msi

Marine Science Institute
University of California, Santa Barbara

Annual Report
2008
2009

Table of Contents

Director's Statement

Director's Statement

I am pleased to present this year's annual report.

This spring marked the physical start to a long-planned collaboration between the NOAA Channel Islands National Marine Sanctuary and the Marine Science Institute with work beginning on the Outreach Center for Teaching Ocean Sciences. Located adjacent to the Marine Science Research Building on Lagoon Road, this building will provide a state-of-the-art facility for teaching marine science. The first phase of the building's construction, office space for NOAA employees, is scheduled to be completed in September 2011.

Established in 1995, the National Center for Ecological Analysis and Synthesis (NCEAS) has become a leader in developing collaborations and technical solutions to overcome obstacles related to the dispersed and heterogeneous nature of ecological data. This very successful partnership between the National Science Foundation, the State of California, the Marine Science Institute and UCSB brings hundreds of participants annually to its location in downtown Santa Barbara. Recently appointed NCEAS Director Dr. Edward McCauley leads the center and its efforts to enhance and extend its contributions to the global science community. You can read much more about NCEAS inside this report. Many thanks to NCEAS Interim Director Dr. William Murdoch for providing the vision to create NCEAS and his dedication to nurturing it over the years.

It's no exaggeration to say that the fiscal health of the University of California has seen better days. I am hopeful that it will improve in the near future but like other departments on our campus, the Marine Science Institute continues to suffer significant cuts to its operating budget. This year we also received a handful of stop work orders from the State of California, essentially requiring some of our research projects to shut down overnight due to the on going budget crisis. This can be devastating to the projects and the people they employ. Despite this adversity, MSI remains a growing and robust community.

An example of this is a new project that Drs. Waite and Israelachvili received funding for from the Dental and Craniofacial Directorate of the National Institutes of Health. In dental and biomedical restorations, water is the nemesis of true adhesion between solid surfaces and polymers. The strong underwater adhesion of marine organisms such as mussels is based on an adaptive set of molecular and biophysical properties that may be systematically translated into medically relevant strategies. I look forward to following the progress of this project, and all of the projects, administered by MSI.

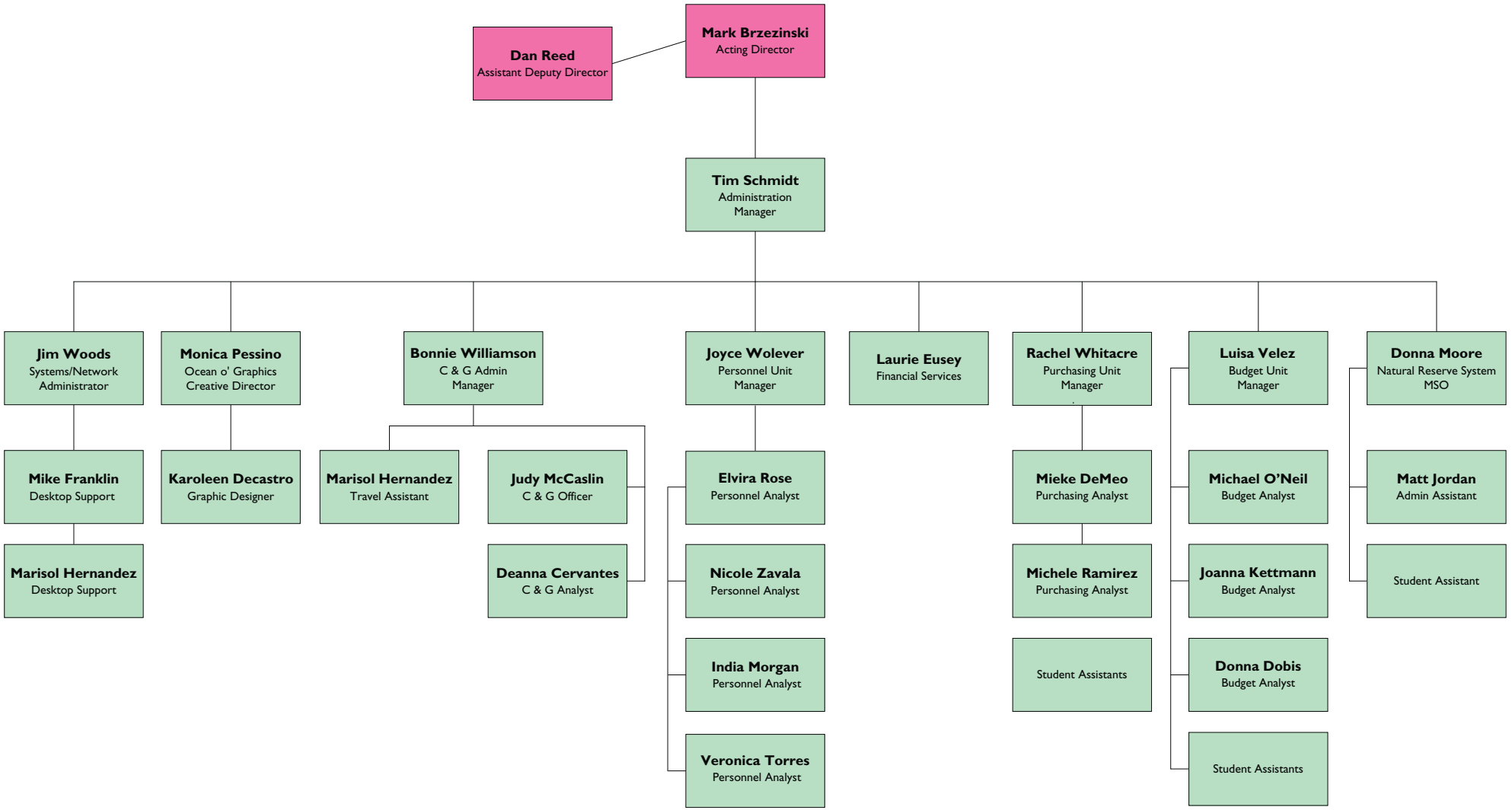
MSI researchers are conducting world-class, cutting edge research in a wide-range of disciplines. It is an honor to be a part of these efforts as both a scientist and the head of the administrative support functions.

Mark Brzezinski
Acting Director

Organizational Charts

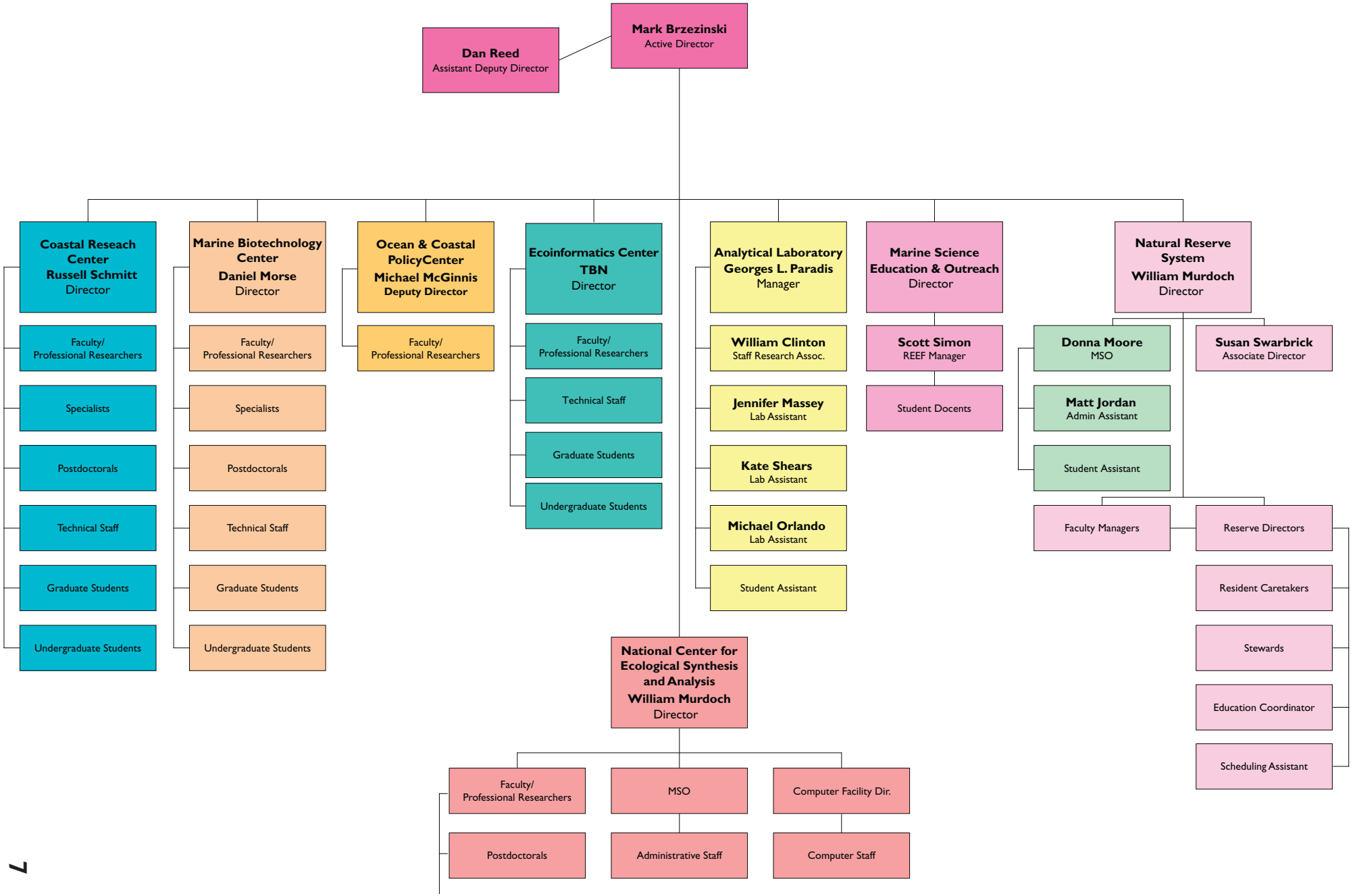
MARINE SCIENCE INSTITUTE

2008–2009 ORGANIZATIONAL CHART



MARINE SCIENCE INSTITUTE

2008–2009 ORGANIZATIONAL CHART



Other Projects & Activities

Seminars, Workshops, Conferences, and Meetings 2008-2009

The Marine Science Institute continues to support various seminars, workshops, conferences and meetings. During the 2008-2009 fiscal year 158 events took place, in which a wide range of marine science topics were highlighted.

Dates	Coordinators	Topic
June 23 – July 28, 2008	John Alroy Arnold Miller* Charles Marshall*	Paleobiology Database (Hosted by NCEAS) (Training Workshop)
July 17–19, 2008	Carlos Carroll*, Erica Fleishman	Landscape and population connectivity (Working Group)
July 17, 2008	Timothy Beechie*, Mary Ruckelshaus*	Resilience of Pacific salmon to climate change (Working Group)
July 19, 2008	Steve Gaines	Luce Fellows Environmental Science to Solutions Initiative
July 21 – July 25, 2008	Peter Walsh*	Efficient wildlife disease control: From social network self-organization to optimal vaccination (Working Group)
July 21 – July 23, 2008	Matthew Jones, Mark Schildhauer	SDCI NMI improvements: Development of Kepler CORE—a comprehensive, open, robust, and extensive scientific workflow infrastructure (Working Group)
July 25, 2008	Daniel E. Morse	Woods Hole Oceanographic Institution researchers meeting
July 29 – August 1, 2008	Juliann Aukema, O. Reichman, Stephanie Hampton	Economic impacts of non-native forest pests and pathogens in North America (TNC) (Working Group)
July 25, 2008	Daniel E. Morse	Morse Lab Postdoctoral Scholars
August 6, 2008	Stephanie Hampton	Ecological Society of America—NCEAS postdoctoral scholars meeting
August 19, 2008	Catherine Boggs	Digital Ocean Charrette
August 24 – 25, 2008	Constance Penley	K-12 Digital Ocean Charrette
August 25, 2008	Daniel Reed	Santa Barbara Coastal LTER REU students research presentations
August 27 – 28, 2008	Erica Fleishman, Susan Frankel*	Risk assessment for climate change and forest pathogens in western North America (Supported by the US Forest Service) (Working Group)
August 28 – 29, 2008	Constance Penley John Melack	K-12 Digital Oceans Charrette

* Non-UCSB personnel

August 28, 2009	Jacob Weiner, NCEAS & University of Copenhagen,	Allocation, plasticity and allometry in plants (EcoLunch Seminar)
September 2–5, 2008	Erica Fleishman	Potential role of contaminants in declines of pelagic organisms in the Upper San Francisco Estuary, California (Working Group)
September 3 – 4, 2008	William Murdoch	NCEAS Science Advisory Board mtg
September 4, 2008	Daniel Schlenk, University of California, Riverside	*Impacts of estrogenic activity in fish from the Southern California Bight* (EcoLunch Seminar)
September 8 – 12, 2008	Jonathan Shurin, Helmut Hillebrand*, Daniel Gruner*	Comparing trophic structure across ecosystems (Extended) (Working Group)
September 11, 2008	Elizabeth Borer, Oregon State University	*Fertilization, consumers, and competition: community context determines grassland viral prevalence* (EcoLunch Seminar)
September 12 – 19, 2008	M. Rebecca Shaw*	Global climate change and adaptation of conservation priorities (Supported by The Nature Conservancy) (Working Group)
September 18, 2008	Francisco Madrinan, NCEAS	*Investigating responses of riverine habitats and Pacific salmon to climate change* (EcoLunch Seminar)
September 22 – 26, 2008	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)
September 25, 2008	Patrick Christie, University of Washington	*Feasibility of marine protected area networks and marine ecosystem-based management in the Philippines* (EcoLunch Seminar)
September 25 – 27, 2008	Patrick Christie*, Richard Pollnac*	Governance feasibility of marine ecosystem-based management: A comparative analysis (EBM) (Supported by The Packard Foundation) (Working Group)
September 29 – October 3, 2008	James Turner*	Effects of trade policy on management of non-native forest pests and pathogens (Supported by The Nature Conservancy) (Working Group)
September 29 – October 3, 2008	Kevin Lafferty, Andrew Dobson*, Mercedes Pascual*	Parasites and food webs - the ultimate missing links (Working Group)
October 1-3, 2008	Randall Peterman*	Monitoring responses of Pacific salmon to climate change (supported by The Moore Foundation) (Working Group)

* Non-UCSB personnel

October 1 – December 31, 2008	Robert Pavia*, James Lindholm*	Distributed graduate seminar - the role of MPAs in ecosystem-based management: Examining the science and politics of an ocean conservation strategy (OT)
October 2, 2008	Lauren Buckley, NCEAS	*The broad-scale ecology of ectothermy* (EcoLunch Seminar)
October 6-10, 2008	Brian McGill*, Rampal Etienne*, Jessica Green*	Tools and fresh approaches for species abundance distributions (Working Group)
October 6 – 10, 2008	Erica Fleishman	Ecosystem analysis of pelagic organism declines in the Upper San Francisco Estuary (Working Group)
October 9, 2008	Anne Magurran, University of St. Andrews	*Diversity and time* (EcoLunch Seminar)
October 9 – 10, 2008	Cathy Boggs	Digital Oceans Charrette
October 10, 2008	Steve Gaines	Sustainable Fisheries Group meeting
October 11 – 13, 2008	Nicholas Gotelli*, Robert Colwell*, Carsten Rahbek*	Synthetic macroecological models of species diversity (Working Group)
October 14 – 16, 2008	Erica Fleishman	Prediction of responses of wild Pacific salmon to climate change (Working Group)
October 14, 2008	Stephanie Hampton, Stefano Allesina	Training Workshop on Genetic Algorithms (Training Workshop)
October 16, 2008	Howard Cornell, University of California, Davis	*Can unsaturation be reconciled with strong interspecific competition in local species assemblages?* (EcoLunch Seminar)
October 17 – 20, 2008	Howard Cornell*, Susan Harrison*, Christy McCain*	The role of niche conservatism in producing biodiversity gradients (Working Group)
October 20 – 24, 2008	John Drake*, Bill Langford*	Machine learning for the environment (Working Group)
October 23, 2008	Sophie Parker, University of California, Santa Barbara	*The impacts of invasive species in California grasslands: potential mechanisms of persistence* (EcoLunch Seminar)
October 27 – 31, 2008	Richard Norby*, Yiqi Luo*, Ram Oren*, I. Colin Prentice*, Paul Hanson*	Benchmarking ecosystem response models with experimental data from long-term CO_2 enrichment experiments (Working Group)
October 27 – 29, 2008	Erica Fleishman, Gary Tabor*	Climate change and conservation (WCS) (Working Group)
October 28, 2008	Ben Gilbert, University of California, Santa Barbara	*Dominance and diversity: Linking species abundances to their effects on community membership* (EcoLunch Seminar)
October 30, 2008	Rich Norby, Oak Ridge National Laboratory	*Forest responses to rising atmospheric CO_2* (EcoLunch Seminar)

* Non-UCSB personnel

October 31, 2008	Sally Holbrook	UC LTER Network Planning Workshop
November 3 – 7, 2008	Lauren Buckley*, Michael Angilletta*, Robert Holt*, Joshua Tewksbury*	Mechanistic distribution models: Energetics, fitness, and population dynamics (Working Group)
November 3, 2008	Steven Gaines	Digital Ocean Planning meeting
November 6, 2008	Christine Peterson, NCEAS	*Seasonal constraints on rockfish larval dispersal along the central California coast* (EcoLunch Seminar)
November 6 – 7, 2008	Erica Fleishman	Valuation of marine ecosystem services (Working Group)
November 10 – 13, 2008	Robert Costanza*, Lisa Graumlich*, Sander van der Leeuw*	Integrated history and future of people on Earth (IHOPE): Building a community data base and testing the resilience - sustainability hypothesis across scales (Working Group)
November 10 – 14, 2008	Erica Fleishman	Evaluation of declines of pelagic organisms in the upper San Francisco Estuary (Meeting)
November 10 – 21, 2008	Chris Wilcox*, C. Josh Donlan*	Exploring compensatory mitigation and markets as mechanisms for resolving fisheries bycatch: Biodiversity conservation conflicts (Working Group)
November 11 – 14, 2008	Erica Fleishman	Prediction of responses of wild Pacific salmon to climate change (Working Group)
November 13, 2008	Stephanie Hampton, NCEAS	*Long-term warming in the world's largest lake - Lake Baikal, Siberia* (EcoLunch Seminar
November 15 – 19, 2008	Helen Regan, Sahotra Sarkar*	Making decisions on complex environmental problems (Working Group)
November 16, 2008	Constance Penley	GreenScreen film project meetings
November 18 – 19	Sally Holbrook Russell Schmitt	4th Annual Moorea Coral Reef LTER site all-investigators meeting
November 20, 2008	Larry Crowder, Duke University	*Steps toward implementation of marine ecosystem-based management* (EcoLunch Seminar)
November 20 – 21, 2008	William Murdoch	NCEAS Scientific Advisory Board
November 21 – 22, 2008	Stephanie Hampton	CRMP Review Team Visit (Meeting)
November 23, 2008	Cheryl Briggs	Workshop on Ecology and Health
December 4, 2008	Jennifer Balch, NCEAS	*Amazon transitional forests: sensitive or resistant to frontier fire?* (EcoLunch Seminar)
December 5, 2008	Margaret Connors, Sandy Andelman	Kids Do Ecology (Meeting)
December 8, 2008	Jennifer Thorsch	Kids in Nature program

* Non-UCSB personnel

December 8 – 12, 2008	Brian Enquist, Richard Condit*, Robert Peet*, Brad Boyle*, Steven Dolins*	Developing an integrated botanical information network to investigate the ecological impacts of global climate change on plant biodiversity (Working Group)
December 8 – 12, 2008	Erica Fleishman	Interactions between the near-coastal ocean and the San Francisco Estuary (Working Group)
December 9, 2008	Vlastimil Krivan, Academy of Sciences of the Czech Republic	*The evolutionary stability of the ideal free distribution* (EcoLunch Seminar)
December 10 – 14, 2008	Boris Worm*, Ray Hilborn*	Finding common ground in marine conservation and management (Working Group)
December 11, 2008	Kerry Woods, NCEAS & Bennington College	*Why we don't know much about late-successional forests: working with long-term studies in slow systems controlled by rare events* (EcoLunch Seminar)
January 4 – 7, 2009	Stephanie Hampton, Dov Sax*	Assisted Migration (Hosted by NCEAS) (Meeting)
January 7, 2009	Erica Fleishman, David Smith*	Conservation research fellows information meeting (Hosted by NCEAS) (Meeting)
January 8, 2009	Marc Cadotte, NCEAS	*Community consequences of changes in phylogenetic diversity* (EcoLunch Seminar)
January 12 – 16, 2009	Aaron King*, Pej Rohani*	Unifying approaches to statistical inference in ecology (Working Group)
January 13 – 15, 2009	Matthew Jones, William Michener*, Kathleen Smith*	INTEROP: Creation of an international virtual data center for the biodiversity, ecological and environmental sciences (Working Group)
January 14, 2009	Steve Gaines	Current status of research on California Sheephead populations
January 15, 2009	Jonathan Davies, NCEAS	*An entangled bank: the generation and maintenance of biodiversity across scales* (EcoLunch Seminar)
January 17 – 21, 2009	Jeannine Cavender-Bares*, David Ackerly*, J. Gordon Burleigh*, Michelle Mack*,Richard Ree*, Peter Reich*	Linking phylogenetic history, plant traits, and ecological processes at multiple scales (Working Group)
January 18 – 21, 2009	Evgeny Zilov*, Marianne Moore*, Stephanie Hampton	The 60-year data set of plankton dynamics in Lake Baikal: Examining facets of the jewel of Siberia (Meeting)
January 20 – 23, 2009	Cory Cleveland*, Alan Townsend*	Revisiting nutrient limitation in tropical forests (Working Group)

* Non-UCSB personnel

January 22, 2009	Whendee Silver, University of California, Berkeley	*The promise and peril of science in a social context: examples from soil carbon sequestration research in California* (EcoLunch Seminar)
January 27 – 29, 2009	James Randerson*, Josep Canadell*, Robert Jackson*	Linking carbon storage in terrestrial ecosystems with other climate forcing agents: A synthesis allowing for effective carbon dioxide stabilization policies (Working Group)
January 27 – 28, 2009	O. Reichman	Open access publishing (Meeting)
January 29, 2009	Lara Kueppers, University of California, Merced	*Feedbacks between climate change and plant distribution* (EcoLunch Seminar)
February 2, 2009	William Murdoch	NCEAS NSF Site visit
February 2 – 5, 2009	Erica Fleishman	Potential role of contaminants in declines of pelagic organisms in the Upper San Francisco Estuary, California (Working Group)
February 5, 2009	Christopher Costello, University of California, Santa Barbara	*TURFs and MPAs for spatially connected resources* (EcoLunch Seminar)
February 5 – 6, 2009	Erica Fleishman	Valuation of marine ecosystem services (Working Group)
February 6 2009	Mark Schildhauer, Matthew Jones, Joshua Madin, Shawn Bowers*, Steve Kelling*, Larry Sugarbaker*	Towards a unified model for describing ecological and environmental observation data (Meeting)
February 7, 2009	Robert Warner	EEMB Graduate Student Symposium
February 9 – 13, 2009	James Watson, Kristin Carden, Michael Marshall, Nada Petrovic, Frank Davenport, Lisa Max, Sara Hughes	Adaptive capacity of human populations to coral reef fisheries dynamics (Luce Fellows hosted by NCEAS) (Meeting)
February 10 – 12, 2009	Matthew Jones, William Michener*, Kathleen Smith*	INTEROP: Creation of an international virtual data center for the biodiversity, ecological and environmental sciences (Working Group)
February 12, 2009	William Michener, University of New Mexico	*Building informatics solutions for multi-decadal ecological research: re-envisioning science, technology, and the academic culture* (EcoLunch Seminar)
February 13, 2009	Jennifer Thorsch	Restoration Ecology meeting
February 17 – 20, 2009	Stephanie Hampton, Jim Regetz	R training workshop (Training Workshop)
February 17 – 20, 2009	Peter Walsh*	Efficient wildlife disease control: From social network self-organization to optimal vaccination (Working Group)
February 19, 2009	Carlos Melian, NCEAS	*Diversification and coexistence in multilevel biological networks assemblages* (EcoLunch Seminar)

* Non-UCSB personnel

February 24 – 27, 2009	Fred Allendorf*, Michael Schwartz*	Genetic monitoring: Development of tools for conservation and management (Working Group)
February 26, 2009	Kevin McKelvey, US Forest Service: Rocky Mountain Research Station	*Can unsaturation be reconciled with strong interspecific competition in local species* (EcoLunch Seminar)
March 2 – 5, 2009	Reginald Archer*, Elizabeth Hoaglund, Margaret Lynch*, Lisa Needles, Steve Sadro*	Identifying successful management strategies for rebuilding collapsed fisheries (Luce Fellows hosted by NCEAS) (Meeting)
March 4 – 5, 2009	William Murdoch	NCEAS Science Advisory Board mtg
March 5 – 7, 2009	Howard Cornell*, Susan Harrison*, Christy McCain*	The role of niche conservatism in producing biodiversity gradients (Working Group)
March 5, 2009	Hector Arita, National Autonomous University of Mexico	*The 'diversity field' of New World bats: linking distribution and diversity patterns* (EcoLunch Seminar)
March 9 – 10, 2009	Mark Schildhauer	Public domain ADMB project (Training Workshop)
March 11 – 13, 2009	Larry Crowder*, Martin Smith*	Envisioning a Sustainable Global Seafood Market and Restored Marine Ecosystems (Working Group)
March 11, 2009	Mark Schildhauer	Public domain ADMB project (Meeting)
March 12, 2009	Jennifer Thorsch	Kids in Nature Program
March 12, 2009	Jason Fridley, Syracuse University	*Diversity and function of a species-rich grassland: more than the sum of its parts?* (EcoLunch Seminar)
March 18, 2009	Michael McGinnis	Developing Adaptive Policy to Climate Disturbance in Santa Barbara County (workshop)
March 18 – 22, 2009	Michael Rosenberg*, Bryan Epperson*, Andrew Storfer*	An Interdisciplinary Approach To Advancing Landscape Genetics (Working Group)
March 19, 2009	Jennifer Williams, NCEAS	*Exotic plant success: experiments, models, life history, and more* (EcoLunch Seminar)
March 19 – 20, 2009	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 (WG)
March 23, 2009	Daniel Morse	CERDEC project meeting
March 23 – 26, 2009	Helene Wagner*, Lisette Waits*	Developing Best Practices For Testing Landscape Effects on Gene Flow (Meeting)
March 23 – 27, 2009	Juliann Aukema, O. Reichman, Stephanie Hampton	Economic impacts of non-native forest pests and pathogens in North America (TNC) (Working Group)

* Non-UCSB personnel

March 26, 2009	Duncan Menge, NCEAS	*Dual paradoxes in ecosystem ecology: examining the nitrogen cycle in tropical and temperate forests* (EcoLunch Seminar)
March 30 – April 1, 2009	James Turner	Effects of trade policy on management of non-native forest pests and pathogens (Supported by The Nature Conservancy) (Working Group)
March 30 – April 3, 2009	Erica Fleishman	Ecosystem analysis of pelagic organism declines in the Upper San Francisco Estuary (Working Group)
April 2, 2009	Amber Budden, NCEAS	*Pride and Prejudice: an exploration of bias in ecological publishing* (EcoLunch Seminar)
April 4 – May 14, 2009	Satie Airame	Luce Science Communication class
April 6 – 11, 2009	Kevin Lafferty, Andrew Dobson*, Mercedes Pascual*	Parasites and food webs ? the ultimate missing links (Working Group)
April 9, 2009	Stefano Allesina, NCEAS	*A prelude and three fugues on groups in ecological networks* (EcoLunch Seminar)
April 9 – 10, 2009	Mark Schildhauer	INTEROP: A Community-driven scientific observations network to achieve interoperability of environmental and ecological data (supported by NSF Ecoinformatics grants) (Working Group)
April 13 – 17, 2009	Elizabeth Crone*, Eric Menges*, Martha Ellis*	When are matrix models useful for management? An empirical test across plant populations (Working Group)
April 16, 2009	Mary O'Connor, NCEAS	*Linking physiological rates and community ecology: effects of temperature on dispersal and species interactions* (EcoLunch Seminar)
April 16 – 18, 2009	Alisa Hove, Robyn Clark, Gail Drus, Skip Forest, Carola Flores	Investigating the impact of integrating social variables into water quality research: A review and meta-analysis(Luce Fellows hosted by NCEAS) (Meeting)
April 23, 2009	Elizabeth Wolkovich, NCEAS	*Linking community and ecosystem ecology through detritus* (EcoLunch Seminar)
April 23, 2009	Margaret Connors, Sandy Andelman	Kids Do Ecology (Meeting)
April 27 – May 1, 2009	Erica Fleishman	Interactions between the near-coastal ocean and the San Francisco Estuary (Working Group)

* Non-UCSB personnel

April 28 – 30, 2009	Randall Peterman*	Monitoring responses of Pacific salmon to climate change (Supported by The Moore Foundation) (Working Group)
April 30, 2009	André M. de Roos, NCEAS & University of Amsterdam	(EcoLunch Seminar)
April 30 – May 1, 2009	William McClintock	MarineMap Development Group mtg
May 1 – 4, 2009	Boris Worm, Ray Hilborn	Finding common ground in marine conservation and management (Working Group)
May 4 – 7, 2009	Richard Norby*, Yiqi Luo*, Ram Oren*, I. Colin Prentice*, Paul Hanson*	Benchmarking ecosystem response models with experimental data from long-term CO_2 enrichment experiments (Working Group)
May 5 – 7, 2009	Erica Fleishman	Prediction of responses of wild Pacific salmon to climate change (Working Group)
May 7, 2009	Victoria Wittig, University of Illinois at Urbana-Champaign	*Impacts of rising carbon dioxide and tropospheric ozone on the growth and productivity of trees* (EcoLunch Seminar)
May 9 – 13, 2009	Daniel Doak*, James Estes*, J. Timothy Wootton*, Terrie Williams*	Conservation planning for ecosystem functioning: Testing predictions of ecological effectiveness for marine predators (EBM) (Working Group)
May 11, 2009	Lisa Stratton	Restoration Ecology Seminar
May 12 – 13, 2009	M. Rebecca Shaw*	Global climate change and adaptation of conservation priorities (Supported by The Nature Conservancy) (Working Group)
May 14, 2009	Lesley Lancaster, NCEAS	*Maternal effects as adaptations to correlational selection in a lizard AND The history of evolutionary diversification in and beyond the California flora* (EcoLunch Seminar)
May 19, 2009	Jennifer Thorsch	Kids in Nature Program
May 22, 2009	Chris Costello Steve Gaines	UCSB and The Nature Conservancy, California Collaboration
May 22, 2009	Jennifer Thorsch	Kids in Nature Program
May 26 – 27, 2009	Erica Fleishman	Evaluation of declines of pelagic organisms in the upper San Francisco Estuary (Meeting)
May 26 – 29, 2009	Jennifer Thorsch	Museum Assessment Program
May 28, 2009	Jonathan Levine, University of California, Santa Barbara	*The importance of niches for the maintenance of species diversity* (EcoLunch Seminar)
May 29, 2009	Jennifer Thorsch	Kids in Nature Program

* Non-UCSB personnel

June 1 – 3, 2009	Christopher Konrad*, Julian Olden*	Evaluating responses of freshwater ecosystems to experimental water management (Working Group)
June 3, 2009	Daniel Morse	Talk presented by Vaibhav Jain, Virginia Tech University
June 4, 2009	Sadie Ryan Simonovich, NCEAS	*The effects of contact structure, demography and movement on disease transmission within a primate metapopulation* (EcoLunch Seminar)
June 5, 2009	Daniel Reed	Santa Barbara Channel LTER undergraduate research
June 8 – 10, 2009	Christopher Costello	Limited-information fisheries management (Working Group)
June 10, 2009	Satie Airame	Luce fellows program meeting
June 11, 2009	Ted Bergstrom, University of California, Santa Barbara	*Economics of BioOne and other journal bundles* (EcoLunch Seminar)
June 19, 2009	Chris Costello	Sustainable Fisheries Project
June 30 – August 4, 2009	John Alroy, Charles Marshall*, Arnold Miller*	Paleobiology Database (Hosted by NCEAS) (Training Workshop)

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:

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, only a small amount 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, are not standardized 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, preservation, 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 deploy 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 capabilities by developing and distributing 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 and software development 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, have 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 depend on integrating data as diverse as climatological records, spatial distributions of organisms, 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 creating a single, fixed data schema, 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

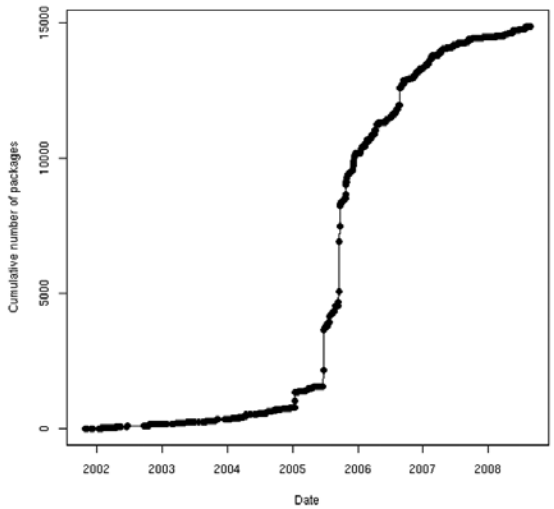


Figure 1: Cumulative number of data packages available from the Knowledge Network for Biocomplexity (KNB) over time. Each data package contains raw ecological data and descriptive documentation that supports proper interpretation and use of the data. Data are contributed from NCEAS, the LTER Network, PISCO, the Organization of Biological Field Stations (OBFS), the UC Natural Reserve System, and other groups representing more than 200 field stations nationally.

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).

In addition to the US collaborators, the EIC has been working with international partners in South Africa, Taiwan, Denmark, 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). A new version of Metacat has been written specifically with features that facilitate deployment in these new locations. The new sites will include research focused on both savanna and marine systems. These activities are supported by an award from the Andrew W. Mellon Foundation. This year has also seen us develop a new collaboration with the Global Biodiversity Information Facility (GBIF) to promote the distribution of data globally. GBIF has installed our Metacat system to manage metadata about museum specimen collections worldwide, and we are currently working out the details that would allow GBIF to become a full partner node in the KNB network. We have also begun a partnership with the National Biological Information Infrastructure (NBII) to improve the exchange of metadata and data in the US. Although the growth rate of the KNB has slowed in the past year, we expect these two new initiatives to massively increase the volume of the accessible data in the KNB in the coming year.

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 pioneered a new approach to analysis and modeling based on '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 released several beta versions of Kepler during 2007 and released the first full version of Kepler (1.0.0) in May 2008. Over 9000 scientists have downloaded Kepler 1.0.0 since its release. Kepler 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 UC Santa Barbara, UC Davis, UC San Diego, UC Berkley, University of New Mexico, and many others.

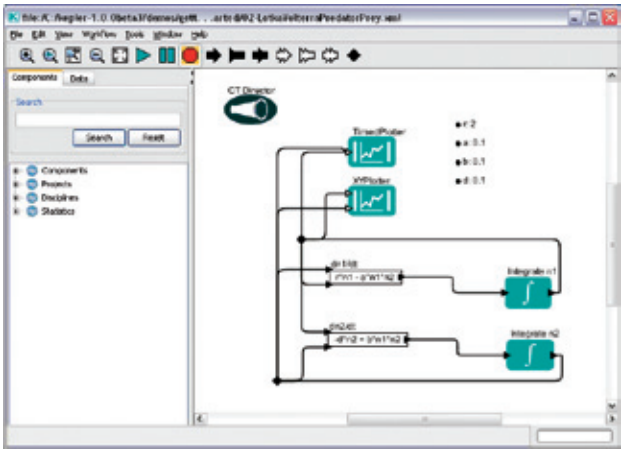


Figure 2: The Kepler scientific workflow system showing the Lotka-Volterra predator-prey model. Each component in a scientific workflow is an independent and re-usable analysis or modeling procedure. Kepler supports components written in many prominent analysis environments, such as R and Matlab, and is extensible to support new environments. Kepler workflows can be saved and shared among researchers to facilitate collaboration.

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 and three new awards in 2008 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, an 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.

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

Funding Source	**Year Funded**	**Description**	**Total** Award
NSF	2002	Science Environment for Ecological Knowledge (SEEK)	$12.05M
SanParks	2005	Analysis Tools for Thresholds of Potential Concern	$78K
SanParks	2005	Spatial Data extensions for Kruger National Park	$39K
NSF	2006	Management and Analysis of Environmental Observatory Data Using the Kepler Scientific Workflow System (REAP)	$2.75M
NSF	2007	A Workshop for Advancing a Unified Model for Observational Data in the Ecological and Environmental Sciences	$50K
Mellon	2007	Data Management and Analysis Tools Supporting Adaptive Management in South African Parks	$256K
Mellon	2007	Deploying Information Management Tools and Increasing Analytical Capabilities of Scientists	$400K
NSF	2007	Development of Kepler/CORE – A Comprehensive, Open, Reliable, and Extensible Scientific Workflow Infrastructure	$1.7M
NSF	2007	Faculty Institutes for Reforming Science Teaching (FIRST)	$132K
NSF	2008	Semantic Enhancements for Ecological Data Management	$599K
NSF	2008	Creation of an International Virtual Data Center for the Biodiversity, Ecological and Environmental Sciences (VDC)	$749K
NSF	2008	A Community-driven Scientific Observations Network to achieve Interoperability of Environmental and Ecological Data (SONet)	$750K

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

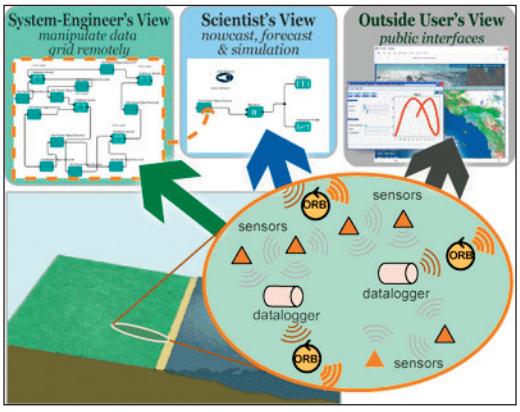


Figure 3: The REAP project uses the Kepler system to support a) sensor network management for system engineers, b) analysis and modeling using sensor data for scientists, and c) web-based data summarization targeting the public

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.

Kruger and SANParks. In addition to these projects that create software for basic research, the EIC obtained new Mellon Foundation support in 2007 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 tools 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.

This initial observational data workshop has led to two new awards in 2008 that focus on data semantics. The first, **SEMTOOLS,** focuses on the use of semantic web technologies in management and analysis of ecological data. In this project we are extending the Metacat and Morpho data management systems to be able to semantically annotate ecological data in order to improve both precision and recall in searching the KNB network. The second award, the **Semantic Observations Network (SONet),** is targeted at achieving community consensus on observational data semantics in order to create an internationally sanctioned observational data model and to engage environmental scientists in the process of creating sub-disciplinary extensions to this general model. We've started this work by convening a Task Group of the international Biodiversity Informatics Standards (TDWG) body that met in Freemantle, Australia in October 2008. This group will shepherd the standards ratification process for the data model produced by SONet.

Virtual Data Center (VDC) and DataNetONE. As the KNB network emphasizes the collation of ecological data, we have seen the need for a broader data repository that supports the diverse environmental data needs of synthetic research. In 2008 we are starting a new initiative to design a distributed and virtual data center that includes data from all environmental sciences. Collaborators from ecology, hydrology, atmospheric sciences, and ocean sciences will design a new data system that allows scientists from any environmental science discipline to easily access data from other disciplines. This new project is being conducted with collaborators from University of New Mexico, University of Kansas, the National Evolutionary Synthesis Center, and other environmental science disciplines. It has also led us to propose a new large scale data network based on the virtual data center concept. This new initiative is called the DataNet Observation Network for Earth (DataNetONE), and involves new collaborations with the digital library community. At UCSB, the DataNetONE project has allowed us to bring new collaborators into the EIC, including Larry Carver from the Davidson Library and Patricia Cruze and John Kunze from the California Digital Library. We expect both the VDC and DataNetONE initiatives to be major emphases of our work over the coming decade.

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 2008 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. We also will be increasing our emphasis on data networking through new data federation initiatives like DataNetONE and on data interoperability through our focus on semantic data integration projects.

EIC Software Systems

Ecological Metadata Language (EML). A standard for representing documentation about ecological and scientific data sets that is utilized broadly within the environmental sciences.

Morpho. A data and metadata management application designed to ease the process of preserving data for long term and collaborative use. Morpho creates metadata in EML format and can be used to contribute to the Knowledge Network for Biocomplexity via its link to Metacat.

Metacat. A metadata and data storage and search server that forms the backbone of the KNB network. Metacat is used throughout the US and internationally, and supports a variety of useful data and metadata management features.

Kepler. A scientific analysis and modeling tool that allows users to create, execute, preserve, and share analytical procedudes using a scientific workflow paradigm.

Peer-reviewed Publications

In press

Berkley C, Bowers S, Jones MB, Madin JS, Schildhauer M. (In press) Improving Data Discovery in Metadata Repositories through Semantic Search. Proceedings of iSEEK'09. IEEE Computer Society.

Wang J., Altintas I., Berkley C., and Jones M.B. (In press). A High-Level Distributed Execution Framework for Scientific Workflows. 3rd International Workshop on Scientific Workflows and Business Workflow Standards in e-Science (SWBES). Dec 10, 2008. IEEE Computer Society Press.

2008

Barseghian D., Altintas I., and Jones M.B. 2008. Accessing and using sensor data within the Kepler scientific workflow system. Pages 26-32 in Gries C. and Jones M.B. 2008 (editors). Proceedings of Environmental Information Management Conference 2008.

Bowers S., Madin J., and Schildhauer M. 2008. A Conceptual Modeling Framework for Expressing Observational Data Semantics. Lecture Notes in Computer Science 5231: 41–54.

Gries C. and Jones M.B. 2008 (editors). Proceedings of Environmental Information Management Conference 2008. 192 pp.

Leinfelder B., Tao J., Costa D., Jones M.B., Servilla M., O'Brien M., and Burt C. 2008. Using metadata for loading and querying heterogeneous scientific data. Pages 90-95 in Gries C. and Jones M.B. 2008 (editors). Proceedings of Environmental Information Management Conference 2008.

Madin J. S., Bowers S., Schildhauer M., and Jones M. B. 2008. Advancing ecological research with ontologies. Trends in Ecology and Evolution 23 (3): 159-168. doi:10.1016/j.tree.2007.11.007

2007

Jones, M B. 2007. Meta-information systems and ontologies A special feature from ISEI'06. Ecological Informatics 2 (3): 193-194. doi:10.1016/j.ecoinf.2007.09.003

Jones C, Blanchette C, Brooke M, Harris J, Jones M and Schildhauer M. 2007. A metadata-driven framework for generating field data entry interfaces in ecology. Ecological Informatics 2 (3): 270-278. doi:10.1016/j.ecoinf.2007.06.005

Madin, Joshua, Shawn Bowers, Mark Schildhauer, Serguei Krivov, Deana Pennington, and Ferdindo Villa. 2007. An ontology for describing and synthesizing ecological observation data. Ecological Informatics 2: 279-296.

Michener, William K., James H. Beach, Matthew B. Jones, Bertram Ludaescher, Deana D. Pennington, Ricardo S. Pereira, Arcot Rajasekar, and Mark Schildhauer. 2007. "A Knowledge Environment for the Biodiversity and Ecological Sciences", Journal of Intelligent Information Systems, 29(1): 111-126. Doi: 10.1007/s10844-006-0034-8

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.

2006

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.

2005

Berkley, Chad, Shawn Bowers, Matthew B. Jones, Bertram Ludaescher, Mark Schildhauer, Jing Tao. 2005. Incorporating Semantics in Scientific Workflow Authoring. 17th International Conference on Scientific and Statistical Database Management. IEEE Computer Society.

Cushing, Judith, Kristin Vanderbilt, James Brunt, Matt Jones, Amarnath Gupta, Peter McCartney. 2005. NSF Long Term Ecological Research Sites Praxis et Theoria – LTER Information Management & CS Research. 17th International Conference on Scientific and Statistical Database Management. IEEE Computer Society.

Fegraus E, SJ Andelman, MB Jones and M Schildhauer. 2005. Maximizing the Value of Ecological Data with Structured Metadata: An Introduction to Ecological Metadata Language (EML) and Principles for Metadata Creation. Bulletin of the Ecological Society of America. 86(3): 158-168.

Michener, W, Beach J, Bowers, S, Downey L, Jones M B, Ludaescher, B, Pennington D, Rajasekar A, Romanello S, Schildhauer M, Vieglais D, and Zhang J. 2005. Data Integration and Workflow Solutions for Ecology. Lecture Notes in Computer Science 3615: 321-324. doi: 10.1007/11530084_32

Michener, William, OJ Reichman, James Beach, Mathew Jones, Bertram Ludaescher, Arcot Rajasekar, Mark Schildhauer, Shawn Bowers, Deana Pennington, Samantha Romanello. 2005. Creating and Providing Data Management Services for the Biological and Ecological Sciences: Science Environment for Ecological Knowledge. 17th International Conference on Scientific and Statistical Database Management. IEEE Computer Society.

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.

One of the main goals of microbial oceanographers is to better understand microbial interactions with larger biogeochemical processes in the ocean. Traditionally, free-living oceanic bacterioplankton have been treated as a "black box" (i.e. all types of heterotrophic bacteria act the same way); however, this approach grossly oversimplifies microbial diversity and their associated processes. Professor Craig

Carlson and his students and colleagues have been actively breaking this black box apart to better understand how specific lineages of bacterioplankton respond to varying biogeochemical patterns in the sea. In their microbial observatory project, focused in the northwestern Sargasso Sea, they have been resolving time-varying trends of members of a major clade of heterotrophic bacterioplankton called SAR11. Recent advances in fluorescent in situ hybridization (FISH) coupled with terminal restriction fragment length polymorphism (T-RFLP) have allowed them to resolve the lineage specific dynamics of SAR11. These findings indicate that at least three of the subclades that comprise SAR11 have specific physiological adaptations that govern the dynamic transitions in time and over depth, indicating that these three SAR11 subclades represent separate SAR11 ecotypes.

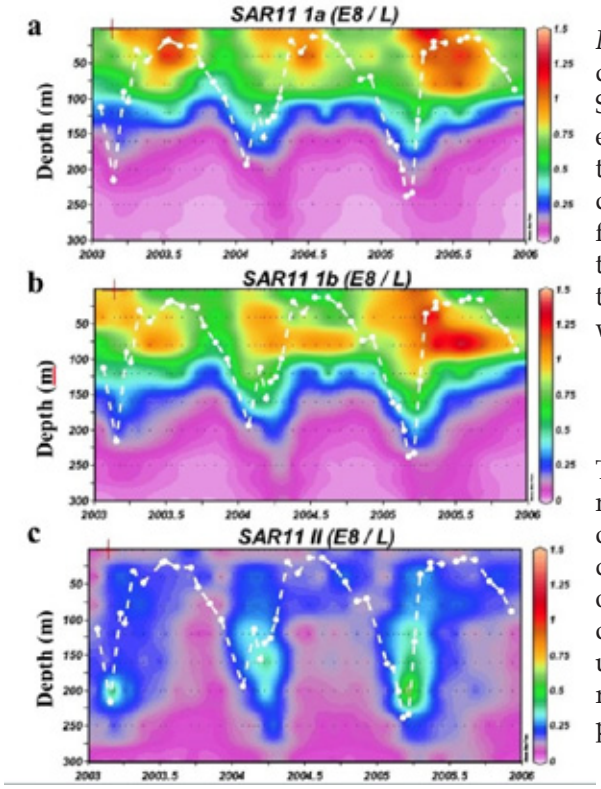


Figure at left. Contour plots of SAR11 ecotype cell densities in the surface 300 m in the northwestern Sargasso Sea from 2003 through 2005 for SAR11 ecotype Ia (a), Ib (b) and II (c). The data reported in this figure were modeled from the quantitative FISH data in combination with relative contribution data from T-RFLP patterns. White dashed line represents the dynamics of the mixed layer depth and is used to display the distribution patterns in the context of water column mixing and stratification.

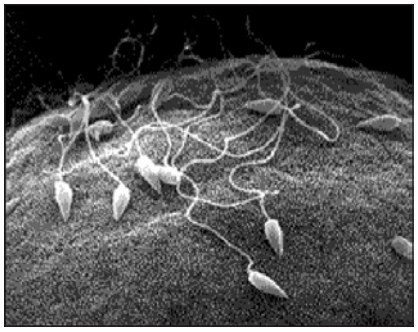
These studies are helping to reveal the influence of microorganisms on global biological and geochemical cycles, and are also providing the tools and baseline data necessary for realistically assessing the impacts of man-made and naturally occurring environmental change. In addition, the recognition of previously unrecognized marine biodiversity is providing a rich resource for new development of biotechnological products and processes.

Extending such efforts to macroscopic ocean flora and fauna, researchers at UCSB 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. These 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.

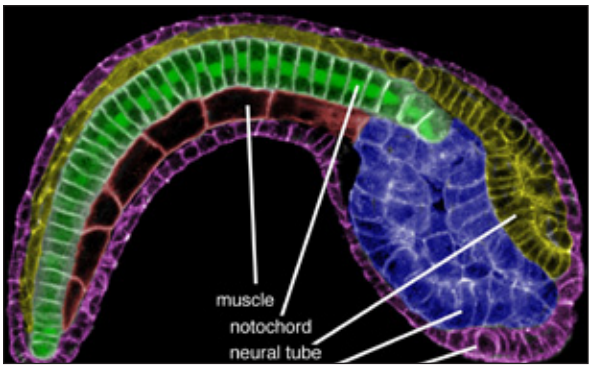
Research at UCSB in the development of new products and industries from marine resources has led to the discovery of promising new diagnostic and therapeutic agents for diseases including cancer, arthritis, epilepsy and Alzheimer's disease, and the development of powerful new enzyme catalysts, novel 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, cell cycle control, 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 that 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 the egg to embryo transition. Using a functional proteomics approach, over 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

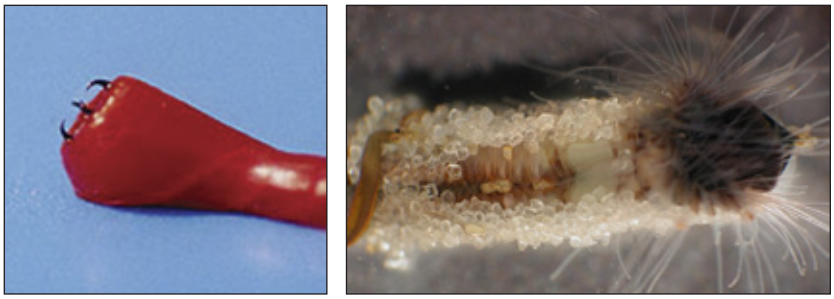


Major tissues of the Ciona tailbud stage embryo, showing the low cell number and simple tissue architecture (false color added for clarity).

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. Within the past year they have mapped one such mutation to a novel gene that is essential for development of the forebrain. This gene, a member of the DMRT family of transcription factors, is expressed from the earliest stages of central nervous system development. A similar gene is found in mammalian genomes, although its function has not been addressed. In a different area, the Smith lab has been collaborating with computer engineers at UCSB to develop advanced image analysis methods for capturing ascidian development in live embryos. The ascidian embryo because of its small size, cellular simplicity, and conserved morphogenesis with vertebrates, is ideal for capturing development in toto from a single living embryo (see figure). Our long-range goal is to fully characterize the range of cell-to-cell interactions, cellular migrations, and force-generating cellular shape-changes that convert the single-cell ascidian embryo into a swimming tadpole larva with 2000 cells.

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 the jaws of a marine worm, discovered to owe their hardness and self-sharpening performance to unique metal constituents (left). 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
July 1, 2008 – June 30, 2009

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 (http://www.nceas.ucsb.edu/) is associated with the Marine Science Institute and is located in downtown Santa Barbara. William Murdoch is NCEAS' Interim Director, Stephanie Hampton is the Deputy Director, and Mark Schildhauer is the Director of Computing.

The Science Advisory Board (SAB) of 19 eminent ecologists met September 3-4, 2008 and March 4-5, 2009 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 May 6-7, 2008.

Research activities focus on working groups, sabbatical fellows, postdoctoral associates, distributed graduate seminars and graduate student internships. During the 2008-2009 fiscal year, NCEAS hosted 11 meetings, 44 working group meetings, and 4 training workshops involving a total of 797 different scientists. In addition, the Center hosted 7 Sabbatical Fellows, 20 Postdoctoral Associates, 7 Center Associates, 13 graduate student interns, and 3 undergraduate interns.

NCEAS activities involve important topics in ecology and allied disciplines such as 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, sociology of scientific collaboration, 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.

Other partners have also supported NCEAS projects. The Moore Foundation has supported several aquatic conservation projects, such as the assessment of salmon response to climate change, assessing human impacts on the California Current marine ecosystem, and a Distributed Graduate Seminar related to reconciling divergent viewpoints of fisheries management. The Andrew W. Mellon Foundation continues to support the development and implementation of management and analysis tools supporting adaptive management in South African parks. The Nature Conservancy has supported Working Groups and a Distributed Graduate Seminar focused on non-native pests and pathogens. The Paul G. Allen Family Foundation has supported a project which focuses on sustainable fisheries. The U.S. Fish and Wildlife Service has provided funding to synthesize information related to the decline of endangered fisheries in the San Francisco Bay Estuary. NOAA Fisheries has supported a working group to address the need for generalizable approaches to detecting species-level responses to large-scale environment management actions. The California Coastal Conservancy has funded NCEAS and the California Ocean Protection Council to convene working groups to evaluate and synthesize methods for deriving the economic value of ecosystem services in coastal marine systems. The Henry Luce Foundation founded graduate fellowships at UCSB as part of a program called Environmental Science to Solutions, in which graduate students received training in leadership, communication and ecoinformatics.

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.

NCEAS encourages wide dissemination of Center-related findings by providing press releases and interviews to popular media outlets, by maintaining a news feature and archive on our website, and by providing media training for our scientists. NCEAS promotes interest in ecology and technology professions, particularly among underrepresented groups, provides outreach experiences to resident scientists, and fosters the inclusion of synthesis in ecology education.

NCEAS provides numerous training opportunities for K-12, graduate school, and professionals. These include a successful Kids do Ecology program and website, Distributed Graduate Seminars, and scientific computing/ecoinformatics workshops. The Center contributes culturally to the community through events such as the Science of Poetry presentation and cable TV program, and participation with Santa Barbara Educators' Roundtable <http://www.sbert.org/> events. The Center also hosted 39 Ecolunch seminars this past year. These seminars are presented by resident and visiting scientists, and are open to the scientific 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 Working Groups/Meetings/Training Workshops
July 1, 2008 – June 30, 2008

Date	Project Leaders	Topic
23 Jun 2008 – 28 Jul 2008	John Alroy, Charles Marshall, Arnold Miller	*Paleobiology Database (Hosted by NCEAS) (Training Workshop)*
17 JUL 2008 – 19 Jul 2008	Carlos Carroll, Erica Fleishman	*Landscape and population connectivity (Working Group)*
17 Jul 2008 – 17 Jul 2008	Timothy Beechie, Mary Ruckelshaus	*Resilience of Pacific salmon to climate change (Working Group)*
21 Jul 2008 – 25 Jul 2008	Peter Walsh	*Efficient wildlife disease control: From social network self-organization to optimal vaccination (Working Group)*
21 Jul 2008 – 23 Jul 2008	Matthew Jones, Mark Schildhauer	*SDCI NMI improvements: Development of Kepler CORE -- a comprehensive, open, robust, and extensive scientific workflow infrastructure (Working Group)*
29 Jul 2008 – 01 Aug 2008	Juliann Aukema, O. Reichman, Stephanie Hampton	*Economic impacts of non-native forest pests and pathogens in North America (TNC) (Working Group)*
27 Aug 2008 – 28 Aug 2008	Erica Fleishman, Susan Frankel	*Risk assessment for climate change and forest pathogens in western North America (Supported by the US Forest Service) (Working Group)*
02 Sep 2008 – 05 Sep 2008	Erica Fleishman	*Potential role of contaminants in declines of pelagic organisms in the Upper San Francisco Estuary, California (Working Group)*
08 Sep 2008 – 12 Sep 2008	Jonathan Shurin, Helmut Hillebrand, Daniel Gruner	*Comparing trophic structure across ecosystems (Extended) (Working Group)*
18 Sep 2008 – 19 Sep 2008	M. Rebecca Shaw	*Global climate change and adaptation of conservation priorities (Supported by The Nature conservancy) (Working Group)*
22 Sep 2008 – 26 Sep 2008	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)*
25 Sep 2008 – 27 Sep 2008	Patrick Christie, Richard Pollnac	*Governance feasibility of marine ecosystem-based management: A comparative analysis (EBM) (Supported by The packard Foundation) (Working Group)*

29 Sep 2008 – 03 Oct 2008	James Turner	*Effects of trade policy on management of non-native forest pests and pathogens (Supported by The Nature Conservancy) (Working Group)*
29 Sep 2008 – 03 Oct 2008	Kevin Lafferty, Andrew Dobson, Mercedes Pascual	*Parasites and food webs - the ultimate missing links (Working Group)*
01 Oct 2008 – 03 Oct 2008	Randall Peterman	*Monitoring responses of Pacific salmon to climate change (supported by The Moore Foundation) (Working Group)*
01 Oct 2008 – 31 Dec 2008	Robert Pavia, James Lindholm	*Distributed graduate seminar - the role of MPAs in ecosystem-based management: Examining the science and politics of an ocean conservation strategy (OT)*
06 Oct 2008 – 10 Oct 2008	Brian McGill, Rampal Etienne, Jessica Green	*Tools and fresh approaches for species abundance distributions (Working Group)*
06 Oct 2008 – 10 Oct 2008	Erica Fleishman	*Ecosystem analysis of pelagic organism declines in the Upper San Francisco Estuary (Working Group)*
11 Oct 2008 – 13 Oct 2008	Nicholas Gotelli, Robert Colwell, Carsten Rahbek	*Synthetic macroecological models of species diversity (Working Group)*
14 Oct 2008 – 16 Oct 2008	Erica Fleishman	*Prediction of responses of wild Pacific salmon to climate change (Working Group)*
14 Oct 2008 – 14 Oct 2008	Stephanie Hampton, Stefano Allesina	*Training Workshop on Genetic Algorithms (Training Workshop)*
17 Oct 2008 – 20 Oct 2008	Howard Cornell, Susan Harrison, Christy McCain	*The role of niche conservatism in producing biodiversity gradients (Working Group)*
20 Oct 2008 – 24 Oct 2008	John Drake, Bill Langford	*Machine learning for the environment (Working Group)*
27 Oct 2008 – 31 Oct 2008	Richard Norby, Yiqi Luo, Ram Oren, I. Colin Prentice, Paul Hanson	*Benchmarking ecosystem response models with experimental data from long-term CO2 enrichment experiments (Working Group)*
27 Oct 2008 – 29 Oct 2008	Erica Fleishman, Gary Tabor	*Climate change and conservation (WCS) (Working Group)*
03 Nov 2008 – 07 Nov 2008	Lauren Buckley, Michael Angilletta, Robert Holt, Joshua Tewksbury	*Mechanistic distribution models: Energetics, fitness, and population dynamics (Working Group)*
06 Nov 2008 – 07 Nov 2008	Erica Fleishman	*Valuation of marine ecosystem services (Working Group)*
10 Nov 2008 – 13 Nov 2008	Robert Costanza, Lisa Graumlich, Sander van der Leeuw	*Integrated history and future of people on Earth (IHOPE): Building a community data base and testing the resilience - sustainability hypothesis across scales (Working Group)*
10 Nov 2008 – 14 Nov 2008	Erica Fleishman	*Evaluation of declines of pelagic organisms in the upper San Francisco Estuary (Meeting)*

10 Nov 2008 – 21 Nov 2008	Chris Wilcox, C. Josh Donlan	*Exploring compensatory mitigation and markets as mechanisms for resolving fisheries bycatch: Biodiversity conservation conflicts (Working Group)*
11 Nov 2008 – 14 Nov 2008	Erica Fleishman	*Prediction of responses of wild Pacific salmon to climate change (Working Group)*
15 Nov 2008 – 19 Nov 2008	Helen Regan, Sahotra Sarkar	*Making decisions on complex environmental problems (Working Group)*
21 Nov 2008 – 22 Nov 2008	Stephanie Hampton	*CRMP Review Team Visit (Meeting)*
05 Dec 2008 – 05 Dec 2008	Margaret Connors, Sandy Andelman	*Kids Do Ecology (Meeting)*
08 Dec 2008 – 12 Dec 2008	Brian Enquist, Richard Condit, Robert Peet, Brad Boyle, Steven Dolins	*Developing an integrated botanical information network to investigate the ecological impacts of global climate change on plant biodiversity (Working Group)*
08 Dec 2008 – 12 Dec 2008	Erica Fleishman	*Interactions between the near-coastal ocean and the San Francisco Estuary (Working Group)*
10 Dec 2008 – 14 Dec 2008	Boris Worm, Ray Hilborn	*Finding common ground in marine conservation and management (Working Group)*
04 Jan 2009 – 07 Jan 2009	Stephanie Hampton, Dov Sax	*Assisted Migration (Hosted by NCEAS) (Meeting)*
07 Jan 2009 – 07 Jan 2009	Erica Fleishman, David Smith	*Conservation research fellows information meeting (Hosted by NCEAS) (Meeting)*
12 Jan 2009 – 16 Jan 2009	Aaron King, Pej Rohani	*Unifying approaches to statistical inference in ecology (Working Group)*
13 Jan 2009 – 15 Jan 2009	Matthew Jones, William Michener, Kathleen Smith	*INTEROP: Creation of an international virtual data center for the biodiversity, ecological and environmental sciences (Working Group)*
17 Jan 2009 – 21 Jan 2009	Jeannine Cavender-Bares, David Ackerly, J. Gordon Burleigh, Michelle Mack, Richard Ree, Peter Reich	*Linking phylogenetic history, plant traits, and ecological processes at multiple scales (Working Group)*
18 Jan 2009 – 21 Jan 2009	Evgeny Zilov, Marianne Moore, Stephanie Hampton	*The 60-year data set of plankton dynamics in Lake Baikal: Examining facets of the jewel of Siberia (Meeting)*
20 Jan 2009 – 23 Jan 2009	Cory Cleveland, Alan Townsend	*Revisiting nutrient limitation in tropical forests (Working Group)*
27 Jan 2009 – 29 Jan 2009	James Randerson, Josep Canadell, Robert Jackson	*Linking carbon storage in terrestrial ecosystems with other climate forcing agents: A synthesis allowing for effective carbon dioxide stabilization policies (WG)*
27 Jan 2009 – 28 Jan 2009	O. Reichman	*Open access publishing (Meeting)*

02 Feb 2009 – 05 Feb 2009	Erica Fleishman	*Potential role of contaminants in declines of pelagic organisms in the Upper San Francisco Estuary, California (Working Group)*
05 Feb 2009 – 06 Feb 2009	Erica Fleishman	*Valuation of marine ecosystem services (Working Group)*
06 Feb 2009 – 06 Feb 2009	Mark Schildhauer, Matthew Jones, Joshua Madin, Shawn Bowers, Steve Kelling, Larry Sugarbaker	*Towards a unified model for describing ecological and environmental observation data (Meeting)*
09 Feb 2009 – 13 Feb 2009	James Watson, Kristin Carden, Michael Marshall, Nada Petrovic, Frank Davenport, Lisa Max, Sara Hughes	*Adaptive capacity of human populations to coral reef fisheries dynamics (Luce Fellows hosted by NCEAS) (Meeting)*
10 Feb 2009 – 12 Feb 2009	Matthew Jones, William Michener, Kathleen Smith	*INTEROP: Creation of an international virtual data center for the biodiversity, ecological and environmental sciences (Working Group)*
17 Feb 2009 – 20 Feb 2009	Stephanie Hampton, Jim Regetz	*R training workshop (Training Workshop)*
17 Feb 2009 – 20 Feb 2009	Peter Walsh	*Efficient wildlife disease control: From social network self-organization to optimal vaccination (Working Group)*
24 Feb 2009 – 27 Feb 2009	Fred Allendorf, Michael Schwartz	*Genetic monitoring: Development of tools for conservation and management (Working Group)*
02 Mar 2009 – 05 Mar 2009	Reginald Archer, Elizabeth Hoaglund, Margaret Lynch, Lisa Needles, Steve Sadro	*Identifying successful management strategies for rebuilding collapsed fisheries (Luce Fellows hosted by NCEAS) (Meeting)*
05 Mar 2009 – 07 Mar 2009	Howard Cornell, Susan Harrison, Christy McCain	*The role of niche conservatism in producing biodiversity gradients (Working Group)*
09 Mar 2009 – 10 Mar 2009	Mark Schildhauer	*Public domain ADMB project (Training Workshop)*
11 Mar 2009 – 13 Mar 2009	Larry Crowder, Martin Smith	*Envisioning a Sustainable Global Seafood Market and Restored Marine Ecosystems (Working Group)*
11 Mar 2009 – 11 Mar 2009	Mark Schildhauer	*Public domain ADMB project (Meeting)*
18 Mar 2009 – 22 Mar 2009	Michael Rosenberg, Bryan Epperson, Andrew Storfer	*An Interdisciplinary Approach To Advancing Landscape Genetics (Working Group)*
19 Mar 2009 – 20 MAR 2009	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 (WG)*

23 Mar 2009 – 26 Mar 2009	Helene Wagner, Lisette Waits	*Developing Best Practices For Testing Landscape Effects on Gene Flow (Meeting)*
23 Mar 2009 – 27 Mar 2009	Juliann Aukema, O. Reichman, Stephanie Hampton	*Economic impacts of non-native forest pests and pathogens in North America (TNC) (Working Group)*
30 Mar 2009 – 01 Apr 2009	James Turner	*Effects of trade policy on management of non-native forest pests and pathogens (Supported by The Nature Conservancy) (Working Group)*
30 Mar 2009 – 03 Apr 2009	Erica Fleishman	*Ecosystem analysis of pelagic organism declines in the Upper San Francisco Estuary (Working Group)*
06 Apr 2009 – 11 Apr 2009	Kevin Lafferty, Andrew Dobson, Mercedes Pascual	*Parasites and food webs ? the ultimate missing links (Working Group)*
09 Apr 2009 – 10 Apr 2009	Mark Schildhauer	*INTEROP: A Community-driven scientific observations network to achieve interoperability of environmental and ecological data (supported by NSF Ecoinformatics grants) (Working Group)*
13 Apr 2009 – 17 Apr 2009	Elizabeth Crone, Eric Menges, Martha Ellis	*When are matrix models useful for management? An empirical test across plant populations (Working Group)*
16 Apr 2009 – 18 Apr 2009	Alisa Hove, Robyn Clark, Gail Drus, Skip Forest, Carola Flores	*Investigating the impact of integrating social variables into water quality research: A review and meta-analysis (Luce Fellows hosted by NCEAS) (Meeting)*
23 Apr 2009 – 23 Apr 2009	Margaret Connors, Sandy Andelman	*Kids Do Ecology (Meeting)*
27 Apr 2009 – 01 May 2009	Erica Fleishman	*Interactions between the near-coastal ocean and the San Francisco Estuary (Working Group)*
28 Apr 2009 – 30 Apr 2009	Randall Peterman	*Monitoring responses of Pacific salmon to climate change (Supported by The Morre Foundation) (Working Group)*
01 May 2009 – 04 May 2009	Boris Worm, Ray Hilborn	*Finding common ground in marine conservation and management (Working Group)*
04 May 2009 – 07 May 2009	Richard Norby, Yiqi Luo, Ram Oren, I. Colin Prentice, Paul Hanson	*Benchmarking ecosystem response models with experimental data from long-term CO2 enrichment experiments (Working Group)*
05 May 2009 – 07 May 2009	Erica Fleishman	*Prediction of responses of wild Pacific salmon to climate change (Working Group)*
09 May 2009 – 13 May 2009	Daniel Doak, James Estes, J. Timothy Wootton, Terrie Williams	*Conservation planning for ecosystem functioning: Testing predictions of ecological effectiveness for marine predators (EBM) (Working Group)*

12 May 2009 – 13 May 2009	M. Rebecca Shaw	*Global climate change and adaptation of conservation priorities (Supported by The Nature Conservancy) (Working Group)*
26 May 2009 – 27 May 2009	Erica Fleishman	*Evaluation of declines of pelagic organisms in the upper San Francisco Estuary (Meeting)*
01 Jun 2009 – 03 Jun 2009	Christopher Konrad, Julian Olden	*Evaluating responses of freshwater ecosystems to experimental water management (Working Group)*
08 Jun 2009 – 10 Jun 2009	Christopher Costello	*Limited-information fisheries management (Working Group)*
30 Jun 2009 – 04 Aug 2009	John Alroy, Charles Marshall, Arnold Miller	*Paleobiology Database (Hosted by NCEAS) (Training Workshop)*

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 public 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. Access to the reserves is restricted to preserve their natural resources and provide security for long-term research and education projects.

- **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). The reserve is a part of the 230-acre Carpinteria Salt Marsh, one of the largest remaining coastal wetland habitats in southern California.

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. It provides critical habitat for a number of endangered species including the Western Snowy Plover. 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 coast just south of Cambria. This 500 acre reserve offers access to offshore giant kelp forests, as well as a very diverse rocky shore. Important terrestrial natural resources include coastal terrace grassland and soft chaparral plant communities. The reserve contains the southern-most remnant of indigenous Monterey pine forest. Overnight facilities are available for research groups and university classes.

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

- **Santa Cruz Island Reserve,** located 24 miles offshore from Santa Barbara, comprises 46,020 acres

of the largest and most topographically diverse of Southern California's offshore islands. Two thirds of the island is owned by The Nature Conservancy and remainder is part of the National Park Service. The island is used by the Natural Reserve System for research and environmental education under a long-term license agreement. The reserve field station is located in the center of the island and provides housing, laboratories, collections, information, a GIS database, and transportation to support research and teaching on and around Santa Cruz Island and neighboring islands in the Channel Island chain.

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. The reserve has active K-12 science education and public outreach programs in addition to supporting research and university instruction.

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

- **The Valentine Eastern Sierra Reserve** is composed of two reserve 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. The reserve supports a well-attended public lecture series in the spring and early summer.

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. The reserve has a very active K-12 outreach program during the summer.

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 analab.msi.ucsb.edu for more information.

MSI Education and Outreach

This year has seen continued growth and development in MSI's Education and Outreach Programs. The REEF continues it's support of science education, both on and off campus, to over 15,000 children and adults (Figure 1). The Mobile REEF Program, now entering it's third year, has taken marine science and environmental education into the classrooms of over 5,100 G4-8 students and the general public at outreach events. This has been accomplished through the continued development of collaborations with a number of campus departments and local, state and national organizations and institutions, including the Office of Academic Preparation, Cheadle Center for Biodiverstiy and Ecological Restoration (CCBER), the Channel Islands National Marine Sanctuary (CINMS), and the National Science Foundation.

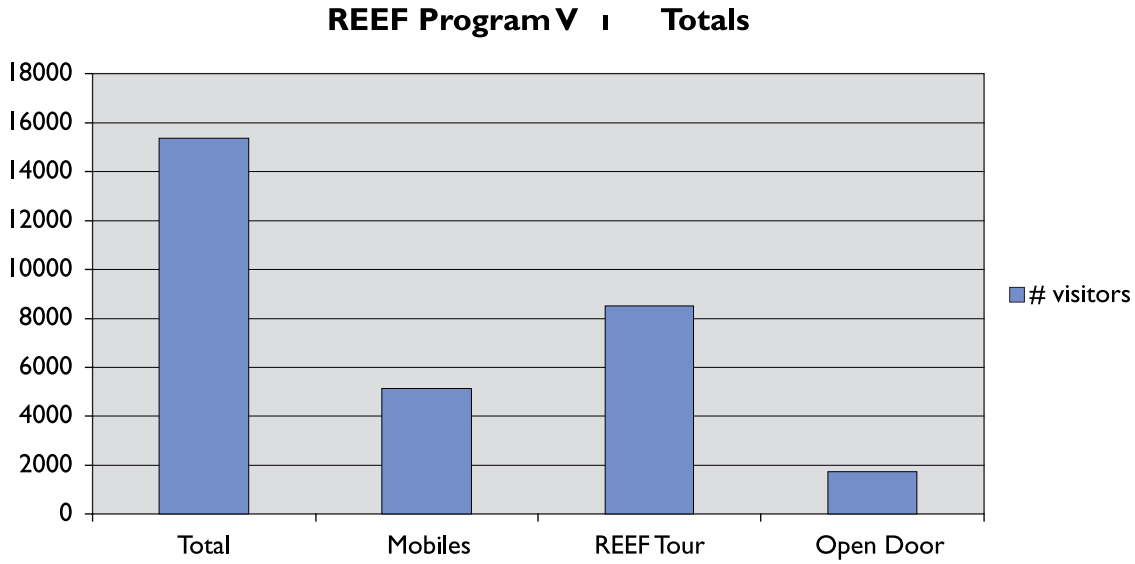


Figure 1. Graph of total number of participants served through MSI Education and Outreach at the REEF.

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 King City in Monterey Co., to San Diego in southern California, and as far east as Las Vegas, Nevada! This year over 3,100 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.

REEF visits by Category	# visitors	# groups
Schools	3149	124
On Campus	1923	78
Outreach	2529	89
UCSB Course	820	36
Other Colleges	70	3
Total	8491	330

Table 1. Number of REEF visits/visitors by category

During the 2007/2008 academic year, The REEF once again supported international programs, including middle school students from Taiwan as part of the Yuan-Lin Cultural Exchange Program, students from Croatia and Engineering Graduate students from Osaka University, Japan

Other 2007/2008 collaborations include::

- Continued collaboration and development with the NOAA Channel Islands National Marine Sanctuary (CINMS) on the development of the Outreach Center for Teaching Ocean Sciences (OCTOS), a new, state –of-the-art, marine science education facility. As well as, the continued implementation LiMPETS Monitoring site at Campus Point that supports 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 Santa Barbara and Goleta Valley Junior Hisgh Schools to bring 20 under-represented middle school students 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.

Awards Administered

Awards Administered

Applied Science Associates, Inc.

I. Leifer A Literature Review of Seep Research	10/13/2008-9/30/2009	$7,984
	Applied Science Associates, Inc. Subtotal	**$7,984**

Cal Department of Parks and Recreation

J. Dugan, H. Page Evaluating Approaches to Enhancing Prey Resources for Nesting Shorebirds on Sandy Beaches	2/27/2008-12/31/2010	$49,954
	California Department of Parks and Recreation Subtotal	**$49,954**

Cal Dept of Water Resources

D. Herbst Characterization of Benthic Communities and Instream Physical Habitat in the San Lorenzo River Watershed	3/31/2008-12/31/2010	$40,000
	Cal Dept of Water Resources Subtotal	**$40,000**

California Coastal Commission

J. Dugan Evaluating Status and Trends in California's Sandy Beach Ecosystems	5/1/2009-4/30/2011	$37,500
	California Coastal Commission	**$37,500**

California State Lands Commission

I. Leifer UCSB Coal Oil Point Seep Studies	4/1/2006-9/30/2010	$30,000
	California State Lands Commission Subtotal	**$30,000**

California State Library

J. Thorsch The Katherine Esau Digital Archive of Plant Anatomy	7/18/2008-8/30/2009	$33,572
	California State Library Subtotal	**$33,572**

Clark County, Nevada

T. Dudley For Effectiveness Monitoring of Spring-fed Wetlands and Riparian Restoration Treatments	12/16/2008-5/1/2011	$899,959
	Clark County, Nevada Subtotal	**$899,959**

Colorado State University

A. Whitmer	10/1/2008-9/30/2009	$419,381
MSP: Culturally Relevant Ecology, Learning Progressions, and Environmental Literacy		
Colorado State University Subtotal		**$419,381**

COM - National Oceanic & Atmospheric Administration

J. Caselle	9/11/2008-8/31/2009	$34,226
Maintenance of PISCO-CINMS Moorings in the Channel Islands National Marine Sanctuary		
COM - National Oceanic & Atmospheric Administration Subtotal		**$34,226**

Conservation and Research Foundation

D. Greenberg, S. Mazer	1/1/2009-12/31/2009	$5,000
Sustainable Agriculture along a Protected Forest Edge in Thailand: Promoting Ecosystem Services to Motivate Forest Conservation in Rural Communities		
Conservation and Research Foundation Subtotal		**$5,000**

David and Lucile Packard Foundation

J. Levine	10/21/2004-10/20/2009	$50,000
Development and Application of Scientific Knowledge to Ecosystem-Based Management of Coastal Marine Systems		
David and Lucile Packard Foundation Subtotal		**$50,000**

Foundation for Research Science and Technology

N. Shears, S. Gaines	10/1/2006-9/30/2009	$13,270
	10/1/2006-12/31/2009	$66,532
The Effect of Marine Reserves on Recruitment, Exploited Species and Fishing		
Foundation for Research Science and Technology Subtotal		**$79,802**

Heal the Ocean, Inc.

D. Greenberg, S. Mazer	3/1/2009-12/31/2010	$15,665
Spatial Patterns of Wastewater Discharge and Coastal Pollution in California		
Heal the Ocean, Inc. Subtotal		**$15,665**

Kern Community Foundation

D. Herbst	6/1/2008-12/31/2009	$18,270
Aquatic Restoration in Upper Kern River of Sequoia National Park		
Kern Community Foundation Subtotal		**$18,270**

Los Angeles Department of Power and Water

R. Jellison	10/1/2008-7/31/2009	$100,000
Monitoring of Limnology and Plankton in Mono Lake		
Los Angeles Dept. of Power & Water Subtotal		**$100,000**

Marisla Foundation (frmly Homeland Foundation)

J. Caselle, S. Gaines	6/26/2008-6/26/2011	$200,000
Coral Reef Research in a Rare, Undisturbed Ecosystem: UCSB and Palmyra Atoll		
	Marisla Foundation Subtotal	**$200,000**

Mineral Science Company, Inc.

D. Valentine	6/23/2008-10/31/2009	$7,500
		6,672
		5,000
Cesium Chloride as a Bacterial Inhibitor		7,244
	Mineral Science Company, Inc. Subtotal	**$26,416**

National Aeronautics and Space Administration

I. Leifer, D. Roberts, B. Luyendyk	12/1/2006-11/30/2010	$173,612
Remote-Sensing Methane Emissions: Field-Validation with Seepage from Marine, Urban, and Submerged City Sources		
S. Stammerjohn, R. Ross, L. Quetin	5/1/2008-4/30/2013	$215,502
Improving Current Assessments and Future Predictions of Carbon Fluxes in the Southern Ocean as Mediated by the Dynamical Response of Ice-Ocean-Ecosystem Interactions to Climate Change		
	National Aeronautics and Space Administration Subtotal	**$389,114**

National Science Foundation

S. Andelman	9/1/2005-8/31/2009	$100,000
RCN: Biodiversity Conservation in Dynamic Landscapes \(BCDL\) Network		
C. Briggs, R. Knapp	6/17/2007-8/31/2010	$546,382
		14,000
		19,575
Collaborative Research: After the Crash: Factors Allowing Host Persistence Following Outbreaks of a Highly Virulent Disease		
B. Cardinale	10/1/2006-6/30/2010	$7,000
		45,000
Effects of Algal Diversity on the Productivity of Streams: Does Diversity Play a Greater Role in Variable vs Constant		
B. Cardinale	3/1/2009-2/28/2013	$389,496
Collaborative Research: Does Productivity Drive Diversity or Vice Versa? Empirical and Theoretical Investigations of the Multivariate Productivity-Diversity Hypothesis in Streams		
C. Carlson	8/15/2008-7/31/2013	$803,765
MO: Collaborative Research: Transitions in the Surface Layer and the Role of Vertically Stratified Microbial Communities in the Carbon Cycle- An Oceanic Microbial Observatory		
C. Carlson, M. Brzezinski	4/1/2009-3/31/2012	$689,579
Mechanisms Controlling the Production and Fate of DOM During Diatom Blooms		
G. Hofmann	12/15/2004-12/31/2009	$15,000
Finding the Genes That Matter: Profiling Gene Expression in Stronglocentrotid Sea Urchins with Different Biogeographic and Temperature Distributions		
G. Hofmann	5/31/2009*4/30/2010	$19,619
A Proposal for a Workshop on Global Environmental Change & Biological Evolution in the Ocean		
M B. Jones, M. Schildhauer,	8/1/2008-7/31/2011	$599,999

Madin, M. O'Brien		
Semantic Enhancements for Ecological Data Management		
J. Kennett	9/15/2008-8/31/2009	$151,994
Collaborative Research: Co-Evolution of Submillennial and Orbital Scale Climate and Ocean Behavior During the Last 700 kyrs: The Unique Santa Barbara Basin Record		
D. Lea	9/1/2006-8/31/2010	$3,574
Collaborative Research: Establishment of a Climate Type-Section for the Tropical Atlantic from Cariaco Basin Sediments		
J. Levine	3/15/2008-2/28/2010	$104,277
		7,550
Collaborative Research: Niches, Neutral Controls Over the Coexistence of California Serpentine Annual Plants		
S. MacIntyre	4/1/2008-3/31/2010	$49,999
	4/1/2008-3/31/2009	$6,932
Turbulent Mixing, Internal Waves, and Intrusions: Temporal and Spatial Variability of Resource Supply and Metabolic Activity in Lakes		
W. W. Murdoch, S. Hampton	10/1/2006-9/30/2011	$3,891,522
NCEAS: National Center for Ecological Analysis and Synthesis		
R. Nisbet	9/1/2007-8/31/2009	$137,000
QEIB: Modeling Disturbances in Systems with Unidirectional Flow		
T. Oakley	4/1/2007-3/31/2010	$120,000
		7,500
CAREER: Exploring Congruence of Fossil and Molecular Estimates of Macroevolutionary Divergence Times in Ostracoda (Crustacea)		
D. Pak	9/1/2008-8/31/2011	$90,915
Collaborative Research: An Ultra-High Resolution, Multiproxy Study of the Past 2,000 Years of Climate Change in Southern California		
D. Reed, S. Gaines, J. Melack,	12/1/2006-11/30/2009	$820,000
D. Siegel, S. Holbrook		169,546
LTER: Land/Ocean Interactions and the Dynamics of Kelp Forest Communities		
O. Reichman, J. Orrock	3/1/2005-2/28/2011	$84,846
CRB: The Role of Apparent Competition and Patch Geometry in Mediating the Invasion and Restoration of Grassland Communities		
M. Schildhauer	8/1/2008-7/31/2009	$250,000
INTEROP: A Community-Driven Scientific Observations Network to Achieve Interoperability of Environmental and Ecological Data		
J. Schimel	9/1/2008-8/31/2012	$254,239
Collaborative Research: Spatial and Temporal Influences of Thermokarst Features on Surface Processes in Arctic Landscapes		
R. Schmitt, S. Holbrook	9/1/2004-8/31/2010	$18,000
		820,004
		58,700
		15,300
		19,150
		230,580
		74,000
		10,000
LTER: Long-Term Dynamics of a Coral Reef Ecosystem		
R. Schmitt, S. Holbrook	7/1/2009-6/30/2010	$150,000
RAPID: Resilience of Coral Reef Ecosystems		
D. Valentine	4/1/2008-3/31/2009	$128,043
	4/1/2007-3/31/2010	$7,970
	7/1/2008-3/31/2009	$7,875

CAREER: Microbial Geochemistry of Natural Marine Gas Seeps - A Research and Education Plan

D. Valentine	9/1/2006-8/31/2010	$13,500

MIP: Interactions between Archaea, Bacteria and their Viruses in the Anoxic Sediments of a Modern Evaporative Basin: Salton Sea, CA

D. Valentine	4/15/2008-3/31/2010	$111,874
		6,750

CAREER: Microbial Geochemistry of Natural Marine Gas Seeps-A Research and Education Plan

National Science Foundation Subtotal	**$10,927,167**

National Academy of Science

M. Heintz	11/1/2008-11/1/09	$20,000

Biological Control on the Flux of Methane from Marine Hydrates to the Atmosphere: A Research Plan

National Academy of Sciences Subtotal	**$20,000**

National Academy of Health

J.H. Waite	8/4/2008-6/30/2010	$450,452
Translating Mussel Adhesion		427,789
National Academy of Sciences Subtotal		**$878,241**

Oregon State University

S. Gaines, R. Warner,	1/1/2005-12/31/2009	$569,360
L. Washburn, G. Hofmann		$547,033

Partnership for Interdisciplinary Studies of Coastal Oceans (PISCO)

Oregon State University Subtotal	**$1, 116,393**

Resources Legacy Fund Foundation

S. Airame, S. Gaines	8/1/2008-6/30/2009	$29,613

Communicating the First Five Years of Monitoring Channel Islands Marine Protected Areas

C. Costello	1/1/2009-12/21/2009	$65,000

Model Development for Marine Life Protection Act

W. McClintock, S. Gaines	7/1/2008-1/31/2010	$75,000

The California Marine Life Protection Act Decision Support System: Recommendations for Development and Maintenance for the North Central Coast Study Region

W. McClintock, S. Gaines	7/1/2008-6/30/2009	$170,000

MarineMap Decision Support System

W. McClintock, S. Gaines	9/1/2008-12/31/2010	$270,700

MarineMap Decision Support System

W. McClintock, S. Gaines	10/1/2008-12/31/2009	$811,205

MarineMap Decision Support System

Resources Legacy Fund Foundation Subtotal	**$1,421,518**

San Francisco Estuary Institute

T. Dudley	4/15/2008-2/15/2009	$2,087

Ventura County Historical Ecological Study

San Francisco Estuary Institute Subtotal	**$2,087**

San Jose State University Foundation

D. Herbst	8/1/2008-3/31/2009	$47,500
Surface Water Ambient Monitoring Program (SWAMP) and TMDLs in the San Lorenzo River		
	San Jose State University Foundation Subtotal	**$47,500**

Santa Barbara Air Pollution Control District

J. Caselle	1/16/09-1/15/2012	$22,900
Repower the R/V Cormorant		
	Santa Barbara Air Pollution Control District Subtotal	**$22,900**

Smithsonian Tropical Research Institute

D. Greenberg, S. Mazer	10/1/2008-3/31/2009	$8,000
Surface Flow, Solar Radiation, and Tree Distributions: Can We Untangle the Effects of Water and Light on Tropical Forest Community Structure?		
	Smithsonian Tropical Research Institute Subtotal	**$8,000**

Society for Conservation Biology

A. Salomon, S. Gaines	3/1/2008-2/28/2010	$85,022
Forecasting the Ecosystem-Level Effects of Marine Reserves to Inform Ecosystem-Based Management		
	Society for Conservation Biology Subtotal	**$85,022**

Souther California Coastal Water Research Project

E. Stratton	3/1/2008-2/28/2010	$22,500
Technical Assistance for Bight'08 Coastal Wetlands Eutrophication Assessment		
	Southern California Coastal Water Research Project Subtotal	**$22,500**

SRS Technologies

C. Briggs	5/1/2008-9/30/2008	$9,999
Detection and Quantification of Batrachochytrium dendrobatidis in Amphibians at Vandenberg Air Force Base		
	SRS Technologies Subtotal	**$9,999**

Texas A&M University

I. Leifer	10/1/2008-9/30/2009	$50,269
Remote Sensing and Sea-Truth Measurements of Methane Flux to the Atmosphere from Near-Surface Gas Hydrates in Continental Margins		
	Texas A&M University Subtotal	**$50,269**

The New Media Studios

C. Blanchette, A. Whitmer	20/1/2005-1/31/2010	$38,593
		5,000
Adding Ocean Science Content and Embedded Assessment Tool Capabilities to the Satellite Observations in Science Education (SOSE) REASoN Project		
	The New Media Studios Subtotal	**$20,000**

UC Biotechnology Research & Education Program (BREP)

J.H. Waite	7/1/2007-6/30/2009	$50,000
Self-Healing Bio-Inspired Polymers: Structure and Mechanics		
UC Biotechnology Research & Education Program Subtotal		**$50,000**

UC Davis

M. Jones, M. Schildhauer	9/1/2007-8/31/2010	$270,000
SDCI NMI Improvement: Development of Kepler CORE - A Comprehensive, Open, Robust, and Extensive Scientific Workflow Infrastructure		
UC Davis Subtotal		**$270,000**

UC MEXUS

I. Leifer	10/1/2008-3/31/2010	$32,144
Passive Acoustic Observations of Marine Seabed Bubbles		
UC MEXUS Subtotal		**$32,144**

UC Office of the President

G. Hofmann, P. Matson	7/1/2008-6/30/2009	$2,092
The Importance of Source Populations: Does Maternal Temperature and Nutrition Influence the Larval Stress Response in the Red Sea Urchin?		
G. Hofmann, E. Hoaglund	7/1/2008-6/30/2009	$32,092 $2,475
Illuminating Pathways: A New Method in Understanding the Movement of Marine Larvae		
D. Pak	7/1/2008-8/31/2010	$64,607
Acidification of California Coastal Waters: The Geological Record of Natural and Anthropogenic pH Variability		
UC Office of the President Subtotal		**$101,266**

UC San Diego

L. Washburn, M. Brzezinski	7/1/2008-6/30/2009	$41,570
Southern California Regional Coastal Ocean Observing System: Surface Current Mapping, Harmful Algal Bloom, and Sub-Surface Water Sections		
UC San Diego Subtotal		**$41,570**

UC Sea Grant

T. Dudley	11/1/200/-10/31/2009	$87,505 31,122
Development of Biological Control for the New Zealand Mud Snail		
J. Dugan, A. Wenner	2/1/2009-1/31/2010	56,861
Beaches as Threatened Ecosystems: An Evaluation of Status and Trends in the Ecology of California's Sandy Beaches		
J. Goddard	12/1/2008-11/30/2009	$11,339
Long-Term Faunal Changes in California Nudibranchs: Climate Change and Local Ocean Health		
UC Sea Grant Subtotal		**$228,397**

University of Mississippi

I. Leifer	8/1/2008-7/31/2009	$30,881
Spatio-Temporal Measurement of Seep Emissions by Multibeam Sonar		
	University of Mississippi Subtotal	**$30,881**

University of Nebraska

D. Wilson	6/1/2009-5/31/2010	$85,451
Modeling Antarctic Paleotopography		
	University of Nebraska Subtotal	**$85,451**

University of New Mexico

M.B. Jones	2/1/2007-1/31/2008	$45,366
INTEROP: Creation of an International Virtual Data Center for the Biodiversity, Ecological and Environmental Sciences		
	University of New Mexico Subtotal	**$45,366**

University of Washington

W. Rice	4/1/2008-5/31/2009	$136,350
Drosophila Seminal Fluid: Proteomic Discovery and Functional Variation Analyses		
	University of New Mexico Subtotal	**$45,366**

USDA Forest Service

E. Fleishman	7/1/2008-12/31/2009	$13,295
A Risk Assessment for Climate Change and Forest Pathogens in Western North America		
E. Fleishman	3/9/2009/9/30/2011	$73,751
Applying Population Ecology to Strategies for Eradicating Invasive Forest Insects		
D. Herbst	9/1/2008-6/30/2011	$100,000
Monitoring of Sentinel Aquatic Management Indicator Species Sites to Account for the Influence of Global Climate Change on Stream Reference Condition		
	US Department of Agriculture, Forest Service Subtotal	**$187,046**

US Department of Commerce, NOAA

J. Caselle	9/11/2008-8/31/2009	$34,226
Maintenance of PISCO-CINMS Moorings in the Channel Islands National Marine Sanctuary		
	US Department of Commerce, NOAA Subtotal	**$34,226**

US Department of the Army

D. Morse	7/1/2006-12/31/2009	$120,000
Biomolecular Mechanism, Cloning, Sequencing and Analysis of Adaptive Reflectin cDNAs and Proteins from Squid		
	US Department of the Army Subtotal	**$120,000**

US Department of Energy

D. Valentine	10/1/2008-09/30/2009	$210,461
Assessing the Efficacy of the Aerobic Methanotrophic Biofilter in Methane Hydrate Environments		
	US Department of Energy Subtotal	**$210,461**

USDI Bureau of Land Management

D. Herbst	9/3/200/-9/30/2012	$20,000
Quantitative Survey of Invertebrate Populations, Physical Habitat Characteristics and Water Chemistry in Rough Creek, Bodie Creek and Tributaries, Bodie Hills, Mono County, CA		
	USDI Bureau of Land Management Subtotal	**$20,000**

USDI Fish & Wildlife Service

T. Dudley, K. Lafferty, A. Kuris	10/17/2007-10/31/2012	$10,500 36,000
Development of Biological Control for the New Zealand Mud Snail		
D. Herbst	8/25/2008-9/30/2013	$19,090 19,090
Monitoring Aquatic Ecosystem Indicators of Spring Restoration on the Sheldon National Wildlife Refuge: Feral Horse Grazing Exclosures		
R. Jellison, D. Herbst	4/1/2009-3/31/2010	$175,173
Assess Responses of Lahontan Cutthroat Trout Prey Items to Changing Hydrological Regimes and Salinty in Walker Lake, Nevada		
S. Mazer	10/6/2008-10/6/2009	$40,000
Connecting People with Nature Through Integration of Climate Change Research and Education		
	USDI Fish & Wildlife Service Subtotal	**$299,853**

USDI Geological Survey

R. Hechinger, A. Kuris	9/19/2008-9/30/2009	$76,763
Status and Potential Distribution of the Invasive New Zealand Mudsnail Aboard Marine Corps Base Camp Pendleton		
J. Kennett	9/16/2008-9/14/2009	$11,938
Record of Abrupt Climate Change in the Santa Barbara Basin		
M. Love	9/16/2008-9/14/2009	$32,236
Comparison of Levels and Profiles of Polycyclic Aromatic Hydrocarbon Metabolites in Bile of Fishes from Off-Shore Oil Platforms and Natural Reefs Along the California Coast		
M. Love	6/1/2008-3/31/2010	$55,000
Arctic Marine Fish Ecology Catalog		
	USDI - Geological Survey Subtotal	**$175,937**

USDI - Minerals Management Service

M. Love	8/22/2007-8/31/2010	$90,000
Continuation of Fish Assemblages Associated with Platforms and Natural Reefs in Areas Where Data are Non-Existent or Limited		
	USDI - Minerals Management Service Subtotal	**$90,00**

Research Summaries
(Contracts/Grants Administered)
July 2008 – June 2009

Satie Airame **8/1/2007-7/31/2008** **20,000**
Gordon and Betty Moore Foundation, 1600

Marine Protected Area (MPA) Monitoring Group: Analysis and Synthesis of Data From 5 Years of Monitoring MPAs in the Channel Islands

Marine Protected Areas (MPAs) were established in the Channel Islands in 2003 to monitor various ecological and socioeconomic variables in this region. To assist the California Department of Fish and Game with preparation of a technical report to summarize results from the first five years of monitoring MPAs in the Channel Islands, UCSB hosted a series of meetings at the National Center for Ecological Analysis and Synthesis (NCEAS). These meetings were designed to promote collaboration and discussion among scientists with complementary data, and to motivate the analysis and synthesis of data in a timely manner. Specific priorities focused on changes in abundance, size, biomass and spawning biomass of species likely to benefit from MPAs; changes in species composition as it relates to ecosystem function; the amount of spillover for fish and invertebrates from MPAs to surrounding areas; and changes in catch per unit effort (CPUE) and total catch. Scientists were encouraged to evaluate habitat changes as they relate to physical alteration (e.g., trawling) and secondary impacts of biological community changes (e.g., habitat forming algae); and to evaluate the distribution of vessels and compliance. The final meeting provided an opportunity for scientists to present their conclusions from data analysis and to receive feedback from other participants.

Satie Airame **3/1/2008-12/31/2008** **18,500**
Steven Gaines
Seaweb, SB080121

Spanish Translation of the Science of Marine Reserves Booklet

The Principal Investigators will assemble a team to produce an updated Spanish translation of the U.S. version of the *Science of Marine Reserves* booklet. The team will consist of a Translator and a Graphic Designer. The PIs will establish a timeline, supervise the translation and graphic design, and oversee printing and distribution of the booklet. A prior Spanish translation of the booklet was limited to Latin American and Caribbean case studies. The current translation will incorporate Spanish translations of four U.S. case studies from the second edition of the *Science of Marine Reserves*, including translations of the graphics.

Satie Airame **8/1/08-6/30/09** **29,613**
Resources Legacy Fund Foundation, 2008-0226

Communicating the First Five Years of Monitoring Channel Islands Marine Protected Areas

This project will develop a 20-page science-based educational booklet about the first five years of monitoring the Channel Islands marine protected areas (MPAs). The primary purpose of the booklet is to meet the need for information for the California Fish and Game Commission's five-year review. This information will also be necessary for education and outreach in southern California, as the state begins the public process to design a network of marine reserves in southern California under the Marine Life Protection Act. It is expected that the booklet will be widely disseminated to many places throughout the world where MPAs are used as management tools. It will include key findings from monitoring related to six priorities: changes in abundance, size, biomass and spawning biomass of species likely to benefit from MPAs; changes in species composition as it relates to ecosystem function; habitat changes as they relate to physical alteration and secondary impacts of biological community changes; amount of spillover for fish and invertebrates from MPAs to surrounding areas; changes in catch per unit effort and total catch; and distribution of vessels and compliance.

Satie Airame **6/18/2008-3/19/2009** **23,240**
Steven Gaines
Oregon State University F0570A-A

Effectively Communicating the Science of Marine Reserves to a Global Audience

During the first year of this grant, the PIs will oversee the development of a global electronic communication approach to enable audiences around the world to access geospatial information about marine reserves. The information will be accessible via a Google Ocean layer that presents scientific findings from key *Science of Marine Reserves* case studies around the globe. Each site will include general information as well as specific scientific findings about the effects of marine reserves. This scientific discussion will present the case study information currently compiled in the *Science of Marine Reserves* booklets and provide opportunity to add additional case studies. Years two and three will focus on development of a *Science of Marine Reserves* website that is linked to the Google Ocean information. The website will greatly expand the content of the booklet versions by presenting easily accessible, dynamic information to a global audience.

Sandy Andelman **9/1/05-8/31/09** **100,000**
National Science Foundation, EF-0443453

RCN: Biodiversity Conservation in Dynamic Landscapes (BCDL) Network

Developing the conceptual foundations for conserving biological diversity in a rapidly changing and uncertain world requires understanding of the linkages among the drivers of species distributions, ecological systems, economic activities, and land-use change. Despite common objectives and recognition of the need for this integration, research in each of these areas commonly proceeds independently. Support for the Biodiversity Conservation in Dynamic Landscapes (BCDL) Research Coordination Network will enable a 5-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 will: (1) identify important gaps in theory and data that limit our ability to plan for new biological reserves and anticipate future patterns of habitat distribution in human-dominated landscapes; (2) coordinate the development of new tools and methods that link ecological, economic and land-use change dynamics, and incorporate key uncertainties into conservation decisions; (3) develop a successful clearing house for tools and other resources needed to advance the scientific basis for biodiversity conservation; and (4) train a cadre of graduate students and early career scientists in quantitative interdisciplinary methods relevant to understanding and conserving complex ecological systems within a dynamic framework. The BCDL Network addresses a fundamental limitation of current conservation and development approaches and will bridge the gap between conservation and land use change 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.

Charlotte Beucher **6/1/2008-5/31/2011** **204,479**
Mark Brzezinski
National Science Foundation, OCE-0752264

Collaborative Research: N and Si Dynamics in the Glacial Southern Ocean

For the past twenty years, evaluating the role of the Southern Ocean in regulating glacial-interglacial atmospheric CO_2 cycles has been a major focus of marine paleoclimate research. Efforts to gauge the strength of the biological pump in the glacial Southern Ocean have been largely inconclusive due to discrepancies among different proxy records. The PIs seek to use two new isotopic techniques to generate multiple downcore records of silicon and diatom-bound nitrogen isotopes in cores from the Subantarctic and Antarctic Zones of the Atlantic and Pacific sectors of the Southern Ocean. The objectives of this research are (1) to evaluate latitudinal trends in N and Si use across the Southern Ocean; (2) to distinguish between supply- (i.e. stratification) versus demand- (Fe availability) driven variations in relative consumption; and (3) to determine the potential for greater Si export from the Southern Ocean, relative to that of nitrate, to the low latitudes during the last glacial period. These

nutrient status records will be the first-of-their kind, aiding efforts to evaluate if Southern Ocean biology could have contributed to changes in atmospheric CO_2, either through enhanced nutrient consumption within the Southern Ocean proper or through silicic acid leakage and its influence on whole ocean alkalinity.

Carol Blanchette **2/1/2005-1/31/10** **43,593**
The New Media Studio

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

UCSB's collaboration enhances the scientific scope and educational evaluation objectives of the SOSE REASoN project through development of an additional 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.

Cheryl Briggs **5/1/08-9/30/08** **9,999**
SRS Technologies

Detection and Quantification of Batrachochytrium dendrobatidis in Amphibians at Vandenberg Air Force Base

The principal investigator will perform real-time quantitative PCR analysis of amphibian chytrid fungus *(Batrachochytrium dendrobatidis)* at Vandenberg Air Force Base. The project involves extracting DNA from swabs of frog skin collected at field sites, and performing real-time PCR to assay for the presence of Batrachochytrium dendrobatidis DNA on the swabs. The results will provide information on whether or not the swabbed frog is infected with fungus, and will furnish a quantitative estimate of the level of infection (numbers of copies of Bd DNA per swab).

Cheryl Briggs **6/17/2007-8/31/2010** **401,019**
Roland Knapp **579,957**
National Science Foundation, EF-0723563

Collaborative Research: After the Crash: Factors Allowing Host Persistence Following Outbreaks of a Highly Virulent Disease

Emerging infectious diseases can have dramatic effects on their host populations. In wildlife species, there are many recent examples of novel pathogens invading native populations, with different pathogens resulting in very different outcomes on their hosts. In some systems, the pathogen sweeps through the local population causing a single outbreak ("episodic"), after which the pathogen goes locally extinct as the pool of susceptible hosts is depleted (e.g., morbillivirus in marine mammals and Ebola in gorillas). Pathogens can also cause regional host extinction in some cases. In other systems, following arrival of the pathogen and subsequent host population crash, the host-pathogen system reaches a new "enzootic" state in which pathogen and host persist, potentially with reduced host population density (e.g., myxomatosis). In the Sierra Nevada Mountains of California, both types of outcomes in a single host-pathogen system have been documented. The pathogen is the amphibian chytrid fungus, *Batrachochytrium dendrobatidis* (Bd), which causes the disease, chytridiomycosis, and is implicated as one of the major causes of amphibian declines worldwide. In this region, the primary amphibian host is the mountain yellow-legged frog, *Rana muscosa,* once a common amphibian that has declined precipitously in recent decades. Based on prior research, invasion of Bd into the remaining uninfected *R. muscosa* populations appears inevitable within the next few years. Therefore, it is critical to understand the factors allowing for host persistence in the enzootic state.

Mark Brzezinski **7/1/2007-6/30/2010** **672,641**
National Science Foundation, 0648130

Silica cycling and the role of diatoms in the North Pacific Subtropical Gyre

This study examines the unique silicon cycle of the North Pacific Subtropical Gyre (NPSG). Most marine silicon cycle studies have focused on the more productive coastal waters or the Southern Ocean where diatoms typically dominate the phytoplankton. Although diatom biomass is much lower in subtropical gyres, silica production is significant in global terms. Silicon cycle studies of the Sargasso Sea in the 1990's implied that subtropical gyres account for 13% of global marine silica production. More recent data from the NPSG show much higher rates of silica production that would increase the contribution of subtropical gyres to as much as 40%. The new estimate is uncertain and based on few data, but suggests that the contribution of subtropical gyres has been underestimated. Differences in the silicon cycle between the NPSG and the Sargasso Sea go beyond differences in average production rates. The two systems are several months out of phase with each other in terms of their seasonal silica production cycles. Unlike the Sargasso Sea, where diatoms bloom regularly in spring in response to winter convective overturn, permanent stratification prevents spring diatom blooms events in the NPSG, where annual diatom blooms occur in summer, when stratification is strongest and nutrient concentrations are at a seasonal minimum. These enigmatic summer blooms contribute significantly to carbon and nitrogen export in the NPSG and likely dominate the annual silicon cycle. This project will expand understanding of the mechanisms controlling the contribution of diatoms to elemental cycling in open ocean ecosystems.

Bradley Cardinale **10/1/06-9/30/09** **52,000**
National Science Foundation, DEB-0614428

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

The investigator seeks to add heterogeneity back to research on 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 a useful system for this work 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. The objectives are: 1) to assess how spatial heterogeneity affects primary production via its control over diversity and the turnover of species composition among habitat patches, and 2) to determine how intermittent disturbance, and the subsequent process of re-colonization of patches, can moderate the impacts of diversity on primary production. Laboratory experiments will be conducted to determine how the diversity of algae affects productivity when species disperse across patches having spatially homo- vs. heterogeneous flow conditions and differing probabilities of disturbance. Field experiments will follow, with manipulation of flow heterogeneity and substrate scour of entire riffle habitats in streams spanning a large natural gradient in algal diversity. While each study has individual strengths and weaknesses, together they span two scales of biological realism designed to link mechanistic process to naturally occurring patterns in the field.

Bradley Cardinale **3/1/092/28/13** **389,496**
National Science Foundation, DEB-0842009

Collaborative Research: Does Productivity Drive Diversity or Vice Versa? Empirical and Theoretical Investigations of the Multivariate Productivity-Diversity Hypothesis in Streams

This research will test and refine a new conceptual model that outlines how the historical perspective that productivity-drives-diversity might be fused with the more recent perspective that diversity-drives-production. The collaborators suggest that these two perspectives can be unified with a multivariate model that distinguishes how three causal pathways operate concurrently to influence the production of biomass by a community: 1) a direct effect of nutrient supply on productivity 2) a direct effect of species richness on productivity, and 3) an indirect effect of nutrient supply on production that is mediated through its control over species richness. The investigators argue that these pathways are fundamentally connected such that the same biological mechanisms by

which nutrient supply influences species richness also determine how species richness influences the utilization of resources and their conversion to biomass. They detail a set of laboratory, field, and modeling studies that are designed to test and refine this multivariate model in freshwater ecosystems, which are experiencing rapid changes in productivity and diversity. They further propose to extend this model to incorporate interactions between producers and consumers, which is important because the majority of diversity-productivity studies have focused only on simplified systems composed of just one trophic level (usually plants).

Craig Carlson **4/1/2008-2/28/2009** **73,795**
University of Miami, SB080099

Continuing Measurement of DOC and DON on U.S. Repeat Hydrographic/CO_2/Tracer Surveys

Dr. Carlson will assist D. Hansell, University of Miami, with measurements of dissolved organic matter (DOM) for the U.S. Repeat Hydrography surveys. During a 42-day cruise in the Indian Ocean sector of the Southern Ocean, the UCSB PI will collect approximately 2,000 samples. The samples will be measured in Carlson's laboratory at UC Santa Barbara. DOC will be measured by high temperature combustion using a Shimadzu TOC-V with auto injection (CV of 1.5-2.5%). DOC and TDN will be measured simultaneously by placing the two detectors (NDIR and chemiluminescences) in series on the Shimadzu. Total nitrogen will be measured via chemiluminescence detection using a Shimadzu TN analyzer attached to the TOC-V. DON is calculated as the difference between total dissolved nitrogen concentrations and dissolved inorganic nitrogen. The Hansell and Carlson laboratories will exchange references and samples for inter-calibration purposes, to ensure the highest quality and comparability between data sets.

Craig Carlson **8/15/08-7/31/13** **803,765**
National Science Foundation, OCE-0801991

MO: Collaborative Research: Transitions in the Surface Layer and the Role of Vertically Stratified Microbia Communities in the Carbon Cycle - An Oceanic Microbial Observatory

The objective of this project is to assess if the mesopelagic microbial community relies on diagenetically altered organic matter and subcellular fragments that are produced by microbial processes in the euphotic zone and delivered into the upper mesopelagic by sinking or mixing. In past efforts this microbial observatory had greater success cultivating members of the euphotic zone microbial community, and revealed an unanticipated growth requirement for reduced sulfur compounds in alphaproteobacteria of the SAR11 clade. Genomic information showed that intense competition for substrates imposes trade-offs on bacterioplankton - there are regions of N dimensional nutrient space where specialists win. The investigators postulate that specific growth requirements may explain some of the regular spatial and temporal patterns that have been observed in upper mesopelagic bacterioplankton communities, and the difficulties of culturing some of these organisms. This research will make cultures of novel bacterioplankton and genome sequences available to the scientific community, and findings may be used directly in foodweb and ocean carbon cycle models. The educational component of the project brings microbial oceanography training to students from many disciplines, through a summer course, and specialized training to graduate and undergraduate students involved directly in research.

Craig Carlson
Mark A. Brzezinski **4/1/09-3/31/12** **689,579**
National Science Foundation, OCE-0850857

Mechanisms Controlling the Production and Fate of DOM During Diatom Blooms

This research will contribute to the greater scientific goal of understanding the role of upper ocean food webs in carbon cycling. The findings will improve the basic understanding of DOM dynamics, aiding modelers in the development of improved representations of key processes in ecosystem models. The PIs will employ a combination of laboratory and field based approaches to: 1) investigate how limitation by either N or Si impacts the chemical composition of the DOM released by diatom blooms, and 2) determine how differences in the composition of DOM produced by diatoms

experiencing different nutrient stresses affects its susceptibility to heterotrophic microbial processing through changes in the productivity, growth efficiency and community structure of bacterioplankton. The focus is on diatom blooms for two reasons. They are a regular feature in regions of the ocean where DOC export is known to be significant, i.e., such as the North Atlantic, making the fate of the DOM produced during blooms a potentially significant mechanism of C export. In addition, the direct release of DOM from phytoplankton is the best studied of numerous DOM processes providing the background for formulating response that drives its consumption. Preliminary data indicates that the waters of the Santa Barbara Channel, California, are an ideal model system for conducting this research because the spring diatom bloom is sufficiently predictable and amenable to the types of manipulations required for these studies, and ambient DOM concentrations are low for coastal waters, allowing small changes in DOM concentrations to be resolved in both laboratory and field experiments.

Jennifer Caselle **5/15/2007-8/30/2009** **371,187**
Cal Coastal Conservancy, 07-013

Filling the Gaps: Marine Protected Area Monitoring in the Channel Islands

Biological surveys of near-shore marine communities are needed to fulfill CA Department of Fish and Game management mandates outlined by the MLMA and the MLPA. Characterization of near-shore communities is required to address the goals and objectives outlined by stakeholder groups in CINMS marine reserve working group process. Fishery-independent estimates of density and size structure of commercially and ecologically important species are essential and can, in turn, be used for stock assessment, ecosystem monitoring, and assessment of marine protected area effectiveness. Near-shore biological surveys within the southern California Bight are a high priority management need because: 1) the majority of private recreational fishers, a large CPFV fleet, and an active commercial live/premium finfish fishery all reside in southern California, making this area of considerable importance socio-economically, and 2) the recent establishment of a large network of marine protected areas in the CINMS is an unprecedented management event and therefore subject to a great deal of scrutiny from state, federal, and worldwide communities. Although several programs already conduct surveys of near-shore resources in southern California, additional resources are needed to fill gaps in the current monitoring schemes and coordinate existing programs into an effective large-scale stock assessment and monitoring program. The PI's purpose is to conduct comprehensive near-shore surveys of the CINMS, to expand near-shore SCUBA surveys in the Channel Islands, and to fill gaps in previous monitoring.

Jennifer Caselle **8/25/07-7/31/08** **33,001**
9/11/08-8/31/09 **34,226**
COM - National Oceanic & Atmospheric Administration, NCND6000-7-15764 & NCND6021-8-41919

Maintenance of PISCO-CINMS Moorings in the Channel Islands National Marine Sanctuary

Near-island instrumentation provides data necessary to understand and track water mass movements affecting recruitment of key species to coastal habitats. Inter-annual and shorter-term upwelling and relaxation events drive recruitment and movement of certain fish species and 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, could help explain anomalies, enable managers to make informed decisions as to placement and size selection of reserves designed to protect or restore particular resources, and explain changes in populations, trophic structure, forcing functions and processes. The PI will conduct multiple research cruises to obtain data from oceanographic instruments from six customized SEA stations that were established around the Channel Islands in 2004 for the purpose of providing information on water temperature and movement within sanctuaries.

Jennifer Caselle **5/1/2007-4/30/2009** **187,309**
US Department of Commerce, NA07NMF4630071

Interpreting Changes in Community Structure in Marine Reserves in Light of Spatial and Temporal Patterns of Settlement

The primary aim is to understand the spatial and temporal patterns of recruitment of commercially and ecologically important fishes and invertebrates in relation to the system of reserves in the Channel Islands (CI) and Santa Barbara Channel (SBC) mainland, and to identify the potential oceanographic causes of these patterns. An understanding of the spatial and temporal patterns of recruitment into and around marine reserves along with knowledge of potential oceanographic causes will provide an essential context to interpreting any observed changes to populations inside and outside reserves as well as any potential regional and local effects of reserves on recruitment. The study will be accomplished by significantly augmenting an existing array of artificial fish recruitment collectors (Standardized Monitoring Units for the Recruitment of Fishes-SMURFs) in the Northern CI and the SBC through a) the addition of well-tested and newly-designed invertebrate collectors to measure settlement of crabs, urchins and lobsters and b) the addition of sets of collectors (for fishes only) over fine spatial scales at several target reserves in the CI to begin to assess the potential recruitment effects of reserves. All results will be incorporated into the existing marine reserve monitoring programs in the CI. Changes in abundance inside and outside of marine reserves are only interpretable if differences in recruitment to these areas are accounted for. As reserve impacts develop, potential spatial and temporal differences in production can be directly compared to patterns of recruitment, providing for the first time an estimate of the spatial extent of any larval export function of marine reserves.

Jennifer Caselle **6/26/08-6/26/11** **200,000**
Marisla Foundation

Coral Reef Research in a Rare, Undisturbed Ecosystem: UCSB and Palmyra Atoll

This award enables the Marine Science Institute, UC Santa Barbara, to remain a member of the Palmyra Atoll Research Consortium for 2008-2010 in order to continue and expand research relating to coral reef ecosystem health and biodiversity. In addition, it provides support for UCSB and other PARC members to conduct research on the Atoll. The major outcome will be a better understanding of healthy coral reef ecosystems which will lead to rational conservation practices.

Jennifer Caselle **1/16/09-1/15/12** **22,900**
Santa Barbara County Air Pollution Control District

Repower the R/V Cormorant

State funds provided to renovate the Research Vessel Cormorant.

Scott Cooper **5/1/2008-5/1/2009** **100,000**
California Regional Water Quality Control Board, 2002-0105

An Assessment of Numeric Targets for Ventura River Watershed Nutrient TMDLs

Section 303(d) of the Clean Water Act requires the State to identify surface water bodies that do not or are not expected to meet water quality standards (comprised of beneficial uses and water quality objectives) with technology-based controls. States must also adopt Total Maximum Daily Loads (TMDLs) for these water bodies when a pollutant causes the impairment. Numeric Targets, which identify the specific in-stream goals or endpoints for the TMDL and equate to attainment of the water quality standard, are a required component of the TMDL. In situations where applicable water quality standards are expressed in narrative terms, it is necessary to develop a quantitative interpretation of narrative standards. Several Reaches and Tributaries of the Ventura River are on the 303(d) list of impaired water bodies for algae, eutrophic effects, low dissolved oxygen, and nitrogen: Ventura River Estuary (algae and eutrophic); Ventura River Reach 1 and 2 (algae); Canada Larga (low dissolved oxygen). These areas exceed the narrative Biostimulatory Substances (phosphorus and

nitrogen) objective in the Basin Plan and resultant eutrophic conditions. The goal of this project is to evaluate different approaches for developing numeric targets for nutrients and eutrophic conditions that attain the biostimulatory substances objective and address the listings of eutrophic, algae, nitrogen and low dissolved oxygen.

Christopher Costello **1/1/09-12/31/09** **65,000**
Resources Legacy Fund Foundation

Model Development for Marine Life Protection Act

Develop "Flow, Fish, and Fishing" two dimensional optimization modeling tool for use in the MLPA Initiative design planning process.

Thomas L. Dudley **10/17/2007-10/31/2012** **56,500**
Kevin D. Lafferty
Armand M. Kuris
US Fish & Wildlife Service, 813327J015

Development of Biological Control for the New Zealand Mud Snail

Invasive non-indigenous species have the potential to alter food webs in aquatic ecosystems, inhibit or displace native species, including threatened or sensitive species, and to interfere with recreational and economic activities in waterways. The New Zealand Mud Snail (NZMS; Hydrobiidae: *Potamopyrgus antipodarum*), native to New Zealand but unintentionally introduced into other continents through human transport, has great potential to cause all three forms of impact to our natural resources. The NZMS is establishing rapidly throughout western waters. Despite efforts to control its spread by public outreach campaigns and cleansing of contaminated equipment, invasion continues. Early detection of invaders can enable pest eradication using physical or chemical treatments before unacceptable impacts occur, but once a new pest is widely established, control may be feasible only by using biological methods that suppress populations to acceptable levels. A series of steps is required to develop an effective and politically-acceptable biological control program, generally requiring several years of testing and evaluation before it can be implemented. Thus, it is critical that a control program be evaluated very soon, before NZMS infestations dominate benthic assemblages throughout North America. The PIs propose that Classical Biological Control (biocontrol), the introduction of natural enemies from the native region of the pest to suppress invasive pest species abundance, is a potentially appropriate, and probably only, means of achieving sustainable mitigation.

Thomas L. Dudley **4/15/08-2/15/09** **2,087**
San Francisco Estuary Institute

Ventura County Historical Ecological Study

This study is designed to research and document information about the pre-modification channel geometry and riparian habitat characteristics of the Santa Clara River. It will also assess channel stability/migration during the historical, pre-1927 era and document the historical extent of perennial, seasonal, and tidal wetland habitats as a basis for setting restoration targets. Specific historical ecological and geomorphic information about local habitats will be gathered and historical drainage network patterns, including discontinuous channels and how tributaries connected to the main channel will be studied.

Thomas L. Dudley **11/1/08-10/31/09** **118,627**
Armand M. Kuris
Kevin D. Lafferty
Ryan F. Hechinger
UC Sea Grant College Program, R/ANS-210

Development of Biological Control for the New Zealand Mud Snail

Invasive non-indigenous species can alter food webs in aquatic ecosystems, inhibit or displace native

species (including threatened or sensitive species), and interfere with recreational and economic activities in the nation's waterways (Allan and Flecker 1993, Parker and Keeney 2004). The New Zealand Mud Snail (NSMS; Hydrobiidae: *Potamopyrgus antipodarum*) has great potential to cause all three forms of impact to our natural resources (Richards 2002). The NZMS, native to New Zealand, has been unintentionally introduced into other continents (Australia, Europe, North America) through human transport. The NSMS is establishing rapidly throughout western US waters, and the invasion continues despite efforts to control its spread through public outreach campaigns and cleansing of contaminated equipment. Early detection of invaders can lead to pest eradication using physical or chemical treatments before unacceptable impacts occur, but once a new pest is broadly established, control may only be feasible using biological methods that suppress populations to acceptable levels (Bellows and VanDriesche 1996, Barbosa 1998).

Thomas L. Dudley **12/16/08-5/1/11** **899,959**
Clark County, Nevada

For Effectiveness Monitoring of Spring-fed Wetlands and Riparian Restoration Treatments

Effective management of tamarisk and other invasive plants depends on control treatments that provide sustained weed reduction and their replacement with self-replicating native and/or beneficial non-native plants. The project goal is to promote adaptive weed management that provides maximal, cost-effective weed control with a minimum of collateral impacts to associated beneficial species, and integrates ecosystem functions into the habitat recovery process. The overall objective is to undertake an extensive evaluation of regional infestation sites, those where tamarisk has been treated and those where treatments may be proposed, to understand the underlying interrelationships among species and physical processes (flood and drought, physical disturbance, fire – both wild and prescribed). Resulting information will be used in weed control planning to ensure that tamarisk management yields substantive restoration of native riparian wildlife habitat, and minimizes the secondary invasion by other noxious weeds that are major inhibitors of ecosystem recovery.

Jenifer Dugan **1/22/2008-1/31/2009** **49,844**
Henry Page
California Department of Parks and Recreation, C0753014

Approaches for Enhancing Prey Resources on Sandy Beaches for Nesting Shorebirds

Sandy beaches are highly valued as aesthetic and recreational resources for humans. Beaches are also vitally important as ecosystems that support wildlife by providing habitat and prey for nesting, migrating and wintering shorebirds and other wildlife. There is increasing pressure to develop environmentally sensitive, cost-effective strategies for managing beaches for both humans and wildlife. The motivation for this study comes from the need to improve approaches for enhancing beach ecosystem function for wildlife support. The results will provide information on potential techniques for enhancement of resources for endangered and threatened bird species, particularly the Western Snowy Plover, a shorebird that depends on beach prey resources during the nesting season. The PIs will investigate approaches that could potentially be applied by resource managers to enhance sandy beach ecosystems for support of higher trophic levels, particularly nesting shorebirds. Specifically they will experimentally examine effects of the addition of 1) macrophyte wrack (e.g., kelps) and 2) selected flightless invertebrate prey (e.g., talitrid amphipods) on the diversity, abundance and composition of the wrack-associated invertebrate community.

Jenifer Dugan **2/1/09-1/31/10** **69,415**
Adrian Wenner
UC Sea Grant College Program, R/ENV-210

Beaches as Threatened Ecosystems: An Evaluation of Status and Trends in the Ecology of California's Sandy Beaches

Climate change is a key environmental driver of the structure and function of California's ocean and coastal ecosystems. Projecting the impacts of climate change must include understanding the

consequences of both ecological and socioeconomic responses to climate change. This need is most crucial along the 1172 miles of coast where California's growing population and economy depends on a narrow strip of land that lies on the edge of an ocean that is warming, rising, and becoming stormier in response to global climate change.

As sea level rises, erosion accelerates, and human populations expand on the coast, evaluating the ecological consequences of intensifying pressures on beach ecosystems becomes increasingly urgent. Once abundant intertidal species appear to have disappeared from many beaches, including species from the upper and lower intertidal zones (e.g. Hayes 1974, Fitch 1950) and extinctions on local to regional scales may have occurred for a number of beach invertebrates. Commercial fisheries for at least 3 beach clam species have collapsed and sport harvest for these species has declined significantly statewide (Fitch 1950, McLachlan et al 1996). Although invasive species of plants and animals are recognized as problems for ecosystems that interact directly with beaches including dunes, rocky shores, and coastal wetland, knowledge of the distribution and impacts of species invasions on beaches is lacking. The limits of our scientific understanding of how sandy beach ecosystems respond to the plethora of human threats are fast emerging as crucial impediments for the conservation of these threatened ecosystems (Schlacher et al 2007).

Jenifer Dugan **2/27/09-1/31/10** **49,954**
California Department of Parks and Recreation

Evaluating Approaches to Enhancing Prey Resources for Nesting Shorebirds on Sandy Beaches

Results of our studies of beach ecosystems suggest that impacts to wrack availability have rapid negative effects on wrack-dependent invertebrates. However, ecological recovery of the wrack-dependent component of the beach ecosystem can be protracted, requiring many months (>7), even when wrack supply is abundant. Dispersal ability and population dynamics appear to plan an important role in the initial colonization of wrack deposited on the beach, and the recovery dynamics of key invertebrates, particularly flightless crustaceans and insects. At Ocean Dunes SRVA in 2008, our experimental addition of wrack-associated invertebrates, provided a stimulus that enhanced the recovery of prey resources in these areas. Although additional information is needed to choose appropriate design scaling, efficiencies, and recovery goals, this approach could potentially be used to enhance prey resources for support of threatened wildlife, such as breeding Western Snowy Plovers, on a larger spatial scale.

Jenifer Dugan **5/1/09-4/30/11** **37,500**
California Coastal Commission

Evaluating Status and Trends in California's Sandy Beach Ecosystem

California's beaches are highly valued for recreation and tourism. Less appreciated is the role of beaches as ecosystems that support unique and rich biodiversity. The fate of California's beaches in the face of rising sea levels and continuing population growth prompts this research. This research project will investigate ecological changes in sandy beach ecosystems in southern California over the past 30 years and evaluate potential causes using comparisons of historic and modern information on ecological communities of beaches. This project will calibrate historically used and modern sampling methods, collect new data at a subset of historically sampled beach sites and archive the historic and more recent physical and ecological data needed to evaluate the status and trends in biodiversity and ecological conditions of sandy beach ecosystems in California. These comparisons will be used to provide baseline information needed for management and assessment of the impacts of climate change and human activities on sandy beach ecosystems.

John Engle **6/19/2007-6/18/2009** **84,924**
UC Santa Cruz, M07AC12503

The Shoreline Assessment of Changes in Rocky Intertidal Communities in the Southern California Bight

The UCSB portion of the MMS Rocky Intertidal Program will consist of coordinating communications for the Multi-Agency Rocky Intertidal Network (MARINe), providing network information to

others, maintaining standards for network protocols, overseeing network database operations and websites, and facilitating other interactions between MMS and MARINe. As the MMS/MARINe coordinator, the PI will interface with network Steering Committee, Data and Science Panels, and participating organizations to enhance productivity by organizing meetings and resolving technical issues, including species taxonomy and survey methodology. In addition to coordinating MARINe information management to promote analysis, synthesis, and publication, the PI also will maintain the network internal website, plan updates to the public website, and assist MARINe members in testing and implementing new field, laboratory, and data management procedures. The primary goal of this project is coordination and facilitation of activities to produce and update a variety of products including a standardized data management system, private and public internet sites, reports, publications, and oral presentations.

Nann Fangue **9/1/2007-8/31/2009** **75,000**
Gretchen Hofmann
National Science Foundation, OISE-0700551

Postdoctoral Research Fellowship

The aim of this project is to investigate the potential affects of climate change on the physiological performance of a marine invertebrate. Implicit with global climate predictions is the notion that climate change does not respect geographic boundaries. To assess and predict the response of organisms and communities, there is a need for the facilitation of cross-border investigations, particularly for organisms distributed across a wide, international biogeographic range. In the coming decades, scientists expect increasing numbers of species invasions and shifts in species range distributions in response to global climate change. It is critical to determine the processes and mechanisms that set species range boundaries and influence performance in novel environments presented by climate change. Because of the poor linkage between biological and political arenas, it is important to unite the study of species whose distributions span political borders. This study examines physiological ecology of the purple sea urchin, *Strongylocentrotus purpuratus* without borders. The postdoctoral fellow will test the overall hypothesis that sea urchin physiological performance will be affected by ecologically relevant (based on current climate change predictions) temperature and acidification stressors. This project is being conducted at the Universidad Autonòma de Baja California in Ensenada, Mexico, where the urchin culturing expertise is located, and at UC Santa Barbara, where samples will be analyzed using the readily available resources for high throughput molecular biology.

Erica Fleishman **2/1/2008-1/31/2011** **1,150,000**
David and Lucile Packard Foundation, 2007-31848

Development and Application of Scientific Knowledge to Ecosystem-Based Management of Coastal Marine Systems

Ecosystem-based management typically is defined as an integrated approach to management that considers the entire ecological, physical, and socioeconomic system. Such a definition engenders little controversy but is difficult to translate into operational guidelines, explicit objectives, and clear measures of success. The National Center for Ecological Analysis and Synthesis (NCEAS) aims to develop scientific knowledge about ecological and socioeconomic processes that affect management and legislative regulation of coastal–marine ecosystems. The particular emphasis is to examine, both conceptually and via empirical evidence, how such knowledge can be transferred effectively to planning, decision-making, and implementation at different scales and in different geographic locations worldwide. This project builds on work conducted from 2004 to 2007 to advance and synthesize scientific understanding needed to support an ecosystem-based approach to managing coastal marine systems. This phase involves a portfolio of complementary activities including scoping workshops with practitioners, working groups, postgraduate training, and informatics support for working groups and the Packard Foundation's seven regional ecosystem-based management initiatives. These activities will be amenable to development and implementation of communication strategies that inform policy, management, and public behavior.

Erica Fleishman **12/7/2007-8/7/2010** **1,280,807**
Gordon and Betty Moore Foundation, 1454

Prediction of Responses of Wild Pacific Salmon to Climate Change

Climate is a major driver of the geographic distribution and abundance of salmon. It is occurring globally, but there has been no organized effort to evaluate its potential effects, and potential management responses, on populations of salmon and their ecosystems. Empirical evidence shows that climate affects the viability of Pacific salmon, with cascading effects on human communities. However, predicting the effects of climate change on Pacific salmon is complicated by obstacles to downscaling coarse-grained climate models, resolving uncertainties in climate change scenarios, and understanding mechanistic responses of salmon and their resources to climate. Experts have identified high-priority research topics and developed a strategic framework for conducting targeted analyses. The National Center for Ecological Analysis and Synthesis (NCEAS) will conduct synthetic research on the following high-priority research topics: identification of mechanisms that limit the geographic range of salmon populations and exploration of how these mechanisms may adapt under projected scenarios of climate change; development of monitoring programs to identify changes in populations of Pacific salmon and attribute them to potential mechanisms, including climatic change; examination of the relative importance of evolutionary and plastic responses of Pacific salmon to climate change; and classification of salmon populations along a gradient of sensitivity or resilience to climate change, along with potential management and conservation strategies that may benefit salmon populations along that gradient under alternative future climates.

Erica Fleishman **5/15/2007-9/30/2009** **94,566**
US Forest Service, 05-JV-11221682-210

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

Resource agencies in the Intermountain West are concerned with the response of bird communities and individual species of birds to fire and fire management. For example, potential violations of the Migratory Bird Treaty Act can constrain implementation of prescribed fire during the spring. The PI will examine whether potential loss of individual birds is likely to have an impact on regional population persistence. Understanding the response of cavity-nesting birds is important because fire affects the quality of habitat for many species. Further, cavity-nesting species often are designated as Management Indicator Species or Sensitive Species. Of the 109 species of birds from the study area, one (Northern Goshawk) is considered Sensitive by USFS, and an additional 23 have been identified as priorities. Among these, Pinyon Jay has been identified as a local concern. Butterflies also tend to respond rapidly to fuels management because their population viability is linked closely to availability of larval host plants and adult nectar sources. This study will address local data gaps on the distribution and abundance of birds, including species identified as Sensitive or priorities, and the response of those species and their habitats to management of wildland fuels and fire regimes.

Erica Fleishman **4/27/2007-12/31/2008** **100,000**
Wilburforce Foundation, UCSB0703

Analysis and Conservation Prioritization of Landscape Connectivity in Nevada

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 support 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.

Participants will test and compare new tools by applying them to conservation-planning challenges in several geographic areas in North America, including the Great Basin and Pacific Northwest. Specifically, participants will develop a manual that evaluates new software tools for connectivity analysis (e.g., Zonation, FunConn, Conserv) with guidelines for use of those tools.

Steven Gaines **1/1/05-12/31/09** **7,953,022**
Robert Warner
Libe Washburn
Gretchen Hofmann
Oregon State University

Partnership for Interdisciplinary Studies of Coastal Oceans (PISCO)

PISCO will refine and expand its comprehensive research program that integrates oceanography, marine ecology, physiology, biomechanics, and genetics. By partnering experts from diverse scientific disciplines toward a common goal, we are producing a comprehensive picture of how the ecosystem functions. Building on our progress over the past six years, PISCO will place renewed emphasis on studying physical oceanography to place biological processes into an environmental context. A complementary set of investigations will use genetic, physiological, and microchemical analyses to explore the connections between oceanographic and biological processes. Database efforts will focus on data availability through an online database and compatibility with other major programs collecting data on the US West Coast. PISCO's highly successful policy and outreach program will expand, enabling the PISCO consortium to take the national lead in providing managers, legislators, and the public with vital information on the state of our coastal waters. Course offerings will expand to three interdisciplinary courses. Intense training efforts will seed both the science and policy realms with young professionals prepared to deliver more holistic science and apply that science to management.

Steven Gaines **6/1/2007-5/31/2009** **200,000**
Andrew W. Mellon Foundation, SB080001

Making Connections: Predicting Variation in Larval Dispersal at Biogeographic Scales

In the last decade, the combined research efforts of the iCORUMBA teams in Chile, Oregon and Santa Barbara have documented important sources of variation in recruitment rates, including abrupt changes in geographical patterns of larval settlement associated with abrupt shifts in the intensity and frequency of upwelling. These patterns create distinct regions of the shore with contrasting patterns of community structure. Within these large geographic regions, however, the sources of variation in recruitment are much more poorly understood. Moreover, even in situations where the pattern of recruitment is predictable, the source of the recruits is largely unknown. The goal of this work is to combine a number of distinct research efforts from recent years into a synthetic and predictive look at population connectivity in coastal upwelling ecosystems.

Steven Gaines **7/1/2007-6/30/2011** **450,000**
John Melack
O. James Reichman
Alice Alldredge
Oliver Chadwick
Bruce Luyendyk
Luce Foundation, SB070105

The Luce Environmental Science to Solutions Initiative

The pathway to environmental solutions has several key steps: synthesizing what we already know, strategic research to fill gaps, effective communication of results, and development and creative implementation of science-based solutions. This pipeline to success rarely flows smoothly, since it requires different people from different types of institutions who historically are not well linked. What should function as an efficient pipeline for new knowledge to produce societal and environmental benefit acts more like disconnected silos. Not surprisingly, environmental solutions

are slow to emerge even when the pieces for success are at hand. The primary goal of this initiative is to educate and involve Ph.D. graduate students on the full trajectory from the identification of important environmental issues through knowledge accumulation and the development of suitable solutions to the actual implementation of those solutions. We will achieve this by supplementing the academic Ph.D. student experience with strategic policy and real-world enhancements. By engaging in focused projects that integrate academia, government and corporate perspectives, the graduates will be prepared to offer genuine solutions to our environmental problems and will have the unique skills needed to enhance the likelihood that they will be implemented. Our initiative will demonstrate to the students the advantages of collaborative teamwork in environmental science. Moreover, working and interacting with people outside of academia will acquaint students with political reality, economics, policy making, and legal dimensions.

Steven Gaines **9/1/2007-8/31/2008** **1,000,000**
Marisla Foundation (formerly Homeland Foundation), 3-07-112

The California Fisheries Fund: Investing in Marine Conservation and Fisheries Reform

Human activities have reached the limits of ocean productivity and have reduced productivity in some cases. Overfishing, bycatch, and habitat damage associated with fishing have impacted the fundamental drivers of ocean productivity and diversity. Many NGOs are working hard, with considerable success, to put into place policies and regulations intended to result in more sustainable fisheries. Several factors are coming together to facilitate the transformation of California fisheries and ocean ecosystem protection, including the implementation of the Marine Life Management Act, the Marine Life Protection Act and the California Ocean Protection Act. However, conservation prescriptions embedded in these policies and regulations are being undercut by strong opposition by fishermen because they are perceived as threats to livelihood and economic health. In addition, fisheries management and research are chronically underfunded by government agencies. Fishermen feel disenfranchised and resentful of conservation actions because they perceive conservation as an added jeopardy rather than a benefit to their livelihoods. Two critical ingredients are needed to complement ongoing fishery reform efforts: capital to finance change, and governance reform that results in incentives for stewardship. The California Fisheries Fund is designed to fill these gaps, and in concert with policy and regulatory reforms, transform fisheries to sustainability and reduce opposition to MPAs and other conservation measures.

Steven Gaines **1/1/2008-9/1/2008** **100,000**
Constance Penley
Ronald Rice
John Melack
Paul G. Allen Charitable Foundation, 9991

Digital Ocean Project

The *Digital Ocean (DO)* project will use collaborative digital technologies to inspire public engagement in preserving the world's oceans. The goal is to create an open-source social learning environment using new and existing technologies, software and networking processes that will allow a broad range of users/producers to interact with valid scientific data about human impacts on the oceans in a way that is fun, engaging, intellectually challenging, and rooted in social interaction. *DO* will serve as a platform for building multi-disciplinary, multi-generational communities. Participants may include scientists, educators, students, communicators, policy makers, and the general public. Given that the kinds of outreach needed for each of these groups is very different, the Planning Process will develop a Strategic and Business Plan to identify possible pilot projects that prioritize different participant groups. Increases in human coastal populations and widespread ignorance of the oceans' crucial roles in maintaining the ecosphere and providing food have led to crisis conditions that, if not reversed quickly, threaten the future of life on earth. The developing interactive, social networking and multi-media capabilities of the Internet and the world-wide web (Web 2.0) offer unprecedented opportunities to establish a fan base for ocean conservation by creating online communities for virtually experiencing undersea life forms and processes that few people will otherwise ever encounter. This project will develop a strategic plan for moving *DO* from concept to pilot development and testing.

Jeffrey Goddard **12/1/2007-11/30/2009** **24,239**
UC Sea Grant, R/OPCENV-08-S-1/3

Long-Term Faunal Changes in California Nudibranchs: Climate Change and Local Ocean Health

The main objectives of this project are to determine: 1) if long-term changes have occurred in abundance, species richness, and community composition of rocky intertidal nudibranch gastropods in central California, and 2) if the observed changes can be explained by natural or anthropogenic climate change, or more localized environmental factors. Additionally, the PI will incorporate a regional example of the effects of climate change on marine ecosystems in exhibits at the Academy of Sciences in San Francisco and use his results on these colorful and popular organisms to highlight the importance of historical ecology and long-term studies for detecting significant ecological changes, and to illustrate the contributions that students can make to Marine Science.

David Greenberg **10/1/08-3/31/09** **8,000**
Smithsonian Tropical Research Institute

Surface Flow, Solar Radiation, and Tree Distributions: Can We Untangle the Effects of Water and Light on Tropical Forest Community Structure?

Topography has dramatic effects on tree species distributions in tropical forests. Ridges, slopes, and valleys differ in the species they support, as evidenced by studies throughout the Americas, in Asia, and in Africa. Given that topography influences surface water flow and affects water regime, this pattern is commonly interpreted as niche partitioning along soil moisture gradients. Such partitioning may facilitate species coexistence and help explain the high alpha diversity of tropical forests.

David Greenberg **1/1/09-12/31/09** **5,000**
Conservation and Research Foundation

Sustainable Agriculture along a Protected Forest Edge in Thailand: Promoting Ecosystem Services to Motivate Forest Conservation in Rural Communities

Tropical forests are being destroyed at alarming rates worldwide – roughly 50% of them have already been lost, and rates of destruction are accelerating. This is a global crisis, as millions of people around the world depend on ecosystem services that these forests provide. Tropical forests are commonly surrounded by rural communities, and they must have local community support to be conserved. We seek to generate such support at Kaeng Krachan National Park, Thailand, and to demonstrate the efficacy of our approach as a model for use throughout the tropics. Our premise is that people may improve their livelihood by taking advantage of forest ecosystem services, which would link their welfare to the presence of undisturbed forest nearby and provide economic incentives for its conservation.

David Greenberg **3/1/09-12/31/10** **15,665**
Heal the Ocean, Inc.

Spatial Patterns of Wastewater Discharge and Coastal Pollution in California

We propose to study spatial patterns of coastal pollution in California associated with effluent discharge by wastewater treatment plants (WWTPs). Effluent in coastal waters endangers human health (Brinks et al 2008; Griffin et al 2003; Henrickson et al 2001), and in California at least 38 WWTPs discharge directly into the Pacific Ocean. Oversight falls to the State Water Resources Control Board (SWRCB), which lacks data on how spatial patterns of coastal pollution relate to the distribution and effluent content of WWTP outfalls. We seek to provide such data, with an interest in helping to inform the regulatory process.

Stephanie Hampton **8/12/2007-9/30/2009** **99,855**
O. James Reichman
COM - National Oceanic & Atmospheric Administration, AB133F07SE3931

Design and Implementation Guidance for a Programmatic Approach to Intensively Monitored Watersheds and Similar Large-scale Management Action Experiments

There is a long history of large-scale ecological experimentation in the research community, but no generalized guidance as to its implementation. There is no corresponding history of large-scale experiments within the resource management community, so the necessary policy guidance is also lacking. Given the wide range of unknowns and resulting odd foundation on which to develop guidance for the design and programmatic implementation of resource management experiments, a collaborative process that brings together experts from a wide diversity of disciplines is the most reasonable approach. A professional, technical working group in a neutral setting is an appropriate approach because it takes the issue out of the immediate political and resource management community (Salmon Recovery in the Pacific Northwest) and allows access by a diverse set of academic, agency and organization science staff who have the technical expertise to tackle the general problem of designing and implementing large-scale ecological experiments in a resource management context, but who traditionally do not work in this arena. The National Center for Ecological Analysis and Synthesis (NCEAS) will host a working group to prepare the following: 1) Experimental design guidelines for large-scale (e.g., watersheds) ecological experiments to demonstrate the effect of management actions such as aquatic habitat restoration on population processes of species of interest, and 2) Implementation guidelines for development of a program of large-scale management action experiments that balances replication, spatial representativeness and cost-effectiveness.

Stephanie Hampton **4/29/2008-4/1/2009** **96,953**
Gordon and Betty Moore Foundation, 1673

Finding Common Ground in Marine Conservation and Management: A Proposal for a Distributed Graduate Seminar

There is increasing concern among scientists, resource managers, and the general public about the current state of marine fisheries and their supporting ecosystems. Recent scientific progress on this topic has been partly overshadowed by significant controversy on how to assess marine resources and how to address current problems in ocean management. Marine ecologists and fisheries scientists often tend to favor contrasting approaches, and we observe that these schools of thought have polarized over time. We now recognize this situation as counterproductive and propose to address this controversy where possible. To help address this concern, the National Center for Ecological analysis and Synthesis (NCEAS) is supporting a Working Group to define common ground among marine ecologists and fishery scientists by 1) developing a unifying terminology and a common analytical framework for assessing marine fisheries and ecosystem change, 2) applying this framework to a number of representative marine ecosystems around the globe, and 3) assessing management successes and failures in order to identify a set of tools that have been proven to reverse trends of degradation in marine fish stocks and ecosystems. This process should also identify areas of continued disagreement, important for focusing future research. The central question we are trying to answer is: how can we merge contrasting objectives, tools, and scientific criteria among marine ecology, fisheries science, and management into a unifying framework. We envision that this group will be acting as a catalyst for joining scientific forces in a quest to sustain and restore valuable marine resources.

Stephanie Hampton **9/4/2007-9/3/2009** **132,902**
O. James Reichman
The Nature Conservancy, 1980863015-CSD-112007

Developing a Return on Investment Approach for Conservation Planning in Argentina

The budgets of even the largest conservation organizations will never be large enough to fully address the many threats to global biodiversity and surrounding natural systems. Consequently, the fundamental challenge is determining how to prioritize. Traditionally, the two considerations

weighed most strongly by conservation organizations in priority setting have been biological value and threat. Indeed, these two priorities form the strategic core of many leading organizations. However, this approach misses an opportunity by ignoring the costs associated with particular conservation choices. Economic theory indicates that the greatest gains are achieved by choosing options that provide the greatest return on investment, an especially important consideration for typically resource-strapped conservation organizations. This return on investment (ROI) approach could greatly improve conservation planning by providing information about the benefit per unit cost for all options under consideration. The purpose of this post-doctoral fellowship is to explore how ROI can improve the quality of environmental decision-making, focusing on the Nature Conservancy's strategic planning for conserving Argentinean grasslands.

Ryan Hechinger **9/19/08-9/30/09** **76,763**
USDI Geological Survey

Status and Potential Distribution of the Invasive New Zealand Mudsnail Aboard Marine Corps Base Camp Pendleton

The primary goal of this baseline survey is to determine the presence/absence of New Zealand Mud snail (NZMS) within the water resources of Marine Corp Base Camp Pendleton. Secondary objectives are to provide information on the distribution and abundance of the NZMS, as well as on encountered non-target gastropods.

Monica Heintz **11/1/2007-11/1/2009** **40,000**
David Valentine
National Academy of Sciences, SB080050

Biological Control on the Flux of Methane from Marine Hydrates to the Atmosphere: A Research Plan

Marine methane hydrates are suspected to be the largest global reservoir for natural gas. Recent estimates of the amount of methane carbon in these deposits range from 500 - 24,000 Gt, with a consensus value of about 10,000 Gt. Methane is a powerful greenhouse gas, 26 times more potent than CO2 on a mole to mole basis. Thus, processes that moderate the flux of methane from hydrate deposits to the atmosphere are an important consideration in development of hydrates as an energy resource, and in understanding the potential role of hydrates as agents of global climate change. The goal of this research is to develop a predictive capacity for the impact of methane-consuming bacteria within the water column, on the flux of methane from marine hydrate deposits to the atmosphere. Microbial oxidation is a primary control on methane flux from today's ocean, yet this process is poorly constrained.

David Herbst **4/1/2008-3/31/2010** **100,000**
Cal Dept of Water Resources, 07-081-256

Lahontan Region Bioassessment Monitoring and SWAMP Scientific Coordination

The California Regional Water Quality Control Board, Lahontan Region (RWQCB), is the State agency responsible for protection of water quality within the Lahontan Region of California. Its jurisdiction extends from the Oregon border to the northern Mojave Desert and includes all of California east of the Sierra crest. The RWQCB needs modern tools to better protect and regulate aquatic life beneficial uses for surface waters. Aquatic habitat quality may be evaluated by sampling in-stream invertebrate and periphyton communities and calculating composite measures of community structure (such as diversity, biotic index, and taxonomic indicator groups), and through multivariate methods that consider physical habitat parameters as well as community structure. The collection of such information is called "biomonitoring" and the assessment of biological integrity using the biomonitoring data is called "bioassessment." The objectives of this project are to implement existing tools for assessing the quality of wadeable streams and rivers, and to develop and advance new such tools. The project will: a) characterize benthic communities and instream physical habitat at selected stream reaches; and b) provide technical assistance to the Lahontan Water Board to assist it in implementing existing bioassessment tools and develop new tools for the future.

David Herbst **3/31/2008-12/31/2010** **70,000**
California Regional Water Quality Control Board, 07-125-130

Characterization of Benthic Communities and Instream Physical Habitat in the San Lorenzo River Watershed

The California Regional Water quality Control Board, Central Coast Region (RWQCB), is the State agency responsible for protection of water quality within the Central Coast Region of California. The San Lorenzo River and associated tributaries are listed as impaired due to sediment, and the RWQCB must utilize Total Maximum Daily Loads (TMDLs) to address the impairments. In order to develop TMDLs and associated implementation actions for sediment, the RWQCB needs better information on the linkage between sediment loads and impairment of aquatic life beneficial uses. Aquatic habitat quality may be evaluated by sampling in-stream invertebrate communities and calculating composite measures of community structure (such as diversity, biotic index, and taxonomic indicator groups), and through multivariate methods that consider physical habitat parameters as well as community structure. The collection of such information is called "biomonitoring" and the assessment of biological integrity using the biomonitoring data is called 'bioassessment." The objectives of this project are to provide a comprehensive picture of aquatic health of the San Lorenzo River and its tributaries with respect to sediment loading; and numeric target measurements to determine water and habitat quality.

David Herbst **6/1/08-12/31/09** **18,270**
Kern Community Foundation

Aquatic Restoration in Upper Kern River of Sequoia National Park

Inventory and visually identify benthic macroinvertabrate assemblages in streams identified for restoration in the Upper Kern River of Sequoia National Park, in order to evaluate recovery of benthic macroinvertebrate assemblages in Upper Kern River restoration sites.

David Herbst **8/1/08-3/31/09** **47,500**
San Jose State University Foundation

Surface Water Ambient Monitoring Program 9SWAMP) and TMDLs in the San Lorenzo River

Evaluate information based on the set of data collected at forty sites, covering nearly all tributaries and most of the main stem of the San Lorenzo River and reference sites in neighboring waterbodies. The full set of sites is represented by the 40 stream locations selected to document the network of streams contributing potential sediment load in the San Lorenzo River, and would include some external reference sites to set natural background loading as context for the TMDL. To accomplish this we will rely on data collected at these sites during physical and biological surveys, but supplemented with historical data from a hydrograph on the San Lo that we will use to develop an index of hydrological alteration.

David Herbst **8/25/08-9/30/13** **38,180**
USDI Fish and Wildlife Service

Monitoring Aquatic Ecosystem Indicators of Spring Restoration on the Sheldon National Wildlife Refuge: Feral Horse Grazing Exclosures

The purpose of this study is to determine the effects of feral horse use on riparian and adjacent areas in the absence of livestock grazing. We hypothesize that springbrook channels protected from feral horse use will have different aquatic life support capacity than areas used by feral horses, and protecting streams from feral horse use will also permit geomorphic recovery of channels (decrease width and increase depth). Damages to spring habitats on the Sheldon National Wildlife Refuge in northern Nevada are associated with trampling, overgrazing, and contamination by feral horse populations. Because cattle grazing has been removed from the SNWR for over a decade, protection of select spring habitats by riparian exclosures permits examination of the independent influence of horse grazing. The success of exclosures in recovering the biological integrity of riparian and aquatic habitat of these

springs will be monitored through the use of benthic macroinvertebrate bioassessment. Contrasts of the diversity of these indicator organisms inside and outside exclosures will provide a measure of the progress and extent of improved habitat conditions over time. Complementary studies of riparian and upland vegetation community recovery will also be conducted.

David Herbst **9/1/08-6/30/11** **200,000**
USDA Forest Service

Monitoring of Sentinel Aquatic Management Indicator Species Sites to Account for the Influence of Global Climate Change on Stream Reference Condition

The objective of this study is to create a method to evaluate impacts from global climate change that will allow the Forest Service to credibly evaluate conditions of stream and lake habitats and confidently attribute any observed impacts to land management activities separate from the potentially confounding influence of global climate change.

David Herbst **9/3/08-9/30/12** **20,000**
USDI Bureau of Land Management

Quantitative Survey of Invertebrate Populations, Physical Habitat Characteristics and Water Chemistry in Rough Creek, Bodie Creek and Tributaries, Bodie Hills, Mono County, CA

To obtain and provide both relevant and timely information that will assist managers in a cooperative effort of the Walker River Implementation Team (WRIT), of which BLM is a member, to support recovery of Lahontan cutthroat trout, a Federally Threatened listed species. The project will also assist BLM and a host of cooperating State and Federal resource agencies in efforts to meet the mandates of both the Endangered Species Act (ESA) and the National Environmental Policy Act (NEPA). Specifically, the project will provide both relevant and timely information to WRIT for evaluation of the potential for establishment of a meta-population of Lahontan cutthroat trout in these waters in support of recovery efforts for this Federally Threatened listed species. Data relevant to recovery efforts collected as part of the proposed project will: 1) Document existing invertebrate populations and associated physical habitat characteristics, and 2): Ensure adequate environmental analysis of possible impacts to existing invertebrate populations that could result from treatments required to remove non-native trout prior to any reintroduction of Lahontan cutthroat trout. The WRIT has identified the evaluation of the potential establishment of this meta-population as a priority conservation action to be included in the updated short-term action plan for the implementation of the Lahontan Cutthroat Trout Recovery Plan, approve 1995.

Gretchen Hofmann **10/19/2007-10/31/2008** **29,700**
Christopher Osovitz
California Energy Commission, MR-07-12J

The Effects of Elevated Atmospheric CO_2 on the Physiology of the Purple Sea Urchin

The central aim of this project is to employ emerging molecular tools to strengthen our understanding of the biological consequences of ocean acidification on California's reef system by investigating the physiology of an important biological member of California's coastal ecosystem, the purple sea urchin, in response to elevated levels of CO_2. The current trajectory of global climate change has generated an urgent need to understand the ecological consequences of such change. In particular, marine systems face the threat of ocean acidification due to increasing atmospheric CO_2 levels. The most recent Intergovernmental Panel on Climate Change (IPCC) report projects global CO_2 levels to reach 540-970 parts per million (ppm) by the year 2100, up from the current level of 370 ppm. This increase in CO_2 could in turn decrease ocean pH (currently 80-8.3) as much as 0.3 pH units, a degree which has already been shown to slow the rate of calcification in the skeletons of calcareous marine organisms. However, the impact of such changes on the physiological ecology of California reef species remains unclear. In order to assess the physiological effects of ocean acidification, skeletal growth and hardness and gene expression will be measured in the calcareous purple sea urchin, *Strongylocentrotus purpuratus* in response to artificially elevated levels of CO_2 under laboratory conditions.

Gretchen Hofmann **7/15/04-12/31/09** **383,534**
National Science Foundation

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

The goal of this proposal 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 will use four congeneric species of temperate sea urchin as study organisms. These marine invertebrates are ideal study organisms for this study because (1) the congeners are closely related yet have different ecological temperature ranges that facilitate comparative studies (2) it is possible to work on early life history stages as well as adults with relative ease and the embryos have intraspecific differences in response to temperature and (3) there are significant, readily available molecular resources for the purple sea urchin as a result of the Sea Urchin Genome Project.

Gretchen Hofmann **12/15/2007-11/30/2008** **20,000**
National Science Foundation, ANT-0808947

Science of Opportunity: A SGER Proposal to Support the Development of Genomic Resources for Antarctic Pteropods.

This grant supports the rapid acquisition of DNA sequence for the Antarctic pteropod *Limacina helicina*, a resource that would allow the development of a cDNA microarray to profile gene expression in this critical marine invertebrate in response to ocean acidification. This acquisition facilitates the collaboration of the PI, a marine molecular ecologist, with Professor Victoria Fabry, an expert in pteropod calcification biology, and a leader in the ocean acidification research community. The resources developed here will be shared with the polar research community, and all DNA sequence data and protocols will be available via web databases. Notably, the genomic tool developed here will be most likely useful for pteropods from Antarctic and Arctic waters.

Gretchen Hofmann **7/1/2008-6/30/09** **32,092**
Paul Matson
UC Office of the President, 08-T-CEQI-08-0007

The Importance of Source Populations: Does Maternal Temperature and Nutrition Influence the Larval Stress Response in the Red Sea Urchin?

This project will examine whether larval stress tolerance is influenced by the maternal environment in the red sea urchin *(Strongylocentrotus franciscanus)* distributed across the Santa Barbara Channel. The graduate student will use genomic tools to study how both habitat temperature and nutritional condition of adult red sea urchins may affect the physiological performance of larvae in response to thermal stress. In addition, he will explore possible effects of climate change by culturing adult urchins from different habitats in the laboratory under increased temperatures. The red sea urchin is an excellent study organism to explore this question because of its large spatial distribution, ease of laboratory culturing, accessibility of genomic information, and ecological and commercial importance.

Gretchen Hofmann **7/1/08-6/30/09** **34,567**
UC Office of the President

Illuminating Pathways: A New Method in Understanding the Movement of Marine Larvae

Larval identification and counting is traditionally accomplished by eye with a microscope. By this method, identifying larvae to species or genus level is difficult to impossible (Levin 1990), and manual counting prohibits addressing these questions because the scale of required monitoring is labor prohibitive. Thus, these questions have heretofore been addressed with indirect methods such as genetics, microchemistry, and recruitment patterns or have not yet been tackled (Palumbi 2004, Levin 2006). The novel method proposed here combines emerging genetic information with recent

technological advances. Our method uses whole-organism in situ hybridization to label specific species of marine larvae with a fluorescent DNA probe (eg. Miller and Scholin 1996) and larvae are then counted with a recently developed large flow-cell sorter. We have had preliminary success with this method on red urchins. I propose to extend this technique to a suite of fisheries species so that we can evaluate the effectiveness of existing reserves, and can refine our criteria for marine reserve design.

Gretchen Hofmann **3/1/2008-2/28/2009** **29,028**
UC Sea Grant, R/ENV-136PD-F

How will Calcifying Larval Sea Urchins Respond to Ocean Acidification and Warming in the Future Ocean: Using DNA Microarrays to Screen for Shifts in Expression of Genes Involved in Calcification

The goal is to determine the impact of ocean acidification and temperature changes on the development and physiology of early life history stages of the red sea urchin, *Strongylocentrotus franciscanus*, using genomics tools. The method is to raise cultures of red urchin at three levels of CO_2 and three different temperatures, then to collect larvae to screen for variation in gene expression using an oligonucleotide microarray designed in the PI's lab. This microarray has a perfect match with purple sea urchins, and preliminary screenings demonstrate that the red sea urchin will also hybridize with the microarray. Resulting data will facilitate understanding of the impact of ocean acidification on economically important marine calcifying organisms. A great deal of information from laboratory experiments shows that a more acidic ocean will reduce calcification and growth rates. However, the mechanisms involved in compensation for the lower saturation states in future oceans are unknown. A genomics approach, whereby we can observe gene expression changes in multiple pathways, allows insight into a "physiological fingerprint" of how the larvae respond to these changes in the ecosystem and will show whether they are capable of calcifying in the future high CO_2 ocean, which holds many unknowns for marine ecosystems. The experiments will: examine how CO_2 impacts calcification and other processes, explore whether there is plasticity/compensation, reveal mechanism, examine and reveal the synergistic actions of ocean acidification and increased temperature.

Gretchen Hofmann **5/1/09-4/30/10** **19,619**
National Science Foundation

A Proposal for a Workshop on Global Environmental Change & Biological Evolution in the Ocean

How the biology of the ocean will react to and modify the ongoing comprehensive global change-driven alterations in the marine environment is presently virtually unknown. The guiding questions of this workshop are:

What are the most compelling questions that are best addressed by an integrative approach combining oceanography and evolutionary biology to address biological responses to rapid environmental change in the ocean?

How can studies of present-day organisms and communities be used to predict long-term adaptations and biological responses to rapid regime shifts?

Can accurate models be developed to predict future effects of multiple environmental changes on organismal, population, and ecosystem level adaptations?

Assuming experimental evolution experiments are tractable, what are the best strategies (microcosms, mesocosms, and choices of organism)?

Sally Holbrook **10/1/2007-9/30/2010** **275,400**
UC San Diego, 54181A

Building Community Based, Grass-Roots Networks: The Cases of Global Lake Ecological Observatory Network (GLEON) and of Coral Reef Ecological Observatory Network (CREON)

UC Santa Barbara, is the lead institution for the Moorea Coral Reef LTER site located in Moorea, French Poyynesia. Key personnel leaders Sally Holbrook, Russell Schmitt and Andrew Brooks will

provide the driving science for coral reefs. During the project period, they will work with other CREON sites to 1) define science questions to be addressed by the CREON network, 2) develop deployment plans for instruments, including agreement on nomenclature and measurement standards, 3) develop common database structures including metadata standards, and 4) identify future participants for CREON and facilitate their entry into the network. The MCR LTER site will serve as a test-bed for development of a sensor network node. CTD (conductivity, temperature, depth) sensors will be deployed on reefs at Moorea. The investigators will test the most efficient way to acquire data and make it available on the internet. One goal is to provide real-time streaming data. The researchers will also explore networking multiple sensors at the site, with the idea of developing an autonomous sensor network. The particular deployment of multiple sensors will be driven by a physical oceanographic science question that will shed light on biological processes. Using an interface such as the cyberdashboard, the prototype network will allow physical oceanographers to query the data and use them to develop and test real time models.

Robert Jellison **4/1/2007-3/31/2010** **464,194**
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, benthic 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. In addition to analyzing responses in each of these ecosystem components during 2007-2012 when new water management initiatives are expected to be implemented in the Walker Basin, results of this project will also be used to establish the scientific foundation for long-term monitoring of the "health" of Walker Lake.

Robert Jellison **10/1/08-7/31/09** **100,000**
John Melack
Los Angeles Department of Water and Power

Monitoring of Limnology and Plankton in Mono Lake

Saline lakes are widely recognized as productive aquatic habitats, which in addition to harboring distinctive assemblages of species, often support large populations of migratory birds. Saline lake ecosystems throughout the world are threatened by decreasing size and increasing salinity due to diversions of freshwater inflows for irrigation and other human uses (Williams 1993, 2002); notable examples in the Great Basin of North America include Mono Lake (Patten et al. 1987), Walker Lake (Cooper and Koch 1984), and Pyramid Lake (Galat et al 1981). At Mono Lake, California, diversions of freshwater streams out of the basin beginning in 1941 led to a 14 m decline in surface elevation and an approximate doubling of the lake's salinity.

The limnological monitoring program at Mono Lake includes the interpretation of a wide array of limnological data collected during monthly surveys conducted during February through December.

Matthew B. Jones **9/1/2007-8/31/2008** **180,000**
Mark Schildhauer
UC Davis, SUB0700051

SDCI NMI Improvement: Development of Kepler CORE - A Comprehensive, Open, Robust, and Extensive Scientific Workflow Infrastructure

The UC Santa Barbara work on this project will include participation in project meetings, interaction with the broader scientific community about requirements for Kepler, and contributions to the development of the Kepler Core software. Specifically, Matthew Jones will oversee and manage the UCS project; Mark Schildhauer will engage with domain scientists to elicit project requirements; the software engineer will participate in the design and re-factoring of Kepler core for maintainability, extensibility, and new core features; and the build and support engineer will re-factor the build system to be NMI compliant, build the test system and write tests, as well as solicit test cases from the project developers and the broader community, and will create and maintain the collaboration infrastructure (web site, wiki, CVS, bug tracking, etc.).

James P. Kennett **9/15/08-8/31/09** **151,994**
National Science Foundation

Collaborative Research: Co-Evolution of Submillennial and Orbital Scale Climate and Ocean Behavior During the Last 700 kyrs: The Unique Santa Barbara Basin Record

The proposed research will investigate abrupt and high-frequency climate change at an ultra-high resolution previously unobtainable before 150 ka, but here spanning most of the 100-kyr climate regime back to ~700ka. Resolving short-term climate behavior before ~150ka is critical for understanding processes, thresholds, and feedbacks that contribute to abrupt climate change. Millenial-scale climate oscillations (Dansgaard/Oeshger cycles) reflect major abrupt shifts in the ocean-atmosphere system, yet knowledge of this important behavior is largely confined to the last glacial cycle, owing to the unavailability of suitable older sequences. This study will extend our understanding of these events and processes for the first time by analysis of a superb suite of 32 high-sedimentation rate (~80-120 cm/kyr) cores taken in 2005 on the Santa Barbara Mid-Channel anticlinal trend, where older, uplifted stratigraphic sequences crop out on the ocean floor. Our preliminary work confirms that Santa Barbara Basin can reveal climate history in unprecedented resolution for this time span, clearly recording earlier D/O-like cycles and abrupt climate-oceanographic behavior of the north Pacific through much of the interval dominated by the 100 kyr glacial-interglacial cycles, an interval not previously studied at this resolution.

James P. Kennett **9/16/08-9/14/09** **11,938**
USDI Geological Survey

Record of Abrupt Climate Change in the Santa Barbara Basin

This project involves the collection and study of marine cores from the Santa Barbara Basin by USGS and UCSB scientists. The USGS will compile climate change data on microfossils in the same sample set being studied by UCSB scientists for oxygen isotopes.

David W. Lea **9/1/06-8/31/10** **3,574**
National Science Foundation

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

The PI and a graduate student propose to participate in the R/V Knorr 195-5 research cruise from the Galapagos Islands. The objective of the cruise is to use the long piston coring facility in the R/V Knorr to recover long sediment cores from the Galapagos region that can be used to construct benchmark paleoceanographic records for the eastern tropical Pacific.

Ira Leifer **4/1/06-9/30/10** **30,000**
Cal State Lands Commission

UCSB Coal Oil Point Seep Studies

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.

Ira Leifer **12/1/06-11/30/09** **173,612**
NASA

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. We propose marine hydrocarbon seeps can ground-reference remote sensing CH4 data determining limitations and abilities of current and next generation remote sensing platforms. Marine hydrocarbons 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. Total field emissions are ~ 100 moles s-1, thus the downwind plume should be satellite observable (e.g., SCIAMACHY, etc.). We demonstrated in a proof of concept study in the Coal Oil Point seep field that remote sensing techniques and AVIRIS sensitivity in particular could measure methane emissions. Recent studies indicate geologic CH4 is significant but poorly constrained due to a lack of data. Seeps are particularly common in oil producing basins (Gulf of Mexico, Gulf of Alaska, S. California) and interior areas (Texas, Wyoming). Also, CH4 remote sensing will aid in areas beyond climate change such as homeland defense and disaster mitigation. We propose 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. Only remote sensing can provide continent scale methane emission data; this study provides the validation. Other benefits include quantification of natural seepage and a technique that will aid homeland defense and disaster mitigation. Disasters, natural or otherwise, can lead to massive releases of methane from natural gas pipelines, presenting a hazard to rescue workers and requiring costly repairs.

Ira Leifer **7/1/2007-12/31/2008** **21,116**
Cal RA Department of Fish and Game, P0775012

Seeps in Santa Paula Creek

This project tests the hypothesis that hydrological factors and topography strongly affect the emission and transport of riverine seep oil to coastal waters. The PI will investigate several of the largest seeps in Santa Paula Creek near its confluence with Sisar Creek and identify hydrological factors that could allow oil transport to coastal waters. He will develop methods to quantify oil emissions from these seeps and quantify emissions with respect to rainy season and aquifer pressure. Results will be compiled of oil sampling investigations in coastal and inland areas, which led to the implication of natural seeps in Santa Paula Creek Watershed as the source(s) of oil that affected coastal and inland resources and their habitats. Finally, the PI will document the locations of capture and species of oiled birds affected by the 2005 VBOI and summarize the outcome of rehabilitation efforts.

Ira Leifer **11/1/2007-10/31/2008** **1,500**
UC MEXUS, SB080052

Developing a UC-Mexico Collaboration on Passive Acoustic Observations of Seabed Bubbles

Measurement of the bubble size distribution is of widespread importance and has long challenged researchers. Although optical approaches are most common, passive acoustics is highly promising with several advantages over optics. Specifically, passive acoustics could allow long-term monitoring of seabed and wetland bubble emissions, which present enormous challenges for optical approaches and remain poorly quantified. Concern for greenhouse gas emissions and the need for data for model initialization provides the impetus to develop new approaches to measure these fluxes. This project supports the PI to travel to Mexico to discuss preliminary data and develop a collaborative research program with Mexican scientists at UNAM-Iztapalapa. Dr. Leifer has extensive experience in field and laboratory optical bubble measurements, including a first effort to passively observe seep bubbles. The Mexican collaborators have extensive experience in bubble hydrodynamics, both experimental and theoretical.

Ira Leifer **8/1/08-7/31/09** **30,881**
University of Mississippi

Spatio-Temporal Measurement of Seep Emissions by Multibeam Sonar

The work to be conducted is to continue technological development aimed at the establishment of a monitoring station/sea-floor observatory (MS/SFO) to monitor and investigate the hydrocarbon system within the hydrate stability zone of the northern Gulf of Mexico. The intention of this and past efforts is to consolidate research effort and to equip the MS/SFO with a variety of sensors and instruments that will enable the determination of a steady-state description of physical, chemical, biological and thermal conditions within the local environment as well as to detect temporal changes of those conditions. Data treatment/processing, an integral component of this research, will be designed and utilized as needed.

Ira Leifer **10/1/08-9/30/09** **50,269**
Texas A&M University

Remote Sensing and Sea-Truth Measurements of Methane Flux to the Atmosphere from Near-Surface Gas Hydrates in Continental Margins

Participate in the TAMU project "Remote Sensing" and coordinate the Santa Barbara Channel field test, collect data, conduct data analysis, and numerical modeling of bubble fate.

Ira Leifer **10/1/08-3/31/10** **32,144**
UC MEXUS

Passive Acoustic Observations of Marine Seabed Bubbles

Passive acoustics is a highly promising, but largely undeveloped, bubble size measurement approach with widespread potential applications and advantages including long-term monitoring of seabed and wetland bubble emissions, both sources of the greenhouse gas, methane. This collaborative pilot lab and field project synergistically combines the extensive field and laboratory (but not theoretical) experience of Dr. Leifer for optical and sonar bubble measurements with UNAM's laboratory and theoretical expertise in bubble hydrodynamics and acoustics (eg., Vasquez et al, 2005). Lab studies will compare theoretical bubble formation sounds for ideal (distilled, stationary) and field (currents, surfactants, seabed boundary) conditions with field data, improving upon Leifer & Tang (2006). Project leveraging includes hydrophone data on whale migration for interpretation based on the lab and field studies to derive long-term emissions at a SCUBA-accessible seep. This will yield further synergies with a remote-sensing methane study by providing temporal context, its "snap shot" of field emissions.

This UC MEXUS collaboration builds upon bubble-science discussions spanning many years through preliminary data acquisition for a collaborative, large-scale research proposal. We seek to provide regulatory agencies and policymakers with a critical tool to assess methane inventories from diverse aquatic sources under current and warmer climate conditions.

Ira Leifer **10/13/08-9/30/09** **7,984**
Applied Science Associates, Inc.

A Literature Review of Seep Research

This project requires working with the MMS southern planning region, northern border of Santa Barbara County to the U.S. /Mexican border in California, regarding setting specific aspects of chemical oceanography for work.

Jonathan Levine **10/21/04-10/20/09** **50,000**
The David and Lucile Packard Foundation

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 proposal outlines a research program applying principles of population, community, and ecosystem ecology to understand the factors controlling the success and impacts of biological invasions. The proposed research couples mathematical models with field experiments to understand such fundamental questions as how many new invaders we should expect 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, the proposed research aggressively pursues a rigorous understanding of the entire invasion process.

Jonathan Levine **3/15/2008-2/28/2010** **218,089**
National Science Foundation, DEB-0743365

Collaborative Research: Niches, Neutral Controls Over the Coexistence of California Serpentine Annual Plants

One of the most enduring mysteries in ecology is how multiple plant species coexist. For almost a century, efforts to answer this question almost invariably invoked niche differences between species. This changed, however, with the recent rise of neutral models suggesting that species similarities, rather than differences, drive their coexistence. Apparent conflict between the role of species differences in neutral and niche theories has spurred interest in a new framework for coexistence. In this framework, species coexist when niche differences, called stabilizing processes, overcome fitness differences between species. This theoretical insight, however, has identified new gaps in the understanding of coexistence. Most importantly, ecologists have little understanding of overcoming large fitness differences among species versus weak stabilization combined with small fitness differences. Where real communities fall along this continuum reveals the importance of niche differences for coexistence, and goes to the heart of debate between niche and neutral theory. This research combines field experiments with population dynamic and statistical models to ask how niche differences and fitness inequality shape the coexistence of California serpentine annual plants.

Milton Love **6/1/2007-9/30/2008** **22,443**
US Department of Commerce, AB133F07SE2838

An Assessment of Derelict Fishing Gear and Other Marine Debris in Deepwater Benthic Habitats off California

Dr. Love will provide data and video archives from southern California underwater surveys. He will then be involved in the production of a report and a website detailing marine debris pollution in southern California water.

Milton Love **8/22/2007-8/31/2010** **760,000**
USDI - Minerals Management Service, M07AC13380

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

The fate of spent offshore platforms off California has been a subject of considerable debate, much of which is focused on the potential importance of fish populations residing at these facilities. Data gaps concerning the fish assemblages exist at some of the oldest facilities, yet these facilities may be the first to be decommissioned. Knowledge of the potential importance of the local population at platforms to the depleted Pacific rockfish stocks is essential for fully evaluating the various options proposed for decommissioning California's offshore oil platforms. Using manned submersible and scuba surveys, this project quantifies spatial and temporal patterns in species composition, density and size structure of fish assemblages at offshore oil/gas platforms and nearby natural reefs. Surveys make use of seafloor habitat maps and regional oceanographic patterns to interpret findings.

Milton Love **5/15/2008-5/14/2011** **460,000**
USDI - Minerals Management Service, M08AX12732

Spatial and Seasonal Variation in the Biomass and Size Distribution of Juvenile Fishes Associated with Petroleum Platforms off the California Coast

Although hundreds of thousands of juvenile rockfishes sometimes inhabit POCS platform midwaters, the role that platforms play as nursery grounds for these badly depleted fishes is not well understood and will be of critical importance to the MMS in assessing the ramifications of different platform decommissioning options. It will also be of great interest to Federal and State agencies concerned with rebuilding overfished stocks and to nongovernmental organizations involved in the decommissioning process. Because fish populations are usually limited by available habitat, energy, or recruitment, it is essential to know the role of each platform as habitat for early life stages, particularly as compared to the natural reefs in the vicinity of platforms. In this study, SCUBA surveys at platforms and natural reefs that are at depths of at least 25 m will provide comparative data on which species settle (i.e., recruit), their densities, size distributions at platforms and natural reefs, as well as the depth at which they recruit at platforms throughout the Santa Barbara Channel region and off central California. Further, a novel experiment employing fish attraction devices (FADs), is designed to evaluate the importance of the shallow portion of platforms (<25 m) for recruitment. The SCUBA survey and FAD experiment build upon previous research to assess the importance of depth for fish recruitment at the platforms. This is particularly crucial in order to analyze the environmental consequences of decommissioning alternatives on local and regional fish populations.

Milton Love **6/1/08-3/31/10** **55,000**
USDI Geological Survey

Arctic Marine Fish Ecology Catalog

This project involves summarizing what is known about the biology, systematics, and ecology of the fishes living in the Chukchi and Beaufort seas, in the northern pare of Alaska.

Milton Love **6/1/08-3/31/10** **32,236**
USDI Geological Survey

Comparison of Levels and Profiles of Polycyclic Aromatic Hydrocarbon Metabolites in Bile of Fishes from Off-Shore Oil Platforms and Natural Reefs Along the California Coast

To determine the environmental consequences of decommissioning platforms on local and regional fish populations, the sources of fish recruitment, the general health, and the contaminant load in

reproducing adults must be known. This information will be especially important for platforms harboring large numbers of resident reproducing adults and serving as nursery habitat for juvenile fishes that eventually may "spillover" or migrate to natural areas and help to replenish populations that are commercial and recreational fishery sources. There is also the potential for recruitment and productivity of adults from species that are regionally depleted and are being considered for listing under the Endangered Species Act.

Sally MacIntyre **4/1/07-3/31/10** **56,931**
National Science Foundation

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

We now know that turbulence production in the upper mixed layer, thermocline and bottom waters of lakes is intensified when frontal systems which induce cooling and higher winds pass through a region. The amplitude of internal waves, whose breaking causes turbulence, increases during these events and varies with bottom slope. In addition, these frontal systems induce stream inflows which spread into lakes at various depths as a function of temperature and discharge. Consequently, during storm events, we can now 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. The proposed work will build upon this knowledge to design experiments to locate these 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, we will be positioned to more accurately quantify lacustrine bacterial and primary productivity than ever before.

Susan Mazer **10/6/08-10/6/09** **40,000**
USDI Fish and Wildlife Service

Connecting People with Nature Through Integration of Climate Change Research and Education

This project will develop and field-test phenology educational products that will engage California residents in connecting with nature by observing, recording, and reporting seasonal changes in biological activities. The four products to be produced here include: (1) A species identification guide with observation protocols for up to 30 California native plant species targeted through a gap analysis for Project Budburst and National Phenology Network; (2) The Phenology Handbook: a field guide for teachers, naturalists and families; (3) An activity guide (worksheets and quantitative exercises appropriate for 5th grade – undergraduate students) for classroom and field use led by teachers and docents and; (4) Creation of phenological gardens at two public elementary schools and at the Boys and Girls Club in Oxnard, where teachers and supervisors will be trained to use our educational tools in the course of year-round phonological observations. Our aim is for these products to be used at the national level, following extensive field-testing throughout California as part of the VFWO and Region 8 Connecting People with Nature Program.

Deborah McArdle **9/1/2007-8/31/2008** **10,000**
Steven Gaines
Marine Conservation Biology Institute, 3675

A Life-History Based Approach to Interpreting and Predicting Resilience: Historical Responses of an Exploited Marine Species to Fluctuations in Fishing and Climate

This project will analyze an extended fishery time series using historical and biological data spanning over a century to determine: 1) the California spiny lobster's historical baseline population, 2) how that population has changed over time, 3) the long-term natural and human causes for those fluctuations, and 4) whether the historical baseline is an appropriate conservation target. It will employ both classical fisheries models and heirarchichal Bayesian methods, and capitalize on the length of the time series, to disentangle signatures of fishing, environmental variation, and population dynamics. Synthesizing historical data and population models, the PIs will seek to identify whether and the extent to which specific life history traits underlie California spiny lobster's

historical responses to fluctuations in fishing intensity and climate. The focus on life history traits will contribute to an improved framework for setting robust, long-term sustainable conservation targets for lobster fisheries and other exploited marine populations with similar relevant traits.

William McClintock **4/15/2008-12/31/2010** **1,476,905**
Steven Gaines
Resources Legacy Fund Foundation, 2008-0019M

MarineMap Decision Support System

The Marine Life Protection Act Initiative (MLPAI) is in dire need of an updated, web-based decision support system (DSS) for designing marine protected areas (MPAs) and communicating proposed designs to stakeholders, the Science Advisory Team (SAT), and Blue Ribbon Task Force (BRTF). Previously, the MarineMap consortium based at UCSB outlined specifications for a proper DSS for the upcoming, South Coast phase of the MLPAI. This system would allow stakeholders to: 1) manipulate interactive maps to view all of the spatial data layers in the MLPAI geodatabase, 2) visualize the results of ongoing monitoring efforts, 3) draw prospective MPA boundaries, perform a variety of analyses using these boundaries that support SAT guidelines, including spacing, habitat calculations, and economic impacts, 4) save and post maps, analytical results and MPA proposals to discussion forums, and 5) participate in online discussions and Wikis (a web page in which users edit content collectively) about these proposals. UCSB is leading the effort to build and manage the MLPAI DSS, providing expertise, guidance and coordination among the entities involved in developing these tools. This project supports the development of the system prototype that, with continued efforts, will ultimately lead to a dramatically improved DSS. UCSB will coordinate efforts among Ecotrust, Farallon Geographics and subcontractors to develop the proposed decision support system.

William McClintock **12/1/2007-12/31/2008** **75,602**
Steven Gaines
Santa Monica Bay Restoration Foundation, 07-14

GIS Support for the Analysis of Data Gaps on Habitats and Resources in Santa Monica Bay

The UCSB PIs will provide geographic information systems (GIS) support for the Santa Monica Bay Restoration Commission (SMBRC) to facilitate the analysis of data gaps on habitats and resources in Santa Monica Bay. In particular, a full-time GIS analyst will work under supervision of Dr. Will McClintock at the UCSB Marine Science Institute (MSI). The GIS analyst is to work in close collaboration with a second individual (to be hired by the SMBRC) who will be primarily responsible for providing data to the analyst for compilation, uploading to the MLPA geospatial database, and displaying and distributing via an ArcIMS web site. The data, database schema, and ArcIMS formats will match comparable and existing data, schemas and formats used by the MLPA Initiative to facilitate use by interested parties once the MLPA Initiative moves to the Southern California Bight.

William McClintock **7/1/08-1/31/2010** **75,000**
Steven Gaines
Resources Legacy Fund Foundation

The California Marine Life Protection Act Decision Support System: Recommendations for Development and Maintenance for the North Central Coast Study Region

Provide technical expertise for data display, habitat mapping and Geographical Information System Analyses for use by the Blue Ribbon Task Force, Regional Stakeholder Group, and Master Plan Team, including the development of ArcIMS-based web-maps and desktop-based mapping services.

Daniel E. Morse **7/1/06-12/31/09** **120,000**
DA / Army Misc. Bases and Agencies

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

The dynamically adaptive 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. Our specific objectives are to clone and sequence the cDNA's 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 project will enable the subsequent design and synthesis of a new generation of electro-optically active materials for new means of optoelectronic communication.

Craig Nicholson **7/1/08-6/30/10** **201,427**
Christopher Sorlien
National Science Foundation, EAR-0810278

Uplift, Subsidence, and Sedimentation Along the Evolving Pacific-North American Plate Boundary

The offshore California Continental Borderland is an ideal natural laboratory to investigate many aspects of continental deformation and plate boundary evolution, including oblique rifting and transform initiation. 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 is generally an area of deposition rather than erosion, suggesting that the record of plate boundary deformation is more complete, more geophysically accessible, and can be better imaged in 3D offshore. Active offshore structures represent a largely as yet unknown hazard to many California coastal communities, and provide important analogs to active buried (less-accessible) onshore structures likely to produce large, damaging earthquakes in the Los Angeles basin and other areas. The PIs will make use of extensive grids of newly released high-quality industry marine multichannel seismic (MCS) data to investigate the crustal deformation and tectonic evolution of the offshore portion of the PAC-NAM plate boundary. Evaluating the offshore structure, stratigraphy and plate boundary deformation of the Continental Borderland will address important questions about the evolution of continents and continental deformation, including: how does strain accumulate and how is it partitioned within plate boundaries, and what controls the crustal architecture at plate boundaries?

Craig Nicholson **3/1/2008-2/28/2010** **255,144**
Christopher Sorlien
James Kennett
National Science Foundation, OCE-0751807

Collaborative Research: A Test for Extending the High-resolution Climate Record back to 1.2 Ma & Investigating the Mid-Pleistocene Climate Transition in Santa Barbara Basin

High-quality, well-dated records are essential for understanding global climate change. ODP Site 893 in Santa Barbara Basin provides one of the highest-resolution paleoclimatic archives of the late Quaternary in the world's oceans, yet has not been extended beyond ~160 ka with deeper drilling, due to safety concerns. In 2005, a towed-chirp and coring cruise verified that deep basin sediments extending to ~700 ka are accessible on the Mid-Channel Trend. These cores contain high-quality partially laminated (varved) sediment with abundant well-preserved microfossils optimal for ultra-high-resolution paleoclimate studies. Newly released multichannel seismic (MCS) data, along with chirp, sonar and industry dart core data indicate that a similar sequence of upper bathyal sediments have been uplifted, folded, and exposed on the northern outer shelf of Santa Barbara Basin, now accessible to piston coring. These sediments extend back to more than 1.2 Ma. IODP is enthusiastic about drilling to recover this older high-resolution record, if suitable, safe drilling strategies can be developed. This project will test the feasibility of extending the record from Santa Barbara Basin back to ~1.2 Ma by conducting 3D modeling of the structure and outcrop stratigraphy of the northern shelf to locate optimal core sites, and by conducting needed IODP site surveys, test coring and core analyses. This work will further understanding of climate variability and major climate transitions, and of factors related to climate destabilization and abrupt climate change, a current societal concern given uncertainties related to global warming and future climatic instability.

Craig Nicholson **2/1/2007-1/31/2009** **55,000**
University of Southern California, 119525

Helping to Evaluate the SCEC 3D Community Fault Model and Regional Seismicity Catalogs

This project will help evaluate 3D fault representations in the SCEC Community Fault Model (CFM), using recently developed relocated earthquake catalogs. This will form the basis for identifying and developing new and alternative representations for faults that are currently missing, incompletely or inaccurately defined in the current CFM, as well as help distinguish between existing alternative fault models. The results will be used to define a set of reference 3D fault surfaces (or calibration points) that exhibit a high degree of consistency between their surface and subsurface expressions such that the position of the fault at depth can be ascertained with a high degree of confidence. These 3D control points can then be used to help calibrate and evaluate the relocated earthquake catalogs. This is particularly critical in areas like the Imperial Valley and along the southern San Andreas and San Jacinto fault systems, where different velocity models and location procedures can significantly shift earthquake hypocenters relative to their mapped surface fault traces. In collaboration with other members of the SCEC CFM Working Group, the results will be used to identify and establish a set of calibration control points, such as reference 3D fault surfaces and principal earthquake hypocenters and focal mechanisms, which based on kinematic consistency and other independent data sets can be used to define the orientation and position of active subsurface fault segments.

Roger Nisbet **9/1/2007-8/31/2009** **137,000**
National Science Foundation, DEB-0717259

QEIB: Modeling Disturbances in Systems with Unidirectional Flow

Many questions in fundamental and applied ecology involve relating biotic responses to abiotic forcing at multiple spatial and temporal scales. It is commonly impossible to establish such links empirically, even with large quantities of data and sophisticated statistical approaches. Simple mathematical models can help elucidate these links and contribute to understanding the broader implications of mechanisms found to occur at one particular scale in space or time. This study focuses on models of populations that disperse in *advective* media, media with net unidirectional flow. Examples include drifting invertebrates in rivers and streams, marine organisms whose larvae are dispersed in local longshore currents, and plants with wind or waterborne seeds. The emphasis is on population dynamics in rivers and streams, for which many ecologists have gathered data on local demographic and behavioral processes operating over small time scales. The models will be used to determine the implication of these findings at larger spatial, and longer temporal, scales. Stream and river systems exhibit high spatial and temporal variability, and the PI will use simple models to address questions arising from this variability. The models will make predictions as to the population level consequences of changes in flow regime. As a result, it will be possible to relate the work directly to some very practical issues in environmental management, including calculation of "instream flow needs," i.e., the flow regime in a river that must be maintained to ensure viability of resident populations and communities.

Roger Nisbet **4/1/2008-3/31/2011** **555,011**
Frank Doyle
National Science Foundation, EF-0742521

Collaborative Research: Homeostasis, Stoichiometry and Dynamic Energy Budgets at Multiple Levels of Biological Organization

Dynamic energy budget (DEB) models describe the rates at which individual organisms assimilate energy and elemental matter, using it for maintenance, growth, reproduction and development. DEB theory offers a powerful theoretical framework for relating suborganismal (biochemical, genetic, and physiological) processes to organismal performance, and thereby to population, ecosystem, and evolutionary change. However, establishing such relationships in particular systems requires a more sophisticated treatment of homeostasis within individual organism than current DEB theory offers. This research will extend DEB theory by exploring the consequences at many levels of

biological organization of a broad range of biochemical and physiological control mechanisms. It will emphasize dynamics in variable environments, adaptive dynamics, and both inter- and intra-specific metabolic scaling relations. There will be parallel efforts to develop general theory on one particular application: the biology of stony corals, a system that requires non-traditonal theory, since the interactions of a cniderian host with symbiotic dinoflagellates (zooxanthellae), as well as with intra-cellular and etracellular microbial communities, create a context where traditional distinctions between levels of biological organization fail, and where the time scales of physiological, ecological, and evolutionary processes overlap. Theoretical developments address general biological problems and will have wide applicability, including leguminous plants and *Rhizobium* bacteria, ruminants and their intestinal flora, chemi-autotrophic taxa in deep seas habitats, and moss-lichen associations.

Todd Oakley **1/1/2004-12/31/2007** **271,300**
Todd Oakley **7/1/2007-6/30/2009** **12,000**
David Plachetzki
National Science Foundation, DEB-0710406

DISSERTATION RESEARCH: Tracing the Origins and History of Animal Phototransduction using Phylogenetic Approaches

This study seeks to shed light on the problem of the evolutionary origins of diversity and complexity using the animal phototransduction protein network as a model. These phototransduction protein networks are implicated in primary vision in all animal eyes and represent ancient evolutionary modules, amenable to phylogenetic study. The primary question explored by this research is: how have the evolutionary mechanisms of duplication, co-option and loss shaped animal phototransduction protein network history? A central hypothesis is that duplication of phototransduction protein networks (via gene duplication) has been a driving force in the diversification of animal visual systems. Opsin proteins mediate animal phototransduction, and a comprehensive, metazoan-wide phylogenetic treatment of their relationships has already been completed. Phylogenies for each of the remaining members of the phototransduciton protein network are underway. This project will be able to vastly improve the quality of its findings by allowing experimental confirmation or our phylogenetic results and predictions. As a test case for the implementation of common phylogenetic tools to a novel problem, this study is poised to yield important contributions that extend beyond the problem of photoreceptor evolution.

Todd Oakley **4/1/07-3/31/10** **127,500**
National Science Foundation

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

The PI proposes 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 proposes to 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.

Henry Page **1/1/2008-12/31/2009** **2,078,317**
Daniel Reed
Stephen Schroeter
Simpson and Simpson Business and Personnel Services, Inc., SB080067

San Onofre Nuclear Generating Station Mitigation Project Monitoring Program

In 1974, the California Coastal Commission (CCC) issued a coastal development permit to Southern California Edison Company (SCE) for Units 2 and 3 of the San Onofre Nuclear Generating Station. A condition of the permit required studying the impacts of the operation of the units on the marine environment offshore from San Onofre, and mitigation of any adverse impacts. As a result of the impact studies, the Coastal Commission added new conditions requiring restoration of southern California wetlands, construction of a kelp reef, installation of fish barrier devices at the power plant, and provision of funds for a marine fish hatchery. The new conditions also require SCE to fund a program for monitoring the implementation of the mitigation effort to be carried out by appropriate and independent scientific and technical personnel and consultants under the direction of the Executive Director of the Coastal Commission. The UCSB investigators will work with CCC officials on implementation and monitoring of the Wetland Restoration and the Mitigation Artificial Reef projects. Their activities will include entering, organizing and managing data, as well as preparation of reports to the CCC on the progress of these projects.

Henry Page **12/1/2007-6/30/2010** **102,772**
Jenifer Dugan
UC Agriculture and Natural Resources, SA7429

Fouling Dynamics and Control Research and Outreach Assessment to Assist California's Coastal Boaters in Reducing Risks from Hull-Borne Invasive Species

Recreational boaters, boating businesses and the marine life that boaters enjoy are threatened by aquatic invasive species (AIS). Boats carry AIS from ports to harbors along the coast. AIS can foul and damage hulls and coastal structures, out-compete and over-grow native marine life, and cause or carry disease. Boaters and boating businesses in the near future will need to adapt to new AIS and antifouling water quality regulations. Boat owners and boating businesses, coating companies, agencies, policy makers, academics, and environmental organizations will need research-based information in the next few years to make technically, ecologically and economically sound decisions and create sustainable policies for controlling AIS among hull fouling while protecting water quality. The PIs will conduct experiments to provide data on the effects of seasons, submersion times, hull coating type, hull cleaning practices, and influence of water quality. Harbors in San Diego Bay and Santa Barbara were selected for study sites because they are located in different biogeographic sub-regions, thereby providing information on fouling patterns on a broader spatial scale and for a larger group of fouling organisms. These harbors are also frequented by small craft, including recreational boats in San Diego and both commercial and recreational boats in Santa Barbara.

Dorothy K. Pak **7/1/08-8/31/10** **64,607**
UC Office of the President

Acidification of California Coastal Waters: The Geological Record of Natural and Anthropogenic pH Variability

The proposed research relates directly to several CEQI priorities, as it addresses gaps in knowledge on the effects of ocean acidification on coastal ecosystems, provides paleoclimate records from the coastal zone for the recent past, and will address the question of how different California coastal environments respond to climate change. Additionally, this research addresses priorities outlined by recent workshops on ocean acidification that recommended "increased and improved monitoring of the carbonate system….in coastal and open-ocean carbonate environments" (Kleypas et al., 2006).

Dorothy K. Pak **9/1/08-8/31/11** **90,915**
National Science Foundation

Collaborative Research: An Ultra-High Resolution, Multiproxy Study of the Past 2,000 Years of Climate Change in Southern California

Santa Barbara Basin 9SBB) is the only location in the northeast Pacific that can provide quality, high-resolution paleoclimate reconstructions due to suboxic bottom waters (minimal biturbation), high biogenic sediment input (including sufficient foraminiferal carbonate for dating, etc.) and

extremely high sedimentation rates (hence high resolution). The study must be high resolution to capture information about specific climate events such as the Little Ice Age (LIA), MCA and the rapid warming of the 20th-21st centuries. Furthermore, the study must be multiproxy to capture short duration events that may only be reflecting specific environmental conditions in the basin and therefore be recorded by specific proxies. The location of the SBB in the subtropics makes it sensitive to record variability associated with strong expressions of the El Nino Southern Oscillation (ENSO) as well as indices of extratropical climate state, i.e. the Pacific Decadal Oscillations (PDO). Both ENSO and PDO variability have been linked to western US drought patterns [Cook et al., 2007; MacDonald and Case, 2005]. Finally, a multiproxy annual to decadal surface ocean reconstruction will enormously benefit the prediction of drought in the western US by providing tests for causal relationships.

Steven Proulx **7/1/08-6/30/11** **564,791**
National Science Foundation, EF-0742582

The Origin of Genetic Interactions by Natural Selection

An understanding of the evolutionary basis of gene interactions and genome structure has only recently become possible, due in large part to the advance of comparative genomics. The goal of this project is to develop theory to describe important components of genome evolution: genetic divergence and gene duplication. Genetic divergence, the evolutionary diversification of alleles, may precede gene duplication and represents an important source of genetic innovation. Natural selection can facilitate genetic divergence whenever a gene functions in multiple contexts, be they internal to the organism (e.g., differentiated tissues) or at the level of the organism (e.g., different environments). The project will focus on within-organism selection for genetic divergence and include gene regulation, dimerization, and alternative splicing. Secondly, it will explore how sources of variability that act at the population level can cause genetic divergence and gene duplication. The importance of a quantitative approach to all aspects of biology cannot be overstated. Creating mechanisms that allow mathematical theory in biology to be presented as part of everyday normal activities will help develop a culture of biologists that embrace theory as a normal part of biological research. This project will contribute to this goal by holding workshops in theoretical biology for undergraduate and graduate students.

Daniel C. Reed **12/1/06-11/30/09** **2,823,546**
Steven D. Gaines
Sally J. Holbrook
John M. Melack
David A. Siegel
National Science Foundation, OCE-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 investigating the relative importance of land and ocean processes in structuring ecosystems at the land-sea margin. Our principal study area is the Santa Barbara Channel and the coastal watersheds that drain into it, and our focal ecosystem is giant kelp forests, which occur on shallow rocky reefs at the interface of the land-sea margin throughout our study area and other temperate coasts throughout the world. The major focus of the work proposed here is developing 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.

O. James Reichman **3/15/05-2/28/11** **84,846**
National Science Foundation

A Workshop on Mapping and Valuing Ecosystem Services

Governments, businesses, and multilateral agencies routinely use cost-benefit analyses to select among policy alternatives and identify worthy investments. Unfortunately for biodiversity, the biosphere and the humans that rely on it, these cost-benefit analyses rarely include costs in terms of degraded ecosystem services. Using three focal project sites and a suite of multiplier projects, The Natural Capital Project is developing data and tools for melding the benefits of ecosystem services (or, conversely, the costs of their loss) with conservation and development planning. Conservation planning, priority-setting and project development have historically emphasized conserving the most species for the least amount of land. Recently, however, conservation NGO's have begun to undergo a revolution in their thinking, recognizing that a sole focus on safeguarding concentrations of biodiversity within protected areas is too disconnected from people. A broader consideration of the economic and social context of conservation decisions will increase conservation's relevance to a broader segment of society, while highlighting how conservation is as much about what happens outside of nature reserves as within the nature reserves themselves. The National Center for Ecological Analysis will support the development of the ecosystem service mapping and valuation tool for the Natural Capital Project.

William R. Rice **4/4/08-5/31/09** **136,350**
University of Washington

Drosophillia Seminal Fluid: Proteomic Discovery and Functional Variation Analyses

The seminal fluid proteins of *Drosophila melanogaster* have been extensively studied. Most fly seminal fluid proteins are accessory proteins (Acps), produced in a paired set of secretory organs called the accessory glands. Upon mating, these proteins are mixed with sperm and several other proteins to produce seminal fluid, which is then transferred to the female. These transferred proteins are responsible for several changes in female physiology and behavior; they induce ovulation and egg-laying, reduce female receptivity to re-mating, stimulate an immune response, and up-regulate feeding behavior. Acps are implicated in mediating sperm competition between males and causing an overall cost of mating in females. In spite of two decades of study, only a handful of seminal fluid proteins have been conclusively demonstrated to be transferred at mating to females, and specific functions have been assigned to even fewer. This research seeks to comprehensively identify the set of seminal fluid proteins present in mated females. These proteins will then be examined for their patterns of molecular evolution and their effects on male reproductive success. The PI hypothesizes that for certain Acps, both coding sequence variation and levels of protein expression will affect male and female fitness.

Luz Rodriguez-Villa **12/1/2007-11/30/2008** **18,000**
Carol Blanchette
UC MEXUS, SB080070

Biodiversity and Rocky Intertidal Benthic Community Structure in Relation to Coastal Natural Resources in the Southern California Bight

Information on the influence of environmental, biological and anthropogenic factors on coastal natural resources is important for adequate management. An ecological analysis of seafloor (benthic) community resources is essential for understanding natural ecosystems. Biodiversity studies provide a fundamental link in developing advantageous strategies, through conservation research and management of the economic sustainability of coastal zones, where exploitation and commercialization of these natural resources and their use for fishing, industry, tourist-recreational and urban interests generate an important source of revenue. Rocky intertidal habitats are extensive zones of great ecological importance, often with high species diversity. Their accessibility facilitates constant anthropogenic alterations, including destruction of habitat and pollution. However, current knowledge of the biodiversity of these communities is inconsistent. Some groups in rocky intertidal habitats are well known and well understood, mainly those with larger organisms and north of

the US-Mexico border. For other important groups, such as benthic macrofauna, awareness is poor, especially south of the US-Mexico border. This project will generate the first large-scale data on benthic macroinvertebrate community structure of rocky intertidal habitats in the southernmost portion of the Southern California Bight (SSCB), spanning from the US-Mexico border in the north to Cabo Colonet, in Baja California, Mexico, in the south. The end-product will expand knowledge of the species richness of macroinvertebrates, serving as a reference frame for future ecological studies.

Anne Salomon **3/1/2008-2/28/10** **163,206**
Steven Gaines
Society for Conservation Biology, SB080092

Forecasting the Ecosystem-Level Effects of Marine Reserves to Inform Ecosystem-Based Management

Mounting evidence suggests that over-fishing can trigger a cascade of indirect effects throughout marine food webs, thereby modifying marine ecosystems and the economic and social systems that rely on them. Fortunately, ecosystem-based management tools such as marine reserves are increasingly being implemented with the goal of restoring marine ecosystem function. Concurrently, managers are increasingly being asked to assess reserve performance at achieving this goal. However, the effects of marine reserves on ecosystem processes are rarely measured despite the fact that the restoration of ecosystem function is their paramount goal. The PI seeks to fill this gap by investigating the extent to which marine reserves alter key ecosystem processes such as predation, herbivory, productivity and carbon flow, all of which are known to drive ecosystem function. She will then use this empirically derived data to develop a predictive model that managers can use to determine where, when and under what conditions the cascading effects of fishing are likely to ensue. By revealing the ecological mechanisms that drive biological patterns of concern to conservation practitioners and managers, this innovative and mechanistic approach will improve scientists' predictive ability to forecast the ecosystem-level effects of marine reserves across a range of oceanographic conditions. This research project has been designed to explicitly inform ecosystem-based management, one of the foremost challenges facing conservation and management practitioners today.

Mark Schildhauer **10/1/2007-9/30/2009** **400,000**
Matthew B. Jones
O. James Reichman
Andrew W. Mellon Foundation, SB080054

Data Management and Analysis Tools Supporting Adaptive Management in South African Parks

Kruger National Park (KNP) 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, has 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. This phase of the project entails the expansion of the data system to the broader collection of parks and research stations in South Africa, and the creation of the additional analysis infrastructure needed to effectively use these data in adaptive management approaches in the parks.

Mark Schildhauer **12/7/2007-1/7/2009** **1,036,961**
Gordon and Betty Moore Foundation, 1666

Public Domain ADMB Project

AD Model Builder (ADMB) is a tool for developing integrated statistical models of complex systems. The principal advantages of the ADMB software suite over other approaches are rapid model development, numerical stability, computational speed, precision of model estimates, and the capacity to accommodate relatively large numbers of parameters and data points. The ADMB software has earned acceptance by researchers working on all aspects of resource management. Population models based on the ADMB software are used to monitor more than 150 different sensitive endangered species and commercially valuable fish stocks around the world. ADMB applications extend beyond stock assessment. This software is used for applications critical to the development of place-based management policies and is an essential building block of the methods used to reconstruct movements of many species of animals tracked with electronic tags. ADMB applications are critical to the missions of fishery management agencies in the United States and abroad. A group of world-renowned resource scientists have established a non-profit charitable organization, the ADMB Foundation, to acquire the ADMB software and establish a system for maintaining and distributing it. As part of this project, the PI's will establish a partnership between the ADMB Foundation and the National Center for Ecological Analysis and Synthesis (NCEAS), with the goal of placing the ADMB software in the pubic domain so that it can be freely distributed via the world wide web.

Joshua P. Schimel **9/1/08-8/31/12** **254,239**
National Science Foundation

Collaborative Research: Spatial and Temporal Influences of Thermokarst Features on Surface Processes in Arctic Landscapes

Recent summaries of international research clearly document the past and future extent of climate warming in the Arctic. These summaries suggest that in the future, rising temperatures will be accompanied by increased precipitation, mostly as rain: 20% more over the Arctic as a whole and up to 30% more in coastal areas during the winter and autumn. These climate changes will have important impacts on Arctic Systems. Of direct interest to the research we propose here is the likelihood that warming will promote permafrost degradation and thaw. Formerly frozen soils may be further destabilized by increased precipitation, leading to hillslope thermkarst failures. We have recently documented that thermokarst failures are abundant and appear to have become more numerous around Toolik Lake on the eastern North Slope and in the western Noatak River Basin in Alaska. We hypothesize that a widespread and long-term increase in the incidence of thermokarst failures will have important impacts on the structure and function of arctic headwater landscapes. We propose to use a systems approach to address hypotheses about how thermokarst failures influence the structure and function of the arctic landscape. Specifically we will focus on the composition of vegetation, the distribution and processing of soil nutrients, and exports of sediments and nutrients to stream and lake ecosystems. We further propose to line results obtained at this hillslope scale to patterns observed at the landscape scale to test hypotheses about the spatial distribution of thermokarst failures in the arctic foothills.

Russell Schmitt **3/1/2008-2/28/2009** **7,500**
Sally Holbrook
UC Office of the President, SB080096

UC LTER Network Planning Workshops

The LTER program is the flagship of the environmental sciences at NSF, designed to explore ecological phenomena that occur over many decades. Hence, a core research theme concerns the responses of the focal ecosystem to climate forcing. UC administers three of the 26 LTER sites, all with a coastal marine focus: the Santa Barbara Coastal (SBC), California Current Ecosystem (CCE) and Moorea Coral Reef (MCR) LTERs. Collectively, these three LTERs involve researchers and

research facilities from 5 UC campuses as well as scientists from two California State Universities. The UC LTERs represent the most productive and economically important coastal marine ecosystems of the Pacific Rim: forests of giant kelp (SBC), coral reefs (MCR) and the coastal pelagic upwelling biome (CCE). This project is designed to capitalize on NSF's long term investment in research and information management infrastructures of the UC LTERs, to enhance the range of issues UC scientists can address and to implement a new model for cross-disciplinary training of graduate students across UC campuses. Such a framework would greatly improve our ability to advance knowledge by facilitating research on major issues that cannot be answered by studying at a single LTER site or ecosystem, but could be addressed effectively using a network - level approach.

Russell Schmitt **9/1/04-8/31/10** **1,245,734**
National Science Foundation, OCE-04174412

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 **7/1/09-6/30/10** **150,000**
National Science Foundation, OCE-04174412

RAPID: Resilience of Coral Reef Ecosystems

We will take advantage of a large-scale, natural disturbance at the NSF-sponsored Moorea Coral Reef LTER site in French Polynesia to explore resilience characteristics of coral reef ecosystems to sets of pulse – press disturbance combinations that alter different attributes of the reef ecosystem. Resilience is the capacity of an ecosystem to return to its previous state following a pulse disturbance such as a cyclone or temperature excursion. Understanding what influences resilience is becoming ever more critical in light of forecasted alterations in disturbance regimes (pulse events) and environmental drivers (press events) associated with Global Climate Change (GCC). Global environmental change not only is altering the intensity of press events, it also is changing the frequency and strength of pulse disturbances. Given these complexities, the ability to forecast how ecosystems will respond to or recover from projected changes in pulse and press events ranks among our most vital scientific challenges.

Stephen Schroeter **7/1/2006-12/31/2008** **40,000**
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 **1/1/2006-12/31/2007** **1,617,689**
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.

Nicholas Shears **10/1/2006-6/30/09** **185,962**
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 "spil r" 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.

Sharon Stammerjohn **5/1/08-4/30/11** **215,502**
Robin Ross
Langdon Quetin
NASA Shared Services Center

Improving Current Assessments and Future Predictions of Carbon Fluxes in the Southern Ocean as Mediataed by the Dynamical Response of Ice-Ocean-Ecosystem Interactions to Climate Change

The Southern Ocean (which is 10% of the Earth's total ocean area) is estimated to be responsible for up to 20% of the global ocean CO_2 uptake of 2.2 Pg C yr-1 (Takahashi et al. 2002; Takahashi et al., in prep). However, a roughly two-fold uncertainty exists in the estimated CO_2 uptake, and the uncertainty depends largely on whether polar continental shelves covered by seasonal sea ice act as one-way CO_2 pumps: in winter out-gassing of CO_2-rich water is prevented by the overlying sea ice

cover, while in spring-summer rapid onsets of phytoplankton blooms at the ice-edge provide a CO_2 sink. The extent to which phytoplankton blooms will provide a CO_2 sink is uniquely dependent on downward carbon export, i.e., the biological pump. To improve current assessments and future predictions of carbon fluxes in Southern Ocean sea ice zones, we will investigate the highly seasonally (and interannually) varying dynamic relationships between sea ice, ocean and the ecosystem using 15 years of data from the western Antarctic Peninsula (wAP) region. We are focused on the wAP region for two reasons; (1) it has been shown to be warming faster in winter than anywhere else on earth and (2) remote and in situ physical, biogeochemical and ecosystem data in this region are more extensive than anywhere else in the Antarctic/ Southern Ocean region.

Elisa Stratton **5/15/08-12/15/09** **22,500**
Southern California Coastal Water Research Project Authority, a Public Agency

Technical Assistance for Bight '08 Coastal Wetlands Eutrophication Assessment

Conduct primary producer, sediment sampling and water quality monitoring within the lagoon and sampling to support estimates of freshwater loading upstream of the lagoon. Primary producer surveys include measurement of macroalgal biomass, submerged aquatic vegetation, benthic diatoms, and water column phytoplankton (and associated nutrient samples).

Jennifer Thorsch **7/18/08-8/30/09** **33,572**
Cal State Library

The Katherine Esau Digital Archive of Plant Anatomy

According to the 2007 study "Encouraging Girls in Math and Science" produced by the IES National Center for Education Research, there is a need for female role models to give girls a sense of achievement and to increase confidence in themselves. Much progress has been made in the past thirteen years in attracting young women to careers in math and science. Yet, most efforts have offered informal learning opportunities such as after-school programs and field trips as ways to engage them. "Under the Microscope: A Decade of Gender Equity Projects in the Sciences," published by the American Association of University Women in 2004, recommended that additional efforts be made to "integrate STEM [Science, Technology, Engineering and Math] gender equity efforts into the curriculum" and to "explore online territory." Our project aimed to address this need through a new web site about the life and achievements of botanist Katherine Esau by providing young scholars with primary source material about her life and her remain research focus – plant anatomy. We also wanted to provide access to as many individual plant anatomical images as we could to satisfy the many requests we get from botanists and educators around the world. As demonstrated in a small survey we conducted, people who teach plant anatomy at the high school and college level want access to high quality images, and Esau was the pioneer in producing superior quality microscope images of thousands of different plants. Local teachers who teach students in grades 5-8 also expressed an interest in additional lesson plans that would incorporate Esau's images and information on plant anatomy and that would support the California content standards for science.

David Valentine **9/1/2006-8/31/2008** **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 **4/15/2005-3/31/2010** **635,624**
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 **9/1/2006-8/31/2010** **347,898**
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 biogeochemistry 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.

David Valentine **6/23/08-10/31/09** **26,416**
Mineral Science Company, Inc.

Cesium Chloride as a Bacterial Inhibitor

The aim of this project is to continue our investigations of the inhibitory properties of cesium salts on oral bacteria with the aims of assisting Mineral Sciences of developing an anti-microbial mouth wash formulation.

David Valentine **10/1/08-9/30/09** **210,461**
DOE/Miscellaneous Offices and Programs

Assessing the Efficacy of the Aerobic Methanotrophic Biofilter in Methane Hydrate Environments

This proposal directly addresses methanotrophic activity in the ocean, and seeks to answer fundamental questions about the methanotrophic biofilter including: What are the primary controls on the methanotrophic biofilter? How rapidly is methane consumed in different environments? How efficient is the methanotrophic biofilter at the sea floor and in waters overlying gas seeps and methane hydrate?

J. Herbert Waite **3/1/2007-2/28/2009** **159,902**
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.

J. Herbert Waite **8/4/08-6/30/10** **878,241**
NIH Dental and NIH Research, National Institute of Health

Translating Mussel Adhesion

Moisture is the nemesis of strong polymer adhesion to metals and minerals. Most engineered adhesive polymers require extensive prior surface cleaning, drying, and sometime even chemical modification for effective adhesion to polar surfaces. Such surface preparation is difficult in vivo since biomineralized tissues and implant material surfaces are necessarily hydrated within the body. Various marine organisms have evolved highly effective adhesive strategies for wet surfaces. The broad goal of this proposal is to obtain mechanistic information about marine adhesion in order to translate it into effective applications for restoration and repair of hard tissues. While the discovery of 3,4-dihydroxyphenylalanine (Dopa)-protein involvement in adhesion has already inspired several new biomedical materials, Dopa is not the only bioinpired theme. The specific aims here are to determine using mass spectrometry whether and to what extent phosphoserine and 4-hydroxyarginine are linked to mussel adhesion on different surfaces, characterize the specific protein-protein interactions during adhesive cross-linking, and to explore how factors such as mass, primary sequence, and side-chain functionalization influence the coating or bridging behavior of mfp-1 on surfaces such as titanium and hydroxyapatite using the surface forces apparatus. Bio-inspired adhesives and sealants are much needed in dentristry and orthopaedics not just to improve the strength and durability of bonding to hard tissues, but also to emancipate the present technology, particularly in dentristy, from reliance on highly reactive and toxic organic formulas.

Robert Warner **9/8/2007-9/7/2008** **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 **4/1/2004-3/31/2009** **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 **7/1/2006-8/31/2008** **211,838**
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.

Libe Washburn **2/1/2005-1/15/2009** **1,191,380**
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 **2/1/2005-1/15/2009** **43,650**
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.

Libe Washburn **7/1/08-6/30/09** **41,570**
UC San Diego

Southern California Regional Coastal Ocean Observing System: Surface Current Mapping, Harmful Algal Bloom, and Sub-Surface Water Sections

UCSB will carry out a set of observations at Stearn's Wharf in Santa Barbara providing a continuous data record of temperature, salinity, and chlorophyll fluorescence.

Kristen Whalen **12/31/2099-00/00/00** **181,660**
Gretchen Hofmann
National Science Foundation, OISE-0754319

PostDoctoral Research Fellowship

The central objective of this project is to develop the sea urchin microarray as a tool for understanding broader aspects of marine herbivore physiology and resistance to dietary chemical stressors. First, I will design and construct an oligonnucleotide array targeting over 2000 genes important in xenobiotic detoxification/efflux, signal transduction, nutrient metabolism and chemoreception. Secondly, I will use this custom designed microarray in combination with sea urchin feeding assays to profile herbivore gene expression in response to a range of chemically diverse (e.g. nonpolar and water-soluble allelochemicals) algal diets/extracts. Finally, I will conduct time-course sea urchin feeding assays with a diversity of algal diets to examine temporal changes in candidate gene expression using real-time quantitative PCR (RT-qPCR).

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 **9/1/2006-8/31/2009** **93,379**
US Department of Commerce, NA06NOS4290203

Mobile REEF Program: A Vehicle for Scientific Literacy

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 regional watersheds and extending out to the Santa Barbara Channel Islands. The focus will be on on-going research conducted by researchers from the Channel Islands National Marine Sanctuary, the Santa Barbara Coastal Long-Term Ecological Research project, and the Partnership for Interdisciplinary Studies of Coastal Oceans. Materials will include stream, estuarine, sandy beach, rocky intertidal and oceanographic studies. 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 includes classroom group-based activities, mobile touch tanks and guided field trips. It 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.

Allison Whitmer **10/1/08-9/30/09** **419,381**
Colorado State University

MSP: Culturally Relevant Ecology, Learning Progressions, and Environmental Literacy

Implement an environmental education program for middle and high school students at Goleta Valley Junior High School, Santa Barbara Junior High School, and Santa Barbara High School. As a component of this programming, we will administer assessments connected with research objectives associated with our environmental literacy framework development and culturally relevant, place-based education assessments. We will recruit one teacher per year to serve as our teacher-in-residence who will assist in mentoring graduate and undergraduate students placed in K12 classrooms. We will recruit teachers to participate in our Research Experience for Teachers summer program. We will also be responsible for recruiting scientists and students from the Santa Barbara Coastal Long-term Ecological Research (SBC LTER) program and the Marine Science Institute to support and participate in local programming.

Michael Williams **12/15/2003-11/30/2008** **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 **6/1/09-5/31/10** **85,451**
University of Nebraska

Modeling Antarctic Paleotopography

In the proposed research supported by this subcontract, Dr. Wilson will expand on existing work that has modeled West Antarctic paleotopography at the Eocene-Oligocene boundary, ~34 Ma (Wilson and Luyendyk, 2008; Fig. 1). The primary motivation is to provide realistic input for climate and ice-sheet models, e.g. DeConto and Pollard (2003), which so far have only accounted for modification of topography by ice loading. For West Antarctica, the work in progress makes additional restorations for thermal subsidence resulting from Late Cretaceous and early Cenozoic extension, for erosion and sediment deposition, and for post-34-Ma horizontal plate motion. The proposed work would involve (1) extending the 34-Ma work to include East Antarctica, especially restoring erosion and thermal subsidence along the continental margin, and (2) constructing a topographic model for the climate transition at 14 Ma, including restorations for both East and West Antarctica.

Louie Yang **9/1/2006-9/30/2008** **92,243**
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.

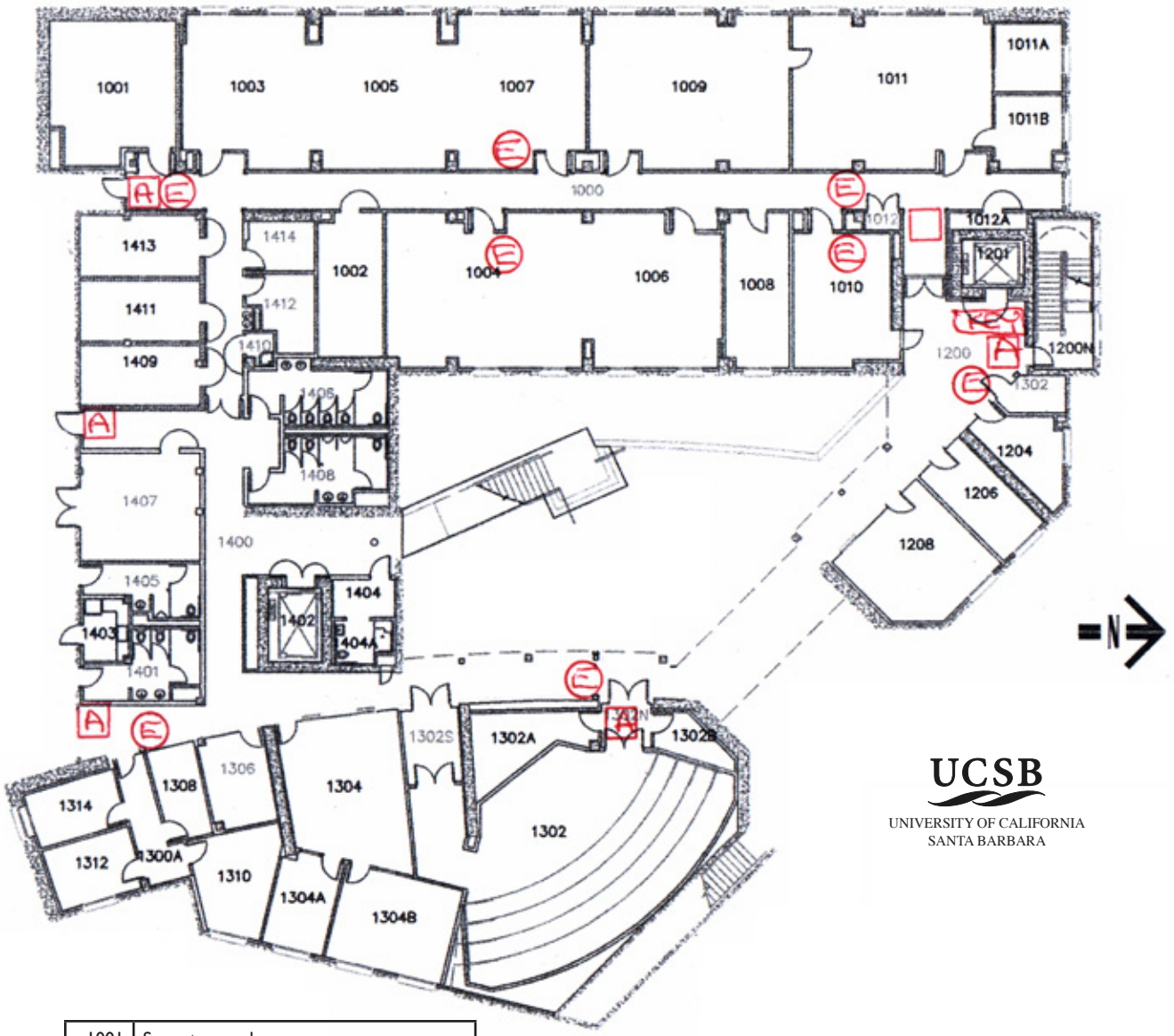
Oran Young **2/1/2007-1/31/2009** **61,941**
UC Sea Grant, R/OPCENV-02

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
06/2009

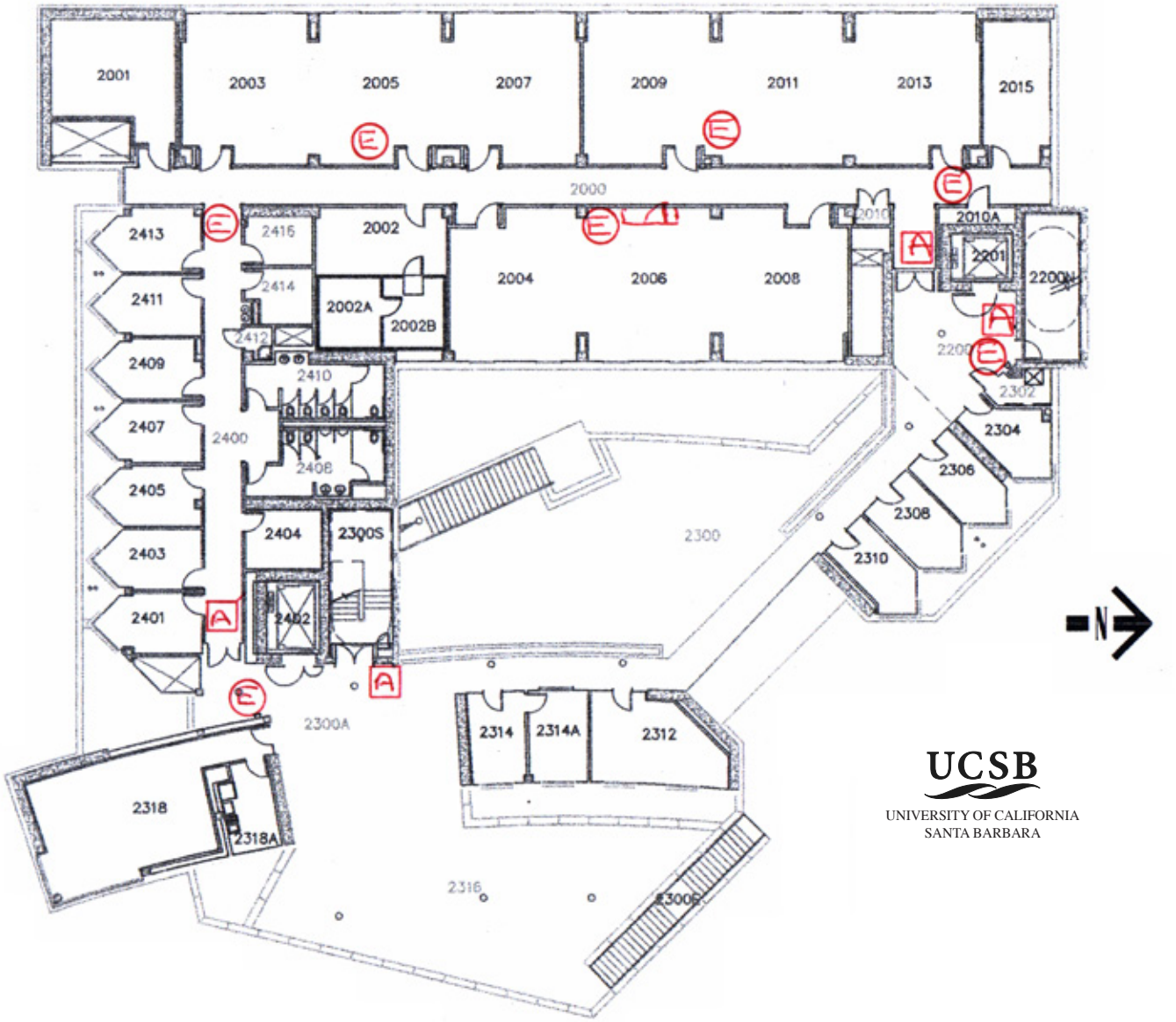


UCSB
UNIVERSITY OF CALIFORNIA
SANTA BARBARA

1001	Seawater workroom
1002	Common support laboratory
1003	Valentine laboratory
1004	Page/Dugan laboratory
1005	Valentine laboratory
1006	EPA laboratory
1007	Siegel laboratory
1008	Hacker laboratory
1009	Analytical laboratory
1010	Hacker laboratory
1011	Analytical laboratory
1204	Carolyn Culver
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
06/2009



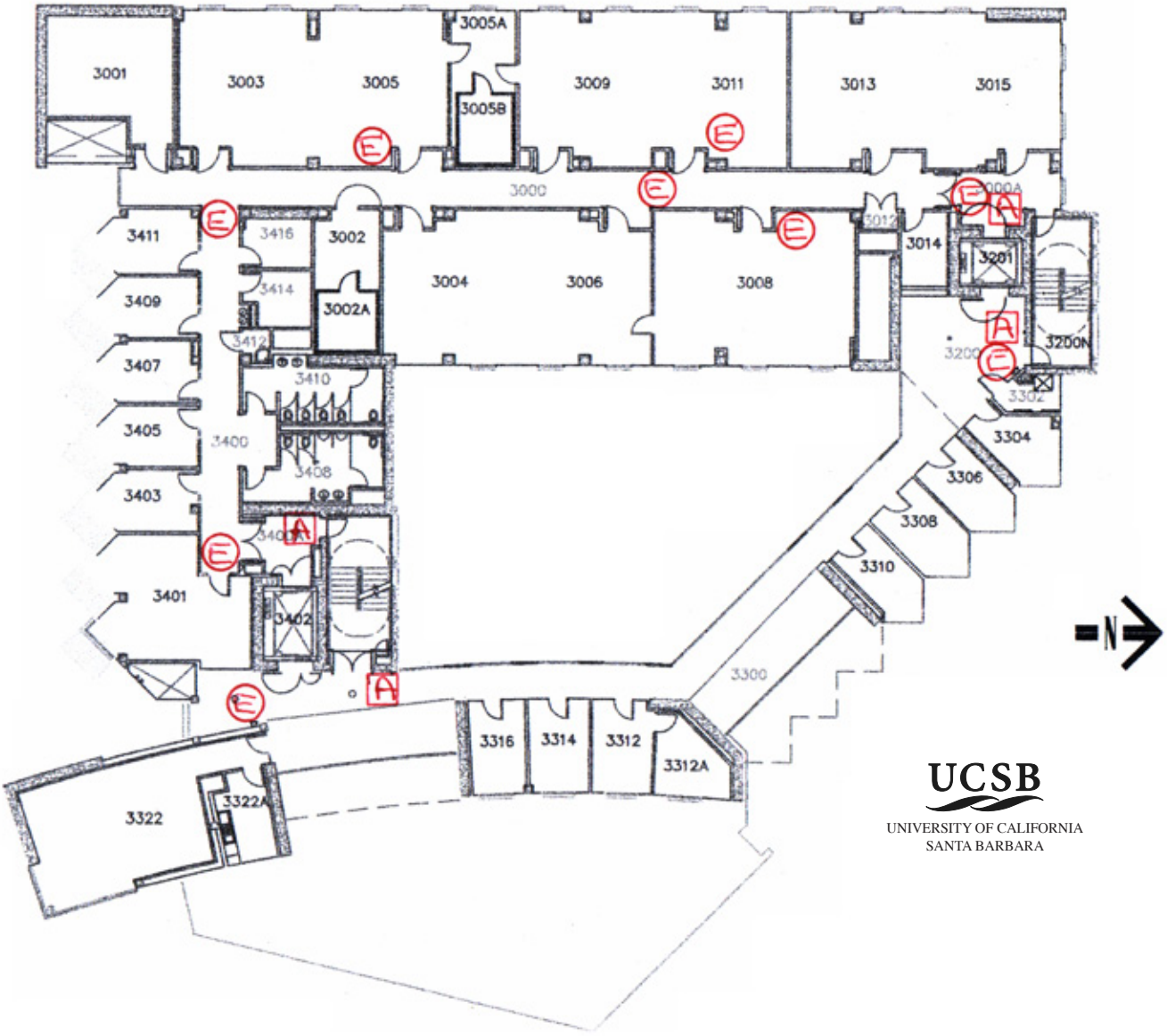
UCSB
UNIVERSITY OF CALIFORNIA
SANTA BARBARA

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	Shared laboratory
2009	Levine laboratory
2011	Levine laboratory

2013	Gaines laboratory
2015	Postdocs
2304	Postdoc office
2306	O'Donnell/Damschen
2308	Kevin Lafferty
2310	Shears/Salomon
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
06/2009

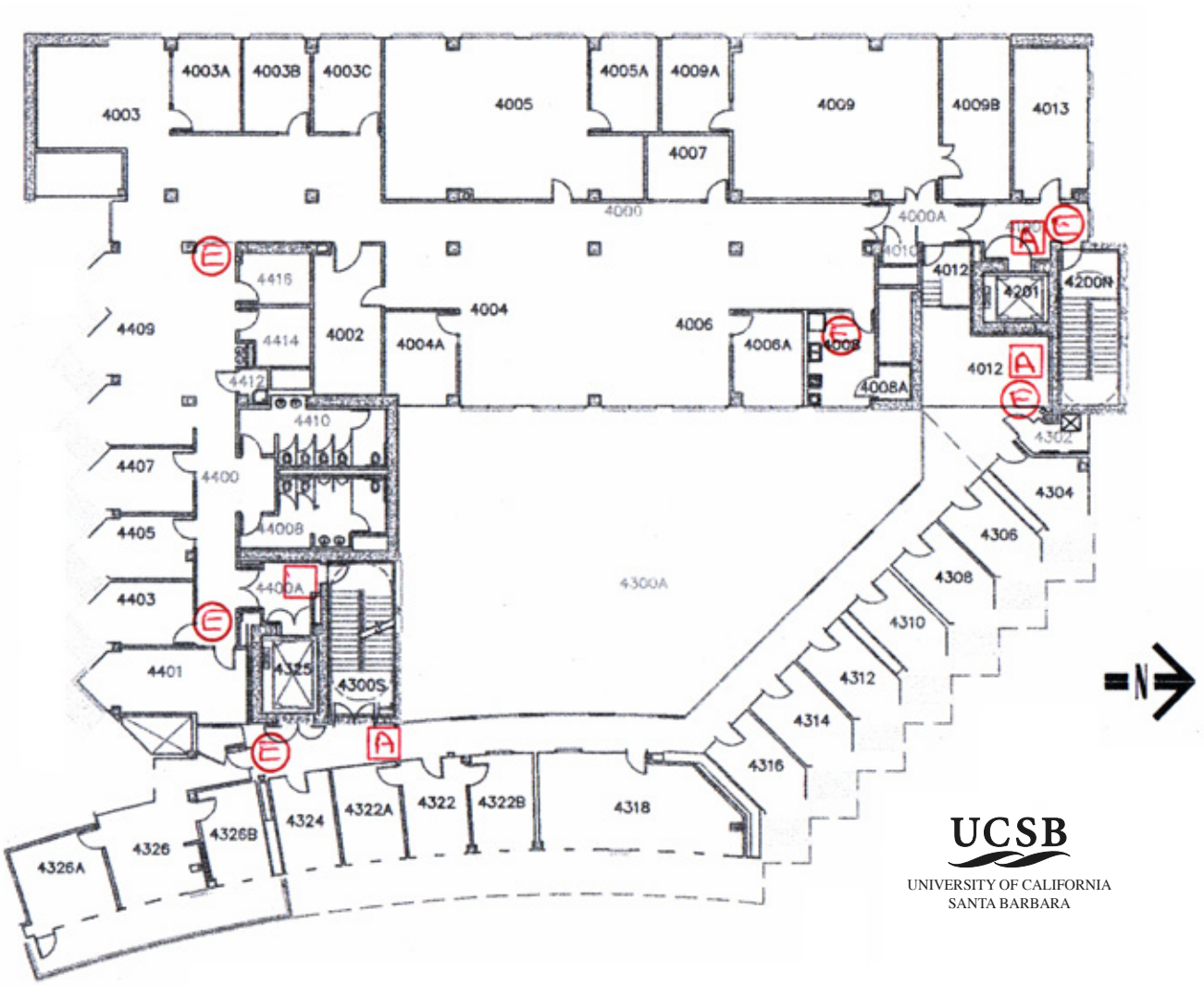


3001	Seawater workroom
3002	Common support laboratory
3003	Reed laboratory
3004	Holbrook laboratory
3005	Reed laboratory
3005a	Common support laboratory
3006	Schmitt laboratory
3008	Gaines laboratory
3009	Warner laboratory
3011	Warner laboratory
3013	Washburn laboratory

3014	Storage
3015	MacIntyre laboratory
3304	Jocelyn Ondre
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	Sustainable fisheries
3403	Margaret O'Brien – Mary Gastil-Buhl
3405	Econinformatics – Derik Barseghian
3407	Econinformatics – Benjamin Leinfelder
3409	Econinformatics – Mark Schildhauer/Dave Vieglais
3411	Econinformatics – Matt Jones

Marine Science Research Building
Bldg. No. 520 - 4th floor
06/2009



4002	Copier/mail room
4003a	Ocean o'Graphics – Monica Pessino
4003b	Storage
4003c	Joyce Wolever
4004a	Rachel Whitacre
4004c	Michele Ramirez
4004d	Mieke DeMeo
4005a	Elvira Rose
4005a	India Morgan
4005b	Veronica Torres
4005c	Nicole Zavala
4005e	vacant
4006a	Luisa Velez
4006a	Donna Dobis
4006b	Joanna Kettmann

4006e	Mike O'Neil
4007	Conference room
4008	Break room
4009a	Jim Woods
4009b	Marine Map
4009d	Mike Franklin
4012	Server room
4013	Marine Map
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	
4322a	Satie Airame
4322b	Robert Warner
4326b	Gay Larsen
4326	Development – Nannette Pedroso
4326a	MSI Director
4401	Tim Schmidt
4403	Chuck Cook
4405	Laurie Eusey
4407	Bonnie Williamson
4409a	Judy McCaslin
4409b	Deanna Cervantes
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	Jack Engle
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			
National Oceanic & Atmospheric Administration	$	34,226	0.18%
DA/Army Misc Bases and Agencies		120,000	0.63%
DOE/Miscellaneous Offices and Programs		210,461	1.10%
NASA/Miscellaneous Centers		389,114	2.03%
National Science Foundation–NSF		10,927,167	56.99%
NIH Research, National Institutes of Health		878,241	4.58%
National Aeronautics and Space Administration		120,000	0.63%
UC Sea Grant College Program		186,827	0.97%
USDA Forest Service		187,046	0.98%
USDI Bureau of Land Management		20,000	0.10%
USDI Fish and Wildlife Service		299,853	1.56%
USDI Geological Survey (Incl Natl Biological Service)		175,937	0.92%
USDI Minerals Management Service		90,000	0,47%
Federal Totals		**$ 13,518,872**	**70.50%**
State			
California Department of Parks and Recreation	$	49,954	0.26%
California Epa Water Control Board		40,000	0.21%
California Ra Coastal Commission		37,500	0.20%
California State Lands Commission		30,000	0.16%
California State Library		33,572	0.18%
Los Angeles Dept Of Water And Power		100,000	0.52%
San Jose State University Foundation		47,500	0.25%
Santa Barbara County Air Pollution Control District		22,900	0.12%
Southern California Coastal Water Research Proj Auth, A Public Agency		22,500	0.12%
UC Biotechnology Research & Education Program (Brep)		50,000	0.26%
UC Davis		270,000	1.41%
UC MEXUS		32,144	0.17%
UC Office of the President		101,266	0.53%
UC San Diego		41,570	0.22%
State Totals		**$ 878,906**	**4.58%**

Private

Applied Science Associates, Inc.	$	7,984	0.04%
Clark County, Nevada		899,959	4.69%
Colorado State University		419,381	2.19%
Conservation and Research Foundation		5,000	0.03%
David and Lucile Packard Foundation (The)		50,000	0.26%
Foundation for Res Science and Technology (New Zealand)		79,802	0.42%
Heal the Ocean Inc.		15,665	0.08%
Kern Community Foundation		18,270	0.10%
Marisla Foundation (Formerly Homeland Foundation)		200,000	1.04%
Mineral Science Company, Inc.		26,416	0.14%
National Academy of Sciences		20,000	0.10%
New Media Studio, The		43,593	0.23%
Oregon State University		1,116,393	5.82%
Resources Legacy Fund Foundation		1,421,518	7.41%
San Francisco Estuary Institute		2,087	0.01%
Smithsonian Tropical Research Institute		8,000	0.04%
Society for Conservation Biology		85,022	0.44%
SRS Technologies		9,999	0.05%
Texas A&M University		50,269	0.26%
University of Mississippi		30,881	0.16%
University of Nebraska		85,451	0.45%
University of New Mexico		45,366	0.24%
University of Washington		136,350	0.71%
Private Totals		**$ 4,777,406**	**24.91%**
Total		**$ 19,175,184**	**100.00%**

Budget Summary
2008-2009

Permanent Funds	FTE	Appropriation	Expense	Balance
Academic Salaries				0
Director				0
Stipend—Director		18,000	0	18,000
Stipend—Acting Director		0	25,000	-25,000
Stipend—Deputy Director		0	0	0
Other	0.75	31,014	39,534	-8,520
Staff Salaries	11.50	721,519	770,790	-49,271
General Assistance		129,558	332,219	-202,661
Employee Benefits		302,170	298,594	3,576
Supplies & Expense		34,493	0	34,493
Travel & Equipment				0
Other				0
Total		**1,236,754**	**1,466,137**	**-229,383**
Less budgetary savings target			24,130	-24,130
Adjusted 2007-08		**1,236,754**	**1,442,007**	**-253,513**

Temporary Funds	Appropriation	Expense	Balance
A-21 Return/General Operations	712,379	256,096	456,283
MSI Development Support	-71,450	-25,554	-45,897
MSB Equipment - Pre-occupancy IDC	53,148	3,329	49,819
Research Support - Valentine Postdoc	0	796	-796
Research Support - Osherenko	2,456	2	2,454
Research Support - Lea	27,499	5,901	21,598
Research Support - Wilson	1,380	1	1,379
Research Support - Brzezinski	6,288	0	6,288
Research Support - Kennett	65	57	8
Research Support - Love	15,000	15,000	0
Research Support - Simons	150,000	44,533	105,467
Dean's Relief Funds - Gaines	16,734	9,900	6,834
EEMB Chair's Funds - Warner	13,333	5,000	8,333
Insurance Claim - Cormorant	40,117	40,117	0
Sale of Surplus Equipment - PISCO	2,365	2,365	0
Outreach Operations	-133,316	27,314	-160,629

Outreach Public Service - APEO Support	1,669	1,669	0
Outreach - Faculty Outreach Grant (Whitmer)	26,000	0	26,000
Coastal Fund Grant - Outreach Interns	12,780	8,436	4,344
Coastal Fund Grant - Outreach Interns	2,300	2,300	0
Coastal Fund Grant - Dugan	14,244	446	13,798
Coastal Fund Grant - Page	894	521	373
Coastal Fund Grant - MacFarlan	996	907	88
Coastal Fund Grant - McGinnis	20,802	10,520	10,282
Green Initiative - Toothman	2,000	0	2,000
Grant Match - Morse NASA/URETI	1,148	1,148	0
Grant Match - Reed SBC-LTER	80,532	45,148	35,384
Grant Match - Quetin/Ross	372	372	0
Grant Match - Schmitt MCR-LTER	223,267	132,217	91,050

Recharges	**Income**	**Expense**	**Jnl to Reserve**	**Balance**
MSI Revenue	104,652	123,254		-18,602
Analytical Lab	185,500	313,022	100,345	-227,867
Mass Spectrometer - Brzezinski	-1,929	9,900		-11,828
CRC copier (discarded Spring '06)	1,879	0		1,879
Mass Spectrometer - Lea	754	83		671
MSI Graphics revenue	50,010	37,317		12,693
Kennett - DOE funds	197	191		6
Culver - Santa Clara Water District Work	1,066	-2		1,068
HP Wide Format Printer	519	968		-449
DOC - Carlson	4,255	1,724		2,531
Boats	7,812	6,948		864
Mt. Holyoke Fellowship - Dutton	501	501		-156
Sale of Wearables	-156	0		0
Software Site License	0	0		0
Outreach Revenue	0			979
Melack Chemical Analysis	979	0		-15,033
Flow Cytometer - Cell Sorter	8,739	742	23,030	

Equipment Reserves	**Balance**
Analytical Lab Maintenance Reserve	93,232
Analytical Lab Depreciation Reserve	-35,627
Flow Cytometer Maintenance Reserve	699
Flow Cytometer Depreciation Reserve	-212,151

Statistical Summary for the Marine Science Institute

1.	Academic personnel engaged in research:	
	a. Faculty	59
	b. Professional Researchers (including Visiting)	29
	c. Project Scientists	13
	d. Specialists	29
	e Postdoctoral Scholars	54
	f Postgraduate Researchers	
	g Academic Coordinators	6
	TOTAL	190
2.	Graduate Students:	
	a Employed on contracts and grants	61
	b. Employed on other sources of funds	
	c. Participating through assistantships	
	d. Participating through traineeships	
	e Other- students at other campuses	
	TOTAL	61
3.	Undergraduate Students:	
	a. Employed on contracts and grants	211
	b. Employed on other funds	
	c. Number of volunteers, & unpaid interns	127
	TOTAL	338
4.	Participation from outside UCSB: (optional)	
	a. Academics (without Salary Academic Visitors)	
	b. Other (specify)	
5.	Staff (Univ. & Non-Univ. Funds):	
	a. Technical	197
	b. Administrative/Clerical	56
6.	Seminars, symposia, workshops sponsored	158
7.	Proposals submitted	171
8.	Number of different awarding agencies dealt with*	111
9.	Number of extramural awards administered	290
10.	Dollar value of extramural awards administered during year**	$104,434,178
11.	Number of Principal Investigators***	149
12.	Dollar value of other project awards ****	$4,437,240
13.	Number of other projects administered	107
14.	Total base budget for the year (as of June 30, 2008)	$3,238,892

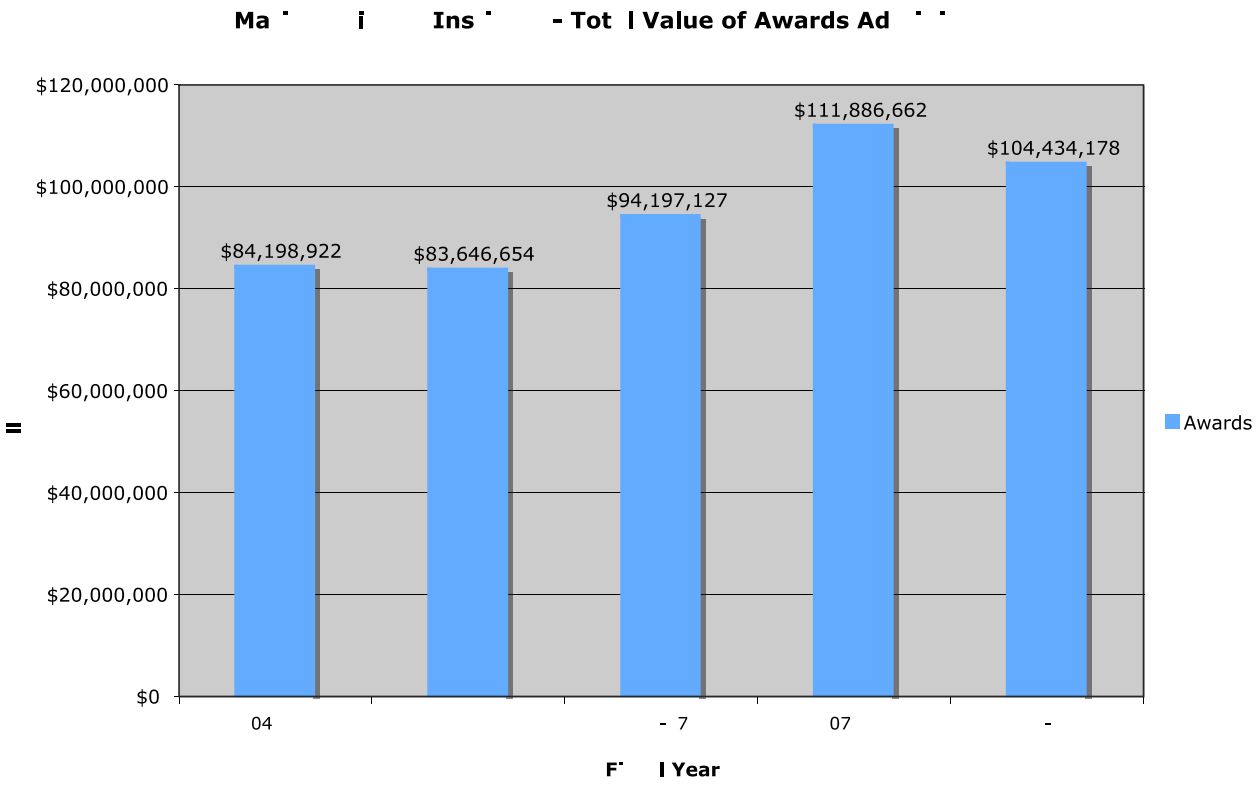
15.	Dollar value of intramural support	$1,009,091
16.	Total assigned square footage in ORU	35,000
17.	Dollar value of awards for year (08 Total)	$18,940,053

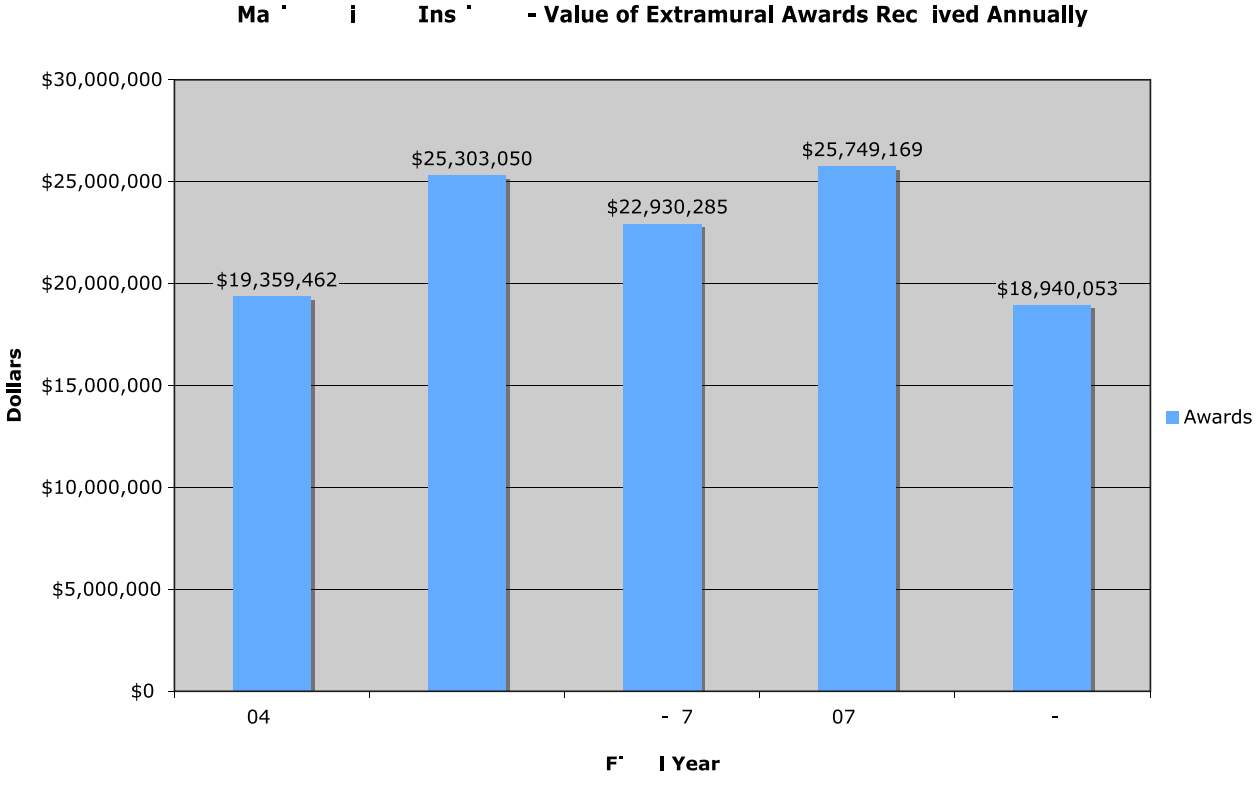
* Count each agency only once (include agencies to which proposals have been submitted).
** If the award was open during the year, even if for only one month, please include in total.
*** Number of PIs, Co-PIs and Proposed PIs (count each person only once.)
**** Other projects - such as donation, presidential awards, fellowships, anything that isn't core budget, extramural, or intramural.

Five-Year Statistical Summary 2005-2009

	2004-2005	2005-2006	2006-2007	2007-2008	2008-2009
1. Academic personnel engaged in research					
a. Faculty	63	59	54	56	59
b. Researchers/Project Scientists	39	30	29	42	42
c. Visiting Researchers	8	7	8	8	
d. Specialists/Academic Coord/Academic Admin.	13	26	32	35	35
e. Postdoctorals/ Postgraduates	54	59	63	85	54
Total	**177**	**174**	**186**	**226**	**190**
2. Staff (Univ. & Non-Univ. Funds)					
a. Technical	168	182	205	218	197
b. Administrative/Clerical	64	49	48	54	56
Total	**232**	**231**	**253**	**272**	**253**
3 Graduate students employed by MSI	97	82	105	99	61
4. Undergraduate students employed by MSI	257	155	164	179	211
5. Publications	1**	1**	1**	1**	1**
6. Seminars, symposia, workshops, etc., sponsored by MSI	115	125	141	163	
7. Proposals submitted	164	205	213	199	171
8. Annual extramural awards	$19,359,462	$25,303,050	$22,930,285	$25,749,169	$18,940,053
9. Extramural awards administered	269	260	289	300	290
10. Other project awards	$1,420,623	$878,572	$1,175,674	$1,283,705	$4,437,240
11. Other projects administered	68	60	57	61	107
12. MSI base budget	$846,304	$868,379	$974,238	$1,011,541	$3,238,892
13. Intramural support	$1,631,875	$2,016,623	$1,596,833	$1,710,775	$1,009,091
14. Total Funds Administered	**$84,198,922**	**$83,646,654**	**$94,197,127**	**$111,886,662**	**$104,434,178**

**Only Departmental Publications


Ma · i Ins · - Tot l Value of Awards Ad · ·
$120,000,000
$100,000,000
$80,000,000
$60,000,000
$40,000,000
$20,000,000
$0
$84,198,922
$83,646,654
$94,197,127
$111,886,662
$104,434,178
04
- 7
07
-
F· l Year
Awards


Ma · i Ins · - Value of Extramural Awards Rec ived Annually
Dollars
$30,000,000
$25,000,000
$20,000,000
$15,000,000
$10,000,000
$5,000,000
$0
$19,359,462
$25,303,050
$22,930,285
$25,749,169
$18,940,053
04
- 7
07
-
F· l Year
Awards

Funding Agencies

Alfred P. Sloan Foundation

American Assn for the Advancement of Science

American Chemical Society

Andrew W. Mellon Foundation

Applied Science Associates, Inc.

Australian Research Council

Burroughs Wellcome Fund

California Artificial Reef Enhancement

California Coastal Commission

California Coastal Conservancy

California Department of Fish and Game

California Department of Parks and Recreation

California EPA Water Resources Control Board

California Fire Safe Council, Inc.

California Sea Urchin Commission

California State Lands Commission

California State Library

Channel Islands Marine Resource Institute

Channel Islands National Park

City University Of New York (CUNY)

Clark County, Nevada

Coastal Fund (formerly Shoreline Preservation Fund)

Colorado State University

Conservation And Research Foundation

David And Lucile Packard Foundation (The)

Duke University

Environmental Defense Fund

Foundation for Research Science & Technology (New Zealand)

Gordon and Betty Moore Foundation

Heal The Ocean Inc.

Japan Aerospace Exploration Agency (Jaxa)(Frmly Nasda)(Japan)

Joint Oceanographic Institutions, Inc.

Kern Community Foundation

Los Angeles Dept Of Water And Power

Luce Foundation

Marine Conservation Biology Institute

Marisla Foundation (Frmly Homeland Foundation)

Michigan State University

Mineral Science Company, Inc.

NASA Shared Services Center (NSSC)

National Science Foundation-NSF

National Academy Of Sciences

Nature Conservancy

New College Of Florida

New Media Studio, The

NIH Dental And NIH Research, National Institute Of

Oregon State University

Paul G. Allen Charitable Foundation

Pew Charitable Trusts

Princeton University

Resources Legacy Fund Foundation

San Francisco Estuary Institute

San Jose State University Foundation

Santa Barbara County Air Pollution Control District

Santa Monica Bay Restoration Foundation

Seaweb

Simpson and Simpson Business and Personnel Services, Inc.

Smithsonian Tropical Research Institute

Society For Conservation Biology

Society for Conservation Biology, Smith Fellows Program

South African National Parks

Southern California Wetlands Recovery Project

Southern California Coastal Water Research Project Auth, A Public Agency

SRS Technologies

Texas A&M University

UC Agriculture And Natural Resources

UC Biotechnology Research & Education Program (BREP)

UC California Inst For Energy Efficiency

UC Center for Water Resources

UC Davis

UC MEXUS

UC Office Of The President

UC San Diego

UC Santa Cruz

UC Sea Grant College Program

UC Toxic Substances Research & Teaching Program

University of Kiel

University Of Massachusetts

University of Miami

University Of Mississippi

University Of Nebraska

University of New Mexico

University Of North Carolina

University of Queensland

University Of South Carolina

University Of Southern California

University Of Washington

US Army

US Department Of Energy

US Dept of Commerce, National Marine Fisheries Service

US Dept of Commerce, National Oceanic And Atmospheric Administration

US Environmental Protection Agency

USDA Forest Service

USDI Bureau Of Land Management

USDI Fish And Wildlife Service

USDI Geological Survey

USDI Minerals Management Service

USDI National Park Service

Virginia Polytechnic Institute

Wetlabs, Inc.

Wilburforce Foundation

Wildlife Conservation Society

MSI Advisory Committee, Administrative, Professional & Technical Staff

Marine Science Institute
2008-2009

Chancellor	Henry T. Yang
Executive Vice Chancellor	Gene Lucas
Vice Chancellor for Research	Michael Witherell
Director	Steven D. Gaines
Deputy Director	Mark A. Brzezinski

Advisory Committee

Craig Carlson, Ecology, Evolution & Marine Biology
Christopher Costello, Associate Professor, Bren School of Environmental Science & Management
Rachel Haymon, Professor, Earth Sciences
Ira Leifer, Associate Researcher, Marine Science Institute
Bruce Luyendyk, Professor, Earth Sciences
Langdon Quetin, Researcher, Marine Science Institute
Russell Schmitt, Ecology, Evolution & Marine Biology, Committee Chair
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 / Director of National Center for Ecological Analysis & Synthesis
Tim Schmidt, ex-officio, Manager, Marine Science Institute

Marine Science Institute
Administrative, Professional and Technical Staff

Deanna Cervantes, Contracts & Grants Analyst

Marie Ciluaga, Analyst

William Clinton, Staff Research Associate, Analytical Laboratory

Karoleen Decastro, Artist

Donna Dobis, Budget Analyst

Mieke DeMeo, Purchasing Analyst

Laurie Eusey, Financial Services Manager

Mike Franklin, Desktop Support

Marisol Hernandez, Desktop Support/Travel Analyst

Joanna Kettmann, Budget Analyst

Jenn Massey, Analytical Lab

Judy McCaslin, Contracts & Grants Officer

India Morgan, Personnel Analyst

Mike O'Neil, Budget Analyst

Michael Orlando, Analytical Lab

Georges Paradis, Manager, Analytical Lab

Veronica Perez, Personnel Analyst

Monica Pessino, Publication Manager

Michele Ramirez, Purchasing Assistant

Elvira Rose, Personnel Unit Coordinator

Tim Schmidt, Manager

Scott Simon, Outreach Coordinator

Luisa Velez, Budget Unit Manager

Rachel Whitacre, Purchasing Unit Manager

Bonnie Williamson, Contracts & Grants Administration Manager

Joyce Wolever, Payroll & Personnel Unit Manager

James Woods, Information Technology

Nicole Zavala, Personnel Analyst

Marine Science Institute Principal Investigators 2008-2009

Marine Science Institute
Principal Investigators
2008-2009

Airame, Satie	Academic Coordinator	Marine Science Institute
Alldredge, Alice	Professor of Marine Science	Ecology, Evolution & Marine Biology
Allesina, Stefano	Postdoctoral Researcher	Nat'l Ctr for Ecol. Analysis & Synthesis
Alroy, John	Associate Researcher	Nat'l Ctr for Ecol. Analysis & Synthesis
Andelman, Sandy	Specialist	Nat'l Ctr for Ecol. Analysis & Synthesis
Becker, Luann	Associate Researcher	Institute for Crustal Studies
Beucher, Charlotte	Postdoctoral Researcher	Marine Science Institute
Blanchette, Carol	Associate Researcher	Marine Science Institute
Briggs, Cheryl	Associate Professor	Ecology, Evolution & Marine Biology
Brzezinski, Mark	Professor	Ecology, Evolution & Marine Biology
Cadotte, Marc	Postdoctoral Researcher	Nat'l Ctr for Ecol. Analysis & Synthesis
Cardinale, Bradley	Assistant Professor	Ecology, Evolution & Marine Biology
Carlson, Craig	Professor	Ecology, Evolution & Marine Biology
Case, James	Research Professor	Marine Science Institute
Caselle, Jennifer	Associate Project Scientist	Marine Science Institute
Chadwick, Oliver	Professor	Geography
Childress, James	Professor of Zoology	Ecology, Evolution & Marine Biology
Clark Jordan	Associate Professor	Earth Sciences
Cooper, Scott	Professor	Ecology, Evolution & Marine Biology
Costello, Christopher	Associate Professor	Bren School of Envir. Sci. & Management
Culver, Carrie	Assistant Researcher	Marine Science Institute
D'Antonio, Carla	Professor	Environmental Studies
Dalin, Peter	Project Scientist	Marine Science Institute
Damuth, John	Researcher	Marine Science Institute

Dawson, Daniel	Reserve Manager	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
Engle, John	Associate Research Biologist	Marine Science Institute
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
Gaines, Steven	Professor of Biology	Marine Science Institute
Gilbert, Benjamin	Postdoctoral Researcher	Marine Science Institute
Goddard, Jeffrey	Assistant Researcher	Marine Science Institute
Goodridge, Blair	Graduate Student Researcher	Ecology, Evolution & Marine Biology
Gosnell, Stephen	Graduate Student Researcher	Ecology, Evolution & Marine Biology
Greenberg, David	Assistant Project Scientist	Marine Science Institute
Halpern, Benjamin	Academic Coordinator	Nat'l Ctr for Ecol. Analysis & Synthesis
Hamilton, Scott		Marine Science Institute
Hampton, Stephanie	Academic Coordinator	Nat'l Ctr for Ecol. Analysis & Synthesis
Hammond, LaTisha	Graduate Student Researcher	Ecology, Evolution & Marine Biology
Hansma, Paul	Professor of Physics	Physics
Haymon, Rachel	Professor	Earth Science
Hechinger, Ryan	Graduate Student Researcher	Marine Science Institute
Heintz, Monica	Graduate Student Researcher	Earth Sciences
Henkel, Sarah	Graduate Student Researcher	Marine Science Institute
Herbst, David	Associate Researcher	Marine Science Institute
Hoaglund, Elizabeth	Graduate Student Researcher	Ecology, Evolution & Marine Biology
Hofmann, Gretchen	Associate Professor	Ecology, Evolution & Marine Biology
Holbrook, Sally	Professor of Biology	Ecology, Evolution & Marine Biology

Holden, Patricia	Assistant Professor	Bren School of Envir. Sci. & Management
Israelachvili, Jacob	Professor	Chemical Engineering
Jellison, Robert	Associate Researcher	Marine Science Institute
Jones, Matthew B.	Database & Information Specialist	Nat'l Ctr for Ecol. Analysis & Synthesis
Kendall, Bruce	Associate Professor	Bren School of Envir. Sci. & Management
Kennett, James	Professor of Oceanography	Earth Sciences
Kinlan, Brian	Graduate Student Researcher	Ecology, Evolution & Marine Biology
Knapp, Roland	Associate Researcher	Marine Science Institute
Kuris, Armand	Professor of Biology	Ecology, Evolution & Marine Biology
Lafferty, Kevin	Associate Research Biologist	Marine Science Institute
Laughrin, Lyndal	Reserve Director	Marine Science Institute
Lea, David	Professor	Earth Sciences
Leifer, Ira	Associate Researcher	Chemical Engineering
Lenihan, Hunter	Assistant Professor	Bren School of Envir. Sci. & Management
Levine, Jonathan	Associate Professor	Ecology, Evolution & Marine Biology
Lisiecki, Lorraine	Assistant Professor	Earth Sciences
Long, Tristan	Postdoctoral Researcher	Marine Science Institute
Love, Milton	Researcher	Marine Science Institute
Luyendyk, Bruce	Professor	Earth Sciences
Macdonald, Ken	Professor of Marine Geophysics	Earth Sciences
Macfarland, Reuben, J.	Graduate Student Researcher	Ecology, Evolution & Marine Biology
MacIntyre, Sally	Professor	Ecology, Evolution & Marine Biology
Madin, Elizabeth	Graduate Student Researcher	Ecology, Evolution & Marine Biology
Madin, Joshua	Postdoctoral Researcher	Marine Science Institute
Matson, Paul	Graduate Student Researcher	Ecology, Evolution & Marine Biology
Max, Lisa	Graduate Student Researcher	Ecology, Evolution & Marine Biology
Mazer, Susan	Professor	Ecology, Evolution & Marine Biology

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
Melian, Carlos	Postdoctoral Researcher	Nat'l Ctr for Ecol. Analysis & Synthesis
Merrill, Loren	Graduate Student Researcher	Ecology, Evolution & Marine Biology
Morse, Aileen	Associate Researcher	Marine Science Institute
Morse, Daniel	Professor	Molecular, Cellular & Devel. Biology
Mostman-Liwanag, Heather	Postdoctoral Researcher	Marine Science Institute
Murdoch, William	Professor of Biology	Ecology, Evolution & Marine Biology
Neal, Andrea	Specialist	Bren School of Envir. Sci. & Management
Nicholson, Craig	Associate Researcher	Marine Science Institute
Nisbet, Roger	Professor of Biology	Ecology, Evolution & Marine Biology
O'Brien, Margaret	Specialist	Marine Science Institute
O'Donnell, Michael	Postdoctoral Researcher	Marine Science Institute
Oakley, Todd	Assistant Professor	Ecology, Evolution & Marine Biology
Osherenko, Gail	Researcher	Marine Science Institute
Osovitz, Christopher	Postdoctoral Researcher	Ecology, Evolution & Marine Biology
Page, Henry	Associate Researcher	Marine Science Institute
Pak, Dorothy	Assistant Researcher Geologist	Marine Science Institute
Passow, Uta	Assistant Researcher	Marine Science Institute
Penley, Constance	Professor	Film & Media Studies
Petzold, Linda	Professor	Mechanical Engineering
Pischedda, Alison	Graduate Student Researcher	Ecology, Evolution & Marine Biology
Plachetzki, David	Graduate Student Researcher	Ecology, Evolution & Marine Biology
Proulx, Steven	Assistant Professor	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	Geography
Rodriguez-Villanueva, Luz	Postdoctoral Researcher	Marine Science Institute
Ross, Robin	Researcher	Marine Science Institute
Rothstein, Stephen	Professor	Ecology, Evolution & Marine Biology
Salomon, Anne	Postdoctoral Researcher	Marine Science Institute
Sandoval, Cristina	Reserve Director	Marine Science Institute
Schildhauer, Mark	Computer & Network Technology	Nat'l Ctr for Ecol. Analysis & Synthesis
Schimel, Joshua	Professor	Ecology, Evolution & Marine Biology
Schmitt, Russell	Professor	Ecology, Evolution & Marine Biology
Schroeter, Stephen	Researcher	Marine Science Institute
Shears, Nicholas	Postdoctoral Researcher	Marine Science Institute
Siegel, David	Professor	Geography
Simon, Scott	REEF Manager	Marine Science Institute
Simons, Rachel	Assistant Researcher	Marine Science Institute
Sokolow, Susanne	Postdoctoral Researcher	Marine Science Institute
Sorlien, Christopher	Associate Researcher	Institute for Crustal Studies
Stammerjohn, Sharon	Assistant Researcher	Marine Science Institute
Stratton, Lisa	Natural Areas Director	Center for Biodiversity & Ecological Restoration
Stucky, Galen	Professor of Chemistry	Chemistry
Suarez, Raul	Professor	Ecology, Evolution & Marine Biology
Swarbrick, Susan	Associate Director,NRS	Marine Science Institute
Sweeney, Alison	Postdoctoral Researcher	Marine Science Institute
Thorsch, Jennifer	Director	Center for Biodiversity & Ecological Restoration

Tirrell, Matthew	Dean and Professor	Engineering
Valentine, David	Associate Professor	Earth Sciences
Vogt, Peter	Researcher	Marine Science Institute
Waite, J. Herbert	Professor	Molecular, Cellular & Devel. Biology
Warner, Robert	Professor of Biology	Ecology, Evolution & Marine Biology
Washburn, Libe	Professor	Geography
Wenner, Adrian	Professor Emeritus	College of Creative Studies
Whalen, Kristen	Postdoctoral Researcher	Marine Science Institute
White, Corwith	Graduate Student Researcher	Marine Science Institute
Whitmer, Allison	Academic Coordinator	Marine Science Institute
Wilson, Douglas	Associate Research Geologist	Earth Sciences
Yang, Louie	Postdoctoral Researcher	Marine Science Institute
Young, Oran	Professor	Bren School of Envir. Sci. & Management