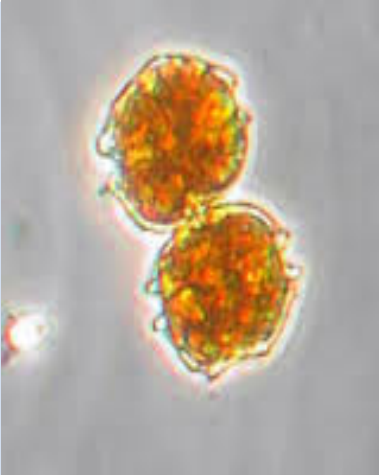




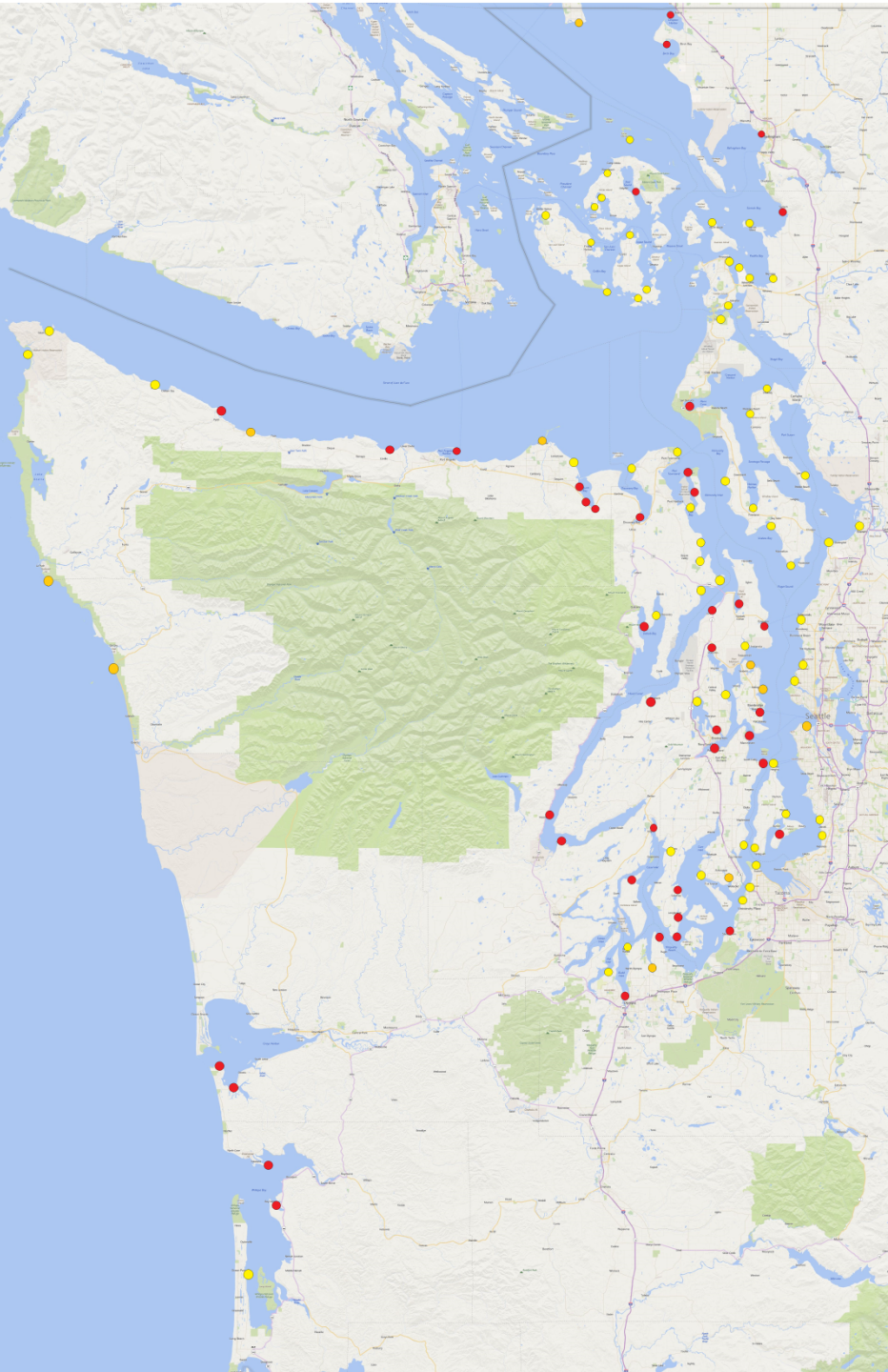


HAB-ITUAL FORECASTING

Jerry Borchert and Audrey Coyne

WA Marine Biotoxin Program

Biotoxin Type:	Paralytic Shellfish Poisoning (PSP)	Amnesic Shellfish Poisoning (ASP)	Diarrhetic Shellfish Poisoning (DSP)
Microscopic Phytoplankton:			
Caused by:	Dinoflagellate <i>Alexandrium catenella</i>	Diatom <i>Pseudo-nitzschia</i> spp.	Dinoflagellate <i>Dinophysis</i> spp.
Toxin Produced:	Saxitoxin (Neurotoxin)	Domoic Acid (Neurotoxin)	Okadaic Acid
Started Monitoring Samples/year:	1957 ~3200 tests/year	1991 ~1500 tests/year	2012 ~2500 tests/year
Action Level:	≥80 µg/100g tissue	2 ≥20 ppm in tissue	≥16 µg/100g tissue



Biotoxin Program

Monitoring Sites

~111 sites in Washington
42 sampled year round
69 sampled seasonally

Coordinated effort
among DOH staff, DFW,
DNR, local health, tribes,
industry and citizen
volunteers

Biotoxin Early Warning System



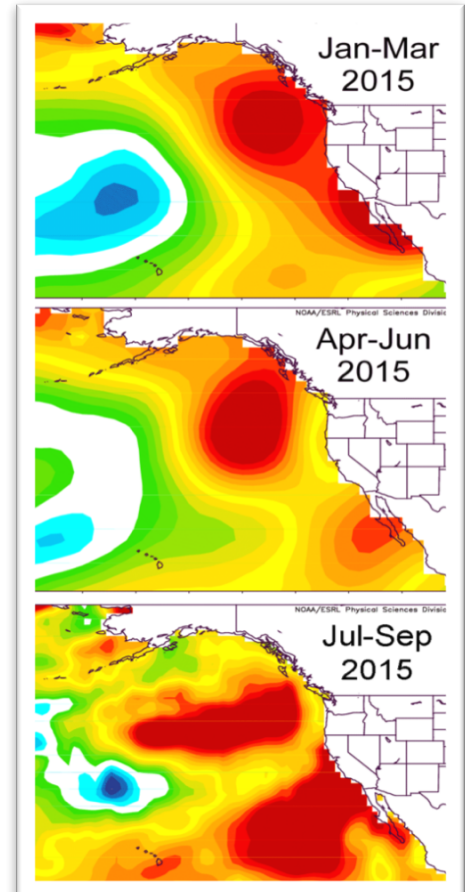
Biotoxin Testing



Phytoplankton Monitoring

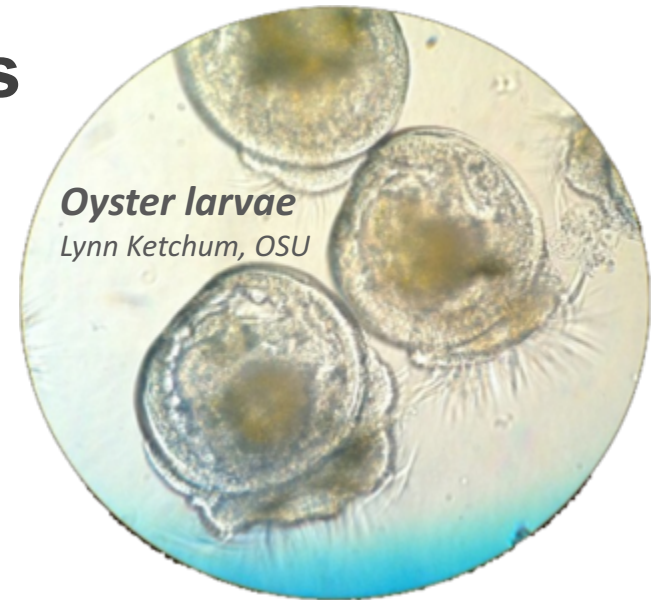


Weather and Climate Data



Connection to Climate Data

- **More factors, more stress, less resilience**
 - **Temperature extremes**
 - **Storm events**
 - **Ocean acidification**
 - **Upwelling changes (season, persistence)**
- **“Changing ocean conditions”**
- **Change in our reliance on fisheries species and seasonality...**



Using Weather and Climate Data



Current Weather Conditions

Helps predict where and when harmful algal blooms may occur or where they will travel once present.



Long term Climate Trends

Helps our program explain current events and prepare for the future.



Working with Partners

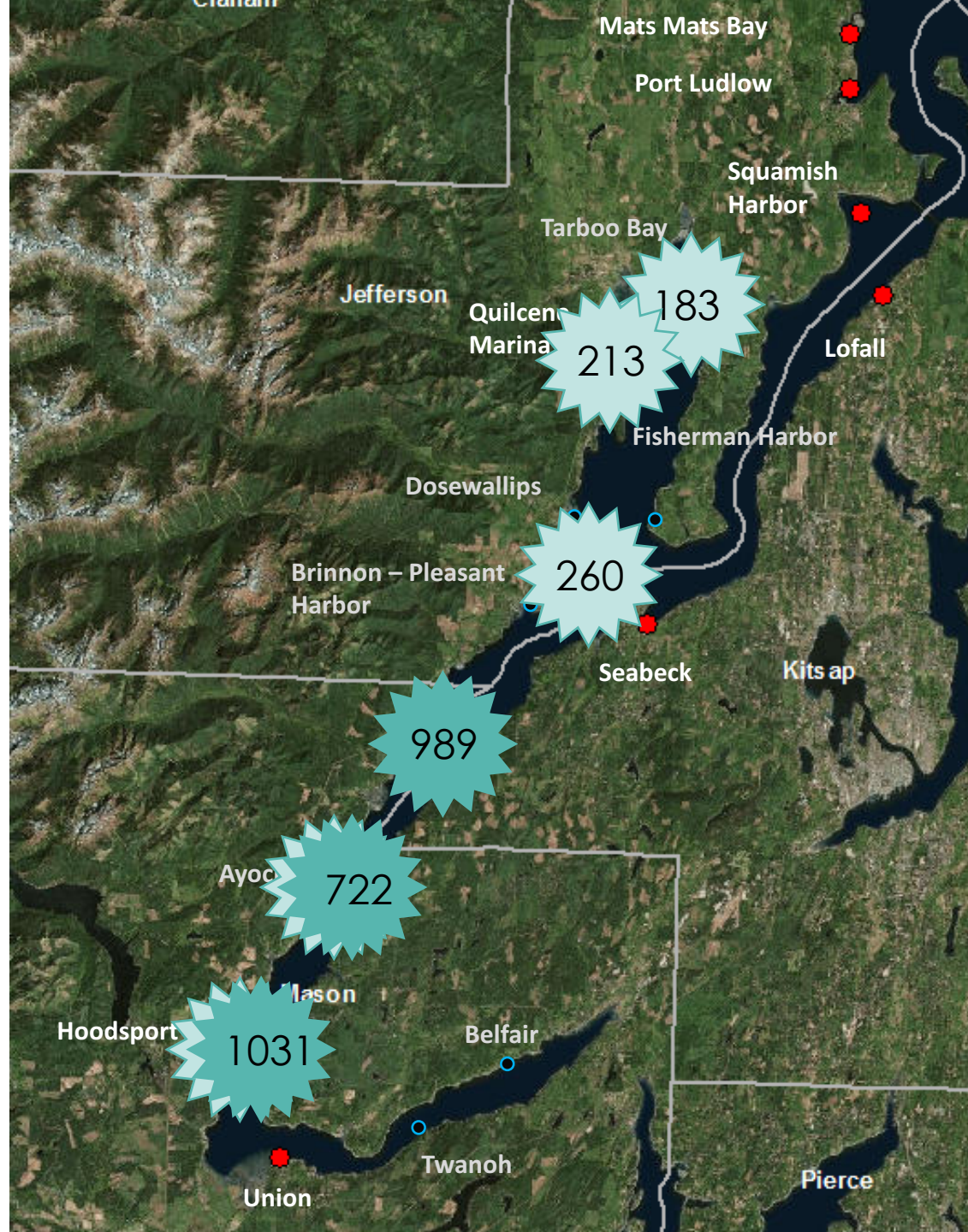
Research partners help develop resources which aid in the forecasting of current and future biotoxin trends.



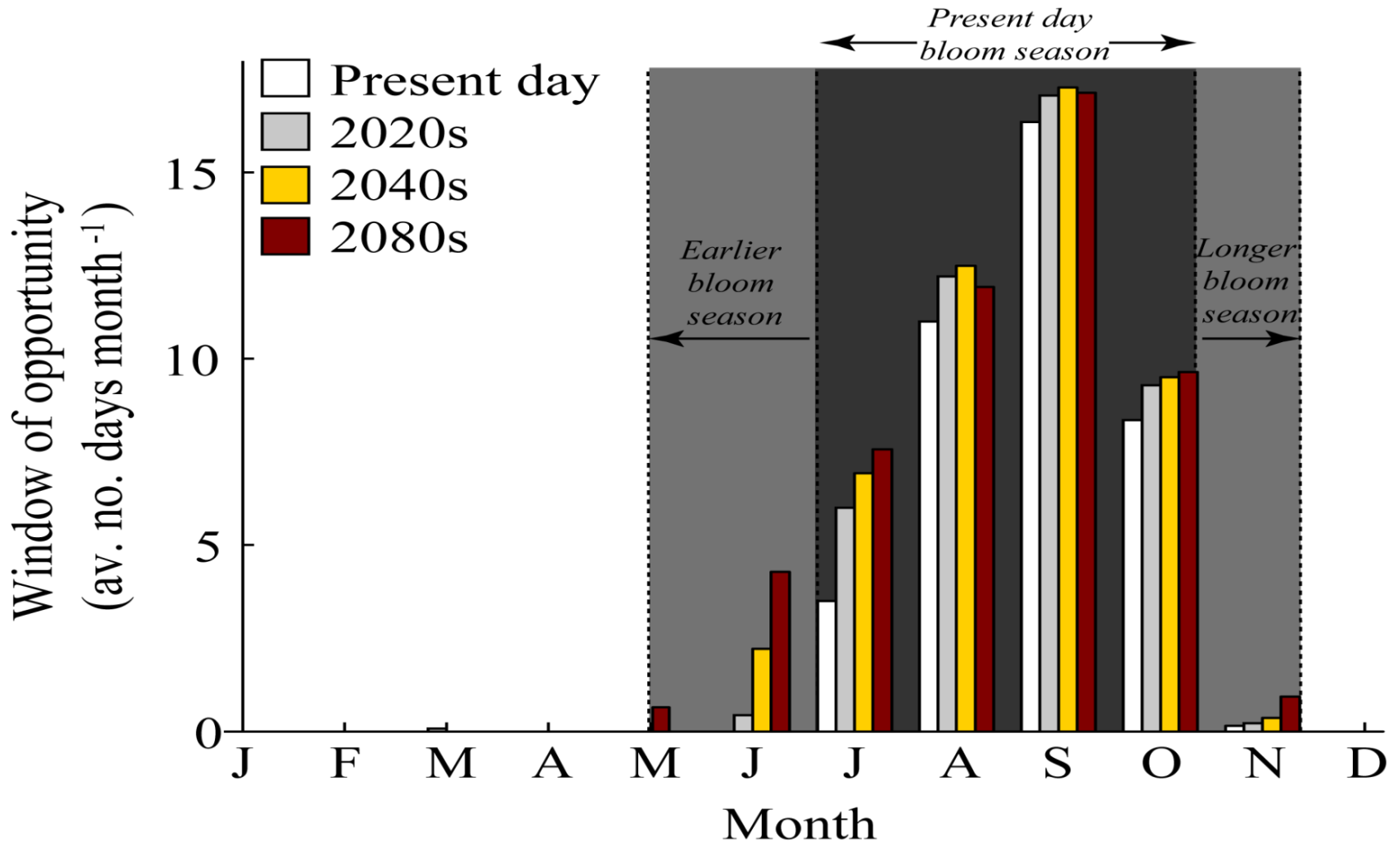
Using Current Weather Conditions

Weather Conditions

Tracking a PSP Bloom in Hood Canal with current wind data.

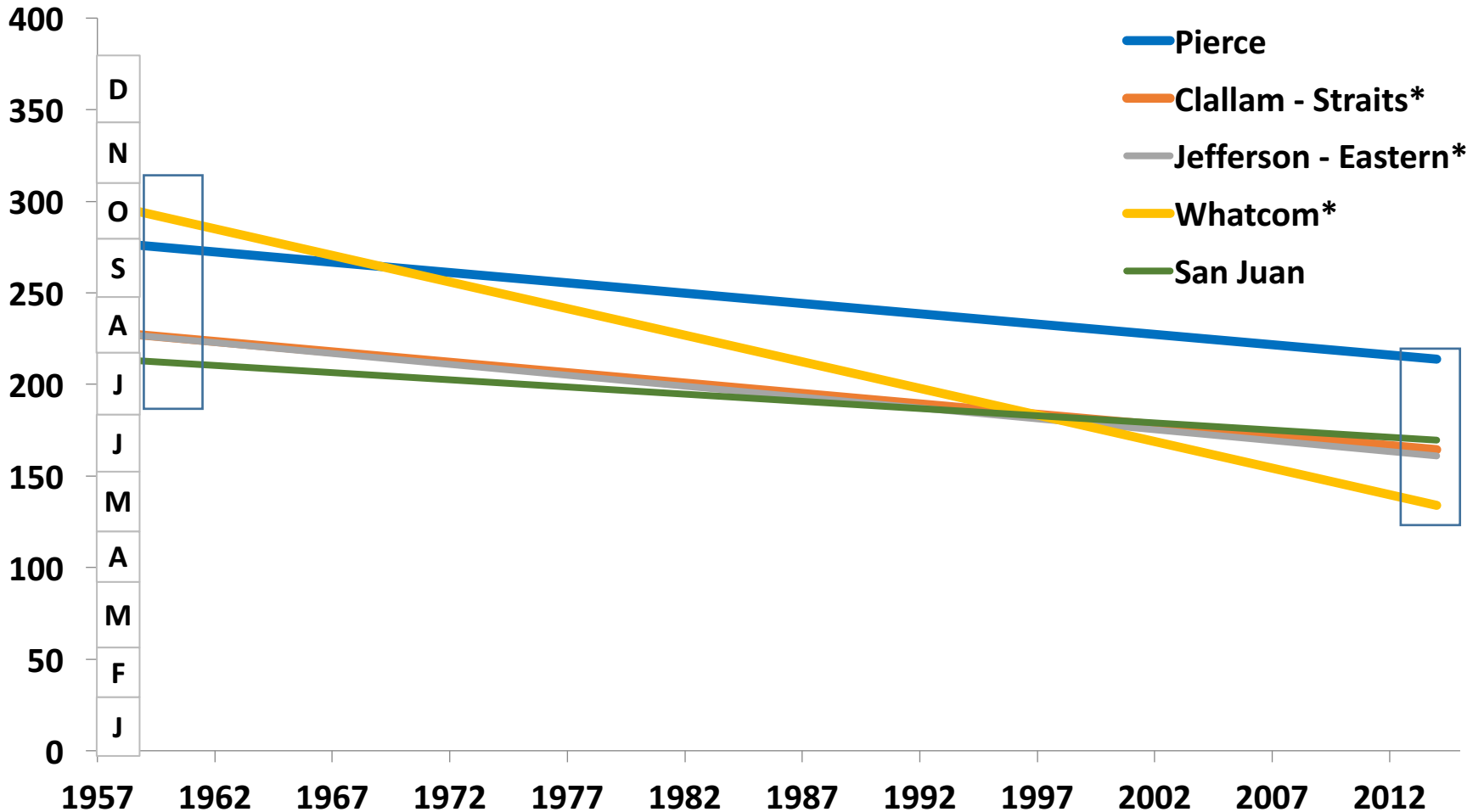


Using Long Term Climate Trends



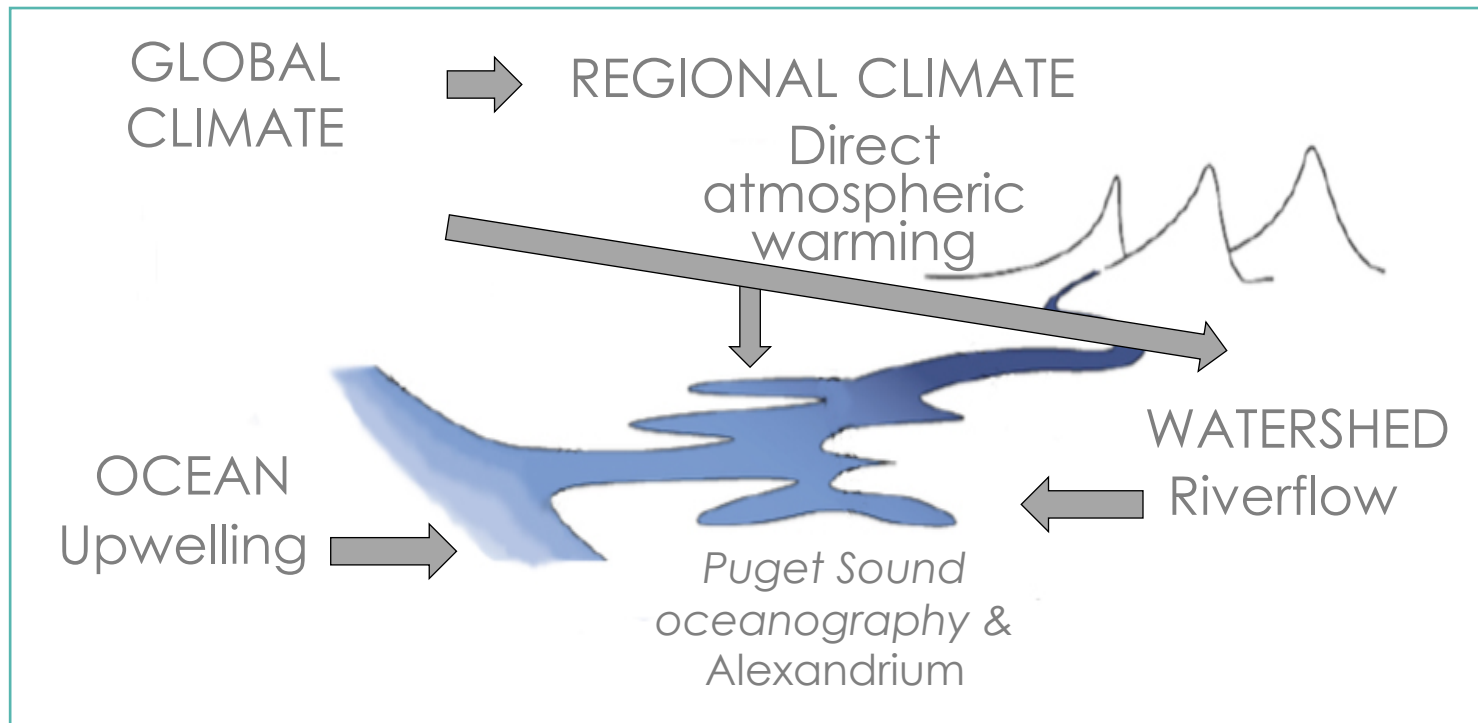
Using Long Term Climate Trends

First PSP Closure of the Year in Puget Sound



Working With Partners, Part 1

Development of a Decision Support Tool for HAB Risk Prediction in Puget Sound in a Changing Climate



Compare the influences of the **OCEAN**, **WATERSHED**, and **ATMOSPHERE** on Puget Sound oceanography & *Alexandrium* now and in the future

Project Outcomes

- Better understanding of possible climate impacts related to PST occurrences and distribution regionally
- Decision Support
 - Stakeholder planning
 - Allocation of resources
 - PST Risk Index



DANGER 

TOXIC SHELLFISH 

Shellfish in this area are unsafe to eat due to biotoxins paralytic shellfish poisoning (PSP) and/or amnesic shellfish poisoning (ASP).

DO NOT EAT clams, oysters, mussels, or scallops. 

SÒ, NGHÊU, HẾN, HÀO BỊ NHỄM ĐỘC. ĐỪNG NHÉN ĂN! 

유독성 조개류. 먹지마십시오! 

សត្វស្រទាត់ ព្យុសស្រទាត់ ឬក្រុមប្រភេទផ្សេងៗ មិនអាចប្រើប្រាស់បានទេ ព្រោះវាមានប៊ុតុកស៊ីន។

ဆိတ်ကုပ-ယေဝဂ်ဂိဝိဒါစာ ဝိမိစာမဝိဒါစာ စာမကိမ်!

有毒貝類・切勿食用! 

MARISCOS TÓXICOS. ¡NO COMER!

ЯДОВИТЫЕ МОЛЛУСКИ. НЕ ПРИНИМАТЬ В ПИЩУ!

Always check the biotoxin hotline:
1-800-562-5632 or
www.doh.wa.gov/shellfishsafety.htm
For more information, contact:

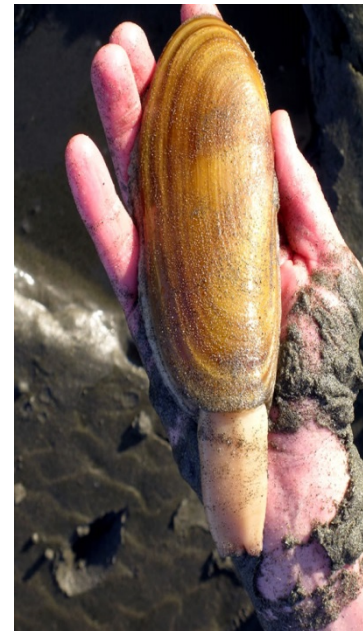

360-236-3330

Working With Partners, Part 2

An early warning system for *Pseudo-nitzschia* HABs on Pacific Northwest outer-coast beaches

Current beach monitoring allows managers to detect when a toxin bloom has already arrived.

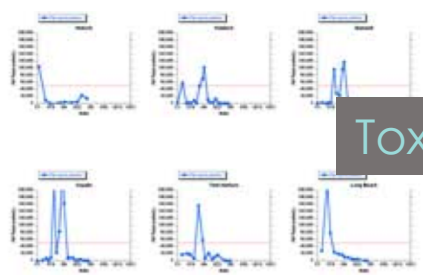
Project Goal is to develop a model- and monitoring-based forecast system for toxin blooms along the Washington and northern Oregon coasts that will supplement current beach sampling.



ORHAB Sample Sites



Pseudo-nitzschia Totals



Pseudo-nitzschia Species

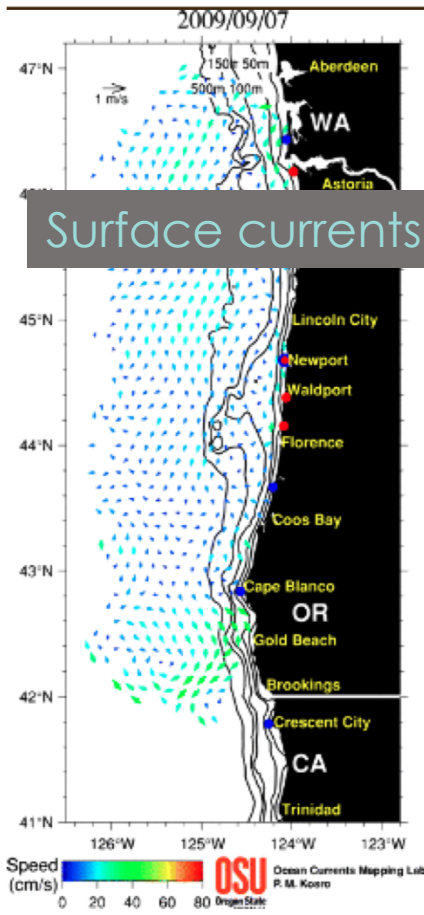


Pseudo-nitzschia (PN) totals are identified by light microscopy and grouped by PN Large and PN Small. The 50k cells/L threshold level for large PN that triggers toxin testing is indicated by a red line across the PN plots. (The trigger for toxin testing for small PN is 1 million cells/L)

Toxic cell abundance

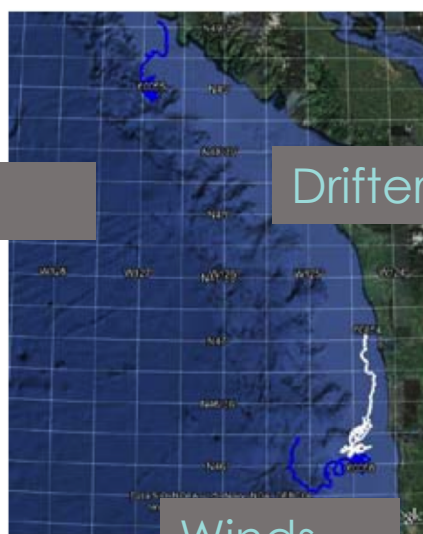
Pseudo-nitzschia spp. have not been recent whole water samples except Hobuck Beach on 9/4 at 14,000 cells/L of the small cell type. The highest levels of DA in razor clams are found at Quinalt Res. B & MocRocks BC on 8/24 at 7 ppm. Alexandrium spp. are present all along the WA coast in recent samples. The highest counts are at Long Beach on 9/4 at 7,000 cells/L of A. catenella. PSP is detectable in shellfish at all sites along the WA coast. The highest counts are found at La Push, Second Beach on 9/2 at 1.5 µg/100g in CA mussels according to WDOH. Dinophysis spp. have been common in recent samples. The highest levels are at Raft River on 8/27 at 4,000 cells/L of D. acuminata.

Surface Currents



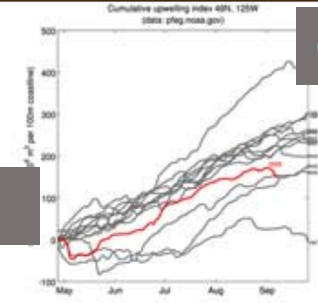
Surface currents

ARGOS Drifters



Drifters

Cumulative Upwelling Index



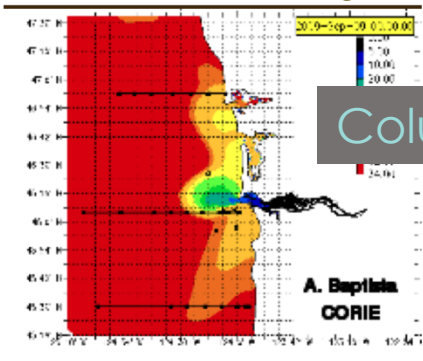
CUI

Strong downwelling favorable winds (from the south) have been prevalent during early September, as observed at NDBC buoy 46029. Surface currents are directed northward over the continental shelves of southern Washington and northern Oregon, and surface drifters have moved northward and toward shore. Model results show the Columbia River plume influencing the southern Washington coast. It is likely that phytoplankton populations along the coast have originated from offshore, especially along the northern Washington coast where the

Columbia River model

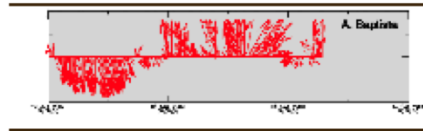
Forecast - Upwelling favorable winds are expected to resume Thursday 9/10 through Saturday 9/12. The marine forecast has winds returning to downwelling favorable by Monday 9/14. As the fall season approaches, there is a greater likelihood of downwelling winds. We forecast high risk levels for transport of Pseudo-nitzschia (not necessarily toxic) from the Juan de Fuca eddy region to coastal beaches in the following week. Condition is red.

Columbia River Model Output



Columbia River model

Winds - NDBC Buoy 46029



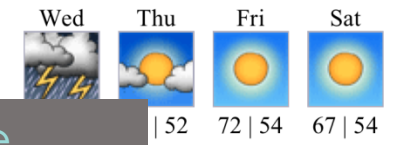
Winds

Columbia River Discharge



River discharge

Weather Forecast - Ocean Shores



Weather

In Conclusion

1 Working Well

Partnerships provide valuable research and resources used by the biotoxin program that help explain current biotoxin events and prepare for future events.

2 Challenges

Program capacity to look at weather and climate data is limited.

There is still a lot to learn about factors that can impact biotoxin events.

3 Takeaways

Weather and climate data is an important early warning tool for the biotoxin program.



Contacts



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**Office of Environmental Health and Safety
Shellfish Certification and Licensing Section
Biotoxin Program**