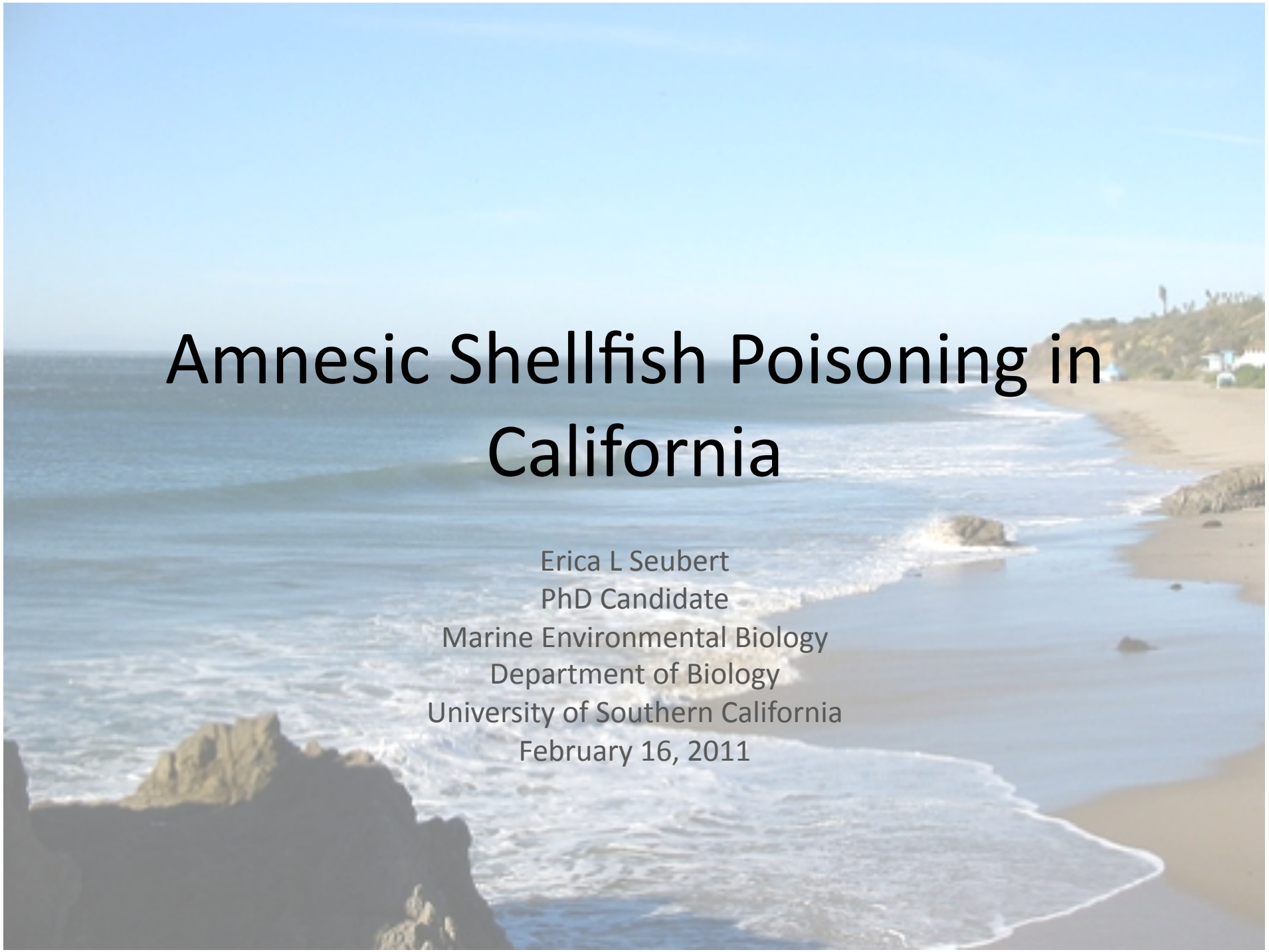

Amnesic Shellfish Poisoning in California

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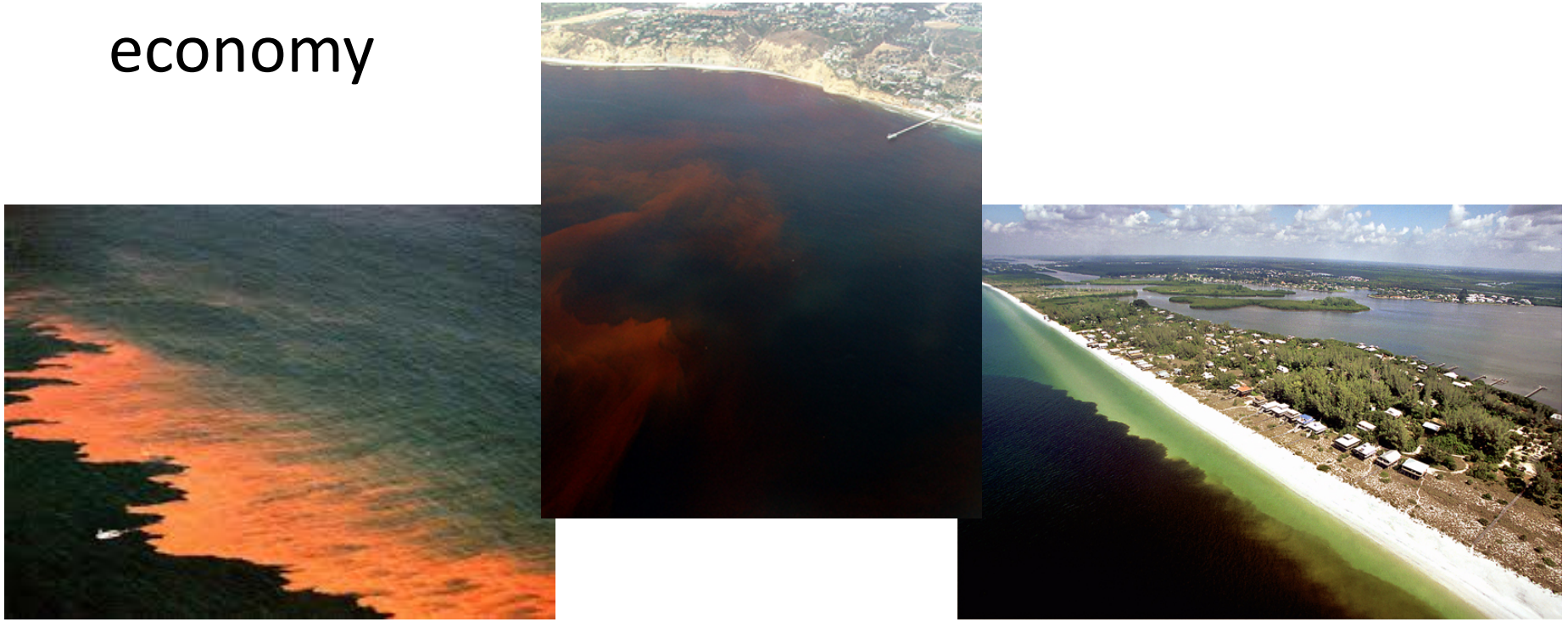
PhD Candidate
Marine Environmental Biology
Department of Biology
University of Southern California
February 16, 2011

Outline

- Define Harmful Algal Blooms (HABs)
  - Identify impacts to the ecosystem and the human population
- Review HABs common to California
- Amnesic Shellfish Poisoning
  - Description
  - Rate of Occurrence
  - Where it occurs
  - Prevention

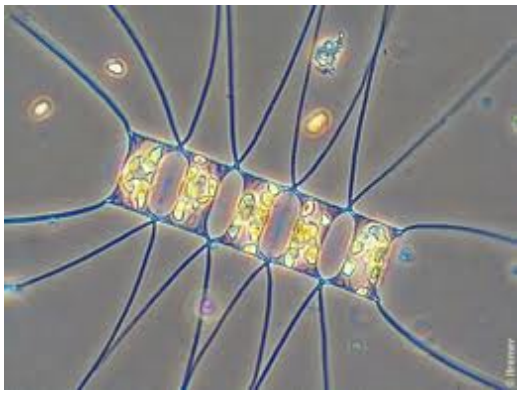
Harmful Algal Blooms (HABs)

- Any increase or accumulation in a population of phytoplankton in an aquatic system that has a harmful effect to the local ecosystem or economy



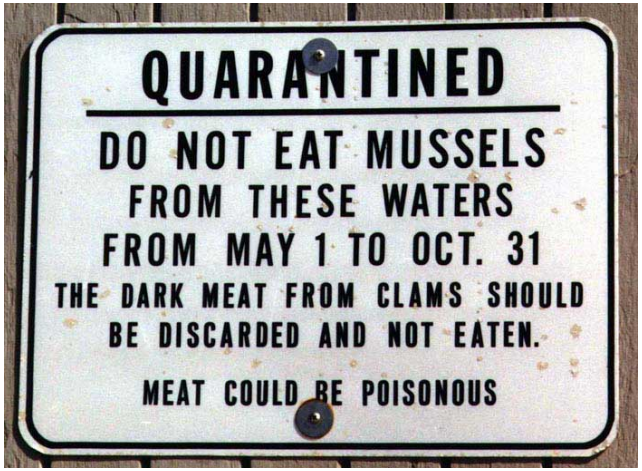
Ecosystem Effects

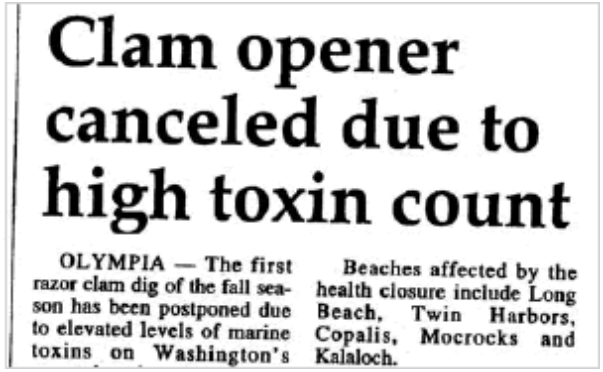
- Injury or death to local wildlife
  - Toxins
  - Decreased oxygen
  - Physical damage
  - Decreased light availability
  - Food web disturbance



Economic Effects

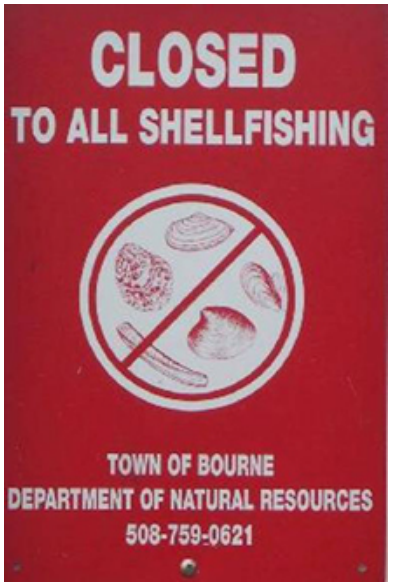
- Reduced Tourism
- Human illness
- Reduced Fishing Effort



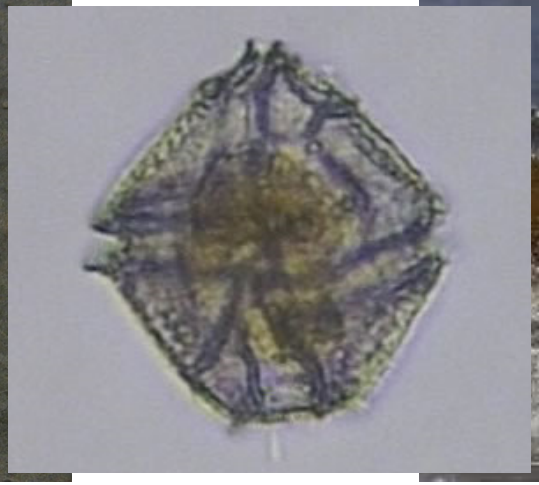


Clam opener canceled due to high toxin count

OLYMPIA — The first razor clam dig of the fall season has been postponed due to elevated levels of marine toxins on Washington's Beaches affected by the health closure include Long Beach, Twin Harbors, Copalis, Mocrocks and Kalaloch.



HABs in Southern California



HABs in Southern California

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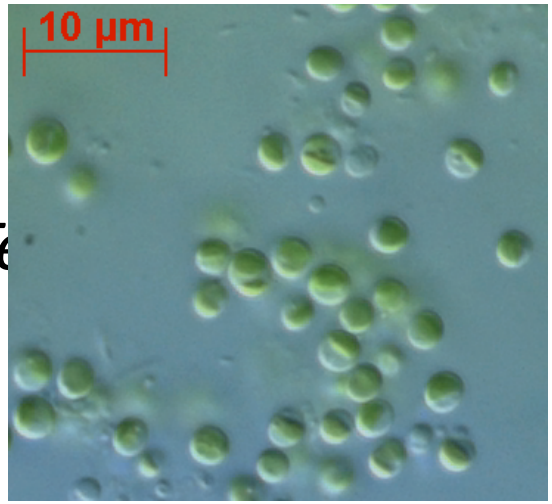
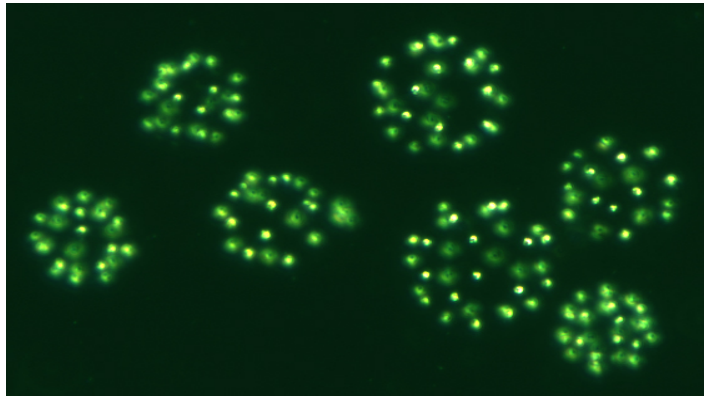
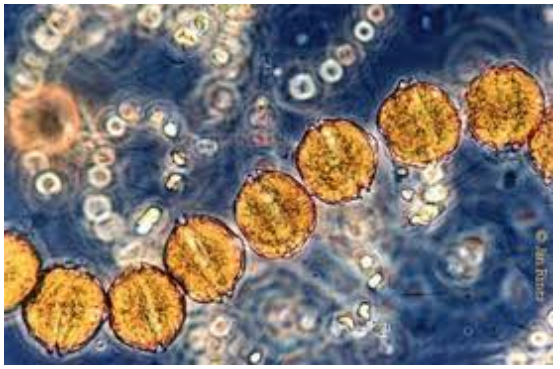




Toxic HABs

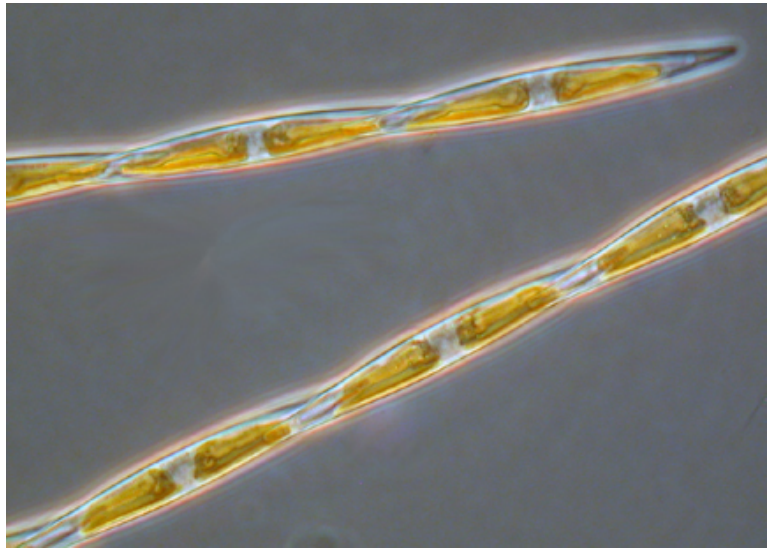


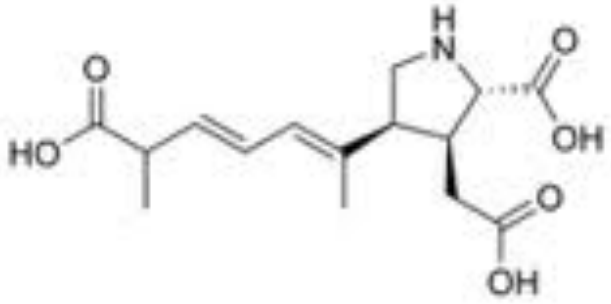
- *Alexandrium catenella*
  - Dinoflagellate
  - Produces the neurotoxin Saxitoxin
  - Regular issue in the Pacific Northwest

- *Pseudo-nitzschia* spp.
  - Regular issue in spring for Southern California

Pseudo-nitzschia spp.

- Chain forming diatom
  - Common member of the phytoplankton community in Southern California
- Produces the neurotoxin domoic acid
- Causes **Amnesic Shellfish Poisoning** in humans





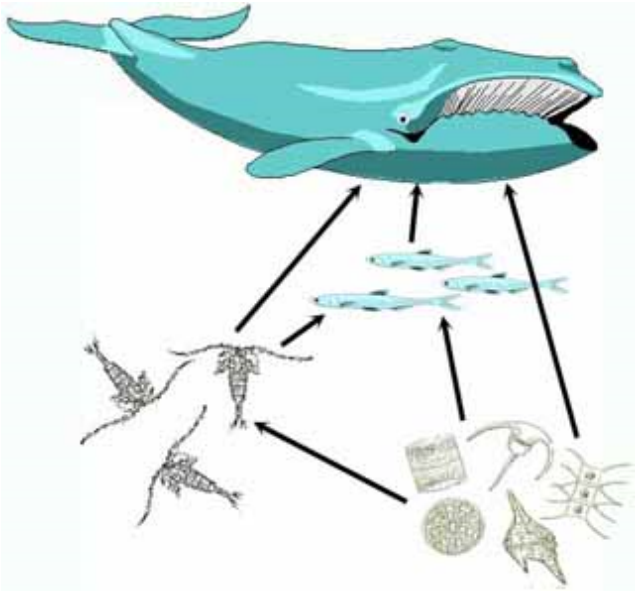
Amensic Shellfish Poisoning (ASP)

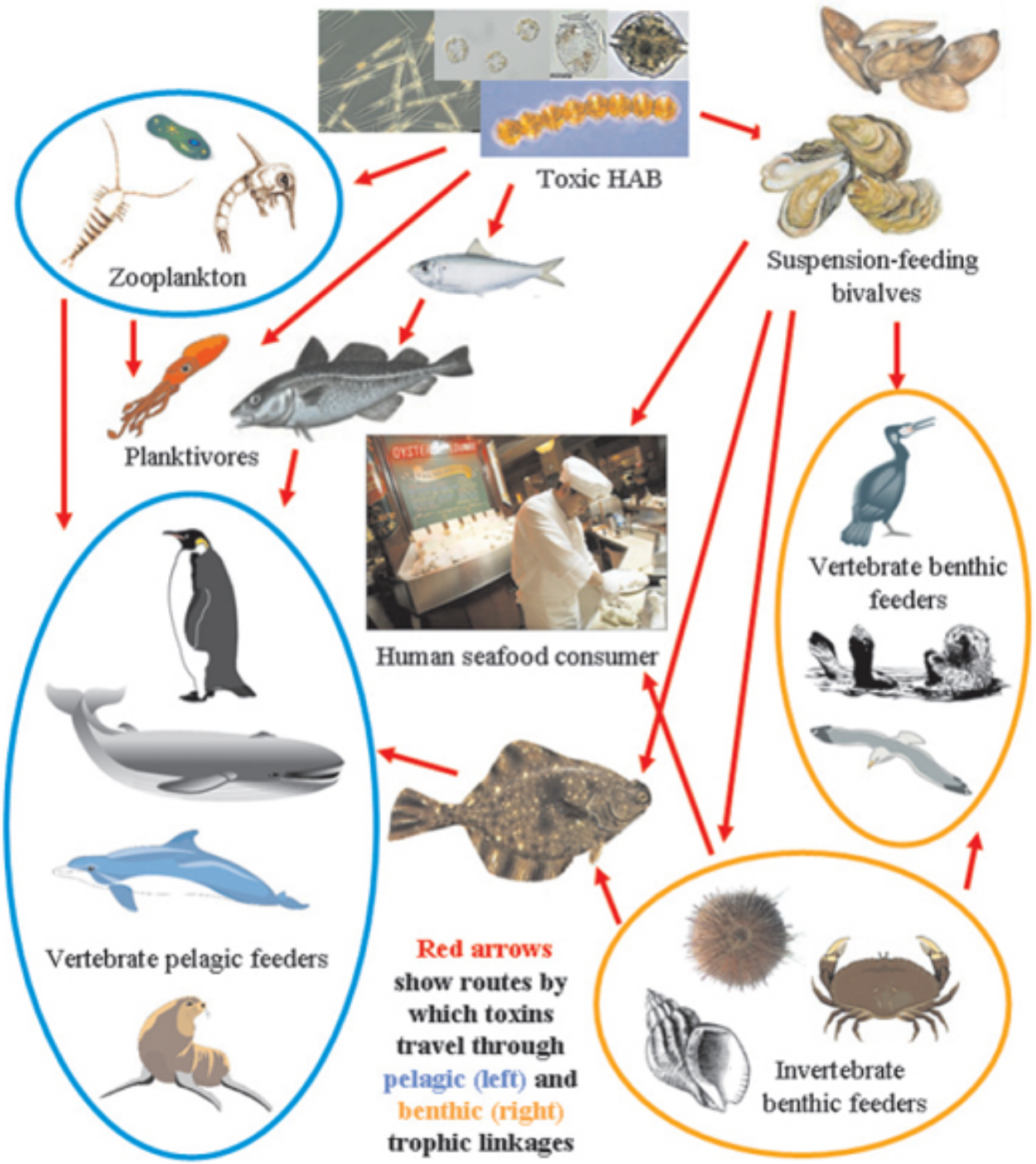
- Symptoms in humans
  - Nausea, vomiting, abdominal cramps, headache, dizziness, confusion, disorientation, short term memory loss, motor weakness, seizures, cardiac arrhythmia, coma, rarely death.

- **How???**
  - **Toxin exposure, mode of action…**

Bioaccumulation

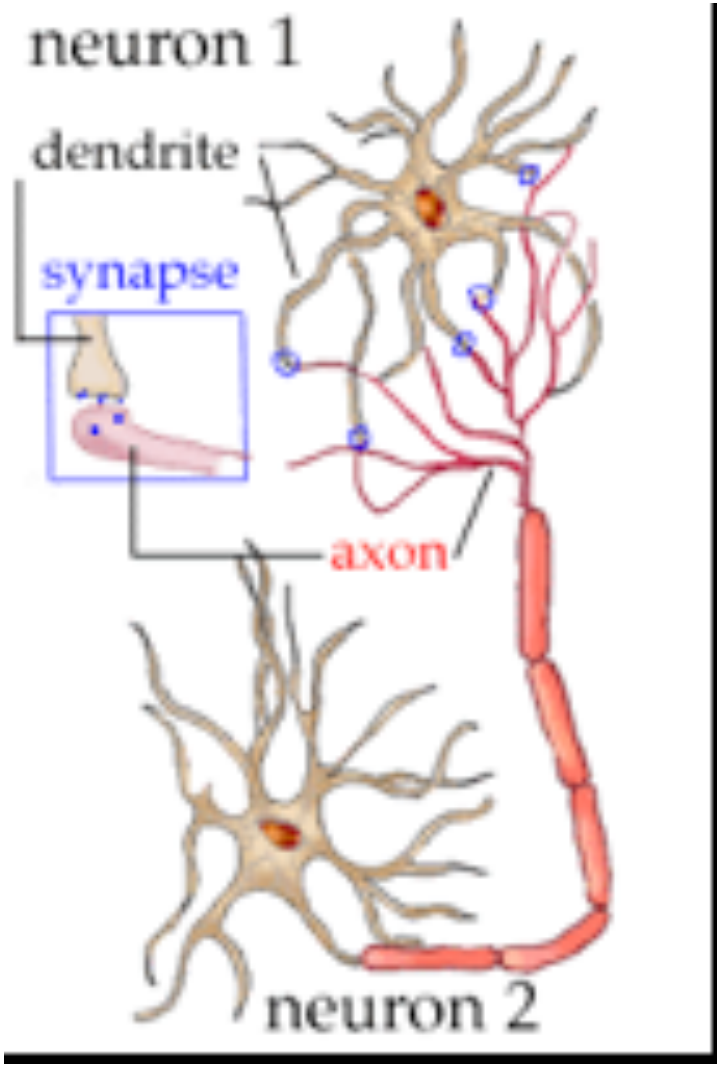
- Individual *Pseudo-nitzschia* cells do not contain enough domoic acid to sicken humans
  - Consumers of *Pseudo-nitzschia* (Zooplankton, Planktivorous fish, shellfish) eat many cells at once, concentrating domoic acid in their tissues



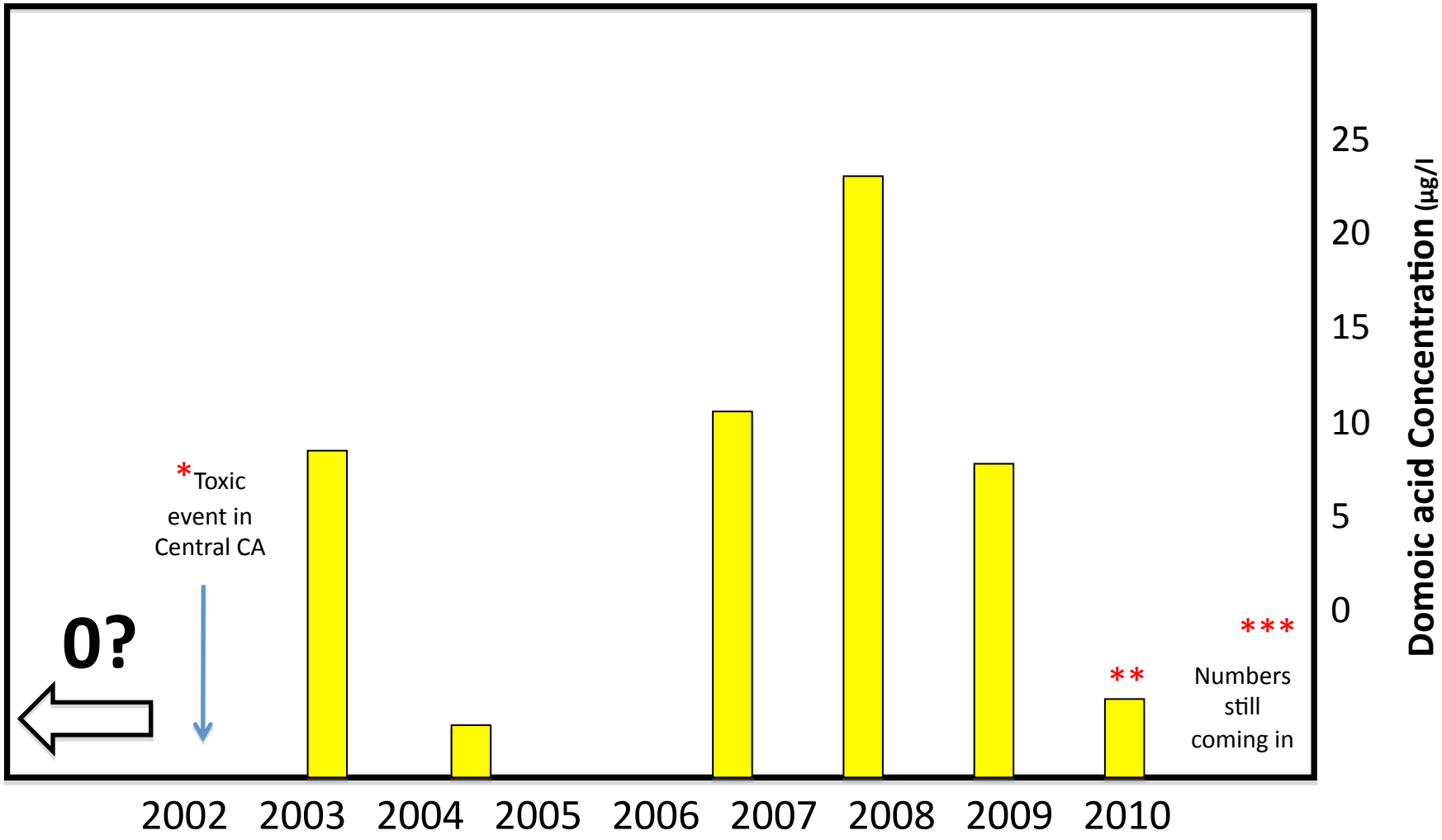

Toxic HAB
Zooplankton
Suspension-feeding bivalves
Planktivores
Human seafood consumer
Vertebrate benthic feeders
Vertebrate pelagic feeders
Invertebrate benthic feeders
Red arrows show routes by which toxins travel through pelagic (left) and benthic (right) trophic linkages

Mode of Action

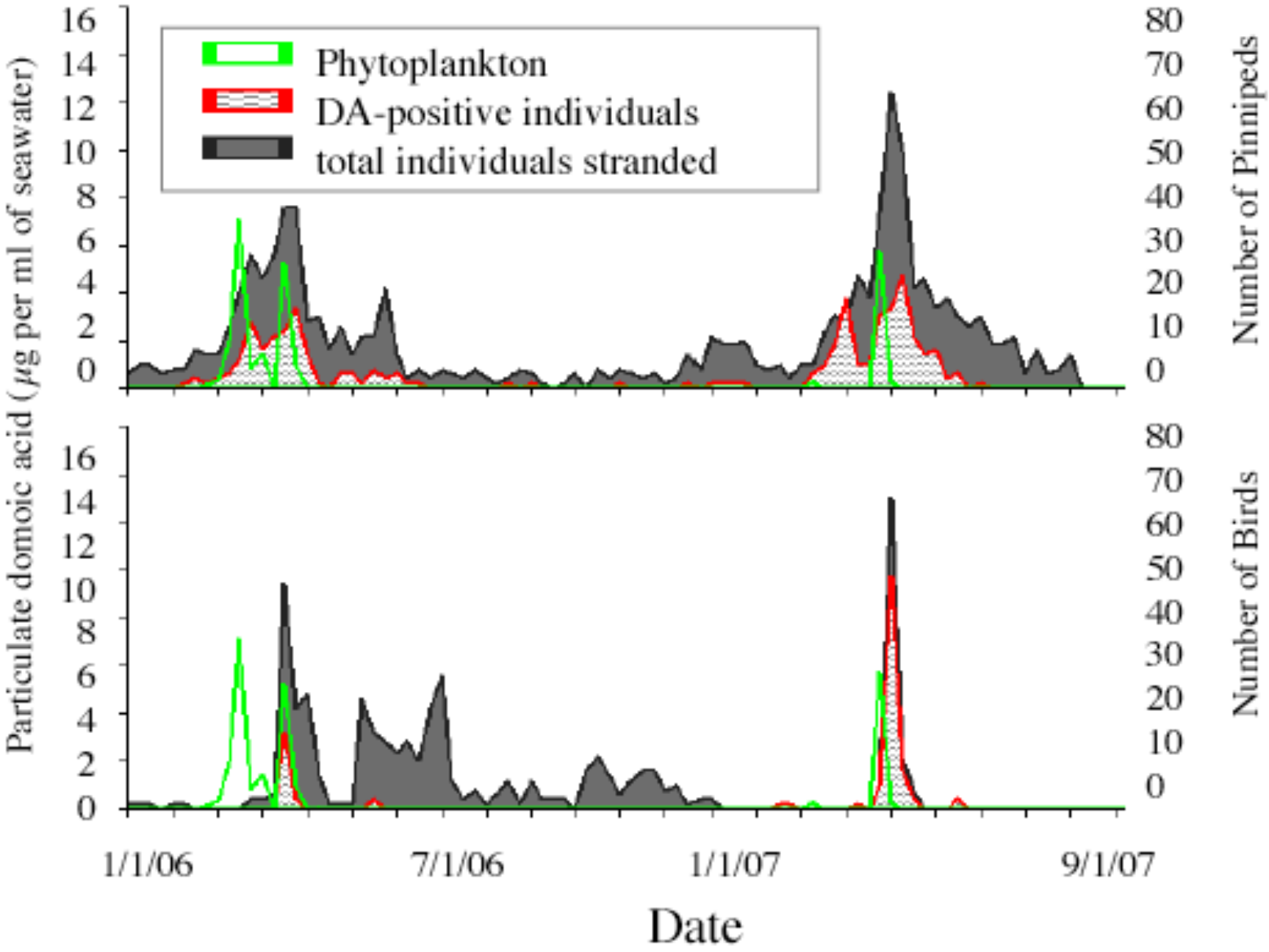
- Domoic acid mimics glutamate (a neurotransmitter) in our hippocampus
  - Floods the neurons with Ca+
  - Can cause permanent damage



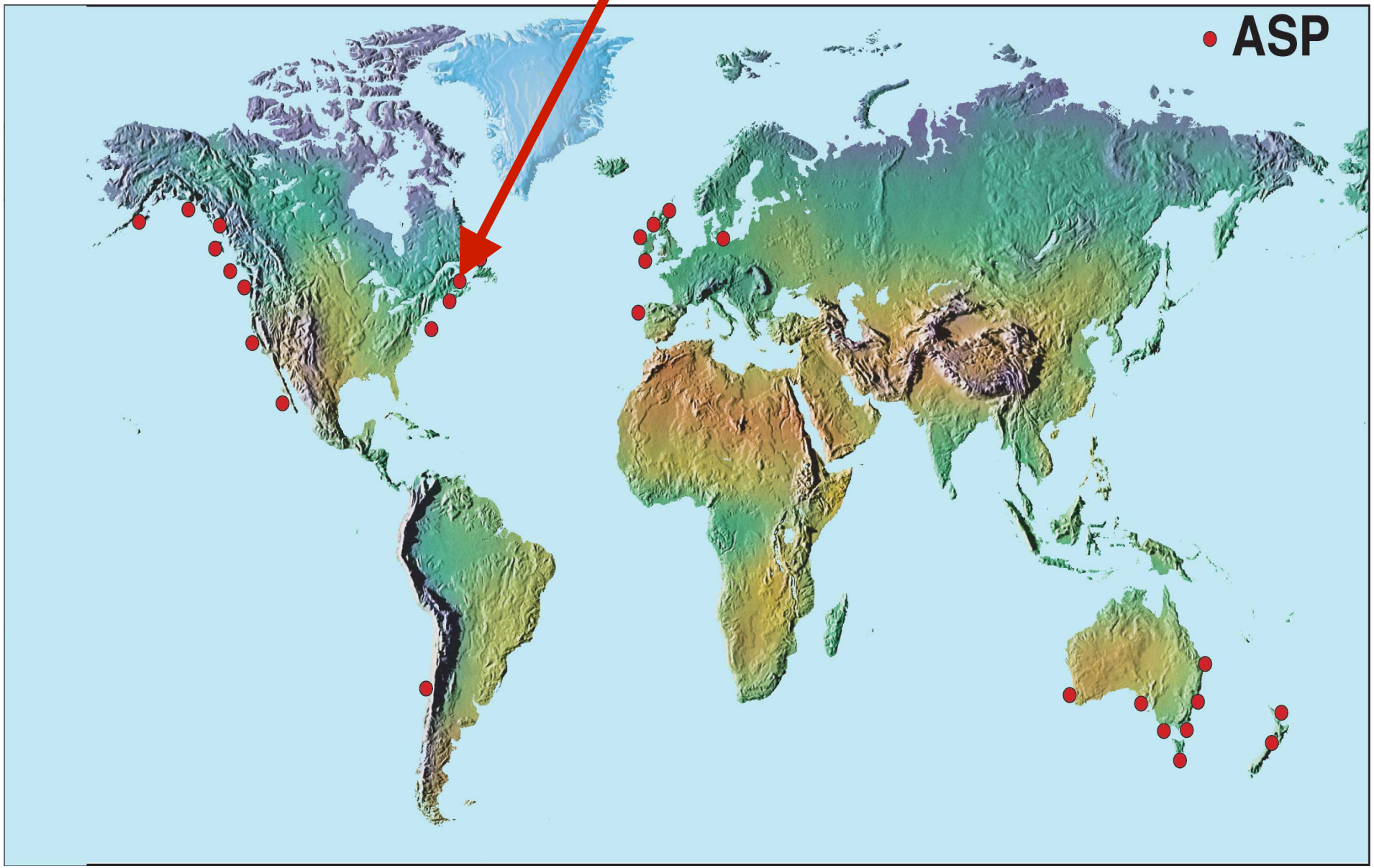
Maximal values of domoic acid in the region of the San Pedro – Long Beach shelf



In Harms Way – Marine Mammals, Birds in Southern California


Phytoplankton
DA-positive individuals
total individuals stranded
Particulate domoic acid (μg per ml of seawater)
Number of Pinnipeds
Number of Birds
0
2
4
6
8
10
12
14
16
0
10
20
30
40
50
60
70
80
1/1/06
7/1/06
1/1/07
9/1/07
Date

1987 – 1st Documented outbreak of ASP in Prince Edward Island, Canada
3 people died and 107 people were sickened



(http://www.whoi.edu/science/B/redtide/HABdistribution/ASP_worldmap_color_2006.jpg)

Monitoring of Domoic Acid by CADPH

- Volunteer based monitoring along the CA coastline
  - Monitor presence of toxic species

ton Map - Mozilla Firefox

istory Bookmarks Tools Help

http://www.cdph.ca.gov/HealthInfo/environhealth/water/Pages/Toxmap.aspx

screen shot

OBB Personal Puppies Recipes Restaurants Shopping Spas/Yoga Travel USC CINAPS - Home Harmful Algal Bloom ...

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id - Google Search | Phytoplankton - Wikipedia, the fre... | Phytoplankton Monitoring Program | **Toxic Phytoplankton Map** | Screenshot - Wikipedia, the free en...

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Conditions

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es Directory

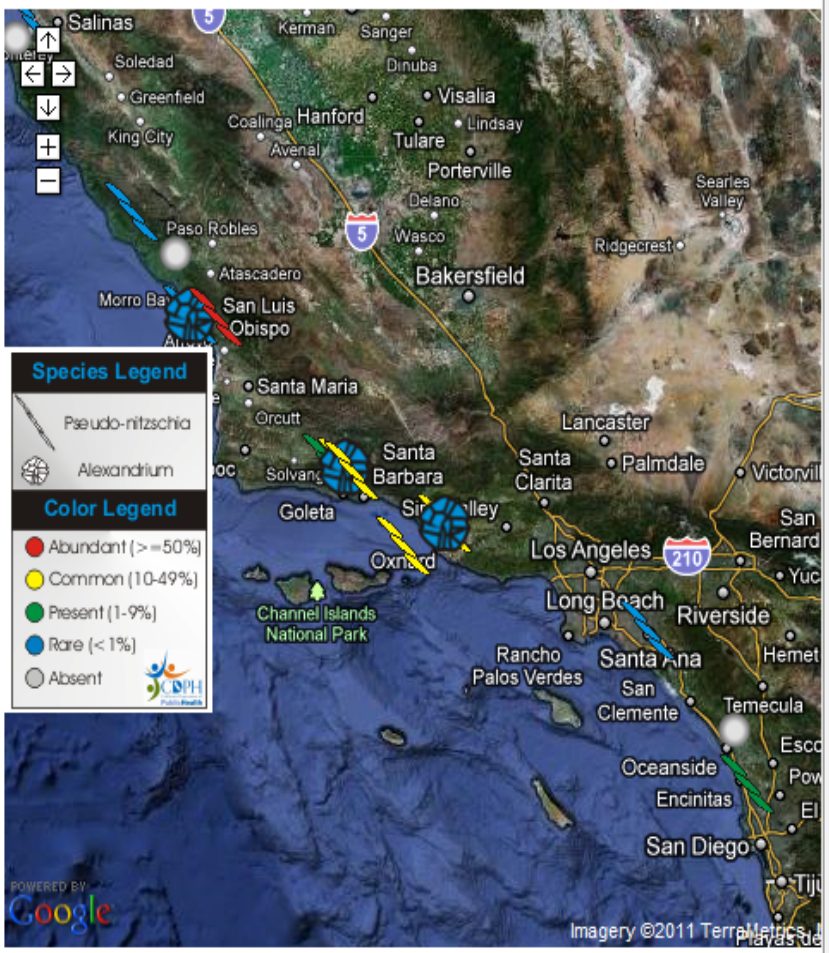
The CDPH Marine Biotoxin Monitoring Program coordinates a volunteer-based monitoring program for toxic phytoplankton along the entire California coastline. A small number of the hundreds of phytoplankton species present in our coastal waters produce toxins that can be fatal to humans and other mammals when concentrated by bivalve shellfish such as mussels, oysters, clams, and scallops. This volunteer-based effort is one of several elements of CDPH's effort to protect the public from these neurotoxins.

The map on this page provides a summary of observations for two of our toxin-producers: *Alexandrium*, a dinoflagellate responsible for the paralytic shellfish poisoning (PSP) toxins, and *Pseudo-nitzschia*, a diatom responsible for domoic acid, which can cause amnesic shellfish poisoning (ASP).

Disclaimer: *the data provided here are informational and qualitative and are not intended to provide guidance to those wishing to sportharvest shellfish. Sport collectors should always contact the CDPH Biotoxin Information Line at 800-553-4133 for information on current shellfish quarantines and health advisories.*

Acknowledgement: *map layers were created using GPS Visualizer.*

January 2011 Week 4



m mt0.google.com...

- Pier Monitoring by SCCOOS
  - Collect comparable data from 6 regional stations in the Southern California
  - Provide timely updates on Harmful Algal Bloom events
  - Aids in the understanding of the timing, extent and impact of HAB events on humans as well as on the ecosystem

SCCOOS

SOUTHERN CALIFORNIA COASTAL OCEAN OBSERVING SYSTEM

Harmful Algal Blooms - Mozilla Firefox

File Edit View History Bookmarks Tools Help

http://www.sccoos.org/data/chlorophyll/index.php

Dance Home Knitting Other Puppy Restaurants Shopping Travel USC Wedding Bank of America | Ho... Harmful Algal Blooms Harm

Harmful Algal Blooms

ABOUT DATA, PRODUCTS and MODELING PROJECTS CLASSROOM INTERACTIVE USERS HOME

Southern California Regions

Morro Bay
Santa Barbara Channel
Ventura County
Los Angeles
South Channel Islands
Orange County
North San Diego
San Diego / Mexico

Available Products

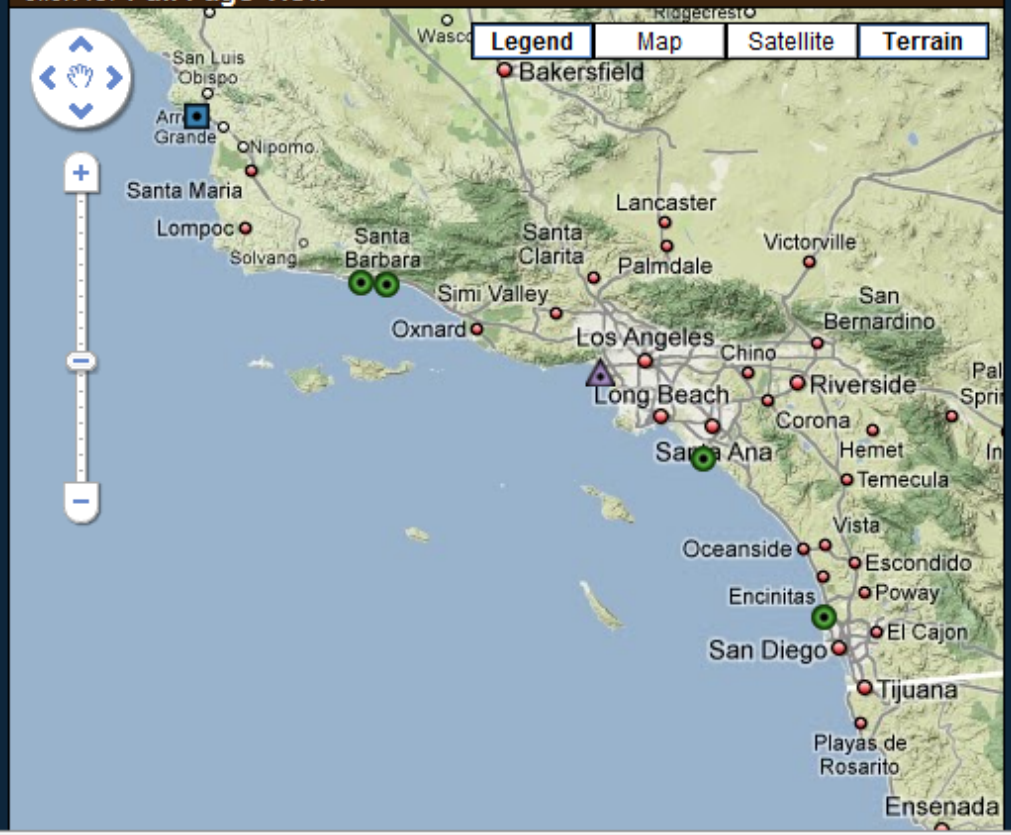
Automated Shore Stations
Bathymetry
Harmful Algae & Red Tides
Manual Shore Stations
Meteorological Observations
Moorings
Plume Tracking
Ports & Harbors
ROMS Model Output
Satellite Imagery
Ship Tracking (AIS)
Ships & Gliders
Shoreline Water Quality
Surface Current Mapping
Wave Conditions (CDIP)
Winds & Rainfall Forecasts

Harmful Algae & Red Tide Regional Map

Map View About HAB News What Are HABs? HAB Species

Follow the links above to learn more about harmful algal blooms (HABs), HAB species, and collection procedures. Click a station on the map below to view data on potential harmful algal species and water conditions at regional stations.

click for **Full Page View**



LEGEND

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

SITES
Cal Poly Pier
Goleta Pier
Stearns Wharf
Santa Monica Pier
Newport Pier
Scripps Pier

Done

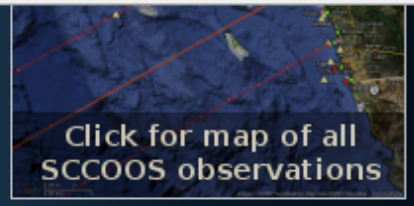
Harmful Algal Bloom Data - Mozilla Firefox

File Edit View History Bookmarks Tools Help

http://www.sccoos.org/data/chlorophyll/history.php?location=Newport Pier

Dance Home Knitting Other Puppy Restaurants Shopping Travel USC Wedding Bank of America | Ho... Harmful Algal Blooms Harm

Harmful Algal Blooms | Harmful Algal Bloom Data



Southern California Regions

Morro Bay
Santa Barbara Channel
Ventura County
Los Angeles
South Channel Islands
Orange County
North San Diego
San Diego / Mexico

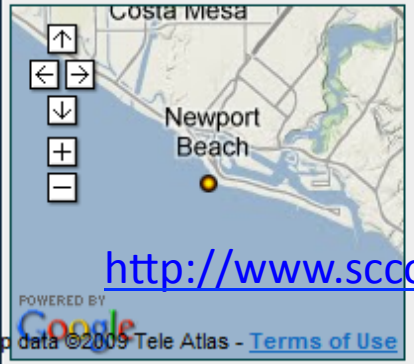
Available Products

Automated Shore Stations
Bathymetry
Harmful Algae & Red Tides
Manual Shore Stations
Meteorological Observations
Moorings
Plume Tracking
Ports & Harbors
ROMS Model Output
Satellite Imagery
Ship Tracking (AIS)
Ships & Gliders
Shoreline Water Quality
Surface Current Mapping
Wave Conditions (CDIP)
Winds & Rainfall Forecasts

Grab Raw Data

NEWPORT PIER

Cal Poly Pier Goleta Pier Stearns Wharf Santa Monica Pier Newport Pier Scripps Pier

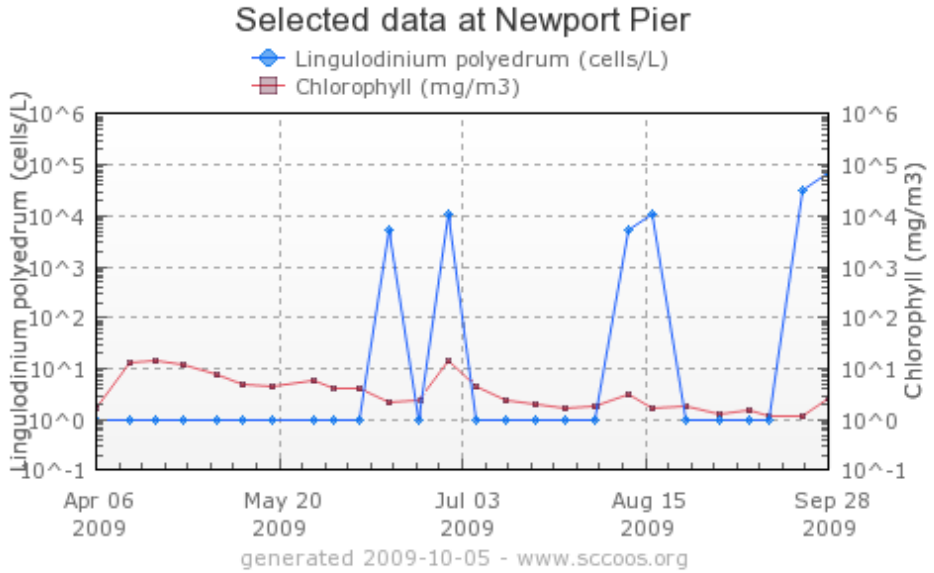


Location: 33° 36.37' N,117° 55.87' W
Provider / PI: USC / Dave Caron

http://www.sccoos.org/data/chlorophyll/history.php?location=Newport%

Click here to download complete data history

Select variables to plot: Lingulodinium polyedrum | Chlorophyll | plot



note: cell counts, chlorophyll, and nutrient concentrations are plotted on a logarithmic scale.

Done

Conclusions

- HABs can cause visible changes in water color, but water color changes does not mean presence of toxin
- Careful monitoring of the phytoplankton community in a given area can ensure health and safety of seafood supply
- ANY QUESTIONS?