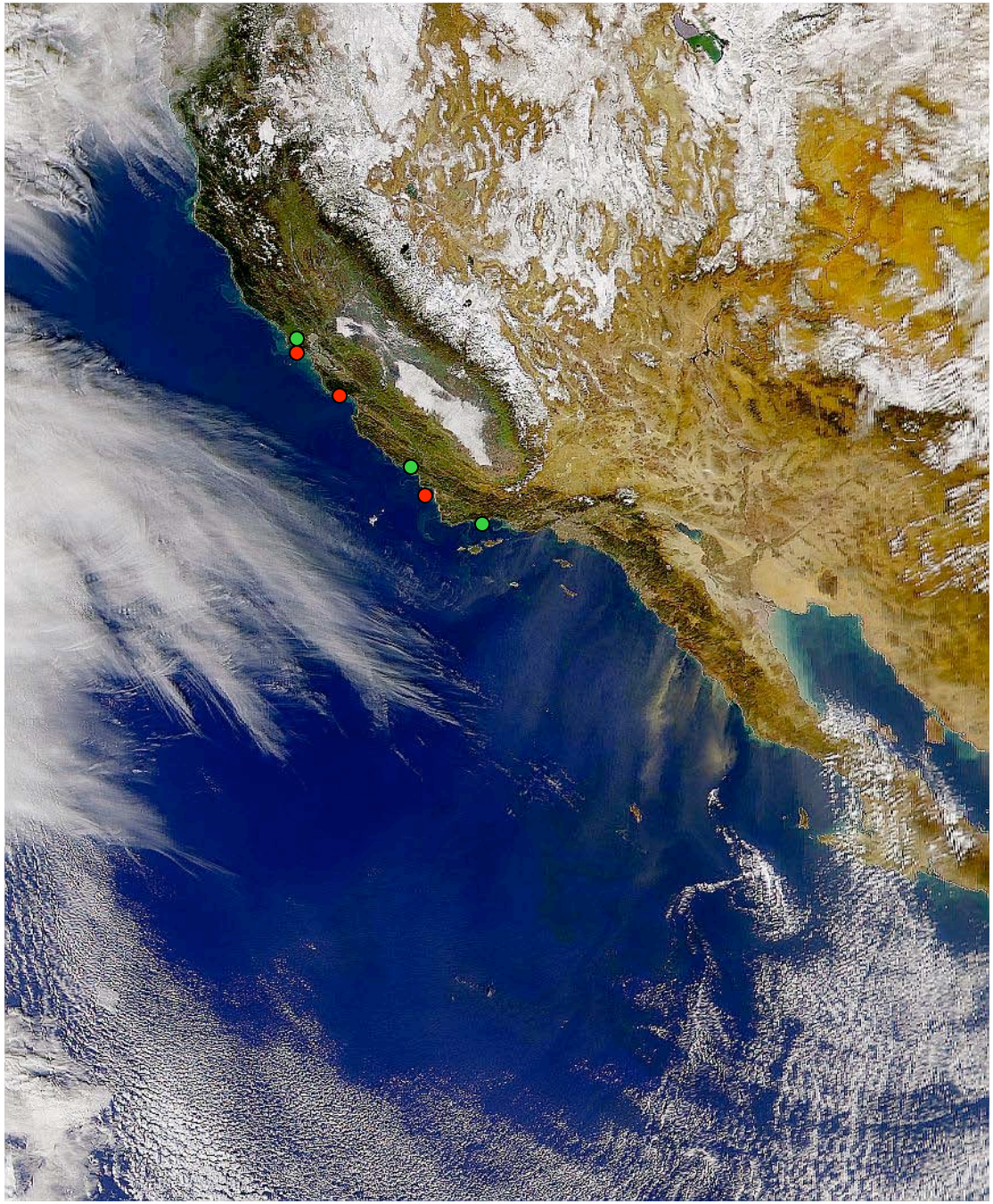


# California HABs, Monitoring, Research

*With Thanks to:*

Dave Caron

Frances Gulland

Gregg Langlois

Debbie McGuire

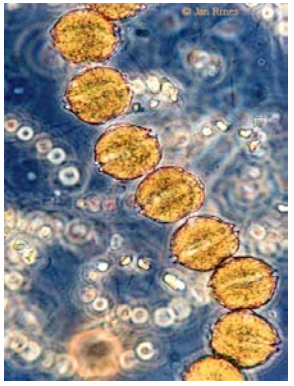
Chris Scholin

HABMAP

# The Rogue's Gallery-- Regulated

***Alexandrium catenella***

- Dinoflagellate
- causes Paralytic Shellfish Poisoning



***Pseudo-nitzschia spp.***

- Cosmopolitan
- Causes Amnesic Shellfish Poisoning

***Microcystis (blue-green algae)***

- Previously a freshwater problem
- Recently monitored in coastal waters

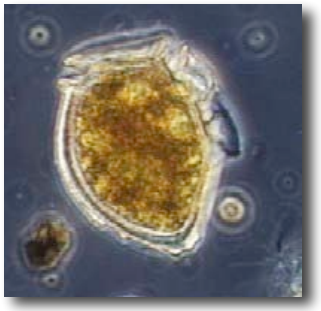
# The Rogue's Gallery-- Not Regulated

***Heterosigma akashiwo***

- Raphidophyte
- Found in embayments and in aquaculture


***Dinophysis***

- recently identified in California
- causes diarrhetic shellfish poisoning



***Lingulodinium polyedrum***

- Red Tide forming dinoflagellate
- Previously thought to be "harmless"

# The Rogue's Gallery- Emerging

*Red Tide producers

***Cochlodinium fulvescens****

- Fish/shellfish killer

***Lingulodinium polyedrum** **

- Produces yessotoxin (Howard 2006, 2007)

***Akashiwo sanguinea** **

- "Harmless" red tide (produces peroxides?)

***Dinophysis spp.***

- Diarrhetic Shellfish Poisoning

***Ceratium spp.** **

- Generally harmless

***Heterosigma akashiwo***

- Bays and estuaries—causes fish kills

# Discovery of Saxitoxin

- 1927, contamination of mussels in San Francisco
- 102 illnesses and 6 deaths
- *Alexandrium* determined to be responsible
- Regulatory limit established as 80µg/100g of tissue
- Lethal (human) dose is 1-4 mg toxin

San Francisco Examiner

Monarch of the Dailies

SATURDAY — SAN FRANCISCO, JULY 16, 1927

MUSSELS KILL MAN, INFANT, MAKE FIVE ILL

Two Families Stricken After Eating Meal of Shellfish Gathered Near Half Moon Bay

Most Favored of Fete

MISS ELITA PARRAGA, San Francisco educated Guatemalan maid, who has returned here after being elected queen of beauty at recent Guatemala celebration.

LATIN BEAUTY QUEEN ARRIVES

SUNSET BORE TROLLEY LINE FUND URGED

$116,000 for Track and Power Supply Recommended by Supervisors' Finance Body

Missing Mate Sought by Wife

Ye Town Gossip

# HAB Timeline

1987: Domoic Acid first identified, but linked to previous events

1991: DA discovered in Monterey Bay, Major bird mortality event

1995: L. polyedrum Red Tide (extending from Baja to Monterey, CA)

1998: P-n bloom along much of the US West Coast
Severe bird and marine mammal mortality

2002: More than 5
Seizures in S

2000: Highest recorded DA values ir
Relatively few impacts on higher t

200


1987 1990 1992 1994 1996 1998 2000

2002: More than 500 sea lion, 20 dolphin
Seizures in Southern California

2006: Pelicans poisoned in Southern California;
Linked to contaminated shellfish

AP Photo/Krista Niles

2007: Highest ever recorded DA in shellfish, Santa Barbara; DA poisoning from Los Angeles to Monterey

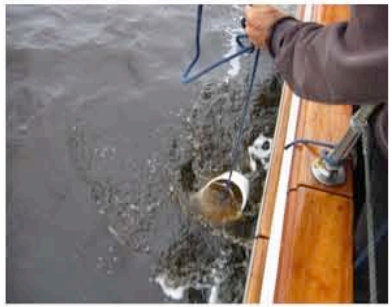
; much of the US West Coast
narine mammal mortality

1998 2000 2002 2004 2006 2008

Highest recorded DA values in Monterey Bay
latively few impacts on higher trophic levels

2003: Pseudo-nitzschia bloom in Santa Barbara,
Massive DA concentrations

2006: Massive red tides in Monterey--shift to "Age of Dinoflagellates?"



# California HAB events

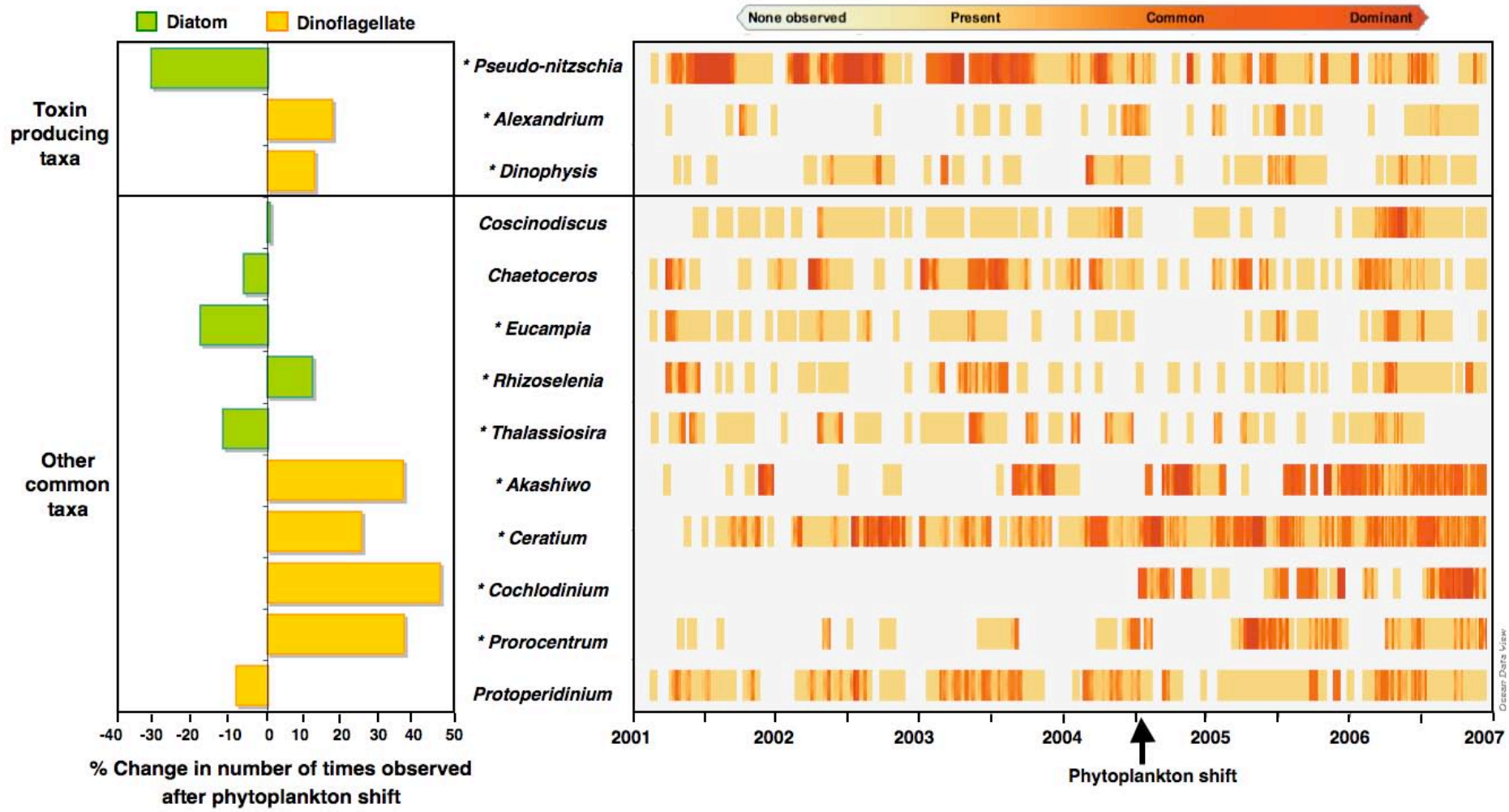
- 2002--first evidence for shift to Southern California
- more than 500 sealion, 31 dolphin seizures in Southern California
- 2003: Pseudo-nitzschia bloom in Santa Barbara Channel exceeded 30 µg/L chl, massive DA concentrations

AP Photo/Krista Niles

***Toxic Algae Poisoning Los Angeles Pelicans***

**LOS ANGELES Apr 13, 2006 (AP)** Pelicans are falling ill and dying from the same toxic algae bloom that is sickening sea lions and making shellfish unsafe for human consumption, wildlife rescuers said.

# Are HAB events more common?




Source: R. Jester, G. Langlois, M. Silver

# Are they related to humans?

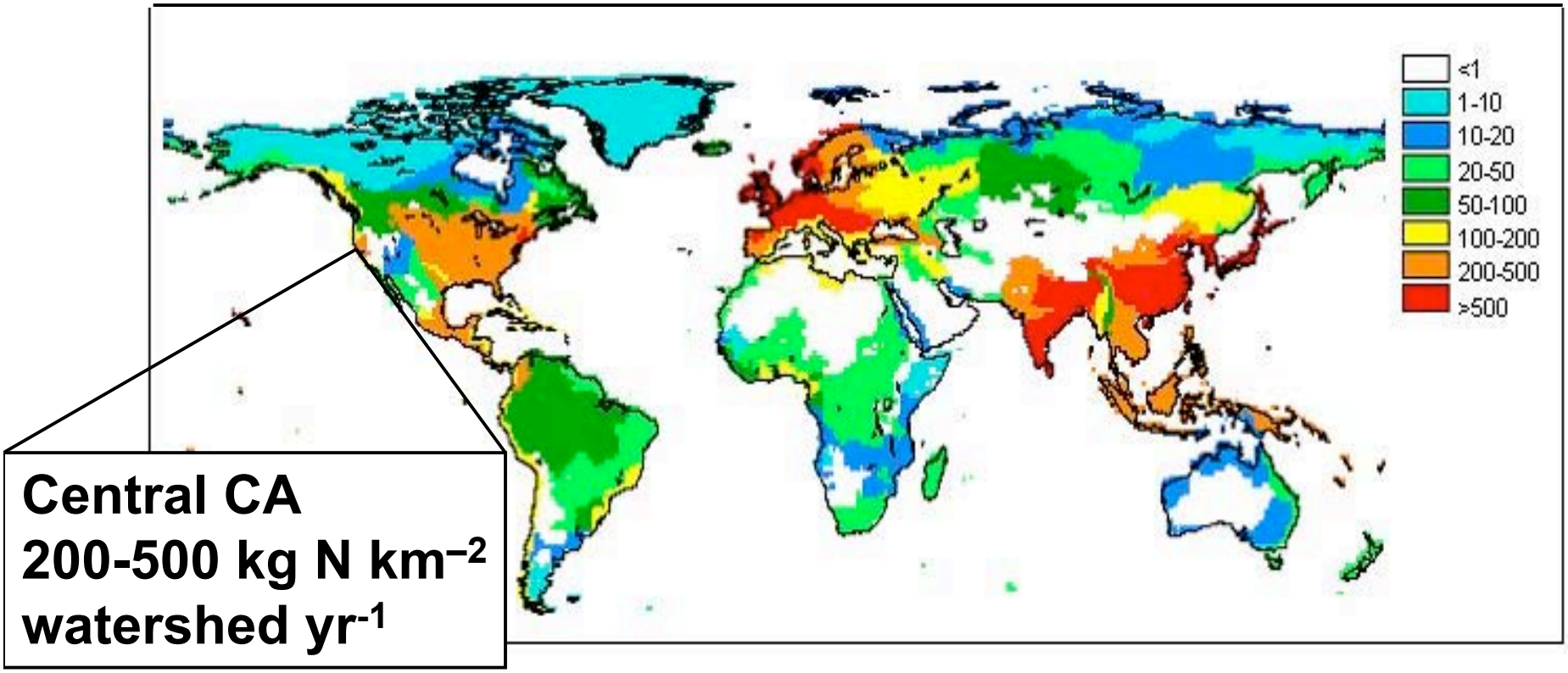
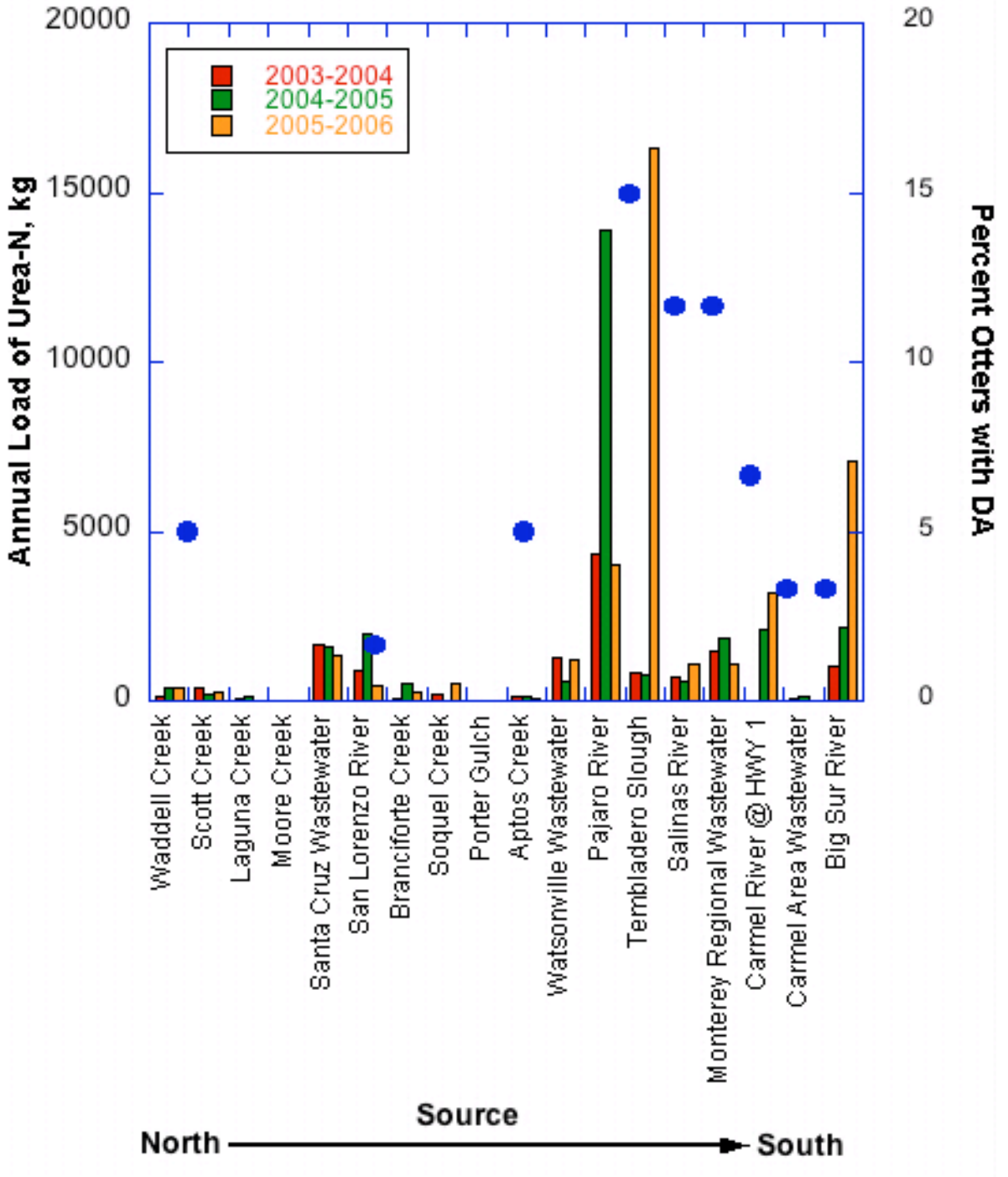



Figure courtesy of Dr. Patricia Glibert, adapted from Seitzinger & Kroeze, 1998 and Glibert & Burkholder, 2006.

About 50% of stranded California Sea Otters show signs of Domoic Acid Intoxication

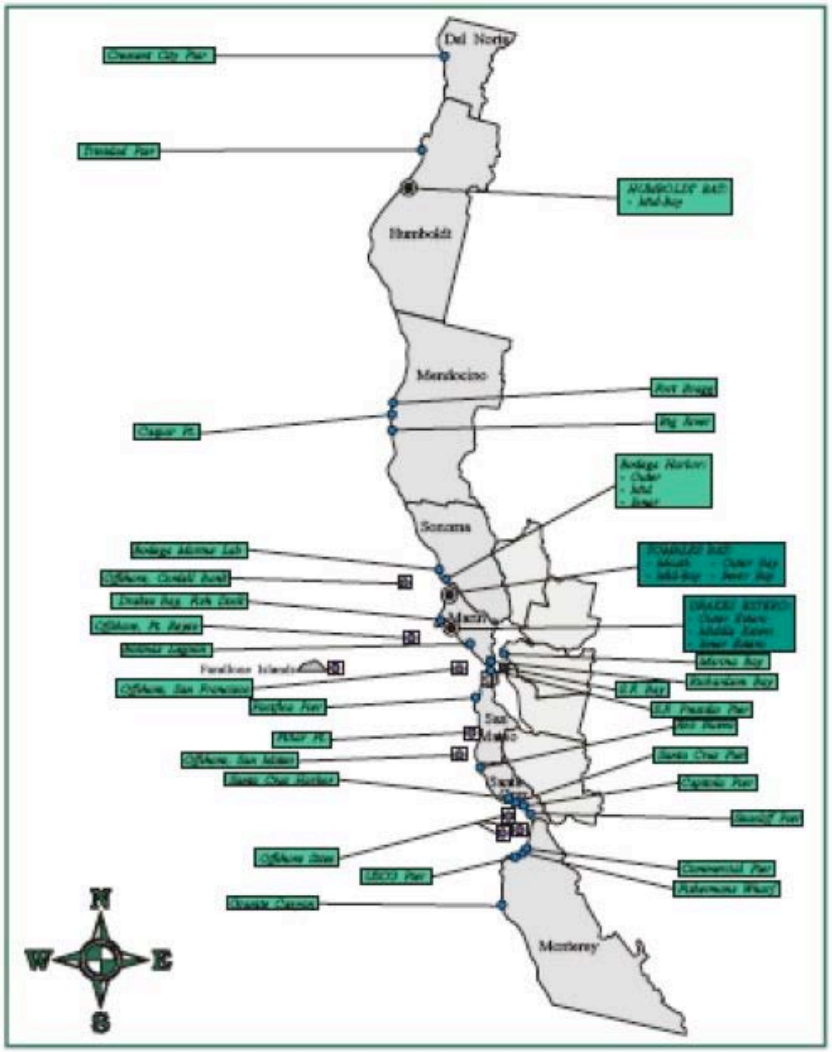
Stranding locations may be linked to urea discharge….

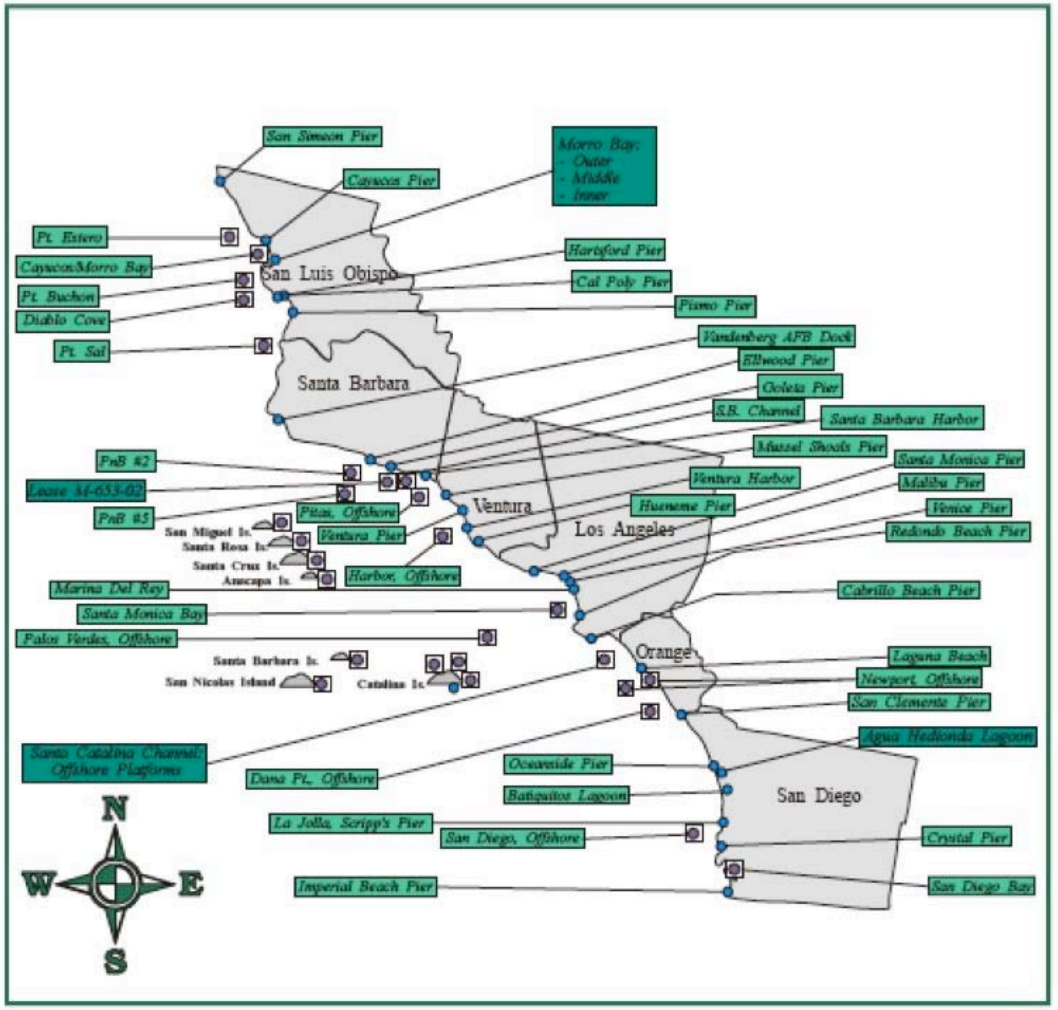


# More Red Tides = New Problems

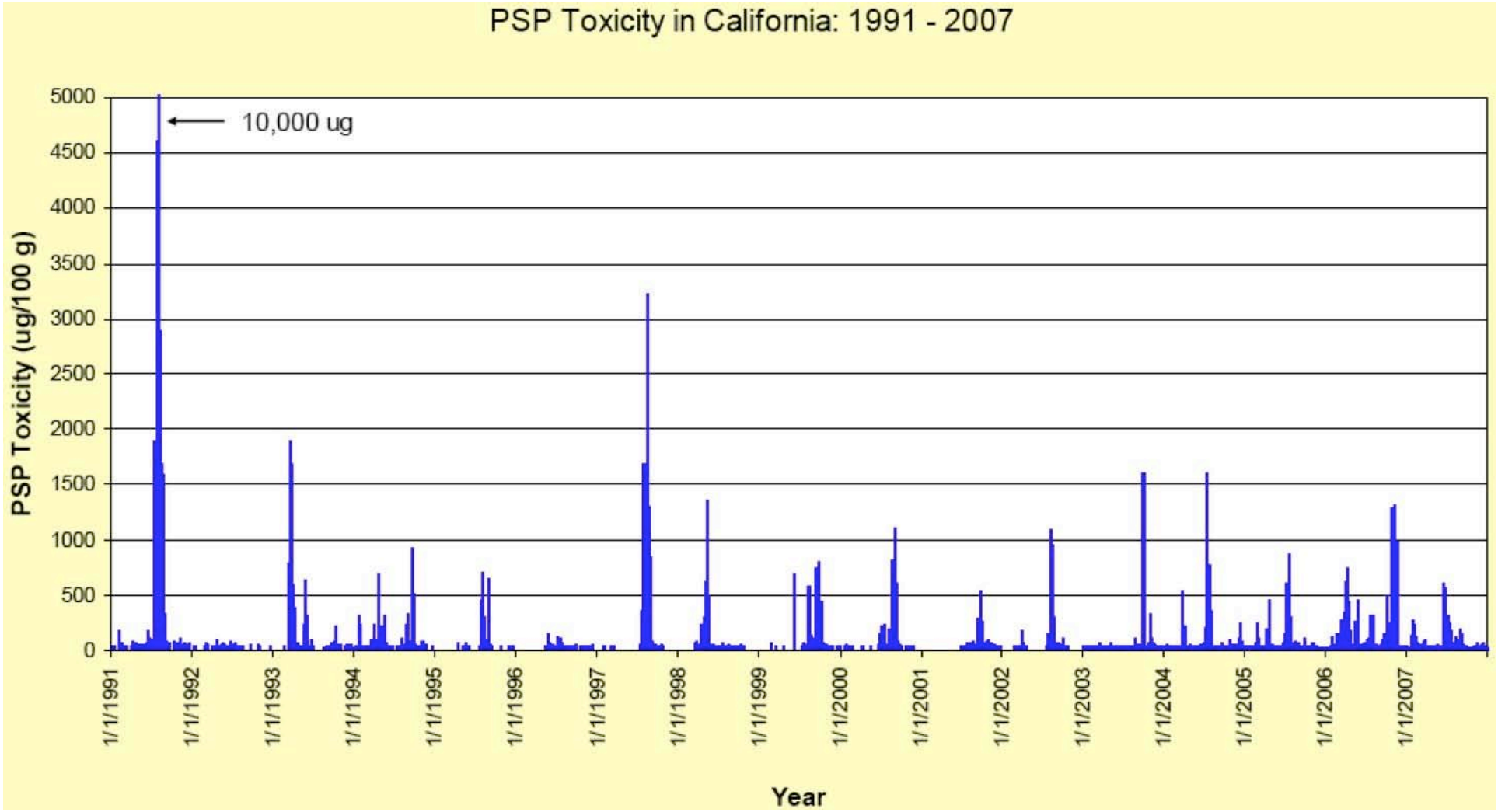
- The increase in all dinoflagellates has resulted in an increase in saxitoxin, yessotoxin, okadaic acid, pectenotoxins, etc.
- *Cochlodinium fulvescens* appeared in Monterey at bloom concentrations in 2004--in 2007, it resulted in a $60,000 shellfish loss to the Monterey Abalone Company
- November 2007, the “harmless” dinoflagellate *Akashiwo sanguinea* is linked to massive bird mortalities
- 2008—coldest ocean temperatures on record—switch back to *Pseudo-nitzschia*?

# CDPH Monitoring Program



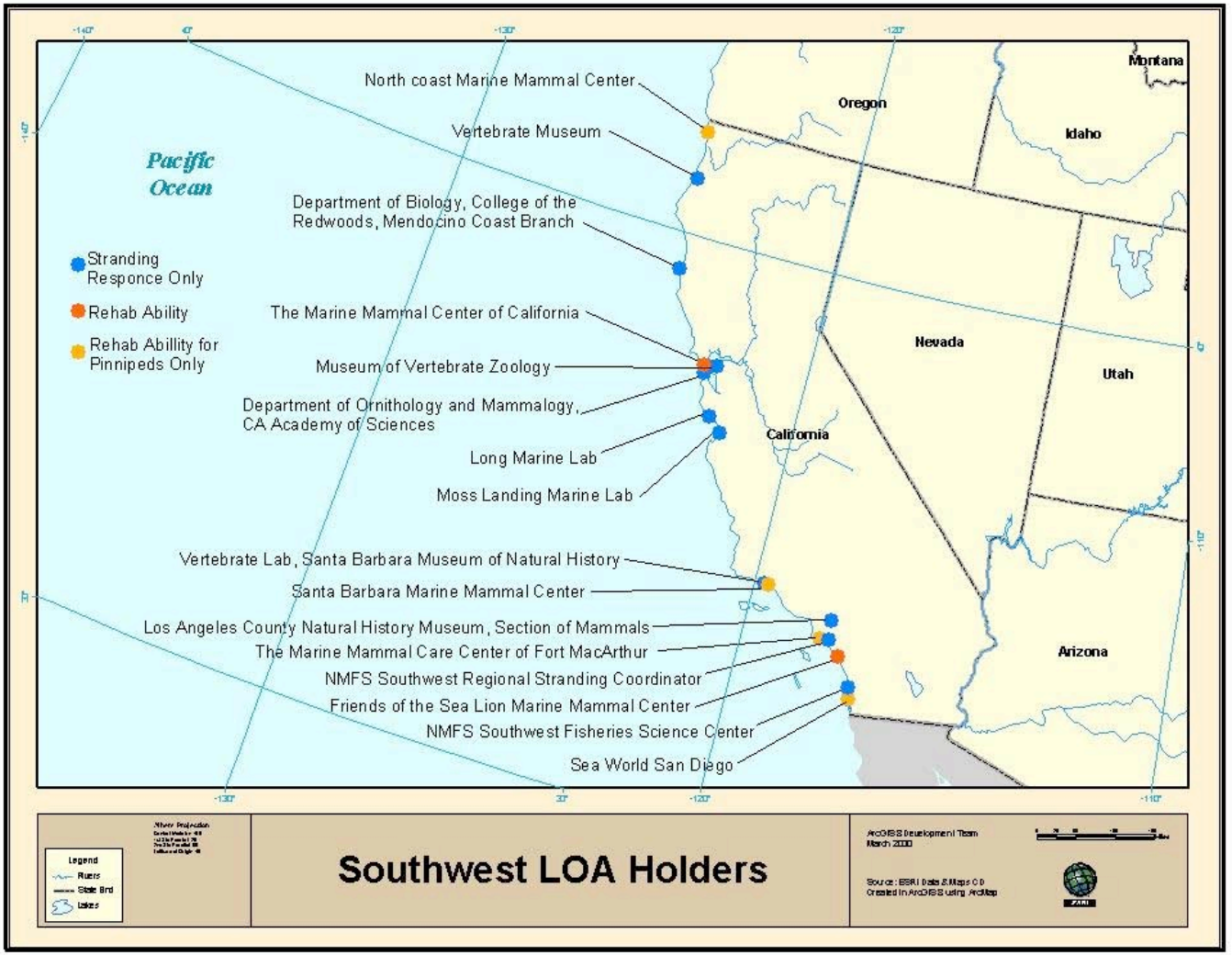



# CDPH Monitoring Program



# Marine Wildlife Monitoring

- Marine Mammal Centers
- California Dept Fish & Game
- Wetlands & Wildlife Care Center
- Other groups



# DA Indicators In Wildlife

- Mid-February, marine mammals come into rehabilitation centers with DA poisoning
- Approximately 6-weeks later, marine birds start to show signs of DA poisoning

# Index Of Suspicion

- Red Tide Occurrence
- Any sick fish-eating bird presenting with mild to severe neurological symptoms
- Within normal weight range for species
- Able to rule out other pathogens
  - Avian Influenza
  - Botulism
  - Newcastle's
- Confirmation of DA through testing

- Health warnings from the CDFG advising of a red-tide occurrence in Southern California - **RELEASE:** **IMMEDIATE**

**"STATE HEALTH OFFICER ADVISES CONSUMERS NOT TO EAT SOME SHELLFISH AND VISCERA OF SARDINES, ANCHOVIES AND CRAB FROM SOUTHERN CALIFORNIA COAST "**

# RAPDALERT: Rapid Analysis of *Pseudo-nitzschia* & Domoic Acid, Locating Events in near-Real Time

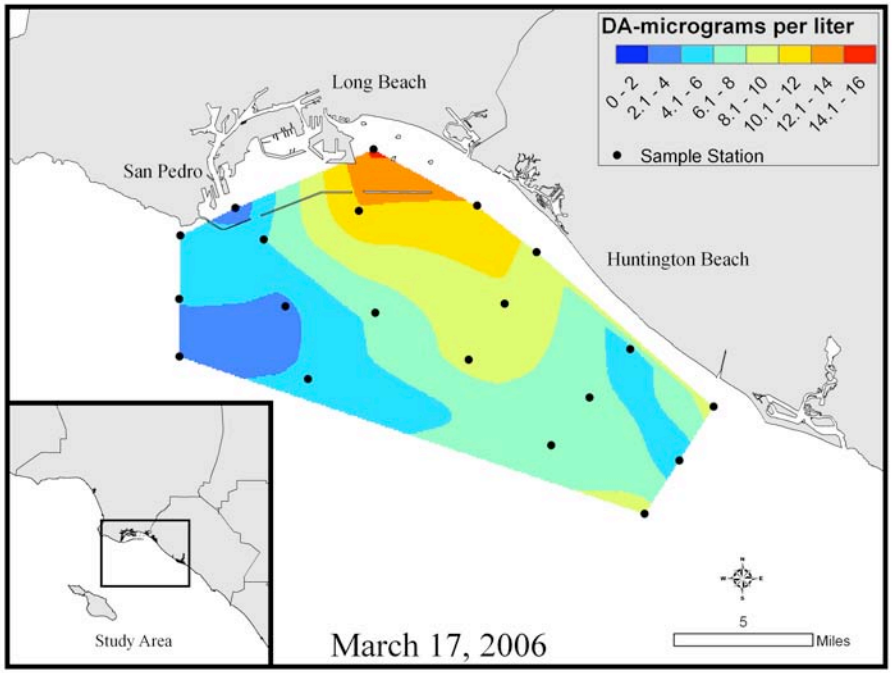
Caron, Jones, Sukhatme, Schnetzer (USC), Estrin (UCLA), Miller (UCSC;SCCWRP), Weisberg (SCCWRP)

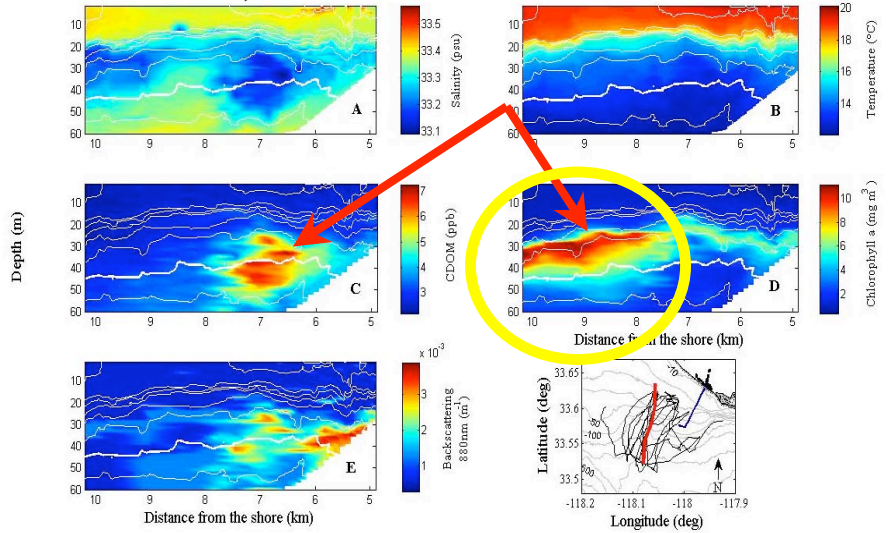
(supported through MERHAB, NOAA)

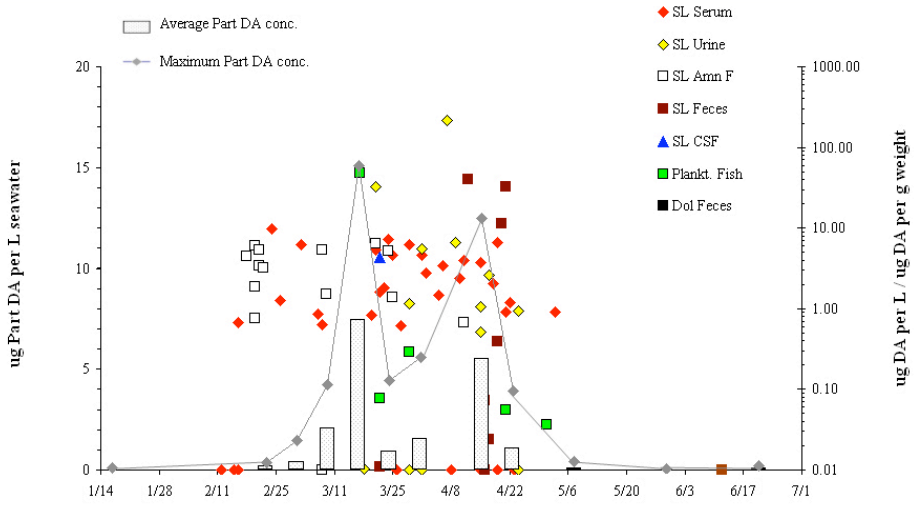
Partnerships with state & regional health agencies, animal rescue agencies

Focus on San Pedro Shelf region.

Pier Monitoring Sites
Autonomous vehicles
Shipboard sampling

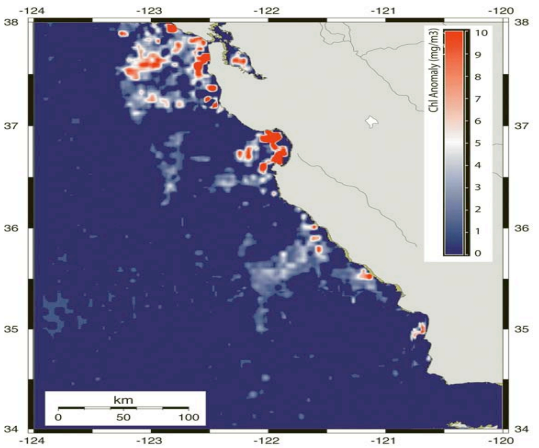


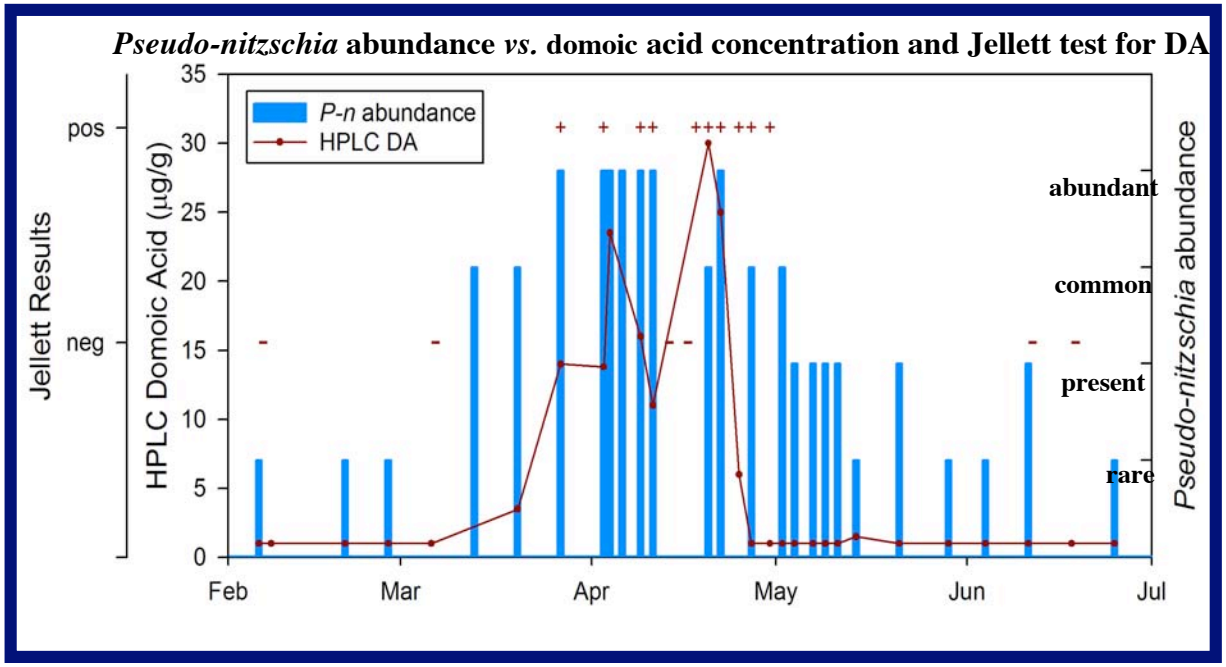
# California Program for Regionally Enhanced Monitoring of Phyco-Toxins (Cal-PReEMPT)

Peter Miller, Raphael Kudela, Gregg Langlois, Mary Silver
(Supported through MERHAB, NOAA

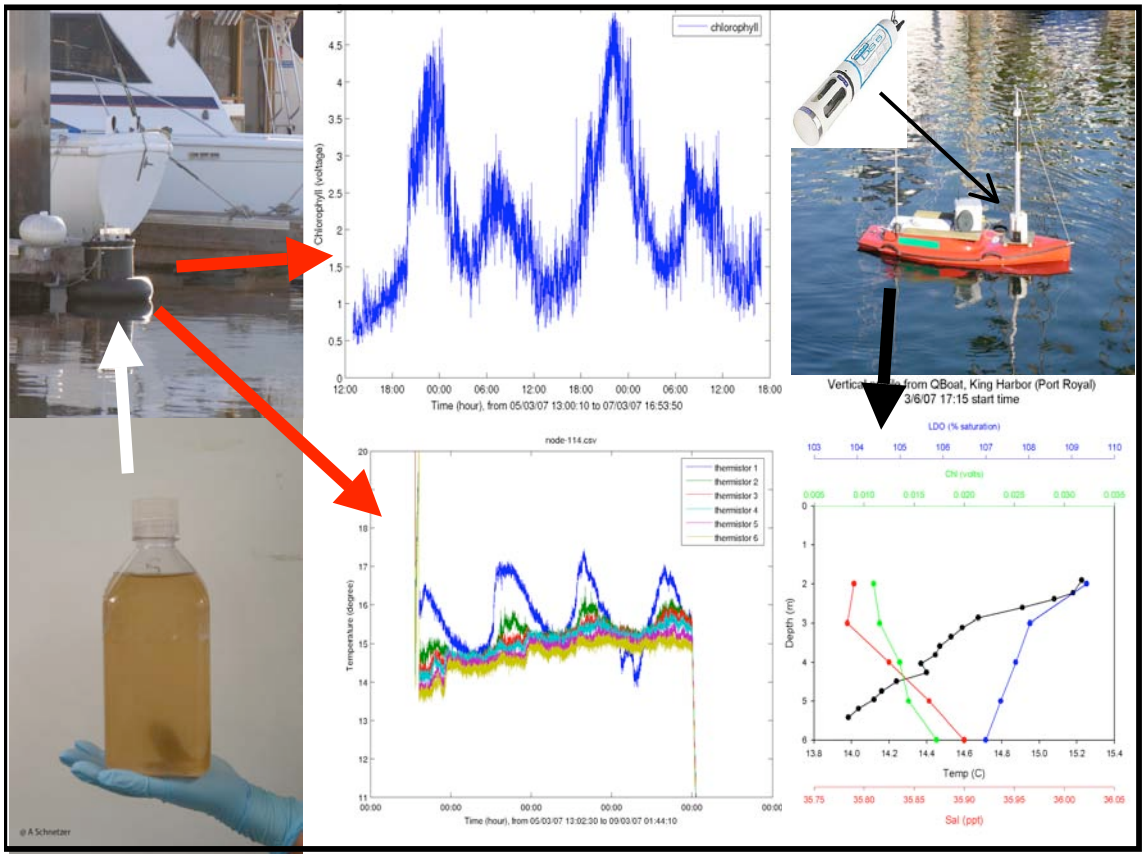


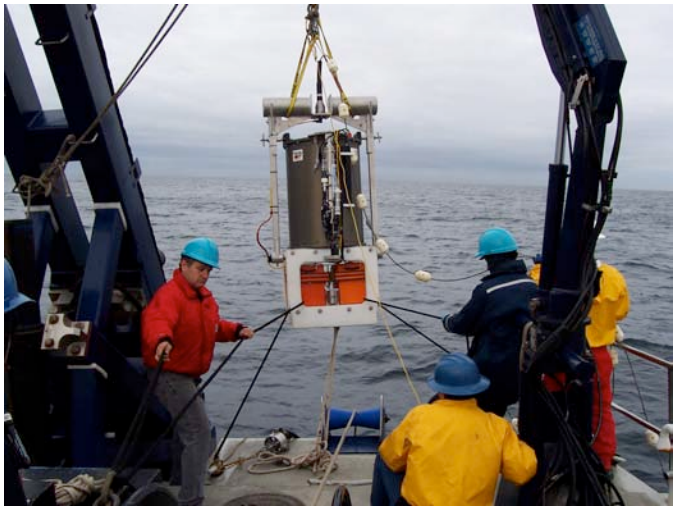


*Testing new methods, focusing on cost-effective improvements to the State monitoring effort…*



# Research Examples



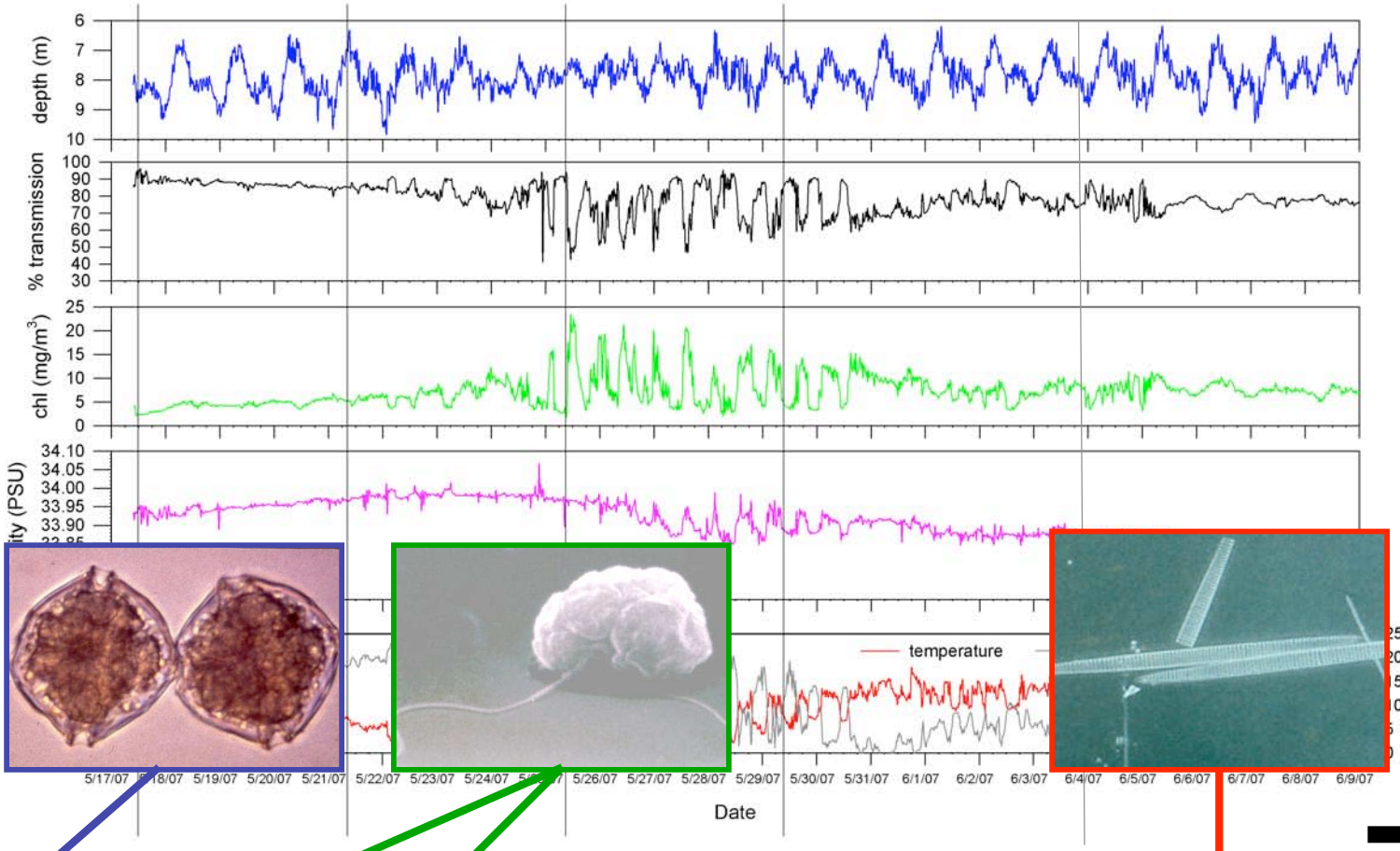



*New technologies such as robotic boats and in situ laboratories are being developed….*

# ESP Field Deployment

Monterey Bay, CA
May 17-June 11, 2007

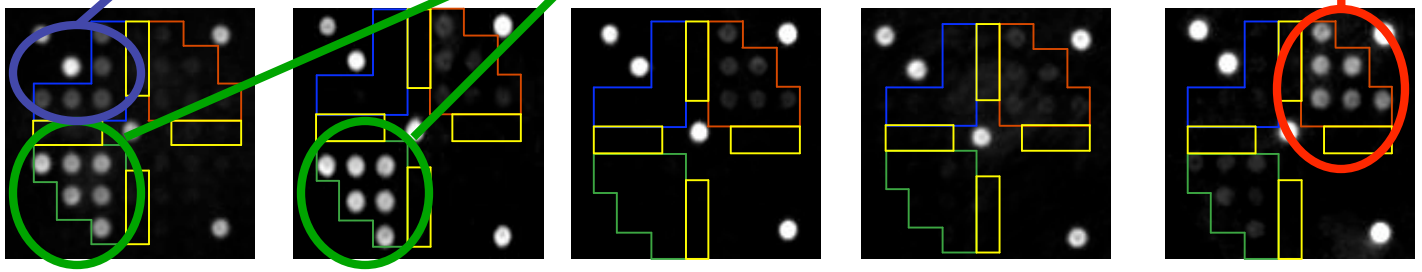
*In situ* Detection of Harmful Algae









May 17, 2007
1000 ml

May 21, 2007
1000 ml

May 25, 2007
1000 ml

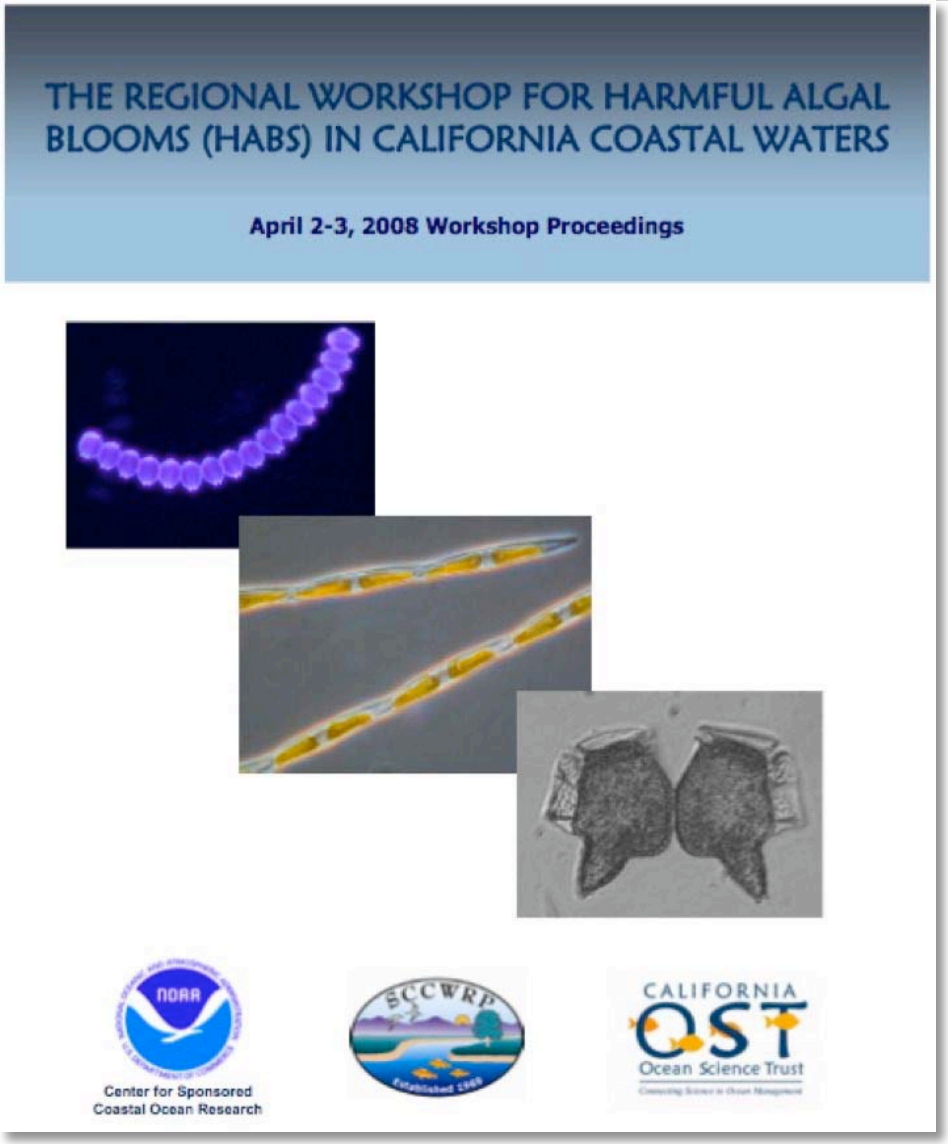
May 29, 2007
1000 ml

June 4, 2007
1000 ml

- control
- *Alexandrium tamarense/catenella*
- *Pseudo-nitzschia multiseries*
- *P. multiseries/ pseudodelicatissima*
- *Heterosigma akashiwo*
- *P. australis*

Greenfield et al. *L&O Methods* (2008)

# California HABMAP




- Voluntary participation
- No mandate or direct government backing
- Accomplishments:
  - Beginning of a standardized monitoring network
  - Cell & Toxin Detection inter-calibration planned
  - Working with CA Sea Grant, Ocean Protection Council
  - Bridges 2 OOS groups, human and wildlife health, local, state, and federal agencies, research, monitoring, and end users