Progress Report

Project Title: Sustaining and Expanding the Southern California Coastal Ocean Observing System

Award number: NA21NOS0120088

Period of Activity: 07/01/2021 - 12/31/2021

Principal Investigator(s):

- Principal Investigator: Eric Terrill, UCSD SCCOOS Technical Director
- Co-Principal Investigator: Clarissa Anderson, UCSD SCCOOS Executive Director

I. PROJECT MILESTONES:

Milestone Table. Developed and modified from SCCOOS milestone table available on the cover page of our FY21 descope report as well as SCCOOS Goals, Objectives, and Tasks in table 4 of our FY21-26 proposal. Projects are organized by SCCOOS subsystems and listed in bold. Project high-level milestones/deliverables are listed below each project. Status of each milestone/deliverable is reported as complete, on-track, or delayed. If the milestone is delayed, a justification for the delay is provided along with a new completion date and description of activities employed or to be employed to mitigate the delay under section II. Progress and Accomplishments.

| Project and Task(s) | Status |
|--|----------|
| GOVERNANCE SUBSYSTEM | |
| SCCOOS Regional Association Organization & Outreach/Education | |
| SIO - 1) Maintain a centralized program office that oversees SCCOOS operations and effectively coordinates with all partners to expand capacity 2) Develop regionally relevant, user-driven analysis, decision-support, and visualization products and tools to address historic and emerging stakeholder requirements in the SCCOOS region; 3) Engage stakeholders to gather customer feedback and refine requirements for SCCOOS products and services. 4) Expand and strengthen state, federal, and industry partnerships to innovate ocean observations and information products in collaboration with CeNCOOS. | On-track |
| OBSERVING SUBSYSTEM | |
| HF Radar Operations & Maintenance | |
| Sustain & operate 31 High Frequency Radar in the SCCOOS Region - continuous service via HFRNet, SCCOOS, and CeNCOOS | On-track |



| California Underwater Glider Network (CUGN) | |
|--|-----------|
| SIO - Sustain & operate two Spray glider lines in the SCCOOS region - continuous service with 3-5 month deployments per Spray | On-track |
| Harmful Algal Bloom (HAB) Monitoring Program + SPATT | |
| SIO/USC/UCLA/UCSB/CalPoly - Sustain weekly sampling at five pier sites in the SCCOOS region for HAB species, particulate toxins, chlorophyll-a, temperature, salinity, & inorganic nutrients. Plankton classification, chlorophyll-a, temperature and salinity are reported weekly and data are submitted weekly to the SCCOOS database. Samples are shipped monthly to USC for domoic acid analysis. Samples are shipped quarterly to UCSB for nutrient analysis. | On-track |
| SIO/USC/UCSB - Sustain weekly SPATT sampling for a suite of dissolved toxins and shipped monthly to USC for analysis. | On-track |
| SCCOOS Automated Shore Stations (SASS) | |
| SIO/CSUN/UCSB - Operate & maintain four SCCOOS Automated Shore Stations (SASS) - continuous data service at a 4 min ingestion frequency, with routine (monthly) sensor cleaning and maintenance. Standard station parameters are temperature, salinity, depth, and chlorophyll fluorescence. | On-track |
| OAH Monitoring on SASS Stations | |
| SIO - Integrate, operate & maintain self-calibrating SeapHOx (pH and Oxygen sensors) on 3 automated shore stations in the SCCOOS region: Scripps Pier, Santa Monica Pier and Stearns Wharf. Data are provided continuously, with near-real time calibrations applied. Routine instrument cleaning and servicing (e.g. reagent replacement) is coordinated with SASS personnel. | On-track |
| CalCOFI- Distribution and abundance of marine birds in the Southern Californ and adjacent waters | nia Bight |
| Farallon Inst - Collect seabird & marine mammal distribution and abundance data on winter, spring, and summer CalCOFI cruises and spring/summer NMFS RREAS (rockfish recruitment survey) and deliver annual reports to SCCOOS for incorporation into CCIEA and NMS reports. | On-track |
| California Multivariate Ocean Climate Indicator (MOCI) | |
| Farallon Inst - Update and disseminate the Multivariate Ocean Climate Indicator (MOCI) - CeNCOOS collaboration- for incorporation into customized data synthesis products and curated data views | On-track |
| Statewide Kelp Canopy Area/Biomass Dynamics | |



| WHOI - Incorporate kelp biomass database into our portal & develop user-driven discovery tools & displays - CeNCOOS collaboration - for incorporation into customized data synthesis products, curated data views, and made available for all relevant assessments, e.g. MPAs | On-track |
|--|----------|
| California Coastal Flood Network | |
| SIO - Support & expand the California Coastal Flood Network, adding a new Southern California site to the threshold validation/evaluation process each year | On-track |
| HABON Pilot - CA IFCB Network O&M | |
| Operate and maintain a network of eleven Imaging Flow Cytobots (IFCBs) to identify HAB species in real-time at critical land-based <i>and</i> offshore locations throughout California. | On-track |
| CDIP - Long Beach Wave Buoy Model Validation | |
| Operate and maintain the Long Beach wave buoy and model validation in support of marine operations/navigation at the Port of Long Beach. | On-track |
| DATA MANAGEMENT AND COMMUNICATION SUBSYSTEM | |
| SCCOOS DMAC | |
| SIO - 1) Support ongoing maintenance, operation, and development of SCCOOS cyberinfrastructure to sustain long-term data stewardship for our partners and stakeholders; 2) Promote data standardization, automation, discovery, and public access; 3) Strengthen data stewardship within the SCCOOS consortium to improve data quality, access, attribution, exchange, delivery, and storage and; 4) Support the functionality of national data assembly centers through leadership in observation and product delivery, quality control methods, and capacity building. | On-track |
| Axiom Data Science | |
| ADS - 1) Enable and support SCCOOS Cyberinfrastructure and development of a new Statewide Data Portal; 2) Ingest and maintain SCCOOS-operated and Non-SCCOOS Data Assets, including sensors, Gliders, HF Radar, models, biological, and historical legacy time series; 3) Implement real-time sensor data quality control system and; 4) Support the creation of data-driven products and applications. | On-track |
| CalCOFI - Data Synthesis and Serving/Product Development | |
| SIO - Data synthesis & product development in support of CalCOFI, fisheries, & National Marine Sanctuaries; continual syntheses and automated, curated data views will be developed and vetted with crucial stakeholder partners | On-track |



| MODELING AND ANALYSIS SUBSYSTEM | |
|--|----------|
| ROMS - 3 km Statewide Operational model | |
| Seatrac - Support & serve real-time, data-assimilative ROMS predictions to SCCOOS & CeNCOOS end-users; models are run on SCCOOS servers and output is provided hourly to daily to the SCCOOS portal | On track |
| ROMS - High Resolution Shelf and Nearshore Physics | |
| UCLA - Support nearshore ROMS development for improved physics of direct relevance to water quality managers and SCCOOS partners; SCCOOS supports a project page with annual updates of model output/visualizations of nearshore physics developments | On track |

| | High-Frequency Radar | | | |
|-------------|----------------------|--|--|--|
| Amount | Funding Area | Task | | |
| \$1,085,000 | Core | Status: The Southern California High Frequency Radar Network (HFRNet), a backbone of the Integrated Ocean Observing System (IOOS), supports both operational and research communities by providing high quality, spatially dense, ocean surface current data in near real-time. These economical and effective remote sensing instruments map coastal ocean surface currents to assess both regional- and local -scale physical changes in the coastal oceans. The 31 SCCOOS individual radar stations, regionally operated, report data to nodes for subsequent processing, quality control, display, backup, and distribution to operational users including the U.S. Coast Guard, NOAA's National Data Buoy Center and Office of Restoration and Response. SCCOOS participates in biweekly technical calls with CA operators and has hosted informational meetings with stakeholders, as detailed in the accomplishments below. | | |
| | | Accomplishments: Tuesday 08/04 @ 12:30pm. Hosted Dr. Cristina Forbes, Oceanographer, U.S. Coast Guard Headquarters, Office of Search and Rescue (CG-SAR) to discuss the various data feeds using HFR surface currents (near real-time, short term prediction system (STPS), and model assimilation. | | |

II. PROGRESS AND ACCOMPLISHMENTS



| | Friday 08/21 @ 10am. CA operators hosted Dr. Cristina Forbes and reviewed the CA ROMS model that is currently available to the USCG electronic data server (EDS) for use in their SAROPS tool. Thursday 08/27 @ 10am. Presented for USCG Blue Technology Center of Expertise Seminar Series with representatives from headquarters, research and development center (RDC), USCG |
|--|---|
| | academy and branch divisions including Environmental and Waterways and SAR. Friday 10/02 @ 10am. Hosted Chris Edwards, UCSC; Flo, SCCOOS, and Natalie Lo, CeNCOOS to hear about their California |
| | Marine Protected Area project and how they are using the HFR network surface currents, most of which may primarily be with model outputs that use assimilation. Chris is involved in the West Coast-wide ocean forecast model (WCOFS) which assimilates the near real-time HFR surface current maps. |
| | Friday 10/16 @ 10am. Hosted Chelsea Carlson (SeaTactics - Meteorologist) and Riley Schutt (U.S. Sailing Team R&D lead) to introduce HFR network surface currents availability and listen to how they may use the data. U.S. sailing team can view trends from HFR surface current maps. Their upcoming race is <2km from the coast; team recommended a nearshore model. |
| | Thursday 10/18 @ 9am. Toured United States Coast Guard SAROPS facility in Los Angeles/Long Beach facility. A Search and Rescue demonstration was shown and how HFR data are used in the decision-making process. |
| | Friday 12/11 @ 10am. Hosted Amy MacFadyen, Chris Barker, and Dylan Righi from the NOAA Office of Response and Restoration involved in running and improving the development of the General NOAA Operational Modeling Environment (GNOME) for predicting the fate and transport of pollutants (such as oil) spilled in water. Also attending the meeting were Jordan Stout, Scientific Support Coordinator for OR&R's Emergency Response Division (ERD) and IOOS Program Manager, Brian Zelenke. We discussed the use of HFR surface currents in conjunction with GNOME model output and availability of STPS for forecasting surface currents from HFR near real-time data. |



| | SCCOOS HF radar personnel have been conducting field work in Southern California. Brian Emery of UCSB has been leading a series of NSF-funded field experiments in which drifters are deployed along range cells of HF radar near Santa Barbara, CA. The goal of the field work is to improve quantification of HF radar errors. David Salazar, Eduardo Romero, and Carter Ohlmann also participated in the experiments. |
|--|--|
| | David Salazar and Eduardo Romero of UCSB and Matthew Ragan of USC performed maintenance operations on radars that measured surface currents in the area of the recent Huntington Beach Oil Spill offshore of Orange County. Matthew Ragan and David Salazar also reinstalled a radar on Catalina Island and reinstalled the radar at Torrance Beach. |
| | Issue (if any): The network is in need of recapitalization. Approximately 15% of the CA High Frequency Radar Network has exceeded the normal service life of the equipment of 20 years and 96% of the network has reached the half-way point of its service life of 10 years. |

| Names of existing and planned HFR stations | Status | Date of most recent antenna calibration | Date planned for next antenna calibration | Recapitalization needs |
|---|---|--|---|------------------------------------|
| AGL1 | Operational. Replaced AC unit and satellite communication dish. | 9/15/2021 | 9/2022 | TX chassis, RX chassis, TX antenna |
| ARG1 | Operational. Replaced satellite communication dish. | 9/15/2021 | 9/2022 | RX chassis, TX chassis |
| PTC1 | Operational. Installed new RX/TX combine antenna at new location. Installed new GPS antenna. | 11/18/2021 | 11/2022 | RX chassis, TX chassis |
| FBK1 | Operational. Vandenberg power infrastructure was replaced/updated resulting in several extended power outages during the reporting period. | 9/27/2021 | 9/2022 | RX chassis |
| LUIS | Operational. | 10/21/2021 | 10/2022 | RX chassis, TX chassis |



| SDPL | Station continues to be operated nominally with some sporadic downtime attributed to scheduled city power outages. | 09/29/2020 | 01/2022 | New HPWREN link antennas |
|------|--|---------------|---------|--|
| SDBP | Operating nominally. Occasionally comms link can go down due to interference from Mexican carrier signals. A high gain directional antenna should solve the problem. | 9/28/2020 | 01/2022 | High gain directional LTE antenna |
| SDSE | Operational. Station is due for a receiver antenna upgrade. Logistics are being worked out with the state park for the installation. Older pattern measurement seems to yield better coverage at this site. | 4/24/2019 | 01/2022 | Rx Chassis |
| SDSC | Site operated nominally the majority of the time but is currently experiencing cooling issues. A trip is being planned to install a new AC unit. | 4/27/2021 | 04/2022 | Rx Chassis Tx Chassis Rx Antenna Tx Antenna |
| SDCP | This site started operation in April 2021 and has been performing nominally ever since. Due to its proximity to the Navy LCAC facility, patterns have not been approved yet. | Ideal Pattern | Unknown | |
| SDUT | Site is operating nominally. This site is currently being tested with a 25 MHz system to help mitigate some of the interference seen when operating at 13 MHz | Ideal Pattern | 01/2022 | Rx Chassis Rx Antenna |
| SDDP | Site operating nominally. Older pattern measurement seems to yield better coverage at this site. | 4/26/2019 | 01/2022 | |
| SDWW | The site was down for a couple of weeks due to a bad A/C unit but operating nominally otherwise. | 6/4/2020 | 01/2022 | Tx Chassis Rx Chassis |
| SDCI | Site has been not operational due to access becoming increasingly difficult. | 10/18/2018 | Unknown | Batteries for solar system Rx antenna |



| | Batteries for the solar system and rx antenna need replacement but requesting approval from the Mexican navy has proven challenging. | | | New HPWREN link antennas |
|------|--|---|---|--|
| SDSL | Site operating nominally. | 9/25/2020 | 01/2022 | Rx Chassis Tx Antenna |
| SDSN | Site operating nominally. | 03/20/2021 | 04/2022 | |
| RFG1 | RFG1 has been operational over the reporting period. There have been occasional short-term outages due to power shut-offs by Southern California Edison, and one 39 hr outage due to the Alisa fire. | 08/31/2021 | 02/2022 | Rx Chassis Tx Antenna New AC |
| TRL1 | TRL1 is a mobile site that is not operating because the trailer is no longer roadworthy. We are currently evaluating possible replacement trailers. | N/A | N/A | |
| SCI1 | SCI1 has been operating fairly consistently during the reporting period. There have been some downtimes due to power failures on the island. | 04/17/2021 | 02/2022 | Rx Chassis Tx Antenna New A/C |
| SNU1 | SNI1 has been out of operation throughout the reporting period. COVID restrictions have prevented access to the site. We are working with the Navy to replace the communications system which is currently down. | Not possible due to military regulations. APMs done via ships of opportunity. | Not Possible due to military regulations . APMs done via ships of opportunity | Rx Chassis Tx Antenna New Trailer Enclosure New AC AIS antenna pattern hardware/license |
| SNII | COP1 has been operational over the | 08/25/2021 | 02/2022 | Rx Chassis |
| COP1 | reporting period. | 56/20/20/21 | | Tx Antenna |
| PTM1 | PTM1 has been operational over the reporting period. | 11/09/2021 | 02/2022 | Rx Chassis Tx Antenna |



| SSD1 | SSD1 is operational, but was down for a few days during the reporting period when there were equipment failures. This required swapping of the electronics boxes which caused the downtime. | 08/06/2021 | 02/2022 | New A/C |
|------|---|------------|--------------------------|--|
| MGS1 | MGS1 has been operational over the reporting period, with intermittent data gaps due to lack of power from the solar/battery array. | 01/01/2021 | 02/2022 | Rx Chassis Tx Antenna New AC |
| NICI | NIC1 has been operational over the reporting period. Operation has been satisfactory. | 01/01/2021 | 02/2022 | New Front Door for enclosure |
| SCCI | The site was reinstalled in October with a new antenna and has been operational since. | n/a | First quarter 2022 | |
| SCDH | The site has been operational during this project period and has been operating without any issues. An antenna pattern measurement was attempted but was aborted to do equipment issues caused by ocean conditions. | n/a | First quarter 2022 | Electronics enclosure (\$5,000) |
| SCTB | The site was reinstalled in July. A new antenna has been ordered and will be installed in the first quarter 2022. | 11/18/2021 | 11/2022 | |
| SCPF | A new GPS antenna was installed in December and has been operating throughout this project period. | 02/28/2018 | First quarter 2022 | New antenna (\$23,000) New Tx chassis (\$42,000) New Rx chassis (\$76,000) |
| SCNB | The electronics were damaged beyond repair after saltwater intrusion. The university's Risk Management office has agreed to cover the cost of replacement and the transmit and receiver chassis are on order. In the meantime SIO has loaned a transmit and receive chassis to keep the site | 10/24/2021 | 10/2022 | New antenna (\$23,000) New cables (\$1,800) New electronics enclosure (\$5,000) |



| | operating. There is a damaged radial antenna and plans are being made to repair the antenna. | | | |
|------|---|------------|---------|------------------------|
| SCDB | The site was offline for several weeks during this period due to a computer failure. A new computer was purchased and installed at the site. | 11/23/2021 | 11/2022 | New antenna (\$23,000) |

Additionally, if your RA operates HFR data servers or other information technology (IT) computing infrastructure for HFR beyond the stations themselves, please include a narrative for each such component in the table below (adding rows as needed).

| Names of RA's HFR IT Systems | Status | Recapitalization needs |
|---------------------------------|--|-------------------------------|
| SIO Portal | Operational | N/A - planned in HFRNet |
| UCSB Portal | Operational - The portal is hosted as a virtual machine that is in the processing of being migrated to a new hardware cluster. | N/A - planned in HFRNet |
| Rutgers Portal | Operational | N/A - planned in HFRNet |
| USM Portal | Operational | N/A - planned in HFRNet |
| MBARI Portal | Operational | N/A - planned in HFRNet |
| UMiami Portal | Operational | N/A - planned in HFRNet |
| OSU Portal | Operational | N/A - planned in HFRNet |

Gliders and Other Uncrewed Systems (UxS)

Summary of glider activities over the reporting period: Line 80 and alongshore

| Mission | Serial No. | Deploy Date | Recover Date | Days | Distance (km) | Dives |
|----------|---------------|-------------|-----------------|------|------------------|-------|
| 21306401 | 64 | 24-Mar-2021 | 13-Jul-2021 | 111 | 2158 | 1000 |
| 21705501 | 55 | 15-Jul-2021 | 28-Oct-2021 | 105 | 2274 | 1041 |



| 0064 active | 64 | 28-Oct-2021 | Ongoing | 46 | 1005 | 419 |
|-------------|----|-------------|-------------|-----|------|-----|
| 21401301 | 13 | 19-Apr-2021 | 12-Aug-2021 | 115 | 2341 | 925 |
| 21803001 | 30 | 12-Aug-2021 | 30-Nov-2021 | 110 | 2539 | 964 |
| 0013 active | 13 | 30-Nov-2021 | Ongoing | 13 | 321 | 118 |

Accomplishments / successes: All operations are on track. Three publications during the report period including contributions to the California Current Integrated Ecosystem Assessment and to the CalCOFI State of the California Current report. The third publication will be part of the Ph.D. thesis of graduate student Alice Ren.

Problems/delays: None

Other UxS activities of note (status/accomplishments, etc.):

Other Core Observation Activities

DMAC Activities

Summary of other Observation Activities over the reporting period:

- Axiom supported the development of a new integrated coastal and ocean observing data portal that unifies data streams across the California coast from CeNCOOS and SCCOOS regions. The CalOOS data portal is available in a prototype environment, as additional changes and new data streams are added: <u>https://data.caloos.org/</u>.
- During this performance period, basic QARTOD tests were applied for <u>139 real-time and</u> <u>historical timeseries datasets</u> that are accessible through the CalOOS data portal.
- Axiom provided technical assistance for setting up and creating station alerts for new IFCB instruments.

Accomplishments / successes:

- During this performance period, Axiom maintained ongoing continuous performance of the SCCOOS data system following IOOS DMAC guidelines. Additionally, Axiom initiated a new data center build out in August 2021 to increase data storage and compute resources for system optimization. This work included: building 60 new m620 compute blades with CPUs, building 3x ceph storage heads, racking 4x m1000e compute and 5x c6320 database chassis, and sledding 120 new 10TB drives.
- A new service was developed on the Axiom infrastructure to calibrate chlorophyll, O2, and pH data that are being collected by SCCOOS Shore Stations prior to their ingestion by packrat. The code reads raw data files, calibrates parameters using a library, and then



continuously writes out new files for ingestion and visualization into the CalOOS data portal. See <u>Santa Monica Shore Station page</u> as an example.

• The MPA Shiny instance was moved to a dedicated server within the SCCOOS data subsystem at Axiom to optimize platform performance.

Problems/delays: None

SCCOOS Automated shore stations (SASS)

Summary of other Observation Activities over the reporting period:

- UCSB personnel met with the Sea Center in Santa Barbara to discuss re-configuring the top-side SASS equipment to accommodate the upcoming installation of the in-situ imaging flow-cytobot (IFCB) at Stearns Wharf.
- SIO personnel continue to work with Orange County Sanitation District (OCSD) at the Newport Beach Pier station to provide real-time oxygen and pH observations to assist with evaluating potential water quality impacts at coastal stations. SIO personnel also deployed an IFCB at the Newport Beach station within the submerged SASS frame and housed the IFCB power and data systems (router, cellular antenna, etc) within the SASS topside waterproof enclosure.
- SIO personnel set up online training and conducted 3 months of training dives with new Santa Monica PI, Kerry Nickols, and students to learn monthly cleaning routines and standard station service.

Accomplishments / successes:

- Continuous real-time data have been reported at 4-min intervals at all four SASS stations throughout the reporting period with only minor interruptions.
- SIO personnel have worked with Axiom data managers to create a new data ingestion portal that will incorporate metadata and auxiliary sensor calibration specifications to provide real-time data products of chlorophyll concentration, oxygen concentration, oxygen saturation, and pH at most SASS stations. Metadata standardization and incorporation of calibration samples for data quality has started at the Scripps Pier and Newport Pier stations.
- SIO personnel continue to work with the Carlsbad desalination plant and OCSD to assist with collaborative data collection to assist with regulatory monitoring.
- SCCOOS personnel at UCSB worked with management at the desalination plant in Santa Barbara to interpret real-time chlorophyll fluorometer measurements.
- Santa Monica station conducts first station cleaning in December 2021 without SIO personnel.

Problems/delays:

• Short periods of data interruptions (<1 week) were caused by network issues, sensor or cable failure at SASS stations. As new infrastructure/recapitalization funding is made available, old sensors and cables will be replaced improving data quality and consistency. Automated cleaning systems, air blasters, installed as prototypes in 2018-2019 are non-operational at all stations until new infrastructure/recapitalization funding can purchase new electronics, relays, and solenoids.

OAH Monitoring on SASS Stations



Accomplishments / successes: Completed construction of two Self-Calibrating SeapHOx units for deployment on SASS in early 2022. Problems/delays: None

Harmful Algal Bloom Monitoring Alert Program

Accomplishments / successes:

- SPATT is collected weekly at three HABMAP sites to better observe dissolved toxic in the environment. Data converted to Darwin Core format and ingested in ERDDAP and GBIF.
- Domoic Acid sample analysis is now conducted monthly at USC (as opposed to quarterly) to address stakeholder needs more rapidly.

Problems/delays: Continual data collection (52 weeks) was conducted at the Scripps Pier station throughout the COVID pandemic with limited personnel and access to campus facilities. Personnel shortages of one full-time, staff equivalent and a reduced number of undergraduate students that assist with the data collection, quality control/assurance, and data dissemination for this project hindered higher level goals such as phytoplankton cell counts and distribution of finalized data. These tasks are currently underway and current data have been uploaded to SCCOOS drives. Cell counts for May to October 2021 and bloom samples (March 2020) will be finished by spring 2022.

CalCOFI - Data Synthesis and Serving/Product Development

Summary of other Observation Activities over the reporting period:

This project has been developing a data synthesis & data product in support of CalCOFI, fisheries, & ecosystem assessments with National Marine Sanctuaries; continual syntheses and automated, curated data views will be developed and vetted with crucial stakeholder partners **Accomplishments / successes:**

Accomplishments for the data visualization include finalizing the first round of scoping efforts with key stakeholders and SCCOOS/ocean observing constituents, conducting a data inventory to determine locations and serving tools of key datasets, drawing a visualization concept, and developing an initial data visualization framework. The initial data visualization concept and framework were presented during a presentation and discussion session at the CalCOFI 2021 Conference.

Problems/delays: None

Multivariate Ocean Climate Indicator (MOCI)

Summary of other Observation Activities over the reporting period: Update of the scripts for data acquisition and quality control to calculate this index have been initiated.

Accomplishments / successes: MOCI update for spring (April - June, updated in July), and summer (July-September, updated in December), and available at the Farallon Institute website (<u>http://www.faralloninstitute.org/moci</u>). Scripts to update buoy data acquisition, quality control and gap-filling were updated. Communication with SCCOOS data portal IT has started, to be able to share this index.

Problems/delays: None



| | IOOS, NOAA, | Other Agency Funding (non-core funding) |
|--|--|--|
| Funding amount spent | Funding Area /Recipient | Task: please provide a status update. |
| Provided \$10,000 Spent \$951.76 Remaining \$9,048.24 | CDIP - Long Beach Buoy Wave Buy Model Validation | Status: on-track Accomplishment: These funds support the maintenance of CDIP Long Beach Wave Buoy Issue (if any): UCSD did not release the funds until October 2021. |
| Provided \$137,500 Spent \$316 Remaining \$137,184 | HABON Pilot - CA IFCB Network O&M | Status: on-track Accomplishments: The UCSB node held their IFCB in-person training June 30th - July 1st. Deployed IFCB at Newport Beach Pier (July 10th), IFCB deployed CCE-LTER cruise (July 10 - Aug 13) in support of an ECOHAB project (Co-PI Anderson) IFCB deployed on DOE-funded power Buoy in Monterey Bay (Aug 11) - CeNCOOS node UCSB IFCB - tested water samples from Plumes and Blooms cruises and SBC-LTER cruises. Delay in deploying the IFCB on Stearns Wharf due to delay in receiving funds but expects to deploy it in the Ty Warner Sea Center pump house this fall and have it display real-time images on the Sea Center TV screen. The Humboldt and UCD/Bodega Marine Lab node held their in-person IFCB training and are preparing to deploy one IFCB in the pump house at Bodega Pier and the other on a fluxy at Hog Island Oyster Company. Currently the IFCB is in lab at Trinidad and samples are being run through it weekly. The UC Davis IFCB has been run in demonstration mode on a flow-through system with water pumped in from Horseshoe Bay just outside the Bodega Marine Laboratory. On September 23rd, SCCOOS held a two-hour CA IFCB Network call for node updates and best practices OCSD ordered an IFCB and will complete the mandatory training; the instrument is ready for deployment on the Newport Beach Pier This will allow us to relieve one IFCB as a mobile/spare for cruises of opportunity. |



| | Kasia Kenitz conducted a comparative study on the number of cells detected between two IFCB instruments deployed at Scripps Pier to determine what calibration standards need to be applied. Kasia Kenitz applied Image annotation for selected samples using IFCB Annotate (web based tool) to validate the performance of the classifier on data from the Del Mar mooring IFCB. Issue (if any): UCSD did not release the funds until October 2021. |
|--|--|
|--|--|

III. PROJECT CHALLENGES/MODIFICATIONS (200 words):

• Seabird observations for the spring 2021 CalCOFI survey were canceled due to COVID-19 protocols and scheduling, which prohibited participation.

IV. PUBLICATIONS:

A. Publications and Reports:

- Arafeh-Dalmau, N., Cavanaugh, K.C., Possingham, H.P., Munguia-Vega, A., Montaño-Moctezuma, G., <u>Bell, T.W.</u>, Cavanaugh, K., Micheli, F. (2021). Southward decrease in the protection of persistent giant kelp forests in the northeast Pacific. *Communications Earth & Environment*, 2:119, 1-7.
 <u>https://doi.org/10.1038/s43247-021-00177-9</u> - references SCCOOS Statewide Kelp Canopy data; SCCOOS PI Tom Bell is a co-author on the paper.
- Bernstein S, Ruiz-Cooley R.I., Kudela R., <u>Anderson C</u>., Dunkin R., Field J.C. (2021). Stable isotope analysis reveals differences in domoic acid accumulation and feeding strategies of key vectors in a California hotspot for outbreaks. *Harmful Algae*. V. 110. <u>https://doi.org/10.1016/j.hal.2021.102117</u> - references SCCOOS HABMAP data, SCCOOS ED Anderson advised the first author and is a co-author on the paper
- Cade, D. E., Fahlbusch, J. A., Oestreich, W. K., Ryan, J., Calambokidis, J., Findlay, K. P., ... & Goldbogen, J. A. (2021). Social exploitation of extensive, ephemeral, environmentally controlled prey patches by supergroups of rorqual whales. *Animal Behaviour*. <u>https://doi.org/10.1016/j.anbehav.2021.09.013</u> references SCCOOS HFR data.
- Catlett, D., Siegel, D. A., Simons, R. D., Guillocheau, N., Henderikx-Freitas, F., & Thomas, C. S. (2021). Diagnosing seasonal to multi-decadal phytoplankton group dynamics in a highly productive coastal ecosystem. *Progress in Oceanography*, 102637. <u>https://doi.org/10.1016/j.pocean.2021.102637</u> - references SCCOOS HABMAP data at Stearns Wharf, co-author Siegel is on the SCCOOS Executive Steering Committee.
- Choi, E. S., Furtado, L. E., & Burton, R. S. (2021). Spatial and temporal variation in the species diversity of coastal California fish eggs. *Marine Ecology Progress Series*, 669, 139-149. DOI: <u>https://doi.org/10.3354/meps13723</u> references SCCOOS SASS at Scripps Pier.



- Dauhajre, D. P., Molemaker, M. J., <u>McWilliams, J. C.</u>, & Hypolite, D. (2021). Effects of Stratification on Shoaling Internal Tidal Bores. *Journal of Physical Oceanography*, 51(10), 3183-3202. <u>https://doi.org/10.1175/JPO-D-21-0107.1</u> - - SCCOOS PI McWilliams, SCCOOS support of ROMS model development.
- Deutsch, C., Frenzel, H., <u>McWilliams, J. C.</u>, Renault, L., Kessouri, F., Howard, E., ... & Yang, S. (2021). Biogeochemical variability in the California Current system. *Progress in Oceanography*, 102565. <u>https://doi.org/10.1016/j.pocean.2021.102565</u> - SCCOOS PI McWilliams is a co-author, SCCOOS support of ROMS model development
- Emery, B., Kirincich, A., <u>Washburn, L.</u> (2021). Direction Finding and Likelihood Ratio Detection for Oceanographic HF Radars. *Journal of Atmospheric and Oceanic Technology*, (Early Online Release). DOI: <u>https://doi.org/10.1175/JTECH-D-21-0110.1</u>. -Utilizes SCCOOS HF radar data; SCCOOS PI Washburn is a co-author
- Estes Jr, M., <u>Anderson, C.</u>, Appeltans, W., Bax, N., Bednaršek, N., Canonico, G., ... & Weatherdon, L. V. (2021). Enhanced monitoring of life in the sea is a critical component of conservation management and sustainable economic growth. *Marine Policy*, 132, 104699. <u>https://doi.org/10.1016/j.marpol.2021.104699</u> SCCOOS ED Anderson is a co-author
- Franklin, E. B., Alves, M. R., Moore, A. N., Kilgour, D. B., Novak, G. A., Mayer, K., ... & Goldstein, A. H. (2021). Atmospheric Benzothiazoles in a Coastal Marine Environment. *Environmental Science & Technology*. https://doi.org/10.1021/acs.est.1c04422 - references SCCOOS HFR data
- Hardison, E. A., Kraskura, K., Van Wert, J., Nguyen, T., & Eliason, E. J. (2021). Diet mediates thermal performance traits: implications for marine ectotherms. *Journal of Experimental Biology*. <u>https://doi.org/10.1242/jeb.242846</u> - references SASS Stearns Wharf data
- Harvey, C. J., Garfield N., Williams G. D., and Tolimieri N., editors. (2021). Ecosystem Status Report of the California Current for 2020–21: A Summary of Ecosystem Indicators Compiled by the California Current Integrated Ecosystem Assessment Team (CCIEA). U.S. Department of Commerce, NOAA Technical Memorandum NMFS-NWFSC-170. <u>https://doi.org/10.25923/x4ge-hn11</u> - SCCOOS PI, Dan Rudnick contributed to Climate and Ocean Drivers.
- Hypolite, D., Romero, L., <u>McWilliams, J. C.</u>, & Dauhajre, D. P. (2021). Surface gravity wave effects on submesoscale currents in the open ocean. *Journal of Physical Oceanography*, *51*(11), 3365-3383. <u>https://doi.org/10.1175/JPO-D-20-0306.1</u> SCCOOS PI McWilliams is a co-author, SCCOOS support of ROMS model development.
- Kavanaugh, M.T., Bell, T.W., Catlett, D., Cimino, M.A., Doney, S.C., Klajbor, W., Messié, M., Montes, E., Muller-Karger, F.E., Otis, D., Santora, J.A., Schroeder, I.D., Triñanes, J., Siegel, D.A. (2021). Satellite Remote Sensing and the Marine Biodiversity Observation Network, Current Science and Future Steps, *Oceanography*, 34, 2. https://doi.org/10.5670/oceanog.2021.215 - references SCCOOS Statewide Kelp Canopy data and SCCOOS PI Tom Bell is a co-author on the paper.
- Leirness JB, Adams J, Ballance LT, Coyne M, Felis JJ, Joyce T, Pereksta DM, Winship AJ, Jeffrey CFG, Ainley D, Croll D, Evenson J, Jahncke J, McIver W, Miller PI, Pearson S, Strong C, <u>Sydeman W</u>, Waddell JE, Zamon JE, Christensen J. 2021. <u>Modeling at-sea</u> <u>density of marine birds to support renewable energy planning on the Pacific Outer</u>



<u>Continental Shelf of the contiguous United States</u>. Camarillo (CA): US Department of the Interior, Bureau of Ocean Energy Management. OCS Study BOEM 2021-014. 385 p. - references SCCOOS seabird surveys; SCCOOS PI Sydeman is a co-author

- Mitchell, R. (2021). "Global Perspectives on Harmful Algal Blooms: Impacts and Responses" International Development, Community and Environment (IDCE). 247. <u>https://commons.clarku.edu/idce_masters_papers/247</u> - references HABMAP data
- Ren, A. S., & <u>Rudnick, D. L.</u> (2021). Across-shore Propagation of Subthermocline Eddies in the California Current System. *Journal of Physical Oceanography*. <u>https://doi.org/10.1175/JPO-D-21-0137.1</u> - Glider data; SCCOOS PI Rudnick is a co-author
- Renault, L., <u>McWilliams, J.C.</u>, Kessouri, F., Jousse, A., Frenzel, H., Chen, R., & Deutsch, C. (2021). Evaluation of high-resolution atmospheric and oceanic simulations of the California Current System. *Progress in Oceanography*, 195, 102564.
 <u>10.1016/j.pocean.2021.102564</u> SCCOOS PI McWilliams is a co-author; SCCOOS support of ROMS model development
- <u>Rudnick, D. L.</u>, Zarokanellos, N. D., & Tintoré, J. (2021). A four-dimensional survey of the Almeria-Oran front by underwater gliders: Tracers and circulation. *Journal of Physical Oceanography*, *1*(aop). <u>https://doi.org/10.1175/JPO-D-21-0181.1</u> SCCOOS PI Rudnick is lead author; references SCCOOS glider data
- Smith J., Shultz D., Howard M.D., Robertson G., Phonsiri V., Renick V., ... & McLaughlin K. (2021). Persistent domoic acid in marine sediments and benthic infauna along the coast of Southern California. *Harmful Algae*, 108, 102103. <u>https://doi.org/10.1016/j.hal.2021.102103</u> - references HABMAP data; SCCOOS ED Anderson advised on data analysis
- Trautman, N., & <u>Walter, R. K.</u> (2021). <u>Seasonal variability of upwelling and downwelling surface current patterns in a small coastal embayment</u>. *Continental Shelf Research*, 104490. references SCCOOS & CeNCOOS CA HFR Network; SCCOOS PI Walter is a co-author
- Waite, H. R., & Sorte, C. J. Negative carry-over effects on larval thermal tolerances across a natural thermal gradient. *Ecology*, e03565. <u>https://doi.org/10.1002/ecy.3565</u> references SCCOOS data
- Weber, E. D., Auth, T. D., Baumann-Pickering, S., Baumgartner, T. R., Bjorkstedt, E. P., Bograd, S. J., ... & Zeman, S. M. (2021). State of the California Current 2019–2020: Back to the Future With Marine Heatwaves?. *Frontiers in Marine Science*, 1081. <u>https://doi.org/10.3389/fmars.2021.709454</u> - Glider data; SCCOOS PI Rudnick is a coauthor

B. Notable Presentations:

- July 21, 2021: CDIP and SCCOOS tours with Birch Aquarium Summer Camp, La Jolla, CA
- August 3, 2021: CDIP and SCCOOS tours with Birch Aquarium Summer Camp, La Jolla, CA
- August 10, 2021: CDIP and SCCOOS tours with Birch Aquarium Summer Camp, La Jolla, CA



- September 26 29, 2021: <u>Eastern Pacific Ocean Conference (EPOC)</u> EPOC President: Clarissa Anderson
- October 10-15, 2021: <u>International Conference on Harmful Algae (ICHA)</u> virtual (La Paz, MX) Clarissa Anderson chaired a session
- October 11-13, 2021: <u>49th Annual MRA Educational Conference & Trade Show</u> in Partnership with California Association of Harbor Masters and Port Captains, La Jolla, CA - Clarissa Anderson <u>presented</u>
- Oct 19-21: <u>NOAA 2021 Ocean and Coastal Community Modeling Workshop</u> hosted by the National Ocean Service, virtual Clarissa Anderson co-organized the workshop on monthly to bi-weekly calls over a 6-month period, and moderated a panel titled, '*What Does it Mean to be Operational?*"
- October 26, 2021: West Watch Webinar SCCOOS presented
- October 26, 2021: <u>Association of Pacific Ports Annual Conference</u> Clarissa Anderson presented
- Nov 4: <u>CA State Senate for the Joint Committee on Fisheries and Aquaculture</u> hearing schedule Clarissa Anderson testified on seasonal HAB outlook (2:02:40 mark)
- November 11, 2021: <u>26th Biennial Coastal and Estuarine Research Federation (CERF)</u> Conference - SCCOOS ED Clarissa Anderson co-moderated a session, *Detecting the Coastal Climate Signal: Sustained observations for decision making* and presented the talk, "Extending the Reach of Operational Harmful Algal Bloom Forecasts to Estuarine Shellfish Harvesting;" Nicholas Soares (graduate student with SCCOOS PIs at Cal Poly) presented "Phytoplankton community response to changing environmental conditions across two central California sites"
- November 15, 2021: <u>NASA DEVELOP Final Presentations</u>: "Southern California Health <u>& Air Quality</u>" Clarissa Anderson advisor
- November 16, 2021: SCCOOS and CeNCOOS Water Quality Focus Meeting SCCOOS co-hosted
- Nov 18: UN Decade Satellite Lab: <u>OASIS for a CLEAN OCEAN</u> Clarissa moderated a panel on <u>Marine Pollution and Stakeholder Requirements</u>.
- December 1-2, 2021: <u>CalCOFI Conference</u> Clarissa moderated a panel and Data Visualization Roundtable
- December 8, 2021: SCCOOS and CeNCOOS Focus Meeting: <u>Cal OOS Tribal</u> <u>Co-Management & Co-Monitoring Roundtable Discussion</u>

V. EDUCATION, MEDIA ENGAGEMENT, AND OUTREACH MATERIALS:

- Padilla, G. Algae blooms make appearance at Central Coast beaches, KSBY California's Central Coast. 25-Aug, 2021
- <u>Updates From The Field, August 2021: Red Tides, Wildlife, And Volunteering</u>. Morro Bay National Estuary Program. September 10, 2021 Features SCCOOS
- Lyons, J. <u>NOAA awards \$41 million for ocean observing</u>. NOAA. September 14, 2021. Features SCCOOS
- Colbert, A. <u>SoCal Oil Spill</u>. Kpbs. Published October 5, 2021 Features Eric Terrill, SCCOOS Technical Director



- Wisckol, M. <u>Seabird fatalities from oil spill expected to grow 'considerably'</u>. The Orange County Register. Published October 5, 2021. Features Clarissa Anderson, SCCOOS Executive Director
- Fryer, H. <u>Changing weather raises fear that O.C. oil spill could reach more coastal areas</u>. Los Angeles Times. Published October 6, 2021. - Features Eric Terrill, SCCOOS Technical Director
- Curwen, T. <u>How a coast crowded with ships, port gridlock and an anchor may have cause</u> <u>O.C. oil spill</u>. LA Times. Published October 6, 2021. - Features Kip Luitt, SCCOOS BOG Member
- Bravo, C. and Gregorio-Nieto, B. <u>Oil Spill Response Teams Scanning Half of San Diego</u> <u>County Shoreline</u>. NBC San Diego. October 8, 2021 - Features Clarissa Anderson, SCCOOS Executive Director
- <u>More Tar Balls Washing Up at San Diego Beaches, Public Urged Not to Touch Them</u>. NBC San Diego. Published October 10, 2021 - Features Clarissa Anderson, SCCOOS Executive Director
- Chandler C. <u>CSUN Part of Network Monitoring Health of Ocean Along California Coast</u>. CSUN Today. October 12, 2021 - Features Kerry Nickols, SCCOOS PI
- <u>2021 MTS COMPASS AWARDS</u>. Sea Technology. October 14, 2021 Features Dr. Daniel Rudnick, SCCOOS PI, ESC Chair, IOOS FAC
- Martin, C. <u>Uc San Diego Works To Mitigate Possible Oil Impacts From Spill Off</u> <u>Huntington Beach</u>. Scripps Institution of Oceanography. October 15, 2021. - Features SCCOOS
- <u>Nickols takes the helm as part of ocean observatory network</u>. Biosphere. October 28, 2021. Features Kerry Nickols, SCCOOS PI
- Kalohelani Danbara. <u>UCSD Works to Protect Against Recent Oil Spill</u>. The Guardian. October 31, 2021 Features Clarissa Anderson, SCCOOS Executive Director
- Educational outreach by M. Carter, SCCOOS PI. Scripps Pier field trip for SIO undergraduate course SIO-175 with Drs. Mark Merrifield and Reinhard Flick. Students were introduced to various long term pier-based programs manual and automated Shore Stations and HABMAP.
- Educational outreach by M. Carter, SCCOOS PI. Scripps Pier field trip for SIO graduate course SIO-221A with Drs. Sarah Gille and Reinhard Flick. Graduate students were introduced to sampling differences of manual and automated observational data.

VI. PRODUCT DELIVERY:

- Six new <u>CA HAB Bulletins</u> published for the months July December 2021
- New joint SCCOOS and CeNCOOS data portal called the "California Ocean Observing System Data Portal" <u>https://data.caloos.org/</u>
 - Currently displays SCCOOS HFR, Glider, and automated shore-station real-time data, IFCB locations
 - Data portal metrics (December 2021) Sensor Stations
 - Total number of sensor stations: 1,548
 - Number of sensor types: 88
 - Number of affiliates: 54



• Total stations with data from the past week: 675

Moving Platforms

- Total number of moving platforms: 64
- Number of affiliates: 3
- Total platforms with data from the past week: 1
- Total platforms with data from the past year: 11
- Two updates of the MOCI Index (Multivariate Ocean Climate Indicator). Index available at: <u>http://www.faralloninstitute.org/moci</u>
 - Spring MOCI (April-June, updated in July)
 - Summer MOCI (July-September, updated in December)

VII. CERTIFICATION UPDATES

- New subaward with Axiom Data Science for 6/1/21 12/31/21 to manage SCCOOS DMAC in coordination with SCCOOS administrative and technical staff.
- Dean Wendt, Cal Poly stepped down SCCOOS Board of Governors and Board Executive Committee
- Michael Jones, TMA BlueTech, stepped down from SCCOOS Board of Governors
- David Covarrubias-Rosales, Centro de Investigación (CICESE) joined SCCOOS Board of Governors
- Mike Conroy, Pacific Coast Federation of Fishermen's Association joined SCCOOS and CeNCOOS Joint Strategic Advisory Committee
- Florybeth La Valle, SCCOOS and CA Sea Grant Postdoc, completed her postdoctoral fellowship funded by the California Ocean Protection Council/SCCOOS and CA Sea Grant

| Cost Categories | Funding provided | Funds spent | Unspent funds remaining | Remaining % |
|-----------------------|---------------------|-------------|-------------------------------|----------------|
| Personnel | 459,413.00 | 68,782.09 | 390,630.91 | 85.03% |
| Fringe Benefits | 193,534.00 | 29,635.39 | 163,898.61 | 84.69% |
| Travel | 65,208.00 | 2,286.69 | 62,921.31 | 96.49% |
| Equipment | 144,061.00 | 0.00 | 144,061.00 | 100.00% |
| Supplies | 49,336.00 | 9,854.09 | 39,481.91 | 80.03% |
| Contractual | 1,212,890.00 | 0.00 | 1,212,890.00 | 100.00% |
| Other | 291,544.00 | 16,133.02 | 275,410.98 | 94.47% |
| Total Directs Charges | 2,415,986.00 | 126,691.28 | 2,289,294.72 | 94.76% |
| Indirects Charges | 552,319.00 | 73,480.99 | 478,838.01 | 86.70% |
| Total Amounts | 2,968,305.00 | 200,172.27 | 2,768,132.73 | 93.26% |

VIII. BUDGET SUMMARY



- 1. Were the oldest ASAP TAS BETC accounting lines drawn down first?
- Give a brief update on project invoicing for the reporting period. Were there any delays with invoicing or payment? UC and Subawards did not receive project funds until October 2021.
- 3. Provide details on any property or equipment charged directly to the award having a useful life of more than one year and an acquisition cost of \$5,000 or more per unit during the period.
- Include changes in key scientific, technical or management personnel, not included in certification. No changes
- 5. Include changes to the organizational structure such as: changes in status or partners organizations and points of contact. As a reminder, a change to the award's Principal Investigator and a change in an award's Key Person Specified in the Application requires NOAA approval through Grants Online. Guidance for both these Award Action Requests is available on Grants Online No changes
- 6. Provide an update about travel completed during the reporting period.
- 7. Give details on any delays with initiating a contract/subaward. Note any issues with the previous year funds or other issues that occurred during the reporting period. Will this result with a work stoppage or cause significant problems with the partnership?
 Delays in actting funds to UC and Subawards

Delays in getting funds to UC and Subawards

| Success Story | Brief Description | Contact |
|-------------------------------|---|-------------------|
| Hyperion Sewage Discharge | July 11, 2021: SCCOOS HFR was used to help particle tracking from a 17 million gallon overflow sewage discharge from the Hyperion 1-Mile Outfall | Mas Dojiri |
| Boat Race | September 12, 2021: Came in third place | Twain Newhart |
| Huntington Beach Oil Spill | October 3: 2021: SCCOOS and PIs helped track the spill, provide data and analysis to first responders and modelers at NOAA OR&R and Cal OSPR | Clarissa Anderson |

IX. SUCCESS STORIES



| <i>L. poly</i> bloom and bioluminescence | Nov 15, 2021: IFCB at Scripps Pier, Newport Beach Pier, and Del Mar Mooring all detected in real-time a bloom of <i>Lingulodinium polyedra</i>, a phytoplankton known to produce magnificent displays of bioluminescence at night (but also responsible for a deadly bloom in spring 2020) SCCOOS PI Anderson and collaborators advised a team of NASA DEVELOP Fall 2021 "Health and Air Quality" interns on creation of satellite remote sensing tools for detecting <i>L.</i> <i>polyedra</i> blooms with novel sensors, such as the JAXA SLGI and Sentinel 3. The team worked for 6 weeks to create an ArcGIS interactive Red Tide dashboard. | Clarissa Anderson |
|--|---|----------------------|
| MOCI use | CalCOFI conference included 2 presentations in which MOCI Index was used | Marisol García-Reyes |

End Report



ACTIVITIES DURING THE REPORTING PERIOD

Objective 1: Enable and Support SCCOOS Cyberinfrastructure and Statewide Data Portal

- Task 1.1: Provide technical support for SCCOOS Cyber Infrastructure. [Status: On track] During this performance period, Axiom maintained ongoing continuous performance of the SCCOOS data system following IOOS DMAC guidelines. Additionally, Axiom initiated a new data center build out in August 2021 to increase data storage and compute resources for system optimization. This work included: building 60 new m620 compute blades with CPUs, building 3x ceph storage heads, racking 4x m1000e compute and 5x c6320 database chassis, and sledding 120 new 10TB drives.
- Task 1.2: Implement and enhance a public-facing SCCOOS data portal for discovery and access. [Status: On track] Axiom supported the development of a new integrated coastal and ocean observing data portal that unifies data streams across the California coast from CeNCOOS and SCCOOS regions. The CalOOS data portal is available in a prototype environment, as additional changes and new data streams are added: https://data.caloos.org/. Revisions were made to the portal landing page, catalog tagging scheme, and data views, based on RA feedback. Additionally frontend and backend work occurred to develop features for the version 2.14 release of the CalOOS data portal, scheduled for Q3. This work includes: symbology changes to sensor layer for better contrast with lighter base layers (OpenStreet Map), user settings for coordinate management, palette manager for color bar management, animation tool to export custom timeseries animations of mapped data layers, print charts and data views as jpg file, and tabular view of latest observations for real-time sensors.

Objective 2: Ingest and Maintain SCCOOS-operated and Non-SCCOOS Data Assets, Including Sensors, Gliders, HR Radar, Models, Biological, and Historical Legacy Time Series

- Task 2.1: Ingest and maintain SCCOOS Data Assets. [Status: On track] Axiom made progress ingesting and serving data collected by SCCOOS regional stations and replicating those data from the SIO data center to the Axiom data system for redundancy and back-up. This work included:
 - developed a new service on the Axiom infrastructure to calibrate chlorophyll, O2, and pH data that are being collected by SCCOOS Shore Stations. The code reads raw data files, calibrates parameters using a library, and then continuously writes out new files for ingestion and visualization into the CalOOS data portal. See <u>Santa Monica Shore Station page</u> as an example.
 - added three new IFCB data streams (CA-IFCB-160:Newport Beach, CA-IFCB-158: Del Mar, CA-IFCB-151: Scripps Pier) to <u>SCCOOS IFCB</u> <u>dashboard</u> and enabled an alert system for instrument monitoring.
 - developed a new <u>CalHABMAP data layer</u> to display phytoplankton abundance, Domoic Acid and nutrients including ammonium, nitrate, phosphate, and silicic acid monitoring data.



- Task 2.2: Ingest and maintain non-SCCOOS Data Assets [Status: On track] Axiom made progress ingesting and serving data collected by SCCOOS's regional data partners for discovery and access in the CalOOS data portal. This work included:
 - added <u>CA ROMS forecast model</u> to SCCOOS THREDDS server for interoperability.
 - ingested two U.S. Navy air quality stations through SCCOOS data infrastructure: Alpha and Laguna Peak.
 - developed a draft data layer containing a 21-year time series of bird, mammal, fish, and crab pot observations from the California Cooperative Oceanic Fisheries Investigations (CalCOFI) aggregated by the Farallon Institute.
 - completed initial work for the ingestion of real-time and historical/qc'd City of San Diego mooring data.

Objective 3: Implement Real-Time Sensor Data Quality Control System

• Task 3.1: Deliver a subsystem to automate data quality tests for environmental data streams according to IOOS QARTOD specifications [Status: On track] During this performance period, basic QARTOD tests were applied for <u>139 historical and real-time</u> sensors that are accessible through the CalOOS data portal. Quality flags are summarized on both the <u>station</u> and <u>sensor</u> pages within the data portal for visual exploration. In addition, the documentation of the test code and thresholds are displayed on sensor pages (example) with links available to the v 1.0 version QARTOD GitHub library accessible through the portal. The source data files served through ERDDAP were updated to include the metadata attributes and quality flags for the QARTOD tests applied.

Objective 4: Maintain and Enhance Existing Data Products and Develop New Data Applications

- Task 4.1: Support existing data products. [Status: On track] Activities completed to support existing data products included:
 - established a local instance of IFCB dashboard to host regional CA IFCB data streams: <u>https://sccoos-ifcbdb.srv.axds.co/dashboard</u>
 - deployed CalHABMAP data from Google drive to SCCOOS instance: <u>https://erddap.sccoos.org/erddap/tabledap/index.html?page=1&itemsPerPage=100</u> <u>0</u>
 - migrated SCCOOS MPA Shiny container to Axiom data system, where it exists alongside the CalOOS data portal: <u>https://mpa-dashboard.caloos.org/</u>
 - resolved bugs associated with HAB and SPATT data storage, and for SCCOOS Shiny server
 - upgraded SCCOOS-hosted Wordpress installs and plugins to the latest versions.

Objective 5: Provide DMAC Support to the SCCOOS Program

• Task 5.1: Participate in regional, state, national and international DMAC activities. [Status: On track] Axiom participated in regular, weekly meetings with SCCOOS to discuss and communicate progress on project tasks. In addition, a Jira project management board was maintained to track data management task progress. Axiom also participated in various regional meetings in support of SCCOOS DMAC: U.S. Navy



NavAir Weather Bulletin, Marine Mammal Stranding Network, CA OOS Water Quality Focus Group Meeting, and the Cal OOS Tribal Co-Management/Co-Monitoring Focus Group, among others.

UPCOMING/PLANNED ACTIVITIES

The upcoming SCCOOS DMAC activities planned for the next year include:

- Public release of the statewide CalOOS data portal in Q3.
- Final development and release of v2.14 CalOOS data portal in Q3.
- Development of features for the v2.15 SCCOOS data portal in Q4.
- Reassessment of the QARTOD tests and parameter thresholds that are being applied to SCCOOS assets.
- Migration of the SCCOOS ERDDAP server from SIO to Axiom data infrastructure for regular maintenance and upkeep relative to IOOS DMAC standards.
- Ingest new datasets, as identified and prioritized by SCCOOS.
- Development of a custom data dashboard for discovery and display of real-time SCCOOS Shore Station assets.
- Further development of CA IFCB dashboard and integration of Machine Learning (ML) data pipeline for data streaming into the HABDAC.
- Support for continued data submission, visualization, and metadata generation for SCCOOS funded projects.
- Participation on behalf of SCCOOS in state and regional groups as determined by SCCOOS, as well as national IOOS and IOOS Association data management committees and working groups and international organizations.

SUCCESSES OR CHALLENGES

The SCCOOS DMAC program has been successful in maintaining high availability of continuous integration observation stations throughout the region, and for continuing to foster relationships with data providers to add new data to the system. Metrics for data availability through the SCCOOS portal during this performance period (June 1, 2021 - December 31, 2021) are listed below. As Axiom began working to support SCCOOS DMAC in spring 2021, there are no prior year metrics to show for comparison.

SCCOOS data portal metrics (June 1, 2021 - December 31, 2021):

Sensor Stations

Total number of sensor stations: 1,455 Number of sensor types: 88 Number of affiliates: 56 Total stations with data from the past year: 611

Moving Platforms

Total number of moving platforms: 64 Total platforms with data from the past year: 11



Data Layers

Total number of data layers: 317 Number of affiliates: 29 Total datasets with data from the past year: 172

| 1111110 | | enunee Zapenaiea | | | | | |
|--|---|---|---------|-------------------------------------|----------------|-------------|----------------------------|
| Operator/Pr incipal Investigator | Field Engineer/Technician Salary including fringe benefits & overhead* | O&M Oversight (PI or O&M manager) salary including fringe benefits & overhead* | Travel* | Supply and equipment expenses | # of radars | # of FTE | # of student s (FTE) |
| Dr. Eric Terrill | \$0 | \$0 | \$0 | \$0 | 11 | 0.9 | 0 |
| Matthew Ragan | \$0 | \$0 | \$0 | \$0 | 6 | 0.9 | 0 |
| Dr. Libe Washburn | \$0 | \$0 | \$0 | \$960 | 9 | 0.9 | 0 |
| Dr. Ryan Walter | \$5293.55 | \$658.19 (38.5% IDC) | \$0 | \$7799.69 | 5 | 0.5 | 0 |

XI. HFR Operations and Maintenance Expenditures

*state indirect cost rate(s)

HFR Operators/PIs did not get accounts setup for FY2021 until late December, so limited funds were used during the reporting period.

XII. HFR Asset and Staffing Inventory

Cal Poly

| Staff Member | (% FTE or #person-months) |
|--|---------------------------|
| Principal Investigator: Dr. Ryan Walter | 0.04 mo |
| Technicians/Engineers: Ian Robbins Grant Waltz | 0.36 mo 0 mo |
| Students | NA |

| Total # of Radars Supported: 5 | | | | | | | |
|--------------------------------|------|----------|-----------|-------------------------------------|-------|-----------|--|
| Operating Institution | Name | Latitude | Longitude | City | State | Frequency | |
| Cal Poly | LUIS | 35.1608 | -120.7584 | Point San Luis (San Luis Obispo) | CA | 13.5MHz | |



| Cal Poly | AGL1 | 34.5769 | -120.6491 | Pt. Arguello (Vandenberg Air Force Base) | CA | 4.8MHz |
|----------|------|---------|-----------|--|----|----------|
| Cal Poly | ARG1 | 34.5769 | -120.6505 | Pt. Arguello (Vandenberg Air Force Base) | CA | 13.5MHz |
| Cal Poly | FBK1 | 34.8698 | -120.6212 | Fallback22, Pt. Sal (Vandenberg Air Force Base) | CA | 12.15MHz |
| Cal Poly | PTC1 | 34.4483 | -120.4717 | Point Conception (Lompoc) | CA | 13.45MHz |

UCSB

| Staff Member | (% FTE or #person-months) |
|---|---------------------------|
| Principal Investigator: Dr. Libe Washburn, Dr. Brian Emery | 0 mo. 0 mo. |
| Technicans/Engineers: David Salazar Eduardo Romero | 0 mo. 0 mo. |
| Students: | NA |

| Total # of Rac | lars Supporte | d: 9 | | | | |
|--------------------------|---------------|----------|-----------|---------------------|-------|------------|
| Operating Institution | Name | Latitude | Longitude | City | State | Frequency |
| UCSB | RFG1 | 34.4612 | -120.0767 | Refugio Beach | CA | 12.200 MHz |
| UCSB | COP1 | 34.4078 | -119.8783 | Santa Barbara | CA | 13.450 MHz |
| UCSB | SSD1 | 34.4191 | -119.5966 | Santa Barbara | CA | 13.445 MHz |
| UCSB | TRL1 | mobile | mobile | Santa Barbara | CA | 13.445 MHz |
| UCSB | MGS1 | 34.2049 | -119.2516 | Oxnard | CA | 13.500 MHz |
| UCSB | PTM1 | 34.0960 | -119.1070 | Point Mugu | CA | 13.500 MHz |
| UCSB | NIC1 | 34.0423 | -118.9154 | Malibu | CA | 13.500 MHz |
| UCSB | SCI1 | 33.9947 | -119.6321 | Santa Cruz Island | CA | 13.480 MHz |
| UCSB | SNI1 | 33.2805 | -119.5225 | San Nicholas Island | CA | 13.440 MHz |

USC

| Staff Member | (% FTE or #person-months) |
|------------------------------------|---------------------------|
| Principal Investigator: Matt Ragan | 0 mo. |



| Technicians/Engineers: Matt Ragan | 0 mo. |
|--------------------------------------|-------|
| Students: | NA |

| Total # of Rac | lars Supported | 1: 6 | | | | |
|--------------------------|----------------|----------|-----------|---------------|-------|-----------|
| Operating Institution | Name | Latitude | Longitude | City | State | Frequency |
| USC | SCCI | 33.4468 | -118.4782 | Avalon | CA | 13.5MHz |
| USC | SCDB | 34.033 | -118.7337 | Malibu | CA | 25.39MHz |
| USC | SCDH | 33.9432 | -118.4424 | Playa del Rey | CA | 13.5MHz |
| USC | SCNB | 33.606 | -117.9314 | Newport Beach | CA | 25.1MHz |
| USC | SCPF | 33.709 | -118.294 | San Pedro | CA | 25.39MHz |
| USC | SCTB | 33.8117 | 118.259 | Redondo Beach | CA | 25.9MHz |

SIO

| Staff Member | (% FTE or #person-months) |
|--|--|
| Principal Investigator: Dr. Eric Terrill Lisa Hazard | 0 mo. 0 mo. |
| Technicians/Engineers: Carlos Garcia-Moreno Thomas Cook* Joseph Chen (programmer) | 0 mo. 0 mo.* <i>no longer with SIO</i> 0 mo. |
| Students: | NA |

| Total # of Rad | lars Supported | 1 : 11 | | | | |
|--------------------------|----------------|---------------|-----------|----------------|-------|-----------|
| Operating Institution | Name | Latitude | Longitude | City | State | Frequency |
| SIO | SDCI | 32.4141 | -117.2437 | Coronado Is. | MX | 24.4MHz |
| SIO | SDBP | 32.5359 | -117.1223 | Imperial Beach | CA | 24.6MHz |
| SIO | SDPL | 32.6658 | -117.2396 | San Diego | CA | 24.6MHz |
| SIO | SDWW | 32.6799 | -117.2474 | San Diego | CA | 24.6MHz |
| SIO | SDSL | 32.8694 | -117.2532 | La Jolla | CA | 4.64MHz |



| SIO | SDSE | 33.0245 | -117.2861 | Encinitas | CA | 25.6MHz |
|-----|------|---------|-----------|----------------|----|---------|
| SIO | SDCP | 33.2577 | -117.4368 | Camp Pendleton | CA | 25.4MHz |
| SIO | SDSC | 32.9177 | -118.4869 | San Clemente | CA | 5.23MHz |
| SIO | SDSN | 33.0298 | -118.5971 | San Clemente | CA | 4.48MHz |
| SIO | SDUT | 33.3882 | -117.5955 | San Clemente | CA | 25.6MHz |
| SIO | SDDP | 33.4607 | -117.7067 | Dana Point | CA | 25.4MHz |

XIII. Observing Asset Inventory



| | WMO ID or NWS/ CMAN | | | Latitude (dec | Longitude Platform | Station Cur | rrently Plat | form RA Fun | ding Platform | | platform | | Variable Names + water | |
|---------|---------------------|---------------------------------|---|---------------|---------------------------------------|---------------|--------------|----------------------------|---------------|-----------------|------------|--------------------------------------|---|---------------------------------|
| | 0 | Statuon Long Name | station bescription | 0eg) | dec deg) lype | Deproyment Op | | | operator | Operator sector | Maintainer | Southern California | sea_water_temperature | |
| M | IN ARCT | | MULTINEED STOLE STALLOLI | /0T4"#0 | DAXII 1/00'6TT- | 1 0007 | | DOS/City of | nen i | Academic | nen n | Coastal Ucean Southern California | (2m), sea_water_temperature | wiwio in in process operation |
| AN | NA | Santa Monica Pier | Automated Shore Station | 34.0086 | -118.4986 fixed | 2005 Y | | Santa Yp | ncso | Academic | ncsp | Coastal Ocean Southern California | (2m), sea_water_temperature | WMO ID In process, operat |
| AN AN | NEWCI | Newport Pler | Automated Shore Station | 33.00/3 | 117.9269 Tixed | | | 500 M | n csn | Academic | ncsu | Coastal Ocean Southern California | (2m), sea_water_temperature | WMU IU IN process, operation |
| 5 | 7760 | | | 10070 | navii / //// | 1 0007 | | = | | ALGUEITC | | mastal Ucean | (uz) | |
| AN | AN | Cal Poly Pier | Harmful Algae Bloom monitoring program | 35.17000 | -120.74100 ation | 2005 Y | - OS | 00S YF | ncso | Academic | Cal Polv | Southern California Coastal Ocean | sea_water_temperature, r mole concentration of nil | Data management under d |
| NA | NA | Stearns Wharf | Harmful Algae Bloom monitoring program | 34.4107 | -119.6874 ation | 2005 Y | - Soc | DOS YF | ncso | Academic | UCSB | Southern California Coastal Ocean | sea_water_temperature, r mole concentration of nil | Data management under c |
| AN | NA | Santa Monica Pier | Harmful Algae Bloom monitoring program | 34.0086 | -118.4986 ation | 2005 Y | - OS | DOS YF | ncso | Academic | UCLA | Southern California Coastal Ocean | sea_water_temperature, r mole_concentration_of_nil | Data management under c |
| NA | NA | Newport Pier | Harmful Algae Bloom monitoring program | 33.6073 | -117.9289 ation | 2005 Y | - So | 00S # | ncso | Academic | usc | Southern California Coastal Ocean | sea_water_temperature, r mole concentration of nil | Data management under c |
| NA | NA | Scripps Pier | Harmful Algae Bloom monitoring program | 32.867 | -117.257 sampling_loc | 2005 Y | soc | DOS YF | ncso | Academic | UCSD | Southern California Coastal Ocean | sea_water_temperature, r mole_concentration_of_nil | Data management under d |
| | | | | | | | | | | | | | | |
| NA | NA | Scripps Pier | OAH Monitoring | 32.867 | -117.257 sampling_loc | 2005 Y | sco | oos M | UCSD | Academic | ucsp | Southern California Coastal Ocean | pH, dissolved_oxygen, tempe | Todd Martz Self-Calibrating S |
| | | | | | | | | | | | | | | |
| NA | See notes | Ln 80 | Glider | 32.82883333 | -122 8945 g lider | 2006 Y | SCO Base | DOS - Sline N | ncsp | Academic | ucsp | Instrument Development Group | sea_water_temperature (0td F | Four gliders ran along this lin |
| NA | See notes | Ln 66 | Glider | 36.88766667 | -122.004 g lider | 2005 Y | NOR | | UCSD | Academic | UCSD | Instrument Development Group | sea_water_temperature (0tq] | Two gliders ran along this line |
| NA | See notes | Ln 90 | Glider | 33.407 | -117.6836667 glider | 2005 Y | NON | A GOMO Yp | ncsp | Academic | ucsp | Instrument Development Group | sea_water_temperature (0td1 | Multiple gliders ran along thi |
| AN N | See notes | Alongshore Ln | Glider | NA | NA g lider | 2018 Y | SCO | DOS - Fill the Funds Yp | ncsp | Academic | ncsp | Instrument Development Group | sea water temperature (0td | Three Sprav underwater glide |
| | | | | | | | | | | | | | | |
| ESTR | NA | Point Estero | High Frequency Radar | 35.45975 | surface_curren -120.977633 t_radar | 2006 Y | sco | ۵۵ w | ncsp | Academic | Cal Poly | Coastal Observing Research and | surface_currents radial_velocity r | no WMO is needed as HFR de |
| RAGG | NA | Ragged Point | High Frequency Radar | 35.787367 | surface_curren -121.33625 t_radar | 2005 Y | 200 | м | ncsp | Academic | Cal Poly | Coastal Observing Research and | surface_currents radial_velocity r | no WMO is needed as HFR de |
| DCLR | NA | Diablo Canyon, LR | Hgh Frequency Radar | 35.217483 | -120.862633 t_radar | 2007 Y | sco | M 800 | UCSD | Academic | Cal Poly | Coastal Observing Research and | surface_currents radial_velocity | no WMO is needed as HFR d |
| DCSR | NA | Diablo Canyon, SR | Hgh Frequency Radar | 35.20245 | -120.846083 t_radar | 2007 Y | sco | м м | ncsp | Academic | Cal Poly | Coastal Observing Research and | surface_currents radial_velocity | no WMO is needed as HFR de |
| FBK1 | NA | Point Sal | Hgh Frequency Radar | 34.86975 | surface_curren -120.6212 t_radar | 2007 Y | sco | М 800 | ncsp | Academic | Cal Poly | Coastal Observing Research and | surface_currents radial_velocity r | no WMO is needed as HFR de |
| FUIS | NA | Point San Luis | Hgh Frequency Radar | 35.160133 | surface_ourren -120.75641 t_radar | 2007 Y | sco | М 800 | ncsp | Academic | Cal Poly | Coastal Observing Research and | surface_currents radial_velocity r | no WMO is needed as HFR de |
| AGL1 | NA | Point Arguello, LR | Hgh Frequency Radar | 34.576883 | surface_curren -120.649083 t_radar | 2008 Y | sco | М 800 | UCSD | Academic | Cal Poly | Coastal Observing Research and | surface_currents radial_velocity r | no WMO is needed as HFR de |
| ARG1 | NA | Point Arguello, SR | High Frequency Radar | 34.57695 | surface_curren -120.6505 t_radar | 2008 Y | sco | 100 M | UCSD | Academic | Cal Poly | Coastal Observing Research and | surface_currents radial_velocity r | no WMO is needed as HFR de |
| PTC1 | NA | Point Conception | Hgh Frequency Radar | 34.4483 | -120.4717 t_radar | 2008 Y | sco | м soo | ucsp | Academic | Cal Poly | Coastal Observing Research and | surface_currents radial_velocity r | no WMO is needed as HFR de |
| COP1 | NA | Coal Oil Point Reserve | High Frequency Radar | 34.407833 | -119.878333 t_radar | 1996 Y | sco | M SOG | UCSD | Academic | UCSB | Coastal Observing Research and | surface_currents radial_velocity | no WMO is needed as HFR d |
| MGS1 | NA | Mandalay Power Generating Stati | iq High Frequency Radar | 34.204883 | -119.251633 t_radar | 1996 Y | 2CO | 100 M | UCSD | Academic | UCSB | Coastal Observing Research and | surface_currents radial_velocity | no WMO is needed as HFR de |
| TRL1 | NA | Emergency Trailer | Hgh Frequency Radar | NA | surface_curren NA t_radar | 1996 N | sco | М 800 | ucsp | Academic | UCCB | Coastal Observing Research and | surface_currents radial_velocity | no WMO is needed as HFR de |
| PTM1 | NA | Point Mugu Naval Base | High Frequency Radar | 34.096117 | -119.107367 surface_curren | 2001 Y | sco | ۵0s الا | ucsp | Academic | UCSB | Coastal Observing Research and | surface_currents radial_velocity | no WMO is needed as HFR de |
| RFG1 | NA | Refugio Sate Beach | High Frequency Radar | 34.4612 | surface_curren -120.0767 t_radar | 2005 Y | sco | 30S M | UCSD | Academic | UCSB | Coastal Observing Research and | surface_currents radial_velocity | no WMO is needed as HFR de |
| SNI1 | NA | San Nicolas Island Navy | High Frequency Radar | 33.2805 | surface_curren -119.52245 t_radar | 2006 Y | sco | ۵0s الا | UCSD | Academic | UCSB | Coastal Observing Research and | surface_currents radial_velocity r | no WMO is needed as HFR de |
| SSD1 | NA | Summerland Sanitary District | High Frequency Radar | 34.419017 | -119.596117 t_radar | 2006 Y | sco | ۵0s الا | ucsp | Academic | UCSB | Coastal Observing Research and | surface_currents radial_velocity | no WMO is needed as HFR de |
| SCI1 | NA | Santa Cruz Island Nawy Site | High Frequency Radar | 33.994833 | -119.631167 t_radar | 2008 Y | | 100 M | ncsp | Academic | UCSB | Coastal Observing Research and | surface_currents radial_velocity r | no WMO is needed as HFR d |



| | WMO ID or NWS/ OMAN | | | Latitude (dec | Longitude | latform | tation Current | hy Platform | RA Fundin | r Platform | | Platform | | /ariable Names + wrater | |
|------------|---------------------|--|--|---------------|----------------|-------------------------|----------------------|---------------|---------------|------------|----------------|------------|--|--------------------------------------|----------------------------|
| Station ID | QI | Station Long Name | Station Description | deg) | (dec deg) T | ype [| Deployment Operati | on Funder/Spo | nso Involveme | Derator (| perator Sector | Maintainer | Data Manager | olumn depth of | Additional notes |
| NBL | NA | San Clemente (North) | High Frequency Radar | -117.631711 | 33.431809 t. | urface_curren _radar | 2009 Y | sccoos | M | n CSD | cademic | UCSB | coastal Observing search and r | urface_currents adial_velocity r | 10 WMO is needed as HFR de |
| NICT | NA | Nicholas Canyon State Beach | High Frequency Radar | 34.042433 | -1189153 t | urface_curren radar | 2010 Y | scoos | λί | ncsp | cademic | UCSB | Coastal Observing s Research and r | urface_currents adial_velocity r | to WMO is needed as HFR de |
| spcb | NA | Camp Pendleton South | High Frequency Radar | 33.218417 | -117.405317 t | urface_curren _radar | 2002 Y | scoods | ¥ | ncsp | cademic | UCSD | Coastal Observing s Research and r | urface_currents adial_velocity r | 10 WMO is needed as HFR de |
| SDPL | NA | Point Loma | High Frequency Radar | 32.665833 | -117.239583 t | urface_curren _radar | 2002 Y | scoos | ¥ | n csp | cademic | ucsp | Coastal Observing s Research and r | urface_currents adial_velocity r | to WMO is needed as HFR de |
| SDSC | NA | San Clemente | High Frequency Radar | 32.91775 | -118.4869 t | urface_curren _radar | 2004 Y | scoods | ž | ncsp | cademic | UCSD | Coastal Observing s Research and r | urface_currents adial_velocity | to WMO is needed as HFR d |
| SDSL | NA | Point Loma Long Range (at SIO) | High Frequency Radar | 32.8694 | -117.2532 t | urface_curren radar | 2005 Y | scooos | ¥ | n csp | cademic | ucsp | Coastal Observing s Research and r | urface_currents adial_velocity r | 10 WMO is needed as HFR de |
| SDDP | NA | Dana Point | Hgh Frequency Radar | 33.460683 | -117.706683 t | urface_curren radar | 2006 Y | scoos | × | ncs n | cademic | UCSD | Coastal Observing s Research and r | urface_currents adial_velocity r | to WMO is needed as HFR de |
| SDSE | NA | San Elljo State Beach | Hgh Frequency Radar | 33.0245 | -117.2861 t | urface_curren radar | 2006 Y | sccoos | λί | ncsp | cademic | UCSD | Coastal Observing s Research and r | urface_currents adial_velocty | no WMO is needed as HFR de |
| SDBP | NA | Border Field State Park | High Frequency Radar | 32.535917 | -117.122267 t | urface_curren _radar | 2007 Y | scoos | ¥ | n csp | cademic | UCSD | Coastal Observing s Research and r | urface_currents adial_velocity r | 10 WMO is needed as HFR de |
| SDWW | NA | Wastewater Treatment Plant, Poi | n High Frequency Radar | 32.679917 | -117.247417 t. | urface_curren _radar | 2007 Y | sccolos | × | ncsp | cademic | UCSD | Coastal Observing s Research and r | urface_currents adial_velocity r | to WMO is needed as HFR de |
| SDUT | NA | Upper Trestles (old: 25MHz Camp | b High Frequency Radar | 33.388383 | -117.595683 t | urface_curren _radar | 2008 Y | sccolos | λί | ncsp / | cademic | UCSD | Coastal Observing s Research and r | urface_currents adial_velocity r | no WMO is needed as HFR de |
| SDCI | NA | Coronado Island | High Frequency Radar | 32.414067 | -117.243733 t | urface_curren _radar | 2014 Y | scoods | ¥ | n csp | cademic | UCSD | Coastal Observing s Research and r | urface_currents adial_velocity r | 10 WMO is needed as HFR de |
| scol | NA | Catalina Island | High Frequency Radar | 33.44685 | -118.478183 t. | urface_curren _radar | 2005 Y | scoos | × | ncsp / | cademic | usc | Coastal Observing s Research and r | urface_currents adial_velocity r | to WMO is needed as HFR de |
| SCNB | NA | Newport Beach | High Frequency Radar | 33.606 | -117.931417 t | urface_curren _radar | 2005 Y | sccolos | ¥ | n csp | cademic | usc | Coastal Observing s Research and r | urface_currents adial_velocity r | no WMO is needed as HFR de |
| SCPF | NA | Point Fermin | High Frequency Radar | 33.704867 | -118.293983 t | urface_curren _radar | 2005 Y | scoos | M | n csp | cademic | usc | Coastal Observing s Research and r | urface_currents adial_velocity r | 10 WMO is needed as HFR de |
| SCDH | NA | Dockweiler Headquarters | High Frequency Radar | 33.933333 | -118.442417 t | urface_curren radar | 2006 Y | scoos | м | n csp | cademic | usc | Coastal Observing s Research and r | urface_currents adial_velocity r | to WMO is needed as HFR de |
| SCTB | NA | Torrance Beach | High Frequency Radar | 33.811683 | -118.391433 t. | urface_curren _radar | 2007 Y | sccoos | ٧f | ucsp / | cademic | usc | Coastal Observing s Research and r | urface_currents adial_velocity r | no WMO is needed as HFR de |
| SCDB | NA | Dan Blocker | High Frequency Radar | 34.03325 | -118.733683 t | urface_curren _radar | 2008 Y | sccolos | ¥ | n csp | cademic | usc | Coastal Observing s Research and r | urface_currents adial_velocity r | 10 WMO is needed as HFR de |
| | | | | | | | | | | | | | | | |
| NA | NA | Agua Hedionda Lagoon near Carlsbad Aquafarm | Burkeolator | 33.139 | -117.339 f | pax | 2014 N | OAP/SCC00 | ¥ s | nso | cademic | ncsp | Southern California t Coastal Ocean | otal_alkalinity (1 m) CO2 1 m), | perated by Todd Martz |
| AA | NA | Agua Hedionda Lagoon near Carisbad Aquafarm | ACDC Gen 2 | 33.139 | -117.339 f | xed | 2018 N | OAP/SCCOO | S YF | / MD | cademic | ncso | bouthern California | 002 (2 m) | perated by Todd Martz |
| NA | NA | Agua Hedionda Lagoon near Carlsbad Aquafarm | SeapHOx | 33.139 | -117.339 fi | bex | 04/2018 N | OAP/SCCOO | d, s | n CSD | cademic | ncsp | Southern California p Doastal Ocean t | 0H, dissolved_oxygen, emperature, | operated by Todd Martz. p |
| NA | NA | Catalina Sea Ranch - NOMAD E | B ACDC Gen 1 | 33.3628 | -118.0628 b | noy | 2019 N | OAP/SCCOO | S YF | ucsp / | cademic | ucsp | Southern California Doastal Ocean | 002 | perated by Todd Martz |
| | | | | | | | | | | | | | | | |
| 93.4 | NA | | Cal COFI nearshore | 32,94905 | -117.27357 s | hip | 2004 U | NOAA | Yp | ucsp / | cademic | ucsp | California Cooperative | ea_water_temperature (s | socoos no longer support |
| 91.7 | NA | | Cal COFI nearshore 3 sampling station | 33.2435 | -117.46542 s | dih | 2004 U | NOAA | ďÅ | n csp | cademic | UCSD | California Cooperative | ea_water_temperature (s | socoos no longer support |
| 96 | NA | 3. | Cal COFI nearshore 1 sampling station | 33.49462 | -117.74741 s | dih | 2004 U | NOAA | μ | ucso / | cademic | ucsp | California Cooperative | ea_water_temperature (s | soco os no longer support |
| 88.5 | NA | Э. | Cal COFI nearshore | 33.67442 | -118.08369 s | dih | 2004 U | NOAA | γp | ncsp / | cademic | ucsp | California Cooperative | ea_water_temperature (s | socoos no longer support |
| 86.8 | NA | ĕ | Cal OOFI nearshore 3 sampling station | 33,88887 | -118.44423 s | dih | 2004 U | NOAA | γp | ucso / | cademic | UCSD | California Cooperative | ea_water_temperature (s | socoos no longer support |
| 85.4 | NA | 36 | Cal COFI nearshore 5 sampling station | 34.02136 | -118.83413 s | dih | 2004 U | NOAA | γp | ncso / | cademic | ucsp | California Cooperative | ea_water_temperature (s | 60000S no longer support |
| 83.3 | NA | 5. | Cal ODFI nearshore | 34,26509 | -119.32781 s | hip | 2004 U | NOAA | Yp | ucsp / | cademic | ucsp | California Cooperative | ea_water_temperature (s | socoos no longer support |
| 81.7 | NA | ŭ | Cal COFI nearshore 8 sampling station | 34.40555 | -119.80037 | dih | 2004 U | NOAA | γp | ncsp | cademic | UCSD | California Cooperative | ea_water_temperature (s | socoos no longer support |
| 8 | NA | 6 | Cal COFI nearshore Sampling station | 34.46667 | -120.48906 s | dih | 2004 U | NOAA | ď | ncsp | cademic | ucsp | California Cooperative | tea_water_temperature (s | socoos no longer support |
| | | | | | | | | | | | | | | | |
| NA | NA | Del Mar Mooring | Mooring | 32.938 | -117.326 | nooring | U -no 2006 longer | scooos | z | ucso / | cademic | UCSD | Scean Time Series | as m 90 m), | Operated by Uwe Send |



| Additional notes | | Operated by Lucas, Davis : | | | | | | | | | | | | | | | | | |
|---|---|---------------------------------------|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|
| Variable Names + water column denth of | | sea_water_temperature (2 m 100 m), | | | | | | | | | | | | | | | | | |
| Data Manager | | Andrew Lucas Lab | | | | | | | | | | | | | | | | | |
| Platform Maintainer | | ucso | | | | | | | | | | | | | | | | | |
| Operator Sector | | Academic | | | | | | | | | | | | | | | | | |
| Platform | | ucso | | | | | | | | | | | | | | | | | |
| RA Funding Involvemen | | γp | | | | | | | | | | | | | | | | | |
| Platform Funder/Sponso | | scooos | | | | | | | | | | | | | | | | | |
| Currently Operation | | z | | | | | | | | | | | | | | | | | |
| Station | | 2020 | | | | | | | | | | | | | | | | | |
| Platform | | mooring | | | | | | | | | | | | | | | | | |
| Longitude (dec.dez) | à | -117.326 | | | | | | | | | | | | | | | | | |
| Latitude (dec dezi | 8 | 32.938 | | | | | | | | | | | | | | | | | |
| Station Description | | Wirrewalker Profiling System | | | | | | | | | | | | | | | | | |
| Station Long Name | | Observing nutrient fluxes and t | | | | | | | | | | | | | | | | | |
| WMO ID or NWS/CMAN | | NA | | | | | | | | | | | | | | | | | |
| Station ID | | NA | | | | | | | | | | | | | | | | | |

