

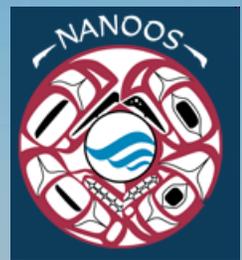
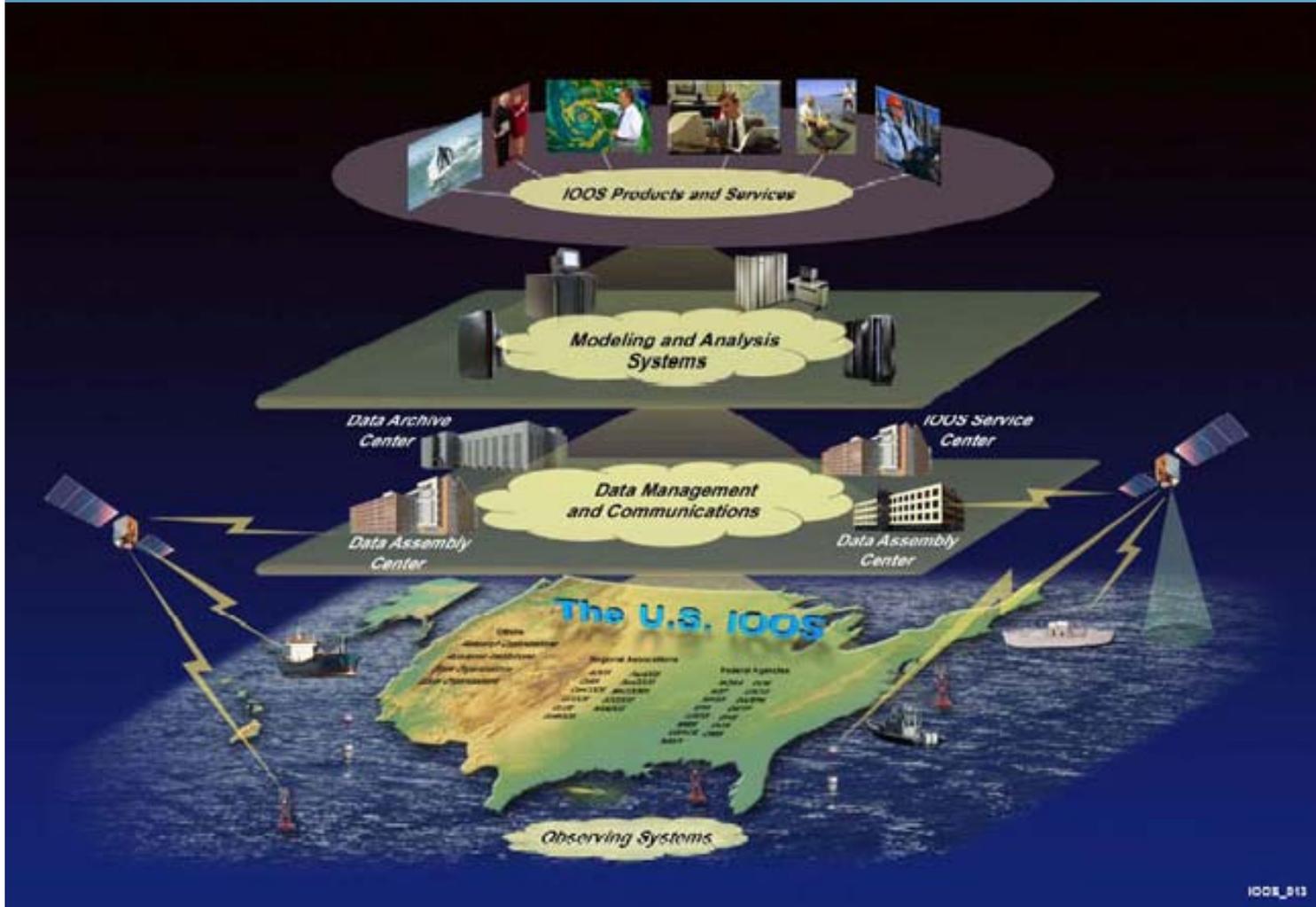
# HAB Research and Monitoring Central and Northern California



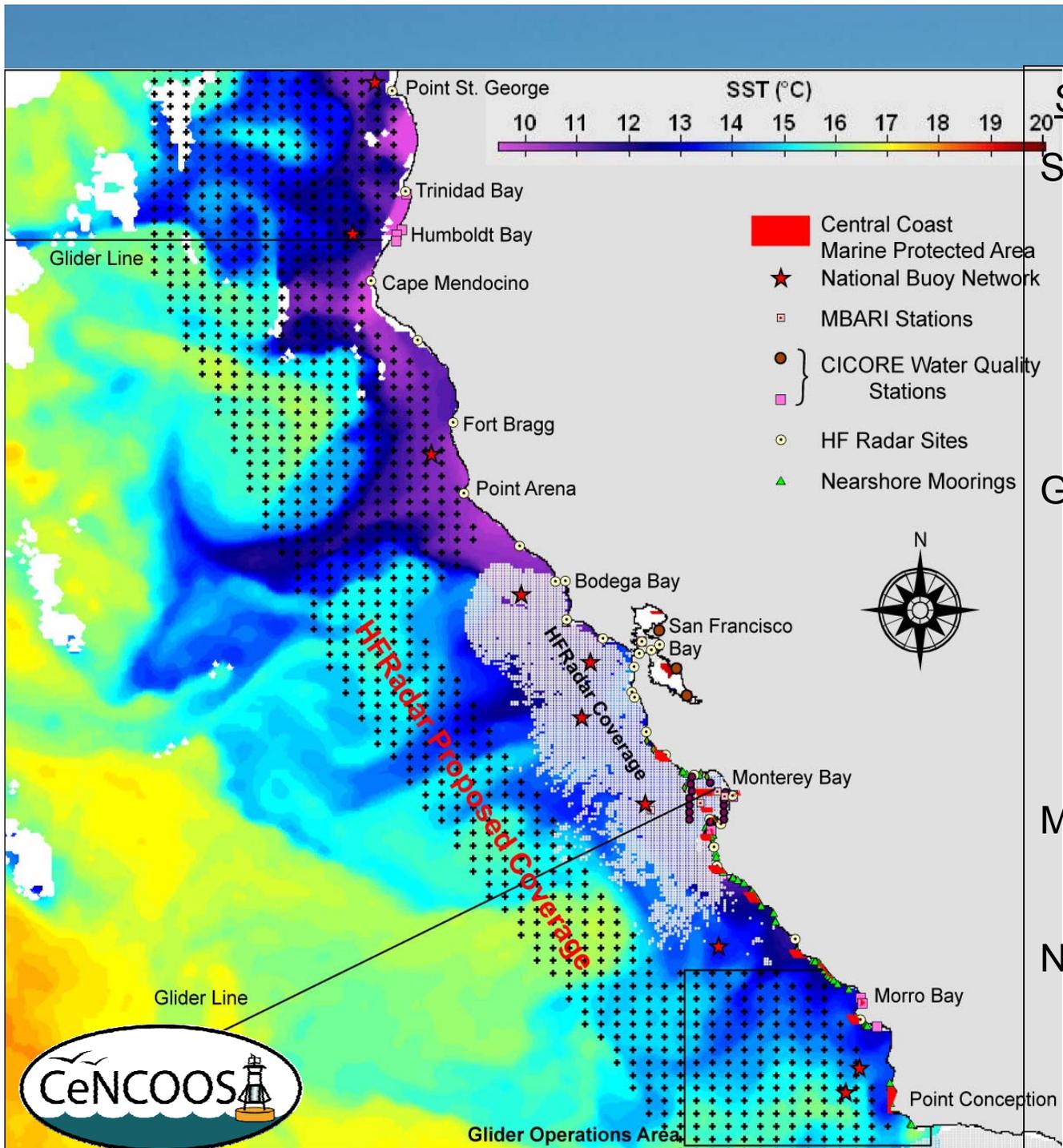
## West Coast Regional Harmful Algal Bloom Summit

Heather Kerkering

February 10, 2009



IOOS\_013



## Structure and Governance

### STAFF

- Director, Coordinator
- Program Coordinator
- Programmer
- Data and Web Manager

### GOVERNANCE

- 15-member Council
- Executive Committee
- MOA
- Strategic Plan

### MEMBERSHIP

- 50+ Partners

### NOAA Funding

- \$400K for 3 years
- \$1.2M (hopefully) for 3 years

## LOCAL: State testing on dead birds expected back Friday; experts say red tide and moth spray unlikely causes

J.M. BROWN - SENTINEL STAFF WRITER

Article Launched: 11/14/2007 3:00:00 AM PST



Department of Fish and Game's Wildlife Laboratory, said he doubts the birds are victims of last week's cargo ship spill of 58,000 gallons of oil into San Francisco Bay, though up to five birds believed sickened from that accident have been found in this area. Jessup said he thinks the two spills are a strange coincidence.

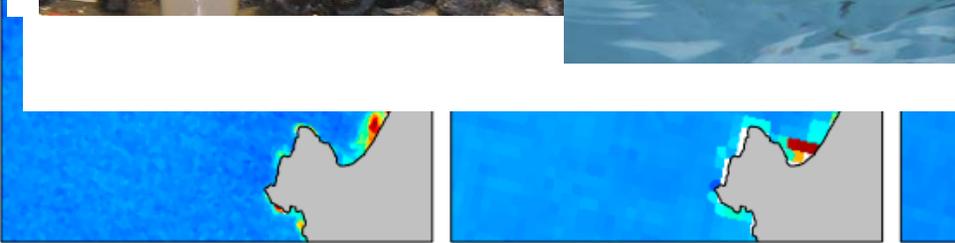
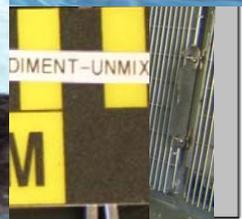
[See video of treatment of a sick surf scote](#)

Jessup believes the mystery spill happened Thursday within a mile of shore because the first sick birds, mostly kinds that stay within 1,000 yards of land, were found Friday. The cause is a mystery, he said,



Nathan Lawrence of Native Birding Rescue picked up this sickened surf scote on the beach near Moran Lake Monday. (Dan Coyro/Sentinel)

# Santa Cruz CDIP model points

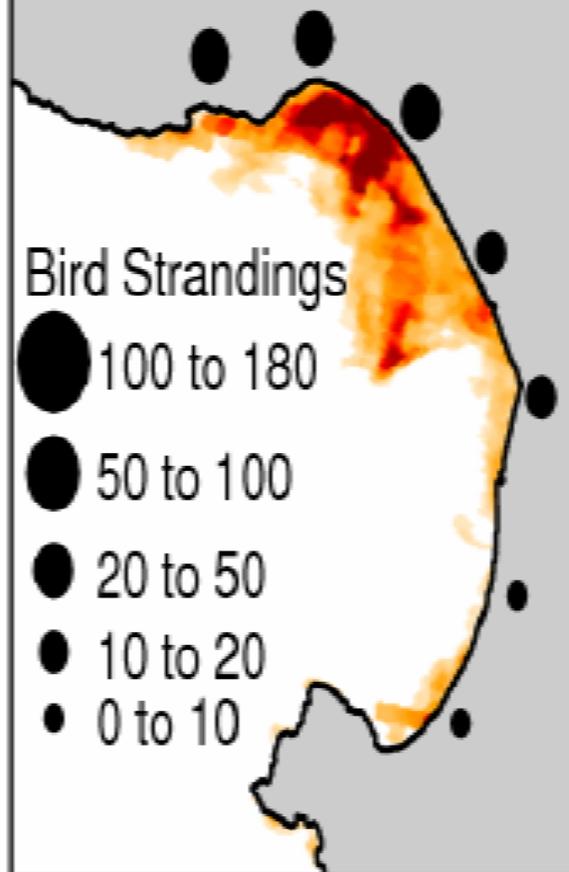


MERIS MCI ( $\text{mW m}^{-2} \text{sr}^{-1} \text{nm}^{-1}$ )

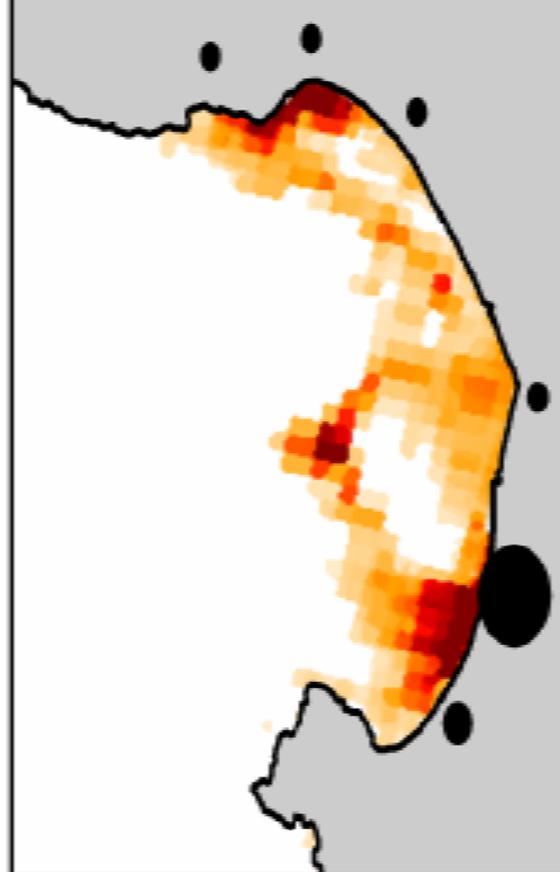


MODIS True Color

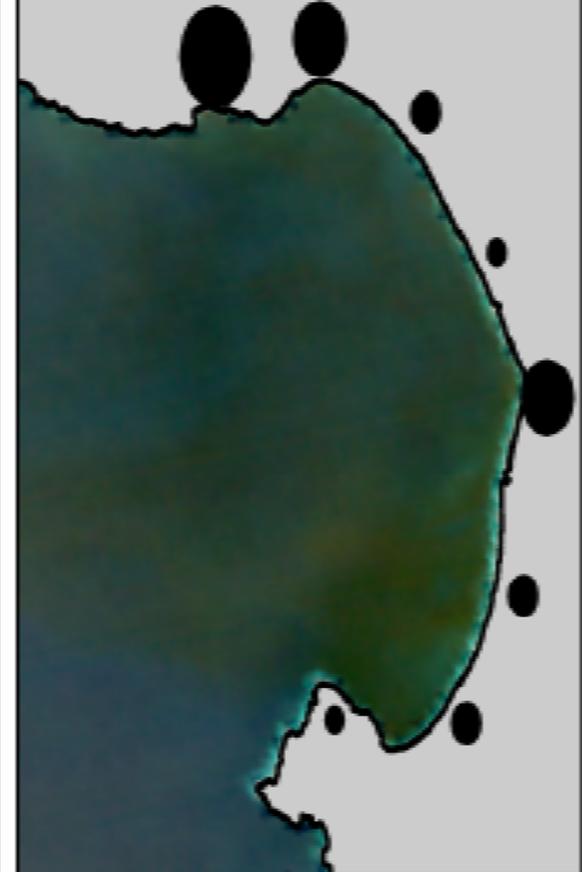
a) 11/7 to 11/18



b) 11/19 to 11/23



c) 11/24 to 12/2



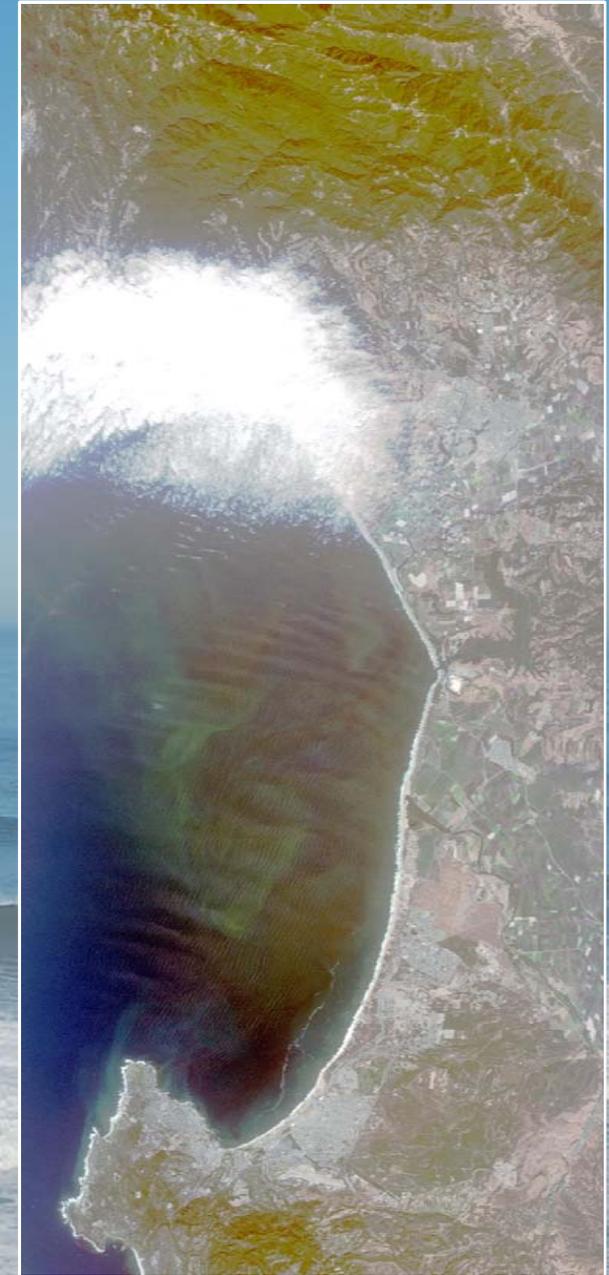
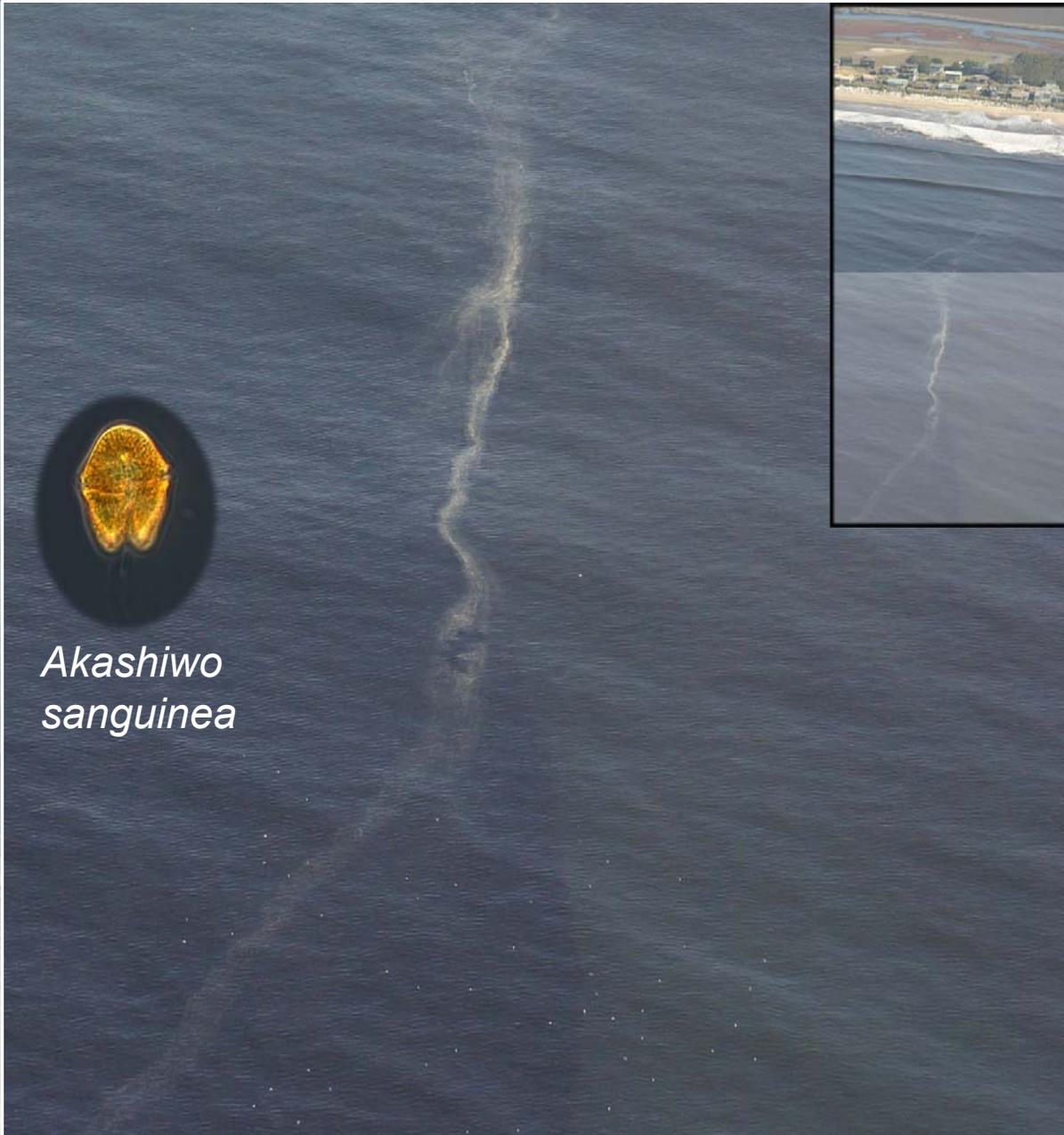
Bird Strandings

- 100 to 180
- 50 to 100
- 20 to 50
- 10 to 20
- 0 to 10

# A newly documented harmful bloom mechanism



# Proteinaceous coating on birds traced to red tide foam



# Solving the Mystery: What did it take?



Coordination, Data Management, Outreach



Seabird and Phytoplankton Ecology from Ship Surveys



Seabird Necropsies and Analysis



Surface Currents from HF Radar; tidal flow



Nutrient and species identification through sampling and lab analysis; satellite imagery; history of red tide events in MB



MERIS; satellite imagery; LOBO moorings; nutrient analysis and species identification



Time Series of Biological Data; Bird Rescues



PLOS one

accelerating the publication of peer-reviewed science

# MB'08: Intense blooms in central, S, N Monterey Bay

## Near-Infrared "Extreme Bloom" Index

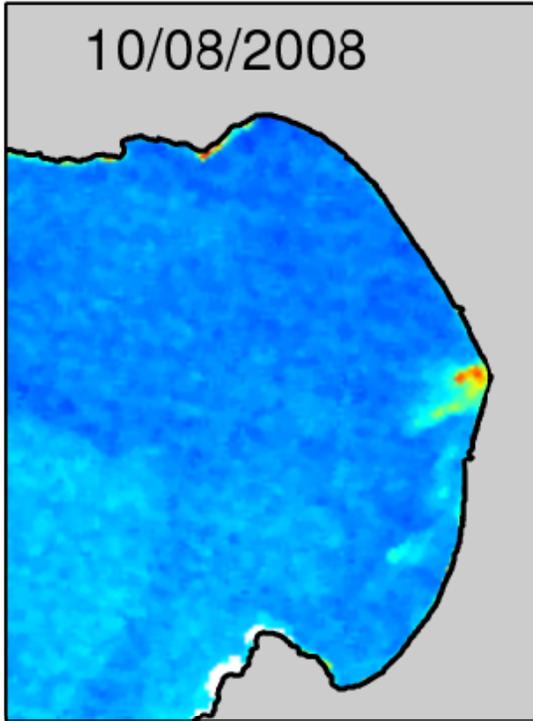
Low

Moderate

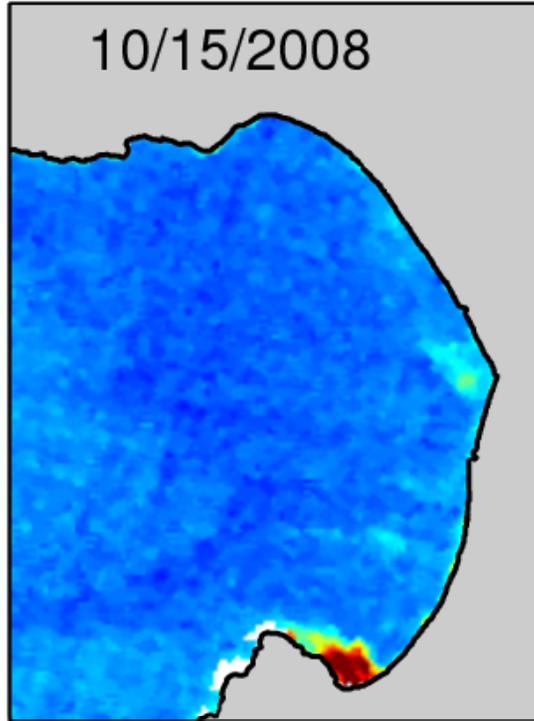
High



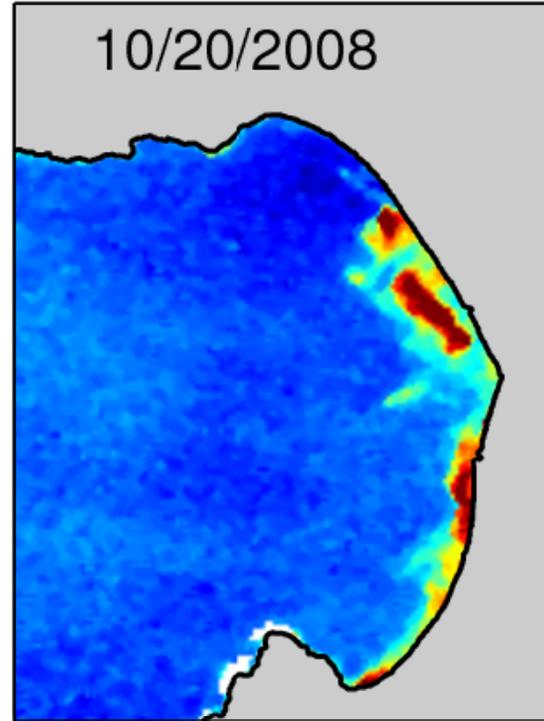
10/08/2008



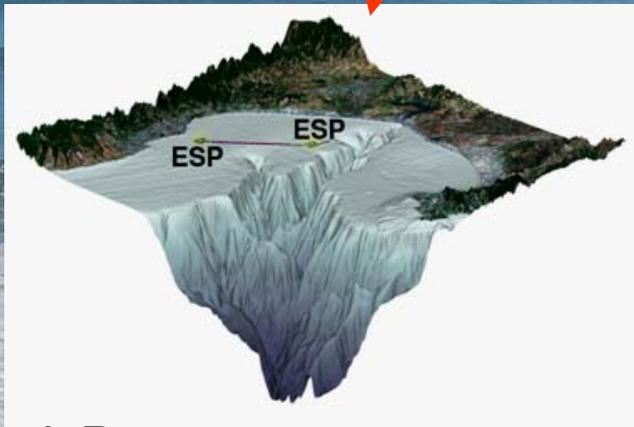
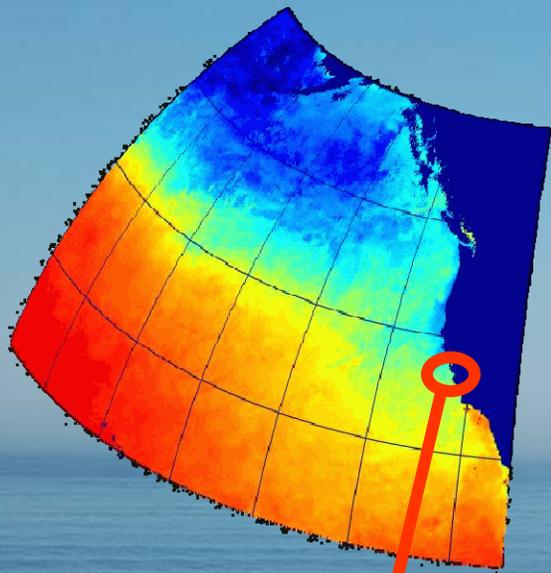
10/15/2008



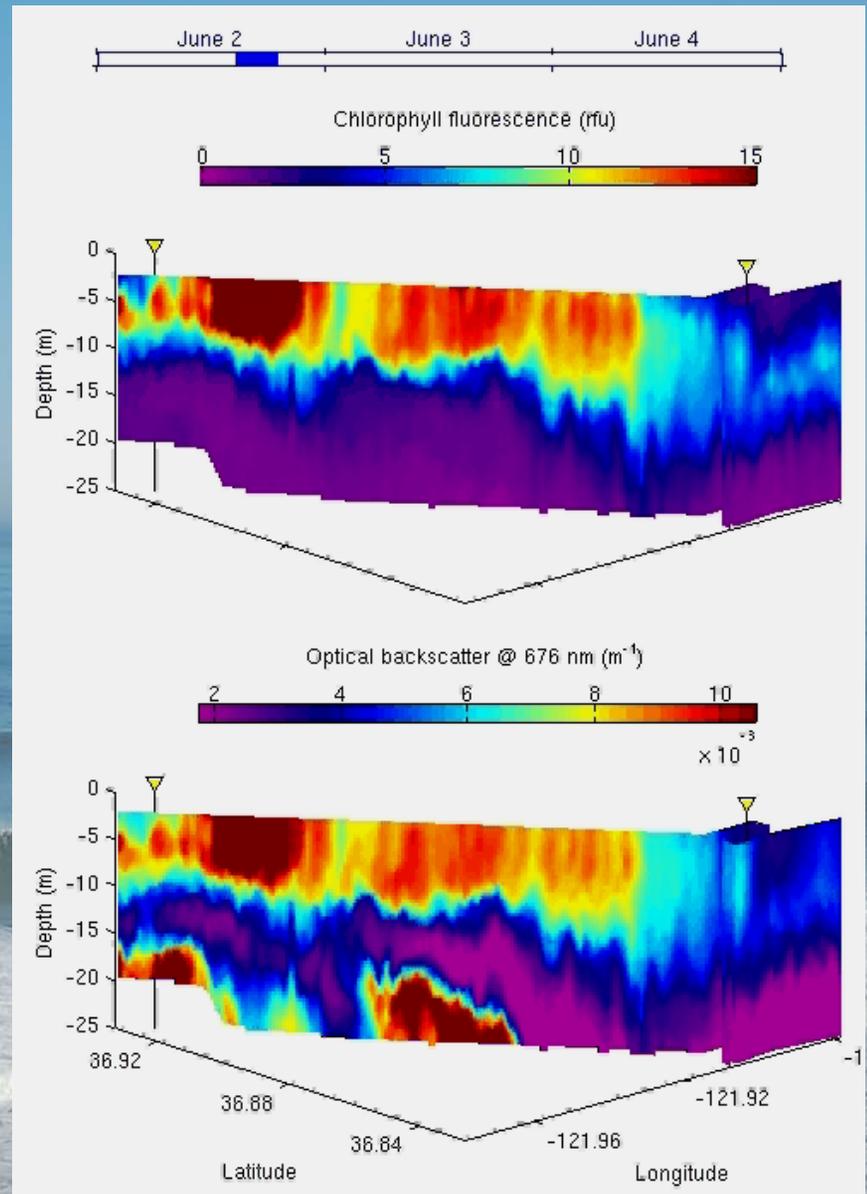
10/20/2008



# MB08: Combining AUV Surveys and ESP Operations

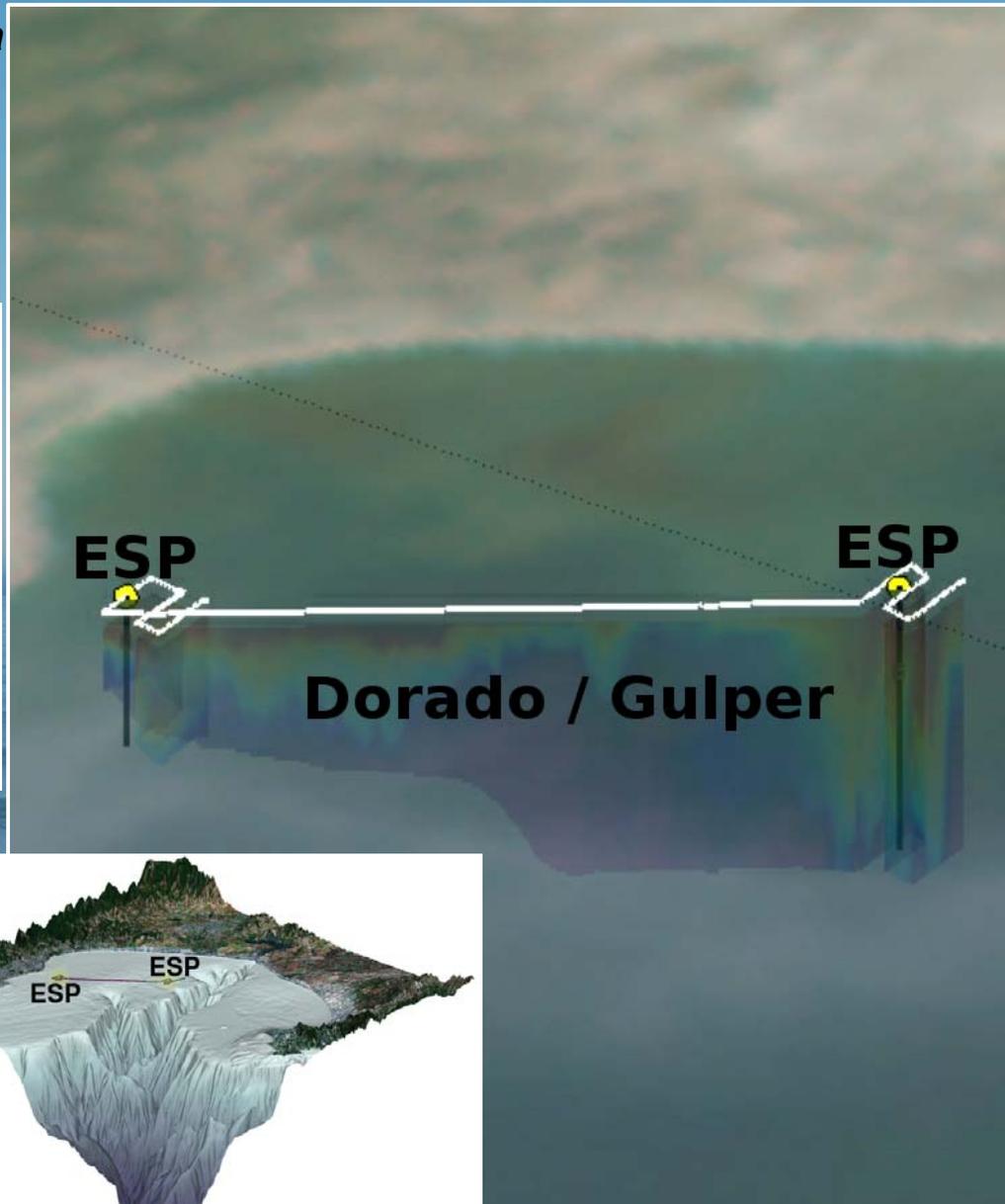
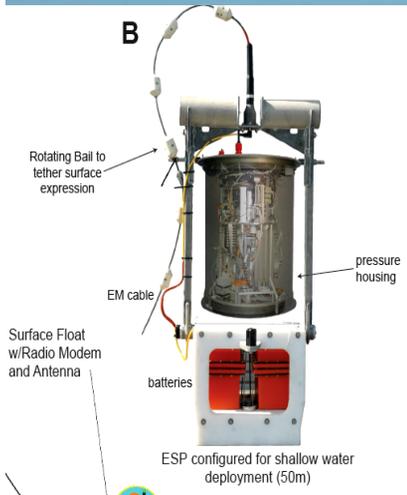


Source: J. Ryan



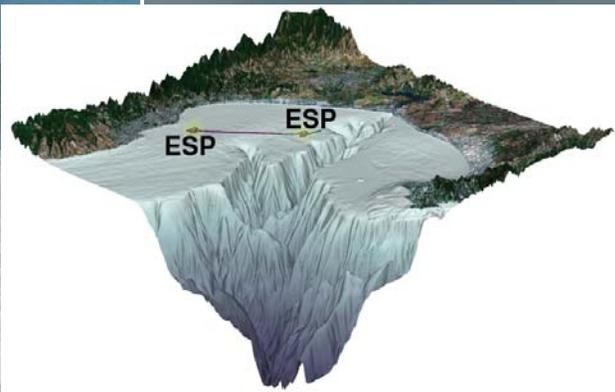
# Other bloom types: ESP array microbial observatory

- *Pseudo-nitzschia*
- *Alexandrium*
- *Heterosigma*
- (bacteria)

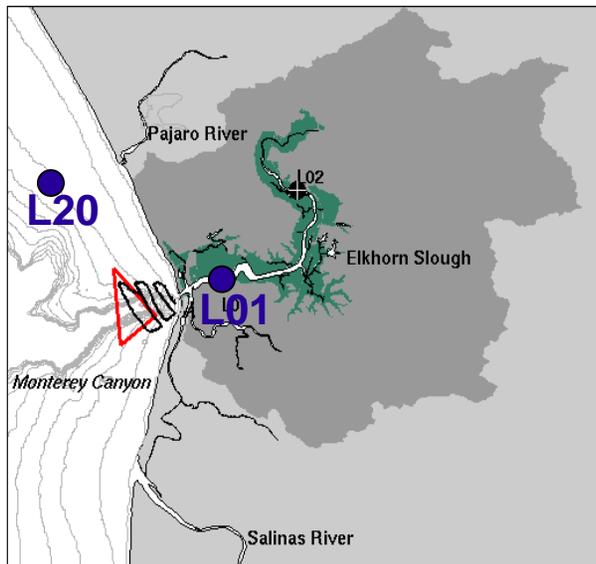


Temperature  
Salinity  
Chlorophyll  
Nitrate

ROMS Forecast  
Monterey winds  
by COAMPS  
ESP  
NOAA  
Coastwatch  
MBARI AUV and  
SIO Glider  
CODAR



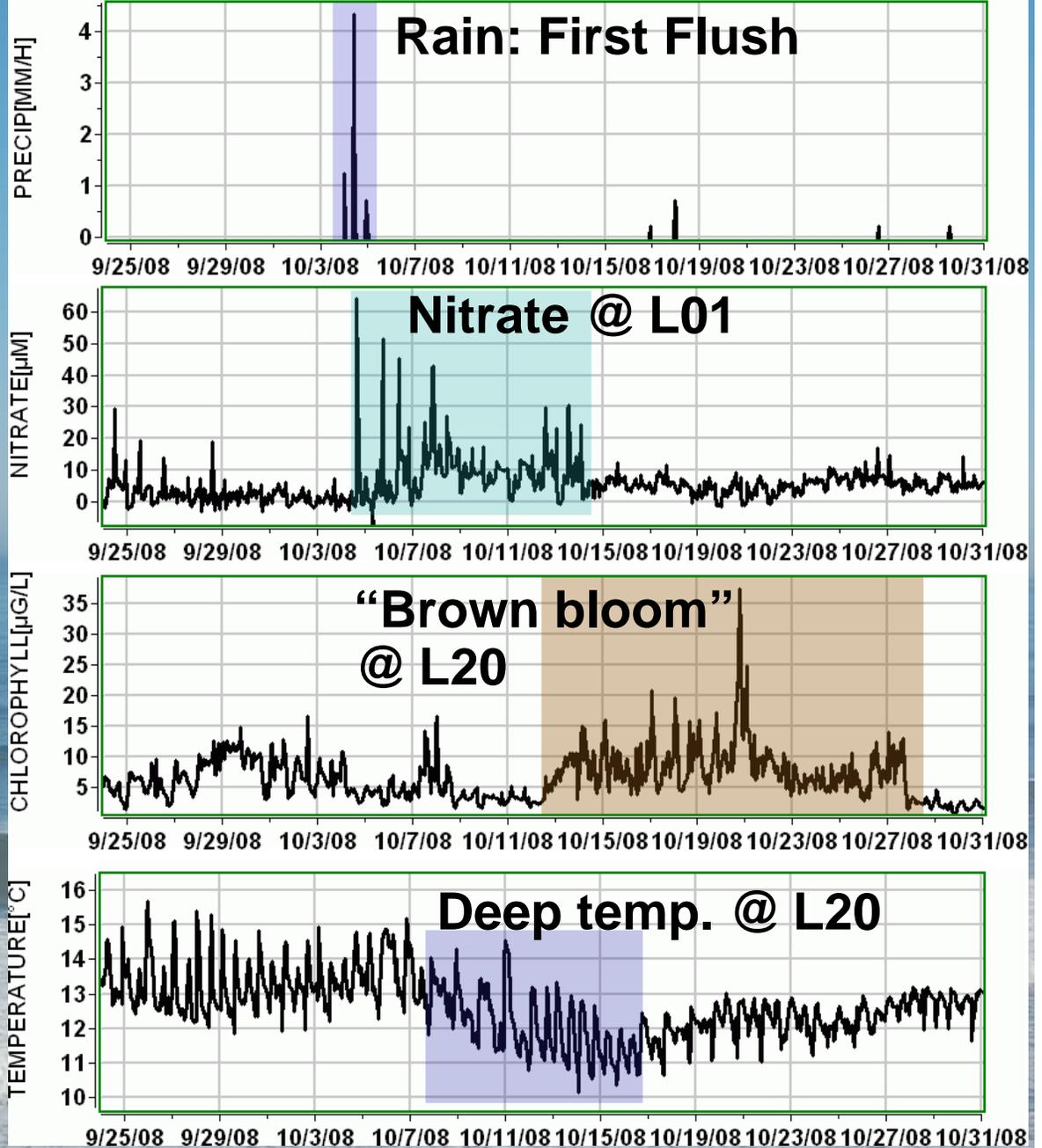
# Nutrients: land-sea exchange? oceanography?



LOBO: K. Johnson

MBARI / UCSC Collaboration

- Phytoplankton
- Nutrients



# Collaborative Ocean Observatory Portal

File Edit View History Bookmarks Tools Help

https://aosn.mbari.org/mb08/

Most Visited Getting Started Latest Headlines Google MB08 Yahoo!

CollOPort Monterey Bay 2008 Experiment (MB08 "Oktoberfest") My Account

Observatory: MB08 Welcome to the Monterey Bay 2008 Collaboration Portal Welcome John Ryan Log Out

Topic: 2008-10-20 Panes: 1 2 3 4 link to this page

Admin Summary Links Discuss Live Docs Contacts

Updated 2008-10-22 20:00:46.0 by John Ryan [Revise](#) [Previous](#)

 [MERIS Monterey Bay ESA.png](#) ([Edit Image](#)) ([Discuss New](#))

MERIS MCI (best index for "extreme blooms") indicates significant intensification / expansion of red tide along much of the coast. Thanks to Dave Foley (NOAA) for producing these images.  
Submitted 2008-10-21 10:43:30.0 by Joshua Doubleday

Hyperion data is available.  
\*.png are browse images.  
\*.tiff are geoTiffs.  
mci.png and flh.png have been normalized to try and heighten the contrast around the median values of the image  
~~flh.png and flh.tiff~~

Summary Links Discuss Live Docs Contacts

**2008-10-20 Summary**  
Updated 2008-10-20 10:44:30.0 by MB08 Administrator [Revise](#) [Previous](#)

We will have a group telecon today at 2pm PST to discuss the following:

- 1) summary of oceanographic & meteorological variability so far (observations + ROMS)
- 2) summary of bloom activity observed thus far (satellite & in situ)
- 3) updates from individual groups on results to date and plans for this week
- 4) prediction from ROMS for coming week
- 5) collaborative plans & opportunities

Phone Number: 818-354-3434  
Meeting ID: 62274

**Yearday 294 (October 20, 2008 GMT) Asset Data**

Summary Links Discuss Live Docs Contacts

**MB08 Links**  
Updated 2008-10-15 10:58:44.436 by Michael Godin [Revise](#) [Previous](#)

**ROMS Ocean Forecast**

- [JPL OurOcean MB08 page](#)

**MB08 Data**

- [MBARI Common format data \(requires username/password\)](#)

**COAMPS Atmospheric Forecast**

Done aosn.mbari.org

Godin / Bellingham

# CeNCOOS served as a conduit to the public

[www.cencoos.org](http://www.cencoos.org)



- Archives
- Latest News
- News Archives
- Other News Links
- IOOS Press Room
- NFRA Home

## Latest News & Events

### ALGAL BLOOMS IN CENTRAL AND NORTHERN CA

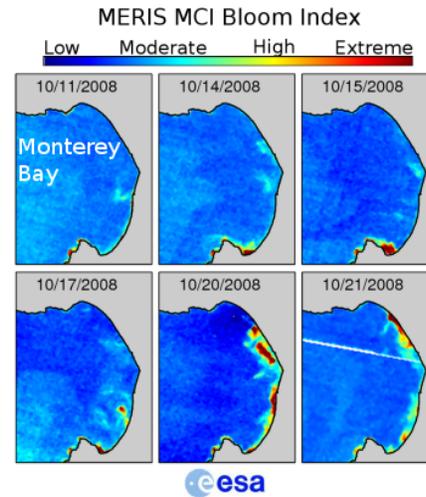


Image Courtesy of European Space Agency. Provided by NOAA CoastWatch

Maximum Chlorophyll Index (MCI) images of Monterey Bay from the Medium Resolution Imaging Spectrometer (MERIS) satellite instrument. "Extreme bloom" (red tide) conditions developed during October in the northern and southern bay. Researchers are studying the causes and consequences of this event, and other types of blooms that are not visible from the surface.



Image courtesy of UCSC researcher  
A photo taken from a ship on October 18th offshore of the Pajaro region (north-central Monterey Bay) showing potential signs of a red tide event.

### UPDATES AND CURRENT RESEARCH FOR FALL 2008

This Fall, 2008, CeNCOOS will make available scientific results or images about algal blooms as they become available. The blooms are composed of one or more species of phytoplankton. Some of these blooms become 'red tides', that appear brown to red in color and can be harmful or harmless to people and animals depending on the organisms making up the bloom. Other blooms are less visible but can still cause health problems. View a PDF fact sheet on harmful algal blooms (HABs) [here](#).

Signs of a developing algal bloom began appearing mid-October this year. Intense blooms have been detected by satellite and studied by researchers on the water. As seen in the satellite imagery provided (at left), last week, the strongest bloom (red area) was in the southern bay. This week a larger intense bloom developed in the northern bay. The extreme bloom patches evident in the images have been sampled by researchers and found to be dominated by *Akashiwo sanguinea*. This species did result in a harmful algal bloom in Monterey Bay in November 2007, but the extent of the bloom thus far has been smaller and no harmful effects have been reported. The CalPREMPT [Plankton Blog](#) is a weekly report on samples of plankton collected by a surface net at the Santa Cruz Wharf and analyzed by researchers. The sample this week indicates the presence of some plankton species known to cause blooms (notably *Akashiwo* spp. which resulted in the November 2007 bloom), but not in large concentrations. This indicates a bloom is not yet currently occurring at that location.

During October 2008, the Monterey Bay Aquarium Research Institute (MBARI) and other US, European, and Japanese partners institutions have been conducting oceanographic surveys as part of the "Monterey Bay 2008 Experiment" (MB08). An advanced observing and modeling system is in place, monitoring the pulse of Monterey Bay to understand the factors that drive the development of red tide and harmful algal blooms. This project is collecting data and creating maps of ocean currents, temperature, and salinity that will be compared with plankton samples and DNA monitoring results to study the ecology of red tide and harmful algal blooms (HABs). Using a variety of instruments including moorings, AUVs (autonomous underwater vehicles), and gliders, as well as satellite sensors turned specifically to Monterey Bay, the project will continue to follow developments throughout this Fall. View initial results and discussions from MB08 project [here](#). CeNCOOS will post scientific results and images about potential algal blooms, harmful or otherwise, as they become available. This intensive experiment in Monterey Bay involves specialists from many collaborating institutions at: MBARI, UC Santa Cruz, UC Davis, Cal Poly, Cal Tech, Scripps, Naval Postgraduate School, Moss Landing Marine Laboratories, Rutgers, NASA, & NOAA.

A significant harmful algal bloom (red tide) event occurred during November 2007 in Monterey Bay, that is believed to have caused large scale bird die-offs and respiratory problems in some local surfers. Understanding algal blooms such as that one and disseminating scientific information as it becomes available, is a high priority for CeNCOOS across our region. With the help of several Monterey Bay researchers and resource managers, CeNCOOS made significant progress toward understanding the factors that played a role in creating the large algal bloom in 2007 ([view our report](#)).

#### Sources of further information:

View the CIMT fact sheet on harmful algal blooms (HABs) [here](#).

## Santa Cruz Plankton Weekly Updates

A CaIPReEMPT project in partnership with CeNCOOS

### Week of February 2, 2009

at · Filed under [Weekly Phytoplankton Update](#)

Sample description by Jenny Lane

Sample date: **Wednesday, February 4, 2009**

#### Quick phyto report:

Pseudo-nitzschia spp.: Rare (< 1%), seriata class.

Alexandrium spp.: Rare (< 1%).

#### Full report:

Sampling time: 8:10am

Weather: Partly cloudy.

Water color: Very deep dark green.

Water conditions: Calm.

Water visibility: ~7'.

Water temp: 10.7C (int); 11.2C (0').

Tide: Falling (Low of -0.3ft at 12:45pm).

A WNW swell is building, with a storm on the way. Steamers had only occasional waves early this morning, but it looks like things have picked up since then. At 8am, NDBC buoy 46042 was registering 4.9ft WWHT (SwH: 4.6ft - WNW; WWH: 1.3ft - SW).

Shorebird activity was low (gulls). Sea lions were rafting in and around the sampling area. The stormdrain path through Cowell's is still open to the ocean. There were quarter-sized, thin spots of foam on the water surface in and around the sampling area.

The net drained quickly, with no detectable slime

#### Pages »

[About](#)

[Disclaimer](#)

#### About »

A CaIPReEMPT project in partnership with CeNCOOS

#### Links »

[CaIPReEMPT](#)

[CeNCOOS](#)

[Peter Miller Research](#)

[Phytoplankton Online Library](#)

[WordPress.org](#)

#### Search »

Search

#### Meta »

[Log in](#)

[Entries RSS](#)

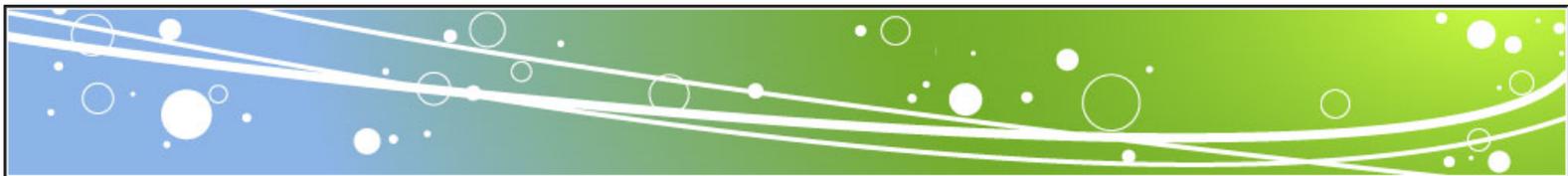
[Comments RSS](#)

#### Credits »

Get a free blog at [WordPress.com](#) |

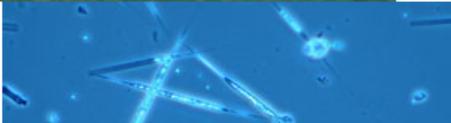
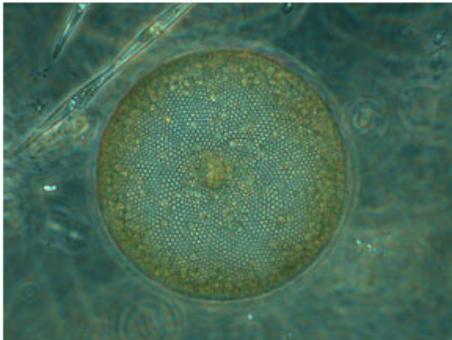
Theme: [Fjords](#) by Peterandrej

<http://cimt2007plankton.wordpress.com/>



## Phytoplankton Identification

Getting familiar with tiny drifters along the West Coast



[HOME](#) | [PHYTOPLANKTON](#) | [GLOSSARY](#)

Phytoplankton are the unsung heroes of our planet. They are primary producers forming the base of the oceanic food chain, serving as the first link in the conversion of sunlight and nutrients into biomass, eventually leading to everything from krill to whales. They are also responsible for much of the oxygen present in our atmosphere (up to 90%). Phyto comes from the greek word meaning 'plant' and plankton translates to 'drifter.' These tiny organisms are plants that drift throughout the world's oceans. Individually they are most often impossible to see with the naked eye, but when gathered together in masses, they can sometimes appear as large colored patches in the water - red, green, brown.

This online phytoplankton library was initially created to help

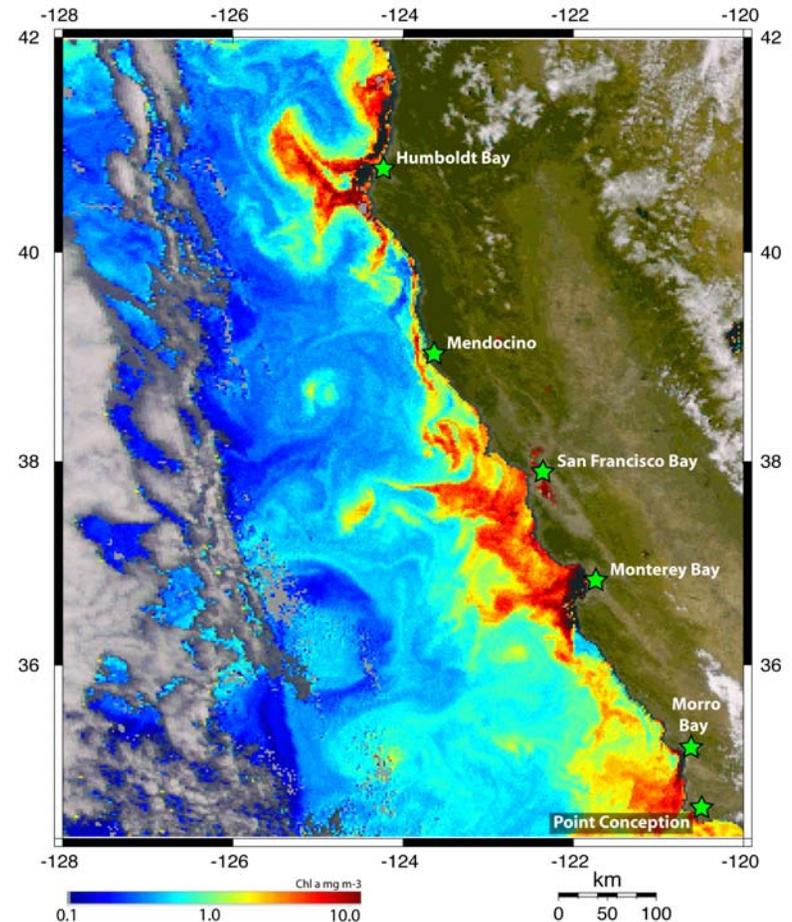
<http://cimt.ucsc.edu/habid/habhome.html>

# HABMAP Workshop

## August 2008

### 5 regional pier stations

- Morro Bay/San Luis Obispo
  - Mark Moline/CalPOLY
- Monterey Wharf
  - Jason Smith/ACT
- Santa Cruz Wharf
  - Raphe Kudela/UCSC
- Tiburon William
  - William Cochlan/SFSU/RTC
- Humboldt HSU



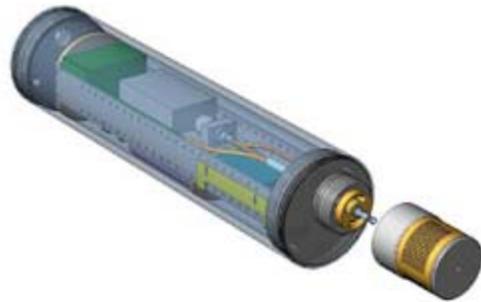
# HAB Pier Station Parameters

- Specimens for HAB taxonomy
  - *Pseudo-nitzschia* spp.
  - *Alexandrium* sp.
  - *Cochlodinium* spp.
  - *Lingulodinium polyedra*
  - *Prorocentrum* spp.
  - *Dinophysis* spp.
  - *Heterosigma* spp.
  - *Akashiwo sanguineum*
  - *Phaeocytis* sp.
- DA concentrations in plankton samples
- Primary inorganic nutrients: nitrate, nitrite, phosphate, silicate
- Extracted Chlorophyll concentrations in plankton samples
- Temperature
- Salinity
- Urea
- pH
- Dissolved Oxygen



# Prototype HAB Station

- Salinity
- Temperature
- Depth
- Flourescence
- Beam Transmission
- Urea and Ammonium
- Dissolved Oxygen
- Particle Size Dist.
- HAB organisms
- Indicator Pathogens
- Nutrients
- Chlorophyll



ISUS sensor with anti-fouling filter



LISST-100



Shown with optional cage, SBE 5P pump, & SBE 43 DO sensor



# Role of a Regional Association

- Adaptive Sampling
- Coordination
  - Combine HAB species and toxin detection with other WQ monitoring programs
  - Lead design of regional monitoring plan
- Data Aggregation and Management:
  - Compile numerical modeling, satellite imagery, shore stations, HF Radar data, in-situ technology to useable and accessible format.
  - Establish methods for data compliance with IOOS DIF
- Engage and Outreach
  - Determine users and information needs.
  - Develop methods to share information.
- Product Development



# Potential Contributions

## Bloom monitoring

(Shoreline surveillance of HABs and toxins)

## Bloom Tracking (space and time)

(Glider observations, buoy reconnaissance)

## 'Event Response' Sampling

(by region - very limited!)

## Regional Ocean Characterization

(Environmental forcing factors)

(Nutrient upwelling mapping, modeling)

## Product Development and Display

(Web-based dissemination of information)

## Pilot Studies

Land-sea experiments

Shellfish Monitoring

Shore Stations

Nutrient Sensors

Satellite Imagery

Surface Currents

COAMPS winds

ROMS Models

AUV technology

Historical Data

Species Identification

Seabird and Mammal  
Ecology

Statistical Modeling

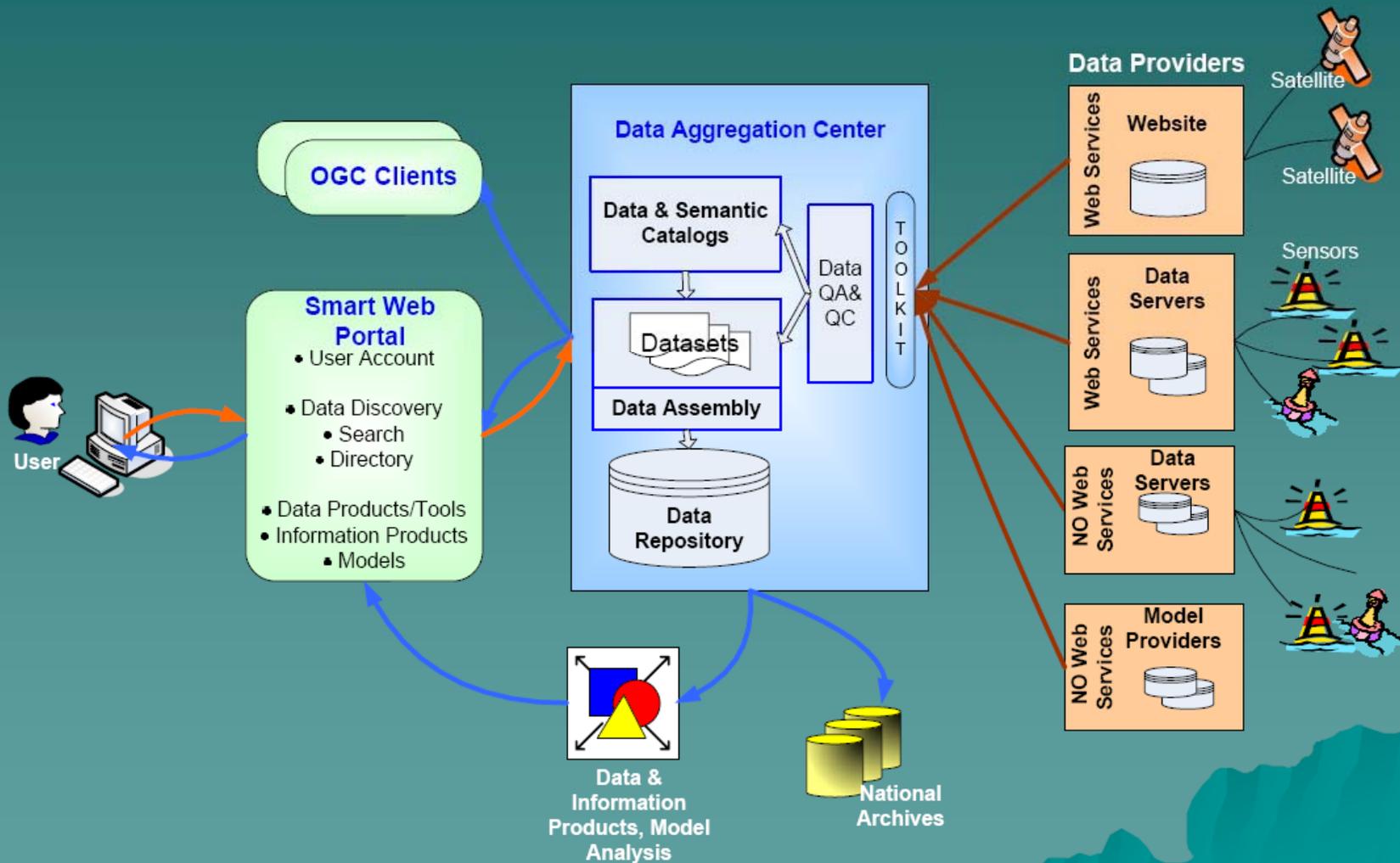
# Questions?

## Acknowledgements

Dave Caron  
Dave Jessup  
Raphe Kudela  
Gregg Langlois  
John Largier  
Melissa Miller  
Mark Moline  
Hannah Nevins  
Elizabeth Phillips  
Steve Ramp  
John Ryan  
Chris Scholin  
Paul Siri  
Jason Smith  
Steve Weisberg



# CeNCOOS Notional Architecture



# The Future

- Provide service for end users
- Data aggregation and clearinghouse
- Statistical Modeling of Historical Data
- High Resolution Upwelling Index
- Improved technologies and sensors for species identification and toxin levels
- Land-sea experiments
- Image processing

