

# Coastal Water Quality Monitoring in the Southern California Bight

*Southern California Coastal Ocean Observing System*

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Scripps Institution of Oceanography  
San Diego, CA



[sccoos.org](http://sccoos.org)

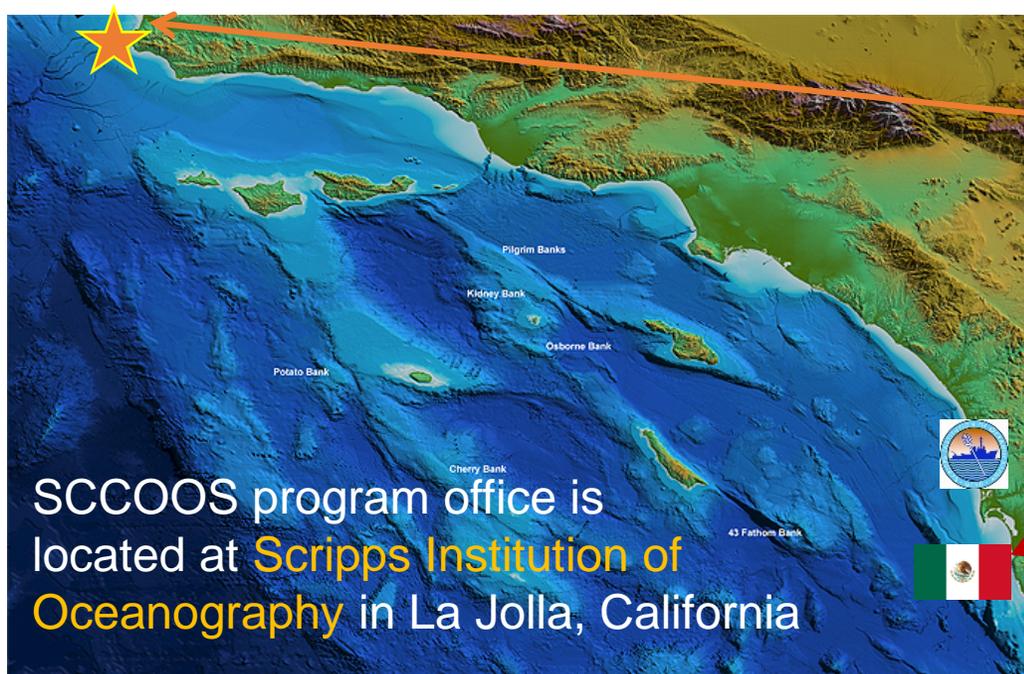
(858)246.2226

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# Where and What is SCCOOS?

## - Southern California Coastal Ocean Observing System

A collaborative network of scientists and research teams from universities, government, NGOs, and industry that collect, aggregate, enhance, and share information on the coastal ocean

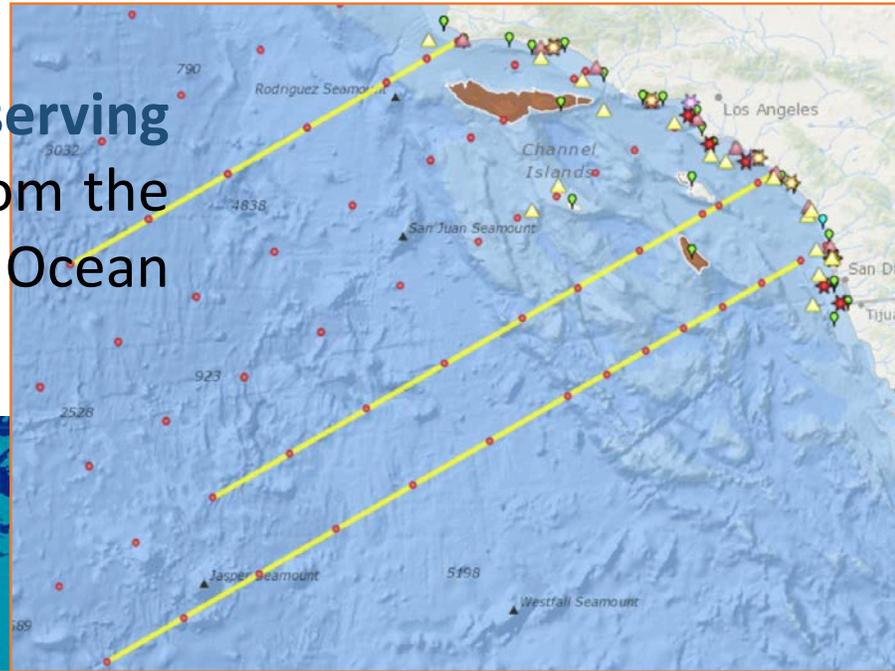


The Southern California Bight extends from Point Conception (Santa Barbara Area) to the US/Mexico Border

# Where and What is SCCOOS?

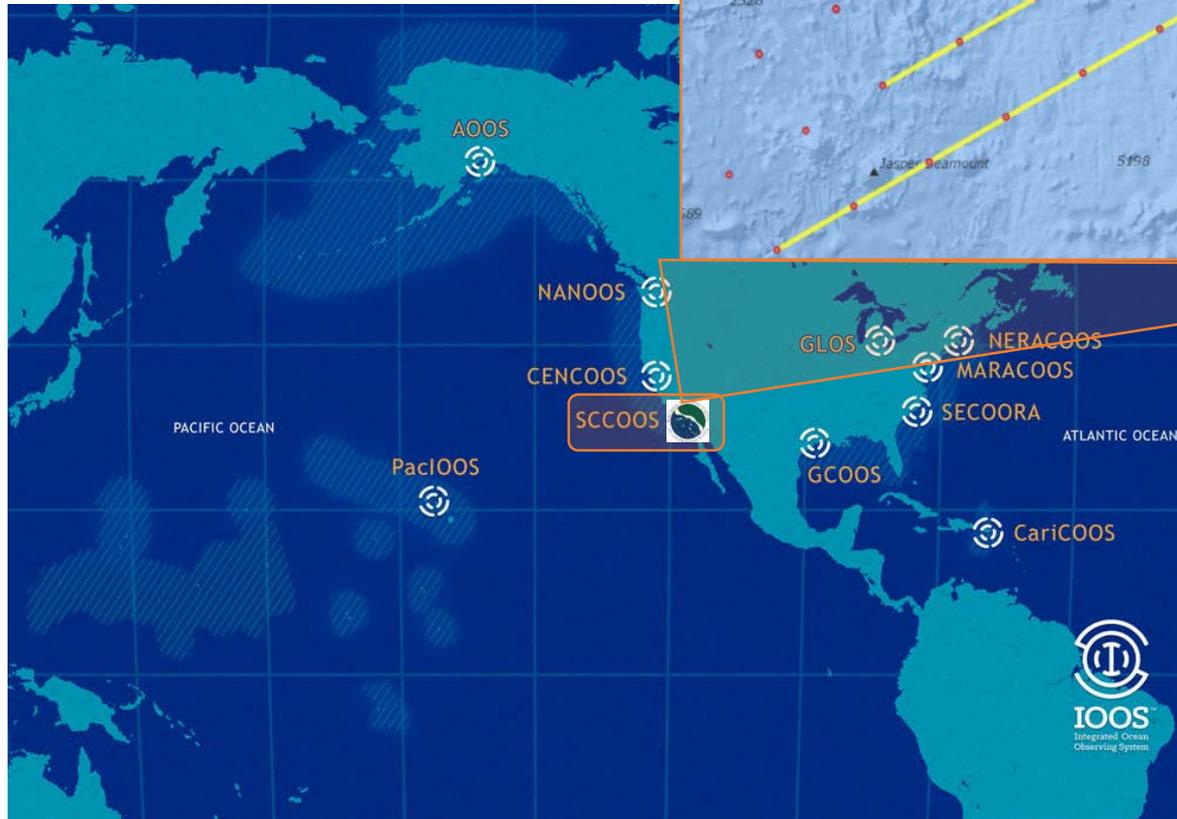
*SCCOOS is part of the U.S. Integrated Ocean Observing System*

The **Integrated Ocean Observing System** or IOOS was born from the Integrated Coastal and Ocean Observation Act of 2009.



## Our Collaborative Network of Ocean Observations

Ocean Acidification Monitoring	2014
Autonomous Underwater Gliders	2007
High Frequency Radar	2005
Harmful Algal Bloom Monitoring	2005
Automated Shore Stations	2005
CDIP Wave Buoys	1978
CalCOFI*	1949
Manual Shore Stations	1916



This law designated **11 regional associations** that act as a science-based decision support system.



# What does SCCOOS do?

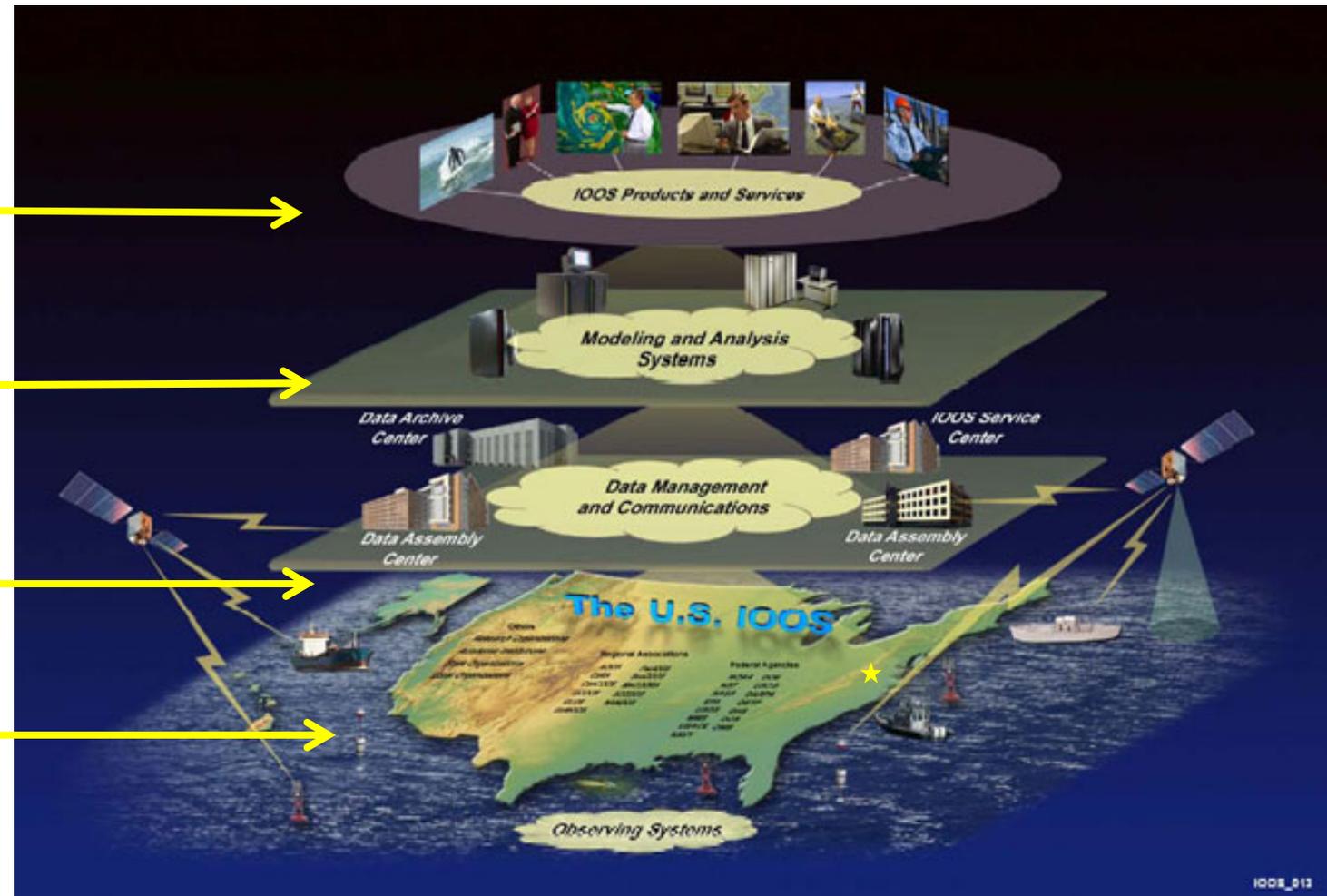
*SCCOOS is like a regional weather monitoring system for the ocean. We produce real-time data and models to help you plan & live better.*

**Products and Services intended to reach users through partnerships**

**Modeling and Analysis Layer**

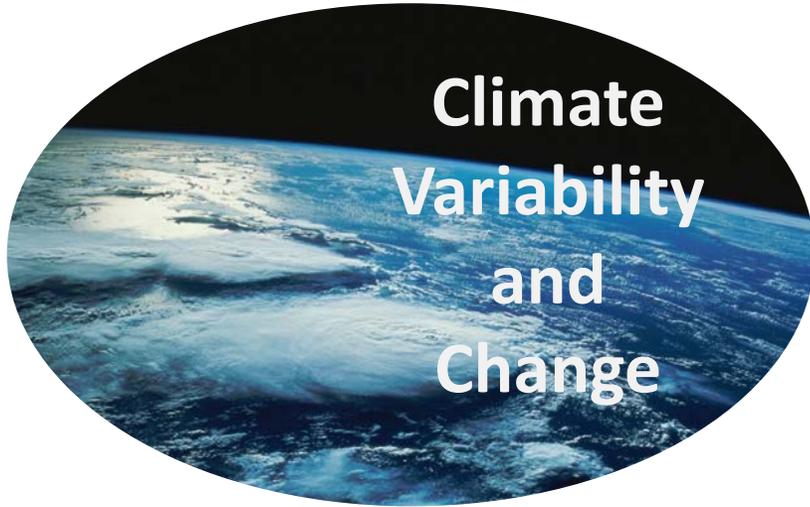
**Data Management Layer**

**Ocean Observing System Layer**



IOOS\_013

**What does SCCOOS do?** *We produce an “end-to-end” coastal ocean observing system to benefit society in four broad focus areas.*



# Ocean Acidification

SCCOOS co-funds nearshore CalCOFI stations to obtain a fuller suite of ecosystem variables on a quarterly basis.

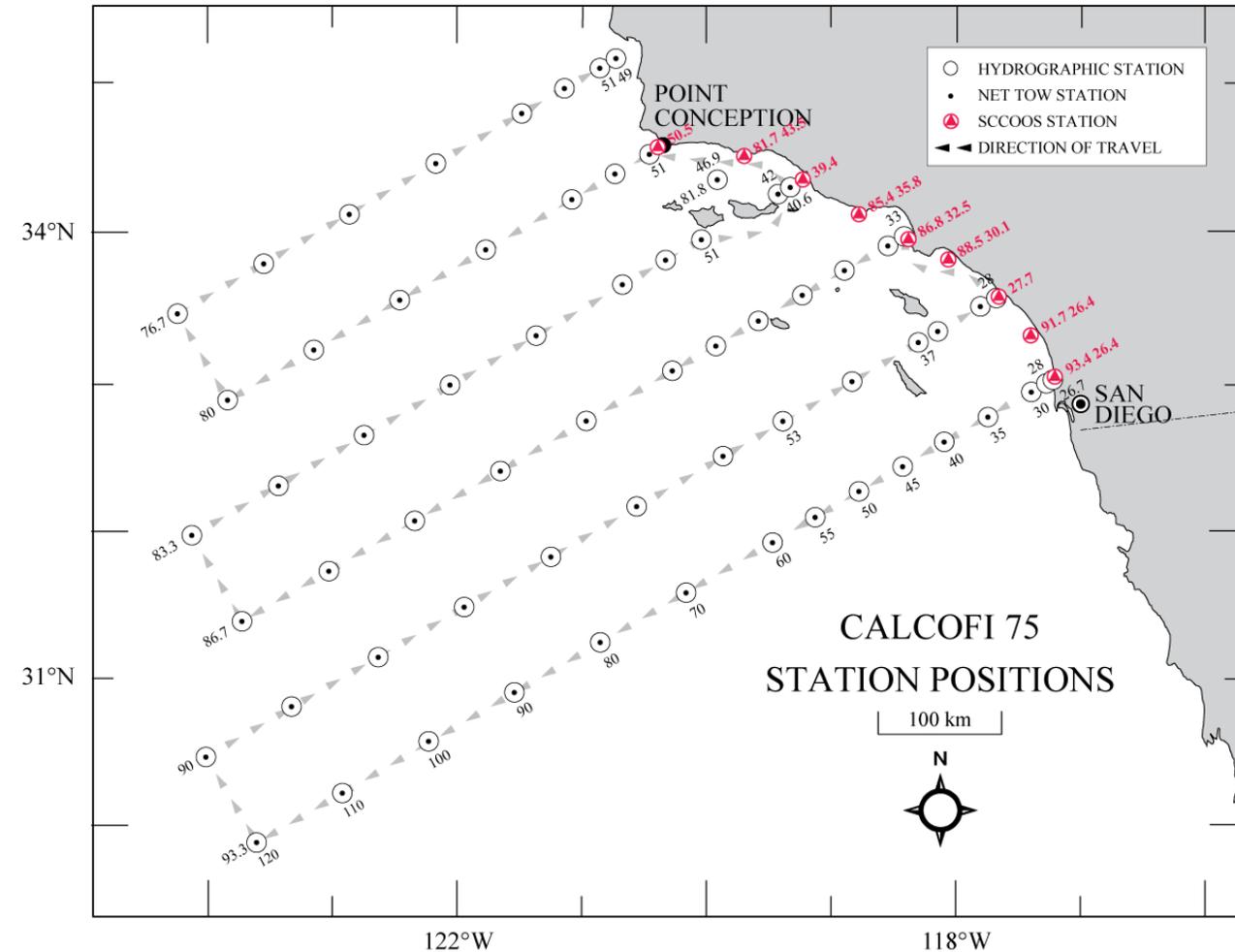
In 2004, CalCOFI added 9 SCCOOS stations to the standard 66 station pattern.

Stations are on the 20m isobath:

- Temperature
- Salinity
- Dissolved oxygen
- Chlorophyll-a fluorescence
- Transmittance
- Nitrate
- PAR

Net tows occur at every SCCOOS station.

Marine mammal and sea bird visual surveys are conducted during transits between stations as well as marine mammal recordings.

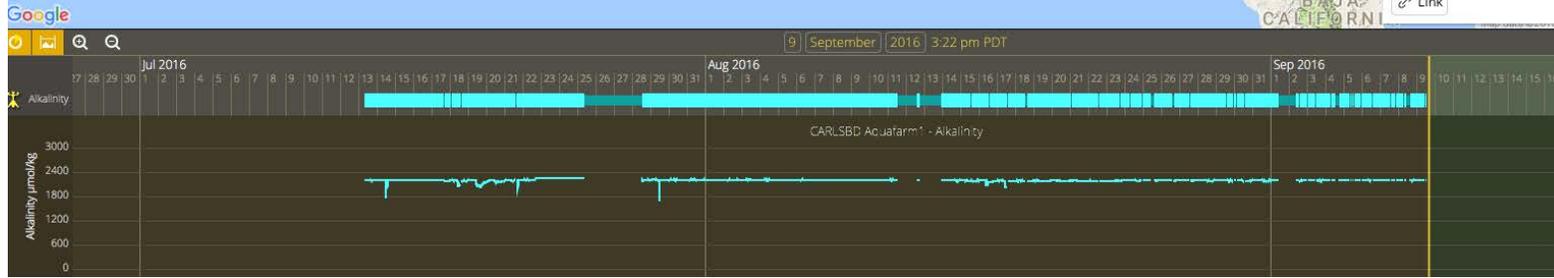


# Ocean Acidification

ipacoa.org

HYDROGRAPHIC	
Alkalinity (total) (-3 ft)	2194.2 $\mu\text{mol/kg}$
CO2 Water (-3 ft)	507.1 $\mu\text{atm}$
Dissolved Inorg. Carbon (-3 ft)	2035.9 $\mu\text{mol/kg}$
Omega - Aragonite Sat. (-3 ft)	2.4
Salinity (-3 ft)	32.4 PSU
Water Temperature (-3 ft)	73.6 °F

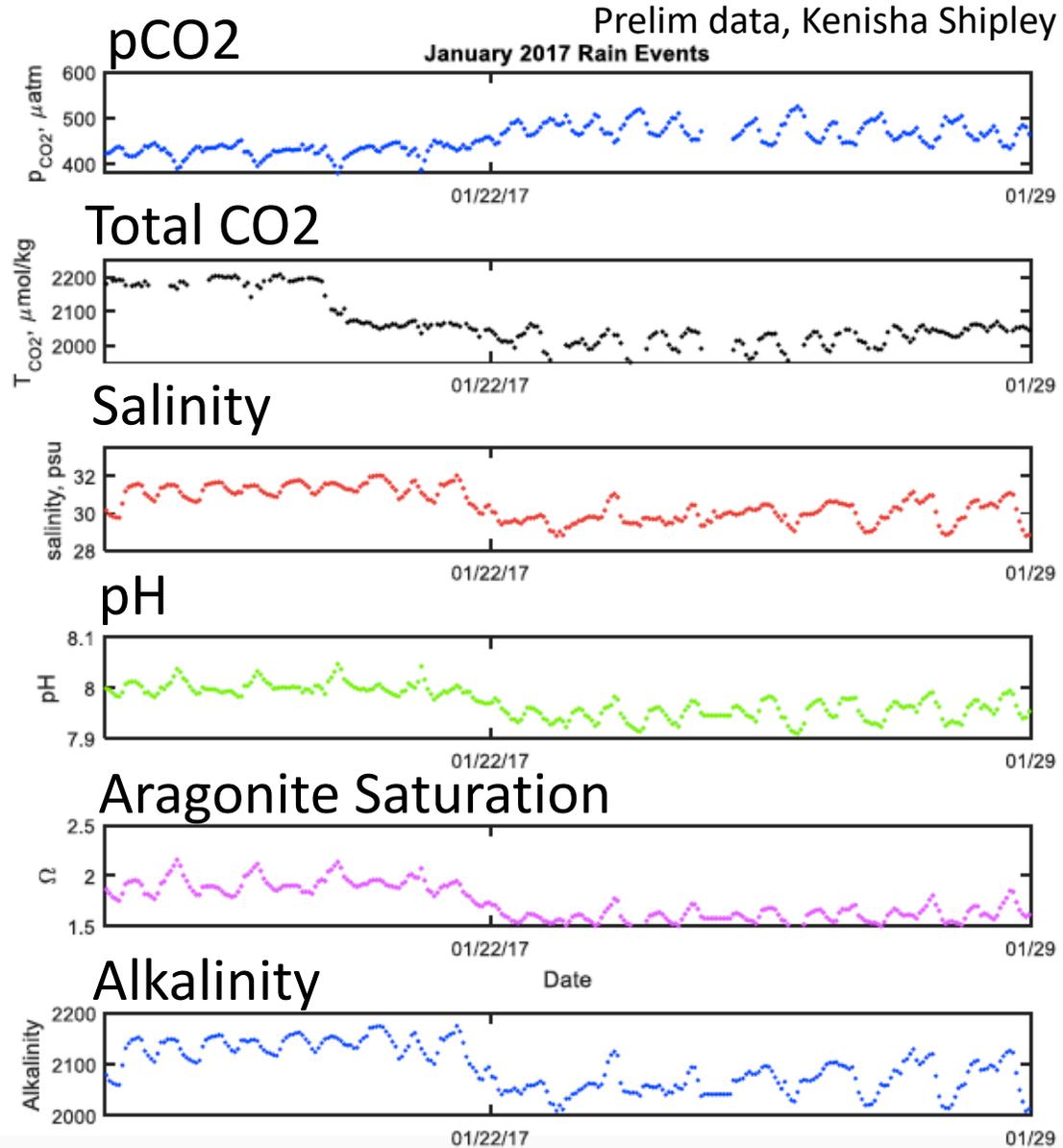
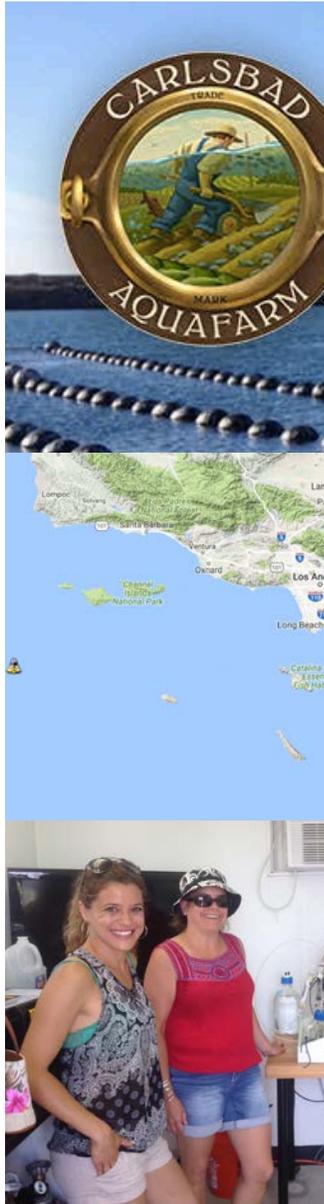
**SCCOOS & CeNCOOS**  
part of West Coast OA Task Force to  
understand gaps  
in CA OA monitoring - collab with OPC



In support of the West Coast shellfish industry, the OOSes have added OA and hypoxia monitoring to their ongoing observations. As part of this project, SCCOOS maintains a CO<sub>2</sub> analyzer (“Burkeolator”) located at Carlsbad Aquafarm, reporting alkalinity, CO<sub>2</sub>, TCO<sub>2</sub>, aragonite saturation, salinity, and water temperature. Additional funding was awarded through a West Coast OOS joint proposal, continuing the operation of the instrument by a SCCOOS subject matter expert (SME).

# Ocean Acidification

SCCOOS is monitoring the entire carbonate chemistry system in lagoon waters that feed the shellfish at Carlsbad Aquafarm

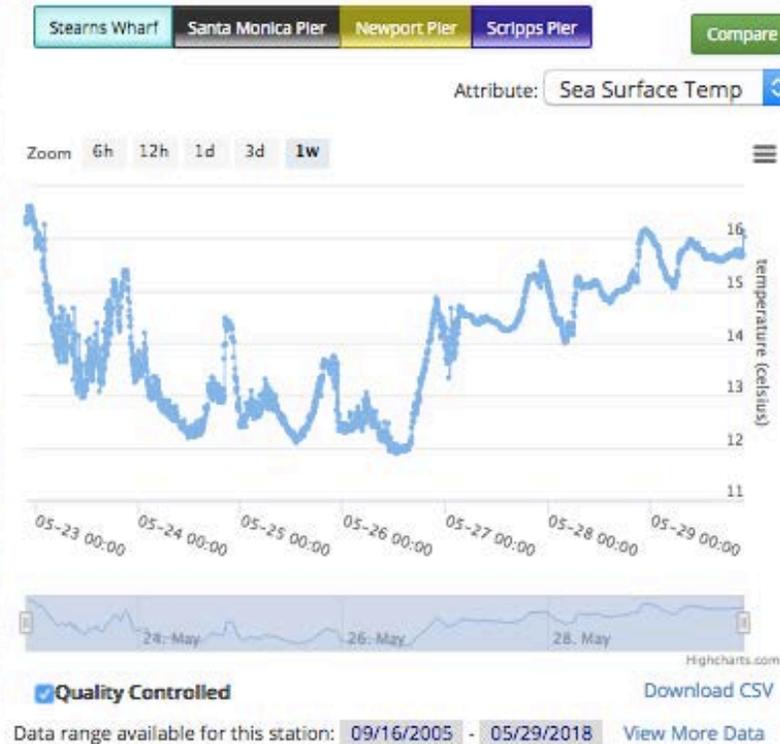


# Automated Shore Stations *SCCOOS* monitors shore stations in Southern California for physical and basic biological parameters

Stearns Wharf	Santa Monica Pier	Newport Pier	Scripps Pier
05/29/2018 14:50:35 -07:00 (Tue) Pacific Time 05/29/2018 21:50:35 UTC	07/13/2015 05:55:42 -07:00 (Mon) Pacific Time ☉ 07/13/2015 12:55:42 UTC	05/29/2018 14:51:12 -07:00 (Tue) Pacific Time 05/29/2018 21:51:12 UTC	05/29/2018 14:51:01 -07:00 (Tue) Pacific Time 05/29/2018 21:51:01 UTC
temperature 16.03°C / 60.86°F	temperature 19.11°C / 66.39°F	temperature 17.67°C / 63.81°F	temperature 18.11°C / 64.59°F
pressure 2.45 dbar	pressure 1.38 dbar	pressure 2.68 dbar	pressure 2.99 dbar
chlorophyll 7.57 ug/L	chlorophyll 10.88 ug/L	chlorophyll 7.80 ug/L	chlorophyll 7.03 ug/L
salinity 33.64 1e-3	salinity 32.94 1e-3	salinity 33.63 1e-3	salinity 33.64 1e-3

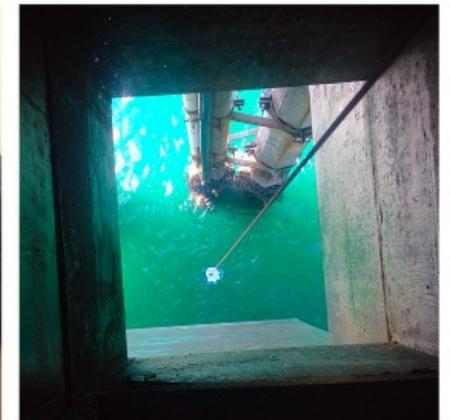
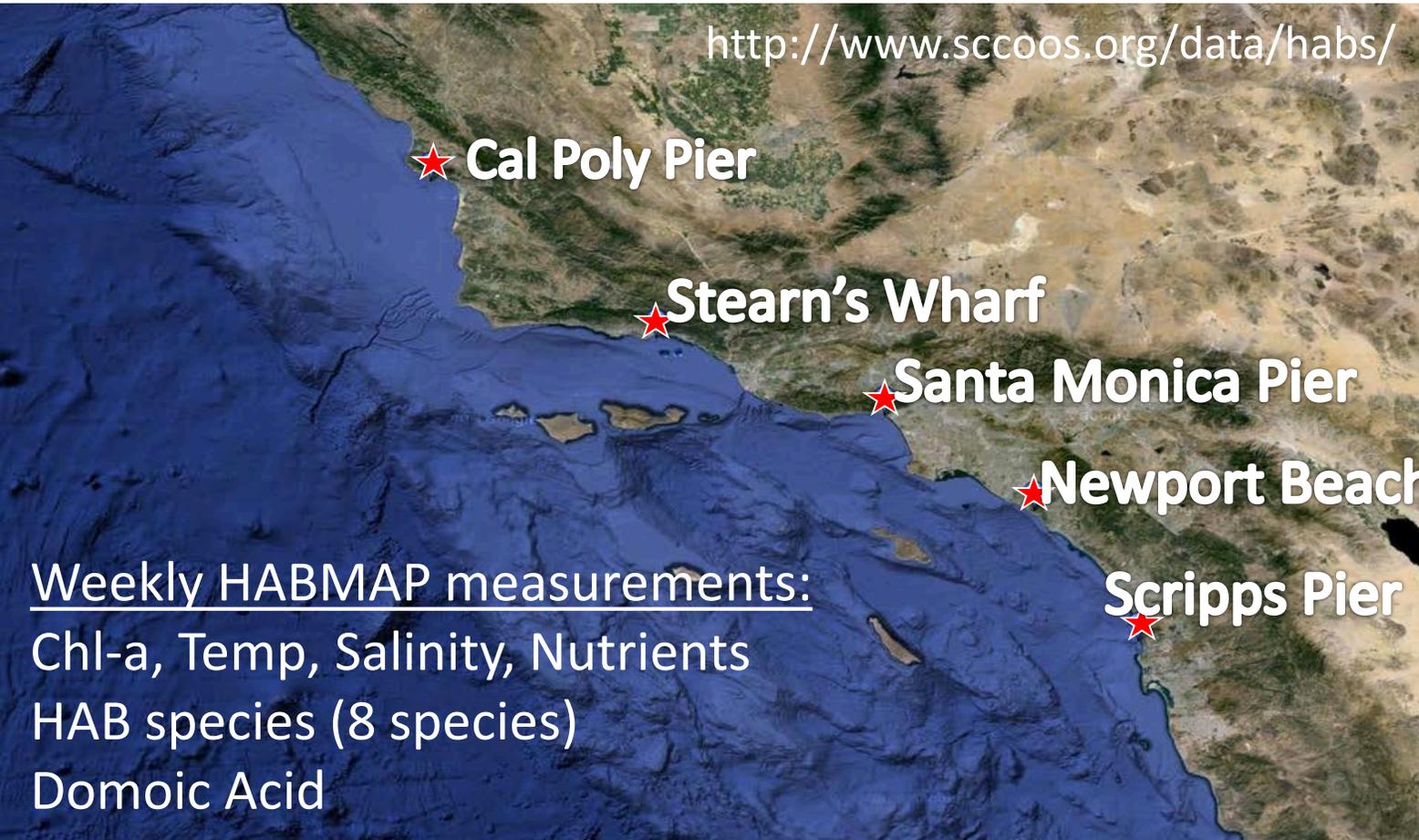


<http://www.sccoos.org/data/autos/>



# Harmful Algal Blooms

SCCOOS monitors shore stations in Southern California for toxins from phytoplankton (algae) and measures environmental conditions at piers



# Harmful Algal Blooms

The C-HARM system predicts where the deadly neurotoxin, *domoic acid*, is likely to be in coastal California, much like a weather forecast



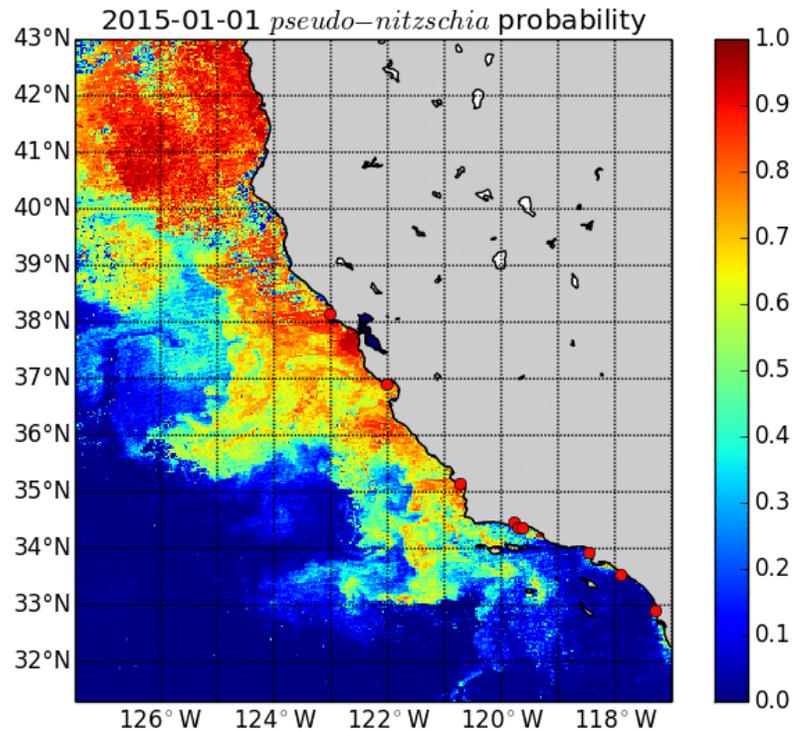
## California Harmful Algae Risk Mapping (C-HARM) System

<http://www.cencoos.org/data/models/habs>

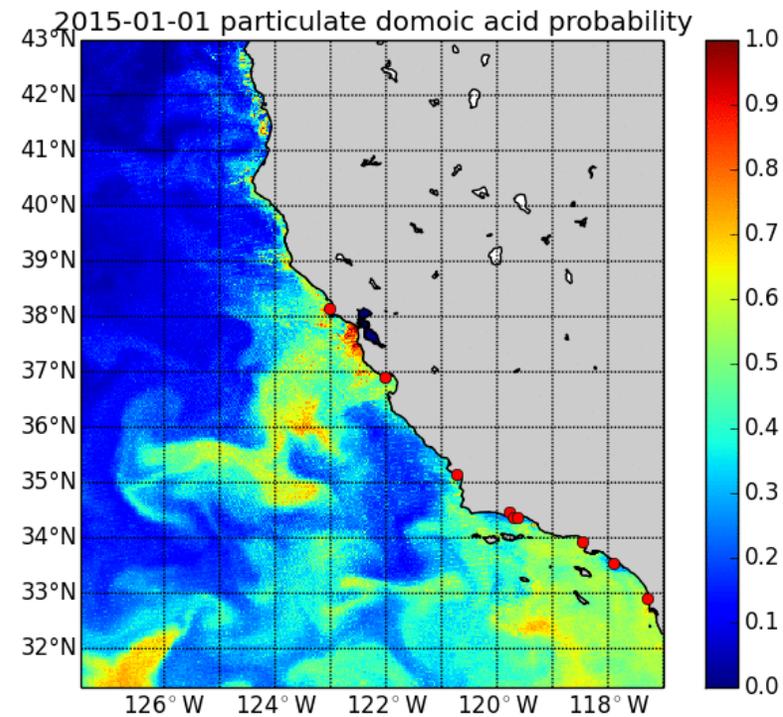
Operational product at NOAA CoastWatch by June 2018 



### *Pseudo-nitzschia* Nowcast



### Particulate Domoic Acid Nowcast



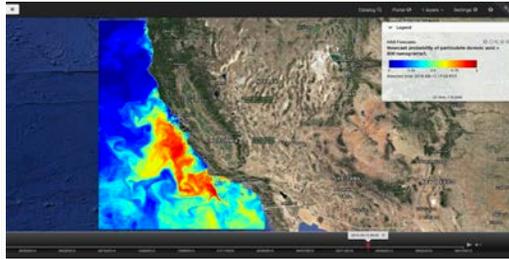
# Harmful Algal Blooms

SCCOOS will soon be hosting a bi-weekly *HAB Bulletin* that synthesizes model output and observations for all of coastal California

## INTEGRATED FORECAST & ANALYSIS TOOL

### California HAB Bulletin

C-HARM



**LEGEND**

- Data within last 7 days
- Data from 7 to 14 days old
- Data older than 14 days

**SITES**

- Santa Cruz Wharf
- Monterey Wharf
- Cal Poly Pier
- Shasta Wharf
- Santa Monica Pier
- Research Pier
- Marine Pier



Near real-time  
Marine Mammal  
Stranding Data, TMMC

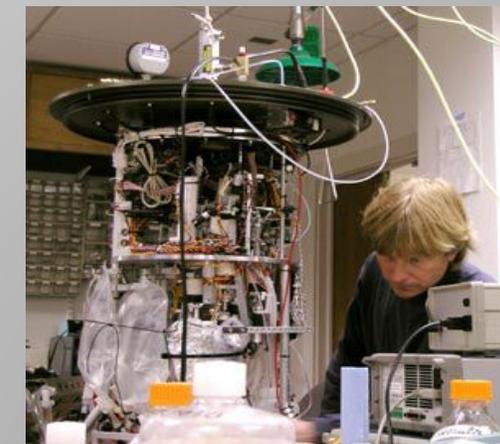
HABMAP/Pier Sampling  
SCCOOS & CeNCOOS



IFCB, Olson & Sosik



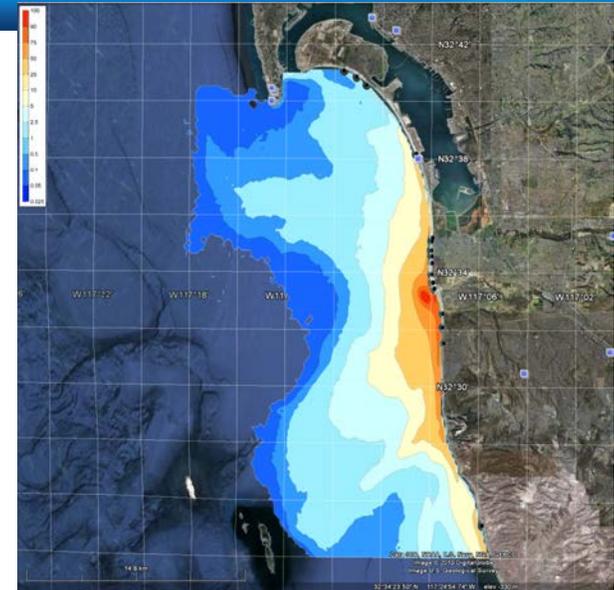
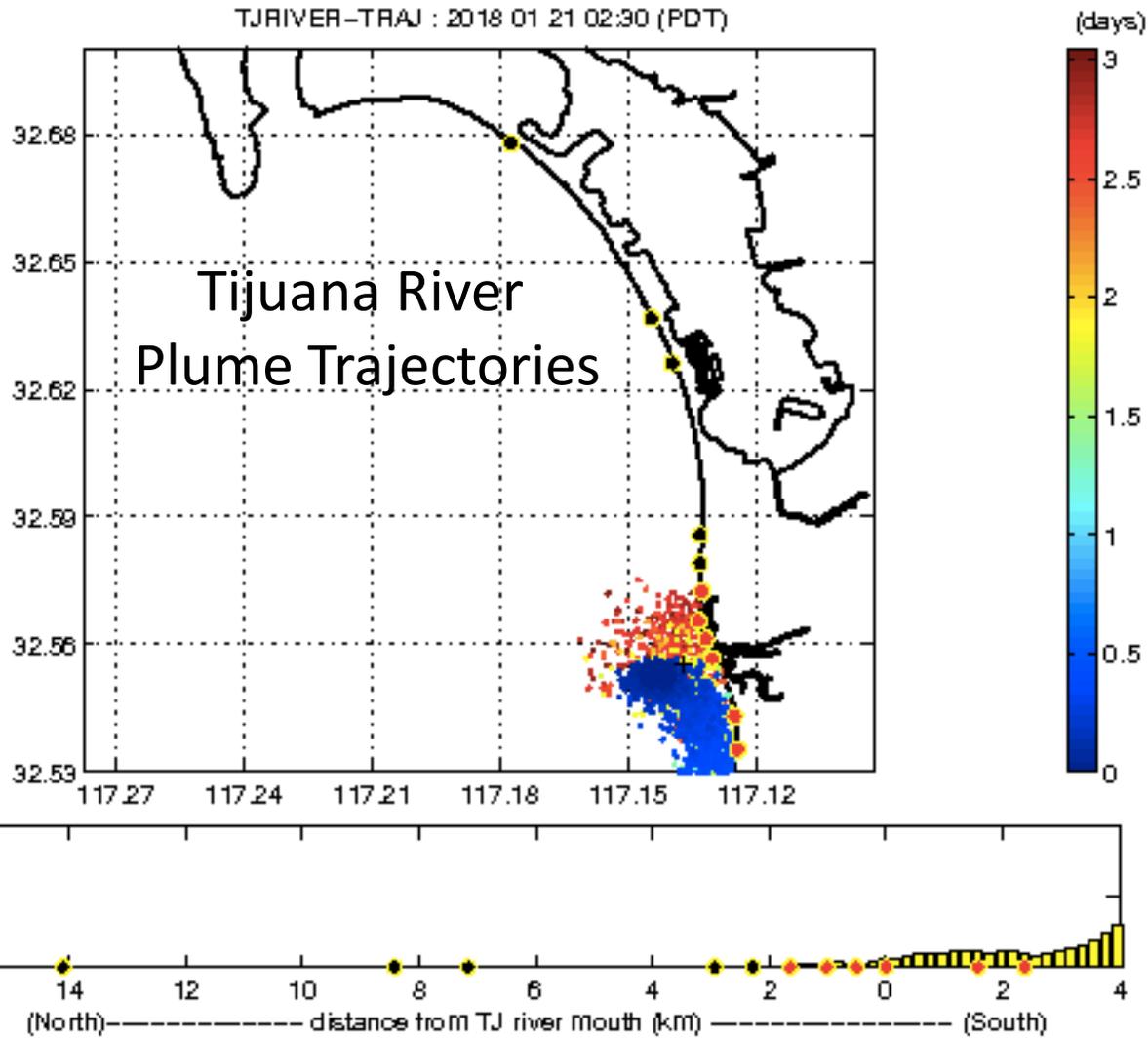
Scripps Plankton  
Camera, Jules Jaffe

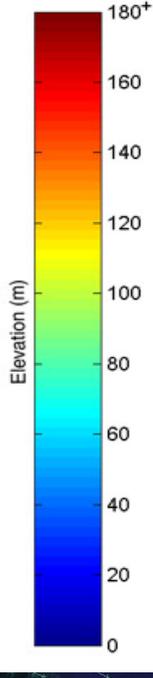
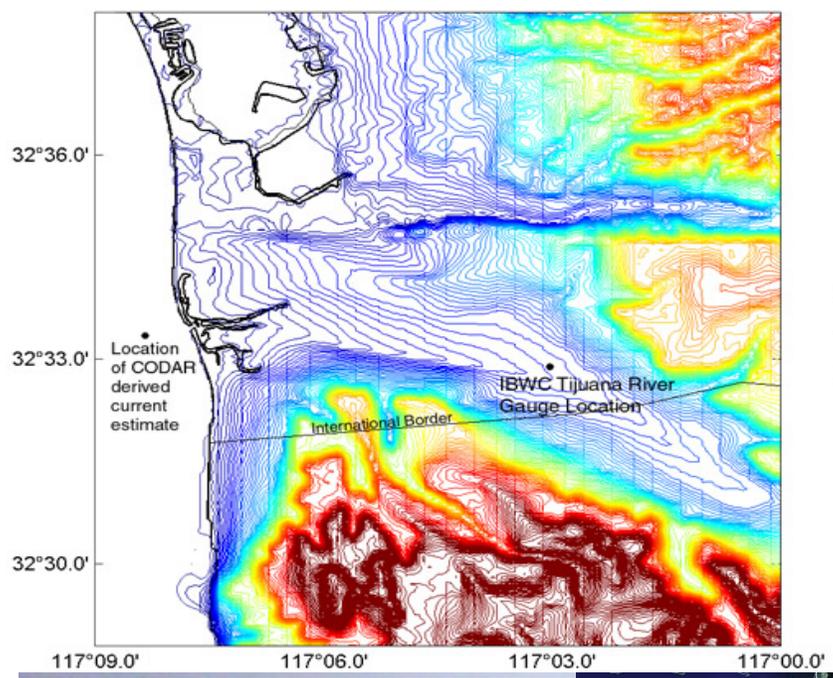


Environmental Sampling  
Processor (ESP), Scholin

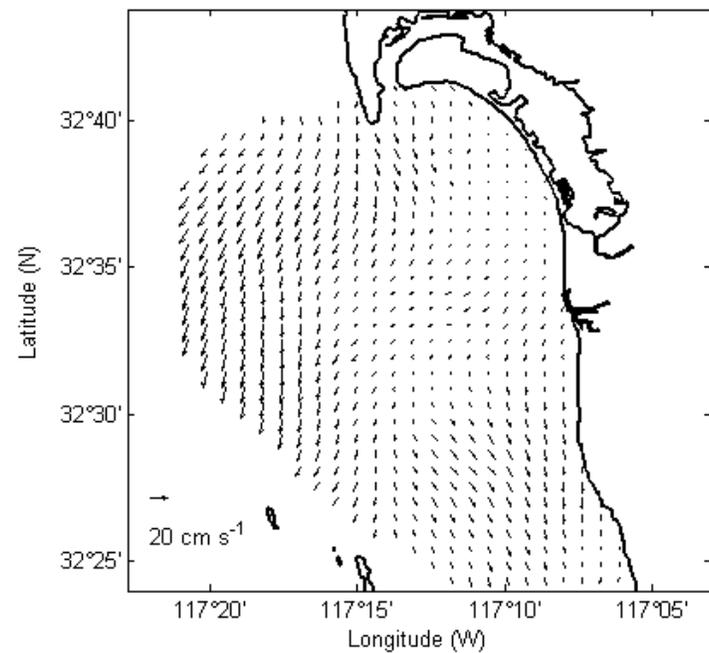
# Coastal Pollution

SCCOOS creates a plume tracking tool for people to follow the possible flow of pollution from Tijuana River Estuary into the Pacific Ocean

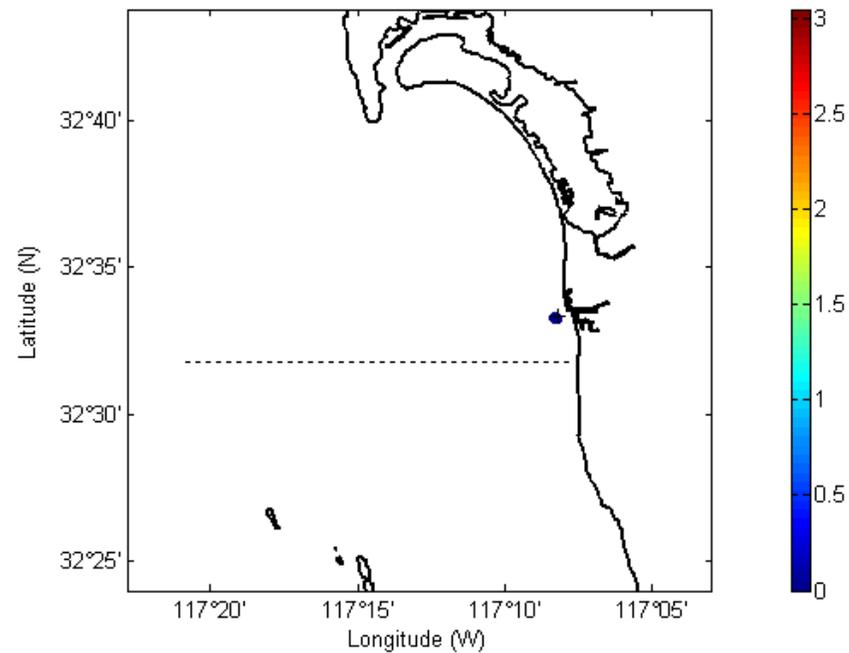




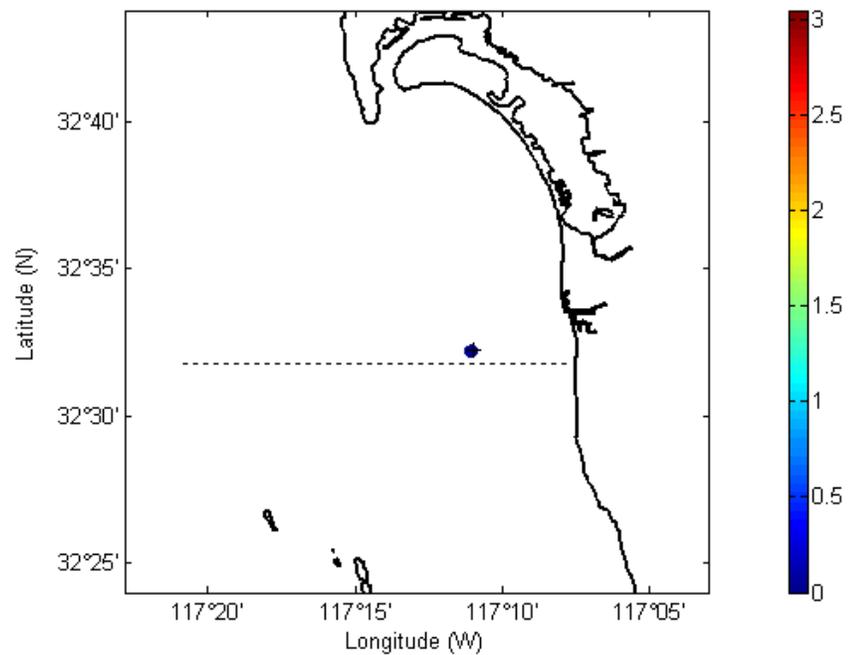
SFC UV : 2005 01 05 03:30 (GMT) [1]



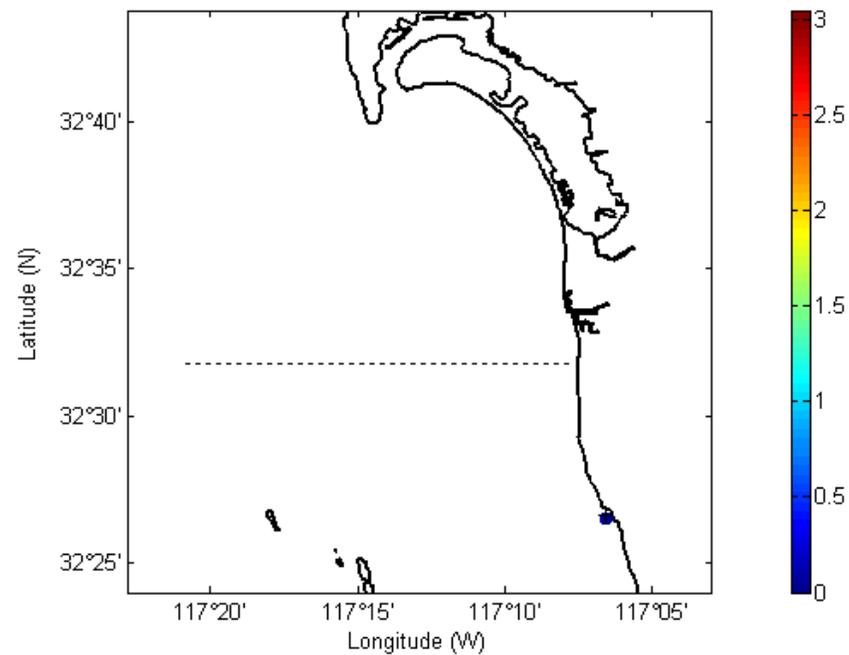
TJR: TRAJ : 2005 01 05 03:30 (GMT) [1]



SBO: TRAJ : 2005 01 05 03:30 (GMT) [1]

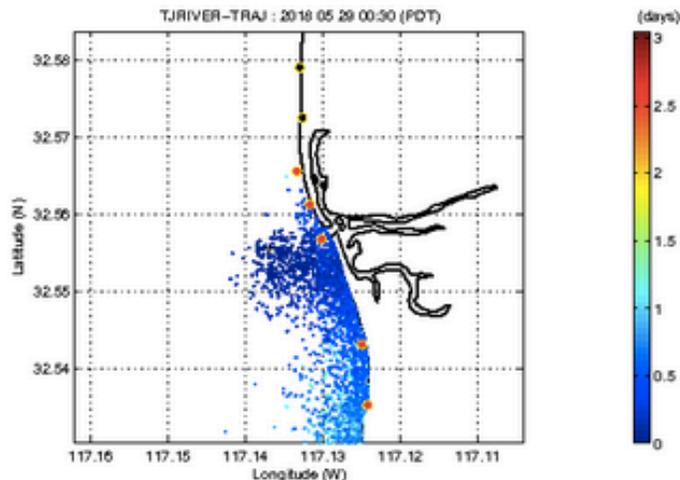
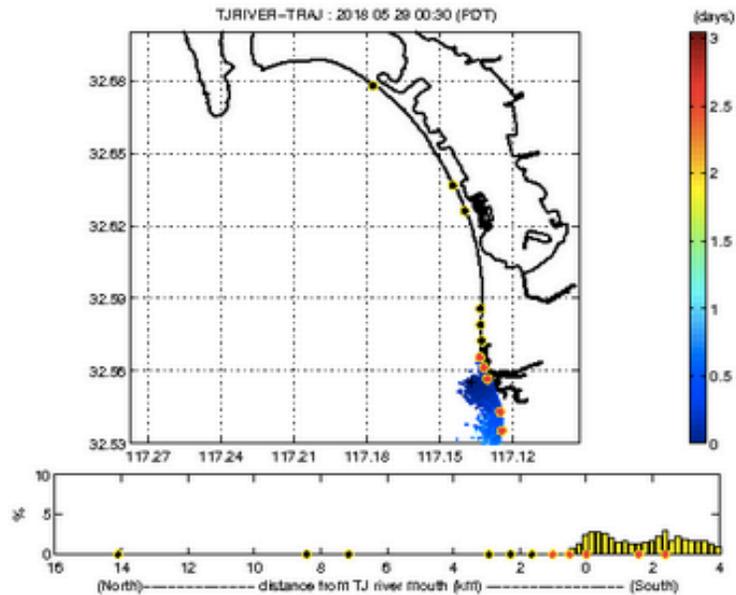


PBD: TRAJ : 2005 01 05 03:30 (GMT) [1]



# Data Visualization and Decision Making

<http://www.sccoos.org/data/tracking/IB/>

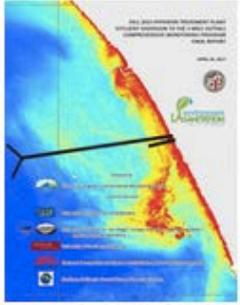


Date: 2018-05-29 07:30 GMT (2018-05-29 00:30 PDT)

Station ID	Station Name	Particle Count	Plume Potential
1	Coronado (North Island)	0	NO
2	Silver Strand	0	NO
3	Silver Strand Beach	0	NO
4	Carnation Ave.	0	NO
5	Imperial Beach Pier	0	NO
6	Cortez Ave.	0	NO
7	End of Seacoast Dr.	1	YES
8	3/4 mi. N. of TJ River Mouth	55	YES
9	Tijuana River Mouth	180	YES
10	Monument Rd.	101	YES
11	Board Fence	214	YES

# Coastal Pollution: SCCOOS monitored the 2006 & 2015 Hyperion Outfall Diversion

## 2015 Hyperion Outfall Diversion

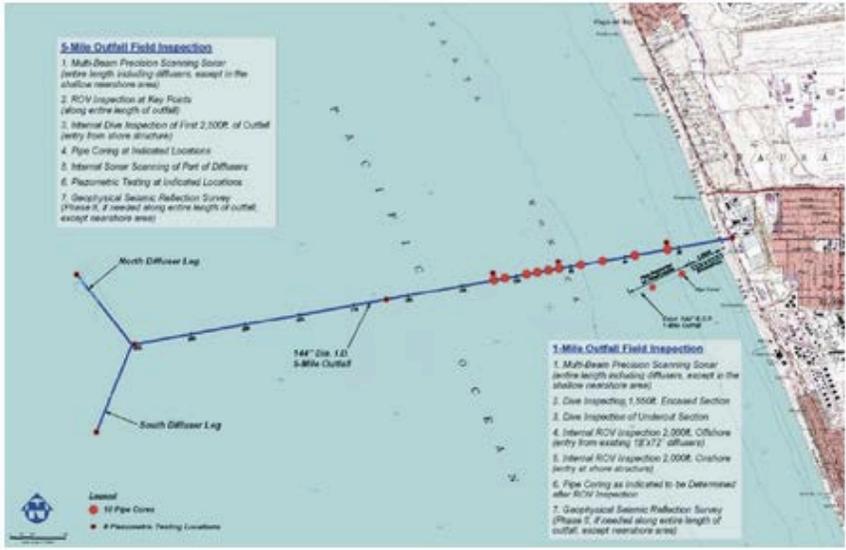


[FINAL REPORT: 2015 Hyperion Outfall Diversion](#)

[Post-Monitoring Fact Sheet \(1.4 MB\)](#)

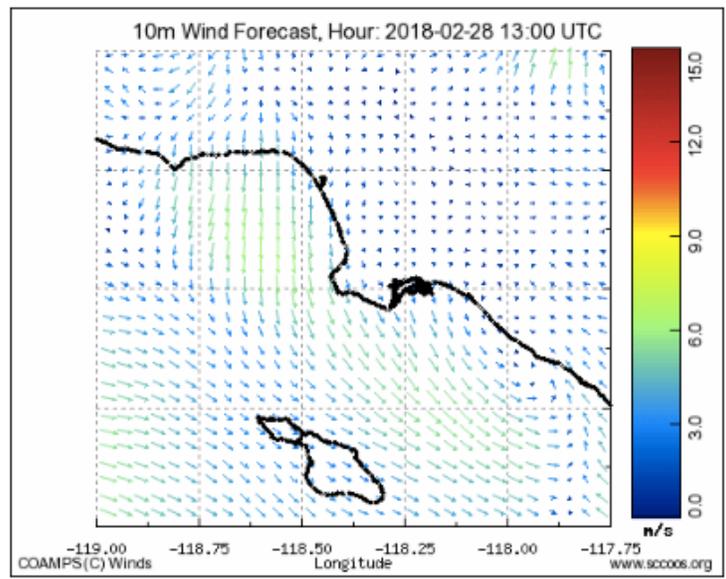
LA Sanitation repaired the effluent pump station, the discharge system of treated wastewater located at the Hyperion Water Reclamation Plant in Playa del Rey.

## Geography of the Hyperion 5-mile diversion

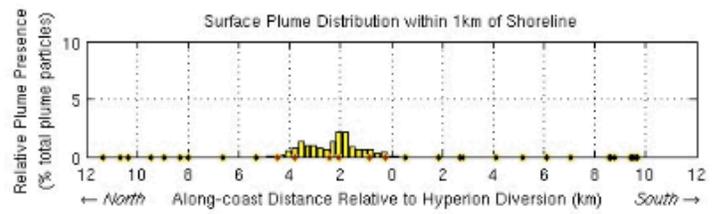
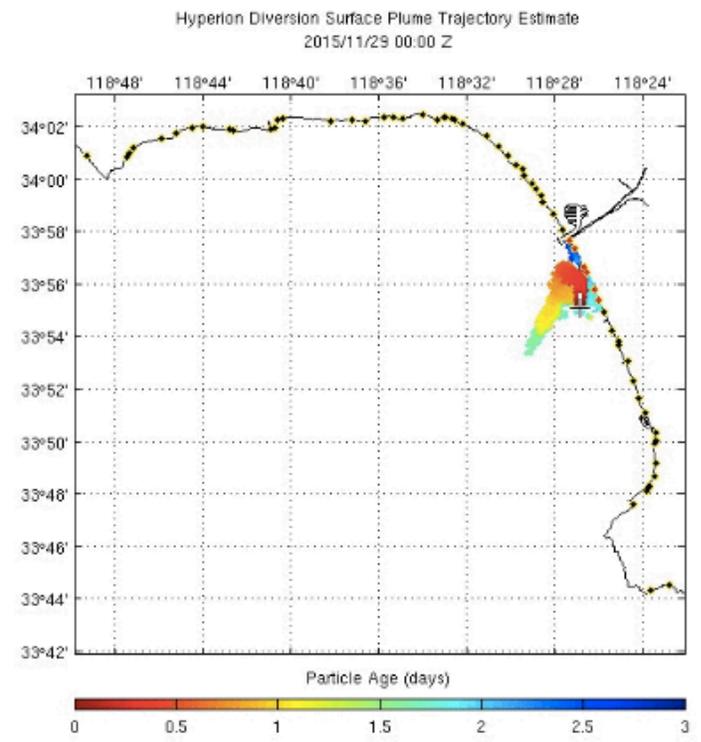


## Real-time tracking: Los Angeles Hyperion sewage outfall diversion

## COAMPS 4km Modelled 10m Wind Fields



## Plume Tracking



[Historic Plume Tracking Images](#)

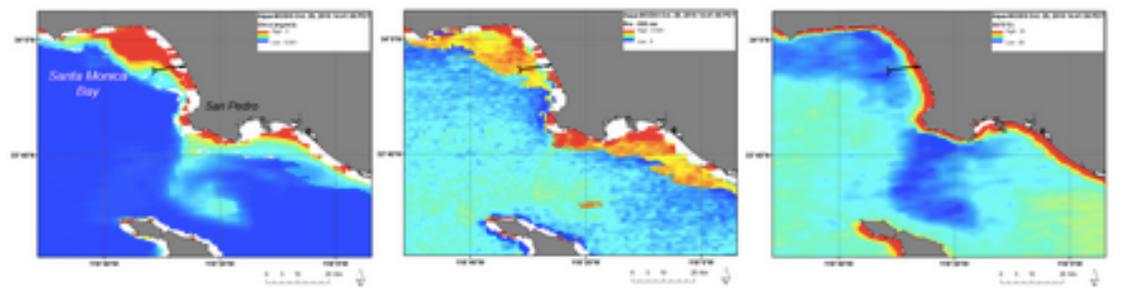
# Coastal Pollution: SCCOOS monitored the 2006 & 2015 Hyperion Outfall Diversion

<http://www.sccoos.org/projects/hyperion/>

Shoreline Fecal Indicator Bacteria					
Station Name	Beach	Total Coliforms	Fecal Coliforms	Enterococcus	EC/TC Ratio
		pass/exceed	pass/exceed	pass/exceed	pass/exceed
SMB MC-2	Malibu Creek				
SMB 1-18	Topanga Co Bch	Pass	Pass	Pass	Pass
SMB 2-3	Will Rodgers SB				
SMB 2-7	SM Cyn SD, SM SB	Pass	Pass	Pass	Pass
SMB 2-8	Venice Pier, Venice Bch	Pass	Pass	Pass	Pass
SMB 2-9	Topsail St, Venice Bch	Pass	Pass	Pass	Pass
SMB 2-10	Culver SD, Dockweiler SB	Pass	Pass	Pass	Pass
SMB 2-12	World Way, Dockweiler SB	Pass	Pass	Pass	Pass
SMB 2-14	Dockweiler SB	Pass	Pass	Pass	Pass
SMB 3-2	Wilshire SD, SM				
SMB 3-5	Ashland SD, SM SB	Pass	Pass	Pass	Pass
SMB 3-8	Windward Av SD, Venice	Pass	Pass	Pass	Pass
SMB 3-9	Strand St, SM Bch				
SMB 5-1	40th St, Manhattan Bch	Pass	Pass	Pass	Pass
SMB 5-2	28th St SD, Manhattan Bch	Pass	Pass	Pass	Pass
SMB 5-3	Manhattan Bch Pier, SD	Pass	Pass	Pass	Pass
SMB 5-4	26th St, Hermosa Bch	Pass	Pass	Pass	Pass
SMB 5-5	Hermosa Pier	Pass	Pass	Pass	Pass
SMB 6-1	Herondo SD, Redondo	Pass	Pass	Pass	Pass
SMB 6-2	Redondo Bch Pier	Pass	Pass	Pass	Pass
SMB 6-3	"Box", Redondo Bch	Pass	Pass	Pass	Pass
SMB 6-4	Topaz, Redondo Bch	Pass	Pass	Pass	Pass
SMB 6-5	Ave I, Redondo Bch	Pass	Pass	Pass	Pass
SMB 6-6	Malaga Cove	Pass	Pass	Pass	Pass

## Satellite October 29, 2015

Aqua-MODIS Chlorophyll-a (chl-a), remote sensing reflectance at 555 nm (Rrs) and sea surface temperature (SST) from Oct. 29, 2015 at 14:41:55 PDT, during the diversion. An area of high chl-a is seen north of the outfall pipes and along the coast of Santa Monica Bay. There is also a smaller bloom circulating off the tip of San Pedro. These high signatures are also seen in the Rrs image at the 555 nm wavelength. These areas are also correlated with regions of cooler SST.

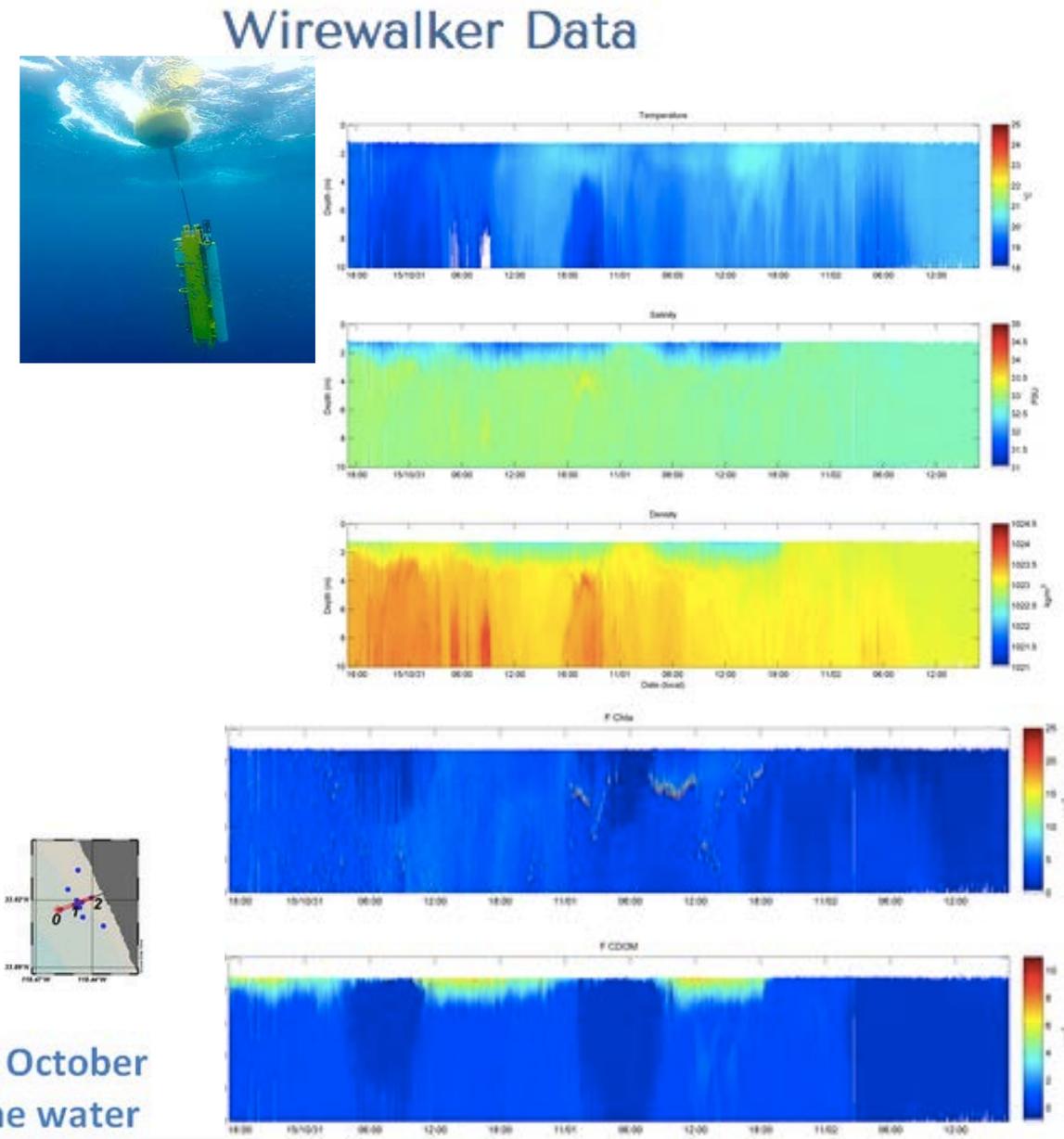
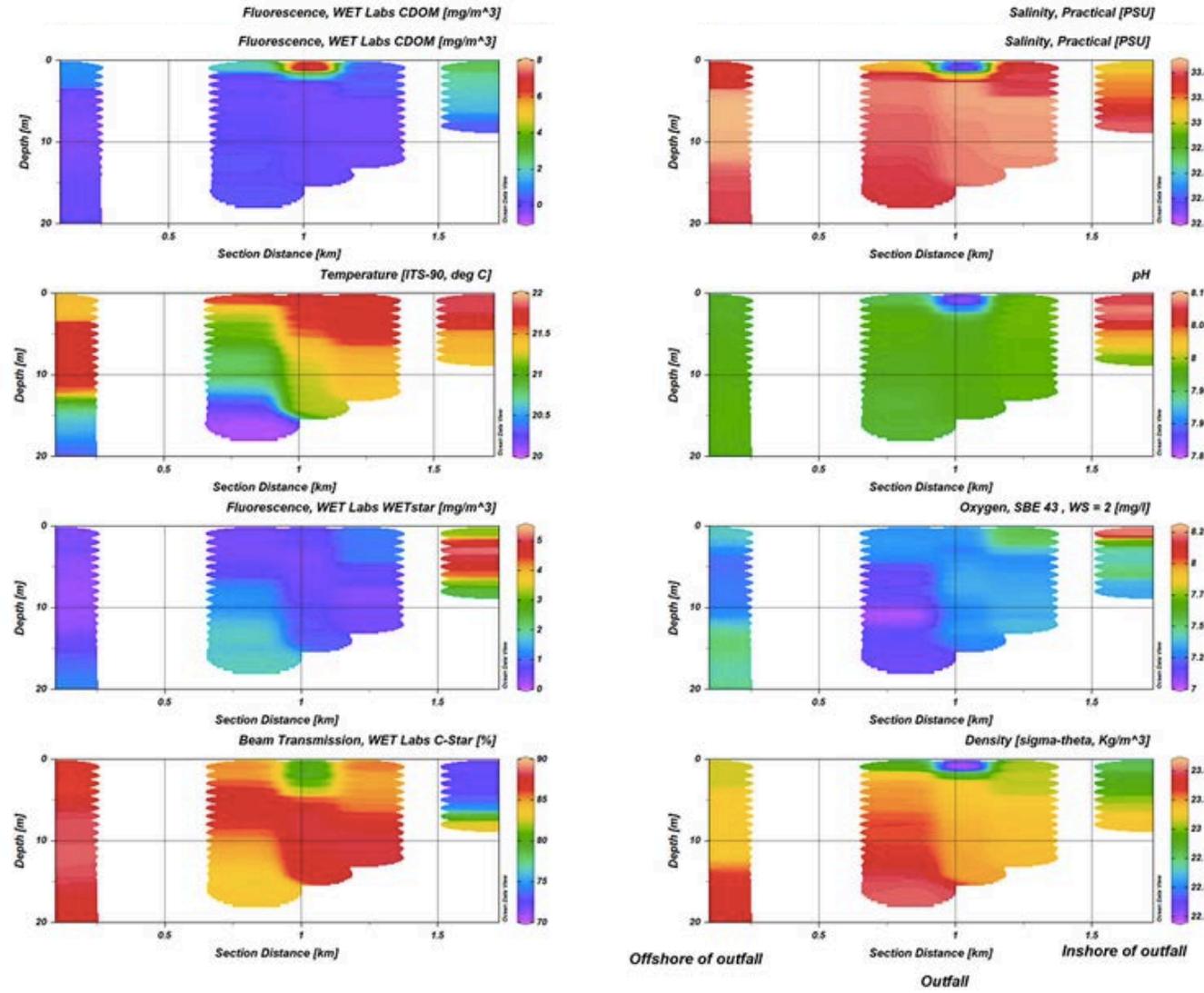


Historic Satellite Images

2015-11-05 2015-11-04 2015-11-03 2015-10-31 2015-10-30 2015-10-29 2015-10-28 2015-10-27 2015-10-26 2015-10-24 2015-10-23 2015-10-22 2015-10-21 2015-10-20 2015-10-19 2015-10-1



# Coastal Pollution: SCCOOS monitored the 2006 & 2015 Hyperion Outfall Diversion



Cross-shelf transect of water quality measured by CTD water profiler on October 26. The effluent plume can be seen prominently in the upper 2-3 m of the water above the outfall and more diffuse inshore.



# Areas of Special Biological Significance

*SCCOOS creates a customized ASBS page for the La Jolla Cove ASBS to monitor local water quality in compliance with state regulations*

Map | **Satellite** | Terrain

[sccoos.org/data/asbs/](http://sccoos.org/data/asbs/)  
[cordc.ucsd.edu/projects/asbs/](http://cordc.ucsd.edu/projects/asbs/)

2000 ft

POWERED BY Google

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Creates Link for Bookmarks

Sites	
08.	Redwood
06.	Trinidad Head
07.	King Range
01.	Pygmy Forest
05.	Saunders Reef
02.	Del Mar
03.	Gerstle Cove
04.	Bodega Bay
14.	Bird Rock
12.	Point Reyes
13.	Double Point
11.	Duxbury Reef
10.	Farallon Islands
09.	Fitzgerald
15.	Ano Nuevo
19.	Pacific Grove
34.	Carmel Bay
16.	Point Lobos
18.	Burns Underwater Park
20.	Salmon Creek
17.	Channel Islands
24.	Mugu Lagoon
22.	So. Channel Islands
32.	Newport Beach
33.	Irvine Coast
30.	Heisler Park
25.	Catalina Head
26.	Little Harbor
27.	Farnsworth Bank
28.	Binnacle Rock
21.	San Nicolas Island
23.	San Clemente Island
31.	SIO
<b>29.</b>	<b>La Jolla</b>

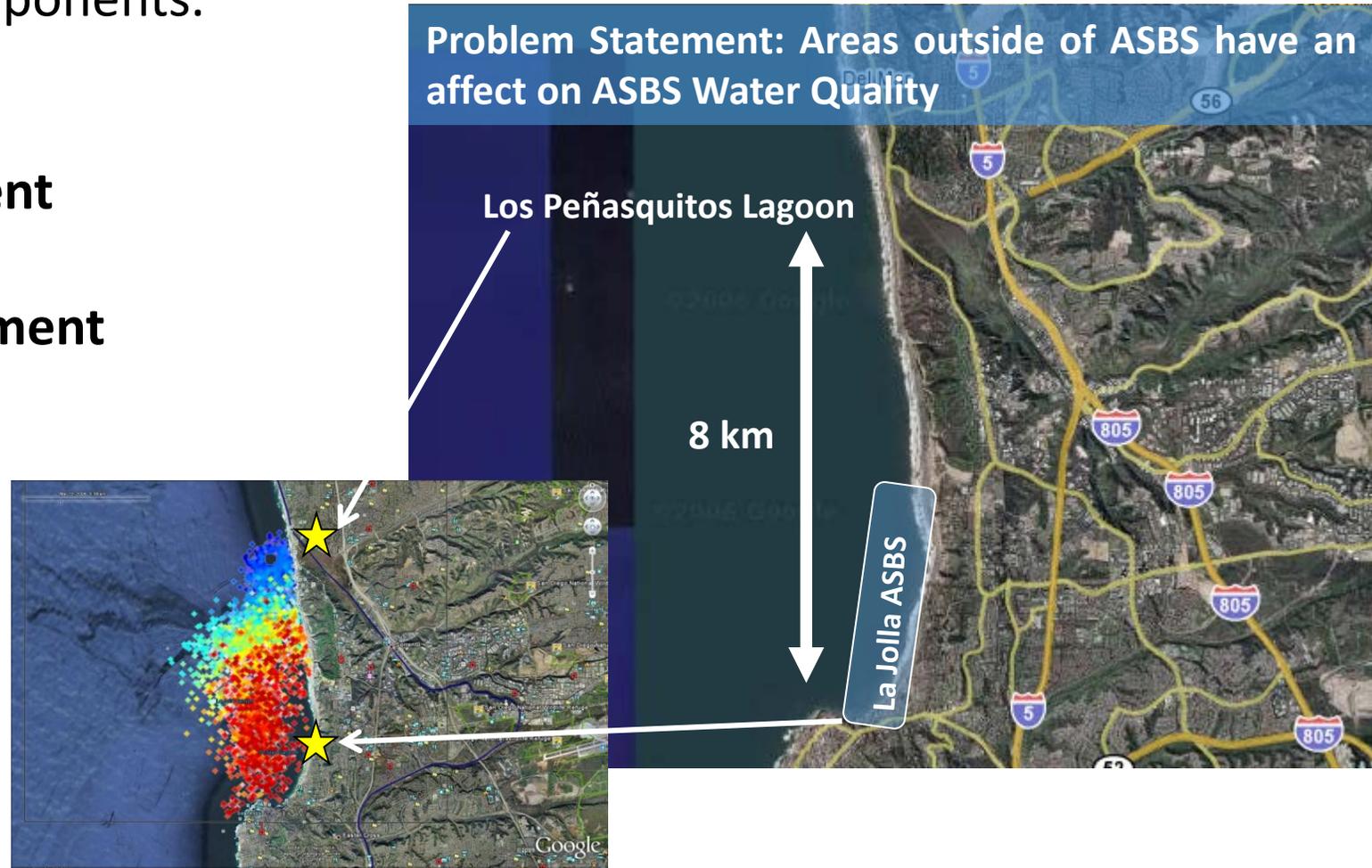
ASBS's are state water quality protected areas that, by legislative order, are not allowed to "receive discharges of waste" and must "maintain natural water quality." There is concern that plumes from these much larger watersheds may be transported into ASBS, altering natural water quality.



# Areas of Special Biological Significance

In 2008, the *City of San Diego*, the *University of California San Diego*, *Scripps Institution of Oceanography*, and *San Diego Coastkeeper* authored a Watershed Management Plan four essential and interactive components.

1. Urban Runoff Management
2. Ocean Ecosystem Assessment
3. Information Systems
4. Public Participation



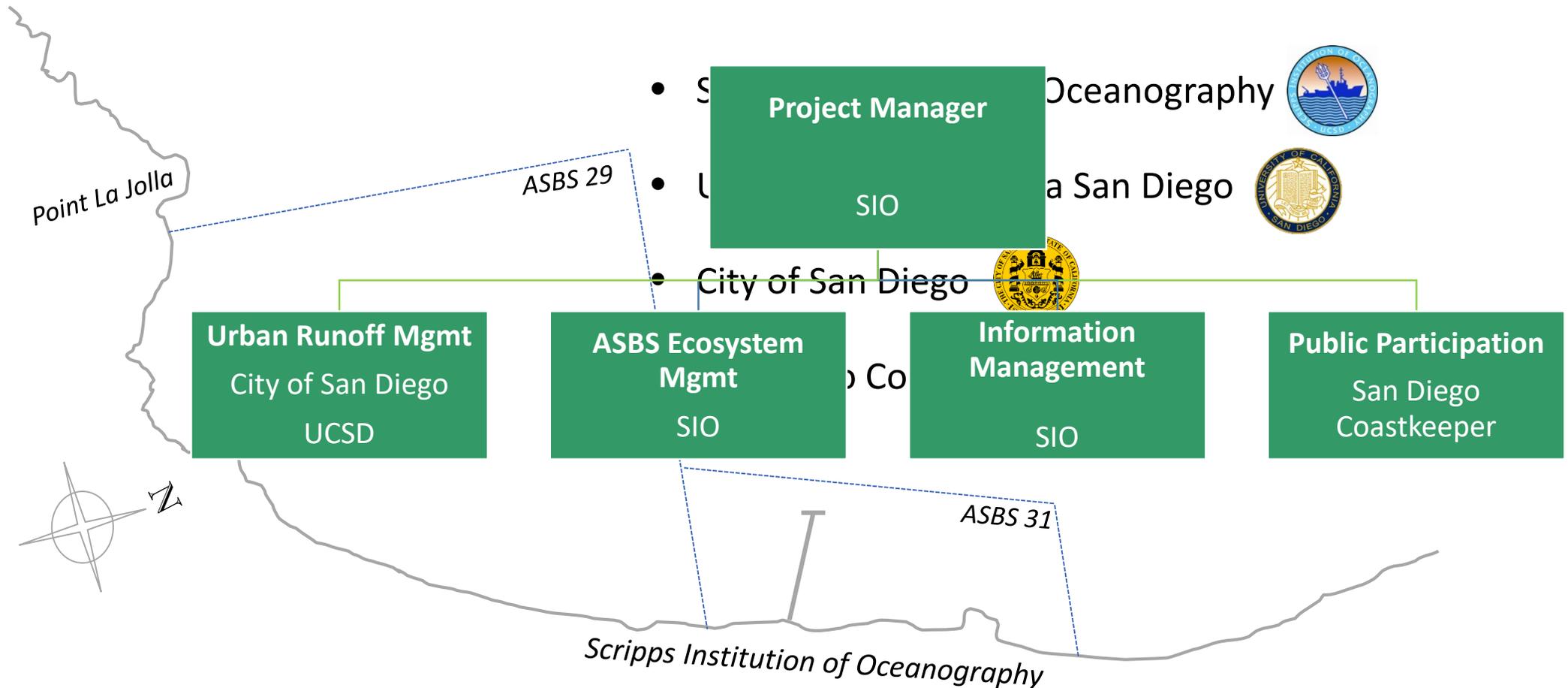
HF Radar currents compute trajectories from Los Peñasquitos with a 3-day lifetime of FIB

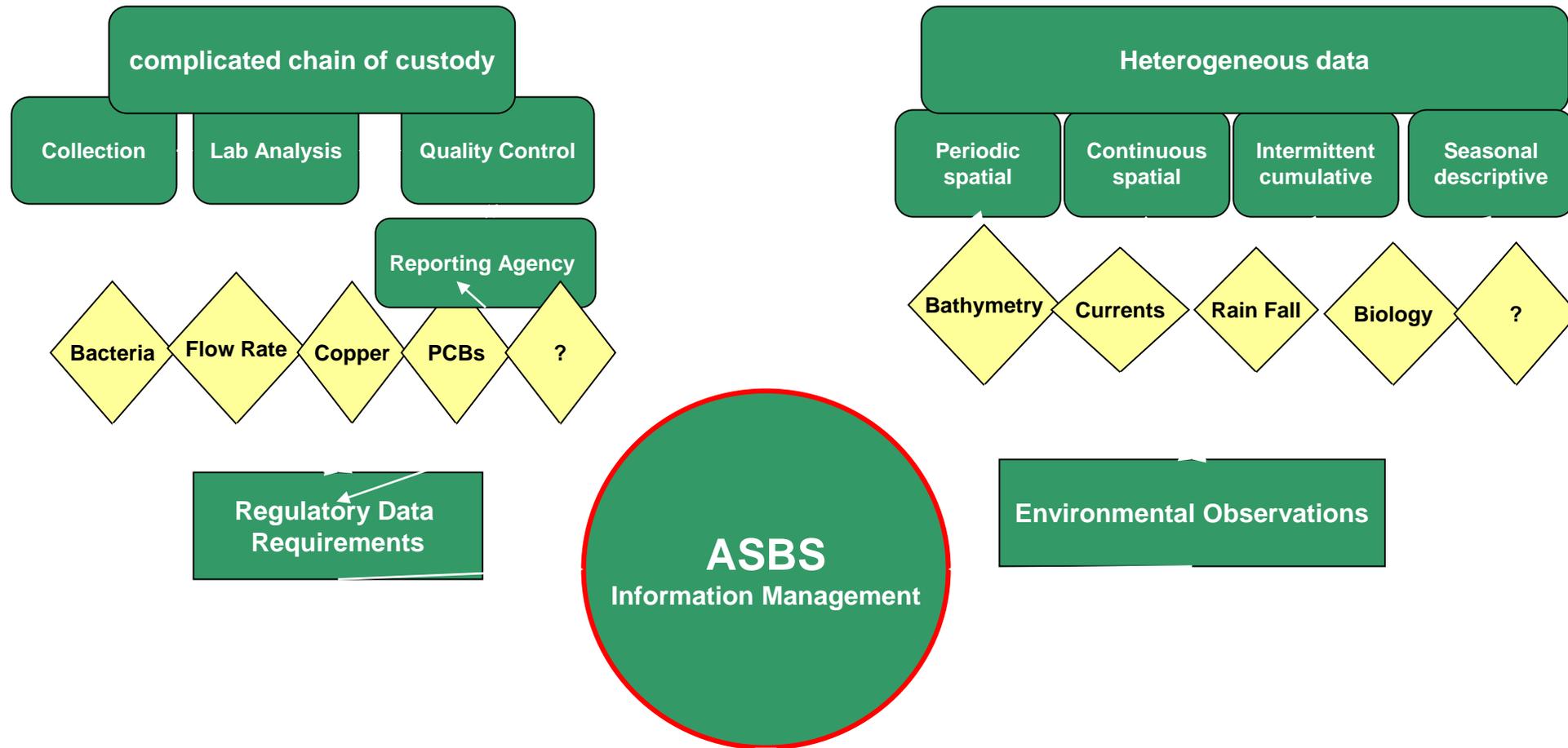


# Areas of Special Biological Significance

Funding for the project has been provided in part through a grant from the State Water Resources Control Board (SWRCB). The development of the Watershed Management Plan came from California Proposition 50.

This plan was prepared by the La Jolla Shores Watershed Management Group





## ASSESSMENT CHALLENGES

**Management Decision Impacts:** *Is change within the ASBS a result of the management decision?*  
**External Human Influences:** *Are they present? Are they avoidable? Are they external to the ASBS?*  
**Natural Variability:** *Are observed changes caused by natural variability? E.g. – climate change?*



# Areas of Special Biological Significance

*SCCOOS created an award-winning, customized data portal*



Large map with slide-able side panels

Map bookmarks to help you zoom to areas of interest

Metadata

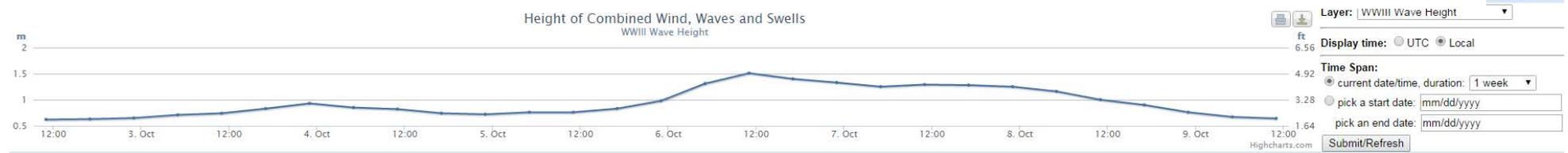
Adjustable map-time

Collapsible legends

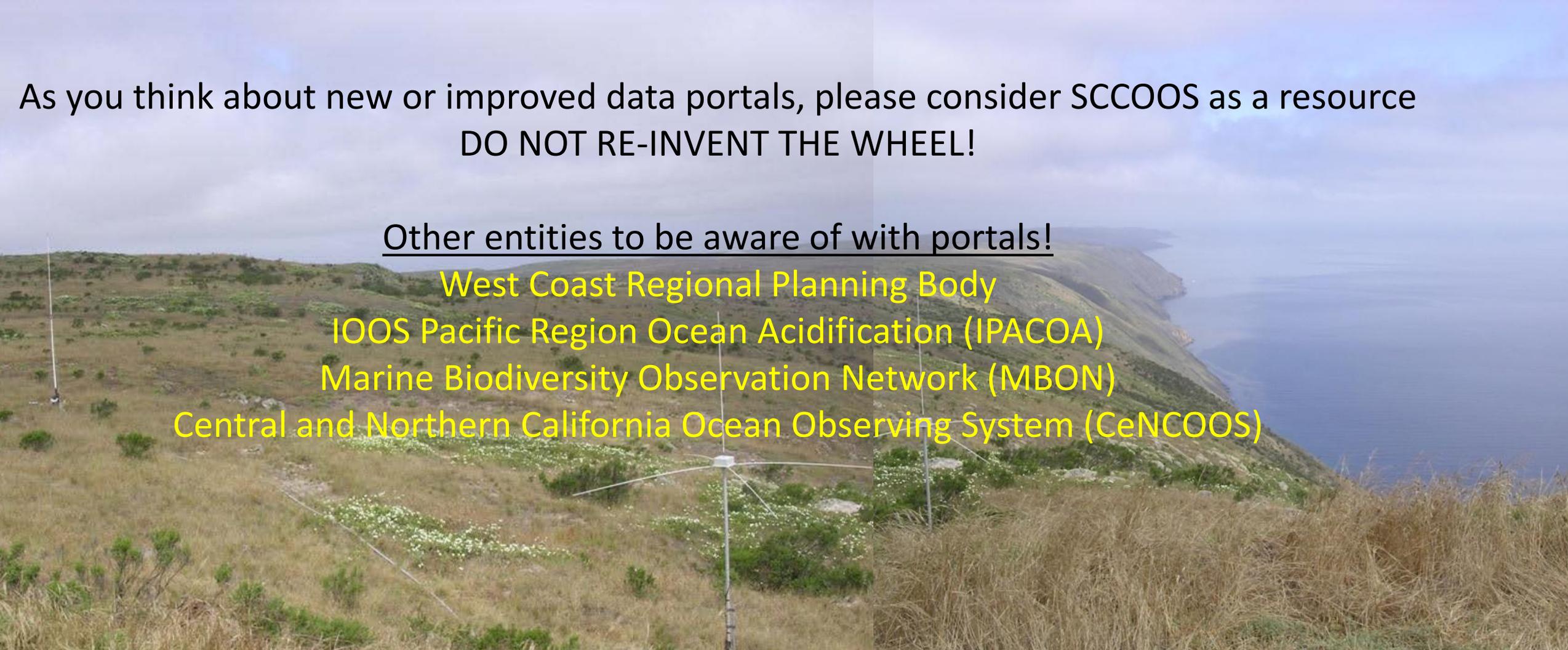
Links to special studies and documents

Specific layers have options which can be changed once selected

Time series of selected data



Since some of the data shown on the website are derived from other sources, the goal has been to provide direct access to disparate data streams. The portal is flexible and accommodates all file types.



As you think about new or improved data portals, please consider SCCOOS as a resource  
DO NOT RE-INVENT THE WHEEL!

Other entities to be aware of with portals!

West Coast Regional Planning Body

IOOS Pacific Region Ocean Acidification (IPACOA)

Marine Biodiversity Observation Network (MBON)

Central and Northern California Ocean Observing System (CeNCOOS)

QUESTIONS?