Integrated Ocean Observing System Implementation: Southern California Coastal Ocean Observing System (SCCOOS)



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This project complies with the Programmatic Environmental Assessment, specifically the Project Design Criteria.

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PROJECT SUMMARY

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Proposal Partners:	California Polytechnic State Un Farallon Institute for Advanced University of California, Irvine (University of California, Los An University of California, Santa E University of Southern Californi	nic State University, San Luis Obispo (Cal Poly) r Advanced Ecosystem Research rnia, Irvine (UCI) rnia, Los Angeles (UCLA) rnia, Santa Barbara (UCSB) ern California (USC)				
Other Partners: Aquarium of the Pacific Birch and Cabrillo Aqua California Department of California HABMAP California Marine Prote California Ocean Prote Carlsbad Aquafarm Catalina Sea Ranch Center for Scientific Re (CICESE) Channel Islands Nation City of San Diego – Wa Coastal Data Informatic Coastal Estuarine Rese Coastal Observing Res County Health Agencie Harbor Safety Committed	arium of Parks and Recreation cted Areas Collaboratives ction Council (OPC) search and Higher Learning al Marine Sanctuary stewater District on Program earch Federation earch and Development	Los Angeles County Sanitation District Marine Technology Society Santa Barbara Long Term Ecological Research Tesoro Petroleum The Maritime Alliance Tijuana River National Estuarine Research Reserve University Autonoma de Baja California U.S. Army Corps of Engineers U.S. Bureau of Energy Management U.S. Coast Guard U.S. Environment Protection Agency U.S. International Boundary and Water Commission U.S. Navy Ventura County Wastewater District West Coast Governors Alliance				
Jacobsen's Pilot Servic	ees es	West Coast Governors Alliance WiLDCOAST				

Additional partners listed in Appendix C (Joint Strategic Advisory Committee) and Appendix B, Table 2.

The principal goal of the Southern California Coastal Ocean Observing System (SCCOOS) is to provide observations and 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 and models, many of which are available in near real-time. SCCOOS priorities and objectives are aligned with the seven societal goals as outlined in the U.S. Integrated Ocean Observing System (IOOS) Summit Reportⁱ. The focus themes, as designated by IOOS, highlight these priorities and are designed to improve safety, enhance the economy, and protect our environment.

- 1. Marine Operations: Enhance products for safe and efficient marine commerce and transportation, search and rescue, homeland security, and events such as oil spill response.
- 2. Coastal Hazards: Improve coastal resiliency through accurate, geo-specific and validated flooding models and critical shoreline information with the long-term goal of improving coastal safety, reducing natural hazards and environmental change impacts, and protecting coastal economics.
- 3. Climate Variability and Change: Improve the understanding and track secular ocean change including sea level rise (SLR), ocean temperatures, and other climate trends in the Southern California Bight.
- 4. Ecosystem, Fisheries and Water Quality: Provide physical, geochemical and biological monitoring, including harmful algal blooms (HABs) forecasts, fisheries management, and water quality pathogen and ocean acidification (OA) tracking to promote and sustain living marine resources.

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, a framework has been developed which provides for the complete life-cycle of the data. The information is readily 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 the information more comprehensible. 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 in 2009, 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.

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PROJECT DESCRIPTION AND NARRATIVE

I.

Governance and Management Subsystem

Background: The Southern California Coastal Ocean Observing System (SCCOOS) was formed in 2003 under the nationwide U.S. Integrated Ocean Observing System (IOOS®) directive to form 11 Regional Associations (RAs) to generate and deliver data for improved decision making to agencies and stakeholders at both local and national levels. SCCOOS works within IOOS to coordinate and expand an integrated coastal observing system in the Southern California Bight (SCB), supporting national and regional priorities (sccoos.org). The five heavily-impacted counties in the SCB area have a population of 17 million people, representing 14% of the coastal population of the United Statesⁱⁱ. In 2012, ocean-related tourism and recreation businesses employed about 193,000 persons in these five counties and contributed \$9 billion of GDP to local economyⁱⁱⁱ. Further, the SCB is distinguished by unique geography, climate, and life. The highly urbanized coastline is adjacent to complex ocean conditions as a result of offshore islands; a diversity of coastline characterized by headlands, bays, beaches, submarine canyons, estuaries;, and coastal mountain ranges, which influence the marine atmosphere. Unique ocean circulation patterns from subtropical water flowing to the north nearshore, and subarctic water moving south offshore, creates a biological transition zone that supports a vast diversity of marine species.

The State of California committed to ocean observing with the 2005 investment of \$21 million for the Coastal Ocean Currents Monitoring Program that established a network of high frequency (HF) radar systems, glider survey capabilities, and modeling infrastructure. SCCOOS will continue to align program activities with the priorities of state-sponsored initiatives, such as the Marine Protected Areas (MPA) Monitoring Enterprise. Cat Kuhlman, The Deputy Secretary for Ocean and Coastal Policy at the California Natural Resources has testified, "The continuation of SCCOOS monitoring will be critical in helping the state to leverage existing efforts to create a MPA monitoring program that can increase our understanding of how climate impacts such as changes in the physical and chemical environments may be effecting the performance of MPAs." In addition, SCCOOS continues to align with the broader regional initiatives including the West Coast Governor's Alliance (WCGA) 2008 Ocean Health Action Plan. In 2012, the three West Coast Ocean Observing Systems (OOS) and the WCGA signed a Memorandum of Understanding (MOU) to advance the effective management of coastal and ocean resources. Inter-regional efforts across the west coast have continued, most recently demonstrated by the WCGA Ocean Data Portal (WCODP) sponsoring of a Sea Grant Fellow to support OOS and WCGA collaboration to inform regional policy.

Governance Structure: SCCOOS is a collaborative observing system with a broad base of stakeholders and partners, and a demonstrated ability to thrive with a diverse set of sometimes conflicting interests and users. The governance structure (Appendix C) was based on a MOU that identifies a consortium of institutions and organizations to fulfill SCCOOS objectives. Representatives from the consortium form the Board of Governors (BOG). In addition, the BOG has expanded to include representatives of federal and public agencies, industry, academia, and international partners in Mexico. BOG members are responsible for the corporate 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.

Program Operations and Staff: SCCOOS operates as a system of partnerships and contractual agreements facilitated by technical and programmatic staff. The Executive Director (ED) provides program oversight and coordination, serving as the principal contact for IOOS, IOOS Association, governance members, and the

advisory committees. The Technical Director (TD) provides technical advice and oversight for observational system capabilities and design, product design, and data operations. Data integration, dissemination, and product development are led by the Information Manager who serves on the IOOS Data Management and Communications Committee (DMAC), and remains current with information technology best practices. The full-time Program Coordinator provides programmatic administrative support, coordinates communications, leads outreach and education efforts, and serves on the IOOS Outreach Committee. The part-time Administrative Analyst serves as a liaison with government agencies, legislative offices, and users. The Chairs of the BOG and ESC work closely with the program staff, including structured weekly calls to ensure a flow of communication.

Goals and Objectives: The principal goal of SCCOOS is to provide observations and 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 the capacity to support an end-to-end system, providing both short-term decision-making and long-term assessment through implementing and leveraging both real-time and historic biological, chemical, and physical observations. Many of the projects outlined in the 2011 <u>Build-Out Plan</u> for SCCOOS, demonstrate that SCCOOS advocates for sustained and enhanced observations while supporting product development. SCCOOS continues to mature as a comprehensive, fully integrated, certifiable, regional observing system. SCCOOS priorities and objectives are aligned with the seven societal goals as outlined in the IOOS Summit Reportⁱ. The focus themes, designated by IOOS, highlight these priorities and are designed to improve safety, enhance the economy, and protect our environment:

- 1. Marine Operations: Enhance products for safe and efficient marine commerce and transportation, search and rescue, homeland security, and events such as oil spill response.
- 2. Coastal Hazards: Improve coastal resiliency through accurate, geo-specific, and validated flooding models and critical shoreline information with the long-term goal of improving coastal safety, reducing natural hazard and environmental change impacts, and protecting coastal economics.
- 3. Climate Variability and Change: Improve the understanding and track secular ocean change including sea level rise, ocean temperatures, and other climate trends in the SCB.
- 4. Ecosystem, Fisheries, and Water Quality: Provide physical, biological, and geochemical monitoring, including harmful algal blooms (HABs) forecasts, fisheries management, and water quality pathogen and ocean acidification (OA) tracking to promote and sustain living marine resources.

Audience and Benefits: In 2009, the Central and Northern Ocean Observing System (CeNCOOS) and SCCOOS formed a single Joint Strategic Advisory Committee (JSAC) to facilitate identification and prioritization of ocean observing requirements across the state. The JSAC includes representatives from city, state, and federal agencies, industry, non-governmental organizations, and educational partners. The JSAC is intended to provide a means for stakeholders and funding agencies to participate in strategic planning efforts, identify the data and information products that are necessary, and provide feedback and guidance for the observing system. In addition to the JSAC, SCCOOS continues to connect with a broad range of coastal and global observing systems and users through extensive outreach.

Work Plan: SCCOOS will continue to effectively manage all contract and governance issues while developing partnerships at the local, regional, national, and international levels, including collaboration with CeNCOOS on statewide priorities. This project-based approach ensures effective stakeholder engagement.

II. Observing Subsystem

All projects within this subsystem are considered base priority, *Tier 2* (Appendix A), except those labeled as *Tier 3*, which are the enhanced projects.

A. Marine Operations

Background: Maritime transportation plays a major role both in southern California's economy and national security. Los Angeles and Long Beach combined comprise the largest port in the U.S. and the eighth largest port in the world. With 140 shipping lines connecting Long Beach to 217 seaports, the Port handles \$180 billion in trade annually, supporting hundreds of thousands of jobs. 47% of all container ships and 50% of California's oil enter through these ports. The Port of San Diego includes the largest naval fleet in the world, and Port Hueneme is the only deep-water port in the 400 nm 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 22 oil platforms, as well as major shipping channels. Additionally, the SCB is home to two of the Navy's major training and test ranges. There are three unique challenges for marine operations (1) 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; (2) to enable effective event responses as needed; and (3) to assure accurate historical data are present to allow for risk assessments and plan for new facilities. SCCOOS has addressed these challenges by partnering with institutions and agencies to provide data access and visualization of critical oceanographic parameters necessary for safe and efficient maritime operations. Key partners include:

1) <u>High Frequency Radar Network (HFRNet)</u>, funded by IOOS and maintained by Scripps, aggregates, and distributes HF radar derived surface current maps for all RAs as well as global partners. SCCOOS leverages HFRNet for total vector calculations, online visualization, data access via web services, and radial and total vector archiving.

2) <u>Coastal Data Information Program (CDIP</u>), funded by the California Department of Parks and Recreation, Division of Boating and Waterways (CDBW), and the U.S. Army Corps of Engineers (USACE), provides near real-time wave measurements, nowcast and forecast wave models, and surface temperature (SST). The USACE considers CDIP as one component of their contribution to IOOS.

3) <u>Climate Observations Division</u> – Funded by the National Oceanic and Atmospheric Administration (NOAA), provides for the development of proto-operational climate observing systems and supports the surveillance of ocean conditions across the California Current Ecosystem (CCE) to provide long term time records of ocean climate for development of indices, tracking El Niño and climate variability, and testing ocean forecast models.

4) <u>Coupled Ocean/Atmosphere Mesoscale Prediction System</u>, produced by the Naval Research Laboratory (NRL), Monterey provides high resolution modeled atmospheric fields (wind, rain).

5) <u>Moderate Resolution Imaging Spectroradiometer</u>, funded by NASA and NOAA, provides atmospheric, oceanic, and land parameters including SST, chlorophyll, and radiance water vapor.

Goals and Objectives: During the project period, the Marine Operations focus area will maintain and advance efforts that are critical for safe and efficient navigation, search and rescue (SAR), oil spill response, and renewable energy projects. Specific objectives that develop products for a wide, diverse user base include (1) maintain and develop customized products: multi-layer views of observations, nowcast and forecast models including waves, currents, winds, SST, bathymetry, and navigation charts, (2) deliver these products to aid oil spill and SAR real-time recovery and post-analysis trajectories, and (3) distribute glider data for assimilation into operational ocean models that subscribe to the Global Telecommunication Service (GTS), including the SCCOOS and CeNCOOS Regional Ocean Model System (ROMS) and Navy models.

Audience and Benefits: At the national level, SCCOOS has testified before the United States House Committee on Transportation and Infrastructure Subcommittee on Coast Guard and Maritime Transportation on, "How to improve the efficiency, safety, and security of maritime transportation". Additionally, in 2015, SCCOOS briefed the Hydrographic Survey Research Panel in Long Beach, and in and the Executive Director of the Marine Exchange of Southern California testified at an IOOS Senate briefing. Stakeholders are interested in both real-time and forecast customized data that support their decision-support tools. Representative users include: California Office of Oil Spill Prevention Response (OSPR), National Weather Service (NWS), NOAA Hazardous Materials Division, Navy, USACE, Catalina Ferry, Marine Exchange, commercial bulk and tanker cargo vessels, cruise ships, commercial fishermen, harbor pilots, and recreational boaters. Real-time surface current measurements are integrated into General NOAA Operational Modeling Environment (GNOME) for trajectory analysis. HF radar data are also communicated to United States Coast Guard's (USCG) Environmental Data Server for SAR, the Environmental Protection Agency (EPA) for their marine debris tracking application, and used in multiple problem-driven applications such as the NOAA Environmental Response Management Application. A recent operational example of HF radar derived surface currents usage occurred on May 19, 2015, in response to a ruptured oil pipeline at Refugio State Beach in Santa Barbara County. Approximately 21,000 gallons of crude oil flowed into the ocean triggering a response from participants within the USCG led oil spill response Area Committee. Ocean surface current data were used to assist in analyzing and tracking the oil spill as it entered the region of coverage approximately 1 km offshore. HF radar operators also established an additional mobile site at Gaviota filling in coverage north of the spill further refining the potential path of the slick. Programmers integrated the new site into HFRNet for near real-time visualization and distribution to operational organizations and the public responding to the spill (http://euler.msi.ucsb.edu/realtime/spill/sim/).

An additional operational application is the Under Keel Clearance (UKC) project at the Port of Long Beach. With the deepening of the Panama Canal, bigger, deeper draft vessels are requesting entry to the California ports. Out of the 4,422 vessels that entered the ports of Los Angeles/Long Beach in 2014, 606 were oil tankers. The issue is how can the port entry be maximized to accommodate these larger vessels while reducing the risk of a vessel running aground? Oceanographic parameters are critical in assuring the safety and operations of vessel traffic. For the past ten years, SCCOOS has provided automated messaging to Long Beach Jacobsen Pilots and port marine operators when large swell has exceeded their operational limits. With additional National Ocean Service/IOOS and industry funding, SCCOOS is supporting the UKC project with the installation of two new wave buoys. The data from these buoys are ingested by the Oxnard NWS and the National Centers for Environmental Prediction (NCEP) for model validation and for local real-time display (cdip.ucsd.edu/custom pages/marine_exchange/). Additional integration and continuation of threshold notifications increases efficiency and safety due to reduced risk.

Work Plan: Development of IOOS-funded infrastructure and methodology used to collect, analyze, and disseminate observations in near real-time will continue. The 28 first priority HF radars and the 5 second priority HF radars are identified in Appendix B, Table 1a and 1b, and supported with best efforts. The table shows the location, approximate operating frequency and how the radars will operate within the national network. In addition to the HF radar operations and maintenance, SCCOOS will support the following:

- UKC project at Long Beach by operating the two critical validation wave buoys.
- Collaborate with the Naval Air Warfare Center (NAWCD) at Point Mugu, and in support of homeland security, expand the near real-time, customized wave and surface currents display with additional areas of interest as funded externally by the Navy (<u>sccoos.org/data/harbors/navair/fullscreen.php</u>).
- Continue to collect and distribute glider data for assimilation into operational models.

- Continue to serve as principal authors in the updating of the IOOS National Wave Plan^{iv}, the IOOS National Surface Current Plan^v and "Toward a U.S. IOOS Underwater Glider Network Plan^{"vi}.
- Continue to provide training to the first responders of maritime incidences for real-time products.

Milestone Schedule:

Year 1: Expand glider operations to cover one alongshore transect (Tier 3). Years 1-5: Upgrade and/or replace HF radar hardware as needed (Tier 3).

B. Coastal Hazards

Background: Coastal resiliency preparation is critical on the West Coast where inundation is often caused by the co-occurrence of high tides, energetic ocean waves and beach erosion. High waves raise the mean water level above the tide level (e.g., wave setup), and create large wave run-up in addition to setup. Erosion of the beach further increases the shoreward penetration of large waves. During storms, wave uprushes can reach more than 3 m above tide level, and beach face erosion can exceed 2 m vertical. Simple inundation models (where the uprush limit depends only on the tide level, wave height, and wave period) yield qualitative, general information. Localized warnings for highway closures and/or structure sandbagging require site-specific wave, beach slope, and berm elevations for model calibration. The 2008 California Coastal Sediment Management Workgroups (CSMW), California Beach Restoration Survey^{vii} indicates that many beaches and structures in the SCB are vulnerable to coincident high surf and tides. Synergies have developed between the U.S. Geological Survey (USGS) Coastal Storm Modeling Project, USACE, CDBW, and CSMW. 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.

Goals and Objectives: The long-term goal of the Coastal Hazards focus area is to develop and distribute validated, customized warnings of wave and tide-induced coastal inundation, erosion, and nearshore transport. This effort will promote safe recreational use of beaches and 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 the SCB. A field monitoring site at Cardiff State Beach where routine monthly sand surveys are ongoing and in-situ water level and inundation measurements have been observed uses existing previously SCCOOS funded, and new observations, to examine the role of waves, tides, and nourishments on ocean front flooding. Results include real-time and 3-day inundation forecasts and improvements to the online site-specific website product (sccoos.org/data/flooding-storm-surge-models/). The proposed effort will build upon the prototype Cardiff project at four new sites. Specific objectives of this proposal are to (1) develop site-specific models for tide and wave-driven inundation for Cardiff, Newport, Seal, and Imperial Beaches (only Cardiff has an on-going field monitoring program), (2) assemble databases of historical observations and bathymetry data for model development, calibration, and verification, and (3) develop and expand integrated, online products that will provide warnings of wave and tide-induced coastal inundation.

Audience and Benefits: The audience for real-time and forecast inundation warnings includes the NWS, USACE, Department of Transportation, Coastal Commission, city governments, and beachgoers. Based upon threshold exceedance, model-based inundation warnings are now being disseminated directly to the NWS and coastal planners. Partnerships have been established with local municipalities to assist with equipment permissions and observational validation of inundation notifications. The same infrastructure exists for disseminating inundation warnings to the NAWCD at Point Mugu for an area that overtops during

high tides and energetic waves. SCCOOS will also partner with the local NWS on their Storm Surge Study by providing wave and current input to their model and collaborating on model validation. With rising sea levels and El Niño winters, it is critical that a high resolution inundation model be developed for future safety and protection of the coastal community.

Work Plan: A site-specific model for tide and wave-driven inundation will be calibrated with field observations of shoreline water level acquired during previous winter storms. Existing observations of shoreline water level, waves, and inundation will provide the inundation model calibration required for issuing localized warnings for highway closures and sandbagging. The CDIP coastal wave model Monitoring and Prediction System (MOPS), developed with SCCOOS support, includes both remotely generated swell and locally generated seas, and yields nowcast and forecast models of waves on the 10 m depth contour, immediately offshore of the surfzone with high temporal (hourly) and spatial (100 m alongshore) resolution. Offshore boundary conditions are provided by the CDIP network of wave buoys and co-located point forecast spectra from the NOAA Wave Watch III global wave model. Field testing in SCB has extensively validated MOPS. Simple inundation modelsviii relate the uprush limit to tide level, and wave height and periodix. These models yield qualitative water level information but do not include site-specific beach morphology. The vertical elevation reached by storm waves depends on the beach slope, which varies seasonally and spatially. Also, the elevation levels in the presently distributed models (38 sites) do not include the effects of local bathymetry, which will be included at the five focus sites. Inundation thresholds, meaning the vertical elevation required to cause particular impacts, are lacking in the presently disseminated warnings except for the Cardiff site. Past observations of water level, waves, and overtopping with beach profiles coupled will allow site-specific, customized, inundation warnings. Stakeholder recommendations for monitoring and modeling to improve product confidence and accuracy will be incorporated. The end-users will provide the feedback on the accuracy and format of the models and warnings, as well as contribute qualitative observations acquired by their staff. The sites chosen for inundation modeling were selected on the basis of access, severity of inundation, logistical support from local agencies, and other factors. Website content and warning messages will be updated at all sites as information becomes available.

Milestone Schedule:

Years 1-2: Compile database of historical bathymetry surveys. Develop model for Newport and Seal. Years 3-5: Develop model for Huntington and Imperial Beaches.

C. Climate Variability and Change

Background: The SCB is profoundly influenced by El Niño^x with southern influences arriving by advection, coastally trapped waves, and atmospheric teleconnection^{xi}. However, ocean temperatures have been historically warm over the past year, in ways different from recent El Niños, as warming extended as far north as the Gulf of Alaska. According to the NWS, El Niño conditions now exist at the equator, with forecasts suggesting a greater than 90% chance that El Niño will continue through winter 2016, with possible weather impacts in the western U.S.^{xii}. Extreme conditions in physical and biogeochemical parameters continue to occur in many locations and appear to be impacting pelagic ecosystems, including fisheries. For example, over the past year southern prey species with lower nutritional value have largely replaced more nutritionally rich northern species in waters of the SCB. A hypothesis currently being explored is that this has resulted in the observed starvation and die-off of young pinniped species. Because of the impacts of this large climate signal on the ecosystem and society, federal sponsors including IOOS, defined and supported a two-part workshop series. The first workshop focused on "what" are these anomalies, and the second workshop on "why" these anomalies occur. In partnership with the Pacific OOS, the first workshop was hosted by SCCOOS at Scripps in May 2015 and included 130 participants (including those from Canada and Mexico)

and 26 presentations. Participants defined the timing and scale of the anomalous oceanographic conditions in the North Pacific. The workshops demonstrate the need to span coastal and global research and operational communities across diverse disciplines to improve our overall ability to integrate oceanographic information within the ocean observing systems (scccos.org/projects/anomalies_workshop/).

Goals and Objectives: An important SCCOOS objective is maintaining and interpreting data from long-term observations which are vital for establishing baselines of key environmental parameters for detecting climate changes. Emerging concerns, such as OA, introduce new priorities to add measurements of the ocean carbonate system for constraining coastal carbon budgets and characterizing natural variability and ocean change. Even though SCCOOS directly funds only a small portion of the data collection for understanding the climate variability, synergistic projects are leveraged. During the project period, expanded integration of a few notable observations will include:

- The Manual Shore Station program which supports the long-term collection of temperature and salinity. Established in 1916, the program will celebrate 100 years of daily ocean observations.
- California Cooperative Oceanic Fisheries Investigations (CalCOFI) has monitored transects since 1949, including 22 years of seabirds, allowing the assessment of human impact and effects of climate change on the coastal ocean ecosystem.
- The HF radar network has a 10 year dataset of coastal currents. These observations offer the opportunity to examine the oceanic response to climate variability along the coastal regions.
- Gliders have been operated routinely on three CalCOFI lines (66.7, 80, and 90) for 8 years, providing a rich data set of the water column.
- Automated Shore Stations and HABS sampling have been monitoring for 11 years (Scripps, Newport, Santa Monica, Stearns Wharf and Goleta piers).
- The first water samples from the Sanitation Discharge Districts were obtained in 1925, 90 years ago, with the addition of a new OA mooring to be deployed October 2015 near CalCOFI line 90.
- The Long Term Ecological Research Network (LTER) and the Partnership for Interdisciplinary Studies of the Coastal Ocean (PISCO) projects have collected time series for over 15 years.
- Ocean Time Series Group The 9 year old Del Mar mooring, located on CalCOFI line 93, telemeters near-bottom (and water column) oxygen and pH conditions.
- CDIP Wave Data Collection Wave and temperature parameters have been measured for 37 years at Scripps Pier and Oceanside. Many other stations in the SCB were started 30-35 years ago.
- CDIP Beach elevations Airborne LIDAR and shore-based surveys for tracking shoreline change were started 14 years ago.

Audience and Users: Managers responsible for long-range planning who are concerned about the ecosystem and the long-term effect of climate change including OA are potential users of the data. The current anomalous conditions have captured the attention of the public and the concern of resource managers, fisherman, and other ocean-related agencies. SCCOOS will continue to provide information to these stakeholders, who include marine scientists, coastal and marine resource managers, and decision-makers working in marine health and climate-related fields, economic sectors affected by ocean climate (including aquaculture, mariculture, recreation and tourism), educators, and the public. It is expected that maintenance of these long-term time series will aid development of future climate change indices for agencies such as the local operational desalinization plant and the local MPAs. The NWS and coastal managers interested in coastal resiliency, with the anticipated larger more frequent storms and sea level rise, will be informed through the wave observation and models, including the flooding index product. These long-term

observations are critical for building a historical database for coastal managers. As climate trends become increasingly evident, the value of these databases will grow.

Work Plan: SCCOOS is committed to and prioritizes sustained data collection 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 re-analyses of ocean state. SCCOOS will provide technical and data management support for an end-to-end system from observations to products relevant to the evolving coastal ocean climate and climate variability.

Milestone Schedule:

Years 1-5: Continue to develop, integrate, and enhance long-term time series products for distribution.

D. Ecosystem, Fisheries, and Water Quality

Background: The SCB hosts diverse ecosystems such as extensive kelp forests, intertidal habitats and sandy beaches along with large populations of seabirds, marine mammals, fish, and plankton. The major currents of the SCB contribute to its biodiversity including the poleward flowing southern California Counter Current, the equatorward flowing California Current and the poleward flowing, subsurface current. A broad range of physical transport processes supply nutrients to surface waters of the SCB that drive productivity primary production and support higher trophic levels. The large human population, vast development of coastal areas, and broad range of human uses present challenges for its ecosystems and biodiversity. Rainfall during winter storms produces extensive plumes of urban runoff that contain pollutants along with pathogenic bacteria and viruses, often resulting in closure of public beaches. A challenge to maintaining water quality, essential for the large population and economy, is the daily discharge of treated sewage into the ocean along with additional inputs from river systems carrying urban and agricultural runoff. The Los Angeles Hyperion, serving a population of 4 million, discharges 340 million gallons of treated wastewater per day into the ocean. In addition, untreated sewage crosses the shoreline border from Mexico.

Two related issues that have come to the forefront over the last few years are the decreases of seawater pH (increased OA) and dissolved oxygen (increased hypoxia) in waters of the CCE. OA and hypoxia can have significant impacts on marine species. Increased hypoxia has been found in SCB waters while regional changes in OA are currently being investigated. The California Current Acidification Network (C-CAN), chaired by a SCCOOS BOG member, is a collaboration of interdisciplinary scientists, resource managers, and industry dedicated to advancing the understanding of OA. Many of the above mentioned programs and SCCOOS scientists are engaged with C-CAN and share the organization's vision which encourages OA monitoring to improve the understanding of linkages between oceanographic conditions and biological responses, and facilitate predictive models. Quantifying the many processes affecting water quality is critical for assessing threats posed for the SCB ecosystems.

Goals and Objectives: For the project period, the overarching goal is to support management efforts through the monitoring of physical, chemical, and biological variables relevant to the ecosystems, while prioritizing those projects in line with NOAA's ecological forecasting roadmap. Specific objectives are to (1) sustain observations of currents, temperature, salinity, phytoplankton, and zooplankton by glider, HF radar, shore stations, and enhancement of nearshore CalCOFI ship surveys including monitoring sea bird, mammal, and krill distribution (*adding krill, Tier 3*), (2) sustain HABS monitoring of the episodic occurrence of blooms of toxic algal species in the CCE, develop enhanced products, (3) sustain the development of products to observe and forecast the dispersion of outfall and storm water plumes, in particular the levels of pathogens,

and (4) work with Principal Investigators (PIs) and users to develop and refine regional ocean indices such as abundance species relevant to coastal habitats, estuarine ecosystems, and fisheries.

In support of the West Coast shellfish industry, the OOSes have added OA and hypoxia monitoring to their ongoing observations, developing an integrated website with the goal of displaying a comprehensive picture of eastern Pacific OA efforts (<u>ipacoa.org/home</u>). As part of this project, SCCOOS maintains a CO₂ analyzer "Burkalator" located at Carlsbad Aquafarm, reporting alkalinity, CO₂, TCO₂, omega aragonite saturation, salinity, and water temperature. Additional funding was awarded through a West Coast OOS joint proposal, continuing the operation of the instrument by a SCCOOS subject matter expert (SME).

Audience and Benefits: Through collaborations with researchers, public health officials, water quality agencies, and state regulators, SCCOOS has developed useful products for a broad range of users. Managers responsible for long-range ecosystem planning are identified users of the data. These include the National Marine Fisheries Service, Southwest Fisheries Science Center (SWFSC), Channel Islands National Marine Sanctuary, Tijuana River National Estuarine Reserve, EPA, USGS, Bureau of Ocean Energy Management (BOEM), California Department of Fish and Wildlife, Multi-Agency Rocky Intertidal Network, non-profit organizations, marine mammal stranding networks, marine managers attempting to minimize whale strikes by ships, commercial fishermen and aquafarms.

SCCOOS provides many agencies with useful products addressing water management and policy of the coastal ocean, including the Publicly Owned Treatment Works (POTW). The outfall water component provides trajectory data products for estimating the transport of surface discharges and river runoff, and uses subsurface observations and high resolution modeling to describe movement of outfall plumes^{xiii}. SCCOOS has recently developed trajectory maps for the California State Water Resources Control Board to track coastal non-point discharges to every Area of Special Biological Significance (ASBS) in our region. SCCOOS collaborates with the Southern California Coastal Water Research Project (SCCWRP) in multi-agency regional studies. In the latest study, SCCOOS is working with regional water quality agencies to understand the relative importance of natural versus anthropogenic sources of nutrient fluxes. Another objective is to understand the carbonate system in nearshore waters, particularly coastal and estuarine OA and hypoxia. Extensive observations are being conducted by POTWs in pursuit of these objectives.

The SCCOOS hosted 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 and provides science-based weekly HAB and phycotoxin monitoring at several locations within the state. These observations and forecasts are used as a successful early warning system by public health agencies as a service to the citizens of the state. The HAB's website provides real-time notifications to the California Department of Public Health, marine mammal and bird rescue centers, and regional agencies of detection of potentially toxic HAB species and their toxins. In collaboration with CeNCOOS, SCCOOS provides the forecast models to predict the formation and evolution of blooms, and continue HAB climatology development to provide statistical forecasts of toxic HAB events.

Work Plan: SCCOOS will support the observations and data life cycle for the following projects: <u>Gliders</u> – Sustain the underwater gliders network of ecosystem observations. Monitoring is accomplished on a series of lines, a round-trip section completed once every two to three weeks. SCCOOS intends to add acoustic data collection to allow the study of underwater sound from marine mammals (*Tier 3*). <u>CalCOFI</u> - SCCOOS will continue to expand the CalCOFI quarterly sampling cruises with the nine stations near the coast. These data connect the offshore CalCOFI time series to the nearshore environment. Long-term changes in marine ecosystems can be indexed by fluctuations in the life history, abundance, and demography of top predators. In the southern CCE, changes in seabird and mammal breeding success, diet and foraging behavior, and abundance are sensitive indicators of ecosystem and food web change^{xiv}.

<u>HF Radar</u> - SCCOOS continues the synthesis of time series to generate indices for ecosystem relevance, focusing on spatial patterns of upwelling and divergence. Maps of connectivity are identified as priorities by SWFSC biologists examining egg and larvae trends. Estimating biological connectivity is critical to ecosystem management and assessment, particularly for the MPAs. Seasonally variable urban runoff bring contaminated flows to regions that may stretch far from sources. In partnership with SCCWRP, SCCOOS conducted a study to examine the potential exposure from 20 southern California storm water discharges^{xv}. The study used a surface transport model to examine coastal circulation using a two-year optimally interpolated surface current mapping dataset to drive the model. These models provided a quantitative, statistical measure of the spatial extent of the discharge plumes in the coastal receiving waters. The exposure maps were used to (1) assess the probability of storm water connectivity to nearby MPAs, and (2) develop a methodology to estimate the mass transport of storm water discharges.

<u>Automated Shore Stations</u> –SCCOOS will maintain the data collection at the four pier sites, measuring daily temperature and salinity. Data are posted, and trend synthesis is ongoing.

<u>Harmful Algal Blooms</u>: The HAB program will continue to maintain five pier-monitoring sites posting real-time temperature, salinity, and chlorophyll fluorescence data to provide indications of fresh water input, upwelling, and algal blooms. Weekly bottle samples measure chlorophyll, nutrients, domoic acid, saxitoxins, and abundances of harmful algal species and other pertinent planktonic assemblages (major phytoplankton and microzooplankton taxa, cyanobacteria, picoplanktonic algae, and heterotrophic bacteria). In addition to monitoring the blooms of toxic algal species, other bloom forming species have been tracked at some stations along with nutrients and the entire algal biomass (chlorophyll) at most stations. The purpose of these "secondary" measurements is to establish a long-enough time/space series to determine the sign, magnitude, frequency, and size of algal blooms as a first necessary step in understanding of their nature. In addition to the success of the HABs early warning system, much has been learned about algal blooms along our coast. There are now at least two models of blooms ready to be tested, compared, and further developed. Thus we are approaching the ability to predict HAB occurrences using independently measured variables.^{xvi}

<u>Ocean Acidification</u>: In addition to the Aquafarm data, SCCOOS plans to ingest the data from the Burkalator located at the Wrigley Institute where additional collection of CO₂ in the San Pedro Bight is planned. SCCOOS will continue with the aggregation and integration of existing and new OA data throughout the SCB. An additional objective is to add continuous underway and autonomous measurements of aqueous carbon dioxide variables including partial pressure of CO₂ total dissolved inorganic carbon and pH to CalCOFI, further developing the OA research, samples, and testing (*Tier 3*).

<u>Fiber Optic Distributed Temperature Sensing (DTS)</u>: System installation will run in parallel with the automated Newport Pier shore station. Temperature is measured continuously in time and space along a fiber out to a range of 8-10 km. (*Tier 3*).

Milestone Schedule:

Year 1: Collaborate and integrate new OA observations such as those being deployed by the Santa Monica Bay Restoration and X Prize next generation sensors.

Year 1: Add acoustics to gliders and Fiber Optic DTS system (Tier 3).

III. Data Management and Communications (DMAC) Subsystem

Background: As an operational Data Assembly Center (DAC), SCCOOS aggregates, curates, and manages the integration and distribution of ocean data. Serving as a federal repository for various stakeholders, the DAC provides quality control (QC), and discovery/access services. The DMAC provides scientists, decision makers, and the public access to products that facilitate a scientific basis for research and management of ocean observations and models. Information is 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. New visualizations and technologies are fostered, making products more comprehensible. SCCOOS DMAC participates in, and contributes to, international programs such as OceanSITES and the Joint Commission of Oceans and Meteorology (JCOMM) wave evaluation testing.

Goals and Objectives: With the intent of being certifiably compliant, the SCCOOS Regional DMAC Implementation Plan describes in detail the infrastructure and data lifecycle for each data stream (sccoos.org/about/dmac/). SCCOOS will continue to provide access to high-quality integrated data and support regional user needs while complying with the national standards and protocols for sharing and archiving data following the "Guidance for Implementation of the Integrated Ocean Observing System (IOOS) Data Management and Communications (DMAC) Subsystem". SCCOOS will also continue to integrate a broad suite of observations in the form of raw data and products. Collaboration with other RAs to advance stakeholders access to cross-regional data services as defined by commonalities in specified user requirements is on-going through IOOS DMAC including workshops. SCCOOS DMAC is well poised to improve ingestion with a level of QC based on Quality Assurance of Real Time Ocean Data (QARTOD) parameters, standardize the web services for all the parameters, submit to National Centers for Environmental Information (NCEI) for archive and enhance data visualization. New data sets will include mooring data, OA discrete sampling and the University of California (UC) Santa Barbara Marine Biodiversity Observation Network (MBON) (MBON - *Tier 3*).

Work Plan:

<u>Computing Infrastructure</u> – For the project duration, SCCOOS will continue to assure that observational data are stored on reliable servers housed at the Scripps facility, with offsite backup up storage in place. To harden disaster/recovery options, migrating to cloud processing and storage is in progress.

<u>Data Ingestion</u> - Observations are collected from a variety of platforms, each of which has its own level of data processing maturity.

<u>Quality Control</u> - SCCOOS plays an active role in the ongoing effort to develop and implement QC standards. The SCCOOS ED has been involved with QARTOD since its inception and continues to serve on the Steering Committee. SCCOOS SMEs have participated in several QARTOD workshops. Data collection through SCCOOS operated programs such as Shore Stations and HABs will be implementing QARTOD QC testing within the next year. The network Common Data Format (netCDF) files, including the QC flags will be made available through the website. Highly leveraged programs such as CDIP, HFRNet, CalCOFI, and Gliders manage their own QC, some of which have already implemented QARTOD QC.

<u>Public Access and Dissemination</u> - SCCOOS participates with IOOS partners in a highly distributed system of interoperable components. SCCOOS submits HF radar and glider data to the IOOS DACs for distribution. The HF radar, glider, and wave observations are all transmitted to the National Data Buoy Center for inclusion on the GTS. SCCOOS actively participates in on-going DMAC efforts to standardize data distribution through the use of web services such as the Sensor Observation Service (SOS) and the Open-Source Project for a Network Data Access Protocol (OPeNDAP)/Thematic Real-Time Environmental Distributed Data Services (THREDDS). Certain netCDF files such as those from the HF radar, gliders, Shore Station data, and CDIP

wave buoys that are registered with the IOOS Service Registry, contain Federal Geographic Data Committee (FGDC) and International Organization for Standardization (ISO) 19115 metadata. Once all SCCOOS data are available in netCDF, metadata will be available in both FDGC and ISO 19115 supplementing existing management and query capabilities (keywords and ontologies). SCOOOS will continue to post web metrics, now showing 179,295 page views and 42,076 users in 2014 (sccoos.org/about/dmac/webstats/). SCCOOS will continue to provide externally funded project specific data management expertise aligned with its recently completed task funded by the UC Environmental Health and Safety in which SCCOOS developed the Coastkeeper's Coastal Champion award winning data portal for the La Jolla ASBS site (sccoos.org/data/asbs/?p=20). The Hyperion wastewater diversion project (http://www.sccoos.org/projects/hyperion/), and the Orange County Sanitation District diversion (http://www.sccoos.org/projects/2012-ocsd-outfall-repair-diversion/) continue to provide external funding for data management including additional data ingest and visualization.

<u>Archive</u> – The long-term data preservation will be at NCEI. Presently, CDIP and HFRNet data are archived at NCEI. The next parameters on the list for archive will be those associated with the Shore Stations data.

Milestone Schedule:

Year 1: Ingest, quality control, disseminate, and visualize the mooring data including OA parameters. Year 1: Ingest, format, and visualize the POTWs data from the quarterly hydrographic surveys. Year 1: Continue to develop and transition to cloud computing.

Year 2: Ingest and visualization the MBON data (Tier 3).

IV. Modeling and Analysis Subsystem

Background: SCCOOS relies upon models to synthesize data in ways consistent with known physical and biogeochemical processes in support of the focus areas of operation. Regional scale forecasts of the ocean are provided by partnerships with UC Los Angeles in support of the two models operated by SCCOOS (1) 3 km ROMS, spanning coastal waters of California, and (2) the coupled ROMS/biogeochemical model which aids evaluation of the effects of nutrient inputs from outfall plumes, river plumes, and upwelling processes on bloom formation and nutrient cycles^{xvii}. The 3 km ROMS nowcast and 3-day forecast model includes the tidal forcing prescribed at the open boundaries and has a data assimilation capability using a multi-scale 3DVAR method. There are several nationwide efforts concurrently being advanced including the West Coast Coastal Ocean Model Testbed (COMT, SCCOOS PI is receiving direct funding), the West Coast Ocean Forecast System (WCOFS, BOG member and PI's serve on the Technical Advisory Committee) and the Nearshore Wave Prediction System (NWPS, SCCOOS is providing validation at Long Beach). Regional efforts include those from the State of California, Pacific Marine Environmental Lab, Oregon State University (OSU), BOEM, and LTER.

Goals and Objectives: During the proposal period, SCCOOS will continue to serve a coordinating role for the model efforts occurring at the regional level. Increasing spatial resolutions of our nowcast/forecast models will be necessary to meet users' needs. This implementation will either consist of an increase (e.g., tripling) of the model resolution over the entire state domain or within a subdomain. The increase of our model resolution will be coordinated with the WCOFS and COMT. Biogeochemical modeling will be used to differentiate anthropogenic from natural components of the nitrogen cycle. For example, a principal focus is to differentiate nitrogen inputs due to coastal upwelling versus those due to human activities such as wastewater discharge. Biogeochemical modeling, combined with field observations, is essential, and critical for also understanding future trajectories of hypoxia, OA, and other climate change effects. Reanalysis of the atmosphere provides a basic record upon which our understanding of past climate variability is based.

The reanalysis 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, SCCOOS will use the reanalysis to identify if recurrent patterns of circulation favor certain species, by comparison with egg, larvae, and catch data, important factors for the MPAs.

Validation of models supported by SCCOOS is critical for establishing predictive skill for support of operations such as spill response and plume dispersion. It is also critical for effective use of model outputs in reanalysis studies aimed at understanding climate change effects on SCB ecosystems. Validation of modeled fields of surface and sub-surface water properties and currents will be carried out using data from glider transects, HF radar, satellite remote sensing, and other data sources such as the <u>Plumes and Blooms</u> program, CalCOFI, and moorings such as operated by SCCOOS, MBARI, and water quality agencies. Since the output from the 3 km ROMS model can be accessed from the SCCOOS web site, it is expected the model performance and nowcast/forecast skill will be evaluated and assessed as a collaborative effort involving both modelers and data providers. The UC Los Angeles modeling teams are expected to publish the results from this performance evaluation and assessment on peer-reviewed journals. To fill the gap between the existing SCB-wide SCCOOS models, and the inner shelf to surfzone, the goal is to develop wave-driven site-specific models for shelf-surfzone interaction at particular sites (e.g., Imperial Beach) that have significant pollution and water quality impacts. Wave breaking nearshore currents transport sediment, biota, and toxic substances alongshore. In a few hours, waterborne materials can advect long distances with weak dilution. Modeling offers the prospect of predicting these occurrences in support of management response (*Tier 3*).

Audience and Users: The biogeochemical models will provide decision-support tools for the complex nutrient ecosystems. All three of the models support water quality management by providing ROMS real-time for current prediction, water properties, and trajectories. The POTW partners who discharge into the SCB have identified these models of plume location as important data products. In addition, the International Boundary Water Commission, California State Parks, and Non-Governmental Organizations such as Coastkeeper, Heal the Bay, and WiLDCOAST will benefit. Ocean surface current circulation tracking during critical events (e.g., Refugio Oil Spill) will utilize the ROMS 3 km model, HF radar trajectory models, in addition to the site-specific models. Both the USCG and NOAA Office of Response and Restoration have access to SCCOOS' 3 km ROMS nowcast/forecast as they become available in real-time to support their decision making processes during search and rescue and oil spill response operations.

Work Plan: Models will be initialized and tested with glider-derived maps of water constituents and currents around POTW outfalls. Validation of the ROMS output against non-assimilated observations (e.g., moored ADCP and temperature data) has yielded promising results^{xviii} 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. The assimilated models will be balanced by forward models forced with reanalysis products to depict the intrinsic variability in oceanic transports. The same wave model used to drive inundation models will be used to model transport by alongshore currents. SCCOOS DMAC is exploring cloud computing for managing the modelling life cycle.

Milestone Schedule:

Year 1: Produce reanalysis products using the 3 km ROMS 3DVAR data assimilative nowcast/forecast system from 2009 to present when there is a good HF radar coverage. Year 1: Add freshwater forcing by rivers and wastewater treatment plants to 3 km ROMS model (Tier 3).

Years 1-5: Develop shelf and surfzone pollution exchange products (Tier 3).

V. Outreach, Stakeholder Engagement, and Education Subsystem

Background and Goals: SCCOOS has partnered with local science education centers, universities, and state/federal agencies with the goal of encouraging educators and general public to learn, educate and promote scientific research through the use of high quality data and products.

Audience and Users: SCCOOS increased their outreach by installing touchscreen displays of real-time products at education centers at the Birch Aquarium, Ocean Institute, Marine Exchange of Southern California, National Marine Sanctuary Kiosk, and the California Surf Museum. In August 2014, CeNCOOS and SCCOOS jointly held a statewide Marine Symposium highlighting "Ocean Observing along California's Central Coast in a Changing Climate" where 75 participants spanning industry and science applauded the State of California and federal representatives for their long-term support of IOOS. A summary table highlights the additional outreach and education efforts. (Appendix B, Table 2).

Work Plan: SCCOOS will continue to leverage partnerships and continue to seek new stakeholder groups to assess information gaps and develop needed products. SCCOOS will continue to collaborate with organizations such as the Maritime Alliance, providing expertise on the Southern California "Blue Economy" maritime industry and serving as a key partner in demonstrating the economic benefit of a regional observing system. Starting in 2016, SCCOOS will partner with the Scripps Center for Marine Biodiversity and Conservation (CMBC) Masters Program connecting students to various research opportunities Outreach, Stakeholder Engagement.

VI. Conclusion

SCCOOS maintains unique, long-term observations in the SCB in order to distribute ocean information of public interest. SCCOOS fulfills the IOOS seven societal goals by 1) identifying trends in the climate environment, and supporting the ecosystem, fisheries, and water quality management, 2) informing operational users for marine and national safety and 3) supporting coastal resiliency. SCCOOS has the data framework to provide these critical products for effective life-cycle management of ocean resources critical to the environment. SCCOOS has the infrastructure, flexibility, and stakeholder participation necessary to address emerging coastal management issues including desalination and ocean energy. SCCOOS is committed to contributing to larger ocean observing collaborations at the regional, national, and international levels with other RAs, state and federal agencies, users, and partnerships, furthering our role as stewards of ocean resources

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Table 1a: SCCOOS Priority HFR Sites for Spill Response, Maritime Operations and Search and Rescue (SAR)									
Operator	Site Name	Site Code	Frequency	Area of Primary Operation					
CalPoly	Rgged Point (old: Piedras Blancas)	RAGG	5	Offshore Coverage for Oil Spill, Santa Barbara Channel Platforms, Diablo Canyon Nuclear					
CalPoly	Point Estero	ESTR	12	Offshore Coverage for Oil Spill, Santa Barbara Channel Platforms, Diablo Canyon Nuclear					
CalPoly	Diablo Canyon (old: Point Buchon)	DCLR	5	Offshore Coverage for Oil Spill, Santa Barbara Channel Platforms, Diablo Canyon Nuclear					
CalPoly	Diablo Canyon (old: Point Buchon)	DCSR	12	Offshore Coverage for Oil Spill, Santa Barbara Channel Platforms, Diablo Canyon Nuclear					
CalPoly	Point San Luis	LUIS	12	Offshore Coverage for Oil Spill, Santa Barbara Channel Platforms, Diablo Canyon Nuclear					
UCSB/CalPoly	Fallback 22 (Point Sal)	FBK1	12	Offshore Coverage for Oil Spill and Santa Barbara Channel Platforms					
UCSB/CalPoly	Point Arguello	AGL1	5	Offshore Coverage for Oil Spill and Santa Barbara Channel Platforms					
UCSB/CalPoly	Point Arguello	ARG1	12	Offshore Coverage for Oil Spill and Santa Barbara Channel Platforms					
UCSB/CalPoly	Point Conception	PTC1	12	Offshore Coverage for Oil Spill and Santa Barbara Channel Platforms					
UCSB	Refugio State Beach	RFG1	12	Offshore Coverage for Oil Spill and Santa Barbara Channel Platforms					
UCSB	Coal Oil Point	COP1	12	Offshore Coverage for Oil Spill and Santa Barbara Channel Platforms					
UCSB	Summerland	SSD1	12	Offshore Coverage for Oil Spill and Santa Barbara Channel Platforms					
UCSB	Mandalay Generating Station	MGS1	12	Offshore Coverage for Oil Spill and Santa Barbara Channel Platforms					
UCSB	Nicholas Canyon	NIC1	12	Offshore Coverage for Oil Spill and Santa Barbara Channel Platforms					
UCSB	Point Mugu	PTM1	12	Offshore Coverage for Oil Spill and Santa Barbara Channel Platforms					
UCSB	San Nicolas Island	SNI1	12	Offshore Coverage for Oil Spill, Santa Barbara Channel Platforms and Maritime Traffic Port of LA/LB					
UCSB	Santa Cruz Island	SCI1	12	Offshore Coverage for Oil Spill, Santa Barbara Channel Platforms and Maritime Traffic Port of LA/LB					
USC	Point Fermin	SCPF	25	Maritime Traffic Port of LA/LB and Inner Shelf Spill					
USC	Santa Catalina East	SCCI	12	Maritime Traffic Port of LA/LB and Inner Shelf Spill					
USC	Newport Beach	SCNB	25	Maritime Traffic Port of LA/LB and Inner Shelf Spill					
SIO	San Clemente	SDSC	5	Offshore Coverage for Oil Spill, Oil Lightering, SAR and Inner Shelf Spill					
SIO	Scripps Long Range	SDSL	5	Offshore Coverage for Oil Spill, Oil Lightering, SAR and Inner Shelf Spill					
SIO	Dana Point	SDDP	25	Offshore Coverage for Oil Spill, Oil Lightering, SAR, Maritime Traffic and San Onofre Nuclear					
SIO	Camp Pendleton (North)	SDSM	12	Offshore Coverage for Oil Spill, Oil Lightering, SAR, Maritime Traffic and San Onofre Nuclear					
SIO	La Jolla (Camp Pendleton South)	SDCP	25	Maritime and Navy Traffic Port of San Diego, SAR and Inner Shelf Spill					
SIO	Point Loma	SDPL	25	Maritime and Navy Traffic Port of San Diego, SAR and Inner Shelf Spill					
SIO	Border Field State Park	SDBP	25	Maritime and Navy Traffic Port of San Diego, SAR and Inner Shelf Spill					
SIO	Coronado Island	SDCI	25	Maritime and Navy Traffic Port of San Diego, SAR and Inner Shelf Spill					
Total		28							

	Table 1b: Secondary Sites: Search and Rescue Land Discharge, Gap Filling and Coastal Marine Protected Areas (MPAs)							
Operator	Site Name	Site Code	Frequency	Area of Primary Operation				
USC	Dan Blocker	SCDB	25	Santa Monica Bay - Water Quality, MPAs and Nearshore Ecosystems				
USC	Torrance Beach (old: Point Vicente)	SCTB	25	Santa Monica Bay - Water Quality, MPAs and Nearshore Ecosystems				
USC	Dockweiler	SCDH	25	Santa Monica Bay - Water Quality, MPAs and Nearshore Ecosystems				
SIO	San Elijo State Beach	SDSE	25	North San Diego - Water Quality, MPAs and Nearshore Ecosystems				
SIO	Wastewater Treatment Plant, Point Loma	SDWW	25	North San Diego - Water Quality, MPAs and Nearshore Ecosystems				
Total		5		REV 8.12.15				

Table 2: Outreach Partners and **Collaborative Activities**

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Table 2: Outreach Partners and				Displ ^{io}		nticipe	Ations of	25°	.85		/ 3/
Collaborative Activities	0	uricu	uston,	OUTS	anel	1050m	othen	nere	ooths	ebina	etin
Local - Southern California Bight				<u> </u>	<u> </u>	<u> </u>		<u> </u>			<u>/ </u>
Area Planning Committees - San Diego and Long Beach	•		•	•	•	•				•	
Aquariums (Birch, Cabrillo, Long Beach)	•	٠	٠					٠		٠	
Carlsbad Aquafarm		٠	•		٠					•	
Catalina Sea Ranch	_	•	٠		•					•	٠
City governments (Encinitas, San Diego)	4			•	•	•				•	•
ducations Centers (Ocean Inst., California Surf Museum)	•	•	•		•	•		•		•	
arbor Safety Committees (San Diego, Los Angeles and Long Beach)	_		-	•	•	•	•			•	•
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July 20, 2015

Jordan Stout / Glen Watabayashi NOAA | Office of Response and Restoration Emergency Response Division

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

Dear Ms. Thomas,

On behalf of NOAA's Emergency Response Division (ERD), we enthusiastically endorse the valuable data and services provided by the Southern California Coastal Ocean Observing System (SCCOOS) at the Scripps Institution of Oceanography, UC San Diego.

Within NOAA's Officer of Response & Restoration, ERD provides scientific support to the US Coast Guard during marine spills of oil and hazardous materials to affect time-critical decisions. A key element of that support relates to contaminant fate & transport and specifically trajectory forecasting. Our staff, including oceanographers and local Scientific Support Coordinator, has worked with SCCOOS and the larger IOOS community for many years to efficiently access physical oceanographic and other data for incorporation into our response modeling efforts. In addition, the SCCOOS' existing networks of established data sources and technical expertise in the fields of surface currents (HF radar), nearshore and subsurface transport, water quality, wave monitoring, telemetry buoys, and un-manned aerial systems have also been instrumental in strengthening our spill response efforts.

The Integrated Ocean Observing Systems work interactively with local, state and federal agencies, resource managers, industry, policy makers, educators, scientists and the general public to provide data, models and products that focus on marine operations, coastal hazards, climate variability and change, and ecosystems, fisheries and water quality. On local, regional and national scales, IOOS organizations' partnerships with our office and others strengthen the overall resiliency of coastal communities.

NOAA | OFFICE OF RESPONSE AND RESTORATION

Alon Watabayash

Glen Watabayashi Technical and Scientific Services Branch Chief

Jordan Stout California Scientific Support Coordinator

NOAA | Office of Response and Restoration Emergency Response Division





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

June 9, 2015

RE: letter of support

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

Dear Ms. Thomas:

On behalf of NOAA National Weather Service in San Diego, we enthusiastically endorse the valuable data and services provided by the Southern California Coastal Ocean Observing System (SCCOOS) at the Scripps Institution of Oceanography, UC San Diego.

The NWS in San Diego uses the SCCOOS data website and tools on a regular basis to support operational forecasts. This includes the satellite imagery, high frequency radar mapping of currents, and the water and land weather observations. During outreach efforts we also promote the use of these tools to mariners and those visiting beaches. Recently developed tools such as the water level Flood Index and the drift trajectory mapping will prove useful for our mission of providing life and property saving information to various agencies through spot weather forecasts and traditional watches and warnings.

As a science-based decision support system, the Ocean Observing System's work interactively with local, state and federal agencies, resource managers, industry, policy makers, educators, scientists and the general public to provide data, models and products that advance our understanding of the current and future state of our coastal and global environment. SCCOOS focuses on coastal observations and product development to provide information necessary to address issues in climate change, ecosystem preservation and management, coastal water quality, maritime operations, coastal hazards and national security.

Sustained funding will be crucial to the maintenance of the program's ocean observing network and to the continuity of the important data products and services that these observations enable. Please feel free to contact me if you have any questions.

Sincerely,

Abrander O Tarky

Alex Tardy, Warning Coordination Meteorologist, NWS San Diego



July 21, 2015

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

Dear Ms. Thomas:

On behalf of Tesoro Refining and Marketing, I enthusiastically endorse the valuable data and services provided by the Southern California Coastal Ocean Observing System (SCCOOS) at the Scripps Institution of Oceanography, UC San Diego in partnership with the US Army Corps of Engineers funded Coastal Data Information Program (CDIP).

For more than 45 years, Tesoro has been serving the fuel transportation needs of the western United States. We are a leading independent refiner and marketer of petroleum products, committed to operating responsibly in the communities we serve. Headquartered in San Antonio, Texas, our operations extend across 18 states.

SCCOOS has been a tremendous help with our Precision Navigation system (Protide program). The data received from the wave buoy's you deployed will enable us to substantially cut our lightering offshore and reduce the overall risk of transporting oil on the West Coast. Some other economic and safety benefits include:

- · Oil spill risk reduced because the oil will not be handled as many times.
- Lightering to reduce draft eliminates the need for additional vessels to call the port.
- Reduced vessel traffic reduces congestion in the port.
- Reduced risk of collision due to fewer ships in the port.
- Reduced air pollution from ships.
- More efficient use of the port infrastructure with enhanced traffic management.

As a science-based decision support system, the Ocean Observing System's work interactively with local, state and federal agencies, resource managers, industry, policy makers, educators, scientists and the general public to provide data, models and products that advance our understanding of the current and future state of our coastal and global environment. SCCOOS/CDIP focus on coastal observations and product development to provide information necessary to address issues in climate change, ecosystem preservation and management, coastal water quality, maritime operations, coastal hazards and national security.

Sustained funding will be crucial to the maintenance of the program's ocean observing network and to the continuity of the important data products and services that these observations enable. Please feel free to contact me if you have any questions.

Sincerely, Captain Robert. B. McCaughey Manager Marine Operations



The Maritime Alliance 2877 Historic Decatur, Suite 200 San Diego, CA 92106 www.themaritimealliance.org

May 30, 2015

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

Dear Ms. Thomas:

On behalf of **The Maritime Alliance (TMA**), I write to express our strong support for the valuable work of the Southern California Coastal Ocean Observing System (SCCOOS) at the Scripps Institution of Oceanography, UC San Diego.

The Maritime Alliance is a non-profit industry association – organizer of the San Diego maritime technology community (the largest BlueTech cluster in the U.S.). It focuses on Economic Development, Ecosystem Development, and National/International Outreach. Our sister organization, TMA Foundation is an educational non-profit that focuses on Workforce Development, Research, and Community Outreach. Together they promote sustainable, science-based ocean industries.

The San Diego **BlueTech** cluster includes approximately 200 firms active across a wide array of sectors including biomedicine, defense, desalination & clean water technology, fish farming, marine recreation, maritime robotics, ocean observation and more. With many companies growing at 15-35% per annum, this fast growing economy sector is receiving considerable attention. For example, as part of a first ever **Blue Vision** for the region, San Diego Mayor Faulconer and County Supervisor Greg Cox announced a major initiative that was jointly approved in March 2015 by the City of San Diego and County of San Diego to give San Diego's **Blue Economy** a boost by creating a **BlueTech** incubator and possibly multiple specialized centers of excellence. In April, the Port of San Diego adopted a similar measure.

As part of the national NOAA-led U.S. Integrated Ocean Observing System (IOOS) Program, SCCOOS is the lead federally supported agency gathering "ocean observing" data in southern California. The availability of the reliable, timely ocean data that SCCOOS collects and the analysis it provides are critical as we develop thousands of good-paying **Blue Jobs** in sustainable, science-based ocean industries. In addition, SCCOOS has been an active, important participant in our events and collaborator with **BlueTech** companies interested in testing innovative technologies and systems regionally.

Sustained funding is crucial to promote the program's ocean observing network, for the continuity of the important data products and services these observations enable, and for SCCOOS to have the resources to actively collaborate with the private sector. Please feel free to contact me if you have any questions.

Sincerely,

Michael B. Jones – President The Maritime Alliance



City of Encinitas

May 28, 2015

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

Dear Ms. Thomas:

On behalf of the City of Encinitas, I enthusiastically endorse the valuable data and services provided by the Southern California Coastal Ocean Observing System (SCCOOS) at the Scripps Institution of Oceanography, UC San Diego. The City of Encinitas is a coastal community along 6.2 miles of coastline in Northern San Diego County. San Diego County has the 5^{th} largest population in the nation and is heavily impacted with urban development. The infrastructure along the shoreline includes: Coast Highway, North Coast Rail Corridor, Interstate I-5, sewer pump stations, utility and gas lines.

The Ocean Observing system is a key component to understanding the impacts due to different wave climates and changing ocean water temperatures. The data is very useful for documenting these large atmospheric and oceanographic fluctuations and how this impacts our local beaches. Over 3 million people per year visit the City of Encinitas coastline which averages approximately 42 million dollars per year to local businesses. The shoreline is a critical infrastructure as well as recreational feature that protects Coast Highway 101 while providing multiple habitat protection and enhances the recreational experience. The SCCOOS data is useful to predict changes over time by utilizing real time data that is easily assessable to the public. The data is utilized by researchers, lifeguards and coastal managers especially to help predict the impacts due to sea level rise and El Nino's.

As a science-based decision support system, the Ocean Observing System's work interactively with local, state and federal agencies, resource managers, industry, policy makers, educators, scientists and the general public to provide data, models and products that advance our understanding of the current and future state of our coastal and global environment. SCCOOS focuses on coastal observations and product development to provide information necessary to address issues in climate change, ecosystem preservation and management, coastal water quality, maritime operations, coastal hazards and national security.

Sustained funding will be crucial to the maintenance of the program's ocean observing network and to the continuity of the important data products and services that these observations enable. Please feel free to contact me if you have any questions.

Sincerely Matheine Werlow

Katherine Weldon Coastal Program Manager

JACOBSEN PILOT SERVICE, INC. Los Angeles and Long Beach Harbors

PILOT SERVICE ______ U.S. FEDERAL LICENSED PILOTS OFFICE (562) 435-5435 • PILOT STATION (562) 432-0664 • FAX (310) 835-2485 P.O. BOX 32248 LONG BEACH. CALIFORNIA 90832-2248

June 15, 2015

Julie Thomas Program Manager Coastal Data Information Program Scripps Institution of Oceanography 9500 Gilman Drive, 0214 La Jolla, CA 92093-0214

Dear Ms. Thomas:

On behalf of Jacobsen Pilot Service, Inc., Pilots for the Port of Long Beach California, I completely endorse the valuable data and services provided by the Southern California Coastal Data Information Program (SCCOOS) and the leveraged US Army Corps funded program Coastal Data Information Program (CDIP) at the Scripps Institution of Oceanography

Our Pilots have been using this valuable information for many years now. We navigate some of the largest VLCC Super Tankers that come into American waters and it's critical for us to monitor the swells closely so we can reduce the chance that the vessel will pitch or roll to a point of touching bottom. Also, during storm conditions we use the offshore wave data to predict the wave patterns at our Pilot Boarding area.

We are in the middle of an exciting project now that uses SCCOOS/CDIP wave data and modeling tools as input into a program called Pro-Tides. This project is a partnership between SCCOOS/CDIP, Port of Long Beach, State of California (OSPR), Tesoro Oil Company, the Marine Exchange, and our piloting company. The goal is to assure that our under keel clearance along the entire route into the port is safe at any given swell condition. Pro-Tides is successfully being used in ports like Rotterdam and Amsterdam to keep their ship movements safe.

SCCOOS and CDIP high-resolution directional wave data and models for the coastal US are accessed regularly by thousands of military personnel, lifeguards, coastal engineers, boaters, fishermen, harbormasters, bar pilots, marine transporters, divers, and surfers. SCCOOS/CDIP also characterizes waves for regional coastlines, seeks to understand and predict the response of beaches to waves, and develops and validates regional sediment management models. Without these publicly available data, life and property would be at risk. In addition, SCCOOS/CDIP enhances and expands the efforts of the Integrated Ocean Observing System (IOOS) around the country.

Sustained funding for SCCOOS/CDIP will be crucial to ensure the maintenance of its at-sea equipment and the continuity of its data sets. Please feel free to contact me if I may be of assistance.

Sincerely,

Captain Thomas A. Jacobsen President

U.S. Department of Homeland Security United States

Coast Guard

Commandant United States Coast Guard 2100 Second Street, S.W. Washington, DC 20593-0001 Staff Symbol: CG-SAR Phone: (860) 271-2747 Fax: (860) 271-2773 Email: Arthur.A.Allen@uscg.mil

14 July 2015

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

Dear Ms. Thomas,

The U.S. Coast Guard (USCG) Office of Search and Rescue supports your operation of ocean observing and modeling systems along the California coastline by the Southern California Coastal Ocean Observing System (SCCOOS). As you know, we are committed to working with you and others to develop ways to improve modeling and predictive tools in U.S. waters, especially those that can improve our abilities to predict search and rescue trajectories. In particular, we are interested in seeing the continued delivery of observational data and predictions into the USCG's Search And Rescue Optimal Planning System (SAROPS). SAROPS is now in operational use for search planning at all 49 USCG command centers, including our Sector Command Centers in San Diego and LA/LB. The data and models of the ocean current along the southern California coastline has greatly improved the Coast Guard's ability to optimally plan searches for lost mariners in that region.

The feedback from USCG search planning personnel on SAROPS has been overwhelmingly positive; however there is room for improvement in the areas of: 1) availability of additional surface current products in the EDS; 2) use of SAROPS in nearshore; and 3) higher confidence in all the surface current products. The ocean currents measured and forecasted velocities from the SSCCOOS are available to the Coast Guard EDS for input into SAROPS and has be of enormous benefit to the USCG search and rescue program.

The USCG Search and Rescue program looks forward to your continuing operations of the observational and model systems along the California coast in support of this critical Coast Guard mission.

Sincerely,

arthur a. alla

Arthur A. Allen Oceanographer U.S. Coast Guard Office of Search and Rescue





UNITED STATES ENVIRONMENTAL PROTECTION AGENCY REGION IX 75 Hawthorne Street San Francisco, CA 94105

June 11, 2015

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

Dear Ms. Thomas:

As Marine Debris Program Coordinator for the U.S. Environmental Protection Agency Region 9, I would like to express my enthusiastic support for the valuable data and services provided by the Southern California Coastal Ocean Observing System (SCCOOS) at the Scripps Institution of Oceanography, UC San Diego.

In recent years, EPA R9 has experienced an increasing need for accurate and timely ocean surface currents information to support our emergency and removal response work and the work of our Regional marine debris program. Oil spills, even some of those originating inland, can have an immediate and often devastating impact on the marine environment and accurate predictions of surface ocean currents and their influence on the behavior of the oil spills greatly enhances the effectiveness of response actions in the field and on the water. Our understanding of the behavior, distribution, fate and transport of microplastic debris in the Tijuana River Estuary as well as our soon-to-be-launched Offshore Marine Debris Search project both need an underpinning of a sound, real-time surface currents data feed to our geospatial viewers which are integral to managing and tracking our work and responses.

As a science-based decision support system, the Ocean Observing System's work interactively with local, state and federal agencies, resource managers, industry, policy makers, educators, scientists and the general public to provide data, models and products that advance our understanding of the current and future state of our coastal and global environment. SCCOOS focuses on coastal observations and product development to provide information necessary to address issues in climate change, ecosystem preservation and management, coastal water quality, maritime operations, coastal hazards and national security.

Sustained funding will be crucial to the maintenance of this program's valuable ocean observing network and to the continuity of the important data products and services that these observations enable. Please feel free to contact me at 415-972-3029 or at <u>cook.anna-marie@epa.gov</u> if you have any questions.

Sincerely,

Arra- Marie looos

Anna-Marie Cook USEPA R9 Marine Debris Program Coordinator Superfund Division

Tijuana River National Estuarine Research Reserve

"A Wetland of International Importance" International Ramsar Convention, 2005



301 Caspian Way Imperial Beach, CA 91932 Office (619) 575 3613 x.333 jcrooks@trnerr.org



12 June 2015

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

Dear Ms. Thomas,

On behalf of the Tijuana River National Estuarine Research Reserve, I enthusiastically endorse the valuable data and services provided by the Southern California Coastal Ocean Observing System (SCCOOS) at the Scripps Institution of Oceanography, UC San Diego. As a science-based decision support system, SCCOOS works interactively with local, state and federal agencies, resource managers, industry, policy makers, educators, scientists and the general public to provide data, models and products that advance our understanding of the current and future state of our coastal and global environment. SCCOOS focuses on coastal observations and product development to provide information necessary to address issues in climate change, ecosystem preservation and management, coastal water quality, maritime operations, coastal hazards and national security.

Here at the Tijuana River Reserve, the SCCOOS effort is vital in helping us fulfill our mission in several different ways. One of our core programs at the TRNERR is monitoring of water quality, weather, and biotic indicators within the Tijuana River Estuary, conducted as part of the NERR System-Wide Monitoring Program (SWMP). Of course, one of our goals is better understand the role of the outflow of the Tijuana River in the near-shore marine environment, and SCCOOS provides this critical larger context for the information we generate. More broadly, because SCCOOS offers a wealth of other data in an easily accessible format, I often rely on it when I need to provide researchers, decision-makers, and the general public with information on our coastal ocean. I especially appreciate the degree to which SCCOOS has been responsive to the needs and ideas voiced by myself and others.

Sustained funding will be crucial to the maintenance of the program's ocean observing network and to the continuity of the important data products and services that these observations enable. Please feel free to contact me if you have any questions.

Sincere Dr. Jeffrey Crooks

Research Coordinator & Lead Scientist, Tijuana River National Estuarine Research Reserve



6/10/15 Julie Thomas Executive Director SCCOOS 9500 Gilman Drive, 0214 La Jolla, CA 92093-0214 CALIFORNIA OREGON WASHINGTON

David Anderson Program Director CeNCOOS 7700 Sandholdt Road Moss Landing, CA 95039

Dear Ms. Thomas and Mr. Anderson,

On behalf of the West Coast Ocean Data Portal (WCODP), I enthusiastically endorse the valuable data and services provided by the Southern California Coastal Ocean Observing System (SCCOOS), Central and Northern California Ocean Observing System (CeNCOOS), and the Northwest Association of Networked Ocean Observing Systems (NANOOS).

The WCODP is a project of the West Coast Governors Alliance on Ocean Health (WCGA) and is dedicated to increasing the access and connectivity of ocean and coastal data and people to better inform regional ocean management, policy development, and planning. The WCODP has collaborated closely with the three Regional Associations of IOOS on the West Coast and have benefited greatly from this partnership. As partners, we rely on CeNCOOS, SCCOOS, and NANOOS expertise in connecting oceanographic data to priority ocean health issues identified by the WCGA. In particular, Jennifer Patterson, Emilio Mayorga, and Darren Wright helped mentor a Sea Grant fellow who developed monthly averaged ocean surface current maps for the West Coast that were used to help plan beach cleanups for marine debris. We look forward to expanding this partnership into other priority ocean health issues such as ocean acidification, hypoxia, and coastal hazards.

We value the efforts made by the West Coast regional associations (SCCOOS, CeNCOOS, and NANOOS), and also the efforts made by their partners from universities and other institutions that comprise the observing system. These additional contributions by others extend the reach and impact of the IOOS investment.

There is a clear, continuing need to operate, maintain and improve the regional observing systems. We would like to see CeNCOOS, SCCOOS, and NANOOS expand and have the capacity to increase instrumentation and provide more information and derived products, especially in the ares of OA. We strongly endorse the need for fully developed 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,

Andy la

Andy Lanier, Oregon Coastal Management Program WCODP Co-Chair

Dr. Steve Steinberg, Southern California Coastal Water Research Project, WCODP Co-Chair



CALIFORNIA OCEAN PROTECTION COUNCIL

July 31, 2015

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

Dear Ms. Thomas,

I write to express the California Ocean Protection Council (OPC) staff's support for the valuable data and services provided by the Southern California Coastal Ocean Observing System (SCCOOS) at the Scripps Institution of Oceanography, UC San Diego. The Ocean Protection Council was created by state legislation in 2004 to coordinate activities of state agencies to improve the effectiveness of state efforts to protect ocean resources, to establish policies to coordinate the collection and sharing of scientific data related to coast and ocean resources between agencies, and to recommend changes in state and federal law and policy.

We appreciate and strongly support the SCCOOS efforts to work interactively with local, state and federal agencies, resource managers, industry, policy makers, educators, scientists and the general public to provide data, models and products that focus on four priority areas; 1) ecosystems, fisheries and water quality, 2) climate and climate change, 3) coastal hazards, and 4) marine operations. Each of these areas aligns closely with the OPC goals and objectives as set out in its current five-year strategic plan. In particular, West Coast cocean observing systems, such as SCCOOS, are an integral part to sustaining and expanding a network of ocean acidification observations to inform the decisions of coastal ocean managers and users. Further, we also support SCCOOS and its partners efforts to add additional monitoring sites and provide high-quality data analyses. SCCOO's efforts are also playing a role in helping to develop a comprehensive statewide marine protected area (MPA) monitoring program. The continuation SCCOOS monitoring will be critical in helping the state to leverage existing efforts to create a MPA monitoring program that can increase our understanding of how climate impacts such as changes is the physical and chemical environments may be effecting the performance of MPAs.

1416 Ninth Street, Suite 1311, Sacramento, CA 95814 Website: www.opc.ca.gov Phone: (916) 653-5656

Julie Thomas Page 2

OPC staff look forward to continued collaboration with SCOOS on these areas as well as identifying new opportunities and data needs. Please feel free to contact me if you have any questions regarding this letter.

Sincerely,

Catherine Kullmon

Catherine Kuhlman, Executive Director, Ocean Protection Council



July 29, 2015

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

Dear Ms. Thomas:

On behalf of the Carlsbad Aquafarm, I enthusiastically endorse the valuable data and services provided by the Southern California Coastal Ocean Observing System (SCCOOS) at the Scripps Institution of Oceanography, UC San Diego.

The Carlsbad Aquafarm is Southern California's only shellfish farm, sustainably growing shellfish since 1954. The farm is committed to producing seafood in a manner that conserves ocean resources.

Key to our future is our current work on developing a hatchery that breeds shellfish that are resilient to the growing challenge of ocean acidification. Shortages of shellfish seed brought about in part by ocean acidification have highlighted the need for a hatchery. Today over 50% of US shellfish growers' seed requirements are left unmet. This shortage represents a loss of millions in farm-gate sales and the loss of countless jobs in the industry

Our hatchery will help address this challenge through the development of high-performing shellfish larvae and seed to supply regional, national and global aquaculture markets. Our mission is to help secure a stable and sustainable supply of shellfish in the face of changing global climate and ocean conditions.

Carlsbad Aquafarm seeks to address the emerging issues of seafood security brought about in part by the changing ocean environment by engaging the leading seafood and shellfish companies, federal agencies, and university researchers in collaborative efforts to mitigate the impact of ocean acidification on vulnerable shellfish larvae.

CARLSBAD AQUAFARM

4600 Carlsbad Blvd Carlsbad, CA 92008 760.438.2444 Our work with the Southern California Coastal Ocean Observing System at the Scripps Institution of Oceanography is exemplary of this approach. SCOOS data is of great value for our team in evaluating the effects of changing ocean chemistry on shellfish throughout their entire life cycle.

nfo@carlsbadaquafarm.com

NOAA's National Shellfish Initiative goal of increasing populations of shellfish in our nation's coastal waters through sustainable commercial production and restoration activities can only be achieved through a highly collaborative endeavors, such as SCOOS, that marshals the expertise of Scripps researchers to capture and distribute easy-to-access information on the ocean chemistry which is vital for the future of US shellfish industry.

The Ocean Observing System's collaborative work with local, state and federal agencies, seafood industry leaders, policy makers, scientists and the public to provide useful data, user-friendly models and products that focus on marine operations, coastal hazards, climate change, ecosystem dynamics, fisheries and water quality is of great value to our company, and to others who wish to build a stronger, vibrant domestic seafood industry.

Sincerely,

Thomas Trimmo

Thomas Grimm CEO and President Carlsbad Aquafarm

CARLSBAD AQUAFARM

4600 Carlsbad Blvd Carlsbad, CA 92008 760.438.2444

nfo@carlsbadaquafarm.com

CITY OF LOS ANGELES CALIFORNIA

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ALEXANDER E. HELOU

ASSISTANT DIRECTOR

June 9, 2015

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

Dear Ms. Thomas:

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

On behalf of the City of Los Angeles, LA Sanitation's Environmental Monitoring Division (EMD), I enthusiastically endorse the valuable data and services provided by the Southern California Coastal Ocean Observing System (SCCOOS) at the Scripps Institution of Oceanography, UC San Diego. SCCOOS provides critically needed coastal and ocean observations and generates extremely valuable 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 the Bay and estimating bacterial concentrations at ankle 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 affected by local marine conditions.

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 (Given et al. 2006); 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. Both Los Angeles County and the City of Los Angeles are very interested in the near-shore current data and SCCOOS's surfzone model to help shed light on the dispersion of legacy pollutants, i.e., DDT and PCBs that were discharged from the Los Angeles County Sanitation Districts' (LACSD) outfall at White Point and onto the Palos Verdes shelf.

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Name of Recipient March 26, 2015 Page 2 of 2

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 vital because their focus 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. The data served publicly greatly benefits monitoring efforts aimed at protecting public health and the environment.

The City of Los Angeles' Hyperion Treatment Plant in 2006 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 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. The 2006 5-mile pipe inspection determined that important preemptive repairs were required in the Effluent Pumping Plant Header instigating a more extensive 5-week diversion and monitoring program in fall 2015. The services that SCCOOS provided in 2006 were invaluable and we are already collaborating with them in preparation for our monitoring effort. 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 LACSD, Orange County Sanitation Districts (OCSD), and the Southern California Coastal Water Research Project (SCCWRP), among several others.

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 proposal and recommends it be funded. Sustained funding will be crucial to the maintenance of the program's ocean observing network and to the continuity of the important data products and services that these observations enable. Please feel free to contact me if you have any questions.

Masahiro Dojiri, PhD Division Manager

emdinfo/Corres/SCCOOS REGIONAL COASTAL OCEAN OBSERVING SYSTEM 2015



Post Office Box 1949 San Pedro, CA 90733 Phone: 310.519.3134 24-Hr. 310.832.6411 FAX: 310.241.0300 info@mxsocal.org www.mxsocal.org

12 June 2015

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

Dear Ms. Thomas:

A non-profit organization providing vessel traffic and

maritime information service for Southern California

On behalf of the Marine Exchange of Southern California and Vessel Traffic Service of Los Angeles and Long Beach, I enthusiastically endorse the valuable data and services provided by the Southern California Coastal Ocean Observing System (SCCOOS) at the Scripps Institution of Oceanography, U.C. San Diego, in partnership with the U.S. Army Corps of Engineers funded Coastal Data Information Program (CDIP).

The Marine Exchange, in partnership with federal, U.S. Coast Guard, state, and local port partners, is a private, non-profit firm that provides maritime information and vessel traffic management services for the maritime community in the waters of Southern California and the ports of Los Angeles and Long Beach. Our firm continually works to anticipate and fully meet the maritime information and vessel traffic requirements necessary to promote a safe, secure, efficient, reliable, and environmentally sound maritime transportation system.

Approximately 26,000 commercial vessels participate in the VTS per year and there are approximately 45 movements of some of the largest vessels in the world per day. Daily, there are dozens of movements of smaller, local vessels such as ferries, crew boats to and from anchored ships and offshore oil platforms, tugs and barges, whale watch and charter fishing boats, and school ships. Hundreds of pleasure vessels transit these waters every day of the year.

The ports of Los Angeles and Long Beach are the #1 and #2 container ports in the country, and together are 9th in the world, with more than 14 million containers imported per year. California only has a 5 day supply of oil, and keeping the tankers moving in and out of the ports and the offshore terminal in El Segundo is critical to preventing fuel shortages for all Californians.

The port complex usually operates and vessels move 24 hours a day, 7 days a week, and 365 days a year. The critical environmental information provided by the SCCOOS/CDIP enables these operations, or provides information that vessel operators and harbor pilots need to determine that it's too rough to conduct operations, and they must be suspended.

Example uses of SCCOOS/CDIP buoy information by my firm and our partners include:

1. TUGS & BARGES: Local tugs with freight barges use buoy readings before making the transit from Los Angeles and Long Beach to Catalina Island to determine if they

can safely make the transit and move their cargo in marginal weather. This keeps food and supplies flowing to and from Catalina Island safely and undamaged.

- 2. FERRIES: Ferries to and from Catalina from Los Angeles, Long Beach, Dana Point, and Newport use buoy information to help determine safe vessel speed for the safety of their vessels, crews, and passengers. This keeps tourism alive on Catalina.
- 3. HARBOR PILOTS: The SCCOOS/CDIP notifies the harbor pilots when there is a large, long-period southerly swell running, which can prevent the safe movement of supertankers into Long Beach. This keeps oil flowing to California.
- 4. UNDER KEEL CLEARANCE PROJECT: To improve use by the Harbor Pilots, the Port of Long Beach, California Office of Spill Prevention and Response, Tesoro and Pier 121 users, and the Jacobsen (Long Beach) Pilot Service partnered to increase the safety and efficiency of supertankers entering the Port of Long Beach. Software has been developed which will calculate the under keel clearance of a vessel based on weather forecasts, actual buoy sea/swell observations, and the ship's characteristics. The project is in the development phase, and critical to its success is extremely accurate wave buoy information, which the SCCOOS/CDIP provides.
- 5. OFFSHORE OIL TERMINAL IN EL SEGUNDO: Buoy information helps determine if it is too rough for the tankers and tugs to conduct oil offload operations safely at this facility. A significant fraction of the jet fuel used by Los Angeles International Airport is refined at this terminal.
- COAST GUARD: We brief the Coast Guard with buoy information every morning. This enables them to conduct their missions more effectively and safely.

As a science-based decision support system, the Ocean Observing System's work interactively with local, state and federal agencies, resource managers, industry, policy makers, educators, scientists, and the general public to provide data, models and products that advance our understanding of the current and future state of our coastal and global environment. SCCOOS/CDIP focuses on coastal observations and product development to provide information necessary to address issues in climate change, ecosystem preservation and management, coastal water quality, maritime operations, coastal hazards and national security.

Sustained funding will be crucial to the maintenance of the program's ocean observing network and to the continuity of the important data products and services that these observations enable. Please feel free to contact me if you have any questions.

Sincerely,

Kipling Louttit ptain, U.S. Coast Guard, Retired Executive Director Marine Exchange of Southern California and Vessel Traffic Service of Los Angeles and Long Beach

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

May 28, 2015

Julie Thomas Program Manager Coastal Data Information Program Scripps Institution of Oceanography 9500 Gilman Drive, 0214 La Jolla, CA 92093-0214

Dear Ms. Thomas:

On behalf of NOAA's National Weather Service in Oxnard, CA, I enthusiastically endorse the valuable data and services provided by the Coastal Data Information Program (CDIP) at the Scripps Institution of Oceanography.

Our marine area of responsibility extends from the San Luis Obispo-Monterey County line southward to the Orange-San Diego County line, and outward to 60 nm. Closer to shore, we also provide forecasts and warnings for beaches, harbors, and coastal areas. Our offshore area is heavily used by both commercial and recreational mariners, while along the coast high surf can threaten beachgoers and cause extensive run up and coastal flooding. The complex sea conditions within this area emphasize the importance of quality buoy information and swell forecasts. Information provided by CDIP, including data obtained from Waverider buoys as well as the nowcasts and forecasts of ocean swells, are critical to supporting our forecast and warnings for these areas.

As a science-based decision support system, the Ocean Observing System's work interactively with local, state and federal agencies, resource managers, industry, policy makers, educators, scientists and the general public to provide data, models and products that advance our understanding of the current and future state of our coastal and global environment. SCCOOS focuses on coastal observations and product development to provide information necessary to address issues in climate change, ecosystem preservation and management, coastal water quality, maritime operations, coastal hazards and national security.

Sustained funding will be crucial to the maintenance of the program's ocean observing network and to the continuity of the important data products and services that these observations enable. Please feel free to contact me if you have any questions.

Sincerely,

Markjackson

Mark Jackson Meteorologist in Charge

Serving Anaheim Brea Buena Park Cypress Fountain Valley Fullerton Garden Grove ntington Beach Irvine La Habra La Palma Los Alamitos lewport Beach Orange Placentia Santa Ana Seal Beach Stanton Tustin Villa Park Yorba Linda Costa Mesa initary District Midway City nitary District Irvine Ranch Water District unty of Orange

ORANGE COUNTY SANITATION DISTRICT

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June 16, 2015

Julie Thomas Executive Director Southern California Coastal Ocean Observing System 9500 Gilman Drive, MC 0214 La Jolla, CA 92093-0214

David Anderson Program Director, Central and Northern California Ocean Observing System 7700 Sandholdt Road Moss Landing, CA 95039

Subject: Support for California Regional Integrated Ocean Observing Systems

I am writing to express my support for continued and expanded operations of the Southern California Coastal Ocean Observing System (SCCOOS) and the Central and Northern California Ocean Observing System (CeNCOOS). With over 25 years of professional experience in ocean monitoring and research off the Orange County coast. I believe that these two programs have benefited the management of this heavily utilized resource.

Collaborations among the Orange County Sanitation District (OCSD), SCCOOS, and CeNCOOS have gone on for more than a decade. Their participation in OCSD's 2012 discharge diversion was important to the overall success of this major infrastructure rehabilitation work. A new project, looking at ocean acidification and hypoxia in southern California, is underway with the deployment of a telemetry mooring scheduled to this fall; data from this mooring will be freely available on the SCCOOS and CeNCOOS websites.

In addition to our project partnerships, I use a variety of SCCOOS and CeNCOOS data products in my work. These range from well-established products like surface currents (derived from high frequency radar) to the new HAB forecasting model. Both web portals allow me easy access to long-term data sets, physical oceanographic models, satellite imagery, climate, and weather.

The end-user engagement, along with the willingness of these partners to leverage their expertise, leadership, and resources, has helped distinguish California's ocean science community. OCSD looks forward to continued National Oceanographic and Atmospheric Administration's (NOAA) funding to ensure that SCCOOS's and CeNCOOS's efforts to provide relevant monitoring information continues and improves. In closing, I provide my strong support for NOAA's continued funding.

Sincerely,

Seuge 2 Abots George V. Robertson

Senior Scientist



UNITED STATES DEPARTMENT OF COMMERCE National Oceanic and Atmospheric Administration National Marine Fisheries Service Southwest Fisheries Science Center 8901 La Jolla Shores Drive La Jolla, CA 92037-1508

June 4,2015

Julie Thomas Executive Director SCCOOS 9500 Gilman Drive, 0214 La Jolla, CA 92093-0214 David Anderson Program Director CeNCOOS 7700 Sandholdt Road Moss Landing, CA 95039

Dear Julie and Dave,

On behalf of NOAA/SWFSC Environmental Research Division (ERD), I enthusiastically endorse the valuable data and services provided by the Southern California Coastal Ocean Observing System (SCCOOS) and the Central and Northern California Ocean Observing System (CeNCOOS).

Working with Dan Rudnick (SCCOOS), ERD implemented an ERDDAP server underneath the IOOS glider DAC. This collaboration greatly improved both machine and user access to IOOS glider data as well as improving the import of data from the points of origin. ERDDAP has proven to be an excellent "middleware" server solution and the IOOS glider DAC implementation is an example of the utility of this software. ERD will continue its close collaboration with the IOOS Glider DAC to ensure data access.

ERD also worked closely with CeNCOOS on the development of CeNCOOS's San Francisco Bay page allowing real time access to observations in the Bay.

ERD is tasked with analyzing environmental data to assist with the multiple NMFS mandates through the Magnuson-Stevens Conservation and Management Reauthorization Act of developing sustainable yields of commercial fisheries and protecting the environment through implementation of the Endangered Species Act, the Marine Mammal Protection Act and international agreements. ERD uses all available data, including IOOS shore station and HFR surface current data, in the analyses they prepare. Two specific assessments are the annual "State of the California Current" report provided to the California Cooperative Oceanic Fisheries Investigations (CalCOFI) program and the California Current Ecosystem Report provided each spring to the Pacific Fishery Management Council as input to their Fishery Ecosystem Plan (FEP). ERD is also assisting the west coast National Marine Sanctuaries as they prepare their condition reports and is participating in the CalEPA review of environmental indices. IOOS data are incorporated in all of these analyses.

Coupled with CoastWatch satellite sea surface temperature (SST) imagery, estimates of coastal upwelling help provide the most important local index of conditions impacting California Current fisheries. In addition to the numerous reports and analyses, ERD has embarked on a review of how the upwelling index is computed and exploring options for increased resolution of the index. IOOS-supported shore stations and especially HFR surface currents are data sets that are being tested as candidates for new computations



of the upwelling index. The eight-year record of west coast HFR surface currents is critical for determining whether these data can improve the resolution of the upwelling index; and if successful, future operation of the array will remain critical for determining environmental indices.

Recognition of the benefits of collaboration toward meeting both IOOS and NMFS mandates is further strengthened by across-line participation. Lynn de Witt (ERD) is on the CenCOOS Governing Board, Cisco Werner (the SWFSC Director) was just appointed to the SCCOOS Governance Board and I serve on the CeNCOOS/SCCOOS Joint Science Advisory Council (JSAC). During February 2015, NWFSC and SWFSC underwent a joint NMFS review of the California Current Integrated Ecosystem Assessment (CCIEA) Program. Julie Thomas (SCCOOS) participated in person and Dave Anderson (CeNCOOS) participated remotely; both contributed to the review discussions.

ERD values the efforts made by the California regional associations (SCCOOS and CeNCOOS), and also the efforts made by their partners from universities and other institutions that comprise the observing system. These additional contributions by others extend the reach and impact of the IOOS investment.

There is a clear, continuing need to operate, maintain and improve the regional observing systems. We would like to see CeNCOOS & SCCOOS expand and have the capacity to increase instrumentation and provide more information and products. We strongly endorse the need for fully developed 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,

Joby

Toby Garfield ERD Director NOAA/NMFS/SWFSC 8901 La Jolla Shores Drive La Jolla, CA 92037



2 June 2015

Julie Thomas Executive Director, SCCOOS La Jolla, CA 92093-0214 David Anderson Program Director, CeNCOOS Moss Landing, CA 95039

Dear Ms. Thomas and Mr. Anderson,

On behalf of the California Sea Grant (CASG) Program I enthusiastically endorse the valuable data and services provided by the Southern California Coastal Ocean Observing System (SCCOOS) and the Central and Northern California Ocean Observing System (CeNCOOS).

CASG is a state-based program that supports research and outreach to encourage more sustainable interaction of coastal California residents with nearshore and estuarine ecosystems and habitats. We aim to make local coastal communities more resilient in an environmentally sustainable way. The research we support, and the programs of outreach we develop and implement as part of our extension program, are aided greatly by data collected and made available by the California IOOS programs. For example, local community stakeholders need better information on coastal storms, king tides, beach erosion and other hazards in order to plan for changing environmental forcing. In addition, the quality and sustainability of our seafood is affected by algal blooms, including harmful (toxic) blooms, that seem tied to local nutrient inputs and coastal ocean properties. IOOS data is key to researchers and stakeholders developing and testing models to better understand these important phenomena.

We value the efforts made by the California regional associations (SCCOOS and CeNCOOS), and also the efforts made by their partners from universities and other institutions that comprise the observing system. These additional contributions by others extend the reach and impact of the IOOS investment.

There is a clear, continuing need to operate, maintain and improve the regional observing systems. We would like to see CeNCOOS & SCCOOS expand and have the capacity to increase instrumentation and provide more information and products. We strongly endorse the need for fully developed Regional Associations that benefit our health, wildlife, economy and oceans through a focus on ecosystems and climate, coastal hazards, water quality, and marine operations. CASG looks forward to a continued, long-term partnership with California's ocean observing systems.

Sincerely,

James E. Eckman, Director

Dr. James E. Eckman, Director, 9500 Gilman Drive - 0232, Scripps Institution of Oceanography, La Jolla, CA 92093-0232 phone: 858-534-4440 • FAX: 858-534-2231 • email: jeckman@ucsd.edu



SOUTHERN CALIFORNIA COASTAL WATER RESEARCH PROJECT

A Public Agency for Environmental Research

May 29, 2015

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

Dear Julie:

The Southern California Coastal Water Research Project Authority (SCCWRP) is pleased to offer this letter of support for your proposal to NOAA that will allow you to continue the valuable data and services provided by the Southern California Coastal Ocean Observing System (SCCOOS).

SCCWRP is a leading U.S. environmental research institute that works to develop a scientific foundation for informed water-quality management in Southern California and beyond. Since its founding as a public agency in 1969, SCCWRP has been a champion of sound interdisciplinary approaches to solving complex challenges in water management. In a similar capacity, SCCOOS is actively engaged in identifying needs of Southern California's water-quality management community by providing data, models and products that advance our understanding of the current and future state of our coastal and global environment

SCCWRP supports SCCOOS through my representation on the SCCOOS Board of Governors, collaborations with SCCOOS to support coastal water quality monitoring, and facilitation of communication among scientists and water-quality managers.

Sustained funding will be crucial to the maintenance of the program's ocean observing network and to the continuity of the important data products and services that these observations enable. We look forward to working with you in continued partnership.

Sincerely,

test B. Hent

Stephen B. Weisberg, Ph.D. Executive Director

101 B Street Suite 900	June 8, 2015 File Number 32	00200
401 B Street, Suite 800	5610 0, 2015	
(610) 609-1900		
Eax (619) 699-1905	Ms. Julie Thomas	
sandag.org	Southern California Coastal Ocean Observing System	
Janaagioig	Executive Director, Scripps Institution of Oceanography	
	Lic San Diago	
	0C San Diego	
	9500 Gillian Drive, No. 0214	
MEMBER AGENCIES	San Diego, CA 92093	
Cities of		
Carlsbad	Dear Ms. Thomas:	
Chula Vista	CUDIECT. Inclosure the of Decision I Interneted Orace Observice Co	rtems
Coronado	SUBJECT: Implementation of Regional Integrated Ocean Observing Sy	stems.
Del Mar	The Southern California Coastal Ocean Observing System	
El Cajon		
Encinitas	On behalf of the San Diego Association of Governments (SANDAG), I	would
Escondido	like to express our support for the Southern California Coastal	Ocean
Imperial Beach	Observing System (SCCOOS).	
La Mesa		
Lemon Grove	Funding for this program is critically important to California of	oastal
National City	constituents, specifically those in the San Diego region. In 2001, SA	NDAG
Oceanside	managed the Regional Beach Sand Project (RBSP), which placed 2.1 r	million
Poway	cubic vards of sand on the region's beaches and followed-up with a s	second
San Diego	RESP in 2012 The SANDAG Regional Shoreline Monitoring Program.	which
San Marcos	was initiated in 1996 and continues today was essential to the design	in and
Santee Coloos Bosch	was initiated in 1990 and continues today, was essential to the desig	coos
Solana Beach	deta ta implement and manifer future efforts to replanish heach	and and
and	data to implement and monitor future enorits to repletish beache	is and
County of San Diego	manage the region's shoreline. Further, the region will continue to ma	ke use
	of improved coastal hazards data products made available by SC	.coos,
	especially those related to inundation and shoreline change.	
ADVISORY MEMBERS		
Imperial County	If El Niño materializes as projected, energetic sea conditions this wint	er will
California Department	challenge coastal management efforts and threaten the safety of o	coastal
of Transportation	residents. Detailed wave, current, and inundation information for our	coast
Metropolitan	will be invaluable. Given the importance of the information SCCOOS pro	ovides,
Transit System	additional funding is needed.	
North County		
Transit District	I appreciate your attention to this request. If you have any questions,	please
United States	contact Rob Rundle at (619) 699-6949 or via email at rob.rundle@sandag	.org.
Department of Defense		
6 D	Sincerely,	
San Diego Unified Port District		11
		11
San Diego County Water Authority	(MILL (Allando	
water Authority	CARYL GALLEGOS A COLOGY	
Southern California		



2015

mas e Director California Coastal Ocean Observing System nstitution of Oceanography man Drive, 0214 CA 92093-0214

. Thomas:

If of Catalina Express, I enthusiastically endorse the valuable data and services provided by the California Coastal Ocean Observing System (SCCOOS) at the Scripps Institution of raphy, UC San Diego in partnership with the US Army Corps of Engineers and California nent of Parks and Recreation funded Coastal Data Information Program (CDIP).

Express is a passenger ferry service that operates daily departures from San Pedro, Long Beach a Point to Catalina Island. Catalina Express utilizes the information provided by the Southern a stations, specifically the San Pedro Channel stations and the Dana Point station, on a daily the stations have proven to be very reliable. During times of inclement weather, the data is our organization in making operational decisions.

an Observing System's work interactively with local, state and federal agencies, resource rs, industry, policy makers, educators, scientists and the general public to provide data, models ducts that advance our understanding of the current and future state of our coastal and global nent. Sustained funding will be crucial to the maintenance of the program's ocean observing and to the continuity of the important data products and services that these observations Please feel free to contact me if you have any questions.

400 Oceangate, Suite 300

Long Beach, CA 90802

www.CatalinaExpress.com

er sident, Operations

Administration: 562-485-3200 Ext 1000 Fax 562-485-3201



UNITED STATES DEPARTMENT OF COMMERCE National Oceanic and Atmospheric Administration National Marine Fisheries Service Southwest Fisheries Science Center 8901 La Jolla Shores Drive La Jolla, CA 92037-1508

31 July 2015

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

Dear Ms. Thomas:

With this letter, I wish to convey the value of the data and services provided by the Southern California Coastal Ocean Observing System (SCCOOS) at the Scripps Institution of Oceanography, UC San Diego. The California Cooperative Oceanic Fisheries Investigations (CalCOFI) seabird surveys, funded by SCCOOS, are an example of the importance of SCOOS. I could go into details with respect to how these data have contributed to valuable insights pertaining to management and conservation. Instead, let me state my support at the very high level. Long term datasets are chronically under-valued, yet they are the correstones that secure the potential to address emerging issues, by providing baselines. In my own position I am frequently challenged to maintain such time series. They are the baselines for evaluating impacts of anthropogenic stressors on marine ecosystems and their components. You have my solid support.

Sincerely,

2: T. Ballon

Lisa T. Ballance

Director Marine Mammal & Turtle Research Division, SWFSC-NOAA Fisheries Chief Scientist Eastern Tropical Pacific Research Program, SWFSC-NOAA Fisheries Adjunct Professor Scripps Institution of Oceanography, University of California San Diego



OF THE PACIFIC @

June 1, 2015

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

Dear Ms. Thomas:

I am writing in support of the SCCOOS proposal for continued funding from NOAA. 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 that now exceeds 1.5 million visitors per year, and that has grown in each of the past thirteen years. 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. 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 NOAA to support SCCOOS's proposal to continue development of this valuable and needed regional observing system.

Sincerely,

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Jerry R. Schubel President and CEO

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





April 30, 2015

Dear Brandon,

Catalina Sea Ranch is the developer of the first offshore aquaculture facility in federally regulated waters of the United States. It has a pioneering permit issued by the U.S. Army Corps of Engineers, and unanimously approved by the California Coastal Commission, for developing 100-acres of ocean space about 6 miles offshore Huntington Beach, California.

I am writing about a bill that Representative Don Young (R-AK) will be introducing to reauthorize the Integrate Coastal Ocean Observing System (ICOOS) Act of 2009. I hope Representative Knight will agree to be a co-sponsor of the bill.

The ICOOS Act provides the foundation for the U.S. Integrated Ocean Observing System (IOOS) – an innovative partnership between 17 federal agencies and 11 regional coastal observing system dedicated to addressing the need for timely and accurate data and information about our oceans, coasts and Great Lakes. IOOS is user-driven, science-based and policy neutral.

IOOS data will provide support for Catalina Sea Ranch's sustainable shellfish operations for reducing our nation's \$11 billion seafood deficit. It will also assist our company taking a leadership position for providing research and technologies for national food security. As the \$135 billion global aquaculture market expands, scientific data will become essential for securing regulatory permits. IOOS resources will be critical for our Marine Big Data[™] venture which allows taking the environmental pulse of an area of the ocean to understand short and long-term trends, anticipate problems and devise mitigation measures for immediate corrective actions. This will lead to sound regulations based on solid science for advancing sustainable offshore aquaculture and responsible marine spatial planning.

Reauthorization will ensure this program continues to collect data and disseminate information on critical issues such as flooding, safe navigation, search and rescue, fisheries, water quality and sustainable aquaculture. One of the hallmarks of the IOOS program is the data standards and protocols that allow for the seamless access to data. Because of IOOS data management, over 50% of the marine data used by the National Weather Service comes from non-federal regional sources.

The ICOOS Act formally recognizes the national network of Regional Associations that complement and enhance the federal observing systems. This recognition and the extension of torte liability to certified RAs is critical for our ability to provide users with the best and most timely information possible. Reauthorization of the ICOOS Act will ensure the continuity of this innovative program. Sincerely,

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Philip Cruver, CEO

Catalina Sea Ranch 820 S. Seaside Avenue, Terminal Island, California 90731 www.catalinasearanch.com



June 30, 2015

Dr. Julie Thomas Scripps Institution of Oceanography University of California San Diego 9500 Gilman Drive La Jolla CA 92093

Dear Julie:

I am delighted to write this letter in support of your proposal, *Southern California Regional Coastal Ocean Observing System.* As the SIO Director of Scripps Educational Alliances and a Program Scientist at the Birch Aquarium at Scripps (BAS), I am pleased to use the resources and partnerships of both organizations to support education and outreach for your ocean observatory program and to promote the use of SCCOOS data and resources by science educators and students throughout California and the nation. We are currently working with the San Diego County Office of Education, the San Diego Unified School District and several other state-wide initiatives to include earth and ocean science data in a wide variety of education and outreach programs and materials designed to help teachers implement Next Generation Science Standards (NGSS). The ability to engage students in using observatory data is one of the goals of our efforts and the participation of SCCOOS staff, including programmers is essential. This effort is in fact a natural extension of the long-term SCCOOS education and outreach effort conducted in collaboration with the Ocean Institute and will allow us to capitalize on those continuing efforts to reach students first locally and then throughout the nation.

We appreciate the breadth of SCCOOS engagement throughout Southern California, including:

- · Birch Aquarium Interactive Display and Exhibit, La Jolla
- Southern California Marine Exchange Visitors Display, San Pedro
- Ocean Institute Science Exhibit and Curriculum, Dana Point
- Cabrillo Aquarium Exhibit, Dana Point
- Channel Islands Marine Sanctuary, Channel Islands
- California Surf Museum Exhibit, Oceanside
- · Educational Tours including the Ocean Science Bowl, Scripps, La Jolla
- Workshops and Marine Symposiums, throughout Southern California

Scripps Educational Alliances and the Birch Aquarium at Scripps offer you their full and unqualified support for this innovative proposal. We look forward to hearing that your project has been funded.

Sincerely,

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Cheryl Peach Director, Scripps Educational Alliances Scripps Institution of Oceanography

Mailing Address: 9500 Gilman Drive #0207, La Jolla, CA 92093-0207 - Location Address: 2300 Expedition Way, La Jolla, CA 92037 Phone: 858.534.FISH - Fax: 858.534.7114 - Website: aquarium.ucsd.edu



United States Department of the Interior BUREAU OF OCEAN ENERGY MANAGEMENT Pacific OCS Region 760 Paseo Camarillo, Suite 102 Camarillo, CA 93010-6064 JUN 3 0 2015

Julie Thomas Executive Director SCCOOS 9500 Gilman Drive, 0214 La Jolla, CA 92093-0214 David Anderson Program Director CeNCOOS 7700 Sandholdt Road Moss Landing, CA 95039

Dear Ms. Thomas and Mr. Anderson,

On behalf of the Bureau of Ocean Energy Management (BOEM) in the Pacific Region, I enthusiastically endorse the valuable data and services provided by the Southern California Coastal Ocean Observing System (SCCOOS) and the Central and Northern California Ocean Observing System (CeNCOOS).

BOEM, in the Pacific Region, has responsibilities for leasing and plans for energy development on the outer continental shelf (OCS) in Washington, Oregon, California and Hawaii. As part of the leasing and plans processes BOEM conducts environmental analysis to meet the requirements of the National Environmental Policy Act (NEPA) and consultations for the Endangered Species Act (ESA) and Essential Fish Habitat (EFH). Subject matters experts within BOEM utilize data provided by SCCOOS and CeNCOOS for these environmental analyses for the OCS off of California. It is essential that BOEM continues to have access to Ocean Observing data for our ongoing operations.

We value the efforts made by the California regional associations (SCCOOS and CeNCOOS), and also the efforts made by their partners from universities and other institutions that comprise the observing system. These additional contributions by others extend the reach and impact of the IOOS investment.

Given BOEM's responsibilities along the west coast of the United Sates, there is a clear, continuing need to operate, maintain and improve the regional observing systems. We would like to see CeNCOOS & SCCOOS expand and have the capacity to increase instrumentation and provide more information and products. We strongly endorse the need for fully developed 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,

Susan F. Zaleski **Biological Oceanographer** BOEM, Pacific Region