

Overview of Oregon HABs

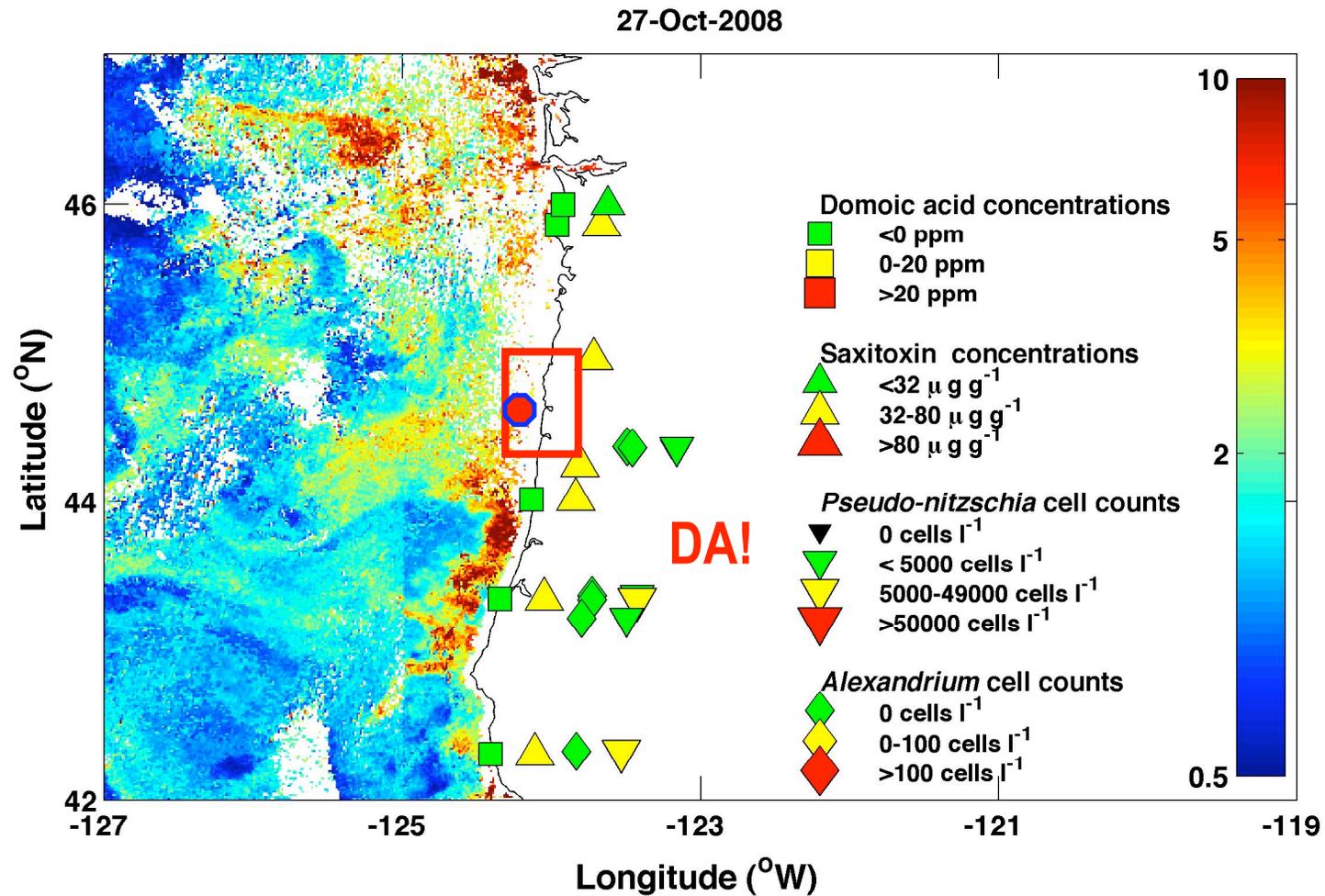
Pete Strutton

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Oregon State University

Oregon HABs: Background

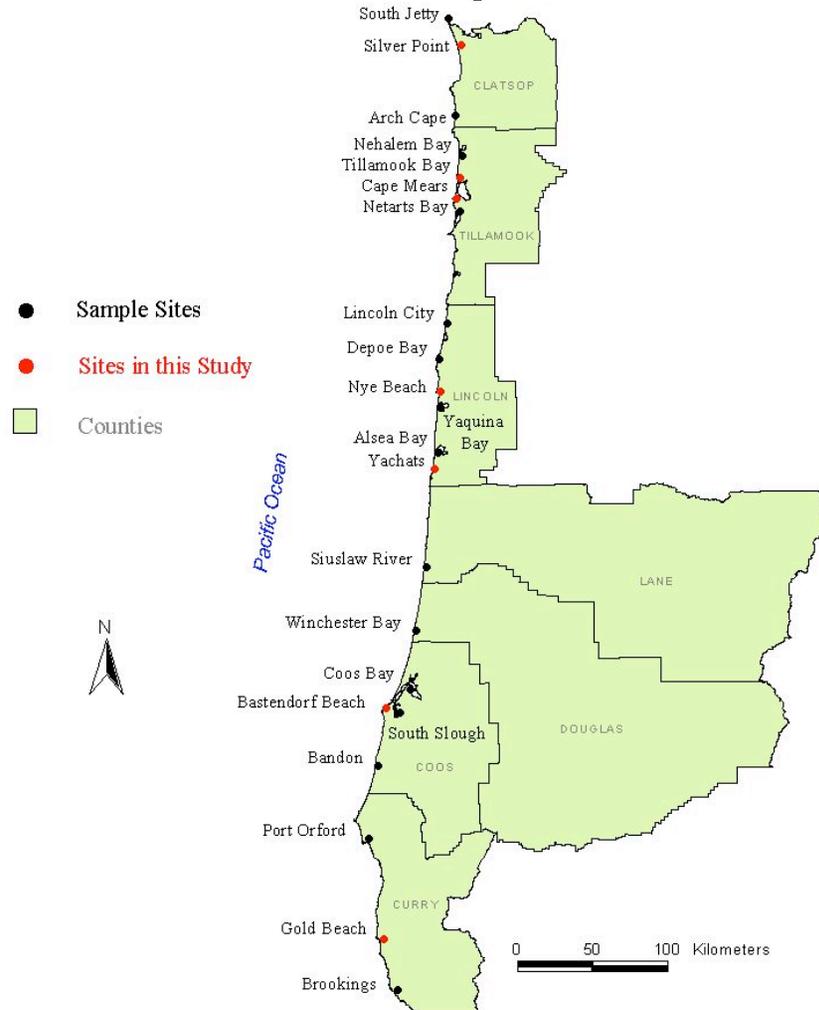
- As for most of the west coast, the main toxic phytoplankton are *Pseudo-nitzschia* and *Alexandrium*
- Until recently, only monitoring was ODA
 - Shellfish tissue from ~20 sites coastwide
 - Saxitoxin from ~1979, DA from ~1998
 - Information used to guide shellfish closures
- Scope of the shellfish industry:
 - Mostly recreational, focused on Clatsop (Columbia river)
 - Estimated economic value: \$4.8 million lost during 2003 closure at Clatsop alone
- No known toxin fatalities in Oregon

Monitoring overview



Oregon Dept of Agriculture sampling

Oregon Department of Agriculture Shellfish Sample Sites



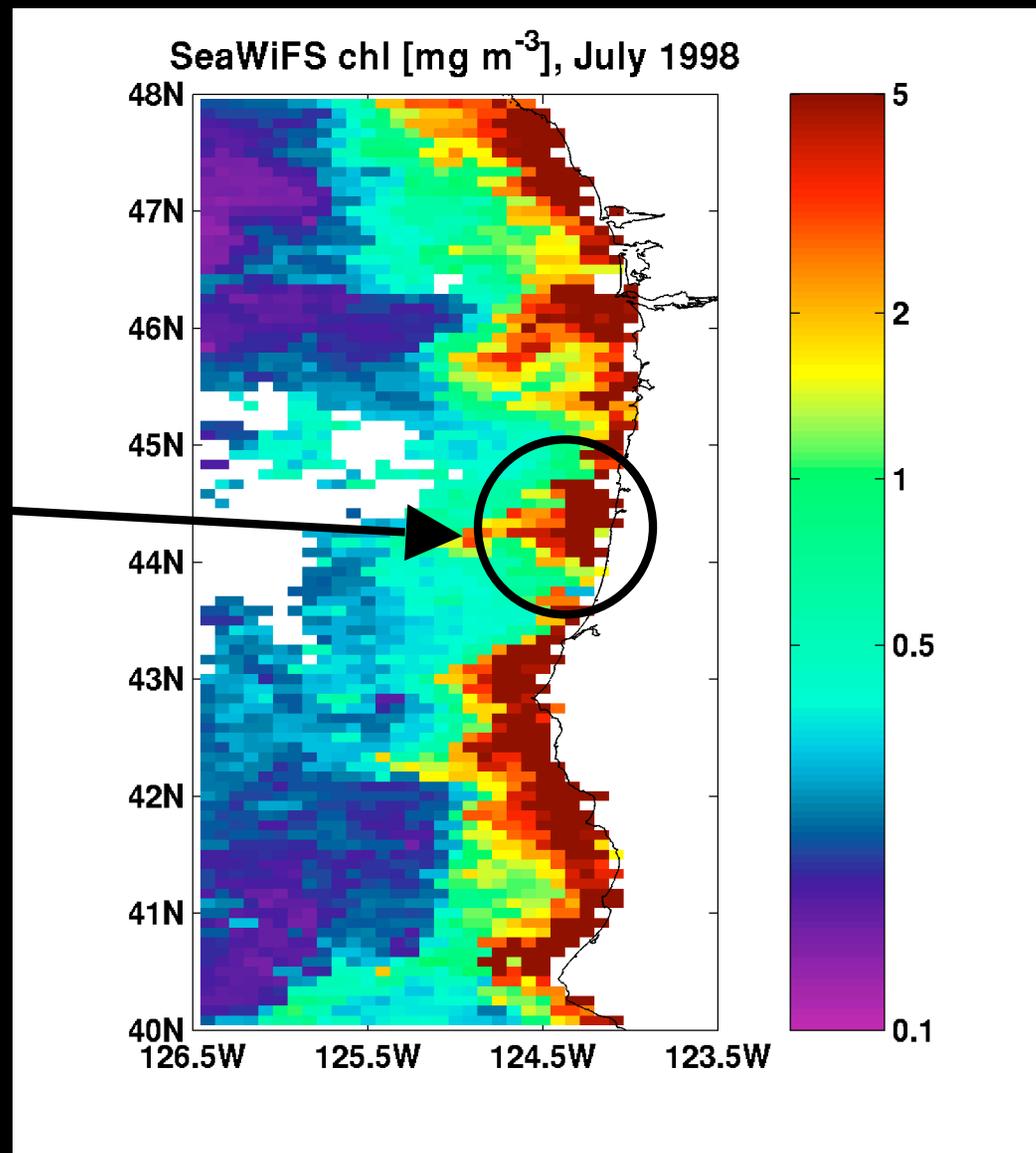
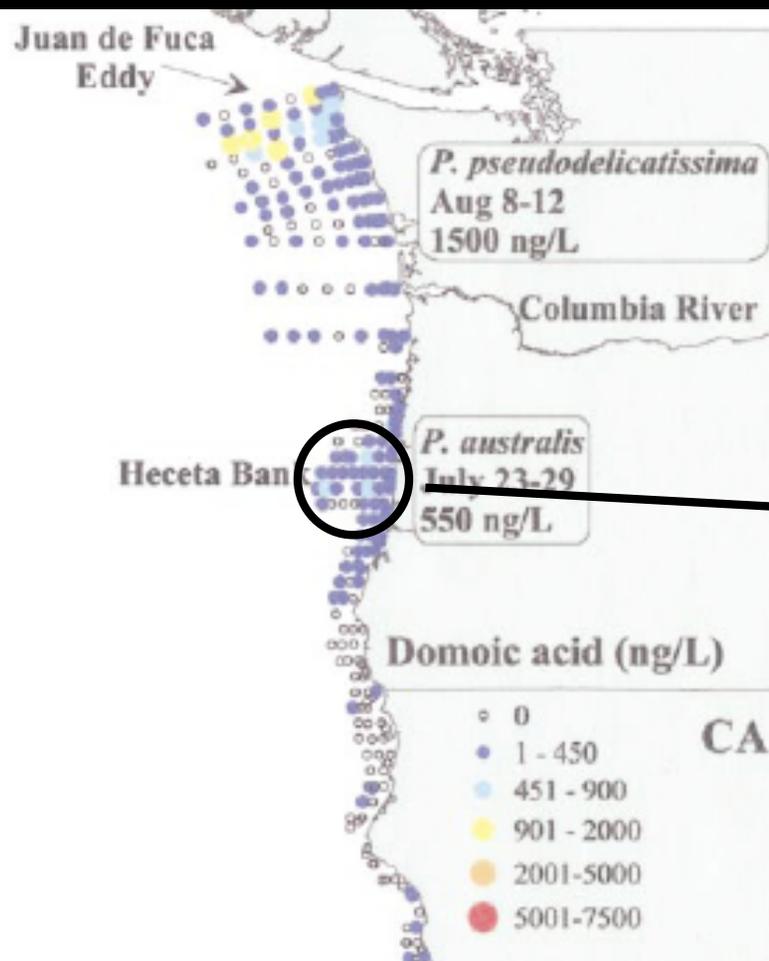
Source: ESRI, Oregon Department of Agriculture

Database of coastal toxin concentrations in shellfish

Backtrack from coastal observations to offshore conditions

- Hot spots
- Correlations with seasonal cycle of upwelling
- El Nino/La Nina and PDO

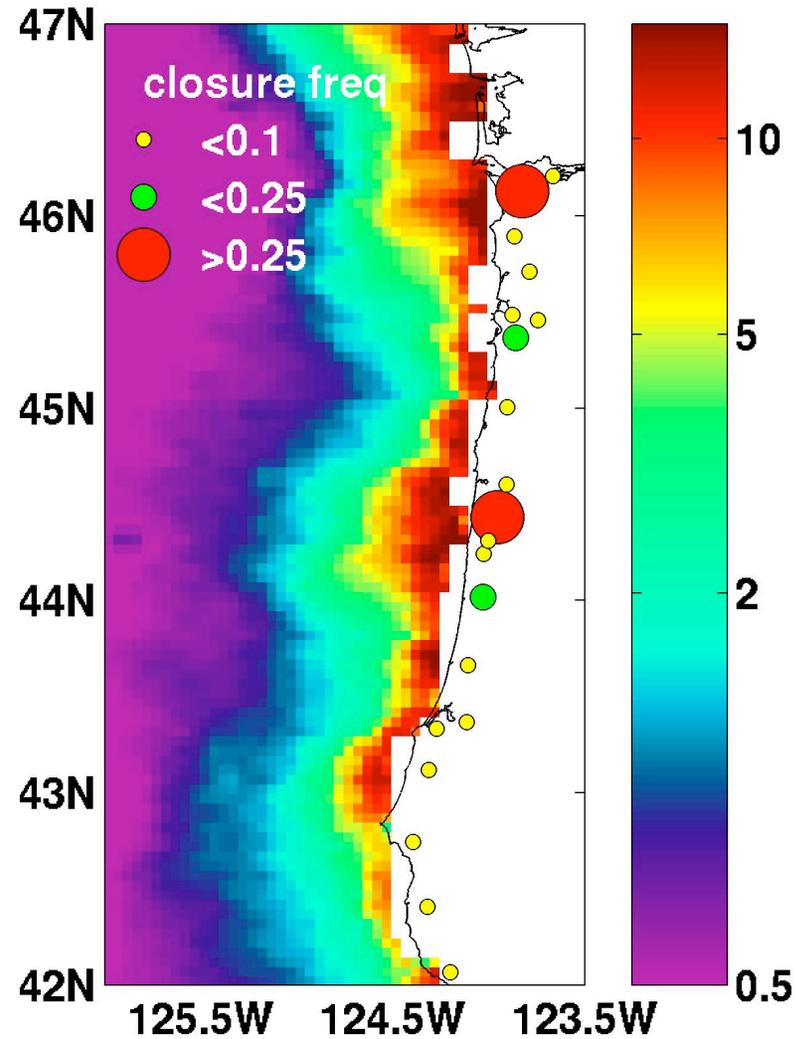
Hot Spots: Heceta Bank



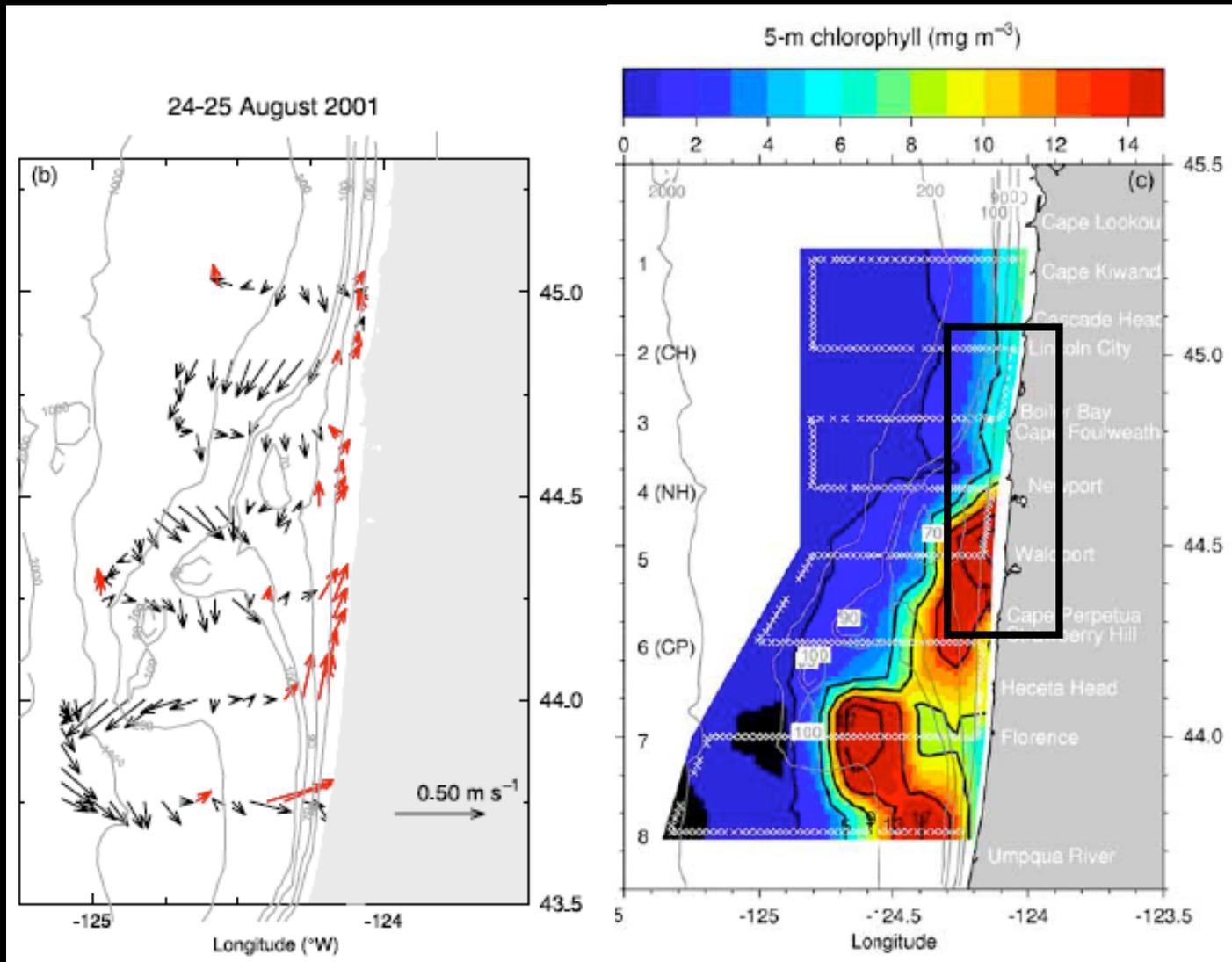
From: Hickey and Banas, 2003

Climatology of chlorophyll and persistent DA

SeaWiFS summer chl and DA closures: 1998-2003

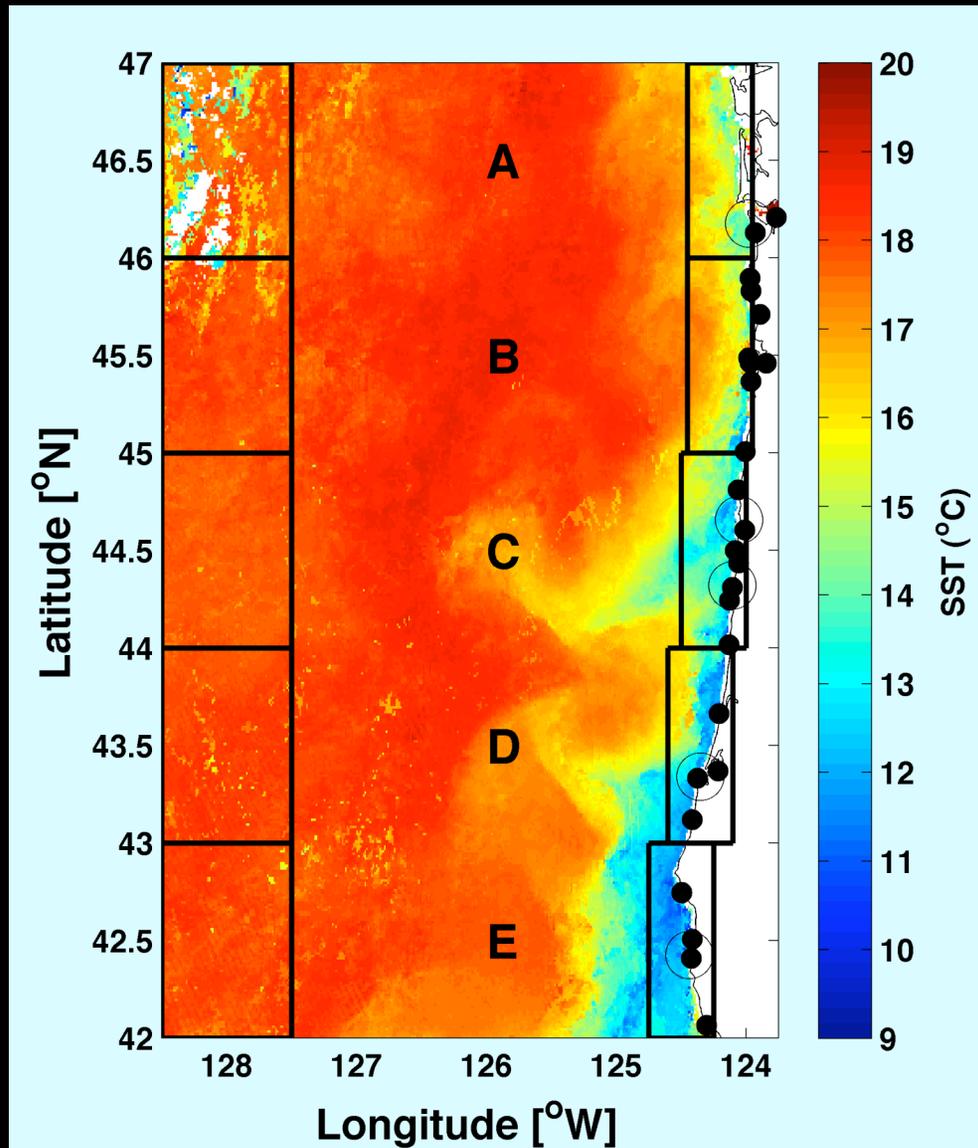


Hot Spots: Heceta Bank

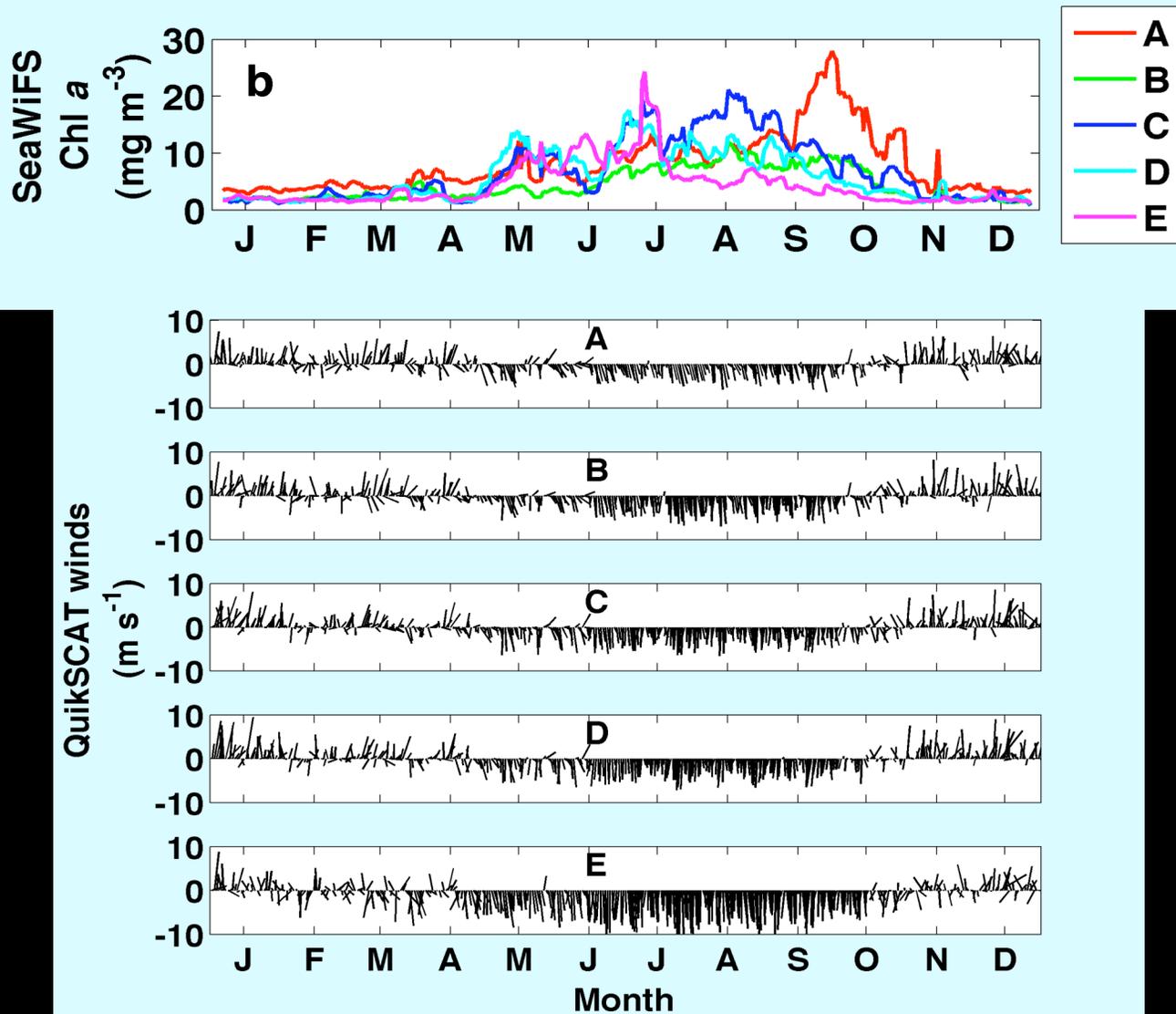


From: Barth *et al.*, 2005

Seasonal variability

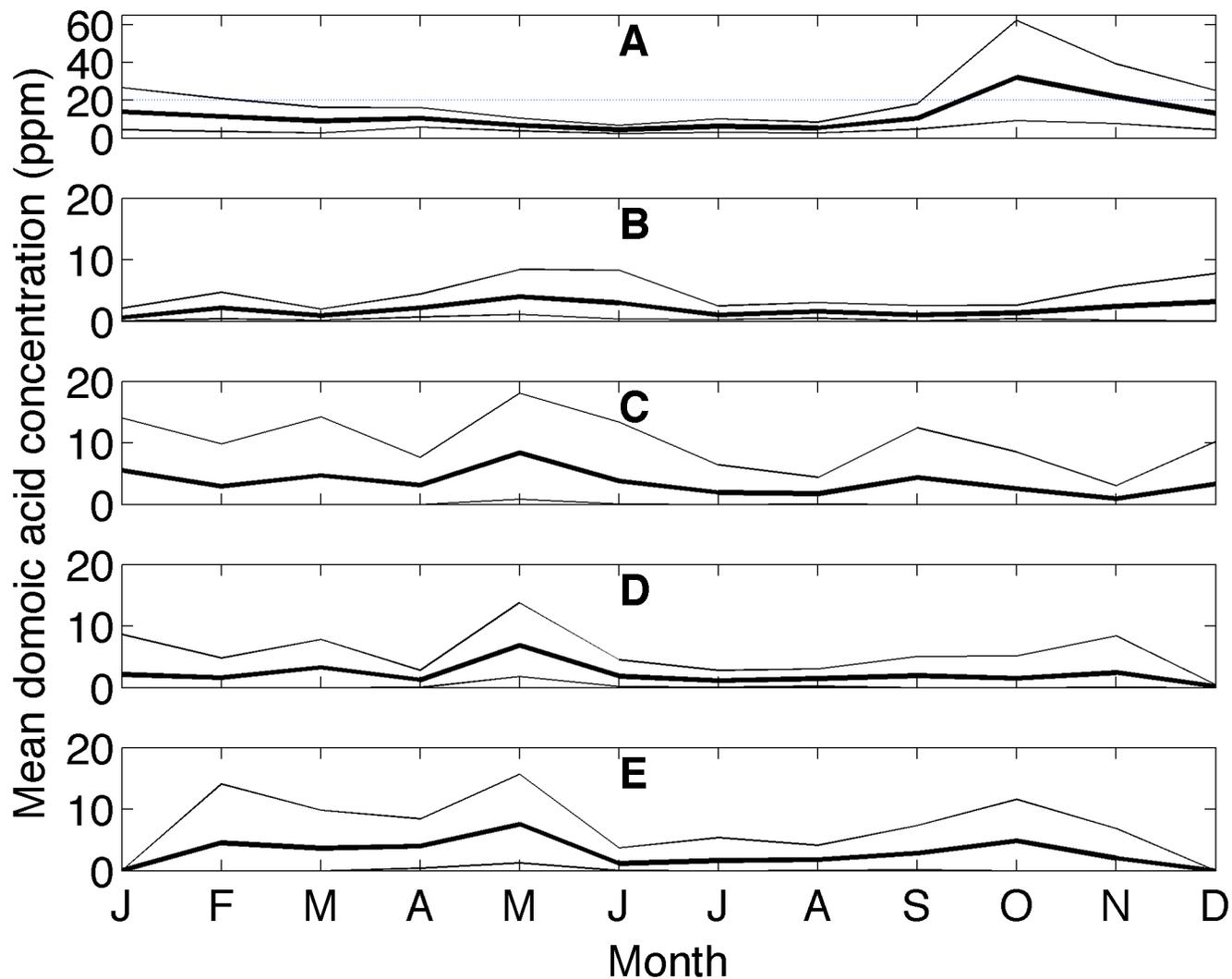


Seasonal variability

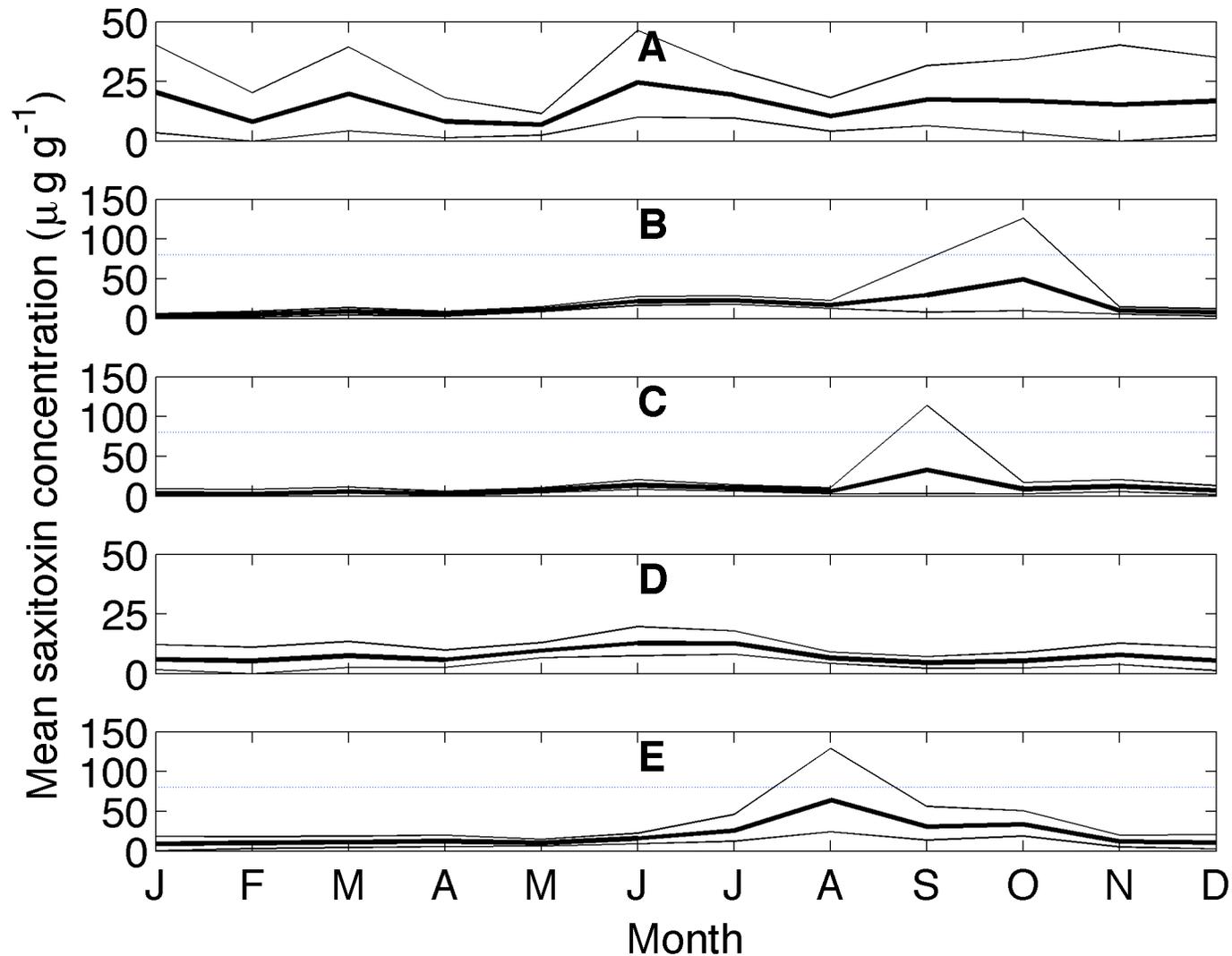


From: Tweddle *et al.*, in revision for MEPS

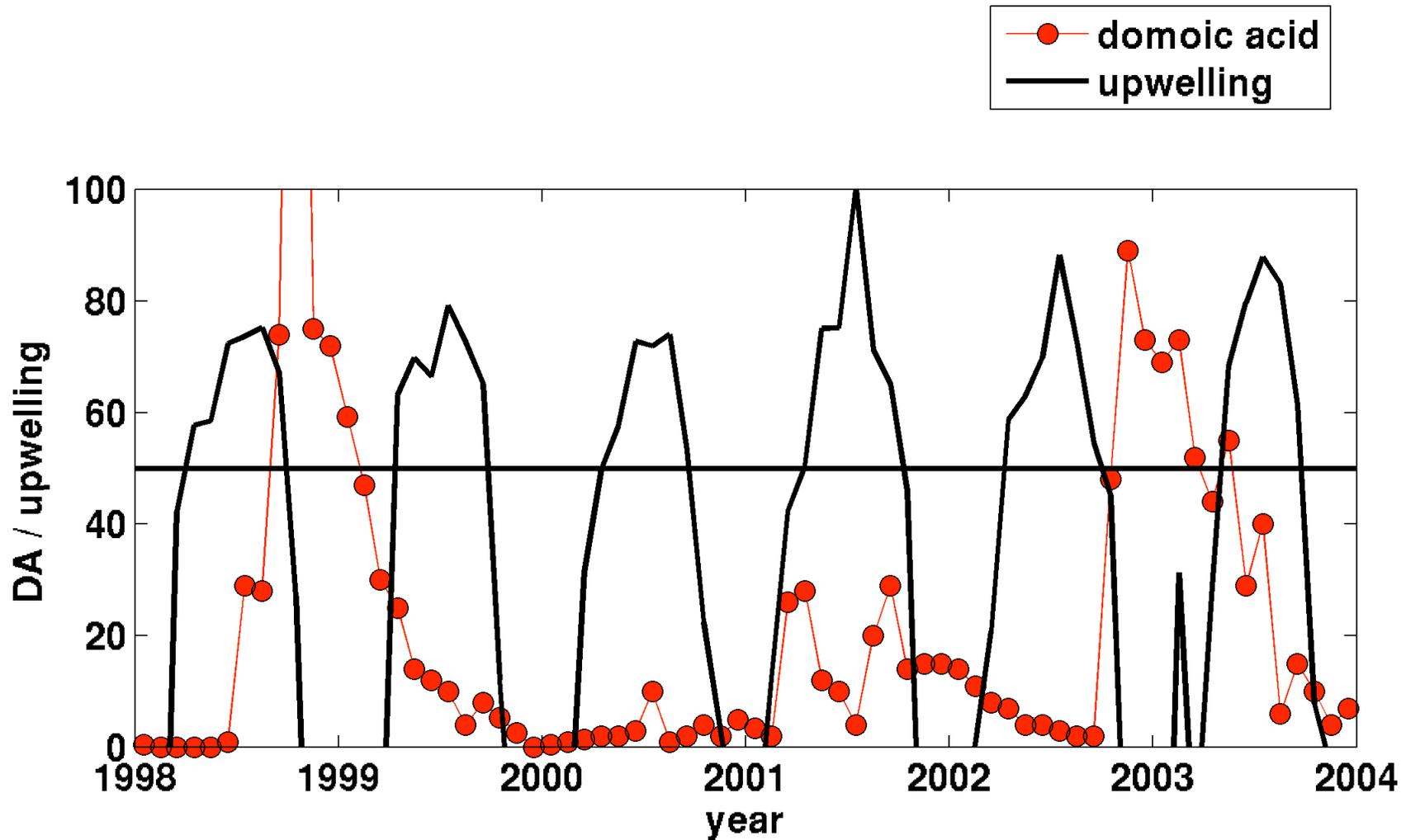
Seasonal variability: Domoic acid



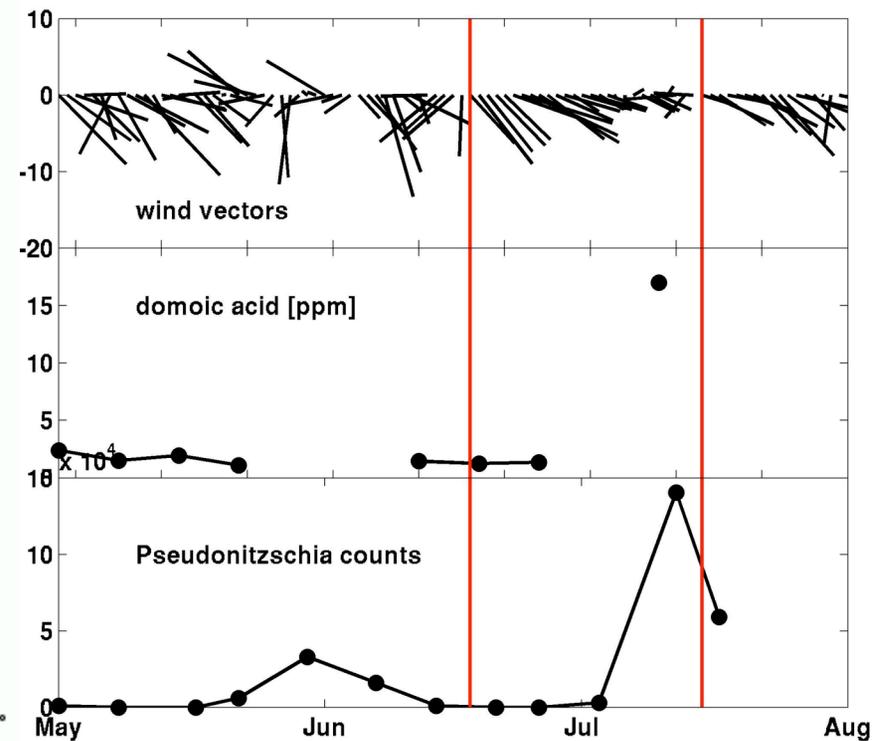
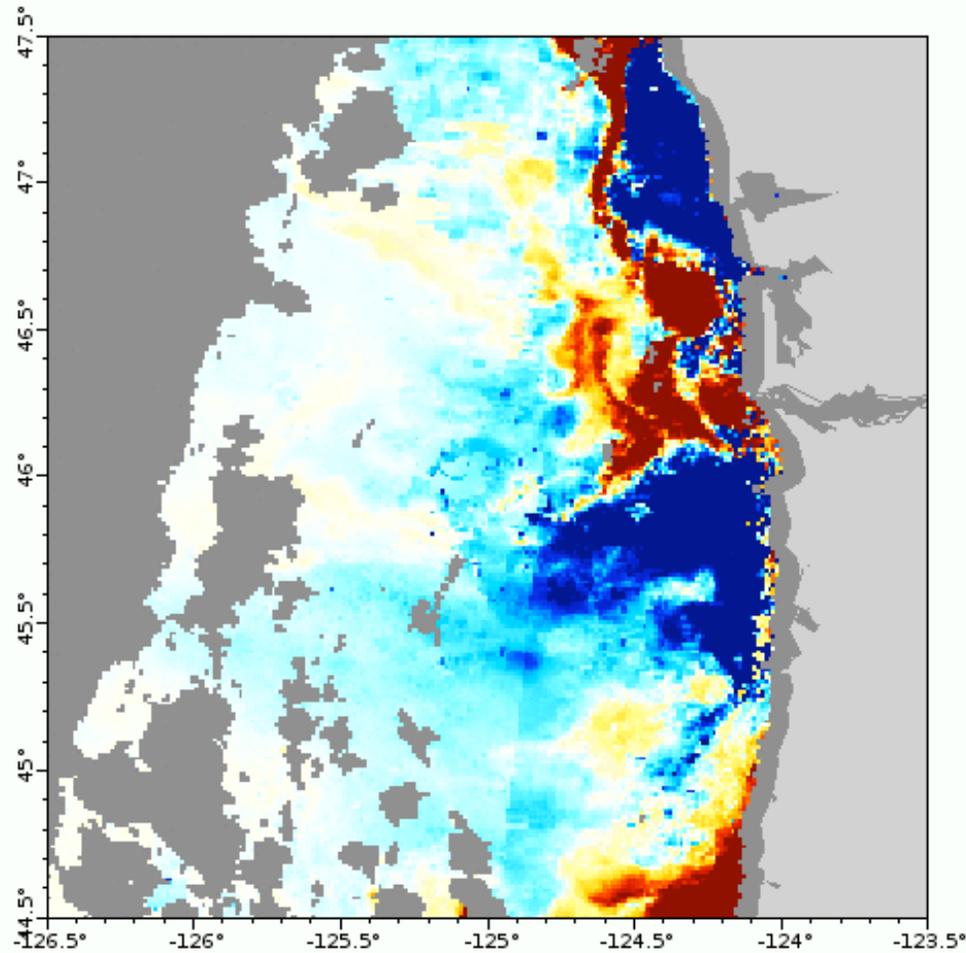
Seasonal variability: Saxitoxin



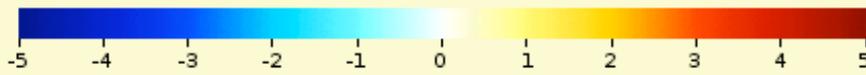
Upwelling, downwelling and domoic acid events



The July 2006 Clatsop event



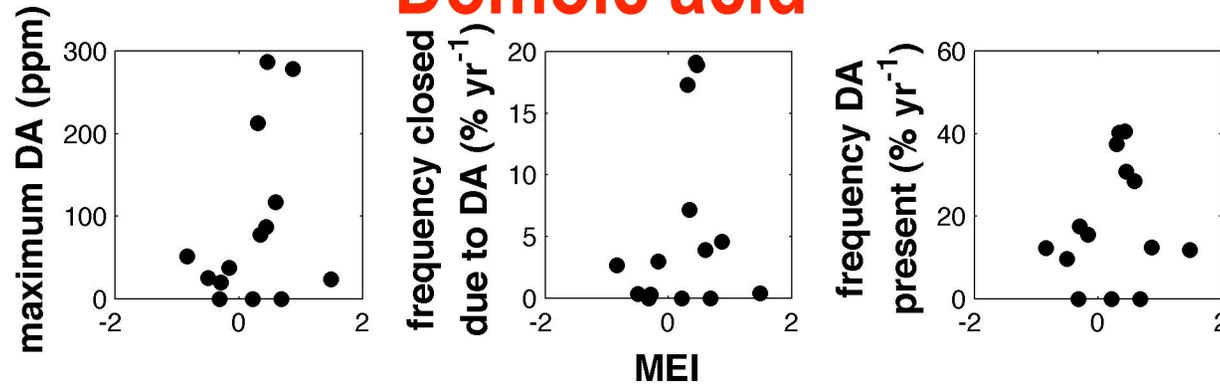
NOAA CoastWatch



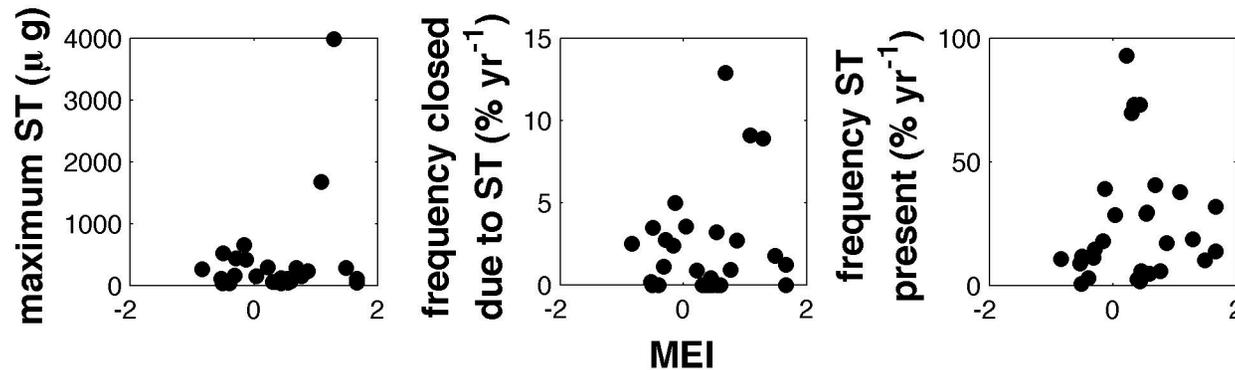
Chlorophyll-a Deviation, Orbview-2 SeaWiFS, 0.0125 degrees, West Coast of US, EXPERIMENTAL
(mg m^{-3}) 2006-07-06 to 2006-07-13
Satellite/Grid Data Courtesy of: NASA/GSFC/DAAC, NOAA NOS/CoastWatch, GeoEye

HABs more frequent and toxic in El Niño years

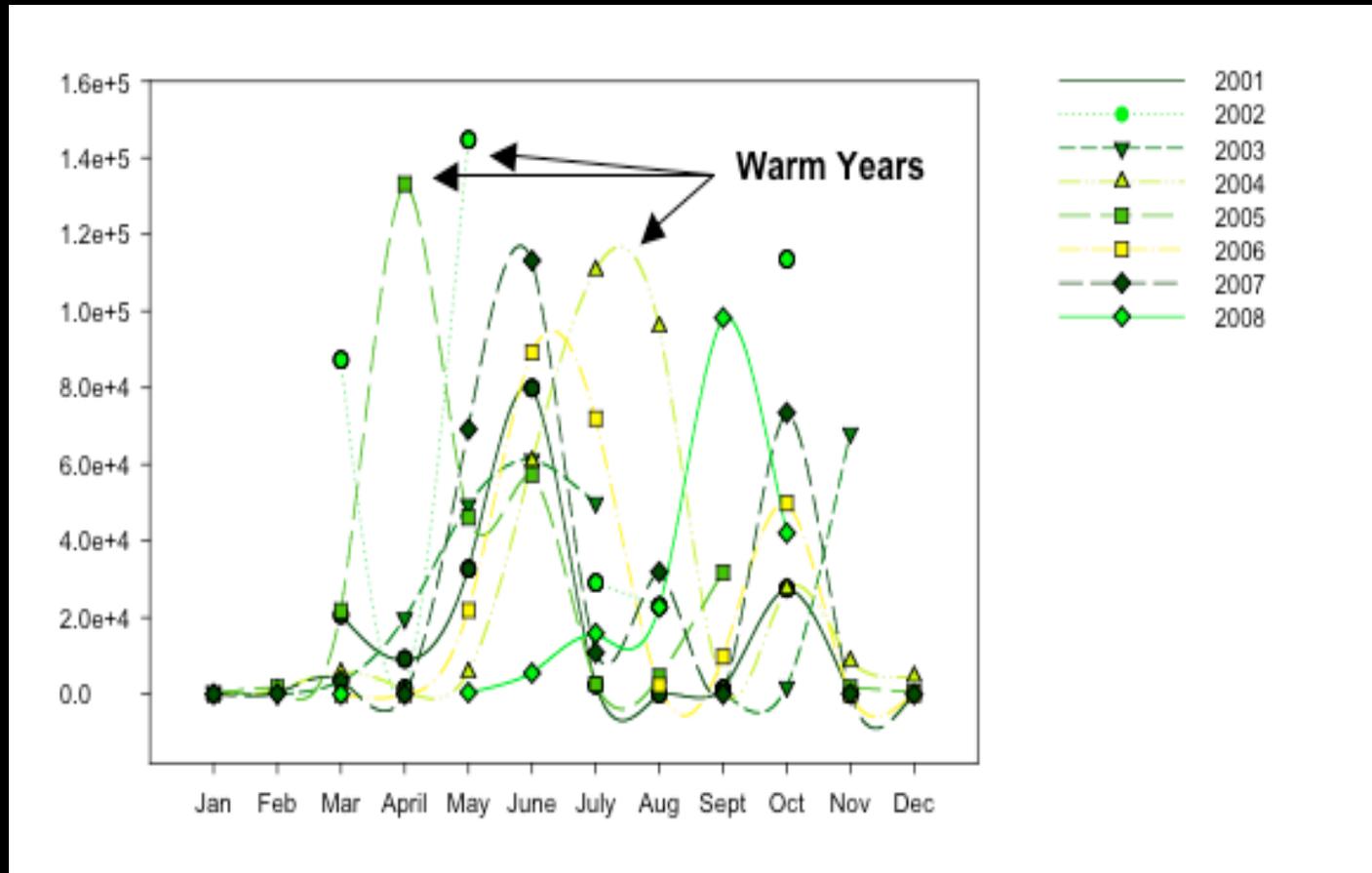
Domoic acid



Saxitoxin



Diatoms in warmer years?



From NH5: Linda O'Higgins and Bill Peterson

Interaction between bacterial assemblage structure and nitrogenous nutrition of *Pseudo-nitzschia* spp.

- Michelle Maier & Tawnya Peterson (OHSU)
 - October 2008 - present
 - Isolates of *Pseudo-nitzschia* from WA, GoMex, Monterey Bay.
- Research plan:
 - *Pseudo-nitzschia* spp. grown on NO_3^- and urea
 - Perform Denaturing Gradient Gel Electrophoresis on PCR-amplified 16S rRNA gene fragments to obtain bacterial “fingerprints” from different treatments and different strains
 - Analyze particulates for domoic acid by LC-MS
 - Design probes for impedance-based biosensor for DNA targets (including *Pseudo-nitzschia*) with Holly Simon & Mariya Smit (OHSU)

Current dissemination of data

Oregon department of Agriculture toxin data

http://www.oregon.gov/ODA/FSD/shellfish_status.shtml#Biotoxin_results_of_interest

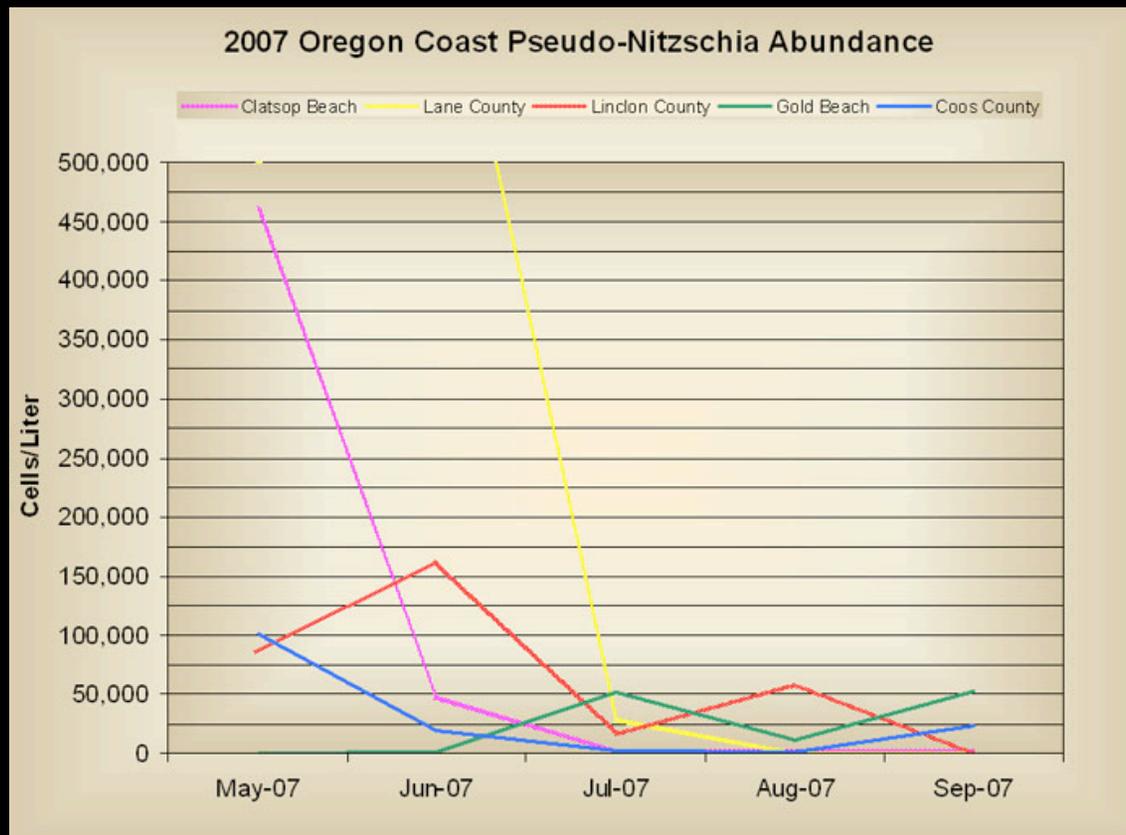
Week of June 1, 2008

- 7.0 // NA mcgm – Gold Beach, Myers Creek (razor clams)
- < 1 ppm // < 36.4 mcgm – Gold Beach, Myers Creek (mussels)
- NA // NA – Yaquina Bay, Oyster Farm (oysters)
- < 1 ppm // 38.9 mcgm – N. Lincoln County, 15th Street (mussels)
- < 1 ppm // < 37.6 mcgm – Newport, Agate Beach (razor clams)
- < 1 ppm // < 36.9 mcgm – Yachats, Smelt Sands SP (mussels)
- < 1 ppm // 48.1 mcgm – Bastendorf Beach to Cape Arago (mussels)
- < 1 ppm // NA – Cannon Beach, Ecola St. Park, Indian Beach (razor clams)
- < 1 ppm // 40.1 mcgm – Columbia River, South Jetty (mussels)
- < 1 ppm // NA – North of Ona Beach State Park (razor clams)
- < 1 ppm // < 35.6 mcgm – South Jetty, Umpqua River (oysters)
- < 1 ppm // NA – Clatsop Beach, South Jetty (razor clams)
- < 1 ppm // < 34.2 mcgm – Clatsop Beach, Seaside (razor clams)
- < 1 ppm // 66.5 mcgm – Silver Point (mussels)
- < 1 ppm // 76.1 mcgm – Cape Mears (mussels)
- 1.3 // NA mcgm – Whiskey Run/Mid Coos County Beaches (razor clams)

Current dissemination of data

Oregon Department of Fish and Wildlife cell count data

<http://www.dfw.state.or.us/MRP/shellfish/razorclams/plankton.asp>



Current dissemination of data

CoastWatch

CoastWatch Browser

CoastWatch West Coast Regional Node

Create custom maps and download oceanographic data. [\[Help\]](#)

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Edit: The Map Grid Data Contour Data Vector Data
 Station Vector Data Station Data 1 Station Data 2

1) Select a region:
 US+Mexico West US N N1 N2 N3 C
 C1 C2 C3 AN BB GG MB SF
 S S1 S2 M M1 M2

(or specify ...)
Max Y: -
Min X: - Max X: -
Min Y: -

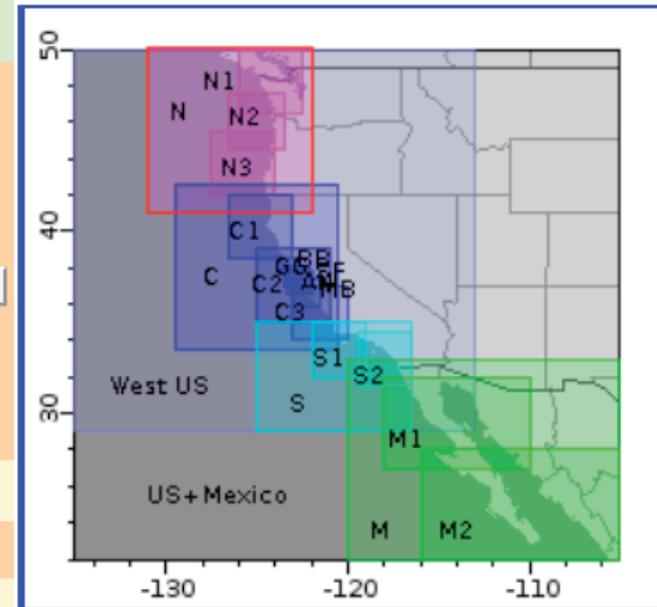
(or ...)
Zoom:
View the region to the:

2) Synchronize times:

3) Select a size:

4) Download the map:

5) Animate: of data, at frames/second.
 (It may take a minute to create it.)

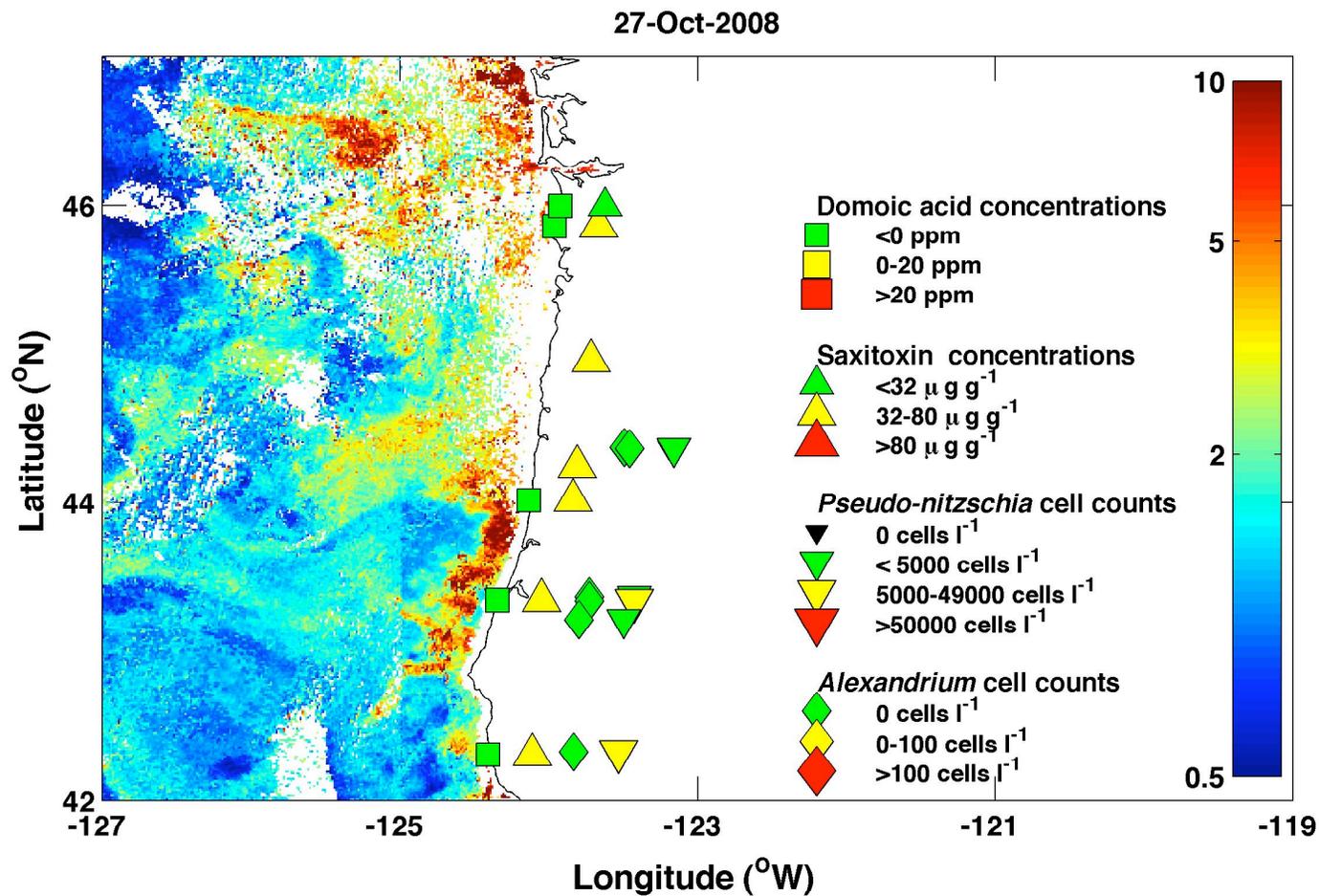


Click to pick a predefined region.

Coordinated dissemination of data

MOCHA
Monitoring Oregon Coastal Harmful Algae

www.coas.oregonstate.edu/habs



Conclusions and continuing work

- Identified hot spots (Heceta Bank and Columbia)
- Upwelling dynamics and seasonal cycle of toxins
- Transition to downwelling critical for coastal impacts
- Links with climate indices
- DA capability at UO, regular monitoring through MOCHA
- Cysts/source populations for *Alexandrium*?
- Still dependent on *in situ* sampling to confirm toxicity
- Developing new satellite products ~ some ability to track
 - Better use of surface wind and model outputs
- Technology development and link to observatories





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Persisting behavioral consequences of prenatal domoic acid exposure in rats[☆]

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Abstract

To investigate the behavioral effects of prenatal exposure to the marine toxin domoic acid, pregnant female rats were injected subcutaneously with 0, 0.3, 0.6, or 1.2 mg/kg of domoic acid on gestational day 13. The offspring were then run through a behavioral testing battery to determine the developmental effects of the toxin on spontaneous alternation in the T-maze, on locomotor activity in the Figure-8 maze, and on working memory in the 8-arm radial maze. In the T-maze, no significant domoic acid induced differences were seen on spontaneous alternation, but there were significant domoic acid effects on latency. Prenatal domoic acid exposure caused a dose-related increase in response latency in the second spontaneous alternation test. There was also a significant domoic acid effect seen in the 1-h long Figure-8 maze test. Locomotor activity measured in the Figure-8 maze detected a persisting effect of the 1.2 mg/kg domoic acid dose, which significantly increased the rate of habituation over the activity test session. This was characterized by higher initial activity followed by greater decline in activity. In the radial-arm maze the control vehicle treated rats showed the normal sex-related difference in spatial learning and memory with males outperforming females. Developmental domoic acid exposure decreased this effect such that the normal sex difference in spatial memory was not seen with the 1.2 mg/kg domoic acid dose. The rats of both sexes with a history of prenatal domoic acid exposure showed increased susceptibility to the amnesic effects of the muscarinic acetylcholine scopolamine, suggesting that they had less functional reserve with which to solve the radial-arm maze memory task. This study demonstrates persisting neurobehavioral effects of acute prenatal exposure to domoic acid at doses that do not cause overt clinical signs of toxicity.

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Keywords: Domoic acid; Prenatal; Locomotor activity; Learning; Memory

