Washington State Harmful Algal Blooms

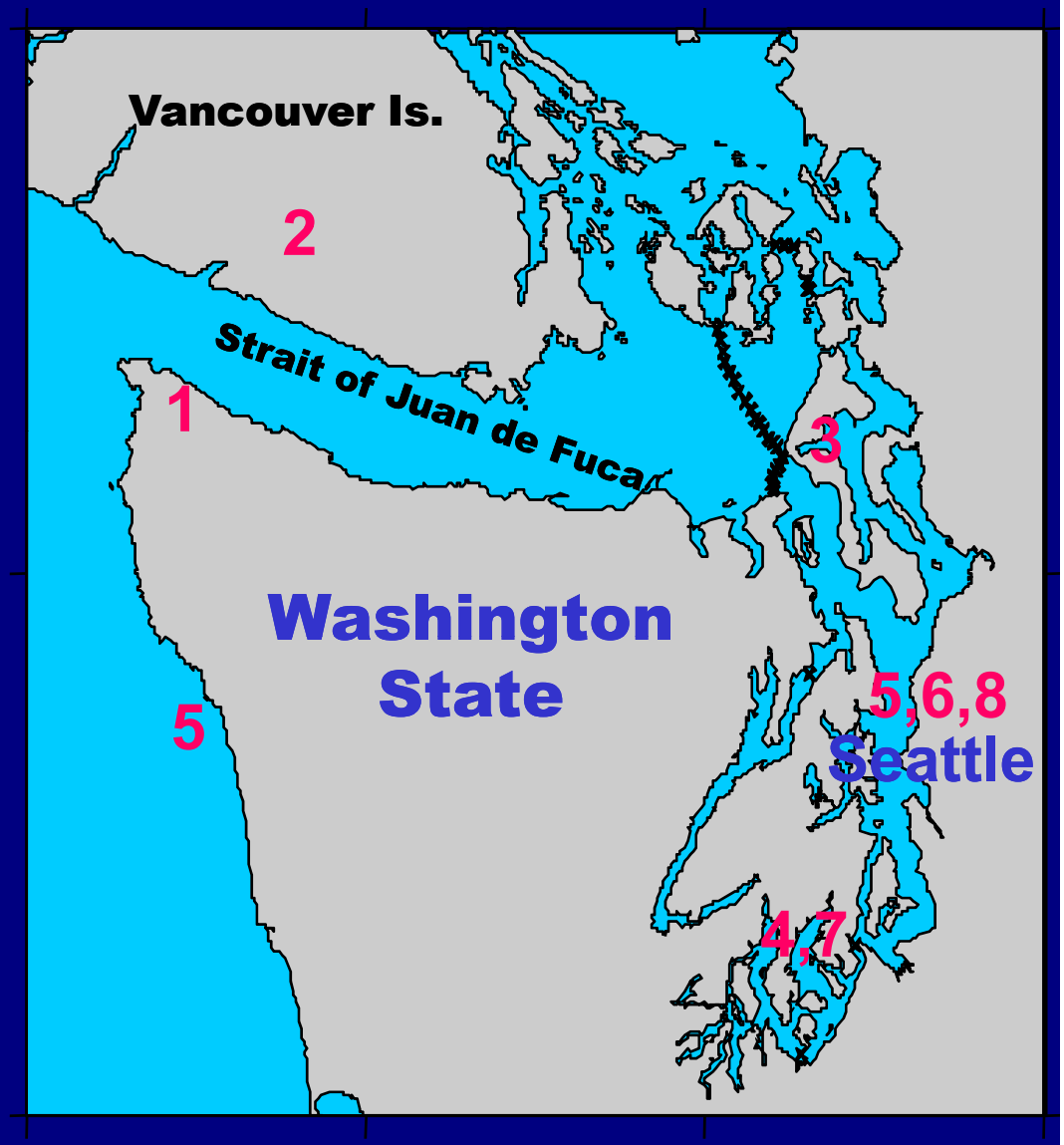
…research and monitoring highlights

Vera L. Trainer
NOAA Fisheries, Seattle WA

West Coast Governors' Association Conference, Portland February 2009

History: Paralytic Shellfish Poisoning

1. 1942 Clallam County
2. 1957 British Columbia
3. 1978 Whidbey Basin
4. 1988 Carr Inlet
5. 1997 All P. Sound & coast
6. 1998 All Puget Sound
7. 2000 Carr Inlet
8. 2006 All Puget Sound

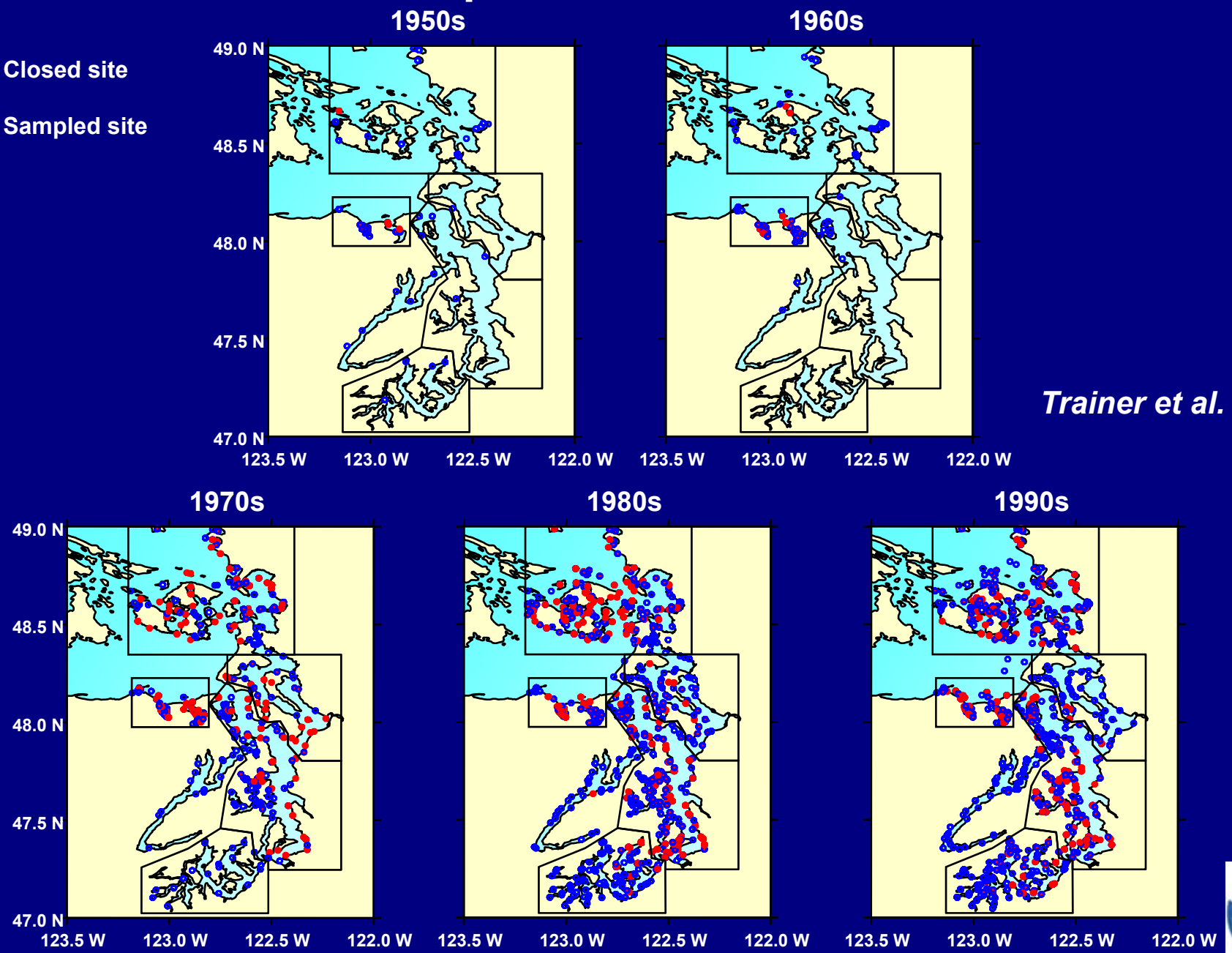


Slide courtesy Rita Horner, UW

Southward creep of closures due to PSP toxins

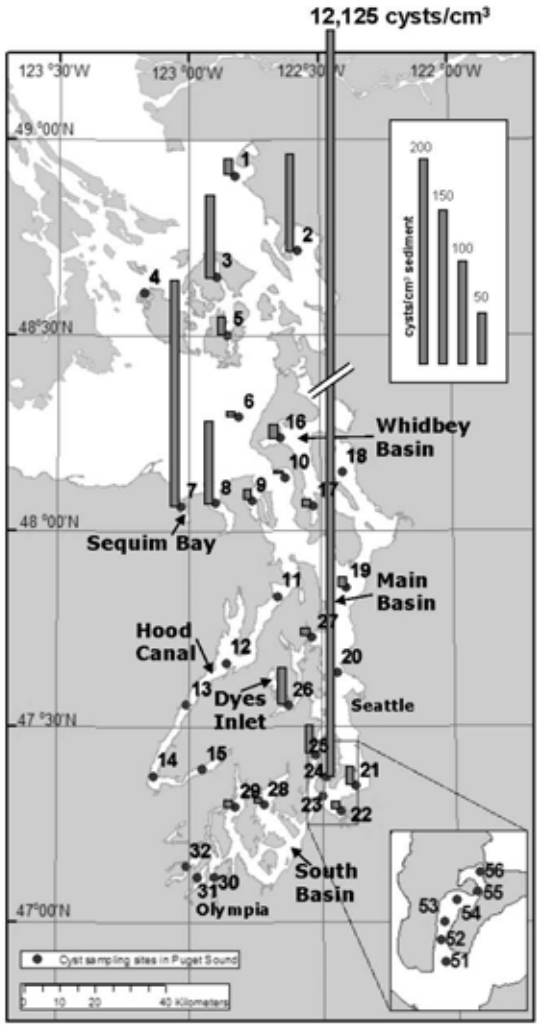
Closed site

Sampled site



Trainer et al. 2003

Distribution of *Alexandrium* cysts

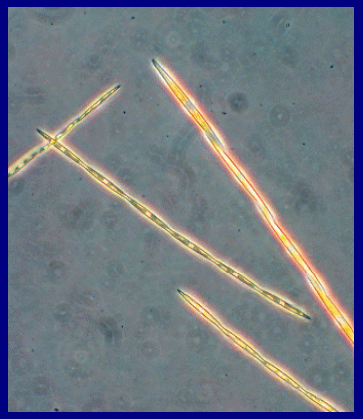


UW ECOHAB Cyst project

Slide courtesy Rita Horner, UW

History: Amnesic Shellfish Poisoning

1. 1991 WA Coast
2. 1994 Hood Canal
3. 1998 WA Coast
   (Ppd)
4. 2002-2003 WA Coast
   (Pa & Ppd)
5. 2002-2003 N. Puget Sound
6. 2005 N. Puget Sound



Pseudo-nitzschia

Slide courtesy Rita Horner, UW

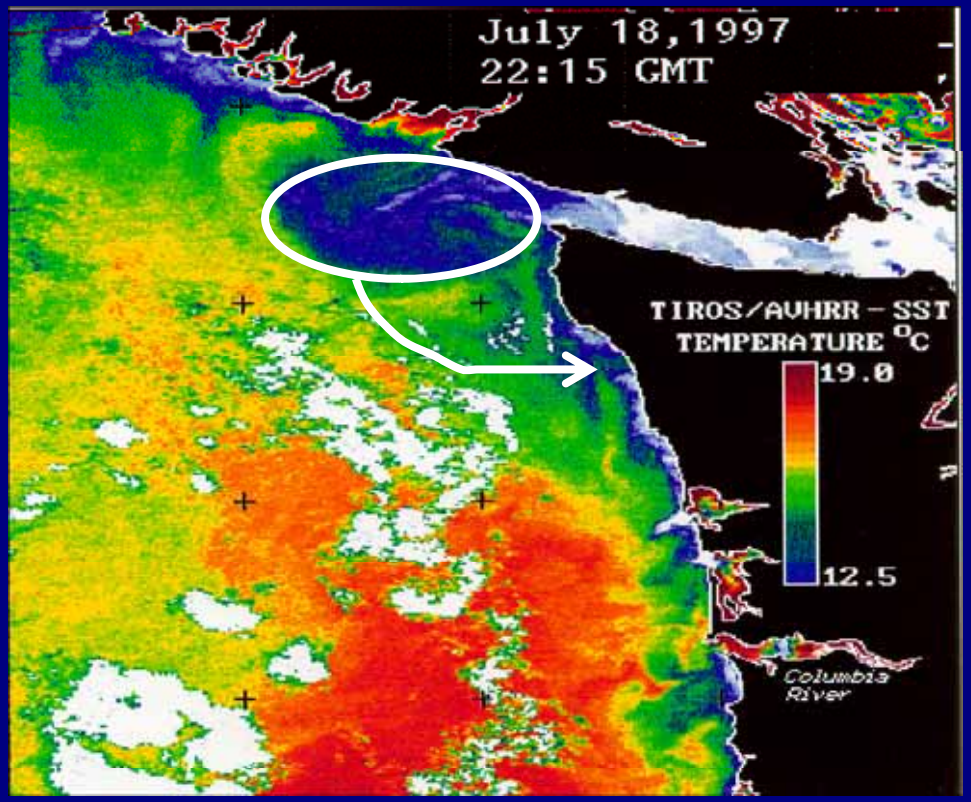
Olympic Region Harmful Algal Bloom (ORHAB) partnership

Synergy of Tribes, State, Federal, private institutions

Funding: MERHAB (NOAA) 2000-2005
State (license fee) 2006-present

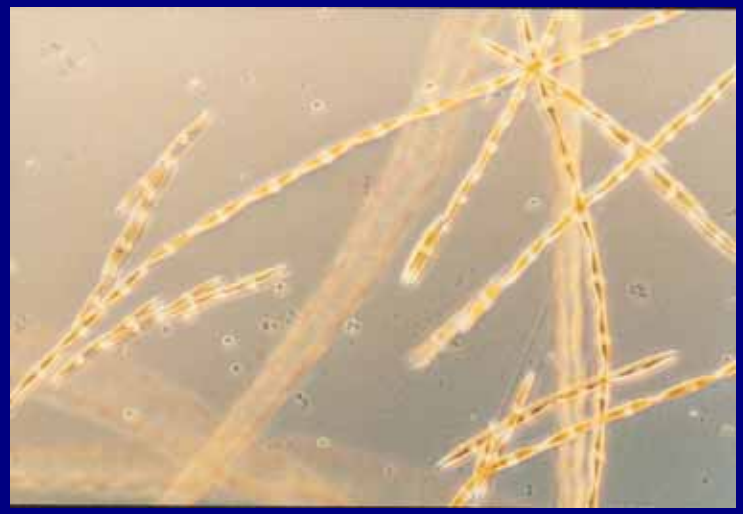
ECOHAB-PNW

The Juan de Fuca eddy region varies in shape and size

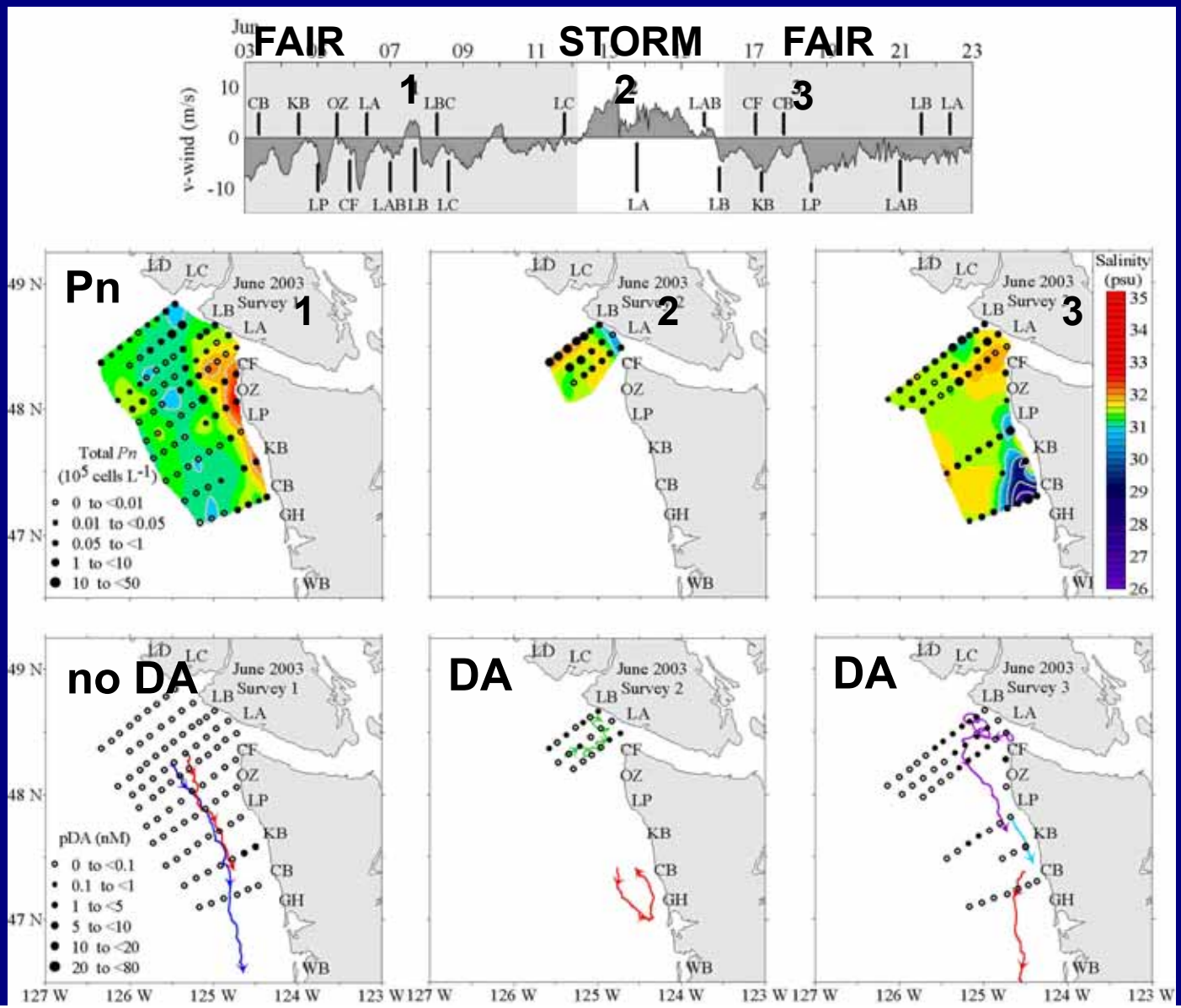


- the center is about 20 km offshore
- ~ 40 km in diameter
- fall storms are thought to bring toxigenic cells from the eddy region to the coast

The eddy is a nutrient-rich, retentive site where toxic *Pseudo-nitzschia* can reliably be found in summer months. We hypothesize that this site is more conducive to the growth of toxigenic *Pseudo-nitzschia* than the coastal upwelling region.



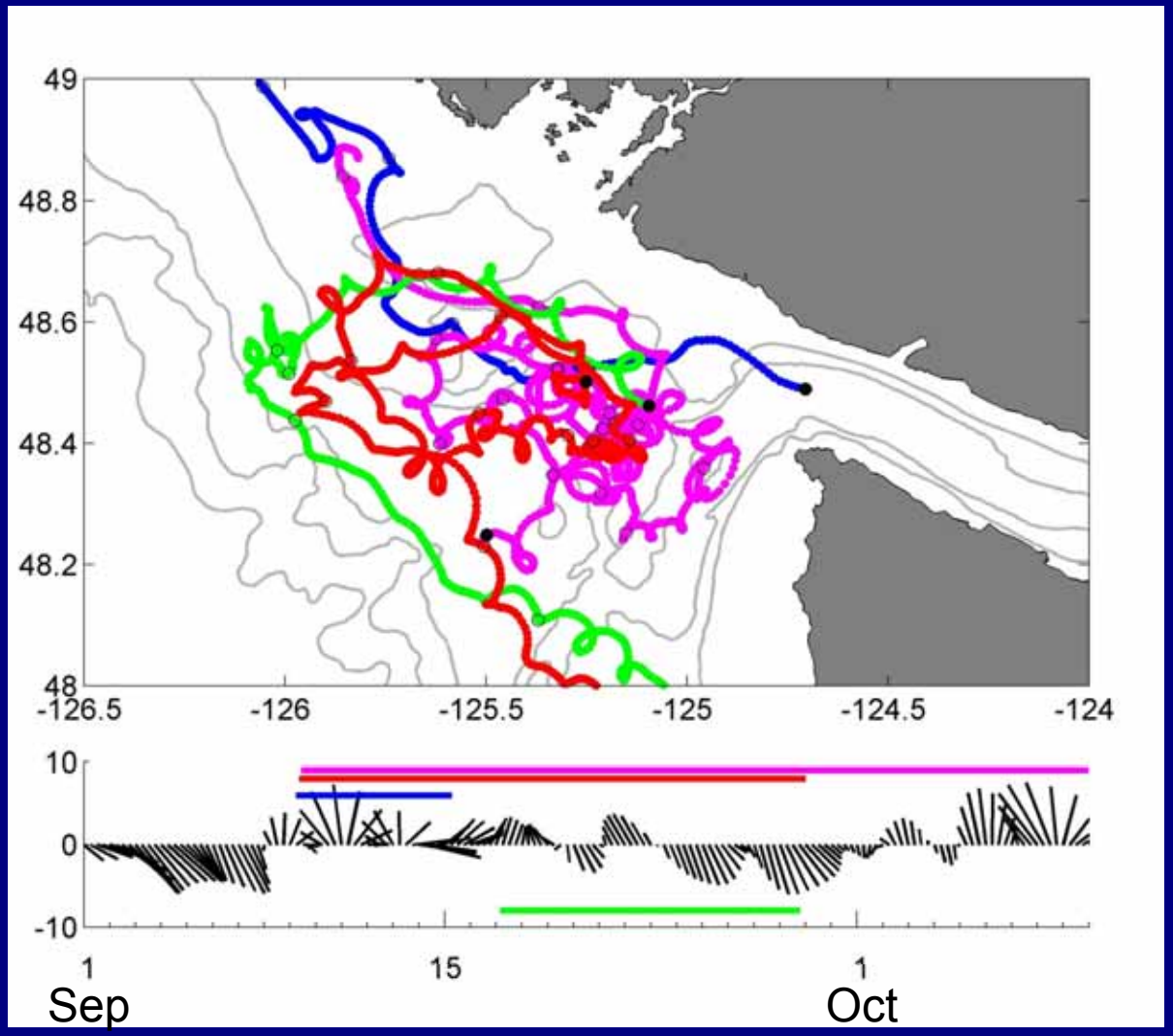
Domoic acid can be produced in situ within the eddy - a proven initiation site for HABs



ECOHAB-PNW

DA at coast only following storm, not associated with coastal upwelling

September 2004
--RETENTION IN THE EDDY--



ECOHAB-PNW

under variable wind conditions surface particles may be retained in the eddy for long periods (pink drifter, >30 days before exiting to north)

The regional economic impact of razor clam beach closures due to harmful algal blooms (HABs) in Washington State

QuickTime™ and a
TIFF (Uncompressed) decompressor
are needed to see this picture.

Huppert & Dyson, UW

Human Health Study
Impacts of long term low level toxin exposure

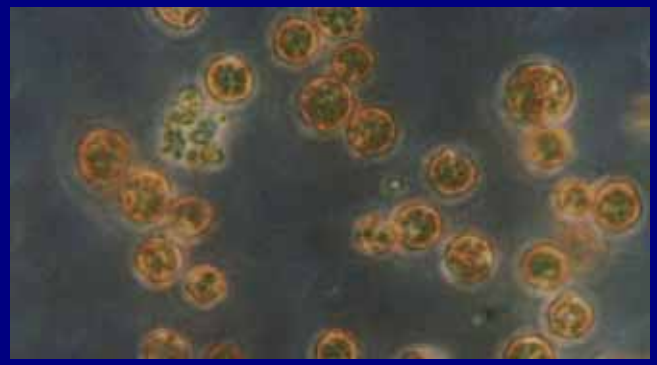
Tribal quota - 100 clams per day for most of the season

General public - 15 clams per day (~8 weekends per year)

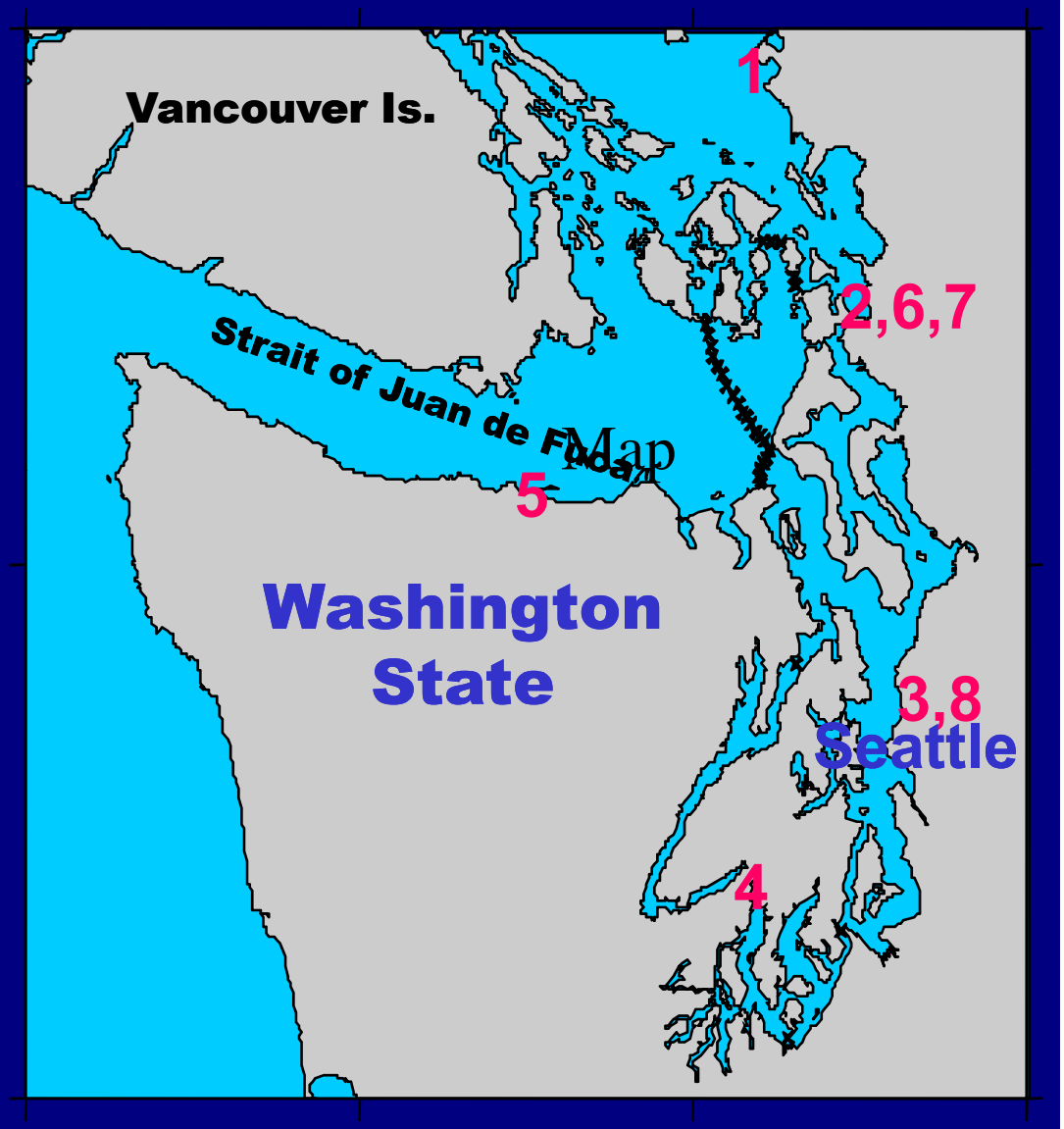
Lynn Grattan & collaborators

History: *Heterosigma* Events

1. 1976 Bellingham
2. 1986 North Puget Sound
3. 1990 Central Puget Sound
4. 1994 Case Inlet
5. 1997 Port Angeles
6. 2006 North Puget Sound
7. 2007 North Puget Sound
8. 2007 Central Puget Sound



Heterosigma



Slide courtesy Rita Horner

Bloom mitigation

Clay in mesocosms in East Sound to an actual *Heterosigma* bloom. One of the few places we always find *Heterosigma* seasonally.

Courtesy Jack Rensel

Ecophysiology and toxicity of *Heterosigma akashiwo* isolates from eastern North Pacific coastal waters

S. Strom, S. Menden-Deuer, K. Fredrickson, R. Crim,
S. Graham, L. Harvey

Insights into *H. akashiwo* bloom development

Toxic to large ciliates

High *H. akashiwo* density

Broad S tolerance allows growth throughout estuary

Grazer avoidance focuses predation on competitors

H. akashiwo seed population

River plume

Increasing salinity (S)

Marine waters

'Grazing gap': low-S grazers replaced by high-S grazers

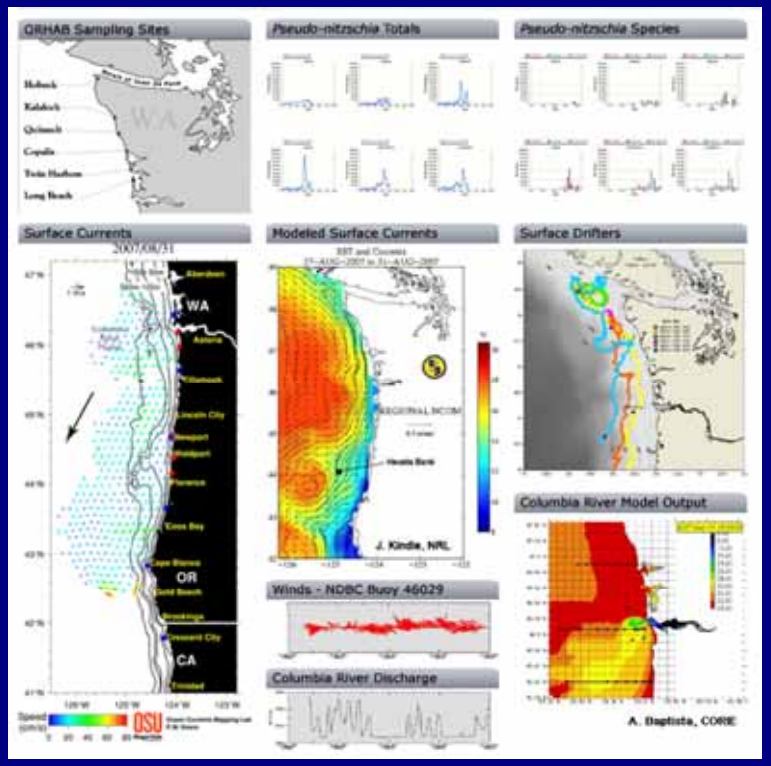
'Ability to grow on multiple sources of regenerated N

Slide courtesy Suzanne Strom

Forecasting

Forecasting capabilities

WA outer coast

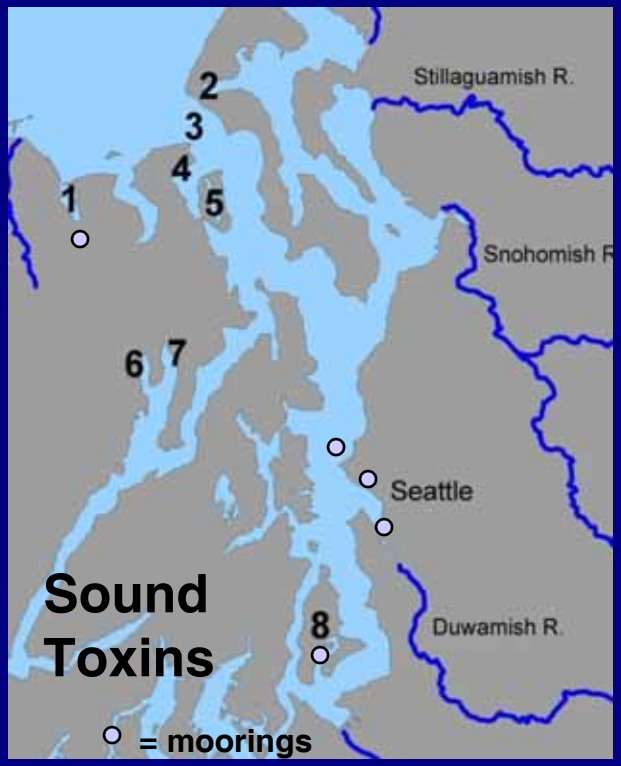


Bulletin components

Sites, *Pseudo-nitzschia* abundance & species, Currents, Winds, Columbia River, Drifters. Narrative

Collaboration with CDC & NOAA National Office

Puget Sound

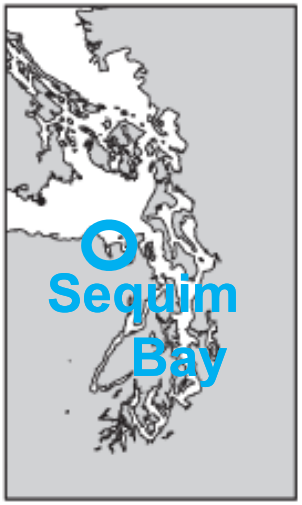


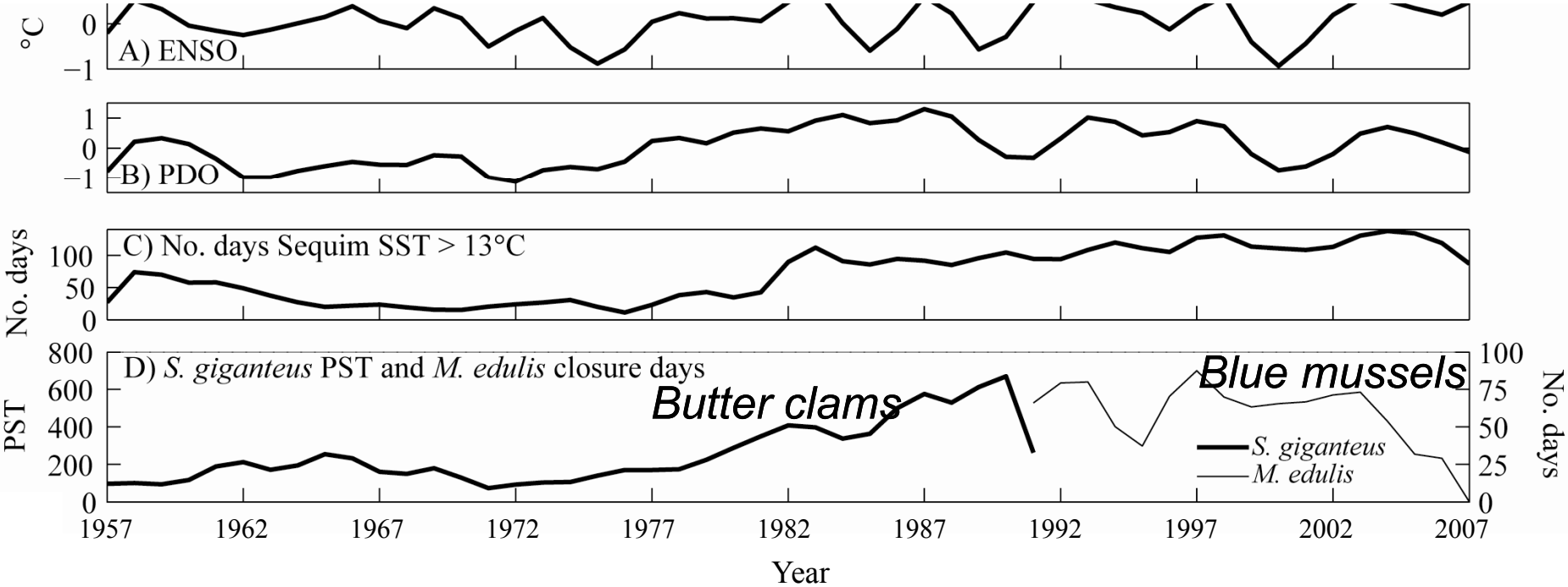
Phytoplankton sampling & ID

1. Jamestown S'Klallam Tribe
2. Penn Cove Mussels LLC.
3-5. Port Townsend Marine Science Center
6. Coast Seafood Co.
7. Taylor Shellfish
8. Vashon Island resident

ENSO, PDO, SST, and PSTs

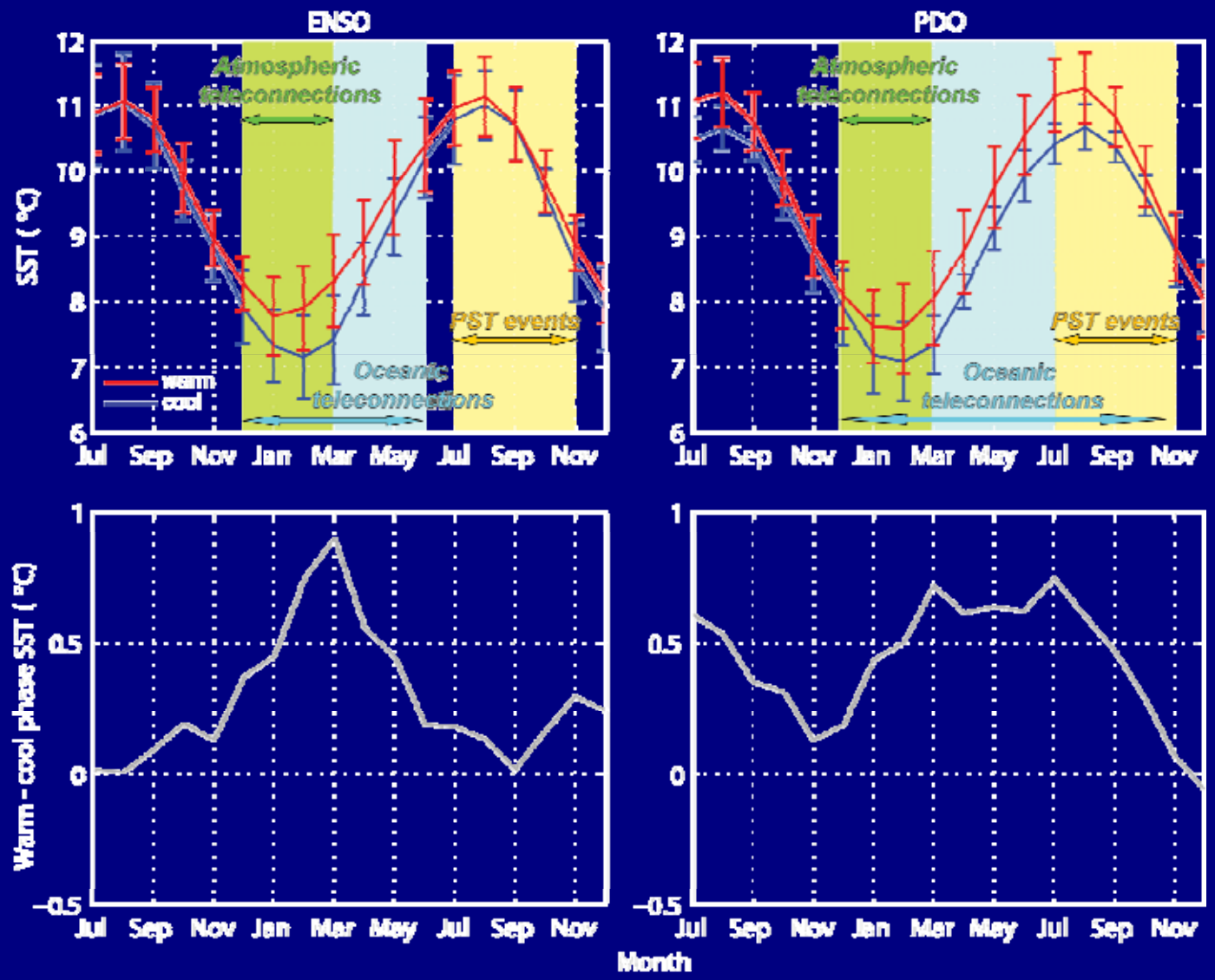
Warm phases of the PDO covary with more days that SST is favorable for *A. catenella* growth each year and butter clam toxicity…





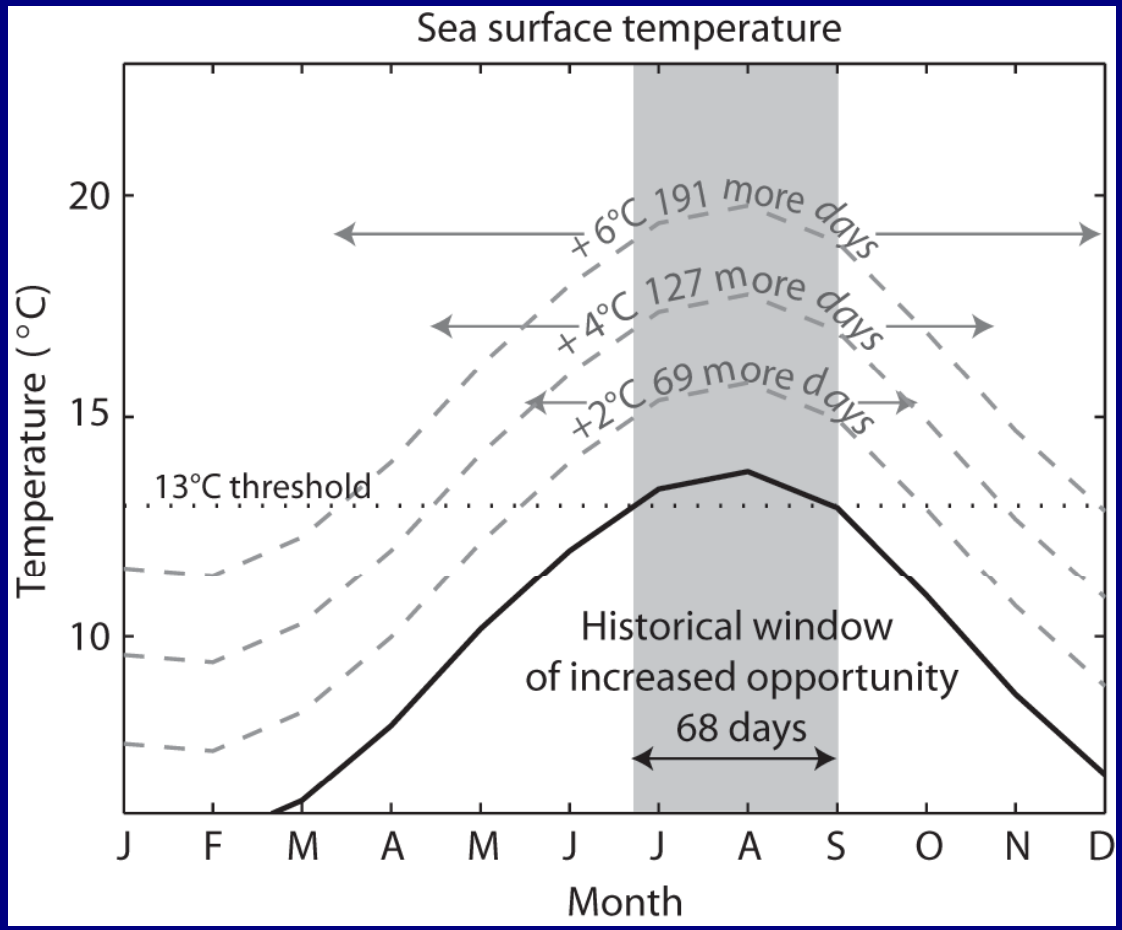
Slide courtesy Stephanie Moore, NOAA

- **Mismatch of ENSO teleconnections to Puget Sound PST events**
- **Persistence of PDO teleconnections - overlap with Puget Sound PST events**



Slide courtesy Stephanie Moore, NOAA

Anthropogenic climate change may increase the window of opportunity for *Alexandrium catenella*



Slide courtesy Stephanie Moore, NOAA

Acknowledgements

ECOHAB-PNW

ORHAB

NWFSC Marine Biotoxin Program

SoundToxins

State partners

..and many others

Washington State HAB collaborators