

## Progress Report

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

Award number: NA21NOS0120088

Period of Activity: 07/01/2022 – 12/31/2022

Principal Investigator: Clarissa Anderson, UCSD - SCCOOS Executive Director

### I. PROJECT MILESTONES:

Milestone Table. Developed and modified from the SCCOOS milestone table available on the cover page of our FY21 and FY22 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. 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.

<b>Project and Task(s)</b>	<b>Status</b>
<b>GOVERNANCE SUBSYSTEM</b>	
<b>SCCOOS Regional Association Organization &amp; Outreach/Education</b>	
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
<b>OBSERVING SUBSYSTEM</b>	
<b>HF Radar Operations &amp; Maintenance</b>	
Sustain & operate 31 High Frequency Radar in the SCCOOS Region - continuous service via HFRNet, SCCOOS, and CeNCOOS	On-track
<b>California Underwater Glider Network (CUGN)</b>	

SIO - Sustain & operate two Spray glider lines in the SCCOOS region - continuous service with 3-5 month deployments per Spray	On-track
<b>Harmful Algal Bloom (HAB) Monitoring Program + SPATT</b>	
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. Harmful plankton taxa abundances, 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
<b>SCCOOS Automated Shore Stations (SASS)</b>	
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
<b>OAH Monitoring on SASS Stations</b>	
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.	Delayed - see details below
<b>CalCOFI- Distribution and abundance of marine birds in the Southern California Bight and adjacent waters</b>	
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
<b>California Multivariate Ocean Climate Indicator (MOCI)</b>	
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
<b>Statewide Kelp Canopy Area/Biomass Dynamics</b>	
WHOI - Incorporate kelp biomass database into our portal & develop user-driven	On-track

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	
<b>California Coastal Flood Network</b>	
SIO - Support & expand the California Coastal Flood Network, adding a new Southern California site to the threshold validation/evaluation process each year	Delayed - sea below
<b>HABON Pilot - CA IFCB Network O&amp;M</b>	
Operate and maintain a network of twelve Imaging FlowCytobots (IFCBs) to identify HAB species in real-time at critical land-based <i>and</i> offshore locations throughout California.	On-track
<b>CDIP - Long Beach Wave Buoy Model Validation</b>	
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
<b>DATA MANAGEMENT AND CYBERINFRASTRUCTURE SUBSYSTEM</b>	
<b>SCCOOS DMAC</b>	
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
<b>Axiom Data Science, a Tetra Tech Company</b>	
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
<b>CalCOFI - Data Synthesis and Serving/Product Development</b>	
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

<b>MODELING AND ANALYSIS SUBSYSTEM</b>	
<b>ROMS - 3 km Statewide Operational model</b>	
Seatrec - 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. This operation was terminated October 31, 2022 and replaced by the WCOFS run at NOAA.	Completed
<b>ROMS - High Resolution Shelf and Nearshore Physics</b>	
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

## II. PROGRESS AND ACCOMPLISHMENTS

High-Frequency Radar		
Amount	Funding Area	Task
\$2,170,000	Core	<p>Status:</p> <p>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.</p> <p>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.</p> <p>Accomplishments:</p> <p>A new solar-powered trailer was delivered to UCSB after many months of delay. Eduardo Romero has been preparing the new trailer for deployment in the case of spills of oil or other hazardous</p>

		<p>materials. Large decal was put on the new trailer identifying SCCOOS, IOOS and UCSB as the operators.</p> <p>Permit approval was received by Channel Islands National Marine Sanctuary (CINMS) for the installation of a new HFR site on Anacapa Island. UCSB, Anthropocene, and CINMS personnel are working to coordinate the installation.</p> <p>Scripps has contracted with CODAROS to assist with the monitoring and service of the Qty. 11 HFR sites within the Institution’s domain. Additional radial site monitoring through email alerts has been implemented on the individual radial sites. CODAROS provides daily hardware and data verification through remote access and dashboard interface.</p> <p>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. Recapitalization would also allow for spare components for when sites go down, which necessitates a lengthy repair from CODAR and long downtimes of certain sites if no backups of certain components (e.g., combined TX/RX antenna).</p>
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<b>Names of existing and planned HFR stations</b>	<b>Status</b>	<b>Date of most recent antenna calibration</b>	<b>Date planned for next antenna calibration</b>	<b>Recapitalization needs</b>
AGL1	Operational. Replaced router, ethernet cable, and ethernet power controller. Installed new satellite modem. Installed new computer and hard drives and updated operating system to 11.7 and installed R21u1 software and AWG to 3.5 firmware.	9/15/2021	ASAP	TX chassis, RX chassis, TX antenna
ARG1	Operational. Installed new computer and hard drives and updated to R21u1 software and AWG to 3.5 firmware. Replaced CodarArchives hard drive.	9/15/2021	ASAP	RX chassis, TX chassis
PTC1	Operational. Installed new computer	09/21/2022	09/2023	RX chassis, TX chassis

	and updated to R21u1 software. Repaired and reinstalled TX/RX combined antenna			
FBK1	Operational. Installed new computer and updated to R21u1 software. Added new guy wire. Replaced GPS Antenna.	9/27/2021	ASAP	RX chassis
LUIS	Operational. Upgraded software to R21u1 and AWG firmware to 3.5.	10/21/2021	1/20/2023	RX chassis, TX chassis
SDPL	Operational. Computer was upgraded. Script was added for site to send radial distributions on a daily basis.	12/15/2022	12/2023	New HPWREN link antennas and power infrastructure
SDBP	Operational. Hardware enclosure was hardened and gaskets were replaced. Computer was upgraded. Script was added for the site to send radial distributions on a daily basis.	06/06/2022	06/2023	
SDSE	Operational. New Tx/Rx chassis were installed after our last receiver failed. Computer was upgraded. Script was added for the site to send radial distributions on a daily basis.	06/06/2022	06/2023	
SDSC	Operational. Station experienced a long outage after the main panel supplying power to the station burned out. Computer was upgraded. Script was added for the site to send radial distributions on a daily basis.	4/27/2021	02/2023	Rx Chassis Tx Chassis Rx Antenna Tx Antenna
SDCP	Operational. Experienced an outage due to a network problem and limited site access. Computer was upgraded. Script was added for the site to send radial distributions on a daily basis.	Ideal Pattern	Unknown	Install AIS receiver and upgrade software to include autoAPM.
SDUT	Operational. Computer was upgraded. Script was added for the site to send radial distributions on a daily basis.	06/07/2022	06/2023	Rx Chassis Rx Antenna
SDDP	Operational. Computer was upgraded. Script was added for site to send radial	6/27/2019	06/2023	Rx antenna

	distributions on a daily basis.			
SDWW	Operational. Computer was upgraded. Script was added for the site to send radial distributions on a daily basis.	12/15/2022	12/15/2023	Tx Chassis Rx Chassis
SDCI	Not operational. This site might be phased out if no headway is made in regaining access to it. Computer was upgraded. Script was added for the site to send radial distributions on a daily basis.	10/18/2018	Unknown	Batteries for solar system Rx antenna New HPWREN link antennas
SDSL	Operational. Computer was upgraded. Script was added for the site to send radial distributions on a daily basis.	6/08/2020	06/2023	Rx Chassis Tx Antenna
SDSN	Operational. Computer was upgraded. Script was added for the site to send radial distributions on a daily basis.	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, TX antenna was re tuned for optima power output	11/17/2022	02/2024	Rx Chassis Tx Antenna New AC
TRL1	TRL1 is now the new solar trailer that was recently delivered to UCSB. The new trailer will be tested soon. Necessary paperwork is currently being processed (e.g. trailer licensing)..	N/A	N/A	
SCI1	SCI1 has been operating fairly consistently during the reporting period.	08/24/2022	08/2023	Rx Chassis Tx Antenna New A/C
SNI1	SNI1 has had outages due to failure of island-supplied power. Eduardo Romero visited the site to correct hardware issues and assess the status of the trailer used to house HFR equipment. We are in the process of purchasing a new trailer for the site to	AIS pattern coming soon	N/A	Rx Chassis Tx Antenna New Trailer Enclosure New AC AIS antenna pattern hardware/license

	house HFR electronics, batteries, and related hardware.			
COP1	COP1 has been operational over the reporting period.	07/2022	07/2023	Rx Chassis Tx Antenna
PTM1	PTM1 has been operational over the reporting period.	08/23/2022	08/2023	Rx Chassis Tx Antenna
SSD1	SSD1 has been operational over the reporting period.	08/06/2021	08/2022	New A/C
MGS1	MGS1 has been operating fairly consistently during the reporting period.	03/23/2022	02/2023	Rx Chassis Tx Antenna New AC
NIC1	NIC1 has been operational over the reporting period. Operation has been satisfactory.	02/01/2022	02/2023	New Front Door for enclosure
SCCI	Operational. Auto APM software installed.	Auto APM installed 4/15/22	06/2023	
SCDH	Non-Operational. The site has been non-operational since mid-February. The electronics need to be relocated and an order was placed for a new enclosure.	n/a	Second quarter 2022	
SCTB	Operational. A new antenna will be installed in the First Quarter.	11/18/2021	First quarter 2022	
SCPF	Operational. The site has been operating satisfactorily throughout this project period. A new air conditioner was ordered to replace a failing unit.	02/28/2018	First quarter 2023	New Tx chassis (\$36,750) New Rx chassis (\$68,250)
SCNB	Operational. The new electronics chassis were installed. Once a new antenna is ordered/delivered it will be installed.	10/24/2021	First quarter 2023	New antenna (\$23,000) New cables (\$1,800) New electronics enclosure (\$5,000)
SCDB	Operational. There have been power	11/23/2021	First	New antenna (\$23,000)



	issues at this site which causes it to occasionally go offline.		quarter 2023	
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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).

<b>Names of RA's HFR IT Systems</b>	<b>Status</b>	<b>Recapitalization needs</b>
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)
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**Summary of glider activities over the reporting period: Line 80 and alongshore**

<b>Mission</b>	<b>Serial No.</b>	<b>Deploy Date</b>	<b>Recover Date</b>	<b>Days</b>	<b>Distance (km)</b>	<b>Dives</b>
22305801	58	31-Mar-2022	21-Jul_2022	112	2265	935
22805501	55	09-Aug-2022	29-Nov-2022	112	2229	1015
0058 active	58	29-Nov-2022	Ongoing	41	861	374
22501301	13	13-May-2022	16-Aug-2022	95	1851	790

22902001	20	02-Sep-2022	20-Sep-2022	18	391	180
22903501	35	20-Sep-2022	25-Sep-2022	5	82	44
22A02001	20	06-Oct-2022	10-Nov-2022	35	826	349
0020 active	20	22-Nov-2022	Ongoing	48	1073	448

**Accomplishments / successes:** All operations are on track. Two publications during the report period.

**Problems/delays:** None

**Other UxS activities of note (status/accomplishments, etc.):** Started collaboration with SWFSC through REFOCUS project. An objective is to integrate pH and nitrate sensors onto newly developed Spray 2 underwater glider.

Other Core Observation Activities

**SCCOOS Automated shore stations (SASS)**

*PIs: Anderson/Carter (SIO), Nickols (CSUN), Washburn (UCSB)*

**Summary of other Observation Activities over the reporting period:**

- The Stearns Wharf automated shore station has been in constant operation over the reporting period. SCUBA diving teams led by David Salazar and Eduardo Romero (UCSB) have performed monthly maintenance operations on the station, such as instrument cleaning and assessment. Salazar has worked with Melissa Carter at SIO on maintenance issues related to the site.
- The Santa Monica Pier automated shore station has been in constant operation over the reporting period. SCUBA diving teams led by Kerry Nickols (CSUN) have performed monthly maintenance operations on the station, including instrument cleaning and assessment, and collection of calibration samples for salinity.
- The Newport Beach Pier (NBP) automated shore station has been in constant operation over the reporting period. SCUBA diving teams led by Melissa Carter (UCSD) have performed monthly maintenance, including sensor cleaning and collection of calibration samples for salinity, pH and oxygen at this station.
- The Scripps Pier automated shore station has been in constant operation over the reporting period. SCUBA diving teams led by Melissa Carter and Kayla Martin (UCSD) have performed monthly maintenance, including sensor cleaning and collection of calibration samples for salinity at this station.

**Accomplishments / successes:**

- Underwater deployment of the IFCB at the Newport Beach Pier station was in collaboration with SASS efforts by Melissa Carter and Kayla Martin (UCSD).
- The Newport Beach station has continued collection of pH measurements since deployment of the SeaBird SeaFET on December 17, 2020 and has continued oxygen measurements since Oct 2016. Carter and Martin worked extensively with SCCOOS data management to provide real-time access to these new parameters, available since January 2022. Additional funding for these sensors and maintenance has been provided by Orange County Sanitation District.
- Carter and Martin worked extensively with SCCOOS data management to incorporate fluorometer calibration coefficients in real-time data displays and in updated calculations of chlorophyll concentration (2013 to present) when WetStar fluorometers were installed at all SASS stations, available since January 2022.
- Testing of EcoTriplet fluorometer at Scripps Pier started with the most recent SASS package swap on December 2, 2022.

**Problems/delays:**

- Biofouling of the fluorometer continues to be an issue at all shore station sites. The air blaster system has helped somewhat with the biofouling situation at Stearns Wharf. All other stations, SIO, NB, and SM need air blaster systems, hardware and software, replaced to be operational. We are still considering moving the fluorometer to the surface and pumping excess water from the IFCB input through the fluorometer. This would greatly facilitate cleaning of the fluorometer. Our recent efforts have focused on improving the air blaster system at Stearns Wharf.
- The SASS network is still in need of recapitalization. All four stations have exceeded 10 years of use of critical underwater infrastructure including pier clamps and conduit, and all stations have original underwater protective cages lasting almost 20 years. In addition, the current WetStar SASS fluorometer is being discontinued and new fluorometers, cables and supporting hardware will need to be purchased and installed to continue these measurements once sensors fail. Recapitalization would also provide for spare components such as backup sensors, pumps, underwater power-data cables, sensor cables, and critical network hardware. Replacement of aging components and having spares on hand can reduce downtimes and continue real-time ocean observations.

Station	Parameters	Date of Most Recent Deployment	Recapitalization Needs
Scripps Pier	Temperature Chlorophyll Salinity Depth pH Oxygen IFCB	CTD Package: 12/2/2022 Self-calibrating SeapHOx: 12/2/2022	Pier Clamp, Power-Data Conduit Replacement (need in 2023) New Fluorometer- (ASAP -Seabird discontinued current fluorometer) CTD Cable x 2 (Backups for other stations - 2023)
Newport Beach Pier	Temperature Chlorophyll Salinity Depth pH Oxygen IFCB	CTD Package: 6/9/2022 SeaFET: 6/9/2022 IFCB: 7/7/2022	Pier Clamp, Power-Data Conduit Replacement (need ASAP) New Fluorometer (ASAP -Seabird discontinued current fluorometer)
Santa Monica Pier	Temperature Chlorophyll Salinity Depth	CTD Package: 3/10/2022	Pier Clamp, Power-Data Conduit Replacement (need in 2023) New Fluorometer-ASAP (Seabird discontinued current fluorometer)
Stearns Wharf	Temperature Chlorophyll Salinity Depth IFCB	CTD Package: 2/25/2022 IFCB: 4/15/2022	Pier Clamp, Power-Data Conduit Replacement (need in 2023) New Fluorometer-ASAP Pier Clamp (2023) CTD Cable

### OAH Monitoring on SASS Stations

*PI: Martz (SIO)*

**Accomplishments / successes:** Three successful Self-Calibrating SeapHOx (SCS) deployments at the Scripps Pier in collaboration with SIO SASS efforts. SCS operated near-continuously from Jul-Dec 2022, generating data with automated calibration points. Data are being provided in real-time to Axiom Data Science for integration into the SCCOOS pipeline.

**Problems/delays:** A 1 year delay in funding for a third SCS resulted in a delay of deployment on Santa Monica Pier. The sensor is now in production and planned to be completed by spring 2023. We plan to work with SASS field team on a deployment on the Santa Monica Pier during the first half of 2023.

## Harmful Algal Bloom Monitoring Alert Program

*PIs: Anderson/Carter (SIO), Shipe (UCLA), Caron (USC), Brzezinski (UCSB), Pasulka (Cal Poly)*

### **Accomplishments / successes:**

Timely information on HAB events at the five sample sites is uploaded to the SCCOOS website and data server on a weekly basis, as well as distributed to local, state, and federal partners in weekly reports to the CA HABMAP (California Harmful Algae Monitoring and Alert Program) listserv. Particulate domoic acid sample analysis is performed monthly on the weekly filtered water samples, monthly to quarterly dissolved toxin analysis from SPATT (both performed at USC) on weekly samples, and quarterly nutrient analyses (UCSB) on weekly samples to address stakeholder needs and feed into the monthly CA HAB Bulletin summaries of HABs and HAB predictions state estimates from the previous month. SIO also submits weekly plankton samples and monthly mussel samples to the California Department of Public Health as part of the statewide Phytoplankton Monitoring Program

**Problems/delays:** SPATT sampling at Stearns Wharf has been impacted by high waves and tides submerging the sampling platform used to retrieve the SPATT sampler. A system redesign is underway. Toxin analysis on weekly water samples and SPATT samples were delayed and backlogged due to COVID-19 interruptions resulting in restrictions on laboratory activities (multiple times). However, the backlog of samples has been resolved, and monthly analyses of the weekly samples are now up to date.

## Multivariate Ocean Climate Indicator (MOCI)

*PI: Garcia-Reyes (FI)*

**Summary of other Observation Activities over the reporting period:** MOCI updated as scheduled.

### **Accomplishments / successes:**

- MOCI Updated for 2022 spring and summer quarters.
- Scripts for input data have been updated.
- Data is now shared in the CalOOS Data Portal

**Problems/delays:** None.

## Seabird and Marine Mammal Observations

*PI: Sydeman (FI)*

**Summary of other Observation Activities over the reporting period:** Surveys conducted in winter, spring CalCOFI, and spring RREAS, but see issues below.

**Accomplishment / successes:** Data collection successful, on track; data reports produced and shared online on schedule.

**Problems/delays:** RREAS was delayed by 2 weeks, then aborted due to shipboard COVID outbreak. Nonetheless about 20 days of data was collected by the end of the survey period.

## Statewide Kelp Canopy Area/Biomass Dynamics

*PI: Bell (WHOI)*

**Summary of other Observation Activities over the reporting period:** Kelp canopy products (biomass/area) were derived for Q2 2022 and Q3 2022 and delivered to the data portal during this six month period.

**Accomplishments / successes:** In addition to adding Landsat 9 OLI2 imagery to the dataset, I have revamped our coastline mapping procedure to better identify and remove pixels with contamination of areas exposed at low tides. I have also submitted a new manuscript that is currently in revision at PLOS One. All data files have been updated in the SBC LTER website and the Environmental Data Initiative for ingestion into the SCCOOS data portal.

**Problems/delays:** None.

### California Coastal Flood Network

**PI:** Merrifield (SIO)

**Summary of other Observation Activities over the reporting period:** Completed installation of 1 additional citizen-science CoastSnap cradle at Torrey Pines State Beach for outreach and future validation studies. Development of the Leucadia flood site remains ongoing, with installation of CDIP Nearshore Buoy 262 for offshore input conditions to the wave runup model.

**Accomplishments / successes:** A storymap for SIO-managed CoastSnap stations was developed ([siocpg.ucsd.edu/coastsnap](https://siocpg.ucsd.edu/coastsnap)) in Dec 2022. The Torrey Pines Station, installed Aug 2022, has averaged 7 user-submitted photos per day.

**Problems/delays:** Permitting delay for *in-situ* beach and wave runup observations at Leucadia (FY22 site).

### DMAC Activities

**PI:** Anderson (SIO), Bochenek (ADS)

**Summary of other Observation Activities over the reporting period:** We continue to ingest, maintain, and serve SCCOOS and non-SCCOOS data assets for discovery and access in the CalOOS data portal.

**Accomplishments / successes:** Hosted demo webinars with the users of the new California Ocean Observing System Data Portal ([data.caloos.org](https://data.caloos.org)). Continued incorporating user feedback to improve [SCCOOS Automated Shore Stations dashboard](#) that is displaying SCCOOS Shore Stations data; implemented automated notification emails for SCCOOS Shore Stations to alert data providers and end-users about real-time data flow interruptions or when collected data is outside of the acceptable thresholds, added seven new IFCB data streams (data are being displayed through an [IFCB dashboard](#)).

In order to increase reliability and timely preservation of sensor data for ingestion by the National Data Buoy Center, Axiom implemented an operational ERDDAP deployment for high priority datasets. This new operational deployment will help ensure that important data sets remain accessible to downstream consumers and are insulated from ERDDAP performance and stability issues. We also ingested various datasets including: the C-HARM model nowcast and forecast surface layer (version 2 and 3), the West Coast Operational Forecast System (WCOFS) to replace CA ROMS, and the ROMS NEMURO West Coast Nowcast (10km). Axiom Data Science also participated in various regional, state, and national DMAC activities, including regular weekly calls and regional meetings in support of SCCOOS DMAC.

**Problems/delays:** None

### CalCOFI - Data Synthesis and Serving/Product Development

**PI:** Semmens (SIO)

**Summary of other Observation Activities over the reporting period:** We continue to create ocean observing data synthesis and serving tools that serve the needs of the California public and ocean ecosystem management organizations along the US West coast. We have been working on the development of both back-end database (i.e., data curation, QA/QC, and preparation) and front-end dashboard components. The front end graphics highlight ecosystem and/or region-specific trends and status reports. Additionally, we are working with SCCOOS, in collaboration with Ian Brunjes, to integrate SCCOOS and CeNCOOS observing data into the dashboard and curated data displays, such as related to toxins (e.g., DDT) and pollution.

**Accomplishments / successes:** We have worked with stakeholders to develop an integrated vision for data serving and visualizing that meets the needs of a range of stakeholders. The current data workflow and vision can be viewed at <https://calcofi.io/docs/>. We have worked with data providers and users to develop a PostGRES SQL database that includes larval fish, hydrographic data, and zooplankton. In addition, we have developed a server setup (<https://github.com/calcofi/server>), an R package - CalCOFI4r (<https://calcofi.io/calcofi4r/>), and an API (<https://api.calcofi.io/docs/>) to ingest and submit data. We also have completed a beta version of the front end interactive data application (<https://shiny.calcofi.io/oceano/>) which has been shared with stakeholders (e.g., CINMS and CCIEA) and iterated upon. We are now working to finalize this dashboard. All progress can be viewed at <https://calcofi.io/>.

**Problems/delays:** None

### ROMS High Resolution Shelf and Nearshore Physics

*PI: McWilliams (UCLA)*

**Summary of other Observation Activities over the reporting period:** We continue to configure nested model domains with surface wave coupling to the circulation and material transport. The present focus is on nearshore currents in the Santa Barbara region.

**Accomplishments / successes:** A new paper on interaction of submesoscale fronts and Langmuir circulations was published in JPO (Hypolite et al., 2023), another is in press in JGR on interaction of internal tidal bores with nearshore fronts (Dauhajre et al., 2022), another on microplastics and fronts in estuaries in Nature Reviews (Wang et al., 2022), another on island effects on oxygen, etc. in the Santa Barbara Channel in GRL (Kessouri et al., 2022), another on overlapping boundary layers in the inner shelf in jPO (Yan et al., 2022), and yet another was published in JPO on surface wave effects on coastal upwelling (Wang et al., 2023).

**Problems/delays:** None.

### CA ROMS 3km

*PI: Yi Chao (Seatrec)*

**Summary of other Observation Activities over the reporting period:** CA 3-km ROMS model was discontinued on October 31, 2022 now that the NOAA 4-km WCOFS model is operational.

**Accomplishments / successes:** Completed. [C-HARM version 3](#) is now available on the CalOOS data portal. This version uses VIIRS Rrs data and WCOFS SST, salinity, and current data.

**Problems/delays:** None.

IOOS, NOAA, Other Agency Funding (non-core funding)

Funding amount spent	Funding Area /Recipient	Task: please provide a status update.
Provided \$20,000 Spent \$12,890.68 Remaining \$7,109.32	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 \$297,500 Spent \$48,116.85 Remaining \$249,383.15	HABON Pilot - CA IFCB Network O&M	Status: on-track Accomplishments: <ul style="list-style-type: none"> <li>● Classifier application at all SoCal sites and management engagement for product development (leverages OPC and PCMHAB project)</li> </ul> Issue (if any): <ul style="list-style-type: none"> <li>● David Salazar and Eduardo Romero assisted Nathalie Guillocheau (UCSB) with the installation and removal of the IFCB at the Stearns Wharf shore station. There have been ongoing component failures of the IFCB. Nathalie Guillocheau and Stuart Halewood have been working with technicians and engineers at McLane Labs to correct these problems.</li> </ul>
Provided \$69,329 Spent \$5,224.03 Remaining \$64,104.97	HFR FCC	Status: on-track HFR Federal Communications Commission (FCC) and Retuning

**III. PROJECT CHALLENGES/MODIFICATIONS RELATED TO COVID (200 words):**

- COVID caused delays in visiting site locations due to access restrictions.
- COVID also caused delays in laboratory analysis of toxin samples, but that backlog has now been resolved, as noted above.

**IV. PUBLICATIONS AND REPORTS:**

\*SCCOOS PIs are in bold

1. Andersen, M. J. (2022). [El Niño conditions facilitate invasion of the non-native seaweed \*Sargassum horneri\* into San Diego’s kelp forests](#) (Doctoral dissertation, UC San Diego). - **References SCCOOS SASS temperature data at Scripps Pier**
2. Byrne, S., **Merrifield, M., Carter, M.,** Cayan, D., Flick, R., Gershunov, A., & Giddings, S. (2022). Southern California winter precipitation variability revealed by 100-year ocean



- salinity record. *Research Square*. <https://doi.org/10.21203/rs.3.rs-1769820/v1>
3. Chivers, S. J., & Greenman, J. V. (2022). Marine mammal stranding patterns provide clues for identifying anomalies along the coastline of California’s Santa Barbara and Ventura counties. <https://repository.library.noaa.gov/> - **References SCCOOS HABMAP data at Stearns Wharf**
  4. Cronin, M. F., Swart, S., Marandino, C. A., **Anderson, C.**, Browne, P., Chen, S., ... & Yu, L. (2022). Developing an Observing Air–Sea Interactions Strategy (OASIS) for the global ocean. *ICES Journal of Marine Science*.
  5. Drake, P., Edwards, C. A., Arango, H. G., Wilkin, J., TajalliBakhsh, T., Powell, B., & Moore, A. M. (2022). Forecast Sensitivity-based Observation Impact (FSOI) in an analysis-forecast system of the California Current Circulation. *Ocean Modelling*. <https://doi.org/10.1016/j.ocemod.2022.102159> - **References SCCOOS, CeNCOOS, and NANOOS as stakeholders**
  6. Freeman, J. B., **Semmens, B. X.**, & Thompson, A. R. (2022). Impacts of marine protected areas and the environment on larval rockfish species richness and assemblage structure in the Southern California Bight. *Marine Ecology Progress Series*, 698, 125-137. DOI: <https://doi.org/10.3354/meps14161>
  7. Gallo, N. D., Bowlin, N. M., Thompson, A. R., Satterthwaite, E. V., Brady, B., & **Semmens, B. X.** (2022). Fisheries surveys are essential ocean observing programs in a time of global change: A synthesis of oceanographic and ecological data from U.S. West coast fisheries surveys. *Frontiers in Marine Science*. <https://doi.org/10.3389/fmars.2022.757124>
  8. Hammond, S.W., Lodolo, L., Hu, S.K. & **Pasulka, A.L.** (2022) Methodological ‘lenses’ influence the characterization of phytoplankton dynamics in a coastal upwelling ecosystem. *Environmental Microbiology Reports*. <https://doi.org/10.1111/1758-2229.13116>
  9. Harvey, M. E., Giddings, S. N., Pawlak, G., & Crooks, J. A. (2022). Hydrodynamic Variability of an Intermittently Closed Estuary over Interannual, Seasonal, Fortnightly, and Tidal Timescales. *Estuaries and Coasts*. <https://doi.org/10.1007/s12237-021-01014-0> - **references SCCOOS SIO SASS data**
  10. Heron, M. J. M. (2022). [Microbial Community Structure of the Sea Surface-Marine Boundary Layer](#) (Doctoral dissertation, UC San Diego). - **References SCCOOS HABMAP data at Scripps Pier**
  11. Hunter, B. T., Flury, J. D., Cocioba, S. S., Cope-Arguello, M. L., Helms, J. M., García, K. H., ... & Becket, E. (2022). Engineering an incubation environment that mimics in situ conditions for in vitro coastal microbiome studies. *BioTechniques*. <https://doi.org/10.2144/btn-2022-0080> - **References SCCOOS SASS temperature data at Scripps Pier**

12. Kessouri, F., Renault, L., **McWilliams, J. C.**, Damien, P., & Bianchi, D. (2022). Enhancement of oceanic eddy activity by fine-scale orographic winds drives high productivity, low oxygen, and low pH conditions in the Santa Barbara Channel. *Journal of Geophysical Research: Oceans*. <https://doi.org/10.1029/2022JC018947>
13. Kenkel, C.D., J. Smith, K.A. Hubbard, C. Chadwick; N. Lorenzen, A.O. Tatters and D.A. Caron. 2022. Reduced representation sequencing accurately quantifies relative abundance and reveals population-level variation in *Pseudo-nitzschia* spp. *Harmful Algae*. [10.1016/j.hal.2022.102314](https://doi.org/10.1016/j.hal.2022.102314).
14. Kurapov, A. L., **Rudnick, D. L.**, Cervantes, B. T., & Risien, C. M. Slope and shelf flow anomalies off Oregon influenced by the El Niño remote oceanic mechanism in 2014-16. *Journal of Geophysical Research: Oceans*. <https://doi.org/10.1029/2022JC018604>
15. McClure, C. (2022). *Using BONCAT-FCM to Quantify Bacterial Production in Marine Observing Programs* (Thesis, UC San Diego). - **References SCCOOS HABMAP sampling at Scripps Pier**
16. Monismith, S.G., Alnajjar, M.W., Daly, M., Valle-Levinson, A., Juarez, B., Fagundes, M., **Bell, T.W.**, Woodson, C.B. (2022), Kelp forest drag coefficients derived from tidal flow data, *Estuaries and Coasts*.
17. Moreno, A. R., **Anderson, C.**, Kudela, R., Sutula, M., Edwards, C., & Bianchi, D. (2022). Development, calibration, and evaluation of a model of Pseudo-nitzschia and domoic acid production for regional ocean modeling studies. *Harmful Algae*. <https://doi.org/10.1016/j.hal.2022.102296>
18. Nichols, C. L., Lambert, G., & Nydam, M. L. (2022). Continued persistence of non-native ascidians in Southern California harbors and marinas. *Aquatic Invasions*. <https://doi.org/10.3391/ai.2023.18.1.02> - References SCCOOS SASS temperature data
19. Ollison, G. A., Hu, S. K., Hopper, J. V., Stewart, B. P., Smith, J., Beatty, J. L., ... & **Caron, D. A.** (2022). Daily dynamics of contrasting spring algal blooms in Santa Monica Bay (central Southern California Bight). *Environmental Microbiology*. <https://doi.org/10.1111/1462-2920.16137>, **References HABMAP data.**
20. Office of Environmental Health Hazard Assessment (OEHHA; 2022). Indicators of Climate Change in California, Fourth Edition, *California Environmental Protection Agency, OEHHA*. - **References SCCOOS and CeNCOOS CalHABMAP data, Acknowledges Clarissa Anderson**
21. Shipley, K., **Martz, T.**, Bresnahan, P., & Wirth, T. (2022). Metabolic rates in the Agua Hedionda Lagoon during the 2020 Southern California red tide event. *Elementa Science of the Anthropocene*. <https://doi.org/10.1525/elementa.2022.00018>.
22. Thompson, A. R., E. Bjorkstedt, S. J. Bograd, J. L. Fisher, E. L. Hazen, A. Leising, J. Santora, E. V. Satterthwaite, **W. J. Sydeman**, M. Alksne, T. D. Auth, S. Baumann-Pickering, N. M. Bowlin, B. J. Burke, E. A. Daly, H. Dewar, J. C. Field, N. T.

Garfield, A. Giddings, R. Goericke, J. Hildebrand, C. A. Horton, K. Jacobson, M. Jacox, J. Jahncke, M. Johns, J. Jones, R. M. Kudela, S. R. Melin, C. A. Morgan, C. F. Nickels, R. A. Orben, J. M. Porquez, E. J. Portner, A. Preti, R. R. Robertson, **D. L. Rudnick**, K. M. Sakuma, I. D. Schroeder, O. E. Snodgrass, S. A. Thompson, J. S. Trickey, P. Warzybok, W. Watson, and E. D. Weber, 2022: State of the California Current Ecosystem in 2021: Winter Is Coming? *Frontiers in Marine Science*. doi: [10.3389/fmars.2022.958727](https://doi.org/10.3389/fmars.2022.958727)

23. **Walter, R. K.**, Huie, S. A., Abraham, J. C. P., **Pasulka, A.**, Davis, K. A., Thomas, P. C.... & **Robbins, I.** (2022). Seasonal controls on nearshore dissolved oxygen variability and hypoxia in a coastal embayment. *Estuarine, Coastal and Shelf Science*. <https://doi.org/10.1016/j.ecss.2022.108123>
24. Wang, Y. H., **Walter, R. K.**, White, C., & Ruttenberg, B. I. (2022). Spatial and Temporal Characteristics of California Commercial Fisheries from 2005 to 2019 and Potential Overlap with Offshore Wind Energy Development. *Marine and Coastal Fisheries*. <https://doi.org/10.1002/mcf2.10215>.
25. Wang, T., Zhao, S., Zhu, L., **McWilliams, J. C.**, Galgani, L., Amin, R. M., ... & Chen, M. (2022). Accumulation, transformation and transport of microplastics in estuarine fronts. *Nature Reviews Earth & Environment*. <https://doi.org/10.1038/s43017-022-00349-x>.
26. Wang, P., **McWilliams, J. C.**, Wang, D., & Yi, D. L. (2023). Conservative Surface Wave Effects on a Wind-Driven Coastal Upwelling System. *Journal of Physical Oceanography*. <https://doi.org/10.1175/JPO-D-22-0120.1>
27. Yan, C., **McWilliams, J. C.**, & Chamecki, M. (2022). Overlapping boundary layers in coastal oceans. *Journal of Physical Oceanography*. <https://doi.org/10.1175/JPO-D-21-0067.1>

## V. EDUCATION, MEDIA ENGAGEMENT, AND OUTREACH MATERIALS:

### A. Notable Presentations, Posters, Exhibits, Tour and outreach efforts

\*Presentations were virtual unless otherwise specified

1. July 28, 2022 - Assemblywoman Laurie Davies visits Scripps Institution of Oceanography, La Jolla, CA - C. Anderson presented
2. August 8, 2022 - San Diego County Teacher's Workshop, La Jolla, CA - C. Anderson presented
3. August 9, 2022 - NOAA Chief Scientist Sarah Kapnick visits Scripps Institution of Oceanography, La Jolla, CA - C. Anderson presented
4. August 12, 2022 - Baja Aquafarms visit, Ensenada, Mexico - C. Anderson presented
5. September 13, 2022 - [2nd National eDNA Workshop](#), Costa Mesa, CA - M. Medina attended
6. September 11-13, 2022 - SIO Academic Retreat, Arrowhead, CA - C. Anderson attended

7. September 14-16, 2022 - [EPOC 2022](#), Mt. Hood, OR - C. Anderson presented and hosted
8. September 19-22, 2022 - [MTS Buoy Workshop](#), Wilmington, NC - R. Timmerman attended
9. September 20-22, 2022 - [UG2 Workshop](#), Seattle, WA - D. Rudnick presented
10. September 22, 2022 - Bight '23 Meeting, Costa Mesa, CA - M. Medina attended
11. September 27, 2022 - CalOOS Data Portal Demo for Principal Investigators - S. Buckelew presented, M. Medina hosted
12. October 5, 2022 - CalOOS Data Portal Stakeholder Tutorial - B. Stone presented, M. Medina hosted
13. October 17-20, 2022 - NCEA MPA Network Assessment, Santa Barbara, CA - C. Anderson presented
14. October 17-19, 2022 - [Tribal Exchange Network Conference](#), Flagstaff, AZ - M. Medina presented
15. October 18, 2022 - [49th Annual Zeke Grader Fisheries Forum](#), virtual - C. Anderson presented
16. October 23-28, 2022 - [11th US HAB Symposium](#), Albany, NY - C. Anderson presented
17. November 1, 2022 - NOAA West Watch Webinar, virtual - C. Anderson presented
18. November 6-7, 2022 - IOOS Directors Retreat
19. November 8-11, 2022 - IOOS All-hands Meeting, San Juan, Puerto Rico
20. November 14-18, 2022 - [14th Annual TMA BlueTech Week](#), San Diego, CA - C. Anderson presented
21. December 5-7, 2022 - [CalCOFI Conference](#), La Jolla, CA - M. Medina presented, M. Frants, B. Best, J. Brown presented on CalCOFI visualizations supported by SCCOOS,
22. December 6-7, 2022 - IOOS FAC, Washington, D.C. - C. Anderson presented

## B. Education/Courses

- SIO171 - Intro to Physical Oceanography - Daniel Rudnick, SIO
- SIO175 - Analysis Ocean/Atmosph Data - Mark Merrfield, SIO
- SIO179 - Ocean Instruments and Sensors - Todd Martz, SIO
- SIO190 - Special Topic/Earth/Ocean/Atmo - Introduction to Acoustics - Mark Merrfield, SIO
- SIOB296 - Special Topics/Ocean Bio - Data Analysis/Modeling Techniques - Brice Semmens, SIO
- SIOG269 - Spec Topics/Marine Chemistry - Marine Chemistry Lab - Todd Martz, SIO
- MSC1403 - Ocean Sampling Techniques - Ally Pasulka and Ryan Walter, Cal Poly, SIO
- AOS107 - Biological Oceanography - Rebecca Shipe, UCLA
- Pier Tour led by Melissa Carter, SIO for SIO22A, Analysis of Physical Oceanographic Data, focused on data comparison between high resolution and once per day sampling. Use of Automated Shore Station data.

- Science volunteer for Birch Aquarium Beach Science Program for 6th graders with the topic of HABs and long term data collection - Melissa Carter, SIO.
- BISC 530 - Plankton Biology - David Caron
- Worked with the California Central Coast Data Science Partnership at UCSB to bring CalCOFI data to their capstone projects. - Erin Satterthwaite/Brice Semmens, SIO
  - The CalCOFI Capstone projects developed online applications:
    - [Visualization: https://shiny.calcofi.io/capstone/](https://shiny.calcofi.io/capstone/)
    - [Code: https://github.com/CalCOFI/capstone](https://github.com/CalCOFI/capstone)

### C. Outreach Materials

- Hypoxia primer for California Citizens (Erin Satterthwaite/Brice Semmens, SIO) developed by data storytelling interns
  - <https://aradams11.github.io/calcofi.github.io/Parallax/parallaxr-output.html>

### D. Media Engagement

- Gammon, K. [What's ailing the sea lions stranded on California beaches?](#) *The Guardian*. Sep 4, 2022.
- Ritchie, E. [Poisonous algae blooms could signal tough season ahead for marine mammal rescue centers.](#) *OC Register*. September 12, 2022
- [The bioluminescence waves are back in San Diego.](#) *CBS8*. September 28, 2022
- Stephens, T. [With Pivot Fellowship, astronomer J. Xavier Prochaska turns to oceanography.](#) UC Santa Cruz. September 7, 2022
- Philanthropy New York: [Simons Foundation Announces First Pivot Fellowship Recipients](#) - mentions Daniel Rudnick
- Rosane, O. [California sea lions stricken by toxic red tide crisis.](#) *People's World*. September 26, 2022.
- Wernik, A. [Hundreds of sea lions treated for domoic acid poisoning in Santa Barbara and Ventura Counties.](#) *KCBX*. September 26, 2022
- Connelly, L. [Glowing neon blue bioluminescent waves are back in OC.](#) The Orange County Register. September 27, 2022
- NOAA. (2022). [A multi-stressor approach to understanding climate change impacts on coastal communities](#): 2022 SOST Opportunities and Actions Roundtable Submissions.
- Graham, K. [Toxic algae bloom along California coast poisoning sea lions.](#) *Digital Journal*. September 4, 2022
- Bravo, C. [It's Back: 'Bioluminescence Chasers' Hunt For Blue Waves as Red Tide Reaches San Diego.](#) *NBC7 San Diego*. September 28, 2022
- Co, R. Algal Bloom: [Domoic Acid Poisoning Hits Santa Barbara Sea Lions, Hundreds Treated.](#) *Nature World News*. September 29, 2022
- Bell, D. [Scripps Oceanography preserves algal treasure chest.](#) Union Tribune. December

17, 2022 - M. Carter facilitates Scripps Tour with W.E. Allen family to commemorate early phytoplankton collection and research efforts that are ongoing through CalHABMAP.

- Purper, B. [Why is 89.5 KSBX off the air? The answer is in the atmosphere.](#) *KCBX*. December 29, 2022 - L. Washburn was interviewed by KCBX about atmospheric ducting of radio signals.
- Gomez-Van Cortright, G. Toxic protists in marine and fresh waters. October, 2022 - D. Caron interviewed for forthcoming article on toxic algae in local (CA) waters.

**VI. PRODUCT DELIVERY:**

- Eleven [CA HAB Bulletins](#) published for the months Jan - Dec 2022
- Two updates of the MOCI Index (Multivariate Ocean Climate Indicator). Index available at: <http://www.faralloninstitute.org/moci>
  - Spring 2022 MOCI (Apr-Jun, Updated August 2022)
  - Summer 2022 MOCI (Jul-Sep, updated in November 2022)
- Design and implementation of a simple SPATT bag holder and deployment system at Stearns Wharf

**VII. SUCCESS STORIES**

Success Story	Brief Description	Contact
Large Domoic Acid Marine Mammal Stranding Event	In August and September 2022 the Channel Islands Marine Wildlife Institute, Pacific Marine Mammal Center, and The Marine Mammal Center encountered over 150 sea lion strandings due to suspected domoic acid toxicity. SCCOOS helped inform the local stranding centers of data observed at our shore stations and C-HARM model forecasts. SCCOOS led, in collaboration with SIO and SCCWRP, a successful NOAA NCCOS rapid response funds to collect water samples offshore where the bloom developed.	Clarissa Anderson

**VIII. Student Hires and Internships (advancing STEM education and retention at SCCOOS)**

- UCSB HABS - Graduate students Michael Maniscalco and Natalie Dorman were employed as graduate student researchers to assist in HABS sampling and sample processing from Stearns Wharf.

- Cal Poly HABs - Madeleine Kwon was employed as an undergraduate research assistant to conduct HABs sampling and sampling processing from the Cal Poly Pier.
- CalCOFI Data storytelling internship- Mallika Gupta & Annie Adams were employed as post-undergraduates to develop a hypoxia primer to communicate about hypoxia in the California Current to California citizens.
- SIO HABs - Undergraduate Scripps-GEO students Alyssa Ayan and Isadora Rojas participated in NSF GEO-Paths paid internship to assist in Cater lab projects including HAB sampling and processing from Scripps Pier.
- SIO SASS- Undergraduate student Emma Smith was employed as undergraduate research assistant to assist with Automated Shore Station maintenance dives and HAB sampling at Scripps Pier.
- CSUN SASS - Graduate students Jessica Peria and Alitzel Villanueva were employed as graduate research assistants to assist with Automated Shore Station maintenance dives at Santa Monica Pier.
- UCSD Coastal Flood Network - Undergraduate Andre Dos Santos was employed as a student intern to assist with the development of the CoastSnap program.
- USC Caron Lab - Undergraduate student Lucas Teran assisted with processing of plankton samples and domoic acid analyses under the supervision of Caron's Research Specialist, Brittany Stewart.

## **IX. CERTIFICATION UPDATES**

- SCCOOS hired new Product Developer, Ian Brunjes, in September 2022
- Yi Chao, Seatrec, project completed and is no longer a SCCOOS PI
- Kristen Koch, SWFSC, was invited to join SCCOOS Board Executive Committee
- George Robertson, OCSD, retired and left SCCOOS JSAC and Executive Steering Committee
- Debbie Aseltine-Neilson, CDFW, retired and left SCCOOS and CeNCOOS JSAC
- Jayme Timberlake, City of Encinitas, resigned and left our JSAC
- Mark Gold, Ocean Protection Council, left our JSAC
- Lynn Korwatch, San Francisco Marine Exchange, retired and left SCCOOS and CeNCOOS JSAC

## **X. EXTRAMURAL FUNDING**

### A. Successful

NOOA, NCCOS

MERHAB: Event Response to the 2022 Southern California Domoic Acid Event

Lead: C. Anderson, SCCOOS/SIO

\$5,000

2022-09-01 to 2023-08-31

B. Pending

NOAA, NCCOS

Regional MERHAB: A novel observing system for HAB intraspecific diversity and associated toxins in Southern California

Lead: A. Barton, UCSD

Co-PI: C. Anderson, SCCOOS/SIO

\$3,000,000

2023-07-01 to 2024-06-30

C. Unsuccessful

NOAA, NCCOS

Future Projections of Multiple Stressor Impacts on the California Current Ecosystem under Climate Change

Lead: D. Bianchi, UCLA

Co-PI: C. Anderson, SCCOOS/SIO

\$600,000

2022-10-01 to 2026-09-30

NOAA, NCCOS

Acidification, HABs, Hypoxia, and Heatwaves: Assessing the impacts and management implications of multiple stressors on indicator species in the California Current Ecosystem

Lead PI: Kroeker, UCSC

Co-PI: C. Anderson, SCCOOS/SIO

\$212,544

2022-10-01 to 2026-09-30

NOAA, NCCOS

Production and fate of domoic acid under the combined influences of ocean acidification and eutrophication

Lead PI: R. Kudela, UCSC

Co-PI: C. Anderson, SCCOOS/SIO

\$120,000

2022-09-01 to 2023-08-31

NOPP

MBON: Southern California Bight marine Biodiversity Observation Network

Lead PI: R. Miller, UCSB



Co-PI: C. Anderson, SCCOOS/SIO  
 \$99,995  
 2022-07-01 to 2023-06-30

**XI. BUDGET SUMMARY**

<b>Cost Categories</b>	<b>Funding provided</b>	<b>Funds spent</b>	<b>Unspent funds remaining</b>	<b>Remaining %</b>
<b>Personnel</b>	\$826,840.00	\$483,931.24	\$342,908.76	41.47%
<b>Fringe Benefits</b>	\$354,013.00	\$197,528.51	\$156,484.49	44.20%
<b>Travel</b>	\$162,038.00	\$40,304.62	\$121,733.38	75.13%
<b>Equipment</b>	\$328,625.00	\$0.00	\$328,625.00	100.00%
<b>Supplies</b>	\$140,282.00	\$91,684.39	\$48,597.61	34.64%
<b>Contractual</b>	\$2,479,946.00	\$901,994.73	\$1,577,951.27	63.63%
<b>Other</b>	\$689,391.00	\$308,243.55	\$381,147.45	55.29%
<b>Total Directs Charges</b>	\$4,981,135.00	\$2,023,687.04	\$2,957,447.96	59.37%
<b>Indirects Charges</b>	\$1,082,304.00	\$579,493.94	\$502,810.06	46.46%
<b>Total Amounts</b>	\$6,063,439.00	\$2,603,180.98	\$3,460,258.02	57.07%

1. Were the oldest ASAP TAS BETC accounting lines drawn down first?
2. Give a brief update on project invoicing for the reporting period. Were there any delays with invoicing or payment?
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.
4. 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 - NA
6. Provide an update about travel completed during the reporting period.  
 - FI (MOCI): N/A

- SCCOOS Program Office:
    - Aug. 12, 2022: Baja Aquafarms visit, Ensenada, Mexico - C. Anderson presented
    - Sep. 13, 2022: [2nd National eDNA Workshop](#), Costa Mesa, CA - M. Medina attended
    - Sep. 11-13, 2022: SIO Academic Retreat, Arrowhead, CA - C. Anderson attended
    - Sep. 14-16, 2022: [EPOC 2022](#), Mt. Hood, OR - C. Anderson presented and hosted
    - Sep. 19-22, 2022: [MTS Buoy Workshop](#), Wilmington, NC - R. Timmerman attended
    - Sep. 20-22, 2022: [UG2 Workshop](#), Seattle, WA - D. Rudnick presented
    - Sep. 22, 2022: Bight '23 Meeting, Costa Mesa, CA - M. Medina attended
    - Oct. 17-20, 2022: NCEA MPA Network Assessment, Santa Barbara, CA - C. Anderson presented
    - Oct. 17-19, 2022: [Tribal Exchange Network Conference](#), Flagstaff, AZ - M. Medina presented & hosted exhibit booth
    - Oct. 23-28, 2022: [11th US HAB Symposium](#), Albany, NY - C. Anderson presented
    - Nov. 6-7, 2022: IOOS Directors Retreat
    - Nov. 8-11, 2022: IOOS All-hands Meeting, San Juan, Puerto Rico
    - Dec. 6-7, 2022: IOOS FAC, Washington, D.C. - C. Anderson presented
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 getting funds to UC and Subawards

End Report

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## ADDENDA

### XI. DMAC Annual Progress 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 that is ongoing through this performance period.
- **Task 1.2: Implement and enhance a public-facing SCCOOS data portal for discovery and access.** [Status: On track] Axiom released 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 at: <https://data.caloos.org/>. The data portal was launched to end users at the May 2022 stakeholders meeting.

#### 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, O<sub>2</sub>, 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 [Santa Monica Shore Station page](#) as an example.
  - added six new IFCB data streams (San Francisco Pier 17, San Francisco Bay Cruises, Monterey Power Buoy, Santa Cruz Wharf, Stearns Wharf, Bodega Marine Lab) to [SCCOOS IFCB dashboard](#) and enabled an alert system for instrument monitoring.
  - updated a new [CalHABMAP data layer](#) 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 [CA ROMS forecast model](#) to SCCOOS THREDDS server for interoperability.
  - visualized the [West Coast Operational Forecast System \(WCOFS\) nowcast](#) about the present and future states of a water body (generally including water levels, currents, water temperature and salinity).
  - ingested an updated [C-HARM model nowcast and forecast prediction](#) of the probability of Pseudo-nitzschia concentration.
  - ingested two U.S. Navy meteorological stations through SCCOOS data infrastructure: Nike Zeus and Laguna Peak.
  - visualized [two data layers](#) containing a 21-year time series of bird, mammal, fish, and crab pot observations from the Rockfish Recruitment and Ecosystem Assessment Survey (RREAS) aggregated by the Farallon Institute.

- visualized the [Multivariate Ocean Climate Indicator \(MOCI\)](#) that synthesizes a number of local and regional ocean and atmospheric conditions to represent the state of the California coastal ocean.
- 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 [338 historical and real-time sensors](#) that are accessible through the CalOOS data portal. Quality flags are summarized on both the [station](#) and [sensor](#) 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:
  - developed an automated shore stations dashboard for a number of stations on the California coast that measure temperature, salinity, chlorophyll, and water level at frequent intervals in the nearshore coastal ocean: [Southern CA](#), [San Luis Obispo](#), [Monterey Bay](#), [Bodega and San Francisco Bay](#), [Humboldt Bay](#)
  - established a local instance of IFCB dashboard to host regional CA IFCB data streams: <https://sccoos-ifcbdb.srv.axds.co/dashboard>
  - developed a [CalHABMAP dashboard](#) to display phytoplankton concentrations at 8 monitoring sites and migrated data storage to an ERDDAP server on Axiom infrastructure: <https://calhabs.svx.axds.co/erddap/>
  - migrated SCCOOS MPA Shiny container to Axiom data system, where it exists alongside the CalOOS data portal: <https://mpa-dashboard.caloos.org/>
  - 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. Rob Bochenek attended and presented at the May 23-25: California Ocean Observing Systems Science Impact and Stakeholder Engagement Meeting. 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.

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## UPCOMING/PLANNED ACTIVITIES

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

- Maintain and enhance the statewide CalOOS data portal.
- 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.
- Maintain and updates to calibration coefficients for automated shore stations data streams available through 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 HADBAC.
- 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.
- SCCOOS hired a Product Developer who will work at UCSD/SIO/SCCOOS in collaboration with Axiom Data Science to develop new data tools and customized solutions for stakeholders and communicate with IOOS DMAC teams. They will also partner with CalCOFI on shared infographics and high-level, statewide products

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## SUCCESSSES 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 (January 1, 2022 - June 30 2022) are listed below, in addition to. 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 (January 1, 2022 - June 30, 2022)**

#### **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: 66

Total platforms with data from the past year: 11

#### **Data Layers**

Total number of data layers: 331

Number of affiliates: 30

Total datasets with data from the past year: 172

**Historic SCCOOS data portal metrics (June 1, 2021 - December 31, 2021) for reference:**

**Sensor Stations**

Total number of sensor stations: 1,261  
 Number of sensor types: 85  
 Number of affiliates: 57  
 Total stations with data from the past year: 397

**Moving Platforms**

Total number of moving platforms: 64  
 Total platforms with data from the past year: 8

**Data Layers**

Total number of data layers: 317  
 Number of affiliates: 29  
 Total datasets with data from the past year: 141

**XII. HFR Operations and Maintenance Expenditures**

Operator/Principal 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 students (FTE)
Dr. Eric Terrill	30,962.52	9,053.61	20,208.79	30,941.33		4	0
Matthew Ragan							
Dr. Libe Washburn							
Dr. Ryan Walter	23,597	11,382	1,184	83,115	5	0.4	3

\*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. During the period 1 January 2022 to 30 June 2022 HFR Operators/Pis used funds from no-cost extensions to cover costs.

**XIII. HFR Asset and Staffing Inventory**

**Cal Poly**

Staff Member	(% FTE or #person-months)
Principal Investigator: Dr. Ryan Walter	0.8 months
Technicians/Engineers: Ian Robbins	1.5 months
Students:	NA

Gabriel Anderson Emmett Ehrnstein Leah Hoogstra	
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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	20% / 10%
Technicians/Engineers: David Salazar Eduardo Romero	58% / 92%
Students: Tim Ha Rebecca He Matthew Gerigk	NA

Total # of Radars Supported: 9						
Operating Institution	Name	Latitude	Longitude	City	State	Frequency
UCSB	RFG1	34.4612	-120.0767	Refugio Beach	CA	13.500 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 Nicolas Island	CA	13.440 MHz

**USC**

<b>Staff Member</b>	<b>(% FTE or #person-months)</b>
Principal Investigator: Matt Ragan	10.48 months
Technicians/Engineers: Carl Oberg	1.0 month
Students:	NA

Total # of Radars Supported: 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**

<b>Staff Member</b>	<b>(% FTE or #person-months)</b>
Principal Investigator: Dr. Eric Terrill Lisa Hazard	0.35 months / 1.85 months
Technicians/Engineers: Carlos Garcia-Moreno Thomas Cook* Joseph Chen (programmer)	6.0 months / 4.0 months / 1.20 months
Students:	NA



Total # of Radars Supported: 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

## IX. Observing Asset Inventory

[SCCOOS 2022 Asset Inventory Spreadsheet](#)