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BOOK OF ABSTRACTS

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ORAL PRESENTATION ABSTRACTS



ORAL PRESENTATION ABSTRACTS

Sarah Abramson^{*1}. Will New Regulations under Clean Water Act 316(b) Effectively Protect Our Coastal Environment from Ongoing Damage Caused by Coastal Power Plants? A Case Study: Santa Monica Bay.

¹Heal the Bay

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California's marine ecosystems are stressed and continue to face multiple threats, including polluted runoff, marine debris, overfishing, destructive fishing practices and harmful algal blooms. In addition to these stressors, existing power plants located along California's coast contribute directly to the degradation of the state's marine environment. Alarmingly, 21 coastal power plants in California utilize antiquated once-through cooling (OTC) technologies and are collectively permitted to withdraw nearly 17 billion gallons of sea water daily. This process indiscriminately kills fish, invertebrates, eggs and larvae, and other sea life through impingement and entrainment. While the impact of individual power plants on local coastal marine ecosystems is significant on its own, the cumulative impacts of closely sited facilities are potentially even more devastating. In the Santa Monica Bay, three power plants – Scattergood, El Segundo, and Redondo Beach Generating Stations – are located in very close proximity along the south Bay. Together these facilities withdraw and recycle 13% of nearshore waters in the Bay every six weeks. Given that these local coastal waters are also highly impacted by other stressors, the collective impacts of these plants are worthy of close analysis, particularly impacts on fish eggs and larvae. In 2004, the United States Environmental Protection Agency issued regulations pursuant to section 316(b) of the Clean Water Act establishing performance standards to reduce the impacts of existing coastal power plants utilizing OTC. Unfortunately, these regulations contain several potential loopholes, such as restoration/mitigation and economic exceptions, which could entirely negate the benefits of these new performance standards. Therefore, we must consider the following questions: Will these regulations effectively protect the coastal environment of Santa Monica Bay from damages inflicted by coastal power plants? And if not, what can be done to improve these regulations at the state level to ensure that OTC-related damages are minimized in the future?

Sarah Abramson^{*1}, **Donald Bren**², **Katie Arkema**², **Bryan Dewsbury**³. Advancements in Marine Ecosystem-Based Management: From Characterization to Implementation.

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Over the past decade policy makers, management agencies, and academic scientists have shown increasing interest in ecosystem-based management (EBM). Yet, the extent that EBM principles, advocated by scientists, are adopted by managers is still uncertain. In this paper we review scientific definitions of EBM and management plans for eight marine and coastal ecosystems to determine if management agencies and academics are approaching EBM in a similar manner. Although scientific literature outlines specific ecological and social principles of EBM, we find these details are only loosely incorporated into management plans and actions. Our results indicate that some principles of EBM are being put into practice, but the gap between these concepts and management plans suggests that this translation needs to be much greater. Our results also reveal a need for operational tools to make scientific principles more practical and further the implementation of EBM.

Steve Aceti^{*1}. The Need for California to Increase its Investment in Beach Restoration.

¹California Coastal Coalition

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In 1978, the state adopted a policy to prevent the loss of the state's beaches, recognizing that erosion can threaten public and private infrastructure, impair the use of beaches by residents and out-of-state visitors and result in decreased habitat for a variety of species. A number of state agencies are involved in coastal sediment issues, but the agency with primary responsibility for restoring and maintaining the state's beaches is the Department of Boating and Waterways (DBW). DBW manages two beach erosion programs. The first, created in 1970, is known as the Beach Erosion Control Program (BECP). The second, established in 1999, is the California Public Beach Restoration Program (PBRP). The DBW often works in partnership the U.S. Army Corps of Engineers (USACE). Since 1999, the state's beach restoration efforts have been overseen and coordinated by the California Coastal Sediment Management Workgroup (CSMW), which was created to look at restoring natural sediment supplies. Since its creation in 2005, the California Ocean Protection Council (OPC) has included beach



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restoration and sediment management among its goals and objectives. Since 1981, DBW has received approximately \$53 million for studies and projects. In recent years, however, most of this money has been used to study problem areas that require restoration and DBW estimates that the total cost of undertaking these projects is approximately \$195,000,000. The projected cost of restoring California's beaches far outweighs the state's previous financial investment in such projects, which will require a strong commitment from the Governor and the Legislature over the next five years to appropriate the necessary funds. It will also require collaborations among agencies so that projects include wetlands restoration, watershed restoration, dam removals and other holistic approaches to solving the problems affecting the state's shoreline consistent with the goals and objectives of the CSMW and the OPC.

Drew Ackerman^{*1}, Jing Ping Xu², Eric D. Stein¹. Linking Watershed and Estuary Models for Characterization of an Effluent Dominated Estuary.

¹Southern California Coastal Water Research Project, ²U.S. Geological Survey

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Southern California estuaries are affected by both direct inputs and inputs from upstream, urbanized coastal watersheds. These inputs include sediment, dry and wet weather urban runoff, and industrial discharges. Management of estuarine and near-shore water and sediment quality requires an understanding of the relationship between inputs and estuarine responses. Linked watershed-estuary models provide a powerful tool to help understand these interactions and to evaluate the effect of proposed management actions. We will present the development of a linked hydrodynamic model for the San Gabriel watershed and estuary. The San Gabriel River estuary in an urbanized system that receives both direct and watershed-based inputs. Freshwater flow into the estuary is predominantly from two streams. Two large power-generating stations (PGSs) also discharge once-through cooling seawater taken from a nearby bay into the estuary. During summer months, discharge from the PGSs is generally over an order of magnitude greater than the terrestrial inputs. This greatly influences typical bi-directional estuarine flow conditions. Observed flows during the study period of July through October 2005 were consistently seaward near the mouth of the estuary, averaging 16 m³ s⁻¹. Additionally, the seawater discharged from the PGSs influence the water column stratification with an observed stratified water column above the discharge and a well mixed one below. An estuarine hydrodynamic model was calibrated based of the 2005 field data and then used to simulate observed wet weather flows from the 2005-06 storm season. Results of the modeling indicate that upstream of the PGSs the estuary is stratified with storm water inputs to the system being approximately an order of magnitude greater than the dry season flows. Downstream of the PGSs, the hydrodynamics are dominated by the effects of the PGS discharge. The results of this model may be used to evaluate pollutant mixing and dilution in the estuary.

Satie Airame^{*1}. The Role of Science in Design, Monitoring, and Evaluation of Marine Protected Areas in California.

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Science is a critical component of the design, monitoring and evaluation of marine protected areas (MPAs). In California, two processes to establish MPAs engaged volunteer scientists to provide advice and guidance. In the Channel Islands process, scientists provided a summary of the scientific literature about fully protected marine reserves, a suite of ecological criteria for design of marine reserves, maps of areas with high value for conservation, and evaluations of alternative proposals developed by stakeholders. Many, but not all, of the ecological criteria were incorporated into the design of the network of state MPAs adopted in April 2003. Although the MPA network was larger than initial proposals, it did not meet the scientific guidelines for size, reducing the likelihood that the network will fully achieve the project goals. Volunteer scientists participated in a series of workshops to craft a monitoring plan for the Channel Islands MPAs. Local scientists provided expertise, and in many cases, obtained funding, needed to monitor ecological impacts of the Channel Islands MPAs. In a process similar to the Channel Islands, a science advisory team was assembled to advise decision makers and stakeholders involved in California's Marine Life Protection Act (MLPA) Initiative process. The scientists developed and prepared a series of lectures about marine science to provide context for the developing policy. The scientists also developed a suite of guidelines for design of MPAs. In an iterative process, scientists evaluated designs for networks of MPAs developed by stakeholders. Decision makers adopted the scientific guidelines for design of MPA networks and, as a consequence, all proposals recommended to the California Department of Fish and Game conformed to the scientific guidelines. In both processes, science provided the conceptual framework and knowledge needed to implement promising policies for marine conservation and sustainable use.



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James Alamillo^{*1}. Educating Subsistence Anglers about Contaminated Fish in Los Angeles County.

¹Heal the Bay

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In 2000, the U.S. EPA and the Natural Resource Trustees (National Oceanic and Atmospheric Administration, the U.S. Fish and Wildlife Service, the National Park Service, California Department of Fish and Game, the California State Lands Commission, and the California Department of Parks and Recreation) as part of their settlement with DDT and PCB manufacturers and dischargers received \$140 million to clean up the Palos Verdes Shelf superfund site, restore impacted natural resources, and protect public health. To address the public health protection goals of the Palos Verdes Shelf, the U.S. EPA and its consultant Impact Assessment Inc., established the Fish Contamination Education Collaborative (FCEC), a partnership between federal and state government agencies, local health departments, community-based organizations, and other local institutions. The FCEC is charged with implementing the public outreach and education component of the U.S. EPA's Institutional Controls (IC), which are designed to reduce the cancer risk to people that consumed. In 2003, Heal the Bay implemented the Angler Outreach Program as a component of the FCEC. While the program uses a multi-pronged outreach approach toward angler education, the primary aim focuses on education of pier anglers in Los Angeles County on the risks of consuming DDT and PCBs contaminated white croaker. In addition to white croaker, pier anglers are educated on other locally caught fish with regards to catch limits and consumption guidelines for DDT, PCBs, and mercury. As of April 2006, Heal the Bay's pier angler program has spoken to over 40,000 anglers and family members about the risks associated with consuming DDT and PCB contaminated fish. However, what makes the Angler Outreach Program a true success is: 1) how the program has been implemented; 2) its flexibility over the last four years; and 3) its longevity in targeting subsistence anglers in Los Angeles County.

James Alamillo^{*1}. Heal the Bay's Beach Report Card®: Communicating Complex Water Quality Issues and Improving Public Health.

¹Heal the Bay

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Historically, beach water quality was important to beachgoers and public officials only when there was a substantial sewage spill. Few people were concerned with the potential health effects associated with swimming in ocean waters polluted by contaminated runoff. Only recently has there been extensive research and study on beach water quality issues. It has been challenging for health agencies to effectively convey the plethora of new information about water quality issues associated with swimming at the beach, and therefore difficult to protect the health of the beachgoing public. Most research has focused on increased understanding of microbiology, risk assessment, mechanisms driving nearshore processes, and limitations of conventional bacterial sampling and measurement. For 16 years, Heal the Bay has provided the public with an easy-to-use tool for deciding where to get in the water, based on current bacteriological data and analysis. The Beach Report Card® (BRC) methodology provides the beachgoing public with easily understood water quality information so they can protect themselves when going to the beach. The BRC assigns a letter grade to each monitored beach based on the frequency of, and magnitude of, exceedances of California's beach bathing water standards. The BRC provides health information for more than 450 beaches throughout California, and is widely available via the Internet, in coastal business establishments such as surf shops, and in local newspapers like the Los Angeles Times. We continue to update and revise the BRC methodology to improve the quality and usability of information produced.

Jacqueline Alder^{*1}, Chamois L. Andersen². Including Humans in the Conservation Equation.

¹ Author of the Millennium Ecosystem Assessment, University of British Columbia, ²Natural Resource Communication Management

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California and the world's marine and coastal ecosystems are economically, socially and ecologically significant. They are also among the fastest deteriorating ecosystems and are inexplicably linked to the well-being of humans. Increasing demands on fish stocks and the continuing decline of estuarine and marine habitat through development and pollution are putting natural



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resources and humans at risk. Time is of the essence, according to the Millennium Ecosystem Assessment (MA), a global research initiative commissioned by the United Nations involving 1,360 scientists from 95 nations.

Similar to California's Ocean Action Plan, the MA calls for greater coordination of management activities only with a greater emphasis on human well-being than previous efforts. It explains how we are weakening nature's ability to deliver key "ecosystem services" to humans, such as providing us with food, shoreline protection, and regulating natural cycles such as climate, disease and water purification. The MA also highlights the trade-offs society needs to consider for the future of ecosystems and human well-being.

Similar to California's Marine Life Management Act, the MA calls for ecosystem approaches, sound science and stakeholder involvement in fisheries management. California's Nearshore Fishery Management Plan is a good example of a framework approach to managing a fishery. This fishery emerged in Southern California in the late 1980s with the market for live finfish, and quickly ricocheted up the coast requiring the state to take immediate action to ensure it remains sustainable.

The MA draws attention to the importance of sustainable fishing activities as well as the intrinsic values of marine ecosystems. The MA highlights the need to include humans in ecosystem management, and identifies ways to better link fishery management tools with fishery management plans, such as through the use of marine protected areas as called for in California's Marine Life Protection Act.

Robert W. Smith¹, Erica T. Jarvis², Valerie E. Raco-Rands², Brock B. Bernstein³, Kevin T. Herbinson⁴, M. James Allen^{*2}. Temporal Trends in Southern California Coastal Fish Populations Relative to 30-Year Trends in Oceanic and Anthropogenic Conditions.

¹Deceased, ²Southern California Coastal Water Research Project, ³Independent Consultant, ⁴Southern California Edison Company

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Southern California fish abundance has changed during the past three decades, raising concerns that these populations are at risk. Causes of these changes may include changing oceanic conditions, overfishing, pollution, and habitat alteration. This study assesses the relationship of southern California fish population trends to trends in oceanic and some anthropogenic environmental variables. Fish population trends were determined from long-term (20 to 30 year) fish databases (power generating station impingement and trawl monitoring; recreational fishing; and publicly owned treatment plant (POTW) trawl monitoring). Combined, these databases provided information on 298 fish species. Environmental trends also were determined from long-term databases (CalCOFI oceanographic data; shoreline temperature; coastal runoff; and POTW contaminant mass emissions). Principal component analysis identified important independent environmental variables (Pacific decadal oscillation, PDO; El Niño-Southern Oscillation, ENSO; offshore temperature; upwelling in north, Southern California Bight (SCB), and south; coastal runoff; and contaminant mass emissions). Stepwise multiple regression analysis identified relationships between fish population and environmental trends, sequentially assessing the relative importance of temperature, upwelling, and other" variables to fish trends. Most fish population trends followed an oceanic variable trend (PDO; SCB upwelling; offshore temperature; ENSO). The PDO influenced the most species (with more species responding negatively than positively) followed by warm-regime upwelling in the SCB. Cold-water species declined during the cold-to-warm regime shift around 1980; this change was compensated only partly by increased abundances of warm-water species. Surface runoff and mass emission trends were difficult to distinguish from positive and negative PDO trends respectively. Some species showed little relationship to oceanic trends perhaps due to fishing or habitat alterations. Nevertheless identification of what oceanic trends influence each species may provide a basis for forecasting natural population changes with deviations indicating possible anthropogenic influences.

Sarah G. Allen^{*1}, Ben Becker², Brannon Ketcham², David Schirokauer², Dawn Adams². Ocean Stewardship through Marine Monitoring at Point Reyes National Seashore.

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The National Park Service developed an Ocean Strategy for preserving the natural resources of coastal parks in 2005. In the nation there are over 70 coastal parks with 3.2 million acres of submerged lands and 4000 linear miles of shoreline. Point Reyes National Seashore (PRNS) as example encompasses 82 miles of shoreline and 22000 marine acres 8200 of which are wilderness. PRNS is creating an integrated long-term monitoring program with goals to protect preserve and restore natural processes and biological diversity. The primary objectives are 1) inventory and monitor park ecosystems for detection of changes over time 2) identify human caused impacts such as disturbance and degrading water quality and 3) adaptively manage based on synthesis of monitoring data.

The monitoring strategy is to sample at multiple scales. At large scales. At large scales the park will collaborate with the regional network of Ocean Observing Systems that will include remote sensors (LIDAR and CODAR). At smaller scales the park developed a strategy to monitor marine indicators such as intertidal community and water quality. The park initiated inventories of coastal biophysical resources nearshore fishes submerged lands vegetation and water quality. The coastal biophysical inventory is surveying algae and invertebrate animals and digitally mapping coastal geology. Subtidal mapping of submerged lands is ongoing in collaboration with other agencies. In Tomales Bay the park initiated an all taxa biodiversity inventory that has identified over 2000 species one of which is new to science and several non-native species. Inventory and legacy datasets have been applied adaptively to manage protect and restore park resources. Examples include NRDA evaluation during oil spills targeted non-native species removal and seasonal closure of breeding areas. Modeling of new data on subtidal areas and shoreline delineation will guide understanding of areas at risk to changes in sea level coastal erosion and water quality.

Constance S. Anderson*¹. Areas of Special Biological Significance: California's 34 State Water Quality Protection Areas.

¹California State Water Resources Control Board

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California's 34 Areas of Special Biological Significance (ASBS) were designated by the State Water Board in the 1970's and one of the six classifications of Marine Managed Areas. ASBS are a subset of State Water Quality Protection Areas and require special protection as determined by the State Water Resources Control Board pursuant to the California Ocean Plan. These coastal and offshore island sites encompass approximately 500 miles of California's coastline, and cover nearly 900 square miles of ocean waters. The California Ocean Plan establishes water quality objectives for California's ocean waters, and under this Plan, and in accordance with the Porter-Cologne Water Quality Control Act, an absolute discharge prohibition is in place. Waste is prohibited from being discharged into ASBSs to protect beneficial uses. In a State Water Board funded study completed in 2004, 1658 discharges into ASBS were identified. These discharges include Military facilities, Marine labs and stormwater sources. This topical session will present recent efforts underway to protect marine water quality and beneficial uses, monitoring and the collection of data on ecosystem health, marine life and water quality, and stormwater BMP's. Presentations by panelists will include issues and challenges faced by institutions and entities in order to comply with the waste discharge prohibition.

Christopher Andrews*¹. Ocean Literacy: Informal Education through the California Aquarium Collaborative and Formal Education in K-12.

¹The Steinhart Aquarium

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See "Nigella Hilgarth" for the summary of this session.

This presentation will discuss the value of partnerships and collaborations to develop meaningful programs to further environmental literacy in informal learning centers such as aquariums, museums and zoos. Specific examples will be cited from other aquariums, as well as from the programs that are being developed for the new California Academy of Sciences, scheduled to open in Golden gate Park (San Francisco) in the fall of 2008.



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Ed Andrews^{*1}. Beach Management: Whose Responsibility Is It? An Assessment of Beach Management in North San Diego County.

¹Carlsbad Beach Preservation Committee

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Our beaches are a natural resource used by hundreds of thousands of people each year. In Southern California, our beaches contribute to our lifestyle by providing a place to enjoy walking along the ocean, playing in the surf or numerous other recreational activities. Beachgoers expect to have access to clean, safe, sandy beaches. Beaches, however, are not stand-alone resources. They are physically threatened by weather patterns that bring storms that remove sand and reduce their width in many areas. Beaches are also threatened by man in a number of other ways such as storm water runoff and pollution. Voluntary stewardship of our beaches is necessary but not enough. So, the question becomes, who is responsible for managing the use, care and preservation of our beaches in North San Diego County? The author will address the topic of beach management by focusing on five key areas: beach access, public health, public safety, beach nourishment and beach amenities. This paper will assess beach management in North San Diego County, including the cities of Encinitas, Oceanside and Carlsbad and discuss the roles and responsibilities of local, state and regional government. Discussions with individuals working in agencies related to the topic areas will be summarized and principal issues identified. Those issues not being addressed by any agency will be flagged as a major cause for concern. In this context, the author will identify the jurisdictions in which beach management is working well and those areas which need improvement. The presentation will feature numerous photographs of local beaches showing the overall condition of the beaches as well as public access areas; public use during high season, public restroom facilities, lifeguard stations, and amenities such as shade areas and water fountains.

Meleah Ashford^{*1}, Kimberly O'Connell², Nathan Schaedler³. The ABC's of Areas of Special Biological Significance Stewardship.

¹Ashford Engineering, ²Scripps Institution of Oceanography, University of California, San Diego, ³MACTEC Engineering

Since 2002, when Scripps Institution of Oceanography (SIO) was directed to either cease its discharges into the San Diego Marine Life Refuge, an Area of Special Biological Significance (ASBS), or seek an exception to the Ocean Plan, SIO has been at the forefront of addressing discharges into ASBSs. SIO is now lending its expertise to work collaboratively with the regulatory and environmental community. A primary result of this effort is the creation of the La Jolla Shores Coastal Watershed Management Plan, a joint project with the City of San Diego and Coastkeeper. This partnership is natural since the City of San Diego discharges into an adjoining ASBS, the La Jolla Ecological Reserve, and is currently in the process of requesting an Ocean Plan Exception, and Coastkeeper is the premier voice for ocean stewardship in California. This presentation will focus on the results of studies conducted to date under the La Jolla Shores Coastal Watershed Management Plan and the NPDES-permit to assess the impact of urban runoff on the health of the ASBS ecosystem (e.g., bioaccumulation study and dilution study) and the engineering and management solutions being evaluated to protect these areas. The results from these studies and the chemistry and toxicity data from ongoing monitoring are being used to better refine pollutants of concern and develop cost-effective BMP implementation strategies. The effort to identify and implement sustainable solutions to protect our ocean will be costly and while enforcement of the California Ocean Plan and Clean Water Act have clearly risen as priorities for both the SWRCB and the clean water advocacy community, a commitment to providing incentives, such as significant grant funding or bonds for implementation, should also be a priority.

Bryan Oles¹, Kelly Chapin¹, Robert Atanasio^{*1}, Charles Wahle¹. Human Uses Patterns and Intensity: The Distribution of Human Activities in the Marine Environment.

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Information about the patterns of human activities in the marine environment is highly relevant to coastal and ocean management, including planning and managing marine protected areas (MPAs). The National MPA Center's Human Uses Patterns and Impacts project has identified secondary datasets that can be used to paint a picture of human uses reliant upon coastal and marine resources. A listing of agencies maintaining these data was created in an e-document with descriptors and links to web based downloads. Data for Washington, Oregon and California were extracted from the U.S. Department



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of Transportation Maritime Database, the U.S. Bureau of Transportation Statistics' Marine Casualty Database, state spatial information collections, and regional watershed marine water quality reports. These were transformed into appropriate GIS formats. The connections between these data and existing west coast MPAs were analyzed using the available suite of ArcGIS tools. Spatial analyses of the data that compare the levels of human activities taking place inside and outside MPAs can indicate those places that are of greater socioeconomic importance to user groups, as well as the places potentially facing greater risk from the negative effects of human activities. These analyses call attention to the importance of incorporating human use data in coastal and ocean management, the limitations of available data on human activities, and the need for more rigorous collection of primary data on human activities.

Shakoora Azimi-Gaylon^{*1}. Why Are New Technologies Needed for Monitoring Bacteria Indicators?

¹California State Water Resources Control Board

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Increasingly, the public is concerned about beach closures and the safety of swimming at public beaches. A 1995 Santa Monica Bay epidemiological study found a correlation between increased incidences of gastrointestinal illnesses and increased levels of bacterial indicator organisms in storm drain runoff. A direct result of this study was the passage of Assembly Bill 411 increasing the monitoring frequency for heavily used ocean beaches. Considerable resources are expended each year to measure indicator bacteria and to determine if recreational beaches are free from fecal contamination. These monitoring programs are compromised because current methods of measuring bacteria are too slow to provide full protection to the public from exposure to waterborne pathogens. Conventional culture-based methods currently used to evaluate recreational waters require an 18 to 24 hour incubation period. Recently published data shows that temporal changes in indicator bacteria levels in beach water occur much more rapidly than the minimum 18 to 24 test period. This lag time means that a beach with bacterial levels exceeding water quality standards on the day the sample is collected is not posted or closed until the following day at the earliest. The current system of posting beaches may not provide the public accurate or useful information when state water standards are exceeded based on bacteriological conditions that existed at least 24 hours previous to the posting. This time lag also inhibits tracking of contamination sources, since the signal can dissipate before upstream tracking is initiated. Assembly Bill 639 required the State Water Resources Control Board, in conjunction with the Department of Health Services, to develop reliable and rapid diagnostic tests. While several new technologies are available for testing indicator bacteria in recreational waters the California Beach Water Quality Workgroup identified four criteria for determining whether there is sufficient equivalency for State acceptance of the new methods.

Brian Baird^{*1}. California State Perspective on Regional Collaboration to Address Ocean Health.

¹California Resources Agency

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The Pew Oceans Commission, the U.S. Commission on Ocean Policy and the U.S. Ocean Action Plan all recommend advancing regional ocean governance to address the growing challenges we face in our oceans and coastal zones. In response, the West Coast Governors are drafting a statement on regional collaboration to address ocean health that will direct gubernatorial staff to work together to advance mutual interests in our oceans and coasts. I will present California's perspective on this agreement and future regional collaboration. I will begin by briefly discussing existing state activities and involvement in regional collaboration, such as the California Ocean Protection Council. I will then identify political and institutional issues and obstacles to regional collaboration for advancing the West Coast statement. I will close with some thoughts on opportunities for and next steps by California to help advance regional collaboration on ocean issues.

Dan Walker¹, John Orcutt², Marcia McNutt³, Stephen Weisberg⁴, Robert Knox², Brian Baird^{*5}. Summary of Session: Development of a National Ocean Research Priorities Plan and Implementation Strategy.

¹Office of Science and Technology Policy, White House, ²Scripps Institution of Oceanography, ³Monterey Bay Aquarium,

⁴Southern California Coastal Water Research Project, ⁵California Resources Agency

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Working with the broad ocean science community, the Joint Subcommittee on Ocean Science and Technology (JSOST) developed the following document, Charting the Course for Ocean Science in the United States: Research Priorities for the Next Decade, which outlines the national ocean research priorities for the United States for the next ten years. In 2005, the National Science and Technology Council established JSOST to provide advice and assistance on national ocean science and technology issues. The JSOST is made up of 25 federal agencies active in ocean science and technology, making it an ideal forum for federal discussion and coordination. In response to the U.S. Commission on Ocean Policy's report, the Bush Administration issued the U.S. Ocean Action Plan (OAP) outlining the fundamental components that provide the foundation to advance the next generation of ocean, coastal, and Great Lakes policy. As part of the OAP, the JSOST was tasked with developing an ocean research priorities plan and implementation strategy that describes a vision for ocean science and technology, identifies key themes, specifies goals, and addresses implications for the use or prioritization of resources. The current document was developed by the JSOST by working with diverse sectors of the ocean community, including state resource management agencies, private industry, and academic institutions through public briefings, a public comment period on planning materials, and a public workshop to ensure that the document reflects national ocean research priorities. This panel, which includes leaders in the ocean community, will provide valuable perspectives on the document and how research efforts will interact with and influence the State of California's recent efforts to address ocean research needs. The session also provides an opportunity for the broad ocean community to ask questions and exchange ideas about the current document and the follow-on Implementation Strategy.

Karen Bane*¹. Integrating Coastal Wetland Restoration and Maintenance into Regional Sediment Management Plans.

¹California State Coastal Conservancy

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Regional efforts to nourish beaches may provide an opportunity to link the Ocean Protection Council's objectives to implement coastal wetland restoration and the California Coastal Sediment Management Plan (see D.1.d., D.1.g, and D.2.a. in the OPC Five Year Strategic Plan, Appendix A). In the next 10 years, restoration of the major coastal wetlands in California will be well underway. Sediment excavation and disposal is one of the most costly elements both for restoration and long-term maintenance of coastal wetlands. In the past, standards to beneficially reuse excavated material for beach nourishment have been difficult to meet. This presentation will highlight ways that the analyses and tools being developed by the Coastal Sediment Master Plan Work Group, a state and federal partnership, may inform design and costs of coastal wetland restoration across the state. The Tijuana Estuary, a site where both sediment extraction and beach nourishment are needed to restore and protect the wetland, will be used as a case study to exemplify this issue of statewide importance. Beach disposal was not approved for past phases of restoration. If beach disposal is not allowed in the future, then the next 250-acre restoration project may be prohibited by costs. In addition, the barrier dunes at the mouth of the Tijuana Estuary will begin to breach by 2045 if the beaches continue to recede at current rates.

Bob T. Battalio*¹. Coastal Morphology and Hazard Studies in Support of Coastal Zone Management.

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Understanding regional and local geomorphology can facilitate assessment of opportunities and constraints within the context of Coastal Zone Management. Conservation of natural coastal geomorphology is likely to have ecologic value as well as recreational and aesthetic benefits. In most cases, however, the primary concern is identification of coastal hazard zones, typically subject to erosion or flooding, as a constraint to future development and management. A geomorphology and modeling study of Southern Monterey Bay, California is described here as a template that can be applied to other California coastal locations faced with complex land use problems and outdated Local Coastal Programs (LCP), for example. The study resulted in estimates of future shoreline positions and limits of coastal flooding. Future high, medium and low risk estimates were provided for 25, 50 and 75 years based on a sediment budget analysis, accounting for sand inputs, outputs, transport pathways and rates, and the relationship between beach volume, shoreline position and relative sea level rise. The analysis was supported by mapping of historic shoreline positions using maps, surveys and aerial photographs, and characterization of the active shoreline in terms of basic dimensions, seasonal, storm and long-term changes. Owing to prior disturbances (sand mining and coastal armoring), a simplified model of shoreline evolution was applied. Coastal flooding due to extreme wave runup was also considered within the context of development setbacks, using values consistent with flood hazard analysis.



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and mapping accomplished by the Federal Emergency Management Agency. The study addressed alternatives for "shore protection" including "no action," "reduced sand mining" and "beach nourishment." The study influenced an update to a LCP in an area subject to both erosion and development pressure, similar to the situation presently facing many communities.

Laurie J. Bauer^{*1}, Matthew S. Kendall¹, Christopher S.G. Jeffrey¹, Greg McFall². Characterization of Marine Debris in Gray's Reef National Marine Sanctuary.

¹NOAA Biogeography Team, ²Gray's Reef National Marine Sanctuary, NOAA National Marine Sanctuary Program

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The accumulation of marine debris in the environment is a problem worldwide due to its detrimental effects on marine biota, the shipping industry, and recreational activities. Anthropogenic debris may enter the ocean through runoff from the land, river discharge, or when discarded at sea. Gray's Reef National Marine Sanctuary (GRNMS) is a popular site for recreational fishing and boating, and there has been increased concern about potential accumulation of debris in the sanctuary. The most recent management plan calls for specific measures to assess, monitor, and remove debris from targeted areas within the sanctuary; however, to date the distribution and abundance of debris in GRNMS has not been quantified. Field surveys were conducted at GRNMS in August 2004, May 2005, and August 2005 to characterize fish, benthic communities and marine debris. Sites were selected randomly within each bottom type (ledge, sparse live bottom, rippled sand, flat sand), and the incidence of marine debris was recorded within 100 m² transects. Marine debris was defined as any man-made object, and was separated into two main categories, fishing gear and other. Approximately two-thirds of all observed debris items were fishing gear, and about half of the fishing related debris was fishing line. Other fishing related debris included leaders and spear gun parts, and non-gear debris included cans, bottles, and rope. The spatial distribution of debris was concentrated in the center of the sanctuary and was most frequently associated with ledges rather than at other bottom types. On ledges, the presence and abundance of debris was significantly related to observed boating activity and physiographic features including ledge height, ledge area, and percent cover. In addition, tidal currents may influence observed debris patterns. The results from this study will aid managers in cleanup and long-term monitoring of debris in GRNMS.

Steven M. Bay^{*1}, Stephen B. Weisberg¹, Jeff Brown¹. Development and Validation of a Multiple Line of Evidence Framework for Integrating Sediment Quality Data.

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Many assessment frameworks have been developed for the characterization of sediment quality, most of which are based on the sediment quality triad of sediment contamination, toxicity, and impacts on resident biota. These multiple line of evidence approaches have been used extensively in site-specific assessments, but they are typically based on best professional judgment. This is difficult to replicate and is therefore problematic for applications such as sediment quality objectives that must be standardized across a wide variety of sites. A framework for integrating multiple lines of evidence (LOE) in a standardized manner was developed for use in California's sediment quality objectives program. The framework is composed of three steps: classification of each LOE into one of several categories based on response magnitude and certainty, integration of the LOE categories to evaluate the potential for chemically-mediated impacts and the severity of biological effects, and a final step of assigning an impact category to the data. The framework was validated by comparing the results for a subset of stations to the assessment obtained based on the best professional judgment of individuals with extensive sediment quality assessment experience. There was a high level of agreement between the impact category for a station obtained using the framework and the consensus category obtained using best professional judgment. The error rate in classification using the framework was similar to that present among professionals and there was no evidence of bias.

Michael Beck^{*1,2}, Mark Carr², Kendra Karr². Conservation Leasing and Ownership of Marine Resources: New Tools for Conservation from Kelp Beds to Shellfish Reefs.

¹The Nature Conservancy, ²University of California, Santa Cruz

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It has been commonly assumed that marine conservation must be substantially different than terrestrial conservation, because it is not possible for groups to acquire interest in the publicly owned oceans. This is an unfortunate misconception. There is significant submerged land and other marine resources available for lease and ownership in the United States and internationally for a diverse array of ecosystems including kelp forests, marshes, seagrasses, oyster reefs, and coral reefs. The Nature Conservancy and partners have been developing and testing these tools. In New York, we have acquired full ownership and stewardship of more than 13,000 acres of subtidal habitat. In Washington, we have helped to develop new state policy specifically for the conservation leasing of submerged lands. In California, we are working with industry partners on two different lease sites encompassing more than 1,700 acres of kelp forest along 15 miles of the Big Sur Coast to examine the effects of kelp canopy loss on juvenile rockfish nursery habitat. These case studies provide valuable lessons on the application of these new tools that can be added to the marine conservation toolbox.

Rita Bell^{*1}, Lynn Whitley², Judy Lemus², Francesca Cava³, Craig Strang⁴, Peter Tuddenham⁵. Developing a "Scope and Sequence" for Ocean Literacy.

¹Monterey Bay Aquarium, ²University of Southern California Sea Grant, ³National Geographic Society, ⁴Lawrence Hall of Science, University of California, Berkeley, ⁵College of Exploration

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An Ocean Literacy Scope and Sequence Workshop, funded by National Geographic Society and NOAA, with support from the Lawrence Hall of Science, COSEE West, COSEE California, Monterey Bay Aquarium and The College of Exploration, was held on April 18-20, 2006, to identify the "big ideas" that should be included in classrooms. The goal of this workshop was to develop a Scope and Sequence to serve as a critical companion to the Ocean Literacy Essential Principles and Fundamental Concepts. These would then "unpack" the principles and concepts and show how they develop and build in learning progressions across grade spans (K-2, 3-5, 6-8, 9-12). This workshop built on the Ocean Literacy Essential Principles and Fundamental Concepts previously identified by scientists and educators on what students should know about the ocean by the end of Grade 12. Although, these ocean literacy principles and concepts have been correlated in a matrix to the National Science Education Standards, increased specificity is needed in order for this content to truly be integrated into mainstream education. Teachers, curriculum and program developers, textbook writers and assessment developers need further guidance to understand what parts of the concept need to be taught at each grade span. It is also important that this information is presented to students so that it builds in logical and developmentally sound ways. The Ocean Literacy Scope and Sequence will provide this level of guidance. This session will provide an update on progress made and building consensus on an ocean literacy scope and sequence. It will also discuss resources available to support ocean literacy in the classroom and some preliminary discussion on how this ocean literacy scope and sequence can be used to support the California Environmental Education Initiative.

Mary Bergen^{*1}. Accuracy and Precision of Measurements of Transect Length and Width Made with a Remotely Operated Vehicle.

¹California Department of Fish and Game

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Stock assessments and evaluations of populations and communities are usually based on estimates of the density of species. Techniques for measuring density are well developed for areas within the range of divers. In deeper water submersibles, remotely operated vehicles and camera sleds have been used to estimate density on strip transects. However, there is little published information on the accuracy and precision of estimates of transect length and width. In this study we evaluate straight line constant velocity protocols, the accuracy and precision of estimates of transect length from ultra short line acoustic tracking and compare measurements of transect width based on sonar and lasers. When ROV tracking was compared to distances measured on sonar maps, the difference between linear tracked and mapped distance ($|LD_t - LD_m|$) averaged 1.7 ± 0.5 m. The error was not significantly different with distance. Our navigation protocols allowed us to maintain relatively constant heading and speed. Distance computed from velocity exceeded mapped distance by 2-4 m. The error was not significantly different with distance. Measurements of transect width made with lasers and sonar were comparable, particularly when the ROV was within 4 m of the substrate. Based on our data, we now believe we can use an ROV to survey strip transects comparable to diver transects. Tracking can be used to measure transect length within 2 m. If tracking fails, distance can be estimated from velocity within 2-4 m. Sonar can be used to measure transect width with considerable cost savings.



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Steven A. Berkeley^{*1}. Rebuilding Overfished Groundfish: Do We Have the Right Goals?

¹Long Marine Lab, University of California, Santa Cruz

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Rockfishes on the West Coast are currently managed with the objective of maintaining a stock-wide biomass of mature females that is at least 40% of the biomass that would exist in the absence of fishing. Under this objective, all fish are presumed equal in their capacity to produce healthy offspring, regardless of their age, size, genetic background, etc. However, recent research on several unrelated groups of fishes, including rockfish, indicates that larvae of older mothers are far more likely to survive than those of younger females. An overfished population will be comprised of younger females with less genetic diversity, features that will continue during the rebuilding period. If age diversity and genetic diversity are important determinants of larval survival, our current management goal is not adequate to ensure healthy, sustainable populations. I argue that a new management objective that protects older fish and maintains a broad suite of genotypes, as well as spawning biomass, is needed to ensure productive, sustainable fisheries. There are three ways of protecting population age structure: 1. Slot size limits, 2. Marine reserves, and 3. Reduced fishing mortality rates. An evaluation of each of these approaches suggests that marine reserves and reduced fishing mortality rates can both protect age structure, but marine reserves also protect by-catch species, maintain species diversity, protect the entire suite of age classes and therefore increase population resilience, preserve ecosystem function, and eliminate the physical impacts of fishing gear on habitat, all of which are important considerations as we move towards ecosystem based management.

Eben Schwartz¹, **Dawn Hayes**², **Jan Roletto**³, **Margo Cowan**⁴, **Shauna Bingham**^{*5}. Building Coastal Stewards with the Channel Islands Naturalist Corps.

¹California Coastal Commission, ²Monterey Bay National Marine Sanctuary, ³Gulf of the Farallones National Marine Sanctuary,

⁴California Department of Parks and Recreation, ⁵Channel Islands National Marine Sanctuary

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Over 100,000 tourists, school children, and local residents visit NOAA's Channel Islands National Marine Sanctuary (CINMS) annually on board local whale watch vessels, marine floating classrooms, and natural history tours. CINMS, in partnership with Channel Islands National Park, administer the Channel Islands Naturalist Corps (CINC) volunteer program. The primary function of Naturalist Corps volunteers is to provide an on-board resource for passengers with questions about the Channel Islands and the abundance and diversity of marine life found in the sanctuary. The Naturalist Corps is a dual-county program, encompassing both Santa Barbara and Ventura Counties, that recruits and trains volunteers to represent the sanctuary and park on board vessels departing out of Santa Barbara Harbor, Channel Islands Harbor, and Ventura Harbor. In addition to educating passengers on whale watch tours, Naturalist Corps volunteers are trained to lead interpretive hikes on the islands. They also attend community outreach events and play an important role in monitoring sanctuary resources, collecting data on marine mammals, marine debris, and vessel traffic in CINMS. In effect, these volunteers are "citizen stewards" and "citizen scientists" dedicated to the resources of the Marine Sanctuary and National Park. They are part of a National Marine Sanctuary volunteer program initiative called Team OCEAN (Ocean Conservation Education Action Network). Team OCEAN has three primary goals: Public education through one-on-one interpretation and a variety of informative brochures; Promoting stewardship by instilling a sense of personal understanding, ownership and responsibility for the Sanctuary among the general public; and establish a Sanctuary presence on the water, emphasizing the importance of proper use of our resources, now and for future generations. Channel Islands Naturalist Corps program implementation strategies, training, partnerships, evaluation tools, and coastal stewardship will be emphasized as part of the "Volunteers Making A Difference" panel session.

Barbara Block¹, **Sal Jorgensen**¹, **Steve Teo**¹, **Andreas Walli**¹, **Robyn Matteson**¹, **Daniel Costa**², **Steve Bograd**^{*3}, **Randy Kochevar**⁴. Using Pelagic Predators as Oceanographic Sensor Platforms in the Eastern North Pacific.

¹Stanford University, ²University of California, Santa Cruz, ³NOAA, ⁴Monterey Bay Aquarium

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Tagging of Pacific Pelagics (TOPP) is a Census of Marine Life project aiming to deploy 4000 electronic tags on top predators in the North Pacific. The electronic tags being used in the TOPP program can measure temperature, pressure, light and salinity with spatial resolutions between 1 km and 60 km. The animals carrying the tags can be considered autonomous ocean



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profilers. The tags provide the physical state of the upper ocean along with the behavioral and physiological characteristics of the animal. We report on the acquisition of depth profiles of temperature and chlorophyll from electronically tagged tunas and sharks in the eastern north Pacific. To date, 270 tuna swimming in the eastern North Pacific, 100 sharks and 80 elephant seals tagged in the years 2002-2005, have gathered over 1.5 million depth-temperature profiles in the upper mixed layer and to depths as deep as 1000 m. We compare algorithms used to derive mixed layer, thermocline and chlorophyll maximum with ocean observations from more traditional world ocean Atlas sources. Salmon sharks equipped with near-real time positioning tags and pop-up satellite archival tags have transmitted in the North Pacific from the Gulf of Alaska to Hawaii and Baja, providing thousands of temperature profiles to depths up to 800 m. Other shark species such as mako and blue sharks provide additional coverage in the eastern and central Pacific basin. These tagged fish will contribute a significant quantity of high-resolution in situ oceanographic data to coastal and global ocean observing programs. Future assimilation of data into near real-time models will greatly improve ocean observation in this region.

Maureen Bornholdt^{*1}. Renewable Energy and Alternate Use on the Federal Outer Continental Shelf: A New Program under the Authority of the Minerals Management Service.

¹Minerals Management Service

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The Energy Policy Act of 2005 (Act) was signed into law on August 8, 2005. Section 388 of the Act authorized the Secretary of the Interior to grant leases, easements, or rights-of-way for renewable energy projects and alternate uses of existing oil and gas facilities on the Federal Outer Continental Shelf. The Secretary of the Interior delegated authority for the new program to the Minerals Management Service (MMS). As part of this new responsibility, MMS will:

- Develop an OCS renewable energy and alternate use program and promulgate rules
- Consult with States and other stakeholders
- Prepare a Programmatic Environmental Impact Statement covering the program and rules
- Serve as lead agency for the project review and decision process with other agencies to ensure compliance with environmental and operational requirements
- Develop a revenue sharing formula by rulemaking for coastal states
- Establish royalties, fees, rentals, bonuses to ensure fair return
- Contract needed scientific and engineering research
- Establish an interagency comprehensive digital mapping initiative for the OCS

Examples of renewable energy sources include wind, wave, current, solar, and generation of hydrogen. Possible alternate uses of existing facilities include offshore aquaculture, research, education, recreation, support for offshore operations and facilities, and telecommunications facilities.

Louis Botsford^{*1}, David M. Kaplan¹. New Directions for the Science of Marine Protected Areas.

¹University of California, Davis

*Presenter's E-mail: lwbotsford@ucdavis.edu

As we begin to implement Marine Protected Areas (MPAs) to increase sustainability of marine ecosystems, there is a need for quantitative methods to compare the performance of proposed designs of MPAs. Methods that allow those proposing reserves and decision-makers to compare the improvement in population sustainability that would result from different proposed spatial configurations are now available, and they can improve California's approach to the implementation of MPAs in several ways. For example, in the MLPA process, the effects of different habitats was evaluated as the percentage in reserves, without accounting for the spatial distribution of habitat; the effects of fishing outside reserves was not accounted for; and the effects of larval dispersal distance were included based on qualitative intuition in the specification of reserve spacing. We now have the ability to estimate the effects of the spatial distribution of habitat, the amount of fishing outside reserves, and larval dispersal distance, on how a specific spatial configuration of MPAs will contribute to the sustainability of populations and ecosystems. The tools to make these estimates will soon be available in versions that can run in conjunction with the available GIS data fast enough to be used in a workshop format. These methods, together with new methods for estimating sustainability in terms of lifetime reproduction will allow the needs for MPAs and how they contribute to sustainability to be more widely understood, by stakeholders and decision-makers, in addition to the scientists involved. Perhaps most important, these new methods provide



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the capability to assess the consequences of extant uncertainties in the performance of MPAS, and the potential for reducing those effects by integrating MPA design with the conventional management outside of reserves.

Margaret Bowman^{*1}, Andrew Rosenberg², Marc Mangel³, Jill Swasey⁴, John Wiedenmann⁴. What Is and Isn't Working with U.S. Fisheries Rebuilding Efforts.

¹Lenfest Ocean Program, ²University of New Hampshire, ³University of California, Santa Cruz, ⁴MRAG Americas, Inc.

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Healthy U.S. fisheries are vital resources for commercial and recreational fishermen, coastal communities, and nutrition-conscious citizens. Unfortunately, many fish populations have been overexploited and are in need of rebuilding to healthy levels. The 1996 Magnuson-Stevens Fishery Conservation and Management Act requires that when fish populations are declared below sustainable levels (overfished), managers must implement rebuilding plans that establish measures to rebuild fish populations. Fishery managers nationwide have established rebuilding plans for 67 fish stocks identified as overfished, and plans are being developed for an additional seven stocks. Nine years after the Act was passed, however, only three stocks out of 67 have been declared rebuilt. As a consequence of the continued overfishing of many fish populations subject to rebuilding plans, and the often delayed or extended rebuilding plan timelines created by managers, most fish stocks that should be rebuilt by now are still in poor shape. At the regional level, managers in New England and the South Atlantic have made the least progress in restoring fishery resources, while the Mid-Atlantic and Pacific regions lead in recovery efforts. In this presentation, Margaret Bowman will summarize the results of a recent evaluation of these 67 rebuilding plans that identified what is working, what isn't working, and what needs to be changed to improve the rebuilding progress of these resources. Some of the information presented will be published by Andrew Rosenberg, Jill Swasey and Margaret Bowman in an upcoming issue of *Frontiers in Ecology and the Environment*.

Peter Brand^{*1}. The Santa Clara River Parkway Project: Restoring River Functions on the California Coast.

¹California State Coastal Conservancy

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The coastal rivers of California determine to a great extent the health of near shore ocean waters. In support of regional coastal habitat restoration efforts, the Coastal Conservancy established the Santa Clara River Parkway, a 25 mile-long corridor along the lower Santa Clara River in Ventura County, California. The project aims to acquire historical floodplain lands in order to restore natural physical processes, enhance habitat for endangered and threatened species, and potentially provide flood control benefits. In the six years since the project's inception, the Coastal Conservancy and its partners, The Nature Conservancy and Friends of the Santa Clara River, have acquired approximately half of the Parkway corridor length. The 116 mile long Santa Clara River is one of the largest rivers in southern California, and one of the last that retains significant natural floodplain areas. The river is extremely dynamic, with peak flood flows surpassing 100,000 cfs and high sediment loads that contribute approximately 65% of all sediment delivered to the offshore Santa Barbara Littoral Cell. Recent baseline studies by Coastal Conservancy scientists suggest that popular river restoration concepts such as "equilibrium" and "bankfull flow" are largely inapplicable to restoration efforts on the Santa Clara and other similar "flashy", high sediment yield rivers in Southern California, thus requiring a new approach to river and floodplain management and restoration.

While the physical context and processes of the river are unique, perhaps more striking is the level of success and cooperation among agencies, politicians, and landowners in pursuing continuous public ownership of the river corridor. With the purchase of important former floodplain areas, levee removal, and subsequent restoration of riparian habitats, the river will regain critical physical and biological functions. Public acquisition and restoration of entire river corridors may be necessary to relieve embattled property owners and meet habitat and water quality goals for the coast and the San Francisco Bay.

Brian P. Brennan^{*1}. Regional Approaches to Shoreline Erosion and Management.

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Peter Bromirski^{1*}, Daniel Cayan^{1,2}, Katharine Hayhoe³, Reinhard Flick¹, Michael Dettinger². Projecting California Coastal Climate and Sea Level Changes.

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California's coastal observations and global model projections indicate that California's open coast and estuaries will experience increasing sea levels over the next century. Sea level rise is expected to continue as a result of both steric thermal expansion as the oceans warm, and eustatic runoff from land-based snow and ice melt. Rates of projected future global sea level rise ranging from 12 cm to about 85 cm over the next century were considered at California coastal locations. This compares to a rate of 12-20 cm per century observed at San Francisco and San Diego during the last 100 years. So far, there is little evidence for an accelerated rate of rise, with the rate off California actually flattening over the last several years. Two climate models are described that provide a set of possible future weather and short-period climate fluctuation-related sea level changes, including those due to El Niño. Possible future maximum sea level scenarios were explored by superimposing the different mean sea level rise projections, the possible future climate scenarios, and the predicted tides for the 21st century. Highest sea levels will usually occur when winter storms and Pacific climate disturbances such as El Niño coincide with high astronomical tides, just as they have in the past. The impacts of future sea level rise will greatly accentuate the effects of high tides coinciding with storms. The occurrence of extreme events follows a sharply escalating pattern as the assumed magnitude of future sea level rise rate increases, or as sea level rise accelerates. Thus, historical coastal structure design criteria may be exceeded in the future as the duration of flooding events increases and as extreme events of a given height become progressively more frequent.

Geoff Brosseau^{1*}. Deposition Happens: What Does Atmospheric Deposition Mean for Stormwater and What Can We Do about It?

¹California Stormwater Quality Association

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Stormwater program managers have recognized for some time that atmospheric deposition can be a significant contributor of pollutants to stormwater runoff. By its very nature, stormwater integrates many of the pollutants generated by society. Stormwater is everywhere, it is on the receiving end of gravity, and its volumes are increasing with increasing populations. Stormwater is often the last stop for a pollutant before it enters a waterway.



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John Muir said 100 years ago, "When we try to pick out anything by itself, we find it hitched to everything else in the universe". Despite his understanding of the connectedness of the various pieces of our environment (air, water, soil) and our own modern day experiences, over the last 35 years of modern environmental regulation we have approached our environment on a piecemeal basis. Recognizing and understanding the disconnects we have created is the first step in removing them. Being significantly impacted by the disconnects, stormwater program managers have started to put the pieces back together. As a result, we have a growing number of research projects that have significantly increased our understanding of the connection between air and water. And we have conducted education efforts to remake the connection in peoples' minds.

But recent regulatory actions, such as new permit provisions and the adoption of total maximum daily loads (TMDLs), have raised the stakes and added a new impetus to removing the disconnects. Recent discussions have resulted in a number of recommendations for doing so and the extent to which these can be adopted could have a major impact on waters being fishable and swimmable.

Maria Brown^{*1}, William Douros², Holly Price³, Dan Howard⁴, Chris Mobley⁵. Gulf of the Farallones National Marine Sanctuary: Navigating the Future.

¹Gulf of the Farallones National Marine Sanctuary, ²National Marine Sanctuary Program, ³Monterey Bay National Marine Sanctuary, ⁴Cordell Bank National Marine Sanctuary, ⁵Channel Islands National Marine Sanctuary

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Our ocean wilderness beyond the Golden Gate of San Francisco is one of the most biologically important ecosystems in the world with an exceptional diversity and abundance of marine life. Twenty-five years after the designation of the Gulf of the Farallones National Marine Sanctuary, the Sanctuary Program will release a revised management plan that addresses critical issues in an ecosystem-based management approach. The Farallones Sanctuary through an extensive public process has identified ten initiatives that will be the compass points by which we will chart a course into the future. Through seabird colony protection, sustainable fisheries, rocky shore habitat restoration, and a California ocean stewardship campaign, the Sanctuary Program will strive to build upon its achievements to become global leaders in ocean protection and citizen stewardship.

William Burns^{*1}. Operationalizing the Precautionary Principle in California Oceans Policy.

¹Monterey Institute of International Studies

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One of the California Ocean Protection Council's Strategic Plan's Guiding Principles is a call for setting priorities for action while taking into account the precautionary principle that emphasizes the priority for resource protection. While adoption of the precautionary principle is salutary given the historic failure of the assimilative capacity approach to protect the world's oceans the devil is in the details. The record to date in operationalizing the precautionary principle in international treaties and national and state legislation and regulations has been disappointing to date. As one commentator has noted [the principle] seems more like a sound bite rather than a principle rooted in the law lacking a rigorous analytical schema. The purpose of this presentation will be develop a framework for operationalizing the precautionary principle as a component of plans to carry the COPC strategic plan forward. In doing so I will: 1. Discuss efforts to date to operationalize the precautionary principle in international treaty regimes with an emphasis on marine conservation treaties as well as in national legislation; 2. Suggest precautionary language for incorporation into pertinent California oceans legislation and regulations; 3. Outline specific mechanisms for operationalizing the precautionary principle across the spectrum of concerns embodied in the COPC Strategic plan with an emphasis on the following components: a. Protection of valuable marine habitats and species; b. Implementation of a viable ecosystems approach to marine species management; c. Improvement of coastal water quality; d. Promotion of the recovery of fish stocks; e. Reduction of the harmful effects of invasive species. The presentation will also outline concerns expressed by opponents to the precautionary principle and suggest means to address those concerns as well as educate the public about the importance of implementing the principle in public policy.



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Melissa L. Carter¹, Fernanda Mazzillo¹, Elizabeth L. Venrick¹, John A. McGowan¹, Lilian Busse^{*1}. Harmful Algal Bloom Monitoring as Part of the Southern California Coastal Ocean Observing System.

¹Scripps Institution of Oceanography

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Harmful algal blooms (toxic and non-toxic) are increasingly found in coastal waters around the US and the world. As part of SCCOOS (Southern California Coastal Ocean Observing System) we are monitoring toxic and potentially harmful algal bloom species, chlorophyll, and environmental parameters twice a week off Scripps Pier in La Jolla, California, USA. We are surveying 2 diatom species (*Pseudo-nitzschia australis* and *Pseudo-nitzschia multiseries*), and 6 dinoflagellate taxa (*Alexandrium catenatum*, *Cochlodinium* spec., *Dinophysis* spec., *Gymnodinium* spec., *Lingulodinium polyedrum*, *Prorocentrum micans*). These species either have been shown to form extensive blooms at Scripps Pier and/or can produce potent toxins which can affect the food chain and human health. We will present data from recent toxic and harmful algal blooms from Scripps Pier. An important question is whether these harmful and toxic algal blooms occurred in the past or are increasing, perhaps due to anthropogenic impacts. For that reason we are also studying historical patterns of harmful algal blooms in southern California. We re-examined samples from a time series from 80 years ago at Scripps Pier (Allen, 1917-1939) and we will compare those data with recent data. Results from this study will give us a deeper understanding of the problem of toxic and harmful algal bloom in southern California, data relevant for protecting the health of humans, marine mammals and fish. This study also stresses the importance of collecting time series data of harmful algal blooms and should be considered an integral component of coastal ocean observing systems.

Chris Caldow^{*1}, Randall D. Clark¹, Mark E. Monaco¹, John D. Christensen¹. Southern California Biogeography Research Provides Powerful Assessment Tool to Aid both Science and Policy Arenas.

¹NOAA

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Through the California Ocean Protection Act, the Ocean Protection Council (OPC) is mandated to improve the effectiveness of state efforts to protect coastal resources. In response, OPC's strategic plan calls for the establishment of "a mechanism or organization to provide data synthesis services with the goal of assembling scientific results from state and national efforts and producing products for diverse scientific, public, and policy audiences." As a model for this type of effort, NOAA's Biogeography Team and Channel Islands National Marine Sanctuary (CINMS) working with academia, government, and NGOs throughout the state recently completed one of the most comprehensive efforts undertaken to understand large-scale marine biogeography within southern California. The critical information provided by this effort on the physical environment as well as the distribution of marine flora and fauna in southern California will be utilized to support the CINMS management plan revision process. During this process, the public called for an evaluation of sanctuary boundary expansion. Results from this assessment indicate that from a biogeographic standpoint boundary options that extend the sanctuary to the coast protect important habitat for many species of interest to the sanctuary and should be considered. In addition to their use in evaluating sanctuary boundary options, the data gathered, analyses performed, and patterns of distribution observed should provide invaluable information to support science, education, and other marine spatial planning such as the Marine Life Protection Act as called for by OPC.

Meg Caldwell^{*1}, Mike Osmond², Satie Airamie³, Billy Causy⁴. Marine Protected Areas: Lessons from California's Marine Life Protection Act Blue Ribbon Task Force.

¹Stanford University, ²World Wildlife Fund, ³Partnership for Interdisciplinary Studies of Coastal Oceans (PISCO), University of California, Santa Barbara, ⁴Florida Keys National Marine Sanctuary

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The California "Marine Life Protection Act" (MLPA) was adopted in 1999 to provide a governance framework for the establishment of a network of Marine Protected Areas (MPAs) in state waters. The Channel Islands marine reserves public participation and decision making process helped shape the substantive and procedural provisions of the MLPA as well as its implementation. The MLPA requires use of the "best readily available science" in reviewing existing MPAs and in establishing new MPAs. This presentation will analyze practical aspects of implementing the MLPA by the MLPA Blue Ribbon Task Force



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as it developed recommendations to the state's Fish and Game Commission for alternative networks of MPAs for California's central coast. In particular, the presentation will explore the following questions from a Task Force member's perspective: How can technical panelists address and communicate uncertainty honestly and credibly for decision makers? How can scientists build trust with decision-makers when conclusions vary among the scientists? How much science, research and data is necessary to make an informed decision? How can decision makers come to a consensus in an atmosphere of so much uncertainty? Is consensus desirable? How and when should maps be introduced? How should socio-economic data be used by decision makers? How should it be weighed against science? Is there a disconnect between science and policy, and how can science and policy be better integrated?

Christopher Campbell^{*1}, David B. Friedman¹. Market Based Systems for Reducing Trash Loading to Los Angeles Area Watersheds.

¹Coalition for Environmental Protection, Restoration, and Development

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Presentation will detail findings of a two-year study effort to identify the potential for market-based strategies to achieve compliance with the Trash TMDL in the Los Angeles Regional Watershed. The report, released on March 24, 2006, utilized trash loading data from the City and County of Los Angeles for baseline assumptions. It makes recommendations for means to engage the private sector in an active partnership for pollution prevention and provides models as to the benefits of trading mechanisms. It also details required next steps in order to create a pilot market system on a regional basis. The study was funded by Congress with additional support from the County of Los Angeles, Cities in Southeast Los Angeles County, the American Chemistry Council and The Polystyrene Packaging Council.

David Cannon^{*1}, Clifton Davenport², Jonathan Gurish³. An Analysis of the Policies, Procedures, and Regulations Related to Regional Sediment Management along the California Coast.

¹Everest International Consultants, ²California Geological Survey, ³California State Coastal Conservancy

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The California Sediment Management Workgroup (CSMW) is in the process of developing a Sediment Master Plan (SMP) to facilitate protection, enhancement, and restoration of California's coastal beaches through federal, state, and local cooperative efforts. Due to a perceived confusion and/or lack of clarity as to the regulatory framework and requirements associated with sediment management activities, an analysis of the policies, procedures, and regulations (PPR Analysis) related to regional sediment management activities along the California coast is underway. The four major components of the PPR Analysis include: (i) review of the most relevant PPRs, (ii) identification of the agencies responsible for administering the most relevant PPRs, (iii) preparation of a beach restoration reference guide (Reference Guide), and (iv) development of recommendations to modify and create PPRs. The focus of the PPR analysis was on the most relevant federal and state PPRs with a limited summary of local PPRs (e.g., coastal cities and counties). Examples of the types of PPRs that will be covered include the National Environmental Policy Act, Clean Water Act, Clean Air Act, Endangered Species Act, California Environmental Quality Act, State Lands Commission Code, California Department of Fish and Game Code, and California Coastal Act. The Reference Guide provides a summary of the environmental review and permitting process associated with beach restoration projects implemented along the open coastline of California. The analysis of the PPRs was used to prepare recommendations to modify existing and new PPRs needed at both the federal and state levels of government. Some of these recommendations and the highlights from the Reference Guide will be discussed during the presentation. Developing recommendations for resolving overlapping or conflicting regulations and illustrating how beach nourishment activities can smoothly proceed are tools that execute the findings and conclusions of the CSMW.

Ralph Cantral^{*1}, Kacky Andrews¹. The History of the Coastal Zone Management Act and How We Got a National System of Coastal Management.

¹Coastal States Organization

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Central will give a brief history of the state-federal partnership developed under the CZMA and will discuss how it has expanded to be a nation-wide system. Although each state has prepared their program using a variety of tools, there are a number of similarities that make them successful. Measuring the performance of these programs continues to present challenges, as much of the focus of the Act is to "prevent bad things from happening" with no specific measurable goals.

David Caron^{*1}. *Pseudo-nitzschia* and domoic acid in the San Pedro Bay: Anatomy of a Recent Harmful Algal Bloom.

¹University of Southern California

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The southern California coast in the region of Los Angeles Harbor and San Pedro Bay has experienced recurrent blooms of diatoms of the genus *Pseudo-nitzschia* and concurrent outbreaks of domoic acid toxicity in recent years. Sampling of coastal waters in this area during spring-summer of 2006 documented the development and demise of a toxic event and its impact on local marine mammal and seabird populations. Abundances of *Pseudo-nitzschia* spp. and domoic acid concentrations peaked during March and again during April, with domoic acid concentrations in the particulate fraction of the plankton reaching values in excess of 10 µg per liter. These values represent some of the highest concentrations that have been recorded in natural plankton assemblages. In particular, concentrations were extremely high within the LA harbor breakwater, indicating that this region may represent a 'hot spot' of *Pseudo-nitzschia* bloom development and domoic acid production. Marine mammal and seabird strandings (or deaths) increased concomitantly with or soon after increases in domoic acid concentrations in the plankton. Domoic acid was confirmed in a number of mammal and bird species including California sealion, brown pelican, western grebe and ruddy duck. Planktivorous fish (anchovies) exposed to the bloom accumulated very high concentrations of domoic acid, and may have constituted an effective trophic link between the toxic alga and larger animals. Studies within the region are focused on documenting the timing and extent of blooms of *Pseudo-nitzschia* species, and on understanding the factors leading to blooms of these species.

Mark Carr^{*1}. Evaluating Alternative MPA Network Designs.

¹University of California, Santa Cruz

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Evaluating alternative designs for networks of marine protected areas (MPAs) was one of the major tasks of the Science Advisory Team engaged in the Marine Life Protection Act Initiative process. The process of evaluation was iterative: stakeholders designed networks of MPAs, scientists evaluated the network designs and provided feedback to the stakeholders, and subsequently, stakeholders improved the designs based on the scientific evaluation. The scientists conducted a comprehensive evaluation of the marine habitats within each of the proposed MPAs and collectively across the proposed networks. The Initiative staff provided the SAT with Geographic Information System (GIS)-based fine-scale and coarse-scale habitat maps with estimates of the fraction of each habitat included in MPAs. The scientists also evaluated the size of each proposed MPA to determine whether or not the MPA would likely protect entire home ranges of species of interest. The scientists estimated the spacing between proposed MPAs to evaluate the potential for dispersal of young between MPAs. Another consideration was the number of MPAs that included each habitat; replication of protected habitats will reduce the risk that any particular habitat will be impacted by a catastrophic disturbance. The scientists applied a sophisticated model to consider the potential of each proposed MPA network to sustain populations of interest, based on their life history characteristics and habitat preferences. Analytical tools developed by the SAT are available for future study regions of the MLPA. The results from the evaluation were presented to decision-makers and stakeholders, who incorporated the suggestions into their final recommendations. As a consequence, all three MPA network designs provided for consideration to the California Department of Fish and Game met, to different extents, all scientific guidelines for MPA network design.

Nicole A. Dobroski¹, Jodi L. Cassell^{*1}, Holly A. Crosson¹. The West Coast Ballast Outreach Project: Coordinating Ballast Water Information Exchange.

¹California Sea Grant Extension Program

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The California Sea Grant Extension Program's West Coast Ballast Outreach Project (WCBOP) coordinates information exchange about ballast water, vessel fouling, and associated Aquatic Invasive Species (AIS) issues along the West Coast of the United States. Initiated in 1999 with National Sea Grant College Program funding, WCBOP began its second phase of outreach in 2005 with funding from the CALFED Bay-Delta Program. Paramount among WCBOP goals is the facilitation of communication amongst stakeholders in industry, government, academia and research, non-governmental organizations and the public. WCBOP outreach efforts are guided by an Advisory Committee whose members represent the range of stakeholders invested in ballast water management, vessel fouling and general AIS issues. Specific outreach materials include the "Stop Ballast Water Invasions" poster and brochure, a newsletter, Ballast Exchange, and a website. Additionally, WCBOP has organized workshops and meetings and is currently developing a seminar series devoted to vessel vector and AIS management. WCBOP outreach efforts not only provide stakeholders with up-to-date information on ballast water, vessel fouling and AIS, but also ensure that regulators have access to timely and accurate information when making science-based policy and management decisions.

Lynn N. Whitley¹, Judy D. Lemus², Rita Bell³, Peter Tuddenham⁴, Tina Bishop⁴, Sarah Schoedinger⁵, Craig Strang⁶, Francesca Cava⁷. The Need for Ocean Literacy in the Classroom.

¹University of Southern California (USC) Sea Grant, ²USC Wrigley Institute for Environmental Studies, ³Monterey Bay Aquarium, ⁴The College of Exploration, ⁵NOAA Office of Education, ⁶Lawrence Hall of Science, ⁷National Geographic Society
*Presenter's E-mail: fcava@ngs.org

All life, including our own, is dependent on the ocean. More and more, our lives have been affected by ocean related events - from disasters like Hurricane Katrina in the United States to the devastating December 2005 tsunami in the Pacific and concerns about global climate change. Unfortunately, our educational system does not currently include the concepts necessary for students, and thus the public at large, to develop a coherent understanding of the importance of the ocean to our daily lives that its health and the future welfare of humankind are intertwined. Society is largely ocean illiterate and a basic understanding of the key concepts needed for sound decision-making on matters related to sustainability and the health of humankind is lacking. The need for ocean literacy had been recognized by at least two pivotal national commissions that called for the inclusion of ocean concepts and topics in K-12 curricula and encouraged teaching and learning about the ocean by students of all ages. Fortunately, the problem of ocean illiteracy has been recognized at national, regional and local levels and actions have begun to change this situation. At present a network of organizations are working together to make understanding the ocean part of the formal K-12 curriculum. The emergent consensus among the members of these organizations has resulted in a definition of ocean literacy that is supported by seven essential principles and forty-four fundamental concepts to be taught in school to promote ocean literacy. This consensus has become an instrument for change and is providing the means to promote new ways of teaching and improving understanding of science in our classrooms. This session will provide an overview of an "Ocean Literacy Campaign" that focuses on increasing teacher's ability to include the ocean sciences in the classroom.

Francesca Cava^{*1}. The Education and the Environment Initiative.

¹National Geographic Society
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The National Geographic Society is a partner in the EEI effort. Ms. Cava will describe the role National Geographic will have in model curriculum development over the next two years. In addition, Ms. Cava will describe the need for students to develop a coherent understanding of the importance of the ocean to their daily lives and the fact its health and future welfare of humankind are intertwined.

Sarah Chasis^{*1}. Should There Be Federal or State Leadership in Regional Agreements.

¹Natural Resources Defense Council
*Presenter's E-mail: schasis@nrdc.org

This panel will explore questions of federalism, state interests, and effective governance. What is the appropriate role for the federal and state governments in managing ocean resources? What is the "national interest" and who determines what that



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is? My presentation will argue for the need for a structure with the federal government to promote regional actions and will discuss whether this structure should be determined through leadership at the federal level or in response to changes already occurring within the states.

Linda Chilton^{*1}, Alfonso Montiel¹, Kiersten Darrow¹, Susanne Lawrence-Miller¹. Cabrillo Marine Aquarium's Los Angeles Ocean Learning Experiences.

¹Cabrillo Marine Aquarium

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Cabrillo Marine Aquarium invites underserved youth and families, particularly those who live along the Los Angeles watersheds, to learn about the marine environment and participate in scientific inquiry through the Los Angeles Ocean Learning Experiences program. The pre-K through adult participants become aware of the effects that our actions, including those within our own neighborhoods, have on the health of the coastal environments and begin to work to promote ocean stewardship themselves. Cabrillo Marine Aquarium is fortunate to be located adjacent to tidepools, sandy beaches, salt marsh and harbor, and our facility emphasizes hands-on, engaging experiences for all ages. The activities in LA Ocean Learning Experiences begin with raising awareness in the Exploration Center, a learning lab for the coastal environment. They join field investigations making predictions and reviewing results. They also learn about aquaculture and marine research in the Aquatic Nursery and discover answers in the Marine Research Library. These informal science experiences are free-choice learning opportunities that foster lifelong learning. Participants come for repeated visits, building upon experiences and working together to identify and solve problems as they occur. The information they gather leads to attitudinal and behavioral change that ensures greater protection of resources. Not only do the participants become advocates for ocean protection but they also become teachers, facilitating the learning of others. We hope that they will gain an enthusiasm for the natural world and for the principals of science and that they apply principals of conservation in their own lives.

Biliana Cicin-Sain^{*1}. Meeting Global Oceans Goals: Trends and Prospects.

¹Gerard J. Mangone Center for Marine Policy, University of Delaware

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The presentation provides a "report card" on national implementation of international ocean goals (established at the 2002 World Summit on Sustainable Development) related to:

- ecosystem management and integrated coastal and ocean management
- control of illegal fishing
- control of land-based sources of pollution
- creation of marine protected areas (MPAs) and networks of MPAs
- ocean management in 43 small island developing nations

The presentation is based on a synthesis of available national-level data and also reflects the expert input received at the Third Global Conference on Oceans, Coasts, and Islands which brought together participants from 80 countries, including 38 Ministers, at UNESCO in Paris. The report, Meeting the Commitments on Oceans, Coasts, and Small Island Developing States Made at the World Summit on Sustainable Development: How Well are We Doing?, was just released in June 2006.

Ross Clark^{*1}, Gage Dayton². The Central Coast Wetland Working Group: A Regional Partnership to Evaluate the Condition of Central Coast Wetlands.

¹California Coastal Commission, ²Moss Landing Marine Labs

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California has adopted a "No Net Loss" policy for wetlands: however, a state wide comprehensive inventory and assessment program does not exist. Thus, it is difficult to track the implementation and attainment of the "No Net Loss" goal. To obtain information on the condition of California's wetlands the state has looked to regional partners. Although many agencies and groups have provided data on the status and trends of wetlands throughout much of California, the central California coast has not been well represented. Recently, the Central Coast Wetland Working Group (CCWG), coordinated by the California Coastal Commission, has been working with other regional programs to inventory and evaluate the condition of central coast wetlands. Tools include the Central Coast Wetlands GIS Project, an updated National Wetland Inventory base layer, a web



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based Wetland Project Tracker, and the use of California Rapid Assessment Method for wetlands (CRAM) to evaluate wetland condition. Together, these tools provide web-based descriptive and spatial data on natural and created wetlands throughout the central coast of California. Over the next 2 years CCWG will continue to compile baseline data on wetland conditions throughout central California as well as evaluate the successes and failures of wetland restoration projects. Compiling data on central coast wetlands will help the State determine if the "No Net Loss" policy for wetlands is being achieved.

Guy R. Cochrane*¹. USGS Geologic and Habitat Mapping and GIS.

¹U.S. Geological Survey

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The U.S. Geological Survey (USGS) has conducted benthic habitat research since 1999 to characterize the marine geological environment. These studies have been conducted on the broad, flat continental shelf, areas of Southern and Central California with special attention paid to state and national Marine Protected Areas (MPAs). The project tasks focuses on mapping the seafloor with sonar, collecting video data in the survey areas, and compiling existing sediment sample data. Areas within MPAs and comparable areas outside MPAs are mapped to allow managers to inventory habitats and monitor the effectiveness of the MPA by comparing protected areas to comparable unprotected areas. As part of this effort an online report format has been developed to publish sonar data files, point features from sediment sample data, point features from video transects, and polygon features with geology and habitat attributes derived from supervised classification of the sonar data. Each GIS data file is listed with a brief description, links to figures, metadata files, and downloadable files. An ArcGIS project file is provided to facilitate use of the files in ArcGIS. The GIS allows the user to develop queries using the attributes of the polygons and that generate models for individual management problems such as how much habitat is available in a given area under consideration as an MPA. Because of the utility of paper maps in the planning of operations and discussion of ideas, future online reports will include PDF versions of maps at 1:24,000 scale that can be printed on a plotter. The PDF maps will represent three tiers of analysis of the data: (1) bathymetry and backscatter images, (2) images of derivative values such as rugosity, and (3) images of geology and habitat. The PDF maps will also include drapes of the third tier products over shaded relief bathymetry.

Joshua N. Collins*¹, **Drew M. Talley**². Life on the Line: The Boundary between Fluvial and Tidal Ecosystems as a Sampling Stratum to Assess Coastal Watershed Health.

¹San Francisco Estuary Institute, ²San Francisco Bay National Estuarine Research Reserve

*Presenter's E-mail: josh@sfei.org

The public debate about the ecological and economic meaning of accelerated sea level rise along the California Coast is intensifying. But data to advance the debate are lagging. A sample frame is needed to organize existing and future data into relevant information. One aspect of the sample frame might be the "head of tide" or fluvial-tidal boundary within coastal watersheds. A general survey of basic ecological and economic indicators, including biological diversity, human population density, and industrial land use density indicate that the risks represented by sea level rise may be greatest where streams and land and sea meet. The existing state and national habitat inventories and assessment programs do not target this nexus. It is not well mapped, gets pooled with adjacent riverine or estuarine or marine sampling strata, or falls between and gets excluded. In this presentation we raise the idea of the head-of-tide as a sampling stratum for assessing the economic and ecological risk of sea level rise, and we propose some basic indicators that can be used by local, regional, state, and national interests coast-wide.

Val Connor*¹. The Role of California's Surface Water Ambient Monitoring Program (SWAMP) in Reducing the Impacts of Non-Point Source Pollution on Coastal Resources.

¹ California State Water Resources Control Board

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Adequate and accurate monitoring and assessment are the cornerstones to preserving, enhancing, and restoring water quality. In 2000, the California Water Boards formed the Surface Water Ambient Monitoring Program (SWAMP) to fulfill the statutory monitoring and assessment obligations of the federal Clean Water Act and the California Water Code. However, the



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program has been designed to stretch beyond federal and state requirements and coordinate a statewide framework of high quality, consistent and scientifically defensible methods and strategies to improve the monitoring, assessment and reporting of California's water quality. Since its inception, SWAMP has partnered with the CA NPS program to use monitoring to assess the impacts of NPS pollution.

For example, the California Monitoring and Assessment Program (CMAP) for wadeable perennial streams was initiated in 2004. This program builds on USEPA's Environmental Monitoring and Assessment Program (EMAP), and is being used to (1) provide a framework for producing valid condition assessments for perennial streams in California, (2) develop tools to facilitate these assessments, and (3) evaluate associations between stream condition and nonpoint source land use categories. Historic EMAP data has been analyzed to produce assessments of the condition of streams statewide and in special study areas in northern and southern coastal California. In addition, a probabilistic monitoring design incorporating land use classes will allow for assessments of status and trends in aquatic life beneficial use protection in streams. CMAP is a collaborative effort involving the State Water Board's Nonpoint Source (NPS) and Surface Water Ambient monitoring Program (SWAMP), the U.S. Environmental Protection Agency (EPA), the California Coastal Commission, and the California Department of Fish and Game.

Ben K. Greenfield¹, Michael Connor^{*1}, Aroon R. Melwani¹, John J. Oram¹, Steven M. Bay¹. A Framework for Assessing Effects of Sediment Contaminants to Wildlife and Humans.

¹San Francisco Estuary Institute

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Contaminated sediments can indirectly affect demersal fish, as well as piscivorous birds, marine mammals and humans. We describe a multiple line of evidence framework to identify sediment contaminant concentrations that would be protective of wildlife and human health. The three lines of evidence are tissue chemistry of resident prey animals (fish or invertebrates), sediment chemistry, and bioaccumulation tests. Key attributes of the framework include sequential application of the lines of evidence, a probability-based approach with multiple categories, and evaluation of separate lines of evidence at different spatial scales. To demonstrate the approach, the framework has been applied to chlorinated organic contaminants in two case-studies: Newport Bay and San Francisco Bay. The case-studies also evaluate use of empirical data and a steady-state food web model to calculate bioaccumulation factors for legacy pesticides and PCBs. Resulting bioaccumulation factors are combined with effects thresholds to identify protective sediment concentrations.

Patricia Conrad^{*1}. Linkages Between Cats, Run-Off, and Brain Disease in Sea Otters.

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Toxoplasma gondii infection in threatened southern sea otters (*Enhydra lutris nereis*) is a major cause of mortality and contributor to their slow rate of population recovery. An updated seroprevalence analysis showed that 52% of 305 freshly deadbeachcast sea otters and 38% of 257 live sea otters sampled along the California coast from 1998-2004 were infected with *T. gondii*. Areas with high *T. gondii* exposure were predominantly sandy bays near urban centers with freshwater runoff. Genotypic characterization of 15 new *T. gondii* isolates obtained from otters in 2004 identified only X alleles at B1 and SAG1. A total of 38/50 or 72% of all otter isolates so far examined have been infected with a Type X strain. The origin and transmission of the Type X *T. gondii* genotype is not yet clear. Sea otters do not prey on known intermediate hosts for *T. gondii* so the most likely source of infection is by highly infectious environmentally resistant oocysts that are shed in the feces of felids and transported via freshwater runoff in the marine ecosystem. As nearshore predators otters serve as sentinels of protozoal pathogen flow into the marine environment since they share the same environment and consume some of the same foods as humans. Investigation into the processes promoting *T. gondii* infections in sea otters will provide a better understanding of terrestrial parasite flow and the emergence of disease at the interface between wildlife, domestic animals and humans



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Alie LeBeau¹, Jerry Schubel¹, Amy Coppenger^{*1}. Cesar Chavez Elementary and the Aquarium of the Pacific: Combining the Best of Formal and Informal Education.

¹Aquarium of the Pacific

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The Aquarium of the Pacific has created a new educational paradigm, using the world ocean as a unifying theme that encourages students to go beyond science, technology, engineering, and mathematics (STEM) to discover the interrelatedness of all knowledge. This engaging ocean theme serves as the cornerstone for a collaborative learning model based on a partnership between an inner-city elementary school and a free-choice learning/informal-education institution.

Within walking distance of the Aquarium of the Pacific, Cesar Chavez Elementary provides the Aquarium with a unique opportunity to broaden its educational reach. The partnership aims at raising the level of scientific literacy in Chavez students. Chavez Elementary is a Title I school that currently enrolls 520 students in kindergarten through fifth grade. The ethnic composition of the student body is primarily Hispanic (80%) and African American (16%), with most families representing low-income demographics and living close to or below the poverty line, and many being ELD (English Language Developers). Furthermore, this elementary school, like most in Long Beach and throughout the state of California, has no dedicated science instructor, no science laboratory or equipment, and few resources.

Based on this immediate need within the community, and the well documented need for improved science learning in California, Aquarium educators began offering supplemental science instruction to all Chavez students in 2005. In addition to receiving on-site science lessons, each class participates in field trips, and 50-minute classroom programs offered at the Aquarium. After completing a full year of service to the school, the program has continued to expand and surpass expectations. All program partners, from teachers to administrators, share the Aquarium's determination to turn this "experiment" into an educational model with far-reaching applications.

Chuck Cook¹, Gordon Fox², Frank Lockhart³, Marija Vojkovich⁴, Stephen Copps^{*3}. Emerging Roles for Fishers, NGOs, Federal, and State Governments in Ecosystem Management off the U.S. West Coast.

¹The Nature Conservancy, ²F/V South Bay, Morro Bay, California, ³NOAA Fisheries Northwest Region, ⁴California Department of Fish and Game

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Ecosystem management of the marine environment is an increasingly important yet ill-defined expectation for the marine environment. Recent regulatory actions on the West Coast offer a glimpse of how ecosystem management strategies may be formulated through collaboration of federal and state governments, non-governmental organizations, and fishing interests. Such actions include the designation and protection of Essential Fish Habitat for Groundfish, and preventing overfishing and rebuilding overfished fisheries. In those cases, decisions by the Pacific Fishery Management Council and NOAA resulted in dramatic changes to protection afforded the marine ecosystem. The strength of the actions is owed to, among other things, strong direction from Congress or the courts, transparent scientific assessment, open dialog with constituents, and partnership across political boundaries (e.g. State/Federal). In the case of Essential Fish Habitat, the decisions were made less difficult by consensus recommendations from partnerships between NGOs and the fishing industry. This presentation offers some ideas on how to shift into an ecosystem approach to management for the West Coast. In particular, we will look at West Coast groundfish management as a case study and at the roles of scientific assessment, fisheries managers, partnership across political boundaries, and the broad range of fishing communities and other stakeholders in the marine ecosystem.

Judy Corbett^{*1}. Connecting Smart Growth and Protecting Water Resources: A Local Government Commission Perspective.

¹Local Government Commission

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Judy Corbett, the developer of Village Homes, the first successful sustainable community designed in the United States, will share what she has learned about connecting smart growth and protecting water resources. During her many years at the helm of the Local Government Commission, she has focused on local government as the place to make change happen.



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California is expecting another 12 million residents by 2030. With few exceptions, the mayors, city councilmembers and county supervisors in our state decide what gets built and where. They do this by approving general plans, zoning ordinances, new subdivisions, urban boundaries, local ordinances and policies, and the like. These decisions have an enormous impact on the quality and quantity of California's water. Land use choices either cause or avoid physical impacts to aquatic, wetland, riparian habitat and habitat connectivity, construction and post-construction urban pollution, and alteration of flow regimes and groundwater recharge. The distribution of impervious surfaces and design of storm drain collector systems also have immediate and long-term effects on aquatic resources watershed-wide. Local decisionmakers can preserve wetlands or build on them; they can require smaller lots, drought tolerant landscaping, and the use of recycled water, or they can approve new developments with large, expansive lawns and other water-consuming amenities. They can require developers to design in such a way as to retain storm water on site, replenishing groundwater supplies, or they can allow the ground to be covered over with impermeable surfaces. The LGC has developed a set of Water Principles that address the disconnect between local land use decisions and water resources, and developed supporting materials to implement them. Ms. Corbett will share examples of how to grow and how not to grow in concert with these principles.

Natalie Cosentino-Manning*¹. Restoring California's Subtidal Marine Habitats.

¹NOAA Restoration Center

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The National Oceanic and Atmospheric Administration (NOAA) Restoration Center (RC) enhances living marine resources to benefit the nation's fisheries by restoring their habitats. The NOAA RC (housed in the National Marine Fisheries Service, Office of Habitat Conservation) performs restoration pursuant to federal legislation and improves the state of restoration ecology and habitat management. The RC is home to the NOAA Community-based Restoration Program (NOAA CRP), a highly successful program that involves communities in the restoration of marine, estuarine and freshwater habitats. To date, the NOAA CRP has provided over \$13 million dollars in federal and matching funds to support community-based habitat restoration projects in California. To improve federal and state coordination, the NOAA CRP has partnered with the California Coastal Conservancy and the California Ocean Protection Council to focus restoration efforts on subtidal habitats along the California Coast and within San Francisco Bay. This presentation will discuss NOAA's momentum in restoring subtidal habitats and how these efforts will help the California Ocean Protection Council's Five Year Strategic Plan to restore and maintain valuable ocean and coastal habitats and resources.

Margo Cowan*¹. Volunteers Making a Difference in California State Parks.

¹California Department of Parks and Recreation

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The California Department of Parks and Recreation boasts the largest number of volunteers of any state agency. In 2005, over 16,000 volunteers contributed more than 950,000 hours of service in support of the mission of California State Parks. Those numbers – as impressive as they are - tell only part of the story. It is no exaggeration to state that volunteers are critical to the operation of each of the 278 units of the California State Park System. DPR relies on well-trained volunteers to deliver quality education and interpretive programs to park visitors, to help preserve and protect the state's diverse ecology, and to assist in creating opportunities for outstanding outdoor recreation. California State Park's 25 state beaches and 16 marine parks and reserves rank among the top ten parks in visitor attendance. In fact, with the exception of Old Town San Diego State Historic Park, state beaches are the most heavily visited units in the State Park System. The presentation will focus on exemplary volunteer programs at two extraordinary marine parks in heavily urbanized San Diego and San Francisco counties Border Field State Park, which contains much of Tijuana River National Estuarine Research Reserve, and Candlestick Point State Recreation Area, the first urban recreation area created in California. In both units, volunteers work with park staff to enhance visitor services, provide docent-led nature hikes and educational activities for school groups, help restore natural habitat, and coordinate public events that generate community awareness leading to environmental action to benefit these unique coastal, wetland and marine habitats. The presentation will highlight cooperative relationships between DPR staff and volunteers and other fundamental partners such as cooperating nonprofit organizations, city, county and state government, NOAA's National Estuarine Research Reserve System, United States Fish and Wildlife Service, and the government of Mexico.



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Gregory B. Crawford^{*1}, Frank J. Shaughnessy¹. Integrated Ocean Observing Systems along the North Coast: New, Key Insights from Monitoring the Nearshore Environment.

¹Humboldt State University

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The Draft Strategic Plan of the California Ocean Protection Council recognizes the importance of research in protecting and managing California's coastal resources. This is particularly noteworthy along the North Coast of California (sometimes considered part of the "Lost Coast"), where, in 2006, still very little is known. As a part of the NOAA-funded, California-wide CI-CORE (California Center for Integrative Coastal Observation, Research, and Education) program, however, nearly continuous, multi-parameter measurements have been made in Humboldt Bay and Trinidad Bay for as much as 3 years. We summarize some important new insights on physical and biological conditions from these observations.

As a consequence of tidal flows moving past the Humboldt Bay sensor, high tide measurements provide insight on nearshore conditions; low tide measurements represent deep bay conditions. We show how the temperature and chlorophyll observations can be used to provide proxy measurements for nearshore coastal upwelling response. The available data show the differences between the low upwelling conditions observed in 2005 and the previous year and fill an important data gap along the west coast for monitoring the nearshore ecosystem.

At Trinidad Bay (an Area of Biological Significance), nearshore waters in winter appear to be strongly influenced by high precipitation events and subsequent discharges from local rivers driven northward towards Trinidad by the Davidson current. The strong storms of late December 2005 appear to be responsible for reducing salinities as low as 19 ppt in early January. Such conditions, which lasted for several days, are expected to have negatively impacted the nearshore coastal community at Trinidad. Winter turbidity and chlorophyll measurements at Trinidad, however, are not related in any simple way to freshwater discharge and will require more extensive future study.

Jeffrey Crooks^{*1}, Drew Talley², Christine Whitcraft³, Lisa Levin³, John Boland⁴. Monitoring, Research, and Adaptive Management in Coastal Wetlands of San Diego.

¹Tijuana River National Estuarine Research Reserve, ²San Francisco Bay National Estuarine Research Reserve, ³Scripps Institution of Oceanography, ⁴Boland Ecological Services

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Adaptive approaches, using monitoring and research to inform management action, have been the centerpiece of the stewardship efforts at the Tijuana River National Estuarine Research Reserve (TR NERR). Monitoring of abiotic and biotic parameters at the TR NERR, as well as nearby Los Peñasquitos Lagoon, provides important baseline information for managers, as well as indicates need for intervention, such as dredging to improve circulation and combat anoxia. More broadly, coupled science and management are also used in efforts to control invasive species at the TR NERR. The Tijuana River Valley Invasive Plant Program has been designed to use invasive plant removals as templates for research assessing a) impacts of invaders, b) best methods of control, and c) ecosystem recovery after eradication. An emphasis of this program has been the invasion and removal of salt cedar (*Tamarix* spp.) in high salt marsh habitats. Adaptive approaches are also being employed in salt marsh restoration. The long-term vision for adaptive restoration was established with the adoption of the Tijuana River Tidal Restoration Program (TETRP) in the early 1990's. TETRP utilizes a modular approach to restoration. As each restoration module is conducted, research and monitoring is carried out, and the new insight gained is applied to the next phase of the program. In addition to offering opportunities for scientific feedback to restoration practitioners, the modular framework works well given both funding and logistical constraints. We are also beginning an effort to increase the degree of adaptiveness within a given project module by determining how to achieve regulatory flexibility, which will allow for rapid responses to changing conditions and maximize the success of restoration projects. responses to changing conditions and maximize the success of restoration projects.



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Richard Cudney-Bueno^{*1}, Luis Bourillón Moreno², Jorge Torre Cosío², Miguel Lavín Peregrina³, Peter T. Raimondi⁴, William A. Shaw¹, Peggy J. Turk-Boyer⁵. Project PANGAS: Implementing Ecosystem-Based Management of Small-Scale Fisheries in the Northern Gulf of California, Mexico.

¹School of Natural Resources, University of Arizona, ²Comunidad y Biodiversidad A.C. (COBI), ³Centro de Investigación Científica y de Educación Superior de Ensenada (CICESE), ⁴Department of Ecology and Evolutionary Biology, University of California, Santa Cruz, ⁵Centro Intercultural de Estudios de Desiertos y Océanos (CEDO)

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The northern Gulf of California Mexico is one of the most productive marine ecosystems in the world. Despite numerous conservation efforts however most of the region's fisheries are in decline and in urgent need of more effective management approaches. Part of the failure in management of fisheries in the Gulf of California and worldwide is due to approaches that ignored wider ecosystem influences and to our lack of understanding of the structure and connectivity of marine fishery populations. Coastal marine ecosystems are complex systems influenced by feedbacks between biophysical and human processes. Keeping these premises in mind in July 2005 the School of Natural Resources of the University of Arizona in collaboration with four other institutions from Mexico and the U.S. (Centro de Investigación Científica y de Educación Superior de Ensenada University of California Santa Cruz Comunidad y Biodiversidad Centro Intercultural de Estudios de Desiertos y Océanos) initiated Project PANGAS an interdisciplinary integrative project for ecosystem-based research and management of small-scale fisheries. Through on-the-ground observational research and modeling and laboratory approaches Project PANGAS strives to answer key questions about how people and the environment interact and how these interactions affect the coastal marine ecosystem. Parallel to this work we engage key stakeholders at various levels and scales of research and work at the interface of science and the implementation of public policies. Our ultimate aim is to provide a scientifically sound basis that can facilitate the development of management decisions grounded in regional biophysical social and political realities. We provide a general overview of the methodological approaches implemented through Project PANGAS and some of the challenges and outcomes of the first year of this initiative.

Karen Reyna¹, Columbine Culberg^{*2}. Ocean Etiquette: Protecting California's Wildlife through Science, Management, and Outreach.

¹Gulf of the Farallones National Marine Sanctuary, ²NOAA National Marine Sanctuary Program

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The largest contributor to California's ocean economy is tourism and recreation. Maintaining activities that contribute to our ocean economy is critically dependent on emerging policy choices for the long-term protection and conservation of ocean resources. Yet people seeking close encounters with marine life via boating, kayaking, diving, snorkeling, swimming, and hiking are increasing. As the amount of people interacting with the marine environment increases, so does the potential for inadvertent negative impacts to marine wildlife and habitats. The negative impacts from human behavior and increasing numbers of people interacting with wildlife can have both short and long term effects on marine species and resources. Such interactions can disrupt wildlife feeding, resting, reproduction, and nesting. Interactions between people and the marine environment can only be fully sustainable when conducted in a non-disruptive manner. In order for human interaction with marine wildlife to be sustainable, marine managers need to determine "best practices", take a coordinated management approach, and develop appropriate policies based on science, while effectively communicating to the public. This presentation will 1) discuss the need to raise public awareness about ocean etiquette by looking at the Central California Coast Seabird Colony Protection Program as a model; 2) identify potentially harmful human-caused impacts to wildlife; 3) discuss current statewide approaches to minimize impacts; and 4) raise questions about the need for policy development, coordinated management and implementation of additional outreach and education initiatives.

John B. Richards¹, Caroline M. Pomeroy¹, Carolynn Culver^{*1}. Sustainable Fisheries: Managers, Fishery Participants, and Scientists Working Collaboratively toward a Common Goal.

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Sustainable fisheries management requires an understanding of not only the biological complexities of the ecosystem, but also the economic and social factors that drive fishing activity. Consideration of all of these parameters can vastly improve the effectiveness of management strategies, and thus our ability to achieve sustainable fisheries. We have been working collaboratively with resource managers, fishing communities and harbor masters to evaluate the sustainability of commercial fisheries of the Santa Barbara Channel region. Fisheries landings data have been analyzed using a multi-faceted approach that integrates the variability of environmental, socio-economic and regulatory variables and ground-truths the findings with the knowledge of the members of our collaborative group. This approach has allowed a more thorough evaluation of the status of our local fisheries. In addition, we have collaboratively identified research, education and infrastructure needs and developed subsequent strategies for addressing some of the challenges associated with achieving sustainable fisheries. Using a case study approach, we describe our methods, findings and recommendations. This approach is broadly applicable to other regions and will be useful to resource managers, port managers, policy-makers and the public at large who share the common goal of supporting sustainable fisheries.

John Daley^{*1}, Dick Long¹, Rich Parker², Schmiedeke Harvey³, Harry Wong⁴. Using Surplus Ships as Man-Made Reefs in California.

¹California Ships to Reefs, ²Orange County Oceans Foundation, ³Sunken Treasures of Los Angeles, ⁴Northern California Oceans Foundation

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The use of ships as man-made reefs is well established. This presentation is to describe a plan by which California can promote economic development in a self funding and potentially revenue generating way, while at the same time, provide (potentially) mitigation of over fishing off the California coast. This plan would be to use surplus MARAD/Navy ships, properly prepared for both environmental assimilation and diver enjoyment, as man-made reefs. The reefs would be located on soft bottom areas typically 100 ft under the water. The reefs would be surrounded by rubble fields (fringing reefs) of surplus concrete to provide hard bottom structure around the pinnacle (ship) reef. Using established dive businesses and strategic positioning of reefs, local economic benefits would be realized by the communities involved. The benefits would also enhance the tax base of those local communities. This plan would include provisions for detailed studies on the effectiveness of man-made reefing structure on specific species, specific locations, and overall improvement of fish populations. In addition, information learned would be published to promote a general understanding of the effects and effectiveness associated with mitigating adverse impact events. This plan will be self-funded through the use fees to be initiated on the dive activity at the various reefs. Similar to other dive destinations, California will require an annual wreck tag for recreational use of California sponsored sites. The implementation of this plan advances California's Action Strategy in that it promotes the research of how man-made reefs enhance our underwater environment. Beyond the current action strategy, this plan would be part of an overall ocean ecosystem restoration program as outlined in the Ocean Protection Council Strategic Plan. Both under ecosystem-based management and economic sustainability sections, the plan would promote revenue sources on a non-consumptive activity and provide additional habitat.

Michael Dalton^{*1}, Caroline Pomeroy². Measuring Impacts on Fishing Communities: A Framework for Integrated Socioeconomic Assessment.

¹California State University, Monterey Bay, ²California Sea Grant Extension Program

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The California Ocean Protection Council's (OPC) Strategic Plan establishes "evaluating economic uses" of the ocean as a goal for improved management. It also calls for the implementation of Ecosystem Based Management (EBM). Although sometimes overlooked, socio-economic information and analysis are important parts of EBM. This presentation describes a framework for integrating local scale data with national information to estimate economic multipliers for valuation and policy analysis. While national data is appropriate for many applications, relying solely on it to represent coastal communities, especially those dependent on fishing, is questionable. Recent estimates of the economic value of living marine resource use to the state's economy do not include wage and employment data for the commercial fish harvesting sector. While national data that are the basis for these estimates do not address fish harvesting as a distinct sector, data on ex-vessel values of fish landed at California ports are readily available and can be used to more accurately estimate the value of fisheries.



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More generally, economic multipliers based on national data that have been downscaled to the county level are used for local and regional policy analysis, including economic impact assessments of fishery regulations. However, county-level data may not be adequate for measuring impacts on communities. Moreover, the downscaling procedure is based on national indicators such as employment, which may not represent the actual economic composition of a county. Using Monterey County as a case study, this presentation demonstrates precisely how commercial fishery ex-vessel revenue data and cost-earnings data from socio-economic surveys can be optimally integrated with other data to more accurately estimate economic multipliers at the local level. Our results show that economic multipliers for the commercial fishing sector are substantially different, by as much as 15,000%, from multipliers based on downscaled national data.

Brad Damitz^{*1}, Holly Price¹. A Regional, Multi-Stakeholder Approach to Addressing Shoreline Erosion in Southern Monterey Bay.

¹Monterey Bay National Marine Sanctuary

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In light of a growing concern regarding the existing and future impacts of coastal erosion and armoring, the Monterey Bay National Marine Sanctuary (MBNMS), along with a number of partners, recently initiated a focused collaborative effort to develop a planning approach that addresses these issues on a regional level. Since early 2005, the MBNMS has coordinated and facilitated a series of regular meetings of the Southern Monterey Bay Coastal Erosion Workgroup, a multidisciplinary stakeholder group comprised of local experts, regulatory agency and local government representatives, conservation interests, and elected officials. The goals of the workgroup are to: compile and analyze existing information on erosion rates and corresponding threats to private and public structures in the southern portion of the Monterey Bay; identify and assess the range of options available for responding to erosion, and; develop a proactive and comprehensive regional shoreline preservation, restoration, and management plan with selected site-specific and broader area-wide recommendations for responding to coastal erosion that minimize environmental and socioeconomic impacts to the maximum extent feasible. The workgroup is assessing a wide range of erosion response alternatives for their appropriateness in specific sub-regions of the southern Monterey Bay. The diverse assortment of approaches being analyzed includes everything from managed retreat, to offshore structures, beach de-watering devices, and beach nourishment. By developing plans for at-risk structures before they are directly threatened by erosion, plans for future developments to avoid future armoring, and plans for improved maintenance/cleanup and restoration of existing sites, it is hoped that this effort will ultimately result in a reduction of coastal armoring and maintenance of beach width in the SMB region.

Jennifer Dare^{*1}, Mark Johnsson². The California Coastal Armor and Bluff Erosion Database.

¹NOAA Coastal Services Center, ²California Coastal Commission

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The coast of California is largely backed by actively eroding coastal bluffs that pose a risk to public safety, a threat to existing development, and create a management challenge in regulating future development. In order to facilitate informed decision-making, we created a Geographic Information System (GIS) to house data about long-term and short-term erosion rates and existing coastal armoring for the State of California. The database is available to coastal program analysts at the California Coastal Commission, the State's coastal planning and regulatory agency, as a GIS as well as an Internet Mapping Server (IMS) that will later be made available to local government planners and ultimately, the public. Existing erosion rate data were collected from a variety of sources including government studies, academic studies, and reports of private consultants. These data were digitized onto a shoreline such that data of different quality, time interval covered, and length of record can be associated with a single location, allowing comparison of existing erosion data with new data submitted in support of coastal permit applications. In addition to bluff erosion, a layer that captures the linear extent and description of all existing coastal armoring was created. By coupling these data, a user can query the database to identify areas that may be susceptible to future armoring request. Both of these data layers are displayed with complementary base layers, including aerial photography, that allow the user to locate and examine an area of interest at different geographic scales. The GIS was designed to be dynamic, serving as a framework for the addition of future erosion rate data and armoring structures. As other useful data become available, they are added to the existing layers. This allows coastal managers throughout California to readily have access to the most recent and relevant armoring and erosion data.



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Peter Dartnell^{*1}, Brian D. Edwards¹, George J. Saucedo², Chris Wills². Huntington Beach 1:24,000 Scale Coastal Mapping: Integrating Bathymetry, Topography, and Geology.

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The State of California is addressing a number of coastal issues including habitat management and restoration, sediment management, and hazards. Combined, high-resolution topographic and bathymetric Digital Terrain Models (DTMs) and geologic maps can provide information useful in addressing these issues. While a number of intermediate-scale maps (1:100,000) exist in various parts of the State, large-scale (more detailed) maps that are important for local projects (such as wetland restoration, beach replenishment, and tsunami inundation modeling) typically do not exist. Currently, only a few areas along the California coast (e.g., Santa Monica Bay, San Diego, and Huntington Beach) have sufficient high-resolution topographic and bathymetric data available close to shore that allow the creation of large-scale maps. The U.S. Geological Survey (USGS) and the California Geological Survey (CGS) are undertaking a pilot project near Huntington Beach to merge offshore bathymetric and geologic data with onshore topographic and geologic data, with a goal of creating seamless 4-m resolution bathy/topo DTMs. The DTMs and geologic maps will extend from Seal Beach south to Newport Beach and from 4-miles onshore to 4-miles offshore. Onshore elevation data include publicly available first-return topographic lidar, interferometric radar, and USGS Digital Elevation Models (DEMs). The onshore geology has been compiled by CGS at 1:24,000 scale. The USGS integrated data from multibeam echosounders and bathymetric lidar to map the offshore bathymetry. Offshore geologic interpretations are based on a hierarchical classification of multibeam bathymetric and acoustic backscatter data that are supported by seafloor photographs, video, and bottom samples. The onshore-offshore geology will be included as a polygon coverage. Because first-return topographic data used in the DTM shows discrete buildings and streets, accurate tsunami inundation models can be created as part of disaster planning that detail likely regions of flooding during post-tsunami run-up.

David D. Davis^{*1}. The Past, the Present, the Future: 35 Years of Lessons Learned and More to Come in Santa Barbara, California.

¹Community Environmental Council

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In January 1969, an oil platform leaked off the shore of Santa Barbara, spilling oil over the beach and wildlife. A year later, the event was remembered at the Santa Barbara City College. A number of concerned community members were so inspired by the success of the event that they decided to form a non-profit organization to continue to promote the ideas that were being shared at the time. As a result, Community Environmental Council was formed. From their beginning, Community Environmental Council (CEC) helped prevent a mass commercialization of the Santa Barbara waterfront, helping clear the way for the "Plan for East Beach" and later protecting Chase Palm Park. Since then CEC has worked within San Luis Obispo, Santa Barbara, and Ventura Counties on various environmental issues including land use sustainability. Throughout the years they have gained knowledge and experience dealing with the land-use planning issues. Through a recent project, CEC has worked closely with such partners as the Economic Community Project and UC Santa Barbara's Geography Department to develop visual tools and computer models to simulate different land-use alternatives. At the forefront of their attention now, is a hot issue in Santa Barbara where slow growth to "preserve the environment" has caused soaring house prices, traffic congestion, big employers leaving, altered communities, and spill over growth. CEC believes that smart growth, where planning communities involves implementing strategies, not just limiting growth, may be the better solution. CEC believes the conversation about how to grow sustainably should include such issues as affordable housing, transportation, economic development, governance, infrastructure, financing, open space, and habitat conservation. They also believe that regional problems will only be solved through regional cooperation.

Gary E. Davis^{*1}. Ocean National Parks Seek Stewardship Partnerships in California.

¹U.S. National Park Service

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California's Ocean and Coastal Information, Research, and Outreach Strategy shares many goals, objectives and recommendations with National Park Service strategic goals and objectives for ocean parks. Coastal and ocean national parks provide California with active, funded, operational, site-level partnerships with shared institutional goals for monitoring, education, outreach, research facilitation, and law enforcement. Six units of the National Park System help citizens understand, protect, and connect to 462 miles of California's coast. Each year, Redwood National and State Parks, Point Reyes National Seashore and Golden Gate National Recreation Area in the north, and Channel Islands National Park, Santa Monica Mountains National Recreation Area and Cabrillo National Monument in the south host 17.5 million visits. Park education and outreach programs contribute to citizen understanding and engagement in many coastal issues. Park monitoring programs inform shared resource stewardship programs in these parks and facilitate research. The National Park Service is actively seeking practical, on-the-ground partnerships with other ocean agencies to help raise awareness of these special places on California's coast, and thereby encourage information sharing, facilitate shared research and monitoring opportunities, and increase coordination of outreach efforts.

Gary Davis^{*1}, David J. Kushner², Kate R. Faulkner³. Channel Islands National Park's Kelp Forest Monitoring Program: 25 Years of Cooperation, Fishery Independent Data Collection, and Marine Protected Area Evaluation.

¹U.S. National Park Service, ²Channel Islands National Park

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Effective ocean stewardship requires partnerships, science and adaptive management. A case study of monitoring, civic engagement, and conservation at the California Channel Islands reveals how science has guided and informed public policy decisions by combining these elements of stewardship. In 1981, with advice and counsel from local universities and other agencies, the National Park Service initiated a program to monitor kelp forest ecosystems in cooperation with the California Department of Fish and Game and the NOAA National Marine Sanctuary Program. Population dynamics of 69 taxa of algae, fish and invertebrates were measured at 16 fixed sites around the five park islands. In the first 25 years, no fewer than 365 scientists from 152 agencies and universities contributed field observations. A ten-member steering committee representing state and federal agencies, and public and private universities and foundations met 60 times to review and guide the program. The kelp forest monitoring program has contributed to at least 16 peer-reviewed scientific papers and 11 technical reports that described changes in kelp forests, provided early warnings of depleted resources and disease outbreaks, evaluated conservation strategies, and informed public policy decisions regarding restoration of impaired resources. In 2005, the number of monitoring sites was doubled from 16 to 32 to better measure the performance of no-take marine reserves established by the State of California in 2003. The extensive data collected over the past 25 years provide an unparalleled opportunity to evaluate changes in the marine environment and measure the effects of the new network of marine reserves. Perhaps the greatest lessons learned from this program are the power of persistence and partnerships and the value of investing in reliable monitoring.

Jon C. Day^{*1}. Spatial and Temporal Ocean Planning and Management: Lessons Learned after 25 Years of Managing the World's Most Complex Marine Ecosystem.

¹Great Barrier Reef Marine Park Authority

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A comprehensive zoning system governing all human activities has long been regarded as the 'cornerstone' for managing the Great Barrier Reef Marine Park (GBRMP). For over 25 years the spectrum of differing zone types has worked well, specifying appropriate locations for extractive activities including fishing, collecting and aquaculture which are allowed in some zones, whilst ensuring an overriding conservation objective. Other zones in the GBRMP provide high levels of protection for specific 'no-take' areas.

Over the years, zoning has evolved and improved (see Day abstract below). However various other spatial management 'tools' and management 'layers' including statutory Plans of Management, permits, Indigenous agreements and industry-specific agreements, have been found to be more effective for managing specific industries or activities such as tourism, shipping, ports, Indigenous hunting, Defence training and some fisheries regulations. Other spatial layers within the Great Barrier Reef Region include the World Heritage Area, Native Title claims, a 'Remote Natural Area' overlay, the Australian Whale Sanctuary, and State Marine Park zoning. Many of these layers are important for management purposes, but are not encompassed within



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the zoning spectrum. Similarly, a variety of temporal management tools are now applied in the GBRMP, including Special Management Areas, GBR-wide closures at specific fish-spawning times and a range of other fisheries regulations.

Many lessons have been learned from nearly three decades of 'adaptive management' in the GBRMP. Ocean zoning remains a fundamentally important management tool for effective management of the GBRMP; however, as this paper outlines, various other aspects of spatial and temporal management are applied in addition to the zoning approach. These various management 'tools' are discussed, along with their advantages and disadvantages, and the management implications for such matters as public understanding, compliance and enforcement.

Jon C. Day*¹. The Relative Roles of Science, Public Participation, and Political Support in Ocean Zoning: Lessons from Australia's Great Barrier Reef.

¹Great Barrier Reef Marine Park Authority

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The Great Barrier Reef (GBR) encompasses one of the world's largest and most complex ecosystems, ranging from shallow coastal areas to mid-shelf reefs and inter-reefal areas, to exposed outer reefs and the deep open ocean. The Great Barrier Reef Marine Park (GBRMP) was established in 1975 to protect the GBR and to ensure its sustainable use. Covering 344,400 km² (bigger than Victoria and Tasmania combined), the GBRMP is a multiple-use park. A comprehensive, multiple-use zoning system governs all human activities, providing high levels of protection for specific areas, whilst allowing a variety of other uses, including shipping, fishing, dredging and aquaculture, to continue in other zones. This means that virtually all reasonable activities are permitted, but zoned and regulated to minimise impacts and conflicts, whilst ensuring an overriding conservation objective. The Representative Areas Program (RAP) was a complex planning and consultative program that resulted in a new zoning network for the GBRMP in mid 2004. The primary aim of the RAP was to better protect the range of biodiversity in the GBR, whilst minimising the negative and maximising the positive impacts for the existing users of the GBRMP. The final outcome included an increase in 'no-take' zones from less than 5% to more than 33%, and today comprises the world's largest systematic network of 'no-take' zones. Scientific knowledge played an important part of the rezoning of the GBRMP, but the successful outcome relied significantly upon two other critical, inter-dependent aspects – the high level of public participation and the consequent socio-political support. All three aspects were essential, but the best scientific arguments in the world alone would not have achieved the final zoning plan. This presentation discusses the importance of involving the public and the political decision-makers throughout the planning process, with lessons learnt for marine and coastal planning elsewhere.

Monica L. DeAngelis*¹. Non-Lethal Deterrence of Pacific Harbor Seals and California Sea Lions.

¹Southwest Regional Office, NOAA National Marine Fisheries Service

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Since the passage of the Marine Mammal Protection Act (MMPA), California sea lion and Pacific harbor seal populations have recovered to healthy levels and the increased abundance of these animals has been accompanied by a growing number of negative interactions with humans. Concern has been raised by West Coast private property owners, dock and marina operators, and commercial and recreational fishers who are seeking ways to protect their property and catch from damage by these species. The 1994 Amendments to the MMPA provided new authority to U.S. citizens to deter marine mammals from damaging fishing gear, catch, and private property, and required National Marine Fisheries Service (NMFS) to publish guidelines for safely deterring marine mammals. None of the various non-lethal deterrence techniques currently available have worked consistently for long periods of time. NMFS' Southwest Regional Office (SWR) is currently working with communities to test techniques to exclude sea lions from hauling out on docks and bait receivers. SWR hosted a workshop in December 2005, to gather information on marine mammal damage of public and private property, and to discuss options for deterring problem animals, in compliance with the MMPA. In attendance were marine biologists, managers, researchers, law enforcement officers, NMFS General Counsel, representatives from several state fish and wildlife agencies, universities, the Pacific States Marine Fisheries Commission, the Marine Mammal Commission, marina operators, city and port officials, and representatives from the commercial fishing industry. The following day, U.S. and Canadian government officials and members of Scientific Review Groups (advisory bodies required by the MMPA) held a meeting. Officials recognized the urgent need to respond to impacted communities and agreed to develop public-friendly preliminary guidance to be posted on agency web pages,



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proceed with the Federal rulemaking process, and continue coordinating with impacted coastal communities in the U.S., Canada, and Mexico.

John Kirlin¹, Phillip Isenberg², J. Michael Harty³, Michael DeLapa^{*1}, Scott McCreary⁴, Melissa Miller-Henson¹, John Ugoretz⁵. Summary of Session: Lessons Learned from the California Marine Life Protection Act Initiative.

¹Marine Life Protection Act Initiative, ²Isenberg/O'Haren, ³Harty Conflict Consulting and Mediation, ⁴CONCUR, Inc., ⁵California Department of Fish and Game

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The Marine Life Protection Act (MLPA) directs the State of California to improve the design and management of a network of marine protected areas (MPAs) in state waters. To implement the MLPA, the California Resources Agency and California Department of Fish and Game (DFG) partnered with the Resources Legacy Fund Foundation. A memorandum of understanding among the three created a Blue Ribbon Task Force (BRTF), a panel of public policy experts to provide advice on implementing the MLPA, supported by professional staff.

In April 2005, the BRTF designated the area between Pigeon Point and Point Conception as the first region as its Central Coast Project. The Central Coast Regional Stakeholder Group (CCRSRG) was appointed by the BRTF chair and the director of the DFG, and met on a monthly basis to develop proposals for a network component of MPAs in the study region. At its March 14-15, 2006 meeting, the BRTF recommended three proposals for networks of MPAs be forwarded on to the DFG and ultimately the Fish and Game Commission for their consideration. Additionally, the BRTF recommended a preferred alternative.

To ensure lessons learned through the Initiative are captured, especially in developing proposed packages for the Central Coast, three independent consultants were retained. Members of the CCRSG, BRTF, Science Advisory Team, Statewide Interest Group, and MLPA Initiative staff were interviewed in April and May 2006. A draft of the lessons learned was released in summer 2006. That draft, which addressed issues such as (a) the roles of the BRTF, SAT, CCRSG, DFG and Initiative staff, (b) the flow of work resulting in development of proposed packages, and (c) public-private partnerships, will provide the beginning point for discussion among panel members

Vanessa DeLuca^{*1}. California's Wetfish Industry: Its Importance, Past, Present, and Future.

¹State Fish Company

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California's fishing industry was largely founded on "wetfish". Sardines, mackerels, market squid and tunas have contributed the bulk of California's commercial fishery harvest for more than a century. This complex of fisheries was instrumental in building the ports of San Pedro and Monterey, as well as San Diego and San Francisco. Vanessa DeLuca grew up amid her family's enterprise, State Fish Company, which grew to become one of the largest processors in California. Surviving the storied sardine decline, and a near-20 year State mandated moratorium on sardine harvest, State Fish Company diversified, but wetfish has remained the lifeblood of the family operation. Vanessa DeLuca recalls how the wetfish industry stepped up to fund millions of dollars in cooperative research in efforts to restore the sardine resource. Fishery managers declared the sardine resource fully recovered in 1999. Today, the California CPS finfish fishery consists of 61 active vessels under a restrictive limited-entry plan. Due to the rising costs of business, California's tuna canning industry exported its processing lines overseas beginning in the 1980s. The last remaining sardine cannery closed its doors in California in 2005. Now most wetfish are processed frozen, and a substantial percentage of the catch is exported. Much in the industry has changed, but much remains the same. California's wetfish industry remains committed to cooperative research, now focused on squid, helping the Ocean Protection Council and Department of Fish and Game improve scientific understanding of market squid, the state's most valuable fishery. Today a key challenge for the wetfish industry is maintaining access to harvestable resources, in light of precautionary management philosophy. Another problem facing California's wetfish industry is maintaining harbor infrastructure, including adequate port offloading and berthing facilities, as well as processing and cold storage space. Surely there is a future for California's historic wetfish industry – which has contributed such rich cultural heritage as well as economic benefits to California for more than a century. State Fish Company is now owned and operated by the second and third generations, and this family enterprise wants to continue providing livelihood and employment for its extended family of fishermen and employees, as well as benefits to the state and nation.



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Eileen Y. Deng^{*1}, Changming Dong², Nikolay P. Nezlin³, Xavier Capet², James C. McWilliams², Keith D. Stolzenbach¹.
Simulation of Stormwater Plumes in the Southern California Bight Using the Regional Ocean Modeling System.

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Southern California estuaries are affected by both direct inputs and inputs from upstream, urbanized coastal watersheds. These inputs include sediment, dry and wet weather urban runoff, and industrial discharges. Management of estuarine and near-shore water and sediment quality requires an understanding of the relationship between inputs and estuarine responses. Linked watershed-estuary models provide a powerful tool to help understand these interactions and to evaluate the effect of proposed management actions. We will present the development of a linked hydrodynamic model for the San Gabriel watershed and estuary.

The San Gabriel River estuary is an urbanized system that receives both direct and watershed-based inputs. Freshwater flow into the estuary is predominantly from two streams. Two large power-generating stations (PGSs) also discharge once-through cooling seawater taken from a nearby bay into the estuary. During summer months, discharge from the PGSs is generally over an order of magnitude greater than the terrestrial inputs. This greatly influences typical bi-directional estuarine flow conditions. Observed flows during the study period of July through October 2005 were consistently seaward near the mouth of the estuary, averaging 16 m³ s⁻¹. Additionally, the seawater discharged from the PGSs influence the water column stratification with an observed stratified water column above the discharge and a well mixed one below. An estuarine hydrodynamic model was calibrated based of the 2005 field data and then used to simulate observed wet weather flows from the 2005-06 storm season. Results of the modeling indicate that upstream of the PGSs the estuary is stratified with storm water inputs to the system being approximately an order of magnitude greater than the dry season flows. Downstream of the PGSs, the hydrodynamics are dominated by the effects of the PGS discharge. The results of this model may be used to evaluate pollutant mixing and dilution in the estuary.

Andrew DeVogelaere^{*1}, Erica J. Burton¹, Richard H. McGonigal¹. Protecting Deep-Sea Corals by Including Davidson Seamount in the Monterey Bay National Marine Sanctuary.

¹Monterey Bay National Marine Sanctuary

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There are 20 documented deep-sea coral taxa on the Davidson Seamount. The distribution of these corals was characterized during a cruise in 2002, and public interest in the seamount has been growing since then. Interesting science and high quality images from the cruise generated an award-winning interactive CD, extensive print and television media coverage, two web sites, an agency promotional poster, numerous public presentations, as well as peer-reviewed publications. As a result, the potential for protecting Davidson Seamount through sanctuary designation arose in the management plan review process for the Monterey Bay National Marine Sanctuary (MBNMS). After receiving input from a focus group of stakeholders and experts, the MBNMS Advisory Council voted to pursue inclusion of the Davidson Seamount in the MBNMS. Sanctuary status would increase national opportunities for education on deep-sea corals and limit extraction of corals from the Davidson Seamount. The potential regulations to achieve this have been presented to other public agencies for consultation, and NOAA's Pacific Fishery Management Council supported protection of the seamount habitats though inclusion in the MBNMS. There continue to be discussions on which branch of NOAA would best be suited for regulating fisheries that might impact these corals. The draft MBNMS Management Plan and supporting Environmental Impact Statement is due for public comment in the fall of 2005 with a final determination scheduled for spring 2006. Consultation with stakeholders has been critical throughout this process, and will be described with an update on the sanctuary designation status for Davidson Seamount.

John H. Dorsey^{*1}, Laura Peters². Ridding California Beaches of Fecal Bacteria: An Assessment of Clean Beach Initiative Projects.

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An important component of the Clean Beach Initiative (CBI) is to assess the effectiveness of funded projects designed to remove potentially pathogenic microorganisms from California's recreational beaches. Problematic beaches are those either being contaminated by urban runoff or sewage, having poor circulation, or both. A project is deemed successful if it significantly reduces levels of coliform and enterococci indicator bacteria, proxies for pathogenic microorganisms, at its target beach, thus meeting California's bathing water standards for recreational waters. The CBI Assessment Project was developed to individually assess the outcome of each project as it was implemented and operated for at least a one-year period. Eighteen projects were selected for assessment in the following categories: Low-flow diversions (9), In-channel disinfection facilities (3), Sewer improvements (2), Pier improvements (2), Treatment wetlands/swales (1) and Mixed consisting of several strategies listed above (1). Fourteen projects have been completed and are being assessed by statistically testing changes in densities of fecal indicator bacteria (FIB) at target beaches. Results to date show that low-flow diversions were most successful since all contaminated runoff is removed from the beach and sent to a local sewage treatment facility. In-channel facilities destroy bacteria using UV systems, but discharged effluent is re-contaminated with FIB from other sources as it travels to the ocean. Projects in the remaining categories still are undergoing assessment and will be discussed during the presentation. In general, if a project can remove runoff from a beach, then FIB densities along that beach will be reduced and water quality standards have a greater chance of being met. Co

Peter Douglas^{*1}. Coastal Management: Still Challenging, and Never Finished.

¹California Coastal Commission

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CZM was born on San Francisco Bay in 1965. California's program for the coast outside the Bay was launched by citizen initiative 34 years ago and is arguably the most comprehensive and strongest anywhere. Joining state land-use regulation with state land-use planning, the program has been controversial from its beginning. Much has been accomplished, some things left undone, some have fallen through the cracks, and much remains to be achieved. The job of coastal managers is never done – it, like environmental stewardship everywhere, is in need of constant doing.

Many lessons can be learned from California's experience and include:

- A strong law means little if the people responsible for implementation don't embrace the spirit and letter of the law
- A permanent, adequate source of funding for implementation is quintessential
- Meaningful adaptive management powers must be included
- To be effective, comprehensive regulatory and enforcement authority at the state and local level is essential
- Program implementation must include accessibility to and transparency of the decision-making process
- Public support and active participation must be encouraged and sustained
- Program insulation from political manipulation is critical
- A culture of idealism, humanism, integrity, professionalism, accountability, excellence, and dedication to public service is fundamental
- The program must eschew pusillanimity and respect reverence

As population concentrated in coastal counties inexorably grows, coastal lands available for new development shrink, conflicts among users and uses intensify, legal and technical elements of management become more complex, and as global warming throws everything into a cocked hat, coastal management becomes more difficult. To sustain effective stewardship, staying power is essential. "Staying power" requires renewable resolve, recognition that denial, despair and capitulation are not options, vigorous recruitment of activists to the cause, and maintaining focus on our vision for a better environmental future.

William Douros^{*1}, John Ugoretz², Scott Kathey³, Jaime Kooser⁴, Gary Davis⁵, Paul Michel⁶, Rebecca Roth⁷. A Federal Perspective on West Coast Regional Collaboration to Address Ocean Health.

¹National Marine Sanctuary, ²California Department of Fish and Game, ³Monterey Bay National Marine Sanctuary, NOAA, ⁴San Francisco Bay National Estuarine Research Reserve, ⁵U.S. National Park Service, ⁶U.S. Environmental Protection Agency,

⁷California Coastal Commission

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The Pew Oceans Commission, the U.S. Commission on Ocean Policy and the U.S. Ocean Action Plan all recommend advancing regional ocean governance to address the growing challenges we face in our oceans and coastal zones. In response, the West Coast governor's are drafting a statement on regional collaboration to address ocean health that will direct gubernatorial staff to work together to advance mutual interests in our oceans and coasts. I will discuss how federal agencies, in particular the National Marine Sanctuaries Regional Office, can facilitate or play a role in regional coordination and reflect on issues and opportunities identified by previous speakers.

Fanny Douvere^{*1}, Charles Ehler². European Perspective on Ecosystem-Based Management: New Approaches to Ocean Zoning and Governance.

¹Man and the Biosphere, United Nations Educational, Scientific, and Cultural Organization, ²Intergovernmental Oceanographic Commission, United Nations Educational, Scientific, and Cultural Organization

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The results of the recent Millennium Ecosystem Assessment, as well as other global and regional assessments of the marine environment, confirm that biodiversity in the world's oceans and coastal areas continues to decline. Parallel to this situation, there has been an equally important need for strategies that enhance an equitable sharing of the benefits derived from the use of marine resources. With the recent implementation of its Marine Strategy (2005) and Maritime Policy (2006), the European Union (EU) has taken global leadership in achieving ecosystem-based, sea use management. The EU is developing a strategic, integrated, and forward-looking framework for its seas that helps achieving sustainable exploitation, taking into account social and economic benefits, while placing biodiversity commitments at the heart of planning and management. Key tools are its Birds and Habitat directives that require all EU countries to designate and protect a network of areas that support important habitats, known as Natura 2000. Marine spatial planning (MSP) and ocean zoning is at the centre of all these initiatives. Mainly driven by European legislation, several countries including Belgium, The Netherlands, Germany and the United Kingdom, have now moved beyond conceptual and theoretical debates by putting MSP and ocean zoning into practice. Belgium is among the first to implement a multi-use planning system covering its entire maritime zone of the North Sea. In doing so, it successfully translated and applied land use planning concepts and techniques to the marine realm. Preliminary lessons from these experiences reveal that MSP is a continuous process rather than a single one-time plan that is often inspired by a range of issues, including biodiversity conservation. It also shows that stakeholder involvement and analysis is critical in managing use conflicts over resources and spaces on a sustainable basis.

Kathleen Drew^{*1}. Washington State Perspective on West Coast Regional Collaboration to Address Ocean Health.

¹Office of Washington Governor Christine Gregoire

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Governor Gregoire's Ocean Policy Work Group (OPWG) was formed in August 2005 through a budget proviso passed by the legislature, in order for Washington State to review its ocean policies. The legislature called for two reports to describe the condition of the state's ocean resources, measures to protect coastal resources; and ways to improve ocean management. Membership in the OPWG is informal; work group participants include state legislators and state agency representatives, tribal observers, federal entities, local government officials, and industry and association representatives. The OPWG began meeting in August 2005, and has met roughly once a month since then. The work group produced an interim report in December 2005, and a final report due December 2006. The OPWG focused its ocean policy review on five central themes: sustainable and resilient communities; marine resource stewardship; coastal vulnerabilities from marine sources; ocean research, observation, and education; and governance. The final report will include future directions and recommendations in these five policy areas.

While this work group began with an internal focus by reviewing the policies of Washington State as related to the outer coasts, the work of the group lends itself to collaboration with Oregon and California. Through reviewing its own policies and initiating prioritization of its ocean affairs, Washington State is in an ideal position to open lines of communication with its neighbors to the south, in pursuit of collaboration on those issues that prove relevant across state borders. Examples of cooperation and collaboration could include coastal habitat mapping, management of migratory state-managed fish stocks, or coastal ocean observation systems. Regardless of the specific issue, the crucial fact is that Washington has begun an ocean policy review for its outer coast, and the opportunity for collaboration with similar efforts underway in California and Oregon has never been more apparent.



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Rachel Surls¹, Paola Aliaga¹, Fanshen Cox¹, Sabrina Drill^{*1}. Environmental Literacy among Recent Immigrants.

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"Our Watersheds" is a curriculum being developed by UC Cooperative Extension to teach adult immigrants about the local Southern California environment in English as a Second Language (ESL) classrooms. Through interactive classroom activities, discussions, and selected readings "Our Watersheds" helps English language learners learn about the environment and important issues critical to protecting water, habitat, and environmental health in Southern California. Sections focus on watersheds and water quality, habitat protection and invasive species, and recreation and public participation in resource management. This program can further the goals and objectives of the California Ocean Protection Council by developing environmental awareness and building capacity for participation and stewardship within immigrant communities. COPA guiding principles include recognition of the interconnectedness of land and sea. We extend this idea by exploring the interconnectedness between coastal watersheds and the diverse human communities that inhabit them.

Pre and posttest surveys were conducted during the development and pilot testing of "Our Watersheds" to determine knowledge of and interest in the environment among ESL students, and assess changes after participation in the program. Survey results indicate that the level of interest in the environment among adult ESL students is very strong and that this group can benefit from environmental education tailored to their needs as newcomers. Before participating in the program more than 85% of ESL students were very or somewhat interested in the environment. However, we found that they may have a lower level of knowledge of some key environmental issues than the "average" American. After participating in "Our Watersheds" participants experienced a significant gain in their levels of knowledge about the environment and sixty-three percent indicated that they had implemented pro-environment behaviors, such as recycling, based on what they learned.

Sharon Franks¹, Peggy Hamner², Bill Hamner², Patricia Kwon², Judy Lemus³, Anthony F. Michaels⁴, Russell Moll⁵, Cheryl Peach⁶, Deidre Sullivan⁷, Lynn Wheatley⁴, Linda Duguay^{*4}. Centers for Ocean Science Excellence in Education (COSEE): A National and Regional Model for Engaging Ocean Scientists and Educators in Collaborative Activities.

¹Scripps Institution of Oceanography, ²Institute of the Environment, University of California, Los Angeles, ³Wrigley Institute, University of Southern California, ⁴University of Southern California, ⁵California Sea Grant, ⁶Birch Aquarium and Scripps Institution of Oceanography, ⁷Marine Advanced Technology Education Center, Monterey Peninsula College

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The COSEE program is a National Science Foundation (NSF) program co-supported with funds from the National Ocean and Atmospheric Administration (NOAA) with goals: To develop catalytic multi-dimensional partnerships between ocean science researchers and educators; To foster communication & coordination among ocean science education programs nationwide; To promote ocean education as an interdisciplinary tool for improving science education by increasing knowledge and interest in ocean sciences as well as increasing the participation of students from under-represented groups. The program began in 2002 and consists of 10 sites around the country. Two of the current sites are in California: COSEE-West and COSEE California. COSEE-West is hosted by USC and UCLA in partnership with LAUSD, other local school districts and a number of informal science centers and aquaria in the greater LA area. COSEE-West strives to improve K-12 ocean science education through activities that provide high quality science content and resources for K-12 Teachers and Informal Educators through a lecture series, workshops, forums and dissemination of ocean science materials. COSEE-California has four major partners - Scripps Institution of Oceanography (SIO), The MATE Center at Monterey Peninsula College, the (MARE) Program, Lawrence Hall of Science, UC Berkeley, and CA Sea Grant. COSEE-California's goal is enhancing the general public's understanding and appreciation of the ocean through the following strategies: facilitating relationships that connect scientists with education outreach organizations, communicating ocean science for undergraduate and graduate students, creating a groundbreaking interactive ocean science and technical careers web site, and developing K-12 Ocean Education sites for infusing ocean science into pre-college classrooms. This presentation will highlight the current activities of these two programs, engagement of the various partners as well as the potential effectiveness of these two programs for increasing both ocean and environmental literacy in California.



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Jack Dunnigan*¹, **Rebecca Smyth**¹. Regional Ocean Governance: Federal and State Roles.

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This panel will explore questions of federalism, state interests, and effective governance. What are the appropriate roles for the federal and state governments in managing ocean resources? What is the "national interest"? How does the fact that much of the ocean falls outside of normal government jurisdictions impact ocean governance and the politics of passing governance legislation? Perspectives will be given from the state, regional and federal standpoint as well as from a non-governmental view on how things are working and how they should work. The introduction to the panel will include a recent history of regional ocean governance efforts around the country.

Ryan H. Dwight*¹. What to do with the *Enterococci* Standard?.

¹Coastal Water Research Group

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U.S. and California water quality standards are based on the dose/response relationship between *Enterococci* levels in recreational marine waters and the risk of contracting significant gastroenteritis. This presentation covers the scientific foundation of the current standard, the numerous publications concerning the uncertainties inherent in the standard, and how the current standard impacts public health and economics. The current standard is causing much controversy in the scientific, political and public arenas. Researchers and others have questioned the current standard based on: 1) Potential other sources of the indicator bacteria; 2) The applicability of the standard to the coastal waters of Southern California; and 3) The inherent variability of water quality testing using indicators instead of pathogens, time delay in obtaining results, and variability of water quality measures over time and space. All of these issues will be presented and countered with published research which show the current use of *Enterococci* is appropriate despite inherent uncertainties. Further, it will be shown that the current standard is not sufficiently stringent to protect the public from exposure to pathogens. This policy failure results in hundreds of thousands of illnesses every year and millions of dollars in economic burden for the Southern California region.

Josh Eagle*¹. Ocean Zoning: Legislative and Administrative Responsibilities.

¹School of Law, University of South Carolina

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Current ocean zoning discourse is focused on three questions: Why might zoning be superior to current management approaches? What kinds of zones should be included in zoning plans? And, how should public opinion, science, and economic information be incorporated into the process of drafting plans? Surprisingly little attention has been paid to institutional design. Most papers and reports contain two implicit assumptions about the ocean zoning enterprise. The first is that government agencies should be responsible for design, approval, and implementation of plans. The second is that one state or federal agency should be responsible for implementing each plan.

The first assumption ignores the important role that legislative bodies play in other zoning contexts. In municipal land-use planning, for example, elected groups such as city councils are responsible for approving zoning plans. And, in "zoning" public lands, legislatures establish criteria for, and approve the designation of, particular places such as parks or wilderness areas. In each context, agency responsibility is limited to the administration of legislatively-created zones. Such allocations of institutional responsibility are not accidental. Legislatures and agencies have distinct incentives, competencies, and Constitutional responsibilities. The act of zoning private or public land, especially when it might result in the exclusion of uses from areas in which they had previously been allowed, is a significant – and highly controversial – task. These aspects of zoning militate toward the conclusion that legislatures, not agencies, should be primarily responsible for crafting and approving plans.

The second assumption discounts the role that multiple agencies might play in the success of the overall enterprise. While a single agency, e.g., a zoning board, implements a land-use plan, a diverse set of agencies administer various public land



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"zones." This approach has advantages, including reduction of system-wide risk through diversification and facilitation of adaptive or experimental management strategies.

Sylvia A. Earle^{*1}. The World Ocean and California: What Is at Stake?

¹Conservation International

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In recent years, human actions have had an unprecedented impact on the health of the ocean, both in California and throughout the globe. A crisis is growing that threatens not only coastal communities that depend directly on living marine resources, but also all people everywhere. The Earth's ocean is a unique feature in our solar system and is essential for maintaining life on this planet. As never before, we are seeing the consequences of abuse in collapsing fish populations, biodiversity loss and physical and chemical changes that are leading to the decline of entire ecosystems. As never again, we have an opportunity now to respond to this crisis, learn from centuries of experience in resource management on land and move beyond localized and ad hoc initiatives – however good they may be – to coordinated global action.

Charles Ehler^{*1}, Fanny Douvere¹. Essential Elements of Sea Use Management: Lessons Learned from International Marine Spatial Planning and Ocean Zoning Practice.

¹Intergovernmental Oceanographic Commission (IOC) and Man and the Biosphere (MAB) Programme, Paris, France

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Considerable work has been done on the conceptual aspects of ecosystem-based, sea use management in the US and other countries of the world. The debate has become academic because of the lack of real practical evidence of what works (good practice) and what does not. However, the goal of implementing ecosystem-based management of marine areas can be moved forward by shifting the focus more toward putting the concept into practice through the tools of marine spatial planning and ocean zoning. This paper will summarize new examples of good practice of marine spatial planning and ocean zoning from around the world to supplement the few well-known examples that are over-used when trying to promote change.

Since the early 1970's the US has led the world in the development of coastal and marine management practice. Over the last decade, however, the centers of innovative practice have moved to other countries. Australia, Canada, and the United Kingdom have become the most innovative countries in implementing marine policies. Belgium, The Netherlands, and Germany have all developed prototype marine spatial plans for their sectors of the North Sea, as has the United Kingdom for the Irish Sea. The People's Republic of China has begun implementing national legislation that requires zoning of uses in its territorial sea; the United Kingdom Has drafted national marine legislation that will authorize marine spatial planning in its seas. The Federal Spatial Planning Act of Germany has recently been amended to extend national sectoral competencies to its EEZ and territorial sea. A Working Group of the OSPAR (Oslo-Paris) Convention is drafting guidelines for marine spatial planning for the Northeast Atlantic region, and the European Union highlighted marine spatial planning in its Maritime Policy released in May 2006. This paper will draw from these international experiences and other cases to define the essential elements of effective ecosystem-based, sea use management, including indicators of successful outcomes, and fundamental activities of management such as performance monitoring and evaluation, enforcement, and stakeholder participation. Lessons for US marine policy and practice will be summarized.

Tim Eichenberg^{*1}. Why Strong Standards Are Needed for Ocean Fish Farming in California.

¹The Ocean Conservancy

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The paper will explain why legislation is needed to establish strong standards for ocean fish farming in California waters.

Richard Eisner^{*1}. California Tsunami Hazards: Science, Policy, and Management.

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Since 1997 the National Oceanic and Atmospheric Administration (NOAA), the Federal Emergency Management Agency (FEMA) and the Governor's Office of Emergency Services (OES) have undergone the process of developing tsunami evacuation planning maps for the State of California. OES is managing the process of the inundation projection generation and has developed a guidance document for use by all coastal counties and jurisdictions in the state. The guidance is intended to assist local governments in use of the inundation projections for evacuation planning, and in dissemination of tsunami watch and warning information within county operational areas as well as to the general public. Naturally, interest in this effort has been significantly heightened since the December 2004 Indian Ocean event. Tsunami modeling was based on potential earthquake sources and hypothetical extreme undersea, near-shore landslide sources. Maximum credible run-up to a specific contour for each county was determined to be reasonable. Modeling was performed by the NOAA/OES-funded University of Southern California (USC) Tsunami Research Group and results were field-verified for accuracy. Detailed maps of future flooding (inundation) are necessary for delineation of evacuation routes and long-term planning in vulnerable coastal communities. In addition, these maps require maintenance and upgrades as better data becomes available and coastal changes occur. Evacuation planning maps are produced by the OES Coastal Region GIS staff based on research data from USC. These products are distributed to operational areas and approved recipients. The entire California coast will be mapped on an approved annual funding schedule from NOAA. Outreach, planning and collaboration by GIS, field coordinators and operational areas planning and collaboration by GIS, field coordinators and operational areas are ongoing. The maps are intended for local jurisdictional, coastal evacuation planning uses only.

Julia A. Ekstrom*¹. Evaluating Current Ocean Management Systems to Facilitate the Development of Ecosystem-Based Management.

¹University of California, Santa Barbara

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This project identifies and prioritizes inconsistencies and gaps in marine management in order to strengthen the California Ocean Protection Council's priority tool to implement COPA. As California shifts marine management from a sector and species-based approach to EBM, knowledge must improve of the governance systems and ecological environments. Perhaps most challenging for implementation, EBM requires that management agencies address tradeoffs, inherent to ecological systems, making management decisions consistent with one another. Understanding the existing governance systems that guide marine activities is a fundamental variable that needs to be considered when implementing EBM. To understand the overall system, analysis of laws from multiple sectors (i.e. fisheries, transportation, and mining) needs to be conducted.

This paper presents the methodology of a dissertation project that quantifies gaps in marine management, aiming to facilitate the implementation of ecosystem-based management (EBM) for California's coastal and marine ecosystems. Working with relevant state and federal agencies, this project acquired baseline information on the existing management within the California Current Large Marine Ecosystem (CCLME), encompassing the coastal watersheds from Washington to Baja California Sur, Mexico seaward approximately 500nm. To discover and quantify relationships between management laws a novel methodology answers questions such as "What are the inconsistencies in ocean policies?" and "Where can coordination be improved to develop EBM?" The method used for this dissertation comprehensively and quantitatively describes the nature and extent of interactions between marine management institutions analyzing the laws and regulations using patented digital integration software. This technology allowed the researcher to upload and divide digital documents into useful pieces (by article or section). It automatically indexes these pieces and uploads them into a web-based database where I can view sections of documents that relate to queries (see <http://julie.tierit.com>). This project validates the quantitative results by conducting case study analyses to assess significantly conflicting sectors in the context of EBM, involving surveys and interviews with key players in marine management.

Mercedes Erdey-Heydorn*¹, **Gary H. Greene**¹, **Ben Becker**². The Potential Marine Benthic Habitat Types of the Point Reyes Region: Mapping the Shallow Nearshore with Multibeam Side-Scan Sonar.

¹Moss Landing Marine Laboratories, ²Point Reyes National Park, National Park Service

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Recent mapping in the shallow nearshore within the boundaries of the National Parks Services' Point Reyes Reserve and adjoining areas using a GeoAcoustics? 470 kHz multibeam side-scan sonar and interferometric bathymetric mapping system



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revealed a rugged and complex seafloor. This survey was undertaken to characterize potential marine benthic habitats that exist from the shoreline out to ¼ miles offshore. Two separate areas were surveyed; one around Point Reyes itself, the other along the stretch of coast north of Duxbury Reef. The data collected imaged in detail basement and bedrock outcrops, sand and gravel bedforms, and flat sediment covered seabed. Around Point Reyes the granite rock outcrops appear to be fractured and faulted hard substrate while the mudstones of the Monterey Formation that make up Duxbury Reef is imaged as folded and deformed differentially eroded, highly rugose bedrock outcrops. Over 21 distinct habitat types were defined and many, especially the rugged basement and bedrock exposures, appear as good habitat for rockfishes. These maps should provide useful information in any MPA consideration and represent the most up-to-date high-resolution mapping methodology. Attempt was made to develop an auto-classification toolset in ArcGIS using supervised image classification tools. First-derivative images (such as slope, TPI, rugosity) were created from the training dataset using ArcGIS Spatial Analyst tools. These datasets and backscatter intensity were then used as input to supervised image classification. The results of the classification were tested on the rest of the data and ground-truthed using sediment samples. The auto-habitat classification technique will be tested in areas where active habitat mapping is taking place and will therefore directly benefit fisheries scientists and managers.

Lesley Ewing^{*1}. Implications for California's Open Ocean Coast from Accelerated Sea Level Rise.

¹California Coastal Commission

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The dynamic nature of the coast has been considered in most coastal planning efforts over the past 30 plus years since the California Coastal Act was enacted. Sea level change, through tides, wave action, atmospheric forcing, storms, El Niños, tsunamis, subsidence and eustatic change, all contribute to shoreline change on a variety of temporal and spatial scales. These factors are considered to varying extents in development of Local Coastal Programs, review of development for set backs from beaches, bluffs or wetlands and decisions on mitigation projects or structures that alter the shoreline. While various coastline and shoreline planning and management efforts for the coast recognize that sea level change is a contributory element to shoreline change, most planning efforts approach sea level rise as a gradual change to which future coastal systems will adapt. Next year, the International Panel of Climate Change releases its next update on global climate, with new predictions for possible ranges of future sea level. It is expected that these new predictions will be higher than those from the 2001 report. Occasional climate studies are predicting a rise in sea level of up to 20 feet. Few if any planning efforts anticipate such conditions or have incorporated detailed policies or procedures for addressing draconian changes in sea level trends.

Some steps toward examination of the coastal responses to a rapid rise in sea level are (1) using current or historic surrogate conditions, such as El Niños, floods, tsunamis or subsidence, as qualitative models of future shoreline change; (2) assessing adaptability of various coastal features (both natural and constructed) to changes in sea level; (3) determining the sea conditions which would exceed the adaptive capacity of various coastal features; and (4) examining the implications for current planning and regulatory efforts.

Lesley C. Ewing^{*1}. The Coastal Management Framework for Shoreline Planning.

¹California Coastal Commission

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Shoreline change and shoreline erosion is a concern for much of the California coast. The forces causing shoreline change and shoreline erosion function on a variety of spatial scales – from the local geologic conditions to regional wave patterns and global sea level change. The potential responses to shoreline erosion problems also develop along these same spatial scales from the individual property owner, to the local community and regional, state and federal entities. At the larger scales of response there are a broad range of potential options to address shoreline erosion, but as the scale of response becomes smaller, so do the range of potential options. Southern Monterey Bay Shoreline Erosion Task Force and the Beach Erosion Authority for Clean Oceans and Nourishment are two examples of efforts in central California to address proactive shoreline planning and management at a regional scale.

One common element for almost all responses to shoreline erosion is the need for review under and consistency with the California Coastal Act. The Coastal Act provides for opportunities to undertake pro-active shoreline management through



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Local Coastal Programs or the development of shoreline management elements. To put the regional options into context, this presentation will cover some of the key aspects of the California Coastal Act that relate to planning and management for shoreline change and California's current coastal management framework.

Christina C. Fahy^{*1}. U.S. Domestic and International Activities to Aid in the Conservation and Recovery of Sea Turtles.

¹National Marine Fisheries Service

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Sea turtles are listed under the U.S. Endangered Species Act and are therefore at risk of becoming extinct in the future, despite inhabiting the world's oceans for over 100 million years. NOAA's National Marine Fisheries Service (NMFS) and the U.S. Fish and Wildlife Service share responsibilities for the research, management and recovery of sea turtle populations under U.S. jurisdiction. These agencies therefore are responsible for helping to manage activities at the federal, state, and local level, both at sea and on the nesting beaches to minimize impacts to sea turtles and ensure recovery of populations. In addition, both agencies are committed to the worldwide protection of sea turtles and are working closely with the international community through various means, including international conventions and agreements, regional fishery management organizations, bilateral agreements, shared research and collaborative monitoring efforts. This paper will provide an overall summary of NMFS and USFWS efforts to conserve and recover sea turtles locally (U.S. west-coast focused), regionally (Pacific-wide), and internationally.

Maurya Falkner^{*1}, Lynn Takata¹, Suzanne Gilmore¹. Directing Policy Development: California's Marine Invasive Species Program.

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In October 1999, California enacted the first statewide mandatory ballast water management law designed to prevent or reduce the introduction and spread of nonindigenous aquatic species via ship's ballast into California state waters. While the Program's initial focus was on foreign ballast water management, during the 2003 Legislative session the law was reauthorized and structured into a multi-faceted program that more comprehensively pursues the prevention of ANS via commercial shipping. The program melds education and outreach with enforcement efforts, resulting in compliance rate levels exceeding 90%. Stakeholder involvement has become integral to policy development. Technical Advisory Groups (TAGs) consisting of scientists, regulators, and shipping industry representatives, are regularly convened to inform management strategies. In areas where priority information gaps have been identified, the program provides limited logistical and financial support. Finally, the program maintains a database that has tracked ballasting practices of vessels entering California since 2000. The system contains a valuable time series of data that can be used to advance management and research in the field.

Katherine L. Farnsworth^{*1}, Jonathan A. Warrick¹. Storm Timing and Dispersal of Fine Sediment into the California Coastal Ocean.

¹U.S. Geological Survey

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The California Coastal Sediment Management Workgroup is developing information on the natural distribution of fine-grained sediment in the coastal ocean as a tool to evaluate the potential impacts associated with sediment management activities. State and Federal agencies are partnering to develop regional solutions to coastal erosion and sedimentation by developing a Sediment Master Plan. The 'Mud Budget' project aims to characterize the natural flux, transport and fate of fine-grained sediment in the California coastal ocean. Without this baseline information, it is impossible to determine how and to what degree human activities alter these natural cycles. Understanding the regional fate and transport of fine-grained materials ('Mud Budget') executes the findings and conclusions of the CSMW. Rivers are the major source of fine-grained sediment to the coastal waters, with fluxes ranging from 70-95% of regional fine-grained sediment budgets. This delivery is very episodic and occurs during infrequent storm events. Due to the small size of the watersheds and their proximity to the coast, the storms that deliver the precipitation to the watersheds also generate storm conditions in the coastal waters. This leads to the processes controlling the dispersal of this material in the ocean being linked not only to fluvial processes but also the



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oceanographic state at the time sediment is delivered. This coupling has direct impacts on the transport and fate of fine-grained sediment delivered to the coastal waters. Critical shear stresses from storm-induced waves surpass those needed to suspend fine-grained material from the sea-floor, allowing for dispersal of the material over larger areas of the shelf. This coupling of delivery and high energy in the receiving waters, leads to different dispersal rates and processes than would happen under average conditions. Thus, storm delivery of sediment and the potential of transport of this sediment in the ocean are strongly linked.

Norman Fassler-Katz^{*1}. Ensuring the Future of California's Maritime Industries.

¹California Senate Transportation Sub-Committee on California Ports and Goods Movement,

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Our legislative committee responded to the request to participate on this panel organized by the Marine Board. The presentation to be made will deal primarily with the latter theme of "An Uncertain Future". In association with the California Marine and Intermodal Transportation System National Advisory Council (CALMITSAC) whose research project: will have accumulated data and information focused on a proposed evolving statewide strategy. With this information as a base, a California statewide maritime strategic plan is being developed for presentation to the state legislature. Given the extraordinary growth of trade moving across the country through our state's "global gateways", the projections and recommendations will have significant bearing on the national trade economy. We will present the summary of best thinking from around the state on the importance of the ports to the state and U.S economies. The latest thinking and findings on strategies for improving the efficiency, reliability, velocity, capacity and security of the Marine Transportation System (MTS) will be shared during our talk. The strategic plan report will also address the environmental and regulatory challenges facing the future for goods movement in and through the state. Within the context of the plan we will over an overview of the regulations, policies and rules governing the maritime industry. The report will assist participants in grasping the complexity of a system which impacts and affects not only just the physical footprint of our 11 public ports, but rather the entire transportation system; from the water to the homes of the consumers who purchase the goods. We will provide an analysis of how our future projections will impact the future of this wide-based industry. Our plan is to "paint a canvas" of our present condition, overlay it with a view of what is to come in the next 2 decades in order to gain a perspective on methods for accomplishing our objectives of growing goods movement while improving the quality of life for those affected along our freight corridors.

Kate R. Faulkner^{*1}. No Island Is an Island: Restoring Islands to Protect Marine Ecosystems.

¹Channel Islands National Park

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The five islands of Channel Islands National Park provide critical habitat for a wide range of wild life that depend on both marine and terrestrial environments. However, intensive land use practices over the past 150 years have degraded the islands, threatened the persistence of some species, and accelerated erosion from land to offshore habitats. In recent years the National Park Service, in conjunction with numerous partners, has undertaken conservation actions to recover terrestrial habitats and wildlife; in turn, supporting a healthier marine ecosystem. These include: a) eradication of rabbits from Santa Barbara Island, b) elimination of sheep and burros from San Miguel Island, c) removal of cattle and pigs from Santa Rosa Island, d) elimination of sheep and pigs (in progress) from Santa Cruz Island, and e) eradication of rats from Anacapa Island. The improvements to the marine environment have been reestablishment of vegetation that benefits nesting seabirds, decreased erosion, improved freshwater and marine water quality, and elimination of direct predation on nesting seabirds, eggs, and chicks. Additionally, the national park and our partners work to reestablish species, such as the bald eagle and peregrine falcon, which were eliminated due to human impacts. Funding from the Montrose Settlements Restoration Program is supporting the reestablishment of bald eagles and the enhancement of island habitats to better support nesting seabirds. The many ecological restoration efforts on the Channel Islands are resulting in improved conditions for marine-dependent plants and animals. Additionally, many of these projects have had a high public profile and have increased awareness of the need to protect and restore our finite marine resources.



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Lara A. Ferry-Graham^{*1}, Melinda Dorin². Evaluating the Ecological Effects of Once-Through Cooling: Contributions of the WISER Program.

¹Moss Landing Marine Laboratories, ²California Energy Commission

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There are 21 California coastal power plants that utilize once-through cooling technology. Although this cooling technology has been used in California for over 50 years, the ecological effects have not been well studied. In order to improve our understanding of the impact of this technology on the species inhabiting California's coastal and estuarine waters, the Public Interest Energy Research (PIER) Program of the California Energy Commission established the Water Intake Structure Environmental Research (WISER) Program through California State University's Moss Landing Marine Laboratories (<http://ecomorphology.mlml.calstate.edu/WISER.html>). This program is meant to identify and fund research that will further our understanding of entrainment impacts, as well as provide better tools for the reduction or removal of impacts where possible. As the result of a workshop that identified research priorities within the scope of the PIER program, WISER solicited proposals via an RFP, subjected these to broad peer-review, and has funded a number of studies specifically focused on accurately quantifying and preventing entrainment losses. These include studies that will 1) implement new techniques for enumerating entrained species; 2) provide improved life history information for entrained species for improving model estimates of entrainment impacts; 3) integrate computational fluid dynamics for quantifying source water areas; 4) identify and test new anti-entrainment technology, and 5) conduct long term surveys of species abundances in potentially affected areas in order to provide a context for entrainment losses. Research results should begin to be available in 2007. WISER is always looking for additional research that meets PIER goals and informal proposals are welcomed.

Betty Fetscher^{*1}, Joshua N. Collins², John Callaway³, Martha Sutula¹, V. Thomas Parker⁴, Michael Vasey⁴, Emily Briscoe¹. Designing an Ambient Monitoring Approach for Intertidal Wetlands.

¹Southern California Coastal Water Research Project, ²San Francisco Estuary Institute, ³University of San Francisco, ⁴San Francisco State University

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California is building a statewide Wetlands Monitoring Program that aims to evaluate the state's progress toward its goal of "No Net Loss" of wetland resources. Because of the ecological diversity of the state and its complex community of wetland managers, a regional approach to wetland program implementation has been adopted, in which components of program are initially developed and implemented by select regional teams of scientists and partner agencies. This strategy allows the state to build concepts and tools based on regional experience and then transfer this expertise to other regions, and eventually statewide. This session will cover monitoring tools and efforts that are being developed, or are underway, by some of the regional partners involved in the statewide program. These include an updated National Wetland Inventory base layer for determining the extent of wetland resources, a system for tracking wetland losses and gains through projects, and the California Rapid Assessment Method for wetlands (CRAM) tool for measuring wetland condition. In addition, partnerships with existing, site-specific monitoring programs that can inform and complement nascent regional efforts will be discussed. The session will also include an examination of the head-of-tide" in coastal rivers and streams which marks the intersection of watersheds estuaries and oceans land and air. This is an important zone where the effects of sea level rise could affect a great number of natural and anthropogenic conditions and processes. As such it will be necessary to understand what kinds of landscape indicators of ecological health are needed in statewide wetland monitoring in order to assess the potential effects of sea level rise for the California coast.

Sarah Fischer^{*1}, Rikki Groeber-Dunsmore¹, Brian Jordan¹, Kelly Chapin¹, Charles Wahle¹, Bryan Oles¹. Marine Protected Area Science, Assessment, and Analysis: A Coordinated Effort on the U.S. West Coast.

¹NOAA National Marine Protected Areas Center

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As the West coast of United States continues to be at the forefront of federal and state MPA activity, vigorous natural and social science, and has a growing interest in place-based management of marine ecosystems, the MPA Center, in partnership



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with the National Marine Sanctuaries Program, NOAA Fisheries and the National Center for Coastal Ocean Science, will pursue a pilot of the national system on the west coast. This pilot will serve as a foundation for developing the national system. The fundamental goal of the west coast pilot is to facilitate and catalyze the effective use of MPAs as an ecosystem management tool to conserve and protect important marine areas and resources on the West Coast, and to inform the development of a regionally-based national system of MPAs. The pilot is expected to result in: an ongoing regional forum for west coast state, federal and tribal MPA programs to efficiently coordinate their management of existing MPAs and collaboratively plan future efforts; and a suite of tools, methods and information for regional MPA planning and adaptive management. This presentation will describe the parallel tracks science, assessment, and analysis, pursued in conjunction with extensive consultation, collaboration, and coordination among stakeholders and agencies, which the MPA Center is undertaking.

Reinhard E. Flick*^{1,2}. Projected Sea Level Rise and the Beaches of California.

¹California Department of Boating and Waterways, ²Scripps Institution of Oceanography, University of California, San Diego
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Beaches in California will be negatively affected by future sea level rise, especially if some of the more dramatic scenarios become reality, such as a 6-m rise over the next century or two. The effects of a more modest 50-cm sea level rise on beaches can be estimated in dollar terms by considering both the amount of sand nourishment needed to maintain shoreline position, and the additional amounts required episodically to replace sand stripped off the beaches by infrequent large storms. The amount of sand needed to simply raise the static beach profile 50 cm from the berm at a nominal elevation of about 2 m to the normal offshore closure depth of 10 m on an overall slope of 1:100, is 600 m³/m. Since there are about 320 km of beach between Point Conception and the Mexican border, 192 million m³ of sand would be necessary to maintain shoreline position in compensation only for such a rise in sea level. At an estimated price of \$5 to \$10 per cubic meter, the total cost for this amount of sand would be in the range of \$1.25 to \$2.5 billion over the next century. However, in order to maintain shoreline position, additional amounts of "extra" replenishment sand in the future will be needed over and above the amounts necessary to offset only the static rise in sea level and the amount permanently removed by each large storm. Assuming that three major storm episodes occur in the next century, and depending upon their timing, an additional 2.5 times the amount of sand needed to compensate for the static global warming sea level rise alone may be needed. The projected cost for this "extra" sand would range from \$3.75 to \$7.5 billion over the next century.

Reinhard E. Flick*¹, **M. Hany S. Elwany**¹, **J. R. Wanetick**¹, **Robert S. Grove**². Beach Width Change Related to Construction of San Onofre Nuclear Generating Station (SONGS), 1964-1985.

¹Scripps Institution of Oceanography, ²Southern California Edison Company
*Presenter's E-mail: ref@coast.ucsd.edu

The 20-year construction history of the San Onofre Nuclear Generating Station (SONGS) offers valuable information useful for planning and evaluating the performance of beach nourishment projects in southern California. SONGS provides a well-documented example of the positive effect of coastal sand nourishment on beach width, and the stabilizing influence of coastal sand retention structures. Between 1964 and 1990, a complete cycle of beach change was observed at SONGS, with a narrow, natural beach at the start, progressing to a much wider and stable beach during construction, and ending with a return to a narrow beach configuration after completion. SONGS Unit 1 construction began at the northern end of Camp Pendleton, CA 2.5 miles south of the Orange County-San Diego County line in 1964. This involved some cliff excavation, digging a foundation, offshore trenching for cooling water pipes, and a lay-down pad using sheet pile driven into the beach for use as a staging area between 1965 and 1968. The much more massive Units 2 and 3 were built between 1974 and 1985. Much more cliff excavation of the 100-ft high sea cliffs was done in addition to foundation work, and dredging for two sets of two 18-ft diameter intake and cooling water pipes. All this resulted in a total of over 1 million cubic yards of sand being placed on the beach by 1975. A second lay-down pad acted as a groin, retarding sand transport from 1975 to 1985. San Onofre State Beach Park, located adjacent to SONGS benefited from a wider beaches during this time. After the Units 2 and 3 lay-down pad sheet pile was removed beginning in 1984, the beach width decreased over the following few years, both at SONGS and at the adjacent state park, especially to the north. Interestingly, the 185,000 cubic yards of sand from the lay-down pad bifurcated with about half moving north, and the other half moving south. Erosion proceeded until the beach returned to a narrow



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condition similar to what existed prior to SONGS construction. The erosion threatened valuable coastal access, including an unpaved road, as well as public infrastructure such as beach picnic and parking areas, and a restroom.

Tom Ford^{*1}, Laura Bodensteiner¹. Santa Monica Bay Needs Your Kelp!

¹Santa Monica Baykeeper

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The Santa Monica Baykeeper Kelp Project began monitoring and restoring the kelp beds of Santa Monica Bay in 1997. From 2001 to 2006, the Kelp Project performed hundreds of biological and physical surveys, and relocated over 98,000 sea urchins. The surveys assessed community structure, including invertebrate, fish, and algal densities. To date, one acre of giant kelp, *Macrocystis pyrifera*, has been restored off of Escondido Beach in Malibu. An additional two acre area is in the early stages of restoration off of Long Point, Palos Verdes. Once restored, these kelp restoration sites have shown increases in fish abundance of 10 to 100 times within one year. The Kelp Project is community based directly incorporating school students, and adults in the restoration and outreach efforts associated with the project.

The restoration and monitoring goals of the Kelp Project incorporate a broad marine community. The project is a platform for future restoration efforts and an example of volunteer monitoring that supports the ecosystem based management goals of the California Ocean Protection Council, California Department of Fish and Game and other agencies. Our efforts provide scientific data and restored habitats; creating a better understood and more robust nearshore community in Santa Monica Bay for present and future generations.

Rod Fujita^{*1}, Mike Dickerson². The Proposed California Fisheries Fund.

¹Environmental Defense, ²ShoreBank Enterprise Pacific

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The California Ocean Protection Act authorizes the creation of a fund to help revitalize California's fisheries. The Ocean Protection Council approved a grant to Environmental Defense, working with ShoreBank Enterprise Pacific, to develop a concept for how such a fund might work. We have completed scoping studies and a needs assessment in several California coastal communities. We will discuss the results of this work and our proposed concept for how capital can be deployed to improve social, environmental, and economic conditions, with a focus on how the proposed California Fisheries Fund could promote better fishery management, research, innovation, and stewardship.

Steven D. Gaines^{*1}, Mark Carr², Rick Starr³, Mary Yoklavich⁴, Steve Palumbi⁵, Loo Botsford⁶, Steven Murray⁷, Jeff Paduan⁸, Heather Galindo⁵, Carrie Kappel⁹. How To Design An Ecological Marine Protected Area Network.

¹Marine Science Institute, University California, Santa Barbara, ²University of California, Santa Cruz, ³California Sea Grant Program, ⁴Southwest Fisheries Science Center, ⁵Hopkins Marine Station, Stanford University, ⁶University of California, Davis,

⁷California State University, Fullerton, ⁸Naval Postgraduate School, ⁹National Center for Ecological Analysis and Synthesis

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The Science Advisory Team that was appointed to advise California's Marine Life Protection Act Initiative developed a suite of science-based criteria for design of ecological networks of marine protection areas (MPAs). The scientists recognized that no single optimum network design would protect the diversity of species and habitats, and accommodate the diversity of human uses of the ocean. To protect the diversity of marine species and habitats, the scientists recommended representing every "key" marine habitat in the MPA network. In addition to biophysical habitats, such as rocky outcrops and banks, soft sediment habitats, and kelp forests, the scientists recommended considering oceanographic circulation features, such as upwelling centers, freshwater plumes, and larval retention areas. To account for differences in distributions of species and shifts in habitat associations due to development through major life stages, scientists recommended designing MPAs that extend from the intertidal zone to deep waters offshore. To protect adult populations of those species likely to benefit, MPAs should have a minimum alongshore span of 5-10 km and ideally 10-20 km, with distances based on adult neighborhood sizes and movement patterns. To facilitate dispersal of young animals out of and between MPAs, the MPAs should be placed within 50-100 km of each other. To evaluate the ecological impacts of MPAs and to buffer against the catastrophic loss of an MPA, at least three to



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five replicate MPAs should be designated for each habitat type within each biogeographic region. MPAs also should consider adjacent terrestrial environment and associated human activities. To facilitate adaptive management, biological changes within MPAs should be monitored and evaluated. By taking into account these criteria, the proposed MPA network designs will likely meet the goals for conservation of marine ecosystems as articulated in California's Marine Life Protection Act.

Newell Garfield^{*1}, Jeffrey Paduan², John Largier³, Heather Kerkerling⁴, Yi Chao⁵, CJ Beegle-Krause⁶, Glen Watabayash⁶.
California's Coastal Ocean Current Monitoring Program (COCMP).

¹San Francisco State University, ²Naval Postgraduate School, ³University of California, Davis, ⁴Central California Ocean Observing System, ⁵Jet Propulsion Laboratory, ⁶NOAA

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The National Oceanic and Atmospheric Administration (NOAA) sponsored Safe Seas 2006, a full-scale response exercise to a simulated ship collision and oil spill in the Gulf of the Farallones National Marine Sanctuary off the Golden Gate. Approximately 40 federal, state, local, private and nonprofit organizations participated in the exercise. The field portion of this scientific spill response exercise was conducted during August 2006. Safe Seas 2006 marked the first time that the NOAA Office of Response and Restoration (OR&R) Hazardous Materials Response Division (HAZMAT) has worked with the Central and Northern California Ocean Observing System (CeNCOOS) in a response exercise. In this presentation we discuss how the NOAA GNOME spill trajectory model was coupled with circulation fields from the Coastal Ocean Currents Monitoring Program (COCMP) Surface Current Mapping Instruments (SCMI) to track the drifters deployed during the exercise to simulate surface pollutants.

Joe Geever^{*1}, Rick Wilson. Ocean Desalination: Getting the Big Picture.

¹Surfrider Foundation

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This presentation will explore the processes for reviewing and permitting ocean desalination facilities in California as an illustration of the findings and recommendations of the recently published reports by the Pew Ocean Commission and the US Commission on Ocean Policy, as well as the California Ocean Protection Council's "Strategic Plan." The presentation gives a brief overview of the substantive environmental issues identified in those reports -- and whether or not current decision-making processes are capable of overcoming the concern over "fragmented" governance highlighted in the reports.

Kirsten Gilardi^{*1}, Jennifer Renzullo¹, Paul K. Dayton², Henry Fastenau³, Jeff June⁴, Edward Saade⁵, Sheila Semans⁶.
Derelict Fishing Gear Removal in California.

¹SeaDoc Society, Wildlife Health Center, University of California, Davis, ²Scripps Institution of Oceanography, ³Bodega Marine Lab, University of California, Davis, ⁴Natural Resources Consultants, Inc., ⁵Fugro Pelagos, Inc., ⁶California State Coastal Conservancy

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Derelict fishing gear is lost commercial and recreational fishing nets, lines, pots, and traps that sit on the seafloor or float in the water column. Because most fishing gear is made of synthetic materials, it remains in the marine environment for decades. Derelict fishing gear negatively impacts the marine ecosystem: it entangles and traps marine organisms, damages the habitat upon which it snags or settles, hinders the deployment of gear by fishermen, presents a navigational hazard to mariners, including submersible operators, and perhaps most importantly, derelict fishing gear can endanger humans, especially divers. The impacts of derelict fishing gear on marine wildlife can be significant. In Hawaii, derelict gear is the most serious human-related threat to the fragile coral reefs of the Northwestern Hawaiian Islands, and it injures and drowns wildlife, including the endangered Hawaiian monk seal. In Washington State's Puget Sound and Northwest Straits region, divers have observed 1 to 3 foot deep accumulations of bird bones under just one of hundreds of derelict nets in the San Juan Islands. In July 2005, the California State Coastal Conservancy and the SeaDoc Society (UC Davis Wildlife Health Center) partnered to establish the California Derelict Fishing Gear Removal Project, with additional support provided by NOAA via the National Fish and Wildlife Foundation and the Northwest Straits Commission. In the pilot year, we developed policies and procedures, acquired permits,



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formed an Advisory Committee, designed and distributed outreach materials, set up a website (www.derelictfishinggear.org) and located and removed derelict fishing gear from state marine waters at specific sites along the coast through contracts with surveyors and commercial divers, as well as volunteer diver efforts. Since July 2006, California Derelict Fishing Gear Removal Project efforts have focused on the Channel Islands National Marine Sanctuary.

Genevieve Giuliano^{*1}. Optimizing Southern California Cargo Movement Flows to Reduce Air Emissions.

¹ METRANS Project, University of Southern California/California State University, Long Beach

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Two themes characterize freight flows in southern California; on one hand are the inter-regional movements of goods that arrive at Los Angeles and Long Beach but are destined for other regions and for which the Los Angeles area is merely an entrepôt. On the other hand are the vast volumes of goods arriving here that must be moved to consignees in the greater Los Angeles region. While both flows generate air quality impacts to the region, virtually all of the intra-regional movement of goods is achieved with diesel trucks, while at least a portion of the inter-regional moves are made via rail, a transportation alternative with fewer adverse air quality impacts per unit of goods moved. The challenge for those of us concerned with the social impacts of goods movement is to find ways of optimizing those intra-regional moves while seeking to improve the air quality performance of the inevitable trucks that must make these short-hauls of arriving and departing goods. Through the work of the METRANS Program at USC, we have striven to study and report on innovations that can achieve these objectives.

Kristina M. Gjerde^{*1}. Global Oceans Governance: The Next Steps.

¹The World Conservation Union (IUCN)

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Almost two-thirds of the oceans lie beyond the zones of national jurisdiction. Yet activities authorized by governments can have a tremendous impact on the ecosystems and biodiversity of the oceans and seabed beyond national jurisdiction (here termed the "High Seas"). The rights and duties of States with respect to utilizing living marine resources, conserving biodiversity and managing human activities in the High Seas are contained in an array of legally binding global and regional agreements, based on the framework provided by the United Nations Convention on the Law of the Sea (UNCLOS). Additional instruments set forth globally agreed commitments, goals and principles for oceans management. However, it is becoming apparent that on the High Seas these duties, commitments, goals and principles are not yet being applied on a consistent basis. In consequence, there are gaps in implementation and coverage that must be addressed. Also lacking are mechanisms such as those now being implemented in California to ensure that governments assess and minimize the impacts of activities and to enable a coherent system of marine protected area networks. Options to improve global oceans governance need to be developed and elaborated, building on lessons learned in California and elsewhere.

This presentation provides a brief orientation to the legal framework for High Seas governance, summarizes recent progress made, and identifies some critical next steps towards achieving integrated, ecosystem-based and precautionary management for the High Seas. It seeks to provide the basis for a wide ranging and stimulating discussion on ways humans can and should manage Earth's last frontier.

Mary Gleason^{*1}, **Will McClintock**², **Paulo Serpa**³, **Chris Ball**³, **Bob Sherwood**⁴, **Brad Pfefferle**⁴. A Decision Support System for Stakeholders, Scientists, and Policy-Makers in the Marine Protected Area Planning Process.

¹The Nature Conservancy, ²Marine Science Institute, University of California, Santa Barbara, ³California Department of Fish and Game, ⁴IM System Group, Inc.

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Science-based marine protected area (MPA) planning requires making essential and complex data available to a wide array of stakeholders, scientists and policy makers, each with different backgrounds and technical expertise. We describe the key ecological and socioeconomic data inputs, decision support tools and analyses used in the Marine Life Protection Act Initiative's Central Coast MPA planning process. We compiled previously dispersed and relatively inaccessible coastal and marine data from California into a common online digital format that formed the basis for MPA planning and evaluation.



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The decision support system included: (1) a marine geodatabase of biophysical and socioeconomic information, (2) web-accessible maps for data display and dissemination, (3) an online MPA decision support tool that allowed stakeholders to cartographically draw and evaluate potential MPAs based on quantitative GIS analysis of thematic data, and (4) a process for providing analytical data on proposed MPAs for evaluation by the MLPA Science Advisory Team (SAT). The planning process was iterative; stakeholders developed alternative MPA packages that were subsequently evaluated by the SAT and then further refined by the stakeholders. Lessons learned during the Central Coast pilot project will guide refinement of the tools and approaches to regional MPA planning in California and beyond. As California will likely be the first state in the U.S. to implement a managed network of MPAs, our decision support system can serve as a model for similar efforts in other state or federal processes.

Steve Goldbeck*¹. San Francisco Bay Regional Sediment Management.

¹Bay Conservation and Development Commission

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The San Francisco Bay estuary is the largest estuary on the Pacific coast. It provides tremendous habitat values, while it is arguably the most urbanized estuary in the United States. The Regional Wetlands Habitat Goals and sub-tidal Habitat Goals processes, are focused on large-scale restoration. This will involve landscape-scale restoration of tidal and sub-tidal areas. Such restoration will require large volumes of sediments. Similarly, the Long Term Management Strategy for Dredged Material (LTMS) has focused on keeping Bay navigation channels open while minimizing impacts of dredging and disposal and emphasizing beneficial reuse. Mining of sand from the Bay is increasing as land and riverine sources dry up and demand increases. The State and Federal water projects are managed without regard to impacts on the flow of sediments to the Bay. Restoration of Delta islands would capture massive volumes of sediments. Ocean Beach near the mouth of the Bay is experiencing serious erosion of sand. San Francisco Bay itself appears to have a decreasing sediment load—reflected in decreasing dredging—and resulting in loss of mudflats and remaining tidal marsh. It also could be exposing legacy mercury contamination in sediments laid down during the Gold Rush. Global sea level rise will further erode inter-tidal habitat. These activities and processes are connected by the movement, deposition and erosion of sediments. Surprisingly little is known about Bay sediment dynamics. Management actions are taken largely without regard for affects to sediment systems and habitat. A regional analysis of the sediment dynamics of the San Francisco Bay estuary is needed, including boundary conditions with the coastal ocean and upstream tributaries. There is a fundamental need to understand and manage cultural practices that affect sediment processes on a regional level. Management models for regional sediment management will be assessed.

Jamie Gonzalez*¹. Resolving Coastal Water Quality Protection and Invasive Species Prevention Issues.

¹University of California Sea Grant Extension Program

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The UC Sea Grant Extension Program in San Diego has been working on programs to prevent hull transport of aquatic invasive species (AIS) by recreational vessels and to protect water quality by reducing use of toxic antifoulants. The California Ocean Protection Council's strategic plan and the California Ocean Protection Act address these issues. Antifouling paints are under regulatory scrutiny in California due to elevated levels of dissolved copper in crowded boat basins. Total Maximum Daily Load (TMDL) programs to regulate copper from antifouling paints are complete or are underway in a few, southern California coastal areas. Other areas have been recommended for addition to the list of waterbodies impaired by dissolved copper. The approved TMDL for Shelter Island Yacht Basin in San Diego Bay encourages boat owners to use nontoxic or less toxic hull coatings. The entire California coast has experienced invasion by species not native to the state or to the area of the coast where they have been discovered. Often, AIS introduced as hull fouling have caused ecological damage and millions of dollars worth of structural damage. The National Aquatic Invasive Species Act of 2005 prescribes antifouling paints to control AIS, yet they simply slow fouling instead of preventing it. The Act discourages in-water hull cleaning, yet frequent cleaning is needed to manage fouling growth on nontoxic hull coatings. Hauling and cleaning is nine times the cost of in-water hull cleaning in San Diego. Based on findings from a 2005 workshop on managing hull transport of AIS, policies developed by the Australian government, our projects involving nontoxic coatings and our experience with stakeholders, we will present recommendations to protect water quality while preventing hull-borne AIS.



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Zeke Grader^{*1}. Current Issues in Commercial Fishing and Commercial Fishing Heritage Harbors: Do They Have a Future in California. The Pacific Coast Federation of Fishermen's Association Perspective.

¹Pacific Coast Federation of Fishermen's Association

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The Pacific Coast Federation of Fishermen's Associations (PCFFA) is the oldest and largest association of commercial fishing organizations on the west coast. We represent many of the working men and women of the west coast commercial fishing fleet. Salmon and Dungeness Crab represent the backbone of our membership (although we do a lot more) and are, for the most part, well-managed and absolutely sustainable fisheries if the government would properly manage pollution, our rivers and watersheds. It hasn't been easy to get here though, with commercial salmon permits reduced from about 10,000 in California in 1979 to approximately 2400 today, we have lost a lot of good people, and this State has lost lot of good businesses and fresh seafood production. Less dependent on inland habitat than Pacific salmon, our Dungeness Crab resource remains strong. However, Dungeness Crab is dependent on healthy wetlands. PCFFA urges all parties to come together in habitat protection, proper management of our streams and watersheds, pollution control and promotion of the high quality sustainably harvested seafood that our membership can provide into the future. Working together, we believe California can have a healthy environment, healthy, sustainable fisheries and profitable, well-managed farms.

Karen Green^{*1}. Biological Tools to Support Protection of California's Natural Resources During Sediment Management Activities.

¹Science Applications International Corporation

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The California Sediment Management Workgroup (CSMW) is in the process of developing regional solutions to coastal erosion and sedimentation issues culminating in a Sediment Management Master Plan (SMMP) to facilitate protection, enhancement, and restoration of California's coastal beaches through federal, state, and local cooperative efforts. The Biological Impact Analysis (BIA) study is one of the tools being developed to help coastal managers resolve sediment management issues, streamline permitting, protect natural resources, and implement the SMMP. The BIA was designed as a reference tool for resource and regulatory agencies, engineers and biologists involved in design of coastal protection projects, preparers of environmental documents, and concerned public. The BIA provides a comprehensive review of biological impacts and benefits associated with beach nourishment and related sediment management activities. The document addresses California's varied coastal habitats and associated sensitive species. Reviewed information for habitats and species includes geographic distribution, ecological functions and life history characteristics, adaptations and responses to disturbance, impact thresholds and recovery rates, and results of relevant monitoring during and after beach nourishment and related sediment management activities. The review examines the scientific basis of concern associated with different types of sediment management activities for each of the treated habitats and species. The review also examines the different types of impact avoidance and mitigation measures used during beach nourishment and related sediment management projects in California. The BIA provides recommendations for appropriate ways to protect California's resources based on current understanding of potential impacts and protection strategies, and identifies research needs to fill critical information gaps.

Rick Starr¹, Mark Carr², Dan Malone², Dave Osorio³, Kristen Green⁴, Ashley Greenley*⁴. Relationships Between Diver and Commercial Fishing Gear Surveys of Nearshore Fishes.

¹University of California Sea Grant Extension Program, ²University of California, Santa Cruz, ³California Department of Fish and Game, ⁴Moss Landing Marine Labs

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Relatively little fishery dependent or independent information is available to evaluate nearshore fish populations. The Department of Fish and Game (CDFG) has started to collect landings, logbook, and other fishery dependent information, and in conjunction with other marine scientists, has developed a standardized protocol for diver surveys of nearshore fishes and invertebrates. As fishery dependent and fishery independent information are collected, however, it is important to understand what the data represent, i.e., how the different sampling techniques relate to one another, how they are affected by environmental variation, and how they vary in time and space. In 2005, we worked with two nearshore commercial



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fishermen to conduct standardized fishing and diving operations in Carmel Bay, California. Our primary objective was to compare estimates of relative abundances and catch per unit effort (CPUE) of nearshore fishes generated from surface-based fishing and SCUBA surveys. We conducted our study in two distinct sites, characterized by high and low relief bottom habitats, to investigate the effects of habitat on fishing and diver surveys. Our last objective was to determine the effects of fish movement in understanding both CPUE and abundance estimates. We tagged more than 1600 fish representing 16 species with external dart tags and also placed sonic transmitters in a total of 36 cabezon, lingcod, and grass rockfish. Each survey method provided a different estimate of species composition and relative abundances of nearshore species. Specific habitat associations were observed in certain species such as the China Rockfish (*Sebastes nebulosus*). Total lengths for six rockfish species (*Sebastes* spp.) were greater at the low relief site than the high relief site. Catch per unit effort, however, was consistently greater at the high relief site for all survey methods.

Jack Gregg^{*1}. Critical Coastal Areas/Areas of Special Biological Significance Interface: The Stakeholder's Challenge.

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The Critical Coastal Area program is a requirement of the state's federally-approved Nonpoint Source Pollution Control Plan that addresses the impacts of land-use on coastal water quality. The primary goal of the CCA program is to address areas of new and expanding development that are impacting (or threatening) coastal water quality by applying the policies and practices of the NPS program (Management Measures or MMs) to those watersheds. State agency staff and land-use specific stakeholders are currently working on appropriate applications of those federally-required measures based on California's regulatory structure and polluted runoff issues. While the state has a plan to gradually implement the management measures based on available resources and water quality threat, the CCAs are conceived as testing grounds where all appropriate MMs will be implemented as soon as possible and where gaps in environmental protection will be filled by developing new management measures.

This program can support both the protection of high quality waters (e.g., ASBSs) and the restoration of water quality in impaired waters (e.g., CWA 303(d) listed waters) by working with local stakeholders and agencies to assess the watershed for sources of polluted runoff, identifying appropriate MMs, educating land-use decision-makers and seeking resources to implement appropriate management practices, including modifications to local planning ordinances where needed. While the CCA program does not have direct federal or state funding, it has been developed by the committed actions of state agency staff, in cooperation with staff of the Ocean Conservancy, and has encouraged local stakeholders seek state and federal grants for watershed assessment and implementation. State agencies are currently working with stakeholders in Humboldt, Sonoma, Marin, San Mateo, Santa Cruz, Orange and San Diego Counties to assess nonpoint source issues and develop recommendations for implementation of all appropriate management measures.

John Griffith^{*1}, **Stephen B. Weisberg**¹. Rapid Methods for Measuring Microbiological Quality of Recreational Water.

¹Southern California Coastal Water Research Project

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Public health officials routinely monitor fecal indicator bacteria levels to assess beach water quality. However, present laboratory processing methods require approximately 24 hours for completion and swimmers may be exposed to poor water quality during this time. New, more rapid assessment methods that would allow for same-day water quality warnings are under development, but require rigorous independent testing. This study evaluated new methods being developed by six research groups. Three groups utilized Quantitative Polymerase Chain Reaction (QPCR). The remaining three groups used either Transcription-mediated Amplification (TMA), Dual-Wavelength Fluorimetry (DWF) or an immunological dipstick method designed to provide a binary answer about whether bacterial concentrations in a sample exceed California's single-sample standard. The study focused on methods for enumerating enterococcus, but two of the groups using QPCR methods and the group using DWF also measured *E. coli* in their test samples. The immunological dipstick method targeted only *E. coli*. Results from two of the QPCR methods and the TMA method were more than 80% accurate with respect to the State standard for enterococci and also proved consistent in terms of effect on beach management decisions, concurring with decisions based on traditional methods results for more than 75% of the samples. Results for one of the *E. coli* QPCR methods were even more promising, with 90% agreement about beach management decisions, which was comparable to the rate of agreement



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between the two traditional methods used in this study. These results have positive implications for the implementation of molecular-based measurement methods for fecal indicator bacteria in the near future.

John Griffith^{*1}, Kenneth C. Schiff¹, Gregory Lyon¹. Microbiological Water Quality at Non-Human Impacted Reference Beaches in Southern California During Wet Weather.

¹Southern California Coastal Water Research Project

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Although wet weather discharges from urban watersheds often have elevated concentrations of fecal indicator bacteria that impact water quality at swimming beaches, not all of these bacteria may arise from human sources. In this study, the contribution of non-human sources of bacteria was quantified at coastal reference beaches in southern California. Operationally, reference beaches were defined as open beaches with breaking waves that receive runoff from undeveloped (93% open space) watersheds and were selected to represent a range of geographical conditions and a range of watershed sizes. Six reference beaches were sampled during storm events during the 2004-2005 and 2005-2006 wet seasons. Samples were analyzed for total coliform, E. coli, and enterococci in the discharge from the undeveloped watershed and in the wave wash where the discharge and surf zone initially mix. Samples collected during wet weather exceeded water quality thresholds established by the State of California greater than 10 times more frequently during wet weather than during recent dry weather in summer or winter, although the frequency differed by beach. These exceedences were greatest 24 hrs following recorded rainfall, then steadily declined for the following three days. Early season storms exceeded water quality thresholds more frequently than did late season storms, often for multiple indicators. In contrast, the vast majority of late season storms only exceeded thresholds for a single bacterial indicator. Large storms exceeded water quality thresholds three times more frequently than smaller-sized storms. This was partly due to the breaching of sand berms during large storm events; small storms could not breach these berms and this restricted watershed discharges from entering the surf zone. When watershed discharges did enter the surf zone, bacterial concentrations in the wave wash were correlated with watershed bacterial flux.

Gary Griggs^{*1}, Matt Slagel². Regional Approaches to Coastal Protection.

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With sea level rising globally and coastlines in most places retreating, public agencies as well as ocean front property owners are becoming increasingly concerned about this ongoing land loss. While cities, counties, as well as coastal home and business owners, are looking at all approaches for dealing with the ongoing erosion, the number of options is limited: 1) do nothing, 2) retreat, and either move the structure landward or demolish the building, 3) nourish or add sand to the fronting beach, with or without a sand retention structure, or 4) armor the coastline. Historically, the typical response to coastal erosion or shoreline retreat has been the construction of a seawall, revetment, or other hard structure. In California, as of 2004, 10% of the state's 1100 miles of coastline had been armored. Considerable public concern has arisen in recent years, however, about the perceived direct or indirect impacts of these. Many of the older seawalls were constructed by individual property owners as stand-alone projects, rather than as part of any regional or integrated effort. As a result, there are many areas where an unsightly assemblage of un-engineered or poorly planned structures exist side by side, which not only are seen as undesirable by the public and permitting agencies, but they also do not provide a uniformly resistant alongshore protection effort. One relatively recent alternative approach in California has been the use of reinforced gunnite, which is colored and sculpted to match the native rock in the cliffs as closely as possible. Colored and textured gunnite or soil-nail walls have been used to stabilize highway road cuts, but only recently has this approach been applied to coastal protection projects as a way to mitigate the visual impacts, but also greatly reduce placement losses or the amount of beach covered by a seawall or revetment.

Gary Griggs^{*1}. Considerations for Beach Nourishment in California.

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Nourished shorelines provide two primary benefits: increased area for recreation, and greater protection against coastal storms. Beach nourishment in California was historically a byproduct of coastal construction or maintenance projects (opportunistic nourishment), and was concentrated primarily in the southern part of the state where over 130 million yds³ of sand were added to the beaches between 1930 and 1993. About half of this amount was divided evenly between the Santa Monica and the Silver Strand littoral cells where the beaches widened significantly. Because of California's high littoral drift rates, beach nourishment, unless it accompanied by some structure for retaining the sand, may not provide a long-term solution to narrow beaches or beach erosion in California. In the absence of any permanent reductions to littoral sand supply, beaches over the long-term will tend to approach some seasonal equilibrium width which is a function of the available littoral sand, the location of barriers or obstructions to littoral transport, the shoreline orientation and angle of wave approach. While beach nourishment appears to be an attractive alternative to either armoring or retreat, there are a number of issues or considerations that need to be carefully evaluated and addressed. These include: the availability of large quantities of beach compatible sand and the impacts and logistics of transporting it to the site, effects of sand placement, life span of the fill, and the costs and financial responsibility for the initial project and subsequent re-nourishment. Now that California's largest dedicated beach nourishment project (SANDAG) has been completed and systematically monitored, government agencies have the opportunity to assess the cost effectiveness of this approach prior to initiating other large-scale nourishment projects. The limitations and costs associated with beach nourishment must be balanced by the ultimate public benefits of the project.

Scott H. Grove*¹. Physical Properties of Southern California Beaches and People's Preferences: Considerations for Beach Nourishment Planning.

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Beaches are California's "number one" tourist and recreational destination. This study of Southern California beaches has two parts. Part 1 provides a snapshot of Southern California beaches, recording the comparative physical properties at intervals along the 200-mile shoreline from Point Conception to the San Diego border. The results of the first part of the study show that beaches in Southern California vary dramatically in terms of width as well as sand type, color, and texture. The second part of this study is a survey of people's opinions about these beaches. For this part, a "Beach Sand Survey" was given to 225 people, who were divided into three groups: 1) the public, i.e., recreational beach users; 2) coastal resource scientists, agency professionals, and educators; and 3) coastal engineers and geologists. The survey was designed to assess what physical factors of beaches are considered important by various users and interest groups. The survey results revealed that people have a wide variety of reasons for enjoying Southern California beaches and a wide variety of perceptions about these beaches. For example, while most people prefer moderately wide beaches with fine-textured sand, some favor very narrow, pebbly beaches, noting that these types of beaches may be adjacent to the best places for either surfing or tide-pooling. The "Beach Sand Survey" also asked whether people were in favor of restoring Southern California beaches using beach nourishment if erosion has unfavorably narrowed them. People had mixed opinions regarding bringing new sand onto beaches, with the majority favoring nourishment and willing to pay an extra tax to restore their beaches.

Robert T. Guza*¹. Overview of the Huntington Beach '06 Field Experiment.

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The Southern California Coastal Observing System (SCCOOS) includes a coordinated network of observations and models that will provide real-time monitoring and assessment of coastal ocean conditions. HF radars measurements are a key element, and provide continuous estimates of the ocean surface circulation over most of the Southern California shelf. However, currents within about 2 km of the shoreline are not measured. Furthermore, very close to the shoreline, breaking surface gravity waves drive currents that can be stronger than the wind- and density-driven currents observed immediately offshore. An objective of the Huntington Beach field experiment (HB06) is to obtain observations that can be used to develop and test models for inner-shelf and surfzone circulation. SCCOOS future plans include implementing operational versions of the models for Huntington Beach and elsewhere. HB06 is a collaborative experiment that includes participants from USC, UCSB, UCLA, JPL, UCSD (Scripps), Cal Poly, USGS, SAIC, Orange County Sanitation District, and the Southern California Coastal Water Research Program. A cross-shore transect will extend from the shoreline to about 8 km offshore (depth 70 m), with the instrumentation concentrated within a few km of shore. Currents and temperature will be measured over the



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water column, with sampling designed to resolve the passage of energetic internal bores that may contribute to cross-shelf exchange at this site. Lagrangian observations of drifters and dye will be obtained, and used to develop models for mixing and dispersion. A pair of AUVs, and extensive bottle sampling, will be used to map distributions of chlorophyll, FIBS, and nutrients. An overview of the field experiment, underway at the time of this conference, will be presented.

Dan Haifley*. Tomorrow's Ocean Stewards.

¹O'Neill Sea Odyssey

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To sustain the policy goals of the California Ocean Protection Council's Strategic Plan and to implement the California Ocean Strategy, California must commit resources for basic ocean education to California's youth, particularly for low-income and minority youth. To successfully do that, we must demonstrate that ocean concepts can positively contribute to academic achievement. One initiative is the inclusion of the Ocean Literacy Essential Principles and Fundamental Concepts [www.coexploration.org/oceanliteracy](http://coexploration.org/oceanliteracy) in academic standards and formal and informal education curricula. Measuring program objectives is expected by educators that use and donors that support informal education programs. Formal educators must "teach to the standards" and be successful in required student testing. Formal and informal educators must therefore demonstrate the alignment of ocean-based curricula to the Standards, and develop evaluation tools that demonstrate their success in raising academic achievement. Because environmental education is recognized as an integrator of academic subjects, using ocean-based education to promote academic achievement is a credible proposition to educators and decision-makers. Under a grant from the Toyota USA Foundation, O'Neill Sea Odyssey and the Monterey Bay national marine Sanctuary translated its curriculum into Spanish, aligned it with State and Federal academic standards, and developed the "O'Neill Sea Odyssey: Investigations in a National Marine Sanctuary" handbook (<http://montereybay.noaa.gov/educate/curric.html>) and distributed it nationally. OSO worked with the Sierra Club's Youth In Wilderness Project on approval of California Assembly Bill 1330, to study the impact of outdoor education. The study found that children who attended outdoor education had science scores 27% higher than those who did not (http://www.yni.org/yi/standards_project/pdf/AB1330summary.pdf). During the 2004/2005 school year cycle 71.5% of OSO students served were ethnic minorities, and 63% were English learners. We postulate that resources must be devoted to ocean concepts to California's next generation, and to demonstrating the role those concepts have in raising academic achievement.

Jeffrey P. Haltiner*. Managing Sediment Processes in the Morro Bay Ecosystem.

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Morro Bay is an active port/marina as well as one of the most important intertidal estuarine wetland systems along the central California coast. The Bay is part of the National Estuary Program (NEP), and supports numerous species of fish, birds, invertebrates and other wildlife. Early PWA research identified rapid bay sedimentation as a threat to the long-term sustainability of both boating and the habitat functions in the Bay. Our results indicated that the Bay had lost approximately 25-percent of its intertidal volume over the past 100 years Subsequent studies identified bay sediment sources, including littoral sand transport to the bay (via the harbor mouth), aeolian transport of barrier beach sand, and fine sediment from the upstream watersheds (Chorro and Los Osos Creeks). Subsequently, a Bay masterplan was developed (through the NEP) to guide future studies and actions. In response to these policy guidelines, studies have been conducted to clarify the problem, and sediment management projects have been implemented. Subsequent studies have included hydrologic and sediment supply modeling in the watershed. In the bay, hydrodynamic models have been developed to describe bay circulation, and a sedimentation model developed and calibrated. This latter model was used to predict the future evolution of the bay, both assuming existing levels of sediment inflow, as well as the benefits of watershed sediment reduction on extending the life of the bay. Sediment management programs have included the acquisition of a large former floodplain site near the downstream end of the Chorro Creek watershed and removal of channel levees to allow sediment trapping on the floodplain, and a wide range of smaller sediment control projects conducted throughout the watersheds.



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Jessica Hamilton^{*1}. Oregon State Perspective on West Coast Regional Collaboration to Address Ocean Health.

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The Pew Oceans Commission, the U.S. Commission on Ocean Policy and the U.S. Ocean Action Plan all recommend advancing regional ocean governance to address the growing challenges we face in our oceans and coastal zones. With gubernatorial support, California, Oregon and Washington are collectively preparing a West Coast Governors' statement on regional collaboration to address ocean health. For over three decades, Oregon has been a national leader in managing its ocean resources for the benefit of future generations. The roots of Oregon's Ocean Resources Management Program (Ocean Program) reach back to the early 1970s when concerns were raised over effects from potential drilling for oil and gas in federal waters and foreign fishing fleets working to within three miles of shore. In 1991, a separate body was created to give coordinated policy advice to the Governor, state agencies, and others and to prepare a plan for Oregon's Territorial Sea. This Ocean Policy Advisory Council (OPAC) is comprised of ocean users, local governments, other interested parties, seven state agencies, Oregon Sea Grant, and other non-voting members. Governor Ted Kulongoski asked OPAC to take two important steps towards managing ocean resources as an ecosystem. First, Governor Kulongoski directed OPAC to implement its 2002 recommendation that the state designate a limited network of marine reserves for ecological purposes. Second, the Governor asked that OPAC advise him regarding the establishment of a National Marine Sanctuary off of Oregon's coast to help coordinate state and federal management of the marine environment and uses such as fisheries, research, energy development, water quality, and recreation and increase Oregon's competitive advantage for federal ocean research funds.

John Hamrick^{*1}, John P. Craig¹, Peter Kozelka², Stephen Carter¹, L.B. Nye³, Amy King¹, David Smith², Mark Sievers¹.
Modeling and Managing Land-Based Sources of Runoff on Estuarine and Near-Shore Resources.

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Large urban harbor systems, such as Los Angles and Long Beach, pose significant challenges with respect to mitigating water quality impairment required under the EPA's TMDL and Superfund programs. Water quality impairment in harbor systems typically includes failure to meet conventional water quality standards as well as thresholds associated with organic compounds and metals in sediment, water and fish tissue. Linked or couple hydrodynamic and water quality models provide powerful tools for evaluating the transport and fate of contaminants and evaluation of source control alternatives. Selection and application of the approach for this study included input from all affected stakeholders, including the US EPA, LARWQCB, Port of Los Angeles, Port of Long Beach, City of Los Angeles, Los Angeles County, City of Long Beach. Because the region to be modeled includes the interconnected harbors, a portion of adjacent San Pedro Bay and three river tributaries, Dominguez Channel, Los Angeles River, and San Gabriel River, a multi-dimensional modeling system applicable for a range of hydrodynamic environments was required. The EFDC model was selected based on its proven ability to simulate the complex hydrodynamic and sediment transport processes responsible for moving organic pollutants and sediment adsorbed metals in environments ranging from the coastal ocean to rivers. The public domain status of the model and its support by EPA further strengthened consensus in that the model would be ultimately available to stakeholders. This paper will describe the development of the models and the linking the primary EFDC Harbor model to the watershed models of the harbors major watersheds and EFDC models of tributaries. Results of model calibration for hydrodynamics, sediment transport, and fate and transport of sorptive contaminants will be presented along with examples of how the model can be used to identify source distribution uncertainty and control strategies necessary for TMDL implementation.

Herrick E. Hanks^{*1}. Rocks, Ecosystems, Partners, and Gateways: Assembling the Components for the Implementation of the California Coastal National Monument.

¹California Coastal National Monument

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The California Coastal National Monument (CCNM) is arguably the Nation's most unique national monument. Under the jurisdiction of the U.S. Department of the Interior's Bureau of Land Management, the CCNM consisting of a network of more than 20,000 offshore rocks, small islands, exposed reefs, and pinnacles that runs the length of the California coastline.



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Established by Presidential Proclamation on January 11, 2000, the stated purpose of the CCNM is to elevate the protection of “all unappropriated or unreserved lands and interest in lands owned or controlled by the United States in the form of islands, rocks, exposed reefs, and pinnacles above mean high tide within 12 nautical miles of the shoreline of the State of California.” The proclamation recognized the CCNM as a biological treasure with overwhelming scenic value and established the CCNM to protect these “irreplaceable scientific values vital to protecting the fragile ecosystems of the California’s coastline.” With a national monument that is as extensive as the CCNM, adjoining or intertwined with a wide variety of jurisdictions, and limited in specific data regarding its various abiotic, biotic, and cultural resources and resource values, the CCNM creates a variety of challenges and opportunities. The award winning resource management plan for CCNM that provides the framework to begin the implementation of this unique coastal resource was completed within the past year. This paper discusses the management approach developed for the CCNM through the planning process, including the major aspects of preservation (management focus), landscape (ecosystem focus), partnerships (collaboration focus), and communities (local focus), as well as the implementation priorities of this “partnership in protection unique California coastal resources.”

Karen Hansen^{*1}, Peter Schaumberg¹. New Rules for Development of Ocean Resources.

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The U.S. is at a critical juncture regarding our use and conservation of ocean resources. Ocean-based economic activity represents over \$4.5 trillion (approximately half of GDP). Most of the world's oceans remain unexplored. At the same time, however, we are “loving our oceans to death.” Thoughtful change is imperative to address the urgent threats facing our oceans while also responding to the call to explore and sustainably develop ocean resources.

Congress recently amended federal policy regarding off-shore uses. The Energy Policy Act of 2005 provides new authorities to facilitate renewable energy production and alternative uses of the outer continental shelf (“OCS”). The Minerals Management Service (“MMS”) manages the OCS oil and gas leasing program and is in charge of implementing the new alternative energy program. Research and commercial access to valuable OCS ocean resources (e.g., mineral resources like methane hydrates and non-mineral resources like waves and wind) is likely to increase. The Act contains economic, environmental, and legal criteria for evaluating new uses of the OCS. MMS recently embarked on an extensive rulemaking process to implement its new responsibilities

This presentation will discuss the new OCS authorities and the rulemaking underway to implement them. The presentation will address a full range of environmental and economic issues that will be addressed in the rulemaking, such as means of developing and providing access, whether to affirmatively designate areas of the OCS for certain types of development based on research and data or merely respond to specific proposals for new uses in specific areas, how to ensure fair competition among existing and new uses and minimize multi-use conflicts, how to value and assure a fair return to the U.S. in establishing costs associated with new uses, how to incorporate environmental requirements into any new program, and how to balance environmental and energy needs. In addition, this presentation will address the MMS rulemaking in conjunction with the California OPC's objective to encourage sustainable economic uses of the ocean.

Cheryl Hapke^{*1}, Dave Reid¹, Krystal Green¹. Long-Term Coastal Cliff Retreat in California: A Systematic Analysis.

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Approximately 72% of the coastline in California is backed by cliffs, and the majority of these are highly developed marine terraces. Various landslide processes along the cliffted portions of coast, such as block falls and slumps, threaten coastal development and jeopardize community infrastructure. High-relief stretches of coast, such as the Big Sur coast, make up 13% of the cliffted coastline. Although these areas are typically sparsely developed, large-scale landslides such as those along the Big Sur coast regularly cause damage to highways and local roads. Critical baseline information regarding coastal cliff retreat in California only exists at the local level, and no consistent methodology has been applied statewide to assess cliff erosion rates. Recently, the U.S. Geological Survey has undertaken a systematic analysis to calculate coastal cliff retreat rates in California as part of the National Assessment of Coastal Hazards project. For this analysis, transects along which cliff retreat was calculated were spaced at 20 m intervals, where data were available. Data sources were 1930s-era NOS T-sheets



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and either 1998 or 2001 topographic lidar, resulting in approximately 70 years of change. Cliff retreat rates were generated for 350 km of coast, using over 17,000 transects. Regional results indicate that Northern California has the highest average retreat rates (-0.4 m/yr), followed by Central and Southern California (-0.3 m/yr and -0.2 m/yr, respectively). These averages are influenced by erosion hotspots associated with large coastal landslides and slumps. The highest rate in the state was measured just north of Pillar Point near Half Moon Bay in Central California, where the 70-year cliff retreat rate was -3.1 m/yr.

John Kirlin¹, Phillip Isenberg², J. Michael Harty^{*3}, Michael DeLapa^{*1}, Scott McCreary⁴, Melissa Miller-Henson¹, John Ugoretz⁵. Summary of Session: Lessons Learned from the California Marine Life Protection Act Initiative.

¹Marine Life Protection Act Initiative, ²Isenberg/O'Haren, ³Harty Conflict Consulting and Mediation, ⁴CONCUR, Inc., ⁵California Department of Fish and Game

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See "Michael DeLapa" for the summary of this session.

Sean Hastings^{*1}, Billy Causey², Satie Airame³, Mike Osmond⁴. Successes and Challenges in Designating and Managing the Channel Islands Marine Reserves Network.

¹Channel Islands National Marine Sanctuary, ²Florida Keys National Marine Sanctuary, ³University California, Santa Barbara,

⁴World Wildlife Fund

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The Channel Islands National Marine Sanctuary (CINMS), located off the coast of southern California, has been the site of a pioneering state and federal partnership and community-based collaboration to establish a marine reserve network. The Channel Islands region is co-managed by several agencies with overlapping jurisdictions and complementary but distinct mandates to manage fisheries and protect ecosystems. Following a community-based collaboration, two separate but interrelated state and federal regulatory processes to designate a marine reserves network occurred. In 2001, the California Fish and Game Commission established ten marine reserves (no-take areas) and two marine conservation areas (limited-take areas) within the state waters (0-3 nautical miles) of the CINMS. In 2003, the CINMS initiated the federal process to extend the marine reserves into deeper waters and habitats. The Channel Islands Marine Reserves Process has required close coordination among agencies and the public to navigate challenging political, legislative, ecological and economic issues. Ideally, the state and federal management regimes should work to complement one another, to provide comprehensive ecosystem-based and fishery management. The Channel Islands Marine Reserves process has provided an opportunity to tap the collective expertise of fishery and marine protected area managers to better understand the complex and poorly understood marine ecosystems. A first step has required all parties to engage in the respective policy and community forums, namely the Pacific Fishery Management Council and Sanctuary Advisory Council. A second step has been to draw out the value each respective policy and public process contributes to the creation and administration of marine reserves. This presentation will cover the successes and challenges of the designation process and the administration of the reserves network including monitoring, education and outreach and cooperative enforcement.

Arlo Hemphill^{*1}, George Shillinger^{1,2}. Linkages Between Open Ocean and Coastal Waters: Implications for Ocean Governance.

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Management approaches to address increasing uses of the marine environment are often focused on single species groups (e.g. RFMOs with a directive to manage tunas and "tuna like" fishes) or tend to separate management of coastal waters from oceanic habitats. This tendency is demonstrated by a strong focus on the nearshore environment by ICZM agencies, with comprehensive governance decreasing as one moves further offshore.

However, there is growing scientific evidence for strong connectivity between coastal waters and the open ocean out to and beyond limits of national jurisdiction. Some of this connectivity has long been documented in scientific literature, particularly in studies on the life histories of catadromous, anadromous, and diadromous fishes and invertebrates. In recent decades,



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knowledge on the role of coastal wetlands as nurseries and breeding grounds for offshore species has dramatically increased. Recent findings are demonstrating the role of physical oceanography in the distribution of marine wildlife and the transport of drift algae habitat and planktonic larvae between nearshore and offshore habitats. Additionally, cutting edge satellite tracking of marine megafauna shows shown distinct intra and multi-species ocean corridors as well as epicenters of resource use both within coastal and oceanic waters.

The emerging knowledge on coastal-oceanic connectivity is providing the scientific underpinnings for static and ephemeral open-ocean protected areas as well as comprehensive ocean-use planning at the scale of large marine ecosystems (LMEs). Ecosystem based management at such large, regional scales has been highlighted in scientific literature and recent regional and global marine assessments. Governments in turn have begun to adopt this approach via new multi-government agreements such as one guiding collaborative management of the Eastern Tropical Pacific Seascape. However, such agreements represent a new breed of governance and increased integration of policies among States and beyond limits of national jurisdiction is needed.

Selina S. Heppell*¹. Matching Tools and Research Needs to Management Challenges: Life History, Space, and Rebuilding.

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Coastwide rebuilding plans for overfished stocks of groundfish consist of a number of protections, including reduced harvest quotas, capacity reduction, bycatch allocations, and spatial management of fishing effort. Explicit spatial-based management efforts include the Rockfish Conservation Areas (RCAs) and additional protected areas for cowcod (*Sebastodes levis*). Although assessments for overfished species generally incorporate state- or region-specific calculations of population recovery (or lack thereof), with exception of cowcod there has been limited effort to directly document benefits to the stocks that may arise from area-specific management. Reductions in fishing mortality in specific locations should result in an increase in the average age and size of fish there, if the fish are relatively sedentary. However, spatial management also results in a redistribution of fishing effort, which may negatively affect some species even when capacity-reduction is also part of the rebuilding effort. Rockfish, like most marine species, have life history stages that occur in different depths and habitats. While a protected area in one location may confer a survival benefit to adults, in another location the juveniles of the same species may be subject to bycatch mortality or reduced growth or survival due to habitat impacts. Research is needed to assess improvement in stock status on spatial scales smaller than whole coasts or states, and should include response variables that are at the sub-population level. Likewise, stock assessments and evaluation of rebuilding success or failure should include tools that can incorporate this information. Ecologically-based life history models that incorporate mechanisms for population change can be used to evaluate how management actions that affect particular life stages of fish can provide valuable guidance for research and management, and should be added to traditional statistical stock assessment methods.

Marc J. Hershman*¹. Academic Perspective on West Coast Regional Collaboration to Address Ocean Health.

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Regional Ocean Governance (ROG) in the US has followed three main tracks over the past two years: institutional change, promoting ecosystem-based management (EBM), and nurturing a cadre of ocean stewards. Institutional change has occurred at the national, state and regional levels, with formation of new official bodies playing roles in coordination, research planning, ocean literacy, and other similar functions. EBM has been promoted as the foundation principle on which to base ROG, and considerable effort is being put into ways to make the principle "operational". Ocean stewards are needed to advance the cause of ROG, but a broad based "advocacy coalition" involving a wide range of players must still be formed. The US West coast states of California, Oregon and Washington are at the beginning stages of institution building, exploring EBM at the scale of the West Coast range, and developing a focused group of ocean stewards to promote ROG and articulate its goals.

John Hildebrand*¹. Effects of Ocean Ambient Noise on the Marine Ecosystem Off California.

¹Scripps Institution of Oceanography

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Review of the evidence suggests that noise pollution is an important factor in the health of marine ecosystems. There is growing concern that noise introduced into the sea by human activities has detrimental effects on marine mammals and other organisms. Higher levels of ambient noise may interfere with the animals' ability to detect sounds, whether from conspecifics, from prey, or natural sounds that aid in navigation or foraging. Such noise may affect reproductive or immune functions and cause more generalized stress. The effects of other pollutants (e.g., chemicals) may be additive or synergistic with those of noise. Marine mammals' patterns of movement and use of habitat can be affected by ambient noise. For example, gray whales were displaced from a breeding lagoon in Baja California when exposed to industrial development activities including noise, and did not return until several years after the activities stopped. Behavioral reactions to chronic noise exposure, and particularly reactions such as habitat abandonment, may have important consequences for marine ecosystem health. Ambient noise off the California coast has increased at a rate of about 3 dB per decade for at least the past four decades. Repeat ambient noise measurements near San Nicolas Island, reveal about 12 dB of increased noise in the low frequency band (10-80 Hz) between the early 1960's and the early 2000's. These data suggest that both more commercial ships, and increased noise from individual ships have contributed to increases in ambient noise.

Jerry Schubel¹, Christopher Andrews², Nigella Hilgarth^{*3}, Mike Schaadt⁴. Summary of Session: Ocean Literacy: Informal Education through the California Aquarium Collaborative.

¹Aquarium of the Pacific, ²Steinhart Aquarium, ³Birch Aquarium, Scripps Institution of Oceanography, ⁴Cabrillo Marine Aquarium

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Within the past three years two major ocean reports have been issued—the first in 35 years. Both reports underscore the importance of increased ocean literacy in conserving and, when necessary, rehabilitating our coastal and ocean ecosystems. The Nation's Ocean Action Plan issued in response to these reports, also made this a priority.

Four of California's five largest aquariums have joined together to form a collaborative to enhance ocean literacy. Led by the Aquarium of the Pacific, the Collaborative brings together Birch Aquarium at Scripps, Cabrillo Marine Aquarium, and the Steinhart Aquarium. Collectively, these institutions attract about five million visitors each year. The partnership will develop and deliver a set of common ocean messages that apply throughout California and indeed to the world ocean.

The aquariums will supplement these messages with regional messages that are more likely to engage their diverse audiences. The directors of the aquariums will provide a progress report at the conference and seek input from other participants. This work builds on the work of the Centers of Ocean Sciences Excellence (COSEE) and the National Marine Educators Association (NMEA), the Southern California regional workshops held at the Aquarium of the Pacific in 2005 and 2006, and the National Conference on Ocean Literacy (CoOL) held in June 2006.

Phillip Hinesley^{*1}, Kathleen Andrews², Ralph Cantrel³. The Current State of Coastal Management.

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Today there is no better testament of success of the State/ Federal partnership forged by the CZMA than the fact that thirty-four coastal and Great Lakes states, territories and commonwealths have approved coastal management programs. Together, these programs protect more than 99 percent of the nation's 95,331 miles of ocean and Great Lakes coastline. Each one of these State Management Programs is diverse and different, and not one program is exactly the same. This is a credit to the current CZM programs that they are federally financed but managed from a state perspective with federal guidance. Under the CZMA, participating states are given the flexibility to design coastal management programs that address their individual priorities, as long as they meet certain national guidelines as laid out in the original CZMA of 1972.

Rainer Hoenicke^{*1}. Providing Land Use Decision-Makers with Long-Term Implementation Tools for Coastal Watershed Protection: Highlights from Three Case Studies.

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Near-coastal resources are often adversely affected by diffuse sources of pollution with a direct link to certain land use decisions in coastal watersheds. Many water bodies in the coastal zone (streams, beaches, Areas of Special Biological Significance) are "impaired" under Section 303(d) of the Clean Water Act or considered in need of protection. The Critical Coastal Areas Program provides a mechanism for local land use decision-makers to apply GIS-based tools for evaluating the relative impacts of various land use scenarios and the types of policies, restoration, protection, and pollution reduction measures that provide the greatest environmental benefits. Nonpoint source characterization and assessment efforts in three pilot areas (the Watsonville Slough, James Fitzgerald Marine Reserve, and Sonoma Creek watersheds) represent the foundation for identifying specific actions designed to reduce and prevent nonpoint source pollutant impacts and restore water quality and beneficial uses. We are presenting preliminary data showing the relative environmental benefits in coastal watersheds of a variety of proposed management measures, such as creation/restoration of natural treatment areas and enhancement of storm water infiltration.

Bridget A. Hoover*¹. Real People, Real Science, Real Results.

¹Monterey Bay National Marine Sanctuary

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Volunteer monitoring programs have been collecting valuable water quality data within the watersheds of the Monterey Bay National Marine Sanctuary for over 9 years. The Monterey Bay Sanctuary Citizen Watershed Monitoring Network coordinates several large scale volunteer monitoring programs that are developing a core dataset of information that is establishing water quality trends; identifying hot spots for follow up action, and establishing a baseline to which future data can be compared against. Unique programs such as Urban Watch measures urban runoff pollutant concentrations in dry season storm drain outflows. The First Flush program compliments Urban Watch by measuring pollutant concentrations from the same locations, but during the first storm of the season which usually arrives in the dark of night. First Flush data has led to additional upstream source tracking for high metal concentrations. Together, these programs are filling a gap in information by monitoring the quality of water in storm drains, a source of water pollution that is overlooked by traditional monitoring programs. Ultimately, these programs will provide a feedback mechanism on current urban runoff control efforts. Snapshot Day is another monitoring event that brings together approximately 200 volunteers on the first Saturday of May to monitor the health of over 100 rivers and creeks from Pacifica to Morro Bay, CA. For the past seven years, approximately half of the sites monitored have shown no exceedances of water quality objectives established for cold water fish. Approximately 12-15 sites have been designated as Areas of Concern each year because they exceeded 3 of 7 water quality objectives for the parameters measured. The citizen-based water quality monitoring efforts within the Monterey Bay National Marine Sanctuary are providing sound, scientifically defensible water quality information that would not be available if it were not collected by volunteers.

William Douros¹, Chris Mobley², Maria Brown³, Dan Howard*⁴, Holly Price⁵. Hard Bottoms, Soft Bottoms, and the Conservation Science Plan at Cordell Bank National Marine Sanctuary.

¹West Coast Region, NOAA National Marine Sanctuaries, ²Channel Islands National Marine Sanctuary, ³Gulf of the Farallones National Marine Sanctuary, ⁴Cordell Bank National Marine Sanctuary, ⁵Monterey Bay National Marine Sanctuary

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Cordell Bank National Marine Sanctuary was designated in 1989 and is nearing completion of the first revision to the original management plan. The completed plan will guide the management of this special marine area for the next five years. Outside participation was an important element in creating the plan and this external input creates an interesting and unpredictable process. The development of the site's conservation science action plan will be presented as an example of how constituent input shifted the research focus in a new direction and how partnerships and collaboration will be critical for successfully addressing many of the proposed actions in the plan.

Dave Hull*¹. California's Heritage Harbors: Assets Worth Protecting.

¹Recreation and Conservation District, Humboldt Bay Harbor

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The Humboldt Bay Harbor, Recreation and Conservation District was formed by the State of California in 1970 to oversee the orderly development of Humboldt Bay by promoting national and international commerce, navigation, fisheries, recreation and the protection of natural resources. In order to balance these multiple objectives, the Humboldt Bay Harbor District operates and maintains the largest marina in Humboldt Bay; manages three wildlife areas; functions as the Port Authority; oversees harbor operation and maintenance activities; initiates or participates in ongoing biological and oceanographic research; and regulates all activities within Humboldt Bay from wetland restoration to maintenance dredging. Since roughly 900 AD, people have been continuously utilizing the fishery resources of Humboldt Bay. As California's second largest natural bay, Humboldt Bay continues to play a significant role as both a nursery area for many commercially and recreationally important fish and shellfish species and as an important commercial fishing harbor. Humboldt Bay, as with all other Heritage Harbors in California, require a variety of ongoing maintenance activities, such as maintenance dredging, structure replacement and shoreline protection, in order to remain viable and safe to the commercial fishing industry. A steady decline in State and federal agency responsiveness, inter- and intra- agency coordination, consistency and funding over the past 20 years has put a crippling burden on the local agencies trying to maintain these facilities. Permit delays, arbitrary environmental windows, the use of "fuzzy" science and biopolitical threats and assertions have all increased the risk to human life, property, commerce and the environment. California's harbors are a vital part of California's heritage, commerce and way of life. Protecting these assets by using objective scientific data, analyzed by accountable regulators and institutionalized by knowledgeable, objective decision makers would vastly streamline the permitting process and decrease arbitrary and inconsistent application of laws. In order to protect these assets, the State should acknowledge the importance of these harbor assets and act to develop a consistent approach to protecting the operation and maintenance of California's Heritage Harbors so that they can continue to be safe, economically viable havens for the commercial fishing industry while ensuring the protection of the environment.

John Kirlin¹, Phillip Isenberg^{*2}, J. Michael Harty³, Michael DeLapa¹, Scott McCreary⁴, Melissa Miller-Henson¹, John Ugoretz⁵. Summary of Session: Lessons Learned from the California Marine Life Protection Act Initiative.

¹Marine Life Protection Act Initiative, ²Isenberg/O'Haren, ³Harty Conflict Consulting and Mediation, ⁴CONCUR, Inc., ⁵California Department of Fish and Game

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See "Michael DeLapa" for the summary of this session.

Anjali Jaiswal^{*1}. Aqua Gems: California's 34 Areas of Special Biological Significance.

¹Natural Resources Defense Council

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California has 34 "Areas of Special Biological Significance" (ASBSS) along its coastline. These "AquaGems" were given special status over 30 years ago to protect the unique and sensitive biological species and communities they harbor, including rich kelp forests, ocean canyons, corals, sea otters, seals, and dolphins. Each AquaGem possesses unique biological characteristics, which support complex yet fragile ecosystems. Californians and tourists alike are drawn to these AquaGems, for activities from scenic viewing, swimming and scuba diving, to photography and scientific research. The AquaGems are also vital to California's economy. Coastal tourism and recreation for California far outperform all other ocean-related activities, such as oil and gas production, shipping, and fishing. Total travel spending in California coastal counties was \$82.5 billion and supported 892,600 jobs in 2004. Protecting our AquaGems is an investment in our economy. Although the State banned pollution into the AquaGems more than 30 years ago, this prohibition has been largely ignored. In fact, these resources are threatened by the largest source of coastal pollution—urban stormwater runoff. As a result, some AquaGems have become so polluted that they cannot even be safely used for wading, let alone as habitats for sensitive species. The State Water Board is at a crossroads in its approach to protecting these AquaGems. In 2003, the Board discovered more than 1,600 illegal discharges into these areas. Some of those who are illegally discharging pollution are unwilling to commit the resources to cleanup. Instead, they are hiring lobbyists to weaken the law protecting these valuable marine resources. What is needed is a practical framework that enforces the law and allows, where appropriate, cities and other polluters a reasonable timeframe to design and implement cleanup plans to protect our AquaGems. The State Water Board must show strong leadership to implement this framework and ensure protection of our most valuable coastal resources.



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David Jessup*¹, **Melissa Miller**¹, **Ken Mayer**¹, **James Estes**², **Tim Tinker**³, **Patricia Conrad**⁴, **Jonna A.K. Mazet**⁴. The Big Picture: What Can Be Done about the Various Forms of Pollution Affecting Sea Otters and Their Ecosystem?

¹California Department of Fish and Game, ²Biological Resource Discipline, U.S. Geological Survey, ³Institute for Marine Science, University of California, Davis, ⁴Wildlife Health Center

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The southern sea otter (*Enhydra lutris nereis*) population in California suffers from periodic epidemics and steady high adult mortality, approximately 50% of which is due to infectious diseases, parasites and intoxications. The result of this high mortality has been little population growth in 10-12 years. Land to sea transfer of pathogens and pollutants appears to be involved in this phenomenon and directly causal in some instances. Unfortunately, the host, environment and disease agent interactions are many and complicated and not easily or simply addressed. Current evidence indicates that oocysts of two protozoal parasites that cause significant fatalities in sea otters are associated with fresh water inputs. Other bacterial and protozoal pathogens may come from sewage or farm run off. Chemical contaminants and legacy pesticides, which may have immune suppressive effects that make sea otters more susceptible to disease. This suite of contaminants appear to originate from terrestrial sources, most are lipophilic, and are likely dispersed by sediments in run off from various sources. Nutrient pollution also appears to promote harmful algal blooms that result in sea otter deaths. Each of these pollutants may also cause human illness or death.

All of these ocean inputs can be seen as forms of non-point source pollution, that by its very nature and definition, are difficult to intercept and regulate. Pending State legislation could assist us in better understanding and eventually reducing various forms of non-point source pollution that harm sea otters, other marine species, and jeopardize human health. This legislation could help focus investigative and enforcement efforts as well. Changes in animal management practices in coastal areas as well as better use of existing State and Federal laws, regulation and permitting processes could also help. Several agricultural "best management practices" are already known and have been shown to reduce nutrient, sediment, pathogen and contaminant runoff, but they are voluntary and thus not widely applied. The aging and inadequate infrastructure in coastal cities is subject to regulation and must be repaired and upgraded. In new designated areas of "special ecological concern" storm water runoff must be reduced and dealt with more effectively. One approach to sewage treatment and to containing and reducing storm water flushing may be the use of artificial marshes or reclaimed wetlands. A new series of marine protected areas (MPA's) for California are being set aside to assure both fisheries recovery and to protect all marine life forms. In the big picture dealing with the larger issues in more comprehensive ways may be more cost effective than dealing individually each non-point pollutant cause of sea otter illness. Specific examples of these approaches will be provided and discussed.

Beth Jines*¹. Innovative Land Use Planning Tools and Actions for Coastal Watershed Protection.

¹California State Water Resources Control Board

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The California Ocean Protection Council's 5 year strategy calls for recognition of the interconnectedness of what is done on the land with what occurs to the ocean. Answering this call requires integration of complex planning, management, and restoration strategies with increasingly challenging regulatory requirements. Growth and economic development pressures in coastal watersheds are not letting up for the very reason they exist - they are desirable places to live and produce a bountiful harvest. In order to sustain these uses of the watershed a new kind of planning is needed, which recognizes the relationship of land use practices on downstream impacts on a watershed scale. Lead state regulatory and planning agencies like the State Water Board and Coastal Commission have adopted integrated land use planning or sustainable development principles as core values. Panel members will talk about their agency experiences, approaches, and policies that support innovative land use planning for coastal watershed protection. Many stakeholders and decision makers believe that enough planning has been done and that it is now time for action. The Water Boards have begun a new sustainable development initiative, working with cities, counties and the Board's stormwater regulatory framework to shift coastal development to lower impact on our coastal resources. Although some progress is being made, more cities and stakeholders need to be involved in innovative land use planning. But what is needed to get there? Some say a paradigm shift from conventional planning and development models is needed, particularly in the coastal urban setting. So where are the tools? This panel will discuss innovative land use policy and planning and regulatory tools that state and local governments and stakeholders can use to achieve coastal watershed



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protection. It will also present examples of 'Low Impact Development' actions that benefit Critical Coastal Areas and Areas of Special Biological Significance.

Burton Jones^{*1}, Robert Guza², Marlene Noble³, George Robertson⁴. From the Shelf Break to the Surf Zone: The SCCOOS Nearshore Study of Transport and Dispersion at Huntington Beach, California.

¹University of Southern California, ²Scripps Institution of Oceanography, University of California San Diego, ³U.S. Geological Survey, ⁴Orange County Sanitation District

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As CWO'06 is occurring, the Southern California Coastal Ocean Observing System (SCCOOS) is carrying out an intensive nearshore observation and prediction study of the dynamics of nearshore and coastal processes that affect the transport and dispersion of contaminants that can potentially affect public health. Through funding from the State of California Coastal Ocean Current Monitoring Program (COCMP) and significant collaboration with local and federal agencies, the study has become a major oceanographic study of the physical and biological dynamics of the inner shelf (from the surf zone out to about 30 meters water depth). Huntington Beach was chosen because of continued microbial contamination that first reached public attention in 1999. Huntington Beach is not alone in its concern for waterborne public health risks. Other sites, including Imperial Beach in southern San Diego County, face similar public health risks from the coastal ocean. The processes affecting transport of coastal discharge from local rivers and runoff streams are of fundamental concern because microbial contamination is often associated with these discharges. The SCCOOS nearshore study provides an intensive observation program of the inner shelf between about the 30 meter isobath and the surf zone, with less intensive observations extending to the shelf break. Observations will include high resolution surf zone measurements of waves and currents, dye studies to evaluate dispersion and mixing associated with specific processes, cross-shelf moored measurements systems for physical, geological and biological processes, autonomous vehicles mapping, HF radar surface current mapping and remote sensing observations. Key observations will be telemetered in real-time and incorporated into data assimilation models. An interactive web page will provide public access to the data and products as a demonstration of the capabilities available to regional managers and decision makers.

Krista Kamer^{*1}, Newell Garfield², Kenneth Coale¹. The California State University Center for Integrative Coastal Observation, Research and Education (CICORE): Research for the Sustainable Use of California's Coastal Resources.

¹Moss Landing Marine Laboratories, ²San Francisco State University

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The California State University (CSU) Center for Integrative Coastal Observation, Research and Education (CICORE) is an applied coastal research center dedicated to ensuring sustainable use of California's coastal zone. Using the statewide distribution of the CSU campuses, CICORE has created a coastal ocean observatory along the entire California coastline. The observatory focuses on the critically impacted region from 100 meters deep up to and onto the shore, including estuaries, wetlands, and other vital coastal habitats. CICORE uses three core technologies, in-situ water quality and meteorological monitoring at fixed locations, high-resolution seafloor bathymetry and habitat mapping, and hyperspectral imaging (HSI) of benthic, shallow water and coastal environments to accomplish its primary goals of providing 1) environmental data and analyses to scientists, agencies and the public for policy development and evaluation, and 2) near real-time publicly accessible internet-based products. Near real-time water quality and meteorological data from throughout the state are publicly available on-line through the main CICORE website (www.cicore.org) and at each member institution's CICORE page. The development of the in-situ network has benefited from partnerships with local and regional groups with common interests and available resources. Data products developed from the high-resolution bathymetry and HSI include maps of sediment movement in San Francisco Bay, kelp abundance and condition, fisheries habitats, eelgrass beds and estuarine habitats, and wetlands classification. CICORE is an active participant in regional ocean observing efforts. Members of CICORE are also members of the Central and Northern California Ocean Observing System (CeNCOOS) and the Southern California Coastal Ocean Observing System (SCCOOS). CICORE is emerging as a leader in CeNCOOS and is continually forming partnerships with other regional COTS and state-funded ocean observing programs in order to further national and global ocean monitoring efforts and resource conservation.



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Robert Kanter*¹. The San Pedro Bay Clean Air Action Plan as a Model for Green Port Air Quality Improvement.

¹Port of Long Beach

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For the first time ever, the Ports of Long Beach and Los Angeles, acting together, and with the cooperation of the staffs of the U.S. Environmental Protection Agency, California Air Resources Board and the South Coast Air Quality Management District, have developed a sweeping, aggressive new strategy to significantly reduce the health risks posed by air pollution from port-related sources. The ports have established uniform air quality standards at three key levels: the San Pedro Bay level, the Project Specific level, and the Source Specific Performance level. The two ports will leverage a number of implementation mechanisms for attaining the proposed standards—including but not limited to lease requirements, tariff changes, California Environmental Quality Act (CEQA) mitigation, and incentives. The Project Specific standard requires development to be below the threshold of significance for health risk.

Scott Kathey*¹, **Doug Huckins**². Marine Enforcement: Crossing Federal/State Lines in National Marine Sanctuaries.

¹Monterey Bay National Marine Sanctuary, NOAA, ²California Department of Fish and Game

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The Monterey Bay National Marine Sanctuary (MBNMS) encompasses an ocean area the size of the state of Connecticut, but has only one full-time Federal enforcement officer to ensure compliance with prohibitions ranging from seabed alteration to low overflights that disturb marine mammals and seabirds. Sixteen percent of the Sanctuary lies within state territorial waters, creating the opportunity for joint enforcement of natural resources held in trust for the State and the nation. State and Federal marine enforcement officers share goals for protection of marine species, water quality, and ocean and coastal habitats from a variety of human threats, such as unlawful resource extraction, rookery disturbance, illegal dumping, seabed damage, and theft of cultural resources.

The Sanctuary has implemented partnerships with the California Resources Agency, specifically the Department of Fish & Game and the Department of Parks & Recreation, to expand patrol and response capability for crucial support to Federal enforcement efforts in the area. The MBNMS Cooperative Enforcement Program was established in 1998 and serves as a model for a similar program recently initiated at the Channel Islands National Marine Sanctuary. The benefits and challenges of State/Federal enforcement partnerships for National Marine Sanctuaries will be explored, using examples from California, Florida, and Georgia. Issues such as Federal deputization, mission goals, command and control, joint patrols, case management, joint training, funding, performance measures, and program evaluation will be reviewed to identify the strengths and limitations of such partnerships. Future opportunities for building upon the successes of the past will be discussed within the context of strained government budgets, rising population trends, and increased homeland security requirements in California.

Kevin Kelley*¹. Endocrine Disruption in Marine Fish.

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The southern California Bight (SCB) represents one of the most dramatic interfaces on earth between the marine environment and an enormous human population, particularly in the Los Angeles/Orange County regions. A greater understanding of the impacts of humanity and its by-products on marine wildlife, such as fishes, has been advanced by studying alterations in endocrine systems. Endocrine systems, which are essential for normal physiological functions, are also exquisitely sensitive to perturbation by environmental factors, both natural (e.g., predator or social stress) and anthropomorphic (e.g., contaminants in water or sediment, direct human interaction) in nature. In benthic flatfish as well as in other types of fish, we have identified several different endocrine-disrupted conditions, which consistently occur in association with proximity of the fish to wastewater treatment plant outfalls or other affected environments. Endocrine systems regulating growth, reproduction, metabolism and defense, have each been found to exhibit disrupted functions in different species and under different environmental conditions in the SCB. These findings will be highlighted, and our efforts to define their underlying mechanisms will be discussed. (Support by Southern California Sea Grant College Program).



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Heather Kerkerling^{*1}, Rondi Robison², Dave Foley³, Josh Pederson⁴, Jeff Paduan⁵, Dale Robinson¹. Collaborative Efforts and Resulting Product Development in the Central and Northern California Ocean Observing System.

¹Central California Ocean Observing System, ²Center for Integrated Marine Technologies, ³Environmental Research Division, NOAA, ⁴Monterey Bay National Marine Sanctuary, ⁵Naval Postgraduate School

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As one of eleven developing Regional Associations under the Integrated Ocean Observing System (IOOS), the Central and Northern California Ocean Observing System (CeNCOOS) is working to improve collaboration among ocean observing activities along the California coast between Point Conception and the Oregon border. Operating as a synergistic collaboration of approximately 55 academic/research institutions, federal, state and local agencies, private corporations, and non-government groups, CeNCOOS strengths include a high diversification of stakeholders in the region, a strong outreach component, and end-user driven product development. In the past year, CeNCOOS has continued to evolve as an organization while improving efforts to link scientific research to management and develop useful tools. The regional system is being built upon existing activities to provide real-time and near-real time data on physical, chemical, biological, and geological parameters from the coastline out to 200 nautical miles and will be directed to meet user needs, such as: facilitating safe and efficient marine operations, managing resources for sustainable use, and ensuring public health. This presentation will focus on the benefits of an ocean observing system to meeting user needs through product development with the goal of improving marine and coastal management. Highlights will include a display of successful CeNCOOS collaborative efforts such as the Data Integration Demonstration Project, the web-based tool for management metadata, oceanObs, the application of state-funded HF Radar technology (Coastal Ocean Currents Monitoring Program – COCMP) to oil spill response, and the progress of pilot projects identified for three Working Groups within CeNCOOS.

Dale Kiefer^{*1}, Frank J. O'Brien², Jack E. Rensel³. A Fish Farm Information System for Analyzing Operations and Environmental Impacts.

¹University of Southern California, ²System Science Applications, ³Rensel Associates Aquatic Science Consultants

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We have developed a fish farm information system to assess the operations and impacts of fish farms. The system provides a three dimensional simulation of the growth and metabolic activity of penned fish as well as the associated flow and transformation of nutrients, oxygen, and particulate wastes in adjacent waters and sediments. The farm model resides within the EASy Marine Geographic Information System, and thus all environmental information from field measurements to satellite imagery are readily available for development and testing of the model. The model itself consists of 4 components, a simple 3-dimensional description of advective and turbulent flow, a PZN description of plankton dynamics, a carbon-based description of fish growth and metabolism within the farm, and description of benthic sedimentation and resuspension. The information system has been applied to a virtual offshore salmon farm located in the Strait of Juan de Fuca and a proposed cobia farm in the coastal water of Puerto Rico. The system will support work by administrators, who establish regulations, by operators, who wish to obtain permits and optimize operations of the farm, and by investors, who wish to assess risks and opportunities.

Judith Kildow^{*1}. The Coastal Tourism and Recreation Industry: Need for Managed Growth.

¹California State University, Monterey Bay

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Human uses of the nation's shoreline have been shifting for several decades. The major shift is from manufacturing and production to service activities. The National Ocean Economics Program has been tracking, measuring and analyzing changes in human uses and values of the US coastline for the past 8 years, identifying trends and forecasting changes. An outstanding feature of the changes is the growth in the coastal tourism and recreation sector, measured as part of the Ocean Economy, defined by the NOEP. In 2003, total value of this industry to the nation was an estimated 93 billion dollars. Since California's economy benefits from this sector more than most states it will be discussed as a microcosm for the nation: The contribution of this sector to the nation's economy, to California's economy, and California's contribution to the nation's economy through Coastal Tourism and Recreation will be discussed. Tourism and Recreation along California's coastline generates an estimated worth of about 19 billion dollars in 2003. What drives this industry and how it is changing, the benefits and costs of this growth



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and current and potential problems associated with it will be discussed. In addition to normal market values, there are other values beyond the market not normally included that easily raise these values, such as the value of beaches, coastal real estate and the added values reflected in the sheer enjoyment of a day sport fishing or a day at the beach. Since this industry will change California's and the nation's shoreline landscape more than any other, the public must understand the implications of these changes, addressing the challenge of how to manage both this industry and the natural resources that support it.

Judy Kildow*¹. Recent Estimates of California's Coastal and Ocean Economics.

¹California State University, Monterey Bay

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The National Ocean Economics Program prepared a report for the Resources Agency of the State of California, released July, 2005, on California's Ocean Economy. That report provided information up to and including the year 2000. This paper will update that report to 2004, providing more recent information about California's Ocean Economy, and its offshore natural resources as well as additional information in new categories that were not included in the previous report, such as California's Coastal Economy. In addition to the new data, this presentation will highlight some key observations about trends and potential policy issues for California's coastal policy makers and compare California's data with that of the nation and other coastal states and regions.

Phillip King*¹. Estimating Attendance at California's Beaches: An Overview with an Analysis of Data from S. Carlsbad and the City of Encinitas.

¹San Francisco State University

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California's beaches play a significant role in the State's economy and ecology. Yet, despite detailed official counts, estimates of attendance at these beaches vary significantly and lead to substantially different estimates of economic and ecological impact. Indeed, at a meeting of the State's beach economists at U.S.C. several years ago, improving estimates of beach attendance was rated the highest priority for data needs. Attendance data is critical in assessing the cost of beach closings, the mitigation required for seawalls, and the benefits of shoreline protection, as well as human intrusion on sensitive habitats. This paper first briefly discussed attendance methodologies used at various beaches throughout the State. The main body of the paper analyzes specific beach attendance data for S. Carlsbad State beach and several beaches in the City of Encinitas. These beaches are unique in that they have two sets of "official" estimates: (1) from California State Parks, based on a methodology developed 30 years ago (and not updated since), (2) from electronic counters installed by the City of Encinitas to collect attendance data. In addition, the paper supplies a third estimates, from counts collected by Dr. King for studies conducted for the cities and Encinitas and Carlsbad and the State of California. We find that both the State Parks data and the electronic data have significant biases that need to be corrected and we suggest techniques to correct the estimates. The paper suggests ways to improve data at these beaches and to establish protocols at other beaches.

Philip King*, Kim Sterrett². The Economics of Regional Sediment Management in Maintaining California Beaches.

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In 2002, the State of California published the California Beach Restoration Study (<http://dbw.ca.gov/beachreport.asp>). The study suggested that a protocol be developed for Regional Sediment Management (RSM) so that government policy makers could make use of sediment which is currently placed elsewhere. RSM involves moving sediment created by harbor dredging, maintenance of flood control projects, and wetlands creation to nourish sediment depleted beaches. In response to the California Beach Restoration Study, the State, in conjunction with the Corps of Engineers and local authorities, has supported several iterations of GIS-based decision support tools to help policy makers implement RSM. A key element of this tool is the economic methodology developed to estimate benefits and costs of RSM. The paper provides an overview for non-economists of the key issues raised in the process of developing these GIS tools as well as the data limitations and pitfalls that need to be addressed in the future. The paper concludes that RSM can work. In particular, pumping or barging (and placing offshore)



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dredge material from harbors seems to be a very cost effective solution which could save taxpayers millions of dollars every year.

John Kirlin^{*1}, Phillip Isenberg², J. Michael Harty³, Michael DeLapa¹, Scott McCreary⁴, Melissa Miller-Henson¹, John Ugoretz⁵. Summary of Session: Lessons Learned from the California Marine Life Protection Act Initiative.

¹Marine Life Protection Act Initiative, ²Isenberg/O'Haren, ³Harty Conflict Consulting and Mediation, ⁴CONCUR, Inc., ⁵California Department of Fish and Game

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See "Michael DeLapa" for the summary of this session.

John Kirlin^{*1}, Michael L. Weber². Incorporating Science into Science-Based Management: The MLPA Initiative.

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Incorporating scientific expertise into decision-making is a central feature of the Marine Life Protection Act (MLPA). Though passed in 1999, it was not until 2005-2006 that the state was able to effectively incorporate science into the decision-making process. The MLPA requires that the Department of Fish and Game convene a science advisory team to assist and advise it in the preparation of scientific guidelines for a MLPA master plan. In the first of three efforts at implementing the MLPA, the Department convened a master plan team, yet lacked public input. This led to great controversy when the Department released its maps depicting potential MPAs. The second attempt failed due to funding shortfalls. The third attempt was launched in a public-private partnership called the MLPA Initiative. This effort had adequate funding, an open and public process, an advising team of scientists setting guidelines and offering evaluations based on the best available scientific knowledge, and a Blue Ribbon Task Force overseeing the Initiative. The science team held a dozen open meetings, and a sub-team participated in discussions of a regional stakeholder group. Experience of the Initiative demonstrates that transparency is critical to the broad credibility of scientific advice and that the role of science is essential in such complex management decision-making. Interactions among the science team, the task force and the public showed how important dialog is to generating mutual understanding of the needs of decision makers and the capabilities and limitations of scientific advice.

Geraldine Knatz^{*1}. Coastal Ports and Terminal Operations.

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Ninety-nine percent of the nation's international trade or 2.5 billion tons per year move through the nation's coastal ports, harbors and inland waterways. Each of the nation's 50 states might rely on 13 to 15 ports to supply or export their goods. Every day \$1.3 billion worth of goods move in and out of the U.S. through our ports. In addition, a growing segment of the U.S. population, currently 8 million annually, use the nation's ports to embark on cruises. Ports were the center of commerce in our early history and while they still provide the same role today, the understanding of their role in today's economy is not well understood by the general public. Unlike many other countries where the national government controls the ports, the administration of U.S. ports is generally by a local (such as city), state government, bi-state agency or special port district. Individual terminals within the port may be operated by the port or leased to private companies, such as international shipping or stevedoring companies. The U.S. has no national port policy and numerous federal agencies have often conflicting responsibilities with respect to addressing port issues. This lack of a federal policy makes it difficult for our nation to plan in any systematic way for the doubling of trade forecasted by the year 2020. With the anticipated increase in trade volumes, ports must focus their attention in several key areas:

1. keeping their land and water boundaries secure;
2. ensuring the development and maintenance of navigable channels and terminal facilities necessary to accommodate the ever-growing volume of trade and size of vessels;
3. addressing environmental impacts which now include health impacts associated with diesel particulates; and,
4. inadequate rail and highway infrastructure servicing the port.



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Dan Walker¹, John Orcutt², Marcia McNutt³, Stephen Weisberg⁴, Robert Knox^{*2}, Brian Baird⁵. Summary of Session: Development of a National Ocean Research Priorities Plan and Implementation Strategy.

¹Office of Science and Technology Policy, White House, ²Scripps Institution of Oceanography, ³Monterey Bay Aquarium,

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See "Brian Baird" for the summary of this session.

Martina Koller^{*1}, Michael Bowen², Robin Carlson¹, Stan Allen¹, Eric Haney³. The Passage Assessment Database: A Tool for Stream Habitat Connectivity Restoration via the Publicly Available CalFish Website.

¹Pacific States Marine Fisheries Commission, ²California State Coastal Conservancy, ³California Department of Fish and Game

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In recognition of the importance of restoring California's once-abundant salmon and steelhead populations, an inter-agency cooperative project was initiated by the California Coastal Conservancy, California Department of Fish and Game, Pacific States Marine Fisheries Commission and others to inventory barriers to fish passage throughout the coastal watersheds of California. The Passage Assessment Database (PAD) is an ongoing map-based inventory of known and potential barriers to anadromous fish in California. The PAD compiles data from more than one hundred agencies, organizations, groups and landowners throughout California. These data allow past and future barrier assessments to be standardized, stored in one place and made easily accessible. The PAD enables the analysis of the cumulative impacts of barriers on salmonid migration in the context of overall watershed health, as well as the identification of barriers suitable for removal or modification. It is also an important tool for determining and tracking the outcomes of passage improvement projects. The PAD is publicly available via the CalFish website (www.calfish.org). CalFish, a California Cooperative Fish and Habitat Data Program, is a multi-agency website and map viewer presenting fish and aquatic habitat data in California. The Calfish website was created to serve a two-fold mission: 1) To create, maintain, and enhance high quality, consistent data that are directly applicable to policy, planning, management, research, and recovery of anadromous fish and related aquatic resources in California; and 2) To provide data and information services in a timely manner in formats that meet the needs of users.

Jaime Kooser^{*1}. The Formal Model of State-Federal Partnerships: The National Estuarine Research Reserves.

¹San Francisco Bay National Estuarine Research Reserve

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The National Estuarine Research Reserve System (NERRS) is a network of protected areas established for long-term research, education and stewardship of more than one million acres of estuarine land and water. These reserves provide essential habitat for wildlife, offer various educational opportunities, and serve as living laboratories for scientists. This partnership program between the National Oceanic and Atmospheric Administration (NOAA) and coastal states partners relies on formal Memoranda of Understanding (MOUs) between the state and NOAA to ensure a long-term joint commitment to the effective operation of the area as a National Estuarine Research Reserve (NERR). Each NERR has a unique combination of partners drawn from coastal zone agencies, resource management agencies, universities, land trusts, private enterprises, and various non-profit organizations, including friends groups. The formal nature of the partnerships ensures a clear delineation of roles and responsibilities, improves the ability to obtain and manage the necessary resources for watershed and estuarine protection, and increases access to resource and management expertise. A major benefit includes the efficiency of relying on national programmatic structures (e.g., scientific protocols) while having the flexibility to address unique site and community characteristics by including pertinent state and local partners. The collaborative nature of developing system-wide programs enables the NERRS to translate locally relevant programmatic outcomes (such as water quality monitoring data, coastal training programs and stewardship methods) into nationally significant results describing the state of the nation's estuaries. The NERRS serves as a catalyst for improved coast and ocean management; transference of this partnership and stewardship model to other special places would provide an even greater benefit to all coast and ocean resources. Examples from California's three NERRs will illustrate this, as well as how these partnerships serve to achieve numerous objectives of the California Ocean Protection Council's Strategic Plan.



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Christine Kreuder-Johnson^{*1}, Tim Tinker², Michelle Staedler³, Dave Jessup⁴, Melissa Miller⁴, James A. Estes², Jonna A. Mazet¹, Erin Dodd⁴, Pat A. Conrad¹. Linking Individual Behavior to Ecosystem Health: Tracking Pathogen Exposure in Southern Sea Otters.

¹Wildlife Health Center, School of Veterinary Medicine, University of California, Davis, ²Department of Ecology and Evolutionary Biology, University of California, Santa Cruz, ³Monterey Bay Aquarium, ⁴Marine Wildlife Veterinary Care and Research Center, California Department of Fish and Game

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Understanding factors that increase the risk of pathogen exposure in sea otters may have broad implications for overall ecosystem health and may improve our understanding of the processes that promote disease in marine mammal populations. Linking individual animal behavior to disease risk in a wildlife population requires a large multidisciplinary research effort. As part of an ongoing collaborative program led by CDFG, USGS, and UC to monitor the recovery of sea otters, 155 otters were captured and radio-tagged. All otters were closely monitored over a 2-3 year period for movement, observation of prey preferences, feeding strategies, and behavior. Individual variation in prey selection was observed with each animal displaying specialization in preferred prey and micro-habitat use patterns. In addition, age- and sex-specific differences were detected in home range size and annual movement patterns. This cohort of intensely monitored sea otters provided an unusual opportunity to evaluate associations between individual animal behavior and pathogen exposure as determined at initial capture and subsequent recaptures. All otters underwent basic health screening at the time of capture and recapture. Blood samples collected at each capture were used to screen otters for exposure to protozoal pathogens, Toxoplasma gondii and Sarcocystis neurona that are known to be important causes of mortality in this population. Multivariate logistic regression techniques were used to measure associations between pathogen exposure and individual animal movement, home range location, micro-habitat use, and diet. Spatial analysis was used to identify clusters of pathogen exposure within sea otter habitat. Specific prey preferences and habitat use patterns significantly increased the risk of pathogen exposure, both singly and interactively. Our results can be used to not only maximize the efficacy of conservation efforts for this species, but to also inform coastal management on mechanisms promoting pathogen exposure in this ecosystem.

Linda Krop^{*1}. Rigs to Grief: Leaving Abandoned Offshore Oil Rigs in Place.

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The oil industry has been seeking to avoid its legal obligations to remove offshore oil and gas platforms and restore the marine environment for many years. The effort began in earnest after the State of California required Chevron to remove four platforms located in State waters offshore Summerland in Santa Barbara County in 1996. The State's interest in removing the platforms stems from the commitments made by the oil industry when these facilities were first approved, as well as the safety risks caused by leaving them in place and the fact that the platforms do not meet the criteria set forth in the Department of Fish and Game's guidelines for artificial reefs.

From 1999 – 2001, the State repeatedly rejected proposed legislation that would allow oil platforms to be left in the ocean. In 2001, the State relied on a report prepared by a "blue ribbon panel" of University of California scientists who reached the conclusion that oil platforms do not provide fish habitat. The National Oceanic and Atmospheric Administration reached the same conclusion in response to a more recent proposal to designate platforms as "essential fish habitat."

Leaving platforms in the ocean creates significant risks for accidents, leaching of toxic pollution, attraction of fish away from productive natural reefs, and liability for the State of California. In addition, such a program would establish a precedent whereby other industries would seek to dump their garbage and unwanted structures in the ocean. For these reasons, environmental organizations throughout the State oppose proposals to change State and Federal law and allow rigs-to-reefs in our ocean waters.



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Raphael M. Kudela^{*1}, Meredith Armstrong², William P. Cochlan³, Peter Miller⁴. A Role for Anthropogenically Derived Nitrogen in the Formation of Harmful Algal Blooms along the U.S. West Coast.

¹University of California, Santa Cruz, ²Ocean Sciences Department, University of California, Santa Cruz, ³Romberg Tiburon Center for Environmental Studies, San Francisco State University, ⁴Institute for Marine Sciences, University of California, Santa Cruz

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The U.S. west coast is generally considered to be dominated by coastal upwelling. However, recent evidence suggests that there is a substantial, and important, role for anthropogenically derived nutrients, particularly reduced nitrogen compounds such as ammonium and urea. Here we present results from field experiments in southern and central California in which the nitrogenous preference was assessed for potential HAB species. From Southern California, we examine the uptake response kinetics in the red tide forming organism *Lingulodinium polyedrum*, recently confirmed to produce yessotoxin. In central California, a series of nutrient amended grow-out experiments in the Gulf of the Farallones (San Francisco Bay outflow) demonstrated that the toxicogenic diatom *Pseudo-nitzschia* is likely present year round, supported by either nitrate, ammonium, or urea. Toxin measurements also suggest that urea-grown natural assemblages have higher toxin cell per cell than assemblages utilizing either nitrate or ammonium, and that toxicity occurs earlier in the growth phase (mid-exponential versus late exponential). In San Francisco Bay, all three N substrates were utilized by mono-specific blooms of the raphidophyte *Heterosigma akashiwo*, with a preference for nitrate or ammonium over urea. Taken together, these results demonstrate that urea is an important nitrogenous source for potential HAB species in California, and that episodic input of anthropogenic N is a common feature of this upwelling dominated system. Based on these findings, we have been working with the California Department of Health Services and regional stakeholders, through both California Program for Regional Enhanced Monitoring of Phycotoxins (Cal-PReEMPT) and the Center for Integrated Marine Technology CIMT). By transferring these research-oriented findings to end-users and managers, we are developing improved HAB monitoring capabilities both regionally and statewide.

Gerhard Kuska^{*1}. Coordinating Management Efforts to Make our Oceans, Coasts, and Great Lakes Cleaner, Healthier and More Productive: Federal Perspectives under the U.S. Action Plan.

¹White House Council on Environmental Quality

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Since the founding of our great nation, discussions and debates have continued over the appropriate roles for federal and state authorities in governing various areas of our nation's interests. In the history of managing our marine environment, federal and state jurisdictions over particular ocean areas and issues have been defined by various laws; and yet questions continue to be raised as to the appropriate role for states and the federal government in managing our marine environment. This presentation will help explore, as part of a larger panel, tentatively named, Alexander Hamilton, Ronald Reagan, and the Ocean: Federal and State Roles in Regional Governance, some questions of federalism. Specifically the presentation will give a perspective from across the federal agencies on how the federal government is working to improve management of the ocean and also explore some ideas for federal/state collaboration.

Leslie Lacko^{*1}, Lesley Ewing². Planning for Sea Level Rise in San Francisco Bay.

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Long-duration tide gages indicate that sea level in the San Francisco Bay estuary has risen nearly 7.1-7.6 inches over the past 150 years, increasing at an annual rate of 0.04-0.08 inches per year, which is consistent with global sea level rise. As global temperatures rise, evidence suggests that the rate of sea level rise will increase. The Intergovernmental Panel on Climate Change estimates that the global mean sea level will rise between 4 and 35 inches by 2100. Additionally, it is expected that the occurrence of extreme events will increase as sea level rises. Tidal flooding associated with increased sea level is expected to impede drainage in low-lying shoreline areas of the Bay and inundate developed waterfronts. Existing tidal marshes may be submerged if the rate of sea level rise disrupts the balance between sedimentation and erosion or if shoreline structures prevent a marsh's landward migration. In the South Bay, North Bay, and the Suisun Bay, shoreline areas have subsided to



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near or below sea level, protected only by levees. Tidal flats in some areas of the Bay have eroded, making them susceptible to tidal inundation, which would result in a loss of sediment stores for tidal marsh formation and foraging habitat for shorebirds. San Francisco Bay is not only a resource with state and national significance, it defines the character of the Bay Area. Differing from California's 1,000-mile-long coastline, the Bay binds the communities that surround it. Should each locality act separately to raise levees or riprap the shoreline, we risk turning a complex estuarine ecosystem into nothing more than a reflecting pool. The San Francisco Bay Conservation and Development Commission is collaborating with regional agencies and local governments to develop a coordinated approach for implementing emission-reduction strategies and adapting to sea level rise in the Bay Area.

Irma V. Lagomarsino*¹. National Marine Fisheries Service Restoration Activities in the Klamath Basin.

*National Marine Fisheries Service

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Located in south-central Oregon and northern California, the Klamath River Basin's water-related problems have been the subject of decades of litigation, Congressional debate, legislation, and federal, state, and tribal government programs and research. NOAA's National Marine Fisheries Service is actively involved in a broad range of partnerships and programs to promote restoration of salmon and steelhead populations in the Klamath River under the authorities of the Endangered Species Act, Magnuson-Stevens Fishery Conservation and Management Act, and the Federal Power Act. For instance, Klamath River fall Chinook salmon are one of the key stocks that NMFS manages under the Pacific Coast Salmon Fishery Management Plan developed under the Magnuson Act. The Salmon Plan provides conservation objectives for Klamath fall Chinook and ocean salmon fisheries must be managed to allow sufficient numbers of spawners to return to the Klamath basin in order to both meet the reproductive needs of the population, as well as fulfill the federally-reserved harvest rights of Indian Tribes. Under the FPA, NMFS is working with FERC on the relicensing of PacifiCorp's Klamath Hydroelectric Project. NMFS submitted a mandatory prescription package in April 2006 for fishways pursuant to the Federal Power Act. If fish passage was provided, more than 58 miles of currently inaccessible fish habitat would be provided resulting in major conservation benefits for Chinook and coho salmon. NMFS also recommended that FERC order the removal of four dams included in the relicensing. Under the Endangered Species Act, NMFS is involved in a variety of programs throughout the Klamath Basin including: (1) development of recovery plans; (2) improved hatchery, irrigation, and forestry practices; (3) improved roads maintenance programs; (4) restoration grants programs. NMFS will report on what it has accomplished and near term actions currently planned in the Klamath Basin.

Gregory Langlois*¹. Marine Biotoxins in California: A Statewide Perspective.

*California Department of Health Services

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California has a long history of experience with the marine biotoxins (saxitoxin and its numerous analogs) responsible for the human health syndrome known as paralytic shellfish poisoning (PSP). We have the distinction of having the longest established monitoring program for PSP in the U.S., initiated in 1927. Much of the early groundbreaking research on method development and PSP toxin characterization was conducted in California.

John Largier*¹, **Steven G. Morgan**¹, **Chris M. Halle**¹, **Claudia Luke**¹, **Deedee Shideler**¹, **Skyli McAfee**¹, **Jennifer Fisher**¹, **Megan M. Sheridan**¹, **Michael Carver**², **Louis W. Botsford**³, **David M. Kaplan**⁴. The Bodega Ocean Observing Node (BOON): Coastal Ocean Observations in the Bodega Region.

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The vision and plan of developing "ocean observing systems" offers many possibilities for improved environmental quality, resource utilization, human safety, and ecosystem stability. The national approach to integrated ocean observing efforts for coastal waters is to establish regional associations, such as the Central and Northern California Ocean Observing System (CeNCOOS). However, many coastal processes and resources play out at smaller scales and we have developed



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a sub-regional node to focus on the Bodega region, i.e., from the Gulf of Farallones to just north of Pt Arena. This region is subject to strong upwelling winds, resulting in an upwelling center at Pt Arena and an upwelling jet separating from the shore at Pt Reyes. In addition, land runoff is received via San Francisco Bay, the Russian River and several smaller coastal watersheds. The region includes two National Marine Sanctuaries and provides critical habitat for many fish (e.g., salmon, rockfish), seabirds, and marine mammals. BOON includes HF radar observations of surface currents, shoreline monitoring of water properties, and moored sensors at Bodega, on Cordell Bank (deployment planned for late 2006) and at several nearshore locations along the National Seashore and in the Gulf of Farallones National Marine Sanctuary. This is combined with additional data from satellites and monitors of wind (NOAA/NDBC) and river flow (USGS). Much of the oceanographic understanding is built on the NSF-funded WEST program. Through collaborations in the region and with state and federal agencies, our aim is to translate these data streams into indicators that can be used to better understand and manage critical issues in environmental quality, resource utilization, human safety, and ecosystem stability in the Bodega region.

John Largier^{*1}, Steven Bograd², Jack Barth³, Daniel Palacios². Environmental Indicators for Ecosystem-Based Management in the California Current System.

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Ecological indicators for ecosystem-based management in the California Current System include indicators of the environment in which marine populations live. These environmental indicators include information on both the physico-chemical properties of the water and the characterization of transport. Successful indicators will capture critical aspects of the spatio-temporal structure of the environment and thus reveal fundamentally important links between population variability and environment variability (in both space and time). Further, successful indicators are based on data that are readily available through time and across space (or will be readily available from the developing ocean observing systems, such as CeNCOOS, SCCOOS and NANOOS). Environmental indicators can be based on forcing parameters (e.g., winds, river inflow) or response parameters (e.g., water temperature, nutrient levels, alongshore current). Ultimately, it is our expectation that indicators will be a key tool in ecosystem-based management. However, prior to that, we need to demonstrate the validity and applicability of indicators. We will review existing environmental indicators, both univariate and multivariate, across a variety of spatial and temporal scales (e.g., synoptic, seasonal, and interannual variability), and comment on their applicability to specific populations or ecosystem attributes. Our perspective will be based on both statistical analysis, where sufficient data exists, and on mechanistic understanding. We will also comment on the use of indicators in retrospective studies, operational decisions ("now-cast"), and environmental forecasts.

John Largier^{*1}, Mitzy Taggart². Improving Water Quality at California's Enclosed Beaches.

¹Bodega Marine Lab, University of California, Davis, ²Heal the Bay

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The State of California established the Clean Beaches Initiative (CBI) Grant Program to respond to the poor water quality and dramatic number of postings and closures revealed by AB 411 monitoring at California's beaches. The major goal of the CBI Grant Program is to reduce health risks through improved water quality at California's beaches. Although exceedance of health standards occurs many more times at enclosed beaches than at other beaches in California, to-date very little CBI funding has been used at enclosed beaches, primarily because of the complex nature of the water quality problem at enclosed beaches. Enclosed beaches are an important natural and economic resource for California. These beaches are within sheltered bays, harbors or estuaries and characterized by low wave energy and warm waters. Approximately 24 million people visit California's enclosed beaches annually and the public health impact of poor water quality at these beaches is of particular concern because they are so popular with young children. At the same time, these sheltered waters also provide key habitat for a rich diversity of animals and plants and act as important nursery areas for young fish. We will present an overview of the enclosed beach problem and potential responses, including source abatement, sediment modification, circulation enhancement, and no action. Further, we will review existing impediments to action. This presentation will be based on the conclusions of the Enclosed Beach Symposium and Workshop held in August 2005.



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Herb Leedy^{*1}. The Use of Oil and Gas Structures in State-Sponsored Artificial Reef Programs: Mineral Management Service Perspective and Policy.

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Rigs-to-Reefs is a term used for converting obsolete, nonproductive offshore oil and gas structures to designated artificial reefs. Under Title II of the National Fishing Enhancement Act of 1984, the National Marine Fisheries Service developed and published a National Artificial Reef Plan. In support of the National Artificial Reef Plan, and in response to affected stakeholders, the MMS adopted a national Rigs-to-Reefs policy that supports and encourages the reuse of oil and gas structures for offshore artificial reef development. Under this policy, coastal states with approved State-sponsored artificial reef plans may cooperate with the oil and gas industry to recycle obsolete structures as permitted artificial reefs as an alternative to onshore disposal. The Louisiana Department of Wildlife and Fisheries, the Texas Parks and Wildlife Department, and the Mississippi Department of Marine Resources have approved State artificial reef plans and administer ongoing offshore rigs-to-reefs programs. The artificial reef coordinators from these States assess the interest of their State in acquiring oil or gas structures offered for reef development, work with the structure operator or their agent in securing the required U.S. Army Corps of Engineers permit, negotiate an agreement for a structure donation, and accept title and responsibility for the structure as a permanent State reef. The MMS artificial reef committee reviews each reef proposal for compliance with internal policy and OCS rules and regulations.

Hunter Lenihan^{*1}, **Chris J. Miller**², **Matthew C. Kay**¹, **Rod Fujita**³, **Ray Hilborn**⁴, **Donna Schroeder**⁵. Collaborative Fishery Research and Co-Management for the California Spiny Lobster.

¹Bren School of Environmental Science and Management, ²California Lobster and Trap Fishermen's Association,

³Environmental Defense, ⁴University of Washington, ⁵Channel Islands Foundation

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A fishery-led partnership of ecologists, fishery scientists, managers, and Environmental Defense has created a collaborative research and co-management program (CALobster), whose objectives are establish a community-based governance program to facilitate fishery management reform, market innovation, and collaborative research; to explore marine reserves as tools in ecosystem-based fishery management (EBFM) through the MLMA/MLPA; quantify reserve effects on fishery yield and social structure; develop scientific protocols for integrating fishery-dependent and independent data into regional stock assessment; and enhance conservation through value-added marketing. Development of EBFM is a promising alternative for sustaining target species and ecosystems upon which they depend. A component of EBFM emphasized in the MLMA, networks of marine reserves, are hypothesized to enhance conventional, single-species fishery management through conservation of biodiversity and habitat, the spillover of larvae, juveniles, and adults, and other processes. A growing body of evidence suggests that reserves can influence fishery yields but at a local scale. Nevertheless, there is generally strong resistance to reserves within the fishing community because reserve impacts are often poorly monitored, socio-economic effects are rarely examined, and integration of marine reserves into regional fishery management plans is only just beginning. Evolution of EBFM requires new ideas generated through cross-fertilization among fishermen, scientists, managers, and environmentalists. We will present objectives and findings of our partnership as evidence that such cross-fertilization is productive and worthy of investment.

Susan Sakaihara¹, **Andrea Lewis**^{*2}. The Education and the Environment Initiative.

¹California Integrated Waste Management Board, ²California Environmental Protection Agency

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California is currently poised to lead the nation in environmental literacy. The California Environmental Protection Agency (Cal/EPA) and the California Integrated Waste Management Board (CIWMB) are actively engaged in the implementation of the Education and the Environment Initiative (EEI) pursuant to AB 1548 (Pavley, Chapter 665, Statutes of 2003) and AB 1721 (Pavley, Chapter 581, Statutes of 2005). Heal the Bay, a non-profit environmental organization and the bill's sponsor, has joined the state's leadership team. These landmark environmental education laws mandate the development of a unified strategy to bring education about the environment into California's primary and secondary schools. Other current key partners include the Office of the Secretary for Education, State Board of Education, the Department of Education, and the California



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Resources Agency. The laws mandate the development of environmental principles and concepts in no less than fourteen subject-matter areas (including ocean literacy), alignment of these principles and concepts to California's academic content standards, inclusion into textbook adoption criteria in the areas of science, history/social science, English/language arts and mathematics, and the creation of a model curriculum for California's K-12 teachers (and others). With a focus on ocean literacy in particular, our presentation will address the impetus for the laws, a review of California's Environmental Principles & Concepts (EP&C), California's K-12 instructional system and the integration of the EP&C and environmental model curriculum into this system of standards, frameworks, instructional materials, and student assessment. The EEI is included in California's Action Strategy (Action 5, Page 17) and this presentation will update participants, and teachers, on implementation activities in support of California's ocean plan of action.

Gerald A. Lieberman*¹. California's Environmental Principles and Concepts Developed under the Education and the Environment Initiative (EEI).

¹State Education and Environment Roundtable

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Presenters Dr. Jerry Lieberman and Jennifer Rigby will discuss California's Environmental Principles & Concepts (EP&C) that have been developed under the EEI. These principles and concepts distill the contributions of over 100 scientists and technical experts, representing state agencies, universities, business and industry, and environmental organizations throughout California. The presenters will describe the process of developing the EP&C, aligning them with California's academic content standards and undertaking an outreach process that led to the approval of the EP&C by the State of California. The presenters will also describe the Model Curriculum that is being developed as part of the EEI, its function within the K-12 education system, and strategies for its review and implementation in school districts across the state.

Chi-Wei Lin*¹, **Bob Brown**², **Steve Allen**³, **Don Allan**⁴, **Sungnome Madrone**⁴. Integrated Watershed Management Approach for the Protection of the Areas of Special Biological Significance in Trinidad.

¹City of Trinidad, ²Streamline Planning Consultants, ³Winzler and Kelly Consulting Engineers, ⁴Redwood Community Action Agency

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The ocean surrounding Trinidad has been designated one of the 34 Areas of Special Biological Significance in California coast. The kelp beds in this water are considered a significant biological species and warrants special protection. The law prohibits an undesirable alteration in natural water quality from waste and discharges. Nonpoint source pollution shall be controlled to the extent practicable. The State Agency listed a total of 57 drainages into this ASBS. One of the smallest towns in California is entrusted with the enormous responsibility of protecting this important ocean resource. Although the potential sources of pollution for the Trinidad ASBS include storm discharge, river outlets, springs and seeps, the main contributors are from the surrounding watershed rivers and streams emptied into the area. Therefore, our approach to address the issue is directed toward the reduction of pollutants at its sources through land use management of the impacting watershed. Our program, funded by the Water Board, integrates watershed management approaches to reduce sediments from timber harvesting activities, improve waste water management to reduce biological contamination, and improve urban design to reduce pollutants in city storm discharges. These approaches are coupled with public education/outreach, stakeholder participations, water quality monitoring and land use planning for their implementation. The potential outcome of this project is the improvement of quality in waters of the ASBS and the watershed, thus benefits both the marine and human lives. Finally, we recognize that the protection of the ASBS must be at a continue and permanent basis. Public supports at the present and in the future are essential for this effort to sustain.. We are beginning to look into public education, ocean stewardship and school education programs. There are still lots work to be done.

Peter Sharp¹, David Garcelon², Annie Little*². Restoration of Bald Eagles to the Northern Channel Islands.

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The Channel Islands off of southern California were a historic stronghold for the American bald eagle (*Haliaeetus leucocephalus*). The last known bald eagle nest on the northern Channel Islands was seen in 1949, and the birds disappeared from the islands by the early 1960's primarily due to the impacts of DDT pollution. In 2002, the Montrose Settlements Restoration Program initiated a study to determine the feasibility of recolonizing the northern Channel Islands with bald eagles. This study involves releasing juvenile bald eagles on Santa Cruz Island (one of the northern Channel Islands) and monitoring the continued effects of DDT on reproduction. From 2002-2006, approximately 60 juvenile bald eagles were released on Santa Cruz Island. As part of the study, biologists monitor the movements of the birds using satellite telemetry and collect prey species and bald eagle blood for contaminant analysis. In 2006, two bald eagle pairs successfully bred on Santa Cruz Island bringing hope that bald eagles will reestablish on all the Channel Islands.

Steve I. Lonhart*¹. Management of the Invasive Asian Kelp *Undaria pinnatifida* at its Current Northern Range Limit in Central California.

¹Monterey Bay National Marine Sanctuary

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In March 2000 the invasive Asian kelp *Undaria pinnatifida* was first discovered in southern California. Within 18 months it had spread as far north as Monterey Harbor. Listed by the Global Invasive Species Database as one of the "100 worst invasive alien species", *Undaria* is considered a threat because "it forms dense forests, resulting in competition for light and space, which may lead to the exclusion or displacement of native plant and animal species." Since September 2002 the Monterey Bay National Marine Sanctuary (MBNMS) and City of Monterey have collaborated to monitor the spread of *Undaria* within the harbor. In addition, volunteers under the direction of MBNMS staff began to manually remove *Undaria* in January 2003. Initially, *Undaria* occurred on floating docks, pier pilings, and vessel hulls. By spring 2004, *Undaria* was observed on the bottom of the harbor, covering any available hard substrate, including small rocks and shells. In 2005, *Undaria* densities were relatively low, and this decline corresponded with anomalous nearshore oceanic conditions during the spring. However, surveys in the spring of 2006 indicate *Undaria* densities are increasing again and recruitment is very high. In spite of removal efforts, monitoring data clearly indicate *Undaria* continues to spread slowly throughout the harbor and may be on the brink of escaping to the open coast. Should *Undaria* become established along the open coast, the ecological consequences for central California are unknown. On the one hand, because *Undaria* lacks chemical defenses and is preferentially consumed by native herbivores, grazing pressure by native herbivores on the open coast could keep densities low and minimize negative impacts. On the other hand, *Undaria* was able to "displace multi-species macroalgal communities" in a New Zealand harbor, altering both community structure and function.

Steve I. Lonhart*, Andrew P. DeVogelaere¹, Josh Pederson¹. The Sanctuary Integrated Monitoring Network (SIMoN): Tracking Ecosystem Health in California's Marine Environment.

¹Monterey Bay National Marine Sanctuary

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Comprehensive, long-term monitoring is a fundamental element of resource management and conservation. The Sanctuary Integrated Monitoring Network (SIMoN) was designed in partnership with the central California science and management community to identify natural and human induced changes to the National Oceanic and Atmospheric Administration's (NOAA) Monterey Bay National Marine Sanctuary (MBNMS). The integration of high quality scientific research and long-term monitoring data sets through this program furnishes the information needed for effective management and provides a greater basic understanding of the sanctuary, its resources and its processes. The principal goals of SIMoN are to: 1) integrate existing and historic monitoring conducted in the MBNMS; 2) establish and maintain essential, long-term monitoring programs; and 3) disseminate timely and pertinent information to resource managers and decision makers, researchers, educators, and the general public. Since its inception in 2003, SIMoN has funded over \$4,000,000 on monitoring and research projects within the sanctuary. Metadata and data summaries from 80 monitoring projects are available online at www.mbnms-simon.org. Project information can be accessed using several web-based data discovery tools. The SIMoN website also features an interactive map service that displays high-end geographic information systems without the need for Internet downloads or plug-ins. SIMoN serves as a model for integrating ecosystem information for other west coast sanctuaries, and continues to collaborate with the Central and Northern California Ocean Observatory System (CeNCOOS) to facilitate discovery of observatory data.



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Milton Love^{*1}, Donna Schroeder², Mary Nishimoto, Linda Snook. An Overview of the Fish Assemblages of Oil and Gas Platforms and Natural Reefs off Southern California.

¹Marine Science Institute, University of California, Santa Barbara, ²University of California, Santa Barbara

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Beginning in 1995, using a manned submersible, we have surveyed the fish assemblages characterizing oil and gas platforms and natural reefs in southern California. During the course of these surveys, we have inventoried over 20 platforms and several hundred natural reefs in a wide range of depths from nearshore waters to more than 100 miles offshore. Rockfishes (genus *Sebastodes*) of more than 35 species, tend dominate both platform and reefs assemblages. In general, there are three distinct fish assemblages around platforms. These are 1) midwaters, composed of young fishes; 2) bottom, composed of older juveniles and adults, and 3) shell mounds, composed of both juvenile fishes and dwarf species. Platform and natural reef fish assemblages tend to be similar with several major exceptions. First, because some platforms act as defacto marine reserves, large fishes tend to be substantially more abundant at these structures and thus may serve as major sources of larval production for several species. Second, there is clear evidence that some platforms form critical habitat as nursery grounds for several rockfish species, including bocaccio, *Sebastodes paucispinis*, an over-fished species. During some years, juvenile recruitment of several rockfish species to some platforms dwarf that which occurs over natural reefs.

Alan Lowenthal^{*1}. A Legislator's Role in Facilitating Clean Air and Goods Movement.

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The parties who move marine cargo in southern California are diverse and vital to the economic health of southern California. But, their economic activity is matched with adverse environmental impacts. Elected officials need to understand the dynamics of that process and then operate as an outside force to urge the various parties to do that they already know needs to be done to clean up the air while they are moving cargo. An effective legislator can be a force to give the various parties and excuse to do what they know they need to do. In that respect the role of the effective legislator is to be a catalyst to inspire discussion followed by appropriate action.

Shannon Lyday^{*1}, Jan Roletto¹, Jamie Hall¹, Dru Devlin¹. Beach Watch: Volunteer Shoreline Monitoring Program.

¹Farallones National Marine Sanctuary

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Beach Watch is a long-term shoreline monitoring program of the Gulf of the Farallones National Marine Sanctuary (GFNMS), implemented by the Farallones Marine Sanctuary Association (FMSA). This pioneering volunteer program was established in 1993 to provide valuable ecosystem data to assist management in resource protection. Trained surveyors conduct beach surveys for dead and live vertebrates along the central California coast between Bodega Head in Sonoma County and Año Nuevo on the San Mateo/Santa Cruz County line. Shoreline surveys create a baseline dataset that can be used for early detection of species mortality events and the effects of environmental factors such as oil spills. Illustrating the importance of beached bird monitoring programs, Beach Watch has provided data for various damage assessment settlements as well as contributed information to the scaling and type of restoration projects. Beach Watch provides experienced wildlife reconnaissance surveyors who can quickly survey local beaches, collect oil and oiled wildlife, aid in the direction of response and clean-up efforts, and assess the change in use of the beaches by many taxa of marine organisms and humans. The use of volunteers in long-term monitoring is financially beneficial, but more importantly, allows the public to take an active role in environmental protection, and increases awareness and the capacity for stewardship.

Tony MacDonald^{*1}. Regional Ocean Governance: Federal and State Roles.

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Absent a national legal framework for managing the EEZ, the current patchwork of federal and state laws provides a confusing and, at times, seemingly contradictory set of state and federal rights, roles and responsibilities regarding use and management of offshore ocean resources. Mr. MacDonald will review the morass of current laws, identify the significant policy issues raised by the conflicting approaches, and discuss the importance of addressing these policy questions in designing and implementing effective regional, ecosystem-based governance.

Orville Magoon^{*1}, James Richmond², Linda Lent³, Aisha Daley. World's Most Successful Beach Nourishment Project.

¹Coastal Zone Foundation, ²Geologist, ³Economist

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Two thousand years ago, on Sedir Island in Turkey, Mark Anthony constructed a beach composed solely of ooid sand grains for Queen Cleopatra of Egypt, who had sworn that her feet should never touch non-Egyptian soils. The ooid sand grains are not found in other locations in Turkey. The nearest probable source of the ooids is the Mediterranean coast of Egypt west of Alexandria. Ooids are unique sand grains, formed around a small nucleus during times when the seas contain excessive amounts of carbon. A discussion will be presented of evidence demonstrating that the ooid sand grains on Sedir Island were most likely shipped in grain barges around 20 B.C.E. and have remained on the beach at Sedir Island, proving that well-engineered beach projects may last over 2,000 years. The management of this historic resource provides both recreational enjoyment and economic and educational benefit to the local economy. In addition to the historic beach, there are archeological sites of high interest on Sedir Island.

Robert E. Malouf^{*1}. Oregon Sea Grant Perspective on West Coast Regional Collaboration to Address Ocean Health.

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The reports of the Pew Oceans Commission and the U.S. Commission on Ocean Policy as well as the U.S. Ocean Action Plan all recommend advances in ocean governance to address the growing challenges that we face in our oceans and coastal zones. One consistent theme in these and other documents is the call for regional and ecosystem-based approaches to resource management. In response, the three West Coast governors are drafting a statement on regional collaboration that will direct gubernatorial staff to work together to advance the states' shared interests in our oceans and coasts. Similarly, all four of the university-based West Coast Sea Grant Programs (UW, OSU, UC, and USC) have joined forces to secure NOAA funding to collaborate on development of a research and information plan for the California Current Large Marine ecosystem of coastal Washington, Oregon and California. Coastal zone management personnel from all three states and the leadership of the four Sea Grant programs have formed a team that will create mechanisms, including workshops and a web-based forum, through which a broad range of stakeholders can provide input into development of the regional plan. I will describe this recently initiated Sea Grant effort from an Oregon perspective, and will reflect on issues identified by other speakers.

John Marra^{*1}. When Will We Tame the Ocean?

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The history of human civilization is the history of the domestication of the land. We no longer have the endless forests of Europe described by Julius Caesar in Gallic Wars, nor the limitless plains of North America described by Lewis and Clark. Nowadays there are few spots left on earth untouched by humankind. For the ocean, domestication is occurring, although at a much slower pace. The ocean is still vast, inhospitable, and unpredictable. But the marks of civilization are there, in habitat destruction, major shifts in the communities of plants and animals, and the loss of larger animal species. The demands on both the ocean and land to provide food for expanding human populations will increase substantially in the coming decades. The goal is to be able to rely on the ocean for protein in a sustainable way, while protecting ocean ecosystems from further degradation. Two paths exist to further utilization of ocean food resources: fishing and aquaculture. Fishing is energetically less expensive since the ocean ecosystem provides services. Aquaculture, on the other hand, provides a product that can be consistently available, and it can replace exploitation of ocean resources with cultivation. Continued fishing (actually, hunting) on the ocean will mean overcoming the overall failure of management. In some cases, the depletion of certain fisheries



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has been, so far, irreversible, and extinction of some fish species through fishing is a strong possibility. The development of aquaculture, by comparison, will mean solving the problems of pollution (aesthetic, chemical, and genetic), and also how the farmed fish are fed; problems that are much less acute than for fishing.

Jim Marshall^{*1}. A Limited Fishery for Red Abalone at San Miguel Island.

¹California Abalone Association

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The California Fish and Game Commission has directed the Department of Fish and Game to work with the California Abalone Association, Federal agencies, and other groups and individuals to develop a plan for a limited fishery for Red Abalone at San Miguel Island (SMI). An Abalone Advisory Group, selected by the Commission, will be tasked with advising the Department as to alternatives for Total Allowable Catch (TAC) and fishery management. The Commission will choose separate Recreational and Market harvest quotas under the TAC and a final fishery alternative. A yearly TAC fishery based on population estimates at SMI and other innovative controls are proposed. A robust monitoring and research program, begun this summer, will track the Red Abalone population and any future harvests at SMI and management will be adjusted yearly. Data from the August 2006 "snapshot" SMI red abalone survey are presented.

Jennifer Martin^{*1}, Ellie M. Cohen¹. A California Current Joint Venture.

¹PRBO Conservation Science

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Joint Ventures—voluntary, public-private, conservation partnerships—were initially established through the North American Waterfowl Management Plan, signed by the U.S. and Canada in 1986 to reverse record declines in waterfowl by restoring and protecting wetlands. Mexico joined in 1994. Inspired by the waterfowl plan's early success and ever-increasing threats, landbird, shorebird and waterbird initiatives were established. In 1999, the North American Bird Conservation Initiative (NABCI) was formed to integrate those efforts for more effective, comprehensive conservation. In North America today there are 16 land-based JVs and plans for more. JVs are incorporating “all bird, all habitat” conservation goals and, as birds can be good indicators of ecosystem function, JVs are viewed as the primary vehicle for implementing conservation continentally. Conspicuously missing, however, are marine JV partnerships to implement science-based, win-win conservation solutions for our oceans. PRBO Conservation Science has begun efforts to establish a California Current Joint Venture (CCJV). The California Current System (CCS), stretching from British Columbia to Baja California and out 200 miles, is one of 5 highly productive eastern boundary currents globally and a major feeding trough for millions of seabirds and other marine predators. The CCS also supports salmon, herring, squid, groundfish and other fisheries vital to coastal economies. Yet, overfishing, bycatch, habitat destruction, climate variability and pollution pose grave threats.

Effective CCS management requires comprehensive cross-jurisdictional approaches. Modeled after the land-based Joint Ventures, a CCJV will be a non-regulatory, voluntary coalition steeped in sound science to help bridge cultural and cross-jurisdictional barriers in ocean management. The CCJV will ultimately bring together commercial and recreational fisheries, regulatory agencies, oil companies, shipping interests, scientists, environmentalists and other stakeholders to protect marine food webs and habitats; promote biodiversity conservation, healthy fisheries, and human health; support the marine economy; and, promote public stewardship of our rich marine environment.

MaLisa M. Martin^{*1}, Mark Carpenter², Ying Poon³, Philip King⁴, Susan M. Ming¹, Heather R. Schlosser¹. GIS Development for the California Coastal Sediment Master Plan.

¹U.S. Army Corps of Engineers, ²KTUA, ³Everest International Consulting, ⁴San Francisco State University

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Recreation, public and aquatic ecosystem health, water quality, navigation safety, storm damage reduction, shoreline protection, sand rights and economic vitality are prime examples of areas of public interest which are directly impacted by the transport and distribution of coastal sediments. The US Army Corps of Engineers and the State of California are working on a comprehensive and adaptive Master Plan to programmatically manage California's coastal sediments. One of the main



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outputs of this project will be a comprehensive GIS database and decision support system set-up for the entire coastal region of California. A GIS database will be the central depository of geo-referenced sediment management data that will be the basis of many analytical tasks to be conducted during development of the master plan and during implementation of priority projects. An important component of the GIS will be the development of decision support tools aimed to assist in the decision making process related to sediment management. The first of these tools developed under the Master Plan is the Coastal Sediment Management Tool (CSMT). The CSMT is a GIS-based management support tool for decision makers to evaluate future dredging and disposal options along the California coastline. Information dissemination will be conducted through the institutionalization of inter- and intra- agency networks, development of a GIS-based Internet map server, and public information outreach. A GIS-based Internet map server will be developed to ensure agency and stakeholder access to GIS-based tools and analysis. The Internet map server will be linked to the coastal sediment management master plan website that will be developed for general public and agency use. A consistent public outreach theme will be the importance of regional planning for sediment management that incorporates and addresses local needs, rather than developing isolated site specific sediment management plans.

John Kirlin¹, Phillip Isenberg², J. Michael Harty³, Michael DeLapa¹, Scott McCleary^{*4}, Melissa Miller-Henson¹, John Ugoretz⁵. Summary of Session: Lessons Learned from the California Marine Life Protection Act Initiative.

¹Marine Life Protection Act Initiative, ²Isenberg/O'Haren, ³Harty Conflict Consulting and Mediation, ⁴CONCUR, Inc., ⁵California Department of Fish and Game

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See "Michael DeLapa" for the summary of this session.

Karen H. McDowell^{*1}. California Aquatic Invasive Species Management Plan.

¹San Francisco Estuary Project

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The introduction of aquatic invasive species (AIS) into California's waters threatens the ecological, social, public health, and economic integrity of the state's water resources. While many agencies have some authority to regulate AIS in California, no centralized authority or management structure exists to coordinate AIS activities. An initial draft of the California Aquatic Invasive Species Management Plan was developed for the Department of Fish and Game several years ago, but the plan was not completed due to lack of adequate funding and staff. In January 2006, the Ocean Protection Council recognized that the development of a comprehensive plan for dealing with aquatic invasive species in California was a high priority, and contracted with the San Francisco Estuary Project to complete the California Aquatic Invasive Species Management Plan and implement selected actions within a one-year time period.

The California Aquatic Invasive Species Management Plan will be presented formally at the California and World Ocean's Conference in September 2006. The presentation will highlight the critical policy changes and implementation actions that will be needed to create the management framework outlined in the plan.

Richard McGonigal^{*1}, Holly Price¹, Erica Burton¹, Jennifer Brown¹, Chad King¹, Sophie DeBeukelaer¹. Evaluating and Siting New Marine Protected Areas in the Offshore Waters of the Monterey Bay National Marine Sanctuary.

¹Monterey Bay National Marine Sanctuary

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The Monterey Bay National Marine Sanctuary has a mandate to protect the marine ecosystem as a whole, including the wide range of species and habitats within its waters. It is therefore evaluating the utility and potential location of new MPAs for their ability to restore naturally functioning ecosystems, to provide areas where research can occur apart from extraction, and to provide ecological "insurance" against environmental variability and unintentional mismanagement. To help in the consideration of MPAs, the Sanctuary convened a multistakeholder working group comprised of a wide variety of interests including recreational and commercial fishing, conservation, research, and fishery managers. The group developed a plan to assess the utility and design of MPAs in the offshore waters of the Sanctuary, outside of three miles, and it is now engaged in



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its implementation. Over the last three years, the Sanctuary and the working group have been developing more detailed goals, compiling more than 80 relevant data layers, and completing a biological resource assessment. Additionally, the Sanctuary has partnered with California to fund the creation of a web-based MPA decision support tool that allows stakeholders to view and query data to evaluate alternative MPA boundaries. Many species in the offshore waters of the Sanctuary spend part of their lives closer to shore, so the design of any offshore MPAs will be coordinated with state-designated MPAs in nearshore waters. This potential state-federal connectivity is an important factor in evaluating the specific MPA candidate areas that the working group has recently identified. Effective assessment and possible implementation of MPAs will depend on continued involvement of a wide array of stakeholders and agencies to craft a solution that both meets conservation needs and allows the continuation of sustainable fishing in the Sanctuary.

Alistair Mcilgorm^{*1}, Judith Kildow². Either Side of the Ocean: An International Comparison of Coastal Issues in California and Eastern Australia.

¹National Marine Science Centre (University of New England and Southern Cross University), ²California State University, Monterey Bay

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The Californian coast and economy is internationally renowned through the media. Similarly the east coast of Australia has a recognised beach culture and is experiencing an increase in the population choosing to live on the coast. Preliminary marine and coastal economic research in Australia has revealed a similarity in issues with California. This paper presents a comparison of problems, symptoms and remedies for a range of issues faced in coastal economies and environments in the two regions. It is apparent that the intensity of the population and economic pressure in California has precipitated a range of needs which Australia and other nations may need to prepare for in the future. However Australia has a range of established and newly declared marine protected areas, and has experienced the associated social and community adjustment in rural coastal communities. Both countries have federal, state and local jurisdictions and a mix of planning legislation which may not be coping sufficiently with the issues the coast is experiencing. Both California and Australia tend to find estuaries to be problematic given their historic use and inherently unresolved ecological, economic and environmental values. Researchers in both nations are considering the use of alternative policy approaches, such as incentives so as alternative futures may be chosen instead of less desirable outcomes. It is apparent that marine tourism is illustrative of both an emerging industry that straddles traditional government agency responsibilities and it's definition, extent, trends, tourist expectations, and environmental impacts need to be evaluated and options addressed in future management regimes. Current studies are opening new awareness of the economic vulnerability of coastal assets and both nations are contemplating the impacts of climate change on the coasts and its societal infrastructure, such as petrochemical processing on the shoreline. In summary this international comparison can assist different nations to recognise the commonality of issues, and to consider the most relevant policy frameworks for achieving sustainable activities on the coast.

Justin Klure¹, Gregory McMurray^{*2}. Ocean Wave Energy Facility Regulation: Integrated Management or Permitting Nightmare?

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Harnessing the energy in ocean waves shows great promise as a renewable energy source, especially on the mid-latitude West Coasts of Europe and North America. The wave climates in these areas, including northern California, Oregon and Washington, appear capable of supplying reliable energy year round, having a higher energy density than that of wind and substantial energy content in all seasons. Technologies are presently being developed that will operate efficiently in water depths bracketing the intersection of the state-controlled Territorial Sea (TS) and the federally-controlled Exclusive Economic Zone (EEZ), generally three statute miles from shore. Oregon's Governor has recently announced that ocean wave energy is a "critical" component of the state's renewable energy objectives. However, many possible environmental effects of this evolving energy source are unknown. There are few applicable models for shared state and federal regulation of ocean energy facilities. While it is assumed that the Federal Energy Regulatory Commission (FERC) will exercise its authority over commercial facilities within or without the TS, pre-commercial facilities within the TS may fall under FERC's 25 MegaWatt bar for some time. Leasing in the EEZ will presumably be conducted under the authority of the Minerals Management Service, whereas the State Lands departments will exercise that authority within the Territorial Sea. Under a federal regime, the states



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will continue to pursue policy objectives under the mandatory authorities of Section 401 of the Clean Water Act and the "consistency" clause of the Coastal Zone Management Act. Conversely, the US Fish & Wildlife and National Marine Fisheries Services will continue to exercise their Endangered Species and Marine Mammal Act authorities in any regime. One model that anticipates and accommodates all of these intersections is Oregon's Hydroelectric Application Review Team (HART) process, which serves to adapt and organize state inputs to FERC's hydroelectric licensing process.

Dan Walker¹, John Orcutt², Marcia McNutt^{*3}, Stephen Weisberg⁴, Robert Knox², Brian Baird⁵. Summary of Session: Development of a National Ocean Research Priorities Plan and Implementation Strategy.

¹Office of Science and Technology Policy, White House, ²Scripps Institution of Oceanography, ³Monterey Bay Aquarium Research Institute, ⁴Southern California Coastal Water Research Project, ⁵California Resources Agency

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See "Brian Baird" for the summary of this session.

Steven Murawski¹, Emily Menashes^{*1}, Elizabeth Norton¹, Denise Woodward¹. NOAA's Ecosystem Approach to Management.

¹NOAA Ecosystem Goal Team

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The National Oceanic and Atmospheric Administration (NOAA) is responsible for stewardship of marine and coastal resources. These responsibilities include managing fisheries, protecting and recovering vulnerable species, monitoring marine and coastal habitats, and protecting these resources and habitats. To attain long-term sustainability of our resources, NOAA is committed to moving toward an ecosystem approach to management (EAM) of the Nation's coastal and marine ecosystems. One of NOAA's strategic goals is to "protect, restore and manage the use of coastal and ocean resources through an ecosystem approach to management", including a vision for the future where "society understands and acts as stewards of healthy coastal and marine ecosystems, not only for our aesthetic enjoyment, but because healthy ecosystems are fundamental to our economic future." Over the past several decades, NOAA has been collecting the knowledge, experience, and information needed to holistically study and manage marine and coastal resources, while keeping the ecosystem in mind. However, work still needs to be done to fully implement EAM. NOAA's future steps towards EAM include improving internal integration and coordination to produce better products and services, and increasing collaboration with partners and stakeholders. To facilitate integration of NOAA's ecological activities and to promote EAM efforts, NOAA formed an Ecosystem Goal Team (EGT), to coordinate activities across NOAA's traditional line office structure. While authors and organizations characterize an ecosystem approach to management somewhat differently, there are several common themes that are captured by the following NOAA definition: An ecosystem approach to management is management that is adaptive, geographically specified, takes account of ecosystem knowledge and uncertainties, considers multiple external influences, and strives to balance diverse societal objectives. NOAA recognizes that the transition to an ecosystem approach to management needs to be incremental and collaborative.

Dennis Hedgecock¹, Dale A. Kiefer¹, Anthony Michaels^{*1}. Aquaculture and Ocean Ecosystems.

¹University of Southern California

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Marine fish, whether wild or caged, must eat, consume oxygen, excrete and defecate as part of their life and growth. Aquaculture is critiqued by its many detractors for these very requirements of the living organisms, in large part, because the concentration of these activities creates a real or perceived environmental impact compared to the same quantity of animals living wild. Further, on a global scale, we now think that more than 90% of the larger fish have been removed by human activity and that in wild fisheries, we are forced to move down the food chain - either by default or to take advantage of the now available production of the feed fishes, no longer under the pressure of the carnivores we have consumed. Thus, the comparison and evaluation of environmental impacts of aquaculture on ocean ecosystems requires careful consideration of mixing scales, density, per-capita physiology and trophic efficiencies. The concentration of fish in a pen creates a local impact that must be balanced against the aggregate impact of that same number of fish in a turbulently mixing ocean. The food



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web impacts of aquaculture and fisheries, particularly those that feed on wild-caught bait fish, depends on the mix of feed options, the metabolic efficiency of caged, selected fish and the fate of bait fish in today's ocean or an ocean with the desired restored stock of carnivores. Each of these factors, taken in isolation can be used to create a positive or negative picture of aquaculture. However, tradeoffs among factors are more usefully employed in an ecosystem based approach to define the management challenges and potential solutions that can guide better decision-making on siting, economics, management, or the decisions on whether and when to allow aquaculture to exist as a part of the food supply of a growing planet.

Keith Michel*¹. Commercial Ocean Shipping.

¹Herbert Engineering Corporation

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Over 90% of world trade is moved by the maritime commercial shipping industry. The liberalization of trade over the last decades has led to a specialization of production amongst nations. In particular, Asia has become the leading provider of manufactured goods. The U.S. demand for petroleum products continues to grow while domestic production declines. More than ever before, the economic and societal well being of the U.S. is dependent upon efficient, safe, and environmentally friendly deep sea shipping. Over the last fifty years, bulk shipping costs have increased at less than one-tenth of the overall inflation rate. This translates into lower costs to the consumer. Seaborne transportation adds only about 2 cents to the price of a gallon of gasoline, \$10 to the cost of a television, and a few hundred dollars to the cost of a car. The safety and environmental performance of ocean going cargo ships have also continuously improved over this period. Many of the technology advancements that enabled this improvement in safety and efficiency were introduced by U.S. shipping and design companies. New ship types originating in the U.S. include containerships, very large crude carriers (VLCC's), and ro-ro's. Merchant shipping, sometimes referred to as the "fourth arm" of the nation's defense, played an integral role in the U.S. successes in World War I and World War II. However, the U.S.-flag share of its waterborne foreign commerce has declined from 22% in 1958 to 8% in 1967 to less than 4% today. This paper reviews the history of shipping operations and ship design in the U.S., and explores the unanswered and very important question as to whether our reliance on the foreign fleet puts U.S. interests at risk.

Paul Michel*¹. Tapping Federal Resources and Services through the Coastal America Partnership.

¹U.S. Environmental Protection Agency

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The U.S. Ocean Action Plan calls for improved ocean governance. At the federal level, eleven of fifteen cabinet-level departments and four independent agencies play important roles in ocean and coastal policy and delivery of federal programs. These agencies interact with one another and with state, territorial, tribal, and local authorities in sometimes haphazard ways. Improved communication and coordination is needed to enhance ocean management and protection. For natural resources conservation and restoration and public outreach, the federal government has already at its disposal, a tried and true coordinating mechanism - - Coastal America. Coastal America is a unique partnership of federal agencies, state and local governments, and private organizations who work together to protect, preserve, and restore our nation's coasts. Coastal America also offers three focus areas to assist its partners: 1. Coastal ecosystem learning centers help the Coastal America partnership raise public awareness of, and increase public involvement in, coastal restoration and protection. To date, 16 marine education institutions and aquaria have been designated as Coastal Ecosystem Learning Centers. 2. Corporate wetlands restoration partnership is a voluntary public-private partnership. Through this program, corporations join forces with federal and state agencies to restore wetlands and other aquatic habitat. This enables businesses to contribute to coastal restoration and protection. 3. Military involvement links military mission and training requirements with coastal restoration needs. When feasible, the military contributes to Coastal America projects as part of their training requirements. As a result, the military accomplishes essential exercises while performing valuable environmental project work in their communities. The Southwest Team of Coastal America (California) has had some success. This paper will present several examples of successful Coastal America projects in California and outline future goals. Coastal America is a model for improved ocean governance.



ORAL PRESENTATION ABSTRACTS

Melissa A. Miller*¹, Spencer Jang², Barbara Byrne², Erin Dodd¹, Elene Dorfmeier¹, Michael Harris¹, Karen Worcester³, David Paradies⁴, David A. Jessup¹, Woutrina Miller². Environmental, Demographic, and Spatial Patterns of Enteric Bacterial Infection in Southern Sea Otters in Central California.

¹Marine Wildlife Veterinary Care and Research Center, Office of Spill Prevention and Response, California Department of Fish and Game, ²School of Veterinary Medicine, University of California, Davis, ³Central Coast Regional Water Quality Control Board ⁴Bay Foundation of Morro Bay

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Although the southern sea otter (*Enhydra lutris nereis*) is a federally protected threatened species, the population has been slow to recover, in part due to high mortality due to infectious agents. Many bacteria and protozoa isolated from sea otters are similar to terrestrial pathogens and evidence suggests that otter exposure could be associated with anthropogenic coastal change. We investigated the prevalence of selected enteric bacteria in feces from sea otters sampled throughout central California between 2000 and 2005. Bacteria of interest included *Campylobacter* spp. including *C. jejuni*, *Salmonella* spp., *Vibrio* spp. including *V. cholerae*, *V. parahaemolyticus* and *V. alginolyticus*, *Plesiomonas shigelloides*, *Clostridium perfringens*, *C. difficile* and *Escherichia coli* H7:0157. Samples were obtained from anesthetized wild otters, from transport cages, at sea otter haulouts and during necropsy of freshly dead animals. Samples from 244 otters (137 live and 107 freshly dead animals) were included in the study. Data on each otter's gender, age class and stranding or sampling location were recorded at the time of sampling. The goals of the study were to: 1.) characterize aerobic enteric bacterial flora of wild otters 2.) determine the prevalence of selected potential bacterial pathogens present in otter feces and 3.) examine the data for associations between the isolation of these bacteria from otter feces and potential risk factors, such as sea otter sex, age class, coastal location and sample period (wet or dry season). We also investigated potential associations between the detection of these bacteria in feces and environmental factors such as high or low exposure to coastal freshwater runoff, sewage effluent and coastal human population density. Potential associations were identified through univariate analyses and further evaluated using logistic regression. Our long-term goals are to investigate potential land-sea connections for these infections and to determine the pathogenicity of enteric bacterial infections in sea otters.

John Kirlin¹, Phillip Isenberg², J. Michael Harty³, Michael DeLapa¹, Scott McCreary⁴, Melissa Miller-Henson*¹, John Ugoretz⁵.

Summary of Session: Lessons Learned from the California Marine Life Protection Act Initiative.

¹Marine Life Protection Act Initiative, ²Isenberg/O'Haren, ³Harty Conflict Consulting and Mediation, ⁴CONCUR, Inc., ⁵California Department of Fish and Game

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See "Michael DeLapa" for the summary of this session.

Susan Ming*¹, Heather R. Schlosser¹, Karen Berresford², Clifton Davenport³. An Innovative „Super-Regional“ Resource Management Initiative: California Coastal Sediment Master Plan.

¹Los Angeles District, U.S. Army Corps of Engineers, ²San Francisco District, U.S. Army Corps of Engineers, ³Division of Mines and Geology, California Department of Conservation

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California Coastal Sediment Master Plan will develop a comprehensive plan for the management of sediment in coastal California to reduce shoreline erosion and coastal storm damages, provide for environmental restoration and protection, increase natural sediment supply to the coast, restore and preserve beaches, improve water quality along coastal beaches, beneficially use material dredged from ports, harbors, and other opportunistic sediment sources, and related purposes. The comprehensive statewide master plan will be the result of a dynamic process of evaluation and prioritization of coastal sediment management needs that focuses on physical relationships and multipurpose benefits of California's coastal watersheds, wetlands, and beaches. The statewide plan, will for the first time, identify, evaluate, and prioritize sediment management approaches in a framework that addresses natural and man-made influences on sediment sources, transport, and deposition. The master plan will identify the means to restore and manage high priority coastal wetlands and beaches with the goal of enhancing and preserving these valuable assets. One of the main outputs of this project will be a comprehensive GIS database and decision support system set-up for the entire coastal region of California. A GIS database will be the central



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depository of geo-referenced sediment management data that will be the basis of many analytical tasks to be conducted during development of the master plan and during implementation of priority projects. Other future outputs will be a sediment strategy and programmatic EIS. The Master Plan will provide coastal managers, planners and engineers with the information needed to develop best management practices and optimize strategies to realize environmental and economic benefits for the State of California and the Nation. The Master Plan will provide regional planning for sediment management that incorporates and addresses local needs, rather than developing isolated site specific sediment management plans.

Leslie Mintz^{*1}. The Education and the Environment Initiative.

¹Heal the Bay

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Heal the Bay, a non-profit organization based in Santa Monica, sponsored the EEI's authorizing legislation, AB 1548. Leslie Mintz will discuss the initial genesis for the legislation and background leading up to former Governor Davis signing AB 1548 into law in October 2003. Ms. Mintz will also highlight Heal the Bay's role in the current EEI implementation effort from a non-governmental perspective.

Leslie Mintz^{*1}, **Shelly Luce**², **Jonathan Bishop**³, **David Beckman**⁴, **Scott Lines**⁵, **Timothy Sobelman**⁶. The Los Angeles River Trash Total Maximum Daily Loads: Perspectives on the Road to Success.

¹Heal the Bay, ²Santa Monica Bay Restoration Commission, ³Los Angeles Regional Water Quality Control Board, ⁴Natural Resources Defense Council, ⁵Long Beach Storm Water Management Division, ⁶Office of Storm Water Management, California Department of Transportation

*Presenter's E-mail: lmintz@HealTheBay.org'

Success has many parents; failure is an orphan. Years into the first major trash pollution limit for a major urban river flowing into the ocean, the work of cleaning up has finally begun in earnest. Our panel will examine the historical evolution and current status of the LA River Trash TMDL from a variety of perspectives: the regulators (the LA regional Water Quality Control Board); the legal environmental community (Natural Resources Defense Council), which legally enforced the Clean Water Act TMDL provisions; the grassroots environmental community (Heal the Bay) who helped to fund the implementation of the TMDL through bond measures like Proposition O regulated local government (Long Beach) and the regulated state entities (CalTrans), who are both working to implement the TMDL. The varied expertise of this panel ensures a comprehensive look at the law, the policy, and the science of this landmark pollution limit. Clear understanding about this TMDL is critical to the full implementation of the Ocean Action Plan, and to fulfillment of the state's mission to protect and restore coastal and inland waters. As a preeminent component of the Clean Water Act, TMDLs are critical to the success of the Ocean Protection Council and its mission.

Michael R. Murray¹, **Sarah D. MacWilliams**¹, **Chris Mobley**^{*1}. Charting a New Course for the Channel Islands National Marine Sanctuary.

¹Channel Islands National Marine Sanctuary

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The Channel Islands National Marine Sanctuary, designated in 1980 and encircling five of islands off the coast of Ventura and Santa Barbara counties, is currently completing a revision of its original management plan. With a goal of providing long-term marine resource protection while facilitating compatible uses, the Sanctuary's new plan charts a progressive 5-10 year course for furthering the scientific understanding, public awareness and understanding, and community stewardship of this nationally significant marine protected area. Leveraging extensive local, state and federal partnerships, both governmental and within the private sector, the new management plan for the Sanctuary promotes a collaborative approach to ecosystem-based management. With management strategies ranging from the coordinated management of California's largest network of marine reserves to the building of a state-of-the-art education facility for teaching ocean science, the new plan reflects the Sanctuary's multi-faceted approach to marine conservation. A management plan overview is presented, sharing planned programs, regulation changes, and emerging issues.



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David E Montagne*¹. Challenges For Using Sediment Quality Objectives in Regulatory Programs: A Permittee's Perspective.

¹Los Angeles County Sanitation Districts

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The sediment quality objectives (SQOs) for direct effects on benthos (aquatic life uses) being developed by the State of California are inherently different from aquatic life-based water quality objectives (WQOs) that currently exist in Basin Plans, statewide plans and the California Toxics Rule. The SQOs are not pollutant specific, relying on a multiple lines of evidence approach incorporating measures of exposure to chemical mixtures along with evidence of biological effect. The intent is to evaluate overall sediment quality as opposed to identifying the cause of impairment". Therefore chemical causation is not inherent in the finding of a SQO exceedance and the SQOs may be exceeded at a site as the result of factors other than toxic pollutant loading. In addition the narrative SQOs are applied as a sampling site assessment tool and additional steps are necessary to relate the site assessment to a water body condition. Therefore unlike WQOs the SQOs do not allow the convenient derivation of pollutant-specific concentrations for effluent limits waste load allocations or clean-up levels. These characteristics reflect the underlying difficulty and large scientific uncertainties about the relationship of specific pollutant loads and sediment conditions to biological response. While the proposed SQOs provide a science-based assessment of sediment condition that actually reflects the uncertainties involved they present challenges in their implementation in a regulatory setting.

Charles Moore*¹. Synthetic Polymers in the Marine Environment: What We Know, What We Need to Know.

¹Algalita Marine Research Foundation

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Synthetic Polymers, commonly known as plastics have been entering the marine environment in quantities paralleling their level of production over the last half century. (Thompson) Thirty years ago the prevailing attitude of the industry was that "plastic litter is a very small proportion of all litter and causes no harm to the environment except as an eyesore."(Derraik) Since that time, US consumption of thermoplastics has sextupled (Center for Environmental Education), and litter is now 60-80% plastic, whether on land or in the marine environment (Plastic Debris Rivers to Sea Project). While undoubtedly still an eyesore, plastic debris is now having significant harmful effects on marine biota. Albatross, fulmars and petrels mistake floating plastics for food and few, if any, individuals of these species remain unaffected; in fact, 44% of all seabird species ingest plastic. Sea turtles ingest plastic bags, fishing line and other plastics, as do 26 species of cetaceans. (Derraik) The numbers of fish, birds mammals, and other marine organisms that succumb each year to derelict fishing nets and lines in which they become entangled is not reliably known, but estimates in the millions have been made (Moore). Plastic particles of two main varieties are prevalent in the world ocean and on beaches. Degraded pieces broken from larger objects, and the basic thermoplastic industry feedstock, resin pellets, usually less than 5 mm in diameter, have been documented to occur worldwide. Ingestion of small plastics by filter feeders at the base of the food pyramid is known to occur (Moore), but has not been quantified. Ready ingestion of degraded plastic pellets and fragments (EPA) raises toxicity concerns since they are known to sorb hydrophobic pollutants (Moore, Takada). The potential bioavailability of compounds added to plastics at the time of manufacture, as well as those sorbed from the environment is a complex issue that merits more widespread investigation (Andrady). The physiological effects of any bioavailable compounds desorbed from plastics by marine biota have not been directly investigated, although laboratory studies of ingestion by birds are in progress (Takada), and a fish study to examine possible xenoestrogenic activity of ingested plastics has been designed by Michael Baker of the UCSD Department of Medicine. "Studies by Gregory, Zitko and Hanlon have drawn attention to ... small fragments of plastic ...derived from hand cleaners, cosmetic preparations and airblast cleaning media"(Derraik). The quantities and effects of these contaminants on the marine environment have yet to be determined, but in a study conducted on the Los Angeles and San Gabriel Rivers in 2004-5, 2 billion plastic particles of all types, less than 4.75mm, were found to flow toward the ocean in three days of sampling (Moore)."There is also potential danger to marine ecosystems from the accumulation of plastic debris on the sea floor...The accumulation of such debris can inhibit the gas exchange between the overlying waters and the pore waters of the sediments..."(Derraik). The extent of this problem and its effects, have yet to be investigated, but based on resin sales in the United States, a little more than half of all plastics will sink in seawater (EPA).



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Lance Morgan^{*1}, Kristina Gjerde². Deep Seabed Ecosystems Within and Beyond California Waters.

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Recent research and exploration using remotely operated vehicles and manned submersibles throughout the waters of California, the United States and the world has documented widespread and diverse deep sea coral ecosystems. New species of deep sea corals are being found at an astonishing rate in areas where they were virtually unknown just a decade ago. In many cases discovery of corals has been accompanied by discovery of damage from commercial fishing. This has lead to an international movement to protect and conserve these fragile and slow growing ecosystems. Waters offshore of California are home to many different types of deep sea corals from Christmas tree corals off southern California, to sponge and coral fields on Davidson Seamount and hydrocoral beds on Cordell Bank. In other areas off southeast USA, researchers have documented extensive stony coral reefs comprised of Lophelia pertusa and Oculina varicosa. In the Aleutians Islands, extensive coral forests of 5m tall octocorals flourish. Exploration of seamounts in international waters has just begun but has already documented many new species of coral as well as impacts from bottom fishing activities. In response to growing conservation concern, MCBI scientists began a review of deep sea coral records and locations in the USA, and threats to these deep-water ecosystems. This research highlights for the first time deep-sea coral areas that may be at risk due to their value as fishing grounds or to other human activities such as hydrocarbon development. Around the world approaches to coral management and conservation have been ad-hoc and mostly enacted through fisheries regulations such as those adopted by the Pacific Fishery Management Council designating corals as "essential fish habitats" off the California coast. However, both in California and beyond, the next step must be towards a more comprehensive approach to ecosystem management.

Susanne C. Moser^{*1}. Adapting to the Impacts of Climate Change: How Ready is Coastal California?

¹National Center for Atmospheric Research

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Governor Arnold Schwarzenegger's Executive Order S-3-05 of June 1, 2005 requested – among other things – that future climate change impact assessments for the State "report on mitigation and adaptation plans to combat these impacts." This presentation reports on a study conducted on the preparedness and adaptive capacity of California's coastal sector. They study is based on interviews with coastal managers in relevant regional, state, and federal agencies, as well as on a survey of local coastal managers. Results indicate considerable capacity in this economically and technologically vibrant state to deal with the impacts of climate change but also a variety of challenging constraints on realizing that potential, raising serious questions about California's readiness to plan for and adapt to the growing risks in the coastal zone.

Sarah S. Mosko^{*1}. Health Effects of Plastics: An Overview.

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Numerous potential health risks stemming from petroleum-derived plastics have come to light in the last decade based on a wealth of animal and human studies. Depending on the type of resin in question, plastics can represent health threats at all three stages in their life cycle: synthesis, period of use and disposal. Either the actual building blocks of the resins or various additives later "mixed-in" (i.e. non-covalently bonded, allowing migration to occur) can be the focus of concern. An overview is presented of the literature on toxicities (endocrine disruption, developmental toxicity, carcinogenicity) associated with four common plastics. a) Polyvinyl chloride - vinyl chloride monomer, a known carcinogen, is released during manufacture. - endocrine disrupting phthalate esters are added in large quantities as plasticizers. - toxic heavy metals additives serve as heat/UV light stabilizers. - dioxins are produced during manufacture and incineration. b) Polycarbonates - the building block is bisphenol-A, a synthetic estrogen. c) Non-stick (e.g. Teflon) coatings - perfluorooctanoate (PFOA or C-8), a known carcinogen that is used and produced during manufacture, is building up in human tissues. - dangerous vapors and particulates are released at high cooking temperatures. d) Polystyrene - polymerization is never complete, allowing leaching of the carcinogenic styrene monomer. - flame retardants (polybrominated diphenyl ethers or PBDEs), known to act as carcinogens and developmental toxins, can be present in high concentrations. Given that the U.S. production of plastic resins has reached



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115 billion pounds/yr (over twice the weight of the entire population), a thorough understanding of potential threats to human health is imperative.

Peter Mull^{*1}, Kim Sterret². Regional Sediment Management: The New Paradigm at Ocean Beach, San Francisco.

¹U.S. Army Corps of Engineers San Francisco, ²California Department of Boating and Waterways

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The US Army Corps of Engineers, San Francisco District, is spearheading a Regional Sediment Management (RSM) demonstration project along the eroded shores of San Francisco's Ocean Beach. Erosion has caused the loss of beach and parking facilities and threatens vital municipal infrastructure including the City's offshore outfall and storm water treatment facilities. Intelligent beneficial reuse of beach-compatible dredged sediment is critical to ameliorate adverse changes to coastal sediment budgets caused by human intervention. The RSM demonstration project involves using sand dredged annually from the San Francisco Bar Main Ship Channel and placing it nearshore to supplement the littoral budget.

Using the hopper dredge "Essayons", the Corps recently completed the second stage of this on-going project in May 2006. To better understand the transport and fate of this sediment the USGS has been retained by the Corps to monitor the sediment dynamics and resultant shoreline morphology changes. This effort will guide future RSM project iterations and provide improvements in shoreline protection practices, ecosystem restoration and navigation operations. This soft solution is more consistent with resource management and regulatory policies, and offer significant environmental advantages over traditional hard armoring of the shoreline. To date, this project has been a model for inter-agency teamwork with multiple stakeholders striving to protect vital public resources while enhancing the environment. Project partners include the Corps, the California Department of Boating and Waterways, the City of San Francisco, the Golden Gate National Recreation Area, and the USGS, with support from resources agencies such as the US EPA, and the California Coastal Commission.

Stephan Munch^{*1}. Dealing with Uncertainty in Rebuilding Science.

¹Marine Sciences Research Center

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In 2000 the U.S. Court of Appeals criticized the National Marine Fisheries Service (NMFS) for setting a rebuilding plan that had an 18 percent chance of success, saying: Only in Superman Comics' Bizarro world where reality is turned upside down could the [National Marine Fisheries] Service reasonably conclude that a measure that is at least four times as likely to fail as to succeed" complies with the law. The court ordered NMFS to develop quotas that have at least a 50 percent chance of rebuilding the stock within the legal timeframe. Although the sentiment of the court is obvious what exactly was meant by a 50% chance of success is not entirely clear given the various types of uncertainty to which any rebuilding analysis is subject. To guarantee that the court's ruling is met we must have a framework in place that explicitly recognizes observation process and structural uncertainty and deals with each in an appropriate fashion. Using a simple population model and simulated data I demonstrate some of the pitfalls of conflating these disparate sources of uncertainty and suggest a Bayesian approach to circumvent these issues.

Chad Nelsen^{*1}, Linwood Pendleton². Non-Market Valuation of Surfing at Trestles in San Clemente, California.

¹Surfrider Foundation, ²University of California, Los Angeles

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Like many forms of outdoor recreation, much of the economic value of surfing is never captured by the market. Surfers are able to access waves without paying entrance fees. Nevertheless, surfing, is likely to contribute significantly to the economic well-being of beach goers. Research to determine the non-market value of resources continues to become more common in the literature and even has been mandated by NOAA and EPA for use in the evaluation of natural resource damages. While many studies have focused on marine and coastal recreation, including the value of marine protected areas for snorkeling and scuba diving, clean water, and beaches, there have been very few (if any) studies on the non-market value of surfing. Meanwhile, surfing supports a multi-billion dollar industry, attracts millions of participants and is an essential element of California's image. We use travel cost methods to demonstrate the non-market value of surfing at Trestles, one of California's



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most famous surfing destinations. We present results of a travel cost surveys of more than 200 surfers at Trestles during the summer of 2006. Estimates of surfing avidity, expenditures, and the non-market value of surfing (i.e. the value surfers place on access to surf sites above the costs associated with getting to them) will be estimated.

Carl E. Nettleton*¹. A Collaborative Three-Legged Stool to Balance Ocean Investigations, Decisions, and Public Understanding.

¹San Diego Oceans Foundation

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Hundreds of millions of dollars are spent annually on ocean research and education by numerous agencies, institutions, universities, non-profits, and industries. Even with these resources, four barriers block common understanding of oceanic processes:

1. A common view of the ocean is lacking. Because the ocean landscape is invisible, people look at the ocean from many perspectives. No process unifies those perspectives.
2. The Eureka Effect. By nature, scientists are trained to tell the world what they have found, and educators are trained to tell the results of scientific inquiry. They are not trained to be collaborators.
3. Competitiveness for funding for ocean research and public education blocks gains that could be made with a collaborative approach.
4. Variable and inadequate government funding. Funding for ocean research and education has been variable and inadequate, frustrating the consistency necessary for long-term understanding.

Overcoming these barriers requires a three-part collaborative process that can be envisioned as a stool. Each leg of the stool represents a successful collaboration that will result in a base to improve management, conservation, and protection of the ocean. The three sturdy legs of the stool are:

1. Investigations. Scientists and researchers collaborating aggressively to close gaps in knowledge.
2. Understanding. Educators joining together to provide innovative and interactively- presented ocean information leading to public support for fact-based ocean policy decisions.
3. Decisions. Ocean interests embracing the mutual goal of demanding that gaps in understanding be closed so policy decisions can be based on agreed-upon facts rather than simply differences in values.

The presentation proposes a unified view of the ocean using geographical information system (GIS) technology to help coordinate collection and sharing of data and integrate and coordinate the institutions responsible for ocean and coastal resources. The presentation was finalized in collaboration with ocean researchers, educators, and interests.

Melissa Neuman*¹, **John Butler**¹. Developing a Sound Recovery Strategy for the First Endangered Marine Invertebrate, White Abalone (*Haliotis sorenseni*).

¹National Marine Fisheries Service

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White abalone (*Haliotis sorenseni*), a deeper-water species inhabiting kelp forest habitats of the southern California and central Baja California coasts, became the first marine invertebrate to be added to the Endangered Species List in May 2001. Critical to developing a recovery plan for white abalone is better understanding the factors that led to its decline, improving estimates of abundance, gaining a better understanding of the species' life history, and refining the focus of future conservation efforts. A threats assessment revealed that the impact of fishery exploitation was likely the major cause for the species' decline. Although the fishery was closed in 1996, the effects of overfishing on the population structure of the species (e.g., Allee effects) have resulted in further declines. Recent surveys conducted at two banks and one island off the southern California coast revealed that the total population size may be higher than previously estimated because the amount of suitable habitat identified at these sites (3, 646 ha) is more than 10 times greater than previously estimated (202 ha). However, densities remain at least an order of magnitude lower (3-50 per ha) than pre-exploitation densities (479-2,300 per ha). Surviving individuals are relatively large (> 100mm), primarily solitary (> 1m from its nearest neighbor), and occur between 30-60m depth at water temperatures of ~ 10-12 oC. Given the scarcity of small (< 100mm) survivors and possible temperature limitations for developing larva, the viability of these populations remains unknown. These data highlight the fact that continued



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monitoring of trends in wild populations is crucial. Future recovery activities should focus on determining the critical densities required for successful spawning, the spatial scale over which recruitment dynamics are operating, and whether artificial enhancement may help in achieving the critical, scale-specific densities necessary for recovery and long-term viability of the species

Teri E. Nicholson*¹, **Karl A. Mayer**¹, **Michelle M. Staedler**¹, **Andrew B. Johnson**¹, **Michael J. Murray**¹. Recent Trends in Live-Strandings of the Southern Sea Otter and Relevance to Mortality.

¹Monterey Bay Aquarium

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During the last few years annual salvage records from beach-cast carcasses of southern sea otters represent roughly 10% of the estimated size of the wild population (Hatfield, USGS), and approximately 50% of estimated mortalities. These salvage records have provided substantial evidence that increased mortality is the primary reason for the population's slow growth (Estes et al. 2003). Since 1984 the Monterey Bay Aquarium's Sea Otter Research and Conservation (SORAC) program has recovered more than 300 live-stranded sea otters but has experienced a significant recent increase in (1) live-strandings, (2) proportion of stranded prime-age adults, and (2) incidence of infectious disease as primary stranding cause. We hypothesized that demographics and stranding causes of live-stranded sea otters would be similar to salvage records, indicating that live-stranded animals are another important resource to better understand factors related to increased mortality. We compared 117 live-stranding cases (2001–2004) with 105 salvaged carcasses (1998–2001, Kreuder et al. 2003). Prime-age adults stranded most frequently in both groups (57% live-strandings vs. 58% salvaged carcasses), followed by juveniles (34% vs. 29%) and aged otters (9% vs. 12%). In addition, infectious disease was the primary cause of stranding for live animals and salvaged carcasses (35% vs. 60%), followed by trauma (30% vs. 29%). Protozoal encephalitis (17% vs. 21%) and acanthocephalan peritonitis (13% vs. 15%) were primary infectious diseases, and shark attack was a common source of trauma (9% vs. 10%). These results indicated that causes of live sea otter strandings were similar to causes of mortality. Furthermore, live-stranded otters may provide information regarding clinical signs of disease and responses to novel treatments that is unobtainable from dead otters, and may enhance understanding of factors related to slow recovery of the southern sea otter population.

Rachel T. Noble*¹. Comparing Routine Methods for Assessment of Recreational Water.

¹University of North Carolina

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Comparing routine methods for assessment of recreational waters Rachel T. Noble University of North Carolina at Chapel Hill, Institute of Marine Sciences Three methods are routinely used to measure indicator bacteria concentrations in recreational waters; membrane filtration (MF), multiple tube fermentation (MTF), and chromogenic substrate (CS) technology kits (such as Colilert-18®, from IDEXX Laboratories, Inc.). To assess comparability of these methods, quantify within-laboratory variability for each method, and place that variability into context of variability among laboratories using the same methods, several large scale intercalibration exercises have been conducted. Typically, labs processed several (3-5) replicate samples from a range of sample types and environments; some created by inoculating seawater with cultured bacteria and some collected directly from aquatic environments. Total coliforms, fecal coliforms (or *E. coli*) or enterococci were measured using a performance-based approach. Overall, results were generally comparable, especially between MF and CS methods. Variability was greatest for the MTF. For all of the studies, method variability within lab was greater than among lab variability. Studies conducted also showed that while correlated, total coliform values were slightly higher using CS than either MTF or MF. Fecal coliform values were ca. 12% lower with CS, reflecting specificity of the CS method for *E. coli* rather than the entire fecal coliform group. No significant differences were observed for enterococcus, though some differences were observed within specific laboratories. Differences for all of these indicators were small and when assessed categorically, there was more than 90% agreement between CS and traditional methods. Verification analyses have demonstrated specific false positive rates associated with each method, with false positive rates sometimes reaching nearly 20%. The large scale studies conducted indicated that rates of exceedence at recreational beaches are directly related to the standard utilized. Additional comparison studies conducted outside of the State of California have yielded generally similar results, with some discrepancies.



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Walter Nordhausen^{*1}, James R. Payne², Deborah French-McCay³, Eric Terrill⁴. Applications of Coastal Observatories for Tracking the Fate and Effects of Dispersed Oil: A Program for Natural Resource Damage Assessment.

¹Office of Spill Prevention and Response, California Department of Fish and Game ²Payne Environmental Consultants, Inc.,

³Applied Science Associates, Inc., ⁴Scripps Institution of Oceanography

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Large areas off the California coastline were designated in 2003 as "Pre-approval Zones" for dispersant application in the event of oil spills. The application of dispersants may reduce impacts to wildlife (e.g., seabirds, sea otters) and shoreline habitats, but with the tradeoff that the dispersed oil may cause impacts to water column organisms. Oil-spill fate and transport modeling is currently being used by CA OSPR to develop the time and spatial scales, and equipment needs for a formal Dispersed Oil Monitoring Plan (DOMP) to document hydrocarbon water column concentrations, potentially exposed organisms (zooplankton), and the impacts of oil spills with and without dispersant use. These measurements are essential to the evaluation of environmental trade-offs justified as a decision to use dispersants under certain circumstances. The growing capabilities of the coastal observatories designed for the coastal waters bordering the State are serving a critical function of provided these much needed measurements. Recent tests tracking simulated dispersed oil (fluorescein dye) using aircraft, shipboard measurements, drifters, and surface current mapping HF radar are quickly showing the need for a continuously operating coastal monitoring system within the State. Without these data, Natural Resource Damage Assessment (NRDA) efforts will be absent critical quantitative and qualitative information. This presentation will consider: Dispersed Oil Monitoring Plan Objectives • Differences in SMART and DOMP Objectives and Approaches Development of the DOMP Use of Oil Spill Fate and Trajectory Models to Inform Sampling Approaches o Sampling Methods o Field Validation of DOMP Protocols using real-time data available from the Southern California Coastal Ocean Observing System (www.sccoos.org) • Possible Implications for Future Spill Response Strategies

Elliott A. Norse^{*1}. Zoning The "Last Frontier": From Concept to Practice.

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The oceans are often called "the last frontier," and some people still portray them as an inexhaustible cornucopia. This had lead to declining ocean health almost everywhere. Frontier resource use is extensive and wasteful. Users are largely unconstrained by legal, economic or social feedbacks. Unfortunately, as populations grow and economic uses and technologies become more powerful, frontier use inevitably becomes unsustainable. Symptoms include serial depletion of large predators and structure-forming species, whose loss reduces ecosystem services on which humans depend. A major underlying reason is that fragmentation of governance and spatial and temporal mismatches among ecological, economic and governance processes are inimical to sustainability in a world that is rapidly globalizing. The existing approach of species-based and activity-based management of the sea do not work because they 1) are piecemeal, and do not account for the interactions among activities; and 2) fail to recognize the heterogeneity of physicochemical, biological and human processes in the sea. An alternative to frontier use long used in many traditional societies is place-based ecosystem management that confers usage rights in a management regime governed by customs, social mores and enforceable laws. A modern version of place-based management suited to the spatial scales of marine ecosystems is comprehensive ocean zoning. Zoning is a framework for ecosystem-based management that reduces conflict, uncertainty, and costs by separating incompatible uses and specifying how particular areas may be used. On a state, regional or national level, zoning would be a science-based public process involving all legitimate interests that would fashion a mosaic of zones to reflect the needs, interests and capabilities for conservation and economic development. This approach to governance would be democratic, proactive and comprehensive, a major advantage at a time increasing demand for place-based government designation for private uses including offshore oil and gas, wind power and aquaculture.

Elliott A. Norse^{*1}. Ecosystem-Based Management: Applying Lessons Learned to Areas Beyond National Jurisdiction.

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Californians are understandably concerned about disappearing fishes and fisheries, habitat damage, pollution, alien species and impacts of global warming in their coastal waters, but harm to oceans beyond state and federal jurisdiction is also rapidly increasing. And while California is striving to improve governance in its waters, governance of the high seas, constituting 64% of the world's ocean, is much weaker than in California waters and in the federal government's Exclusive Economic Zone. The remoteness of high seas from dense human populations confers some protection; they are far less polluted by chemicals or far less plagued by invasive species than San Francisco Bay and other bays and harbors. But fishing now occurs in the world's remotest areas, and is draining the open ocean of its last concentrations of large predators, including tunas and billfishes. Moreover, fishing is no longer confined to the surface layer; longlining for Patagonian toothfish ("Chilean seabass") in subAntarctic seas occurs as deep as 3,500 meters, while bottom trawling for deep-sea sharks, grenadiers and orange roughy on continental slopes and seamounts can drag the seafloor as deep as 2,000 meters. Bottom trawling is a particular concern; it is the most destructive fishing method, and is now happening in the most vulnerable ecosystems on Earth. The fact that many seamounts are cloaked with physically fragile and demographically vulnerable coral and sponge communities means that a few passes of a trawl can cause essentially irreversible damage. Moreover, the fishes trawlers take there aggregate in dense schools, encouraging "serial overfishing" or destroying populations and then moving on to the next seamount, and so on. These concerns can only be addressed with ecosystem-based management strategies including banning of destructive fishing methods and establishment of protected areas on the high seas. Nothing less will safeguard high seas ecosystems.

Patrick O'Connor*¹. Offshore Oil and Gas Production: The New Era.

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The Oil and Gas Industry in the US is focused on 3 areas - Gulf of Mexico (GoM); Alaska and West Coast California. This paper focuses on the GoM where the offshore industry began. There are about 4,000 offshore facilities in the GoM representing a significant proportion of the United States Oil and Gas production. Over the past 59 years the offshore industry has made enormous strides since the installation of the first offshore platform back in 1947. Importance to the nation: The dependency of the US on this resource has increased dramatically and any sustained production shortfall has a significant price impact on the US market. This increased dependency was painfully evident in the aftermath of hurricane Katrina. Current status and trends With the deepwater facilities, there is greater concentration in production in fewer facilities and in a geographically smaller area. Hence, a major storm can have disproportionate impact than in the past. Much of the near shore and shallow water infrastructure is aging and frequently, high volume pipelines cross older facilities that do not have the same robustness as new designs. Hurricanes Ivan, Katrina and Rita caused more disruption to production than other storms in history. Each of these storms had a different footprint. The biggest contributor to Ivan's downtime was loss of pipelines. With Katrina, the legacy will likely be onshore infrastructure and people. With Rita the biggest risk was the drifting of MODUs (Mobile Drilling Units) and the potential for platform collision and/or pipeline damage from dragging anchors. Future challenges and opportunities: In the next decade, it is expected that the industry will increasingly focus on deepwater and ultra deepwater developments, with water depths up to 10,000 ft and beyond.

John C. Ogden*¹, **Frank Muller-Karger**², **Henry Norris**³, **Christina Carollo**¹, **David Reed**¹. Ecosystem Approaches to Management and Governance of Florida's Coastal Ocean.

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The key to ecosystem-based management of the marine environment is the identification of ecoregions which are the spatial framework for the application of new tools and programs in marine resources management, conservation, and governance. Ecoregional assessment helps to identify information gaps, locate appropriate monitoring and study sites, extrapolate site-specific information to larger areas or interpolate it to a finer scale, predict effects of various management or development scenarios, identify critical infrastructural relationships, assess cumulative impacts, and identify areas requiring protection for endangered species or critical habitats. Marine ecoregions present special challenges since they are not easily compartmentalized and generally present a continuum of overlapping, often interdependent systems. The Florida Ocean and Coastal Resources Council, appointed under the Oceans Act of 2005 has made ecoregional assessment among its top research priorities to be considered for funding in 2007. In this context, Florida implemented the Geospatial Assessment



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of Marine Ecosystems (GAME) project with the following goals: (1) to identify, catalog, and inventory physical, biological, chemical, geological, atmospheric data and reports, as well as human use information; (2) to develop a comprehensive data management strategy to address all data gathering, storage and mapping needs; (3) to develop a GIS-based map of relevant collected data and a preliminary definition of marine ecoregions; (4) to seek stakeholder input on the draft products; and (5) to assess data gaps and develop a prioritized list of data collection requirements necessary to fill them. Other research priorities of the Council are an ocean observing system, studies of land-sea connections and harmful algal blooms, and a comprehensive ocean and coastal economic study. The longer term goals of the Council include comprehensive ocean governance strategies.

John J. Oram*¹, **Jon E. Leatherbarrow¹**, **Jay A. Davis¹**, **D. Schoellhamer²**, **M. Lionberger²**. Modeling the Fate of Particle-Associated Contaminants in San Francisco Bay, California.

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Understanding the long-term fate of contaminants in San Francisco Bay is one of the primary objectives of the Regional Monitoring Program for Water Quality (RMP). Many contaminants of interest are known to associate with sediment particles and follow sediment transport pathways. These sediment transport pathways are currently not well understood, making it difficult to predict contaminant fate from monitoring alone. Numerical transport models of varying complexity are therefore being developed to help interpret monitoring results in the context of the estuarine processes that govern chemical fate. Such models are valuable tools for environmental managers to evaluate the impacts of current and potential management strategies. Currently, contaminant modeling efforts are focused on polychlorinated biphenyls (PCBs), which are of high regulatory priority in San Francisco Bay and the subject of a TMDL. A spatially explicit multi-box mass budget model of PCBs was developed to improve understanding of their long-term fate in the Bay. The model is capable of accounting for external inputs from various transport pathways: runoff from the Central Valley via the Sacramento-San Joaquin River Delta, runoff from local Bay Area tributaries, atmospheric deposition, and municipal wastewater effluent. Model results will greatly improve our understanding of the fate of PCBs, and sediment associated contaminants in general.

Dan Walker¹, John Orcutt^{*2}, Marcia McNutt³, Stephen Weisberg⁴, Robert Knox², Brian Baird⁵. Summary of Session: Development of a National Ocean Research Priorities Plan and Implementation Strategy.

¹Office of Science and Technology Policy, White House, ²Scripps Institution of Oceanography, ³Monterey Bay Aquarium,

⁴Southern California Coastal Water Research Project, ⁵California Resources Agency

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See "Brian Baird" for the summary of this session.

William O'Reilly*¹, **Robert T. Guza¹**, **Richard J. Seymour¹**, **Corey B. Olfe¹**. California Coastal Wave Predictions from an Observational Network.

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Accurate nearshore wave height and direction information is needed to initialize surfzone and beach process models. The alongshore variation in wave conditions in California, owing to the topographic and bathymetric complexity of the State's coastline, is of particular importance in regional sediment management (RSM) studies. To meet the wave information needs of coastal engineers, planners and researchers, the Coastal Data Information Program (CDIP), at Scripps Institution of Oceanography, is implementing a coastal wave observation and prediction system as part of Southern (SCCOOS) and Central (CeNCOOS) California Integrated Ocean Observing Systems.

The coastal wave prediction system provides detailed model estimates of wave energy and direction along California's coastline, just seaward of the surfzone, using data from an observational network of strategically deployed directional wave buoys. Directional wave spectra estimates, derived from the buoy network observations, are linked with a wave propagation model to make hourly wave predictions every 100-200m along the coast in water depths of 10-15m. Both sea and swell are



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included in the coastal estimates, as are wave propagation time lags between the buoys and the prediction sites. The wave prediction system is designed to make hindcast and nowcasts of coastal wave conditions, and can potentially improve the accuracy of short-range forecasts of longer period swell. Field validation of the methodology, and example applications and model products, will be presented.

Gail Osherenko^{*1}. Why Governance Matters: Diagnosis of the Problem.

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We know the oceans are in trouble due to climate change, overfishing, invasive species, and pollution. The loss of ecosystem services is measurable in reduced biodiversity, declining food production, coastal erosion, and storm damage costs. An international, interdisciplinary group of researchers and resource managers, under the auspices of the National Center for Ecological Analysis and Synthesis (NCEAS) has diagnosed problems of governance as the root of these alarming trends. Specifically, we identify fragmentation of management authority, spatial mismatches between the scale of governance and the geographic range and distribution of ecosystems, and temporal mismatches between governance and ecological processes as the key problems that must be remedied, and recommend comprehensive ocean zoning as an important part of the solution.

This paper characterizes the nature of the 3-fold problem and illustrates each facet using well-known cases. Since the fundamental drivers of ocean ecosystem degradation are rooted in governance problems, the California Ocean Protection Council may overcome these problems and achieve its mission by developing a coherent ocean governance system (including cooperation with federal agencies and adjacent states). The COPC is well-positioned to address problems of fragmentation while providing the flexibility to respond to both fine-scale, local and large-scale, regional systems. We need a governance structure that can respond rapidly to avoid sudden ecosystem flips as well as change course before gradual, imperceptible ecosystem changes produce unsolvable problems.

The rapid increase in existing uses of the sea (e.g. shipping, desalination, LNG production and transport) and the rise of new uses (e.g. offshore renewable energy, aquaculture and mariculture, hydrogen production, hydrate mining) require improved ocean governance. The NCEAS Working Group on Ecosystem-Based Management: The Role of Zoning is exploring place-based solutions including marine spatial planning and zoning to address the serious challenges of ocean governance.

Jeffrey Paduan^{*1}, Newell Garfield², Michael Coo¹, Bruce Lipphardt³, David Kaplan⁴, Judd Muskat⁵. Short Term Drifting Particle Forecasts Using Ocean Surface Current Mapping Data From COCMP.

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As the title implies, the Coastal Ocean Currents Monitoring Program (COCMP) is establishing a network of systems to continuously map the complex circulation patterns along California's shoreline. One important class of benefits to such a system is the ability to track the movement of buoyant materials. This includes hazardous materials, such as spilled oil, as well as larval communities and individuals lost at sea. Real time mapping data is needed because the trajectories of surface particles are complex and varied. The pathway of any particular water parcel in the coastal ocean is often significantly different than another pathway that began just a couple of kilometers away. In addition to spatial variations, ocean currents change dramatically on short time scales in response to tides, sea breeze forcing, and passing fronts. Hence, the description of surface particle behavior, from both a statistical and individual point of view, requires the type of data produced by the high frequency (HF) radar systems deployed by COCMP. This presentation will highlight the tracking ability of the COCMP network. It will also focus on a new capability of the system to produce critical, short-term (24 hour) trajectory forecasts. The forecasts are created using a continuously updated fit to tidal and low-frequency fluctuations in the surface current observations. The forecasts, therefore, are self contained products that have the potential to add a great deal of real-time information to those users tasked with responding to spills or search and rescue cases. Examples of the operating network and forecast system will be presented from the areas around Monterey Bay and San Francisco Bay, which are part of the Central and Northern California Ocean Observing System (CeNCOOS).



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Imad A. Hannoun¹, Li Ding¹, E. John List¹, Susan Paulsen^{*1}. Use of Models to Assess Water Quality Associated with a Regional Seawater Desalination Plant in Carlsbad, California.

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Much of California's population is located near its coast and this population – and the products and practices of that population – may adversely affect coastal water quality. Increasingly the coastal ocean is also viewed as a potential source of water supply and several desalination facilities are being evaluated and proposed within the State. The San Diego County Water Authority is proposing a 50 mgd Regional Seawater Desalination Project (RSDP) that would be co-located with Encina Power Station (EPS) in Carlsbad California. The RSDP would utilize the existing EPS cooling water intake (located within Agua Hedionda Lagoon) and discharge structures (which discharge to the ocean via a shoreline channel). Discharges of cooling water and seawater concentrate may affect nearshore water quality and the quality of water available to potential desalination facilities can be influenced by wastewater discharges storm water runoff and other sources of coastal pollution. To evaluate the water quality impacts of the discharge in a quantitative manner model simulations were developed to evaluate different ambient and operational conditions in support of the San Diego County Water Authority's Environmental Impact Report. The discharges were modeled with a computational fluid dynamics (CFD) code called the Estuary and Lake Computer Model (ELCOM) a three-dimensional numerical simulation code designed for practical numerical simulation of hydrodynamics and thermodynamics for inland and coastal waters. The model includes terms for advection and diffusion of momentum salinity temperature tracers and water quality variables. ELCOM was used to evaluate several future operating scenarios including both average and extreme conditions that could be expected to produce a "worst case" impact on the ocean floor. ELCOM has also been used to evaluate the source of water at the EPS intake including the impact of wastewater discharges located in the ocean a few miles from the EPS intake. Detailed simulation results will be presented.

Robbin Peach^{*1}. An Ecosystem Approach: More than Good Management, Marketing, and Money.

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The implementation of effective ocean management also takes more than good science, planning, and policy. It takes the tacit agreement, will, of the people. Ecosystem management is a relatively new concept. Implementing it is a creative challenge. An effective regime will occur only if people muster the energy for the demanding but inspiring work of thinking and acting beyond their normal paradigms. Policy makers, planners, resource users and the public must be willing to engage in exuberant debate, tolerate a degree of tension, and keep everyone engaged long enough to achieve results without mutiny. It involves an ongoing messy, perturbing, discovery process. The Commonwealth of Massachusetts is currently engaged in a comprehensive initiative to examine and enhance the management of its ocean waters. To bolster both the state's efforts and other independent initiatives aimed at ocean stewardship, the Massachusetts Ocean Partnership Fund (MOPF) is being launched as an innovative public-private partnership. Involved are collaborating state, federal, and local government, foundations, NGOs, academic institutions, businesses and individuals interested in providing leadership and funding for key ocean initiatives in Massachusetts. Zoning policy is one such initiative. MOPF is taking responsibility for being a source of movement. More than just a funding resource, MOPF is a heuristic tool to bring diverse stakeholder groups together, providing a neutral forum for identifying and working through the many complex and intertwined issues in the creation and implementation of ecosystem management. MOPF is helping determine the most effective methods to secure political will, substantial science and analysis, planning, coordination, and public participation needed to move ecosystem-based management and zoning forward. Come hear what we're learning.

Note: MOPF is modeled on a similar fund in California – the Resources Legacy Fund.

Stephanie Peck^{*1}. The Southern California Coastal Ocean Observing System: Meeting User Needs at the Regional Level, Integrating at the Federal Level.

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The Southern California Coastal Ocean Observing System (SCCOOS) is a consortium of eleven Southern California universities and laboratories located throughout the region, including two organizations in northern Baja California. SCCOOS, through principal funding from NOAA Coastal Observation Technology System (COTS) and the State of California Coastal Ocean Current Mapping Program (COCMP), is creating a sophisticated regional observing system that incorporates existing traditional observational programs, adds new infrastructure and tools, and provides these observations in a web-based synthesis available to a broad spectrum of users. SCCOOS is an operational 24/7/365 observation system employing technologies that include HR radar, meteorological stations, automated and manual shore stations, moorings, boat based sampling, gliders, and computer modeling. SCCOOS endeavors to synthesize its observations into products and applications that assist ocean and coastal resource managers and improve decision-making about and management of the ocean environment and its resources. SCCOOS efforts are stakeholder driven and highly collaborative with strong support from local, regional, state and federal agencies and engagement with coastal organizations and related industry. The organizational structure is project oriented, and efforts are overseen by a Board of Governors and guided by a Senior Advisory Committee (SAC) comprised of representatives of eighteen state and federal agencies. SCCOOS is one of eleven Regional Associations (RA) developing a regional coastal ocean observing system that will comprise the national backbone of the Integrated Ocean Observing System (IOOS). SCCOOS's governance and organizational structures have been developed to foster cohesion of all regional stakeholder needs and promote a unified system at both the regional and national levels. This talk will provide an overview of SCCOOS's formation, governance and activities, and products and applications.

Barbara A. Peichel*¹. Ecosystem-Based Management in Elkhorn Slough, California.

¹Elkhorn Slough National Estuarine Research Reserve

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The Elkhorn Slough estuary, located along the central California coast in Monterey Bay, is a critical link between terrestrial and marine ecosystems. Containing the second largest tract of salt marsh in the state, it provides critical habitat for over 780 species of marine mammals, birds, fish, and marine invertebrates. Elkhorn Slough also supports numerous commercial and recreational activities such as kayaking, fishing, bird watching, and hiking. The estuary currently faces unprecedented rates of salt marsh loss and exceptionally high levels of nutrient pollution. Sound management of Elkhorn Slough's tidal habitats is essential because estuaries are among the most threatened ecosystems in California. The overarching goal of the Elkhorn Slough Ecosystem-Based Management (EBM) Initiative is to conserve and restore sustainable estuarine habitats through the application of EBM. Addressing the interconnected threats to estuarine habitats needs to be incorporated with an understanding of ecosystem services in order to be successful. A new approach was needed to apply the principles of EBM to tidal restoration efforts since most past marine EBM efforts have focused on fisheries protection. The Elkhorn Slough EBM initiative will develop and integrate physical, biogeochemical, and ecological data with socioeconomic information to predict the likely outcomes of different restoration strategies. This information will be used by Elkhorn Slough Tidal Wetland Project participants to select optimal large-scale tidal restoration projects that are beneficial to estuarine habitats and water quality, politically and economically feasible, and supported by the community in the long-term. Challenges of implementing EBM including the use of scientific data, involvement of stakeholders, and development of planning frameworks will also be discussed during the session on Alternative perspectives on implementing marine ecosystem-based management on local and regional scales".

Oscar Pena*¹. Reinvesting in the Infrastructure of Commercial Fishing.

¹Ventura Port District

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Within a few years, the District will invest over \$1 million in renovating the infrastructure serving the commercial fishing industry. The majority of funds will renovate/replace the existing fish pier utilized to offload fish. Additional funding is necessary to modify a 10,000 sq. ft. building once used for processing and shipping fish to other areas. The Local Coastal Plan identifies commercial fishing as the top priority use in Ventura Harbor. The District, in partnership with Santa Barbara Harbor has contracted with the University of California, Principal Investigator Dr. Caroline Culver and Professor John Richards, to evaluate the "Commercial Fisheries of the Santa Barbara Channel and Associated Infrastructure Needs." Without this needs assessment, the District is not certain how to preserve commercial fishing and the Ventura Harbor as a California fishing heritage harbor. Commercial fishing has helped support the economic viability of other businesses in the harbor. The fishing



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industry has also encouraged tourism within the harbor through public outreach programs and marine related events. For over 30 years, there has been commercial fishing in this region. Today the majority of fish offloading in Ventura Harbor is squid. The District has observed a decline of fishing vessels in the harbor, loss of sportfishing charters, and a reduction of fish offloading particularly in the high-end fin fish products due to a strict limitations and complex regulations. Finding common ground on managing and regulating the industry will contribute to an effective conservation and restoration effort that will restore commercially valuable species We endorse OPC's efforts to support market-based fishery management approaches and encourage sustainable economic activity in large and small harbors.

Linwood Pendleton^{*1}, Michael Hanneman, Craig Mohn. The Non-Market Impact of Beach Water Quality Impairment in Southern California.

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We use a three tiered model of participation, activity-choice, and beach choice to estimate the economic impact of changes in water quality in southern California. We find that a day-long closure at Huntington Beach would lead to a loss of recreational welfare well in excess of \$100,000. Similarly, a minor improvement in beach water quality at Malibu, from an average grade of C to an average grade of A would generate approximately \$140,000 in welfare gains for beach goers. More dramatic changes in beach water quality yield even more substantial welfare impacts. Dramatic declines in water quality at clean beaches, like Zuma Beach, would lead to the loss of millions of dollars in beach goer welfare (in this case more than \$5 million); a summer time closure of swimming waters at Huntington State Beach would result in even greater losses (we estimate a loss of over \$9 million in beach goer welfare)

Suzan Given¹, Linwood Pendleton^{*1}, Alexandria Boehm². Regional Public Health Cost Estimates of Contaminated Coastal Waters: A Case Study of Gastroenteritis at Southern California Beaches.

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We present estimates of annual public health impacts, both illnesses and cost of illness, attributable to excess gastrointestinal illnesses caused by swimming in contaminated coastal waters at beaches in southern California, USA. Beach-specific enterococci densities are used as inputs to two epidemiological dose-response models to predict the risk of gastrointestinal illness at 28 beaches spanning 160 km of coastline in Los Angeles and Orange Counties. We use attendance data along with the health cost of gastrointestinal illness to estimate the number of illnesses among swimmers and their likely economic impact. We estimate that between 627,800 and 1,479,200 excess gastrointestinal illnesses occur at beaches in Los Angeles and Orange Counties each year. Using a conservative health cost of gastroenteritis, this corresponds to an annual economic loss of \$21 or \$50 million depending upon the underlying epidemiological model used (in year 2000 dollars). Results demonstrate that improving coastal water quality could result in a reduction of gastrointestinal illnesses locally and a concurrent savings in expenditures on related health care costs.

Janice Peters^{*1}. Current Issues in Commercial Fishing and Commercial Fishing Heritage Harbors: Do They Have a Future in California?

¹City of Morro Bay

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The City of Morro Bay manages a small regional harbor with strong cultural and economic ties to fishing. Fishing businesses, and the eclectic people that operate them, are under great economic pressure, with continually diminishing access to the resource, even as fish stocks are recovering or fully recovered. Many of our life-long fishers have given up or been forced to pursue other occupations. Our City has gone from four sport landings to one, two fuels dock to one struggling station, and our 50-year old marine chandlery is closing. Morro Bay harbor and its surroundings are some of the most pristine and beautiful areas on the Pacific coast, and we are dedicated to preserving it. We are also dedicated to preserving our fishing history and



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heritage. The current regulatory provisions prevent over-fishing and protect sustainable fishing areas. We believe that the environmental community should support local fishing businesses to provide fresh, sustainable-harvest seafood to the world. As our fishers and the infrastructure that supports them decline to what is now a crisis level in Morro Bay, we need to work cooperatively and creatively with environmental groups, or our proud fishing heritage will be lost in the very near future.

Jonathan Phinney^{*1}, Russ Davis², John Barth³, Elizabeth Clarke¹. The Pacific Coast Ocean Observing System (PaCOOS): The Developing “National Backbone” for the California Current.

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The California Current (CC) is a coastal boundary current system originating at the bifurcation of the North Pacific Current at the Canadian-U.S. border and traveling south along the entire US West Coast before exiting the coastal region off southern Baja California, Mexico. The CC forms the California Large Marine Ecosystem (LME) coursing by three countries and the three ocean observing Regional Associations within the US. Its length and breadth heavily influences the ecology, weather, climate and socio-economics of the entire region with little regard for the political boundaries. PaCOOS is the developing national ocean observing “backbone” for the CC comprised of representatives from federal and state government agencies, and the three Regional Associations. Its role is as an integrator of the ocean observing system along the entire California LME. The ocean observing system products include data serving leading to improved ecosystem assessments and ultimately ocean-related forecasts analogous to weather forecasts. PaCOOS’ initial focus is on trans-boundary ecological assessments and forecasts, for example, fisheries or Harmful Algal Blooms that affect the entire CC. Overtime, and with additional resources, PaCOOS could expand to other CC-wide forecasting improvement and development related to weather, climate and transportation. To date data access and management as well as pilot ecosystem assessments and models (forecasts) are under development. PaCOOS’ lasting legacy is likely to provide a forum for development of trans-boundary assessments and forecasts affecting the three countries and three Regional Associations in the CC.

Ricardo Pineda^{*1}, Alan R. Luloff². Implementing No Adverse Impact (NAI) Concepts in California’s Coastal Zone.

¹California Department of Water Resources, ²Association of State Floodplain Managers

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Over 71% (\$7B) of annual U.S. disaster losses occur in coastal areas. In 2005, three large Hurricanes (Katrina, Rita and Wilma) made landfall in less than 3 months with Hurricane Katrina alone causing more than 1,300 deaths and more than \$100 billion in flood damages. Continued development of coastal areas, without consideration for natural hazards, will undoubtedly result in future storm and flood damages, and increased public expenditures for shore protection, emergency response, and post-storm repairs. The Association of State Floodplain Managers (ASFPM) is promoting an approach for people addressing coastal hazards called “No Adverse Impact”. The No Adverse Impact (NAI) approach to flood damage reduction is essentially a “do no harm” policy – the actions of a community or property owner should not adversely impact other people or the coastal resource. Actions may be direct, such as not causing shoreline erosion on the adjacent property or indirect, that is, having no adverse economic impact within the estuary or in the coastal watershed. NOAA is working with the ASFPM to develop a handbook (in both English and Spanish) to help coastal communities implement No Adverse Impact concepts as their community develops and responds to their coastal hazards. “Implementing No Adverse Impact Concepts in the Coastal Zone” provides a vision, principles, and tools communities can use to help protect their citizens and prevent the devastating consequences of at-risk development in coastal hazard areas. “NAI in the CZ” shows communities how they can ensure that any development occurring on the coastline or within the coastal watershed takes mitigation measures to avoid adversely impacting others or the coastal resource. This session includes case studies describing how NAI concepts have been addressed in California coastal projects.

Caroline Pomeroy^{*1}. Integrating Social Science Information into California’s Fishery Management Plans to Achieve Sustainable Fisheries: What’s Worked, What Hasn’t, and What Might.

¹California Sea Grant Extension Program

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California's 1998 Marine Life Management Act (MLMA) fundamentally changed the state's approach to marine fishery management. Modeled after the 1996 federal Sustainable Fisheries Act, the MLMA requires the use of social and economic "essential fishery information" in the development of new state fishery management plans (FMPs). New state FMPs are required to "observe the long-term interests of people dependent on fishing for food, livelihood, or recreation," and manage fisheries so that "the adverse impacts of fishery management on small-scale fisheries, coastal communities, and local economies are minimized." Social science information has two primary functions in the FMP process: informing the design of management that sustains fisheries in biophysical and human terms, and evaluating the impacts of management actions before as well as after implementation. Previously, state FMPs were developed in an ad hoc manner at the Legislature's direction, and without a consistent approach. Under the new institutional framework, the state's FMP development efforts have had mixed success in generating and using social, cultural and economic data to address the new human dimensions mandates. We conducted key informant interviews with individuals involved in the state and federal West Coast FMP processes to explore their experiences and insights gained during this institutional transition. Our results focus on the needs, opportunities and constraints to the meaningful use of human dimensions information in California's FMPs in particular and ocean management in general. We conclude with recommendations to the Ocean Protection Council and other coastal and marine policy-makers as to how they can support the generation and use of social scientific information to achieve sustainable fisheries in ecological and human terms.

Larry G. Pondella¹, Daniel Pondella². Can We Save the Big Fish?: An Analysis of the Gill Net Ban (Proposition 132).

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Fisheries collapse and the decline of large fishes in marine ecosystems is a critical debate on a global scale. To address one aspect of this debate, we report on a single event, the removal of gill nets from the nearshore arena in the southern California bight (Proposition 132), and examine this effect on large marine fishes from this ecosystem. The populations of four apex predators from coastal reef communities had either completely collapsed or severely declined due to over fishing prior to this management action. Both fisheries dependent and independent monitoring programs demonstrated a return of white seabass (Sciaenidae: *Atractoscion nobilis*), soupfin shark (Triakidae: *Galeorhinus galeus*), leopard shark (Triakidae: *Triakis semifasciata*) and giant seabass (Polyprionidae: *Stereolepis gigas*).

Richard Powers¹. Bringing Local Communities to the Goods Movement Table.

¹Gateway Cities Council of Governments

Because of their location, the members of the Gateway Cities Council of Governments experience much of the negative impact of port operations at the Ports of Los Angeles and Long Beach. Our cities experience truck traffic from the ports, congestion and air pollution from diesel exhaust. The Gateway Cities COG has been a vigorous participant in discussions over expanding the I-710 Freeway to accommodate greater truck traffic. While diverting truck traffic from our streets of the small cities who are members of the COG will improve congestion and diminish damage to our streets, the COG remains concerned that air quality needs to be mitigated in advance of main line construction of truck lanes on the I-710 Freeway. The issue for us is public health.

Jeff Pratt¹. The Living Watershed Perspective, A Treatment and Prevention of Watershed Ills at the Local Government Level.

¹Ventura County Watershed Protection District

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Over the last three decades, communities of all sizes have turned to watershed protection as a means to sustain the watershed services that they care most about - including water supply, water quality, recreation, flood protection, and habitat preservation. During this same time, advances in technology have made it possible to model, describe and predict the complex interactions of various watershed components at a level of detail never before possible. Ventura County is a community that has made the choice to aggressively pursue watershed protection. Ventura County now has an independently funded Watershed Protection District (District) that reports to the County of Ventura Board of Supervisors. The District's mission



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and pursuits include the conservation of water, surface and groundwater protection, habitat restoration, recreation, and flood protection.

The foundation of the District's approach to watershed protection is the development of complex living watershed models. These living models are designed to describe the complex interconnection between watershed development and watershed health with a level of confidence never before possible. These living models are intended to evolve with the watershed and are dependent upon open stakeholder involvement and well-defined consensus processes.

The District is comprised of four major watersheds defined by their distinct discharge points along the coast of the Pacific Ocean. The characteristics of each of these watersheds vary markedly. The variation among the watersheds demand distinct approaches to their respective protection. Three of the four watersheds face intense growth pressures. The protection strategies and approaches employed within these three watersheds will be examined. These approaches range from prevention (e.g., preservation) to treatment for their various ills.

Holly Price^{*1}, Sean Morton², William J. Douros³. New Approaches for a Complex Coastal Ecosystem: A Long-Term Management Plan for the Monterey Bay National Marine Sanctuary.

¹Monterey Bay National Marine Sanctuary, ²NOAA, ³ West Coast Region, National Marine Sanctuary Program

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Monterey Bay National Marine Sanctuary covers nearly 300 miles of shoreline, 5,322 square miles of marine waters and contains some of the most productive and diverse habitats on the California coast. MBNMS has recently completed a draft revision of its Management Plan to guide its activities in resource protection, research and education over the next five to ten years. The plan draws on extensive input from the public, multistakeholder workgroups and the Sanctuary Advisory Council. Due to its location adjacent to a long stretch of coastline, a wide array of complex interrelated issues face the site. Coastal development issues addressed in the plan range from beach erosion and armoring to potential impacts of desalination plants, while ecosystem protection issues include bottom trawling effects, marine protected areas and introduced species. Water quality strategies focus on polluted runoff from agricultural and urban areas, beach closures and microbial contamination, and discharges from cruise ships. Wildlife disturbance plans address marine mammals and seabirds, use of personal watercraft, and tidepool visitation impacts. Approaches to address these issues, many of which are now successfully underway, include research and monitoring, education and outreach, development of policy and collaborative plans, new regulations, emergency response and enforcement. In addition to these specific issues, the plan also focuses extensively on coordination and fostering of long-term monitoring through the Sanctuary Integrated Monitoring Network, and on building ocean literacy and constituencies through interpretive facilities and signage, bilingual outreach and volunteer programs. A key element throughout all these efforts is the use of cooperative partnerships with other agencies, stakeholder groups, scientists and the public to carry out the work. This presentation will provide an overview of the plan components, highlight work underway to carry out key priorities, and outline the partnership opportunities that are essential to making the plan a success.

Pete Raimondi^{*1}. Monitoring and Distinguishing Changes and Ecosystem Dynamics from Pollution Impacts in Rocky Intertidal Ecosystems.

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All ecological systems display temporal dynamics and spatial variation. Such temporal and spatial variance is the sum (or product) of natural or anthropogenic forcing. Estimating the contribution of each is the basis for robust assessments of impact in ecological systems and should be the basis for damage assessment. Almost all robust models allowing estimation of the variance structure of ecological communities rely on the existence of long-term, spatially expansive, and method consistent monitoring data. Such data rarely exist, typically because of the short term funding cycles of most programs. When data have been collected over time and space, they generally suffer because of method inconsistency. Here, I present an overview of a long-term, spatially expansive monitoring program that we have used to: 1) assess temporal and spatial variability in coastal ecological communities and 2) distinguish natural from anthropogenic sources of variance.



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Ananda Ranasinghe^{*1}, Stephen B. Weisberg¹, Robert W. Smith², David E. Montagne³, Bruce Thompson⁴, James M. Oakden⁵, David D. Huff⁶, Chris Beegan⁷. A Measure of Benthic Invertebrate Community Condition for California Bays and Estuaries.

¹Southern California Coastal Water Research Project, ²Deceased, ³County Sanitation Districts of Los Angeles County, ⁴San Francisco Estuary Institute, ⁵Moss Landing Marine Lab, ⁶University of Minnesota, ⁷California State Water Resources Control Board

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An indicator of benthic community condition that combines four existing benthic index approaches was developed for California bays and estuaries. Habitat-specific versions of five benthic indices were developed for two soft-bottom benthic habitats. The indices were based on different types of measures including (a) community measures, (b) presence, abundance and pollution tolerance of several species, or (c) mixtures of (a) and (b). In each habitat, performance of the indices was evaluated individually and in combination using independent data rated by nine benthic ecologists. A four-index combination (Benthic Response Index (BRI), Index of Biotic Integrity (IBI), Relative Benthic Index (RBI) and a realized species richness index similar to the River Invertebrate Prediction and Classification System (RIVPACS)) had the highest accuracy and was selected as the indicator of benthic condition. This combination correctly classified as affected or unaffected 91.7% of the evaluation samples from the southern California euhaline bays habitat and 100% from the polyhaline San Francisco Bay habitat. The indicator was developed only in these two habitats because sufficient data for indicator development were available only here. Future indicator development in other habitats is anticipated once additional data are collected.

James Rasmus^{*1}, Brad Fowler². Clean Beaches Initiative Grant Program Session: Meeting New Demands Disinfecting Urban Runoff.

¹PBS&J, ²City of Dana Point

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Just a few years ago, the popular Salt Creek and South Monarch Beaches in South Orange County, California were subject to public health postings when bacteria there exceeded State AB 411 standards. The source of the bacteria was Salt Creek, an urbanized creek that drains significant portions of the Cities of Dana Point and Laguna Niguel and discharges at the beaches. The creek conveyed a typical mix of urban pollutants including fertilizers, animal waste and detergents as it wound its way to Monarch Beach. The Salt Creek Urban Runoff Treatment Facility (URTF), an ozone treatment facility, was designed and constructed, using a \$4 million Clean Beaches Initiative Grant, to bring the beaches into compliance with state water quality standards. In spite of the challenge of treating dry season flow rates with a high variability of pollutant loading; the Salt Creek URTF has yielded excellent results since it began operation in October 2005. This paper will describe the ozone treatment system and components utilized at the Salt Creek URTF. An overview of the selection of ozone disinfection, versus UV light, will be provided. Design and permitting challenges successfully met will be recounted. Operating data, and the challenges and solutions for operating the URTF will be presented. Facility start up challenges and solutions will be discussed as well. Disinfecting urban runoff is still relatively uncommon but is gaining interest as municipalities and districts nationwide work to meet increasingly demanding urban runoff regulatory requirements. The process used to design, construct and operate the Salt Creek URTF is adaptable to many communities concerned with the public health, environmental, financial and regulatory impacts of bacteria in dry weather urban runoff.

Kit Rawson^{*1}, Jody Kennedy¹, Jacques White², Kirsten Evans³. The San Juan County Marine Stewardship Area: An Ecosystem-Based Management Plan for an Archipelago.

¹San Juan Marine Resources Committee, ²The Nature Conservancy, ³School of Marine Affairs, University of Washington

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San Juan County consists of over 200 islands in northwestern Washington State. Situated at the confluence of Georgia and Juan de Fuca Straits, the archipelago supports a diverse and productive marine ecosystem that attracts visitors, new residents, researchers, and harvesters. Because the cumulative effects of human activities are threatening the ecosystem characteristics that attracted people in the first place, the county government designated all marine waters in the county a marine stewardship area. A county-appointed Marine Resources Committee (MRC) representing a diversity of local marine



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interests is developing an ecosystem-based management plan that will incorporate both voluntary and regulatory measures to protect and restore the marine ecosystem. The MRC is using The Nature Conservancy's conservation action planning process, adapted for the local marine ecosystem and to include social and cultural as well as ecosystem goals. A group of marine scientists with local expertise selected a set of target species and habitat types to represent the entire ecosystem and rated the current status of each of these targets. Local stakeholders, including commercial and recreational harvesters, wildlife viewing businesses, other tourism representatives, and conservationists identified and ranked the top threats to the targets and across the whole system. In addition to scientists and stakeholders, many governmental entities and non-governmental organizations with management authorities and mandates in the San Juan Islands have contributed information and ideas. The results have been compiled into a relational database, designed to adapt with new science. The MRC is currently using this tool combined with an extensive public outreach campaign to develop protection and restoration strategies to recommend to marine resource managers and the county government. The goal of the MRC is to obtain widespread public support for recommended conservation strategies by involving stakeholders, managers, scientists, and the community in the development of those strategies.

Dave Reid^{*1}, Cheryl Hapke¹. Regional Shoreline Change Trends along California's Beaches.

¹U.S. Geological Survey

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As part of a national project, the U.S. Geological Survey has completed an analysis of shoreline change along California's sandy beaches. This is the first regional, systematic measurement of shoreline change conducted along the California coast. Both long-term (~120-year) and short-term (~25-year) rates were calculated for over 750 km of coastline. Data sources include historical maps (NOS T-sheets and USGS DRGs) and modern (1998) lidar data. Three historical shorelines were digitized from georeferenced maps (1880s, 1930s, 1950s-70s) and represent visual estimates of the high water line (HWL) on the beach. A 1998 shoreline was derived from topographic lidar data as the intersection of the mean high water (MHW) datum with the foreshore. Initial results revealed that using the HWL shoreline from the historical data and the MHW shoreline from the lidar resulted in an accretional bias in the shoreline change rates. A methodology using a simple total water level model, including wave run-up, was subsequently developed to adjust for this bias in the data.

The Digital Shoreline Analysis System (Thieler et al., 2005) was used in conjunction with GIS to produce shoreline change rates along transects spaced at 50 m intervals. Long-term rates were calculated for nearly 15,000 transects, and over 16,000 transects were included in the short-term analysis. Results show that 48% of beaches were eroding in the long-term, increasing to 62% in the short-term, indicating that many beaches are shifting towards chronic erosion. The net shoreline change rate for California's sandy beaches, when averaged over the data-coverage area, is 0.3 m/yr in the long-term, and -0.2 m/yr in the short-term. The long-term accretion is attributed to both large-scale engineering and nourishment projects in Southern California and sediment influx from large rivers in Northern California. Central California had the highest percent of eroding beach, in both the long- and short-term.

David Revell^{*1}, Gary B. Griggs². Historic Beach Changes and Storm Event Responses along Santa Barbara and Ventura Counties, California.

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The coastlines of Santa Barbara and Ventura Counties face a myriad of decisions that will shape the habitat, recreation, tourism, and economic future of their beaches. Many of these revolve around the issue of managed retreat and shoreline armoring. In most cases these decisions are being made with little understanding of the long-term coastline changes, sandy supply, or even the magnitude of shoreline change that a single storm event can cause. The processes that shape this coastline function across a variety of time and space scales requiring a comprehensive regional approach to facilitate a parcel level understanding. With regional sediment management of the Santa Barbara Littoral Cell as a background focus, we focus on some of the results of a historic change analysis of the beaches in Santa Barbara and Ventura Counties over the last 125 years. The effects of dam impoundment on sand delivery, and shore protection structures have been studied and show ~40% reduction in sand supplied to the littoral cell. Yet harbor dredging records have remained essentially constant for the past 40+ years, indicating a steady supply of sediment. What effect has this reduction in supply had on the health of the



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beaches? Historic maps and aerial photography hint at an interdecadal climate response. Remote sensing show the response of the shoreline and beaches to the 1997-98 El Niño. Climate cycles, El Niño storm events, as well as human alterations and engineered structures have had various levels of impacts along different reaches of this coastline. It is intended that these analyses will inform some of the shoreline issues ongoing in the Santa Barbara littoral cell including: dam removal, endangered species management, artificial surf reefs, and coastal erosion management alternatives.

Jennifer Rigby^{*1}. California's Environmental Principles and Concepts Developed under the Education and the Environment Initiative (EEI).

¹The Acorn Group

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Presenters Dr. Jerry Lieberman and Jennifer Rigby will discuss California's Environmental Principles & Concepts (EP&C) that have been developed under the EEI. These principles and concepts distill the contributions of over 100 scientists and technical experts, representing state agencies, universities, business and industry, and environmental organizations throughout California. The Presenters will describe the process of developing the EP&C, aligning them with California's academic content standards and undertaking an outreach process that led to the approval of the EP&C by the State of California. The Presenters will also describe the Model Curriculum that is being developed as part of the EEI, its function within the K-12 education system, and strategies for its review and implementation in school districts across the state.

Steve Ritchie^{*1}, Donald G. Danmeier². The South Bay Salt Pond Restoration Project: Using Adaptive Management to Plan a Multi-Objective Project.

¹California State Coastal Conservancy, ² Philip Williams and Associates

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Over the past two centuries, urban development, agricultural activities and commercial salt production have eliminated 85 to 90 percent of the historic tidal marshes that fringed San Francisco Bay. Restoration of the approximately 15,000 acres of former salt ponds in South San Francisco Bay represents a significant opportunity to contribute to the health of the Bay and the recovery of threatened, endangered and special-status species. However, planning for such large-scale restoration must recognize existing values of the former salt ponds to migratory shorebirds and waterfowl. Satisfying these competing objectives largely comes down to balancing the relative distribution of pond and tidal habitats and increasing the productivity of pond habitats. The South Bay Salt Pond (SBSP) Restoration Project will restore a mosaic of tidal and managed-pond habitats to balance the competing objectives of marsh- and pond-dependent species. Marsh establishment in tidal habitats will rely primarily on estuarine sedimentation and natural vegetative colonization. Many of the ecological benefits of salt production ponds will be maintained within a reduced salt pond habitat area by grading and managing water and salinity regimes to support higher densities of shorebirds and waterfowl. Adaptive management will be integral to the phased implementation of the plan. Management decisions will be updated and adapted to changing conditions as new insight emerges regarding how restoration and management are actually achieving the project objectives. This insight will be informed by periodic monitoring and specific adaptive management experiments, or 'applied studies', designed to reduce key uncertainties. Through a continued process of monitoring, experimentation, and feeding new information into the decision-making process, adaptive management will influence the ultimate mix of tidal and managed pond habitat, and the time required to reach this endpoint.

Kerry Ritter^{*1}. Multi-Lag Cluster Enhancement of Fixed Grids for Variogram Estimation in Near Coastal Systems.

¹Southern California Coastal Water Research Project

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Maps are useful tools for understanding, managing and protecting our marine environment. Despite the benefits, there has been little success in developing useful and statistically defensible maps of environmental quality and aquatic resources in the coastal regions. Heterogeneous oceanic conditions often make extrapolation to non-sampled locations questionable. Kriging is a statistical approach that uses information observed at sampled locations to improve predictions at non-sampled locations. The precision and accuracy of those predictions rely entirely on our ability to capture the spatial variability of the response or what is referred to as the variogram. While many designs for estimating the variogram have been proposed, these are often



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difficult to implement. In this study we investigate simple design strategies for augmenting fixed grid designs where the goal is to estimate the variogram. In particular we introduce the multi-lag cluster designs where clusters of sites, spaced at various lag distances, are placed around fixed locations on an existing sampling grid. We examine trade-offs for resource allocation with respect to replication at particular spatial scales, spatial coverage, and sample configuration (e.g. how samples are placed around grid sites). We apply these techniques to develop a survey for the San Diego Sanitation District for the purpose of mapping chemical contaminants around their sewage outfall.

Kerry Ritter^{*1}, Steve Bay¹, Rober Smith. Development and Evaluation of Chemical Sediment Quality Guidelines Based on Benthic Macrofauna Responses to Sediment Chemistry.

¹Southern California Coastal Water Research Project

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Resource managers often rely on chemical indicators referred to as sediment quality guidelines (SQGs) to assist them in assessing the level of sediment contamination in our coastal waters. SQGs are typically derived from large data sets containing paired chemistry and toxicity data. However, calibrating SQGs to toxicity data, such as the survival of amphipods, to various contaminant concentrations in the sediment may not accurately reflect how benthic macrofauna, indigenous to the specific region or area, respond to the same chemical profiles. For example, some studies have shown that benthos may be more sensitive to anthropogenic impact than toxicity. In our presentation we consider the effectiveness of current SQGs for predicting the state of benthos and quantify some of the differences in responses between benthos and amphipod survival with regard to different chemical concentrations. Finally we present an alternative chemical SQG specific to predicting the state of benthos in marine sediments.

Jim Ayers¹, Chris Crenz¹, Ben Enticknap¹, Jon Warrenchuk¹, Santi Roberts^{*1}. Recommendations Towards Ecosystem-Based Fisheries Management of the California Current Large Marine Ecosystem.

¹Oceana

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Governor Schwarzenegger's Ocean Action Plan well reflects his vision for a shift towards ecosystem-based management in California waters. The plan identifies the Ocean Protection Council (OPC) as the entity that can move management in this direction. However, the details of such a regime remain elusive. An overarching theme must be the importance of managing California state waters as part of the larger California Current Large Marine Ecosystem (CCLME). Thus, management must necessarily cross many jurisdictional boundaries including federal waters of the U.S., British Columbia and Mexico, state waters of California, Oregon, and Washington, and international waters beyond the EEZ. Jurisdiction is further divided by agencies responsible for managing certain ocean resources within those boundaries.

Here, we discuss how one might implement ecosystem-based fisheries management across a Large Marine Ecosystem within the existing management framework. We also identify the challenges of such an approach and suggest ways to improve the current management structure. We recommend that accounting for ecosystem dynamics be made an explicit goal of management practices, and suggest that a successful approach will encompass, at a minimum, the following objectives:

- Account for predator requirements and food-web dynamics in making allocation decisions and setting harvest levels
- Maintain ecosystem characteristics within natural bounds of variation
- Establish and continue research and monitoring of ecosystem processes and functioning
- When or where information is insufficient, take precautionary management measures that minimize risk to ecosystem health.
- Identify, protect and restore habitats and important ecological areas of the marine ecosystem
- Account for variable marine environmental conditions when formulating management plans
- Develop precautionary and adaptive approaches to ecosystem-based management
- Eliminate harmful subsidies



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Dale Roberts^{*1}, Tara Anderson², Jodi Pirtle³, Dan Howard¹. Seafloor Mapping as a Foundation for Resource Conservation at the Cordell Bank National Marine Sanctuary.

¹Cordell Bank National Marine Sanctuary, ²Australian Institute of Marine Science, ³University of Alaska

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A solid understanding of the relationships existing among biotic and abiotic components of natural areas is needed to make sound resource management decisions. Recognizing this, the California Ocean Protection Council has made the production of fine scale habitat maps a high priority. At Cordell Bank National Marine Sanctuary, information from habitat maps has been combined with visual observations taken from the Delta submersible to describe unique physical habitats and their biological associates. A variety of habitats have been observed, including pinnacles, rocky-reefs, boulder-fields, cobbles, sand, and mud. A diverse fish fauna, dominated by rockfish (95% of all fish) was seen on Cordell Bank. Multivariate statistical analyses revealed that spatial-position on the bank, depth, and substratum type were important variables explaining assemblage composition, and species patterns. The habitat affinities of structure forming invertebrates has also been observed and unique associations between invertebrates and fishes was discovered. The relationships between physical habitat, fishes and invertebrates observed at Cordell Bank and the techniques used to describe them can be applied elsewhere and may be particularly useful in the designation and monitoring of marine protected areas.

George Robertson^{*1}, Michael Mengel¹, Alex Steele², Scott Johnson³, James Rounds⁴, Fred Stern², Bob Brantley⁴, Eric Terrill⁵. Co-operative Regional Water Quality Monitoring Program.

¹Orange County Sanitation District, ²Los Angeles County Sanitation Districts, ³Aquatic Bioassay Consulting Inc., ⁴City of Los Angeles, Hyperion, ⁵Scripps Institution of Oceanography

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The Central Bight Water Quality Program (CBWQP) began in July 1998 when the City of Oxnard, the City of Los Angeles, the Los Angeles County Sanitation Districts, and the Orange County Sanitation District recognized the benefits of a coordinated regional coastal water quality sampling program. The project goal is to collect regional, near-synoptic data to document the spatial interactions of discharges to receiving waters. The objectives are to: (1) improve data quality; (2) expand spatial coverage; (3) preserve historical POTW- discharge sites for data continuity and assessments with California Ocean Plan (COP) criteria; (4) document of seasonal cycles; (5) document coastal runoff; (6) serve as a base for future projects; and (7) enhance data analysis, presentation and communication. We improved data quality by agreeing on instrumentation and developing standard operating procedures for instrument calibrations, sampling, and data reduction. Spatial coverage was greatly expanded, with sampling occurring from Ventura County to Orange County, while maintaining existing ocean outfall sampling sites. Quarterly sampling has allowed the documentation of seasonal cycles and changes in water column structure, as well as chronic and episodic events such as, respectively, dry-weather (summer) and wet-weather (winter) land-based surface runoff. The existing CBWQP station grid has formed the basis for recent regional studies covering the coastal shelf from Point Conception to the US-Mexico Border. While the CBWQP continues to provide a strong base for new regional and special studies, we see benefits in adding new agencies to expand the area routinely covered off southern California. Finally, we have begun working with SCCOOS on data presentations and anticipate new informational products, such as integrating satellite imagery and surface water quality data, for use by environmental managers and the public. Data is now available on the Southern California Coastal Ocean Observation System (SCCOOS) web site (www.sccoos.org).

Jan Roletto^{*1}. SEAS & IOOS: Sanctuary Ecosystem Assessment Surveys and Integrated Ocean Observing Systems.

¹Gulf of the Farallones National Marine Sanctuary

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The Gulf of the Farallones is a complex region with high biological diversity; nationally significant wildlife breeding and foraging areas; significant commercial and recreational fishing; estuarine habitats; numerous federal and state protected marine and estuarine waters; watershed influences and impacts from eight million San Francisco Bay Area residents. Integrated conservation science programs will help solve specific management problems, enhance ecosystem protection efforts, and assist in the interpretation of the ecosystem for the general public. The Gulf of the Farallones National Marine Sanctuary's (GFNMS) Conservation Science program ensures that science activities address management issues and are effectively



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integrated into the education and ecosystem protection programs of the sanctuary and those of other resource trustee agencies. Implementing an effective, integrated conservation science program, linked with other regional and West Coast marine resource management agencies is a primary management goal of the GFNMS. This presentation will review the priority management issues within the GFNMS, the central and northern California coast and the West Coast sanctuaries. Management issues include: wildlife disturbance, oil pollution, water quality, invasive species, and filling information gaps to better characterize sanctuary resources and trends. Conservation science programs developed to address those management issues include: Beach Watch; SEALS-Sanctuary, Education, Awareness and Long-term Stewardship; Sanctuary Ecosystem Assessment (SEA) Surveys; SEA Stations; CSCAPE-Collaborative Survey of Cetacean Abundance and Pelagic Ecosystem; and the infrastructure for improved data collection, data exchange and integrated analyses; SWiM-System Wide Monitoring; SIMoN-Sanctuary Integrated Monitoring Network; IMaST- Information Management and Spatial Technology; and SHIELDS- Sanctuaries Hazardous Incident Emergency Logistics Database System.

Rebecca Roth^{*1}. What More Is Needed to Manage California's Ocean.

¹California Coastal Commission

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With one in eleven Americans living along the California coast, the future of California's coast and ocean depends on visionary management. Successful management of California's coast and ocean lies in addressing the State's major issues: 1) nonpoint source water pollution and its interconnection between the ocean and land; 2) public access to the coast and within the water; 3) management of public trust resources, such as water, sand and habitats; and 4) development pressure competing with resource protection. Five tools are critical to address these major issues of California's ocean future. First, broadly implement governance by going beyond traditional partnerships and eliminating government fragmentation. This model involves an expansion of government working with nonprofit entities, task forces, advisory councils, the private sector, and individual citizens. Second, identify and create a permanent, adequate funding source for key programs. This includes addressing the funding needs for all organizations that have a role to play in governance. Third, foster opportunities for the public to gain an appreciation and understanding of the coast and ocean through direct, first-hand experience and participation because public participation and education are fundamental to drive public policy, decision makers, and actions that will protect coast and ocean resources. Fourth, improve scientific understanding in applied decision making to ensure that public policy discussions focus on ocean threats, such as sea level rise, shoreline erosion and increased nitrogen. Fifth, create political will and leadership that recognizes and implements California's existing strong laws and programs relating to the stewardship of coastal and ocean resources. Together these approaches are vital for the present and future well-being of California's coast and ocean.

Susan Sakakihara^{*1}. The Education and the Environment Initiative.

¹California Integrated Waste Management Board

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The Office of Education and the Environment (OEE) in the California Integrated Waste Management Board is codified in law as the coordinating arm in the State of California for environmental education and long-term, sustaining office for EEI implementation. Ms. Sakakihara will describe the role of the OEE in this work, staffing requirements and training, and the OEE workplan in support of the EEI and education about the environment in California.

Charles R. Santerre^{*1}. The Safety and Nutritional Benefits of Farmed Fish.

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The U.S. popular press has been filled with scary stories about environmental contaminants in farmed salmon mercury in large marine species pigments in fish feed and flame retardants in sportfish. On the flip side there have been numerous scientific reports demonstrating the nutritional benefits from consuming fish. Conflicting stories can leave the consumer and the healthcare professional confused about whether seafoods are safe and nutritious. The Dietary Guidelines Advisory Committee recommends that Americans increase their annual intake of seafood from 16.6 to 26 pounds per person. This



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increase in intake will necessitate that more seafood products be produced using aquaculture. Therefore it is important that these farm-raised products provide nutritional benefits while also being safe to consume. In this presentation we discuss the health benefits from eating fish including farmed fish. We will attempt to put some of the issues regarding the risks from environmental pollutants into perspective. We will focus some of the discussion on selected aquaculture products (salmon catfish trout and crayfish) which have been at the center of the debate.

Jerry Schubel¹, Christopher Andrews², Nigella Hilgarth³, Mike Schaadt^{*4}. Summary of Session: Ocean Literacy: Informal Education through the California Aquarium Collaborative.

¹Aquarium of the Pacific, ²Steinhart Aquarium, ³Birch Aquarium, Scripps Institution of Oceanography, ⁴Cabrillo Marine Aquarium

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See "Nigella Hilgarth" for the summary of this session.

Korie Schaeffer^{*1}, Abe G. Doherty². San Francisco Bay Subtidal Habitat Goals Project.

¹NOAA, ²California State Coastal Conservancy

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The San Francisco Bay Subtidal Habitat Goals Project will establish a comprehensive and long-term management vision for protection, restoration, and appropriate use of the subtidal habitats of San Francisco Bay. This planning project is using an ecosystem-based management approach to develop recommendations and goals for use, protection, restoration, and research to improve subtidal habitat management in San Francisco Bay. There are many ongoing and emerging management challenges resulting from increased human use of subtidal habitats in the San Francisco Bay. These uses include dredging, sand mining, transportation projects, recreational use, marinas, shipping and ports, fishing, and industrial uses (e.g., factories, power plants, refineries). Furthermore, the natural resources of the Bay are threatened by non-native species and other systemic alterations (e.g., bathymetric changes, water control in the delta and both point and non-point source pollution). Because of these pressures and new techniques for restoring subtidal habitats such as eelgrass and native oyster reefs, there is an increased need to develop a plan to protect and enhance subtidal resources within the San Francisco Bay. The Subtidal Habitat Goals Project will identify opportunities, challenges and threats within the San Francisco Bay ecosystem and provide a biological basis to guide protection strategies, restoration and research priorities, and management policies of public resource agencies. The project is supported by the California Ocean Protection Council and is a collaborative interagency effort between the San Francisco Bay Conservation and Development Commission (BCDC), the State Coastal Conservancy (SCC), the National Oceanic and Atmospheric Administration (NOAA), the US Environmental Protection Agency (EPA) and the San Francisco Estuary Project (SFEP).

Ken Schiff^{*1}, Keith Stolzenbach², Lisa Sabin¹. Impact of Atmospheric Deposition on Water Quality in the Los Angeles Region.

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The contribution of atmospheric deposition to trace metal emissions in stormwater runoff was investigated by quantifying wet and dry deposition fluxes and stormwater discharges within a small, highly impervious urban catchment in Los Angeles. At the beginning of the dry season in spring 2003, dry deposition measurements of chromium, copper, lead, nickel, and zinc were made monthly for one year. Stormwater runoff and wet deposition samples also were collected, and loading estimates of total deposition (wet + dry) were compared with loadings in stormwater runoff. Wet deposition contributed 1 to 10% of the total deposition inside the catchment, indicating the dominance of dry deposition in semi-arid regions such as Los Angeles. Based on the ratio of total deposition to stormwater, atmospheric deposition potentially accounted for as much as 57% to 100% of the total trace metal loads in stormwater within the study area. Despite potential bias attributable to processes that were not quantified in this study (e.g., resuspension out of the catchment or sequestration within the catchment), these results demonstrate atmospheric deposition represents an important source of trace metal contribution in stormwater to waterbodies near urban centers.



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Kenneth Schiff^{*1}, Jack Colford², Stephen Weisberg¹. Water Quality Indicators and the Risk of Illness in Non-Point Source Impacted Recreational Waters.

¹Southern California Coastal Water Research Project, ²University of California, Berkeley

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Numerous studies have demonstrated relationships between indicator bacteria and human illness at marine beaches impacted by point sources of pollution with known human fecal contributions, but extrapolating current water quality thresholds built upon these relationships at locations where nonhuman sources of fecal pollution is uncertain. A good example is Mission Bay, CA where tremendous resources have been expended eliminating human sources of fecal pollution, yet 20% of ongoing microbiological monitoring samples during dry weather exceed water quality objectives. This study answered two questions: 1) did water contact increase the risk of illness in the two weeks following exposure to water in Mission Bay? and 2) did the risk of illness increase with increasing levels of microbial indicators of water quality? Baseline health at the time of exposure and again two weeks later were measured in a cohort of 8,797 beachgoers during the summer of 2003. Nearly 2,000 water samples were analyzed for bacterial indicators (enterococcus, fecal coliforms, and total coliforms) using both traditional and non-traditional methods (chromogenic substrate or quantitative polymerase chain reaction), novel bacterial indicator (*Bacteroides*), and viruses (somatic and male-specific phage, adenovirus, Norwalk-like virus) and associations between water exposure and water quality indicators with health outcomes were assessed. While the incidence of diarrhea and skin rash were elevated in swimmers compared to non-swimmers (RR 1.36, 95% CI 1.04-1.78), there was no statistically increased risk in 12 other 12 symptoms measured including highly credible gastrointestinal illness (HCGI). The incidence of illness was not associated with indicators traditionally used to monitor beaches nor with the non-traditional water quality indicators. These results contrast with most other recreational bathing studies, most likely because of the lack of human sources of fecal pollution.

Daniel Schlenk^{*1}, Mary Ann Rempel¹, Xin Deng¹, Jeff Armstrong². Relationships between Metrics of Reproductive Fitness, Population, and Exposure to Estrogenic Chemicals in Demersal Flatfish Collected near the Municipal Wastewater Outfall of Orange County, California, U.S.A.

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Estrogenic activity has been widespread in field and laboratory studies in the Southern California Bight. However, the relevance of exposure to chemical(s) causing this response to higher-level adverse effects, particularly in the field, has not been well-characterized. Long term monitoring studies have been conducted on demersal flatfish species collected near the Orange County Sanitation District (OCSD) outfall and stations as far as 7.7 km down current and 35 km upcurrent. Measures of estrogenic activity (vitellogenin (vtg) expression in male animals) failed to correlate with reduced gonadosomatic indices (GSI), impaired stages of gonadal development, or ova-testes in male animals. In addition, gender ratios measured in Hornyhead Turbot (*Pleuronichthys verticalis*) over an 18 year period indicated male-dominance consistent with elevated GSI in recently collected male fish. Variable levels of vtg were continually observed in plasma samples from fish collected in the locations analyzed with the notable exception of Dana Point where values were similar to purged animals maintained in the laboratory for 21 days. These results are consistent with previous studies showing vtg expression in male flatfish, but no alteration in overall flatfish abundance at the sampled sites.

Heather Schlosser^{*1}, Susan M. Ming¹, Donald L. Ward¹. Multi-Purpose Submerged Reef at Oil Piers in Ventura County, California for the National Erosion Control Development and Demonstration Program (Section 227).

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The US Army Corps of Engineers and the Beach Erosion Authority for Clean Oceans and Nourishment are participating in the National Section 227 Program. The objective of the Section 227 project, located at the former Mobil Oil Piers in Ventura County, CA, is to design a coastal erosion abatement structure to retain beach nourishment with minimal impact to the adjacent shoreline. The rock revetment-backed beach at Oil Piers has narrowed in recent years as a result of the demolition of the Mobil Oil Piers in 1998. Shoreline protection is required to retain beach nourishment in a manner that also preserves and/



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or enhances natural resources and recreation opportunities. This protection shall have no, or minimal, impacts to the adjacent shorelines, and should not be more obtrusive than the former oil piers. The proposed solution to control the shoreline erosion is a multi-purpose submerged reef comprised of geotextile containment cells. The reef is designed not only to block wave energy from reaching the shoreline, but also to rotate the incident wave energy to approach the shore in a more shore-normal direction and reducing the longshore transport in the project area.

Benefits of the multipurpose submerged reef include a wider beach for beach recreation, enhancement of surfing conditions, and ecological enhancements. The marine ecology provides an environmental benefit as well as added amenity in the form of a dive site. The multiple benefits of a submerged reef are very applicable to California Beaches. Beaches are the leading tourist destination in the US, receiving 85% of all tourist related revenue, over \$260 billion annually. Over 500,000,000 tourists visit the Californian beaches. Erosion is the number one concern that people have about beaches, and so erosion control that still provides beach amenity has great value.

Susan Schlosser^{*1}, Jeff Robinson², Vicki Frey³, John Mello³, Sharon Kramer⁴, Paula Golightly³, Mark Wheettle³, Julie Neander⁵, Ruth Blyther⁶, Frank Shaughnessy⁷, Greg Crawford⁷, Andrea Pickart⁸. A Community-Based Approach to Coastal Resource Management in the Humboldt Bay Ecosystem.

¹University of California Sea Grant Program, ²Recreation and Conservation District, Humboldt Bay Harbor, ³California Department of Fish and Game, ⁴Stillwater Sciences, ⁵City of Arcata, ⁶Redwood Community Action Agency, ⁷Humboldt State University, ⁸U.S. Fish and Wildlife Service

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Managers and citizens of Humboldt Bay and its watershed share many of the objectives detailed in the California Ocean Protection Council Draft Strategic Plan. Our natural resources are a large and important economic base for area residents as well as the state of California. Locally, the importance of successful stewardship is strongly recognized. Due to our sparse population and isolated geographic location, we meet challenges differently from areas elsewhere in California. Stakeholder groups, area scientists and local management entities collaborate in an effort to conserve and protect our natural resources using a community-based approach.

Leadership by the Humboldt Bay Harbor, Recreation, and Conservation District, the Redwood Community Action Agency, and the Scientific Advisory Committee for Estuarine Restoration, in community-based work results in direct interaction of decision makers, managers, planners, land owners, community groups, educators, tribes, students and citizens. Vital information is provided by Humboldt State University, the Humboldt Bay Harbor District, California Department of Fish and Game, and the California Sea Grant Extension Program. The accomplishments of the Humboldt Bay Watershed Advisory Committee, the Center for Integrative Coastal Ocean Research and Education, and the Humboldt Bay Cooperative Eelgrass Project includes restoration of priority salmonid habitat, a regional approach to estuarine restoration, real-time water quality data, and eelgrass habitat information.

Our presentation will focus on selected challenges faced by management in the Humboldt Bay ecosystem including water quality, aquatic habitat protection and restoration, invasive species, sediment dynamics, and population and habitat needs of threatened species. We will outline plans to formalize this community-based approach, one we hope may be used as a model in other regions of the state or country.

Astrid Scholz^{*1}, Charles Steinback¹, Mike Mertens¹, Linwood Pendleton². The Role of Socioeconomic Data in Designing and Evaluating Marine Protected Area Networks.

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While there is growing recognition that successfully addressing socioeconomic concerns during the process of designing marine protected areas (MPAs) is critical to their implementation and success, the practicalities and data requirements are daunting. Readily accessible information tends to be coarse scale and not originally intended for use in area-based management. We report here on socioeconomic data on consumptive and non-consumptive uses of the ocean that were collected and used in the Central Coast Project of the Marine Life Protection Act (MLPA) Initiative. We begin by discussing



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the types of quantitative and qualitative data available, to stakeholders and decision-makers. We then describe a project to acquire information on commercial fishing use patterns in 19 fisheries, tying fishermen's expert knowledge to landing tickets and other agency-collected datasets. We will discuss results from interviews with over 100 fishermen on the central Coast of California for a project undertaken in support of California's Marine Life Protection Act Initiative. Using participatory geographic information systems (GIS), we elicited fishermen's knowledge of the fishing grounds and their relative importance for data layers that will be used to assess the viability of network proposal scheduled to be designated in the second half of 2006. We report on methodological and process lessons from this project, and describe how results were used in the evaluation of MPA alternatives. We also report on the data and other considerations pertaining to non-consumptive uses, and describe how this information was used in the process. We finish with a discussion of the lessons learned from the use of socioeconomic information in this stage of the MLPA process, and reflect on future modifications to the development and use of socioeconomic data for MPA design processes.

Nathaniel Scholz^{*1}, Michele Jacobi², Erica Boyce³, George Graettinger², Tom Siewicki³. Assessing the Ecological Impacts of Storms.

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The ecological assessment component of NOAA's Coastal Storms Program is evaluating the relationships between coastal development, storm events, and the mobilization of contaminants from roads and other impervious surfaces in Southern California. A key goal is to develop an enhanced watershed database and mapping tool for the region that will incorporate available environmental monitoring data for surface waters and sediments. The work will specifically focus on pollutants that originate from motor vehicles in urban and urbanizing watersheds. These include polycyclic aromatic hydrocarbons, or PAHs, (from oil, grease, and diesel exhaust) as well as dissolved metals (from vehicle brake pads and other sources). Residential and agricultural-use pesticides will also be considered. To delineate the potential impacts of these toxic chemicals on fish and other aquatic species, new research will be conducted to fill key data gaps related to the health of fish, including endangered species. A related aim is to develop new tools that can be used by local partners to monitor the health of stormwater-exposed fish in the nearshore marine environment. Finally, this project will expand an existing web-accessible ecotoxicological database to include PAHs, metals, and other contaminants that are commonly associated with urban environments. The collective aim of this work is to help local communities identify watersheds where stormwater runoff is likely to impact ecologically or economically important species at the freshwater/nearshore interface. This information will ultimately inform future efforts to mitigate or otherwise reduce the ecological impacts of non-point source pollution in Southern California.

Donna Schroeder^{*1}, Milton S. Love¹. Ecological and Political Issues Surrounding Decommissioning of Offshore Oil and Gas Facilities in California.

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To aid legislators, resource managers, and the general public, we summarize and clarify some of the issues and options that the State of California faces in decommissioning offshore oil and gas production platforms, particularly as these relate to platform ecology and social values. Both local marine ecology and political climate play a role in decommissioning offshore oil production platforms. Conflicting social values among stakeholders in California increases the need for understanding ecological impacts of various decommissioning alternatives (which range from total removal to allowing some or all of platform structure to remain in the ocean). We will present an up-to-date overview of the scientific information available to make decisions in the decommissioning process, including assessment of platform habitat quality, estimation of regional impacts of decommissioning alternatives to marine populations, and determination of biological effects of any residual contaminants. We will also present an overview of liability issues concerning any artificial reef program. Potential management strategies consistent with rigs-to-reefs options include enhancing platform structure with rocky substrate and designating reefed platforms as marine protected areas. The overarching conclusion from both ecological and political perspectives is that decommissioning decisions should be made on a case-by-case basis, taking in consideration first the social goals of management and the public, and then using scientific information to achieve those goals.



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John Dixon¹, Tom Ebert², John Richards³, Pete Kalvass⁴, David Kushner⁵, Peter Halmay⁶, Dave Rudie⁷, Stephen Schroeter^{*1}. The Role of Collaborative Data Collection for Fishery Management: Lessons Learned from a Long-Term Study of Settlement of Red Sea Urchins in California.

¹University of California, Santa Barbara, ²Oregon State University, ³California Sea Grant, ⁴California Department of Fish and Game, ⁵National Park Service, ⁶San Diego Sea Urchin Fisherman, ⁷San Diego Sea Urchin Processor
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Effective stock assessments ideally require both fishery dependent and fishery independent data. Because of logistical limitations assessments of west coast red sea urchin stocks have for the most part relied on fishery-dependent data (i.e. landings and logbooks). In the past several years, major effort has been put forward to develop a cooperative data collection program with fishery participants. Here we discuss details of an ongoing 16-year study of bi-weekly settlement of sea urchins at sites in northern and southern California, an important fishery-independent measure of stock health. This program, which has received modest levels of funding from a self-imposed landing tax, has depended critically on cooperative efforts, by fishery participants, members of resource and other governmental agencies, and university research scientists. It provides a real world example of successful and sustained collaborative research for fisheries management that offers insights useful in expanding this necessary and cost-effective activity. This study benefited greatly by the range of knowledge and perspectives brought to it by participants with training and experience in fishing, sea food processing, resource management, and science.

Jerry Schubel^{*1}, Christopher Andrews², Nigella Hilgarth³, Mike Schaadt⁴. Summary of Session: Ocean Literacy: Informal Education through the California Aquarium Collaborative.

¹Aquarium of the Pacific, ²Steinhart Aquarium, ³Birch Aquarium, Scripps Institution of Oceanography, ⁴Cabrillo Marine Aquarium

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See "Nigella Hilgarth" for the summary of this session.

Dawn Hayes¹, Eben Schwartz^{*2}. Connecting Californians to the Coast: The Coastal Cleanup Day and Adopt-A-Beach Programs.

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The California Coastal Commission has been coordinating California Coastal Cleanup Day since 1985. During these 22 years, more than 700,000 volunteers have turned out on the third Saturday of each September to California's shorelines, removing over 11 million pounds of debris. The Adopt-A-Beach Program, initiated soon after the Coastal Cleanup Day Program began, continues these volunteer cleanups during the rest of the year. These two programs represent the largest volunteer efforts directly related to the marine environment in the state. However, these programs extend far beyond the marine environment itself. Over the years, the Coastal Commission has expanded the programs, especially Coastal Cleanup Day, pushing the event as far inland as the Pit River, the Owens River, Lake Tahoe, and the Salton Sea. This expansion has had two primary purposes: first, data collection over the years has shown that the majority of debris on our coastline originates along urban or inland creeks and waterways. By expanding up the watershed, we can stop trash where it starts. Second, by holding Coastal Cleanup Day along inland creeks and rivers, we raise awareness about the connections that each Californian has to our coast, no matter where he or she may live. Through these educational efforts, we have been able to develop a broader constituency committed to coastal protection and restoration while preventing trash from reaching the ocean, where it can cause the greatest harm to marine wildlife.

Franklin Schwing^{*1}, David G. Foley², Holly J. Price³, Steven J. Bograd¹, Cara Wilson¹, Petra M. Stegmann², Daniel M. Palacios², Chad King³. Integrated Multi-Sensor Satellite Habitat Maps for Coastal Management.

¹Southwest Fisheries Science Center, NOAA National Marine Fisheries Service, ²Joint Institute for Marine and Atmospheric Research, ³Monterey Bay National Marine Sanctuary

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A beneficial tool for regional planners and various stakeholders of coastal resource management is a data map depicting representative ocean conditions of coastal and adjacent waters. Classifying the mean state and variability of the pelagic realm provides valuable information for discussing such issues as the designation of marine reserves and protected areas. An enhanced science-based product has been developed that permits evaluation of the geographic scope and persistence of oceanographic conditions alongside other data sets such as biogeographical distributions of marine species, substrate type, climate variability, and human activities. Products from a growing suite of satellite sensors can be integrated to characterize the physical and biological properties of the coastal habitat and classify distinct pelagic regions. These regions can identify the primary ocean processes and features that segregate marine populations, akin to benthic substrate classifications. The goal of this work is to provide operational synthesis maps of relevant oceanographic conditions for use in planning and establishing marine protected areas in the coastal waters of California and elsewhere.

Jerry Secundy^{*1}. Next Steps: California Air and Water Board Collaboration on Atmospheric Deposition and Water Quality.

¹California State Water Resources Control Board

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Addressing atmospheric deposition impacts on water quality is a shared responsibility between the air and water boards. The problems will be resolved or clarified by air and water organizations working together.

On February 9, 2006, for the first time, the California Air Resources Board and Water Resources Control Board jointly sponsored a workshop: Atmospheric Deposition and Water Quality. Speakers were encouraged to address three topics in their presentations: Regulatory gaps, new and expanded partnerships, and research needs.

- Results of two major atmospheric deposition studies in California were presented: (1) Air Resources Board staff discussed its several year collaboration with Lahontan Regional Water Board and UC Davis at Lake Tahoe, focused on water clarity; and (2) UCLA and SCCWRP researchers described their work in the Los Angeles Basin.
- The challenges of identifying and quantifying atmospheric deposition pollutants in TMDL programs were described by three Regional Water Boards (Los Angeles, San Francisco Bay, and Lahontan). TMDLs are eventually incorporated into Basin Plan Amendments.
- The California Stormwater Quality Association stressed that storm water permittees cannot afford to treat all pollutants found in storm water; recommending that allowance be given for pollutant loads than can be traced to atmospheric deposition.
- The U.S. Geological Survey presented results of its pollutant monitoring studies of Sweetwater Reservoir, a drinking water reservoir adjacent to a developing eight-lane highway in San Diego County.

Air and Water Board Executive Office and staff have met to discuss next steps. Several possibilities are under consideration and still in the concept stage. One is a potential collaboration between the Air and Water Boards, USEPA, the Los Angeles Regional Water Quality Control Board, and Regional Air District. The purpose is to assist the Regional Water Board develop its TMDL for the ports of Long Beach and Los Angeles and Domingues Channel. The TMDL addresses many pollutants - including metals (e.g., chromium, copper, lead, mercury), PAHs, and PCBs. Regional Water Board

Dolores Wesson¹, Stephen Sellers^{*2}, Leslie Ewing³, Edward Myers, William Brooks, Nat Stoltz, Pedro Restrepo.
Coastal Storms and Human Safety.

¹Scripps Institution of Oceanography, ²Governor's Office of Emergency Services, ³California Coastal Commission *Presenter's E-mail: Stephen.Sellers@oes.ca.gov

Storm related disasters cost more Californian's their lives than any other natural disaster. While we have made great strides in developing emergency management systems and implementing mitigation projects, storms still cause extensive damage in the state. Witness the recent federal declaration for storm related flooding and landslides for 16 counties in the state. Over the course of the last few years, we have witnessed an astounding growth in the quantity and effectiveness of GIS products and other technology (e.g., Doppler radar). Technological developments present great promise to emergency managers, but it is still mostly a promise and not a reality. The Coastal Storms Project for Southern California is an attempt to more effectively establish the nexus between technology and emergency managers in real time, during storm events. We can better integrate



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real time data, models, and GIS products into tools that emergency managers can use to protect lives and property in storm events.

Richard Seymour^{*1}. Offshore Resource Development: Wind, Wave, and Tide Energy.

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Although alternatives to petroleum or coal for generating electrical energy have not been adopted as serious goals by the nation, it seems inevitable that this condition will exist within a decade or two. Offshore renewables could and should be a part of a national strategy of developing alternatives. Offshore wind energy extraction involves the construction of wind turbines, otherwise identical to those used on land, on floating or fixed foundations - usually out of sight of land. The technology is well established. Wave energy extraction (an indirect form of wind energy utilization) converts the water particle motions induced by swells and waves into mechanical or electrical energy. The energy in waves can be intercepted as close to shore as the edge of the surf zone or far offshore. Tide energy extraction systems utilize one of two attributes of ocean tides: the difference in water level between high and low tides in locations where tide ranges are large (requires a large impounding dam or barrage to hold back high water until low tide occurs) and/or the increased velocity of certain between-basin tidal flows caused by natural or constructed restrictions in channel width and/or depth. The technology for transmitting electrical power from offshore locations to the land grid is not limiting to any of the three potential energy sources. All three methods have some degree of inability to regulate power output to temporal demand, seasonally and daily. Environmental concerns vary by technology, ecological conditions, location, and political climate. All these factors degrade the economic value of the power produced. At the same time, their non-air polluting nature, renewable aspects, and the inability of a third party to control the source of the power increase their value.

Arthur Shak^{*1}, Gregory Woodell², Jon T. Moore³. 70 years of Regional Sediment Management in Los Angeles and Orange Counties.

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The Los Angeles and Orange County coastlines are the most heavily populated segments of California's coast. Both areas have long histories of dealing with the problems and opportunities that are unique to urbanized beaches. Their case histories show that the shoreline can be preserved and enhanced and still balance the sometimes competing interests of resource preservation, growing recreation demand, and storm damage protection.

Los Angeles County is one of the first public agencies in the United States to recognize the need to preserve and enhance its coastline. Its formal commitment to maintain its beaches dates back to 1930. Orange County with a similar history of beach nourishment, stabilization measures, and institutional policies has followed a similar course of action. A review of how these two areas have managed their beaches provide examples of the benefits and successes of regional sediment practices.

This paper will review the historical background of this urban shoreline, discuss some of the important natural processes and man-made affects that influence its beaches, and show by example what well run regional sediment management programs can look like.

Paul Shoenberger^{*1}. Ocean Water Desalination Program.

¹West Basin Municipal Water District

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West Basin Municipal Water District is the regional wholesale provider of imported and recycled water to approximately 850,000 people in southern Los Angeles County. The District is intricately involved in providing a balanced water supply portfolio through the distribution of imported and recycled water, integration and implementation of cutting edge water conservation programs, and the development of ocean water desalination. West Basin has over ten years experience in the operations of advanced membrane systems. The District currently operates a 35 mgd advanced membrane recycled water



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facility that provides five types of designer water. The complete spectrum of designer water services needs of local cities for use as irrigation water for landscaping at parks and schools, groundwater recharge for aquifer protection from coastal influence, to high purity water for industrial customers at local refineries. West Basin plans to capitalize on this extensive desalination experience by applying this same desalination technology to the development of ocean water desalination. West Basin is one of the leading agencies in the development of ocean water desalination technology throughout the country. Through extensive piloting and research, the District has proven that ocean water desalination is a viable process and provides a long term cost effective supplemental water supply. West Basin anticipates that ocean water desalination will comprise approximately 8% of the District's total water supply portfolio within the next 20 years. As membrane technology continues to advance in energy efficiency and treatment effectiveness, the cost of desalinating ocean water has steadily trended downward quickly approaching the cost associated with importing water from Northern California. As the regional manager of the public's water supply, West Basin is proactively pursuing ocean water desalination and other supplemental water supplies today as these programs take several years to plan, permit, and construct. The planning and implementation of programs like ocean water desalination are critical to the future supply portfolio and success of California's economy. West Basin has been a long time supporter of implementing environmentally proactive water supply programs that contribute to the conservation of the District's water resources. As good environmental stewards and managers of the public's water resources, West Basin is focused on implementing an ocean water desalination program that exceeds all regulatory and safe drinking water requirements, supplements our future water supply portfolio, is sensitive to marine habitats, and collaboratively works with local and national environmental organizations to implement an environmentally responsible project.

Craig S. Shuman^{*1}, Cyndi L. Dawson¹, Chris Knight¹, Gregor Hodson¹. Reef Check California: A Tropical Model of Community Monitoring in a Temperate Environment.

¹Reef Check Foundation

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Once at the forefront of coastal management and marine conservation, California has allowed its once bountiful marine resources to decline. The combined effects of overpopulation, pollution and overfishing, coupled with the lack of a coherent long-term management strategy, have resulted in a striking decrease in the abundance and size of many key species of fish and invertebrates. For nine years, the Reef Check Foundation has trained volunteers to monitor coral reefs around the world and has engaged local communities in sustainable management programs. Noting that the threats to California's nearshore rocky reef ecosystem are similar to those faced by coral reefs, Reef Check has developed a new California program. The development of the new monitoring protocol involved important decisions including the selection of indicator organisms and the level of scientific rigor that is suitable for volunteer divers. Utilizing teams of trained volunteers, Reef Check California is building a statewide monitoring network to help collect the data needed to make informed management decisions in a cost effective manner while simultaneously building a constituency of informed citizens who support science-based management.

Susan A. Snow-Cotter^{*1}. A State Perspective on Asserting Interests beyond State Waters.

¹Massachusetts Office of Coastal Zone Management

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This presentation will provide a historical perspective of how Massachusetts has, in several situations, asserted its interests beyond state waters. The justification and policy implications of those incidents will be addressed as well current needs to pursue cooperative proactive management of federal/state waters. Experiences with ocean planning at both the state and regional levels in the Gulf of Maine will provide perspective on how effective regional governance might be approached on a national scale.

Susan A. Snow-Cotter^{*1}. Toward Comprehensive, State-Wide Ocean Planning in Massachusetts.

¹Massachusetts Office of Coastal Zone Management

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In response to an array of ocean use proposals located in or near the oceans of the Commonwealth of Massachusetts, including proposals for gas pipelines, wind farms, aquaculture facilities, offshore sand-mining, wave energy production and so



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forth, Governor Mitt Romney initiated the Massachusetts Ocean Management Initiative in 2002 to consider ways to proactively plan for the Commonwealth's ocean waters. Following an intensive Task Force process in 2003-2004, Waves of Change: The Massachusetts Ocean Management Task Force Report and Recommendations was released. This report outlined a series of recommendations designed to improve comprehensive management ocean resources of the Commonwealth's ocean waters. The cornerstone recommendation in the report was a call for ocean resource management legislation that authorizes the development of an ocean management plan for state waters. In March of 2005, Governor Romney introduced the Oceans Act which was modeled after the Task Force recommendation. State Senator O'Leary from Cape Cod, who had served on the Ocean Management Task Force, also submitted similar legislation that included a provision that would allow the designation of marine protected areas. After public hearings and significant stakeholder involvement, a compromise piece of legislation was reported favorably out of the Joint Committee on Natural Resources in December of 2005. The Oceans Act legislation, currently being reviewed by the Senate Ways and Means Committee, authorizes the Secretary of Environmental Affairs to develop an ocean management plan that would be implemented through existing authorities and would guide individual siting decisions. The intent of the legislation is to empower the state to plan for – rather than simply react to – ocean use proposals. This talk will outline the planning process envisioned by the Massachusetts Oceans Act and address some of the challenges encountered to date in developing a technical approach to ocean planning.

Michael L. Sowby¹, Marian E. Ashe¹, Stephen F. Foss¹, Peter R. Ode¹, Russel Fairey², Erin R. Maloney². Survey of the Non-Indigenous Species Occurring within the Coastal Waters of California.

¹California Department of Fish and Game, ²Moss Landing Marine Laboratories

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The Ballast Water Act of 1999 directed the California Department of Fish and Game (DFG) to conduct a biological survey of the major ports, harbors and bays of California to develop a baseline of non-indigenous aquatic species (NIS) introduced from ballast of ocean-going vessels. Biological communities examined include the fouling, benthic, nekton, and plankton communities among others. The investigation, using field surveys and a literature review identified a total of 360 NIS. In addition, 247 species were classified as cryptogenic: species that at this time are unable to be classified as either introduced or native. In addition, the study identified, where possible, the date of the initial observation of the species in California, the geographic origin of the NIS, and the potential pathways (vectors such as ballast water, hull fouling, intentional introduction, etc) the species took in reaching California. In 2003, the Legislature passed the Marine Invasive Species Act which directed DFG to continue the NAS survey program in the coastal and estuarine waters of the State to determine if new NIS introductions have occurred since the original baseline investigations. The new NAS program consists of an investigation of the intertidal and shallow subtidal regions of the open coastline, revisiting the harbor, bay and estuarine areas of the state, and a revisit of the open coastline region. This program is scheduled to be completed by 2008 and the results reported to the Legislature by January 2009. This paper presents an overview of the investigations directed by both the Ballast Water Act of 1999 and the Marine Invasive Species Act of 2003.

Jim Stahl¹, J.R. Gully¹. Promoting Public Stewardship: The "No Drugs Down the Drain" Campaign.

¹Los Angeles County Sanitation Districts

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Treated wastewater effluents are a potential source of waste pharmaceuticals to coastal waters in the Southern California Bight. Some of these compounds have the potential to disrupt the endocrine system of marine life. In addition to conducting research to assess concentrations of endocrine disrupting chemicals in effluents and marine receiving waters and effects on marine fish, the Sanitation Districts of Los Angeles County (Districts) have taken a proactive approach to public stewardship by promoting a regional effort to educate consumers on proper disposal of waste pharmaceuticals. In conjunction with the City of Los Angeles, Orange County Sanitation District, and the City of San Diego, and in partnership with the California Pharmacists Association and the California Poison Control System, the Districts have developed and are implementing the "No Drugs Down the Drain" program. Through this program, literally millions of postcards with information on environmentally sound pharmaceutical disposal are being distributed at pharmacies and government offices in Southern California. In addition to this local consumer outreach effort, the Districts are working with the state and with hospitals to minimize disposal of waste pharmaceuticals, and are involved in state and national efforts to develop a pharmaceutical product stewardship program.



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Eric Stein^{*1}, Martha Sutula¹, Elizabeth Fetscher¹. Development of an Integrated Regional Assessment Program for Southern California Wetlands.

¹Southern California Coastal Water Research Project

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Historic and continued loss of wetland and riparian systems is one of southern California's most pressing natural resource management issues. In 1997, the southern California Wetlands Recovery Project (WRP) was formed to increase regional coordination of wetland preservation, restoration, and management among 17 state and federal agencies. As of September 2003, the WRP had spent of \$61.8 million on 34 wetland acquisition, restoration and enhancement projects. However, the WRP currently lacks the ability to assess the progress of regional wetland ecosystem recovery, relative to continued wetland loss and degradation. To address this shortcoming, the WRP is developing an integrated wetlands regional assessment program (IWRAP) that will assess status and trends of wetland condition, measure recovery progress, evaluate the effect of anthropogenic stressors, and evaluate the effect of wetland management actions on the regional wetland ecosystem. The IWRAP will encompass all tidal and non-tidal wetland classes within southern California's coastal watersheds, and is based on a three-tiered assessment design: Level I assessment evaluates extent and distribution of wetlands and associated resources. Level II assessment evaluates wetland condition and stressors on a regional scale. Level III assessment addresses detailed management questions of stressors and condition on a site-specific scale. Key elements of the IWRAP are that 1) assessment questions are directly linked to management questions; 2) the intensity of a specific assessment is commensurate to the importance of the management question being addressed; 3) assessments are adaptive, and choices regarding special studies and other intensification efforts are informed by the results of coarser monitoring; 4) assessments are cost-effective, yet scientifically rigorous; and 5) project specific performance monitoring is consistent with ambient assessment. The estuarine component of the IWRAP includes 13 assessment questions that will evaluate wetland condition relative to areal extent, hydrology, sediments, contaminants, biota, and landscape context. When fully implemented, the IWRAP will streamline reporting of monitoring data, making them more accessible for routine scientific evaluation of restoration and management techniques, and will help to evaluate recovery priorities and ensure that WRP use of public funds has a lasting regional impact.

Robert Stein^{*1}. Clean Beaches Initiative Projects in Newport.

¹Public Works, City of Newport Beach

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Weekly water samples taken in Newport Bay indicate that total coliform, fecal coliform and enterococcus counts sometimes exceed single-sample AB 411 standards. As a result, some areas in the bay are frequently posted advising the community to avoid water contact at these locations. To address this problem, the City of Newport Beach obtained a Proposition 13 CBI Grant to implement a dry-weather storm flow diversion program. The City selected five candidate storm drains for evaluation. Intensive flow and water quality monitoring of the storm drains was performed for two weeks. The measured bacterial loads were then used as inputs into a 2D hydrodynamic and water quality numerical model to evaluate the transport of the loadings to beach areas. The results of this study are surprising and instructive. Based on the recommendations of the report, the City opted to pursue alternative and innovative solutions. The first project is a 500-foot long rockswale, designed to infiltrate large urban flows and attendant bacterial constituents. Construction of this rockswale has been completed within an existing drainage ditch along Newport Boulevard upstream of the Turning Basin in Newport Bay. Post construction monitoring has begun. The second project deals with a common problem in man-made embayments: lack of proper circulation. The City conducted four years of studies and field trials to understand the hydrodynamics of Newport Bay, work with equipment suppliers to develop an effective circulation device, and garner community support. A system of compact circulation units has been designed for installation in the Newport Islands Channels later this year, using Proposition 40 CBI funds. The predicted water quality improvements based on numerical modeling will be presented.



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Jill Stewart-Pullaro^{*1}, Patrick Brown², Fred Holland³. Pathogen Source Tracking in South Carolina.

¹NOAA, ²Belle Baruch Institute for Marine and Coastal Science, University of South Carolina, ³Hollings Marine Laboratory, NOAA

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The primary goal of the Pathogen Source Tracking Program at Center of Excellence in Oceans and Human Health at the Hollings Marine Laboratory is to develop techniques capable of rapidly detecting and determining the source of microbes of public health concern in coastal waters. Various platforms are being tested for molecular detection of microbial targets, including the Luminex xMap® system for rapid and simultaneous detection of marine bacterial pathogens and host-specific bacteria; and polymerase chain reaction (PCR) assays for quantitative or real-time detection of indigenous vibrio and mycobacteria, enteric viruses, protozoan parasites, and harmful algal bloom species. An innovative two-stage multiplex fluorescent PCR technique has been developed named SIVCA, or Species Identification via Chimeric Amplification. Currently, ten different harmful algal bloom species can be simultaneously identified using this novel approach, and adaptation for detection of enteric bacteria is planned. Validated assays are also being field tested, allowing for improved assessment of coastal water and shellfish quality. As part of the field tests, researchers have determined the general distribution of bacterial indicators, coliphages, and noroviruses among creek orders in South Carolina tidal creeks. Results to date suggest that headwaters and urban creeks are reservoirs for fecal bacteria, and that bacterial indicators do not adequately model enteric pathogens in these systems. Similar analysis of South Carolina oysters has further demonstrated an inability of bacterial indicators to model enteric viruses and naturally-occurring vibrios in shellfish. It is expected that the methods under development will allow rapid, cost effective, and specific identification of harmful marine organisms that could supplement the current bacterial indicator system.

Sue Stickel^{*1}. The Education and the Environment Initiative.

¹Curriculum and Instruction Branch, California Department of Education

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The EEI's model curriculum must be reviewed by the Curriculum Development and Supplemental Materials Commission and ultimately approved by the State Board of Education. Ms. Stickel will describe the State's K-12 instructional system in terms of standards, frameworks, instructional materials, and student assessment – and discuss the integration of the EEI model curriculum into this system: the work to date and the role the Department of Education will play in its approval by the State Board of Education.

Deborah Streeter^{*1}. Religious Congregations as Advocates for Ocean Stewardship: New Constituencies, New Messengers.

¹Upwellings Ministry of Environmental Stewardship

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Religious leaders and communities are a large untapped resource for promoting ocean conservation and stewardship. Every religious tradition promotes an ethic that humans have a responsibility to care for all creation. Religious wisdom literature can inspire believers to action that adds to the effect of simple information. Many religious traditions have a long history of activism. No social movement in the U.S. has succeeded without the support of the religious community. Religious leaders are trained and respected public speakers and credible messengers, and have also been shown to be very effective advocates and partners with science. In the central coast area thousands of people worship each week in an effort to find meaning in their lives and improve their communities. Ocean stewardship can be encouraged as faithful action. This session will report on the work of a planning group comprised of religious leaders from a broad representation of faiths, the Monterey Bay Aquarium Center for the Future of the Oceans, the Monterey Bay National Marine Sanctuary, the Santa Clara University, Environmental Studies Institute and Monterey Bay Sanctuary Foundation who are developing this pilot program.

Lisa Suatoni^{*1}. Rebuilding Fish Populations: Emerging Science Points to New Approaches.

¹Natural Resources Defense Council

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Ten years after the reauthorization of the Magnuson-Stevens Fishery Conservation and Management Act (1996), a number of lines of research indicate that the task of rebuilding fish populations to resilient levels is not as easy - or simple - as was once believed. As we have seen from the other panelist's presentations, this is the case operationally (Margaret Bowman) - as well as scientifically (as indicated by Berkeley, Heppell, and Munch's work). What does this mean for moving forward? First it suggests that although conceptually appealing, the current tools used in forecasting rebuilding trajectories are likely to be overly simplistic and quite likely overly optimistic. To advance rebuilding efforts in the United States, it may be necessary to confront the complexities of the task by broadening our analytical approach and by modifying our implementation strategies to accommodate those complexities. Practical suggestions include: the development of new analytical tools (e.g., the incorporation of various forms of uncertainties in the rebuilding analyses, modeling more complex relationships between age and fecundity), the adoption of new standards (e.g., a higher standards regarding probabilities of success), and more effective management techniques (e.g., habitat protection, fishing mortality decision rules).

Ussif Sumaila^{*1}, Lisa Suatoni². Economic Benefits of Rebuilding.

¹University of British Columbia, ²Independent Consultant

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This paper determines the potential net present value (NPV) that can be derived by the commercial and recreational sectors from rebuilding nineteen different overfished stocks from around the United States. Two management scenarios referred to as 'recent catch' and 'rebuilding' were analyzed and compared. The 'recent catch' scenario forms our baseline and reflects recent catches from populations of fish that are currently considered depleted, or overfished. The projection of these catches, over the time frame of the study, is intended to represent an approximation of what might happen if these populations were not rebuilt to healthy levels and current catch levels were to continue into the future essentially unchanged. The 'rebuilding' scenario, on the other hand, uses the projected catches that are expected as the stocks rebuild following implementation of the National Marine Fisheries Service's (NMFS) currently adopted rebuilding plans. The results from our analysis indicate that the potential to increase NPVs from currently overfished stocks of the United States is high if the stocks are rebuilt. It is therefore economically sensible to stay the course with respect to restoration of overfished U.S. stocks. Indeed, it appears from our analysis that much can be gained from strengthening these efforts.

William Sydeman^{*1}, Jaime Jahncke¹, Brenna Langabeer¹. Top Predators as Indicators for Fisheries and Habitat Conservation in the California Current.

¹Point Reyes Bird Observatory Conservation Science

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Ecosystems are characterized by complex, often non-linear, and unpredictable biotic and abiotic interactions. Nonetheless, a new paradigm for ocean habitat, fisheries, and wildlife conservation is developing which takes into account ecosystem considerations. What are these ecosystem considerations, and how can they be used in management and conservation decisions? Herein, we investigate this question. We evaluate 2 key aspects of an ecosystem-based approach to management: temporal and spatial environmental variability. A variety of physical oceanographic measurements are considered to be important indicators of spatial and temporal variation in ecosystem form and function (see Largier et al.). In this paper, we expand this concept to top marine predators, and evaluating the role of birds, mammals, turtles, and large predatory fish (salmon and hake) as ecosystem indicators. Top predators sometimes perform well as ecosystem indicators, as integrators of the ecology of mid-trophic level organisms. Nonetheless, based on lack of basic biological information for many species and most ecological interactions (predation, competition, etc.), we conclude that substantially more analysis and new data collection in some critical areas is required for effective implementation of an ecosystem-based approach in the California Current at this time.

Drew Talley^{*1}. Ecosystem Engineering and Food Web Effects of a Terrestrial Invader on the Coastal Margin.

¹San Francisco Bay National Estuarine Research Reserve

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Exotic plant invasions represent one of the greatest threats to wetlands, with the potential to alter nutrient cycling, communities, and entire ecosystems. These effects arise from a number of mechanisms, including alteration of the physical structure of the environment, competitive interactions, and trophic changes. Here we examine the invasion of a traditionally terrestrial or riparian tree into a coastal salt marsh in southern California, and discuss both the impacts of the invasion on the ecosystem as well as the recovery following eradication. We then introduce an investigation that builds on this study to look at invasive ecosystem engineers over a broader geographic range.

Eric Terrill^{*1}. Developing Coastal Observatories for Managing Coastal Water Quality and Public Health Risks.

¹Coastal Observing Research and Development Center

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The Southern California Coastal Ocean Observing System (SCCOOS) works interactively with local, state and federal agencies, resource managers, policy makers, educators, scientists and the general public in order to improve our understanding and delivery of coastal observations, and to provide products that improve management of our coastal ocean environment. According to a recently released study prepared by the National Ocean Economics Program, California has the largest ocean economy in the country; visits to the beach alone generate over \$5 billion annually. Managing this resource is a top priority for the state. SCCOOS has recently been funded by the statewide, \$21M California Ocean Currents Monitoring Program (COCMP) and the NOAA Coastal Observation Technology System (COTS) to establish an observation system for southern California. Components of the system include shoreline monitoring stations, offshore buoys, autonomous vehicles, remote sensing, and surface current monitoring via HF radar. The monitoring of ocean currents is an identified priority for the state because they are central to many management and safety issues (beach and water quality, oil spills and search-and-rescue, harmful algal blooms, biological connectivity, etc.). This talk will examine how these investments in the science and implementation of the system are aiding decision making related to impaired water quality and public health risks. Discussion will include how prototype data products are in use by resource managers, policy makers, public safety personnel, health officials, and the general public.

Brian Tetreault^{*1}, **Holly Price**². Vessel Traffic Management Measures to Protect the Monterey Bay National Marine Sanctuary: Ten Years Later.

¹United States Coast Guard, ²Monterey Bay National Marine Sanctuary

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In the mid 1990s with the memories of the EXXON VALDEZ disaster still fresh in mind, there were calls on the National Oceanic and Atmospheric Administration (NOAA) and the U.S. Coast Guard to take action to protect the valuable resources in the Monterey Bay National Marine Sanctuary. The Sanctuary is home to an incredible diversity of marine life and supports robust tourism and commercial fishing industries. It is also in close proximity to one of the largest port complexes on the U.S. West Coast in San Francisco Bay, which is home to several oil refineries. San Francisco Bay was the destination of the EXXON VALDEZ on its ill-fated final voyage from Alaska. Environmental interests called for drastic vessel routing measures to protect the Sanctuary, while the shipping industry was reluctant to embrace potentially costly actions that could increase external intrusion into their operations and – if implemented hastily – potentially be more hazardous than no action at all. The Coast Guard and NOAA worked together to form a workgroup consisting of these diverse interests, representatives of local governments and other interested parties in an attempt to come to consensus on the best means to protect the Sanctuary. After a complex process of gathering and analyzing information several vessel routing measures were developed and ultimately approved by the International Maritime Organization. This presentation will review the process of developing the measures, examine the effect this effort had on similar issues throughout the United States and evaluate the effectiveness of the measures through analysis of vessel traffic data recently made available through advances in technology.

Cynthia J. Thomson^{*1}, **Caroline Pomeroy**². Ecosystem-Based Fishery Management: From Principles to Application.

¹NOAA National Marine Fisheries Service, ²California Sea Grant

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Fishery management plans typically focus on a particular species or species complex. However, even within this species-specific framework, it has become increasingly common for management to be driven by broader concerns - e.g., forage needs of target and non-target species; habitat protection; effort displacement; bycatch of finfishes, marine mammals and sea turtles that are overfished, ESA-listed or otherwise warrant special protection. This expansive view of fishery management requires careful consideration of the internal dynamics of fisheries as well as the interactions between fisheries and other components of the ecosystem. Achieving such holistic understanding of California fisheries is challenging - given the number, diversity and dynamic nature of our fisheries. This presentation describes general trends in California commercial fisheries during 1981-2005 and disaggregates these trends into meaningful components that reflect the complex and dynamic nature of fishery participation. Examples are provided that demonstrate how changes in biological, social, economic, regulatory and environmental factors affect particular fisheries; how these changes reverberate across other fisheries and within fishing communities; and how management has dealt with such changes. Fisheries reflect many of the same principles that characterize the larger ecosystem within they occur - e.g., the complexity of interactions among individual components, the role of diversity in buffering the effects of change the major restructuring that occurs when critical thresholds are exceeded, and the high degree of uncertainty. Making these principles operational requires careful consideration of lessons learned from the past three decades of fishery management, along with clear policy guidance regarding what constitutes a desirable state for fisheries. The presentation concludes with recommendations for how existing information can be used to develop fishery management strategies that reflect ecosystem principles and the types of social and economic research and data needed to further advance such strategies.

Ed Thornton^{*1}, Abbey H. Sallenger Jr.². The Effects of Sand Mining on Erosion Rates of Southern Monterey Bay.

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Southern Monterey Bay was the most intensively mined shoreline (with sand removed directly from the surf zone) in the U.S. during the period from 1906 until 1990, when the mines were closed following hypotheses that the mining caused coastal erosion. It is estimated that the yearly averaged amount of mined sand between 1940 and 1984 was 128,000 m³/year, which is approximately 50 percent of the yearly average dune volume loss during this period. To assess the impact of sand mining, erosion rates along an 18 km range of shoreline during the times of intensive sand mining (1940-1990) are compared with the rates after sand mining ceased (1990-2004). Most of the shoreline is composed of unconsolidated sand with extensive sand dunes rising up to a height of 46 m, vulnerable to the erosive forces of storm waves. Erosion is defined here as a recession of the top edge of the dune. Recession was determined using stereo-photogrammetry, and LIDAR and GPS surveys. Long-term erosion rates vary from about 0.5 m/year at Monterey to 1.5 m/year in the middle of the range, and then decrease northward. Erosion events are episodic and occur when storm waves and high tides coincide, allowing swash to undercut the dune and resulting in permanent recession. Erosion appears to be correlated with the occurrence of El Niños. The calculated volume loss of the dune in southern Monterey Bay during the 1997-98 El Niño winter was 1,820,000 m³, which is almost seven times the historical annual mean dune erosion of 270,000 m³/year. The alongshore variation in recession rates appears to be a function of the alongshore gradient in mean wave energy and depletions by sand mining. After cessation of sand mining in 1990, the erosion rates decreased at locations in the southern end of the bay but have not significantly changed at other locations.

David Turbow^{*1}, Leslie A Henrickson¹, Sunny C. Jiang², Rick Wilson³. Web-Based Investigation of Recreational Water Related Illness.

¹Touro University International, ²University of California, Irvine, ³Surfrider Foundation

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Decades of epidemiology research has established a link between recreational exposure to contaminated marine waters and various acute illnesses, such as gastroenteritis, and infections of the eyes, ears, and skin. It has been a challenge to monitor illness rates because of an underreporting of water associated illness. In this study, 1379 valid responses were analyzed to a web-based, self-reported illness survey posted by Surfrider Foundation over an eight year period (1997-2004). Subjects were recruited by means of self-selection via website visitation. Reported cases were screened to meet inclusion criteria. Demographic characteristics of respondents as well as the range and severity of reported symptoms experienced were assessed. The mean age of respondents was 28 years (SD= 9). Using Geographic Information Systems, a spatial



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and temporal analysis of the responses in Southern California was also performed. Illness reports were most commonly submitted in the late spring and summer months. Univariate and multivariate analyses were conducted to assess severity of symptoms. Infections of the sinuses and other upper respiratory symptoms (32.9%), and sore throat were most commonly reported, followed by gastrointestinal symptoms (12.4%). Severe symptoms, such as high fevers, complaints of swollen glands, problems with the lymph nodes, and infection wounds that did not heal properly, tended to be significantly predictive of the likelihood to see a doctor ($\chi^2 = 3.27$, $t=2.411$, $p<.05$). The total number of illness reports increased yearly over the study period, with the exception of 2001. The method employed can be used to elicit illness data and rapidly transmit the information to governmental agencies and other stakeholders. Despite inherent limitations in quantifying self-reported illnesses and in determining an overall response rate to the survey, web-based methods can be more widely adopted in the future as a viable means of coordinated disease surveillance efforts for coastal recreational waters.

John Ugoretz^{*1}, Sean Hastings², Holly Price³. California's National Marine Sanctuaries as Partners in Designing and Managing Marine Protected Areas in State Waters.

¹California Department of Fish and Game, ²Channel Islands National Marine Sanctuary, ³Monterey Bay National Marine Sanctuary,

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California is home to four of the National Oceanic and Atmospheric Associations (NOAAs) National Marine Sanctuaries; Cordell Banks, Gulf of the Farallones, Monterey Bay, and Channel Islands. These Sanctuaries, established to conserve, protect, and enhance marine biodiversity, ecological integrity and cultural legacy, encompass more than 35% of California's coastal waters. Given the Sanctuaries' purpose of ecological protection and their ability to provide both financial and staff support for ongoing monitoring, enforcement and management of marine protected areas (MPAs), they are valuable partners for State efforts to improve California's MPAs. Two ongoing and recent efforts provide good examples of how Sanctuaries can provide assistance to design and management efforts. In the Channel Islands, a 1999 request for the establishment of new MPAs by a group of recreational anglers led to a multi-year State/Federal partnership and planning effort. This effort included data collection and analysis supported by the Sanctuary, a stakeholder working group co-chaired by the Sanctuary Manager and Department of Fish and Game's (Department) Marine Region Manager, and a direct working relationship between Department and Sanctuary staff. Since completion of that process, the Sanctuary has provided continuing support for monitoring and enforcement efforts as well as acting as the primary source for public outreach materials. The second effort is the recently concluded Marine Life Protection Act (MLPA) Initiative's central coast working group process. The Sanctuary program provided support for data collection and analysis as well as staff support for certain portions of the process and actively participating on the regional stakeholder working group. Given the overlapping jurisdictions and similarities in mission between the Sanctuaries and Department, ongoing partnerships are likely to be the rule. Learning from these past efforts can help streamline future MPA processes and provide opportunities for clear linkages between State and Federal planning efforts.

John Kirlin¹, Phillip Isenberg², J. Michael Harty³, Michael DeLapa¹, Scott McCreary⁴, Melissa Miller-Henson¹, John Ugoretz^{*5}. Summary of Session: Lessons Learned from the California Marine Life Protection Act Initiative.

¹Marine Life Protection Act Initiative, ²Isenberg/O'Haren, ³Harty Conflict Consulting and Mediation, ⁴CONCUR, Inc., ⁵California Department of Fish and Game

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See "Michael DeLapa" for the summary of this session.

John Ugoretz^{*1}, Dennis Bedford¹. Moving towards a State Policy on Rigs-to-Reefs: Considerations for Leaving Decommissioned Platforms in Place.

¹California Department of Fish and Game

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A number of offshore oil platforms, piers, and islands have been constructed along the California coast. Complex marine biological communities have developed on and around these structures. Resource users consider these structures as assets



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to available resources and frequently fish around them. Researchers are beginning to understand the roles they play in providing increased habitat for fishery resources and increased biological productivity.

Platforms at the end of their productive life have and will continue to be decommissioned. Some have been removed completely, while others, particularly older piers and very nearshore structures, have been left in place. In one case, a platform that had become seabird roosting habitat was reconstructed and intentionally left in place to promote roosting. Considerable interest has developed in alternate disposition of these structures which would preserve their habitat value by converting them to artificial reefs, as has been done elsewhere.

Properly planned rigs-to-reefs projects may provide benefits to marine resources and users. Each platform, however, must be considered individually for a variety of factors to determine its viability as habitat and potential environmental impacts of leaving it in place.

The State of California has no formal policy on the use of decommissioned platforms as artificial reefs. We present several considerations in the development of a formal policy. We pose key questions that must be answered for each platform and discuss recommendations on important features of a State policy on rigs-to-reefs.

Doris Vidal^{*1}, S.M. Bay¹, J. Gully², Roberto Hagstrom³, M. Rempel³, K.M. Kelly⁴, D. Montagne², J. Reyes⁵, D. Schlenk³.
Sexual Abnormalities and Other Endocrine Abnormalities in Southern Coastal California Coastal Flatfish.

¹Southern California Coastal Water Research Project, ²Los Angeles County Sanitation District, ³University of California, Riverside, ⁴California State University, Long Beach, ⁵California State University, Long Beach

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The occurrence of male testis-ova or intersex (presence of oocytes in testis) and other endocrine abnormalities are frequently encountered in fish living in areas near wastewater outfalls. These anomalies are linked to endocrine-disrupting compounds present in the environment. The goal of this project was to evaluate potential endocrine disruption effects in coastal flatfish living in southern California (USA) and to develop rapid screening and quantitative methods for measuring the incidence of endocrine disruptor effects. The assays used in this assessment-included, vitellogenin (an egg yolk precursor) ELISA, gonad histopathology and some immunoassays for endocrine factors, which were applied to hornyhead turbot (*Pleuronichthys verticalis*). Although the number of fish examined per site was not large, testis-ova formations were found in some male turbot collected near outfalls. Fish affected by intersex condition also showed evidence of elevated production of vitellogenin and estradiol. In general, the levels of estradiol present in collected males were higher than female levels. Abnormal levels of other hormones, such as low levels of cortisol were also found in affected fish. The results of this study showed that the chosen biomarkers can be successfully used to assess and monitor the effects of endocrine disruptors in marine flatfish such as hornyhead turbot. These results also, warranted more comprehensive and meticulous studies to further investigate and assess endocrine disruption in flatfish near Southern California municipal wastewaters. These new studies are now underway.

Carol A. Vines^{*1}, Hyun-Min Hwang², Swee Teh², Michael Denison², Susan Anderson¹, William Bennett¹, Andrew Brooks³, Gary N. Cherr¹. *Gillichthys mirabilis*: A Model Species for Detecting Endocrine Disruption in California Wetlands.

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The longjaw mudsucker, *Gillichthys mirabilis*, is a common native fish of California wetlands that utilizes burrows for reproduction, resulting in exposure to anthropogenic or naturally occurring stressors through direct contact with sediment, as well as water or food. *Gillichthys* have a limited home range, but vertically integrate the marsh plane, providing valuable information on contaminant exposure at specific locations within marshes. The Pacific Estuarine Ecosystem Indicator Research Consortium (PEEIR, EPA, EaGLeS program) has been developing a suite of biomarker responses in resident species of California marshes, including indicators of reproductive health, as an integrative tool for determining overall wetland condition. Analysis of reproductive biomarker responses in *Gillichthys mirabilis* collected from or outplanted at various marshes in San Francisco Bay and Southern California included presence of choriogenins (egg shell proteins) in male/immature fish, and gross and histological examination of gonads for ovotestes (intersex) or tumors. In addition, fish tissues were



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analyzed for levels of persistent organic compounds, including organochlorines, known endocrine disrupting compounds. Sediments collected from stations where fish were either trapped or outplanted were analyzed for a variety of chemicals (PCBs, PAHs, metals, pesticides) as well as in a reporter gene cell bioassay specific for estrogenic activity. Fish collected from known contaminated marshes exhibited increased numbers of male/immature fish with choriogenins. In addition, fish at these marshes exhibited ovotestes and gonadal tumors. Reproductive impairment was observed particularly at stations where the corresponding sediments exhibited estrogenic potential in the cell reporter assay, and contained high levels of organochlorines, PAHs and metals. Fish outplanted at selected stations within contaminated marshes showed a similar trend that correlated with higher levels of organochlorines in both sediment and tissue. This approach can be applied to fish in other aquatic environments and provide wetland managers with additional tools for assessing or monitoring marsh condition.

Charles Wahle^{*1}, Kelly Chapin¹, Rikki Grober-Dunsmore¹, Sarah Fischer¹, Jonathan Kelsey¹, Ralph Lopez², Joseph Uravitch¹, Lani Watson³, Nicole Woodling⁴, Lisa Wooninck². The State of Place-Based Marine Management in U.S. Waters: Emerging National and West Coast Trends.

¹Science Institute, NOAA Marine Protected Area Center, ²NOAA Fisheries, ³NOAA Ocean Service, ⁴University of California, Santa Cruz

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Marine protected areas (MPAs) hold promise as multifaceted tools for conserving important marine habitats and resources. A critical first step on the journey toward the effective use of this tool in a national system of MPAs is to document and assess the potential contribution of existing managed areas to local, regional and national conservation goals. To this end, NOAA's National MPA Center, the National Ocean Service, the National Marine Fisheries Service, and their federal, state and territorial partners have compiled an unprecedented inventory of marine managed areas (MMAs) throughout U.S. waters. This growing database of over 1,500 federal, state, territorial and local MMAs ranges from New England, to the Gulf of Mexico, to the remote Pacific Islands. The inventory provides information about the location, purpose, and type of protection provided by MMAs and reveals important insights into the current state of place-based management in the U.S. Patterns emerging from the inventory confirm some, and refute other, widely held perceptions about how MMAs are used in US waters. For example, most U.S. MMAs: were established after 1970; are managed by state, not federal agencies; provide permanent year-round protection; target whole ecosystems rather than focal resources; focus on natural heritage conservation; are relatively small; and allow multiple uses including fishing and other extractive activities. Similar patterns are seen among West Coast MMAs (CA, OR, WA) MMAs, which vary widely in purpose, level and type of protection, and potential effects on ecosystems and human users. When combined with growing data sets on natural and cultural resources, human use patterns and ocean governance, the MMA Inventory data will allow, for the first time, an objective, science-based assessment of the current state of place-based management in U.S. waters and the identification of future conservation and management priorities to inform an effective national system of MPAs.

Dan Walker^{*1}, John Orcutt², Marcia McNutt³, Stephen Weisberg⁴, Robert Knox², Brian Baird⁵. Summary of Session: Development of a National Ocean Research Priorities Plan and Implementation Strategy.

¹Office of Science and Technology Policy, White House, ²Scripps Institution of Oceanography, ³Monterey Bay Aquarium,

⁴Southern California Coastal Water Research Project, ⁵California Resources Agency

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See "Brian Baird" for the summary of this session.

Barry Wallerstein^{*1}. The Ports and the Air Quality Management District: Working Together to Move Cargo and Clean the Air.

¹South Coast Air Quality Management District

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The fundamental mission of the South Coast Air Quality Management District is to promote cleaner air in southern California. But it also is committed to do so in a manner that helps promote business by working closely with the two ports on innovative clean air policies and technology. It sets the agenda for air quality, monitors progress in meeting those clean air goals, works with industry on innovative clean air technologies and acts as a clearinghouse for information on progress in meeting air



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quality goals in the region. By working closely with the two ports, the AQMD is playing a pivotal role in balancing economic growth with environmental responsibility.

Alfred Wanger*¹. From the Headwaters to the Ocean and Back: Understanding the Key to Coastal Resource Protection.

¹California Coastal Commission

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Polluted runoff from land-based activities is one of the biggest threats to coastal resources in California. It is essential to understand the land-sea connection and the relationship of coastal watersheds to the health and vitality of our coastal waters and ecosystems to better protect our ocean and coastal resources. Protecting our resources requires action to tackle land based impacts and sources of pollution. Addressing these problems on a watershed basis through coordinated action between jurisdictions that share watersheds makes good sense for environmental, financial, social, and administrative reasons. The key to success lies in improving the way we develop and manage our land. Integrating land use decisions and water quality protection is necessary to protect and restore the health and function of coastal waters and ecosystems. Watershed scale land use planning, based on collaborative assessments of natural and cultural resources, offers a framework for communities to simultaneously address issues of mutual concern such as flood plain management, wetland and habitat protection, and compliance with water quality laws and regulations, among others. A watershed scale framework can be used to direct growth into areas that are most suitable for development, and protect those areas with important watershed functions (e.g. groundwater recharge areas, habitat and wetlands, etc.) or cultural features. Development needs of local communities can be addressed by combining this approach with a coordinated strategy to implement Low Impact Development (LID) techniques in all new development and redevelopment projects throughout coastal watersheds. This approach can enhance the protection of pristine waters and the rehabilitation of impaired waters, while supporting the development of livable and sustainable communities.

Libe Washburn*¹, Jennifer Caselle², Eric Terrill³, Daniel Reed², David Siegel¹, Grace Chang⁴. A California Coastal Observing System for Marine Ecosystem Studies: A Multi-Agency Partnership on the South-Central Coast.

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Since 2000 an extensive coastal ocean observing system has been established in the Santa Barbara Channel and along the central coast for studying the regional circulation and its consequences for marine ecology. The observing system is a partnership among several agencies supporting large multi-year programs including: the Partnership for Interdisciplinary Studies of Coastal Oceans (PISCO), the Southern California Coastal Ocean Observing System (SCCOOS), the Coastal Marine Initiative (CMI), the Santa Barbara Coastal Long Term Ecological Research project (SBC-LTER), the Plumes and Blooms (P&B) project, the California Coastal Environmental Quality Initiative (CEQI), and the Network for Environmental Observations of the Coastal Ocean (NEOCO). Observing infrastructure includes a network of surface current mapping systems, an extensive array of moorings on the mid and inner shelves for measuring current velocity and water properties, and pier-mounted instrumentation. Cruises during SBC-LTER have sampled a wide range of events including strong wind-drive upwelling, stormwater runoff plumes, and toxic algal blooms. P&B observations every 2-3 weeks have generated a time series of cross-channel transects since 1996 resolving seasonal and inter-annual variability including el Niño. Investigators from PISCO and the SBC-LTER use bottom-mounted substrates, moored samplers, bio-diversity surveys, and small boat sampling to evaluate the effects of changing circulation patterns on coastal water quality, kelp forests, fish populations, and intertidal communities. An important goal of the observing system is to link evolving coastal circulation processes to ecosystem response on a range of time and space scales. These observations also provide critical information for evaluating the effects of the marine protected areas in the Channel. Funding for the observing system comes from the National Science Foundation, UC Marine Council, California Coastal Conservancy, W.M. Keck Foundation, Minerals Management Service, David and Lucile Packard Foundation, the Gordon and Betty Moore Foundation, NASA, and NOAA.



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Christopher Webb^{*1}, Clif Davenport², Rob Rundle³, Anne-Lise Lindquist¹. The Sand Compatibility and Opportunistic Use Program.

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The California Coastal Sediment Management Workgroup (CSMW) has developed process guidance on managing sediments within the coastal zone, to address the problems of an existing deficit of sediment within many littoral cells, undesired sedimentation within certain watershed areas, and unintended sediment capturing in both areas. The State and Federal members of CSMW are partnering in this regional management of sediment by developing a "Sediment Master Plan" (SMP). CSMW developed a tool in the form of a Statewide Master Opportunistic Sand Program (OSP) that executes findings and conclusions of the Master Plan. This program (tool) facilitates use of opportunistic sand (material available at low or no cost from excavation as part of maintenance activities and/or improvements or development) as beach fill. Opportunistic beach fill is considered a potentially inexpensive approach to offset the sediment deficit in littoral cells, while providing a discharge option to the party generating the sediment. The Statewide OSP establishes criteria and methods for: 1) determining the compatibility of material for beach fill (including less-than-optimum beach fill); 2) inventorying sand sources; 3) identifying suitable receiver beaches; 4) planning transportation modes; 5) implementing projects; and 6) performing monitoring. The plan is crafted as a template to assist local agencies in developing opportunistic beach fill projects and improving local sediment management. Two such programs are already in place, with two others being established. The intent is to enable other local agencies to perform such operations as needed. A local pilot project has been developed for the SMP in North San Diego County as a test case. The project envisions an OSP occurring at South Oceanside Beach. An environmental review document was certified, and the City of Oceanside is processing approvals to perform beach nourishment in the near future.

Rodney Weihar^{*1}. Developing Essential Coastal and Marine Economic, Demographic, and Social Data for Regional Ecosystems Management.

¹NOAA

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NOAA, as well as other Federal agencies, is adopting an ecosystems approach to management of large marine and coastal systems. An important part of ecosystems management is the human component and interactions between ecosystems service and functions. An essential building block for the ecosystem management approach is the development of a common, universally accessible and intuitive Ecosystems-Economics database. The NOEP has been a leader in developing the economic and demographic data bases and systems necessary for effective management at the regional level. New and innovative approaches have been particularly important in the case of California. This paper will discuss the role of expanding regional data systems and non-market value estimates such as those in California in applications at the national level to coastal and marine management decision-making.

Dan Walker¹, John Orcutt², Marcia McNutt³, Stephen Weisberg^{*4}, Robert Knox², Brian Baird⁵. Summary of Session: Development of a National Ocean Research Priorities Plan and Implementation Strategy.

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⁴Southern California Coastal Water Research Project, ⁵California Resources Agency

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See "Brian Baird" for the summary of this session.

Michael Weisse^{*1}, Daniel P. Costa¹. Animal Platforms for the Collection of Oceanographic Data as Part of an Integrated Ocean Observation System.

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Here we evaluate the use of satellite-linked electronic tags on California sea lions for the collection of physical oceanographic data in coastal upwelling centers, and northern elephant seals in the pelagic North Pacific. This animal collected oceanographic data complements more traditional methods for assimilation into ocean observation systems and models. Sea lions and elephant seals provide a level of temporal and spatial coverage in three dimensions that is impossible to replicate using standard sampling methods. Thus tag-bearing animals can be used as autonomous ocean profilers to obtain oceanographic data for regions and during times where traditional observations are sparse. Environmental data can be merged with behavioral information collected with the electronic tags and provide us with an understanding of the location and dynamics of apex predator foraging habitat. Sea Mammal Research Unit satellite relay data loggers (SRDL) were used to track the movement and diving behavior of male sea lions and adult male and female elephant seals during 2003 through 2005. Temperature only tags (2003) and newly designed SRDL-CTD tags (2004) with ARGOS quality locations were used to identify and describe sea lion and elephant seal foraging oceanographic habitat based on the temperature and salinity profiles of the 3D water column. One of the challenges in defining oceanographic habitat usage is to do so at a scale that is biologically relevant to the animals, both temporally and spatially. To compare how sampling resolution may impact how oceanographic habitat is defined we are using prototype temperature only SMRU-GPS tags (2005) that simultaneously log ARGOS locations and GPS locations. We'll discuss the different tag technologies used in relation to defining sea lion and elephant seal foraging habitat and the potential for providing real-time data for operational oceanography.

Katherine Weldon^{*1}, Paul Hartman¹, Meleah Ashford¹. Experiences in Using UV Light to Disinfect Urban Runoff.

¹City of Encinitas

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Cottonwood Creek flows across Moonlight Beach year-round and has contributed to water quality degradation at the beach for years. The creek drains approximately three square miles of heavily developed land within the City of Encinitas, California. Moonlight Beach is one of North San Diego County's most famous recreation areas. Recent studies estimate annual attendance at Encinitas' beaches at over 2 million, bringing in nearly \$50 million to the local economy. The City obtained funding through the Clean Beaches Initiatives grant program and selected an ultra-violet treatment process to treat urban runoff in the creek. The Moonlight Beach Urban Runoff Treatment Facility was brought on-line in August 2002 and has been operating successfully for 3.5 years. The UV Facility is located 230 yards upstream of Moonlight Beach. It diverts approximately 135 gallons per minute of dry weather flows from the creek through a series of filters and an UV disinfection unit designed to inactivate bacteria and viruses. This presentation will discuss the recently completed intensive monitoring program and effectiveness assessment of the facility. Two effectiveness assessment measurements were used: water quality monitoring and beach posting data. Concentrations of bacteria were routinely monitored above and below the facility, and before and after project implementation. Beach postings were assessed using data from the San Diego County Department of Environmental Health. Bacteria removal efficiencies through the UV Facility were calculated at 99%. Through weekly monitoring and a special study, the City determined that additional sources of bacteria and regrowth contributed to degradation of water quality downstream of the facility. The bacteria removal efficiency from the facility influent to the creek mouth was measured at approximately 50%. Monitoring showed an improvement of water quality in the mixing zone. Annual days of beach postings at Moonlight State Beach have declined since 2000.

Dean Wendt^{*1}. Marine Ecosystem-Based Management in Action: A Case Study of San Luis Obispo Science and Ecosystem Alliance in Morro Bay, California.

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Everyone is talking about ecosystem-based management of marine resources, but how do you do it? The US Commission on Ocean Policy, the Pew Commission Report, and the California Ocean Protection Act, each call for "ecosystem-based management" (EBM) of marine resources that emphasizes a more holistic management concept involving participation of scientists, stakeholders and managers in an institutional network that defines and encompasses the linkages and boundaries of ecosystems. Managers, scientists and policy-makers, however, continue to struggle with how to implement ecosystem-based management in marine environments. To date, most EBM efforts are developing on local/regional scales. An in depth account of lessons learned from grass-roots EBM projects can inform other communities as they embark on similarly-scaled efforts and even larger efforts at regional, state, and national levels. The San Luis Obispo Science and Ecosystem Alliance



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(SLOSEA) will present an overview account of four years of work that led to a formalized EBM program in Morro Bay, California. We will report on the process by which our community achieved an EBM program including: 1) how to build the necessary foundation; 2) how to engage a community in shared fact finding; 3) how to link science to management for decision making; and 4) what lessons were learned, including specific recommendations for others undertaking similar efforts.

Lynn N. Whitley^{*1}. Extending Marine Science Education to the Community through the University of Southern California Sea Grant Parent Child Education Program.

¹University of Southern California Sea Grant Program

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The University of Southern California Sea Grant Parent Child Education Program (PCEP) is aimed at making basic science concepts approachable and fun for parent and child together as well as developing a sense of environmental stewardship, independent thinking and creative expression through positive action. As a team, parent and child attend a short course in marine/environmental science focusing on the urban / ocean connection. Participants also engage in life and learning skills activities presented in a format that connects these lessons to the marine science topics. Additionally, they participate in a field trip and a culminating project. Many of these participants have never been to the beach or seen the ocean and have no understanding of how their actions can impact the marine environment. Through the innovative PCEP learning process our parent-child teams gain an elementary understanding of science and develop an increased regard and sense of responsibility relating to local environmental issues that impact the Santa Monica Bay. In addition to achieving a heightened awareness of environmental stewardship, the PCEP introduces effective communication techniques, initiates thoughts of new and exciting future career paths in the marine, health, or social science employment arenas, and fosters a lifelong interest in science and quality of self, family, and home. The Parent Child Education Program received development funding through the California Coastal Commission's Whale Tail Grant Program and is often school-based. Recently the PCEP has explored a community-based model to extend the program to a local community center frequented by members of underserved and underrepresented groups, participants are primarily Latino and African-American. Challenges and successes of this program and the new model will be discussed.

Cope Willis^{*1}, Moira McEnespy¹, Adrienne Harrison², Lori Cary-Kothera², Nancy Cofer-Shabica², Rebecca Smyth², Ruth Blyther³, Jennifer Bloese⁴. Linking Land and Sea: Northern California Coastal Conservation Needs Assessment.

¹California State Coastal Conservancy, ²NOAA Coastal Services Center, ³Redwood Community Action Agency, ⁴Pacific Marine Conservation Council

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The coast of northern California contains large stretches of contiguous undeveloped coastline that support habitats and species of global significance, including old growth coastal redwood forests and productive kelp beds. In general, land and marine conservation strategies for this region are planned independent of each other. Connecting land conservation strategies to marine strategies creates a more integrated approach to coastal conservation and creates opportunities for the conservation community in northern California to protect and restore its coastal resources at the ecosystem level. The National Oceanic and Atmospheric Administration's Coastal Services Center and the California State Coastal Conservancy sponsored the Linking Land and Sea: Northern California Coastal Conservation Needs Assessment.

The Redwood Community Action Agency and the Pacific Marine Conservation Council were selected to develop a needs assessment tool to identify opportunities for connecting land and marine conservation planning efforts and capacities of the coastal conservation community in Mendocino, Humboldt and Del Norte counties to implement plans. A mix of three county-wide meetings, surveys, and small group interviews with key terrestrial and marine conservation players were used to assess regional conservation planning and implementation needs. The results of the interviews and meetings are synthesized in a final report that highlights what coastal conservation organizations need to better protect and restore the rich coastal resources in northern California.

Addressing the needs and recommendations emphasized in the final report will most directly support the ecosystem-based management objective of the strategic plan. The goal of Linking Land and Sea is to recognize the interconnectedness of land and sea and develop conservation plans that integrate marine and terrestrial resources. Additional strategic plan objectives



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that are addressed by Linking Land and Sea include habitat restoration, market-based fisheries, and sustainable economic activity.

Chris Wills^{*1}, Gary Greene², George Saucedo¹. Regional Geologic and Habitat Maps: Tools for Understanding Habitats, Environments, Resources, and Hazards.

¹California Geological Survey, ²Moss Landing Marine Laboratory

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Much can be learned about benthic habitats and seafloor substrate from interpretation of multibeam bathymetry and backscatter data, but in many areas high-quality recent data covers only part of the area of interest, or a variety of data sets of different types and scales must be integrated to cover the area. Over the past 30 years, these data have been included in regional geologic maps published by the California Geological Survey, in cooperation with the U.S. Geological Survey. Geologic maps show materials that can be distinguished based on interpretation of bathymetry and multibeam or sidescan sonar surveys, samples, seismic reflection profiles, gravity and magnetic data. The California Continental Margin Geologic Map Series (Greene and Kennedy, 1987-1989) was based primarily on interpretation of seismic reflection profiles, and was published as a series of 1:250,000 scale maps. Recent maps rely more heavily on multibeam and sidescan data, and have been published at 1:100,000 (Wagner and others, 2002, Kennedy and Tan, 2005a,b). Complete geologic maps represent interpretations of the materials that make up the land surface and sea floor, including the origin and movements of those materials. The physical properties of these materials correlate with habitat, and so are a key component of sediment budget studies. Information on the age, origin, and movement of materials are also key components of sediment budget studies, as well as studies of fault or landslides activity, including tsunami potential. Because geologic maps integrate information from many sources and show details related to material properties, habitats, resources, and hazards, they are beneficial to biologists, resource planners, environmentalists, and land-use decision-makers. The standardization of regional geologic maps at 1:100,000 scale allows a common format that preserves the detail from large-scale studies and allows it to be seen in regional context of an entire shelf, basin or littoral cell.

Harry Helling¹, Sarah Wilson^{*1}. SeaTech: After-School Teens Hooked on Ocean Technology.

¹The Ocean Institute

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The Ocean Institute in partnership with Scripps Institution of Oceanography, the Capistrano Valley Boys & Girls Clubs and the Institute of Electrical and Electronics Engineers is developing SeaTech, a multi-year youth-based program providing underserved middle and high school students with career exploration and information technology (IT)-intensive oceanographic research experiences. IT-based studies of marine mammal bioacoustics are designed to 'hook' students into after-school clubs, field explorations, and summer research institutes. The scope of experiences provides the opportunity for teens to become scientifically literate stewards for the ocean environment and share their knowledge with their community. SeaTech is a two year program that begins with a 'breadth of experience' phase where teens are exposed to a range of IT-rich skills. First year SeaTech students experimented with 'smart' robots in a project with Woods Hole Oceanographic Institution, collected ocean sound files, built hydrophones and learned about current research with Scripps Institution of Oceanography, and operated an Ocean Observatory 'network of sensors' with the University of Washington. Field experiences included biodiversity surveys in the Dana Point Marine Life Refuge, marine wildlife observation cruises, and water quality monitoring. Second year activities allow students to work directly with the Whale Acoustics Lab at Scripps where students learn to use special software to analyze marine mammal acoustic data. Students are trained to identify specific species and report back to the scientific community.

SeaTech is a model for connecting research communities, informal science education centers, and after-school teen programs. Teens, while benefiting from improved science and technology training, were shown to be able to make meaningful contributions back to the scientific community. Considering there are over 3,400 Boys and Girls Clubs across the United States, SeaTech offers a national model for addressing growing concerns about the number of skilled technology workers entering careers in science, technology, engineering, and math.



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Karen Worcester*¹. The Canary in the Coal Mine: How Do Sea Otter Health Issues Shape a Regulatory Response?

¹Central Coast Water Board

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The Central Coast Water Board has responsibility for ocean water quality across most of the range of the threatened southern sea otter. More and more scientific evidence points to the major role land-based pollutants play in sea otter disease and mortality. The Central Coast Region is collaborating closely with researchers to understand these issues, and ultimately must ensure that our regulatory programs adequately address them. What are the probable sources of pollutants of concern for otters, and what kinds of actions can we take to reduce impacts? Regional Boards have regulatory authority over both point and non-point pollution sources. On the Central Coast, wastewater treatment plants are probably the largest source of point source loading to the ocean. In the Monterey Bay area, the five major ocean dischargers have come together to form the Central Coast Long Term Environmental Assessment Network (CCLEAN). This monitoring consortium is assessing loads of various pollutants from both treatment plants and from river mouths and is actively partnering with Department of Fish and Game and U.C. Davis scientists to better understand the nature of pathogen and chemical impacts on the southern sea otter. Data from CCLEAN and the Central Coast Ambient Monitoring Program show high levels of pollutants leaving some central coast rivers. Non-point source runoff likely owns the lion's share of responsibility for pathogenic disease impacting sea otters. Organisms of concern are known to originate in humans, domestic farm animals, pets, and terrestrial wildlife. Chemical impacts may also originate in stormwater runoff from urban or agricultural land. Relatively new regulatory programs, including the stormwater permitting program and the Conditional Waiver for Agriculture, offer better mechanisms for managing these non-point sources than have been available in the past. However, the more we understand the sources and causes of disease, the better we will be able to target regulatory and management efforts to address this serious problem.

Karen Worcester*¹. Healthy Functioning Watersheds: Implementing and Tracking Long-Term Goals for Watershed Protection.

¹Central Coast Water Board

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The California Central Coast Water Board has been developing a long-term vision for our Region, including measurable goals and individual objectives. Implicit in the vision, "Healthy Functioning Watersheds", is the need to define "health" and track it to measure success. The three measurable goals state that by 2025, 80% of all aquatic habitat is healthy and the other 20% is getting healthier; 80% of all groundwater is clean and the other 20% is getting cleaner; and 80% of land is properly managed to support a healthy watershed and the other 20% shows positive improvement in management. In order to track these ambitious goals, we are developing multi-parametric tools to assess health of aquatic habitat, track land use activities as they affect water quality, and monitor groundwater quality. Our new Conditional Waiver Program for Agriculture provides a good example of how we envision this effort proceeding. This program requires development of a farm plan, 15 hours of water quality education, participation in a cooperative monitoring program which integrates with our Central Coast Ambient Monitoring Program, and reporting of management practice implementation through a web-based data delivery portal. For the first time ever, we have an opportunity to understand what practices are being implemented and where, and can relate that to where we see water quality problems and improvements. Similarly, we are aggressively seeking ways to promote Low-Impact Development in our growing towns and cities, with the intent of maintaining impervious surface cover in our watersheds at 10% or less. We plan to develop tracking mechanisms to "credit" urban areas for acreage employing low-impact practices. We are now brainstorming ways to align our traditional program work with our new goals and objectives. We also need to develop initial watershed assessments so that we understand how well we are currently meeting our goals. And finally, we need to plan how to leverage funding and staffing resources, as well as relationships with other organizations, to reach or maintain our goals and long-term vision.

Robert Wyland*¹. Shoreline Change in Southern Monterey Bay.

¹Naval Postgraduate School

Erosion rates in southern Monterey Bay have been measured for the period 1940 to the present using stereo-photogrammetry, and LIDAR and GPS surveys. Long-term erosion rates vary from about 0.5 m/year at Monterey to 1.5 m/year in the middle of the range, and then decrease northward. Erosion events are episodic and occur when storm waves and high tides coincide,



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allowing swash to undercut the dune and resulting in permanent recession. Erosion appears to be correlated with the occurrence of El Niños. Set back lines for 50, 75 and 100 year criteria have been determined and are used for future planning and development considerations. Erosion areas of concern are identified for long term planning.

T. Chopin¹, A. Neori², M. Troell³, A. Buschmann⁴, R. Pereira⁵, A.T. Critchley⁶, Charles Yarish^{*7}. The Use of Economically and Ecologically Important Seaweeds in Integrated Multi-Trophic Aquaculture: A Guide for Sustainable Development of Marine Farms in the 21st Century.

¹Centre for Coastal Studies and Aquaculture, University of New Brunswick, ²Israel Oceanographic and Limnological Research, Ltd., ³Beijer International Institute of Ecological Economics, ⁴Universidad de Los Lagos, ⁵Centre for Marine and Environmental Research, Rua dos Bragas, ⁶Acadian Seaplants Limited, ⁷Department of Ecology and Evolutionary Biology, University of Connecticut

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The value of cultivated, managed and wild harvested seaweeds is valued at \$U.S. 6.2 billion with 92% of this value derived from aquaculture. The most valued of the maricultured seaweeds is the red alga *Porphyra*, or "nori" or "laver." It is a major source of food for humans throughout the world, although it is primarily cultivated in Asia (China, Japan and South Korea). Worldwide production of this species has an annual value of over \$U.S. 1.33 billion. In addition to *Porphyra*, other edible seaweeds include *Gracilaria*, *Undaria* and *Laminaria* that have a value of \$U.S. 3.0 billion. *Laminaria japonica*, with over 4.01 million metric tons, is the single largest aquacultured crop in the world, i.e. more than any single carp or bivalve species. Seaweeds are also the industrial sources of carrageenans (*Chondrus*, *Eucheuma* and *Kappaphycus*), alginates (*Ascophyllum*, *Laminaria*, and *Macrocystis*) and agars (*Gelidium* and *Gracilaria*). These important polysaccharides or phycocolloids are used in the food, textile, paint, biotechnological and biomedical industries and have a global value of approximately U.S. \$615 million. Seaweeds have significant value in agriculture as soil additives, fertilizers and seaweed meals with a value of \$U.S. 53 million. The increasing demand for safe, healthy, traceable and minimally processed foods is creating an opportunity for seaweed products as functional foods, nutraceuticals, and alternative medicinal products. They have the capacity to contribute more to global food production -i.e. not only as "Asian only" or "health food" but to become a more common nutritious component of our diets. There is also now renewed interest in using seaweeds and shellfish as biological nutrient removal systems in integrated multi-trophic aquaculture of finfish and crustaceans. From a global perspective, the nutrient removal capability of extractive crops like seaweeds and bivalves remove from the sea nutrients in a quantity that equals the total discharges from the production of marine fish and shrimp (fed aquaculture). The development of integrated multi-trophic aquaculture practices appears increasingly necessary to remedy the socio-economic and environmental limitations of monospecific fed aquaculture whose sustainability is now questionable. To address this pressing environmental issue, the extractive role of seaweeds in integrated multi-trophic farm systems will be discussed as a way to reduce wastes and provide higher incomes to the marine farmer of the 21st century.

Marissa Yates^{*1}, Robert T. Guza¹, Richard Seymour¹, William O'Reilly¹, Roberto Gutierrez¹. Seasonal Sand Level and Wave Energy Variability on Southern California Beaches.

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Since May 2002, nine airborne LIDAR surveys mapped sand levels between the back beach and waterline along a 79 km reach from Point La Jolla to Dana Point. The infrequent LIDAR surveys were supplemented with monthly in situ surveys at Torrey Pines Beach (7 km), and about 40 km to the north, at San Onofre Beach (4 km). EOF analysis shows strong alongshore variation in the magnitude of the well-known seasonal cycle of winter erosion and summer accretion of the beach face. For example, beach width varies seasonally by about 30 m at Torrey Pines, but is not detectable at San Onofre. The high alongshore variability persists after removing sites with atypical features like exposed bedrock, cobbles, and lagoon mouths. The wave field varies alongshore due to sheltering by offshore islands. CDIP directional wave buoy observations were combined with a numerical model to estimate the wave field hourly, at 100 m alongshore intervals, along the 10 m depth contour. EOF analysis shows the seasonal cycle of wave energy variation decreases from South to North, consistent with the observed seasonal sand level variations (larger at Torrey Pines than San Onofre). However, there is more alongshore variability in seasonal sand level fluctuations than in seasonal wave energy. A simple model for wave-driven changes in beach width, which includes changes associated with both cross-shore and alongshore sediment transport, has been developed.



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Preliminary comparisons show good agreement with observations at Torrey Pines and San Onofre. Model development, including testing over the entire survey region, is ongoing.

Mary Yoklavich^{*1}, Milton S. Love². Fishery-Independent Assessments of Demersal Fishes Using Habitat Maps and Direct Observations from Submersibles.

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Following the precipitous decline of rockfish stocks along the Pacific Coast, and the subsequent creation of Marine Protected Areas (MPAs) like the large Cowcod Conservation Areas off southern California, it was evident that more effective methods were needed to assess rockfish populations in untrawlable habitats in deep water (30 m). We have developed non-extractive methodologies that couple direct observations from a small manned submersible and seafloor maps of benthic habitats to survey various rockfishes and other demersal species over major rocky banks and outcrops, most of which are longtime fishing sites off California. Georeferenced maps of seafloor substratum types and bathymetric data are used to identify sites of high and low relief rock substrata within depths that represent likely rockfish habitats. Quantitative survey analyses of the number of fishes, distances from and along the track lines, and area of each rocky bank (as calculated from the habitat maps) are used to estimate total number of fish in a study area. Several sources of uncertainty are evaluated and accounted for in the resulting estimates of abundance and biomass. The results from our unique fishery-independent visual surveys have contributed to the recent stock assessment of cowcod off southern California, and have established baselines of diversity and density for fish assemblages associated with MPAs. Time series of results from our visual surveys are now critical to evaluate trends in fish abundance with respect to increased time of protection within MPAs off California.

Adam Young^{*1}. Evaluation of Seacliff Erosion Protection Using Airborne LIDAR and GIS Spatial Analysis.

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The instability and retreat of seacliffs in San Diego County has resulted in the construction of various seacliff erosion control devices ranging from basal seawalls to full-bluff height retaining walls. The scope of this project was to quantify the effectiveness of these different seacliff protection methods. This was accomplished by comparing cliff face retreat rates of natural or unprotected seacliffs to adjacent protected areas using airborne LIDAR and GIS spatial analysis. This study investigated a 13 kilometer stretch of coastline in northern San Diego County, California over a six year time period from April 1998 to April 2004.

The study area was divided into three seacliff sections based on general stratigraphy and lagoon or river incisions. Regional volumetric seacliff change was quantified for each section using two digital elevation models derived from airborne LIDAR. Each section was then further divided into two meter wide seacliff compartments and GIS analysis was performed to back calculate the rate of seacliff face retreat for each compartment. The overall results indicate that seacliff protection did not completely prevent erosion during the study period, generally because it did not provide adequate protection for both subaerial and marine erosional processes. For example, basal seawalls provided protection against marine processes, but provided no direct protection against subaerial processes. In addition, other controlled areas continued to erode due to outflanking, overtopping, and undermining. Seacliff protection that used a combination of cliff control methods were the most successful. This study also investigated the role of groundwater and surface drainage conditions. These results indicate that areas affected groundwater seepage, and areas where surface drainage systems were not adequately maintained had higher rates of erosion as compared with adjacent areas.

Mark E. Zegler^{*1}. Geographic Information System Assessment of Fishery, Tourism, and Marine Protected Area Dynamics on the Border of Belize and Mexico.

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California is committed to developing a series of marine protected areas (MPA's) from Oregon to the Mexican border. Implementing marine protected areas are an important strategy for conservation as well as economic development. However, the impact of marine protected areas upon local communities is uncertain. Comparative research was conducted in communities that utilize marine protected areas that are adjacent to the Mexican and Belizean borders. This research was conducted to determine the change in stakeholder coastal use patterns that are a result of implementing marine protected areas in the Mesoamerican Barrier Reef System (MBRS) Program. The MBRS Program has established a network of marine protected areas in the Western Caribbean to conserve marine habitats and to promote transboundary conservation. Fieldwork for comparative case-studies occurred at the following transboundary MBRS MPA's: the Bacalar Chico Marine Reserve in Belize and the Xcalak Reef National Marine Park in Quintana Roo, Mexico. Interviews with stakeholders in the region identified their use of marine habitats by drawing maps of their coastal use patterns. Interview data for each case-study was recorded for two time periods: 'before' and 'after' MPA designation. These "map biographies" of the stakeholders coastal use patterns were subsequently integrated into a geographic information system. Fieldwork in Belize suggested that the spatial extent of the range of commercial fishers has decreased while the range of touristic activities and management activities has increased. Fieldwork in Quintana Roo suggested that the spatial range of commercial fishers has remained the same while the range of touristic activities and MPA management activities has increased. The difference in coastal use patterns between Belize and Mexico suggests that different intervention strategies are necessary in order to involve stakeholders in the conservation programs of each MPA.

POSTER PRESENTATION ABSTRACTS



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Babagana Abubakar*¹. Atlantic and Indian Oceans Pollution in Africa.

¹Nigeria Ports Authority

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Africa is the second largest and most populated continent after Asia. Geographically it is located between the Atlantic and Indian Oceans. Most of the Africa's most populated and industrialized cities are located along the coast of the continent facing the Atlantic and Indian Oceans, example of such cities include Casablanca, Dakar, Accra, Lagos, Luanda and Cape town all facing the Atlantic Ocean and cities like East London, Durban, Maputo, Dar-es-salaam and Mogadishu are all facing the Indian Ocean. As a result of the geographical locations of African Coastal Cities plus increase in their population, industries, sea port operations, petroleum exploration activities, trafficking of toxic wastes and improper waste management culture lead to the incessant increase in the pollution of the two oceans.

Recommendation: In view of the above situation I came up with the under-listed suggestions/recommendations: i. International organizations who's work that are related to Ocean and Pollution should send their teams of researchers to come and investigate the trend of this menace and proffer a possible lasting solution. ii. The United Nations should use its capacity to educate and convinced the African Union to pass a resolution making it compulsory on all the African Coastal Countries to set up ocean regulatory bodies in their respective countries. iii. The International Maritime Organization (IMO) should assist with her technical know how to educate the various Sea Ports in Africa on how to be degreasing their Quay Aprons without necessarily causing Ocean Pollution. iv. The organization of the petroleum exporting countries (OPEC) should use its capacity to find a way in controlling the incessant oil spillages going on in the African Gulf of Guinea region since many of the Gulf of Guinea Countries are its members. v. The World Health Organization (WHO) the International Atomic Energy Agency (IAEA) should also jointly send their team of researchers to come and investigate the trend of this pollution especially along the Coast of Somalia and Gulf of Guinea and proffer possible lasting solution before it becomes too late.

Conclusion: We cited on how the Atlantic and the Indian Oceans are polluted in Africa in relation to the petroleum, industrial and Sea Port activities in addition to the Toxic waste Trafficking, however some governments and non-governmental organizations are trying in fighting the menace, but the increasing nature of Ocean pollution in Africa is calling for assistance. It was in view of this situation I came up with the above listed suggestions/Recommendations, which I believe if implemented and adopted it will help in reducing the pollution otherwise the pollution of the Atlantic and Indian Oceans will ever remain on the increase.

Babagana Abubakar*¹. New Challenges Threatening the Ozone Layer.

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Since the beginning of the 1990's when the importation of fairly used Refrigerators, Air-conditioners and propellants that can easily go broken containing chlorofluorocarbon substances that is capable of destroying the Ozone layer started in commercial quantity in Africa, the African refuse mountains began metamorphosing into mountains of dumped broken Refrigerators, Air-conditioners and Propellants which are collectively becoming a threat to the Ozone layer, because of the continuous discharging of the Chlorofluorocarbon gases by the refuse in to the atmosphere in each passing second..Nobody can actually quantify the numbers of Refrigerators, Air-conditioners and Propellants imported and disposed in Africa over the last fifteen years, but the facts still remains that the numbers of metamorphosing mountains keeps on increasing in both size and numbers in each passing day. They have even become sources of raw materials for the local blacksmiths, children and refrigerators repairers who use parts of the dumped refrigerators, Air-conditioners and Propellants for their constructions, toys and repairs respectively.This explains the reason why despite the global efforts toward protecting the Ozone layer by the United Nations (UN), governments, International Organizations and climatologist among many others, but yet the hole in the Ozone layer keeps on expanding and the global temperature keeps on rising which resulted in the unusual phenomenon like the hurricanes "Katrina" and "Rita" the unusual floods in China, Thailand, Mozambique and to some extent even the Tsunami disaster that claims millions of lives in 2004.The Rapid rising in temperature of the Tropical world countries and increase in the cases of cancer patients among many other unusual happenings over the last eight years.



POSTER PRESENTATION ABSTRACTS

Katie K. Arkema^{*1}. The Ability of Kelp Forests to Filter Nearshore Waters and Impact Water Quality.

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The role of kelp forests in altering concentrations of waterborne subsidies, and in sequestering these materials into nearshore food webs is fundamental to understanding the ecosystem function of kelp forests and their impact on coastal water quality. Primary producers take up nitrate as water passes through the forest, and invertebrates and fishes consume particulate organic carbon in the form of plankton, propagules and microbes. Despite its importance, the ability of kelp forests to act as filters for nearshore waters is poorly understood. Kelp forest invertebrates, in particular, may have the potential to impact coastal water quality. Research in bays and estuaries has demonstrated that filtering by invertebrates fulfills key ecosystem functions such as maintenance of water clarity and control of eutrophication. However, in California much of the shoreline is steep and rocky and watersheds open directly into the ocean. The coastal ecosystems in these areas are characterized by kelp beds, supporting dense communities of suspension feeders that may function as alternative natural filters. Here I present data from subtidal surveys where I quantified filter feeder abundance, consumption of phytoplankton, water chlorophyll concentration (an indicator of water quality) and current speed. Using the epiphyte, *Membranipora tuberculata*, as a model species, I have developed methods to quantify the amount of chlorophyll consumed per colony area per unit time. My work indicates that *Membranipora* alone removes about 12.5% of chlorophyll from the system per hour, which has a profound effect on the biomass of suspended chlorophyll in 1 six hour tidal cycle. My results also show that current speed and ambient chlorophyll concentrations influence filtering rates, which indicates that the filtering capacity of these organisms may vary spatially and temporally with ambient environmental conditions. My results address research needs identified in recent California ocean policy initiatives. Understanding how kelp forests alter pathways of materials suspended in coastal waters and influence processes that control eutrophication is important for an effective ecosystem-based approach to the management of critical habitats for economically important species and water quality.

Edward Armstrong^{*1}, Jorge Vasquez¹, Sue Heinz². A Data Management Infrastructure for Oceanographic Satellite Products and Implications for Coastal Management.

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Regional resource management in coastal oceans in support of fisheries, marine protected areas, or recreation management among many others requires a wide variety of satellite-based products available in a timely fashion. Although many remotely sensed geophysical products are currently available including measurements of ocean chlorophyll, wind, sea surface height, and waves, sea surface temperature (SST) is of fundamental importance to assess coastal circulation (such as upwelling), potential biological productivity as well as being the most immediate indicator of ocean temperature. Here we present an example of how a regionally focused management activity can leverage off the products and services of an oceanographic satellite project that is global in scope. Specifically, we describe the data management and distribution infrastructure of the GODAE (Global Ocean Data Assimilation Experiment) High Resolution Sea Surface Temperature Pilot Project (GHRSST-PP; <http://www.ghrsst-pp.org>). This is an international effort to produce high quality enhanced Level 2 SST products (known as L2P) as well as merged (fused) SST products from a number of satellite sources on both polar orbiting and geostationary platforms. The infrastructure developed at the Jet Propulsion Laboratory (JPL) in support of the GHRSST-PP Global Data Assembly Center (GDAC) was designed to meet the requirements of this project including its stringent realtime nature (data available within 4 hours of satellite downlink). The infrastructure/capability includes dedicated software and hardware to ingest, monitor and track the data and metadata generated from global satellite data producers, as well as provide for the construction of custom subsetted regional products and other value added products such as those produced through data fusion of the multiple satellite data streams. Data delivery and access is supported through a number of techniques including facilitating data discovery through a web-accessible granule-level metadata catalog water drainage, and allows better predictions of rainfall in specific locations.

Christy Bell^{*1}, Pete Raimondi¹, Bernardi Giacomo¹, George Maya¹, Dave Lohse¹, Steve Lonhart², Carrie Miner¹, James Moore^{3,4}, Sara Worden¹. Assessment of the Impact of Withering Disease on the Genetic Structure of Black Abalone Populations: Implications for Recovery and Restoration.



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¹Ecology and Evolutionary Biology Department, University of California, Santa Cruz, ²Sanctuary Integrated Monitoring Network (SiMoN) Project, Monterey Bay National Marine Sanctuary, ³California Department of Fish and Game, ⁴Veterinary Medicine, Medicine, and Epidemiology, Bodega Marine Laboratory

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The black abalone (*Haliotis cracherodii*) has experienced mass mortalities along the coast of California since the mid-1980s and is now a candidate for protection under the USA Endangered Species Act. Mortality is due to infection by a pathogen that leads to a fatal wasting disease called withering syndrome (WS). Working with MARINe (Multi-Agency Rocky Intertidal Network) and PISCO (Partnership for Interdisciplinary Studies of Coastal Oceans) monitoring groups we have documented the northward progression of WS along the California coast. Abalone populations are sampled at 22 sites from Point Conception to Bodega Bay. The last extant large and healthy populations exist in the Monterey Bay National Marine Sanctuary. Recent declines in the southern portion of the Sanctuary are cause for concern, but whether these declines are due to WS remains to be seen. Ongoing monitoring has been coupled with molecular techniques to answer the following questions: 1) Does the genetic structure of healthy populations differ from that of diseased ones? 2) To what degree is this difference attributable to normal geographic population genetic structure? 3) Does the genetic structure of populations differ before vs after the disease hits? Using non-lethal techniques, we collected tissue from abalone at seven sites (2005-2006) and used archived samples (CDFG) from seven sites (1995-1999) between Halfmoon Bay and Santa Barbara. Comparisons were made using the molecular marker Mitochondrial Cytochrome Oxydase 1 (COI) (Hamm and Burton 2000). Our preliminary findings have only recovered eight of the original twelve haplotypes previously found in samples from 1997-1998 (Hamm and Burton 2000). Work is continuing to elucidate the extent of loss in genetic variability due to WS mortalities. Together the spatial patterns of abalone population and genetic structure will inform management and restoration decision makers regarding this threatened and ecologically important species.

Eric Bjorkstedt^{*1}, Churchill B. Grimes¹, James H. Howard². Ocean Observing Off Northern California: Achievements and Aspirations of a Partnership Between NOAA's National Marine Fisheries Service and Humboldt State University.

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As part of the effort to build the Pacific Coast Ocean Observing System (PaCOOS), NOAA's National Marine Fisheries Service and Humboldt State University have engaged in a partnership to develop an ocean observing capability that takes advantage of the University's research vessel, the R/V Coral Sea, to conduct oceanographic surveys off northern California. To this end, the Fisheries Ecology Division of the Southwest Fisheries Science Center has stationed a scientist at Humboldt State University to lead the program. Since April 2006, cruises have occupied seven stations along a 60 nm cross-shelf transect off Trinidad Head on a quarterly basis. At each station, we collect plankton samples with Bongo, manta, and Pairovet nets according to CalCOFI protocols and conduct CTD casts to characterize the physical structure of the coastal ocean. In addition to this subset of CalCOFI sampling, we fish a multiple-net, opening-closing Tucker trawl at each station to support ancillary research on cross-shelf distributions of larval fish, with a focus on larval rockfish. Near surface temperature, salinity, and chlorophyll a fluorescence are collected continuously along the ship track. Preliminary results indicate that this sampling design is capable of resolving important structures and patterns in the coastal ocean. These early achievements suggest that implementing oceanographic surveys off northern California as part of PaCOOS is feasible, but that the ability to schedule such cruises to take advantage of periods of favorable weather is critical to consistent success. Looking to the future, we expect to extend sampling to transects off Crescent City and False Cape, and to collect a broader array of samples and data (including nutrient concentrations and marine mammal and bird distributions) to provide a comprehensive view of the coastal ocean off northern California

Joe Breman^{*1}, Heather K. Kerkering². Ocean Observing.

¹ESRI, ²Central California Ocean Observing System

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GIS application of the Marine Data Model; for marine and coastal environments As we move rapidly into the information era where decisions are made based on available data, and new information is created from existing data, the body of marine knowledge has surged forward at a rate that challenges our computer capacity to store, process, and share it. Natural



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phenomena such as hurricanes and tsunamis illustrate the importance of a focused effort to manage and share information, while the slower processes of erosion and climate change also influence our environment in ways that demand our attention. A data model helps us categorize and give structure to the many different ways to store and analyze marine data of all types. Geospatially “enabling” makes it possible to create maps and 3-dimensional scenes of the marine environment that represent the information in ways invaluable to decision making. A specific example of spatially enabling the Calcofi database in a 3D viewer for analysis will be explored in this session. A data model for marine applications is complex because of the many varied uses of the data (as discussed in detail in Chapter 2). Modern marine data sets are generated by an extremely varied array of instruments and platforms, all with differing formats, resolutions, and sets of attributes (Figure 1.1). Users must deal with a wide variety of data sources and a myriad of data “structures” (e.g., tables of chemical concentration versus raster images of sea surface temperature versus gridded bathymetry versus four-dimensional satellite data formats, etc.). A comprehensive data model is needed to support a much wider range of marine objects. This is essential for advanced management and to perform cartographic, and analytical tasks. The marine data model we will present in this panel can help to identify and organize the data that we are challenged to use in a GIS to create new information that can be critical to decision making.

Carrie Bretz^{*1}, Rikk Kvitek¹. Seafloor Mapping Lab (SFML) at California State University Monterey Bay: Supporting Marine Stewardship through Science, Technology, and Education.

¹California State University Monterey Bay

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High-resolution bathymetry and seafloor habitat maps are becoming the standard requisite for nearly every coastal marine management program at the state and federal level. As a society, our ability to understand and manage ecosystems is increasingly dependent upon mastery of advanced technologies for acquiring, analyzing and visualizing geospatial information pertaining to the physical, biological and societal properties of these systems. The high quality marine habitat and baseline data products from such efforts are increasingly relevant and valuable to science and to the resource managers that must apply the information to current research initiatives and critical environmental issues. The Seafloor Mapping Lab (SFML) (<http://seafloor.csumb.edu>), within the Division of Science and Environmental Policy at California State University Monterey Bay, specializes in high-resolution acoustic remote sensing for coastal habitats. Combining research and education with state-of-the-art geospatial technology, the SFML offers unique hands-on, field-to-finish experience to students while conducting professional habitat mapping surveys for resource management and basic research along the continental margins. The successful execution of this mission has made SFML an effective collaborator with a variety of resource agencies and applied research consortiums including: CICORE, CeNCOOS, CDFG, USGS, USACE, and the California Coastal Conservancy. Data from these collaborations have been used to monitor coastal erosion, assess tsunami potential, identify essential fisheries habitat, design and manage marine protected areas, develop tools for the sustainable management of California's squid and rockfish fisheries, facilitate ecosystem-based management within the Elkhorn Slough National Estuarine Research Reserve and Morro Bay, and maintain shipping channels and facilitate beach replenishment at the mouth of San Francisco Bay.

Erickson D. Burres^{*1}, Angie Bera². Demographics of Citizen Monitors within the Coastal Zone.

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Citizen Monitoring presents organizations to both inform and engage the public while also obtaining much needed water quality data. This data is in high demand but often un-obtainable through traditional agency programs. Through citizen monitoring data can be obtained and proper water quality management decisions can be made. Data presented to agencies is done so under QAPPs (Quality Assurance Project Plans) but there still appears to be some stigma attached. This study characterized volunteers as to display the potential for professional competency.



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Douglas Campbell*¹, **Regula Campbell**¹. Ellen Browning Scripps Memorial Park, La Jolla, California: Conceptual Development Plan.

¹Campbell and Campbell

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This Conceptual Plan illustrates the consensus recommendations of the November 18-19, 2005 Community Workshop sponsored by the Scripps Park Project. The Plan represents a broad consensus of opinions of over 60 workshop participants. The Park and its offshore waters -The La Jolla Ecological Reserve –designated as an "Area of Special Biological Significance (ASBS)-represent an environmental and ecological resource of worldwide significance. This spectacular dynamic shoreline at the edge of a major urban center is increasingly subject to the impacts of heavy visitor use and the adjacent community. The effects of these impacts, and the lack of specific public policy initiatives have led to the current concern that inaction will lead to irreversible deterioration of an irreplaceable resource. A New Vision for Scripps Park The defining physical features of Scripps Park- it's sweeping bluff tops, cliffs, beaches and ocean waters - are products of a unique meeting of sea and land. The present appearance and condition of the coastal bluffs and shoreline of the Park are the result of on-going, dynamic environmental processes. At any given point in time, the physical setting of the Park is a signature of dynamic processes. The experience of these processes is integral to the experience of the identity and character of the Park. The dynamic nature of the Park's environment, and the necessity that the land and the waters be considered as parts of an inseparable whole are fundamental to understanding the park, and must underlie public policy guiding all planning, design and environmental management efforts. The specific interrelationships amongst shoreline erosion processes, surface and groundwater flow patterns, water quality, geology and soils, and flora and fauna of the site must continue to be taken into consideration in formulation of guiding principles, landscape design and engineering concept plans, implementation, and on-going environmental management.

Linda Catton*¹. Considering Allee Effects when Evaluating Overfished Benthic Broadcast Spawning Invertebrate Populations: A Case Study of a Pink Abalone (*Haliotis corrugata*) Population near San Diego, California.

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Commercial benthic invertebrate species are frequently both ecologically and economically important, challenging fisheries managers to balance economic and conservation priorities. However, many over-harvested shellfish species may be subject to further population declines below a threshold density due to an extreme reduction in fertilization success. This reduction of fertilization success at low population sizes is known as an Allee Effect, and is likely exacerbated in species with limited mobility (i.e. abalone). Therefore, stock assessments of these species should include an evaluation of small-scale spatial characteristics that could influence successful reproduction in low-density populations.

For the last three years, I have collaborated with the California Department of Fish and Game to characterize the status of a potentially recovering pink abalone (*Haliotis corrugata*) population near San Diego, CA. Abalone had provided a substantial fishery for over eighty years in California, culminating in the depletion of the five major southern California commercial species by 1997. A devastating combination of disease and over-exploitation reduced the population levels well below the current theoretical lower-density limits (2,000 abalone / ha). In order to evaluate the recovery status of the pink abalone population, we are conducting an intensive mark-recapture study in addition to quantifying characteristics of aggregations, such as the number of individuals in an aggregation, the size-frequency of those individuals, and the sex ratio within the aggregations. Current estimates reveal that the population density is still far less than the theoretical minimum spawning density, although individuals are often aggregated into groups of two or more. Coupling the number of individuals per aggregation with data on the sex ratio and size-frequencies may allow for more insightful predictions of the reproductive potential of this population.

Mitchell S. Craig*¹, **Joy C. Andrews**¹, **Brandy Barnett**¹, **Carlin Dare**¹, **David K. Yang**¹, **Laurence E. Schemel**². In-Situ Monitoring of Water Quality in South San Francisco Bay.

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We installed continuous-recording water-quality monitoring sondes at two locations in South San Francisco Bay in summer 2005 to enhance existing monitoring capabilities. The new instruments record temperature, salinity, turbidity, fluorescence, dissolved oxygen, tidal level, and pH. Data are posted on the web at www.csueastbay.edu/cicore. One of the instruments is located at Dumbarton Pier, where water-quality data have been recorded since 1989. The new instrument at Dumbarton is deployed at a mean water depth of 5 m, at a fixed distance of 1 m above water bottom. Combined with data from an existing surface deployment at the same location, the new data enable us to examine stratification and destratification processes related to tides, winds, and freshwater inflow. The other new instrument is located at San Leandro Marina, deployed near the water surface. The instruments are cleaned in the field every 3 weeks, and returned to the laboratory every 6 weeks for calibration and more extensive cleaning. The new sondes utilize automatic wipers to inhibit biofouling. Stations are serviced more frequently during the summer months, when biofouling is most severe. Samples of bottom sediments were collected in spring 2006 in the vicinity of the instruments and analyzed for particle size distribution using a laser-diffraction instrument. Bottom sediment is primarily silt and clay, with the exception of occasional coarser deposits of shell fragments. Water samples are collected at the station locations every 3 weeks for more accurate determination of salinity in the laboratory. Periods of high rainfall, primarily during winter, coincide with lowered salinities and turbidity pulses at the Dumbarton station. Fluorescence and dissolved oxygen data provide baseline data for evaluating the effects of wetlands restoration projects that are currently underway in the South Bay.

Carolina DaCosta^{*1}, P.T. Raimondi¹, K. Cox¹, R. Gaddam¹, D. Lohse¹, C. Bell¹, M. George¹, M. Miner¹, S. Worden¹.
Reserves in Reverse: The Recent Change in Access Status of Stornetta Ranch and the Resulting Effect on Red Abalone Populations.

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The Stornetta Ranch, in Mendocino County, CA, historically consisted of 1711 acres of private property including 2.5 miles of coastline. Prior to 2004, this coastline had virtually no public access or harvesting making it a de facto reserve. In 2004, the Multi-Agency Rocky Intertidal Network (MARINe) and Partnership for Interdisciplinary Studies of Coastal Oceans (PISCO) worked with the California Department of Fish and Game (CDFG) to perform a preliminary intertidal survey of Stornetta. A large population of unharvested red abalone (*Haliotis rufescens*) was found during the survey. The area was opened to the public in 2005 and harvesting of abalone immediately began. To determine the effects of harvesting, permanent intertidal plots were established in 2005 to monitor abalone populations. These red abalone plots vary in distance from the coastal access point. Size frequency data show a wide distribution where access is limited, and a marked absence of individuals of legal take size in areas of easier access. Given that the fecundity of red abalone increases exponentially with size (Hobday and Tegner 2002), total fecundity will decrease relative to harvest pressure. Using age-structured models as a reference, analysis from this study shows that recovery from only one year of harvest will take 20 years. High densities of fecund abalone are required for successful reproduction. Mortality and long recovery time make the species vulnerable to over-fishing. Change in access status can have dramatic consequences on red abalone populations and close monitoring may provide insight for sustainable management policy. As other privately owned coastal lands in California are changed to public access, effective management of these areas is critical to conserving marine resources.

Amy Dean^{*1}, Ashley Conrad-Saydah^{2,3}. Investigating Demographics and Acanthocephalan Parasite Load of *Emerita Analoga*: A Model to Engage Urban Youth.

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The Sand Crab Monitoring Project is a National Marine Sanctuary program with two main goals: to engage youth in the protection of California's coastal resources through participation in intertidal monitoring and to generate a long-term, quantitative dataset for use in assessing changes in the health of sandy intertidal ecosystems along the west coast of the United States. Here, we focus on data collected by trained high school and college interns from the Careers in Science Intern Program at the California Academy of Sciences. The interns, who hail from groups typically underrepresented in the sciences, have monitored the abundance, distribution, and Acanthocephalan parasite load of *Emerita analoga* at Ocean Beach in San Francisco since 2003. *E. analoga* often dominate the biomass of sandy beach communities and are the primary intermediate



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hosts for Acanthocephalanes. Definitive and dead end Acanthocephalanes hosts, such as Surf Scoters (*Melanitta perspicillata*) and sea otters (*Enhydra lutris*), are infected when intermediate hosts are ingested. Mean *E. analoga* abundance varied considerably across years. In both 2004 and 2005, the rate of Acanthocephalan infection in the *E. analoga* population was 55%. However, from 2003-2005, the mean number of parasites per infected crab increased significantly from 1.00 in 2003, to 1.98 in 2004, to 2.75 in 2005. This increase could result in a proliferation of parasites in definitive and dead ends hosts. The value of this project extends far beyond the creation of a long-term dataset. Student participants become excited about the world's oceans, experientially learn the need for environmental stewardship, and often pursue careers in the sciences. Of the former Careers in Science interns that have participated in the Sand Crab Monitoring Project, 65% have pursued marine science related research opportunities in college. We hope this study will serve as a model for future monitoring projects throughout the world.

Tonya S. Del Sontro^{*1}, Ira Leifer¹, Bruce Luyendyk¹. Beach Tar Accumulation at Coal Oil Point, California: Distribution, Variation, and Possible Sources.

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The Coal Oil Point (COP) natural marine hydrocarbon seep field in the Santa Barbara Channel releases >100 barrels oil day-1, some of which deposits as tar on local beaches. Oil and gas seep from and orient parallel to three E-W trending faulted anticlines. The three seep trends are ~0.5, ~1.5, and ~3 km offshore of COP. This natural and continuous "oil spill" presents an opportunity for studying the fate of petroleum in the ocean, thereby aiding coastal management, especially in sensitive habitat areas near seeps.

Bridget Dobrowski^{*1}. AWQA: Meeting the Needs of Agriculture to Protect Coastal Water Quality.

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Beach tar accumulation at COP was surveyed on 57 random days throughout 2005 along 12 transects separated by 20-m. Tar accumulations were determined in six different size classes yielding up to 16 kg/day over 16,000 m². This is about ten percent of the tar that could originate from the seep field. The data shows a seasonal variation with mean summer tar accumulation one order of magnitude higher than mean winter accumulation. Time variations in tar distributions were compared to environmental factors and suggest that higher tar accumulations are related to lower speed winds, diminished offshore winds, low swell, and higher water temperatures. Emission variability, weathering and sinking of oil/tar, and storms may also have played a role in observed temporal and spatial variations. A winter tar anomaly of ~40 kg on February 27 may be related to unusually high rainfall in January and February of 2005.

Changming Dong^{*1}, Jian Peng², Hongchun Zhang³, James C. McWilliams¹, Keith Stolzenbach⁴. Numerical Simulation of DDT Distribution in Southern California Bight.

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Among a variety of anthropogenic pollutions in Southern California Bight (SCB), the levels of DDT and its metabolites (collectively termed DDTs) are of particular concern to the coastal community. The previous studies suggested that the Palos Verdes Shelf sediments have remained the dominant source of DDTs in the water column of SCB. To better assess the spatial distribution, dispersion, and fluxes of dissolved DDTs within and beyond SCB, Regional Oceanic Modeling System (ROMS) is applied. In the model, the dissolved DDTs is considered as a passive tracer. With a constant concentration of DDTs near the sediment-water interface at designated 'hot spots' off the shelf of Palos Verdes, the model is integrated for a sufficiently long term to reach a quasi-stable state for water column DDTs. The result shows that the distribution of DDTs is comparable with the observational data, and through the SCB current system DDTs are advected and dispersed to the open ocean.



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Barry Hibbs¹, Alejandra Lopez¹, Mercedes Merino¹, Gary Duby^{*1}. Observing Solute Flux Changes over a Twenty-Four Period in the San Diego Creek Watershed.

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The average concentration of selenium in the ocean is ~0.05ppb. Though this poses no risks to organisms, there are areas of greater concentrations adjacent to continents where rivers transport solutes from terrestrial sources. For example, in the San Diego Bay of southern California, selenium concentrations exceed the EPA standard of 5.0 µg/L. In the San Diego Creek Watershed, which empties into the San Diego Bay, selenium concentrations are as great as 600 µg/L -hazarding plants and animals in the marine environment. A program developed by the State Water Resources Control Board of California in response to Proposition-13 contracted with CSULA to investigate the source(s) of selenium in the watershed. One endeavor in this task was to monitor the surface waters in San Diego Creek every 2 hours for 24 hours. This investigation was intended to evaluate the quantity of selenium currently transported from the San Joaquin Hills into the watershed via San Diego Creek. This study intended to fulfill that objective and support the policies of the California Ocean Protection Act. To accomplish this goal water samples were collected upstream near the San Joaquin Hills and approximately one kilometer downstream every 2 hours for 24 hours. Surface water parameters were also measured (i.e. pH, temperature, electrical conductivity and dissolved oxygen content) during sampling. The results indicate that headwater sources in the San Joaquin Hills are not a significant source of selenium into the watershed during dry seasonal periods (average upstream value was 1.550 µg/L). The results also indicate that San Diego Creek is an effluent stream and that ground water is responsible for selenium loading into the channel (average downstream value increased to 3.718 µg/L). Loadings of additional environmental contaminants such as nitrates are also derived from groundwater enriched through anthropomorphic activities.

Eric Egland^{*1}, Ira Leifer², Bruce Luyendyk². Sonar Return Quantification of Hydrocarbon Spatial and Temporal Emissions.

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The results indicate that headwater sources in the San Joaquin Hills are not a significant source of selenium into the watershed during dry seasonal periods (average upstream value was 1.550 µg/L). The results also indicate that San Diego Creek is an effluent stream and that ground water is responsible for selenium loading into the channel (average downstream value increased to 3.718 µg/L). Loadings of additional environmental contaminants such as nitrates are also derived from groundwater enriched through anthropomorphic activities.

Ian Faloona^{*1}, Anthony Wexler¹, Douglas Day¹. Atmospheric Climate Monitoring at the Bodega Marine Lab.

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Northern California is a unique locale because of the particularly intense upwelling induced along its shores by the strong, prevailing northwesterly winds that are driven by the Pacific High during the spring and summer. This California Current upwelling system sustains some of the most biologically productive waters in the world's oceans. Moreover, the winds bring atmospheric chemical compounds from shipping, Asia's rapidly increasing industrialization centers, and natural sources in the ocean. These chemical constituents indicate the state of the 'background' atmosphere and its levels of greenhouse gases and aerosols. There is considerable concern that the response of this important marine ecosystem to global climate change may not be favorable; moreover, changing emissions from the coastal zones might further impact air quality along the highly populated coastlines of California.

UC Davis researchers have been monitoring trace gases and atmospheric particles at the Bodega Marine Lab for several years in order to better understand the North American background atmospheric composition. For example, inspection of the high resolution CO data has revealed frequent spikes during onshore flow that can be used to estimate regional ship emissions. Perennial nucleation events have been observed where elevated concentrations of ultrafine particle number concentration (3-10 nm in diameter) appear to correlate with ocean upwelling, not the tidal cycles as observed elsewhere. Shorter term measurements have been made of dimethylsulfide (DMS) and nitrous oxide (N₂O) that also exhibit a strong



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dependence on upwelling strength. We will show some of the main meteorological and sea state variables that control the emissions of these important biogeochemical species, and estimate their contribution to the total carbon, sulfur, and aerosol loading in the coastal atmospheric environment.

Lara Ferry-Graham*¹. Evaluating the Ecological Effects of Once-Through Cooling: Contributions of the WISER Program.

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There are 21 California coastal power plants that utilize once-through cooling technology. Although this cooling technology has been used in California for over 50 years, the ecological effects have not been well studied. In order to improve our understanding of the impact of this technology on the species inhabiting California's coastal and estuarine waters, the Public Interest Energy Research (PIER) Program of the California Energy Commission established the Water Intake Structure Environmental Research (WISER) Program through California State University's Moss Landing Marine Laboratories (<http://ecomorphology.mlml.calstate.edu/WISER.html>). This program is meant to identify and fund research that will further our understanding of entrainment impacts, as well as provide better tools for the reduction or removal of impacts where possible. As the result of a workshop that identified research priorities within the scope of the PIER program, WISER solicited proposals via an RFP, subjected these to broad peer-review, and has funded a number of studies specifically focused on accurately quantifying and preventing entrainment losses. These include studies that will 1) implement new techniques for enumerating entrained species; 2) provide improved life history information for entrained species for improving model estimates of entrainment impacts; 3) integrate computational fluid dynamics for quantifying source water areas; 4) identify and test new anti-entrainment technology, and 5) conduct long term surveys of species abundances in potentially affected areas in order to provide a context for entrainment losses. Research results should begin to be available in 2007. WISER is always looking for additional research that meets PIER goals and informal proposals are welcomed.

David G. Foley*¹, **Lynn M. de Witt**². CeNCOOS Demonstration Project: Meeting Central and Northern California's Needs for Marine Information.

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The development of the emerging integrated ocean observing system (IOOS) offers a unique opportunity to alleviate the bewildering array of data portals and formats facing a party interested in accessing information about the marine environment. The data sources and types are quite diverse, ranging from physiological and hydrographic samples from fisheries surveys, to basic physical parameters from moorings and near shore stations, to oceanic properties derived from satellites and numerical simulations. The methods required for quality control and quality assurance share this diversity. As each regional association (RA) moves towards integration of their data they face two issues. First, there must be a system that meets IOOS data management and communications standards immediately. Additionally, the RAs must always be considering improved data management solutions, which will enhance the infrastructure to handle the data flows in 5 and 10 years. We present here the results of the initial efforts by the partners of the Central and Northern California Ocean Observing System (CeNCOOS) to produce a data distribution system that is both compliant with IOOS DMAC standards, and which, more importantly, meets the needs of the CeNCOOS data users. We also discuss how the regional partners are working together to provide solutions to provide for the long-term stewardship of the data.

Stephen Foss*¹, **Peter R. Ode**¹, **Michael Sowby**¹, **Marian Ashe**¹. California Aquatic Non-Native Organism Database (CANOD).

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The Ballast Water Program is an effort to control the introduction of non-native species into our coastal waters from the ballast of ships. The initial phase involved both field collections and a literature review which resulted in creation of a database that includes information on all known non-indigenous aquatic species in the marine and estuarine waters of the state. The



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current 5-year phase will include a re-survey of the ports and estuaries surveyed in 2000, as well as a more intensive survey in the San Francisco Estuary and, for the first time, a comprehensive survey of California's outer coast. This poster will show data sources for the California Aquatic Non-native Organism Database (CANOD), a project timeline, and a summary of main findings from the study. The survey found a total of 607 organisms that were categorized as introduced or were considered likely to have been introduced. All areas of the California coast studied have experienced some level of invasion. Species totals are greatest in the two major commercial ports, San Francisco and L.A./Long Beach. However, the smaller ports, harbors, and bays along the coast also have a substantial number of non-native species. Annelids, primarily polychaete worms, were the dominant taxon and arthropods (crabs, shrimp, etc) were the second most abundant taxon identified. Other common taxa identified included molluscs, fish, and cnidarians. The most common potential pathways of introduction were ballast water, hull/ ship fouling, and aquaculture, but pathways were unknown for many species. Most species introduced to California appear to have come from the northwest Atlantic, the northwest Pacific, and the northeast Atlantic. The database and a report submitted to the Legislature in 2002, titled *A Survey Of Non-Indigenous Aquatic Species In The Coastal And Estuarine Water Of California* can be found on the Web at <http://www.dfg.ca.gov/ospr/organizational/scientific/exotic/MISMP.htm>.

Hartmut Frenzel¹, Changming Dong¹, Nicolas Gruber^{1,2}, James C. McWilliams^{1,2}. Modeling of a Coastal Upwelling Event in the Southern California Bight.

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An unusually strong upwelling event with very low sea surface temperatures was observed throughout the Southern California Bight in March 2002. The temporal evolution of the upwelling was recorded by the Santa Monica Bay Observatory mooring in detail (T-S string, surface CTD, and fluorometer). Satellite images show that the upwelling of cold, nutrient-rich water began in the Santa Barbara Channel and spread within four days to Santa Monica Bay. Similarly, the phytoplankton bloom began as patch in the Santa Barbara Channel and quickly grew to cover most nearshore areas of the Southern California Bight. The upwelling was driven by persistently strong alongshore winds acting upon weakly stratified waters. At the mooring site, water from depths of over 80 m was upwelled to the surface, leading to a drop of about 3.5 degrees C within only two days. The injection of new nutrients into the euphotic zone led to a phytoplankton bloom that occurred about one week after the peak of the upwelling. The surface chlorophyll concentrations were the highest recorded by the SeaWiFS satellite since September 1997 at this site. In the following weeks, many marine mammals died in the Southern California Bight. The neurotoxic domoic acid, produced by Pseudo-nitzschia diatoms, is believed to be the cause for this mass mortality. We have modeled this upwelling event with the Regional Oceanic Modeling System (ROMS) and a coupled biogeochemical model. The grid covers the Southern California Bight at high horizontal resolution. A successful simulation of this wind-driven event required the setup of a realistic wind field. We used the atmospheric mesoscale model MM5 to generate the wind forcing. Forced by a high resolution MM5-reanalyzed wind (2 km), the model qualitatively reproduces the upwelling processes, including the peak and relaxing processes of the upwelling event and the subsequent phytoplankton bloom.

Suzanne Gilmore^{*1}, Maurya Falkner¹, Lynn Takata¹. Considerations for the Treatment of Ballast Water in California.

¹California State Lands Commission

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Non-indigenous species (NIS) are organisms that have been transported by human activities into regions where they did not occur historically. Once established, NIS can create negative economic, ecological, and human health impacts. Sources of NIS introductions have been attributed to several vectors including ballast water, hull fouling and aquaculture. Because of the large volume and frequency of discharges, ballast water from commercial vessels is considered the primary vector for the worldwide transfer of NIS in coastal environments.

In 2003, the California State Legislature passed Assembly Bill 433. Under Public Resources Code, Section 71201(d), the California State Lands Commission (CSLC) is directed to move the state expeditiously toward elimination of the discharge of



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NIS into the waters of the state, based on the best available technology economically achievable. More specifically, Section 71204.9 directs the CSLC to recommend specific performance standards for the treatment of ballast water in consultation with the State Water Resources Control Board and in consideration of recommendations provided by a technical advisory panel.

The CSLC recently submitted a report to the California Legislature recommending specific performance standards for the discharge of ballast water. The recommendations were based on the best available technology economically achievable and were designed to protect the beneficial uses of State waters. The CSLC believes the adoption of performance standards by the State of California is essential to move technology development forward. While the Report does identify specific standards organized by organism size class, several information gaps were highlighted including a lack of biological evidence and substantial challenges in identifying "best available technology economically achievable." A variety of treatment technologies have been suggested for the elimination or reduction of organisms found in ballast water, but further biological testing and economic evaluation will be necessary before widespread implementation is feasible.

Richard M. Starr¹, Ashley P. Greenley², Roger Thomas³, Jason Felton², Kristen Green^{*2}. Ecology and Movements of Nearshore Fishes near Bolinas, California.

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In June 2005, we started a collaborative project to gather information about species targeted in commercial and recreational fisheries in the heavily used area off Bolinas, California. We worked with charter boat skippers and recreational, sport and commercial anglers to catch, tag, and release fishes that typically occur in central California nearshore habitats. All fishes were caught using rod and reel gear and identified to species. Total length was recorded to the nearest centimeter. Fish condition at release was recorded, and individuals exhibiting swim bladder barotrauma were vented using a hypodermic needle prior to release. All target species were tagged using external T-bar anchor tags. Tag number, coordinates of release, and catch depth were recorded. We tagged 5078 individuals of 13 species. Black rockfish comprised approximately 66% of the catches, and 85% of the tag returns. Commercial and recreational anglers notified us when they recaptured a tagged fish via the phone number on the tag. Recapture data, including date, latitude and longitude, depth, and tag number were collected and recorded from these anglers. Since tagging, about 3.3% of the total tagged fish have been recaptured. Most of the tagged species exhibit strong site fidelity, moving less than a few nautical miles (nm) from the initial tagging location. With the exception of a yellowtail rockfish recaptured 17.1 nm from initial release location, the mean recapture distance for all species was less than 0.75 nm. 86% of recaptured black rockfish were recaptured within 1 nm of initial release location, whereas 100% of lingcod recaptures were within 0.5 nm of release location. The length-frequency data we collected indicated that much of the catch in the study region was comprised of individuals that are immature.

Ami Groce^{*1}, Dean Pasko¹, Tim D. Stebbins¹, Dan A. Ituarte¹, R. Nick Haring¹, Wendy E. Storms¹, Kerry J. Ritter², Ken C. Schiff². Preliminary Results of the San Diego Sediment Mapping Study: Sediment Conditions on the Mainland Shelf during 2004.

¹City of San Diego, ²Southern California Coastal Water Research Project
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Maps are useful tools for understanding, managing and protecting the environment, although there has been little success in developing statistically defensible maps of environmental conditions in marine coastal regions. In one of the first efforts to address this need in coastal waters, the City of San Diego, in collaboration with the Southern California Coastal Water Research Project, implemented a 2-phased Sediment Mapping Study in 2004. Phase 1 was designed to a) document existing benthic conditions in the mapping region, b) evaluate spatial variability in sediment quality surrounding the Point Loma and South Bay Ocean Outfalls (PLOO and SBOO). Sites were located from off Point La Jolla into northern Baja California, and at depths from 17 to 224m. Sediments were analyzed for grain size, total organic carbon, total nitrogen, trace metals, pesticides, and PCBs. This poster presents details of the descriptive analyses of sediment quality conducted for Phase 1, and includes preliminary maps and results of pattern analyses using various multivariate techniques. These findings are compared to historical values for the region, and will be used along with data generated on spatial variability to help construct the variograms necessary for design and implementation of Phase 2.



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Doyle Hanan^{*1}, Diane Pleschner-Steele², Natalie Wong³, Michael Robinson³, Louis Zeidberg⁴. Market Squid Industry-Agency Cooperative Research and Biological Observations.

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Market squid, *Loligo opalescens*, are an important component of the marine ecosystem as well as the object of California's largest and most valuable fishery. Improving knowledge of the squid resource relative to oceanographic cycles, the marine ecosystem, and the fishery complements the ecosystem focus of California ocean protection policies. To address research needs and develop a cooperative industry-agency squid research plan, the non-profit California Wetfish Producers Association (CWPA) sponsored a workshop for agency and independent scientists and squid fishermen. Workshop participants identified short-term and long-term market squid research priorities, from which CWPA developed a pilot research program, funded in part by CWPA and NMFS, Southwest Fisheries Science Center. Field research elements include:

1. Train fishermen to perform a plankton collecting project in nearshore areas adjacent to squid spawning grounds to complement CalCOFI's quarterly cruises, conducted primarily offshore. The focus is to quantify the seasonal presence of squid paralarvae.
2. Develop a CPUE index of abundance using lightboat captains' estimates of squid attracted to the fishing grounds, recorded by time and tonnage.
3. Capture pre-ovulatory female squid to estimate lifetime fecundity.
4. Develop a geographic information system (GIS) database of available squid and oceanographic data to facilitate tracking squid abundance relative to oceanographic factors such as sea surface temperature, upwelling, chlorophyll, etc.

CWPA also field-tested the BioSonics hydroacoustic echosounder to quantify adult squid abundance. Based on the success of the field trial, plans are now underway to incorporate this technique routinely as a fifth research element. A follow-up workshop sponsored by CWPA on April 29, 2006, developed a research protocol; CWPA plans to implement the field work in the 2006 summer squid fishery in Monterey, in cooperation with the Department of Fish and Game.

R. Nick Haring^{*1}, Timothy D. Stebbins¹, Dean Pasko¹, David W. James¹. A 10-Year Regional Assessment of Benthic Infaunal Assemblages Off the Coast of San Diego.

¹City of San Diego Marine Biology Laboratory

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The City of San Diego has conducted regional benthic surveys of the continental shelf and slope off San Diego since 1994. The main objectives of these surveys are: (1) to characterize benthic conditions for the large and diverse coastal region off San Diego; (2) to characterize the ecological health of the marine benthos in the area; (3) to gain a better understanding of regional conditions in order to distinguish between areas impacted by anthropogenic or natural events. Benthic infauna and sediment samples were collected annually from 1994-2003 using the USEPA probability-based EMAP random sampling design. The study area ranged from off Del Mar in northern San Diego County south to the US/Mexico border. A total of 324 different sites were sampled during this 10-year period ranging in depth from 9 to 461 m. Patterns of macrobenthic community structure and various environmental parameters were addressed using a suite of univariate and multivariate statistics. Bray-Curtis similarity and cluster analyses classified six major and four minor (containing 1 to few samples) macrobenthic assemblages. Cluster mapping and ordination by MDS discriminated assemblages stratified along depth contours, with no apparent spatial patterns with respect to point source inputs. Results from the univariate analyses varied but were comparable to other historical values recorded from the Southern California Bight. Infaunal abundances ranged from 39 to 1467 individuals per sample (mean = 317), and the total number of species ranged from 21 to 266 per sample (mean = 101 species). Overall, these data suggest that the structure of benthic communities off San Diego has not changed substantially in recent years.



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Kerry M. Howard^{*1}. Strategies to Protect Coastal Resident Fish Passage.

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Alaska enjoys healthy populations of anadromous and resident fish. Both are protected by law and are actively managed. Alaska also has a broad-based resource economy, which relies on oil and gas development, mining, timber harvest, and other resource sectors. The timber industry in Alaska is currently in significant decline. The State and the industry are actively working to ensure economic timber sales while protecting other important state resources. Much of the timber industry's operating expenses can be attributed to road-building costs. Anadromous fish streams that could be affected by timber harvest or road-building are protected both by the State's Forest Resources and Practices Act and the State's Anadromous Fish Act. Fish passage must also be provided in non-anadromous or "resident" fish streams. The State of Alaska is working actively to define the level of fish passage that must be provided in these streams to ensure sustainable fish populations while allowing timber operators flexibility to help reduce road-building costs. The Department of Natural Resources has convened a Scientific Advisory Working Group (SAWG) to provide scientific and technical guidance in this policy consideration. Two main topics being considered are the appropriate design discharge for culverts to provide passage for non-anadromous fish, and the conditions under which temporary barriers to fish populations can occur without affecting the sustainability of fish populations. SAWG recommendations will be provided to the State to evaluate and develop methods to provide appropriate fish passage while simultaneously aiming to provide flexibility. Recommendations may also provide additional direction for fish passage issues in other resource development sectors. Effective management of resident fish populations while allowing appropriate development activities to occur is key to ensuring healthy watersheds and coastal environments.

Michele Jacobi^{*1}, **George Graettinger**¹, **Mary Geddes**², **Jill Bodnar**². Watershed Database and Mapping Project for the Southern California Bight.

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For the past several years, NOAA's Office of Response and Restoration (OR&R) has produced integrated Watershed Database and Mapping Projects for coastal watershed areas that have been impacted by the release of toxic chemicals from hazardous waste sites and non-point sources. As part of NOAA's Coastal Storm Program, OR&R is developing a Watershed Project focusing on the potential impacts of coastal storms on surface runoff, water quality, and the health of native fish and other at-risk species in the Southern California Bight. The project combines regional contaminant data along with relevant geospatial data to assist in establishing management priorities and help determine the best methods and locations for site cleanups and habitat restoration projects. Sediment chemistry, tissue chemistry, and benthic toxicity data from Point Conception south to the Tijuana Estuary have been incorporated into NOAA's Query Manager application. Query Manager is a freely downloadable relational database and query engine that allows users to query contaminant and toxicity studies for a site-specific or watershed-wide area. Where appropriate, sediment guidelines have been incorporated into Query Manager to provide comparison of sediment concentrations with potential guidelines and to facilitate assessment of ecological risk to NOAA trust resources present in the region. Users can import these regional data into ArcGIS to view the contaminant data in context of a wide variety of geographic information compiled for the Watershed Project, such as regulated facilities, roadways, terrain, land use, hydrology, habitat, and species distribution. This Watershed Database and Mapping Project also includes an Internet-based interactive mapping website and a comprehensive Watershed Webguide that provides background information on the project's history and objectives, user guides for all applications and tools, available metadata, and related websites.

Dave James^{*1}, **Ami K. Groce**¹. Water Quality in the South Bay Region of San Diego, Southern California: Spatial and Temporal Trends in Bacteria Levels.

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The City of San Diego's ocean monitoring program for the South Bay Ocean Outfall (SBOO) region has been conducted since 1995 in accordance with NPDES permit requirements for the City's South Bay Water Reclamation Plant (SBWRP) and/or the International Wastewater Treatment Plant (IWTP) operated by the International Boundary and Water Commission. In



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addition to treated IWTP and SBWRP effluent discharged via the SBOO, the South Bay region receives contaminated water from several major non-point sources, including the Tijuana River, San Diego Bay, and Los Buenos Creek in northern Baja California. Pre-discharge (1995-1998) indicator bacteria densities in water samples from offshore and shore stations were compared to those from post-discharge years (1999-2005). Spatial and temporal trends in total and fecal coliform levels were examined to investigate possible effects of the SBOO discharge and other non-point sources of contamination. During years with heavy rainfall, river discharge and runoff during and after storm events strongly affected water quality conditions. Bacterial concentrations and visible satellite imagery data indicate that waters discharged from the Tijuana River, Los Buenos Creek, and other non-point source stormwater runoff can critically impact water quality along the shore and at nearshore stations. In contrast, effects of wastewater discharge from the SBOO are generally restricted to offshore areas at depths below the thermocline.

David J. Kushner^{*1}, Michael D. Moss¹, Kate R. Faulkner¹. Assessment of the Channel Islands' Marine Protected Areas Using a Long-Term Ecological Monitoring Program.

¹Channel Islands National Park

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There have been widespread and dramatic changes to the marine communities and populations within the Channel Islands during the past 24 years. These changes, a result of both man-made (fishing) and natural perturbations have been documented by the National Park Service Kelp Forest Monitoring Program which has been ongoing since 1982. Establishing fishery independent baseline of the ecological condition of newly established Marine Protected Areas (MPA's) at the Channel Islands is critical in understanding the effectiveness of MPA's as a ecosystem management tool. Channel Islands National Park has shown that a long-term ecological monitoring program can show MPA effects. In 2005, the Park expanded its existing kelp forest monitoring program by establishment of 16 additional fixed sites to ensure adequate inside/outside MPA baseline data for future evaluation. In 2005, three years of funding was provided by the NPS Natural Resource Preservation Program to establish a baseline of this new network of MPA's. Funding will be needed after 2007 to continue this monitoring program.

Chris LaFranchi^{*1}. Spatial Use Patterns among Non-Consumptive Users of the Channel Islands.

¹Channel Islands National Marine Sanctuary

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Under a state/federal partnership, a commitment was made to monitor socioeconomic conditions following the establishment of no-take marine reserves in the CINMS in 2003. From May – September 2006, private boaters will be intercepted at anchorages in the Channel Islands and surveyed using a GIS-based, interactive computer program. Private boats in the Sanctuary were approached using a skiff launched from a CINMS research vessel and invited to take a survey either aboard their vessel or the research vessel. The result will be the first spatially-explicit database of non-consumptive use, intensity, associated expenditures, and knowledge, attitudes, and perceptions of private boaters in relation to the Sanctuary and no-take marine reserves. All data collected, moreover, are spatially related to a set of biogeophysical Sanctuary attributes. Methods developed and data acquired have implications for socioeconomic monitoring and, ultimately, determining the net effect of marine reserves on human well being: 1. They contribute to a baseline measurement of the present values enjoyed by non-consumptive users in the CINMS, related to biogeophysical attributes, and 2. They provide a basis for establishing a set of combined socioeconomic and ecological indicators that can ultimately be used to monitor the impact of marine ecosystem health on non-consumptive use activities and values.

David Lapota^{*1}. Current Status of Green Abalone Outplanting off Point Loma, San Diego.

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California has a statewide closure on the harvest or collection of any abalone species from San Diego County to San Francisco. Reduced populations have prompted more stringent management regulations and have stimulated interest in developing methods for enhancing natural populations. Earlier attempts at reseeding small hatchery-reared abalone into existing California abalone habitats revealed poor survival and little, if any, recruitment of new abalone. These results contrast



with reseeding efforts in Japan where larger abalone seed were outplanted and survival rate approached 70%. Based on these later observations, our group has grown green abalone to a size of approximately 70 mm before attempting to outplant into areas off Point Loma. The primary goal was to create and maintain reproductive nodes within the site. Increased clusters of gravid adults should increase fertilization success and new recruitment. Four sites were chosen for initial outplanting efforts. The first trial test plant of 200 3-4" green abalone off Point Loma was completed on 11 March 2003. The site was at a depth of 7 meters. Abalone from the Navy "abalone farm" were housed in plastic condos and transported out to the site in insulated coolers. Approximately 13 abalone were placed in each of the condos. Predator and scavenger densities were estimated as well as kelp coverage. In the early stage of outplanting efforts, preliminary evidence was encouraging. Two months following outplanting, 77% of the abalone is believed to be alive, but cryptic, but unverified. Thirty-one empty shells were found within the site during this 2-month period. Later outplants have verified a survival rate of approximately 50% following 6 months of outplanting. Artificial habitat essentials may include the insertion of live kelp plants into semi-enclosed cages for increased retention and survival of the abalone.

Homa Lee^{*} 1, Marlene Noble¹, Jingping Xu¹, Jonathan Warrick¹, Patrick Barnard¹, Brian Edwards¹, William Normark¹, Robert Bosenbauer¹, Mary McGann¹, James Hein¹. Sediment and Contaminant Transport in the California Urban Ocean.

¹U.S. Geological Survey

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Californians have a particularly close relationship with their coastal ocean, and are highly dependent on the sea for recreation, commerce, security, energy resources, fisheries, and waste disposal. As a result of these activities, the ocean and beaches are contaminated, the coastline has been modified, and coastal and marine ecosystems are heavily impacted. Evaluating our impact on the ocean and its impact on us in the urban setting requires a sound understanding of coastal and marine geologic and physical oceanographic processes. These processes affect all geologic and biologic settings and environments. Important elements are sediment erosion and transport on land and the addition of human products and byproducts to the system. These materials pass from these sources into the marine environment toward sinks in the continental margin. The U.S. Geological Survey has embarked on a five-year study of the movement of sediment and contaminants and the impacts that these processes have on California's residents and their developments. This project considers the sources of sediment and contaminants on land and tracks the pathway these materials follow through estuaries, coastal systems, continental shelves, and finally into submarine canyon/fan systems. Within each of these steps from source-to-sink, we are collecting data using remote sensing, sediment samples, bottom tripods, current meters, and laboratory analyses, with all results placed within a geographic information system database. Some of the initial results are stunning and include the observation that internal bores and swash are significant mechanisms for transporting contaminants toward the beach and a recognition that hyperpycnal flows from rivers are a major means of transporting human and geologic materials to the seafloor. Based on our substantially improved understanding, we are producing updated GIS interfaces, coastal zone maps and reports on sediment and contaminant transport processes within the urban ocean areas of California.

Ira Leifer^{*} 1, Ken Wilson². Factors Affecting Oil Emissions from an Abandoned Oil Well in Nearshore Waters off Summerland, California.

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In the mid to late 19th century, natural seep areas along coastal and inshore areas often were targeted by prospectors to locate construction sites for oil production facilities. Inadequate abandonment procedures typical of the early 20th century, left a legacy of leaking oil wells, many in areas of natural seepage. This has led to recurrent seepage problems, continued concern by the public and regulators, and multiple and sometimes unsuccessful abandonment efforts. This study focused on the repeatedly problematic Treadwell T-10 Well, the world's first offshore oil well. Oil emissions occurred from two vent areas on diametrically opposed sides of the T-10 Well. Using two oil seep collection tents, which included on-board video monitoring, quantitative seepage rates were measured through a tidal cycle at both vents. Surveys were done through an interval of extreme high and low tides. Total oil emissions were 1.3 kg (~ a little over a quart) over the eleven hour deployment. Oil and gas emissions were strongly influenced by tidal changes with the oil to gas ratio increasing at low tide. Moreover, changes in the oil to gas ratio were inversely correlated between the two vents demonstrating subsurface connectivity. Video derived rise velocities of very oily bubbles (black) suggested they were primarily gas, which was confirmed by analysis of the collected gas



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and oil [gas to oil ratio of ~10 to 1]. Other factors affecting beach and sea surface oiling also have been identified, including but not limited to: currents, hydraulic pressure, and the kelp beds. Investigation of geological data, historical records and sea surface surveys strongly suggest a fault trend passing through the T-10 well site, and may explain the failure of repeated abandonment efforts.

Anita Leinweber^{*1}, Nicolas Gruber^{1,2}, Rebecca Shipe³, Levanto Schachter³, Hartmut Frenzel¹, James McWilliams^{1,2}, Keith Stolzenbach⁴. Santa Monica Bay Observatory: Mooring and Shipboard Observations.

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The Santa Monica Bay Observatory (SMBO) is a multi-platform observing system that documents the temporal variations of physical, chemical, and biological properties within Santa Monica Bay. The Observatory, which is part of the Southern California Coastal Ocean Observing System (SCCOOS) consists of a mooring, a shipboard based timeseries program, and a pier station. The mooring is located at 33°55'N, 118°43'W and was first deployed in June 2001. It is instrumented with a meteorological station, a surface CTD, a fluorometer, and a transmissometer. A downward looking Acoustic Doppler Current Profiler (ADCP) and 10 microcats measure ocean currents, temperature, and salinity in the upper 100m water column. Data are sent back to UCLA daily and are available to the public through our website: www.smbayobservatory.org. A gas analyzer measures the surface water saturation of CO₂ and oxygen with respect to the atmosphere. Since January 2003, bi-weekly cruises to the SMBO site have been added for discrete water sampling. Measurements include CTD casts, dissolved inorganic carbon (DIC), alkalinity, macro- and micronutrients, chlorophyll, and phytoplankton species. We present a few highlights based on the data collected at the SMBO site over the last 5 years, emphasizing the valuable use of these data for research, outreach, and public service. Some examples: (i) Early detection and full documentation of strong, but episodic upwelling events, which have led to blooms of Pseudo-nitzschia, a harmful algae. (ii) The discovery of large diurnal variations of CO₂ not only in the surface water, but also in the atmosphere, driven in part by the interaction of fossil fuel CO₂ emissions in the L.A. basin with the land-sea breeze. (iii) Anomalous decreases in surface water DIC concentrations, due to, perhaps, nitrogen fixing organisms. (iv) The documentation of rapid successions of phytoplankton species, hinting at the possibility of predicting harmful algal blooms.

Judith D. Lemus^{*1}, QuikSCience: An Innovative Approach to Engage Diverse Students in Ocean Sciences.

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The QuikSCience Challenge is a collaboration between the USC Wrigley Institute for Environmental Studies, Quiksilver and the Quiksilver Foundation. The partners share a common mission to improve K-12 science education in America by using children's love of the ocean to make science more approachable, relevant and fun through a learner-centered and exploration-based marine science competition for middle and high school students. The partnership leverages the credibility and familiarity of the Quiksilver brand among youth, the financial support of the Quiksilver Foundation and the expertise of the USC Wrigley Institute in the area of marine science and education to achieve its goals. The Challenge fosters inquiry, stewardship, creativity and leadership skills and offers students the opportunity to take ownership of their own learning. Moreover, working with both K-12 students and teachers, and engaging parents in the process, the Challenge enhances public understanding, appreciation and stewardship of the oceans, a key Education and Outreach Objective ("Increase public awareness of ocean and coastal issues and encourage individual stewardship") of the California Ocean Protection Council Five-year Strategic Plan. Preliminary results suggest that this unique program attracts a different and more diverse population of students than traditional science-based competitions. The potential use of this type of flexible and learner-centered approach to engaging diverse and underrepresented students in science and ocean stewardship will be presented.



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Newell Garfield¹, Regan Long^{*2}, Donald Barrick³. The Effect of Salinity on Monitoring San Francisco Bay Surface Currents Using Surface Current Monitoring Instruments (SCMI).

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A major component of the California voter-approved Propositions 40 & 50 is real time monitoring of surface currents. This mandate is being met through the deployment of a network of interconnected Surface Current Mapping Instruments (SCMI) which are shore mounted radio systems which process the reflected signals from low power transmitters (50 Watts) that operate in the 5-42 MHz frequency range. The first instruments for monitoring San Francisco Bay were deployed in late 2005 at the Romberg. In late 2005, instruments were deployed at the SFSU-Romberg Tiburon Center for Environmental Studies, Treasure Island and the Berkeley Marine Center to monitor the San Francisco Bay. These instruments were deployed in time to observe the winter and spring freshet caused by the heavy local rains in Central California. SCMI works by measuring the emitted energy reflected off the ocean surface waves back to the instruments. This energy requires a certain amount of electrical conductance by the water. Seawater has plenty of conductance, but freshwater has none. This presentation will discuss the performance of the SCMI during the very low salinity conditions encountered in San Francisco Bay this winter to establish the operational limits of the equipment in estuaries and what this means in terms of real time monitoring during extreme events.

Christy Loper^{*1}. A Field Guide to Sailors, Divers, and Anglers in the Channel Islands: How Knowledge of and Attitudes toward Marine Reserves Affect the Behavior of Private Boaters.

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This study will convey preliminary results from a recent survey of Channel Islands private boaters' knowledge, attitudes, and perceptions. Within the Channel Islands National Marine Sanctuary (CINMS) nine no-take areas were established in state waters (zero to three miles from shore) in 2003. Further marine reserves are expected to be established in federal waters (beyond three miles) in the near future. Establishment of the CINMS marine reserves required socioeconomic monitoring to determine the economic and social impacts to human users of the Channel Islands. The National Oceanic and Atmospheric Administration (NOAA) has conducted surveys of most of the major user groups of the CINMS, including commercial fishermen and charter boat operators. However, due to budget constraints and difficulty in sampling, information on use, spatial distribution, expenditures, and values for marine reserves have not been collected from private boaters. As such, private boaters, particularly those engaged in non-consumptive recreation, remain an outstanding group of users that have not been analyzed. Results from this survey will shed light on how knowledge of and attitudes toward marine reserves affect the behavior of private boaters. Are they aware of the no-take marine reserves? If so, how do they know when they are in a marine reserve? How well do they understand Channel Islands regulations? How do they get their information about the Channel Islands? Are there conflicts between private boaters and other users of the CINMS? How do these factors affect behavior while in the Channel Islands? The answers to these questions will be used by CINMS staff to better manage the Channel Islands natural resources—and the visitors who care about them.

Thomas Lorenson^{*1}, Francis D. Hostettler¹, Jennifer A. Dougherty¹, Robert J. Rosenbauer¹, Kenneth E. Peters¹, Mary Elaine Dunaway². Overview of Natural Oil Seepage in the Santa Barbara Channel and Southern Santa Maria Basin, Southern California.

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A five year study of tars and oils in southern California waters and beaches was undertaken as part of a joint U.S. Geological Survey-Minerals Management Service (USGS/MMS) program to chemically relate tarballs and oils to their natural, mainly submarine sources. Natural sources for these petroleum hydrocarbons include prolific onshore and offshore shallow oil seeps, especially prominent along the southern California coast. Anthropogenic sources include possible accidental oil spills from vessels, from offshore drilling rigs and pipelines, and from ships involved in the processing and transport of oil. To date, a sample set of about 650 tars and oils have been analyzed for thirty-two different parameters resulting in a chemical fingerprint



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for each sample. Using statistical analysis on oil source-related biomarkers we are able to separate the oils into genetic families. Oil and tar distribution can be mapped, resulting in illuminating seasonal patterns of tar deposition on local beaches. An extensive area of active seeps have been located by sidescan imagery and sampled by ROV in the area centered near Point Conception. Here the seeps exude tar in large quantities creating an estimated 5 km² area of intermingling seeps up to 5 m thick producing an estimated 150,000 barrels of tar paving the seafloor. Near Santa Barbara, we, in cooperation with the University of California, Santa Barbara, we have sampled six offshore seeps around Coal Oil Point. Seep oil recovered here is much lighter and geochemically distinct from those near Point Conception and occurs in similar fashion to as far west as offshore Gaviota. Our results thus far demonstrate that beached tar can be related to natural sources and that there is extensive offshore seepage. Future work will focus on fingerprinting platform-produced oils, monitoring unusual beach tar deposition events, and perhaps making flux measurements of selected seeps.

Sarah S. McCarthy*¹, **Julann Spromberg**¹, **John Incardona**¹, **Jennifer McIntyre**², **Janet Labenia**¹, **Mark Myers**¹, **Laura Reed**³, **Katherine Lynch**³, **Linda Rhodes**¹, **Gina Ylitalo**¹. Impacts of Stormwater Runoff on Coho Salmon in Restored Urban Streams.

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Beginning in the late 1990s, several agencies in the greater Seattle area began conducting fall spawner surveys to evaluate the effectiveness of local stream restoration efforts. These surveys detected a surprisingly high rate of mortality among migratory coho females that were in good physical condition, but had not yet spawned. In addition, adult coho from several different streams showed a similar progression of symptoms (disorientation, lethargy, loss of equilibrium, gaping, fin splaying) that eventually led to the death of the affected animals. In recent years, pre-spawn mortality(PSM) has been observed in many lowland urban streams that have been surveyed to date, with overall rates ranging from ~ 20% to 90% of the fall runs. By comparison, continuous daily surveys of wild coho spawners on Fortson Creek (a forested drainage on the north fork Stillaguamish River, Washington) revealed < 1% PSM. Although the precise cause of PSM in urban streams is not known, conventional water quality parameters (i.e., temperature and dissolved oxygen) and disease do not appear to be causal. Rather, the weight of evidence suggests that adult coho, which enter small urban streams following fall storm events, are acutely sensitive to non-point source stormwater runoff containing pollutants that typically originate from urban and residential land use activities. To investigate the effects of urban stormwater runoff on coho embryos, we constructed a constant-flow bypass system allowing the incubation of embryos in untreated stream water and water filtered through sand and activated charcoal. Embryos exposed to untreated stream water had consistently higher rates of developmental defects and mortality when compared to embryos raised in filtered stream water. Our collective results to date suggest that stormwater runoff has important negative impacts on both the survival and reproductive success of coho salmon in urban and urbanizing watersheds.

Caryn Neiswender¹, **Stephen Miller***¹, **Dru Clark**¹, **John Helly**². Digital Archiving in an Imperfect World.

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Since the launching of the SIOExplorer online archive five years ago, the collection has grown to hold the data from 688 expeditions by the Scripps Institution of Oceanography (SIO), dating back to 1953. The bulk of the collection comes from multibeam swath mapping of the seafloor (300 expeditions), but the SIOExplorer Digital Library holds 102,000 objects from many diverse sensors, as well as documents and images. The collection is accessible with a Java CruiseViewer graphical interface over a global map, as well as from a webform or from Google. As expected over this span of 53 years, with evolving sensors, recording media, vessels, careers, naming conventions, and cumbersome mixtures of intermediate and final data products, we have faced more than a few challenges in automating the building of the digital collection. Data files have been automatically identified and harvested with very little human intervention, using a template of prioritized rules based on directories and filenames. While much of the metadata has been harvested automatically, we are discovering wide variations due to a mixture spelling errors, abbreviations, and changes in data types, often introduced by key punches on rolling ships. These variations and errors are obstacles to searches for critical datasets. Funds will never exist to repair the errors on a case-by-case basis. We are currently developing methodology to assess variations in metadata values across the entire collection, and semi-automatically identifying and repairing problems. We are in the midst of building a related collection with the Woods Hole Oceanographic Institution (WHOI) which will provide online access to more than 5000 explorations of the seafloor,



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including Alvin submersible and Jason ROV data, along with WHOI cruises. Funding is currently supported by the DIGARCH initiative, a joint program of NSF and the Library of Congress, NSF IIS 0455998. <http://SIOExplorer.ucsd.edu>

Chuck Morton¹, Michael Galloway¹. 53 Acre Guadalcanal Village Marsh Restoration as Mitigation for a Transportation Improvement Project on State Highway 37 in Solano County.

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Tidal marsh restoration as mitigation for a transportation improvement project on a State highway can be successful and result in a win-win situation. Caltrans has completed the widening of a 2-lane highway to 4 lanes to reduce existing and projected traffic congestion along State Route 37. In order to widen the highway, adjacent tidally influenced salt marsh was affected. After extensive coordination with various resource agencies and design review, Caltrans was able to limit this impact to less than 7 acres of tidal wetlands and waters of the US. Portions of this marsh are habitat for the Salt Marsh Harvest Mouse, the California Clapper Rail, and the Black Rail. The San Francisco Bay Conservation and Development Commission authored AB 719 in 1990, which allows Caltrans to fill up to 13 acres of wetlands with the provision that the impact be mitigated at a 4:1 ratio. AB 719 mentions the use of Guadalcanal Village as an appropriate mitigation location for the impacts resulting from the highway improvement project. Guadalcanal Village is located just west of the Napa River on the north side of Mare Island in Solano County. Caltrans, and their consultants, in coordination with the US Fish and Wildlife Service, the San Pablo Bay National Wildlife Refuge, and other federal and state resource agencies, developed a plan to restore this site to a tidally influenced salt marsh. The restoration plan required the creation of 14.8 acres of mudflats and subtidal sloughs, 29.1 acres of tidal wetland habitat, and 5.6 acres of upland refugia habitat. Caltrans breached the levee between the restoration site and Dutchman Slough, a large tributary of the Napa River, on October 31, 2001. Pickleweed, salt bush, salt grass, and cord grass have all been recorded on the site. The site is completely vegetated, by natural recruitment, and in surveys conducted in 2005, revealed salt marsh harvest mice breeding on the site.

Kelly Munkittrick¹, David Methven¹, Simon C. Courtenay². Development of an Effects-Based Monitoring Protocol for Fish Populations in Coastal Areas.

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There are a wide variety of stressors that affect aquatic ecosystems. While changes can be identified at a range of ecological levels, we have been developing an approach to aquatic cumulative effects assessment that is driven by the responses of fish populations. This approach is defined as "effects-based" as opposed to the more common stressor-based or values-based approaches to environmental assessment. The effects-based approach was used as the basis for the development of the fish survey component of the Canadian Federal Environmental Effects Monitoring (EEM) requirements for pulp and paper mills, metal mines and sewage treatment plants. It uses fish population characteristics such as growth rates, reproductive investment, energy storage and age distributions to identify areas where fish performance is different from that seen at reference sites. These identified areas of concern become the sites where detailed, hypothesis-driven research is conducted to identify the stressors responsible for those changes. The effects-based approach we use was developed in freshwater environments where it works well in many situations with point source effluents. It has not been effectively applied in marine and estuarine areas, probably due to a combination of factors related to effluent dilution and dispersion, and residency of fish, as well as the absence of background data on nearshore and coastal, non-commercial fish species. There is considerable controversy about the causes of changes near anthropogenic developments, as well as the magnitude of change in whole organism characteristics that should be accepted or tolerated. This process requires the development of specific targets for interpreting the ecological or regulatory relevance of changes in individual-level performance endpoints such as growth or reproductive investments.

Nikolay P. Nezlin¹. Stormwater Runoff Plumes in Southern California from Satellite Data.

¹Southern California Coastal Water Research Project

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Satellite imagery is a valuable source of information about spatio-temporal dynamics of stormwater plumes, providing information about their size, persistence, and direction of propagation. The knowledge of freshwater runoff plume dynamics in southern California (SC) is important for management of coastal water quality, because river discharge associated with episodic winter rainstorms can be a major source of pollutants and pathogens to coastal waters. Optical signatures of freshwater plumes were analyzed in different coastal zones of the Southern California Bight using SeaWiFS and MODIS satellite imagery. The availability of satellite data in SC after rainstorms gradually increases with the number of earth-observing satellites and technical improvement of satellite sensors. The total volume of precipitated water is a primary factor regulating plume size. This relationship is quantitatively different in different regions, and can be explained by the differences in watershed size, terrain, and land-use. The direction of plume propagation results from the near-shore circulation. In particular, during spring transition typical to California Current System, equatorward currents associated with wind-driven upwelling can transport stormwater plumes downcoast. The most pronounced plumes, characterized by high concentration of suspended inorganic matter, were observed within two-three days after rainstorms; later color shifts in the plumes indicate the presence of phytoplankton biomass resulting from their response to the nutrient loading of the plumes. Correlations between ocean color and other characteristics of water surface (salinity, transmissivity, total suspended solids concentration, other water quality parameters) were different in different river systems and changed during several days following a storm.

Eric Niven¹, H. Gary Greene², Chris Wills³. Big Sur Integrated Mapping Project.

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The California coast is an active tectonic region, especially in the rugged and scenic central portion of Big Sur (stretching roughly from the Monterey Peninsula to San Simeon). Recently the entire terrestrial portion has been comprehensively mapped to delineate active landslides as well as to refine the geology. Our present study continues interpretation offshore to produce a seamless integration of onshore-offshore maps. The seafloor from the intertidal to bathyal depths is also an area of active geological processes, yet has only been partially interpreted. At the margin, highly active erosion from marine and atmospheric forces causes the coastline itself to be in transition.

Interpretation is being made where data exists for the region's coastline and offshore areas, in the form of multibeam bathymetry, backscatter and side-scan sonar, LiDAR, soundings, samples, cores, and subbottom profiles. The result will be a set of comprehensive thematic maps, in print and GIS formats, of rock types, sediment patterns, geologic structures, and potential habitat types. These outputs are another step in fully defining the geologic forces which have created and continue to modify the Big Sur landscape as well as the adjacent seafloor.

This interpretation also characterizes the potential marine benthic habitats of the region. The Big Sur coast is known for abundant marine life; the California Sea Otter Refuge and Monterey Bay National Marine Sanctuary have been established to ensure protection of native species and the ecosystem as a whole. Integral to successful marine management is categorization of seafloor features so as to define and delineate specific habitat types as defined by substrate types.

Jeffrey Onsted^{1,2}, Gail Osherenko³, Kristin Hart¹, Keith Clarke¹. California's Coastal Zone Management Program: Retaining Agricultural Land in the Face of Urban Growth.

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The California Coastal Act of 1976 identifies the retention of agricultural lands along the coast as one of its primary objectives. However, tremendous coastal population pressure has made it challenging for the Coastal Commission to prevent conversion of these lands to urban uses. This ongoing project seeks to discover how effective the Act has been in accomplishing this goal by examining urban change along the Coastal Zone both before and after the 1976 Act. At the same time, an examination of the Williamson Act and its effectiveness is underway to discover both what effect this has on farmland conversion on its own as well as how it mixes with the restrictions along the Coast. The necessary data to populate a GIS for two test counties: Santa Barbara and Ventura has been acquired. By exploiting the advantages of GIS it is possible to create thousands of



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map possibilities ranging not only in scale, but also in time and in content. So far, quite a few time-series maps that visually demonstrate not only the growth of urban lands inside and outside the Coastal Zone, but also the concomitant loss of agricultural land have been assembled. The maps also reflect whether or not farmers are enrolled in the Williamson Act. Concurrently, a survey of farmers is underway as well as the interviewing of key officials. This will tease out the decision-making processes that have lead to farmland conversion in coastal areas from both the perspective of a landowner as well as the entities that mediate land use change throughout the region. When complete, this project will provide a much-needed distillation of the attitudes, economics, and legal milieus comprising the confluence of circumstances that both cause and prevent farmland loss along the coast.

Dean Pasko^{*1}, Daniel A. Ituarte¹, Timothy D. Stebbins¹. Benthic Sediment Conditions in Mainland Shelf Habitats off San Diego 10 Years Later.

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Since 1994 the City of San Diego has conducted summer surveys of sediment conditions throughout the San Diego region in order to evaluate patterns and trends over a large geographic area. Such region-wide monitoring is designed to assess the quality and characteristics of sediments and provide additional information that may help identify and distinguish reference areas from sites impacted by wastewater and stormwater discharge. These surveys are based on an array of stations randomly selected each year using the USEPA probability-based EMAP design. In July 2005, the City revisited the 1995 survey sites in order to compare conditions 10 years later. These sites covered an area ranging from Del Mar south to the United States/Mexico border, and encompass two wastewater discharges: the Point Loma and South Bay Ocean Outfalls. Preliminary findings suggest that overall sediment particle size composition along the shelf during 2005 was little different from the 1995 survey. Only 8 of 36 stations sampled in 2005 differed by more than 0.05 mm (mean particle size) from 1995 samples. In contrast, concentrations of total organic carbon (TOC) and total nitrogen (TN) were generally higher in 2005 than in 1995. For example, over 60% of the TOC and TN samples exceeded median values for the Southern California Bight (SCB) in 2005, while less than 8% exceeded these benchmarks 10 years earlier. Concentrations of trace metals in sediments followed a similar trend. Twenty-one stations sampled in 2005 had 3 or more metals whose concentrations exceeded their respective SCB median values, nearly twice as many as found in 1995. Some of these changes may be related to record rainfall and storm-related discharges that occurred from late 2004 through early 2005, while others may be associated with anthropogenic impacts (e.g., disposal of dredged materials).

Anitra L. Pawley^{*1}, Brannon Ketcham², Darren Fong³. Coastal Watershed Assessment: A Template for Assessing Conditions at the Watershed Level.

¹Sea Grant, University of California, Davis, ²Point Reyes National Seashore, ³Golden Gate National Recreation Area

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The National Park Service has initiated a Coastal Watershed Assessment Program to assist parks in the synthesis of pertinent information to support long-term park planning and management needs. Point Reyes National Seashore and Golden Gate National Recreation Area manage more than 150,000 acres and 125 miles of the California coast, including four state Areas of Special Biological Significance. As part of the assessment, we developed methodologies to portray watershed condition using a standardized reporting structure linked to widely used indicator reporting frameworks (Pressure State Response Model and EPA's Science Advisory Board Framework). The standardized set of analyses combine GIS analysis, statistical approaches and index methods to create a standard reporting format for a range of watersheds, from highly pristine to highly impacted. The framework approach allows for comparisons across watersheds using anthropogenic stressor factors (agricultural impacts, legacy issues, etc.) categories of pollutants, such as coliform, dissolved oxygen, nutrients, and turbidity and biotic parameters such as invertebrate, salmon and pinniped populations. The result is a consistent watershed summary reporting format with associated tables that allow managers a quick glance at pressures on the system, current conditions, and data gaps. Watershed summaries for 14 California coastal watersheds have been completed. The results illustrate the varied conditions along our coastline and the potential differences in how these areas should be managed. The presentation also briefly discusses the pros and cons of different methods to summarize information and the lessons learned in conducting the analysis.



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Josh Pederson*¹. OceanObs: A Web-Based Inventory of Ocean Observing Activities in the Central and Northern California Ocean Observing System (CeNCOOS).

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The primary purpose of oceanObs, a web-based inventory of ocean observing activities in the Central and Northern California Ocean Observing System (CeNCOOS), is to facilitate discovery of observing data products. Metadata-level information, including sensor locations, data product formats, and observing parameters, is made publicly available through the oceanObs website. A mechanism to query the inventory allows resource managers, scientists, and educators to find access to specific data products. Also, the locations of sensors and ocean observing devices can be dynamically mapped on demand and integrated into the popular Google Earth mapping application. While serving as the primary data discovery tool for CeNCOOS, oceanObs also provides a framework for regional partners to organize and track metadata on their activities. This allows partners to administer their metadata over time in a format consistent with the needs of the regional coordinator and the Integrated Ocean Observing System (IOOS). Developed for CeNCOOS by the Sanctuary Integrated Monitoring Network (SIMoN), a program of the Monterey Bay National Marine Sanctuary (MBNMS), oceanObs is viewed as a model for inventorying ocean observing activities by other regional associations of IOOS.

Jian Peng*¹, **Keith A. Maruya**¹, **Ken Schiff**¹, **David Tsukada**¹. Organochlorine Pesticides in Stormwater Entering the Newport Bay Watershed.

¹Southern California Coastal Water Research Project

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Newport Bay is one of the few remaining large coastal wetlands in Southern California. Elevated levels of legacy organochlorine pesticides (OCPs) in this multi-use watershed have prompted regulatory action, including the development of TMDLs. To estimate current loadings and apportion major sources of these persistent, hydrophobic contaminants, stormwater runoff from different land uses was collected and analyzed for DDTs, chlordanes, aldrin/dieldrin/endrin, chlorpyrifos and diazinon by GC-MS. Preliminary results for San Diego Creek -- the major tributary to upper Newport Bay -- showed that DDTs (sum of six DDT, DDE and DDD isomers) were present at concentrations up to 13.7 and 0.7 ng/L for particulate and dissolved phases, respectively. Averaged over typical wet weather flow conditions, these results are not inconsistent with loadings estimated by EPA in 2002. A comprehensive estimate of loadings in the UNB watershed will be available once sample processing and analyses are completed. In addition, these and other samples (e.g. bedded sediments) will be analyzed using chiral gas chromatography (CGC) and isotope ratio mass spectrometry (IRMS) in an effort to identify and apportion sources of pesticides, information that is key for designing and implementing effective mitigation strategies.

John L. Butler¹, Rikk Kvitek², Deanna Pinkard*¹. The Importance of Detailed Ocean Mapping for Assessing the Status of Threatened Marine Organisms: A Case Study.

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Strong associations between marine organisms and the environments and habitats in which they live have proven to be important predictors of the distribution of various fishes and invertebrates. We surveyed the endangered white abalone, *Haliotis sorenseni*, using a remotely operated vehicle with the aid of detailed benthic maps produced by multibeam sonar surveys. Preliminary observations indicated that *H. sorenseni* reside mainly near the sand-rock interface at depths of 30 – 60 m, so surveys were concentrated at these areas. Abalone were surveyed using visual strip transect methods, and search area was precisely quantified for an estimate of density per unit area. Rocky habitat between the depths of 30 - 60 m was quantified using a combination of rugosity and Topographic Position Analysis (TPI). An estimate of the total number of white abalone residing at several offshore banks and islands was made possible by the quantification of habitat area. Habitat area was much larger than previously predicted, and therefore the predicted total number of white abalone was higher than previously reported. Although total numbers were higher than previous estimates, densities were more than an order of magnitude lower



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than historic values, and the distances between abalone (typically 5 m) was larger than necessary for successful reproduction (2 m). The use of detailed habitat maps provided by multibeam sonar surveys was instrumental in choosing broad survey locations, specific transect locations, and in calculating the amount of available appropriate white abalone habitat.

Benjamin Pister^{*1}, Kaustuv Roy¹. Community Composition and Diversity on Anthropogenic Substrates in Urban Rocky Intertidal Environments.

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Jetties, breakwaters, and armored shorelines constructed of riprap occupy approximately 30% of southern California's coast. Riprap usually consists of large quarried boulders, or concrete blocks, and is easily colonized by benthic organisms. It is one of the most common coastal construction materials in many countries, and can persist for centuries. Despite extensive distribution in both space and time, such anthropogenic structures have received very little scientific investigation. In addition the ecological consequences of these additions to coastal ecosystems remain unknown. In this study I quantitatively compared rocky intertidal community composition and diversity on riprap and neighboring rocky intertidal benches in southern California. While diversity did not significantly differ between most sites, community composition often did with some species occurring in significantly greater abundances on riprap. In addition, communities living on riprap were relatively lush and consisted of indigenous intertidal organisms. These results suggest that coastal riprap structures host healthy intertidal communities, play significant roles in near shore ecology, and serve to increase the local habitat for some species. As human populations in coastal areas continue to grow, we can expect the addition of even more riprap in marine environments. Human presence on the coast has also caused many types of disturbance to near shore ecosystems. Thus, riprap habitats are very important subjects for conservation research and coastal management.

David Pohl^{*1}, Robert Stein², Ying-Keung Poon³. Protection and Restoration of Newport Beach Marine Life Refuge: Implementing the Goals of the California Ocean Protection Council Strategic Plan at Little Corona.

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The City of Newport Beach is implementing a protection and restoration program for the Newport Beach Marine Life Refuge. The Refuge is a designated Area of Special Biological Significance (ASBS) located in Orange County, California. The City is taking a holistic approach by understanding the inherent complexities of this marine ecosystem and its connection to the adjacent watershed, tidal currents, and public use. The strategy is to protect and restore this refuge by identifying and understanding the potential impacts to the ecosystem and implementing priority measures to mitigate these impacts using an adaptive management approach. The restoration program includes re-introducing species through a designed renovation program, and monitoring program effectiveness. This program addresses key goals of the California Ocean Protection Council Strategic Plan that include protecting valuable marine habitats and species, restoring vital habitats, and improving coastal water quality. Implementation of the protection and restoration plan is underway and current activities include baseline studies to identify the potential impacts to the ASBS and develop mitigation measures. Results from the water quality and flow investigation of the coastal creeks and the cross contamination study of tidal and near shore currents from Lower Newport Bay are summarized in this paper. Also summarized is the strategy for the renovation of the ASBS through the re-introduction of key species and the quantitative assessment measurements (metrics) used to assess the impacts of canyon discharges, public use, and longshore-driven contaminant loads. The health of the ASBS and the effectiveness of the mitigation and restoration measures are also presented. These metrics, which consider key ASBS species, will also be used to assess the effectiveness of storm water quality improvements, educational outreach activities to reduce impacts from scavenging and trampling, erosion control measures, and integrated watershed management plans that improve water and sediment quality in Lower Newport Bay.

Jane Reid^{*1}, S. Jeffress Williams¹, Nadine Golden¹, Chris Jenkins². Sedimentary Character of California's Continental Margin: Views from usSEABED.

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Continental shelf margins are dynamic sedimentary environments that contain vital benthic habitats and affect many human functions such as navigation, national defense, cables, pipelines, and trawling. The sediment in the nearshore may contain resources such as sand and gravel aggregates, valuable for beach nourishment to mitigate coastal erosion, enhance recreation, and restore degraded coastal ecosystems, while the rocky areas may provide critical cover for *Sebastes* and other fishes. New GIS-based digital geologic maps, based on unified and integrated digital datasets of the surficial character of continental margins are critical tools for better understanding of geologic history and processes, the distribution of habitats and resources, and for managing coastal-marine issues. The USGS and its collaborators are compiling and integrating seabed observations and analyses from existing reports and datasets into usSEABED (<http://walrus.wr.usgs.gov/usseabed>), a nationwide integrated seafloor characterization database. usSEABED holds point data of texture and statistical values, numeric values based on descriptive data, selected geochemical and geophysical parameters, compositional information such as, phosphorite, heavy minerals, and sulfide odor, and biologic data such as seagrass, shells, brittlestars, and siliceous oozes. In California, usSEABED contains data for more than 25,000 locations, including surficial and subbottom layers. Original sources include data collected by the USGS, the U.S. Navy, NOAA, universities, local agencies, and private consortia. The data held in usSEABED are available to the marine community through USGS Data Series publications. The initial publication for the Pacific coast (California, Oregon, Washington) will be available through the authors at this symposium. We present examples of the data held in usSEABED and surficial-sediment maps along California shelf. In addition, we discuss the value of such a compilation and seek further data and partners for usSEABED. usSEABED provides an ongoing data source and data repository to aid the marine science community's understanding of seafloor character, processes, and resources.

Pedro Restrepo^{*1}, Geoffrey Bonnin¹. NOAA Atlas 14: The New Precipitation Frequency Atlas for California.

¹NOAA, National Weather Service

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The rainfall frequency atlases and technical papers published by the National Oceanic and Atmospheric Administration's (NOAA) National Weather Service (NWS) serve as de-facto national standards for rainfall intensity at specified frequencies and durations in the United States. The previous standards were published between 1961 and 1973. The NWS has published updates to the standards as NOAA Atlas 14 for the semiarid southwest (Volume 1) and the Ohio River basin and surrounding states (Volume 2), and is working on updates to Hawaii, Puerto Rico, and the U.S. Virgin Islands. NOAA's Coastal Storms Program (CSP), in conjunction with the State of California is in the planning stages for updating the rainfall frequency atlases for remainder of the State of California. The Hydrometeorological Design Studies Center located within the NWS Office of Hydrologic Development is responsible for the update. This paper provides an overview of the recent updates including use of considerably longer data records than were available in the 1960/70's, emphasizing data quality control and consistency, use of advanced statistical approaches, and web-based delivery of the final product. Owing to the update for California being in the initial stages, the paper will also focus on the benefits of this update for regional, state and local managers.

Karen Reyna^{*1}, Kelley Higgason¹, Gerard McChesney², Richard Golightly³, Jennifer Boyce⁴. Central California Coast Seabird Colony Protection Program: Reducing Human Disturbances through Monitoring, Coordinated Management, and Outreach.

¹Gulf of the Farallones National Marine Sanctuary, ²Common Murre Restoration Project, U.S. Fish and Wildlife Service,

³Department of Wildlife, Humboldt State University, ⁴ Restoration Center, NOAA

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The Seabird Colony Protection Program is a new program aimed at improving the survival and recruitment of Central California Coast seabird colonies harmed by the 1998 Command Oil Spill. The successful prosecution of the Command led to the recovery of \$4,000,000 for natural resource damages. An estimated 1,490 Common Murres and other surface-nesting seabirds were killed or injured, and many miles of beaches from Año Nuevo to Pacifica were lightly oiled. This program will use a portion of these funds to address one of the biggest obstacles to the recovery of these populations: human disturbances.

The goal is to reduce human disturbances at seabird breeding and roosting sites from Point Reyes to Point Sur with an emphasis on species most affected by the Command oil spill. Breeding seabird species, particularly those surface-nesting



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species, are highly susceptible to human disturbances. The potential to harm breeding seabirds can come from various sources including: recreational activities such as kayaking, boating, diving, wildlife viewing and hiking; planes and helicopters; and fisheries operations that fish or anchor near breeding colonies.

This is a collaborative program among federal and state agencies, stakeholders and non-governmental organizations. A multi-pronged approach to achieving program goals includes: 1) a seabird monitoring plan for identifying management needs and documenting long-term results; 2) reviewing current regulatory and enforcement approaches and adopting changes if necessary; and 3) an education and outreach component that can help ocean users and pilots understand how to protect seabird colonies.

Jim Ayers¹, Ben Enticknap¹, Chris Krenz¹, Santi Roberts^{*1}, Geoff Shester², Jon Warrenchuk¹. Recommendations towards Ecosystem-Based Fisheries Management of the California Current Large Marine Ecosystem.

¹Oceana, ²Stanford University

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Governor Schwarzenegger's Ocean Action Plan well reflects his vision for a shift towards ecosystem-based management in California waters. The plan identifies the Ocean Protection Council (OPC) as the entity that can move management in this direction. However, the details of such a regime remain elusive. An overarching theme must be the importance of managing California state waters as part of the larger California Current Large Marine Ecosystem (CCLME). We recommend that accounting for ecosystem dynamics be made an explicit goal of fisheries management practices, and suggest that a successful approach will include the following objectives.

- Account for predator requirements and food-web dynamics in making allocation decisions and setting harvest levels
- Maintain ecosystem characteristics within natural bounds of variation
- Establish and continue research and monitoring of ecosystem processes and functioning
- When or where information is insufficient, take precautionary management measures that minimize risk to ecosystem health.
- Identify, protect and restore habitats and important ecological areas of the marine ecosystem
- Account for variable marine environmental conditions when formulating management plans
- Develop precautionary and adaptive approaches to ecosystem-based management
- Eliminate harmful subsidies.

In particular, we discuss Oceana's involvement in separate initiatives in federal and state waters to accomplish ecosystem-wide habitat protection and sustainability, including the Essential Fish Habitat and Marine Life Protection Act processes. We believe much of this work could form a solid foundation from which the OPC can build ecosystem-based management in California waters and beyond.

Dan Robinette^{*1}, Adam C. Brown¹, Julie Lansen¹, Nadav Nur¹, William J. Sydeman¹. Using Top Predators to Assess the Efficacy of the Vandenberg State Marine Reserve.

¹PRBO Conservation Science

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The Vandenberg State Marine Reserve (VSMR) was established in 1994, but its efficacy in protecting local marine populations has yet to be tested. We tested the hypothesis that lower trophic level organisms are more abundant inside the VSMR than outside by monitoring the foraging habits of four seabirds (Brandt's and Pelagic Cormorants, Pacific Loons, and Surf Scoters) and two marine mammals (harbor seals and California sea lions). In theory, the abundance and species composition of foraging predators will reflect the community structure of lower trophic level organisms within a given habitat. We measured foraging rates at study plots inside and outside the reserve using a paired design. The VSMR spans the coastal boundary of Point Arguello and we controlled for headland effects by selecting one pair of study plots on the windward side and one on the leeward side of the promontory. We gathered data from April-July in each of 6 years (2000-2005), examined trends over the six-year period, and compared plot-specific annual variation to infer trends in prey abundance over time. All species but harbor seals showed either no difference or a higher abundance outside the reserve than inside. The three demersal fish specialists



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(harbor seal and Brandt's and Pelagic Cormorants) foraged more in leeward plots than windward while the benthic invertebrate specialist (Surf Scoter) foraged more in windward plots. There were no differences between windward and leeward plots for Pacific Loons and California sea lions which prey primarily on pelagic organisms. Our results suggest that prey abundance is not enhanced inside the VSMR. Possible explanations include inadequate reserve size for prey with large home ranges or, conversely, fishing pressure in the area is too low to impact areas outside the reserve. Our results also suggest a strong difference in benthic community structure between windward and leeward habitats.

Dale Robinson^{*1}, Newell Garfield¹, Chris Raleigh¹, Dwight Peterson¹. SF-BEAMS: an Evolving Estuarine Ocean Observing System.

¹San Francisco State University

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The San Francisco Bay Environmental Assessment and Monitoring Station (SF-BEAMS) was initially conceived to serve the needs of San Francisco State University researchers investigating the ecology of the Bay. Located mid-way between the Golden Gate and San Pablo Bay, the facility at Tiburon, CA is situated along the main channel between the ocean and the San Francisco Delta, an excellent location for monitoring material transport in the Bay. The program has expanded its role and capabilities to coordinate with statewide IOOS efforts. The facility is a charter member of the California State University (CSU) CICORE (Center for Integrative Coastal Observation, Research and Education) program which uses the constellation of CSU campuses along the California Coast to create a distributed, yet integrated, coastal observing array. SFBEAMS is also a central site in the State-funded COCMP (Coastal Ocean Currents Monitoring Program) to monitor surface currents along the whole State coastline. The CICORE data, products and development plans are discussed in the context of our evolving role in ocean observing.

Rondi J. Robison^{*1,2}, Laura Beach², Heather Kerkering¹, Gary Griggs², Raphe Kudela², Don Croll². The Center for Integrated Marine Technologies: Long-Term Ocean Observing System in Monterey Bay Provides Oceanographic Data and Monitoring Information toward Improving the Understanding of Ocean and Coastal Ecosystems.

¹Center for Integrated Marine Technology, Central California Ocean Observing System, ²University of California, Santa Cruz
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The Center for Integrated Marine Technologies' (CIMT) a project within the Central and Northern California Ocean Observing System (CeNCOOS) was organized to understand the relationship between the physical dynamics and productivity, from wind to whales, of California's coastal ocean. CIMT can provide the California Ocean Protection Council (OPC) with an ecosystem-based understanding of Monterey Bay. CIMT's mission is to create a coastal ocean observing and forecasting system that provides a scientific basis for the management and conservation of Monterey Bay, and serves as a model for monitoring all of California's coastal marine resources. This effort has been simultaneously collecting data via moorings, shipboard surveys, apex predator tagging and tracking, and satellite, aircraft, and land-based remote sensing since 2002 and is built on a foundation of data since 1997. Data integration provides new insights to complex interactions among resource characterization, climatic events, riverine input of iron, wind-driven coastal upwelling of nutrients to phytoplankton production, linkages to offshore water quality, and the distribution and abundance of animals from zooplankton to marine mammals. This long term monitoring approach allows for an improved understanding of the ocean and coastal ecosystems and the ability to develop predictive models of how marine resources respond to variability in coastal dynamics. Information on monitoring Monterey Bay is available and can prove valuable in the marine protected area process, water quality monitoring, restoring and maintaining ocean and coastal habitats and resources, and creating sustainable fisheries. The CIMT data collected is being integrated in multiple formats from raw data to models to GIS and is being shared with stakeholders to develop products that meet user needs. This poster fits under ocean observing and highlights CeNCOOS' CIMT project and the end user needs efforts that can help inform the OPC on the scientific understanding of ocean resources and ecosystem monitoring.



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Mary Bergen¹, Michael Connell¹, Steven C. Holz², Konstantin A. Karpov¹, Andrew Lauermann², Christine A. Pattison¹, Derek Stein¹, Michael Prall¹, Dirk Rosen^{*2}, Yuko Yokozawa². Remote Operated Vehicles: A New Approach to Monitor the Effectiveness of Marine Protected Areas on Reef Finfish.

²Marine Applied Research and Exploration, ¹California Department of Fish and Game

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The California Department of Fish Game (the Department) and Marine Applied Research and Exploration (MARE) have partnered to expand the scope of the Department's remote operated vehicle (ROV) program. Their efforts over the past three years have culminated in development and implementation of new quantitative methods for monitoring the effectiveness of MPAs (Marine Protected Areas) off four of the northern Channel Islands in Southern California. This poster provides an overview of the methods, including ROV navigation and piloting, as well as quantification of habitat and finfish. Two oral presentations describing the methods in greater detail are also being submitted for this conference. Exploratory surveys were initially directed at 18 sites. Five site pairs in and adjacent to five Marine Protected Areas were then selected for annual quantitative surveys. We use multi-beam acoustic maps provided by Rikk Kvitek of Cal State University Monterey Bay and side scan sonar maps from Guy Cochran of the United States Geological Survey to select the sites and to plan subsequent sampling. Sampling procedures include flying the ROV along randomly selected track lines, maintaining a constant speed and distance from the substrate. Our ROV sampling efficiency has improved dramatically, increasing from 18 km of viable track line in 2003, to 74 km in 2004, and 113 km in 2005. Quantitative surveys were completed at four of the ten sites in 2004 and at all ten sites in 2005.

Yelena Sapozhnikova^{*1}, Ed Wirth¹, Ken Schiff², Jeff Brown², Michael Fulton¹. Antifouling Pesticides in the Coastal Waters of Southern California.

¹NOAA National Ocean Service, ²Southern California Coastal Water Research Project

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After the recent actions of the United Nation's International Maritime Organization legislation banning the use of harmful organotins, organic booster biocides were introduced as alternatives to organotin compounds in antifouling products. The purpose of this study was to measure concentrations of Irgarol 1051, its major metabolite M1 (aka GS26575), and other antifouling pesticides (diuron, chlorothalonil, dichlofluanid and TCMTB) in Southern California's marinas and determine whether detected concentrations could pose any environmental risk. Water samples were collected from marina areas in four harbors of Southern California, including Dana Point Harbor, Oceanside Harbor, Mission Bay, and San Diego Bay in August-September 2005. Samples were prepared using solid phase extraction C-18 and analyzed utilizing Liquid Chromatography tandem Mass Spectrometry coupled with Electrospray Ionization. The highest concentrations of irgarol and M1 were detected in Dana Point Harbor reaching up to 304 and 68 ng/L, respectively. Dana Point Harbor was the largest marina sampled in this study with up to 2500 pleasure crafts. Irgarol was observed at concentrations up to 64 and 71 ng/L in Oceanside Harbor and San Diego Bay marinas, respectively. Oceanside Harbor has berths for 950 pleasure crafts. San Diego Bay is a deep water harbor, with small boat marinas located throughout the Bay. The lowest levels of irgarol were detected in Mission Bay – up to 8 ng/L. Mission Bay has numerous marinas and anchorages located primarily in the southwest corner. In general, concentrations of irgarol reflected boating activity in the area. Diuron concentrations ranged 8-12 ng/L. Irgarol is highly toxic to aquatic plants at concentrations as low as 136 ng/L. Some of the high irgarol concentrations measured in this study may be high enough to impact phytoplankton communities in the environment. To our knowledge, this is first study reporting irgarol concentrations in western areas of the US.

Jessica Schneider^{*1}, Drew M. Talley¹. San Francisco Bay National Estuarine Research Reserve System Wide Monitoring Program: Ocean Observing in Coastal and Inland Waters.

¹San Francisco Bay National Estuarine Research Reserve

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The National Estuarine Research Reserve (NERR) system has for over 15 years been systematically gathering water-quality, meteorological, and biological data over a range of spatial and temporal scales as part of their System Wide Monitoring Program (SWMP). With the establishment of the San Francisco Bay NERR in August of 2003, this program added its 26th



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set of monitoring stations nationwide. The SF Bay NERR will be performing monitoring across a gradient of both salinity and anthropogenic disturbance, at two main sites in the San Francisco Estuary – China Camp (San Pablo Bay) and Rush Ranch (Suisun Bay). At each site, we will be measuring water quality parameters at 2 locations, and sending those data in real-time to a website for public and scientific use. Similarly, a weather station at Rush Ranch will make meteorological data (taken at 15 minute intervals) available, and at both sites we will be performing monthly nutrient sampling. These data will be integrated into the broader Central and Northern California Ocean Observing System (CeNCOOS), providing much-needed inland and shallow-water data to complement the extensive, high-quality (but generally deeper-water and offshore) data in the CeNCOOS system. Together, these data provide an ecosystem-based network for understanding the temporal and spatial variability the ecosystem, establish a baseline for measuring changes in environmental conditions and ecological processes, and though creating a long-term dataset, will provide a research framework for evaluating ecosystem conditions and interpreting and predicting responses to change.

Frank Shaughnessy^{*1}, Susan Schlosser², Ginger Tenant¹, Clark Fenton, Randy Klein. The Relative Importance of Nitrogen and Suspended Sediments to the Eelgrass Ecosystem in Humboldt Bay.

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OPC priorities for coastal ecosystems, water quality, economics, outreach and research intersect in the development of management policies for the eelgrass ecosystem in Humboldt Bay, CA, which contains ~ 40% of the eelgrass in the state. The waterfowl and juvenile rockfish and Dungeness crab that rely on this ecosystem are examples of why it is so important.

G. Jason Smith^{*1}, Kendra Hayashi¹, Traci Conlin¹, Kenneth Coale¹. The Alliance for Coastal Technologies (ACT): A National Partnership Supporting Coastal Monitoring Efforts.

¹Moss Landing Marine Laboratories

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An ecosystem based policy, as has been developed for other areas around the country, is a goal for Humboldt Bay. Comprehensive studies of the eelgrass ecosystem in the bay, supported by local agencies, the private sector, the Humboldt Bay Harbor Conservation & Recreation District, Humboldt State University, as well as the Table Bluff Reservation - Wiyot Tribe, the Center for Integrative Oceanic Observation, Research and Education (CICORE), and California Sea Grant have only been undertaken recently, which places this bay at least a quarter of a century behind other locations in the information needed to develop effective policy. The objective of this presentation is to evaluate the relative importance of nitrogen and suspended sediments in degrading the light environment for the bay eelgrass ecosystem, and to discuss policy implications. Eelgrass in the bay is not experiencing nitrogen limitation or toxicity, and while there is enough nitrogen to support eelgrass algal epiphytes, the latter are suppressed by epiphyte grazers. Shoot densities are lowest in parts of the bay receiving the most suspended sediments from watersheds, and the spatial pattern of eelgrass compensation depths relative to watershed position will be presented. This analysis suggests that suspended sediments should presently get more policy emphasis than nutrient loading.

Timothy Stebbins^{*1}, P. Ed Parnell², David W. James¹, Ami K. Groce¹, Dean Pasko¹, Daniel A. Ituarte¹, Wendy E. Storms¹, Kathy M. Langan-Cranford¹. Sediment Quality on the Continental Slope off San Diego, Southern California: A Pilot Study of Deep Benthic Habitats.

¹ Marine Biology Laboratory, City of San Diego, ²Scripps Institution of Oceanography

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Little is known about benthic conditions on the continental slope off southern California, although this region may be a major sink for the accumulation of contaminants. In an effort to begin investigating such habitats as part of its enhanced ocean monitoring objectives, the City of San Diego, in collaboration with the Scripps Institution of Oceanography, implemented a Deep Benthic Pilot Study (DBPS) in October 2005. The DBPS was designed to target depositional areas in the Loma Sea Valley located west of the City's monitoring region for the Point Loma outfall and an EPA designated disposal site. Sixteen sites were distributed at depths around 200, 300, 400 and 500m along four offshore transects and modified to target areas most



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susceptible to sediment accumulation. Sites were classified into three "classes" based on geography, sediment composition and slope. Sediments were analyzed for grain size, total organic carbon, total nitrogen, total volatile solids, sulfides, trace metals, pesticides, and PCBs. Bottom water conditions were characterized based on CTD data. Preliminary results indicate no accumulation of PCBs or chlorinated pesticides in the study area. Sediment chemistries are closely linked to grain size compositions. Sediments sampled from the axial valley of a submarine canyon near the outfall were much coarser and had correspondingly lower concentrations of metals and organic enrichment than those sampled in the alluvial plain of the canyon and nearby shelf slope. Alluvial and deep sediments were organically enriched leading to low oxygen concentrations in the overlying water. Results will be described in detail and compared to values for a few other deep sites sampled off San Diego and elsewhere in 2003 as part of the multi-agency Bight'03 project. Implications and recommendations for future monitoring of deep benthic habitats off San Diego will be discussed.

Christina Swanson^{*1}, Anitra Pawley¹, Peter Vorster¹, Gary Bobker¹. Measure for Measure: Using an Ecological Scorecard to Integrate Information, Evaluate Ecosystem Condition, and Improve Public Understanding and Outreach.

¹The Bay Institute

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Ecological indicators, which integrate large amounts of data into simple interpretations and conclusions, are essential tools for communicating complex scientific information to scientists, resource managers, decision makers and the public. The Bay Institute's Ecological Scorecard Project uses science-based indicators to evaluate the health of ecosystems and biological resources, the efficacy of ongoing management efforts, and the resultant value of those resources to people. Our first scorecard was developed for San Francisco Bay, the largest estuary on the west coast of North America. This estuary, and its vast watershed, has been the focus of multiple federal, state, and local regulatory actions and ecosystem restoration efforts for the past several decades. However, until recently, there have been no useful or accepted performance measures to either monitor or evaluate the effectiveness of these activities. The San Francisco Bay Index, first released in 2003 and updated in 2005, uses more than three dozen indicators to assess and track the management, ecological condition, and resource value of the Bay. For each indicator, the measured value is compared to "reference conditions" and scored on a five-point scale. The indicators are then aggregated into one of eight indexes that provide integrated evaluations of specific aspects of the estuary's function and management, for example freshwater inflow or the fish community. Results are presented both as numeric scores and easily understood letter grades, A through F (like the Joint Ocean Commission's recent Report Card). Four tiers of reports, ranging from the single page "scorecard" to detailed technical appendices for each index, maximize accessibility to a broad range of users, from scientists to the general public. Tools such as the San Francisco Bay Index enhance public understanding and support for conservation and restoration efforts. The San Francisco Bay Index is available at www.bay.org/ecological_scorecard/htm.

Lynn Takata^{*1}, Maurya Falkner¹, Suzanne Gilmore¹. Reducing Nonindigenous Species Release through Commercial Vessel Fouling in California: Considerations, Challenges, and a Way Forward.

¹California State Lands Commission

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Passed in 2003, California's Marine Invasive Species Act renewed and expanded the state's program to prevent the introduction of non-indigenous species from commercial vessels. In addition to its existing ballast water management responsibilities, the California State Lands Commission (CSLC) was charged with the development of recommendations to reduce the discharge of nonindigenous species (NIS) to California through non-ballast commercial vessel mechanisms (essentially vessel fouling). Recommendations were to be submitted to the California State Legislature in April 2006.

As directed by the Act, the CSLC assembled a technical advisory group (TAG) that included representatives from the maritime industry, the research community, and federal and state resource agencies. The group held four meetings throughout 2005, during which they considered the hull husbandry practices of the commercial vessels fleet, environmental conditions and vessel behaviors that influence fouling, and the management frameworks that had been adopted or considered by other regions. The most difficult challenge for evaluating the risk of fouling for introductions to the state was the limited amount of scientific data across the types of vessels that regularly operate in California. The challenge, therefore, was to develop effective, feasible, and scientifically sound recommendations with a limited knowledge base, and within a restricted timeframe.



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The CSLC therefore formulated a series of recommendations that included 1) management actions that could be implemented immediately to address high risk situations, and, 2) actions to fill priority research and outreach gaps that will be necessary to refine management measures in the future. This poster will provide insights to the considerations of the TAG and the CSLC, the recommendations presented to the California Legislature, and the rationale behind them. Finally, preliminary data from current CSLC efforts to address key information gaps will be presented.

Carlos Torres^{*1}, Jose Castillo¹, German Larrazabal¹. Modeling 3D Coastal Circulation in Boundary-Fitted Coordinates: The General Curvilinear Ocean Model Project.

¹Computational Science Research Center, San Diego State University

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A combination of general curvilinear transformations of the flow equations, adapted grids, and a semi-implicit algorithm are used to construct a time-dependent three-dimensional primitive equations coastal ocean model. The model, referred as GCOM (General Curvilinear Ocean Model), is able to reproduce the complex oceanographic phenomena arising from topography-flow interaction. Preliminary model simulations are presented for Monterey Bay.

Jerome Wanetick^{*1}, Edgar Milik², Jen Bowen², Karen Baker². A Real-Time Data Acquisition, Storage and Access System.

¹Integrative Oceanography Division, Scripps Institution of Oceanography, ²Scripps Institution of Oceanography

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A design effort was initiated at the Integrative Oceanography Division (IOD) at Scripps Institution of Oceanography (SIO) to address the need for a database-driven data acquisition, storage, and access system. Recognizing the need for similar systems in a number of different research and monitoring programs at SIO, data managers from SCCOOS, CalCOFI, and CCE-LTER formed a design team under the collaborative umbrella of the Ocean Informatics Environment where a participatory design strategy was used to engage cross-program participation and to address multiple system needs. A modular design resulted, providing maximum system flexibility using an Open Source Software architecture as the overarching design principle: MySQL for the database engine; Java, for network listening servers and parsers; and PHP and Apache for serving the data on the Web.

Jonathan Warrick^{*1}, Paul DiGiacomo², Nicolay Nezlin³, Burt Jones⁴, Scott Johnson⁵. River Plume Properties and Dynamics Offshore Southern California.

¹Coastal and Marine Geology, U.S. Geological Survey, ²Jet Propulsion Laboratory, ³Southern California Coastal Water Research Project, ⁴University of Southern California, ⁵Aquatic Bioassay and Consulting Laboratories

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The rivers of southern California deliver episodic pulses of water, sediment, nutrients and pollutants to the region's coastal waters. The results presented here suggest that these river plumes can quickly separate into two, distinct plumes – a buoyant surface plume dominated by surface water processes and a negatively buoyant (hyperpycnal) bottom plume along the seabed caused by the exceptional river sediment loads. As part of the multi-agency Bight'03 Water Quality Study, we monitored river plume dispersal patterns and processes from eight large southern California river systems using in-situ boat sampling, satellite remote sensing, high-frequency radar current measurements, surface drifters, and moored instrumentation. River inputs were controlled by strong winter storms, rapid erosion of the region's mountains, extensive urban and agricultural land use, and extensive flood control and water management infrastructure. Buoyant plumes offshore southern California are the dominant coastal pathway for river water and dissolved nutrients and were observed to be highly dynamic, responding to the storm event river, wind and oceanographic forcing. Buoyant plumes were observed to advect 10 km/d, rates adequately high to deliver these materials to adjacent coastal basins within days. Quantifying these rates is important since a phytoplankton bloom occurring due to nutrient discharge from a particular river may occur offshore of another river mouth of the region. Hyperpycnal plumes appear to be the dominant pathway for sediment dispersal from the Santa Clara River (one of the eight systems studied) and were observed by a moored instrumentation in 10-m water depth off the Santa Clara River. These observations revealed that highly concentrated fluid muds existed in the lower 20-50 cm of the water column immediately following



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discharge events as observed from ABS, OBS, and transmissometer sensors and coincided with reductions in bottom salinity and offshore bottom currents of 5-10 cm/s from CTD and PC-ADP measurements.

Dolores Wesson¹, Stephen Sellers², Leslie Ewing³, Edward Myers⁴, William Brooks⁵, Nat Scholz⁶, Pedro Restrepo⁷.
Coastal Storms in Southern California: Novel Decision-Support Systems and Tools.

¹Coastal Storms Program, ²Southern Region, State Office of Emergency Services, ³California Coastal Commission, ⁴NOAA Office of Coast Survey, ⁵NOAA Coastal Service Center, ⁶NOAA Fisheries, ⁷NOAA National Weather Service

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Southern California is a prime location for the development of novel decision-support systems and tools given its coastal population, its geography, and climate. The Coastal Storms Program is a NOAA effort in close collaboration with state and local agencies and universities to lessen the impacts from storms to coastal communities. Overview of the Coastal Storms in Southern California. Setting the stage for regional needs, and program goals as a whole, including the rationale for the projects currently under development. Coastal Storms and Human Safety. A regional overview of the impact of storms with an emphasis on human safety, the emergency management system in California, and roles and responsibilities of state and local government. Impacts of Storms on Coastal Environments. An overview of mitigation programs addressing coastal inundation, and impacts of storms in California, including, lessons learned and potential synergies among programs. Bathymetric/Topographic Digital Elevation Model and V-datum development. This project is key to accurately predicting coastal inundation in the region; a Vdatum application will be developed to create a common reference to combine disparate data. Decision Support Tools. This project is developing a decision-support tool to address regional priorities defined by end-users by bringing real-time weather information and planning data into the same GIS-based platform for the first time. Assessing the Ecological Impacts of Storms. This project will evaluate how storms mobilize contaminants from non-point sources into estuarine systems and how storm-driven loading fluxes affect local species. NOAA Atlas. This project will update precipitation frequency estimates. This Atlas is used for a multitude of planning purposes, from reservoirs to local storm water drainage, and allows better predictions of rainfall in specific locations.

David Witting¹. Factors Influencing the Spatial Distribution of Contaminants in Fishes Occupying the Southern California Coast.

¹NOAA

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The bioaccumulation and transfer of contaminants in fish may be influenced by the spatial distribution of contaminants in sediments or the water column as well as several fish-specific factors (e.g. body size, trophic level, and movement patterns). The relative significance of each of these factors may be used to develop models for evaluating the impacts of contaminants on aquatic food webs and human consumers of fish. We examine the roles of habitat use, trophic level, and movement patterns on bioaccumulation rates based on a survey of 23 species of fish (~1200 individuals) collected from the coastal region between Ventura and Dana Point, California. We compare spatial patterns in concentrations of contaminants that are largely attributed to a single point source (PCBs and DDTs) to those of a contaminant that is generally considered to be atmospherically deposited (mercury) with no major point sources in the region. Our analysis suggests that habitat use and movement patterns can play a larger role than body size or trophic level in determining bioaccumulation rates of PCBs and DDTs. Data also suggest a greater spatial variation in mercury concentrations in fish exists than one would expect in the absence of known point sources of mercury.

Sara Worden¹, Pete Raimondi¹, Christy Bell^{2,3}, Carolina DaCosta¹, Maya George¹, Dave Lohse¹, Steve Lonhart³, Melissa Miner^{2,3}. Serious Decline in Central California Black Abalone Populations: Outlook for Recovery and Community Structure Implications.

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POSTER PRESENTATION ABSTRACTS

Populations of black abalone (*Haliotis cracherodii*) have been steadily declining in the southern portion of the species' range due to a fatal disease called "withering syndrome". Withering syndrome (WS) is caused by the bacterium *Candidatus Xenohaliotis californiensis*, which attacks the lining of the digestive track and results in reduced body mass, weakness, and eventual withering of the abalone's foot until it can no longer cling to the substratum. Declines have been so severe across all regions in southern California that the species is now a candidate for protection under the USA Endangered Species Act. Researchers at UC Santa Cruz, working with the MARINe (Multi-Agency Rocky Intertidal Network) and PISCO (Partnership for Interdisciplinary Study of Coastal Oceans) monitoring groups have documented the northward progression of WS along the California coast. Recently, concern about the northward movement of WS into some of the final remaining large populations of black abalone prompted the Monterey Bay National Marine Sanctuary to provide funding to monitor additional sites within the sanctuary's boundaries. Sites now range from Pt. Conception to Pigeon Point. At each site, black abalone are counted and measured within permanently marked plots. By counting and measuring abalone, we can document both population declines (indicated by decreases across all abalone size classes), and recruitment events (indicated by increases in the number of abalone 50mm in length). Implications of the declines are presented, including the effect of losing these large grazers on intertidal community structure, and the outlook for black abalone recovery.

Timothy Zimmerman^{*1}, Jessica Brown². Ocean Protection through Effective Communication: Ocean Knowledge, Misconceptions, and Public Opinion.

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If few Americans understand the ocean beyond the surf zone (Steel, et al., 2005), how can we engage them in ocean protection? This presentation highlights what we currently know about student and public knowledge of the ocean and will suggest effective ocean protection communication strategies. We argue that understanding public ocean knowledge and non-scientifically normative ideas, or misconceptions, about the ocean is critical to implementing the California Ocean Protection Council (OPC) Five-year Strategic Plan. Examples of known, common misconceptions highlight the challenge that lies ahead for California. For example, the draft OPC Strategic Plan calls for "Outreach efforts...[that] engage all Californians in the protection of the state's ocean and coast" yet according to educational research and public surveys, people don't believe their personal actions impact the ocean (AAAS, 2004; Belden Russonello & Stewart, 1999; Brody, 1994; Mellman Group, 1999). Therefore scientists and policy makers must take public knowledge of the ocean into account when seeking to implement and communicate about policies that promote ocean protection. Public surveys reveal that many Americans believe most of the ocean is already protected (Belden Russonello & Stewart, 1999; Mellman Group, 1999). Educational research reveals that students, even those living in coastal areas, perceive ocean resources as limitless (Brody & Koch, 1989-1990; Brody, 1994) and think coral reefs are widespread throughout the ocean (Brody, 1994 & 1996; Philips, 1991). Research on such misconceptions demonstrates that many misconceptions are resistant to change, even in the face of instruction (Posner, et al., 1982). Additionally, Frick, et al. (2004) and others suggest that content knowledge is correlated to value and behavioral change. Thus, just as teaching a student requires an understanding of their current knowledge base, developing an ocean literate society that will actively protect ocean resources necessitates an awareness of, and strategies for, addressing ocean misconceptions.



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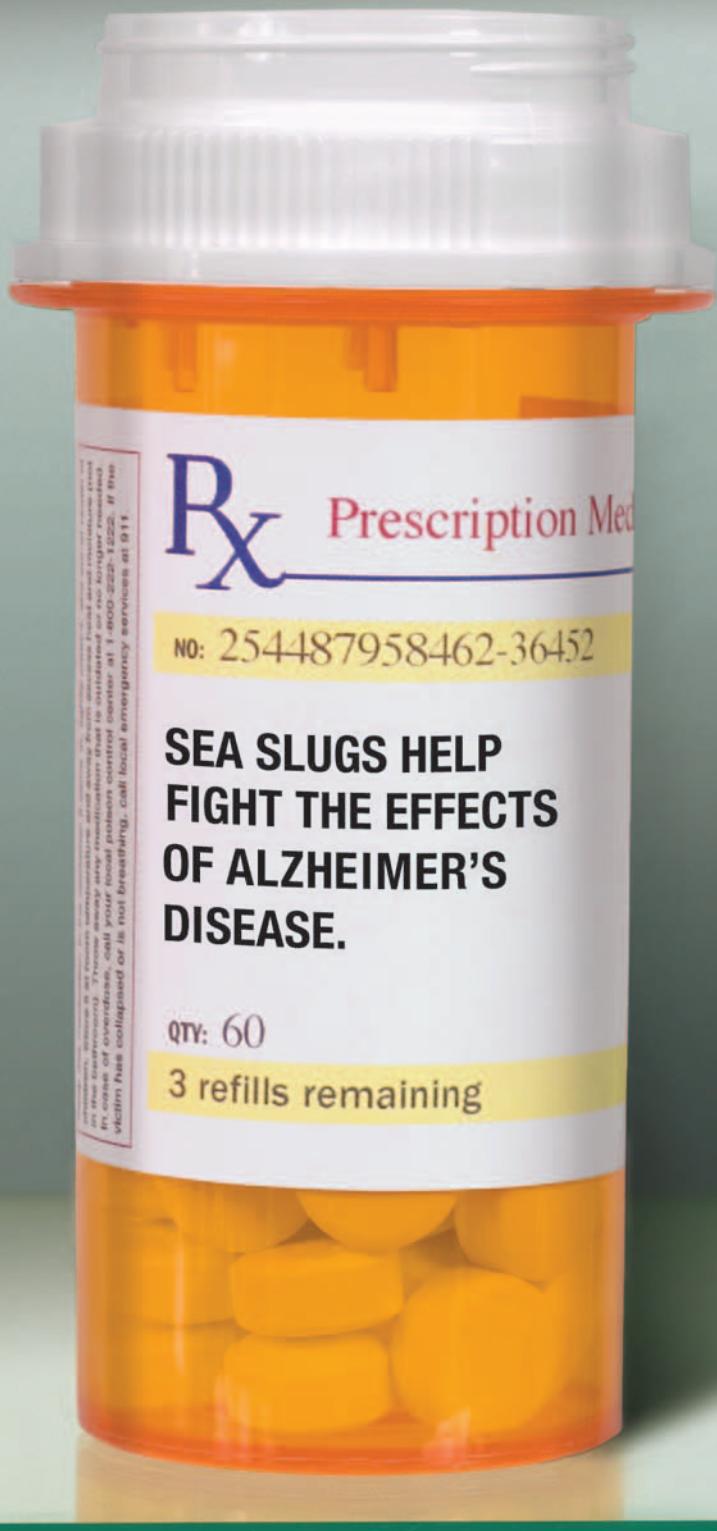
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