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During the past year, the Center for Ocean Solutions (COS) reached a critical point in its development as a number of seeds sown in previous years bore fruit and we finalized plans to guide us through 2016.

First, building on relationships and research in the southwestern Pacific, our Climate Change and Coral Reefs working group authored the “Scientific Consensus Statement on Climate Change and Coral Reefs” which was broadly supported by the scientific community with over 3,100 endorsees and received worldwide attention in the media with more than 2,500 articles. In addition to helping bring worldwide attention to climate-related causes of coral reef degradation, we worked closely with Pacific island leaders to encourage action to alleviate local stressors—steps that can be taken now without waiting for a global solution.

Two of our science and engineering collaborations reached important milestones this year when their devices were deployed and operated in the ocean for the first time. The Kelp Forest Array, an underwater node that monitors climate change and human impacts on the ocean and will function as a high-tech platform for future research, was installed this summer in the Monterey Bay kelp forest. Scientists are using this node as an underwater lab to conduct experiments in the natural environment, yielding more true-to-life results than experiments using laboratory tanks. With live data streaming, research can be monitored closely so modifications or repairs are timely and results can be broadcast directly to resource managers.

Our second device, the Environmental Sample Processor and Microfluidics Block (ESP/MFB), was installed on the wharf in Santa Cruz, Calif. in fall 2011 and then in Tasman Bay, New Zealand, this summer. The device performs high-speed water quality monitoring vital to aquaculture and recreation, providing results in minutes rather than after a 24-hour testing cycle, and thereby significantly improving response time for warnings such as beach closures.

Although COS has a primary focus on the California Current and the broader Pacific due to our location and core partnerships, our mission to find solutions for the major challenges facing the ocean requires that we both work on solutions that are transferable and remain active on the national and international stage. We accomplish this through efforts such as our recent coral reef work in the Pacific and by ‘porting’ some of our California work to other locales, as with the ESP/MFB installation in New Zealand. We had another important opportunity to have broader impact when one of our early career fellows, Ryan Kelly, and I were invited to the White House to meet with Office of Science and Technology Policy staff on the emerging topic of ocean acidification. In addition, Early Career Fellow Melissa Foley was asked to meet with government representatives in
New Zealand to share our expertise in ecologically based marine spatial planning and a third early career fellow, Jack Kittinger, organized a mini-symposium on “Interdisciplinary Analyses of Long-Term Change in Coral Reef Ecosystems” at the influential International Coral Reef Symposium in Australia.

Consistent with one of our key objectives to develop future ocean leaders, COS is fledging its first cohort of early career fellows. Matt Armsby, who joined COS in 2008 to work on ocean governance, departed in 2011 to spend a year as a clinical lawyer and law and policy fellow at Stanford’s Environmental Law Clinic. He is now an attorney in Sacramento at the Resources Law Group working on ocean, coast and fisheries programs. In the coming six months, three more of our early career fellows will move on to exciting next steps in their careers. Brock Woodson will take up a tenure-track position at the University of Georgia, Melissa Foley will start a Mendenhall Fellowship with the United States Geological Survey working with an interdisciplinary team researching land- and seascape-level changes following the removal of two dams on the Elwha River in Washington, and Ryan Kelly will join the faculty at the University of Washington with a tenure-track position.

Part of our growth and maturation involves rethinking programs and objectives as lessons are learned and we prepare for our next phases. This year Professor Larry Crowder, our science director, and I worked together closely with our Management Committee to finalize, publish and begin implementing our strategic plan which will guide COS for the coming four years. An important element of this effort was to define rigorous project selection criteria in response to the growing interest from external partners to collaborate with COS. We also scoped our project portfolio mix in terms of timescale, with half our projects focused on deliverables in the next 1-3 years; most of the remaining projects will produce results in 3-5 years while a few will address emerging issues in the distant future. Re-evaluations in our organization also led to transferring the workload of our fellowship and curriculum committee to the Center’s directors who now consult directly with disciplinary experts from COS’s partners when reviewing early career fellow applications. We also terminated distribution of an electronic COS newsletter in favor of a comprehensive, up-to-date, searchable website and concluded some projects due to timing, project completion or strategic choices.

We capped our growth in staffing and number of projects by initiating our fifth working group which is focused on Social-Ecological Resilience in Small-Scale Fisheries. In addition to this working group and our Climate Change and Coral Reefs working group, Larry, who orchestrates the working groups with Lucie Hazen’s capable assistance, has catalyzed working groups on Coastal Hypoxia in the California Current, Climate Change and Pelagic Predators in the Pacific and the Rapid Detection of Marine Pathogens, which is helping to guide our ESP/MFB work.

Even as COS matures, Larry and I are taking steps to maintain a collaborative, energetic and practical outlook in our team, most recently by relocating our growing Monterey staff to an open-format office conducive to collaboration. We continue to be committed to guiding our organization toward delivering real-world solutions to the ocean’s challenges that are based on the best available science and policy. We thank our collaborators and the broader ocean and coastal research and policy community for your support and involvement in this important work.

Meg Caldwell
FY 2011 / FY 2012 Metrics

Build Strong Relationships

Government
(Local, State, Federal, International)
- 2011: 24
- 2012: 34

NGOs
- 2011: 16
- 2012: 23

Research & Academic Institutions
- 2011: 27
- 2012: 36

Foundations
- 2011: 4
- 2012: 4

For Profit Organizations
- 2011: 4
- 2012: 3

International
(Non-US based partners from all categories above)
- 2011: 2
- 2012: 13

Apply Research-based Approaches for Problem-solving

Working Groups
- 2011: 4
- 2012: 5

Workshops/Courses
(For students)
- 2011: 4
- 2012: 4

Symposiums/Workshops*/Briefings
(*Workshops for working professionals)
- 2011: 3
- 2012: 7

Convey Findings and Solutions

Staff Talks
- 2011: 41
- 2012: 36

COS Published Guides and Reports
- 2011: 2
- 2012: 9

Peer-Reviewed Published Articles
- 2011: 21
- 2012: 25

Progress & Academic Institutions
- 2011: 7
- 2012: 8

Advance Leadership Skills

Campuses Represented by Students
- 2011: 13
- 2012: 7

Interns Working at COS
(At fiscal year end)
- 2011: 8
- 2012: 15

Campuses Represented by Interns
- 2011: 5
- 2012: 11

Note: Circle sizes represent year-over-year increases or decreases in each category. Numbers represent the number of interactions or events within that category.
This year the Center’s Management Committee provided advice and consultation to the COS directors as we finalized our 2012-2016 Strategic Plan and developed new hiring guidelines.

One of our Management Committee members, Mike Sutton, stepped down from the committee to take up his new role with the National Audubon Society as vice president of the Pacific Flyway; we wish him every success and thank him for his invaluable contribution to COS. Pending Mike’s replacement at the Aquarium, Julie Packard has asked Chris Harrold, Director of Conservation Research at the Aquarium, to serve on the COS Management Committee.
Robert Dunbar is the William M. Keck Professor of Earth Sciences at Stanford University and the Victoria P. and Roger W. Sant Director of the Earth Systems Program. Professor Dunbar was the founding director of the Interdisciplinary Graduate Program in Environment and Resources and the 2009 recipient of the Richard W. Lyman Award. He is also the first J. Frederick and Elisabeth B. Weintz University Fellow in Undergraduate Education and a senior fellow of the Stanford Woods Institute for the Environment. He serves on the Board of Trustees of the U.S. Consortium for Ocean Leadership.

Chris Harrold is the director of Conservation Research at the Monterey Bay Aquarium, where he has worked since 1985. He received his bachelor’s and master’s degrees from Stanford University and his Ph.D. from the University of California, Santa Cruz. Chris has conducted field work from the high intertidal zone to two miles below the ocean surface. Chris has published scientific papers and book chapters on topics ranging from sea otter foraging ecology to the role of drift kelp in deep-sea communities. He chairs the Sanctuary Advisory Council and the Research Activities Panel of the Monterey Bay National Marine Sanctuary and is an adjunct scientist at the Monterey Bay Aquarium Research Institute (MBARI).

Jeff Koseff is the Perry L. McCarty Director of the Stanford Woods Institute for the Environment, the William Alden Campbell and Martha Campbell Professor of Civil and Environmental Engineering, and the Michael Forman University Fellow in Undergraduate Education, all at Stanford University.

Stephen Monismith is chair of Stanford University’s Civil and Environmental Engineering, and the Obayashi Professor in the School of Engineering. Since 1996, he has been director of the Environmental Fluid Mechanics Laboratory at Stanford. He was a resident fellow at Robinson House (Stanford’s environment theme house) and was a 1989 recipient of the Presidential Young Investigator award. Prior to coming to Stanford, he spent three years in Perth, Australia as a research fellow at the University of Western Australia. A Bay Area native, Professor Monismith received his B.S., M.S. and Ph.D. from the University of California at Berkeley.

Stephen Palumbi is the director of Hopkins Marine Station. He is a senior fellow of the Stanford Woods Institute for the Environment and a Harold A. Miller Professor in Marine Sciences. Professor Palumbi’s published books include “Death and Life of the Monterey Bay,” “The Future is Wild,” “The Evolution Explosion” and “Marine Reserves: An Ecosystem Tool for Marine Management and Conservation.” He has also contributed to films to enhance science communication including the BBC/Animal Planet TV series “The Future is Wild,” “Urban Shark Hunting,” “Resilience on the Reef” and “The Secret Life of Whales.” Professor Palumbi moved his laboratory from Harvard University in August 2002 to Stanford University’s Hopkins Marine Station. He received his B.A. in biology from Johns Hopkins University and his Ph.D. in marine ecology from the University of Washington.

Chris Scholin is the president and CEO of the Monterey Bay Aquarium Research Institute (MBARI). Previously, Dr. Scholin served as chair of MBARI’s Research Division from mid-2005 to early 2009. He also serves on an External Advisory Committee for the University of Miami’s Oceans and Human Health Center as well as on the Board of Trustees of the Monterey Bay Aquarium. A Missouri native, he received a B.A. in biology from the University of California, Santa Barbara, an M.A. in molecular biology and immunology from Duke University and a Ph.D. from the Massachusetts Institute of Technology-Woods Hole Oceanographic Institution (MIT/WHOI) Joint Program in biological oceanography. 

Our 2012-2016 Strategic Plan, created under the guidance of our Management Committee, informs the projects we select, the people we bring on board and the audiences we reach.
The work at the Center for Ocean Solutions is linked to our vision and overarching goals set forth in our 2012-2016 Strategic Plan. For example, one of our working groups pulled together an interdisciplinary team to articulate a scientific consensus statement on the health of coral reefs, while another team examined the distribution of top predators in the North Pacific—loggerhead turtles, white sharks, and blue whales among them—and found that where these animals feed and reproduce could change over the next 100 years as global ocean temperatures increase and productivity patterns shift, and a third group explained how to apply ecological principles to California’s ocean and coastal decision-making. Similar examples are woven throughout this report.
CREATING FOCUS
The work undertaken by the Center for Ocean Solutions tracks the three focal areas we identified as critical to solving the key challenges facing the ocean. These initiatives are Climate Change, Land-Sea Interactions and Ecosystem Health. These focal areas are inextricably linked and our work in one area informs and advances our work in other areas.
CLIMATE CHANGE

We work to deliver timely information on climate change and to define “successful adaptation” as well as to catalyze adaptation actions in the Pacific. During the year, COS focused on four important aspects of climate change. We produced an important guide for applying existing California and federal laws to ocean acidification (OA), an impact of global CO₂ emissions that is changing ocean chemistry in ways that may weaken marine organisms including commercially important shellfish. Protecting coral reefs from impacts of climate change, such as warming surface waters, acidification and sea level rise, received a boost when a “Scientific Consensus Statement on Climate Change and Coral Reefs,” drafted by a COS working group, was released internationally with more than 3,100 endorsements from the global scientific community. Our work on climate change in California involved a multi-pronged effort with workshops, focus groups and media outreach to bring the latest science to decision-makers and coastal managers regarding climate change adaptation, and the first deployment of a research and monitoring device to conduct in-situ experiments and sense environmental and climate-related changes in the nearshore ocean.

Ocean Acidification

At the request of state officials, COS researched and published “Why Ocean Acidification Matters to California, and What California Can Do About It: A Report on the Power of California’s State Government to Address Ocean Acidification in State Waters.” The report shows that the state possesses ample legal authority to address multiple potential causes of ocean acidification hotspots, and it lays out approaches to empower state agencies that seek to understand the science and policy relevant to OA. COS is engaged in a similar effort with Washington State where Ryan Kelly, one of our early career fellows, is an advisor to the Governor’s Blue Ribbon Panel on Ocean Acidification. Further, a COS co-authored scientific article entitled “Mitigating Local Causes of Ocean Acidification with Existing Law” that appeared in Science in May 2011 was amplified for a national legal audience by Kelly and Executive Director Meg Caldwell. The legal article will be published in February 2013 by the Harvard Environmental Law Review.
the Kelp Forest Array (KFA) that went live this year. The KFA began data gathering of oceanographic metrics, such as water temperature, current speed and direction, dissolved oxygen concentration, salinity and acidification (pH). With a multiple-node design, the KFA will host a wide variety of instruments and short-term experiments. Located in the kelp forest off Stanford’s Hopkins Marine Station and the Monterey Bay Aquarium, the KFA is already providing a mind-boggling stream of real-time data at over a gigabyte per hour, demonstrating a true collaboration between engineers and marine scientists. The KFA will also support the operation of a shallow water Free Ocean Carbon Experiment (sw-FOCE) exploring the impacts on marine life of anticipated future levels of carbon in the coastal ocean.

**Climate Change and Coral Reefs**

During the year, COS catalyzed a working group composed of experts from around the world to assess the current state of knowledge about climate change and coral reefs. Participants, representing diverse disciplines such as coral morphology, marine ecology, hydrodynamics and evolutionary biology, determined that since extensive knowledge already exists, the time was right to draft a scientific consensus statement calling on leaders worldwide to take meaningful action to protect coral reef ecosystems in the face of climate change. The “Scientific Consensus Statement on Climate Change and Coral Reefs” received so far 3,197 endorsements from scientists around the world, and was one of the top announcements at the premier conference on coral reefs, the International Coral Reef Symposium (ICRS), in July 2012. Media coverage was extensive with over 2,500 stories worldwide, including an ABC News Australia panel discussion with Caldwell. Further, COS Early Career Fellow Jack Kittinger organized a mini-symposium at ICRS on “Interdisciplinary Analyses of Long-Term Change in Coral Reef Ecosystems.” Management Committee member Steve Palumbi and Science Director Larry Crowder met with the governors of American Samoa and the Commonwealth of the Northern Mariana Islands in San Francisco and, in American Samoa, with the United States Coral Reef Task Force’s All Islands Committee, which adopted our Scientific Consensus Statement. Further, Governor Tualafono of American Samoa drafted a climate change resolution based on the COS consensus statement. Tualafono’s resolution was adopted at the recent Pacific Forum in the Cook Islands and was endorsed by regional leaders.

Because local efforts to protect coral reefs are effective in the short term and can be undertaken without waiting for a global solution, the working group also wished to communicate ways to reduce local stressors to regional governments, especially within the southwestern Pacific where cultural and economic ties to coral reefs are particularly strong. To improve the effectiveness of this message and to build momentum for the scientific consensus statement more generally, Caldwell and working group member Robert Richmond of the University of Hawaii met with numerous government and other stakeholders in the region during the annual Association of Pacific Island Legislatures (APIL) assembly, building on ties formed several years ago during COS’s initial work in the Pacific. Subsequently, APIL adopted a resolution based on our consensus statement.

**Climate Change Adaptation**

As more coastal communities are tackling local climate change impacts, such as sea level rise and coastal erosion, COS has responded with work that brings the latest science to adaptation planning and decision-making. During the year, COS played a major role in coordinating and contributing to the Coastal Issues chapter of the “Southwest Climate Assessment,” a technical advisory report for the “National Climate Assessment,” that summarizes and synthesizes climate concerns for the six Southwest states (Arizona, California, Colorado, Nevada, New Mexico, Utah). Caldwell and COS Research Analyst Eric Hartge are the lead authors of the “Coastal Issues” chapter that summarizes coastal climate change impacts in California and policy options to advance adaptation. The United States Global Change Research Program,
which works under a Congressional mandate, will release the full assessment in 2013.

Another milestone in our climate change adaptation work was the completion of “Rising to the Challenge: 2011 California Coastal Adaptation Needs Assessment” which revealed a significant uptick in California coastal professionals’ attention to preparing and planning for climate change over the last six years, despite belt tightening in most local and state agencies. However, lack of money to prepare and implement plans, insufficient staff and lack of technical know-how are significant challenges. COS affiliated researcher Susanne Moser and Education and Training Director Adina Abeles teamed with University of Southern California and California Sea Grants and UC Berkeley experts to produce the report and announce the results, which received wide media coverage in the state.

This year COS, working with NOAA Coastal Services Center, had expected to hold follow-up training in communicating climate change. After surveying potential participants, it was determined that the timing was not yet right; however this concept will remain on COS’s radar for future exploration. In the meantime, COS is collaborating with Stanford Woods Institute for the Environment (Stanford Woods Institute) and Stanford Professor Jon Krosnick to understand effective communications approaches for discussing adaptation policy options and advancing adaptation planning with state and federal decision-makers.

An area of special interest for COS is how Monterey Bay communities are preparing for and adapting to climate change. This year, we continued our series of workshops with “Preparing for the Future: Climate Change and the Monterey Bay Shoreline” which attracted 90 attendees from local, regional, state and federal government, NGOs, research institutions and others from Santa Cruz and Monterey counties. COS’s Director of Education and Training, Adina Abeles, co-authored a report on the workshop and COS now hosts a new website with information on climate change in the Monterey Bay region. COS sustained the momentum developed at the workshop by working with the United States Geological Survey and Moss Landing Marine Laboratories to convene an expert meeting on shoreline changes along California’s Central Coast in order to better inform local decision-makers, and COS organized two focus groups that explored the understanding and attitudes of local ocean-fronting homeowners. This fall COS will co-host a follow-up Monterey Bay workshop to highlight new findings and ideas for regional collaboration on climate change adaptation for those who attended the earlier Monterey Bay Shoreline workshop.

Finally COS’s work in collaboration with The Natural Capital Project and The Nature Conservancy on “Incorporating Natural Capital into Climate Adaptation Planning” (INCCAP) now includes exploratory work with the California Coastal Commission to incorporate principles of ecosystem services into coastal development permit decision-making. The InVEST analysis tool developed by the Natural Capital Project is being utilized to inform this project. The INCCAP project is no longer working with one of the original collaborators, the Elkhorn Slough Tidal Wetland Project, since their work is outside of the timeframe of our grant and does not meet INCCAP selection criteria. However, work with the remaining two original collaborators, the Greater Monterey County and Santa Cruz County, is nearly complete. The resulting “Integrated Regional Water Management Plans” will use the InVEST coastal vulnerability model to assess the vulnerability of the coastline and assist in prioritizing adaptation strategies. We also are contributing recommendations for the plan’s climate change chapter to accurately reflect the importance of ecosystem services and highlight selection of “multi-benefit” strategies in project prioritization.

Future Endeavors
Our work on climate change will continue to focus on advancing understanding of how climate change affects the dynamics of ocean and coastal systems, communicating and translating these changes, and helping coastal communities adapt effectively for long-term sustainability. In September 2012, an output of one of COS’s working groups, Climate Change and Pelagic Predators, was published.
Our Climate Change and Pelagic Predators working group released research that modeled data on climate change projections and Pacific predator migration. The results revealed that Pacific habitats could move northward as much as 1,000 kilometers, impacting habitats and migration patterns of pelagic predators such as white sharks.

in *Nature Climate Change*. The results of comprehensive modeling work, led by COS affiliated researcher Elliott Hazen, predict a slow but steady northward migration of North Pacific ecosystems, while biodiversity in the California Current is expected to remain high. The northward migration of biodiversity may alter migration and feeding patterns for large pelagic predators such as sea lions, sharks, sea turtles and seabirds.

Our fall 2012 climate change adaptation follow-up meeting in the Monterey area was timed with the West Coast Governors’ Alliance’s outreach on the recently released National Academies report, “Sea-Level Rise for the Coasts of California, Oregon and Washington: Past, Present, and Future.” During the coming year, we intend to augment the KFA with a shallow water Free Ocean Carbon Enrichment (sw-FOCE) experiment and develop a real-time online database and graphical features to help understand coastal changes. We will also work to identify ocean acidification hotspots in the California Large Marine Ecosystem and continue communicating ocean acidification knowledge. We will build on our work with Pacific island leaders to translate the momentum of the “Scientific Consensus Statement on Climate Change and Coral Reefs” into action. In this effort, we are fortunate to have Noah Idechong, vice speaker, House of Delegates, Palau and University of Hawaii Professor Bob Richmond assisting us.

We also expect to produce papers on the results of our focus groups with local ocean-fronting homeowners and on shoreline change in Monterey Bay. To support the adaptation information needs of California’s planners and managers, COS is developing workshops for planners and managers to directly address some of the barriers to action they currently face and reported in “Rising to the Challenge: 2011 California Coastal Adaptation Needs Assessment.”

“Communities are willing to adapt to the reality of climate change, but they are struggling. This is a story that needs to be told when billions of dollars in assets are at risk.”

SUSANNE MOSER
LAND-SEA INTERACTIONS

We are striving to deliver viable and affordable methods to rapidly detect marine pathogens and to enhance our understanding of hypoxia in the coastal ocean. Our Land-Sea Interactions focal area reached an important milestone when a device for detecting pathogens in coastal waters went operational for the first time in winter 2011. Also, a working group on coastal hypoxia substantially advanced its research on dissolved oxygen (DO) in California’s waters. This year MARINE, COS’s ocean leadership development and curriculum enhancement program for graduate students, focused on land-sea interactions in a series of seminars.

MARINE Program
Under Margaret Krebs’ and Adina Abeles’ leadership, we refined our curricular approach. The National Science Foundation, the National Academy of Sciences and the Stanford Commission on Graduate Education have called for more interdisciplinary experiences in post-secondary education. Inspired by this collective charge, we designed the leadership development experience for graduate students and postdocs as a “collaboratory” to extend their learning beyond the classroom and research lab by giving early career scholars the opportunity to engage in real-world problem solving in the role of pro bono consultants to NGO or government decision-makers. This year the collaboratory focused on water quality in the Elkhorn Slough, with The Nature Conservancy as the “client.” We coupled the collaboratory with our continuing academic year seminar series, each seminar preceded by related journal clubs led by COS early career fellows.

The first seminar linked knowledge to action in a case study of Mexico’s Yaqui Valley while the second offered a panel discussion on implementing ocean acidification research with speakers from science, business and government. The final seminar explored desalination scientific and technological issues, an important and growing form of coastal infrastructure.

Detecting Marine Pathogens
Placed on Santa Cruz Wharf in the Monterey Bay, the Environmental Sample Processor (ESP) and Microfluidics Block (MFB), developed in conjunction with MBARI, began feeding real-time results of microbial water quality that can inform decisions on issuing beach warnings and closures in a more timely manner. The ESP can yield water quality testing results to coastal managers in 120 minutes instead of 24 hours after samples are collected.

The ESP/MFB methodology for water quality monitoring was developed by COS’s Rapid Detection of Marine Pathogens working group convened by COS Early Career Fellow Kevan Yamahara. The working group facilitated critical coordination and communication among four academic
and government lab research groups now experimenting with the ESP/MFB technology and developed a work plan that included testing the efficiency of the ESP nucleic extraction method, transfer of current laboratory methods to the ESP and comparison of the MFB results to regular laboratory rapid methods.

In collaboration with New Zealand’s Cawthron Institute, COS and MBARI staff deployed the ESP/MFB in Tasman Bay to increase understanding of land-sea interactions by monitoring the discharge of the Motueka River. The international team monitored the effects of agricultural river discharge on water quality as well as the impacts of river pollutants on proposed aquaculture sites in Tasman Bay. The New Zealand deployment was also an opportunity to field test several new analytical techniques for detecting Bacteroidales source tracking markers that will help pinpoint sources of agricultural pollutants.

New Working Group

The COS-catalyzed working group led by Stanford Professor Fiorenza Micheli, Consequences of Coastal Hypoxia in the California Current Large Marine Ecosystem, is exploring four questions related to hypoxia, or the occurrence of low dissolved oxygen (DO) in seawater attributable to either upwelling or nutrient runoff from land. The working group is determining how hypoxia in the California Current should be defined, if the frequency and range of low DO has changed in recent years, the relative importance of naturally occurring versus human drivers of hypoxia and finally, the ecological and economic consequences. Results of this work were initially shared with the Southern California Coastal Water Research Project’s board. Several manuscripts detailing the results are now in preparation for broad dissemination.

Future Endeavors

In the coming year, we expect to work with MBARI and NOAA researchers to install the ESP/MFB in additional pilot locations that will provide further “proof of concept.” In Southern California, the ESP/MFB will be deployed to monitor fecal indicators and pathogens as well as harmful algae species. By field-testing the device in Puget Sound, Washington, we can work on developing assays specific for aquaculture, such as fish pathogens and harmful microbes. The Coastal Hypoxia working group will cap off its work with a meeting to share its finding with colleagues studying coastal hypoxia and with a consensus paper on the results of its work.
ECOSYSTEM HEALTH

Objectives for our Ecosystem Health focal area center on improving governance and sustainability of marine resources, creating practical ways to reduce cumulative impacts and providing marine managers with expert guidance. The focal area is shaped around a set of interwoven issues vital to the long-term sustainability of the ocean: ecosystem-based marine planning, social-ecological systems, ocean governance, cumulative impacts, and marine ecosystem thresholds and indicators. Progress was made on all fronts including workshops and a policy briefing on ocean governance, the formation of a working group on small-scale fisheries and the publication of a guide to aid California’s coastal and ocean agencies as they analyze and make planning decisions affecting the long-term sustainability of the state’s marine ecosystems. Science Director Larry Crowder also worked with an interdisciplinary team to define and convey worldwide metrics to evaluate ocean health.

Ecosystem-based Marine Planning
California agency staff must fulfill diverse legal mandates to ensure sustainability along the coast and in the ocean in the face of expanding human activities. At their behest, COS developed a user-friendly reference guide, “Incorporating Ecological Principles into California Ocean and Coastal Management: Examples from Practice” to support their work with clear explanations and examples of how to operationalize scientific principles and knowledge in daily decision-making. The guide applies four ecosystem principles (guidelines developed by a COS working group of leading scientists using the best-available information on how to maintain and restore healthy ecosystems) to existing decision-making processes. The guide, developed by early career fellows Ashley Erickson, Melissa Foley and Erin Prahler with Meg Caldwell, is being broadly distributed to agency staff, research institutions, environmental law clinics and NGOs. Early feedback from agency staff is very positive including requests from agency leadership to work with them to enhance understanding and use of the guide by their staff.

Following up on the publication last year of “Decision Guide: Selecting Decision Support Tools for Marine Spatial Planning,” COS is working with the NOAA Coastal Services Center and NOAA National Marine Protected Areas Center to develop an interactive rubric that will enable practitioners to identify decision support tools, models, and methods to aid in ocean planning. The rubric will be available at Digital Coast and likely also available at National Ocean Council and NOAA.

Monterey Bay and California at large are effective “sandboxes” where COS can develop programs or solutions that can be ported to other regions or nations. This year, COS’s work in building the scientific and institutional foundation for ecosystem-based marine planning in California was applied to New Zealand when one of our early career fellows was asked to brief government agency and NGO staff. Melissa Foley provided a detailed discussion of our work at the invitation of the New Zealand government as it embarks on linking terrestrial planning and decision-making with marine planning in the Hauraki Gulf.

Social-ecological Systems
This year, COS initiated work on incorporating social data into ecosystem-based planning. An
important undertaking was the August 2012 announcement of the Ocean Health Index that scores marine ecosystems in coastal countries worldwide based on their ecological, social, economic and political conditions. The index is the first broad, quantitative assessment of the critical relationships between the ocean and people, with an emphasis on sustainability. Larry Crowder represented COS among the 30 member organizations from universities, non-profit organizations and government agencies that determined that while scores ranged from 36 to 86, the global average was 60 out of 100. The release of the index received extensive media coverage worldwide such as the *Los Angeles Times*.

In April, under the leadership of Crowder and COS Early Career Fellow Jack Kittinger, we brought together an interdisciplinary group of experts for a workshop on the human dimensions of marine planning. We are working on “Putting people into ocean planning: a framework for incorporating human dimensions data,” a guide for ocean planners and managers. We are also conducting two innovative reviews designed to help planners learn from the past and better integrate human communities’ needs, concerns and knowledge into their work.

For the first, “Disparate use of social data in ocean planning practice,” we studied 70 ocean plans and surveyed nearly 100 coastal planners and managers. The review shows that significant disparities exist in the collection, analysis and use of social data in planning practices. The second review, “Progress and promise in spatial human dimensions research for ecosystem-based ocean planning,” is an exploration of how research that spatially characterizes human uses and activities in the ocean can be used effectively in marine ecosystem management and planning. Also this year, Kittinger developed a policy briefing on community-based fisheries management in Hawaii and led a workshop on integrating Native Hawaiian traditional ecological knowledge and management practices into conventional marine resource management.

Crowder and Kittinger also organized a new working group, “Social-Ecological Resilience in Small-Scale Fisheries” (SES-SSF), that brought together social scientists, ecologists and managers to explore emerging knowledge in fisheries management and sustainable livelihoods. The group is exploring new dimensions of social-ecological linkages in small-scale fisheries and the social-ecological history of small-scale fisheries in Monterey Bay. Our newest working group has taken research on small-scale fisheries a step further by weighing social and economic demands along with traditional conservation goals to develop sustainable solutions for a resource critical to ocean and human well-being.

“We evaluated 10 public goals for each country. The ocean health index is a device to help us think about the ocean in a more integrated way.”

LARRY CROWDER
**Cumulative Impacts**

This term refers to the total harm to human health and the marine environment that results from a combination of stressors over time. Characterizing and quantifying cumulative impacts, such as fishing, pollution and dredging, on the ocean remains an enormous challenge. Led by early career fellow Melissa Foley, COS is running a pilot project in Monterey Bay to ground truth a cumulative impacts model for California state waters developed by Ben Halpern of UC Santa Barbara based on the best-available science. The work uses existing ecosystem condition data for Monterey Bay to create cumulative impact scores based on ecosystem health metrics for habitats such as kelp forests, subtidal rocky reefs and soft sediment. The result of this pilot should be a scientifically validated way to assess stressors, and the identification and prioritization of Monterey Bay stressors that could be reduced. The results of this pilot study, coupled with our legal analysis of cumulative impact analysis and use of models in decision-making, will inform agency staff who are eager to improve cumulative impact analysis for coastal and ocean decision-making, and seek scientifically validated and legally sound approaches.

**Marine Ecosystem Thresholds and Indicators**

This year COS formed a new project with the University of California at Santa Barbara (NCEAS), NOAA’s Ecosystem Science Program (NWFSC) and Rod Fujita of the Environmental Defense Fund to identify management objectives and performance metrics to help managers determine if an ecosystem-based management scheme is effective in supporting ecosystem health and functioning. The identification and pilot testing of such indicators and thresholds is being funded by a four-year grant from the Gordon and Betty Moore Foundation. Our main goal is to develop analytic tools that support marine planning based on ecosystem thresholds and scope policy vehicles that could apply ecosystem thresholds and indicators to marine management.

**Future Endeavors**

In the coming year, COS Early Career Fellow Erin Prahler will collaborate with the California Ocean Science Trust on a project to identify and recommend policy approaches to prevent and manage introductions of invasive species in key regions of the state. The resulting scientific findings and policy recommendations will be presented to the California Agencies Aquatic Invasive Species Team in October 2012 with a final report in 2013. We are also developing seminars and training materials on ocean governance and on the Ecological Principles Guide. Building on this guide, we are preparing a law review article that will evaluate legal and scientific approaches to cumulative impacts analyses at the state and federal level as well as a book chapter on ecosystem-based marine planning. Further, we will soon launch an interdisciplinary collaborative with the National Science Foundation on “Understanding the role of coastal fisheries ecosystems in food security and community well-being.”
DEVELOPING LEADERS
For our vision to be realized, it’s critical that we train tomorrow’s ocean leaders.
LEADERSHIP DEVELOPMENT AND EDUCATION

An important goal for COS laid out in our 2012-2016 Strategic Plan is to “advance leadership skills for up-and-coming and established decision-makers.” In addition to the numerous workshops, seminars, symposiums and other educational efforts described above as part of our focal area work, the Fisheries Leadership and Sustainability Forum (Fisheries Forum), under Executive Director John Henderschedt’s careful guidance, conducted two “Fisheries Forums” nationally and one regional focus group. The MARINE program work described earlier and our early career fellowship program continue to be key elements of our leadership development work.

Fisheries Leadership and Sustainability Forum

Through this collaboration with the Stanford Woods Institute, the Nicholas Institute at Duke University and the Environmental Defense Fund, we conducted our semiannual Fisheries Forums for the eight regional fisheries councils in the United States. The first, in Sept. 2011 at Stanford University in California, was on “Coastal and Marine Spatial Planning and the Role of Regional Fishery Management Councils in Multi-Sector Spatial Planning” while the second, held in Beaufort, N.C. in May 2012, explored the “Socioeconomic Considerations and Human Dimensions of Fisheries Management.” In Sept. 2012, COS’s Kimberly Gordon helped orchestrate and lead another Fisheries Forum in Monterey, this time as a discussion oriented policy-lab style event on the subject “National Standard 1 and Optimum Yield.”

In December 2011, the Fisheries Forum orchestrated a focus group with the Mid-Atlantic Fishery Management Council to elicit feedback from stakeholders on engaging the recreational fishing community in the council’s management process. The focus group was attended by 27 members of the recreational community from North Carolina to Massachusetts, representing private boat and shore-based anglers, party and charter boat owners and operators, regional advocacy groups, retailers and media.

The Fisheries Forum also produced a topical report on “The role of the Regional Fishery Management Councils in multi-sector spatial planning: Exploring existing tools and future opportunities” as well as updating its report on “Risk policy and managing for uncertainty across Regional Fishery Management Councils.”

MARINE

Much of the educational work organized by this collaboration with the Stanford Woods Institute is woven into the focal areas described above; however the initiative conducted two communication workshops attended by 38 graduate students in the Monterey Bay area that prepared them to compete for slots in TEDx Monterey Sea Change in April 2012. Two MARINE students—a current student and an alumnus—joined Larry Crowder in the line-up of speakers at the daylong event.

MARINE also held its second interdisciplinary problem solving ‘collaboratory’ on “Water Quality in the Elkhorn Slough.” The 24 participating students from five Monterey Bay campuses delved into professionally prepared reports on Elkhorn Slough in order to develop recommendations for a strategy and role for their “client,” The Nature Conservancy. Through this process, students gained a perspective across multiple disciplines including agriculture, economics and public health.

Implementing the concept of a Monterey Marine Passport System, whereby students can register for ocean-related courses at any of the...
seven MARINE campuses, has been challenging. However, as a first step, we are pursuing a first-order passport memorandum of agreement between the ocean-related graduate programs at UC Santa Cruz and Stanford. This pilot will inform our development of a multi-campus passport system.

**Stanford**
COS also sponsored a seminar series for Stanford’s chapter of the Coastal Society entitled “Connecting the Drops” which explored human activities in the ocean, explicitly focusing on “social” rather than natural dimensions of ocean management. Several COS early career fellows made presentations to as many as 40 undergraduate students during the series.

**Future Endeavors**
New this year the Fisheries Forum is helping to design the national conference, “Managing our Nation’s Fisheries 3,” co-sponsored by the eight Regional Fishery Management Councils and the National Marine Fisheries Service. The Fisheries Forum has been asked to design and facilitate one of the three major sections of the conference under the theme “advancing sustainability.” The Fisheries Forum will also work with the New England Fisheries Management Council to design and execute a workshop that will help them advance their risk policy for managed fisheries.

For MARINE, programs this fiscal year will focus on ocean leadership featuring case studies on translating knowledge into action. We will also organize a ten-day practicum on ocean leadership led by Jeff Langholz, an associate professor at the Monterey Institute for International Studies, which will emphasize collaboration, innovation and communications skills. To help advance local capacity in Pacific Ocean communities, we plan to include at least two marine graduate students from Pacific Ocean coral reef nations among the students in the practicum.
We took steps to strengthen our organization further, including holding teamwork training for staff and developing best practices for hiring new staff. We also kicked off an active process to identify and bring on board program leads for each of our three focal areas. We engaged a staffing search firm to assist us with a “cluster hire” approach for our program leads. So far we have received over 50 applications for the three positions from highly qualified candidates worldwide, and shortly we will embark on the finalist interview process. We are also actively interviewing to fill five Early Career Fellows (ECF) positions that will replenish our ECF program with excellent candidates from a broad set of disciplines. We are close to bringing on board both a Finance and Administration Manager and a Communications Manager.

We also welcomed Myriah Cornwell to COS as the inaugural Stanford Woods-Packard Fellow. Myriah earned her Ph.D. at Duke University in marine social sciences where she concentrated on the role of citizen science in marine conservation. In her role at Packard, Myriah is managing the seabird program and working with Walt Reid on developing new program areas. At COS, she is working with us on our human dimensions research including the SES and Small Scale Fisheries working group. We will be collaborating on a paper to review the potential for citizen science in aiding marine conservation. A possible future application of this approach is monitoring California’s new network of marine protected areas (MPAs).

Last fall the early career fellows joined COS directors Caldwell and Crowder in a half-day leadership development session led by Wendy Millet of the Stanford Woods Institute. The training focused on teamwork and goal-setting. To advance professional development among our entire staff, we engaged a communications coach to assist with presentation skills, message development and general writing skills in order to increase the confidence and effectiveness of COS team members presenting to an audience and developing written materials. The eight staff members who have participated so far report greater confidence in presenting to an audience, articulating research, running meetings and developing materials.

In the new fiscal year, Meg Caldwell will participate in Stanford’s Faculty Voice and Influence Program, a year-long program aimed at arming leading women at Stanford with the skills, training, research, access and close-knit support to dramatically increase their influence at Stanford, within their disciplines and in public debate. Continuing with our internal leadership development commitment, the fall 2012 COS “talk fest” was redesigned as a special two-day leadership training retreat for the entire COS staff. The retreat was a rustic camping experience on the Big Sur coast. Nationally renowned leadership trainer, Beth Farb of Dialogos worked with Meg Caldwell, Larry Crowder, Adina Abeles and Margaret Krebs to develop an energizing and customized agenda for COS’s leadership retreat.

At the end of fiscal year 2012, our Monterey office took up residence in new quarters that provide more breathing room for our growing staff and, due to its open and airy layout, is stimulating collaboration and the creative energy needed to take on the year ahead.
APPENDICES

The following pages detail our collaboration partners and our communication milestones such as presentations, publications and media coverage.
**APPENDIX A: EXTERNAL PARTNERS**

We define external partners as individuals and organizations working with COS to co-create projects or outputs, in both informal and formal ways.

Over the last year, our engagement with external partners has deepened and the number of external partners has grown, including a significant increase in the number of partners based internationally. *(New partners for FY2012 are indicated by *)

Our external partners for the last 12 months included:

**Local, state, regional, federal and international governments**

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<thead>
<tr>
<th>Organization</th>
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<tr>
<td>City of Pacific Grove</td>
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<td>City of Santa Cruz</td>
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<tr>
<td>Monterey County</td>
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<tr>
<td>Santa Cruz County</td>
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<tr>
<td>San Francisco Bay Conservation and Development Commission</td>
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<td>California Coastal Commission</td>
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<tr>
<td>California Energy Commission Public Interest Energy Research Program</td>
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<td>California MPA Monitoring Enterprise</td>
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<td>California Ocean Protection Council</td>
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<td>California Ocean Science Trust</td>
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<td>State of Hawaii*</td>
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<td>Washington State Department of Ecology*</td>
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<td>Integrated Regional Water Management Program</td>
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<td>New England Fisheries Council*</td>
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<tr>
<td>Council on Environmental Quality</td>
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<td>Elkhorn Slough National Estuarine Research Reserve</td>
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<td>Gulf of the Farallones National Marine Sanctuary</td>
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<td>Monterey Bay National Marine Sanctuary</td>
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<td>NOAA Coastal Services Center</td>
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<td>NOAA Coral Reef Conservation Program*</td>
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<td>NOAA Coral Reef Ecosystem Division*</td>
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<tr>
<td>NOAA Hawaiian Islands Humpback Whale National Marine Sanctuary*</td>
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<td>NOAA Headquarters</td>
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<td>NOAA International Program</td>
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<td>NOAA National Marine Fisheries Service</td>
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<td>NOAA Southwest Fisheries Science Center*</td>
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<tr>
<td>Ocean Research and Resource Advisory Panel</td>
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<td>San Francisco Bay National Estuarine Research Reserve</td>
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<td>South Slough National Estuarine Research Reserve</td>
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<tr>
<td>Tijuana River National Estuarine Research Reserve</td>
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<td>United States Geological Survey*</td>
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<tr>
<td>Republic of Kiribati</td>
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<td>Republic of Palau*</td>
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**NGOs**

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<th>Organization</th>
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<tr>
<td>Aldo Leopold Leadership Program</td>
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<td>California Current Acidification Network</td>
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<td>Census of Marine Life</td>
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<td>Center for the Future of the Oceans</td>
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<td>Central Coast Wetlands Group</td>
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<td>COMPASS</td>
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<tr>
<td>Comunidad y Biodiversidad*</td>
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<tr>
<td>Conservation International</td>
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<tr>
<td>Consortium for Ocean Leadership</td>
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<tr>
<td>EBM Tools Network</td>
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<tr>
<td>Environmental Defense Fund</td>
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<tr>
<td>European Project on Ocean Acidification (EPOCA)*</td>
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<td>ICLEI Local Governments for Sustainability Institute for Sustainable Communities*</td>
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<td>IUCN (International Union for the Conservation of Nature)</td>
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<td>Meridian Institute</td>
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<td>The National Audubon Society*</td>
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<td>National Council of Environmental Legislators</td>
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<tr>
<td>The Nature Conservancy – California</td>
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<tr>
<td>Natural Resources Defense Council</td>
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<td>Ocean Conservancy*</td>
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<td>Resources Legacy Fund*</td>
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<td>Stockholm Resilience Center*</td>
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A postdoctoral fellow at NOAA's Southwest Fisheries Science Center and a COS working group member and affiliated researcher, Elliott Hazen recently spearheaded a study on the migration of Pacific habitats due to climate change, an effort that received worldwide media attention.
### Research and Academic Institutions

- American Bar Association*
- ARC Centre for Excellence – Coral Reef Studies*
- California Sea Grant
- California State University, Monterey Bay
- Cawthron Institute
- Central and Northern California Ocean Observing System
- Monterey Institute for International Studies
- Moss Landing Marine Laboratories
- National Center for Ecological Analysis and Synthesis
- Natural Capital Project
- Naval Postgraduate School
- Pacific Marine Analysis and Research Association
- Palau International Coral Reef Center*
- Sacramento State Center for Collaborative Policy
- Southern California Coastal Ocean Observing System
- Southern California Coastal Water Research Project
- University of Southern California Sea Grant
- Boston University
- Duke University, Nicholas Institute for Environmental Policy Solutions
- James Cook University
- Oregon State University*
- Pontificia Universidad Catolica de Chile*
- Rutgers University*
- University of Arizona*
- University of British Columbia
- University of California, Los Angeles
- University of California, San Diego
- University of California, Santa Barbara*
- University of California, Santa Cruz
- University of Hawai‘i
- University of Iowa
- University of Miami*
- University of Texas, Austin
- University of Queensland
- University of Washington*
- Woods Hole Oceanographic Institution

### Foundations

- Gordon and Betty Moore Foundation
- David and Lucile Packard Foundation
- Okeanos Foundation
- Resources Legacy Fund

### For Profit Organizations

- Blue Earth Consultants, LLC
- Phillip Williams & Associates/ESA
- Susanne Moser Research & Consulting

### International Partners

**Foundations**

- ARC Centre for Excellence – Coral Reef Studies*
- Cawthron Institute
- Comunidad y Biodiversidad*
- European Project on Ocean Acidification (EPOCA)*
- IBA (International Bar Association) – Maritime Law Division
- IUCN (International Union for the Conservation of Nature)
- James Cook University
- Republic of Kiribati
- Republic of Palau*
- Palau International Coral Reef Center
- Pontificia Universidad Catolica de Chile*
- University of Queensland
- Stockholm Resilience Center*

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Kim Jordan (left) works closely with Duke University, EDF and other partners on the Fisheries Forum while Lucie Hazan is an important liaison with the many members of our working groups.
APPENDIX B: PUBLICATIONS
(Listed alphabetically by first COS author)


M.R. Caldwell and L.B. Crowder. “Strategic Plan.” Center for Ocean Solutions, February 2012


Visiting Fellow Rod Fujita, pictured here with intern Katrina Ole-Moiyoi, collaborated with Early Career Fellow Melissa Foley on an important paper suggesting a new approach to managing the ocean for long-term sustainability.
A geographic center for our work is the Monterey Bay, home to species such as these elephant seals. We’ve produced studies on climate change and the shoreline, coastal adaptation, coastal erosion and nearshore oceanography in the bay.
APPENDIX C: SELECTED STAFF TALKS AND PRESENTATIONS
(Listed in chronological order)

2011

**Kevan M. Yamahara**, “Autonomous Detection of Fecal Indicators and Pathogens in Coastal Waters Using In-Situ Real Time PCR.” Internal Water Association Health Related Water Microbiology, Rotorua, New Zealand, Sept. 18-23, 2011


**Margaret (Meg) Caldwell**, “Coastal and Marine Spatial Planning (CMSP) Social Science and Legal Expertise Integration.” Oregon Coastal and Marine Spatial Planning Science Workshop, Corvallis, Ore., November 29-30, 2011


**Melissa Foley**, “Decision support tools for marine spatial planning.” SeaSketch workshop for the Auckland Council and Department of Conservation, Auckland, New Zealand, December 6, 2011


**Melissa Foley**, “Understanding the links between spatial connectivity and ocean health.” Cawthron Institute, Nelson, New Zealand, December 12, 2011

2012


**C. Brock Woodson and Stephen G. Monismith**, “Spatiotemporal variability in cross-shelf exchange in Monterey Bay.” Association for the Sciences of Limnology and Oceanography/American Geophysical Union Ocean Sciences Meeting, Salt Lake City, Utah, February 21-25, 2012


**C. Brock Woodson**, “The Monterey Bay Inner Shelf: Coastal Ocean Dynamics in Your Backyard.” UC Santa Cruz Ocean Sciences, Santa Cruz, Calif., April 21, 2012

**Margaret (Meg) Caldwell**, Panel: “Scientific insights on desalination.” California State University at Monterey Bay, Monterey, Calif., May 3, 2012


**Margaret (Meg) Caldwell**, Panel: “Over 40 Years in the Struggle for Ocean Policy.” Capitol Hill Ocean Week, Washington, D.C., June 5-8, 2012

**Margaret (Meg) Caldwell** and Bob Richmond of the University of Hawaii’s Kewalo Marine Laboratory, “What Every Pacific Islander Should Know About Climate Change.” Association of Pacific Island Legislatures, Saipan, Northern Mariana Islands, June 21, 2012


**Adina Abeles** and **Bob Richmond** of the University of Hawaii’s Kewalo Marine Laboratory, “What Every Pacific Islander Should Know About Climate Change.” Association of Pacific Island Legislatures, Saipan, Northern Mariana Islands, June 21, 2012

**Ryan Kelly**, Webinar: “Ocean Acidification, Policy, and the NGO Community, with Presentation from the Center for Ocean Solutions on Policy Options for Addressing Ocean Acidification at the State Level.” Hosted by the Ocean Conservancy, Washington, D.C., July 24, 2012

**Melissa Foley and Corina Marks**, “Groundtruthing a cumulative impact model in Monterey Bay.” Monterey Bay Marine GIS User Group meeting, Santa Cruz, Calif., July 19, 2012


**Margaret (Meg) Caldwell** and Bob Richmond of the University of Hawaii’s Kewalo Marine Laboratory, “What Every Pacific Islander Should Know About Climate Change.” Association of Pacific Island Legislatures, Saipan, Northern Mariana Islands, June 21, 2012


**Ryan Kelly**, Webinar: “Ocean Acidification, Policy, and the NGO Community, with Presentation from the Center for Ocean Solutions on Policy Options for Addressing Ocean Acidification at the State Level.” Hosted by the Ocean Conservancy, Washington, D.C., July 24, 2012

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At a leadership development workshop exploring the theme of research by design, Larry Crowder brainstorms with Ryan Kelly, Eric Hartge and Adina Abeles.


**C. Brock Woodson**, “The Monterey Bay Inner Shelf: Coastal Ocean Dynamics in Your Backyard.” UC Santa Cruz Ocean Sciences, Santa Cruz, Calif., April 21, 2012

**Margaret (Meg) Caldwell**, Panel: “Scientific insights on desalination.” California State University at Monterey Bay, Monterey, Calif., May 3, 2012


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APPENDIX D: MEDIA COVERAGE

2011

Tackling the Other Carbon Problem: What we can do about ocean acidification?
September 6, 2011 Daily Sightline
California adopts shark fin ban.
September 7, 2011 The Washington Post

Rare undersea volcanic vents show oceans’ increasing acidity likely to hurt biodiversity, endanger ecosystem stability, say Stanford researchers.
September 12, 2011 Stanford Report

Shut down shark fin hunt on coast.
September 16, 2011 Monterey Herald
Move, Adapt, or Drown.
September 28, 2011 Okinawa Institute of Science and Technology

Decline and recovery of coral reefs linked to 700 years of human and environmental activity.
October 3, 2011 PhysOrg.com
Decline and Recovery of Coral Reefs Linked to 700 Years of Human And Environmental Activity.
October 4, 2011 Science Newsline
Quick recovery of coral reefs possible.
October 4, 2011 Bits of Science
Decline and Recovery of Coral Reefs Linked to 700 Years of Human and Environmental Activity.
October 4, 2011 Science Newsline

Health of Coral Reefs Linked to Human and Environmental Activity.
October 3, 2011 Yahoo! News
Decline And Recovery of Coral Reefs Linked to 700 Years of Human And Environmental Activity.
October 4, 2011 Science Newsline

Recovery in Hawaiian Coral Reefs.
October 4, 2011 Green: Hawai'i's Sustainable Living Magazine
Decline, recovery of coral reefs linked to human activity.
October 4, 2011 Hawaii 24/7

Coral Reef History Linked To 700 Years Of Human And Environmental Activity.
October 4, 2011 redOrbit
Decline and Recovery of Coral Reefs Linked to 700 Years of Human and Environmental Activity, Study Finds.
October 4, 2011 Stony Brook News

Coral reef decline and recovery linked to 700 years of human activity.
October 5, 2011 Conservation Maven
The resilience of Hawaiian reefs suggests a real opportunity for conservation.
October 5, 2011 The Earth Times

700-Year Historical Reconstruction Shows Hope for Hawaii's Coral Reefs.
October 13, 2011 Ecology

Science for Climate Adaptation: Reflections from Behind the 8 Ball.
October 15, 2011 Science Policy

Clean Water Act failing in new climate.
October 30, 2011 U-T San Diego

Marine Life Protection – Silent Spill.
November 19, 2011 Santa Barbara Independent

Dropping Ocean Oxygen Levels Concern Scientists.
November 21, 2011 ABC 7 News: KGO-TV (San Francisco, CA)

GPS saves the world—but who’ll save GPS?
November 21, 2011 Wired.UK
Research published in the peer-reviewed journal *PLoS ONE* revealed the importance of marine protected areas to help species such as this abalone bounce back after hypoxic events, periods of low dissolved oxygen in seawater that can cause mass mortality.
2012

Getting Warmer: Climate change workshop focuses on adapting to the inevitable.
December 1, 2011 Monterey County Weekly

Local governments address climate change.
December 5, 2011 Monterey County Herald

Overfishing of bluefin tuna in Mediterranean affects Atlantic stock: study.
December 12, 2011 FIS United States

State moves to protect marine areas, not just species in the ocean.
December 13, 2011 KPCC Radio (Southern California)

350 square miles of California water soon to be restricted fishing areas.
December 27, 2011 KPCC Radio (Southern California)

Op-Ed: Australian government allows import of whale meat, ouch.
December 28, 2011 Digital Journal

Does the USGCRP have high-level political buy-in for connecting climate science to society?
January 10, 2012 Climate Science Watch

Researchers Propose Putting A Price on Whales.
January 11, 2012 The Washington Post

Great Barrier Beefs: Survey reveals fishers' doubts about major Australian conservation effort.
January 15, 2012 Conservation Magazine

170-pound Marlin tagged off Big Island wins 2011 Great Marlin Race.
January 25, 2012 Hawaii News Now

OXYGEN-STARVED WATERS Hypoxic zones moving closer to West Coast shores, increasing threats to marine life.
January 29, 2012 Monterey County Herald

Tagged whale makes surprising journey.
February 16, 2012 Associated Press/World News Australia

‘Mobile marine reserves’ needed.
February 17, 2012 BBC Mobile

Protection zones ‘should go mobile’.
February 18, 2012 Press Association (UK)

‘Mobile nature reserves’ could save marine species from extinction.
February 18, 2012 The Guardian

Mobile marine reserves may end slaughter of endangered sea life.
February 18, 2012 The Independent

Revealed: the new species threatened by deep-sea mining.
February 20, 2012 The Ecologist

Calif. officials use king tides to prepare people to cope with rising sea levels.
February 21, 2012 Environment & Energy

Otter Luck: Sea otter population dwindling dramatically and great white sharks may be to blame.
February 21, 2012 The Daily Mail: Mail Online (UK)

West Marine Announces “Green Product of the Year” Honorees.
February 21, 2012 The New York Times

Turtles ‘face extinction’ without marine protection.
February 22, 2012 The Telegraph (UK)

Rare whales’ meandering may sustain its survival.
February 22, 2012 Charlotte Observer (McClatchy News Service)

Study tracks ocean path of baby turtles.
March 5, 2012 The Stanford Daily

Stanford marine biologists search for the world’s strongest coral.
March 20, 2012 PhysOrg.com

Native Hawaiians Provide Lessons in Fisheries Management.
March 23, 2012 Scientific American

Ancient Hawaiians Caught More By Fishing Less.

Ancient civilizations reveal ways to manage fisheries for sustainability.
March 23, 2012 Science Daily

Ancient sustainability.
March 23, 2012 Seafood Today

Ancient civilizations reveal ways to manage fisheries for sustainability.
March 23, 2012 iShoutLoud

Ancient civilizations reveal ways to manage fisheries for sustainability.
March 23, 2012 Science Codex

Ancient Civilizations Reveal Ways To Manage Fisheries For Sustainability.
March 23, 2012 Sign of the Times

Ancient native secrets of sustainable ocean fishing.
March 25, 2012 Earth Times

Ancient Fisheries Can Teach Modern Lessons.
March 27, 2012 Sci-tech Today

Ancient civilizations reveal ways to manage fisheries for sustainability.
March 29, 2012 Seed Daily
<table>
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<tr>
<th>Date</th>
<th>Title</th>
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<tr>
<td>March 29, 2012</td>
<td>Carbon Dioxide in Oceans Harm Washington’s Shellfish, Panel Says.</td>
<td>King5.com (Seattle, Wash.)</td>
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<td>April 4, 2012</td>
<td>Mobile Reserves Follow Wildlife Where It Needs Protection.</td>
<td>Co.EXIST</td>
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<td>April 9, 2012</td>
<td>Past Serves as Lesson in Sustainable Fishing: Hawaiian societies caught as much fish as modern fishers.</td>
<td>Voice of America</td>
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<td>April 12, 2012</td>
<td>Inaugural Monterey Bay Marine GIS Users Meeting.</td>
<td>USGS Sounds Waves</td>
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<td>April 16, 2012</td>
<td>Winners and Losers: How Climate Change Affects Coral Reefs.</td>
<td>PRI’s The World</td>
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<td>April 19, 2012</td>
<td>Water symposium emphasizes conservation, communication.</td>
<td>Venture County Star</td>
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<td>April 23, 2012</td>
<td>‘Green’ seafood labels are under fire.</td>
<td>The Washington Post</td>
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<td>April 26, 2012</td>
<td>Scientist of the Week: Jack Kittinger.</td>
<td>Laboratory Equipment</td>
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<tr>
<td>May 1, 2012</td>
<td>Water Quality Tested with New Technology.</td>
<td>Television New Zealand</td>
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<tr>
<td>May 4, 2012</td>
<td>Mike Sutton Moves from Aquarium to Audubon.</td>
<td>Monterey County Weekly</td>
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“I think I speak for all of us at COS when I say that I am thrilled to be involved with such a dynamic organization that’s dedicated to solving some of the most thorny challenges facing the world’s ocean.”

MEG CALDWELL