

**Sanitation Districts of Los Angeles County
Joint Water Pollution Control Plant**

**Proposed Special Study
2016**

**BASELINE ASSESSMENT OF HYPOXIA AND OCEAN ACIDIFICATION EVENTS
NEAR THE SEAFLOOR IN SANTA MONICA BAY (JWSS-16-002)**

Goals and Objectives:

Existing quarterly monitoring of oceanic conditions is not sufficient to define duration, frequency, and magnitude of ocean acidification and hypoxia (OAH) events. Furthermore, the pH electrode technology used on the monitoring device is not sufficiently accurate to measure subtle shifts in pH or aragonite saturation associated with OAH. The California Current Acidification Network (C-CAN) recommends high frequency sampling using moorings and state of science sensor technology for measuring pH (i.e. ISFET pH sensors). C-CAN also recommends sampling at least two carbonate chemistry parameters (e.g. pH and pCO₂), in order to properly characterize the carbonate chemistry and determine the aragonite saturation level, which is most directly relevant to the health of shelled marine species.

The goal of the proposed Special Study is to deploy a mooring near Santa Monica Bay (SMB), to continuously collect oxygen, pH and pCO₂ data from a location near the sea floor for a period of two years to assess the magnitude, frequency, and duration of hypoxia and low aragonite saturation events in various layers within the water column. The main study objectives are summarized below:

1. Establish a baseline dataset to assess and track OAH in the SMB
 - a. Collect continuous, high quality data to identify variability patterns in oxygen, pH, and CO₂ using state-of-art sensors to:
 - i. Identify seasonal, event scale and instantaneous extremes
 - ii. Contribute to trends analyses
 - iii. Support a variety of biogeochemical assessment studies
2. Provide data for validation of models being developed to assess the contribution of local anthropogenic nutrients sources to OAH and inform restoration efforts by the Santa Monica Bay Restoration Commission (SMBRC)
3. Contribute to the development of a long-term, high frequency coastal water quality monitoring network to assess spatial and temporal trends in OAH and high chlorophyll (HABs) events and their associated impacts within coastal waters of Los Angeles County and beyond
4. Develop expertise in the operation and maintenance of moorings equipped with next generation oxygen and acidification sensors

Benefits:

High-precision, time-series data on pH and pCO₂ is currently absent from monitoring programs in SMB. Existing monitoring activities for acidification, aragonite saturation state, and hypoxia in the SMB are limited to synoptic monitoring, which provides excellent spatial coverage but no

data on the high frequency changes in OAH in the Bay. Discharger and Regulatory agencies alike see the value in time series data for making management decisions and are moving towards deployment of moorings within the Bay for a standard suite of water quality parameters. Inclusion of a high precision instrument package for pH, pCO₂, and dissolved oxygen on these moorings would provide valuable time-series information on OAH within SMB. Furthermore, incorporation of pH, pCO₂ and dissolved oxygen sensors would bring monitoring in SMB in-line with the West Coast-wide monitoring strategy proposed by the C-CAN.

The proposed Special Study will provide a proof of concept for using state of science instruments (pH, pCO₂, and oxygen) deployed to collect high frequency time-series data at a representative location on the shelf in the SMB. The collected data will be made available in support of ongoing research on OAH in SMB, including model validation, and C-CAN applications. These efforts are consistent with the objectives of the SMBRC Pelagic Ecosystem Comprehensive Monitoring Program and the data will also be presented and analyzed in future State of the Bay Reports.

Approach:

The mooring design will consist Satlantic SeapHOX (includes an ISFET pH sensor integrated with an SBE-37 CTD unit) and SAMI pCO₂ sensor. The Sanitation Districts will also co-locate a thermistor string to continuously measure water column stratification. Santa Monica Bay Restoration Commission (SMBRC) staff will lead development and submission of a QA plan that will be approved by the EPA prior to data collection. Sanitation Districts of Los Angeles staff will provide field support for the deployment, maintenance, retrieval, and data analysis/interpretation. Southern California Coastal Water Research Project will provide short and long-term data management and storage.

During the first year of deployment, the mooring will be sited just offshore of the Sanitation Districts of Los Angeles County's (Sanitation Districts) light energy monitoring station L1 (**Figure 1**) in approximately 25 meters of water. The instrument package will be suspended approximately 15 meters below the surface within the upper mixed layer of the water column. This configuration will be used to provide validation data for the OAH model being developed as well as baseline OAH event data for the surface layer.

After the first year of deployment, the mooring and thermistor string will likely be relocated to deeper water (~70 meters) offshore of Sanitation Districts water quality monitoring station 3103 (**Figure 2**) and the instrumentation suspended approximately 10 meters above the bottom. It is anticipated that this configuration would be used for the second year of the study to obtain a baseline for OAH events near the bottom where potential biological effects are likely the greatest. These data will also be used for OAH model validation of the deep layer.

Project Duration:

Following anticipated approval of the Special Study in April 2016, delivery of sensors and assembly of mooring hardware is expected by July of 2016. The mooring is expected to be deployed by the Fall of 2016 and data collection for this Special Study will continue for two years. Final data analysis and interpretation is expected to be completed by the end of 2018 with a final report submitted to the Board by May 15, 2018.

Deliverables:

The primary deliverable will be a final report describing the results with particular emphasis on the frequency, magnitude, and duration of OAH events in the nearshore surface and offshore bottom layers. Until submission of the final report, quarterly progress reports will be submitted to the Board.

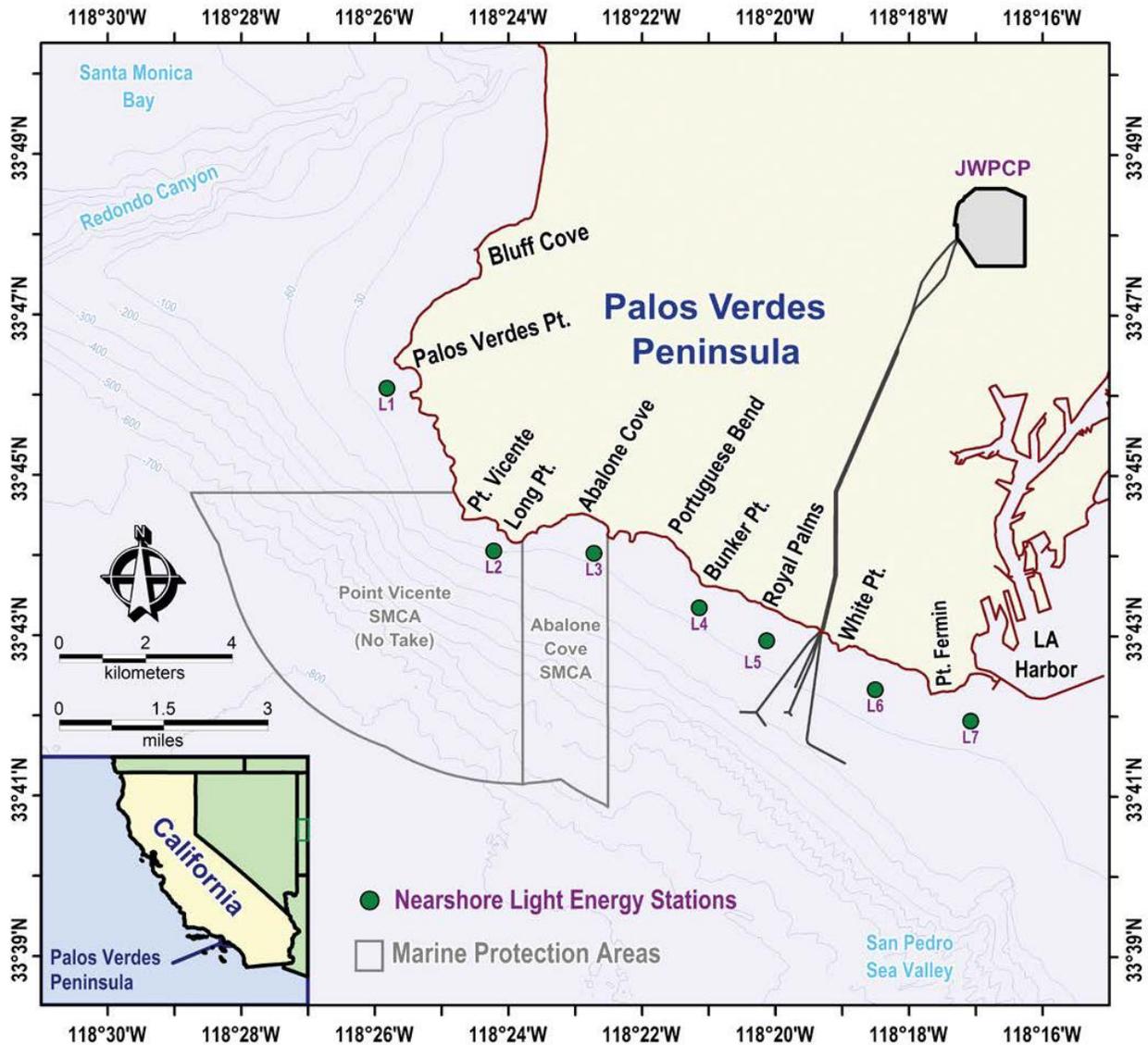


Figure 1 Map of the Sanitation Districts light energy monitoring stations. For year one of the study, the mooring and thermistor string will be co-located just offshore of station L1 with the instrumentation suspended about 15 meters below the surface.

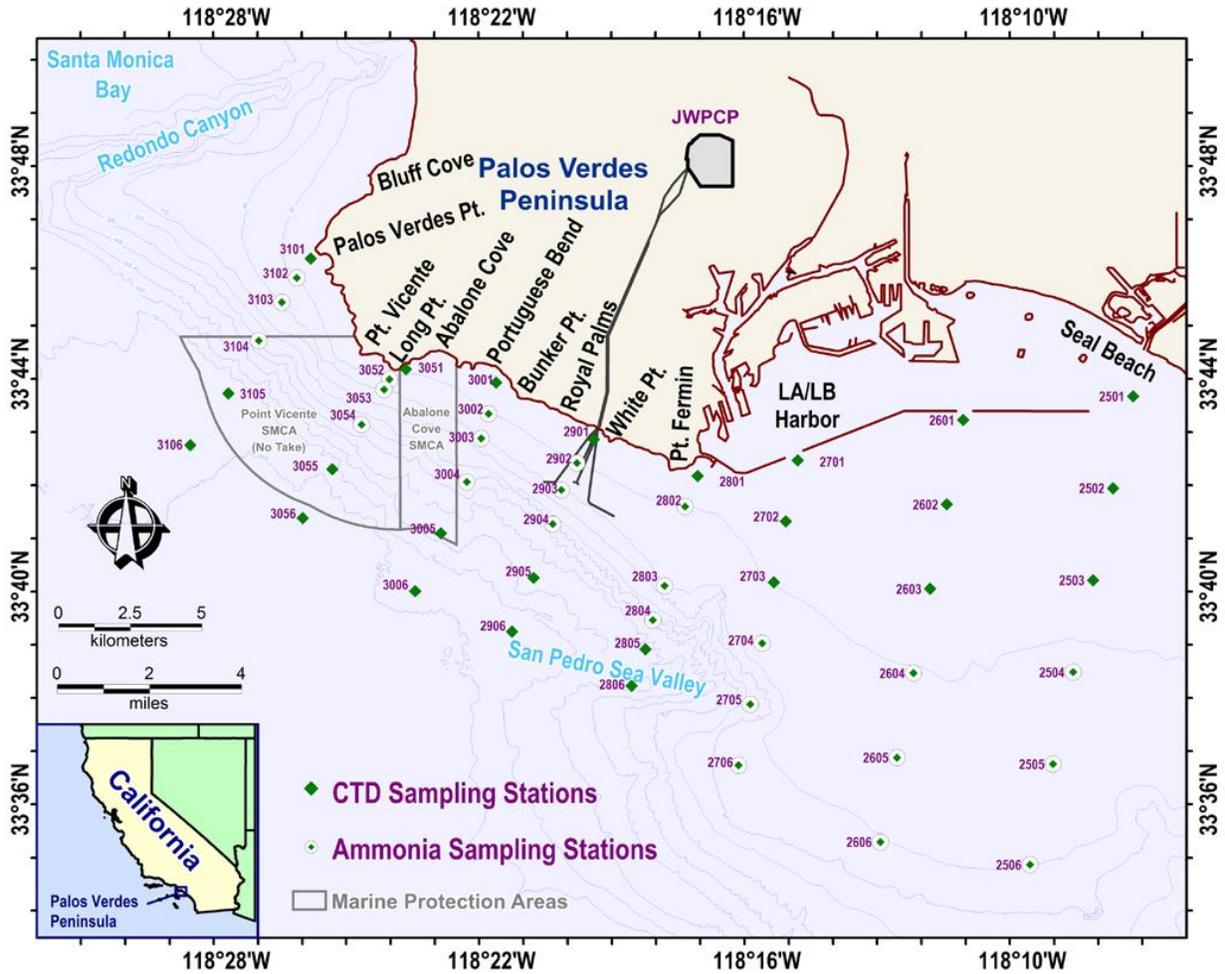


Figure 2. Map of the Sanitation Districts nearshore/offshore water quality monitoring stations. For year two of the study, the mooring and thermistor string will be co-located just offshore of station 3103 in 70 meters of water with the instrumentation suspended about 10 meters above the bottom.

Collaborators:

The National Estuary Program, SMBRC, SCCWRP, City of Los Angeles, C-CAN, OAH modeling partners at University of California Los Angeles, University of Washington, and NOAA’s Pacific Marine Environmental Laboratory, as well as University of Southern California and University of California Irvine researchers studying biogeochemical cycling in the SMB.