Larvae at Coastal Study Sites

In May of 2001, NOAA listed the white abalone as an endangered species throughout its range, from Point Conception, California, USA, to Punta Abreojos, Baja California, Mexico, based on a comprehensive status review of the species. The decline of white abalone was attributed to over-exploitation by commercial and recreational fisheries in the absence of adequate regulatory mechanisms. NOAA's status review identified an urgent need for human intervention in the recovery of the species; in large part because sub-threshold abalone densities in nature, resulting in repeated recruitment failure, make it unlikely that the species will recover on its own. The four objectives of this work are: 1) to equip and set up a hatchery within the existing holding facility at UCSB, 2) to determine the effect of environmental conditions on larval settlement and the susceptibility of early juveniles to predation, 3) to conduct experimental outplanting of larvae and possibly juvenile abalone, and 4) to conduct developmental, ws-RLP, OTC baths, and shell disease studies.

Hunter Lenihan **3/1/2006-3/31/2008** **$81,685**
Kevin Lafferty
UC Sea Grant, R/F-200A-F-1/2

Assessing Withering Syndrome Resistance in California Black Abalone: Implications for Conservation and Restoration

Black abalones were once abundant in California (CA) where they played important ecological, social and economic roles. Withering Syndrome (WS) and overfishing have caused catastrophic declines in black abalone populations, especially in southern California. Some (~1%) of black abalones survive WS infections. It is crucial for restoration and management efforts in CA to determine whether remaining subpopulations are WS resistant and if resistance is heritable. In addition, black abalone spawning methods have not been well developed. Poor spawning success to date impedes research and conservation because populations are so depressed in the wild that only very few individuals can be collected from the field so as to avoid species extinction. To advance restoration and enhancement programs for this species, the PIs will assess the role of WS in the survival of wild populations and advance spawning techniques. They will address the following research questions: 1) What are the best methods to spawn WS-resistant black abalone? 2) Is it possible to quantify more effectively bacterial loads in infected individuals using real-time PCR (Q-PCR; relative to traditional histology)? 3) Are abalones that survive in the wild resistant to WS? Resistance may be conferred by a reduced prevalence or intensity of bacterial infection and or reduced disease in infected individuals, questions that will be addressed by a Q-PCR test.

Jonathan Levine **10/21/2004-10/20/2009** **$625,000**
David and Lucile Packard Foundation, 2004-27672

Understanding Biological Invasions from Introduction through Impact

Biological invasions are a leading threat to natural ecosystems and cost the American economy tens of billions of dollars annually. At the same time, invasions can be regarded as large scale perturbations to ecological communities, providing unique opportunities to understand how these systems are structured. This project will undertake a research program applying principles of population, community, and ecosystem ecology to understand the factors controlling the success and impacts of biological invasions. The research couples mathematical models with field experiments to

understand such fundamental questions as how many new invaders can be expected over the coming decades, and what factors regulate the impact of invaders once they have established. By examining key questions at the introduction, establishment, spread, and impact stages, this research aggressively pursues a rigorous understanding of the entire invasion process.

Jonathan Levine **7/1/2003-12/31/2007** **$516,240**
National Science Foundation, DEB-035608

Environmental Variation, Dormancy, and Rare Plant Persistence in Invaded Habitats

The goal of this project is to examine how rare annual plants persist in the highly variable, exotic grass dominated habitats of the California Channel Islands. With tenfold annual variation in rainfall, and over fifteen rare and endangered annual plants, the island system provides a unique opportunity to examine how germination biology, environmental variation, and surrounding community dynamics influence persistence. To accomplish this, a powerful combination of single and multispecies models, experimental manipulations of environmental variation, and analysis of natural population dynamics will be undertaken. Stochastic single species population models and their multispecies counterparts will be developed for seven rare island annual plants and their exotic grass competitors. Models will be parameterized with demographic rates of plants sown into experimentally imposed rainfall environments in the presence and absence of exotic grass competitors. Sensitivity and elasticity analyses will quantify the importance of dormancy for the ability of populations to increase when rare. Whether environmental variation favors or inhibits persistence will be tested by examining model systems varying in the probability of different patterns of annual rainfall. Single and multispecies models parameterized in the presence and absence of exotic grasses will quantify invader influences on persistence and the predicted effects of environmental variation. These predictions will be tested by experimentally manipulating the sequence of high and low rainfall years through the three years of the project. Lastly, the natural population dynamics of the focal island annuals will be used to test whether multispecies models better predict temporal patterns of abundance than their single species counterparts.

Jonathan Levine **8/1/2005-7/31/2008** **$214,734**
US Department of Agriculture, 2005-35320-16273

Plant-soil feedbacks and the regulations of native shrub recolonization of exotic grasslands

The goal of this project is to understand how plant-soil feedbacks regulate plant invasion dynamics in natural ecosystems. Research will be conducted on Santa Cruz Island, California, where livestock grazing coupled with the introduction of European annual grasses in the early part of the last century converted habitats from native coastal sage scrub to non-native grasslands. Although grazing has been removed, native coastal sage scrub species such as Eriogonum arborescens and Artemisia californica have not recolonized into areas dominated by exotic annual grasses, such as Avena fatua. The PI will investigate how native shrub effects on a) nutrient cycling and b) how soil biota differ from the dominant exotic grass. He will assess how these differences affect native shrub and exotic grass performance. Finally, he will address how plant-soil feedbacks combine with competitive interactions to influence shrub reinvasion of exotic annual grasslands on the islands.

Milton Love **6/1/2001-6/30/2007** **$1,185,396**
California Artificial Reef Enhancement, SB020084

The Ecological Role of Natural Reefs and Oil and Gas Production Platforms on Rocky Reef Fishes in Southern California

In response to a recognized need for the development of scientific understanding of the biology and ecology of fish assemblages living around offshore oil/gas platforms, the PI is involved in a regional approach to research addressing questions about how fishery productivity at the platforms and natural reefs has contributed to key reef fish populations in southern California. A major focus is on determining the relative habitat values of oil/gas platforms and reefs and how ocean influences affect survival and recruitment in the study area. MMS is using the results for environmental assessments associated with oil/gas exploration on existing offshore leases and platform decommissioning in the Santa Barbara Channel and Santa Maria Basin (e.g., oil spill risk assessments and effects of habitat

modifications). Other federal, state and private agencies are using the data to assist in decision-making on issues pertaining to fishery management, conservation biology, marine refuges, and artificial reefs. The study addresses the relative contribution of Platforms in supplying hard substrate to reef fish populations, length of time fishes reside at offshore platforms, comparison of daily growth rates of rockfishes from platforms and natural reefs, habitat value of offshore platforms, description of associated biological communities, and role of oil/gas pipelines as fish habitat.

Milton Love **8/1/2006-1/31/2007** **$10,767**
Environmental Defense Fund, SB070008

Facilitating Cooperative Partnerships in Support of Sustainable Fishing

Because the fishing industry depends upon a public resource base or "commons", conventional methods of fisheries management and governance often employ a top-down approach, where a centralized agency makes resource management decisions beginning at the highest conceptual level and social organization, and then works down to the details. The result is often a complicated regulatory process that is costly and difficult to enforce. Regrettably, the top-down approach has not prevented the overexploitation of many fished species. The PI seeks to generate a report that outlines "best practice" methods for creating a successful, local program for cooperative research. He plans to outline in this report a range of stakeholder responses to proposed management reform measures aimed at increasing sustainable fishing practices through innovative fiscal tools.

Milton Love **2/1/2007-1/31/2008** **$31,279**
UC Sea Grant, R/FISH-203

Two Decades of Fishing the Santa Barbara Channel: An Examination of Effort and Catch with Regard to Serial and Localized Depletions of Reef Fishes

Historically, rockfishes (genus Sebastes) and lingcod (Ophiodon elongatus) have been of great recreational and commercial importance on the Pacific Coast. A number of these species have been listed as overfished by NOAA Fisheries. Stock assessments have not been conducted on most species, and arguably some of these species have also been overharvested. Despite evidence that many reef fishes are relatively sedentary, management has traditionally focused on large geographic scales. Because this process has not proven effective, there is now some support for regional or even port-by-port fisheries management (often called local-area management). One of the issues inherent in this management debate is the extent to which localized depletion of stocks takes place. Indeed, some elements in the fishing community have claimed that no such depletion exists. Thus, what is needed is a study that examines evidence of whether or not localized and relatively long-standing depletion of reef fishes has occurred. The Graduate Student Trainee will extract and examine the data contained within his vessel daily logs and associated Fish and Game log book entries covering more than twenty years of CPFV activity. He will apply a standardized system for classifying fishing site locations with respect to distance from port, exposure to weather and other values inherent to a site. He will then construct a computer database set of these values and others contained within the log form or deduced from text entries (mined from log notes). This database will be manipulated, summarized and tested with respect to two hypotheses. The hypotheses are: 1) Serial depletions of rockfish (genus Sebastes) availability that followed an initially expanding return/opportunity cost maxima have occurred within the study area; and 2) There exist sustained depletions of rockfish availability and therefore populations on relatively fine-grained spatial scales (varying sharply over a few miles or less). These are correlated with a site's accessibility to fishers. (This accessibility is equivalent to what is termed "opportunity-cost" within environmental economics literature.)

Milton Love **8/27/2003-9/30/2006** **$215,139**
US Geological Survey, 03WRAG0037

Rocky Reef Fish and Trophic Interactions Associated with Offshore Oil and Gas Platforms in Southern California

The goal of this research is to develop information to understand how offshore oil/gas platforms contribute to regional fish populations and fishery productivity in the Santa Maria Basin and Santa Barbara Channel. The study involves broad scale sampling at numerous oil/gas platforms and

natural reefs in the Southern California Bight, in cooperation with researchers and resource managers of the National Oceanic and Atmospheric Administration's National Ocean Service (Channel Island Marine Sanctuary), NOAA Fisheries, California Sea Grant Program, Minerals Management Service, California Department of Fish and Game and various other state agencies involved in fisheries management and conservation biology Although the coordination and cooperation of research effort has been great, there continues to be a need for greater compilation and integration of biological and physical data to develop process understanding and comparisons of fishery productivity at natural reefs and man-made structures. An important task for this research team is the completion of an inventory of all of the marine fishes occurring between the Alaskan - Canadian border in the southeastern Beaufort Sea and Cabo San Lucas, southern Baja California..

Milton Love **8/5/2005-8/4/2009** **$426,278**
USDI - Minerals Management Service, 1435-01-05-CA-39315

Reproductive Ecology and Body Burden of Resident Fish Prior to Decommissioning

The primary goal of this study is to fill gaps in information about the reproductive ecology and body burden of resident fish prior to decommissioning. This goal will be met through three separate work tasks or phases. The first phase will determine whether otolith or "ear bone" microchemistry can identify intrinsic markers associated with juvenile rockfish and adult flatfish residing at platforms. Unique signatures of elements (including heavy metals) incorporated in otoliths potentially can be used to measure the extent to which platforms function as nurseries, particularly for rockfishes, and contribute to the replenishment of regional populations in natural areas. If once a platform "fingerprint" is identified, otolith microchemistry can also be useful for identifying adult fish that have moved between platforms and natural areas. The second phase is a survey of levels of heavy metal contaminants present in fishes from platforms and natural areas. The results will begin to establish the relative importance of such contaminants at platforms given the background load in the regional populations.

Milton Love **8/3/2005-8/31/2008** **$670,000**
USDI - Minerals Management Service, 1435-01-05-CA-39322

Fish Assemblages Associated with Platforms and Natural Reefs in Areas Where Data Are Non-Existent or Limited

The MMS defines decommissioning as the process of ending oil, gas, or sulfur operations and returning the lease or pipeline right-of-way to a condition that meets regulation requirements. The MMS works to ensure that wells are plugged to prevent pollution; that pipelines are decommissioned and sometimes removed to prevent seepage of hydrocarbons and to resolve conflicts with other uses of the OCS; and that all sites are cleared of obstructions to minimize use conflicts. The MMS will conduct detailed environmental reviews of any proposed decommissioning projects to evaluate the impacts from platform removal on regional fish populations. When a platform is disassembled, habitat is removed, and numerous fishes and invertebrates are killed. However, the impacts of platform removal on regional populations of coastal organisms are not yet known, particularly on the economically important rockfish species, on the Pacific OCS. Assessment of the effects of platform activities and of the habitat created by the structure of platforms on marine populations greatly bears upon decommissioning issues, as questions about Essential Fish Habitat and the ecological role of Pacific OCS platforms are still unresolved. In order to understand the environmental consequences of decommissioning platforms on local and regional fish populations, there is a need to know the importance of platforms as fish habitat when compared to adjacent natural reefs. The UCSB PI will conduct research aimed at collecting data necessary for making the comparisons, including: 1) density and size structure of the fishes inhabiting both platforms and natural reefs, and 2) location, area and number of natural reefs.

Milton Love **6/2/2004-12/2/2006** **$250,000**
USDI - Minerals Management Service, MMS 1435-0104CA-35031

Assessing the Fate of Juvenile Rockfishes at Offshore Platforms and Natural Reefs in the Santa Barbara Channel

In some years, juvenile rockfishes recruit to some oil/gas production platforms in the Santa Barbara Channel/Santa Maria Basin region in astounding numbers, and the survivorship and growth of fishes residing around these structures are traceable over time as demonstrated in previous MMS-funded research. Given the role of platforms as nursery habitats, it is important to assess the fate of juvenile rockfishes that settle on platforms and natural reefs, and to understand what processes affect the temporal and spatial variability of recruitment. This study, the first of its kind, is aimed at 1) directly linking ocean current patterns to the timing of delivery of juvenile rockfishes settling on offshore platforms; and 2) estimating the proportion of these juvenile fishes that, if the platforms did not exist, would have been transported to natural reef habitat.

Sally MacIntyre **3/1/2007-3/31/2008** **$421,624**
National Science Foundation, DEB-0640953

Turbulent Mixing, Internal Waves, and Intrusions: Temporal and Spatial Variability of Resource Supply and Metabolic Activity in Lakes

The long term goal of this research is to develop a predictive understanding of how physical forcings in lakes effect and control ecosystem function. The PI is using insights gained in the last decade into hydrodynamic processes in lakes along with state-of-the-art instrumentation to identify key physical processes and their links to ecosystem function. During storm events, the investigator is able to envision hot spots where solute fluxes and metabolic activity are intensified and cold spots where change is only possible if currents transport water from hot spots. This phase of the study involves the design of experiments to locate hot and cold spots and quantify the bacterial and primary productivity. Via time series arrays, collaborative modeling efforts, and adaptive sampling based on real time data on the physical state of the lakes, researchers will be positioned to more accurately quantify lacustrine bacterial and primary productivity than ever before.

Sally MacIntyre **8/1/2001-7/31/2007** **$439,956**
National Science Foundation, NSF DEB 0108572

Turbulent Mixing: Effects on Resource Supply and Primary Production in Lakes

The long term goal is to develop a predictive understanding of how physical forcings in lakes affect and control ecosystem function. Knowledge of hydrodynamic processes in lakes has increased dramatically in the last decade, and linking these processes to biological ones on the same temporal and spatial scales is essential for fully understanding controls of ecosystem function. Previous studies have correlated turbulence production with the destabilization of basin scale internal waves due to wind forcing and have linked turbulence production to lake size and bathymetry. This knowledge will be used in the current work to design experiments on spatial/temporal variation of turbulent mixing and its consequences for nutrient fluxes, primary productivity, and spatial heterogeneity of community structure in lakes ranging from 0.1 to 100 km2. The PI will conduct experiments on time scales relevant to changes in bacterial and phytoplankton physiology and growth over several seasons to determine the effect of natural variability on responses. New insights at the process level will allow scientists to make better predictions of changes in lacustrine ecosystems due to physical forcing. Extrapolation based on the new understandings of the relation of turbulent mixing to the internal wave field will allow predictions to longer time scales and to other lakes.

Sally MacIntyre **5/1/2003-4/30/2007** **$299,064**
National Science Foundation, OCE 0235238

Collaborative Research: Physical Limnology for the Parasite Ecologist

How infectious diseases influence population dynamics and community interactions is an understudied aspect of aquatic ecology. This research focuses on the ecological interaction between a common microparasitic fungus and its Daphnia host species, and the consequences to coexisting zooplankton and their phytoplankton prey. The collaborators will merge three disciplines (community ecology, physical limnology and epidemiological modeling) in explaining spatial and temporal patterns of host-parasite dynamics. Comparative and manipulative experiments will be conducted in parallel with modeling to couple physical mixing with host-parasite population dynamics in a broad set of lakes. The coupling of ecological and physical-mixing processes is

a generally important goal since most aquatic microparasites, unlike their animal hosts, do not swim. Hence, sinking and resuspension of parasite spores from the sediment may limit horizontal transmission and spread of diseases in lakes and oceans.

Susan Mau **5/1/2006-4/30/2008** **$33,900**
David Valentine
University of Kiel, MOIF-CT-2006-02164

The Role of Water Column Methane Oxidation in the Global Carbon Budget - Marine CH4 Oxidation

The release of large amounts of the greenhouse gas methane from shallow marine gas reservoirs and dissociating gas hydrates at continental margins is said to have advanced warming episodes in Earth's history. However, methane emitted at the seafloor is consumed partly in the ocean by microbial oxidation reducing the portion reaching the atmosphere. It is the main purpose of this project to quantify the fraction of CH4 oxidized in the water column in relation to the amount discharging, dispersed in the water column and escaping into the atmosphere at different seep settings. In the outgoing phase, Dr. Susan Mau will learn the 14C/3H-tracer technique including the synthesis of the tracers at the University of California, Santa Barbara, to measure oxidation rates of CH4 in the water column. This will allow integrated investigation of several vent sites situated in 10-100 m water depth in the Santa Barbara Basin. The area is ideally suited as it is one of the most active areas of natural marine hydrocarbon seepage in the world. The comparison of the results from distinct settings will provide new insight to the buffer system of the ocean with regard to hydrocarbon seepage. This is of great value for the assessment of the climatological response of a sudden release of CH4 from shallow marine gas resources and gas hydrates.

William McClintock **7/1/2005-9/30/2007** **$483,664**
Steven Gaines
Resources Legacy Fund Foundation, 2005-0072M

Hardware and Support Enhancements to the Marine Life Protection Act Initiative Geographic Information System

According to the separate memorandum of understanding between the Resources Agency, the Department of Fish and Game and Resources Legacy Fund Foundation (RLFF), RLFF has agreed to fund GIS hardware and support enhancements for the Marine Life Protection Act (MLPA) Initiative, a public-private partnership.

John Melack **12/1/2005-10/31/2006** **$2,237**
Shoreline Preservation Fund - Associated Students UCSB, Fall 05-11

The Creation of Adaptive Monitoring for Estuarine Ecosystems: Monitoring of the Devereux Slough, Coal Oil Point Reserve

The ultimate goal of this project is to help bridge the gap between good ecological science and estuarine management by using a specific location to create effective long term monitoring. To do this, the researcher will continue to develop a long term monitoring protocol at Devereux Slough (Coal Oil Point Reserve - COPR) that will be applicable for other Californian estuaries. Initiation of this monitoring long term will help alert COPR managers to ecosystem changes and the management issues that should be addressed at Devereux. The unique feature of this research is the testing of current estuarine monitoring protocols at a single location to determine the successes and pitfalls of these programs, and to help in the development of an economically and time efficient monitoring regime. The result of this project will be the creation of a detailed monitoring manual for long term standardized research at Devereux Slough that incorporates the use of undergraduate interns to help in field collection, data entry and analysis. Students will gain hands-on experience with fish and invertebrate surveying, bathymetric mapping, habitat restoration analysis, bird monitoring and water quality sampling.

John Melack **9/1/2001-8/31/2006** **$200,000**
UC Davis, UCD 005230

Western Center for Estuarine Ecosystem Indicator Research

As part of the Western Center for Estuarine Ecosystem Research, the PI is responsible for flying high-resolution videography over selected targets for comparisons with indicators of ecological health. The measurements at UCSB will be coordinated with field studies conducted under the EPA Center program.

John Melack **7/1/2004-6/30/2007** **$58,000**
Craig Carlson
UC Water Resources Center, SB050002

Nutrient Deposition and Alteration of Food Web Structure in High Sierran Lakes: Response by Microbial Communities

High-elevation lakes of the Sierra Nevada, once considered isolated from human impacts, are increasingly experiencing the effects of population expansion. Nutrient loading, the result of increasing atmospheric deposition, and the stocking of non-native trout, halted in National Parks but continuing on Forest Service lands, are major anthropogenic impacts to these remote ecosystems. The ecological impacts of both trout stocking and atmospheric pollutants have been studied in high-elevation lakes of the Sierra for nearly two decades, and have been shown to impose significant and lasting impacts at a regional scale, including eradication of endangered species, alterations to algal productivity, and changes in zooplankton population dynamics. Connecting these shifts to ecosystem function and biogeochemical cycling is necessary for understanding and predicting ecological impacts in these lakes, yet this has not yet been a focus, despite the documented sensitivity of alpine lake ecosystems to even minor changes in water chemistry or nutrient availability. This research seeks to investigate potential ecosystem impacts of eutropication and trout introductions by examining the role of microbes in the structure and function of Sierran lakes.

John Melack **7/1/2005-10/28/2006** **$90,000**
USDI - National Park Service, J8C07050007

Assessment of Coastal Water Resources and Watershed Conditions in and Adjacent to Channel Islands National Park and Cabrillo National Monument

The UCSB research team will work closely with personnel from the National Park Service, Channel Islands National Park and Cabrillo National Monument, Channel Islands National Marine Sanctuary (CINMS/NOAA), California Department of Fish & Game, Channel Islands Marine Protective Areas (MPA), USGS, and the University of California, to identify sources of data and other information regarding the status of coastal water resources in Channel Islands National Park and Cabrillo National Monument. Reports for each park will be generated to assess the state of knowledge regarding the condition of coastal water resources in these Parks; describe important habitats and biological resources; identify current and imminent threats from human activities; and offer recommendations for continuing studies.

Paige Miller **6/1/2005-5/31/2007** **$10,000**
National Science Foundation, 0409561

NSF Minority Postdoctoral Fellowship

Theory on the evolution of sex chromosomes has focused on XY systems, neglecting ZW systems despite their importance in nature and the fundamental differences between the two systems, which may have profound evolutionary consequences. The ZW sex determination system fundamentally differs from the XY in two ways: A) in ZW systems, there is colinear transmission of both the W chromosome and the cytoplasmic DNA, and B) both sex chromosomes reside in females, thus potentially affecting the early development of offspring via maternal effect genes. This project investigates the consequences of the unique characteristics of a ZW system via three major approaches: 1) The development of theory concerning the genetic conflict that arises during the evolution of a ZW sex determination system, 2) The creation of a new female limited sex

chromosome (neo-W) in a line of Drosophila melanogaster, and monitoring of subsequent sex-specific fitness changes, and 3) A genomic comparison of the distribution (X vs. autosomes) of maternal effect genes in G. domesticus (chicken) ZQ genome with the XY systems of D. melanogaster (fly), C. elegans (nematode), and H. sapiens (mammal).

Aileen Morse **1/27/2006-11/30/2009** **$142,171**
University of Queensland, SB060101

Coral Reef Targeted Research and Capacity Building for Management

Coral reefs worldwide are suffering degradation from a number of disparate natural and man-induced causes. Tackling the root-causes of degradation through effective coastal management measures is likely the best way both to reduce further damage and to allow reefs to return to viable healthy states. Nevertheless, there can also be opportunities for direct intervention to actively restore injured coral reefs. As part of an international research effort, the UCSB investigator seeks to answer the following question: Does the use of "larval flypapers" to effect controlled settlement and metamorphosis of larvae of selected coral species in a lab-based hatchery facility contribute to enhanced growth and survival of recruits out-planted to the field for purposes of restoration? The research objectives are as follows: 1) To design a low-cost land-based hatchery operated at local level to provide reliable sources of coral larvae, and for the intermediate grow-out of young coral polyps for use in restoration/remediation projects. 2) To investigate the success of collecting gametes from individual coral colonies from nearby healthy sites for rearing under hatchery conditions to provide a supply of young recruits for out-planting into damaged areas. 3) To investigate what is likely to be the most cost-effective size to out-plant juveniles to field. 4) To investigate the effect on reef restoration of out-planting young polyps, derived from hatchery-produced larvae that have been newly settled on "larval flypapers" onto standardized artificial modules (SMs) and natural reef substrate.

Daniel Morse **1/1/2006-6/30/2007** **$20,000**
Camille & Henry Dreyfus Foundation, SG-06-046

Environmental Chemical Signals Bring New Life to Coral Reefs: Development of New Interdisciplinary Teaching and Public Education

This project involves the development, presentation and assessment of an innovative instructional vehicle, and the associated syllabi and materials, for the academic and public teaching of a new interdisciplinary paradigm placing environmental chemistry at the center of marine resource biology and conservation. The principal investigator's discoveries over the past two decades have helped lead to the emergence and acceptance of this new paradigm in research, but because academic teaching and public education have not yet achieved this integration, both students and the general public are, for the most part, completely unaware of the essential roles that environmental signals and their recognition play in the control of life and ecosystems in the marine environment (and indeed, on the planet as a whole). This project addresses the educational gap by developing and assessing the efficacy of a new undergraduate course and an ancillary public education program that present as their central focus: 1) the critical role that environmental chemistry plays in the control of marine resource biology, and 2) the essentiality of environmental chemistry in modern approaches to marine environmental conservation.

Daniel Morse **8/1/2005-8/31/2007** **$238,970**
Marine Biological Laboratory, 27343

Biomolecular Mechanism, Cloning, Sequencing and Analysis of Adaptive Reflectin cDNAs and Proteins

The dynamically adaptive optical properties of cephalopod skin are driven by unique biomolecular mechanisms that change skin color, reflectance and texture. While the mechanisms responsible for the changes in color and texture are largely understood, it is the dynamic changes in reflectance that are most poorly understood. Our specific focus in this 12-month Phase-One project is to clone and sequence the cDNAs coding for the dynamically adaptive reflectin proteins from squid (genus

Loligo), and determine from the deduced sequences, molecular models and experimental analyses of the adaptive reflectin proteins the molecular domains and mechanisms that govern the dynamically adaptive changes in reflectance.

Daniel Morse **8/18/2004-8/23/2006** **$3,500**
Oak Ridge National Laboratory, 4000034927

CNMS RS 2003-04S: Scaffolding of Biosynthetic Enzyme Systems to Nanostructured Electrodisc for Controlled Synthesis of Inorganic Materials

This project, conducted by graduate student Meredith Murr, is aimed at understanding the catalytic and structure-directing mechanisms of the silicatein filament in order to develop biologically inspired new routes to materials synthesis. Siliceous marine sponges have developed unique biomolecular machinery for the well-controlled supramolecular assembly of silicon-based biomaterials. In particular, the needle-like glass structures, or spicules, of the marine sponge Tethya aurantia are composed of a central (axial) protein filament surrounded by well-ordered silica nanoparticles. To begin to elucidate the determinants of specificity, self-assembly and templating, the molecular details of the filament surface are required. Studies will be conducted to help determine how the filament is able to stabilize the formation of ordered inorganic products. The results could lead to the design of biologically-inspired catalytic templates that can mimic the desirable properties of the silicatein filament.

Daniel Morse **8/19/2002-8/18/2007** **$2,971,750**
Paul Hansma
Galen Stucky
J. Herbert Waite
Princeton University, 00000532

Synthetic Self-Healing Structural Materials

This research will develop generic, robust rules and design tools governing synthesis and performance of self-healing structural materials, based on exemplars from biological systems that combine some of the desirable properties of Kevlar and silicones. New routes to synthesis of these multifunctional materials will be developed, together with a robust and generalizable understanding of the fundamental physics and design principles underlying their assembly and behavior. Practical uses include self-healing fibers, solids, armors and protectants, coatings, resins, adhesives and packaging materials. Robust and generalizable rules and design tools governing the physical properties and synthesis of self-healing structural materials should find wide application in extensions to predictive property design in other multifunctional materials as well. This project aims to develop fundamental design principles and new routes to synthesis for manufacture of self-healing fibers, resins, solids and composites based on lessons extracted from the biological protein models. The UCSB team will develop, test and optimize synthetic analogs of the natural self-healing proteins and protein-based composites on which their approaches are based, and then translate the results of these studies to second generation synthetic materials that are thermally robust, resilient, processible and economically manufacturable.

Daniel Morse **2/25/2006-4/30/2007** **$49,943**
UC Lawrence Livermore National Laboratory, B558555

Purification and Mechanism of Action of APB Mineralization-Controlling Protein

The formation of calcium carbonate by marine organisms is one of the primary examples of biomineralization. DOE has a strong interest in understanding the physical and chemical controls on calcium carbonate formation because its deposition sequesters large volumes of carbon and impacts sea water chemistry on a global scale. Currently, LLNL has a DOE Office of Basic Energy Sciences funded project to understand the physical controls on the growth of calcium carbonate due to its interaction with peptides, proteins and other biomolecules associated with carbonate formation by marine organisms. Specifically, the project deliverables call for molecular scale investigations of calcite growth in the presence of proteins extracted from the mineralizing portions of Abalone shell,

particularly two acidic proteins known as AP8-a and AP8-b. The UC Santa Barbara PI is the world's leading expert in extracting, purifying and identifying proteins from Abalone and is a leading expert on the more general subject of biomineral formation. In the proposed project, UCSB will extract and purify AP8-a and AP8-b proteins. Solutions of these proteins will be provided to LLNL for atomic force microscopy measurements of calcite growth kinetics. The resulting data will be analyzed by both the LLNL and UCSB investigators in order to determine the mechanisms of modification induced by the proteins.

Daniel Morse **3/1/2006-2/28/2007** **$233,552**
UC Sea Grant, R-MP-95-F-3/3

Marine Bio-Nanotechnology: High-Performance Materials from Sponge Silicatein

The objectives of this project are: 1. To complete this project's characterization of the molecular mechanisms by which the silicatein proteins isolated from a common California marine sponge control the synthesis and nanostructures of titanium dioxide for the efficient conversion of solar energy to electricity. 2. To apply the results of these studies to optimize nanostructural control of the resulting titanium dioxide made by the sponge proteins and their synthetic ("biomimetic") counterparts; and to optimize the performance of the resulting titanium dioxide nanocrystals for more efficient photovoltaic conversion of solar energy to electricity. 3. To extend these results to develop innovative methods for the economically efficient nanofabrication and improved performance of other semiconductors for advanced microelectronic, optoelectronic and medical applications required for the next generation of computers, communications devices, chemical and biological sensors, energy transducers, "smart" medical implants and biochips. 4. To provide training in the unique interdisciplinary approach of this project, combining new developments in marine biotechnology, advanced instrumentation and materials engineering, to produce high-performance nano-structured materials.

Daniel Morse **7/1/2006-11/30/2007** **$285,000**
US Department of the Army, W911NF-06-1-0285

Biomolecular Mechanism, Cloning, Sequencing and Analysis of Adaptive Reflectin cDNAs and Proteins from Squid

The dynamically adaptive optical properties of cephalopod (octopus, squid and cuttlefish) skin are driven by unique biomolecular mechanisms that change skin color, reflectance and texture. While the mechanisms responsible for the changes in color and texture are largely understood, it is the dynamic changes in reflectance that are most poorly understood. The specific objectives of this project are to clone and sequence the cDNAs coding for the dynamically adaptive reflectin proteins from squid (genus Loligo), and determine from the deduced sequences, molecular models and experimental analyses of the adaptive reflectin proteins, genetically engineered mutants and synthetic peptide analogs of these proteins the molecular domains and mechanisms that govern the dynamically adaptive changes in reflectance. Results of this study will enable the subsequent design and synthesis of a new generation of electro-optically active materials for new means of optoelectronic communication.

Craig Nicholson **8/1/2005-7/31/2007** **$150,748**
Christopher Sorlien
National Science Foundation, EAR-0439859

Accommodating Oblique Plate Motion in the California Continental Borderland: The Interaction Between Rotating and Non-Rotating Domains

Understanding continental structure and the dynamics of plate boundary deformation is a major initiative in earth science. This project is part of a coordinated effort to conduct integrated, multi-disciplinary studies of the crust and mantle structure and evolving plate boundary deformation both onshore in southern California and offshore in the California Continental Borderland. The Borderland was the locus of Pacific-North America plate motion for about 70% of its displacement history, and recent GPS data suggest that up to 20% of current plate motion is still located offshore.

This project will make use of extensive grids of existing high-quality industry multi-channel seismic (MCS) data that have recently become available to investigate the crustal deformation and tectonic evolution of the offshore portion of the PAC-NAM plate boundary. A prime objective is to document how the crustal architecture accommodates plate boundary transpression, differential rotation, spatial variations in fault slip and the termination of faults. Project results will be incorporated into regional community fault, structure and velocity models for southern California that form the basis for estimating earthquake hazards, interpreting geodetic strain data, understanding plate boundary evolution, and other aspects of continental deformation, including fault interaction and fault system dynamics.

Craig Nicholson **4/1/2004-9/30/2006** **$273,819**
James Kennett
Christopher Sorlien
National Science Foundation, OCE 0350573

A Test for Extending the High-Resolution Climate History Back to ~450ka: The Interface Between Climate, Tectonics, and Sea-level Change in Santa Barbara Basin

The ODP Site 893 in Santa Barbara Basin provides one of the highest-resolution climatic and paleo-climatic archives of the late Quaternary being studied from the world's oceans. Oxygen isotropic and microfossil results reveal a remarkable correlation of climate change between Santa Barbara Basin and the Greenland Ice Sheet during the last 70 ka, suggesting synchronous climate changes linked through the atmosphere. The investigators will interpret data collected in 2002, use a 3D model to precisely locate favorable sites for piston coring and select sites to sample the extreme climate transition from Oxygen Isotope Stage -12 to 11, and OIS-6 to 5e to ground-truth the seismic correlation from Site 893. Based on the PIs' experience with Site 893, each core will provide crucial high-resolution windows into how global climate changed during these older time periods, and critical insights into the behavior of late-Quaternary climate change at decadal to millennial to orbital scales. The new data will also help evaluate the nature and speed of earlier climate transitions, and thus provide better understanding of the causes of abrupt global climate warming.

Craig Nicholson **2/1/2004-1/31/2007** **$75,000**
University of Southern California, 083262

Continuing to Build and Evaluate the SCEC 3D Community Fault Model

The purpose of this project is to continue to develop useful digital databases of subsurface information, and to use these data to provide digital 3D structural representations of active fault surfaces for input into the SCEC 3D Community Fault Model (CFM). This includes developing digital 3D fault surfaces and down-dip projections of seismogenic faults based on subsurface well data, seismic reflection data and relocated seismicity, developing alternative fault models that include non-planar fault geometry, as well as testing and evaluating the existing CFM for fault continuity, consistency and compatibility to accommodate finite strain.

Todd Oakley **1/1/2004-12/31/2007** **$271,300**
Nikolaos Schizas
National Science Foundation, 0316330

A Multi-Gene Phylogeny of Maxillopod Crustaceans to Facilitate Comparative Study of Eye Evolution

As benefactors of a detailed stratigraphic record, riotous diversity, and cosmopolitan distribution, the Maxillopoda (ostracods, copepods, barnacles, and others) have enormous potential to provide information about evolution, biodiversity, ecology and global change. However, a major obstacle to utilizing this potential is the lack of reliable phylogenetic hypotheses for the group. This project has two major goals: 1) to provide a large-scale molecular phylogeny of maxillopod crustaceans and; 2) to use the phylogeny to test hypotheses about maxillopod eye evolution. A selected team of researchers and collaborators with complementary expertise in the major maxillopod groups will sample a taxonomically diverse array of about 100 maxillopod species that is nearly comprehensive at the level of family to order. They will obtain DNA sequence from four different nuclear genes that will allow not only resolution of maxillopod relationships, but also integration with other studies in

arthropod phylogeny. With regard to maxillopod eye evolution, a preliminary phylogeny based on extensive preliminary strongly supports independent origins of compound eyes in both myodocopid ostracods and branchiuran fish lice. The PI's will examine statistically the alternative hypothesis that compound eyes were lost multiple times rather than gained.

Todd Oakley **4/1/2007-3/31/2008** **$120,000**
National Science Foundation, DEB-0643840

CAREER: Exploring Congruence of Fossil and Molecular Estimates of Macroevolutionary Divergence Times in Ostracoda (Crustacea)

This is an empirical study of origination times of numerous lineages of Ostracoda (Crustacea). This study will have broad implications for understanding the controversies surrounding divergence time estimation by investigating hypotheses to explain observed incongruities between fossil and molecular divergence time estimates in Ostracoda. A primary goal is to examine in detail causes of incongruence observed in preliminary data; considering molecular, statistical and paleontological explanations. To ensure a balanced approach, the PI (who is trained in molecular phylogeny and molecular evolution) will collaborate with two postdoctoral researchers (sequentially) with primary training in morphology/taxonomy and paleontology. In addition to detailed inquiries into the causes of molecular/fossil incongruence, the lineage divergence times in question have direct bearing on several important evolutionary hypotheses that are a focus in the lab of the PI, such as the recent origin of compound eyes in myodocopid ostracods. A primary goal is to examine the sensitivity of character evolution hypotheses to different possible divergence time estimates.

John Orrock **12/15/2004-5/31/2007** **$43,571**
O. James Reichman
National Science Foundation, DEB-0502069

SGER: Does Manipulation of Top Predators Lead to Rapid Shifts in the Structure of Ecological Communities?

The role of predation in affecting the structure of natural communities is a central question in ecology. However, rarely do systems exist where food webs are amenable to large-scale experimental manipulation, and food webs are often too complex to explicitly track all participants. This project capitalizes upon the planned reintroduction of the Island Fox (Urocyon littoralis) to San Miguel Island to determine if top predators lead to rapid shifts in island plant communities by affecting rodent consumers (i.e., a trophic cascade). Evaluating the effect of top predators requires either long-term data from systems with and without top predators or systems where the timing of predator manipulation is known. This study combines both, using long-term data from systems with and without predators as well as experimental data from a system where the duration of predator removal is known. This unique combination of contemporary and historical data makes it possible to rigorously evaluate the role of top predators in insular food webs as well as evaluate how quickly top predators lead to shifts in ecological communities.

Gail Osherenko **3/1/2006-5/31/2008** **$13,238**
Keith Clarke
University of Southern California

California's Coastal Zone Management Program: Retaining Agricultural Land in the Face of Urban Growth

Nearly all of California's coastal communities are facing a serious shortage of housing for low- and moderate- income workers and looking to remaining agricultural land and open space for land to build high density housing developments. The California Coastal Act, promulgated in 1976 to protect the beauty of the Coast, is now being tested in a new time of housing shortages and astronomical price increases. The Act identifies retention of important farm- and rangeland as one of the top three priorities for land use in the coastal zone, yet the rate of population growth in coastal communities coupled with patterns of development that foster sprawl threaten conversion of agricultural land both within and outside the coastal zone. Even when planners promote "smart growth" alternatives to sprawl, remaining agricultural land in and close to urban areas provides tempting sites for location

of development. California employs a complex of economic, regulatory and legal tools to protect agricultural land: regulatory restrictions (command and control mechanisms), tax incentives, and purchase of property rights. This project examines and evaluates the role of each of these policy instruments in preventing the conversion of agricultural land. The researcher and graduate student will explore the interplay among the three approaches to agricultural land retention.

Gail Osherenko **3/1/2005-2/28/2007** **$42,211**
Keith Clarke
USC Sea Grant, 101571

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Christopher Osovitz **7/1/2005-6/30/2007** **$12,000**
Gretchen Hofmann
UC Mexus, SB060030

Investigating the role of physiological tolerances in setting marine species' biogeographic boundaries

This is a dissertation project investigating the physiological underpinnings of the biogeographic ranges of two sea urchin species whose southern range boundaries are located near Punta Eugenia, Baja MX. The purple sea urchin (Strongylocentrotus purpuratus), the red sea urchin (S. franciscanus) and many other marine species share this point as a southern range boundary. It is widely thought that this point is a thermal barrier for these species because a relatively large thermal cline exists there. Since physiological thermal tolerances are thought to limit species ranges at such locations, many studies suggest that species' distributions may shift pole-ward in response to global ocean warming. However, these hypotheses are largely based on hypothetical data, and physiological states of marine species near their southern range boundaries have rarely been investigated. In order to investigate this phenomenon, the investigator will compare gene expression among natural populations of S. purpuratus and S. franciscanus from the center of their biogeographic range (Oregon, USA) toward their southern range boundary (Punta Eugenia, Baja, Mexico). This project will aim to answer two questions: 1) What are the general trends of S. purpuratus' gene expression along the southern portion of its biogeographic range? 2) Does S. purpuratus' sister species S. franciscanus utilize similar differential expression trends across its biogeographic range? Using this twofold approach will allow the PI to make conclusions regarding a species' general physiological response to environmental variation (#1) as well as specific responses to what extent such responses are universal to other species (#2). Such an endeavor would benefit understanding of marine community structure as well as offer insight to species responses to future climate change.

Henry Page **10/1/2005-1/31/2007** **$30,456**
Stephen Schroeter
Jenifer Dugan
Channel Islands National Marine Sanctuary Foundation, SB060087

Variation in Larval Supply Inside and Outside of a Marine Protected Area Within the Channel Islands National Marine Sanctuary

The overall project goals are to improve understanding of factors regulating populations of commercially, recreationally, and ecologically important invertebrate species inside and outside of a Marine Protected Area (MPA) on Santa Cruz Island. Specifically, the investigators will: 1) test whether the larval supply of selected invertebrates differs inside and outside of an MPA on Santa Cruz Island, 2) investigate relationships between larval supply and the density of adults, 3) examine how larval supply varies among selected taxa, 4) involve stakeholders in research within the Channel Islands National Marine Sanctuary, and 5) provide preliminary data that can be used to generate a more comprehensive proposal to improve understanding of factors regulating benthic populations within MPAs.

Henry Page **9/18/2006-1/31/2008** **$9,999**
Jenifer Dugan
Channel Islands National Park, J8C07060004

An Investigation of the Responses of Benthic Invertebrate Species to Marine Protected Areas in the Channel Islands National Park

Shallow rocky reefs are a critically important nearshore coastal ecosystem of the California Mediterranean region. Populations of commercially (e.g., red sea urchins, rock crabs), recreationally (rock scallops), and ecologically (e.g., purple sea urchins, keyhole limpets) important invertebrate species occur on shallow rocky reefs located inside and outside of Marine Protected Areas (MPAs) within the Channel Islands National Park (CINP). Populations inside and outside of MPAs are potentially linked through the passive transport of planktonic larvae by ocean currents. The PIs are deploying 12 temporary moorings as part of another study to monitor larval recruitment of key invertebrate species inside and outside of MPAs within the CINP. The proposed project will complement the larval monitoring by: 1) analyzing NPS data collected during the Kelp Forest Monitoring Program on the composition and density of selected benthic invertebrates, including sea urchins, scallops, crabs, and keyhole limpets, at the locations of larval monitoring sites located at CINPS sites at Santa Cruz and Santa Rosa Islands, and 2) conducting quantitative field surveys on the composition and density of benthic invertebrates at larval monitoring sites at these islands where CINPS data are not available.

Henry Page **9/16/2002-3/30/2007** **$164,015**
Jenifer Dugan
Milton Love
Hunter Lenihan
USDI - Minerals Management Service, Task 85339 MMS-31063

Ecological Performance and Trophic Links: Comparisons Among Platforms and Natural Reefs for Selected Fish and their Prey

The overall objective of this research is to provide decision-makers with information on the quality of offshore platforms as reef habitat. Specifically, the investigators will: 1) explore whether indices of ecological performance (e.g., size, individual growth, production) of a model fish and its invertebrate prey differ between a platform and a natural reef over time; 2) test whether the performance (nutritional condition, growth) of a model fish differs among offshore platforms and natural reefs located in different regions of the Santa Barbara Channel at one time; 3) examine depth fidelity, territoriality, foraging activity budgets, and mortality of a model fish as a means of linking prey and predator performance; and 4) acquire data that can be integrated into models, such as ECOPATH, to describe the flow of energy and material among trophic levels on platforms and natural reefs.

Langdon Quetin **10/15/2002-9/30/2008** **$596,520**
Robin Ross
Virginia Institute of Marine Science, 518606/1247

LTER: Palmer Antarctica LTER: Climate Change, Ecosystem Migration and Teleconnections in an Ice-Dominated Environment

The UCSB investigators are responsible for the Zooplankton and Micronekton component of the PAL LTER study of the pelagic ecosystem west of the Antarctic Peninsula. The work consists of three major areas, core data sets, process experiments, and synthesis and modeling. The core data sets constitute the time series that is the legacy of the LTER, and that allows the investigators to test hypotheses about processes that occur on time scales of decades. UCSB's investigators are responsible for: 1) collection of core data sets during the spring and summer season, primarily during the annual research cruise in January/February; and 2) documentation of data collection methods, quality control/quality assurance of the core data sets, and placement of the core data sets and documentation into the PAL LTER database within two years of collection. Shorter-term process studies on such questions as grazing rates of larval krill on surfaces or factors driving the documented seasonal decrease in biomass of krill in the area will be undertaken in one- or two-year sequences. They will also participate in synthetic and modeling activities, including continuation of the EOF analysis begun during the 1996-2002 period of the project, and analysis of the abundance and distribution of the five major macro-zooplankton species in the PAL LTER study region with the ten-year time series.

Daniel Reed **12/1/2006-11/30/2007** **$820,000**
Steven Gaines
John Melack
David Siegel
Sally Holbrook
National Science Foundation, 0620276

LTER: Land/Ocean Interactions and the Dynamics of Kelp Forest Communities

The Santa Barbara Coastal LTER (SBC LTER) is an interdisciplinary research and education program established in April, 2000 to investigate the relative importance of land and ocean processes in structuring ecosystems at the land-sea margin. The principal study area is the Santa Barbara Channel and the coastal watersheds that drain into it, and the focal ecosystem is giant kelp forests, which occur on shallow rocky reefs at the interface of the land-sea margin throughout the study area and other temperate coasts throughout the world. The major focus of this work is to develop a predictive understanding of the structural and functional responses of giant kelp forest ecosystems to environmental forcing from the land and the sea. The amount of nutrients and organic matter delivered to the kelp forest from land and the surrounding ocean varies in response to short- and long-term changes in climate, ocean conditions and land use. Variation in the supply of these commodities interacts with physical disturbance to influence the abundance and species composition of the forest inhabitants and the ecological services that they provide. The overarching question of this research is: How do abiotic drivers acting over different spatial and temporal scales interact to influence kelp forest structure and function?

Daniel Reed **4/1/2000-3/31/2008** **$5,037,911**
Scott Cooper
Steven Gaines
Sally Holbrook
John Melack
National Science Foundation, NSF OCE 9982105

LTER: Land/Ocean Interactions and the Dynamics of Kelp Forest Communities

This LTER (Long-Term Ecological Research) site in the Santa Barbara region is focused on ecological systems at the land/ocean-margin. The location is typical of many semi-arid regions in that it includes a large number of watersheds with episodic stream flow that vary in size and land use. The focal coastal ecosystem of this research will be giant kelp (Macrocystis pyrifera) forests, which

are extremely important to the ecology and economy of coastal areas along the west coast of North and South America. Kelp forests occur on shallow coastal reefs and are affected in both positive and negative ways by land and the open ocean through the movement of water carrying constituents (e.g., sediments, nutrients, larvae, pollutants) from these different sources. Kelp forests have a unique trophic structure in which producers (macroalgae) and consumers (sessile invertebrates that filter plankton) compete for space. Competition between macroalgae and sessile invertebrates can be mediated by the relative supply of nutrients and particulate organic matter to the reef.

Daniel Reed **11/1/2004-1/31/2007** **$40,352**
UC Davis, UCD 013981-02

Mechanical Consequences of Flexibility for Benthic Marine Organisms

The UCSB investigator will oversee field technicians who will conduct monitoring of kelp survivorship in the field. The technicians will also deploy and retrieve a physical instrument used to record wave heights at the core field site of the study, and will carry out morphological measurements and measurements of holdfast strength on kelp plants collected in the Santa Barbara area. The field technicians will also assist the UC Davis investigator during periodic visits to UCSB in deploying devices for determining drag coefficients of kelps and in deploying sensors that directly measure wave forces imposed on these organisms in nature.

Daniel Reed **7/1/2004-8/31/2007** **$354,967**
Sally MacIntyre
Mark Brzezinski
Sally Holbrook
UC Office of the President, UCOP 012856-01

Ecosystem Functioning in Giant Kelp Forests: Linking Hydrodynamics to an Essential Forage Species and its Benthos

Giant kelp (Macrocystis pyrifera) is heavily harvested and is a critical forage species for numerous other marine organisms, many of strong commercial value to fisheries. The subtidal forests formed by this kelp may also have the capacity to function as natural filters to improve coastal water quality. However, despite the clear economic and ecological importance of giant kelp forests, their relationship to surrounding waters and the linked responses of organisms within the community to forest-flow processes have not been explored in any detail. The investigators aim to examine mechanistically 1) the degree of connection of this vital system to its surrounding waters, 2) rates of consumption or production of waterborne subsidies by kelp forests, 3) the interplay of nutrients, light, and flow in determining kelp growth, and 4) the implications of forest-flow interactions for benthic inhabitants of the forest. The experimental efforts will employ extensive flow measurements, geochemical and biochemical analyses, and traditional ecological methods in exploiting a breadth of expertise in hydrodynamics, marine ecology, biological oceanography, and algal physiology. As such, this work will address pressing problems in coastal water quality, it will increase knowledge of the ecosystem role of a critical forage species, and it will outline the nature of cascading ecological processes that impact fisheries.

Daniel Reed **3/15/2006-2/28/2007** **$5,000**
Carol Blanchette
Steven Gaines
Allison Whitmer
UC Sea Grant, R/W-1200PR-F-1/1

Rapid Response Support for the 7th International Temperate Reef Symposium

The primary objectives of the Seventh International Temperate Reef Symposium (7th IRS) are: 1) to promote the exchange of information among academic scientists, resource managers, government agencies and the interested public on topical issues pertaining to the ecology and management of shallow rocky reefs in temperate regions throughout the world, and 2) to train the next generation of scientists in effective reef conservation and management, and educate them on the virtues of

international collaborations. The 7th ITRS will be held at UC Santa Barbara June 26-July 1, 2006. This funding from UC Sea Grant will provide partial lodging costs for 25 graduate students to attend the symposium.

Daniel Reed **4/10/2006-7/1/2006** **$10,000**
USDI - Minerals Management Service, 0106PO39729

Sponsorship of 7th International Temperate Reef Symposium

The primary objectives of the Seventh International Temperate Reef Symposium (7th IRS) are: 1) to promote the exchange of information among academic scientists, resource managers, government agencies and the interested public on topical issues pertaining to the ecology and management of shallow rocky reefs in temperate regions throughout the world, and 2) to train the next generation of scientists in effective reef conservation and management, and educate them on the virtues of international collaborations. The 7th ITRS will be held at UC Santa Barbara June 26-July 1, 2006. This funding from the Minerals Management Service will provide participant costs for foreign scientists to attend the symposium.

O. James Reichman **9/1/2001-12/31/2006** **$450,000**
Sandy Andelman
Andrew W. Mellon Foundation, MELLON SB020119

Postdoctoral Training in the Management of Environmental Information: A Proposal to the Andrew W. Mellon Foundation

Despite many years and dollars spent in pursuit of useful information about the environment, even the simplest forms of communication between providers and users of the information is extremely difficult, to the extent that scientists may be limited by the inability to access the vast amounts of information that exists. Inaccessibility is particularly true for ecological information. Within the universe of information, ecological data may be as dispersed and heterogeneous as any of interest to scientists and other users. Understanding complex ecological and environmental issues requires information across many scales and disciplines, from the molecular level to whole organisms and from genetics to global change. Contemporary ecological research commonly relies on integrating data as diverse as climatological records, spatial distributions of individuals, changes in biodiversity over space and time, responses of species to experimental manipulations, genetic structure of populations, patterns of human alterations of ecosystems, and much more. The scope of information needed to understand ecological systems is enormous. This project will support three postdoctoral associates in ecology and computer science at the National Center for Ecological Analysis and Synthesis to work on informatics research on the cutting-edge elements of the Center's efforts to imbue the community of information users with a capability for sharing information.

O. James Reichman **1/1/2003-12/31/2006** **$700,000**
Andrew W. Mellon Foundation, SB030058

Production Implementation of the Knowledge Network for Biocomplexity

Information is the raw material of knowledge and understanding. The research enterprise is designed to generate information - data - and facilitate its incorporation into higher order understanding and true knowledge of the systems under consideration. The geometric increase in information, and its availability in machine form, has made the amount of data accessible overwhelming; unfortunately it has not led to a commensurate increase in knowledge in most fields. This is particularly true for ecological information, which is important for advancing the basic understanding of natural systems. Within the universe of information, ecological data may be as dispersed and heterogeneous as any of interest to scientists and other users. Understanding complex ecological interactions involves both the biotic and abiotic realms, and commonly relies on integrating data as diverse as climatological records, spatial distributions of individuals, changes in biodiversity over space and time, responses of species to experimental manipulations, genetic structure of populations, patterns and processes of ecosystem functioning, and much more. Research at the National Center for Ecological Analysis and Synthesis (NCEAS) has revealed both the need for, and the power of, more generic access to data to address ecological questions.

O. James Reichman **3/23/2005-3/31/2008** **$300,000**
Sandy Andelman
Andrew W. Mellon Foundation, SB050085

Deploying Information Management Tools and Increasing Analytical Capabilities of Scientists Through the National Center for Ecological Analysis and Synthesis

The National Center for Ecological Analysis and Synthesis (NCEAS) was established to use existing data to address important ecological questions. Accordingly, its research and training activities (including Working Groups, Postdoctoral Associates, and Center Fellows, totaling more than 3,500 individuals in 10 years) focus on the acquisition and access to distributed and heterogeneous ecological information. NCEAS has been engaged in extensive research projects to develop generic data access tools for ecology and allied disciplines. Concurrently, the Andrew W. Mellon Foundation has provided unique support to help deploy the tools, a crucial activity that is not supported by more traditional entities. With this support, the Principal Investigators have discovered that a distinctive opportunity exists at NCEAS to develop informatics tools and train hundreds of scientists in their use. Specifically, while at the Center, scientists are fully engaged in accessing, integrating, and sharing information to conduct their projects and thus are primed to employ new informatics tools. This award from the Andrew W. Mellon Foundation provides support for one person for informatics training and three analytically adept postdoctoral associates to significantly strengthen informatics training for hundreds of scientists who visit the Center each year.

O. James Reichman **6/20/2004-3/31/2008** **$1,859,855**
Sandy Andelman
David and Lucile Packard Foundation, 2004-27169

Knowledge and Capacity-Building to Support Ecosystem-Based Management for Sustainable Coastal-Marine Systems

This is a partnership between the National Center for Ecological Analysis and Synthesis (NCEAS) at UC Santa Barbara and the Packard Foundation that focuses the attention of innovative scientists of the highest caliber on generating the knowledge needed to support an ecosystem-based approach to managing coastal-marine systems. Coastal systems are heterogeneous and dynamic. They also are frequently chaotic, corruptible by invasion of exotic species, and strongly influenced by both nearby and remote processes, including human activities. The current global population and associated activities of more than 6 billion people are generating unprecedented rates of change in these systems. Thus they cannot be managed successfully by existing approaches. In this context, perhaps the greatest challenge for today's scientific, conservation, and policy communities is to develop ways to ensure new knowledge is relevant and of high quality. A related challenge involves delivering this information in a timely fashion and making the results accessible to managers and decision makers so that scientific information is considered in making environmental policy.

O. James Reichman **10/1/2006-8/15/2007** **$85,826**
Gordon and Betty Moore Foundation, 1203

Wild Salmon Ecosystems

Climate is a major driver of the geographic distribution and abundance of salmon. Climate change is occurring globally, but there has been no organized effort to evaluate the potential effects of climate change on populations of salmon and the ecosystems they inhabit. Sufficient data and expertise exist to conduct such an assessment. Developing and implementing a process to synthesize the data is the critical step toward achieving this evaluation. This project will initiate the process of synthesizing existing data on the potential effects of climate change on salmon. In collaboration with a Steering Committee assembled by the Moore Foundation, the National Center for Ecological Analysis and Synthesis will convene a multidisciplinary group of approximately forty-five scientists and practitioners with relevant expertise. The experts will identify the most important topics related to the potential effects of climate change on salmon and their ecosystems, and develop a strategic framework for conducting targeted analyses and syntheses of existing data.

O. James Reichman **9/15/2006-3/31/2007** **$3,000**
National Marine Fisheries Service, SB070079

Multivariate Statistical Analysis Workshop

This award provides support from the National Oceanic and Atmospheric Administration, Northwest Fisheries Science Center for the Multivariate Statistical Analysis workshop with Dr. Marti Anderson at NCEAS October 16 -20, 2006. The focus of this training workshop was to analyze data from multi-species communities. Dr. Anderson is at the forefront of developing multivariate data from multi-species communities.

O. James Reichman **3/15/2005-2/29/2008** **$210,328**
John Orrock
National Science Foundation, DEB-0444217

CRB: The Role of Apparent Competition and Patch Geometry in Mediating the Invasion and Restoration of Grassland Communities

Biological invasions are a leading cause of extinction that imperil the structure and function of ecological communities. Consumers can play an integral role in the outcome of invasions, as evidenced by classical biological control whereby exotic plants are controlled by the introduction of exotic consumers. However, the role of native consumers in affecting biological invasions remains unclear. This project evaluates an untested hypothesis with direct implications for biological invasions: exotic plants can subsidize native consumers, leading to stronger impacts of native consumers on native plants (i.e. apparent competition). Furthermore, this study examines how differences in resources and protective cover between native and exotic patches of vegetation affect the spatial extent of apparent competition by influencing consumer behavior. When consumer incursions limit the spatial extent and pattern of apparent competition, the size and shape of native patches determines what areas, if any, are free of apparent competition. By measuring consumer abundance, activity, and impact in patches of varying geometry, a second untested hypothesis is examined: differences in native and exotic habitats alter consumer behavior, changing the spatial extent of apparent competition and setting geometric thresholds at which patches of native plants are too small or too narrow to persist.

O. James Reichman **8/1/2000-7/31/2007** **$16,664,400**
National Science Foundation, NSF DEB 0072909

National Center for Ecological Analysis and Synthesis

The Center for Ecological Analysis and Synthesis is located in downtown Santa Barbara. The Center provides an outstanding physical and intellectual setting for visiting scientists who conduct collaborative research on major fundamental and applied problems in ecology. The Center's high performance computing facilities and skilled technical staff enable resident and remote researchers to tackle complex and computationally challenging problems. The results of the Center's research, both data and publications, are disseminated widely to the scientific community, as well as to other user groups, such as resource managers and policy makers.

O. James Reichman **10/1/2006-9/30/2011** **$3,418,276**
National Science Foundation, DEB 0553768

NCEAS: National Center for Ecological Analysis and Synthesis

The National Center for Ecological Analysis and Synthesis (NCEAS) was established in 1995 in recognition of the need for a facility where ecologists and scientists in allied disciplines could collaborate to conduct multidisciplinary research. The Center's mission is to advance the state of ecological knowledge through the use of existing information, organize and synthesize ecological information to make it useful to all users, and to influence the way in which ecological research is conducted by promoting a culture of synthesis and collaboration. The Center supports three primary modes of research - working groups (2-20 individuals interacting to address important questions), Postdoctoral Associates (15-18 per year) and Center Fellows (4-6 sabbatical visitors per year).

Because research at NCEAS relies on using existing information, the Center is involved with many collaborators to develop generic data access tools for a broad user community, from student and resource managers to scientists.

O. James Reichman **2/1/2003-1/31/2007** **$364,197**
Joshua Schimel
National Science Foundation, NSF DEB 0235624

CRB: The Role of Seed Limitation, Resource Competition, and Community Complementarity in Invasions and Restorations

One of the largest and most persistent conversions of a native plant community worldwide is the invasion of 9.2 million ha of native perennial grassland in California by exotic annual grasses and forbs from the Mediterranean region. In addition to the loss of native plant biodiversity, this invasion has potentially altered basic ecosystem processes through increased nitrate leaching, altered fire regimes, and decreased carbon storage. The conversion of native plant communities may also have affected the value of this land for agriculture by decreasing the quality of summer grazing. Invasions by exotic species are one of the most serious threats to global biodiversity and restoration is a critical tool to mitigate existing biodiversity losses. Clearly the ability to predict the outcome of invasions and restorations would be a great asset to global conservation efforts while providing important information for the basic understanding of basic ecological processes. Currently, there is little general theory on restoration, while invasion theory is quite well developed. Although these processes may seem dissimilar, predicting the outcome of restoration and invasion both involve understanding the conditions under which small populations establish and spread in the face of competition from abundant, resident competitors, and thus can be interpreted within the context of competition and invasion ecology.

O. James Reichman **10/1/2002-9/30/2007** **$2,910,756**
Mark Schildhauer
Matthew B. Jones
National Science Foundation, NSF EF-0225676

ITR Collaborative Research: Enabling the Science Environment for Ecological Knowledge

Continuing advances in computation and communication are transforming the scientific process. Biodiversity research, like the fields of molecular, structural and proteomic biology, is re-inventing itself with new technology applications, and is evolving into an increasingly predictive and integrative science focused on important research and policy issues. This international ITR collaboration takes on key challenges for biodiversity researchers by modeling, designing and implementing the data discovery, integration and visualization components for a semantic web in environmental science. The initiative stands on the foundation of substantial and productive NSF investment in ecological and biodiversity informatics and it brings together four highly collaborative, forward-looking institutions in a partnership committed to inventing and supporting a global computing infrastructure for environmental biology. The project involves a multidisciplinary team of computer scientists, ecologists and technologists collaborating in complementary IT R&D and working group units.

O. James Reichman **10/1/2005-6/30/2007** **$50,000**
The Nature Conservancy, CR0002-64689

A Workshop on Global Climate Change and Adaptation of Conservation Priorities

Climate change is broadly recognized as a threat to global biodiversity. The Nature Conservancy, along with many major conservation NGOs, has recognized climate change as a threat to its conservation investments and the long-term success of its mission. The broad spectrum of responses to this threat have included efforts to change national energy policy, promote new technologies, manage carbon stocks through mitigation and sequestration, and to reduce greenhouse gas emissions through meaningful implementation of the Kyoto Protocol and other policy instruments. These activities are essential, but not sufficient responses if we are to maintain biodiversity in the face of certain climatic change to which we have already committed ourselves due to past and present

industrial activities. Moreover, responses have not adequately provided an active role for land stewards, resource managers, and conservation planners. The goal of Climate Change Impacts and Adaptation Tools Workshop is to review and advance simple and effective methodologies for incorporating climate change impacts into conservation planning assessments for more resilient and adaptable conservation blueprints. The vision for success of a climate methodology would be one that allows for explicit interpretation of direct and indirect ecological responses to the climate changes and provides guidance in strategic planning for an uncertain future.

O. James Reichman **8/15/2006-8/14/2007** **$240,377**
The Nature Conservancy, SB070032

The Economic Impact of Non-native Forest Pests and Pathogens in North America

The intent of this project is to quantify the economic impact of non-native forest pests and pathogens in North America. Although there are well-documented examples of non-native forest pests and pathogens altering forest composition (e.g., hemlock woolly adelgid, chestnut blight), the economic costs of these impacts have not been credibly estimated. There is a sense, however, that the economic threats are substantial, and rising because additional non-native pests and pathogens continue to establish in the United States at a rate of approximately one potentially significant introduction per year. Examples of these recent invaders include sudden oak death, emerald ash borer, and Asian longhorn beetle. Using postdoctoral fellows, graduate student research assistants, working groups, distributed graduate seminars, and other techniques of interdisciplinary research and data analysis, the National Center for Ecological Analysis and Synthesis will assess non-native forest pests and pathogens from both ecological and economic perspectives. Researchers will consider the effects of economic activities such as importation of goods using solid wood packaging, shipment of logs and lumber, and importation of live plant material. Effective use of limited public funds to control invasions of non-native forest pests and pathogens depends on an understanding of the full extent of economic impacts of invasive pests over a time period of decades to centuries.

O. James Reichman **9/1/2002-8/31/2006** **$323,734**
University of North Carolina, UNC-5-37135

An Information Infrastructure for Vegetation Science

This is a subcontract from an NSF award to Robert Peet at the University of North Carolina (UNC) entitled: "An Information Infrastructure for Vegetation Science ? Phase II." Scientific and technical computing personnel from UCSB's National Center for Ecological Analysis and Synthesis (NCEAS) will provide guidance for the technical design and development work related to the VegBank system that is part of UNC's project. Specifically, the products comprising the VegBank system will benefit from NCEAS resources including: 1) database design expertise, 2) database development knowledge, 3) interface design skills, 4) robust hardware and networking infrastructure, and 5) technical oversight within the framework of the NCEAS' scientific computing staff.

William Rice **2/1/2002-1/31/2008** **$605,000**
National Science Foundation, NSF DEB-0128780

Gender-Specific Fitness and Intersexual Developmental Conflict in a Drosophila Model System

Males and females express overlapping sets of genes. This shared hereditary material can be selected toward different gender-specific optima and produce sexually antagonistic selection. Intersexual genetic conflict occurs during development when an allele moves one sex toward its gender-specific optimal phenotype, but has the opposite effect in the other sex. A recent pilot experiment in the PI's lab using a Drosophila melanogaster model system, provides preliminary evidence that the genome of this species contains substantial sexually antagonistic fitness variation and suggests that a large fraction of the genome-wide genetic variation for fitness is divergently selected between sexes. Building on the pilot study, the investigator will quantify the extent to which the genome-wide standing genetic variation for fitness is concordantly vs. discordantly selected between the sexes.

William Rice **8/15/2001-7/31/2003** **$158,315**
UC Riverside, UCR SB020044

The Origin of Barriers to Fertilization and Their Role in Speciation: From Populations to Proteins

The UCSB investigator will clone a sample of fifty genomic haplotypes and assay these genomes for 1) their fitness (total, adult, juvenile, and sperm competition) when expressed in males, 2) their fitness (total, adult, and juvenile) when expressed in females, and 3) the harm to a male's mate (both through behavior and through seminal fluid) when these genomes are expressed in males. In collaboration with D. Howard and R. Harrison, the UCSB investigator will assay five pairs of populations which have adapted to the same laboratory environment for ~ 1,000 generations but that experienced independent intersexual coevolution (parallel populations). Males will be assayed with females from their population of origin (con-population females) and with females from the parallel population that was derived from the same ancestral population (hetero-population females). The PI will characterize both the defense phenotpye of the males (in the context of sperm competition) and the degree to which they harm their mates via seminal fluid proteins.

William Rice **8/1/2003-7/31/2007** **$303,906**
University of Washington, UW 806099

IRCEB: The Origin of Barriers to Fertilization and Their Role in Speciation: From Populations to Proteins

The UCSB investigator will clone a sample of fifty genomic haplotypes and assay these genomes for 1) their fitness (total, adult, juvenile, and sperm competition) when expressed in males, 2) their fitness (total, adult, and juvenile) when expressed in females, and 3) the harm to a male's mate (both through behavior and through seminal fluid) when these genomes are expressed in males. In collaboration with D. Howard and R. Harrison, the UCSB investigator will assay five pairs of populations which have adapted to the same laboratory environment for ~ 1,000 generations but that experienced independent intersexual coevolution (parallel populations). Males will be assayed with females from their population of origin (con-population females) and with females from the parallel population that was derived from the same ancestral population (hetero-population females). The PI will characterize both the defense phenotype of the males (in the context of sperm competition) and the degree to which they harm their mates via seminal fluid proteins.

Robin Ross **1/1/2006-12/31/2008** **$241,951**
Langdon Quetin
National Science Foundation, ANT-0529087

Collaborative Research: US SO GLOBEC Synthesis and Modeling: Timing is Everything: The dynamic coupling among Phytoplankton, Ice, Ice Algae and Krill (PIIAK)

The annual advance and retreat of sea ice (from a summer minimum of approximately 4 million km2 to a winter maximum of 20 million km2) play a dominant role in the Southern Ocean (SO) ecosystem and have been called the largest seasonal process on Earth. The life history of Euphausia superba, Antarctic krill and a key species in the food web of the Southern Ocean ecosystem, is intricately involved with seasonal sea ice dynamics. Recent results from the U.S. SO GLOBEC field program as well as historical information on sea ice dynamics and Antarctic krill recruitment suggest a shift in the paradigm that all pack ice is equally good habitat (i.e., that sea ice varies in its habitat quality for larval krill). Through this data synthesis and modeling program, historical records of krill condition factor, larval growth, and recruitment will be linked to variability in sea ice dynamics via its coupling to phytoplaknkton incorporation and sea ice algal biomass. The project has two main goals: 1) Develop, refine, and link diagnostic datasets and models of phytoplankton decreases in the fall, phytoplankton biomass incorporation into sea ice, sea ice growth dynamics, sea ice algal production and biomass accumulation, and larval krill energetics, condition, and survival. 2) Hindcast variability (spatially within a season as well as interannually) in the quality of pack ice habitat and larval krill condition west of the Antarctic Peninsula (WAP) from present back to 1979 by linking mechanistic data sets and models in a two-dimensional model.

Robin Ross **3/1/2005-9/30/2005** **$16,132**
UC San Diego, 518607/1247

Long-Term Ecological Research on the Antarctic Marine Ecosystem: Climate Migration, Ecosystem Response and Teleconnections in an Ice-Dominated Environment

The UCSB investigator will conduct chemical analyses of samples jointly collected in Antarctica by the LTER team.

Cristina Sandoval **1/1/2006-7/31/2006** **$11,638**
Susan Swarbrick
Shoreline Preservation Fund - Associated Students UCSB, FALL05-10

Buffer protection and restoration at Coal Oil Point Reserve (Renewal)

This project will continue to create a buffer of restored coastal scrub habitat along the boundaries of Coal Oil Point Reserve. Specifically, the project will continue the restoration of the northern boundary, western boundary, the Pond Trail, and the east end of Devereux Slough.

Cristina Sandoval **2/15/2007-4/15/2010** **$261,000**
Susan Swarbrick
Wildlife Conservation Board, WC-6046PP

Restoration of the Devereux Slough margin on Coal Oil Point Reserve

The restoration of the Devereux Slough ecosystem is on the Wetlands Recovery Project Work Plan, and is considered a priority project (Tier 1). Devereux Slough received global recognition as an Important Bird Area by the National Audubon Society for its diversity and abundance of birds, and in particular, the presence of several rare and endangered species. The Coal Oil Point Reserve contains 170 acres, 50 of which are degraded from past agricultural practices. The Work Plan for this project includes restoration of all 50 acres, to be completed in several phases over 2-year periods. This first phase will restore and enhance the biological functions of approximately seven acres of the Devereux Slough margin, a critical habitat to many of the species that live there. The western margin and a portion of the eastern margin of Devereux Slough are presently degraded from invasion of exotic plants including large trees, shrubs and annual weeds. Restoration of the margins of Devereux Slough will directly benefit several rare plants, butterflies and endangered and threatened species of birds. Restoration will greatly enhance habitat value for bird species such as the Western Snowy Plover, the California Least Tern, and the Belding's Savannah Sparrow; estuarine fish such as the Tidewater Goby; butterflies such as the Western Pygmy Blue and the Wandering Skipper, and a number of sensitive plants.

Mark Schildhauer **9/22/2006-9/22/2009** **$250,000**
Matthew B. Jones
O. James Reichman
Andrew W. Mellon Foundation, SB070042

Data Management and Analysis Tools Supporting Adaptive Management in South African Parks

Kruger National Park is faced with a challenge common to many research stations where dozens of loosely coordinated monitoring and experimental projects are underway at any time. The main challenge is how to effectively collect, present, and preserve this highly variable collection of scientific data for collaborative and integrative analyses. The Andrew W. Mellon Foundation has supported a partnership between Kruger National Park and the National Center for Ecological Analysis and Synthesis (NCEAS) over the past two years to address this informatics challenge by implementing and refining an approach for archiving KNP's scientific field data using methods developed and tested by NCEAS, the Long Term Ecological Research program, and other partners. The successful deployment of a metadata archive (Metacat) at KNP, along with two successful training workshops in its use, have validated the power and viability of this approach. Kruger National Park is now part of a global "Knowledge Network for Biocomplexity" (KNB), which is based on the use of metadata standards in ecology, particularly Ecological Metadata Language, or "EML" documents

that are stored in Metacat database servers. The EML metadata specification is also being used by NCEAS, LTER, the Organization of Biological Field Stations, and the Ecological Society of America, all of which are examples of other major ecological research institutions that are committed to using a common metadata standard for documenting their data. At Kruger, staff and scientists have been trained to use the Morpho metadata and data management application to document their data holdings and upload these to the Kruger data repository (Metacat). This project will expand the data system to the broader collection of parks and research stations in South Africa and create the additional analysis infrastructure needed to effectively use these data in adaptive management approaches in the parks. This phase of the research will simplify the data management infrastructure to make it much easier to deploy in the parks in South Africa. In addition, the research will allow the quantitative results to be made available on the Web for use by resource managers and scientists.

Russell Schmitt **11/16/2004-11/1/2006** **$1,391,737**
Sally Holbrook
Gordon and Betty Moore Foundation, SB050036

Initial Instrumentation of the Moorea Coral Reef Long-Term Ecological Research Site

This award provides funds to purchase instruments and equipment associated with the newly-funded National Science Foundation Long-Term Ecological Research (LTER) Site at the Richard Gump South Pacific Research Station in Moorea, French Polynesia. A central goal of the LTER program is to advance understanding of ecological phenomena within and among ecosystems that occur over long periods of time and ranges of spatial scales. The research objectives of the Moorea LTER are to better understand key processes in coral reef ecosystems that 1) modulate ecosystem function, 2) shape community structure and diversity, and 3) determine abundance and dynamics of constituent populations. Such mechanistic understanding will allow more accurate predictions of how coral reef ecosystems will respond to environmental change. Coral reefs are among the most complex of biological phenomena. Because of their complexity, scientists have an incomplete understanding of the multitude of abiotic forcing functions and biotic processes that collectively determine their structure, function and dynamics. A number of perturbations are predicted to cause sweeping change in coral reef ecosystems, and indeed that coral reef ecosystems may collapse within the coming few decades, a period equivalent to the duration of an LTER site. While there are numerous coral reef monitoring programs, descriptive ecology alone cannot elucidate the mechanistic basis of change in these systems.

Russell Schmitt **7/1/2000-6/30/2007** **$700,121**
Sally Holbrook
National Science Foundation, NSF OCE 9910677

Abundance, Dynamics and Coexistence of Interacting Damselfishes: Quantifying the Contributions of Causal Processes Across Spatial Scales

This study focuses on the causes of variation in abundance of reef fishes whose local populations are linked via exchange of reproductive output. Research has shown that the size of a local population of these organisms is determined by several simultaneously-operating processes, and the key to understanding the relative importance of these processes is the interplay between larval supply and density-dependent interactions. It is now understood that a local population cannot be considered in isolation of other sub-populations or species, and multiple spatial scales must be examined to fully comprehend the dynamics of the system. Finally, several frameworks now exist that can allow evaluation of the contributions of various processes in setting local features (e.g., larval supply of potential competitors, habitat availability, food supply, predation pressure). These quantitative frameworks need to be applied to real systems to resolve several fundamental - and largely unanswered - questions for reef fishes, including the relative importance of the multiple processes that affect local abundance and dynamics, the degree of variability in their importance, the determinants of relative abundance and coexistence of competitors, where and how population regulation occurs, and whether the dynamical behavior of the system as a whole differs from that predicted from dynamics at smaller spatial scales.

Russell Schmitt **9/1/2004-8/31/2009** **$2,618,456**
Sally Holbrook
National Science Foundation, OCE-0417412

LTER: Long-Term Dynamics of a Coral Reef Ecosystem

This award establishes a Long-Term Ecological Research (LTER) site focused on dynamics of coral reef ecosystems at the island of Moorea, French Polynesia, location of the University of California's Gump Research Station. Coral reefs are of great ecological importance, having the highest species diversity of any marine habitat and ranking near the top of all ecosystems with respect to annual total gross productivity. The communities are supported structurally by reef-building corals and trophically by efficient recycling. Unlike highly productive terrestrial ecosystems, the key biotic interaction underlying reef systems is the mutualistic relationship between hermatypic corals and photosynthetic zooxanthellae. Hermatypic corals are both functional autotrophs and herotrophs and derive carbon from multiple sources. In addition to biotic interactions, numerous other biological processes are influenced by a variety of abiotic events that can operate at spatial scales ranging from millimeters to hundreds of kilometers, and which can vary on short to long time scales. Both the scientific community and the public have tremendous interest in and concern about conservation of coral reef ecosystems. This project will greatly increase understanding of these systems, and as such, will inform government officials, resource managers and others charged with conservation and management of coral reefs.

Russell Schmitt **5/1/2007-6/30/2008** **$15,000**
Sally Holbrook
UC Office of the President, 6773

The Conservation Technology Initiative

Conservation science is in its infancy, yet there is a critical and growing need for more effective science-based conservation actions. A major hindrance to obtaining critical scientific information is the failure to develop and harness potentially powerful technologies. The investigators believe that quantum advances in the ability to manage and conserve critical living resources can result from a better coupling of technology and science where the technology infrastructure development is driven by the science. This project involves a model for such a "Conservation Technology" approach that has great potential for enabling revolutionary advances in conservation science and radically altering the ability to manage and conserve effectively the natural world. Achieving this vision requires a novel integration of disciplines, many of which traditionally have not worked together (e.g., ecology and engineering). The strategy is to tap appropriate expertise from several UC campuses (UCSB, UC San Diego, UC Santa Cruz and UC Davis) to focus initial developmental efforts around a common model ecosystem (coral reefs) and base of field operations (UCB's Gump Research Station). The science program that motivates this research has two inter-related goals, both of which require technological innovation and infrastructure. The first is to advance fundamental scientific understanding on issues relevant to conservation (e.g., What is the functional significance of biodiversity and hence, what are the most important aspects to conserve?). The second goal is to address the universally appreciated need for new - and more effective - conservation tools to resolve such urgent problems as the maintenance of biodiversity, the control of exotic species, the enhancement of depleted populations and the restoration of degraded habitats.

Russell Schmitt **7/1/2001-6/30/2008** **$1,540,000**
UC Toxic Substances Research and Teaching Program, SB020063

Coastal Toxicology Component of the UC TSR &TP

The overall objective of the Coastal Toxicology Program is to help resolve pollution-related environmental problems in California's aquatic ecosystems. This is accomplished by facilitating faculty research on appropriate issues, and by providing students with research and training opportunities in environmental toxicology. The resolution of environmental problems requires interdisciplinary efforts and accordingly, the Coastal Toxicology Program is comprised of a network of UC scientists from the Santa Barbara, Santa Cruz, Davis and Los Angeles campuses as well as

Scripps Institution of Oceanography, Bodega Marine Lab and Lawrence Berkeley Lab.

Russell Schmitt **7/1/2000-6/29/2007** **$749,029**
USDI - Minerals Management Service, Task 17600 MMS-31063

Coastal Marine Institute Program Management

The Coastal Marine Institute (CMI) Program Management provides administration and management for the program, serving as an interface between the University of California, the Minerals Management Service, and the State to ensure that objectives and interests of the agencies are translated into appropriate actions by the CMI. Program management includes administration of the annual study solicitation and review process, as well as overseeing contract management of all studies to assure that they are conducted in accordance with specifications delineated in the technical proposal.

Russell Schmitt **9/25/2001-9/30/2006** **$140,877**
USDI - Minerals Management Service, Task 18234 MMS-31063

Spatial and Temporal Variation in Recruitment to Rocky Shores: Relationship to Recovery Rates of Intertidal Communities (Flow-through to P. Raimondi - UCSC)

Intertidal communities are considered among the most vulnerable to impacts resulting from oil spills because most species are sessile and because oil is deposited on intertidal surfaces during ebb tides. In such communities, recovery following a catastrophic event will be largely dependent on recruitment of propagules to the affected area. The propagules of many organisms (e.g., mussels and barnacles) disperse widely (>10 kilometers) while others (e.g., many algal species, tunicates and bryozoans) disperse over relatively short distances (meters to 100's of meters). Therefore, the timing and spatial extent of dispersal will set constraints on when and where recovery will occur. Although there is a general appreciation of the importance of larval stages and recruitment to the population dynamics of marine species, researchers still lack an understanding of the level of variation of recruitment in space and time on the California coast. More importantly, there is almost no information on the variation in recovery rates (spatial variation) that occur along the coast of California and the degree to which variable recruitment affects local recovery.

Russell Schmitt **9/1/2002-8/31/2006** **$1,200,000**
Evelyn Hu
William M. Keck Foundation, SB030003

The Ecotechnology Initiative: Bioengineering Approaches to Restoration Bottlenecks

This is an Interdisciplinary Research Program in Ecotechnology that blends the investigators' unique strengths in ecology, marine science, and engineering to develop new techniques and technologies for the conservation of natural resources. Ecotechnology is a new, proactive approach to such critical conservation issues as restoration of degraded habitats, maintenance of biodiversity and enhancement of exploited populations. Restoration frequently is a necessary adjunct to other strategies used to protect natural resources, yet there is a lack of effective techniques to assist recovery of degraded marine habitats and species. Researchers are poised for major advances in the development of ecotechnological applications to conservation issues due to recent breakthroughs in the theoretical understanding of the ecological bottlenecks to restoration and dramatic advances in the development and miniaturization of technology that can be used to sense and manipulate systems at the nanometer or micron scale. This Program in Ecotechnology has the potential to catalyze a paradigm shift in the approach taken to environmental restoration.

Stephen Schroeter **7/1/2006-12/31/2007** **$20,445**
California Sea Urchin Commission, SB070019

Studies of Sea Urchins Settlement in Southern and Northern California

The patterns of settlement of red (Strongylocentrotus franciscanus) and purple (S. purpuratus) sea

urchins may have important impacts on the commercial fishery and provide an important fishery-independent measure of stock health. The investigators have monitored weekly to bi-weekly sea urchin settlement at multiple sites in southern and northern California since February 1990. Studies to date have identified spatial and temporal patterns in sea urchin settlement (including the effects of periodic El Niños and La Niñas) and have identified some of the likely mechanisms responsible for these patterns. They have added value to their work by volunteering their time and collaborating with University researchers and private industry. In particular, work done in collaboration with Jan Svejkovsky of Ocean Imaging has given important insights into the effects of large-scale oceanographic forcing on sea urchin settlement patterns, while collaborative work on population genetics with Dr. Ron Burton has shed light on the structure of parental source populations during a heavy settlement event. Perhaps most importantly, their long-term and geographically extensive record of sea urchin settlement continues to provide the only integrated, fishery independent index of the condition of the breeding stock, since larval supply and settlement are a function of the effective breeding population. The value of this inexpensive tool for monitoring the health of the sea urchin resource in California increases each year the study is continued.

Stephen Schroeter **3/1/2003-2/28/2007** **$55,957**
John Dixon
California Wildlife Foundation, SB030101, Task 1

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Stephen Schroeter **1/1/2006-12/31/2007** **$502,183**
Daniel Reed
Henry Page
Simpson and Simpson Business and Personnel Services, Inc., SB060076

San Onofre Nuclear Generating Station Mitigation Project Monitoring Program - Wetland

In 1974, the California Coastal Commission (CCC) issued a permit to Southern California Edison (SCE) for Units 2 and 3 of the San Onofre Nuclear Generating Station (SONGS). Conditions of the permit require monitoring the impacts of the operation of Units 2 and 3 on the marine environment offshore from San Onofre, and mitigation of any adverse impacts. As a result of the impact studies, the CCC added new conditions which require the permittee to 1) create or substantially restore at least 150 acres of southern California wetlands, 2) install fish barrier devices at the power plant, 3) construct a 300-acre kelp reef, and 4) partially fund the construction of an experimental white sea bass hatchery. This research program enables the UCSB principal investigators to assist the Commission in carrying out its oversight, monitoring and mitigation functions.

Stephen Schroeter **1/1/2006-12/31/2007** **$1,115,506**
Daniel Reed
Henry Page
Simpson and Simpson Business and Personnel Services, Inc., SB060076

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Stephen Schroeter **11/1/2005-11/30/2006** **$10,000**
UC Sea Grant, R/F-116PD-F-1/1

Elements of Quantitative Stock Assessment for Evaluating Alternative Management Strategies

This research addresses the issues of industry involvement in stock assessment and fisheries management which are currently of interest to various federal and state resource agencies in California and other states. It is built on a foundation of almost seventeen years of related research that has been conducted in cooperation with university researchers, members of the California Department of Fish & Game, and members of the California red sea urchin fishery. This project aims at producing practical results that can help in addressing the practical problems of assessing red sea urchin stocks and the impacts of fishing and fishery management practices on them. Specifically, the PI will: 1) provide a set of cost-effective field protocols for producing accurate and precise estimates of stocks, 2) initiate an experimental program to evaluate a suite of alternative management practices, including the use of marine protected areas (MPAs) on red sea urchin stocks, and 3) disseminate these results by working cooperatively with the Sea Grant advisory program.

Nicholas Shears **10/1/2006-6/30/2007** **$39,810**
Steven Gaines
Foundation for Research Science and Technology, UCAL0601

The Effect of Marine Reserves on Recruitment, Exploited Species and Fishing

There is a need for sound scientific information on the ecological and socio-economic impacts of Marine Protected Area (MPA) networks. While MPAs are predicted to benefit local fisheries through "spillover" of adults and increased larval output from MPAs (recruitment effects), they may also have negative effects on fishing through reducing the available fishing area and displacing fishing effort. Demonstrating and understanding the potential recruitment effects of MPAs and determining whether they can compensate for increased fishing effort in fished areas requires a detailed understanding of the interactions between physical oceanography, recruitment, target populations and fishing effort. The PI will use numerical modeling and empirical field studies to investigate the interaction between MPA networks and fishing. His work will form part of an ongoing large-scale interdisciplinary project investigating the relationship between physical oceanography, larval dispersal, fishing and the effects of MPAs in the California Channel Islands marine reserve network.

Mark Steele **10/1/2002-9/30/2007** **$120,264**
University of Rhode Island, 030603/532577

A Test for Shelter Limitation of Reef Fish Populations at Large Spatial Scales: An Integrated Empirical and Theoretical Approach

Overall, this project includes monitoring of reef fish population dynamics, a large-scale field experiment, and mathematical modeling of reef fish population dynamics. It includes three investigators: Dr. Graham Forrester, the principal investigator at the University of Rhode Island; Dr. Mark Steel, who was originally the co-PI at URI, but who has now moved to UC Santa Barbara where he will be the PI on the UCSB subcontract; and associate investigator Dr. Rick Vance who is the PI on the subcontract to UCLA. All three investigators collaborated on the prior award from NSF for which the present project is a renewal. The three investigators will collaborate in most aspects of the current award. At UCSB, Dr. Steele will be responsible for directing fieldwork, managing and analyzing data,

preparing reports and publications. Dr. Steele will be involved with field research and will recruit and train UCSB students to analyze otolith growth increments and assist the research as necessary.

David Valentine **9/1/2006-8/31/2009** **$80,000**
American Chemical Society, 44969-AC2

Community Succession and Hydrocarbon Oxidation in Marine Microbial Mats: An In-situ Time Series Experiment

Microbial mats develop and thrive at the oxic-anoxic interface in marine environments, acquiring energy by oxidizing sulfide to elemental sulfur and sulfate. Microbial mats are abundant in areas of petroleum seepage and are thought to be fueled by sulfide produced in the subsurface during anaerobic petroleum oxidation; a direct role for microbial mats in petroleum oxidation has not been established. This research investigates the development of microbial mat communities and their role in petroleum oxidation through a series of in-situ experiments at a marine hydrocarbon seep field located in shallow water off the coast of Central California. The PI will fabricate and deploy benthic devices over natural petroleum seeps to serve as modular surfaces for the development of microbial mat communities. Devices will be deployed overlying seeps of distinct gas and oil composition, and samples from the modular surface will be collected regularly to provide for a time series of biological and geochemical analyses. Changes in the bacterial community will be followed using molecular biological tools including automated ribosomal intergenic spacer analysis and 16SrDNA sequencing. Growth of the overall community will be tracked by carbon and nitrogen abundance. Development of petroleum-oxidizing activity will be tracked through the abundance and isotopic composition of lipid biomarkers. This work will be the first to quantify the rates and patterns of mat development in natural petroleum seeps and is important because mats are one natural mechanism by which marine bacteria detoxify harmful chemicals such as sulfide and petroleum.

David Valentine **9/1/2004-8/31/2006** **$35,000**
American Chemical Society, ACS PRF 40643-G2

Microbial Alteration of Natural Gas in Marine Sediments and Waters

Natural hydrocarbon seeps continuously release massive quantities of oil and gas into the marine environment worldwide. Seepage influences water, beach, and air quality, as well as marine and terrestrial life. Microbes live in and around seeps and survive by consuming oil, sulfides, and possibly gas. This activity provides a visible indication of subsurface hydrocarbons, generates biogeochemical "hotspots" in the coastal ocean, and alters the distribution of emitted hydrocarbons. The fate of marine petroleum has been the focus of considerable study. However, little is known about the importance and fate of gases, which make up the majority of emissions; there exist major gaps in knowledge, especially with regard to ethane and propane. The Principal Investigator hypothesizes that propane, and to a lesser extent ethane, are consumed in seep areas, and that this activity serves as a major control on the composition of released hydrocarbons and on seep biology. This study seeks to address the PI's hypotheses by directly quantifying rates of ethane and propane consumption for the first time, in concert with analyses of gas concentrations and stable isotope distributions.

David Valentine **4/1/2007-3/31/2008** **$270,000**
Methanogenesis Corporation (Canada), SB070096

Methane from Deep Coal: Enrichment, Isolation and Characterization of Subsurface Methanogenic Communities

The goals of this project are to isolate, identify and characterize microbes active in coalbed methanogenesis with the ultimate goal of using this knowledge to develop strategies to accelerate in situ biogas production within deep coal deposits. Using samples collected from deep coal deposits, the investigator will isolate the most active and important members of the microbial community, including both fermentative and methanogenic organisms. The physiological characteristics of the isolates will be investigated for their suitability toward in situ gas production. Isolates will also be

combined to allow for investigation of defined consortia, which are expected to have the greatest capacity for methane generation at natural subsurface conditions.

David Valentine **4/15/2005-3/31/2010** **$388,356**
National Science Foundation, 0447395

CAREER: Microbial Geochemistry of Natural Marine Gas Seeps - A Research and Education Plan

This project integrates research and education focusing on the fate of methane seeping naturally into the marine environment - an issue of environmental and economic relevance. The primary research goal is to determine the impact of microbial methane oxidation on the flux of methane from the sediments to the ocean/atmosphere in areas of active gas seepage. Educational goals are: 1) to train graduate students in the integrated study of microbiology and geochemistry; 2) to educate undergraduate students in the marine sciences through year-long research projects, and through incorporation of results into general education courses; 3) to incorporate undergraduate students into ocean going research by including them as active participants in proposed cruises through a formal field studies course; and 4) to introduce K-12 students and teachers to the topic of marine hydrocarbons through participation in UCSB's Floating Lab outreach program.

David Valentine **8/31/2003-7/31/2007** **$299,670**
National Science Foundation, EAR-0311894

Collaborative Research: Hydrogen Isotope Biogeochemistry of Anoxic Environments - Field and Laboratory Studies

The goal of this project is to develop compound-specific hydrogen isotope analyses as a tool for process-oriented biogeochemical studies of anoxic environments. Analytical techniques are now well established, and the next major hurdle is to understand the biochemical controls on isotopic distributions in these environments. This study will seek such understanding through a combination of field and laboratory studies, implemented as a collaboration between PI's at Caltech and UC Santa Barbara. Research will focus on sulfate-reducing bacteria (SRB) due to their quantitative importance for carbon cycling in marine settings. The results of this research are potentially important for a wide range of scientific disciplines, including microbial ecology (novel approaches for quantifying the importance of interspecies hydrogen transfer in microbial communities), carbon cycling (isotopic mass-balance estimates of organic matter remineralization by anaerobic processes), organic geochemistry (identification of lipids produced by H2-consuming microbes), paleoclimatology (improved understanding of the preservation of organic D/H ratios during diagenesis), Earth system history (novel tools to study redox conditions of the geologic past) and biochemistry (methods for identifying the cellular location of hydrogenase enzymes).

David Valentine **9/1/2006-8/31/2009** **$334,398**
National Science Foundation, MCB-0604191

MIP: Interactions between Archaea, Bacteria and their Viruses in the Anoxic Sediments of a Modern Evaporative Basin: Salton Sea, CA

The PI will conduct a series of environmental and laboratory studies designed to assess the impact of energy availability and stress on Bacterial, Archaeal and viral communities in anoxic environments. The research site is at the Salton Sea, CA, where the dissolution of subsurface salt deposits and the rapid mineralization of sedimentary carbon generate strong gradients of energy stress and availability. Diverse Bacterial and Archaeal communities coexist throughout the sediment, and the site is readily accessible. The hypothesis that is being tested is : Energetic stress imparted on anoxic microbial communities tends to favor Archaea over Bacteria, also resulting in a concomitant shift in the composition of the viral community. The timing for research on the Salton Sea is critical, as the rapidly expanding population of southern California is pressing for major water transfers away from desert agriculture to urban uses. The Salton Sea is a terminal basin and receives nearly all its water from agricultural runoff; proposed changes to the rate of water input will lead to dramatic changes in volume and salinity (and thus biogeohemistry and ecology) of the Salton Sea. While the exact fate

of the Salton Sea is uncertain, major changes can be expected - there is a clear need to study the novel microbes of this environment. Furthermore, this work will lead to an understanding of the microbial ecosystem present in the sediments of the Salton Sea, which may become useful to policy makers as this lake begins to dry.

J. Herbert Waite **7/11/2003-5/31/2007** **$2,483,600**
Galen Stucky
Francis Zok
National Institutes of Health, Public Health Service, R01 DE014672

Biomimetic Blades: Mincing with Less Mineral

Tooth enamel and dentin are the premier materials in vertebrates for hardness and abrasion resistance. The superb properties of these materials are vital adaptations for proper ingestion nutrition and, when compromised through decay or injury, pose many fundamental and technical challenges to effective restoration. In polychaete worms such as Glycera and Nereis, the tooth-like jaws have a resistance to wear that is comparable to enamel; however, this is accomplished with a tenth as much mineralization (Glycera) or no mineralization at all (Nereis). The investigators believe that these mainly proteinaceous jaws offer important insights into the design of biocompatible wear-resistant materials. Based on preliminary studies they seek to demonstrate that specific proteins/polymers can be hardened and toughened by mineralization, metal ion chelation, or both. The aim is a state-of-the-art chemical, structural and mechanical characterization of the jaws using mass spectrometry, molecular biology, X-ray analysis and nanoindentation. Rigorous engineering principles will be applied to the analysis of jaws to distill a set of biomimetic rules regarding the relationship between structure and wear. Significant correlations between the chemical, microstructural and mechanical properties will be used to direct the preparation of His-containing copolymers into hard films containing Cu or Zn ions. The chief health benefits of this research will be insights about lightweight replacement materials with superior hardness and abrasion resistance.

J. Herbert Waite **3/1/2007-2/28/2008** **$189,947**
UC Sea Grant, R/MP-97

Studies on the Rapid Self-Assembly of Elastic Tensile Fibers from Natural Protein Polymer Found in Marine Snails

The development and fabrication of new tensile materials based on biomimetics is of broad industrial and biomedical interest. Because biological materials are synthesized in aqueous conditions and at ambient temperatures with highly specialized molecules, they offer considerable potential for design of new materials. Additionally, the synthesis of novel materials now emphasizes the use of molecules that organize spontaneously into hierarchically complex structures in differing environments. With self-assembly, materials can be produced with lower energy cost and reduced dependence on fabrication machinery or environmentally damaging processing. Marine organisms synthesize many structural materials that withstand repeated tensile stresses or protracted periods of time in the harsh marine environment. Recently, the PI and collaborators characterized an elastomeric protein polymer comprising the egg capsules of marine snails and found that it is a highly extensible elastic material with unusual mechanical behavior they termed "recoverable-yield". The goal of this part of the project is to complete biochemical characterization and to study the mechanism of self-assembly in this natural polymer in order to elucidate the molecular basis for its novel elastic properties, and to mimic these properties in fibers produced experimentally in vitro.

Robert Warner **9/7/2006-9/7/2007** **$18,000**
National Geographic Society, 8079-06

Unexpected Indirect Consequences of Predator Removal on Coral Reef Community Structure

The objectives of this research are twofold and will draw on collective expertise in the fields of population and community ecology, behavioral ecology and marine biogeography. The first goal is to understand the patterns of spatial abundance and distribution of key reef organisms and reef features as they relate to one another. This will serve to verify the differences in community structure

between the two areas and allow an estimate of relative risk of predation. To do so, it will be necessary to quantify the abundance and distribution of a subset of species in key trophic levels (i.e., predatory and herbivorous fishes and algal biomass) as well as the distribution of different habitat types in a fine-resolution (to the nearest 5cm) spatially-explicit framework. Using this grid-based approach will allow the identity and location of focal species within each trophic group to be spatially 'mapped' onto one another and onto habitat type. The second objective will be to quantify behavioral responses of herbivorous fishes (prey) to the risk imposed by the presence of their predators (i.e., piscivorous fishes). This will be accomplished by measuring behavioral characteristics relevant to the risk-reward trade-off imposed by predation risk on herbivorous fish species. For example, researchers will quantify variables such as duration and distance of herbivore foraging excursions from refuge areas and density of foraging and spawning aggregations in order to compare behaviors of prey species between the two islands with different levels of predation risk. For this purpose, two divers will descend and allow a short period of 'habituation' to diver presence to occur. For each of the focal behaviors and for each focal herbivore group (e.g., territorial, roving, etc.), one 30-minute survey will be done.

Robert Warner **4/1/2004-3/31/2008** **$268,137**
Steven Gaines
National Science Foundation, OCE-0351843

Collaborative Research: Tracking Larval Invertebrate Dispersal Trajectories Using Calcified Structures

Many marine species produce pelagic larvae that can be advected away from their natal source by oceanic currents. Predicting their destination has been one of the foremost challenges for marine biologists. The potential interactions among larval swimming behaviors, complex ocean circulation dynamics, and variability in pelagic duration make it difficult to predict the sources of larvae settling into adult habitat. Yet, identification of the natal source of incoming recruits has tremendous consequences for understanding population dynamics as well as for the design of effective marine reserve networks. Fish biologists have successfully exploited otoliths as environmentally induced natural tags to examine exchange among fish populations in some systems. Despite pressing needs to also understand the dispersal trajectories of invertebrate larvae, ecologists have paid less attention to analogous environmentally induced tags in larval invertebrate hard parts. Invertebrate ecologists only recently demonstrated the potential to use the elemental composition of molluscan statoliths and protoconchs as tags of natal origin. However, to date, no study has effectively used this tool to identify the natal source of any marine invertebrate recruit. This research will use environmentally induced tags in the statoliths of recently recruited Kelletia kelletii whelks to examine exchange of larvae among distinct regions of this species' range.

Robert Warner **7/1/2006-6/30/2007** **$106,312**
Jennifer Caselle
UC Office of the President, 06CEQI070034

Assessing the Assessment: New Models for Informing the Design of Monitoring and Evaluation Programs for Kelp Forest Ecosystems in California's MPAs

Through this collaboration of researchers at UC Santa Cruz and UC Santa Barbara, the investigators are conducting critical and timely studies required of a monitoring and evaluation program for Marine Protected Areas (MPAs) designed to protect kelp forest ecosystems in California's Channel Islands and central coast. This research is being designed and conducted so as to provide managers with baseline monitoring at a time when it is most critical to the success of a long-term monitoring program for the evaluation of the existing (Channel Islands) and proposed (central California) MPA networks. The studies are aimed at developing optimal, cost-effective monitoring programs for kelp forest ecosystems in the recently implemented Channel Islands Marine Reserves (CIMR) and the existing and impending MPA network in the Central Coast Study Region (CCSR). The basis of this research includes three key components: 1) analysis of the PIs' and other historical kelp forest monitoring data sets, 2) specific studies conducted by PIs, post-docs, collaborators and graduate students intended to produce a

well-documented baseline and to evaluate components of monitoring and evaluation design, and 3) conducting these studies at sites in order to expand existing monitoring to key locations in response to recently implemented (CIMR) and proposed (CCSR) MPAs.

Robert Warner **7/1/2005-10/31/2006** **$30,000**
UC Office of the President, SB060009

Defining the Extent of Larval Exchange Among Kelp Rockfish (Sebastes atrovirens) Populations Using Otolith Microchemistry

The extent to which populations are connectd through larval dispersal remains one of the fundamental unresolved issues in marine ecology. Larval connectivity among marine populations has far-reaching consequences for understanding population dynamics and the structure of marine communities, as well as the management of exploited species. Despite its importance, the level of connectivity among marine populations remains poorly understood. Currently, explicit information regarding the sources and destination of larvae remains unknown for any marine species with pelagic larvae, which is necessary both for the development of effective management strategies and the design and placement of marine protected areas. Recent developments in the use of elemental signatures contained within the calcified structures and hard parts of fishes have shown great promise as a means of reconstructing the past histories of individual fish. This project conducted by graduate student Julie Standish will use the variation in otolith chemistry of a nearshore rockfish species (Sebastes atrovirens) to evaluate larval exchange and determine potential limitations to dispersal along the coast of California.

Libe Washburn **2/1/2005-9/30/2007** **$1,003,839**
UC San Diego, 0478.01SB

Short-Medium Range Resolution/Long Range HF Radars-Task A.1

As part of the Southern California Coastal Observing System (SCCOOS)m UCSB will collaborate with other institutions in the Southern California Bight, including Scripps Institution of Oceanography, USC and CalPoly San Luis Obispo to operate an array of HF radars for mapping surface currents. This portion of the project involves purchase, installation, calibration and operation of approximately twenty-one HF Radar installations. The installation consists of the placement of HF radar mast, antenna and associated computer hardware and shelter.

Libe Washburn **2/1/2005-9/30/2007** **$32,653**
UC San Diego, 0478.03SB

Two Bight-Scale Sections Using an Underway CTD-Task C.1

As part of the Southern California Coastal Observing System (SCCOOS)m UCSB will collaborate with other institutions in the Southern California Bight, including Scripps Institution of Oceanography, USC and CalPoly San Luis Obispo to operate an array of HF radars for mapping surface currents. Researchers will use the current data obtained from the radar array to develop products for agencies charged with managing coastal ocean waters. UCSB will lead the research effort to acquire one line of CTD stations from ships that regularly travel between the mainland and one of the offshore islands in the Southern California Bight.

Corwith White **10/13/2005-10/12/2008** **$78,000**
Bruce Kendall
American Assn for the Advancement of Science, SB060039

Population Connectivity and the Management of Coastal Fishery Species across the California-Mexico International Border

This project focuses on the interconnections between populations of fish and invertebrate species on either side of the California-Mexico international border. Despite the fact that California is moving quickly toward promoting sustainable harvest through ecosystem-based management approaches

in its own waters, there has been little consideration of the role of other regions in supplying individuals. Indirect evidence suggests that ocean currents may cause a significant number of marine communities in California to depend on larval re-seeding from Baja, Mexico, with populations in Channel Islands National Park being particularly susceptible to fluctuations in recruitment from southern source locations. Without consideration of the role of cross-border connectivity, California and National Park Service efforts to safeguard their populations and create sustainable harvests will be misinformed and likely unsuccessful. The graduate student researcher will estimate the frequency, direction, and magnitude of larval exchange across the US-Mexico border using oceanographic and state-of-the-art genetic tools, and will evaluate using a modeling framework for implications of cross-border connectivity on conservation and management of fishery resource populations shared by both countries. Current and novel management strategies will be explored to identify practical solutions providing for successful management of an ensemble of valuable fishery species along the west coast of North America.

Allison Whitmer **12/1/2006-9/30/2007** **$12,224**
Shoreline Preservation Fund - Associated Students UCSB, Fall 06-02

REEF Aquarist and Mobile REEF Internship Program

This program offers UCSB undergraduates an opportunity to extend their learning outside of the lecture hall through experiential education in marine and environmental science. Aquarist interns learn about aquarium facility operation, exhibit design and construction, and husbandry, as well as research support. Aquarists serve as techs for the Blue Water Task Force. Mobile REEF interns learn to coordinate and operate the Mobile REEF Unit (van and mobile touch tank) for transport to local schools and public events to teach about local coastal ecosystems and natural history. REEF interns also assist the REEF manager in training volunteer undergraduates in conducting the REEF Tour Program. There is a strong public education component, as volunteers and interns conduct tours for the public and K-12 classes at the REEF and through visits to tri-county classrooms.

Allison Whitmer **9/1/2006-8/31/2007** **$50,000**
US Department of Commerce, NA06NOS4290203

Mobile REEF Program: A Vehicle for Scientific Literacy

Staff and volunteers from UCSB's Marine Science Institute (MSI) and the Ty Warner Sea Center (TWSC) will receive specialized training from MSI, TWSC and Channel Islands National Marine Sanctuary (CINMS) education staff and researchers, including scientists from the Santa Barbara Coastal Long-Term Ecological Research (SBC LTER) and Partnership for Interdisciplinary Studies of Coastal Oceans (PISCO). Trained staff will take the Mobile REEF, a specially designed van, to classrooms in Santa Barbara and Ventura Counties to provide a hands-on, inquiry-based program. This program will provide students with an introduction to organisms, habitats and ecosystems occurring in our regional watersheds and extending out to the Santa Barbara Channel Islands. The program will focus on on-going research conducted by CINMS, SBC LTER and PISCO scientists including stream, estuarine, sandy beach, rocky intertidal, and oceanographic studies. The use of the Magic Planet (a multimedia digital imagery sphere) will allow program staff to connect local ecosystems with global ocean systems and issues. This Meaningful Watershed Experience, which includes the Magic Planet; mobile touch tanks; and data-driven, group-based activities; will empower students with the critical thinking skills necessary to excel in education and make informed decisions about the policies that will affect their environment.

Robert Wilkinson **1/1/2005-12/31/2006** **$28,000**
UC Institute for Energy Efficiency, C-05-12B

A Statewide Assessment of Energy Use Associated with California Water Use

Energy use associated with water use in California is significant based on a series of reports, some including California case studies. A statewide assessment of this type of energy use, however, has not been performed. Such assessment is necessary to determine what priority should be given to managing energy use associated with water use, and to determine if and how the California Energy

Commission or other organizations might take actions related to water use that would help to control and manage energy demand and costs and the air quality impacts of energy use. This project has one goal: to perform a credible, fully documented, statewide assessment that will allow policy-makers to make these types of decisions.

Robert Wilkinson **12/2/2005-9/30/2007** **$114,560**
UC Santa Cruz, SB060086

Developing a Tool to Guide State and Local Desalination Planning: A Comprehensive Economic and Environmental Framework to Fully Assess the Benefits and Costs of Desalination

This research involves: 1) undertaking a literature review of desalination cost and benefit research; 2) identifying, securing, reviewing, and analyzing the cost and benefit analyses of existing and proposed desal plants; and 3) reviewing and analyzing the documents provided by agency participants as in-kind contributions. The core of the work is a series of workshops designed to help develop a thorough understanding of the potential costs and benefits of desalination as an urban water supply strategy.

Michael Williams **12/15/2003-11/30/2007** **$225,757**
Joshua Schimel
William Murdoch
Susan Swarbrick
National Science Foundation, NSF DBI 0330442

Sedgwick Reserve Infrastructure Development

Sedgwick Reserve is one of the largest reserves in the University of California's Natural Reserve System. It is exceptional for its biological diversity and landscape heterogeneity. The Reserve is available for use as a research site and outdoor classroom by researchers, teachers and students from any institution of higher learning, government agency or scientific organization. Located about 50 km northwest of the UC Santa Barbara campus, on the slopes of the San Rafael Mountains, Sedgwick Reserve has become a site for both important ecological research and for major outreach activities in environmental education. This grant provides support to upgrade the Reserve's existing infrastructure in preparation for a new multipurpose building funded by UC. The University's long-term goal is to provide facilities that would support world-class environmental research and university-level instruction, as well as K-12 environmental education, while restoring and preserving Sedgwick's natural resources.

Douglas Wilson **7/10/2005-6/28/2008** **$40,012**
Joint Oceanographic Institutions, Inc., JSA-44 T309A44

Integrated Ocean Drilling Program Scientific Cruise 309

In contrast to mid-latitude sites, the formation of ODP Site 1256 at the Miocene equator does not allow unambiguous absolute orientation using paleomagnetic remnant directions. Additionally, many paleomagnetic basement samples from Site 1256 have proven to be unreliable in the presence of drilling overprint. Most Hole 1256D samples of length greater than 10 cm have been optically scanned prior to splitting, both for ODP Leg 206 and IODP Expedition 309. This project will integrate the scanned images of core pieces with logging images from the FMS and UBI tools, with the primary goal being to provide unambiguous piece orientation for structural and paleomagnetic purposes. Benefits of the work will include determination of magnetic polarity, a critical component of the Expedition's objectives on constraining the source of marine magnetic anomalies, and providing orientation for structures such as microfaults, where information on sense of shear from the core will provide much more information than just interpretation of the logging images.

Douglas Wilson **11/12/2005-8/31/2007** **$43,991**
Joint Oceanographic Institutions, Inc., T312A44

Integrated Ocean Drilling Program Scientific Cruise 312

Shipboard paleomagnetic measurements during Expedition 312 were limited by conservative sampling strategy in low recovery, intended to preserve material for shore-based sampling, and also by the limitations of the shipboard magnetics lab. Samples in general showed incomplete removal of drilling overprint. Thermal demagnetization, important for estimating blocking temperature at which intrusive rocks acquired their magnetization, was done on only eight samples due to recovery and time constraints. New measurements in a shore-based lab will offer significantly better characterization of the magnetization prior to drilling overprint. Integration of sample data with downhole magnetic field data provides the best chance of determining in situ magnetization direction and intensity. Characterization of in situ magnetization will address fundamental questions on the source layer of marine magnetic anomalies.

Louie Yang **9/1/2006-8/31/2007** **$44,376**
Jonathan Levine
UC Office of the President, SB070021

The Ecology of Rare Events: Resource Pulses in Space and Time

The Postdoctoral Fellow's research focuses on the consequences of spatial and temporal variability in natural communities, and, in particular, the influence of rare events of large magnitude on ecological systems. Resource pulses are uncommon events of resource superabundance that occur in many natural systems; for example, post-spawning salmon mortality and seed masting. These events are of broad interest because they represent extreme examples of spatiotemporal variability found in all natural systems. This phase of the postdoctoral study will have four parts: 1) Continued gathering of broader insights into resource pulses and spatial subsidies through review, meta-analysis and theoretical approaches; 2) Continued study of periodical cicadas as resource pulses during the cicada emergences of 2007 and 2008, with specific questions investigating indirect effects of cicada fertilization on other herbivores, and the integrated effects of cicada fertilization and herbivory; 3) Study of the effects of variable resource dynamics in other systems, including ongoing work investigating the effects of hurricane-driven seaweed pulses on small islands in the Bahamas; 4) Development of similar questions in a California field system, possibly to study the effects of windblown detritus in alpine habitats.

Oran Young **9/1/2004-8/31/2006** **$37,016**
The New Media Studio, BERKMAN_NSF_DUE_0329044

Marine Mammal Commission Digital Library of International Environmental and Ecosystem Policy Documents

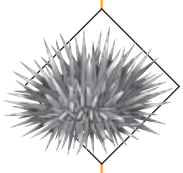
This flow-through award from the National Science Foundation provides funds to support graduate student Julie Ekstrom, whose task is to create, with input from the advisory board, a simple multiple-choice questionnaire about the functionality, operation, design and application of the Digital Library of International Environmental and Ecosystem Policy Documents. The student will also oversee the interpretation of the user activity logs and questionnaire, to iteratively refine the digital library so that it can be effectively utilized and maintained in future years. REU (Research Experiences for Undergraduates) students will be involved with the project and will be supervised by the graduate student.

Oran Young **2/1/2007-3/31/2008** **$265,553**
UC Sea Grant, R/OPCENV-02-S-1/2

Facilitating Ecosystem-Based Management Through a Quantitative Evaluation of Ocean Management Systems Interplay

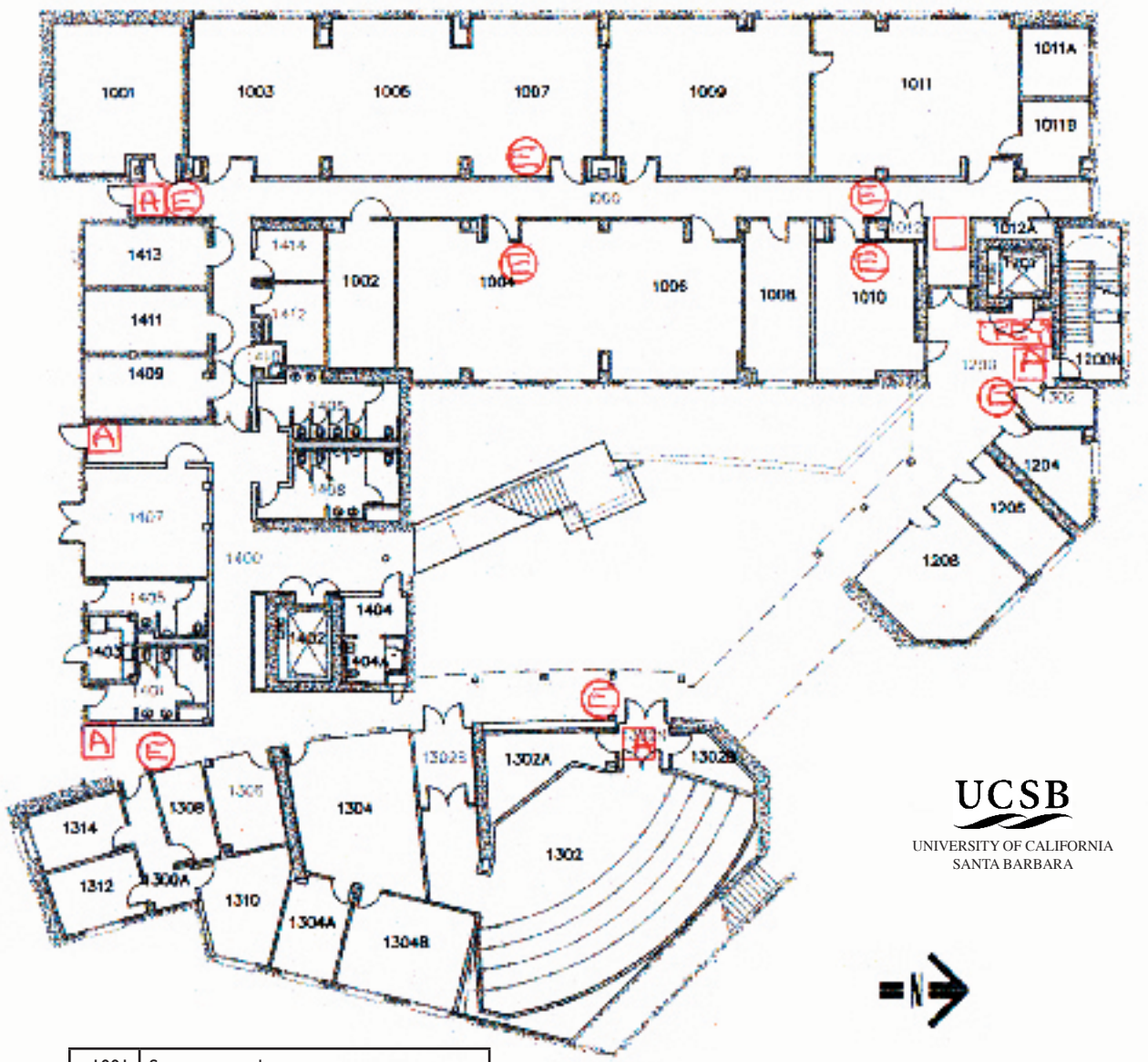
Fragmented sector-based management is a source of today's problems with ocean health. Ocean management traditionally has been divided into individual sectors, such as transportation, mining, and fishing. Due to increased coastal populations and improved technology, uses affecting the ocean have increased, resulting in overlapping laws that regulate different activities. Inconsistent management and lack of coordination across political jurisdictions between sectors has resulted

in sector-based management. When one sector makes a decision, it can result in unintended consequences for other sectors. The goal of this project is to facilitate implementation of Ecosystem-Based Management (EBM) for California's coastal and marine ecosystems. Because ecosystems span across political borders, this study focuses on the entire California Current Large Marine Ecosystem, extending from Washington to south of Baja, Mexico and seaward approximately 500 nautical miles. This large marine ecosystem, bounded by bathymetry and current systems, is one of the most productive marine regions in the world and is heavily populated. This project will assess uncoordinated and conflicting marine management between California and other jurisdictions (Oregon, Washington, Baja, and Mexico) quantitatively and comprehensively, which has never been done before.



Space

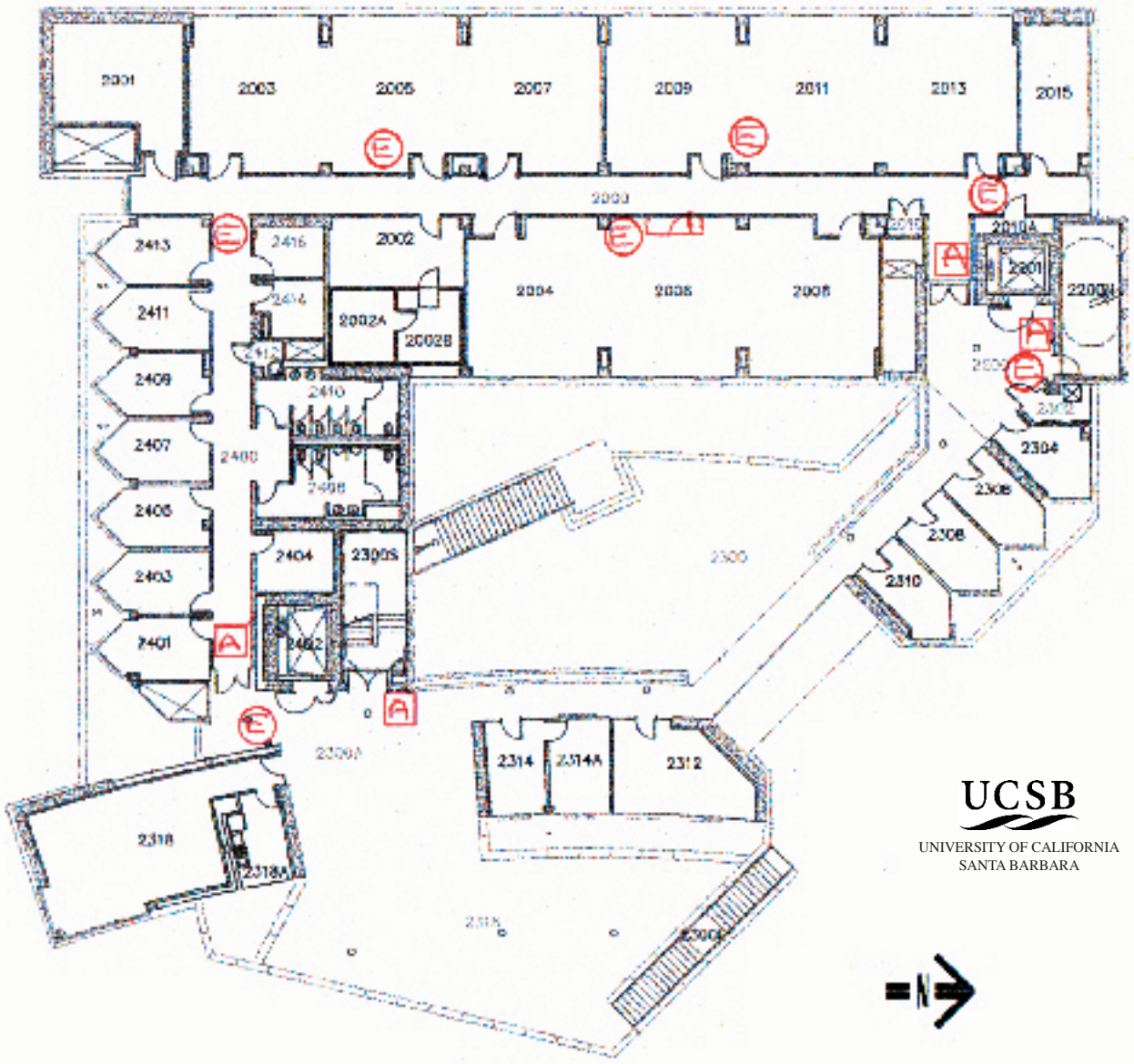
Marine Science Research Building
Bldg. No. 520 - 1st floor
01/2007



1001	Seawater workroom
1002	Common support laboratory
1003	Valentine laboratory
1004	Page/Dugan laboratory
1005	Valentine laboratory
1006	EPA laboratory
1007	Siegel laboratory
1008	Postdoc/Visiting Scholar office
1009	Analytical Laboratory
1010	Hazardous Materials Storage
1011	Analytical Laboratory
1204	Carolyn Culver/Patricia Halpin
1206	Graduate Student office space

1208	Graduate Student office space
1302	Auditorium
1304	Graduate Student office space
1304a	Graduate Student office space
1304b	Graduate Student office space
1308	Copier room
1310	Graduate Student office space
1312	Postdoc office space
1314	Postdoc office space
1409	Seawater workroom
1411	Seawater workroom
1413	Seawater workroom

Marine Science Research Building
Bldg. No. 520 - 2nd floor
01/2007

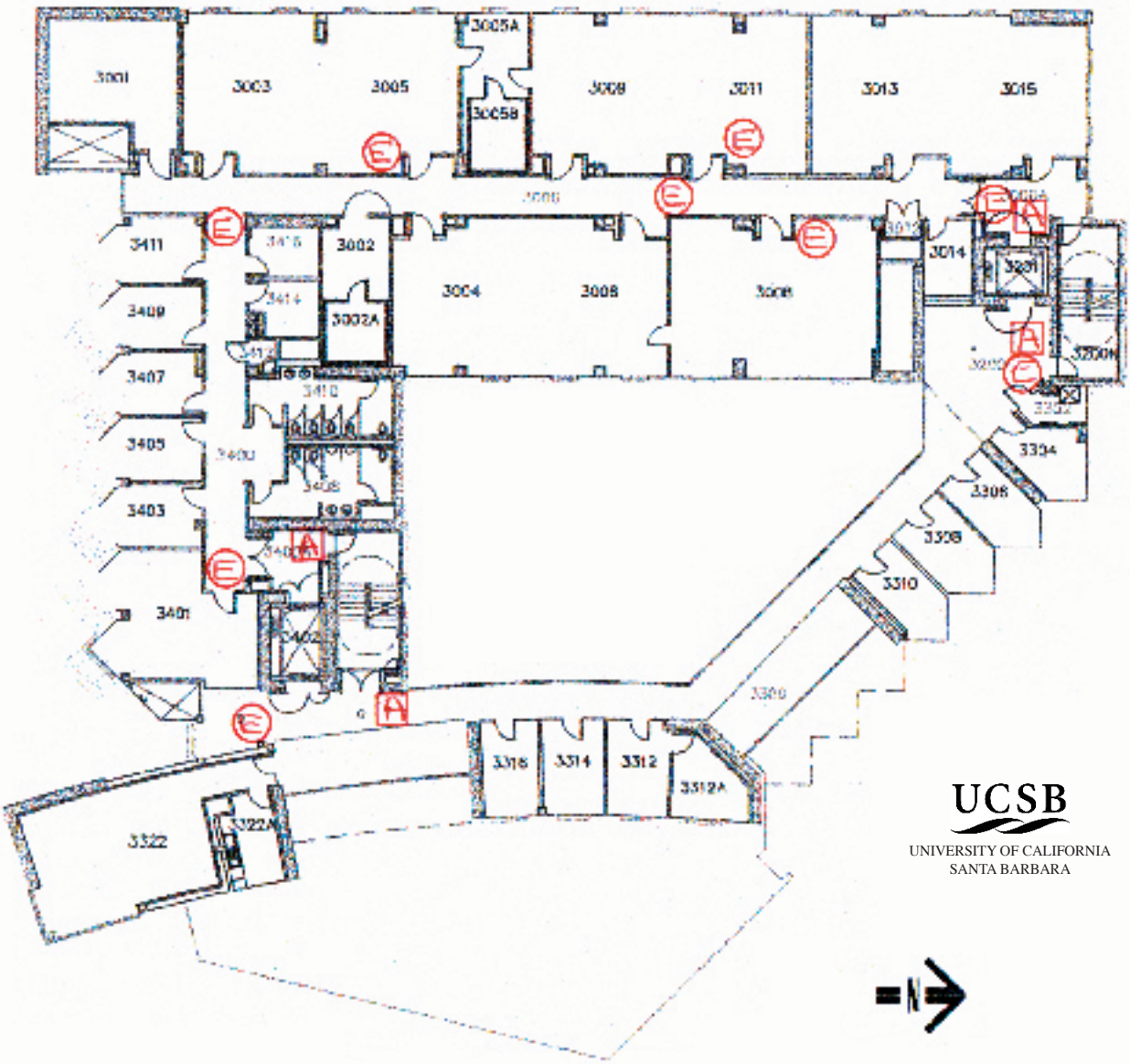


2001	Seawater workroom
2002	Common support laboratory
2002a	Environmental room
2002b	Environmental room
2003	Hofmann laboratory
2004	Quetin/Ross laboratory
2005	Hofmann laboratory
2006	Quetin/Ross laboratory
2007	Hofmann laboratory
2008	Dudley laboratory
2009	Levine laboratory
2011	Levine laboratory

2013	Gaines laboratory
2015	Will McClintock
2304	Postdoc office
2306	O'Donnell/Damschen
2308	Kevin Lafferty
2310	Allison Whitmer
2312	Natural Reserve System/ Donna Moore
2314	Natural Reserve System/ William Murdoch
2314a	Natural Reserve System/ Sue Swarbrick
2318	Conference room

2401	Mark Page
2403	Jenifer Dugan
2404	Storage
2405	Langdon Quetin
2407	Robin Ross
2409	Todgham/Place
2411	Gretchen Hofmann
2413	Postdoc office

Marine Science Research Building
Bldg. No. 520 - 3rd floor
01/2007

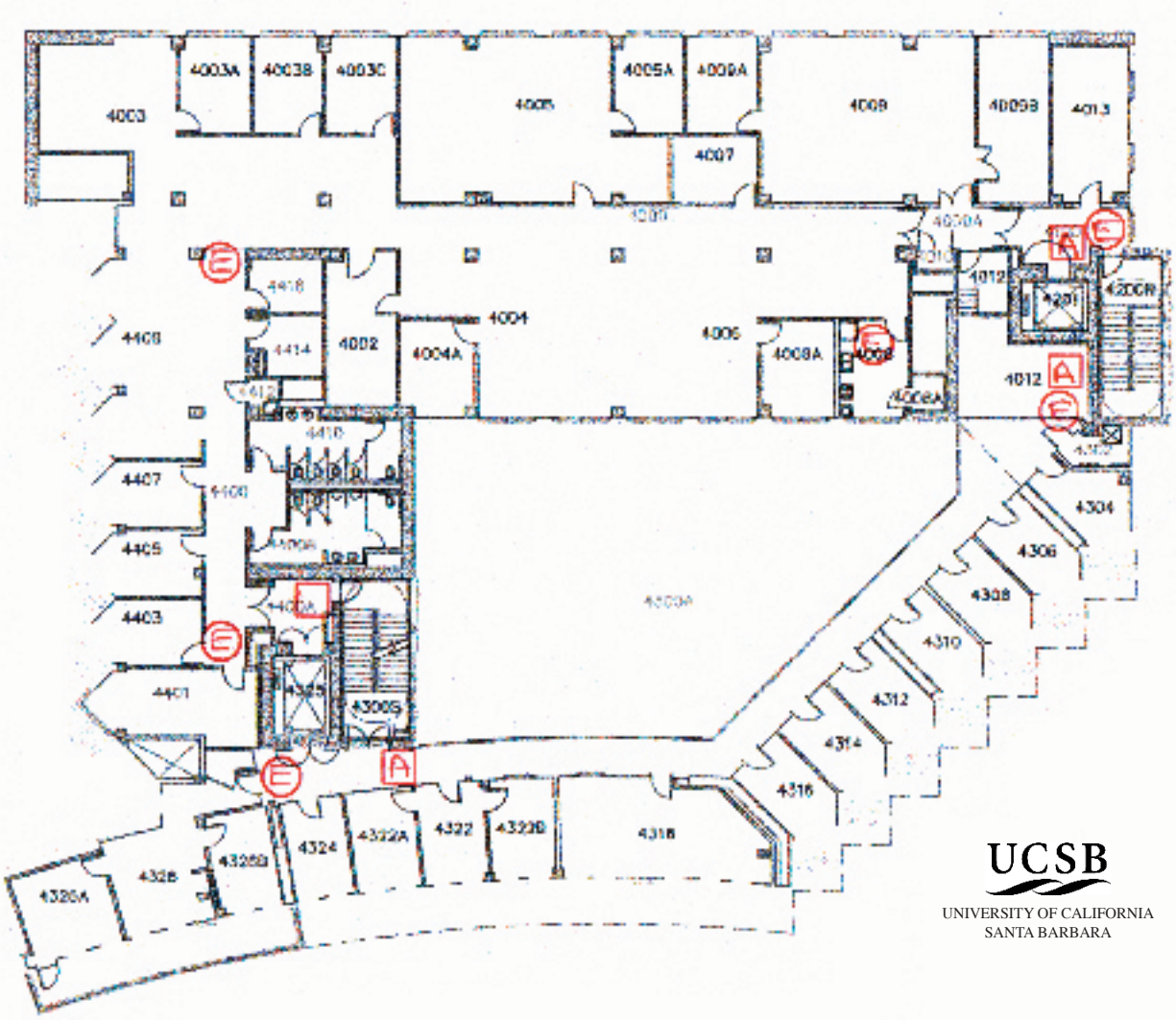


3001	Seawater workroom
3002	Common support laboratory
3003	Reed laboratory
3004	Holbrook laboratory
3005	Reed laboratory
3005a	Common support laboratory
3006	Schmitt laboratory
3008	Gaines laboratory
3009	Warner laboratory
3011	Warner laboratory
3013	Washburn laboratory

3014	Storage
3015	MacIntyre laboratory
3304	Thomas Dudley
3306	Postdoc office – Miller
3308	Dan Reed
3310	Andrew Brooks
3312	Postdoc office
3312a	Postdoc office
3314	Russell Schmitt
3316	Sally Holbrook
3322	Conference room

3401	Margaret O'Brien/Jordan Morris/ Sabine Grabner
3403	Econinformatics – Chris Barteak/Kevin Drury
3405	Econinformatics – Derik Barseghian/Dan Higgins
3407	Econinformatics – John Madin/Benjamin Leinfelder
3409	Econinformatics – Matt Jones/Mark Schildhauer/Dave Vieglais
3411	Postdocs – Anne Salomon/Nick Shears

Marine Science Research Building
Bldg. No. 520 - 4th floor
01/2007



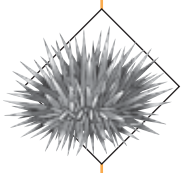
UCSB
UNIVERSITY OF CALIFORNIA
SANTA BARBARA

4002	Copier/mail room
4003a	Ocean O'Graphics – Monica Pessino
4003b	Storage
4003c	Joyce Wolever
4004A	Rachel Whitacre
4004d	Steve Gilbert
4005A	Elvira Rose
4005a	India Morgan
4005b	Veronica Torres
4005c	Nicole Zavala
4005e	vacant
4006A	Deb Owens
4006a	Donna Dobis
4006b	Bonnie Roper
4006e	Mike O'Neil

4007	Conference room
4008	Break room
4009B	Server room
4009b	Jim Woods
4009d	Mike Franklin
4012	IT storage
4013	Shipping/receiving
4304	Sally MacIntyre
4306	Libe Washburn
4308	Gail Osherenko
4310	William Freudenberg
4312	Jonathan Levine
4314	Jen Caselle
4316	Carol Blanchette
4318	Conference Room

4322	Eugenio Carpizo
4322a	Satie Airame
4322b	Robert Warner
4324	Development
4326	Development – Nannette Pedroso
4326a	MSI Director
4401	Tim Schmidt
4403	Jim Reichman
4405	Laurie Eusey
4407	Bonnie Williamson
4409A	Judy McCaslin
4409B	Joanna Yates
4409C	Marisol Hernandez

Marine Science Institute Trailers



319-a	Jack Engle
319-b	Jack Engle
319-c	Jack Engle
319-d	Herb Waite
319-e	Herb Waite
325-a	John Richards
325-b	Craig Nicholson
325-c	Craig Nicholson
325-d	Miriam Polne-Fuller
325-e	Jack Engle
334-a	Scott Simon
334-b	REEF
334-c	REEF

Statistical Summary

Research Support Summary

	Awards	Percentage of Total
Federal Agencies		
Channel Islands National Park	$ 9,999	0.04%
National Aeronautics and Space Administration	213,545	0.93%
National Marine Fisheries Service	3,000	0.01%
National Science Foundation	9,169,588	39.92%
UC Sea Grant	371,147	1.62%
US Department of Agriculture	152,500	0.66%
US Department of Commerce	64,010	0.28%
US Department of Energy	86,070	0.37%
US Department of the Army	285,000	1.24%
US Environmental Protection Agency	16,332	0.07%
US Fish & Wildlife Service	385,781	1.68%
USDC - National Oceanic & Atmospheric Administration	2,762,276	12.03%
USDI - Minerals Management Service	264,657	1.15%
USDI - National Park Service	86,562	0.38%
Federal Totals	**$ 13,870,467**	**60.38%**
State		
California Coastal Conservancy	$ 78,738	0.34%
California Department of Fish and Game	74,632	0.33%
California State Lands Commission	10,000	0.04%
California Regional Water Quality Control Board	100,000	0.44%
Michigan State University	82,082	0.36%
Shoreline Preservation Fund - Associated Students UCSB	23,881	0.10%
UC Berkeley	60,796	0.26%
UC Biotechnology Research and Education Program	50,000	0.22%
UC Davis	60,012	0.26%
UC Genetic Resources Conservation Program	1,900	0.01%
UC Mexus	15,500	0.07%
UC Office of the President	270,761	1.18%
UC San Diego	491,051	2.14%
UC Sea Grant	104,815	0.46%
UC Toxic Substances Research and Teaching Program	26,000	0.11%
Wildlife Conservation Board	261,000	1.14%
State Totals	**$ 1,711,168**	**7.46%**

Private

American Assn for the Advancement of Science	$ 39,000	0.17%
Andrew W. Mellon Foundation	250,000	1.09%
California Artificial Reef Enhancement	317,873	1.38%
California Sea Urchin Commission	20,445	0.09%
David and Lucile Packard Foundation	584,025	2.54%
Dersu & Associates	15,750	0.07%
Environmental Defense Fund	10,767	0.05%
Foundation for Research Science and Technology	39,810	0.17%
Gordon and Betty Moore Foundation	276,442	1.20%
Luce Foundation	450,000	1.96%
Marine Biological Laboratory	23,000	0.10%
Methanogenesis Corporation (Canada)	270,000	1.18%
National Geographic Society	18,000	0.08%
Oregon State University	1,719,701	7.49%
Paul G. Allen Charitable Foundation	2,000,000	8.71%
Princeton University	315,000	1.37%
Resources Legacy Fund Foundation	47,433	0.21%
South African National Parks	78,900	0.34%
The Nature Conservancy	270,377	1.18%
The New Media Studio	51,810	0.23%
University of Queensland	86,125	0.38%
University of Southern California	38,238	0.17%
Virginia Institute of Marine Science	204,000	0.89%
WetLabs, Inc.	125,681	0.55%
Wilburforce Foundation	25,000	0.11%
Wildlife Conservation Society	103,673	0.45%
Private Totals	**$ 7,381,050**	**32.16%**
Total	**$22,962,685**	**100.00%**

Budget Summary
2006-2007

Permanent Funds	FTE	Appropriation	Expense	Balance
Academic Salaries				0
Director				0
Stipend—Director		18,000	18,000	0
Stipend—Acting Director		0	9,750	-9,750
Other	0.75	31,014	36,771	-5,757
Staff Salaries	13.0	792,370	779,937	12,433
General Assistance		66,653	381,756	-315,103
Employee Benefits		343,002	337,535	5,467
Supplies & Expense		61,589	-6,595	68,184
Travel & Equipment				0
Other				0
Total		**1,312,628**	**1,557,153**	**-244,525**
Less budgetary savings target			24,130	-24,130
Less 2006/07 budget cut			7,781	-7,781
Add 2006/07 budget cut relief			7,781	7,781
Adjusted 2006-07		**1,312,628**	**1,533,023**	**-268,655**

Temporary Funds	Appropriation	Expense	Balance
A-21 Return/General Operations	467,259	129,757	337,502
Herbst A-21	397	397	0
Prézlin A-21	268	268	0
MSI Development Support	-16,934	38,488	-55,423
Special Building Furniture Funds	-38,238	-38,238	0
MSB Equipment - Pre-occupancy IDC	316,869	109,906	206,963
Research Support - Dudley Salary	52,533	38,725	13,808
Research Support - Osherenko Salary	38,108	37,236	872
Research Support - Lafferty	330	133	197
Research Support - Osherenko	1,800	515	1,285
Research Support - Pak	65	65	0
Research Support - Lea	37,789	6,626	31,162
Research Support - Wilson	1,442	53	1,389
Research Support - Matthys	60	60	0
Research Support - Brzezinski	9,288	3,000	6,288

Research Support - Kennett	4	-412	416
GUS Support	183,130	161,212	21,918
Insurance Claim - Kuris	23,655	23,655	0
Insurance Claim - Reed	1,755	1,755	0
Insurance Claim - PISCO	1,906	1,906	0
Outreach	-60,961	33,331	-94,292
Student Support - Lea	7,500	7,500	0
Grant Match - Morse NASA/URETI	26,568	21,619	4,949
NASA/URETI- on hold	15,990	0	15,990
Grant Match - Reed SBC-LTER	42,500	19,070	23,430
Grant Match Reed SBC-LTER (old)	11,109	11,109	0
Grant Match - Quetin/Ross	26,478	11,288	15,190
Grant Match - Schmitt MCR-LTER	156,866	65,246	91,620
Grant Match - Kennett/Lea	6	6	0

Recharges	**Income**	**Expense**	**Balance**
MSI Revenue	155,292	107,291	48,001
Analytical Lab	242,189	235,947	6,242
Analytical Lab Depreciation Reserve	0	111,497	-111,497
GUS Revenue	27,366	14,058	13,307
Mass Spectrometer - Brzezinski	25,324	21,167	4,157
CRC copier (discarded Spring '06)	2,823	944	1,879
Revenue - Love	63	63	0
Mass Spectrometer - Lea	21,883	19,244	2,639
MSI Graphics revenue	36,782	29,423	7,359
Kennett - DOE funds	2,170	652	1,518
Culver - Santa Clara Water District Work	2,016	950	1,066
HP Wide Format Printer	662	1,122	-460
DOC - Carlson	5,550	3,062	2,488
SPF Fellowship - Arkema	132	132	0
Mt. Holyoke Fellowship - Dutton	1,500	999	501
Sale of Wearables	4,881	6,013	-1,132
Software Site License	0	361	-361
Outreach Revenue	15,841	15,841	0
International Temperate Reef Symposium	112	112	0
NCAR Conference - Osherenko	0	1,960	-1,960
Kruger National Park - ECP07/ECP15	14,916		14,916
Holden Creek Analysis	9,138	9,138	0
Melack Chemical Analysis	3,000	3,021	-21

Statistical Summary for the Marine Science Institute

1.	Academic personnel engaged in research:	
	a. Faculty	54
	b. Professional Researchers (including Visiting)	27
	c. Project Scientists	8
	d. Specialists	11
	e Postdoctoral Scholars	49
	f Postgraduate Researchers	13
	g Academic Coordinators	9
	TOTAL	171
2.	Graduate Students:	
	a Employed on contracts and grants	105
	b. Employed on other sources of funds	
	c. Participating through assistantships	
	d. Participating through traineeships	
	e Other- students at other campuses	6
	TOTAL	111
3.	Undergraduate Students:	
	a. Employed on contracts and grants	164
	b. Employed on other funds	
	c. Number of volunteers, & unpaid interns	130
	TOTAL	294
4.	Participation from outside UCSB: (optional)	
	a. Academics (without Salary Academic Visitors)	
	b. Other (specify)	
5.	Staff (Univ. & Non-Univ. Funds):	
	a. Technical	205
	b. Administrative/Clerical	48
6.	Seminars, symposia, workshops sponsored	141
7.	Proposals submitted	213
8.	Number of different awarding agencies dealt with*	94
9.	Number of extramural awards administered	289
10.	Dollar value of extramural awards administered during year**	$94,197,127
11.	Number of Principal Investigators***	138
12.	Dollar value of other project awards ****	$1,175,674
13.	Number of other projects administered	57
14.	Total base budget for the year (as of June 30, 2006)	$974,238

15.	Dollar value of intramural support	$1,596,833
16.	Total assigned square footage in ORU	35,000
17.	Dollar value of awards for year (08 Total)	$22,930,285

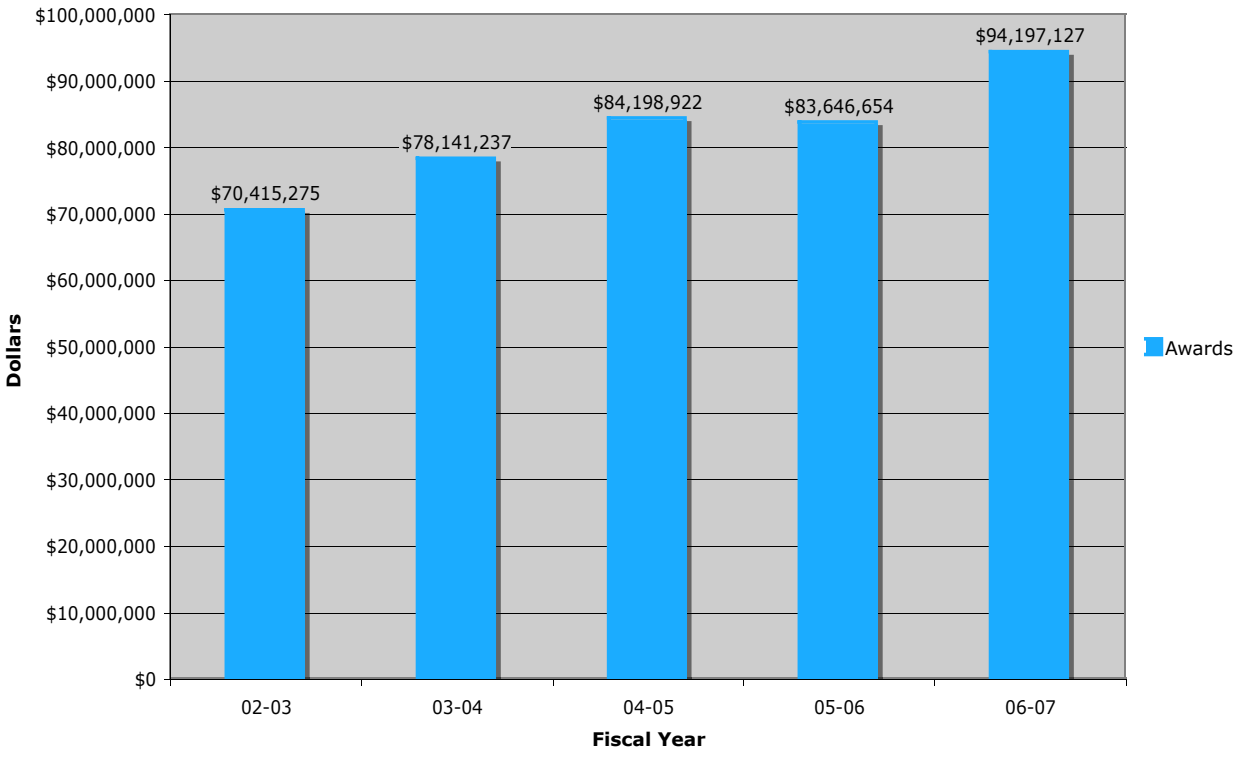
* Count each agency only once (include agencies to which proposals have been submitted).
** If the award was open during the year, even if for only one month, please include in total.
*** Number of PIs, Co-PIs and Proposed PIs (count each person only once.)
**** Other projects - such as donation, presidential awards, fellowships, anything that isn't core budget, extramural, or intramural.

Five-Year Statistical Summary 2003-2007

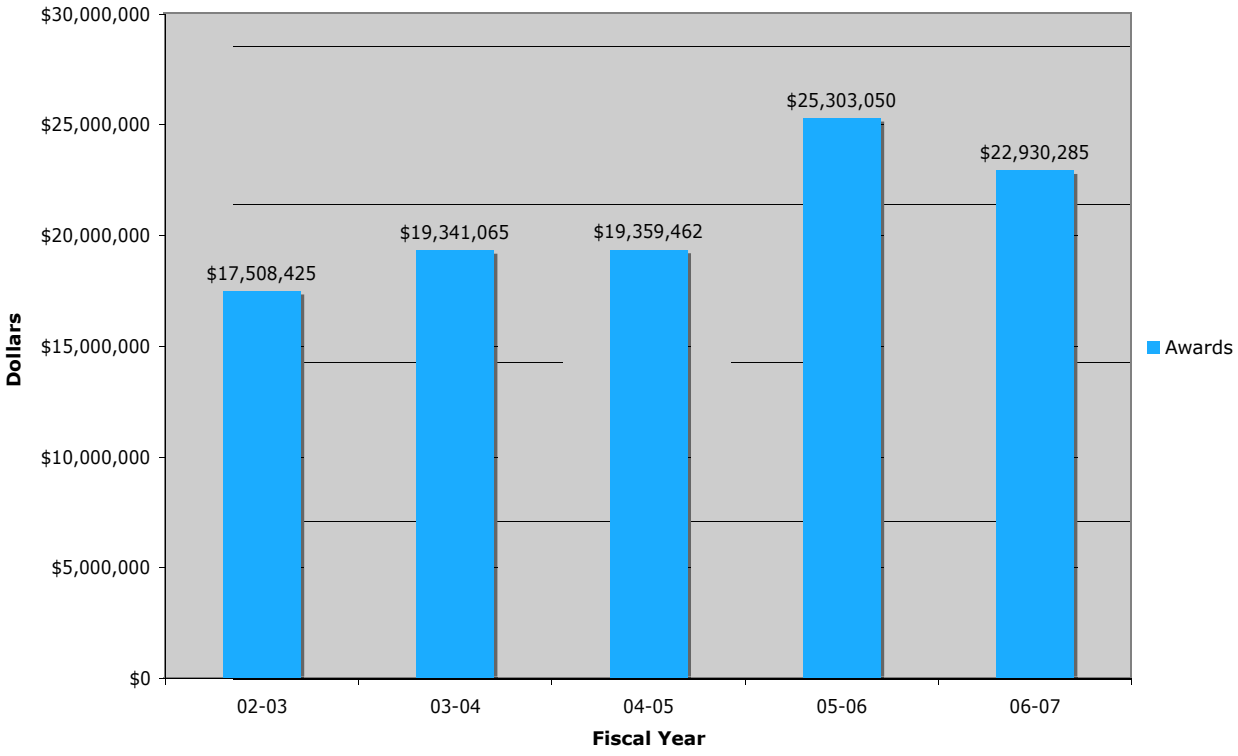
	2002-2003	2003-2004	2004-2005	2005-2006	2006-2007
1. Academic personnel engaged in research					
a. Faculty	62	58	63	59	54
b. Researchers/Project Scientists	52	50	39	30	29
c. Visiting Researchers	12	7	8	7	8
d. Specialists/Academic Coord/Academic Admin.	15	18	13	26	32
e. Postdoctorals/ Postgraduates	56	60	54	59	63
Total	**197**	**193**	**177**	**174**	**186**
2. Staff (Univ. & Non-Univ. Funds)					
a. Technical	186	200	168	182	205
b. Administrative/Clerical	35	28	64	49	48
Total	**221**	**228**	**232**	**231**	**253**
3 Graduate students employed by MSI	88	110	97	82	105
4. Undergraduate students employed by MSI	177	216	257	155	164
5. Publications	2**	2**	1**	1**	1**
6. Seminars, symposia, workshops, etc., sponsored by MSI	105	109	115	125	141
7. Proposals submitted	191	182	164	205	213
8. Annual extramural awards	$17,508,425	$19,341,065	$19,359,462	$25,303,050	$22,930,285
9. Extramural awards administered	238	246	239	260	289
10. Other project awards	$292,948	$1,145,713	$1,420,623	$878,572	$1,175,674
11. Other projects administered	53	55	68	60	57
12. MSI base budget	$834,306	$857,373	$846,304	$868,379	$974,238
13. Intramural support	$1,513,343*	$1,552,076	$1,631,875	$2,016,623	$1,596,833
14. Total Funds Administered	$70,415,275	$78,141,237	$84,198,922	$83,646,654	$94,197,127

*Includes $500,000 in matching funds from the State of California for NCEAS. **Only Departmental Publications

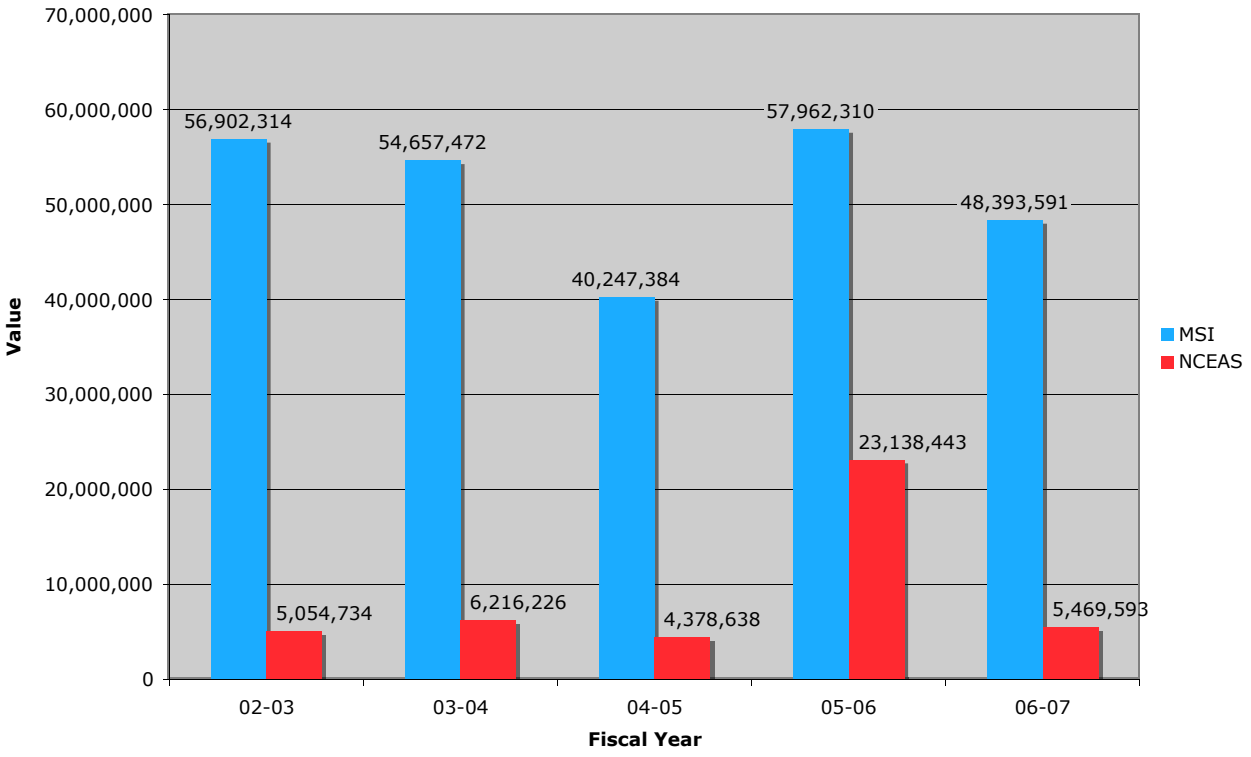
Marine Science Institute - Total Value of Awards Administered



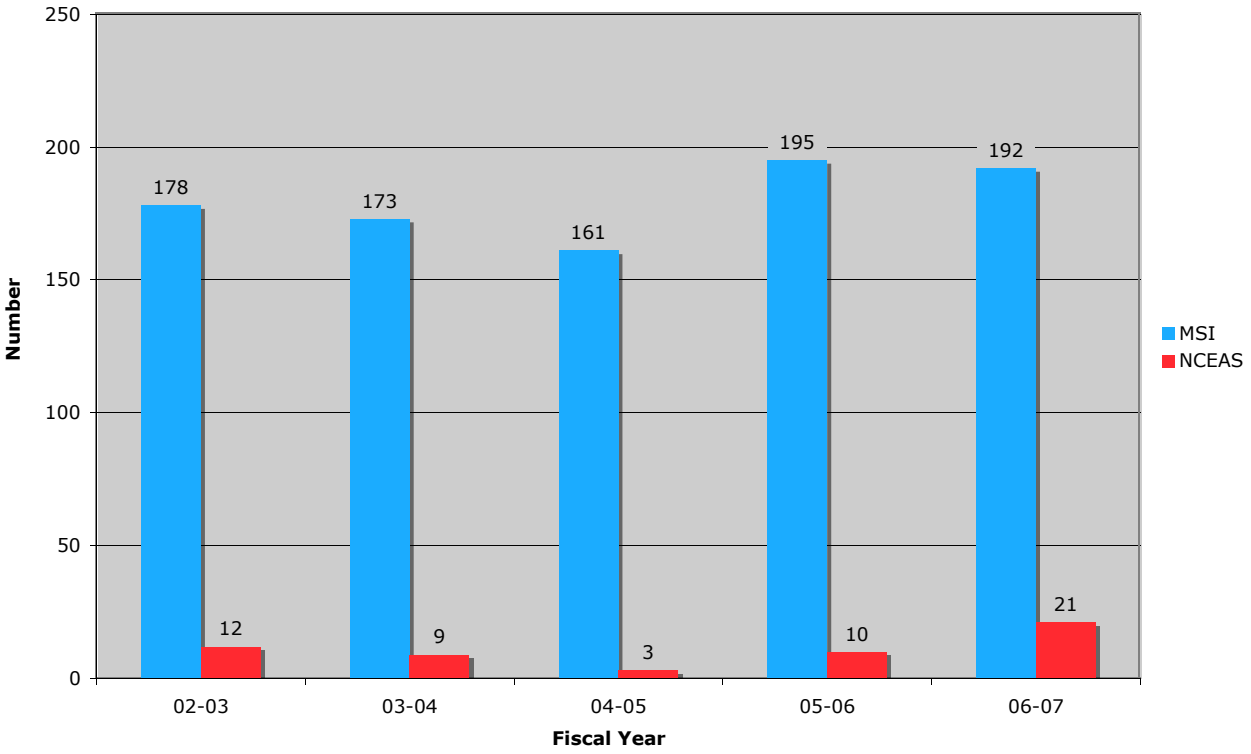
Marine Science Institute - Value of Extramural Awards Received Annually



Value of Proposals Submitted Annually by MSI & NCEAS



Number of Proposals Submitted Annually by MSI & NCEAS



Funding Agencies

American Assn for the Advancement of Science

American Chemical Society

Andrew W. Mellon Foundation

California Artificial Reef Enhancement

California Coastal Conservancy

California Department of Fish and Game

California Regional Water Quality Control Board

California Sea Urchin Commission

California State Lands Commission

California Wildlife Foundation

Camille & Henry Dreyfus Foundation

Center of Imaging Processing in Education

Channel Islands Marine Resource Institute

Channel Islands National Marine Sanctuary Foundation

Channel Islands National Park

City of Santa Barbara

David and Lucile Packard Foundation

Dersu & Associates

Environmental Defense Fund

Field Museum of Natural History

Foundation for Research Science and Technology

Gordon and Betty Moore Foundation

Harvard University

Joint Oceanographic Institutions, Inc.

Los Angeles Department of Water and Power

Luce Fountation

Marine Biological Laboratory

Martin V. & Martha K. Smith Foundation

Methanogenesis Corporation (Canada)

Michigan State University

Montana State University

National Aeronautics and Space Administration

National Geographic Society

National Marine Fisheries Service

National Science Foundation

Oak Ridge National Laboratory

Oregon State University

Paul G. Allen Charitable Foundation

Princeton University

Public Health Service

Resources Legacy Fund Foundation

ShorelinePreservationFund-AssociatedStudents UCSB

Simpson and Simpson Business and Personnel Services, Inc.

South African National Parks

SRS Technologies

The James S. McDonnell Foundation

The Nature Conservancy

The New Media Studio

The Pew Charitable Trusts

UC Berkeley

UC Biotechnology Research and Education Program

UC Center for Water Resources

UC Davis

UC Genetic Resources Conservation Program

UC Institute for Energy Efficiency

UC Irvine

UC Lawrence Livermore National Laboratory

UC Mexus

UC Office of the President

UC Riverside

UC San Diego

UC Santa Cruz

UC Sea Grant

UC Toxic Substances Research and Teaching Program

UC Water Resources Center
University of Kiel
University of Miami
University of North Carolina
University of Queensland
University of Rhode Island
University of Southern California
University of Washington
US Department of Agriculture
US Department of Commerce
US Department of Energy
US Department of the Army
US Department of the Navy
US Environmental Protection Agency
US Fish & Wildlife Service
US Forest Service
US Geological Survey
USC Sea Grant
USDC - National Oceanic & Atmospheric Administration
USDI - Minerals Management Service
USDI - National Park Service
Utah State University
Virginia Institute of Marine Science
WetLabs, Inc.
Wilburforce Foundation
Wildlife Conservation Board
Wildlife Conservation Society
William M. Keck Foundation
Wilburforce Foundation
Wildlife Conservation Board
Wildlife Conservation Society
William M. Keck Foundation

MSI Advisory Committee, Administrative, Professional & Technical Staff

Marine Science Institute
2006-2007

Chancellor	Henry T. Yang
Executive Vice Chancellor	Gene Lucas
Vice Chancellor for Research	Michael Witherell
Director	Steven D. Gaines
Deputy Director	Mark A. Brzezinski
Assistant Deputy Director	Daniel Reed

Advisory Committee

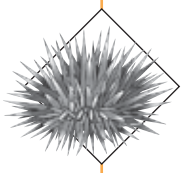
David Clarke, Professor, Materials
Christopher Costello, Associate Professor, Bren School of Environmental Science & Management
Rachel Haymon, Professor, Earth Sciences
Gretchen Hofmann, Associate Professor, Ecology, Evolution & Marine Biology, Committee Chair
Kevin Lafferty, Assistant Researcher, Marine Science Institute
Ira Leifer, Associate Researcher, Marine Science Institute
Hunter Lenihan, Assistant Professor, Bren School of Environmental Science & Management
Bruce Luyendyk, Professor, Earth Sciences
Langdon Quetin, Researcher, Marine Science Institute
David Valentine, Assistant Professor, Earth Sciences
Oran Young, Professor, Bren School of Environmental Science & Management

Ex-Officio members -

Mark Brzezinski, Deputy Director of Marine Science Institute, Professor, Ecology, Evolution & Marine Biology
Steven Gaines, Director of Marine Science Institute, Professor, Ecology, Evolution & Marine Biology
Daniel Morse, Director of Marine Biotech Center, Professor, Molecular, Cellular & Developmental Biology
William Murdoch, Director of Natural Reserve System, Professor, Ecology, Evolution & Marine Biology
Omer Reichman, Director of National Center for Ecological Analysis & Synthesis, Professor, Ecology, Evolution & Marine Biology
Tim Schmidt, ex-officio, Manager, Marine Science Institute
Russell Schmitt, Director of Coastal Research Center, Professor, Ecology, Evolution & Marine Biology

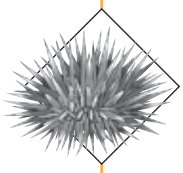
Marine Science Institute
Administrative, Professional and Technical Staff

Marie Ciluaga, Analyst
William Clinton, Staff Research Associate, Analytical Laboratory
Donna Dobis, Budget Analyst
Adrienne Estes, Purchasing Assistant
Laurie Eusey, Financial Services Manager
Mike Franklin, Desktop Support
Steve Gilbert, Purchasing Assistant
Marisol Hernandez, Desktop Support/Travel Analyst
Ryan Kleiner, Artist
Jenn Massey, Analytical Lab
Judy McCaslin, Contract & Grants Officer
India Morgan, Personnel Analyst
Mike O'Neil, Budget Analyst
Deb Owens, Budget Unit Manager
Georges Paradis, Manager, Analytical Lab
Nanette Pedroso, Development Analyst
Monica Pessino, Publication Manager
Bonnie Roper, Budget Analyst
Elvira Rose, Personnel Unit Coordinator
Tim Schmidt, Manager
Kate Steger, Anlytical Lab
Veronica Torres, Personnel Analyst
Rachel Whitacre, Purchasing Unit Manager
Bonnie Williamson, Contracts & Grants Administration Manager
Joyce Wolever, Payroll & Personnel Unit Manager
James Woods, Information Technology
Joanna Yates, Contracts & Grants Analyst
Nicole Zavala, Personnel Analyst



Marine Science Institute Principal Investigators 2006-2007

Marine Science Institute
Principal Investigators
2006-2007



Airame, Satie	Academic Coordinator	Marine Science Institute
Alldredge, Alice	Professor	Ecology, Evolution & Marine Biology
Alroy, John	Associate Researcher	Marine Science Institute
Andelman, Sandy	Specialist	Marine Science Institute
Anderson, Clarissa	Graduate Student Researcher	Ecology, Evolution & Marine Biology
Arkema, Katie	Graduate Student Researcher	Ecology, Evolution & Marine Biology
Becker, Luann	Associate Researcher	Institute for Crustal Studies
Beucher, Charlotte	Postdoctoral Researcher	Marine Science Institute
Blanchette, Carol	Assistant Researcher	Marine Science Institute
Briggs, Cheryl	Associate Professor	Ecology, Evolution & Marine Biology
Brooks, Andrew	Assistant Researcher	Marine Science Institute
Brzezinski, Mark	Professor	Ecology, Evolution & Marine Biology
Buston, Peter	Project Scientist	Marine Science Institute
Campbell, Brian	Graduate Student Researcher	Earth Science
Cardinale, Bradley	Assistant Professor	Ecology, Evolution & Marine Biology
Carlson, Craig	Assistant Professor	Ecology, Evolution & Marine Biology
Case, James	Research Professor	Marine Science Institute
Caselle, Jennifer	Assistant Researcher	Marine Science Institute
Chadwick, Oliver	Professor of Geography	Geography
Childress, James	Professor of Zoology	Ecology, Evolution & Marine Biology
Clarke, Keith	Professor of Geography	Geography
Cooper, Scott	Professor of Ecology	Ecology, Evolution & Marine Biology
Costello, Christopher	Associate Professor	Bren Environmental Sci & Management
Culver, Carrie	Marine Resource Specialist	Marine Science Institute

D'Antonio, Carla	Professor of Environmental Studies	Environmental Studies
Damschen, Ellen	Postdoctoral Researcher	Marine Science Institute
Dawson, Daniel	Reserve Director	Natural Reserve System
Dixon, John	Associate Researcher	Marine Science Institute
Doyle, Frank	Professor	Chemical Engineering
Dudley, Tom	Associate Researcher	Marine Science Institute
Dugan, Jenifer	Associate Researcher	Marine Science Institute
Dutton, Jessica	Graduate Student Researcher	Ecology, Evolution & Marine Biology
Engle, John	Associate Research Biologist	Marine Science Institute
Estrada, Abril	Graduate Student Researcher	Chemistry
Fangue, Nann	Postdoctoral Researcher	Marine Science Institute
Fleishman, Erica	Academic Coordinator	Nat'l Ctr for Ecol. Analysis & Synthesis
Foltz, Kathleen	Associate Professor	Molecular, Cellular & Devel. Biology
Fredensborg, Brian	Postdoctoral Researcher	Marine Science Institute
Freudenburg, William	Professor	Environmental Studies
Gaines, Steven	Professor of Biology	Marine Science Institute
Goddard, Jeffrey	Assistant Researcher	Marine Science Institute
Halpern, Benjamin	Assistant Researcher	Nat'l Ctr for Ecol. Analysis & Synthesis
Halpin, Patricia	Assistant Researcher	Marine Science Institute
Hansma, Paul	Professor of Physics	Physics
Haymon, Rachel	Professor of Geology	Earth Science
Henkel, Sarah	Graduate Student Researcher	Marine Science Institute
Herbst, David	Associate Researcher	Marine Science Institute
Herrity, Vishna	Academic Coordinator	Gevirtz Graduate School of Education
Hofmann, Gretchen	Associate Professor	Ecology, Evolution & Marine Biology
Holbrook, Sally	Professor of Biology	Ecology, Evolution & Marine Biology
Holden, Patricia	Assistant Professor	Bren Environmental Sci & Management
Hu, Evelyn	Professor	Electrical & Compute
Israelachvili, Jacob	Professor	Chemical Engineering

Jellison, Robert	Associate Researcher	Marine Science Institute
Jones, Christopher	Systems & Database Specialist	Marine Science Institute
Jones, Matthew B.	Database & Information Specialist	Nat'l Ctr for Ecol. Analysis & Synthesis
Keller, Edward A.	Professor of Geology	Earth Science
Kendall, Bruce	Associate Professor	Bren Environmental Sci & Management
Kennett, James	Professor of Oceanography	Earth Science
Kinlan, Brian	Graduate Student Researcher	Marine Science Institute
Knapp, Roland	Associate Researcher	Marine Science Institute
Krause, Dale	Research Professor of Geology	Marine Science Institute
Kuris, Armand	Professor of Biology	Ecology, Evolution & Marine Biology
Lafferty, Kevin	Associate Research Biologist	Marine Science Institute
Lambert, Adam	Postdoctoral Researcher	Marine Science Institute
Laughrin, Lyndal	Reserve Director	Marine Science Institute
Lea, David	Professor of Geology	Earth Science
Leifer, Ira	Associate Researcher	Chemical Engineering
Lenihan, Hunter	Assistant Researcher	Bren Environmental Sci & Management
Levine, Jonathan	Assistant Professor	Ecology, Evolution & Marine Biology
Long, Tristan	Postdoctoral Researcher	Marine Science Institute
Love, Milton	Research Zoologist	Marine Science Institute
Luyendyk, Bruce	Professor of Geophysics	Earth Science
Macdonald, Ken	Professor of Marine	Earth Science
MacIntyre, Sally	Professor	Ecology, Evolution & Marine Biology
Madin, Joshua	Postdoctoral Researcher	Marine Science Institute
Mau, Susan	Postdoctoral Researcher	Earth Science
Mayfield, Margaret	Postdoctoral Researcher	Marine Science Institute
McArdle, Deborah	Graduate Student Researcher	Ecology, Evolution & Marine Biology
McClintock, William	Associate Project Scientist	Marine Science Institute
Melack, John	Professor of Biology	Ecology, Evolution & Marine Biology
Miller, Paige	Postdoctoral Researcher	Marine Science Institute
Morse, Aileen	Associate Researcher	Marine Science Institute

Morse, Daniel	Professor	Marine Science Institute
Murdoch, William	Professor of Biology	Ecology, Evolution & Marine Biology
Nicholson, Craig	Research Geologist	Marine Science Institute
Nisbet, Roger	Professor of Biology	Ecology, Evolution & Marine Biology
O'Donnell, Michael	Postdoctoral Researcher	Marine Science Institute
Oakley, Todd	Assistant Professor	Ecology, Evolution & Marine Biology
Ohlmann, J.	Assistant Researcher	Marine Science Institute
Orrock, John	Postdoctoral Researcher	Nat'l Ctr for Ecol. Analysis & Synthesis
Osherenko, Gail	Researcher	Marine Science Institute
Osovitz, Christopher	Graduate Student Researcher	Ecology, Evolution & Marine Biology
Page, Henry	Associate Researcher	Marine Science Institute
Pak, Dorothy	Assistant Project Scientist	Marine Science Institute
Plachetzki, David	Graduate Student Researcher	Ecology, Evolution & Marine Biology
Polne-Fuller, Miriam	Academic Coordinator	Summer Sessions
Prézelin, Barbara	Professor of Biology	Ecology, Evolution & Marine Biology
Quetin, Langdon	Researcher	Marine Science Institute
Reed, Daniel	Researcher	Marine Science Institute
Reichman, O. James	Professor of Biology	Nat'l Ctr for Ecol. Analysis & Synthesis
Rice, Ronald	Professor	Communications
Rice, William	Professor of Biology	Ecology, Evolution & Marine Biology
Richards, John	Marine Resource Specialist	Marine Science Institute
Rivera, Ajna	Postdoctoral Researcher	Marine Science Institute
Roberts, Dar	Professor of Geography	Geography
Ross, Robin	Researcher	Marine Science Institute
Rowell, Kirsten	Assistant Researcher	Marine Science Institute
Salomon, Anne	Postdoctoral Researcher	Marine Science Institute
Sandoval, Cristina	Reserve Director	Natural Reserve System
Schildhauer, Mark	Computer & Network T	Nat'l Ctr for Ecol. Analysis & Synthesis

Schimel, Joshua	Professor	Ecology, Evolution & Marine Biology
Schizas, Nikolaos	Associate Project Scientist	Marine Science Institute
Schmitt, Russell	Professor of Ecology	Ecology, Evolution & Marine Biology
Schroeter, Stephen	Research Ecologist	Marine Science Institute
Shears, Nicholas	Postdoctoral Researcher	Marine Science Institute
Siegel, David	Professor of Geography	Geography
Simpson, Julie	Graduate Student Researcher	Ecology, Evolution & Marine Biology
Smith, Katherine	Graduate Student Researcher	Ecology, Evolution & Marine Biology
Sorlien, Christopher	Associate Researcher	Institute for Crustal Studies
Stammerjohn, Sharon	Assistant Researcher	Marine Science Institute
Steele, Mark	Assistant Researcher	Marine Science Institute
Stucky, Galen	Professor of Chemistry	Chemistry
Swarbrick, Susan	Associate Director	Natural Reserve System
Valentine, David	Associate Professor	Earth Science
Vogt, Peter	Research Geologist	Marine Science Institute
Waite, J. Herbert	Professor	Molecular, Cellular & Devel. Biology
Warner, Robert	Professor of Biology	Ecology, Evolution & Marine Biology
Washburn, Libe	Professor of Geography	Geography
Wenner, Adrian	Professor Emeritus	Ecology, Evolution & Marine Biology
White, Corwith	Graduate Student Researcher	Marine Science Institute
Whitmer, Allison	Academic Coordinator	Marine Science Institute
Wilkinson, Robert	Assistant Researcher	Bren Environmental Sci & Management
Williams, Michael	Reserve Director	Natural Reserve System
Wilson, Douglas	Associate Research Geologist	Earth Science
Yang, Louie	Postdoctoral Researcher	Marine Science Institute
Young, Oran	Professor	Bren Environmental Sci & Management
Zippay, Mackenzie	Graduate Student Researcher	Ecology, Evolution & Marine Biology
Zok, Francis	Professor of Materials	Materials