

SCCOOS: HAB & Toxin Monitoring Efforts

Megan Medina
SCCOOS Deputy Director

23-May 2024
IOOS Fall Meeting, SIO





31 HF Radar



3 Glider Lines



5 Shore Stations w/ OAH
and HAB monitoring



3 Buoys and Moorings



6 Coastal Flooding Sites



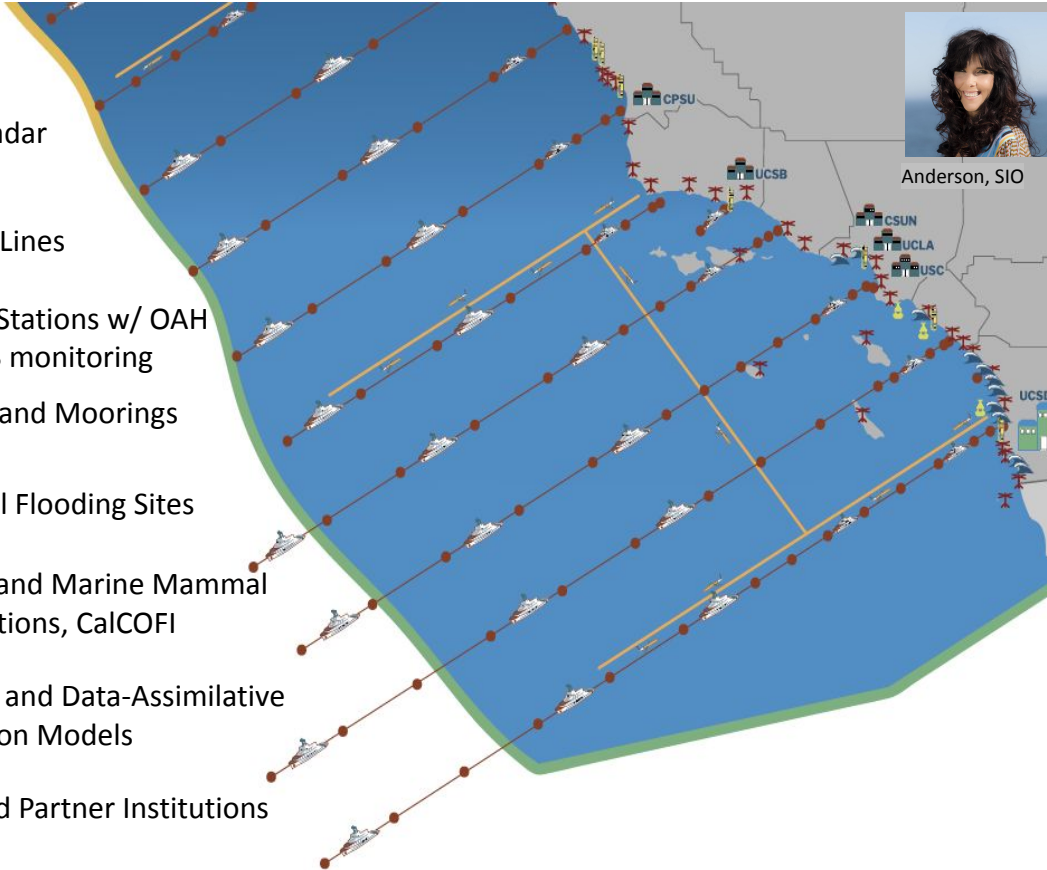
Seabird and Marine Mammal
Observations, CalCOFI



Forward and Data-Assimilative
Circulation Models



9 Funded Partner Institutions



Anderson, SIO



McWilliams, UCLA



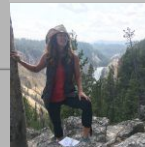
Rudnick, SIO



Washburn, UCSB



Caron, USC



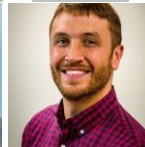
Shipe, UCLA



Sydeman, FI



Ragan, USC



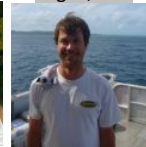
Walter, Cal Poly



Terrill, SIO



Santoro, UCSB



Robbins, Cal Poly



Carter, SIO



Martz, SIO



Pasulka, Cal Poly



Merrifield, SIO



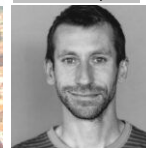
Semmens, SIO



Bell, WHOI



Garcia-Reyes, FI



Bochenek, ADS



Lowe, CSULB

SCCOOS Supports 21 Principal Investigators

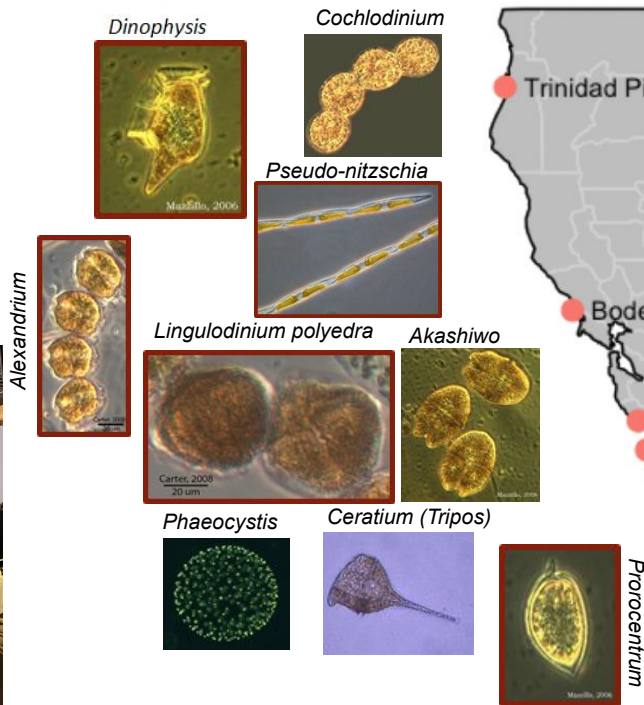
*SCCOOS puts the "ocean observing" subsystem at a premium,
supporting as many long-term data providers in the region as possible*

Grass-roots academic monitoring effort begun in 2008 and supported by SCCOOS & CeNCOOS

Weekly measurements:

- Chl-a, Temp, Salinity, Nutrients
- HAB species (8-9 taxa)
- Domoic Acid + SPATT toxins
- Weekly alerts to HABMAP listserv
- Monthly QC'd data now served via ERDDAP
- Synthesis with models: CA HAB Bulletin

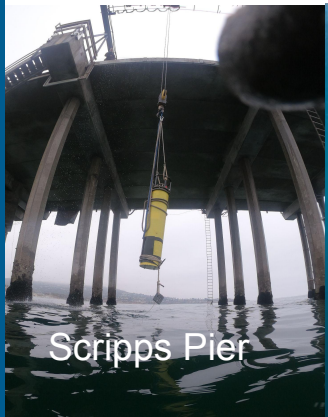
10 Institutions



Highly collaborative state-funded effort to build out an IFCB Network for California



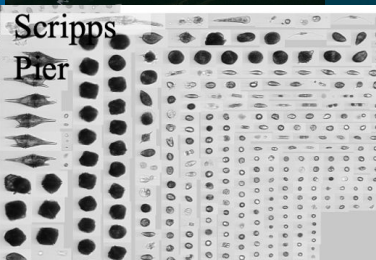
CA Imaging Flow Cytobot Network 12 IFCBs, 9 operational



Scripps Pier



Del Mar Mooring
U. Send



Scripps
Pier



Del Mar



Hog Island



Bodega Marine Lab



San Francisco Pier 17



Santa Cruz Municipal Wharf



Power Buoy



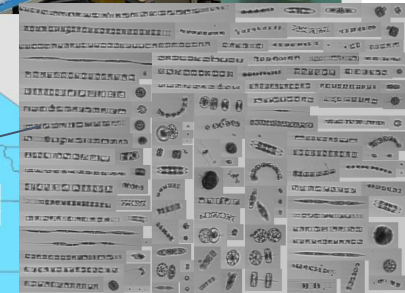
Stearns Wharf



Newport Pier



Del Mar Mooring
Scripps Pier



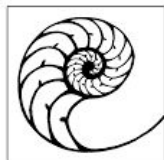
<https://ifcb.caloos.org/dashboard>



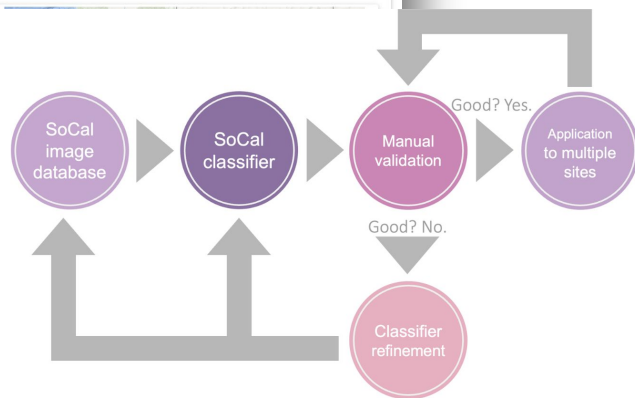
Axiom
DATA SCIENCE

Real-time Data Access and Image Classification

- ❖ Data available on CalOOS IFCB dashboard (ifcb.caloos.org)
- ❖ Data transfer and integration managed by Axiom Data Science
 - Real-time extraction of blobs and features
 - Real-time image classification
- ❖ Data available for download through the [UCSD Library Archive](#) (in progress)



Axiom
DATA SCIENCE



Harmful Algal Bloom Dashboard

Classified Images

Meet the Culprits

Model Metrics

Data Filters

Dataset

Scripps Pier IFCB 183

The date range available for Scripps Pier IFCB 183
from 2023-05-01 00:01:13UTC to 2024-05-13
23:56:03UTC. Please select a subset date range of
available data to display.

start date - end date:

2024/05/11 ~ 2024/05/13

Data resolution

Daily

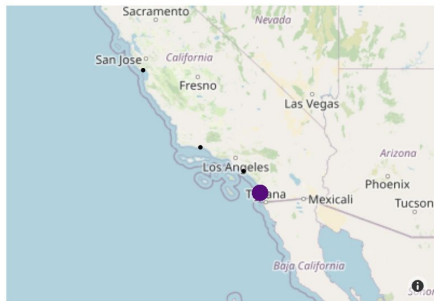
Parameter

Carbon Concentration

Download data as CSV

Harmful Algal Bloom Dashboard

This tool enables exploration of harmful algal bloom (HAB) data in coastal areas where where an Imaging Flow Cytobot (IFCB) captures pictures of phytoplankton in the water. Researchers trained machine learning algorithms to classify the images and detect harmful algal bloom causing species. Use the filters on the left side of the page to select an IFCB location and a date range to display which HAB taxa were detected during that time period. Results are shown either as concentrations or biovolume and can be binned into hourly or daily resolution. Please note, all data displayed on this dashboard was determined using a machine learning model and may contain inaccuracies, since the data has not yet been validated by a human.

Selected IFCB: Scripps Pier IFCB
183

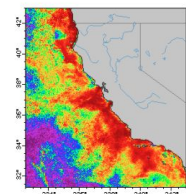
- Harmful Algal Bloom Data Assembly Center: a centralized location for existing HAB data products including near real-time imagery, sampling feeds, and access to HAB modeling results.
- <https://habdac.portal.axds.co>
- IFCB HAB Dashboard:
 - Data illustrated in a **comprehensible graphical interface** for effective HAB management
 - **Customizable data product resolution** (hourly, daily, weekly etc.)
 - **Easy download** of IFCB data products
 - Currently in the staging area but soon to be released to the public.

Synthesize State, Mammal, and CalOOS data + C-HARM output sccoos.org/california-hab-bulletin

California Harmful Algae Risk Mapping (C-HARM)

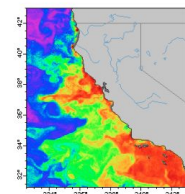


Probability of Pseudo-nitzschia Bloom for April 2023



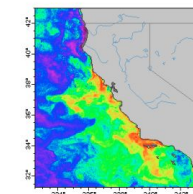
0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1
Probability of Pseudo-nitzschia > 2000 cells/L D
Coastal Pseudo-nitzschia, cellular density, acid, and particular domestic acid probability, California and Southern Ocean coast, 2023 present
2023-04-01T00:00:00Z
Data courtesy of NOAA/NMFS/USFWS/CO, CoastWatch West Coast

Probability of Particulate DA for April 2023



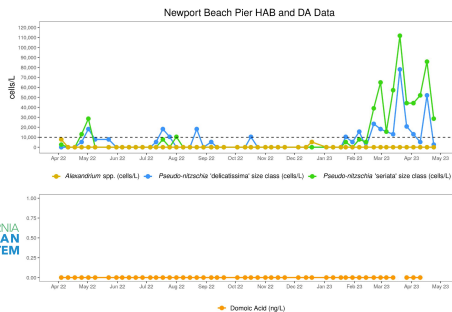
0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1
Probability of Particulate Domestic Acid > 500 nanogram/L D
Coastal Pseudo-nitzschia, cellular density, acid, and particular domestic acid probability, California and Southern Ocean coast, 2023 present
2023-04-01T00:00:00Z
Data courtesy of NOAA/NMFS/USFWS/CO, CoastWatch West Coast

Probability of Cellular DA for April 2023

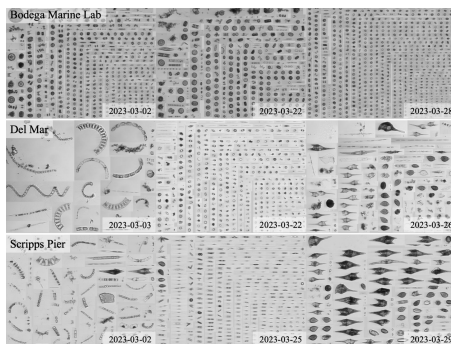


0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1
Probability of Cellular Domestic Acid > 20 nanogram/L D
Coastal Pseudo-nitzschia, cellular density, acid, and particular domestic acid probability, California and Southern Ocean coast, 2023 present
2023-04-01T00:00:00Z
Data courtesy of NOAA/NMFS/USFWS/CO, CoastWatch West Coast

CA Harmful Algal Bloom Monitoring Alert Program (HABMAP) Plankton tows

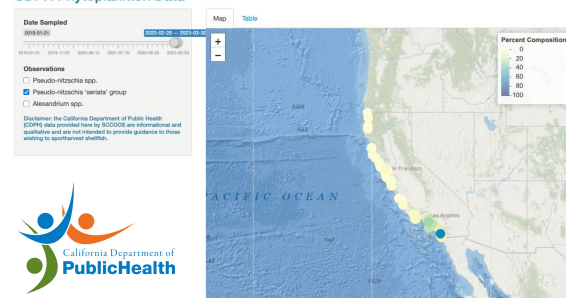


CA IFCB Network Water Sample Imagery



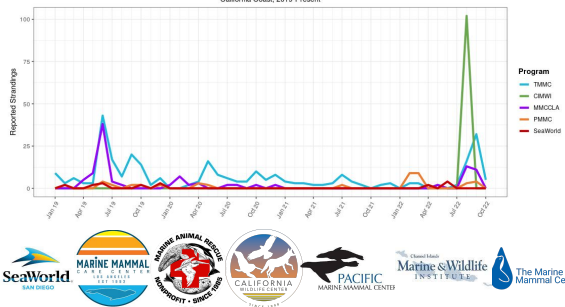
California Department of Public Health (CDPH) Phytoplankton Obs.

CDPH Phytoplankton Data



Suspected DA Toxicosis Marine Mammal Strandings

Suspect Domoic Acid Strandings of California Sea Lions
California Coast, 2019-Present

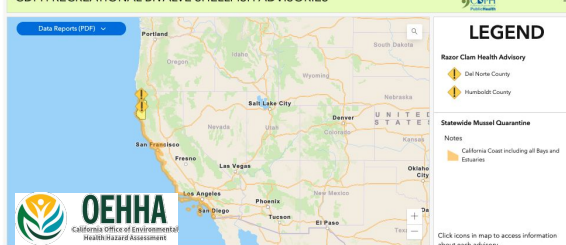


CDPH & Office of Env. Health Hazard Ass. (OEHA) Advisories

STATEWIDE MUSSEL QUARANTINE

Effective May 1, 2023, CDPH implemented a sport-harvested mussel quarantine along the entire California coast. For the latest information or questions, contact (800) 953-4133 or redtide@cdph.ca.gov. [CLICK HERE FOR MORE INFORMATION](#)

CDPH RECREATIONAL BIVALVE SHELLFISH ADVISORIES



Several scientific breakthroughs resulted from SCCOOS monitoring in

Red Tide: Multidisciplinary Studies of an Exceptional Algal Bloom in Southern California

Special Issue in *Elementa: Science of the Anthropocene*

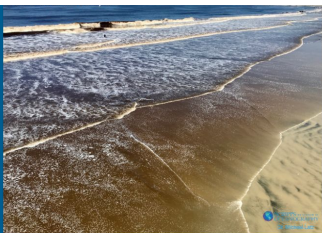
Guest Editors: Jeff Bowman, Andrew Barton, Clarissa Anderson

*5 papers published so far

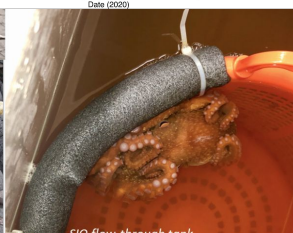


1

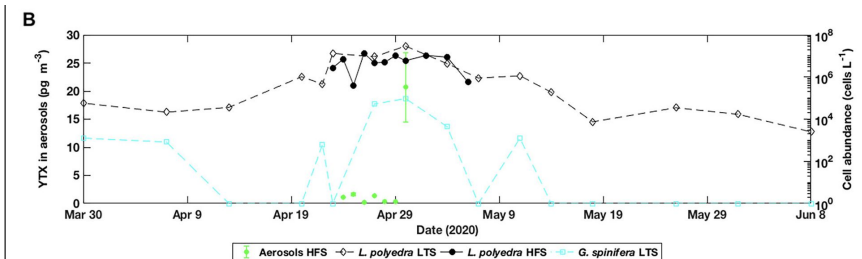
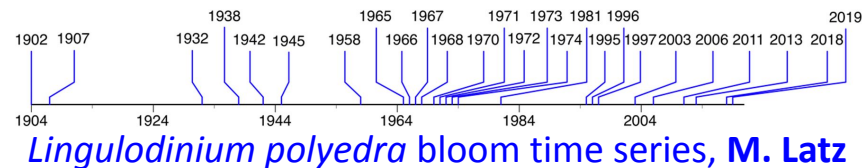
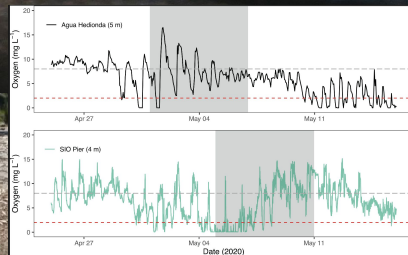
Organismal responses to deteriorating water quality during the historic 2020 red tide off Southern California
Skelton et al. 2024



Credit: Celeste Kroeger

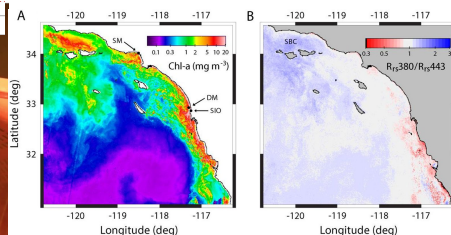


SIO flow-through tank



Yessotoxin production and aerosolization during the unprecedented red tide of 2020 in southern California
Ternon et al. 2024

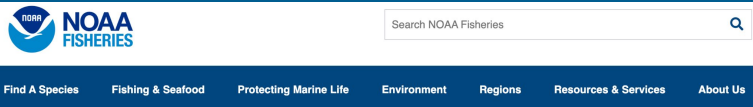
2



Satellite detection of dinoflagellate blooms off California by UV reflectance ratios
Kahru et al. 2021

3

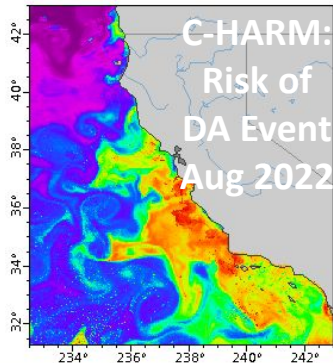
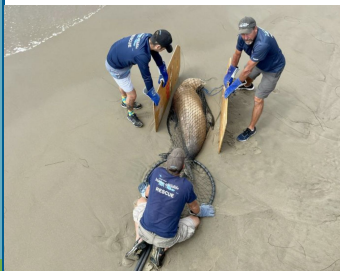
HABMAP monitoring was essential to tracking and mitigating DA events in 2022 and 2023



NEWS

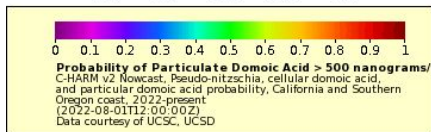
Toxic Algal Bloom Spreads Along California Coast, Poisoning Sea Lions

August 29, 2022



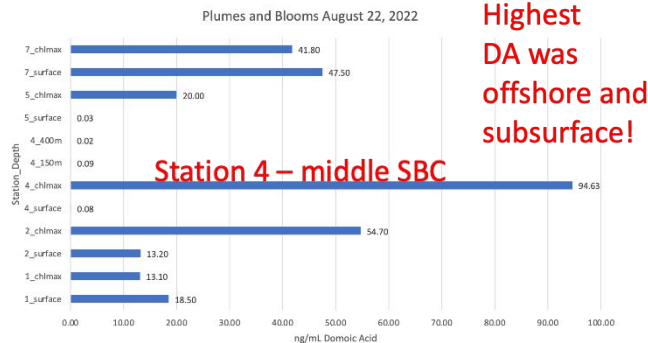
Aug - Sep 2022 Stranding Event, 400+ animals!

-began in Santa Barbara and spread to central and southern California



Particulate domoic acid concentrations

Trace amounts detected in all samples, up to approx. 95 ng/mL !!



Highest DA was offshore and subsurface!

*Not detected (0.01 ng/mL detection limit)

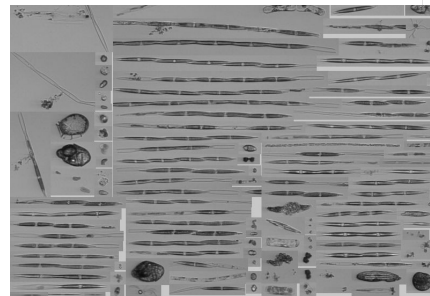


Steffaney Wood



Monica Thukral

Pseudo-nitzschia australis was observed across many locations in CA in August. This image was taken with an IFCB in the Santa Barbara Channel during a CalCOFI cruise (courtesy: Allen Lab, R. Lampe)



Thanks to NOAA Event Response Funds



Headlines: Domoic Acid Stranding Events

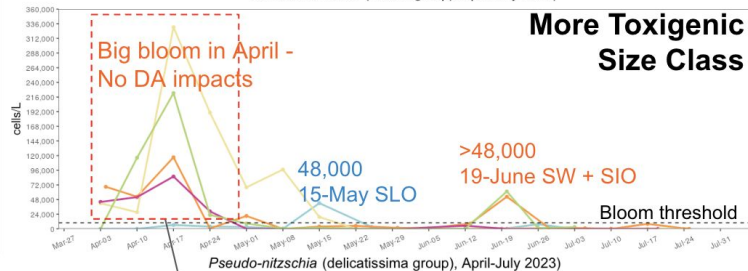
HABMAP monitoring was essential to tracking and mitigating DA events in 2022 and 2023

Cal-HABMAP SCCOOS Shore Stations

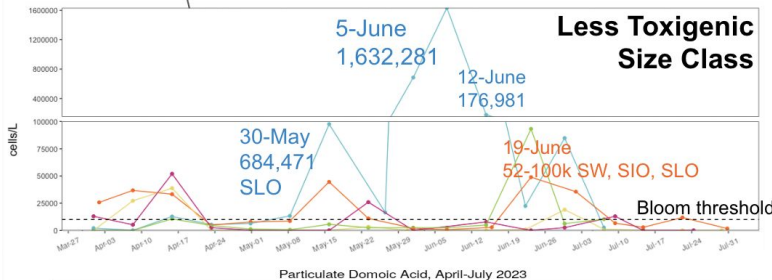
— Scripps Pier — Newport Beach Pier — Santa Monica Pier — Stearns Wharf — Cal Poly Pier

Pseudo-nitzschia (seriata group), April-July 2023

**More Toxicogenic
Size Class**

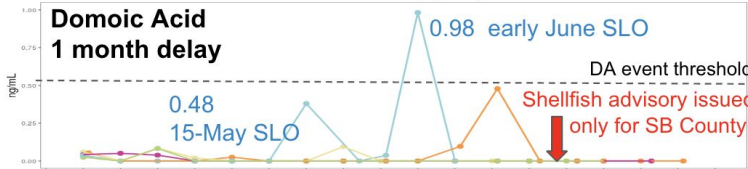


**Less Toxicogenic
Size Class**



Particulate Domoic Acid, April-July 2023

**Domoic Acid
1 month delay**



Sea lions are sick and dying along Southern California's coast. Here's what to know

July 11, 2023 - 5:00 AM ET

Juliana Kim



**Hundreds of Sea Lions Are Dying. Is an
Algal Bloom to Blame?**

June 21, 2023 By Livia Albeck-Ripka

The New York Times

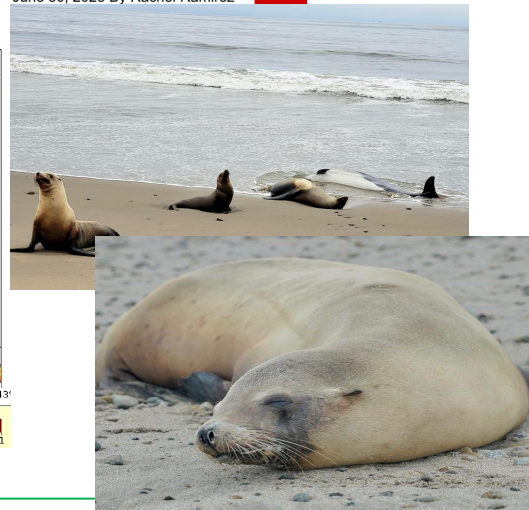
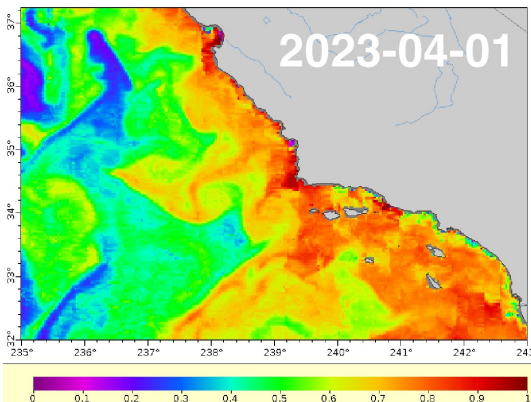
**For California marine mammals, toxic algae
bloom is a mass casualty incident**

June 27, 2023 By Dennis Romero



**Hundreds of dolphins and sea lions have washed
up dead or sick in California amid toxic algae
outbreak**

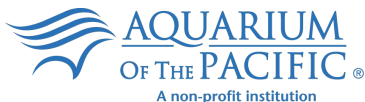
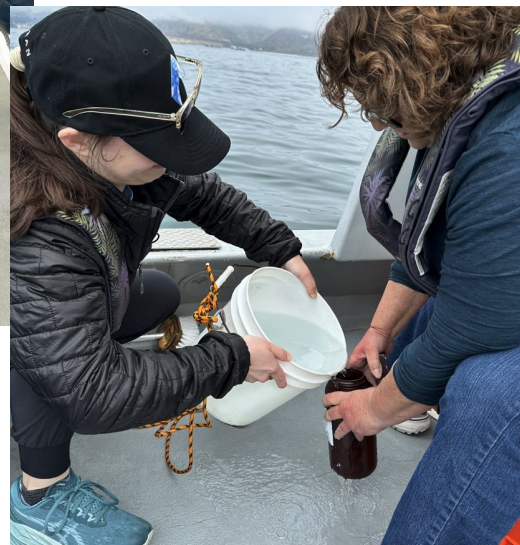
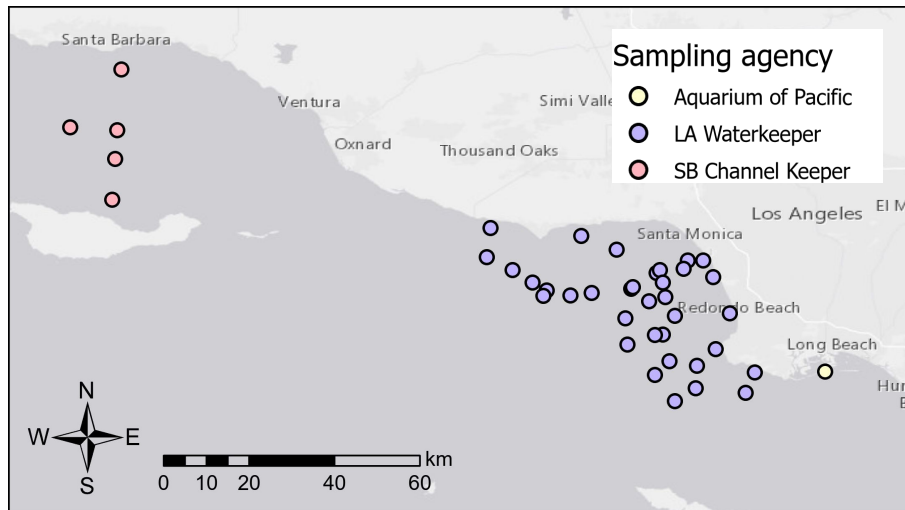
June 30, 2023 By Rachel Ramirez



Marine & Wildlife
INSTITUTE



Supported offshore sampling observing in 2023 - working to formalize and expand this team with IRA funding



Eastern Pacific Ocean Conference

70th Anniversary



September 11-14, 2024
Timberline Lodge, Mt. Hood, OR
 Abstract deadline TBC

Optimizing Ocean Observing Networks for Detecting the Coastal Climate Signal



September 23 - 25, 2024
Boulder, CO and Virtually
 Abstract and travel request deadlines
 are due May 31, 2024

NOAA West Watch Bi-monthly webinar *NANOOS, CeNCOOS, SCCOOS*



Jun 18, Aug 20, Oct 15, Dec 17
Online
 Webinar series to share information
 about climate conditions and
 impacts