# Southern California Coastal Ocean Observing System

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Southern California Coastal Ocean Observing System (SCCOOS)

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## Table of Contents

# PROJECT SUMMARY

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**Other Partners**

Birch Aquarium
Bureau of Ocean Energy Management, Regulation and Enforcement
California Coastal Commission
California State Coastal Conservancy
California Cooperative Oceanic Fisheries Investigation (CalCOFI)
California Current Ecosystem Long Term Ecological Research (CCE-LTER)
California Department of Fish and Game (DFG)
California Office of Spill Prevention and Response (OSPR)
City of Los Angeles Environmental Monitoring Division
City of Los Angeles Wastewater District
City of San Diego Wastewater District
County Health Agencies (Santa Barbara, Ventura, Los Angeles, Long Beach, Orange County and San Diego)
Earthguide
Jet Propulsion Laboratory (JPL)
Los Angeles County Sanitation District
Marine Exchange of Southern California
Naval Air Systems Command (NAVAIR)
NOAA Southwest Fisheries Science Center (SWFSC)
NOAA HAZMAT
NOAA National Weather Service (NWS)
The Ocean Institute
Orange County Sanitation District (OCSD)
Partnership for Interdisciplinary Studies of Coastal Oceans (PISCO)
Santa Barbara Coastal Long Term Ecological Research (SBC-LTER)
Sea Grant
Southern California Coastal Water Research Project (SCCWRP)
U.S. Army Corps of Engineers (USACE)
U.S. Coast Guard (USCG)
U.S. Environmental Protection Agency (EPA)
U.S. Geological Survey (USGS)
U.S. Navy
University of California, Irvine (UCI)
Ventura County Wastewater District

# I. PROJECT SUMMARY

The principal goal of the Southern California Coastal Ocean Observing System (SCCOOS) is to provide observations and data products to a diverse stakeholder community of managers and planners, operational decision makers, scientists, and the general public. As the regional observing system for Southern California, SCCOOS has developed the capabilities to support short-term decision-making and long-term assessment by implementing and leveraging biological, chemical, and physical observations, many of which are available in near real-time.

SCCOOS has aligned its organizational priorities and objectives with the focus areas designated by the National Federation of Regional Associations for Ocean Observing:

Ecosystems and Climate Trends: To monitor climate trends and environmental effects on the Southern California Bight by collecting physical, chemical, and biological time series.

Water Quality: To provide monitoring, tracking, and prediction tools for harmful algal blooms, outfall and stormwater plumes, and surfzone contaminants.

Marine Operations: To advance integrated, customized products that are critical for safe and efficient navigation, search and rescue, and oil spill response.

Coastal Hazards: To promote safe recreational use of beaches and provide warnings of wave and tide-induced coastal inundation.

Coastal and Marine Spatial Planning: To work collaboratively to pursue a comprehensive, adaptive, integrated, ecosystem-based, and transparent spatial planning process.

SCCOOS works interactively with local, state, and federal agencies, resource managers, industry, policy makers, educators, scientists, non-governmental organizations, and the public. As a result, data and information are made available in a variety of formats to ensure that products are useful and easy to access, while preserving the necessary detail to support the scientific and educational communities. SCCOOS continues to explore new visualizations and technologies to make data and products more comprehensible and widely available.

In order to achieve an effective outreach and education strategy that fully engages a wide range of audiences, SCCOOS focuses on developing projects through partnerships on the local, regional, and national levels. SCCOOS collaborates with the Central and Northern California Ocean Observing System (CeNCOOS) on statewide issues and formed a Joint Strategic Advisory Committee, of users and stakeholders across the state, to create a unified and coordinated approach to ocean observing in California. SCCOOS is also committed to contributing to larger ocean observing collaborations regionally, nationally, and internationally.

# II. COORDINATED REGIONAL MANAGEMENT

## Background

The Southern California Coastal Ocean Observing System (SCCOOS) was formed in 2003 under the nationwide Integrated Ocean Observing System (IOOS) mandate to form 11 Regional Associations (RAs) to execute directives of the National Oceanic and Atmospheric Administration (NOAA). SCCOOS works within national IOOS to coordinate and expand a coastal observing system in the Southern California Bight (SCB), a unique and heavily-impacted area with a population of 24 million people, representing 25% of the coastal population of the United States. The region has 21 Publicly Owned Treatment Works (POTWs) and 175 million beach users who spend more than $1.5 billion annually on tourism. At the same time, the SCB is used heavily for military operations and commercial transportation; the Los Angeles/Long Beach port complex accounts for approximately 45% of all container traffic in the United States.

## Goals and Objectives

Working with local, state, and federal agencies, resource managers, policy makers, educators, scientists, and the general public, the SCCOOS mission is to provide the scientific information and observations needed to better understand and manage the changing conditions of the coastal ocean. SCCOOS has aligned its organizational priorities and objectives with the focus areas designated by the National Federation of Regional Associations for Ocean Observing (NFRA): Ecosystems and Climate Trends, Water Quality, Marine Operations, Coastal Hazards, and Coastal and Marine Spatial Planning. Specific objectives include: 1) Identify new stakeholders, data product needs, and optimal methods for communicating information; 2) Serve as the regional entry point for timely and historical observations to IOOS and partner data systems; 3) Provide resource managers and decision-makers with science-based, optimized, mission-driven, and publicly available data, products, forecasts, and decision support tools. Products are designed for short-term decision-making and long-term environmental assessments.

## Governance Structure

With the complex interactions of the SCB's competing ocean uses in mind, SCCOOS has evolved into a collaborative, sustainable observing system with a broad base of stakeholders and partners. The SCCOOS governance structure is based on a Memorandum of Understanding that established a consortium of institutions and organizations to fulfill SCCOOS objectives. Representatives from the consortium members form the Board of Governors (BOG). The BOG makes all corporate-like decisions concerning management and operations with commitment to the SCCOOS mission and program longevity. The Executive Steering Committee (ESC) advises the BOG on technical matters, funding distribution, and strategic planning. The Chairs of the BOG and ESC also work closely with the SCCOOS program staff.

## Program Operations and Staff

SCCOOS operates as a system of partnerships and contractual agreements facilitated by technical and programmatic staff. The Executive Director provides program oversight and serves as the principal contact for governance members, advisory committees, NFRA, and IOOS. The Technical Director provides technical advice and oversight for observational system capabilities and design, product design, web site, and data operations. Data integration, dissemination, and product development are performed by the Information Manager and two programmers. The part-time Administrative Analyst serves as a liaison with government agencies, legislative offices, and product users. The Program Coordinator provides programmatic support, coordinates communications, and leads outreach and education efforts.

Program staff and principal scientists work closely with the Central and Northern California Ocean Observing System (CeNCOOS) to collaborate on statewide initiatives, data collection, informational products, outreach and education, and future priorities. Staff members also participate in regional and national efforts with State agencies, other RAs, NFRA, and IOOS. A hallmark of the state of California's commitment to ocean observing was the investment of $21 million for the Coastal Ocean Currents Monitoring Program (COCMP) in 2005 that established a network of high frequency (HF) radar systems, glider survey capabilities, and modeling

infrastructure. Ocean observing continues to be a priority for the California Ocean Protection Council as evidenced by a recently passed resolution that strongly encourages its continued development and a consensus statement issued by the Science Advisory Team (Appendix J, K). SCCOOS also works to align program activities with the priorities of state-sponsored initiatives, such as the Marine Protected Areas Monitoring Enterprise, as well as broader regional initiatives, in particular the West Coast Governors' Agreement on Ocean Health. In the 2008 Action Plan, the West Coast Governors specifically called out the importance of ocean observations to achieving many of the action plan's goals.

### Joint Strategic Advisory Committee

In 2009, CeNCOOS and SCCOOS formed a single Joint Strategic Advisory Committee (JSAC) to identify and prioritize regional ocean observing requirements across the state. The JSAC includes representatives from city, state, and federal agencies, industry, non-governmental organizations, educational partners, and other regional ocean observing systems. The JSAC is intended to provide a means for stakeholders and funding agencies to participate in strategic planning efforts and provide feedback and guidance for projects. Seats on the JSAC are filled voluntarily and may be relinquished at any time.

## III. OBSERVING SUBSYSTEM

### 1. ECOSYSTEMS AND CLIMATE TRENDS

### A. Background

The Southern portion of the California Current System consists of the southward flowing, surface intensified California Current, northward flowing Southern California Counter Current, and the northward flowing, subsurface California Undercurrent. Thus, waters from both the north and the south affect the SCB and the resulting mixture of waters has striking effects. The SCB is profoundly influenced by El Niño (Lynn and Bograd, 2002) with southern influences arriving by advection, coastally trapped waves and atmospheric teleconnection. For example, previous studies have shown that the most powerful El Niños are characterized by an advective component which brings distinctly southern water and species into the SCB (Lynn et al., 1998). The physical features of the SCB make it a remarkably productive area of the world's oceans. The flow structures in the SCB are thought to influence retention of organisms, while the vertical fluxes at meso and submesoscales provide nutrients to the euphotic zone. Seasonal upwelling also causes the intrusion of low-oxygen waters onto the shelf, an intensifying phenomenon, off Oregon, for example (Chan et al., 2008).

Southern California is fortunate to have the 60-year California Cooperative Oceanic Fisheries Investigations (CalCOFI) with its unique sustained ship surveys. The National Science Foundation-funded California Current Ecosystem Long Term Ecological Research (LTER) program, the Santa Barbara Coastal LTER program, and the Partnership for Interdisciplinary Studies of Coastal Oceans (PISCO) are focused on the regional effects of climate change. This combination of efforts gives the SCB an established baseline and makes the region an ideal site for further development of observational systems. Ongoing observations, including gliders and HF radar, are coordinated with CeNCOOS. Discussions are also underway with the other Pacific coast RAs (AOOS, NANOOS, and PacIOOS) concerning future collaborative projects.

### B. Goal and Objectives

The overarching goal of the SCCOOS Ecosystems and Climate Trends component is to monitor ocean climate trends and responses in the SCB through the ongoing collection of physical, chemical, and biological variables. Specific objectives are to:

- Sustain observations of currents, temperature, salinity, phytoplankton and zooplankton throughout the SCB through ongoing operations of glider and ship transects, HF radar, shore stations, and enhancements of nearshore CalCOFI ship surveys.
- Begin observations of dissolved oxygen on glider transects to quantify trends in upwelling induced hypoxia, and nitrate to improve monitoring of the coastal ecosystem.
- Begin observations of the $CO_2$ system on shore stations to monitor ocean acidification.
- Produce climate quality reanalyses of ocean state using a model assimilating SCCOOS data.

- Work with users to develop and refine indices, including connectivity, relevant to ecosystem and fisheries management and marine spatial planning.

## C. Audience and Benefits

Managers responsible for long-range planning and members of the general public concerned about climate change are potential users of the data and indices. Specific users include the NOAA National Marine Fisheries Service (NMFS), NOAA Southwest Fisheries Science Center (SWFSC), U.S. Environmental Protection Agency (EPA), U.S. Geological Survey (USGS), the U.S. Bureau of Ocean Energy Management, Regulation and Enforcement, California Department of Fish and Game (DFG), Multi-Agency Rocky Intertidal Network (MARINe), non-profit organizations, marine mammal stranding networks, commercial fishermen, and the public. The California Fish and Game Commission will likely consider adoption of MPAs in Southern California by the end of 2010. SCCOOS will work closely with MPA Monitoring Enterprise staff as the South Coast MPA Monitoring Plan is developed and implemented in anticipation of the first five-year review in 2016.

Reliable ocean data are essential as society grapples with a response to climate change, both natural and anthropogenic, and as the Coastal and Marine Spatial Planning (CMSP) process begins on the West Coast. The central role of SCCOOS is to provide these data as well as improved or new informational products derived from ocean observations. For example, reliable physical indices may be used to set harvesting guidelines and the documented effects of El Niño will be used by planners throughout Southern California. As model predictability improves, enhanced understanding of ocean currents and connectivity will aid coastal management, including MPA assessments.

## D. Work plan

SCCOOS is focused on the sustained collection of data to provide a reliable climate record of ocean changes. Analyses of these data are intended to produce indices as assessments for ocean and ecosystem health. State-of-the-art models assimilate these data to produce predictions and reanalyses of ocean state. The goal is an end-to-end system from observations to products relevant to the evolving coastal ocean climate and ecosystem.

Underwater gliders form a network of climate observations in SCCOOS. Bight-wide monitoring is accomplished on a series of lines, a round-trip section completed once every two to three weeks. Observed variables include temperature, salinity, velocity, and measures of phytoplankton, and zooplankton. Data are transmitted by satellite from each glider dive and posted online within hours of collection. Gliders have remained a proven and stable platform. The addition of dissolved oxygen and nitrate sensors will expand the suite of observed variables relevant to ecosystem health. A continuing objective is the establishment of glider lines along the West Coast and Alaska. Collaboration with CeNCOOS is emerging for new glider lines in Northern California.

In order to increase the density of observations in the heavily used waters off Los Angeles, a time series section across the San Pedro Channel will be sustained using an underway conductivity-temperature-depth profiler (uCTD). The sampling will occur every other week from offshore of the Long Beach Breakwater to Two Harbors on Catalina Island, providing important data for products related to sub-surface water parameters. A climate quality time series in this urban region is vital to establish a baseline and observe change.

SCCOOS proposes to continue the operations and maintenance of the HF radar array composed of twenty-five short and medium range systems and six long range systems. The array provides seamless coverage of surface ocean currents along the SCB and interfaces with the CeNCOOS and NANOOS array to cover the entire West Coast. Data from the network are broadcast to the National Data Buoy Center (NDBC) using the NOAA IOOS-sponsored National Network. SCCOOS proposes to begin the synthesis of the HF radar time series to generate indices for climate and ecosystem relevance.

The long-term collection of water properties at shore stations document climate change at the focal points of human use along the coast. Ten historical shore stations, measuring daily temperature and salinity, are maintained on the West Coast through a partnership with the California Department of Boating and Waterways (CDBW). Historical analysis of the data has also been used by the California State Water Board to assess

climate-scale natural variability of coastal salinity values for analyzing potential impacts of brine discharges from planned desalination plants. It is expected that maintenance of these long term time records will provide data to develop future climate change indices for local MPAs.

Changes in the seawater $CO_2$ system are occurring as a consequence of both upwelling and ocean acidification, caused by increased levels of $CO_2$ in the ocean resulting from dissolution of anthropogenic $CO_2$. Such changes can have consequences for a variety of marine organisms. In fact, the recent difficulties in cultivation of shellfish larvae along the US West Coast may well be a consequence of increased levels of $CO_2$ in the seawater. To begin to address ocean acidification, we plan to design, install, and operate a system on Scripps pier to measure $CO_2$ levels. Discussions are underway with the National Park Service to include additional ocean acidification sensors on SCCOOS platforms such as gliders and automated shore stations.

SCCOOS will continue to expand the utility of CalCOFI by extending the quarterly sampling cruises to add nine stations near the coast. Measured variables include salinity, temperature, zooplankton, phytoplankton, and fish and invertebrate larvae. These data, now in their fifth year of collection, connect the offshore CalCOFI time series to the nearshore environment. SCCOOS data are being assimilated into an ocean model with the goal of producing a reanalysis of ocean state. Such reanalyses of the atmosphere are routine, providing a basic record upon which our understanding of past climate variability is based. The reanalyses of the coastal ocean is expected to complement a similar record of the ocean climate, allowing retrospective studies relevant to the ecosystem and fisheries, a first step to developing indices and forecasts. For example, the reanalysis could be used to identify if recurrent patterns of circulation favor certain species, by comparison with egg, larvae, and catch data (Appendix, Figure 1). The addition of a biogeochemical component to the model will help to clarify the connection between climate and the ecosystem.

An upcoming goal is to develop physical indices relevant to the Pacific sardine (*Sardinops sagax*) and market squid (*Loligo opalescens*) fisheries. The sardine fishery is one of the few that uses a physical index in the determination of harvest guidelines. This physical index, the three-year average SIO pier temperature, is a proxy for physical conditions farther offshore that profoundly affect sardine health. Market squid are strongly influenced by environmental variability, as evidenced by the crash observed in the fishery in El Niño years. Therefore, market squid recruitment is quite likely to be amenable to prediction using physical indices.

The quantification of connectivity between regions is central to a number of problems in the coastal ocean, including assessing the fate of pollutant discharges and quantifying larval transport as it influences fisheries management, species biogeography, and population genetics. Connectivity is quantified by evaluating the probability that water parcels from one site are advected to another using high-resolution ocean circulation model output (Mitarai et al. 2009), or from direct observations of surface current by HF radar. Maps of connectivity are identified as priorities by NOAA SWFSC biologists examining egg and larvae trends. Estimating biological connectivity is critical to CMSP efforts, such as MPA management and assessment.

Long-term changes in marine ecosystems can be indexed by fluctuations in the life history, abundance or demography of top predators, such as marine birds and mammals. In the Southern California Current, changes in seabird and mammal breeding success, diet and foraging behavior, and abundance are sensitive indicators of ecosystem and food web change (Sydeman et al. 2001, 2006, and 2009). SCCOOS will continue a 22-year record of seabird and marine mammal observations conducted with the CalCOFI surveys.

## E. Milestone Schedule

Twice monthly: *Deploy uCTD measurements of San Pedro Channel and post data online*
Monthly: *Continue offshore glider surveys, collect measurements of temperature, salinity, velocity, and measures of phytoplankton, and zooplankton; post data online*
Monthly: *Continue to collect CalCOFI observations and expand shore stations*
Year 1: *Add O2 / pCO2 sensors to automated shore stations to monitor ocean acidification*
Years 1-2: *Develop and refine indices for Pacific sardine and market squid fisheries*
Year 3: *Add O2 / NO3 sensors to gliders to begin observations of dissolved oxygen*

3 times yearly: *Conduct shipboard observations with CalCOFI surveys to count seabirds and marine mammals; post in online database*
Annually: *Publish survey reports and maps of species' distribution and abundance on SCCOOS web site*
Ongoing: *Conduct coastal connectivity reanalysis with 1km and 3km ROMS*

## 2.) WATER QUALITY

### A. Background

Maintaining good water quality is essential for the health of the large population and regional economy in Southern California. Year-round coastal water uses include shipping, recreational boating, swimming, surfing, diving, fishing, aquaculture, military activity, and wastewater discharge. These sometimes conflicting uses motivate CMSP management efforts in the state and federal governments. A challenge to maintaining water quality is the daily discharge of nearly 1.5 billion gallons of treated sewage into the ocean along with additional inputs from river systems carrying treated sewage, stormwater, urban, and agricultural runoff. Additional untreated sewage crosses the border from Mexico. Some of these discharges contribute bacterial and viral contamination and may influence harmful algal bloom (HAB) development. Human uses of the ocean also damage marine ecosystem health, including fisheries and marine mammals. Delivering timely data products summarizing critical observations of the SCB is imperative for effective management of ocean resources.

### B. Goal and Objectives

The Water Quality component addresses three water quality areas: HABs, outfall and stormwater plumes, and surfzone contaminant transport. The goal is to support management efforts and improve water quality related to these areas. Specific objectives are to:

- Deliver information products describing HABs in the SCB using a variety of approaches.
- Develop data products to observe and forecast dispersion of outfall and stormwater plumes.
- Develop surfzone tools to track and locate sources and respond to beach contamination events.

### C. Audience and Benefits

SCCOOS provides many agencies with useful products for management and policy of the coastal ocean. SCCOOS has developed trajectory maps for the California State Water Resources Control Board to track coastal non-point discharges to Areas of Special Biological Significance (ASBS). The SCCOOS HAB component notifies the California Department of Public Health, marine mammal and bird rescue centers, and regional agencies of HAB events. SCCOOS works with local POTWs, including Orange County Sanitation District (OCSD) to improve their regional monitoring by, for example, mapping POTW plumes from ocean outfalls (Appendix, Figure 2). SCCOOS collaborates with the Southern California Coastal Water Research Project (SCCWRP) in multi-agency regional studies. For the latest study, "Bight' 08," SCCOOS used observations and modeling to examine HABs and nutrient fluxes in the SCB.

The HAB component will provide several products beneficial to coastal managers, public health officials, and regulators to respond to bloom events: 1) real-time detection of potentially toxic HAB species; 2) forecast models to predict the formation and evolution of blooms; and 3) HAB climatology development to provide statistical forecasts of toxic HAB events.

The outfall and stormwater component will provide trajectory data products for estimating the transport of surface discharges from POTWs and river runoff, and will use subsurface observations and high resolution modeling to describe sub-surface movement of outfall plumes. The surfzone component will produce a contaminant trajectory tool for use with routine beach water quality monitoring data to assist managers and public health agencies in identifying persistent sources of unhealthy water. This tool will be used in real-time during spill events to predict beach impact. The SCCOOS water quality component is a strong collaboration between researchers, water quality agencies, and state regulators whose goal is to develop useful products for a broad range of users and clients.

### D. Work plan

*Harmful Algal Blooms:* The SCCOOS online HAB program complements the statewide HAB Monitoring

and Alert Program (HABMAP) that was initiated by NOAA, the California Ocean Science Trust, and SCCWRP. SCCOOS together with CeNCOOS has extended the HAB network along the California coast. The HAB program maintains five pier-monitoring sites posting real-time temperature, salinity, water level, and chlorophyll fluorescence data to provide indications of fresh water input, upwelling and algal blooms. Weekly bottle samples measure chlorophyll, nutrients, domoic acid, and harmful algal species. Distribution is also via the California HABMAP Listserv. When HABs are detected, opportunistic sampling from additional shore sites, gliders, and boats determines their extent and severity. POTW monitoring provides quarterly hydrographic surveys and opportunistic surveys of developing HAB events. Gliders map HABs based on chlorophyll fluorescence and particle concentration, such as during the springs of 2009 and 2010 when they detected domoic acid-producing *Pseudo-nitzschia* blooms. Targeted boat sampling confirmed the presence of the *Pseudo-nitzschia*. Barnacles growing on gliders have proven excellent bio-accumulators of domoic acid and are now routinely bio-assayed at the end of deployments.

*Outfall and stormwater plumes:* All observing and modeling assets will be used to understand the environmental effects of outfall and stormwater plumes, including gliders, HF radar, plume models (e.g. EPA's Roberts, Snyder and Baumgartner [RSB] model), the Regional Ocean Modeling System (ROMS), and biogeochemical (NPZ) modeling. The observations and ROMS have sufficient spatial resolution to resolve outfall plume distributions (Cetinic et al., 2010; Petrenko et al., 1997; Todd et al., 2009). Models will be initialized and tested with glider-derived maps of water constituents and currents around POTW outfalls (e.g. OCSD). An important objective is to evaluate nowcasts and forecasts of plume dispersion. The POTWs who discharge into SCB have identified these models of plume location as important data products. POTW partners include the OCSD, the City of Los Angeles, the Sanitation Districts of Los Angeles County, and the City of San Diego. The POTW operators provide CTD data to SCCOOS for establishing high-resolution, near-coast climatology. Modeling supports water quality efforts by running ROMS in real-time to predict currents, water properties, and trajectories, all regularly posted online. Validation of the ROMS output against non-assimilated observations (e.g. moored ADCP and temperature data) has yielded promising results (e.g. Dong et al. 2009) and additional validation is ongoing to assess the skill of the model in shallow water. Development and validation of finer spatial resolution ROMS is important for better resolving plume dynamics on small scales.

A coupled ROMS/biogeochemical model will aid evaluation of the effects of nutrient inputs from outfall plumes, river plumes, and upwelling processes on bloom formation and nutrient cycles within the SCB. Objectives include nowcasts and forecasts of bloom dynamics and ultimately to forecast HABs. Biogeochemical modeling will be used to differentiate anthropogenic from natural components of nitrogen dynamics. SCCOOS will continue to track river and stormwater plumes using near real-time simulated particle trajectories derived from HF radar observations of surface currents. Real-time HF radar-derived trajectories for the Tijuana River discharge are available on the web site and tracking tools have been developed for the sanitations districts to determine when coastal beach users are likely to be affected by the effluent plumes. Stormwater trajectories and plume trajectories will be combined with agency bacterial data to test simulations of shoreline contamination. SCCOOS successfully applied this approach to the Tijuana River and a nearby outfall for the County of San Diego Department of Environmental Health and the City of Imperial Beach (Kim et al., 2009). This approach can be extended as needed for other river and outfall sites in Southern California. The State Water Resources Control Board affirmed the value of the trajectories for ASBSs at the recent JSAC meeting.

*Surfzone Contaminant Transport:* Bacterial contamination of beaches through surface surfzone transport processes is a great concern for public health, stormwater management, and regulatory agencies in Southern California. A wave-driven surfzone current prediction system developed by the Coastal Data Information Program (CDIP), a SCCOOS partner, provides real-time estimates of the current direction and mean speed at multiple points along Southern California beaches. SCCOOS will provide the surf-zone model as a real-time surfzone contaminant trajectory tool to estimate the alongshore extent of discharges from land sources, and entrainment from offshore effluent plumes. These surfzone trajectories will be coupled with the HF radar data

outside the surfzone for monitoring storm drain and river discharges. The long-term goal is to combine the proposed surfzone trajectory model with surfzone mixing and bacterial sunlight decay models to make quantitative predictions of contaminant concentrations.

E. Milestone Schedule

Weekly: *Measure temperature, salinity, chlorophyll, and nutrients at pier sites to monitor HABs; distribute data*
Twice monthly: *Deploy gliders to detect and map HABs based on chlorophyll fluorescence and particle concentration in the Los Angeles area*
Four times yearly: *HAB glider operations for Santa Barbara Channel (30 day deployments)*
Year 1: *Validation of code for Shoreline/Surfzone Currents Toolset*
Year 1: *Implement the 3-km California statewide ROMS ocean forecasting system for real-time operations*
Years 1-2: *Conduct a systematic validation of the 1-km ROMS and 3-km California statewide ROMS*
Years 1-2: *Integration of anthropogenic nutrient loading into ecosystem and biogeochemical cycle models*
Year 2: *Shoreline/Surfzone Currents Toolset operational*
Year 3: *Improve and refine the 1-km SCB ROMS forecasting system using improved lateral boundary conditions as provided by the newly developed 3-km California statewide ROMS solutions*
Years 3-5: *Simulations of biogeochemical cycles of carbon, nutrients, and oxygen; validate with observations*
Ongoing: *Automated Shore Station sampling at four pier sites (SD, OC, LA, SB)*
Ongoing: *Continue to develop exposure maps and trajectories for river and outfall plumes*

## 3.) MARINE OPERATIONS

### A. Background

Maritime transportation plays a major role in Southern California's economy and national defense system. Los Angeles and Long Beach combined comprise the largest port in the U.S. and the fifth largest port in the world. The Port of San Diego includes the largest naval fleet in the world, and Port Hueneme is the only deep water port between Los Angeles and San Francisco and the only Navy controlled port between San Diego and the Puget Sound. The Santa Barbara Channel and San Pedro shelf are the locations of several active oil fields with sustained reserves, as well as major shipping channels.

The unique challenge for marine operations in Southern California is to assure that the vast amount of maritime traffic is provided with the highest quality ocean observations and models to assure safe and efficient transit as well as effective event response. SCCOOS has addressed this challenge by partnering with institutions and agencies to provide data access and visualization of waves, surface currents, and winds, critical parameters necessary for safe maritime operations. Collaborations and leveraged programs include: 1) CDIP, cooperatively funded by the CDBW and the U.S. Army Corps of Engineers (USACE), providing near real-time wave measurements and nowcast and forecast wave models. The USACE considers CDIP as one component of their contribution to IOOS. 2) COCMP. 3) For wind model output, the Naval Air Weapons Center Division (NAWCD) and UCLA provide the Coupled Ocean/Atmosphere Mesoscale Prediction System (COAMPS) and Weather Research and Forecasting (WRF) model. SCCOOS has integrated these parameters into a customized Ports and Harbors interactive online display along with navigational charts, shipping lanes, and user-specified transfer points (Appendix, Figure 3). These maps are consistent with the approach of CMSP as they provide integrated, map-based tools for coastal management.

SCCOOS works collaboratively with state and federal partners to integrate and distribute data relevant to marine operations. Wave and current data are ingested into NDBC and NWS data systems for dissemination. The integration of wave data on the NOAA PORTS site is now available at four ports: Los Angeles/Long Beach, San Francisco, Mouth of the Columbia and the Chesapeake. This will serve as a template for further IOOS data integration and displays. Remotely sensed satellite products also aid in marine operations. SCCOOS provides access to the following distributed data in a simple-to-use format: MODIS (Moderate Resolution Imaging Spectroradiometer) sea surface temperature (SST), chlorophyll, and normalized water-leaving radiance from NASA; Optimally Interpolated SST from The National Centre for Ocean Forecasting

(NCOF); and Geostationary Operational Environmental Satellite (GOES) water vapor, visible, and infrared from NOAA. These parameters provide valuable information for sea-going vessels.

In collaboration with CeNCOOS, SCCOOS contributes to regional coordination by participating in maritime transportation meetings throughout the state where there is interest in employing the web template from the Los Angeles/Long Beach site. The two regions also work closely on HF radar and wave buoy maintenance. At the national IOOS level, SCCOOS was invited to present at the Hydrographic Survey Research Panel, NOAA Science Advisory panel on maritime transportation, and the Transportation Research Board. These events reinforce the visibility and recognition that SCCOOS is receiving for its marine operation products. SCCOOS recently partnered with CeNCOOS and NOAA's Western Regional Collaboration Coordinator to collaboratively present an ocean observing system session at the NWS Western Regional Conference. The Eureka NWS offered to partner with the RAs to further enhance its One Stop Marine Page. SCCOOS has also played a key role in writing both the IOOS National Wave Plan and the IOOS National HF Radar Plan.

## B. Goal and Objectives

The goal of the Marine Operations component is to continue to advance previously IOOS-funded projects that are critical for safe and efficient navigation, search and rescue (SAR) and oil spill response. Specific objectives are to:

- Maintain and develop customized products: multi-layer views of observations, nowcast and forecast models including winds, waves, and currents, SST, bathymetry and navigation charts.
- Deliver ocean current data and surface wind analyses to aid oil spill and SAR real-time recovery and post-analysis trajectories. In collaboration with the Oxnard and San Diego NWS, continue to expand the on-demand capability to provide risk assessment in a given area/region and impact assessment.
- In collaboration with the NAWCD at Point Mugu, continue to expand the near real-time, customized wave and surface currents display with additional areas of interest as provided by the Navy.
- Communicate glider data to the Naval Oceanographic Office for assimilation into the Navy Coastal Model (NCOM), which is published for public distribution by NOAA National Centers for Environmental Protection (NCEP). Assess skill of NCOM and other ocean forecasting systems to provide accurate forecasts of ocean conditions.
- Provide training to first responders of maritime incidences in the use of SCCOOS products.

## C. Audience and Benefits

Representative stakeholders and users include: Catalina Express Ferry (one million passengers from San Pedro to Catalina since year 2000), commercial cargo vessels, commercial fishermen, harbor pilots (San Diego, Los Angeles, Long Beach and Port Hueneme), the Marine Exchange of Southern California, NWS, NOAA HAZMAT, California Office of Oil Spill Prevention Response (OSPR), the U.S. Coast Guard (USCG), U.S. Navy, USACE dredgers, passenger cruise ships, recreational beachgoers and boaters. The audience includes users of different levels of sophistication and technical knowledge, but all of these stakeholders are interested in both real-time and forecast customized data that complement their decision-support tools. Web-training sessions on applicable products have been presented to the Los Angeles and Long Beach and San Diego Harbor Safety Committees, OSPR, and the San Diego Area Regional Standards Committee.

SCCOOS will continue to provide unique customized products that will be readily and routinely available to the maritime community. NOAA benefits from real-time surface current measurements integrated in General NOAA Operational Modeling Environment (GNOME) for trajectory analysis. Surface current data are made available to OSPR in a netCDF/shape file format, a capability that has been tested in both drills and in real spills. The customization and integration of near real-time products aid decision-making capabilities for the USCG, emergency responders and the general public at large. CDIP's high resolution wave map browser for nowcast and forecast models is available for the SCB. Local, nearshore wave models are also available that depict conditions as mariners approach or depart from ports/harbors or assist dredging operations.

## D. Work plan

Development of IOOS-funded infrastructure and methodology used to collect, analyze and disseminate

observations in near real-time will continue. The customized, integrated products and seamless geo-referenced user tools have been expanded to all regions within Southern California. Interactions with stakeholders aid in site customizations. For example, the USCG recently requested the integration of on-demand location referencing for tracking small vessel operations. With complete coastal coverage of the SCB for waves and surface currents, SCCOOS is well poised to support future offshore renewable energy projects.

A drifter trajectory tool based on the UCLA ROMS allows users to populate the SCB with simulated drifters and using a 72 hour forecast, visualize surface drifters trajectories. This application is particularly useful for estimating trajectories of floating objects in the coastal ocean including people, debris, and drifting boats. As requested by the NAWCD, winds and surface currents have been integrated with the existing operational wave observations/models. As glider data are now being delivered to NCOM, this partnership between SCCOOS, the Navy, and NOAA NCEP will allow SCCOOS to generate and distribute model-based products from the operational model for maritime operations and coastal model validation.

### E. Milestone Schedule

Years 1-2: *Conduct a systematic validation effort of the WRF system using independent wind measurements*
Years 3-5: *Improve the WRF system as needed with a particularly focus on cloud parameterization*
Annually: *Provide training to first responders of maritime incidences in the use of SCCOOS products*
Ongoing: *High frequency (HF) radar operations and maintenance*
Ongoing: *Continue to operate the real-time WRF system and distribute model output*
Ongoing: *Maintain and expand integrated, customized products with multi-layer views of observations, nowcasts, and forecasts*
Ongoing: *Deliver glider data for assimilation into Navy Coastal Model*
Ongoing*: Deliver ocean current data and surface wind analyses to aid oil spill and SAR real-time recovery and post-analysis trajectories*

## 4.) COASTAL HAZARDS

### A. Background

Coastal inundation on the West Coast is often caused by the co-occurrence of high tides and energetic ocean waves. High waves cause both a super-elevation of the mean water level above the tide level and large oscillations about that level. The California Beach Restoration Survey 2008, a report by the California Coastal Sediment Management Workgroup (CSMW), indicates that several beaches and structures in the SCB are vulnerable to dangerous high surf and coastal flooding conditions during storms where wave uprushes can reach several meters above tide level. Simple inundation models (where the uprush limit depends only on the tide level, wave height, and beach slope) yield qualitative, general information, but not the site-specific information most valuable for issuing localized warnings for highway closures and/or structure sand-bagging.

Synergies have developed between the USGS Coastal Hazards Project, USACE, CDBW and CSMW. In 2008, SCCOOS co-authored the San Diego Foundation Regional Focus 2050 Study, sponsored by the California Energy Commission. The inundation infrastructure served as a basis for the sea level rise projections for year 2050. SCCOOS is also providing high level participation on the “Pacific Climate Impact Initiative,” a multi-agency effort to promote enhancing scientific data, planning tools, predictive models and design approaches to prepare for and protect against coastal inundation.

### B. Goal and Objectives

The goal of the SCCOOS Coastal Hazards component is to build upon previously-funded inundation projects. This effort will help cities meet emerging challenges to coastal infrastructure resiliency and reduce loss of life and property associated with nearshore waves and wave-driven currents in the populous coastal communities of Southern California. Specific objectives are to:

- Continue observations and stakeholder participation to validate and refine inundation models.
- Develop and expand integrated, online, customized products that will provide warnings of wave and tide-induced coastal inundation.

## C. Audience and Benefits

The audience for real-time and forecast inundation warnings includes NWS, the Emergency Alert Network, recreational beachgoers, USACE, California Department of Transportation, California Coastal Commission, and regional city and county governments. Partnerships have been established with Encinitas and San Diego, to assist with equipment permissions and observational validation of inundation notifications. SCCOOS will partner with the NWS on their Storm Surge Study by supplying wave and current input to their model and collaborating on model validation. In collaboration with CeNCOOS, the existing inundation dissemination infrastructure transmits (as yet unvalidated) warnings to the Monterey NWS for the Carmel Lagoon. The same infrastructure exists for disseminating inundation warnings to the NAWCD for an area that overtops during high tides and energetic waves. SCCOOS also participates in IOOS-funded inundation discussions addressing on-going technical issues contributing NOAA's national activities on coastal resiliency.

The long-term observation of waves, beach sand levels, and inundation are critical for building a historical database for coastal managers. As climate trends and changes become increasingly evident, the value of these databases will grow as well. With rising sea levels and El Niño winters, it is important that a West Coast inundation model be developed for future safety and protection of the coastal community.

## D. Work plan

A site-specific model for tide and wave-driven inundation will be calibrated with field observations of shoreline water level acquired during winter storms. Existing data streams will be used to estimate and forecast water level and wave conditions seaward of the surfzone. New field observations of shoreline water level, waves, and inundation will provide the inundation model calibration required for issuing localized warnings for highway closures and sand-bagging.

NOAA tide gauges provide water level, including the astronomical tides, storm surge, El Niño and other regional factors. The CDIP coastal wave model (MOPS, *developed with SCCOOS support*) includes both remotely generated swell and locally generated seas, and yields nowcast and forecast models of waves on the 10m depth contour, immediately offshore of the surfzone with high temporal (hourly) and spatial (100m alongshore) resolution. Offshore boundary conditions are provided by the CDIP network of wave buoys and co-located point forecast spectra from the NOAA WaveWatch III global wave model. Field testing in SCB has extensively validated MOPS.

Simple inundation models (Ruggiero et al., 2004 and Stockdon et al., 2006) relate the uprush limit to tide level, wave height, and beach slope. These models, used in the existing inundation forecasts, yield qualitative information but not the required site specific information quantifying the importance of ramps, structures, riprap, and other factors. Therefore, the inundation thresholds and wave run-up estimates in the presently disseminated warnings are rudimentary. New observations of water level, waves, and beach profiles on the seaward side of the inundated regions (Appendix, Figure 4), coupled with video of the resulting inundation, will allow site-specific, customized, inundation warnings. Model-based inundation warnings, such as predicted overtopping of Hwy 101, will be disseminated directly to users via the web and/or automated call. Highway departments have indicated willingness to work cooperatively to improve warnings by providing information on when highways flood during storm events.

The site of the proposed work will be selected on the basis of access, severity of inundation, and logistical support from local agencies. The inundation observations proposed for 2011 will build upon results obtained in 2010 along a 1.6 km stretch of beach and highway in Cardiff (Appendix, Figure 4). Ten self-contained pressure sensors (borrowed at no cost from Woods Hole Oceanographic Institution) will be used to measure water and waves on the seaward side of the highway shoulder. Highway overwash will be measured with video cameras mounted atop private residences, a lifeguard tower, and at the San Elijo Lagoon Conservancy.

## E. Milestone Schedule

Storm Events: *Monitor storm inundation at selected locations, including measuring run-up heights and inundation using pressure sensors, video cameras, and visual observations*

Pre- and Post-Storm Events: *Survey sand levels on beaches*

Post-Storm Events: *Validate and refine inundation model*
Fall/Winter Annually: *Shoreline inundation forecast, validation, dissemination of warnings*
Ongoing: *Expand development and integration of inundation web site*

### 5.) COASTAL AND MARINE SPATIAL PLANNING

In support of the Interagency Ocean Policy Task Force's recommendations for effective CMSP, SCCOOS, CeNCOOS, and NANOOS will work with the West Coast regional planning body as it is established and as it pursues a comprehensive, adaptive, integrated, ecosystem-based, and transparent spatial planning process. This process must be based on sound science, including the analysis of important physical and ecological patterns and processes. The West Coast RAs will facilitate the completion of these assessments by the planning body as it prioritizes CMSP planning needs. The CMSP process will also involve the creation of an information management system for planning and public interaction. SCCOOS and CeNCOOS will work with the California Coastal Conservancy and NOAA on a proposed project to create ecological habitat maps using the Coastal and Marine Ecological Classification Standard classification scheme. This information will provide valuable data layers for CMSP tools.

## IV. DATA MANAGEMENT COMMUNICATION (DMAC) SUBSYSTEM

SCCOOS will continue to provide access to high-quality integrated data and support regional user needs while complying with the standards and protocols for sharing and archiving data that are developed nationally. SCCOOS will also continue to integrate a broad suite of observations including: surface currents, satellite imagery, wave conditions and forecasts, meteorological conditions and forecasts, water quality, algal blooms, ocean temperature, salinity, chlorophyll, and density in the form of data products and raw data. Observations are collected from a variety of platforms including: shore stations, ships, gliders, remote sensing, HF radar, and physical sample collections. Observation integration occurs within models for nowcast and forecast parameters such as waves, winds, ocean salinity, temperature, and currents. These observations and model output are available in a user-friendly display on the SCCOOS web site and serve as a decision support system. A subset of fused products SCCOOS plans to focus on are expansion of the HABs to a statewide system, integration of additional Southern California gliders, projection of the plume tracking visualization onto additional discharges, improving underlying code to support additional ports and harbors, and improved integration with CalCOFI.

SCCOOS actively participates in the IOOS Data Integration Framework (DIF) and will continue efforts to standardize data distribution through the use of services such as the Sensor Observation Service (SOS) and the Open-Source Project for a Network Data Access Protocol (OPeNDAP), one version being Thematic Real-Time Environmental Distributed Data Services (THREDDS) throughout the course of this proposal. By leveraging CDIP and the HF Radar National Network programs, SCCOOS will target THREDDS distribution for both wave and surface current data. SCCOOS has developed standards and guidelines for waves Quality Control (QC) and processing at a national level through QARTOD (Quality Assurance of Real-Time Data) and at the international level through the Joint Technical Commission for Oceanography and Marine Meteorology (JCOMM). SCCOOS participants play an active role in the ongoing effort to develop QC standards for HF radar derived surface currents. Wave and current data have associated XML and FDGC compliant metadata.

SCCOOS will actively collaborate with the other Pacific coast RAs over the course of the funding cycle to advance stakeholder access to cross-regional data services as defined by commonalities in specified user requirements. Initially, SCCOOS and the Pacific coast RAs propose to improve access to existing data services (products, map-based visualizations, information) through collaborative effort to establish common web site linkages. Future effort will focus on the development of shared visualization services (common Application Programming Interfaces and Web-Map Services) that focus on products common to all regions (e.g. glider data, model nowcasts and forecasts, key climate variables and HF radar). These common data services will be established and maintained as a core component of the SCCOOS DMAC effort. The data

management effort provides scientists, decision makers, and the public access to products and data services that will facilitate a scientific basis for research and management of the Southern California ocean environment.

## V. MODELING AND ANALYSIS SUBSYSTEM

As described in previous sections, SCCOOS relies upon models to fuse and synthesize data in a consistent manner to support the focus areas of operation. These subsystem components include:

*Regional scale* forecasts of the ocean are provided by partnerships with JPL/UCLA for ROMS in addition to partnerships with the Naval Oceanographic Office for the NCOM (Appendix, Figure 5). ROMS is presently operated at 1km resolution within the SCB, and will be expanded to have inner nests at 250m at nearshore areas of interest (e.g. POTWs) and a statewide model operated at 3km. All ROMS operations are driven by the WRF Model. The 1km and 3km ROMS and NCOM models will be operated on a 72 hour cycle, with new model output available for nowcast/forecast twice daily and daily forecasts, respectively. Both ROMS and NCOM assimilate the glider data feeds, remotely sensed data of sea surface temperature and height using 3D-VAR (three-dimensional variational) 'nudging' style assimilation approaches. SCCOOS will evaluate and verify model performance against non-assimilated observations. A regional-scale reanalysis effort for purposes of developing biologically relevant physical indices will be conducted using the Massachusetts Institute of Technology General Circulation Model using a 4D-VAR (four-dimensional variational) data assimilation approach that includes those non real-time data feeds (e.g. ship casts) that are not included in the nowcast/forecast models. While the hindcast reanalysis is expressly designed for climate and ecosystem reanalysis, the real-time systems support operational forecasts for water quality and marine operations.

*Wave Models,* initiated with CDIP's wave buoys*,* predict swell and sea conditions in the SCB and will be implemented by their operational refraction model. Shoreline wave conditions are predicted and archived at MOP points and used to drive surfzone currents and inundation models. Surfzone currents directly support estimates of shoreline transport of discharges in addition to providing situational awareness to marine safety groups, including lifeguards. The current and wave height predictions are also used for modeling shoreline change.

*Trajectories* will be computed based upon both data-driven computations (HF radar surface currents) and forecasted through real-time ROMS. Hindcast reanalysis of trajectories from discharge sites will be generated and communicated in the threat assessment of potential oil spill sites in addition to those managing MPAs and ASBS sites for assessing local discharge impacts.

## VI. OUTREACH AND EDUCATION

With a strong consortium of partners and expert advisors, SCCOOS will enrich and expand outreach and education efforts in the next five years. In order to achieve an effective outreach and education strategy that fully engages a wide range of audiences, SCCOOS will focus on developing projects through partnerships on the local, regional, and national levels. The JSAC members provide connections to a diverse range of user groups and SCCOOS will leverage partnerships based at local science education centers, universities, and federal agencies. SCCOOS staff and scientists will continue to reach new audiences and receive feedback by participating in trainings and workshops, webinars, conferences, special events, and informal meetings.

In Southern California, SCCOOS will build on existing partnerships with the Ocean Institute, Earthguide, Centers for Ocean Sciences Education Excellence (COSEE) California, SIO, the Birch Aquarium, the Aquarium of the Pacific, and the Tijuana River National Estuarine Research Reserve (TRNERR). Statewide and West Coast initiatives will be developed in collaboration with CeNCOOS, NANOOS, California Coastal Conservancy, California Sea Grant, University of Southern California Sea Grant, COSEE-West, and the West Coast Governors' Agreement. National initiatives will be coordinated with NFRA, IOOS, NOAA Office of Education, National Marine Sanctuaries (NMS), National Estuarine Research Reserve System (NERRS),

National Climate Service, Sea Grant, Center for Ocean Solutions, COSEE, and COSEE Networked Ocean World (COSEE NOW).

Locally, SCCOOS will expand existing programs that use ocean observing data while exploring new technologies and visualizations to make data more comprehensible and easily available. SCCOOS has a long-standing partnership with the Ocean Institute, an experiential education organization, and shares the goal of making ocean science data relevant and exciting through hands-on experiences. Designed by the Ocean Institute and COSEE California, the fifth grade "Weather and Water" program brings SCCOOS climate data into the classroom and meets Earth Science standards on the water cycle and weather. In the Tijuana River Valley, TRNERR uses SCCOOS water quality data to teach students and visitors about local sources of pollution and threats to the environment. Recently, SCCOOS teamed up with Earthguide, an educational media development group based at Scripps, to design an interactive map that allows visitors to explore climate trends and visualizations of SCCOOS data (Appendix, Figure 6). The pilot project illustrates El Niño conditions through SCCOOS SST and is accompanied by online resources for teachers and students. The display will be launched at the Birch Aquarium and can be adapted for other regional aquariums and science centers.

Regionally, SCCOOS plans to focus on coastal ocean and climate-related exhibits, kiosks, and online products. Building on the successful incorporation of SCCOOS data into the NMS Interactive Touch Screen Kiosk Program, SCCOOS will pursue opportunities to include climate and ocean data in additional kiosks and exhibits in the region. SCCOOS will assess information gaps and develop climate information products through current partnerships with NOAA's California Nevada Climate Applications Program, California Sea Grant, and NERRS's Coastal Training Program. SCCOOS will work directly with teachers and informal educators through demonstrations, workshops, and trainings such as the "Ocean Observing Systems" Institute provided by COSEE-West and USC Sea Grant. SCCOOS and CeNCOOS will continue to find innovative ways to use technology to broaden the impact of ocean observing systems, such as with a recent series of "Ocean Gazing Podcasts," produced by COSEE NOW.

Nationally, SCCOOS will collaborate with the IOOS office and NFRA Education and Outreach Committee to share success stories and implement public programs to improve awareness of global climate change and effects on the ocean and coastal environment. As part of this proposal, SCCOOS will work with the NFRA Education and Outreach Committee and other regions on a series of objectives:

- COSEE NOW Collaboration: Continue to develop common educational products and services utilizing the COSEE NOW online infrastructure.
- Evaluation Metric: Develop a standardized evaluation process to determine if products and programs are effectively engaging targeted audiences.
- Deepwater Horizon Oil Spill Response: Communicate information about the research plans, monitoring efforts, technologies, and data collected in the Gulf of Mexico.

## VII. CONCLUSION

SCCOOS maintains unique, long-term biological, chemical, and physical observations in the Southern California Bight in order to distribute ocean information of public interest. SCCOOS identifies trends in the climate and environment, supports the water quality management community, informs operational users for marine safety, and delivers coastal hazard information to coastal managers. SCCOOS is focused on providing these critical observations and products for effective management of ocean resources and the environment in Southern California. The program also has the infrastructure, flexibility, and stakeholder participation necessary to address emerging coastal management issues such as CMSP, MPAs, and ocean energy. SCCOOS is committed to contributing to larger ocean observing collaborations at the regional, national, and international levels with other Regional Associations, state and federal agencies, users, and partnerships.

# IX. BUDGET NARRATIVE

***Salaries/Benefits:*** SIO salary recharge rates are used for calculating salaries. The rates include components for employee benefits, provisions for applicable merit increases and range adjustments in accordance with University policy. Fringe benefits are not shown separately, but are included in the salary cost category. Only actual direct hours are charged to the projects.

***Travel:*** Cruise and field experiment travel is included, as well as maintenance of sensors and moorings. Travel funds are allocated for two IOOS Regional Workshops per year. Additional travel is allocated for coordination and data management meetings. Travel to conferences to present results of this work to the science community is also included. The total travel costs include multiple travelers and multiple trips to Washington, DC (IOOS coordination), Sacramento and San Francisco (State coordination) and various field sites.

***Equipment:*** The following will be purchased: Seabird SEACAT sensor for measuring Conductivity, Temperature, Depth (CTD), Autonomous Measuring System (AMS), Spray Gliders, ADPs, and Nitrate Sensors. The SEACAT is not available for lease from the vendor. One AMS will be purchased from Battelle and deployed off the SIO Pier and cannot be leased. One AMS will be fabricated at SIO and cannot be leased. The SIO/IDG group does not have Spray gliders available for lease. The ADPs and sensors require customization for installation on the Spray glider and are not available for lease. UCSD is requesting to retain ownership of the equipment after the project ends.

***Supplies:*** Various project specific supplies and expendable materials are included to perform the work proposed. These include but are not limited to such items as calibration charges, maintenance and repairs, laboratory and cruise supplies chemicals, computer materials and peripherals, networking services, small boat services, technical shop services, sensors, software licenses, and communication costs.

***Contractual:*** Multi-campus awards, sub-awards, and subcontracts are included and grouped together on the 424A. An outline of the sub-awards by Institution follows, representing coverage of the four Focus Areas of Ecosystem and Climate Trends, Water Quality, Marine Operations and Coastal Hazards, plus Coastal Marine Spatial Planning:

- *University of California, San Diego*: Gliders, CalCOFI, Climate Re-Analysis Models, Automated Shore Stations, Ocean Acidification, HABS, High Frequency Radar, Surfzone and Inundation Modeling, Data Management, Regional Coordination.
- *University of California, Santa Barbara*: CTD, ROMS, HABS, Gliders, High Frequency Radar
- *University of California, Los Angeles*: HABS, ROMS, Biogeochemical Models, WRF Model
- *Cal Poly*: HABS, High Frequency Radar
- *University of Southern California*: HABS, Gliders, High Frequency Radar
- *Farallon Institute*: Distribution of Marine Birds
- *NOAA Southwest Fisheries*: Modeling of Environmental Indices

As part of this collaborative effort, NOAA Partner NMFS SWFSC is requesting funds to be transferred directly to the Southwest Fisheries Science Center, Fisheries Resources Division, La Jolla.

***Other:*** UNOLS ship costs and the MPL Support Cost. Ship time is requested for two days on the R/V New Horizon and one day on the R/V New Horizon. MPL Support Cost: Other costs for the proposed program consist of Laboratory Support Services that are calculated at 22% of the MPL direct salary cost.

***Indirect Costs:*** Indirect costs are calculated with a base overhead rate of 18% (SIO/MPL) and 54.5% (UCSD/SIO) of total direct costs less tuition remission and equipment.

## COMPLIMENTARY PROJECTS

Complimentary research projects and programs include (but are not limited to):

California Cooperative Oceanic Fisheries Investigations (CalCOFI) http://calcofi.org/
California Current Ecosystem (CCE) Long Term Ecological Research (LTER) http://cce.lternet.edu/
Coastal Data Information Program (CDIP) http://cdip.ucsd.edu/
Coastal Observing Research and Development Center (CORDC) http://cordc.ucsd.edu/
Consortium on the Ocean's Role in Climate (CORC)
http://sose.ucsd.edu/DATA/CORC/corc_stateestimation_welcome.html
Partnership for Interdisciplinary Studies of Coastal Oceans (PISCO) http://www.piscoweb.org/
Santa Barbara Coastal LTER http://www.lternet.edu/sites/sbc/

City of Los Angeles Hyperion Outfall Diversion Modeling (SIO)

Climate reanalysis through CORC with emphasis on large-scale structures offshore in the CCS (SIO)

Coastal ocean management and decision support to coordinate coastal ocean modeling and data assimilation activities that utilize satellite data (JPL)

Collaborative project on Forecasts and Projections of Environmental and Anthropogenic Impacts on HABs in Coastal Ecosystems (UCSC, California Department of Public Health, SCCWRP, USC, JPL, MBARI)

Collaborative research on ocean acidification (UCSB, OSU, UC Santa Cruz, UC Davis)

Collaborative Research: Climate Simulation and Operational Forecasting for VOCALS Using a Regional Earth System Modeling Framework (UCLA)

Collaborative Research: Topography, Boundary Currents and the Submesoscale (UCLA)

Collection and analysis of seawater samples from the California coast (SIO)

Delicacy, Imprecision, and Uncertainty of Oceanic Simulations: An Investigation with ROMS (UCLA)

Development and Utilization of the Regional Oceanic Modeling System (ROMS) (UCLA)

ECOHAB: A Regional Comparison of Upwelling and Coastal Land Use Patterns on the Development of HAB Hotspots Along the California Coast (UCSC, USC, MBARI, JPL, MLML, NOAA)

HF Radar National Network Data Management Development (SIO)

Investigations of atmospheric and ocean responses in the SCB to wind regional relaxations (UCSB, SIO)

Investigations of coastal trapped waves based on PISCO, SBC-LTER, and other data sets (UCSB)
Collaborative research to investigate poleward flows following wind relaxations (UCSB, CalPoly, Rutgers)

Ocean color study of plumes and blooms in the Santa Barbara Channel (UCSB)

Pt. Loma Ocean Outfall Plume Behavior Study (SIO)

Quality control of oceanic CO2 measurements: preparation, certification, and distribution of reference materials (SIO)

Remote Assessment of Giant Kelp Dynamics - The Engineer of California's Nearshore Ecosystems (UCSB)

Santa Monica Bay Observatory biogeochemical Mooring Time Series (UCLA)

Santa Monica Bay Observatory studies of harmful algal blooms in Santa Monica Bay (UCLA)

Spray glider operation and research through CORC (SIO)

Surveys of beach sand level and modeling of wave conditions through CDIP (SIO)

VIIRS ocean color instrument calibration/validation effort (USC)

# REFERENCES


## Ecosystems and Climate Trends

Chan, F., J. A. Barth, J. Lubchenco, A. Kirincich, H. Weeks, W. T. Peterson, and B. A. Menge1, 2008. Emergence of Anoxia in the California Current Large Marine Ecosystem. Science, 319(5865):920.

Lynn, R.J., T. Baumgartner, C.A. Collins, J. Garcia, T.L. Hayward, K.D. Hyrenbach, A.W. Mantyla, T. Murphree, A. Shankle, F.B. Schwing, K.M. Sakuma and M. Tegner, 1998. The State of the California Current, 1997-1998: Transition to El Niño Conditions. CalCOFI Reports, 39:25-49.

Lynn, R.J. and S.J. Bograd, 2002. Dynamic Evolution of the 1997-99 El Niño-La Niña Cycle in the Southern California Current System. Progress in Oceanography, 54(1-4):59-75.

Mitarai, S., D.A. Siegel, J.R. Watson, C. Dong, and J.C. McWilliams, 2009. Quantifying connectivity in the coastal ocean with application to the Southern California Bight. J. Geophys. Research, Vol. 114, C10026, doi:10.1029/2008JC005166

Sydeman, W.J., M. M. Hester, J. A. Thayer, F. Gress, P. Martin, and J. Buffa. 2001. Climate change, reproductive performance, and diet composition of marine birds of the southern California Current, Progress in Oceanography, 49:209-329.

Sydeman, W.J., R.W. Bradley, P. Warzybok, C.L. Abraham, J. Jahncke, K.D. Hyrenbach, V. Kousky, J.M. Hipfner, and M.D. Ohman. 2006. Planktivorous auklet *Ptychoramphus aleuticus* responses to ocean climate, 2005: Unusual atmospheric blocking? Geophysical Research Letters, 33, L22S09, doi:10.1029/2006GL026736.

Sydeman, W.J. et al. 2009. Seabird and climate in the California Current – a synthesis of change. CalCOFI Reports 50: 82-106.

## Water Quality

Cetinic, I., Jones, B. H., Moline, M. A., Schofield, O. (2010). Resolving urban plumes using autonomous gliders in the coastal ocean. Continental Shelf Research / Elsevier.

Dong, C., E.Y. Idica, and J.C. McWilliams, 2009. Circulation and multiple-scale variability in the Southern California Bight. Prog. Oceanography 82, 168-190.

Kim, S. Y., B. D. Cornuelle, and E. J. Terrill, 2009. Assessing coastal plumes in a region of multiple discharges: the U.S.-Mexico border. Environ. Sci. Technol., 43 (19), 7450–7457, doi:10.1021/es900775p

Petrenko, A.A., B.H., Jones, T.D., Dickey, M., LeHaitre, and C., Moore, 1997. Effects of a sewage plume on the biology, optical characteristics and particle size distributions of coastal waters. Journal of Geophysical Research-Oceans, 102 (C11), 25061-25071.

Roberts, P.J.W., 1999. Modeling Mamala Bay outfall plumes. I: Near field. Journal of Hydraulic Engineering-Asce, 125 (6), 564-573.

Roberts, P.J.W., W.H., Snyder, and D.J., Baumgartner, 1989. Ocean Outfalls .1. Submerged Wastefield Formation. Journal of Hydraulic Engineering-Asce, 115 (1), 1-25.

Todd, R. E., D. L. Rudnick, and R. E. Davis, 2009. Monitoring the greater San Pedro Bay region using autonomous underwater gliders during fall of 2006. Journal of Geophysical Research, 114, doi:10.1029/2008JC005086.

U.S. Environmental Protection Agency, 1999. Review of potential modeling tools and approaches to support the BEACH program. 823-R-99-002. U.S. EPA Office of Science and Technology, Washington, D.C.

## Marine Operations

National Oceanic and Atmospheric Administration (NOAA), 2006. WaveWatch III Model, Center of Operational Products and Services, http://polar.ncep.noaa.gov/waves/wavewatch/wavewatch.shtml

National Operational Wave Observation Plan, 2009. http://ioos.gov/library/wave_plan_final_03122009.pdf

National Surface Current Mapping Plan, v1.0, 2009. http://ioos.gov/library/surfacecurrentplan9_3lowres.pdf

## Coastal Hazards

California Beach Restoration Survey 2008, 21. http://www.dbw.ca.gov/pdf/DraftCBReS_2008_12052008.pdf

San Diego Foundation Regional Focus 2050 Study http://www.sdfoundation.org/news/pdf/Focus2050glossySDF-ClimateReport.pdf

Ruggiero, P., Holman, R.A. and Beach, R.A., 2004. Wave run-up on a high-energy dissipative beach. Journal Of Geophysical Research-Oceans, 109(C6).

Stockdon, H.F., Holman, R.A., Howd, P.A. and Sallenger, A.H., 2006. Empirical parameterization of setup, swash, and runup. Coastal Engineering, 53(7): 573-588.

FIGURES

ECOSYSTEMS AND CLIMATE TRENDS

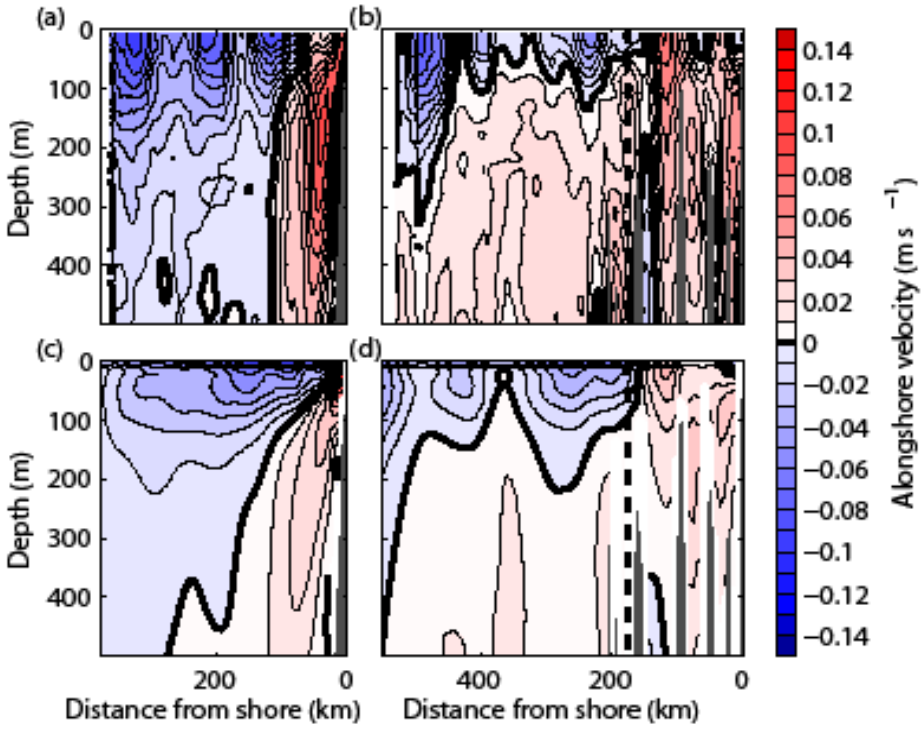


Figure 1. (a,b) Mean alongshore currents from all glider observations, and (c,d) CalCOFI Line 80.0., (b,d) CalCOFI 90.0. Contours are drawn every 0.01 m s-1 with the zero contour bold. Positive velocities are poleward. The dashed line at 175 km along Line 90.0 (b,d) denotes the location of the Santa Rosa Ridge. Dark grey shading represents the bathymetry along the survey lines. The reanalysis incorporates data from gliders, ships, floats, and satellites.

WATER QUALITY

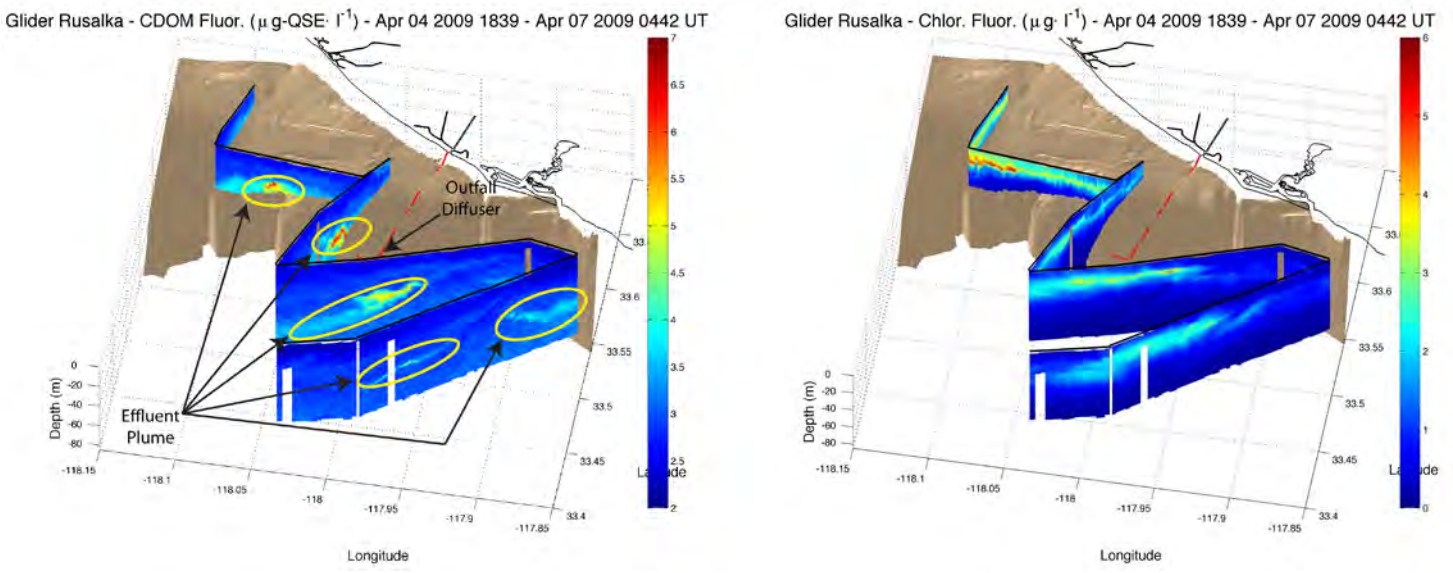


Figure 2. A curtain plot of colored dissolved organic matter (CDOM, left) and chlorophyll (right) from a glider survey of the region off Huntington Beach, CA during April 4-7, 2009. The red line coming from the coast is the Orange County Sanitation District's ocean outfall pipe. The effluent diffuser is at the offshore end of the pipe. The yellow circles highlight regions of CDOM concentration above 4 µg CDOM/L indicative of the suspended effluent plume from the outfall. Effluent is both directions upcoast and downcoast from the outfall due to current reversal during the glider's transit of the area.

## MARINE OPERATIONS

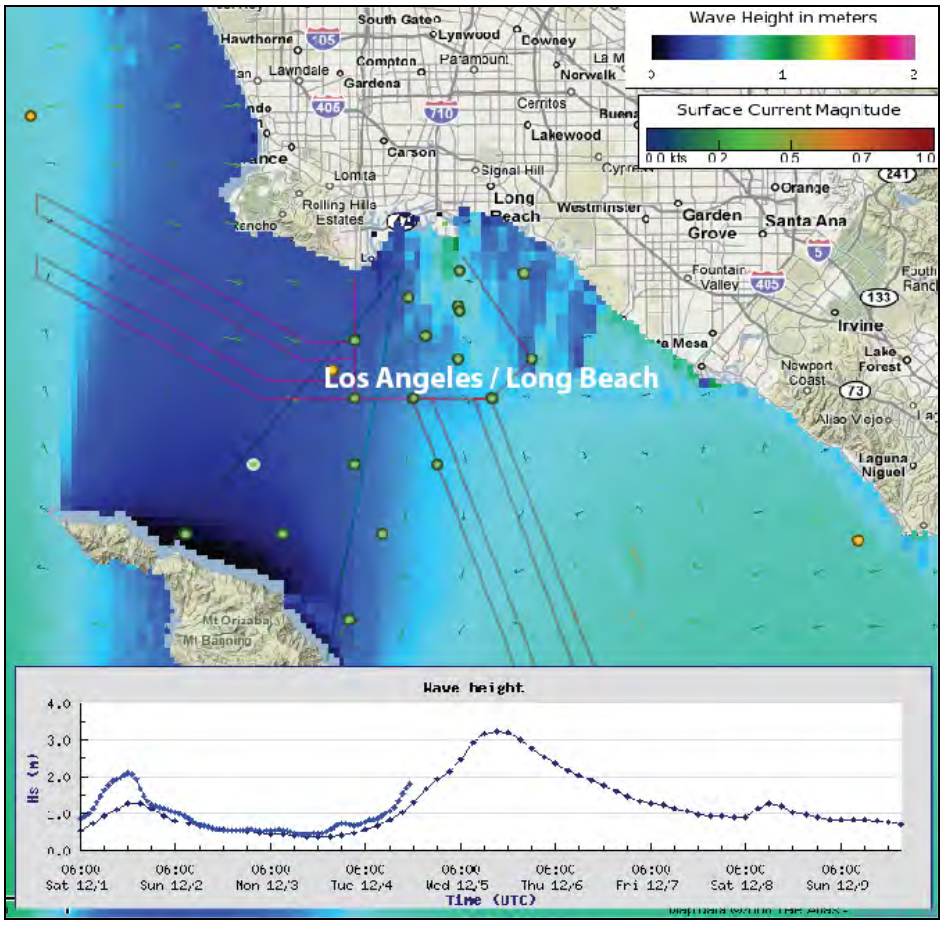


**Figure 3.** Port of Los Angeles and Long Beach. San Pedro Buoy is the yellow dot in north bound separation zone. Each green dot is a key location for the maritime community such as Pilot transfer point or ferry transits. The user can click on the green dots for the complete wave spectra. The arrows represent surface current vectors. www.sccoos.org/data/harbors

Insert: Automated messages are sent to the Long Beach harbor pilots during energetic, long period wave events (over 1 meter and 12 seconds). The threshold warning for these long period events is critical to the pilots' operations as the deep draft vessels will pitch and will lack the under-keel clearance necessary for entering the harbor. The cost estimate is between $100,000-$200,000 per day to retain a vessel offshore.

## COASTAL HAZARDS

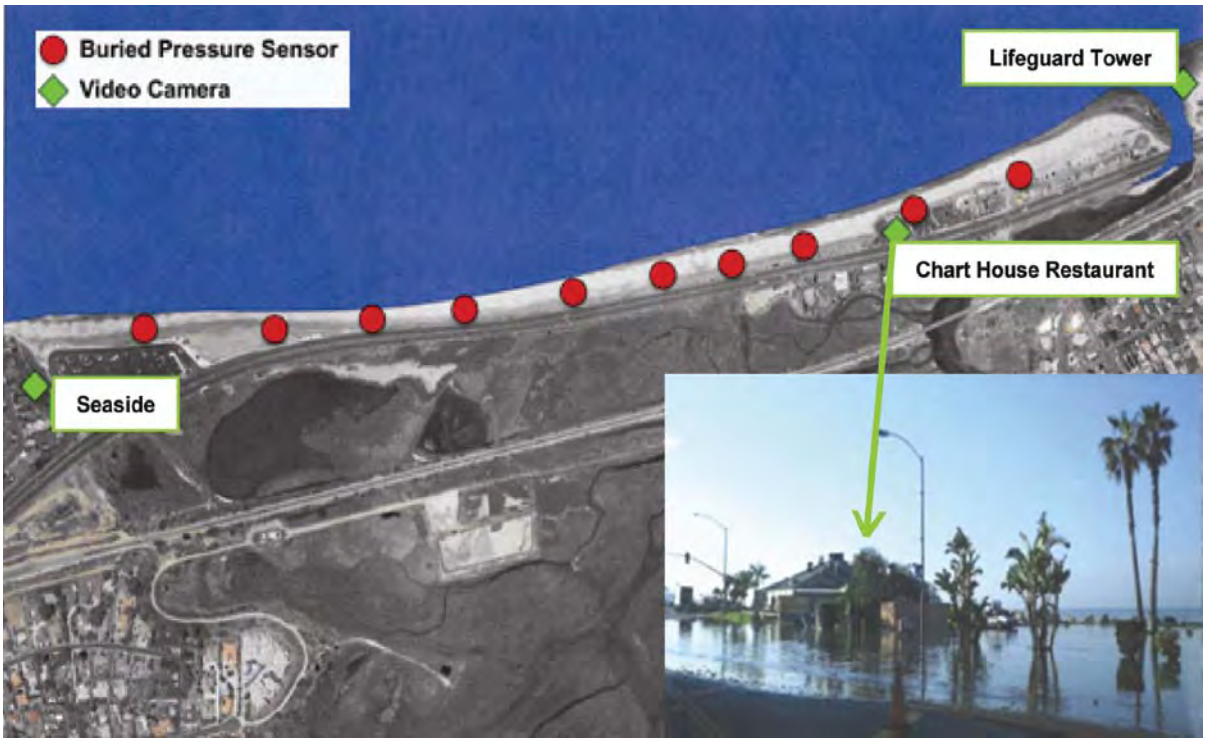


**Figure 4.** Cardiff, CA. Beach erosion and inundation experiment shows proposed pressure sensor and video camera locations.

Pressure sensors are aligned along Highway 101 which has frequent overtopping during high tides and energetic waves. Insert shows the Chart House Restaurant parking lot on January 30, 2010.

## OCEAN MODELS

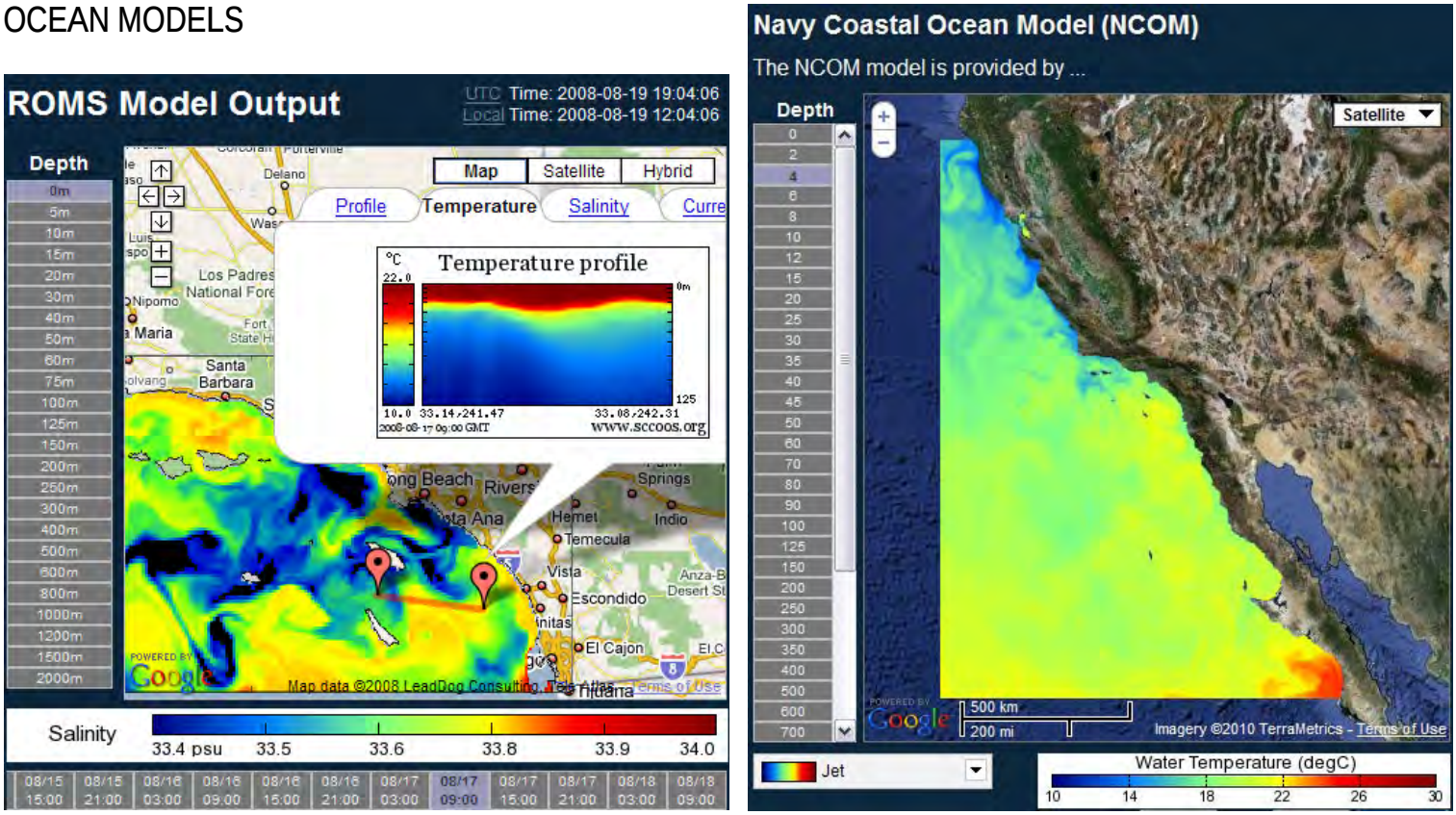


Figure 5. Image on left shows interactive display of Regional Ocean Model System (ROMS) model output provided by the Jet Propulsion Laboratory. The display allows interactive view of 4-Dimensional data by selecting depth, parameter, and cross-section at a given time. Image on right shows similar display (in prototype) of West Coast Global Navy Coastal Ocean Model (NCOM) output with ability to select by depth, layer, and time.

## OUTREACH and EDUCATION

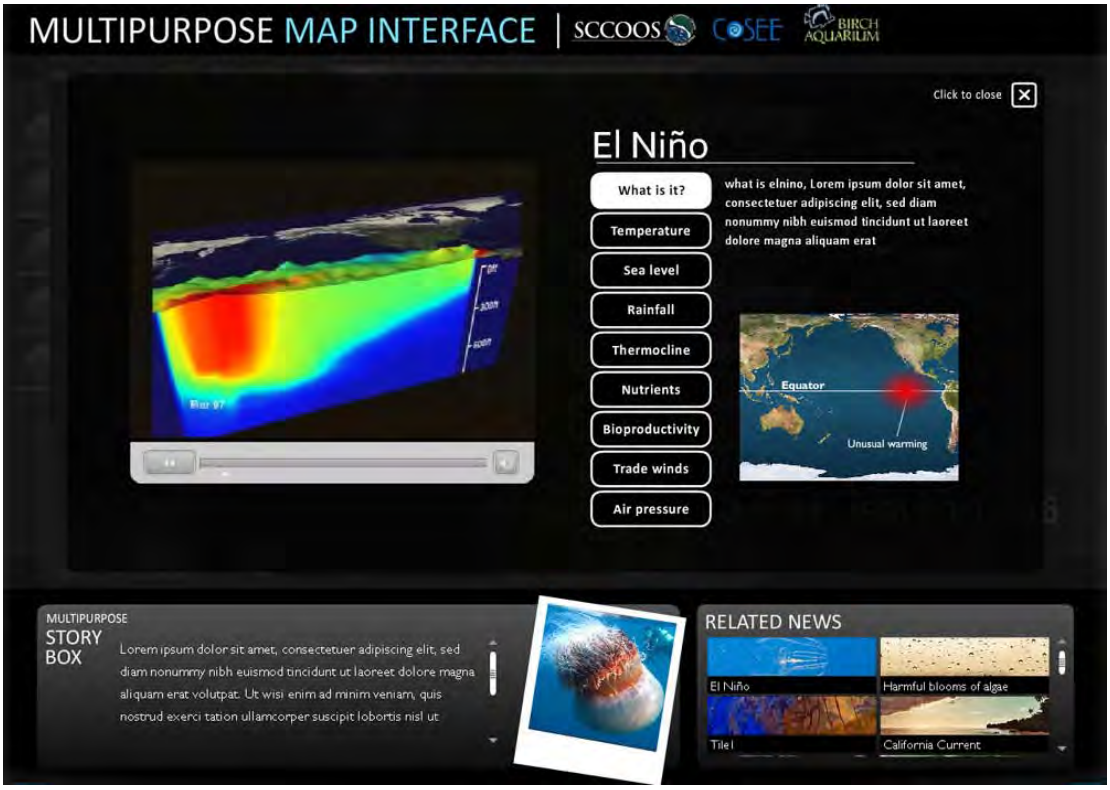


Figure 6.
Interactive map (in development) designed by *Earthguide* that allows visitors to explore climate trends and visualizations of SCCOOS data.

The pilot project illustrates El Niño conditions through SCCOOS SST and is accompanied by stories of recent events, related news, and online resources for teachers and students.

# GOVERNANCE

## MEMORANDUM OF UNDERSTANDING – CONSORTIUM MEMBERS

*California Polytechnic University, San Luis Obispo*
*California State Los Angeles*
*Centro de Investigación Científica y de Educación Superior de Ensenada, Baja California (CICESE)*
*Jet Propulsion Laboratory, NASA*
*Scripps Institution of Oceanography, University of California, San Diego*
*Southern California Coastal Water Research Project*
*Universidad Autónoma de Baja California*
*University of California, Irvine*
*University of California, Los Angeles*
*University of California, Santa Barbara*
*University of Southern California*

## JOINT STRATEGIC ADVISORY COMMITTEE

Deborah Aseltine-Neilson, *California Department of Fish and Game*
Brian Aldrich, *U.S. Coast Guard*
David Bitts, *Pacific Coast Federation of Fishermen's Associations*
Meg Caldwell, *Center for Ocean Solutions*
Mike Clancy, *Fleet Numerical Meteorology and Oceanography Center*
Chris Crompton, *Southern California Stormwater Monitoring Coalition*
Jeff Crooks, *Tijuana River National Estuarine Research Reserve*
Mas Dojiri, *City of Los Angeles*
Bill Douros, *NOAA National Marine Sanctuaries*
Linda Duguay, *USC Sea Grant*
Lesley Ewing, *California Coastal Commission*
Roberto Garcia, *Naval Air Systems Command*
Steven Goldbeck, *San Francisco Bay Conservation and Development Commission*
Dominic Gregorio, *California State Water Resources Control Board*
Larry Honeybourne, *Orange County Health Agency*
Sam Johnson, *U.S. Geological Survey*
Greg Langlois, *California Department of Public Health*
Robin Lewis, *California Oil Spill Prevention and Response*
Amber Mace, *Ocean Protection Council*
Skyli McAfee, *California Ocean Science Trust*
Captain Richard McKenna, *Marine Exchange of Southern California*
Melissa Miller-Hansen, *California Marine Life Protection Act Initiative*
Russ Moll, *California Sea Grant*
Dave Panzer, *U.S. Bureau of Ocean Energy Management, Regulation and Enforcement*
Jonathan Phinney, *NOAA Southwest Fisheries Science Center*
Randy Poole, *Sonoma County Water Agency*
Cheri Recchia, *Ocean Science Trust Monitoring Enterprise*
Dave Reynolds, *NOAA National Weather Service*
George Robertson, *Orange County Sanitation District*
Sam Schuchat, *California Coastal Conservancy*
Sheila Semans, *California Coastal Conservancy*
Arthur Shak, *US Army Corps of Engineers*
Linda Sheehan, *California Coastkeeper Alliance*
Paul Siri, *Ocean Science Applications*
Rebecca Smyth, *NOAA Coastal Services Center*
Ex-Officio, Zdenka Willis, *U.S. Integrated Ocean Observing System*

# RESUMES

## MARK A. BRZEZINSKI

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### Education

Ph.D., Biological Oceanography, Oregon State University, 1987
B.S. Biology/Marine Science, Southampton College of Long Island University

### Professional Experience

Interim Director of the Marine Science Institute, 2010-present
Acting Director of the Marine Science Institute, UCSB, 2007-2009
Professor, Ecology Evolution and Marine Biology, 1999-present
Chair, Interdepartmental Graduate Program in Marine Science, UCSB, 2004-2009
Deputy Director of the Marine Science Institute, UCSB, 2001-2007
Associate Professor, Ecology Evolution and Marine Biology, 1995-1999
Assistant Professor, Biological Sciences, UCSB, 1989-1995
Guest Investigator, Woods Hole Oceanographic Institution, 1989

### Selected Publications

Brzezinski, M.A., Baines, S. B., Balch, W. M., P. Beucher, C.P., Chai, F., Dugdale, R. C., Krause, J. W., Landry, M. R., Marchi, A., Measures, C. I., Nelson, D. M., Parker, A. E., Poulton, A. J., Selph, K. E., Strutton, P. E.,Taylor, A. G.,Twining, B. S. 2010. Co-limitation of diatoms by iron and silicic acid in the equatorial Pacific. Deep-Sea Research II, in press.

Anderson, C. R., D. A. Siegel, R. M. Kudela, and M. A. Brzezinski, 2009. Empirical models of toxigenic Pseudo-nitzschia blooms: potential use as a remote detection tool in the Santa Barbara Channel. Harmful Algae 8: 478-492.

Anderson, C. R., D. A. Siegel, M. A. Brzezinski, and N. Guillocheau, 2008. Controls on temporal patterns in phytoplankton community structure in the Santa Barbara Channel, California. J. Geophys. Res.-Oceans 113: C04038.

Brzezinski, M. A., C. Dumousseaud, J. W. Krause, C. I. Measures, and D. M. Nelson, 2008. Iron and silicic acid concentrations together regulate Si uptake in the equatorial Pacific Ocean. Limnol. Oceanogr. 53: 875-889.

Anderson, C. R., M. A. Brzezinski, L. Washburn, and R. Kudela, 2006. Circulation and environmental conditions during a toxigenic Pseudo-nitzschia australis bloom in the Santa Barbara Channel, California. Mar. Ecol. Prog. Ser. 327: 119-133.

## DAVID A. CARON

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### Education

B.S., University of Rhode Island, Microbiology, 1975
M.S., University of Rhode Island, Oceanography, 1977
Ph.D., MIT and Woods Hole Oceanographic Institution, Biological Oceanography, 1984

### Professional Experience

Professor, University of Southern California, 1999-present
Professor, Department Chair, University of Southern California, 2003-2006

Professor, Section Head, University of Southern California, 1999-2003
Senior Scientist, WHOI, 1997-1999
Visiting Lecturer, University of Massachusetts, Dartmouth, 1996-1998
Associate Scientist with tenure, WHOI, 1993-1997
Associate Scientist, Woods Hole Oceanographic Institution, 1989-1993
Visiting Lecturer, Bridgewater State College, Bridgewater, MA, 1986-1999
Assistant Scientist, Woods Hole Oceanographic Institution, 1985-1989
Assoc. Res. Scientist, Lamont-Doherty Geological Observatory of Columbia Univ., 1984-1985

Recent Awards and Honors: Mary Sears Chair for Excellence in Biological Oceanography (1999); Seymour Hutner Award (Society of Protozoologists; 2002); President, International Society of Protistologists (2004-2005); Fellow, American Academy of Microbiology (2007)

### Selected Publications


Fitzpatrick, E., D.A. Caron and A. Schnetzer. 2010. Development and environmental application of a genus-specific quantitative PCR approach for Pseudo-nitzschia species. Marine Biology. In press.

Gilg, I.C., L.A. Amaral-Zettler, P.D. Countway, S. Moorthi, A. Schnetzer and D.A. Caron. 2010. Phylogenetic affiliations of mesopelagic acantharia and acantharian-like environmental 18S rRNA genes off the Southern California coast. Protist. 161: 197–211.

Caron, D.A. and P.D. Countway. 2009. Hypotheses on the role of the protistan rare biosphere in a changing world. Aquatic Microbial Ecology. 57: 227–238.

Caron, D.A. 2009. New approaches and accomplishments for assessing protistan diversity and ecology in natural ecosystems. Bioscience. 59: 287-299.

Caron, D.A., P.D. Countway, P. Savai, R.J. Gast, A. Schnetzer, S.D. Moorthi, M.R. Dennett, D.M. Moran and A.C. Jones. 2009. Defining DNA-based operational taxonomic units for microbial eukaryote ecology. Applied and Environmental Microbiology. 75: 5797-5808


## YI CHAO


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### Education

Ph.D., Atmospheric and Oceanic Science (AOS) Program, Princeton University, 1990
M.A., Geophysical Fluid Dynamics (GFD) Program, Princeton University, 1987
B.Sc., Atmospheric Physics, University of Science and Technology of China, 1985

### Professional Experience

Adjunct Professor, Department of Atmospheric and Oceanic Sciences, UCLA, 2006-present
Scientist, Research Scientist, and Principal Scientist, Jet Propulsion Laboratory, 1993-present
Deputy Manager & Manager, Climate, Oceans and Solid Earth Section, JPL, 2006-2009
Supervisor, Ocean-Atmosphere Interaction Group, JPL, 2005-2006
Post-doctoral Scholar, University of California at Los Angeles, 1990-1992

### Selected Publications


Wang, X., Y. Chao, C. Dong, J. Farrara, Z. Li, J. C. McWilliams, J. D. Paduan, and L. K. Rosenfeld, 2009. Modeling tides in Monterey Bay, California. Deep-Sea Research II, doi:10.1016/j.dsr2.2008.08.012.

Li, Z., Y. Chao, J.C. McWilliams, and K. Ide, 2009. A Three-Dimensional Variational Data Assimilation Scheme for the Regional Ocean Modeling System. Journal of Atmospheric and Oceanic Technology, 25, 2074-2090.

Chao, Y., Z. Li, J. Farrara, J. C. McWilliams, J. Bellingham, X. Capet, F. Chavez, J.-K. Choi, R. Davis, J. Doyle, D. Frantaoni, P. P. Li, P. Marchesiello, M. A. Moline, J. Paduan, and S. Ramp, 2008.

Development, implementation and evaluation of a data-assimilative ocean forecasting system off the central California coast. Deep-Sea Research II, doi:10.1016/j.dsr2.2008.08.011.
Chao, Y., Z. Li, J. D. Farrara, M. A. Moline, O. M. E. Schofield, and S. J. Majumdar, 2008. Synergistic applications of autonomous underwater vehicles and the regional ocean modeling system in coastal ocean forecasting. Limnol. Oceanogr. 53: 2251-2263.
Li, Z., Y. Chao, J. C. McWilliams, and K. Ide, 2008. A three-dimensional variational data assimilation scheme for the Regional Ocean Modeling System: Implementation and basic experiments, J. Geophys. Res., 113, C05002, doi:10.1029/2006JC004042

## BRUCE D. CORNUELLE

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### Professional Preparation

B.A., Physics, Magna Cum Laude, Pomona College, Claremont, CA, 1978
Ph.D., Physical Oceanography, MIT-Woods Hole Oceanographic Institution Joint Program, 1983

### Professional Experience

Research Oceanographer, Senior Lecturer (unsalaried), Scripps Institution of Oceanography, 1999-present
Associate Research Oceanographer, Lecturer (unsalaried), Scripps Institution of Oceanography,1991-1999
Assistant Research Oceanographer, Scripps Institution of Oceanography, 1985-1991
Mellon Postdoctoral Fellow, Scripps Institution of Oceanography, 1983-1985
Research Assistant, MIT, 1978-1983
Director, CASPO Division, Scripps Institution of Oceanography, 2007-2009
Director, PORD, Scripps Institution of Oceanography, 1999-2007
Associate Director, Physical Oceanography Research Division, SIO, 1992-1999

Recent Awards and Honors: NSF Graduate Fellowship, Mellon Foundation Postdoctoral Fellow, 2002
Acoustical Society of America; Medwin Prize for Acoustical Oceanography, Fellow, ASA

### Selected Publications

Hoteit, I., B. Cornuelle, S.Y. Kim, G. Forget, A. Kohl and E. Terrill, "Assessing 4D-VAR for dynamical mapping of coastal high-frequency radar in San Diego," Dynamics of Atmospheres and Oceans, 48, 175-197, doi:10.1016/ j.dynatmoce.2008.11.005 (2009).
Kim, S.Y., B.D. Cornuelle, and E.J. Terrill, "Anisotropic Response of Surface Currents to the Wind in a Coastal Region," J. Phys. Oceanogr., 39, 1512-1533, doi:10.1175/2009jpo4013.1 (2009).
Kim, S.Y., E.J. Terrill, and B.D. Cornuelle, "Assessing Coastal Plumes in a Region of Multiple Discharges: The US-Mexico Border," Environ. Sci. Technol., 43, 7450-7457, doi:10.1021/Es900775p (2009).
Moore, A.M., H.G. Arango, E. Di Lorenzo, A.J. Miller, and B.D. Cornuelle, "An Adjoint Sensitivity Analysis of the Southern California Current Circulation and Ecosystem," J. Phys. Oceanogr., 39, 702-720, doi:10.1175/2008jpo3740.1 (2009).
Rasmussen, L.L., B.D. Cornuelle, L.A. Levin, J.L. Largier, and E. Di Lorenzo, "Effects of small-scale features and local wind forcing on tracer dispersion and estimates of population connectivity in a regional scale circulation model," J. Geophys. Res-Oceans., 114, doi:10.1029/2008jc004777 (2009).

## RUSS E. DAVIS

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### Education

Ph.D. and M.S. Chemical Engineering, Stanford University, 1967

B.S. Chemical Engineering, University of California, Berkeley, 1963

### Professional Experience

Research Professor, Scripps Institution of Oceanography, 2007-present
Research Oceanographer, Scripps Institution of Oceanography, 2000-2007
Professor of Oceanography, Scripps Institution of Oceanography, 1977-2000
Assistant/Associate Professor, Scripps Institution of Oceanography, 1968-1977
Assistant Research Geophysicist, University of California San Diego, 1967-1968

Recent Awards and Honors: Member, National Academy of Science; Fellow, American Geophysical Union; Fellow, American Academy of Arts and Sciences; Fellow, American Meteorological Society; A.G. Huntsman Award (1997); Henry Stommel Medal, WHOI (2000); David Packard Distinguished Lecturer (2006); Albert I Medal, IAPSO (2007)

### Selected Publications


Davis, R.E., M.D. Ohman, B. Hodges, D.L. Rudnick, J.T. Sherman, 2008. Glider surveillance of physics and biology in the southern California Current. Limnol. Oceanogr. 53, 2151-2168.

Checkley, D.M., Jr., R.E. Davis, A.W. Herman, G.A. Jackson, B. Beanlands, L.A. Regier, 2008. Assessing plankton and other particles in situ with the SOLOPC. Limnol. Oceanogr. 53, 2123-2136.

Sherman, J., R.E. Davis, W.B. Owens and J. Valdes, 2001. The autonomous underwater glider 'Spray.' IEEE Oceanic Eng., 26, 437-446.

Davis, R.E., J.T. Sherman and J. Dufour, 2001. Profiling ALACEs and other advances in autonomous subsurface floats. J. Atm. Oceanic Tech., 18, 982-993.


## CURTIS DEUTSCH


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### Education

Ph.D., Atmospheric and Oceanic Science, Princeton University, Princeton, 2003
B.S., Physics, Oberlin College, Oberlin, 1996

### Professional Experience

Assistant Professor, Department of Atmospheric and Oceanic Science, UCLA, present
Postdoc, School of Oceanography at the University of Washington
Science Steering Committee for the Ocean Carbon and Biogeochemistry Program

### Selected Publications


Deutsch, C. A., J. J. Tewksbury, R. B. Huey, K. S. Sheldon, C. K. Ghalambor, D. C. Haak, P. R. Martin *(2008)*, Impacts of climate warming on terrestrial ectotherms across latitude, *Proceedings of the National Academy of Sciences*.

Deutsch, C., J. L. Sarmiento, D. M. Sigman, N. Gruber, J. P. Dunne *(2007)*, Spatial coupling of nitrogen inputs and losses in the ocean, *Nature*.

Deutsch, C., S. Emerson, L. Thompson *(2005)*, Fingerprints of climate change in North Pacific oxygen, *Geophysical Research Letters*.

Deutsch, C., D. M. Sigman, R. Thunell, A. N. Meckler, G. H. Haug *(2004)*, Isotopic Constraints on the Glacial/Interglacial Oceanic Nitrogen Budget, *Global Biogeochemical Cycles*.

Deutsch, C., N. Gruber, R. M. Key, J. L. Sarmiento, A. Ganaschaud *(2001)*, Denitrification and $N_2$ fixation in the Pacific Ocean, *Global Biogeochemical Cycles*.

## ANDREW G. DICKSON

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### Education

B.Sc., University of Liverpool, UK Chemical Oceanography, 1974
Ph.D., University of Liverpool, UK Chemical Oceanography, 1978
Postdoc at MBA, Plymouth, UK Chemical Modeling of Estuaries, 1978-1980
Postdoc at University of Florida Acid-base chemistry in seawater, 1980-1982

### Professional Experience

Professor of Marine Chemistry, Scripps Institution of Oceanography, 2010-present
Professor-in-Residence of Marine Chemistry, Scripps Institution of Oceanography, 2006-2009
Assoc. Prof.-in-Residence of Marine Chemistry, Scripps Institution of Oceanography, 1995-2006
Assoc. Research Chemist, Scripps Institution of Oceanography, 1991-1995
Lecturer, Department of Chemistry, University of California, San Diego, 1988,'89,'90
Lecturer, Scripps Institution of Oceanography, 1987-1995
Adjunct Lecturer, Scripps Institution of Oceanography, 1985
Assistant Research Chemist, Scripps Institution of Oceanography, 1983–1991
Visiting Assistant Research Scientist, Department of Chemistry, University of Florida, 1983
Visiting Assistant Research Chemist, Scripps Institution of Oceanography, 1982-1983

### Selected Publications

Checkley, D. M., Dickson, A. G., Takahashi, M., Radich, J. A., Eisenkolb, N., & Asch, R., 2009. Elevated $CO_2$ enhances otolith growth in young fish. *Science* 324, 1683.

Sabine, C. L., Feely, R. F., Millero, F. J., Dickson, A. G., Langdon, C., Mecking, S., & Greeley, D., 2008. Decadal Changes in Pacific Carbon. *Journal of Geophysical Research* 113, C07021, doi:10.1029/2007JC004577.

Dickson, A. G., Sabine, C. L., & Christian, J. R. (Eds.) 2007. Guide to best practices for ocean $CO_2$ measurements. PICES Special Publication 3, 191 pp.

Dickson, A. G., Afghan, J. D. & Anderson, G. C., 2003. Reference materials for oceanic CO2 analysis: A method for the certification of total alkalinity. *Marine Chemistry* 80, 185–197.

Lueker, T. J., Dickson, A. G. & Keeling, C. D., 2000. Ocean $pCO_2$ calculated from dissolved inorganic carbon, alkalinity, and equations for $K_1$ and $K_2$: validation based on laboratory measurements of $CO_2$ in gas and seawater at equilibrium. *Marine Chemistry* 70, 105–119.

## FALK FEDDERSON

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### Education

Ph.D., Scripps Institution of Oceanography, Physical Oceanography, 1999
B.S., New York University, Computer Science, 1993 (Phi Beta Kappa)
B.E., Stevens Institute of Technology, Electrical Engineering, 1993 (Valedictorian)

### Professional Experience

Associate Research Oceanographer, Scripps Institution of Oceanography, 2008-present
Assistant Research Oceanographer, Scripps Institution of Oceanography, 2008-2009
Woods Hole Postdoctoral Scholar, 2000-2002
Post-doctoral Researcher, Scripps Institution of Oceanography, 1999-2000
Graduate Research Assistant, Scripps Institution of Oceanography, 1993-1999

### Select Publications

Clark, D. B., F. Feddersen, R. T. Guza, Cross-shore Surfzone Tracer Dispersion in an Alongshore Current, J. Geophys. Res., in press, 2010.

Feddersen, F., Quality Controlling Surfzone Acoustic Doppler Velocimeter Observations to Estimate the Turbulent Dissipation Rate, J. Atmospheric Oceanic Tech., in press, 2010.

Spydell, M. and F. Feddersen, Lagrangian drifter dispersion in the surfzone: Directionally-spread normally incident waves, J. Phys. Oceangr., 39, 809-830, DOI: 10.1175/2008JPO3892.1, 2009.

Spydell, M., F. Feddersen, and R. T. Guza, Observations of drifter dispersion in the surfzone: The effect of sheared alongshore currents, J. Geophys. Res., 114, doi:10.1029/2009JC005328, 2009.

Feddersen. F., Breaking wave induced cross-shore tracer dispersion in the surfzone: Model results and scalings, J. Geophys. Res., 112, C0912, doi:10.1029/2006JC004006, 2007.

## RALF GOERICKE

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### Education

Vordiplom, Biology, Kiel University, 1981
M.A., Ecology, Indiana University, 1983
Ph.D., Biological Oceanography, Harvard University, 1989
Post Doc, Chemical Oceanography, Woods Hole Oceanographic Institution, 1990-1993

### Professional Experience

Research Oceanographer, Scripps Institution of Oceanography, 2004-present
Associate Research Oceanographer, Scripps Institution of Oceanography, 2001-2004
Assistant Research Oceanographer, Scripps Institution of Oceanography, 1993-2001

### Selected Publications

S. McClatchie, R. Goericke, G. Auad, and K. Hill, in press 2010, Re-assessment of the stock-recruit and temperature-recruit relationships for Pacific sardine (Sardinops sagax). Can. J. Fish Aquatic Science

Roth, M., M. Latz, D. Dehyn, and R. Goericke, 2010. Green fluorescent protein regulation in the coral Acroporo yongei during photoadaptation, in press. J. Experimental Biology.

Hereu, C.M, B. Lavaniegos, and R. Goericke, 2010. Grazing impact of salp (Tunicata, Thaliacea) assemblages in the eastern tropical North Pacific, *J. Plankton Res. 32 (6): 785-804*

S. McClatchie, R. Goericke, R. Cosgrove, and R. Vetter, In press 2010. Oxygen in the Southern California Bight: multidecadal trends, impact of El Niño, and implications for demersal fisheries. Geophys. Res. Letters.

M. R. Landry, M. D. Ohman, R. Goericke, M. R. Stukel, and K. Tsyrklevich, 2009. Lagrangian studies of phytoplankton growth and grazing relationships in a coastal upwelling ecosystem off Southern California. Progress in Oceanography, doi:10.1016/j.pocean.2009.07.026.

## ROBERT T. GUZA

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### Education

B.A., Johns Hopkins University, Maryland
M.S., Scripps Institution of Oceanography, UCSD, 1971
Ph.D., Scripps Institution of Oceanography, UCSD, 1974

### Professional Experience

Professor, Scripps Institution of Oceanography, 1975-present
Center for Coastal Studies/Integrative Oceanography Division, Co-Director, 1994-2009

Selected Professional Activities: Outstanding Journal Paper Award (Amer. Soc. Civil Eng., Ocean Division, 1991); AGU Fellow (l993); California Shore & Beach Preservation Association 2001 award for outstanding contributions to coastal engineering (with Pawka and O'Reilly); AGU Outstanding Student Paper (junior author w/ student Okihiro 1991, Schmidt 2002, Omand 2006 & Apotsos 2006)

### Selected Publications


Clark, D.B., F, Feddersen, and R.T. Guza, Cross-shore Surfzone Tracer Dispersion in an Alongshore Current, J. Geophys. Res. Oceans, in press.

Spydell, M., F. Feddersen, and R.T. Guza, 2009, Observations of drifter dispersion in the surfzone: The effect of sheared alongshore currents. J. Geophys. Res. Oceans, 114, C07028, doi:10.1029/2009JC005328.

Yates, M.L, R.T. Guza, and W.C. O'Reilly, Beach Shoreline Change: Observations and Equilibrium Modeling, J. Geophys Res, 114, C09014, doi:10.1029/2009JC005359, 2009

Young, A.P., R.T. Guza, R.E. Flick, W.C. O'Reilly, and R. Gutierrez. Rain, Waves, and Short-Term Seacliff Evolution, Marine Geology, V267, Issues 1-2, pp 1-7, 2009

Young, A.P., R.E. Flick, R. Gutierrez, and R.T. Guza, 2009, Comparison of short-term seacliff retreat measurement methods in Del Mar, California, Geomorphology, *V 112*, *318-323*


## BURTON H. JONES


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### Education

B.S., Biological Engineering, Rose-Hulman Institute of Technology, 1971
Ph.D., Zoology (Biological Oceanography), Duke University, 1977
Post-Doc, Biological Oceanography, Bigelow Laboratory for Ocean Sciences, 1977-1980

### Professional Experience

Research Professor, Department of Biological Sciences, USC, 2009-present
Research Associate Professor, Department of Biological Sciences, USC, 1993-2008
Natl. Research Council Senior Fellow, NOAA Great Lakes Environ. Research Laboratory, 1992-93
Acting Associate Director, Allan Hancock Foundation, 1983-86
Research Assistant Professor, Department of Biological Sciences, USC, 1981-93
Research Associate, Department of Biological Sciences, USC, 1980-81
Postdoctoral Fellow/Research Scientist, Bigelow Laboratory for Ocean Sciences, 1977-80
Research Assistant/Teaching Assistant, Duke University, 1972-77/1971-72

### Selected Publications


Corcoran, A.A., Reifel, K.M., Jones, B.H., Shipe, R.F., 2010. Spatiotemporal development of physical, chemical, and biological characteristics of stormwater plumes in Santa Monica Bay, California (USA). *Journal of Sea Research* In press.

Caron, D.A., Garneau, M.-E., Seubert, E., Howard, M.D.A., Darjany, L., Schnetzer, A., Cetinic, I., Filteau, G., Lauri, P., Jones, B., Trussell, S., 2010. Harmful algae and their potential impacts on desalination operations off southern California. *Water Research* 43.

Noble, M., B. Jones, P. Hamilton, J. Xu, G. Robertson, L. Rosenfeld, and J. Largier, 2009. Cross-shelf transport into nearshore waters due to shoaling internal tides in San Pedro Bay, CA. Continental Shelf Research 29:1768-1785.

Reifel, K. M., S. C. Johnson, P. M. DiGiacomo, M. J. Mengel, N. P. Nezlin, J. A. Warrick, and B. H. Jones, 2009. Impacts of Stormwater Runoff Contaminants in the Southern California Bight: Relationships among Plume Constituents. Continental Shelf Research 29:1821-1835.

Cetinic, I., G. Toro-Farmer, M. Ragan, C. Oberg, and B. H. Jones, 2009. Calibration procedure for Slocum glider deployed optical instruments. Optics Express 17:15420-15430.

## SAM McCLATCHIE

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National Marine Fisheries Service, La Jolla, CA, Sam.McClatchie@noaa.gov

### Education

Ph.D., Oceanography. Dalhousie University, Halifax, Nova Scotia, Canada, 1985
First Class Honors B.Sc., Zoology, University of Canterbury, Christchurch, NZ, 1979

### Selected Publications

McClatchie, S., Goericke, R. Rich Cosgrove, R. and Vetter, R. In press. Oxygen in the Southern California Bight: multidecadal trends and implications for demersal fisheries. Geophysical Research Letters.

McClatchie, S., Goericke, R., Auad, G. and Hill, K. In press. Re-assessing the temperature index for Pacific sardine (*Sardinops sagax*) stock assessment. Canadian J. of Fisheries and Aquatic Sciences.

Weber, E.D. and McClatchie, S. 2010. Predictive Models of Northern Anchovy *Engraulis mordax* and Pacific Sardine *Sardinops sagax* Spawning Habitat in the California Current. Marine Ecology Progress Series 406: 251-263.

Weber, E.D. and McClatchie, S. 2009. rcalcofi: Analysis and visualization of CalCOFI data in R. CalCOFI Reports 50: 178-185.

McClatchie, S., Goericke, R, Schwing, F. and 29 other authors. 2009. The state of the California Current, 2008–2009: Cold conditions drive regional differences. CalCOFI Reports 50: 43-68.

## JOHN A. MCGOWAN

Research Professor of Oceanography, Emeritus, Scripps Institution of Oceanography,
University of California, San Diego, CA, 858-534-2074, jmcgowan@ucsd.edu

### Education

B.S., M.S., Oregon State University
Ph.D., Scripps Institution of Oceanography, UCSD

### Research Interests

Multiple stable states in the community of the North and South Pacific central water masses; Large scale patterns in space and time and the Californian El Niños; Diversity maintenance; Biogeography; Timeseries in coastal California; Climate and pelagic ecology.

### Selected Publications

Hatch, M. B. A., S. A. Schellenberg, J. A. McGowan and M. L. Carter (in prep). Ba/Ca variations in the modern intertidal bean clam *Donax gouldii*: An upwelling proxy?

Carter, M. L., J. McGowan, L. Busse, E. Venrick, and M. Hilbern (in prep). Phytoplankton bloom dynamics in Southern California: Have there been any changes since 1930?

McGowan, J. A. and M. Williamson. 2010. The copepod communities of the North and South Pacific gyres and the form of species abundance distributions. Journal of Plankton Research 32, 273-283.

Kim, H.-J., A. Miller, J. A. McGowan, and M. L. Carter, 2009. Coastal phytoplankton blooms in the Southern California Bight. Progress in Oceanography doi:10.1016/jpocean.2009.05.002.
McGowan, J. A., D. R. Cayan and L. M. Dorman, 1998. Climate-Ocean variability and ecosystem response in the Northeast Pacific. Science 281, 210-217.

## JAMES C. MCWILLIAMS

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### Education

B.S., Honors, Engineering and Applied Mathematics, California Institute of Technology, 1968
M.S., Applied Mathematics, Harvard University, 1969
Ph.D., Applied Mathematics, Harvard University, 1971
Research Fellow in Geophysical Fluid Dynamics, Harvard University, 1971-74

### Professional Experience

Louis B. Slichter Professor of Earth Sciences in the Institute of Geophysics and Planetary Physics and Department of Atmospheric Sciences, UCLA, Los Angeles, CA, 1994-present; Chair, 2007-present
Research Scientist at the National Center for Atmospheric Research, Boulder, CO, 1974-2005

Honors and Committees: Fellow of the American Geophysical Union (2001); Member of the National Academy of Sciences (2002); JPL Earth Science Advisory Council (1997-present); Visiting Committee for the Division of Geological and Planetary Sciences, California Institute of Technology (1999-present); Scientific Committee for the Département Terre Atmosphère Océan, École Normale Supérieure (2003-present); Fluid Envelope Sub-Section Head, National Academy of Sciences (2007-present)

### Recent Publications

Dong, C., E.Y. Idica, and J.C. McWilliams, 2009. Circulation and multiple-scale variability in the Southern California Bight. Prog. Oceanography 82, 168-190.
Mitarai, S., D.A. Siegel, J.R. Watson, C. Dong, and J.C. McWilliams, 2009. Quantifying connectivity in the coastal ocean with application to the Southern California Bight. J. Geophys. Research, Vol. 114, C10026, 21 PP., 2009. doi:10.1029/2008JC005166
McWilliams, J.C., 2009. Targeted coastal circulation phenomena in diagnostic analyses and forecasts. *Dyn. Atmos. Oceans*, 48, 3-15.
McWilliams, J.C., F. Colas, and M.J. Molemaker, 2009. Cold filamentary intensification and oceanic surface convergence lines. *Geophys. Res. Lett*., 36, L18602. doi:10.1029/2009GL039402.
Gruber, N., H. Frenzel, S.C. Doney, P. Marchesiello, J.C. McWilliams, J.R. Moisan, J. Oram, G.K. Plattner, and K.D. Stolzenbach, 2006. Eddy-resolving simulations of plankton ecosystem dynamics in the California Current System: Part I: Model description, evaluation, and ecosystem structure. Deep Sea Res. I. 53, 1483-1516.

## MARK ALAN MOLINE

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### Education

Ph.D. Biology, University of California, Santa Barbara, 1991-1996
B.A. Biology, St. Olaf College, 1987
Postdoctoral Associate, Rutgers University, 1996-1997

### Professional Experience

Director, Center for Coastal Marine Science, 2004-present
Professor, California Polytechnic State University, 2007
Associate Professor, California Polytechnic State University, 2003-2007
Adjunct Professor, UC Santa Barbara, 2000-2004
Assistant Professor, California Polytechnic State University, 1998-2002

Recent Awards and Honors: Fellow, California Council on Science and Technology (2008); Distinguished Scholarship Award, Cal Poly State University (2007); Editors' Citation for Excellence in Refereeing, American Geophysical Union (2005); Earth Systems Scholar, NASA (2004); Frontiers Scientist, National Academy of Science (2002); National Research Distinction Award, Cal Poly State University (2002); Presidential Early Career Award for Scientists and Engineers (2002); Young Investigator Award, Office of Naval Research (2000); New Investigator Program Award, NASA (1999)

### Selected Publications


Schofield, O., H.M. Ducklow, D.G. Martinson, M.P. Meredith, M. A. Moline, and W.R. Fraser. Observing marine ecosystems responses to rapid climate change along the West Antarctic Peninsula. Science, 328: 1520-1523. DOI: 10.1126/science.1185779.

Benoit-Bird, K. J., M. A. Moline, C. M. Waluk, and I. C. Robbins. 2009. Integrated measurements of acoustical and optical thin layers I: Vertical scales of association. Continental Shelf Research, 30 (1): 17-28.doi:10.1016/j.csr.2009.08.001.

Moline, M. A., K. J. Benoit-Bird, I. C. Robbins, M. Schroth-Miller, C. M. Waluk, B. Zelenke. 2009. Integrated measurements of acoustical and optical thin layers II: Horizontal length scales. Continental Shelf Research, 30 (1): 29-38.doi:10.1016/j.csr.2009.08.004.

Moline, M. A., and O. M. Schofield. 2009. Remote real-time video-enabled docking for underwater autonomous platforms. J. Atmos. Oceanic. Technol. 26 (12): 2665–2672, doi:10.1175/2009JTECHO666.1.

Moline, M. A., S. M. Blackwell, J. F. Case, S. H. D. Haddock, C.M. Herren, C.M. Orrico, E. Terrill. 2009. Bioluminescence to reveal structure and interaction of coastal planktonic communities. Deep-Sea Res., 56: 232-245, doi:10.1016/j.dsr2.2008.08.002.


## WILLIAM C. O'REILLY


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### Education

B.A., University of Michigan, Env. Eng.,1983
B.A., University of Michigan, Civil Eng.,1983
M.S., Ph.D., Scripps Institution of Oceanography, Oceanography, 1985, 1991
Post-Doctoral Researcher, Scripps Institution of Oceanography, 1991-1993

### Professional Experience

Senior Development Engineer, Scripps Institution of Oceanography, 1993-present
Research Assistant Professor (25% time), US Naval Postgraduate School, 1996-2001
Visiting Scholar, College of Engineering, U.C. Berkeley, 1999-2001

### Selected Publications


Ardhuin, F, W.C. O'Reilly, T.H.C. Herbers, and P.F. Jessen, 2003. Swell transformation across the continental shelf. Part I. Attenuation and diretional broadening. J. Phys. Oceanogr., 33, 1921-1939.

Elgar, S., R. T. Guza, W. C. O'Reilly, B. Raubenheimer, and T.H.C. Herbers, 2001. Wave energy and direction observed near a pier, J. Waterway, Port, Coastal, and Ocean Engineering, 127, 2-6.

Ardhuin, F, Herbers, T.H.C., and W.C. O'Reilly, 2001. A hybrid Eulerian-Lagrangian model for wave spectra evolution with application to bottom dissipation on the continental shelf, J. Phys. Oceanogr., 106.
Herbers, T.H.C., Hendrickson, E.J., and W.C. O'Reilly, 2000. Propagation of swell across a wide continental shelf, J. Geophys. Res. 105, 19729–19737.
O'Reilly, W. and R.T. Guza, 1998. Assimilating coastal wave observations into regional swell predictions. Part I: Inverse Methods. Journal of Physical Oceanography, 28(4): 679-691.

## DANIEL L. RUDNICK

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### Education

B.A. Cum Laude, University of California, San Diego, Physics, 1981
Ph.D., Scripps Institution of Oceanography, UCSD, Oceanography, 1987
Postdoc, Woods Hole Oceanographic Institution, 1987-1989

### Professional Experience

Professor, Scripps Institution of Oceanography, 2001-present
Deputy Director of Education, Scripps Institution of Oceanography, 2005-2008
Associate Professor, Scripps Institution of Oceanography, 1997-2001
Assistant Professor, Scripps Institution of Oceanography, 1993-1997
Assistant Professor, School of Oceanography, University of Washington, 1989-1993

### Selected Publications

Cole, S. T., D. L. Rudnick, and J. A. Colosi, 2010: Seasonal evolution of upper-ocean horizontal structure and the remnant mixed layer. *Journal of Geophysical Research*, 115, C04012, doi:10.1029/2009JC005654.
Todd, R. E., D. L. Rudnick, and R. E. Davis, 2009: Monitoring the greater San Pedro Bay region using autonomous underwater gliders during fall of 2006. *Journal of Geophysical Research*, 114, doi:10.1029/2008JC005086.
Davis, R. E., M. D. Ohman, D. L. Rudnick, J. T. Sherman, and B. Hodges, 2008: Glider surveillance of physics and biology in the southern California Current system. *Limnol. Oceanogr.* 53, 2151-2168.
Rudnick, D. L. and J. Klinke, 2007: The underway conductivity-temperature-depth instrument. *J. Atmos. Oceanic Technol.*, 24, 1910-1923.
Rudnick, D. L. and W. Munk, 2006: Scattering from the mixed layer base into the sound shadow. *Journal of the Acoustical Society of America*, 120, 2580-2594.

## REBECCA SHIPE

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### Education

B.S., The Pennsylvania State University, 1995 (Biology)
Ph.D., University of California, Santa Barbara, 2000 (Marine Science)

### Professional Experience

Asst. Professor, Inst. of the Environment and Dept. of Ecology and Evolutionary Biology, UCLA, 2003-2010
Postdoctoral Researcher, Biological Sciences Department, USC, Los Angeles, 2001-2002

### Selected Publications

Corcoran, A.A., Reifel, K. M., Jones, B. H., Shipe, R. F., 2010. Spatiotemporal development of physical, chemical and biological characteristics of stormwater plumes in Santa Monica Bay, California (USA). Journal of Sea Research. 63:129-142.
Shipe, R.F., Leinweber, A., Gruber, N., 2008. Abiotic controls of potentially harmful algal blooms in Santa Monica Bay, California. Continental Shelf Research. 28:2584-2593.
Shipe R.F., Carpenter E.J., Govil S., Capone D.G, 2007. Limitation of phytoplankton production by Si and N in the western Atlantic Ocean. Marine Ecology Progress Series. 338:33-45.
Shipe, R. F., Curtaz, J.,Capone, D. G. and Carpenter, E. J, 2006. Diatom biomass and productivity in oceanic and plume-influenced waters of the western tropical Atlantic Ocean. Deep Sea Research I. 53:1320-1334.
Shipe, R. F., and M. A. Brzezinski, 2003. Siliceous plankton dominate primary and new productivity during onset of El Nino conditions in the Santa Barbara Basin, California. J. of Marine Systems. 42:127-143.

## DAVID ALAN SIEGEL

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### Education

Ph.D., Geological Sciences (Ocean Physics), University of Southern California, 1988
M.S., Geological Sciences, University of Southern California, 1986
B.S., Engineering Sciences, B.A., Chemistry, UCSD, 1982

### Professional Experience

Director, Earth Research Institute, UCSB, 2010
Director, Institute for Computational Earth System Science, UCSB, 2002-2010
Professor, Department of Geography, UCSB, 1998-present
Adjunct Scientist, Woods Hole Oceanographic Institution, 2001
Professor, Donald Bren School of Environmental Science and Management, UCSB, 1998-2001
Associate Professor, Department of Geography, UCSB, 1993-1998
Assistant Professor, Department of Geography, UCSB, 1990-1993
Postdoctoral Scholar, Woods Hole Oceanographic Institution, 1989

### Selected Publications

Costello, C., A. Rassweiler, D. Siegel, G. De Leo, F. Micheli and A. Rosenberg, 2010: The value of spatial information in MPA network design, *Proceedings of the National Academy of Sciences*, in press.
Watson, J.R., S. Mitarai, D. A. Siegel, J. E. Caselle, C. Dong, and J.C. McWilliams, 2010: Realized and potential larval connectivity in the Southern California Bight. *Marine Ecology Progress Series*, 401, 31-48.
Berkley, H.A., B.E. Kendall, S. Mitarai and D.A. Siegel, 2010: Turbulent dispersal promotes species coexistence, *Ecology Letters*, 13, 360-371.
Cavanaugh K.C., D.A. Siegel, B.P. Kinlan and D.C. Reed, 2010: Scaling giant kelp field measurements to regional scales using satellite observations, *Marine Ecology Progress Series*, 403, 13-27.
White, C. K.A. Selkoe, J. Watson, D.A. Siegel, D.C. Zacherl, and R.J.Toonen, 2010: Ocean currents help explain population genetic structure. *Proceedings of the Royal Society, B: Biological Sci.*, 277,1685-1694.

## WILLIAM J. SYDEMAN

President/Senior Scientist, Farallon Institute for Advanced Ecosystem Research,
Petaluma, CA, 707-478-1381, wsydeman@faralloninstitute.org

### Education

Ph.D., Ecology, University of California, Davis, CA, 1999

M.Sc., Biology, Northern Arizona University, Flagstaff, AZ, 1985
B.S., Biology, Lewis and Clark College, Portland, OR, 1979

### Professional Experience

Research Associate, Bodega Marine Laboratory, UC Davis, 2008-present
President/Senior Scientist, Farallon Institute, Petaluma, CA, 2007-present
Research Associate, Integrative Oceanography, UCSD, La Jolla, CA, 2000-present
Director of Marine Ecology, PRBO Conservation Science, Petaluma, CA, 1992-2007

Professional Activities: NCEAS working group, Marine Climate Impacts (June 2009-present); Science Advisory Team, California Ocean Protection Council (2008-present); Co-Chair, Advisory Panel for Marine Birds and Mammals, PICES (2003-present)

### Selected Publications


Sydeman, W.J., S.A. Thompson, J.A. Santora, M.F. Henry, K.H. Morgan, and S.D. Batten. 2010. Macro-ecology of seabird-plankton associations in the North Pacific. Journal of Plankton Research (in press).

Sydeman, W.J. and S.J. Bograd. 2009. Marine ecosystems, phenology and climate change: Introduction. Marine Ecology Progress Series 393:185-188.

Sydeman, W.J. et al. 2009. Seabird and climate in the California Current – a synthesis of change. CalCOFI Reports 50: 82-106.

Sydeman, W.J., J.F. Piatt, and H. Browman (Editors), 2007. Seabirds as Indicators of Marine Ecosystems. Special Volume. Marine Ecology Progress Series 352.

Thayer, J.A. and W.J. Sydeman, 2007. Spatio-temporal variability in prey harvest and reproductive ecology piscivorous seabird, *Cerorhinca monocerata*, in an upwelling system. Marine Ecology Progress Series 329:253-265


## ERIC J. TERRILL


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### Education

Ph.D., Physical Oceanography-Applied Ocean Sciences, Scripps Institution of Oceanography, 1998
B.S., Applied Mechanics and Engineering Science (*magna cum laude*), UCSD, 1993

### Project Experience

Technical Director of SCCOOS and founder and director of the Coastal Observing R&D Center (CORDC) at Marine Physical Laboratory, Scripps Institution of Oceanography. Recipient of the Young Investigator Award, Office of Naval Research

### Selected Publications


Kim, S. Y., B. D. Cornuelle, and E. J. Terrill, 2009. Assessing coastal plumes in a region of multiple discharges: the U.S.-Mexico border. Environ. Sci. Technol., 43 (19), 7450–7457, doi:10.1021/es900775p

Kim, S., E.J. Terrill. A statistical model for water quality predictions from a river discharge using coastal observations. Eos Trans. AGU, 88(52), Fall Meeting, Supplement.

Kim, S. Y., E. J. Terrill, and B. D. Cornuelle, 2008. Mapping surface currents from HF radar radial velocity measurements using optimal interpolation, J. Geophys. Res., 113, C10023,doi:10.1029/2007JC004244

Hoteit, I., B. D. Cornuelle, S. Y. Kim, G. Forget, A. Kohl, and E. J. Terrill, 2008, Assessing 4D-VAR for dynamical mapping of coastal high-frequency radar in San Diego, Dynam. Atmos. Oceans, doi:10.1016/j.dynatmoce. 2008.11.005

## JULIANNA O. THOMAS

Executive Director, Southern California Coastal Ocean Observing System
Program Manager, Coastal Data Information Program, Scripps Institution of Oceanography,
University of California, San Diego, 858-534-3034, jot@cdip.ucsd.edu

### Professional Experience

Executive Director, Southern California Coastal Ocean Observing System (SCCOOS), 2008-present
Program Manager, Coastal Data Information Program (CDIP) and Southern California Beach Processes Study (SCBPS), 2001-present
Data Manager, CDIP, 1984-2001

### Selected Publications

Swail, V., J. Thomas, S. Gulev, J. Turton, M. P. Etala de Aso, B. Lee, R. Jensen, D. Meldrum, and V. Cardone, Enhanced Global Wave Observation Network, OceanObs 09.

Thomas, J., E. Terrill, R. Guza, and W. O'Reilly, Long Beach/Los Angeles Harbor IOOS Demonstration Project, Regional Integrated Ocean Observing System, CFDA 11.473 CSC, NOAA, 2007.

## LIBE WASHBURN

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### Education

Ph.D. Engineering Science, University of California, San Diego, 1982
M.S. Engineering Science, University of California, San Diego, 1978
B.S. Mechanical Engineering, University of Arizona, 1974

### Professional Experience

Professor, Department of Geography, UCSB, 1998-present
Associate Professor, Department of Geography, UCSB, 1993-1998
Assistant Professor, Department of Geography, UCSB, 1991-1993
Research Assistant Professor of Physical Oceanography, Center for Earth Sciences, USC, 1985-1990
Postgraduate Research Oceanographer, Scripps Institution of Oceanography, 1982-1985
Research Asst./Teaching Asst., Dept. of Applied Mechanics & Engineering Sciences, UCSD, 1977-1982
Aeroballistics Engineer, General Dynamics, Convair Division, San Diego, CA, 1975-1977

### Selected Publications

Melton, C., L. Washburn, and C. Gotschalk, 2009, Wind relaxations and poleward flow events in a coastal upwelling system on the central California coast, in press, J. Geophys. Res., Vol. 114, C11016, doi:10.1029/2009JC005397

Ohlmann, C., P. White, L. Washburn, E. Terrill, B.M. Emery, and M. Otero, 2007, Interpretation of coastal HF radar derived surface currents with high resolution drifter data, J. of Atmospheric and Oceanic Tech., 24, 4, 666–680.

Cudaback, C., L. Washburn, and E.P. Dever, 2005, Inner-shelf circulation near Pt. Conception California, 110, C10007, doi:10.1029/2004JC002608.

Bassin, C.J., L. Washburn, M.A. Brzezinski, and E.E. McPhee-Shaw, 2005, Sub-mesoscale coastal eddies observed by high frequency radar: A new mechanism for delivering nutrients to kelp forests in the Southern California Bight, Geophys. Res. Let., 32, L12604, doi:10.1029/2005GL023017.

Beckenbach, E.H., and L. Washburn 2004, "Low frequency waves in the Santa Barbara Channel observed by high frequency radar", J. Geophys. Res., 109, doi:10.1029/2003JC00199.

FY2011 Implementation of the U.S. Integrated Ocean Observing System (IOOS)
Southern California Coastal Ocean Observing System (SCCOOS)

Responses to National Environmental Policy Act (NEPA) Questions

Question C1. Is the proposed activity going to be conducted in partnership with NOAA or would the proposed activity require NOAA's direct involvement, activity, or oversight? If yes, describe NOAA's involvement, activity, or oversight, including the name of the office or program that is involved.

NOAA representatives from the offices of the Coastal Services Center, National Marine Sanctuaries, National Weather Service, Sea Grant, Southwest Fisheries Science Center, and Tijuana River National Estuarine Research Reserve participate in the SCCOOS and CeNCOOS Joint Strategic Advisory Committee.

Question C2. Would the proposed activity involve any other federal agency(ies) partnership, direct involvement, activity, or oversight? If yes, provide the name(s) of the agency(ies) and describe its involvement, activity, or oversight.

The proposed activity would involve the participation of federal agencies on the SCCOOS and CeNCOOS Joint Strategic Advisory Committee including U.S. Army Corps of Engineers, U.S. Coast Guard, U.S. Geological Survey, and U.S. Bureau of Ocean Energy Management, Regulation and Enforcement.

Question D1. Provide a brief description of the location of the proposed activity.

The proposed activity is located in the Southern California Coastal Ocean region. The Categorical Exclusion for the Southern California Coastal Ocean Observing System (SCCOOS) Project is available online and upon request.

Question E1. List any federal, state, or local permits, authorizations, or waivers that would be required to complete the proposed activity. Provide the date the permit, authorization, or waiver was obtained or will be obtained. Provide copies of the permit, authorization, or waiver as appropriate. Was a NEPA analysis prepared for the permit, authorization, or waiver? If yes, state the title of the NEPA analysis and provide copies of the NEPA analysis. NO.

Question F1. Is there the potential for the proposed activity to cause changes that would be different from normal ambient conditions (e.g., temperature, light, turbidity, noise, other human activity levels, etc.)? If yes, describe the changes and the circumstances that would cause these changes. NO.

AQUARIUM
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September 19, 2010

Julie Thomas, Executive Director
Southern California Coastal Ocean Observing System
Scripps Institution of Oceanography
9500 Gilman Drive 0214
La Jolla, CA 92093

Dear Ms. Thomas:

I am writing in support of the SCCOOS proposal for continued funding from NOPP. It is very clear that the entire IOOS system—the backbone and the regional programs—is a critically important addition to the nation's ocean infrastructure. In some areas, such as Southern California, the regional ocean observing system takes on special importance because of the intensity of societal pressures on the ocean, the multiplicity of uses, and economic and public health implications of those uses, and the complex oceanographic processes on a variety of spatial and temporal scales.

The Southern California Bight is surrounded by a population of more than 20 million people—more than the population of the entire State of New York. It is home to the Nation's two largest ports, through which enter more than one-third of all imports to the U.S. It receives more than 1.3 bgd of partially treated wastewater. It is a major recreational outlet for millions of people with some of the nations, and the worlds, most beautiful and popular beaches. It has the potential to be home to a significant offshore aquaculture industry, and the availability of critical oceanographic data will be important in determining whether, or not, this happens. It soon will become the next segment of the California coast for establishment of a series of Marine Protected Areas. The list goes on, and one thing is clear and that is that we need diverse and high quality oceanographic data to generate the kinds of information that are needed to manage this enormously valuable resource for maximum benefit to society while protecting the natural ecosystem.

The next phase in the evolution of SCCOOS, and indeed of all of the regional systems, will be to forge more and stronger partnerships with a diverse set of potential end-users of the data and to work with them to develop an array of informational products. These informational products must be tailored to meet the needs and opportunities of the end users and be delivered on schedules that are sensitive to their needs. SCCOOS is well positioned to grow its customer base and meet the need for tailored and timely products. We also need to make the public more aware of the importance of SCCOOS and other components of IOOS so they will be supportive of the public investments that are needed to sustain this important network.

The Aquarium of the Pacific is the only large aquarium in all of Southern California with an attendance of 1.5 million visitors per year. We are very interested in strengthening our partnership with SCCOOS to make the public more aware of the power and the promise of ocean observing and to bring some of the informational products you are developing to our visitors in our new Ocean Science Center which will open in May 2011 and feature a Science on a Sphere. We also are very interested in working with SCCOOS to convene groups of potential stakeholders to help shape the portfolio of informational products to serve a variety of end-user needs.

In summary, I, and the Aquarium of the Pacific, are very supportive of SCCOOS efforts and applaud the progress SCCOOS has made in building regional observing capabilities for Southern California. We urge NOPP to support SCCOOS's proposal to continue development of this valuable and needed regional observing system.

Sincerely,

Jerry R. Schubel
President and CEO

100 Aquarium Way, Long Beach, CA 90802
Telephone 562 590 3100 Facsimile 562 590 3109
www.aquariumofpacific.org

BIRCH AQUARIUM
AT SCRIPPS
Scripps Institution of Oceanography
University of California, San Diego

September 22, 2010

Dr. Eric Terrill, Technical Director
Julie Thomas, Executive Director
Southern California Coastal Ocean Observing System (SCCOOS)
Scripps Institution of Oceanography
University of California, San Diego
9500 Gilman Drive, La Jolla, CA 92093

Dear Eric and Julie,

I am delighted to write this letter in support of the Southern California Coastal Ocean Observing System (SCCOOS) five-year proposal to the National Oceanographic Partnership Program (NOPP) and National Oceanic and Atmospheric Administration (NOAA). As the Scripps Institution of Oceanography's Director of the *Center for Ocean Sciences Education Excellence-California* (COSEE CA) and a Program Scientist at the Birch Aquarium at Scripps, I am pleased to use the resources and partnerships of both organizations to support SCCOOS and to promote the use of ocean observing system data and resources by science educators and students throughout California and the nation.

We are working with *Earthguide*, an educational media development group based at Scripps, to design and build an educational interface that links climate-related ocean and coastal science topics to near real-time data from the Southern California Bight provided by SCCOOS. The pilot project will introduce the El Niño phenomenon and link it to SCCOOS sea surface temperature data. The project will be launched with an interactive touch screen display at the Birch Aquarium, a format that could also be featured at other aquariums and science centers. The display will be accompanied by an online *Earthguide* resource that supports related K-14 curricula and highlights SCCOOS data sets. Online resources will include an activity guide for teachers and materials for students. SCCOOS and *Earthguide* will coordinate with COSEE CA to introduce the project at teacher professional development events and promote it in additional venues.

COSEE-CA and the Birch Aquarium at Scripps offer you their full and unqualified support for this five-year proposal. We look forward to hearing that SCCOOS outreach and education efforts will be strengthened and expanded with this funding.

Sincerely,

Cheryl Peach
SIO Director, COSEE-CA
Scripps Institution of Oceanography

Stephen Birch Aquarium-Museum
Scripps Institution of Oceanography
University of California, San Diego

Mailing Address
9500 Gilman Drive, Dept. 0207
La Jolla, CA 92093-0207

Location Address
2300 Expedition Way
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Telephone (858) 534-FISH
Fax (858) 534-7114
Web Site aquarium.ucsd.edu

United States Department of the Interior

BUREAU OF OCEAN ENERGY
MANAGEMENT, REGULATION AND ENFORCEMENT

Pacific OCS Region
770 Paseo Camarillo
Camarillo, California 93010-6064

September 27, 2010

Sirs,

The Pacific Region of the Bureau of Ocean Energy Management, Regulation and Enforcement (BOEM), formerly the Minerals Management Service, supports continued funding by the National Oceanic and Atmospheric Administration (NOAA) of grant proposals from the Southern California and Central and Northern California Coastal Ocean Observing Systems (SCCOOS and CeNCOOS, respectively). The data provided by these efforts has been a great asset to our management of the offshore oil and gas program and is expected to continue to be an asset to our assessment and management of offshore renewable energy, sand and gravel, and marine minerals offshore California.

We strongly encourage continued support for both SCCOOS and CeNCOOS to maintain, operate, and improve the regional observing systems. The upcoming fiscal year's grant is entitled "FY2011 Implementation of the U.S. Integrated Ocean Observing System (IOOS)." It is important that the programs retain the ability to generate information and maintain the ability to disseminate it to the public, academia and government agencies. The information and data gathered during the grant period will assist BOEM in our mission. We strongly endorse both observing systems' efforts and, in particular, this proposal.

In order to fulfill our mission to secure ocean energy and oil and gas on the outer continental shelf (OCS) in a safe and environmentally sound manner, we use information about the marine environment in making management and regulatory decisions and during day-to-day operations. Both SCCOOS and CeNCOOS provide a valued source of detailed information that improves our ability to perform our mission. Off the Pacific coast, offshore oil and gas operations are concentrated in the Southern California Bight. In addition, we anticipate that the Renewable Energy Program will become an increasingly important part of our mission, and opportunities for the development of renewable energy on the OCS extends along much of Pacific Coast of the United States. We have developed renewable energy/alternative use regulations and guidance according to the requirements of the Energy Policy Act of 2005 (see 30 CFR 285). We also have mission responsibilities providing access to OCS sand and gravel and offshore marine hard minerals for which both the SCCOOS and CeNCOOS programs can provide data.

We are pleased that SCCOOS and CeNCOOS can provide timely and accurate oceanographic information and data products that are useful to BOEM and other agencies including current direction and speed, meteorological data, river plume locations, pollutant sources, and other marine information.

To date, BOEM has used SCCOOS data in a variety of ways:

- Response to oil spills – BOEM uses near-shore oceanic currents on a small scale as well as wind speeds and directions. The SCCOOS data products such as the High Frequency (HF) radar, buoy information and related information greatly enhances our ability to determine spilled oil trajectories. It is also a valuable training tool for oil spill drills.
- River plume and pollutant tracking – The use of SCCOOS data products, such as the HF radar and buoy information, enable us to follow these episodic events. Recently, we have used this information to develop environmental impact analyses for offshore oil and gas projects.
- Sea surface temperature and chlorophyll data – The SCCOOS provides continuous information on these critical oceanographic parameters that we can use for such biological events as domoic acid-related events.
- Fish and fisheries – The SCCOOS oceanographic data (current speed and direction) has been used to help elucidate patterns of larval fish transport. The BOEM does use this kind of information to understand the contribution of offshore structures (such as oil platforms) to fish populations at a regional scale.

We have not directly used CeNCOOS data as of yet, but we anticipate this data source will become valuable to us in the near future as we review and take action on renewable energy proposals as well as the sand and gravel and offshore marine hard minerals proposals.

The websites of these observing programs provide a single, data-rich portal through which the many types and kinds of oceanographic and biological data can be accessed. A variety of publications are also available, providing BOEM scientists access to a single website and the opportunity to gather both mission-critical data and links to other websites that provide related information.

In sum, BOEM will continue to utilize the valuable data and information that the SCCOOS and CeNCOOS provide to us and many other users. Therefore, we regard the funding NOAA provides as critical to the continuation of these observing programs.

Sincerely,

Ellen G. Aronson
Regional Director
Pacific OCS Region

Coastal Conservancy

September 20, 2010

Steven Ramp
Program Director
Central and Northern California
Ocean Observing System (CeNCOOS)
Monterey Bay Aquarium Research Institute
7700 Sandholdt Road
*Moss Landing, CA 95039*

Julie Thomas
Executive Director
Southern California Coastal Ocean
Observing System (SCCOOS)
Scripps Institution of Oceanography
9500 Gilman Drive, 0214
La Jolla, CA 92093-0214

RE: Support for California Integrated Ocean Observing System Implementation Proposals

Dear Dr. Ramp and Ms. Thomas:

Californian's take great pride in their beautiful, productive and healthy coastline. In 2004, in collaboration with IOOS and California's two regional associations, CeNCOOS and SCCOOS, the State invested $21 million in start-up funds to develop an ambitous program to monitor and map ocean surrents along our entire coast. With this network of shore-based, high-frequency radar (HFR) stations, and with the work of your two organizations, Californians now have access to mapped ocean surface currents 24 hours a day, regardless of daylight or weather conditions. And because of this seamless network, California is in a much better situation to respond hazards like the disastrous oil spill that hit the Gulf Coast was this spring and summer.

The continued development, implementation and maintenance of a responsive and integrated observing system in California is critically important for the State and its coastal communities. Recently, the California Ocean Protection Council (OPC) adopted a resolution to continue to support the development of IOOS, and in California, CeNCOOS and SCCOOS as regional centers of expertise for ocean observing. The OPC Science Advisory Team has also issued a consensus statement on the importance of ocean observations for State management priorities.

I am happy to see CeNCOOS and SCCOOS continue to strive to work collaboratively to address statewide issues through the Joint Strategic Advisory Committee, on which I serve, and through the timely delivery of seamless, integrated ocean observing products, including those based on HFR observations. I support these efforts, and I support your proposals to continue the positive development and implementation of an integrated ocean observing system in California.

Sincerely,

Sheila Semans
COCMP Program Manager
State Coastal Conservancy/Ocean Protection Council

1330 Broadway, 13th Floor
Oakland, California 94612-2530
510•286•1015 *Fax:* 510•286•0470



CALIFORNIA COASTKEEPER ALLIANCE

PO Box 3156, Fremont, CA 94539
(510) 770 9764 www.cacoastkeeper.org

September 23, 2010

Dr. Steve Ramp, Program Director
Central and Northern California Ocean Observing System

Ms. Julie Thomas, Executive Director
Southern California Coastal Ocean Observing System

Dear Dr. Ramp and Ms. Thomas,

The California Coastkeeper Alliance (CCKA) supports the continued development and operation of the Central and Northern California Ocean Observing System (CeNCOOS) and the Southern California Coastal Ocean Observing System (SCCOOS) through their proposals to the National Oceanographic Partnership Program and NOAA, entitled, "CeNCOOS: Integrating Marine Observations to Inform Decision Makers and the General Public," and "FY2011: Implementation of the U.S. Integrated Ocean Observing System: Southern California Ocean Observing System," respectively. CCKA is a member of the CeNCOOS/SCCOOS Joint Strategic Advisory Committee. Founded in 1999, CCKA is a non-profit organization that coordinates, supports and enhances the work of the local California Waterkeeper programs to provide a statewide voice for safeguarding California's waters, and its world-renowned coast and ocean, for the benefit of all Californians and for California's future. We advocate before state decision-makers on waterway- and ocean-related issues important to California's communities.

We believe the work and mission of California's Ocean Observing Systems (OOS) align well with CCKA's mission and goals. There is tremendous value in having an independent organization provide both continuous and real-time ocean observing data products, and assembly and synthesis of local ocean data sets, to assist with our mission of protecting water quality and protecting the coast against sea level rise. The data products and services provided by the California OOS are invaluable in advancing the ocean information needed to address land-sea interactions and issues. For example, the ability to provide real-time and forecasting contaminant tracking through a user-friendly online interface is extremely useful in understanding coastal water pollution and informing health managers. We also see value in the long-term monitoring that serves to aid in siting and evaluating marine protected areas and informing our team and the public on oceanic shifts and impacts from our changing climate. We look forward to future collaborations and furthering our relationship with the OOS and greatly support the focus and plans outlined in the proposals.

There is a clear, continuing need to operate, maintain and improve the regional observing system. CeNCOOS and SCCOOS data are and will continue to be essential for monitoring both short and long-term environmental change. We and the state would benefit from expansion of both programs, including an increase in capacity to enhance instrumentation and provide more information and products. We strongly endorse the need for fully developed local Regional Associations that benefit our health, wildlife, economy and oceans through a focus on ecosystems, climate, coastal hazards, and water quality. Thank you.

Sincerely,

Linda Sheehan, Executive Director

UNIVERSITY OF CALIFORNIA, SAN DIEGO UCSD

BERKELEY • DAVIS • IRVINE • LOS ANGELES • MERCED • RIVERSIDE • SAN DIEGO • SAN FRANCISCO SANTA BARBARA • SANTA CRUZ

SCRIPPS INSTITUTION OF OCEANOGRAPHY
CLIMATE, ATMOSPHERIC SCIENCE & PHYSICAL OCEANOGRAPHY (SIO)

9500 GILMAN DRIVE #0224
LA JOLLA, CALIFORNIA 92093-0224

August 29, 2010

Julie Thomas, Executive Director, SCCOOS
Eric Terrill, Chief Scientist and Director, SCCOOS

Dear Julie, Eric:

I am happy to write in support of your effort to continue SCCOOS. SCCOOS's science-based decision support provides vital data, information and research regarding climate change, ecosystems, marine operations, water quality, hazards and other issues to a wide range of coastal decision makers in California.

Over the past year we have made progress in finding ways to collaborate between SCOOS and the California Nevada Climate Applications Program (CNAP), which is one of the NOAA sponsored Regional Integrated Sciences and Assessments (RISA) centers. Our focus on diagnostics of climate variability and change and your real time products and modeling are proving to be a useful complementary alliance. The coastal user community is very diverse and our partnership is providing us access to a set of coastal stakeholders that otherwise would be difficult for us to connect with. Through the interactions that you have set up, we are also working well with SCCOOS regional ocean modeling researchers (B. Cornuelle and colleagues) to add some new cloud-inferred net radiation estimates into Cornuelle et al.'s ocean model; preliminary results are encouraging in improving the accuracy of model ocean state variables when compared to observations. The joint work that we are establishing with California Sea Grant to assess information gaps and user profiles for a set of wetland managers and other coastal users is another area where we should be able to make headway.

The improved ocean observations, coastal predictions, and a range of information that you are supplying to coastal decision makers is of great importance, especially in view of the variability of the coastal zone and the pending additional changes that are looming as global climate warms. We are impressed at the progress you have made in spinning up an engaged, user-friendly program for the California coastal community. We look forward to working with you on coastal climate issues and helping you convey salient information to the user community.

Sincerely,

Dan Cayan
*Director, California Nevada Applications Program*

CSU The California State University
COUNCIL ON OCEAN AFFAIRS, SCIENCE AND TECHNOLOGY

*www.calstate.edu/coast*

Dr. Steve Ramp, Program Director
Central and Northern California
Ocean Observing System

Ms. Julie Thomas, Executive Director
Southern California Coastal Ocean
Observing System

September 24, 2010

Dear Dr. Ramp and Ms. Thomas,

The California State University (CSU) Council on Ocean Affairs, Science and Technology (COAST) supports the continued development and operation of the Central and Northern California Ocean Observing System (CeNCOOS) and the Southern California Coastal Ocean Observing System (SCCOOS) through their proposals to the National Oceanographic Partnership Program and the National Oceanic and Atmospheric Administration titled, "CeNCOOS: Integrating Marine Observations to Inform Decision Makers and the General Public" and "FY2011: Implementation of the U.S. Integrated Ocean Observing System: Southern California Ocean Observing System", respectively.

The CSU spans the entire state of California and CSU COAST faculty, technical staff and students from a number of campuses participate in both CeNCOOS and SCCOOS. CSU data stream to and can be accessed through the CeNCOOS and SCCOOS websites and the OOSes in turn make use of the data to advance our understanding of the coastal ocean and the processes that affect it. These relationships are mutually beneficial and aid each program in meetings its mission and goals. Additionally, CSU COAST looks forward to working with CeNCOOS and SCCOOS to provide unique educational and workforce development opportunities to CSU students.

There is a clear, continuing need to operate, maintain and improve the regional observing systems. The data collected are and will continue to be essential for monitoring both short and long-term environmental change. CSU COAST supports the expansion of both CeNCOOS and SCCOOS so that they have the capacity to increase instrumentation and provide additional information and products. We strongly endorse the need for fully developed local Regional Associations that benefit our health, wildlife, economy and oceans through a focus on ecosystems and climate, coastal hazards, water quality, and marine operations.

Sincerely,

Krista Kamer, Ph.D.
COAST Coordinator

Bakersfield Channel Islands Chico Dominguez Hills East Bay Fresno Fullerton Humboldt Long Beach
Los Angeles Maritime Academy Monterey Bay Northridge Pomona Sacramento San Bernardino
San Diego San Francisco San José San Luis Obispo San Marcos Sonoma Stanislaus

CENTER FOR OCEAN SOLUTIONS

September 24, 2010

Dr. Steve Ramp, Program Director
Central and Northern California Ocean Observing System

Ms. Julie Thomas, Executive Director
Southern California Coastal Ocean Observing System

Dear Dr. Ramp and Ms. Thomas,

The Center for Ocean Solutions (COS) supports the continued development and operation of the Central and Northern California Ocean Observing System (CeNCOOS) and the Southern California Coastal Ocean Observing System (SCCOOS) through their proposals to the National Oceanographic Partnership Program and the National Oceanic and Atmospheric Administration titled, "CeNCOOS: Integrating Marine Observations to Inform Decision Makers and the General Public," and "FY2011: Implementation of the U.S. Integrated Ocean Observing System: Southern California Ocean Observing System," respectively.

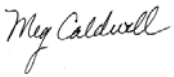
Stanford University, the Monterey Bay Aquarium, and the Monterey Bay Aquarium Research Institute joined forces in 2008 to create COS. By combining expertise in biology, engineering, oceanography, economics, law and policy, public education and outreach, COS works to solve ocean challenges. In addition, COS focuses on enhancing graduate-level marine educational opportunities as well as providing exceptional outreach programs to inform and empower action by decision makers from local, state, national and international public, private, and nongovernmental organizations.

Heritage Harbor
99 Pacific St. | Suite 155A | Monterey, CA 93940
831.333.2077 **T** | 831.333.2081 **F**
www.centerforoceansolutions.org

We believe the mission of CeNCOOS and SCCOOS align well with our mission and main initiatives: climate change; marine spatial planning, land-sea interactions, and education and outreach. Specifically, we see value in long-term monitoring that serves to address the siting and evaluation marine protected areas, dynamic oceanographic conditions as they relate to marine spatial planning, and informing our team and the public on oceanic shifts and impacts from our changing climate. We appreciate the efforts of CeNCOOS and SCCOOS to integrate such a variety of technologies and scientists to inform decisions makers as well as to contribute knowledge through COS-hosted workshops. We look forward to future collaborations and furthering our relationship with California's two Regional Associations (RAs) and greatly support the focus and plans outlined in the proposals.

There is a clear, continuing need to operate, maintain and improve the regional observing system. Data from the RAs are and will continue to be essential for monitoring both short and long-term environmental change. We would like to see both programs expand and have the capacity to increase instrumentation and provide more information and products. We strongly endorse the need for a fully developed local Regional Association that benefits our health, wildlife, economy and oceans through a focus on ecosystems and climate, coastal hazards, water quality, and marine operations.

Sincerely,



Meg Caldwell
Executive Director

CoSEE
Centers for Ocean Sciences Education Excellence

September 21, 2010

Dr. Steve Ramp, Program Director
Central and Northern California Ocean Observing System

Ms. Julie Thomas, Executive Director
Southern California Coastal Ocean Observing System

Dear Dr. Ramp and Ms. Thomas,

The Centers for Ocean Sciences for Education Excellence - Networked Ocean World (COSEE NOW) strongly supports the continued development and operation of the Central and Northern California Ocean Observing System (CeNCOOS) and the Southern California Coastal Ocean Observing System (SCCOOS) through their proposals to the National Oceanographic Partnership Program and the National Oceanic and Atmospheric Administration.

COSEE NOW is comprised of a national network of scientists and educators who are using real time data and resources from ocean observing systems to enhance public understanding of the ocean. Our mission is to use transformative ocean research and effective education practices to inspire students and the general public in ocean exploration, discovery and stewardship. Our collaborative efforts with CeNCOOS and SCCOOS, including the development of an educational podcast and video, monthly conference calls as part of the National Federation of Regional Association Education and Outreach Committee, and creation of educational tools using real-time data in California, have all been successful and a demonstrated benefit to our audiences. We would like to continue working with CeNCOOS and SCCOOS in the ocean education arena to increase public awareness of climate change, specifically ocean acidification and sea level rise in California. We appreciate their emphasis on education and outreach in the submitted proposals.

There is a clear, continuing need to operate, maintain and improve the regional observing systems. Ocean observations are and will continue to be essential for monitoring both short and long-term environmental change. We would like to see CeNCOOS and SCCOOS expand their capacity to increase instrumentation and provide more information and products. We strongly endorse the need for developed ocean observing systems that benefit our health, wildlife, economy and oceans through a focus on ecosystems and climate, coastal hazards, water quality, marine operations, and education and outreach.

Sincerely,

Janice McDonnell

Janice McDonnell
Director, Centers for Ocean Science Education Excellence Networked Ocean World
Science Engineering & Technology 4-H Agent

City of Encinitas

September 15, 2010

Julie Thomas
Southern California Coastal Ocean Observing System
Executive Director, Scripps Institution of Oceanography
University of California San Diego
9500 Gilman Drive #0214
San Diego, CA 92093

Dear Ms. Thomas,

SUBJECT: Implementation of Regional Integrated Ocean Observing Systems: The Southern California Coastal Ocean Observing System (SCCOOS)

On behalf of the City of Encinitas, I would like to express our support for the Southern California Coastal Ocean Observing System (SCCOOS).

Funding for this program is of critical importance to California coastal constituents, specifically those in the San Diego region. The City of Encinitas utilizes this data on a daily basis for program planning, monitoring, sea level rise and monitoring the affects from El Niño. Every key project along the coast relies on this data for baseline project planning for sediment transport modeling and nearshore habitat assessments. The wave and buoy data is critical for wave forecasting during program planning. The City utilizes the monitoring data for critical analysis on beach width changes due to seasonal and storm changes and predictions how waves will impact our beaches in the future. The data has been utilized by consultants to predict sea level rise over the next 50 years and how it affects the US Army Corps of Engineers studies in Encinitas and Solana Beach. The wave data is critical while analyzing the affect from the El Niño and how our beaches change and by how much. The City is also participating in the inundation and shoreline change project which will be very helpful in prediction of overtopping the Coast Hwy 101 and how that will affect traffic and public resources during high surf advisory.

The El Nino Winter of 2010 re-emphasised the importance of this data when Hwy 101 was undermined and overtopped during the January and February storms. The data provides justification and evidence for FEMA and Coastal Commission while the City repairs existing infrastructure. Detailed wave, current, and inundation information for our coast is invaluable. Given the importance of the information SCCOOS provides, additional funding is needed.

I appreciate your attention to this request. If you have any questions, please contact me at (760) 633-2632 or kweldon@ci.encinitas.ca.us.

Sincerely,

Katherine Weldon

Katherine Weldon
Coastal Program Manager

Tel 760/633-2600 FAX 760/633-2627, 505 South Vulcan Avenue, Encinitas, CA 92024 TDD 760/633-2700

# CITY OF LOS ANGELES
CALIFORNIA



DEPARTMENT OF
PUBLIC WORKS

BUREAU OF SANITATION

ENRIQUE C. ZALDIVAR
DIRECTOR

TRACI J. MINAMIDE
CHIEF OPERATING OFFICER

VAROUJ S. ABKIAN
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ALEXANDER E. HELOU
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ENVIRONMENTAL MONITORING DIVISION
12000 VISTA DEL MAR, SUITE 604
PLAYA DEL REY, CA 90293
TEL: (310) 648-5610
FAX: (310) 648-5731

September1, 2010

Dr. Eric Terrill, Technical Director
Julie Thomas, Executive Director
Southern California Coastal Ocean Observing System (SCCOOS)
Scripps Institution of Oceanography
University of California, San Diego
9500 Gilman Drive
La Jolla, CA 92093

Dear Dr. Terrill and Ms. Thomas:

**LETTER OF SUPPORT FOR THE SOUTHERN CALIFORNIA COASTAL OCEAN OBSERVING SYSTEM (SCCOOS)**

The City of Los Angeles, Bureau of Sanitation's Environmental Monitoring Division (EMD) is supportive of the Southern California Coastal Ocean Observing System efforts to develop the Regional Coastal Ocean Observing System (RCOOS) for Southern California. SCCOOS provides badly needed coastal and ocean observations and generates extremely useful products for environmental managers, regulators, and nongovernmental agencies (e.g., environmental groups). The City conducts extensive monitoring in the coastal ocean of Southern California, primarily in Santa Monica Bay. A significant portion of this effort involves tracking the Hyperion Treatment Plant's effluent plume as it is discharged from the 5-Mile Outfall pipe into Santa Monica Bay and estimating bacterial concentrations at unkle depth in the surfzone due to the potential for pathogens to adversely impact public health. The effluent plume has the potential for traveling considerable distances and depositing organic particles, metals, and organic pollutants into the sediment within the Bay. Storm drains are the major source of bacteria and other pollutants to these waters, and they mostly discharge into the surfzone.

Southern California beaches and near-shore waters are world famous, and nearly 80 million people engage in water contact recreational activities at Los Angeles and Orange County beaches every year. This is not only an important component of the Southern California life style, but also an important economic engine for the region. Unfortunately, it has been estimated that between 627,800 and 1,479,200 "excess" cases of gastrointestinal illness occur at these beaches each year with estimated healthcare costs of $21 million to $414 million annually; therefore, ensuring good, safe water quality along our coast is an extremely high priority. In addition, the deposition of pollutants and their subsequent accumulation have adverse impacts on the benthic macrofaunal and demersal fish and invertebrate communities. Some of the seafood, e.g., white croakers, have been issued fish advisory notices and may not be safe for consumption.





Knowledge of circulation patterns in the coastal region is meager, especially from a regional perspective. A better understanding of circulation in the shallow and near-shore regions could be extremely valuable because it holds the potential to forecast the fate of surfzone and near-shore pollutants, which would increase our ability to protect public health and the environment.

The work conducted by SCCOOS is important because it is focused on improving our understanding and potential for modeling dispersion within a few hundred meters of the shoreline, which is where most water-contact recreation occurs, as well as the near-shore waters. This information will be useful in studying stormwater dispersion and fate, as well as discharges from wastewater treatment plants. I believe this will greatly benefit monitoring efforts aimed at protecting public health and the environment.

In November 2006, the City of Los Angeles' Hyperion Treatment Plant diverted the flow of its wastewater from a pipe with an outfall that is five miles from the shoreline to one that is only one mile from the shoreline in order to inspect the 5-mile pipe. The diversion lasted approximately three days and about 800 million gallons of secondary-treated effluent was discharged through the 1-mile pipe. EMD in conjunction with other researchers conducted an extensive monitoring effort during this diversion. Our monitoring effort greatly benefited from surface current information provided through the Southern California Coastal Ocean Observing System (SCCOOS). The real-time current information provided by SCCOOS enabled us to adaptively modify our sampling grid to better track the discharge plume and to predict the dispersion of the surface plume by the use of a trajectory model developed by SCCOOS researchers using high frequency radar data. If the winds had blown onshore, EMD would have utilized the surfzone model developed by Scripps Institution of Oceanography through SCCOOS to predict the dispersion of the effluent in the surfzone. We believe improved understanding of dispersion in the surfzone may similarly benefit our monitoring efforts in the future, as well as those of other monitoring agencies in southern California, for example the Los Angeles County Sanitation Districts (LACSD), Orange County Sanitation Districts, and the Southern California Coastal Water Research Project, among several others. Both Los Angeles County and the City of Los Angeles are very interested in the near-shore current data and surfzone model of SCCOOS to help shed light on the dispersion of legacy pollutants, i.e., DDT and PCBs that were discharged from the LACSD outfall at White's Point and onto the Palos Verdes shelf.

Also, within the next few years, the Hyperion Treatment Plant in Playa del Rey will need to repair the portion of the 5-mile outfall pipe that was identified as problematic during its internal outfall inspection in November 2006. During this repair period, the City of Los Angeles' Bureau of Sanitation will call upon and work closely with SCCOOS scientists to design and conduct a monitoring program tailored for the diversion of the secondary-treated effluent from the 5-mile to the 1-mile outfall as the City did in 2006.

In summary, the City of Los Angeles shares an interest in better understanding the dynamics of water transport in the surfzone and near-shore waters, which may increase our understanding of the fate of flow from storm drains and other sources into the surfzone as well as the flow from offshore sources into near-shore waters. Because of this, the City believes it will continue to directly benefit from the ocean observing activities proposed by SCCOOS; the City wholeheartedly endorses the 5-year proposal to the National Oceanographic Partnership Program (NOPP)-NOAA for SCCOOS funding and recommends it be funded.

Sincerely,

Masahiro Dojiri, PhD
Division Manager

COUNTY OF ORANGE
HEALTH CARE AGENCY

PUBLIC HEALTH SERVICES
ENVIRONMENTAL HEALTH

DAVID L. RILEY
DIRECTOR

DAVID M. SOULELES, MPH
DEPUTY AGENCY DIRECTOR

RICHARD SANCHEZ, REHS, MPH
DIRECTOR
ENVIRONMENTAL HEALTH

MAILING ADDRESS:
1241 E. DYER RD., #120
SANTA ANA, CA 92705-5611

TELEPHONE: (714) 433-6000
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E-MAIL: ehealth@ochca.com

*Excellence Integrity Service*

September 16, 2010

Dr. Eric Terrill, Technical Director
Southern California Coastal Ocean Observing System
Scripps Institution of Oceanography
9500 Gilman Drive 0214
La Jolla, CA 92093

Dear Eric,

As a representative of a Southern California public health agency and beach water quality manager, I would like to take this opportunity to voice our continued support for the Southern California Coastal Ocean Observing System (www.sccoos.org). SCCOOS has evolved into a comprehensive and accurate observing system providing partners, stakeholders and the public with an extensive array of useful ocean observation data and products, much of it real time.

We continue to support SCCOOS by providing shoreline bacteriological water quality monitoring data to SCCOOS on a regular basis. The user-friendly web site provides consumers with recent and historical monitoring site data, GIS reference maps, and compliance analysis with state marine bathing water standards. Site navigation is extremely easy and intuitive. In addition to water quality data, SCCOOS has coordinated the development of a high frequency radar current monitoring system. This real time surface current monitoring system has allowed the San Diego County Environmental Health Agency to predict when contaminated water from the Tijuana River will impact the southern beaches of San Diego County. They are able to preemptively prevent swimmers from being exposed to contaminated ocean waters. This system can also be used to predict where sewage spills or urban runoff will impact when they reach ocean receiving waters.

The use of predictive models, coupled with existing and enhanced water quality monitoring methodologies and real or near real time ocean observing systems, will allow better prediction of potential public health risks associated with the recreational use of California's marine waters. It is important that SCCOOS continues to be an integral part of the solution to these challenges. We strongly support your efforts and look forward to continued and future collaborations with SCCOOS.

If you have any questions, please feel free to call me at (714) 433-6015.

Very truly yours,

Larry Honeybourne
Program Manager
County of Orange, Health Care Agency
Environmental Health

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL WEATHER SERVICE
520 N. Elevar St.
Oxnard, CA 93030

September 22, 2010

Julie Thomas
SCCOOS Executive Director
Scripps Institution of Oceanography
University of California at San Diego
9500 Gilman Drive, Mail Code 0214
La Jolla, CA 92093-0214

RE: Federal Funding Opportunity – FY2011 Implementation of the U.S. Integrated Ocean Observing System (IOOS)

Dear Julie,

NOAA's National Weather Service Los Angeles/Oxnard weather forecast office supports SCCOOS and its proposal to the FY2011 NOAA-National Oceanographic Partnership Program (NOPP).

As you are aware, we serve a very complex – and highly traveled – marine area that requires specific and accurate marine observation and prediction information to best serve the marine community. The results of this project could directly benefit multiple areas of our marine services program plus – through the project's goal of building a long term data collection of waves, currents and wind observations – it could benefit NOAA's role in better understanding and communicating climate change and its impacts across our coastal communities.

This project can have tremendous benefits on our overall marine program responsibility to help better ensure safe and efficient marine transportation across our waters. More specifically, the work to develop detailed ocean current data and surface wind analyses can benefit our support of oil spill response, and marine area search and rescue efforts. We also would value integrating coastal wave height and alongshore current information for an improved rip current warning and advisory program. This, along with the proposed web page designed to provide important rip current information for lifeguards, can ultimately help mitigate a hazard that potentially impacts a very large population of beachgoers across southern California. The information can very much benefit our marine and climate services.

Sincerely,

Mark E. Jackson
Meteorologist in Charge
WFO Los Angeles/Oxnard

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Weather Service Forecast Office
11440 West Bernardo Court
Suite 230
San Diego, California 92127-1643

September 9, 2010

Julie Thomas
Executive Director, Southern California Coastal Ocean Observing System
Scripps Institution of Oceanography
University of California San Diego
9500 Gilman Drive 0214
La Jolla, CA 92093

Julie:

I am writing to show my support for the continuation of your funding of the NOAA Southern California Coastal Ocean Observing System (SCCOOS) and its partner the Coastal Data Information Program (CDIP). In particular I want to express support for the SCOOS Proposal, ***FY2011 Implementation of the U.S. Integrated Ocean Observing System (IOOS).***

The NWS San Diego uses the Coastal Observations collected through SCCOOS/CDIP in daily support of its Marine Forecast and Warning Responsibility. I have been at the NWS San Diego office since 2003, and data from these programs have been dependably available to our operations staff during this entire time. Forecasters make frequent use of the many tools on the SCCOOS and CDIP website such as automated and manual shore observations, including wave height and water temperature, meteorological observation, and bathymetry maps of the bight.

Julie and her staff have taken time to visit our office on numerous occasions and give presentations on their current research.

Currently Julie and her staff are working with local and headquarters NWS representatives to improve forecast and warnings of rip currents at local beaches.

We value this long-standing relationship between the San Diego NWS, SCCOOS and CDIP. We sincerely hope it will continue to be funded in the years to come.

Sincerely,

/s/

James K. Purpura
Meteorologist-In-Charge

OCEAN INSTITUTE
EXPERIENCE IS THE TEACHER

Dr. Eric Terrill, Technical Director
Ms. Julie Thomas, Executive Director
Southern California Coastal Ocean Observing System
Scripps Institution of Oceanography
9500 Gilman Drive 0214
La Jolla, CA 92093

Sept 24, 2010

Dear Dr. Terrill & Ms. Thomas:

As a community-based organization conveniently located in Dana Point Harbor, the Ocean Institute primarily serves residents and visitors from several surrounding counties with year-round, hands-on activities. In addition, school groups from across the country participate in our programs. Currently, the Ocean Institute hosts some 115,000 students a year. We also have a 75-foot research vessel, *R/V Sea Explorer,* and two tallships that offer opportunities in marine education and maritime history.

In recent years, the Ocean Institute has committed itself to raising public awareness of environmental issues concerning climate change, sea level change and ocean acidification. A newly developed 9th grade Climate Change program focuses directly on this topic. One thousand 9th graders from the Anaheim Union High School District have participated in the program. Presently we are developing a climate change exhibit for our public audience to further our efforts to educate citizens on this environmental issue.

The Ocean Institute supports the efforts of SCCOOS. We support any and all efforts to educate citizens about the state of the oceans and fragile coastline. We feel one great way to accomplish this is to introduce teachers, students and public participants on how to work directly with oceanographic and meteorological data. We have already found some success with this by incorporating historical and real time data from SCCOOS into our 5th grade Weather & Water program. Some 4,000 students have participated in our program and an estimated 200 teachers have attended training and implemented our 9-week Weather and Water curriculum developed for the classroom. In addition, over the last four years we have participated in COSEE-West and USC Sea Grant's five-day "Ocean Observing Systems" Institute for teachers and informal educators. One day of the week, participants spend the day at the Ocean Institute with a cruise on our research vessel and laboratory activities based on SCCOOS data.

These types of educational experiences can lead to human enlightenment and empower individuals to adopt stewardship of our fragile environment. In addition, we can see many possibilities to get our school groups involved with these data sets as part of a hands-on educational experience either onsite or through the regional web sites. As part of this we are excited for the opportunity to partner with SCCOOS on the development of an interactive map display at our site featuring climate data including El Nino and sea surface temperatures.

Thank you for this opportunity to participate in this project,

Sincerely,

Rick Baker
Vice President of Education
Ph. (949) 496-2274 x311
rbaker@ocean-institute.org

24200 Dana Point Harbor Drive, Dana Point, California 92629
Tel: 949.496.2274 · Fax: 949.496.4296 · Web: www.ocean-institute.org

SANDAG

401 B Street, Suite 800
San Diego, CA 92101-4231
(619) 699-1900
Fax (619) 699-1905
www.sandag.org



September 21, 2010 3200200

Ms. Julie Thomas
Southern California Coastal Ocean Observing System
Executive Director, Scripps Institution of Oceanography
University of California, San Diego
9500 Gilman Drive #0214
San Diego, CA 92093

Dear Ms Thomas:

SUBJECT: Implementation of Regional Integrated Ocean Observing Systems: The Southern California Coastal Ocean Observing System (SCCOOS)

On behalf of the San Diego Association of Governments (SANDAG), I would like to express our support for the Southern California Coastal Ocean Observing System (SCCOOS).

Funding for this program is of critical importance to California coastal constituents, specifically those in the San Diego region. In 2001, SANDAG managed the Regional Beach Sand Project (RBSP), which placed 2.1 million cubic yards of sand on the region's beaches. SANDAG's Regional Shoreline Monitoring Program, which was initiated in 1996 and continues today, was essential to the design and evaluation of the RBSP. SANDAG can utilize SCCOOS data to implement and monitor future efforts to replenish beaches and manage the region's shoreline. In fact, SANDAG has begun the planning phase for RBSP II, scheduled for completion by 2012, and will continue to make use of improved coastal hazards data products made available by SCCOOS, especially those related to inundation and shoreline change.

Last winter the San Diego region saw energetic sea conditions that challenged coastal management efforts and threatened the safety of coastal residents. Detailed wave, current, and inundation information for our coast will be invaluable as the region plans for future weather-related and other events that impact our coastline. Given the importance of the information SCCOOS provides, additional funding is needed.

I appreciate your attention to this request. If you have any questions, please contact me at (619) 699-6949 or rru@sandag.org.

Sincerely,

ROB RUNDLE
Principal Regional Planner

RR/ST/cd

SCCWRP
Established 1969

SOUTHERN CALIFORNIA COASTAL WATER RESEARCH PROJECT
*A Public Agency for Environmental Research*

September 22, 2010

Dr. Steven Ramp, Executive Director
Central and Northern California Ocean Observing System (CeNCOOS)

Julie Thomas, Executive Director
Southern California Coastal Ocean Observation System (SCCOOS)

Re: FY2011 Implementation of the U.S. Integrated Ocean Observing System (IOOS)

Dear Dr. Ramp and Ms. Thomas,

On behalf of the Southern California Coastal Water Research Project (SCCWRP) and the California Harmful Algal Bloom Monitoring and Alert Program (HABMAP), I would like to indicate our support for the continued development and operation of California's Ocean Observing Systems, the Central and Northern Ocean Observing System (CeNCOOS) and the Southern California Coastal Ocean Observing System (SCCOOS). With five-year support from the National Oceanographic Partnership Program (NOPP) and National Oceanic and Atmospheric Administration (NOAA), we understand that you will develop new information products and decision support tools, while continuing to provide timely data and critical observations of the coastal ocean.

SCCWRP is a research institute focused on the coastal ecosystems of southern California, from watersheds to the ocean, and our mission is to provide a scientific foundation for the management decisions of our member agencies. In a similar capacity, CeNCOOS and SCCOOS are actively engaged in obtaining and synthesizing ocean observations to meet the needs of coastal managers and decision makers. SCCWRP is able to provide a discussion forum for the outcomes of your data collection and research among various sectors of the water quality management community, via the SCCWRP Commission. In addition, I am in a unique position to assist your upcoming work as a member of the SCCOOS Board of Governors. SCCWRP will continue pursuing collaborations with CeNCOOS and SCCOOS over the next five years to support coastal water quality monitoring and facilitate communication among scientists and water quality managers.

HABMAP is a consortium of researchers and monitoring entities that was formed to promote development of a coordinated statewide harmful algal bloom (HAB) alert network in California. The Steering Committee's current foci include shore-based monitoring of HABs, offshore monitoring, intercalibration workshops and summits, and expanding website capabilities. Longer term objectives include predictive forecasting of HABs; long-term observations from gliders, moorings, coastal stations, and satellites; and development of real-time particle transport models with a product interface that can be used by resource managers. CeNCOOS and SCCOOS have played a major role in HABMAP's establishment, and we look forward to engaging in ongoing collaboration.

In summary, we appreciate the highly effective partnership developed among SCCWRP, California's HAB researchers, and the observing systems to date, and anticipate strengthening this alliance in the future. If I may be of any further assistance, please do not hesitate to contact me at (714) 755-3203.

Sincerely,

Stephen Weisberg, Ph.D.
Executive Director

3535 Harbor Blvd. Suite 110, Costa Mesa, CA 92626-1437
(714) 755-3200 *fax* (714) 755-3299

Linda S. Adams
*Secretary for*
*Environmental Protection*

# State Water Resources Control Board

**Division of Water Quality**
1001 I Street • Sacramento, California 95814 • (916) 341-5455
Mailing Address: P.O. Box 100 • Sacramento, California • 95812-0100
FAX (916) 341-5463 • http://www.waterboards.ca.gov

**Arnold Schwarzenegger**
*Governor*

Dr. Eric Terrill, Technical Director
Ms. Julie Thomas, Executive Director
Southern California Coastal Ocean Observing System
Scripps Institution of Oceanography
University of California, San Diego
9500 Gilman Drive #0214
La Jolla, CA 92093

Dear Dr. Terrill and Ms. Thomas:

IMPLEMENTATION OF THE U.S. INTEGRATED OCEAN OBSERVING SYSTEM (IOOS) DURING FEDERAL FISCAL YEAR 2011

I am writing this letter to indicate our support for the continued development and operation of the Southern California Coastal Ocean Observing System (SCCOOS). I understand that federal support of the regional components of the Integrated Ocean Observing System (IOOS) is executed through competitive grants administered by the National Oceanographic Partnership Program (NOPP) and the National Oceanic and Atmospheric Administration (NOAA), and, as a State agency member of the SCCOOS Joint Strategic Advisory Committee, I would like to take this opportunity to commend SCCOOS for its proactive engagement of the user community and the stakeholder process it has developed to identify regional priorities.

The mission of the State Water Resources Control Board (State Water Board) is to preserve, enhance, and restore the quality of all of California's water resources, including our coastal waters. We regulate point and nonpoint sources of pollution to protect all beneficial uses, including marine life and human health, in the ocean, bays, coastal estuaries, and beaches. I regard the data products and services provided by SCCOOS as invaluable in advancing the ocean information needed to fulfill this charge. Collectively, the National Pollutant Discharge Elimination System discharger community and public health agencies within Southern California make a significant investment in water quality monitoring.

SCCOOS has demonstrated an ability to deploy new technological capabilities that integrate these separate efforts and provide value-added data and products that allow rapid assessment of ocean conditions. SCCOOS's ability to rapidly provide ocean





condition information during the 2006 Hyperion discharge diversion event by the City of Los Angeles is a clear indicator of the emerging capability that requires continued investment. Recently, SCCOOS contributed to our work with the Areas of Special Biological Significance (ASBS) in Southern California by providing trajectories of the runoff from the Los Penasquitos Lagoon to the ASBS in La Jolla.

I see tremendous value in having an independent organization provide both continuous real-time ocean observing data products, and assembly and synthesis of local ocean data sets, to assist with our mission of protecting ocean and beach water quality. SCCOOS capabilities include real-time assessment of contamination flows, tracking transport of sewage outfalls and rivers, historical time series, online data access, and prediction for risk management. These capabilities provide water quality and public health managers with improved and reliable information and a greater understanding of coastal water pollution. Historical trend information provided by SCCOOS will prove valuable for assessments of costly infrastructure programs, Best Management Practices, and Total Maximum Daily Loads.

We recognize that through its outreach and user needs assessments, SCCOOS has been developing a regional ocean observing system that is responsive to local and regional needs—a goal that is consistent with NOPP, NOAA and IOOS goals. SCCOOS has established effective collaborative partnerships with the State Water Board, the southern coastal Regional Water Quality Control Boards, and the Southern California Coastal Water Research Project. It is critical that SCCOOS continue the progress it has made in developing the coastal ocean observing system for the Southern California Bight. The State Water Board understands SCCOOS is funded by grants from NOAA and the State of California's Coastal Conservancy, and encourages continued support for SCCOOS to maintain, operate, and improve the regional observing system.

Should you have any questions, please feel free to contact me at (916) 341-5488 (dgregorio@waterboards.ca.gov).

Sincerely,

Ed Haven for

Dominic Gregorio, Senior Environmental Scientist
Division of Water Quality

United States Department of the Interior

U. S. GEOLOGICAL SURVEY

Western Coastal and Marine Geology Team
400 Natural Bridges Drive
Santa Cruz, CA 95060
(831-427-4746), sjohnson@usgs.gov

September 2, 2010

Dr. Eric Terrill, Technical Director
Julie Thomas, Executive Director
Southern California Coastal Ocean Observing System (SCCOOS)
Scripps Institution of Oceanography
9500 Gilman Drive, 0214
La Jolla, CA 92093

Dear Dr. Terrill and Ms. Thomas,

I am writing to provide a letter of support for the proposal submitted by the Southern California Coastal Ocean Observing System (SCCOOS) to the National Oceanographic Partnership Program (NOPP) and NOAA, entitled "FY2011 Implementation of the U.S. Integrated Ocean Observing System (IOOS)." I am a Research Geologist for the U.S. Geological Survey's Western Coastal and Marine Geology Team (WCMG), also Chair of the USGS Western Region Ocean Science Coordination (WROC) group. WCMG works across the western U.S. with a focus on coastal geologic hazards (e.g., erosion, tsunamis, earthquakes), seafloor and habitat mapping, environmental quality and monitoring, natural resources, and communication/outreach on these topics. The WROC attempts to coordinate and integrate multidisciplinary (geology, biology, geography, hydrology) ocean science conducted across ten science centers in the western U.S., including Alaska and Hawaii. I also serve as a member of the SCCOOS Science Advisory Committee. Through these roles, I've become familiar with the history and development of SCCOOS. I've been continually impressed with the range of data products and services provided by SCCOOS and with their commitment to provide these to the public through an excellent, easy-to-use web portal.

WCMG hosts one large effort, the "California Urban Ocean Project" that focuses largely on sediment "source-to-sink" issues in southern California. Project members commonly rely on SCCOOS for real time and archived information on wave climate, surface currents, and other ocean conditions to provide the framework for understanding sediment and contaminant budgets and transport. As one example, we're presently conducting an important ecosystem restoration and sediment transport experiment ("fate and transport of fines") for the Tijuana Estuary and offshore area that has relevance for much of the urban California coast and involves numerous important stakeholders (e.g., California Coastal Conservancy, California State Parks, National Estuary Research Reserve, Southern California Wetlands Recovery Project, California Sediment Management Workgroup). SCCOOS "plume tracking" data offshore of the Tijuana River was important to the design of this investigation and is being relied on as an important data set as work continues and analysis begins. As another example, we are using SCCOOS data for our work in the USGS Southern California Multihazards Demonstration Project, building an inundation and physical effects scenario for a large (i.e., 100 yr) winter storm – this work also has obvious importance for evaluating sea level rise impacts. More generally, SCCOOS data are and will continue to be essential for monitoring both short- and long-term environmental change, a critical regional need during this highly dynamic period of changing climate.

My understanding is that SCCOOS is now funded entirely by grants from NOAA National Ocean Service and by the State of California. I think continued support of SCCOOS from these sources is very important to the regional ocean science community. There is a clear continuing need to operate, maintain, and improve the regional observing system. I hope this letter will be helpful in obtaining continuing support for SCCOOS. Please do not hesitate to contact me directly if you need additional information.

Sincerely,

Samuel Y. Johnson
Research Geologist
Western Region Oceans Coordinator

WEST COAST GOVERNORS' AGREEMENT on OCEAN HEALTH
CALIFORNIA OREGON WASHINGTON

September 15, 2010

Steven Ramp
Program Director
Central and Northern California Ocean Observing System (CeNCOOS)
Moss Landing, CA 95039

Julie Thomas
Executive Director
Southern California Coastal Ocean Observing System (SCCOOS)
La Jolla, CA 92093

Jan Newton
Executive Director
Northwest Association of Networked Ocean Observing Systems (NANOOS)
Seattle, WA 98105

**RE: Support for West Coast Integrated Ocean Observing System Implementation Proposals**

Dear Dr. Ramp, Ms. Thomas, and Dr. Newton:

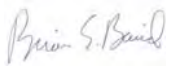
In 2006, the Governors of California, Oregon, and Washington entered a landmark partnership by signing the West Coast Governors' Agreement on Ocean Health. Together, the Governors have committed to protecting the health of the West Coast's ocean and coastal ecosystems and the economies that depend on them. To achieve these goals, the governors released their Action Plan in 2008, laying out ambitious but concrete steps to improve the health and resiliency of the West Coast's communities and ocean environment.

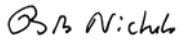
In their Action Plan, the governors emphasized that the three West Coast Regional Associations (RAs) of the Integrated Ocean Observing System (IOOS) – CeNCOOS, NANOOS, and SCCOOS – are regional centers of expertise providing essential data and information for local, regional, state and federal managers. Continued advancement of the RAs is essential for developing and sustaining the appropriate scale of observations necessary to realize many of our regional goals, including an ecosystem approach to management and effective adaptation to coastal climate change impacts. In particular, the West Coast RAs employ proven technologies and methods that enable timely oil spill preparedness and response; a deeper understanding of Harmful Algal Blooms and hypoxic events; and the tools to address regional impacts driven by global climate changes. The West Coast RAs also are poised to make critical contributions to help support the new Coastal and Marine Spatial Planning (CMSP) frameworks, policies and plans being developed in our states as well as future regional planning efforts, including those established under the national CMSP framework.

The delivery of timely informational products that summarize relevant observations of the coastal ocean – both long-term and real-time – is critical for effective management of our West Coast ocean and coastal resources. We support the proposals by CeNCOOS, NANOOS, and SCCOOS to continue the positive progress these organizations have been making in the development and implementation of an integrated ocean observing system on the West Coast.

We look forward to working with you in continued partnership.

Sincerely,





Brian Baird
Assistant Secretary for Ocean and Coastal Policy, California

Jessica Hamilton
Natural Resources Policy Advisor, Office of Oregon Governor Kulongoski

Bob Nichols
Executive Policy Advisor, Office of Washington Governor Gregoire

# Resolution of the California Ocean Protection Council Regarding Ocean Observing

WHEREAS, oceans and coastal waters affect all our lives – driving weather and storms, influencing climate, providing transport for millions of tons of cargo, and sustaining coastal and marine resources; and

WHEREAS, the Nation's coastal and Great Lake regions are home to more than half the nation's population, but lack basic information to protect those communities and their environment, to track, understand and predict change, and to provide quality information to those who work on or near the water;

WHEREAS, it is the mission of the Ocean Protection Council (OPC) to ensure that California maintains healthy, resilient, and productive ocean and coastal ecosystems for the benefit of current and future generations; and

WHEREAS, understanding the changing ocean environment and how coastal ecosystems respond to such changes is vital for swift, confident, and effective management; and

WHEREAS, Congress passed the Integrated Coastal and Ocean Observation Act of 2009, which established the Integrated Ocean Observing System (IOOS) as a program in NOAA and recognized the eleven regional systems, including two in California; and

WHEREAS, the deployment and operation of a sustained IOOS will: (1) improve the safety and efficiency of marine operations, (2) improve prediction of weather and natural hazards (including tsunamis and storm surges) to reduce resulting damages and costs, (3) improve predictions of climate change and its socio-economic consequences, (4) improve national security, (5) reduce public health risks, (6) help protect and restore healthy ecosystems, and (7) sustain and restore living marine resources; and

WHEREAS, implementation of IOOS will require a substantial sustained investment in research, infrastructure, evolving data products, system enhancements, and operational support of real-time information, carried out through a strong state-federal collaboration; and

WHEREAS, many elements of a national system are already in place, but most now operate independently, and the IOOS would combine these elements into an interconnected coastal network;

WHEREAS, monitoring ocean surface currents is a core component of IOOS, and the 5-year implementation strategy National Surface Current Plan identifies supporting existing infrastructure as a primary initial objective; and

WHEREAS, California has invested $21 million to build the infrastructure for the Coastal Ocean Currents Monitoring Program (COCMP), a 55-station, land-based high-frequency Radar (HF Radar) system to map ocean surface currents along California's coastal waters up to 150 km offshore, 24/7/365, regardless of weather, visibility or time of day; and

WHEREAS, COCMP is operated by the California's two Regional Associations for ocean observing the Southern California Coastal Ocean Observing System (SCCOOS) and the Central and Northern California Coastal Ocean Observing System (CeNCOOS) but currently lacks ongoing operational support.

NOW, THEREFORE, the California Ocean Protection Council hereby:

FINDS that the U.S. and the world are facing critical decisions about management of the oceans, coastal waters, and fresh water resources, and improved data and predictions resulting from IOOS is needed to support these decisions and provide for a sustained recovery of all marine ecosystems; and

FURTHER FINDS that understanding and tracking the physical, chemical and ecological processes that underpin many ocean issues requires an observing system that includes targeted observations of ocean surface currents, ocean temperatures and salinities, dissolved chemical constituents, and the structure, function and resilience of coastal marine ecosystems, including the human component.

RESOLVES to strongly encourage the continued development, implementation and maintenance of a responsive and integrated observing system in California, across the country and around the world; and

FURTHER RESOLVES to continue to devote resources, as available, and cultivate collaborations with federal, state and regional government agencies and educational and research institutions that maintain and develop ocean monitoring capabilities, and to continue to seek out opportunities to leverage funding for expanded observations at regional, state and federal levels; and

FURTHER RESOLVES to continue to support the development of the SCCOOS and CeNCOOS as regional centers of expertise for ocean observing; and

FURTHER RESOLVES to work with Congress and the National Oceanic and Atmospheric Administration to substantially increase IOOS funding for regional observations, and to implement the recommendation in the Surface Current Mapping Plan, and specifically to support ongoing operation of California's HF Radar Network; and

FURTHER RESOLVES to better communicate the need for and benefits from and integrated ocean observing system to decision-makers, advisory bodies, managers, and the public.

# Ocean Protection Council Science Advisory Team
# Consensus Statement on Ocean Observing

Most of the important science relating to California's coastal ocean requires well-conceived, regular and sustained measurements of the marine environment and its many ecosystems. These measurements are critical for accomplishing the Ocean Protection Council's (OPC) mission *to ensure that California maintains healthy, resilient, and productive ocean and coastal ecosystems for the benefit of current and future generations.* Understanding the changing ocean environment and how coastal ecosystems respond to such changes is vital for swift, confident, and effective management. The OPC has demonstrated leadership in the establishment of ocean observing systems for California. These systems monitor critical oceanographic processes and parameters (e.g., coastal upwelling, ocean circulation, water temperature) and the health of coastal marine ecosystems (e.g., monitoring marine protected areas) that enable scientists, managers and policy makers to identify and respond to changes in California's marine environment and to ensure sustained use of resources and the many services generated by our coastal ecosystems. The Ocean Protection Council Science Advisory Team (OPC-SAT) encourages the OPC to continue to devote resources and cultivate partnerships that maintain and develop these activities, and to continue to leverage their actions to promote expanded observations at the regional, state and federal levels.

The list of scientific and management issues served by well conceived, regular and sustained measurements of the coastal ocean and its ecosystems, including the human component, is long and continually evolving. Important examples include:

1) Describing dynamic patterns of winds, waves and currents that impact real time issues including the fate and impact of hazardous material spills, success of search and rescue efforts, geographic opportunities for ocean-based energy production, and current and future threats of coastal storm damage;
2) Identifying shifts in ocean circulation, ocean temperature and ocean water volume associated with a changing ocean climate, which influence the distribution and productivity of species and fisheries, sea level rise and coastal erosion;
3) Characterizing the timing, magnitude and distribution of harmful algal blooms and pathogen pollution and their impacts on ecosystems and human and animal health;
4) Quantifying physical and biological processes that influence biodiversity, fisheries productivity and facilitate management for sustainable fisheries;

5) Revealing patterns of oceanographic conditions and associated ecosystems that determine the foundation upon which marine spatial management is planned and implemented;
6) Depicting spatial and temporal patterns of runoff and atmospheric deposition including coastal pollution and ocean acidification.
7) Characterizing the spatial patterns and dynamics of human activities that influence and respond to marine ecosystems and their management.

Understanding and tracking the physical, chemical and ecological processes that underpin these issues requires an observing system that includes targeted observations of ocean surface currents (e.g., exploiting the OPC's investment in the high-frequency radar network), ocean temperatures and salinities (e.g., establishing repeated glider surveys), dissolved chemical constituents, and the structure, function and resilience of coastal marine ecosystems, including the human component. We now have the tools, approaches and expertise that can help prioritize which sources or types of information are of most value in specific management of decision-making processes.

The OPC-SAT strongly encourages the continued development, implementation and maintenance of a responsive and integrated observing system, which are critical for the stewardship of California's coastal ocean.

Gary Griggs, on behalf of the Ocean Protection Council Science Advisory Team
Chair, Ocean Protection Council Science Advisory Team
Director Institute or Marine Sciences
University of California Santa Cruz

**Project Title:** Southern California Coastal Ocean Observation System - Project 2011 to 2015

**Project Short Title:** SCCOOS 2011 to 2015 **Project Status:** Submitted

**UNOLS Project ID #:** 102703 **Version #:** 1

**Last Modified:** 9/28/2010 6:05:00 PM **Date Submitted:** 9/28/2010

**Project Created By:** Ralf Goericke

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**P.I. Name:** Ralf Goericke **Institution:** SIO

**Phone:** (858) 534-7970 **Fax:**

**Email:** rgoericke@ucsd.edu

**Institution:** SIO - UCSD, Scripps Institution of Oceanography

**Address:** 9500 Gilman Drive
La Jolla, CA 92093 USA


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| Co P.I. Name | Institution | Phone | Email |
|---|---|---|---|

No Associated Co-PI

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**Science Discipline:** Biological Oceanography **Large Program Abbr:**

**If Other Science Discipline, specify:**

**Large Program Comments:**

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**Project Status:** New Proposal

| Agency/Division/Program | Grant/Project Number | Agency Funding Status |
|---|---|---|
| NOAA | | To Be Submitted |

**Agency Description:**

**Institutional Proposal #:**

**Proposal Deadline submitted for:**

**Project Start Date:** 9/01/2011 **End Date:** 8/31/2016

**Project Budget:**

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| Year | Ship(s) Requested (Name Or Size) | Total Days Req. | Start Date | Repeat/Multi-ship/ Clearance Req./Est. Cost | Status |
|---|---|---|---|---|---|
| 2011 | New Horizon | 1 | 11/15/2011 | N/N/N/21000 | Submitted |
| 2012 | New Horizon | 1 | 7/01/2012 | N/N/N/22050 | Submitted |
| 2012 | New Horizon | 1 | 11/15/2012 | N/N/N/22050 | Submitted |
| 2013 | New Horizon | 1 | 11/15/2013 | N/N/N/23152 | Submitted |
| 2014 | New Horizon | 1 | 11/15/2014 | N/N/N/24310 | Submitted |
| 2015 | New Horizon | 1 | 11/15/2015 | N/N/N/25525 | Submitted |

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**Project Webpage:**

**Summary of Field Work:** Nearshore observations in the context of the CalCOFI cruises

**Summary of Facility Requirements:** Standard CalCOFI requirements

**Summary of Other Requirements or Comments:** none