

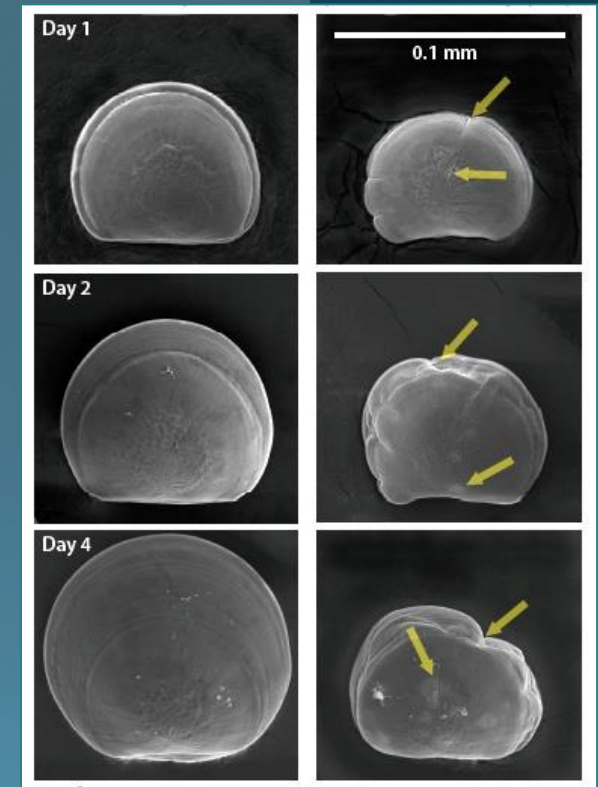
Northwest Shellfish vs Ocean Acidification



Andy Suhrbier, Pacific Shellfish Institute
Climate Change Research and Action in Washington State
Evergreen State College, January 2016

Fast → Background

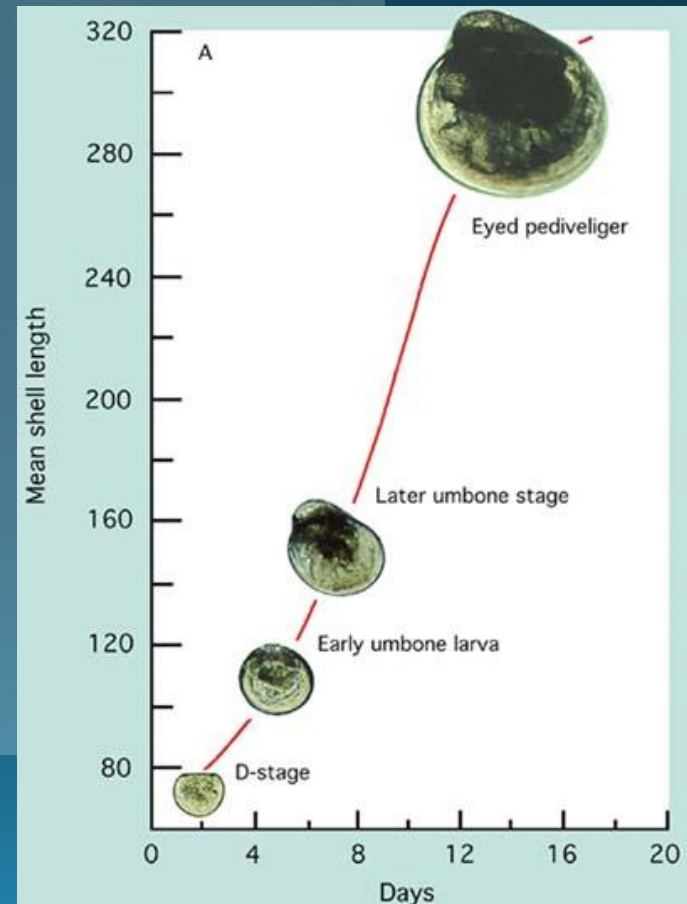
- Ocean Acidification
 - Increased CO₂ in the atmosphere
 - Introduced into seawater
 - Decreases pH
 - Decreases Ω aragonite
 - Calcium Carbonate availability
- Shellfish
 - Need calcium carbonate to form shells
 - High energy expense in early development
 - Reduced natural set success
 - Hatchery failures



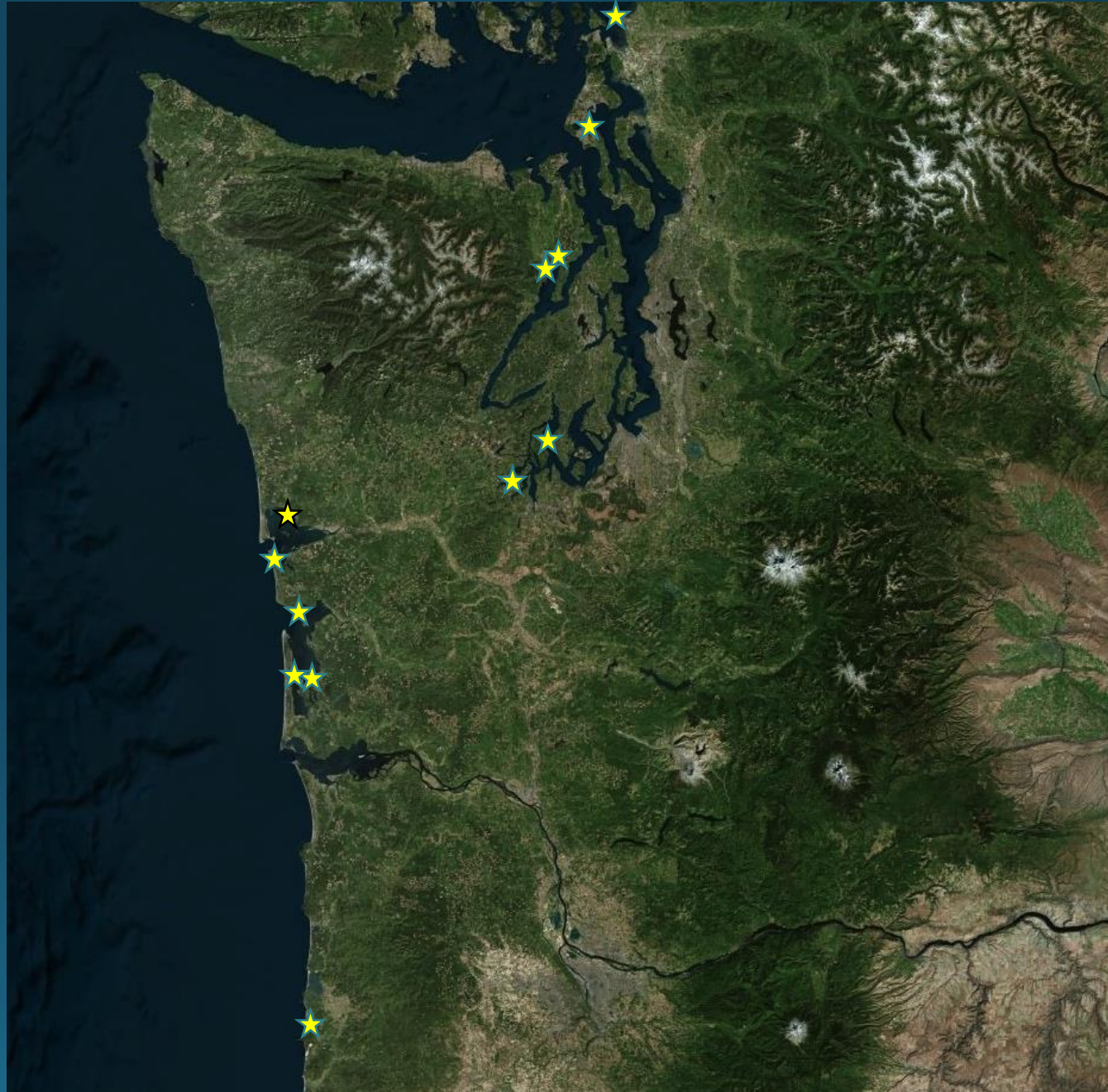
OSU SEM, Waldbusser et al.

Current Research and Action

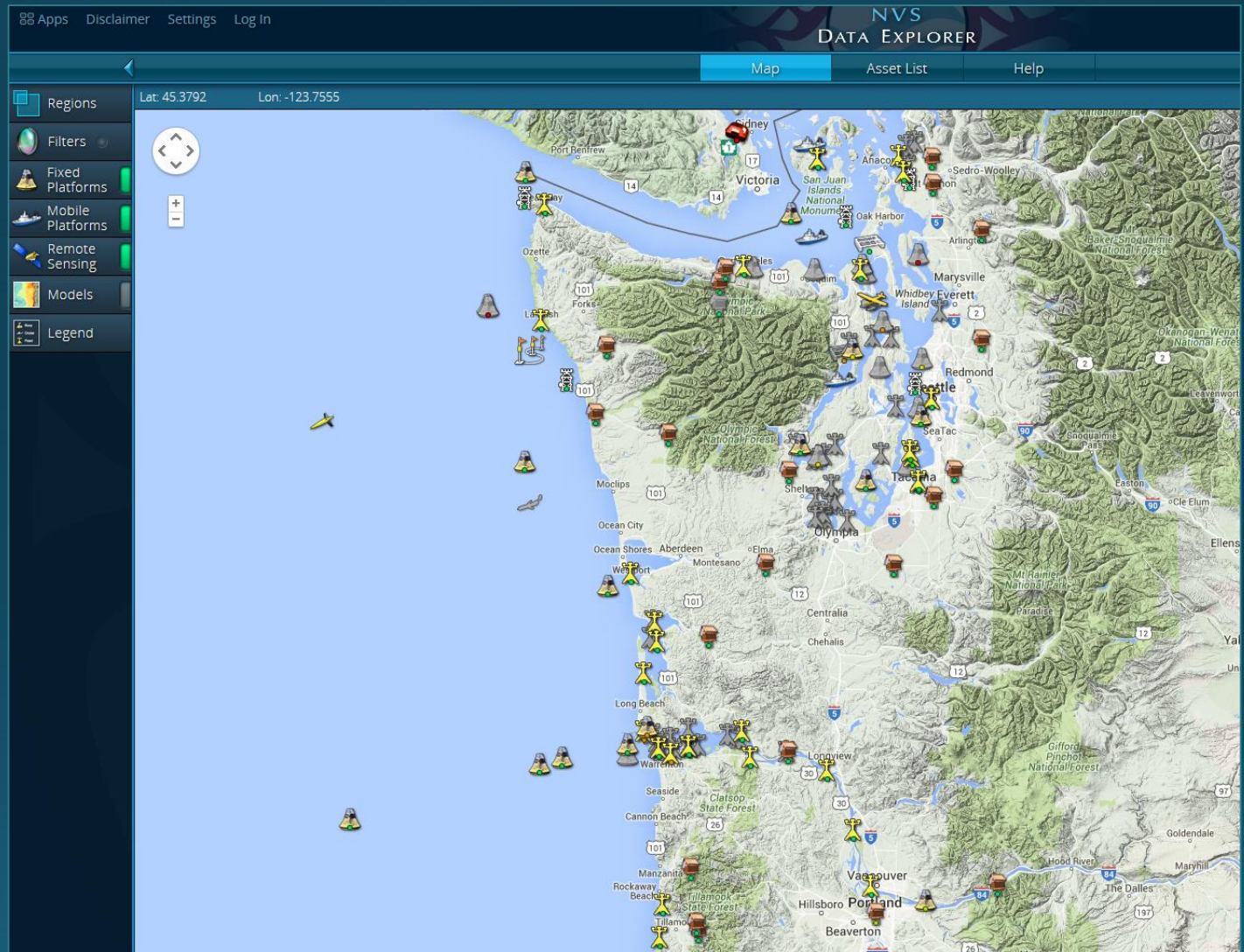
- **Baseline Studies**
 - **Water Quality Determination**
 - T, S, DO, pH and Carbon Chemistry
 - p & TCO₂ and Ω aragonite
 - **Physiological Effects**
- **Actions**
 - **Monitoring**
 - **Hatchery modifications**
 - **Breeding Programs**



Baseline Studies



Baseline Studies & Real Time Info



<http://nvs.nanoos.org/Explorer>

* iPhone, iPad apps

Bay Center Port



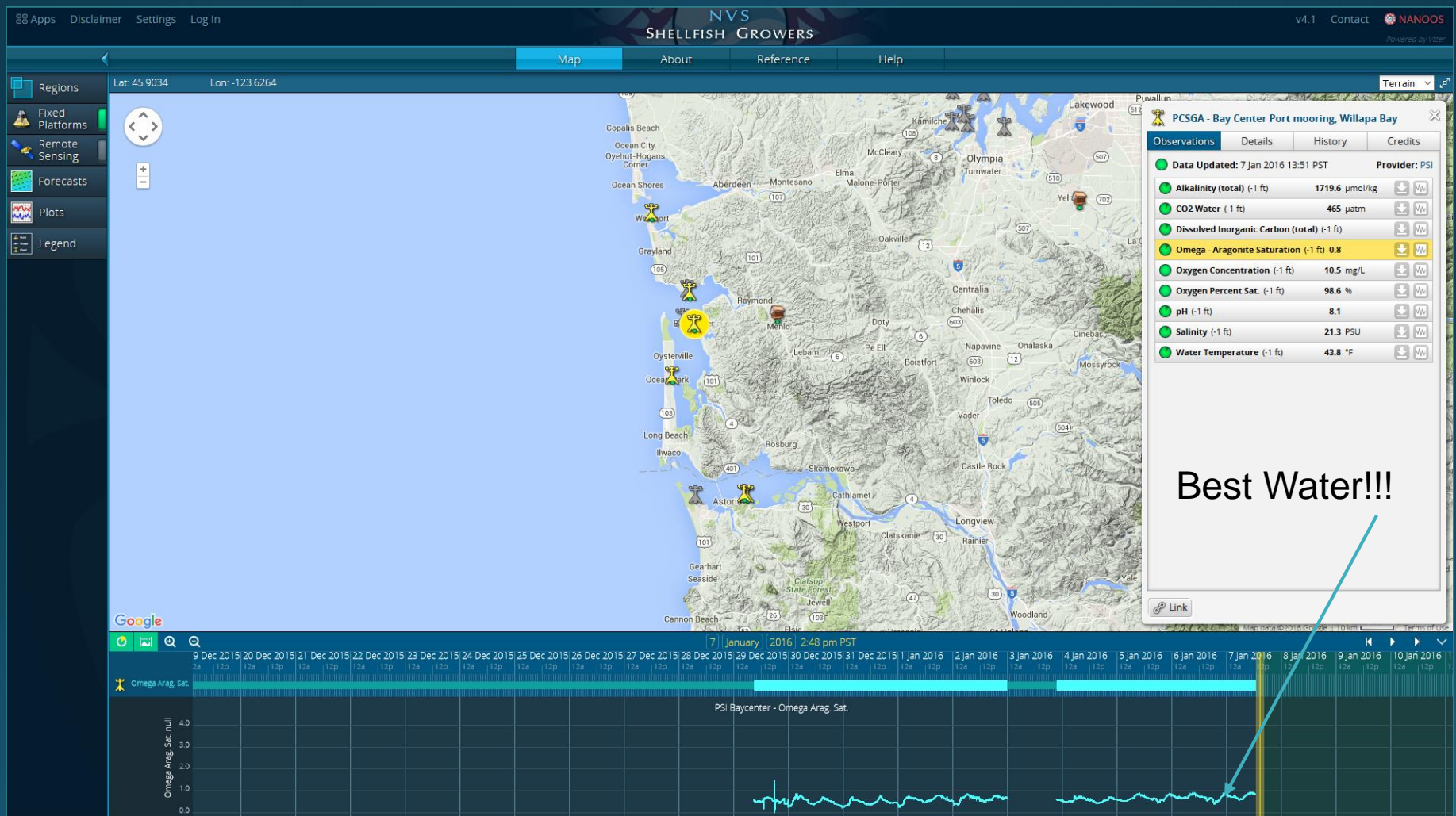
Bay Center



Bay Center



Bay Center Real Time Data



Nahcotta Port



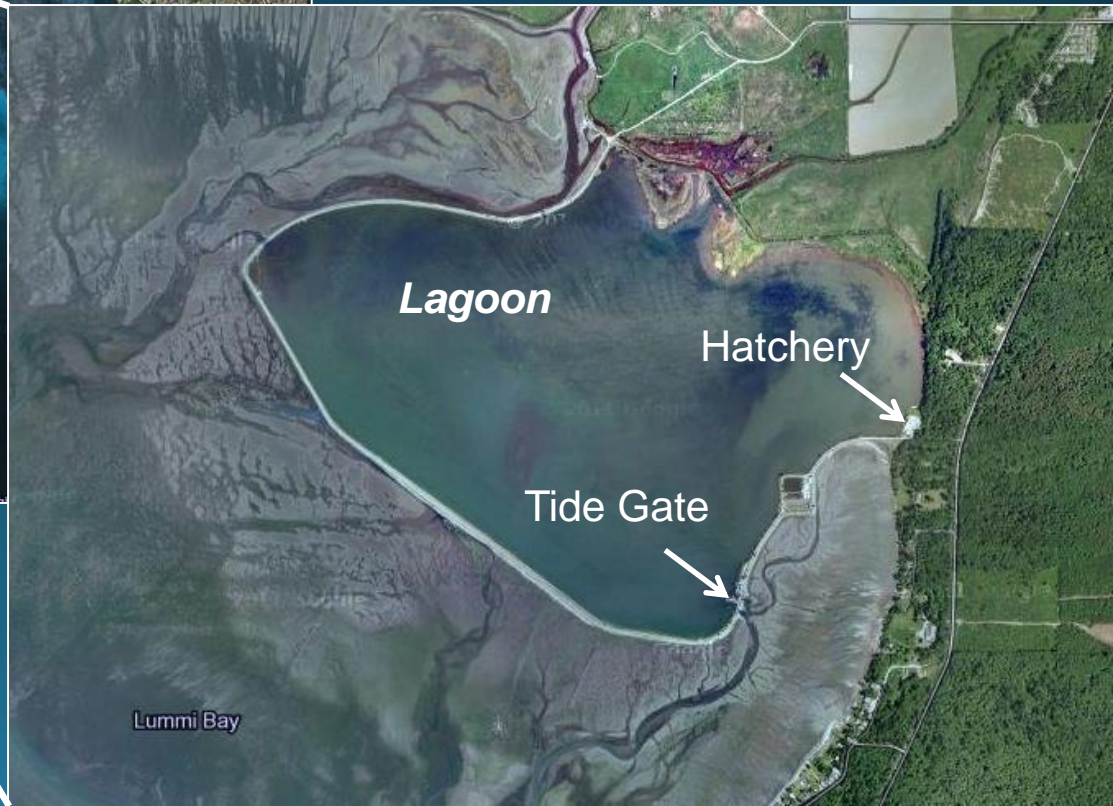
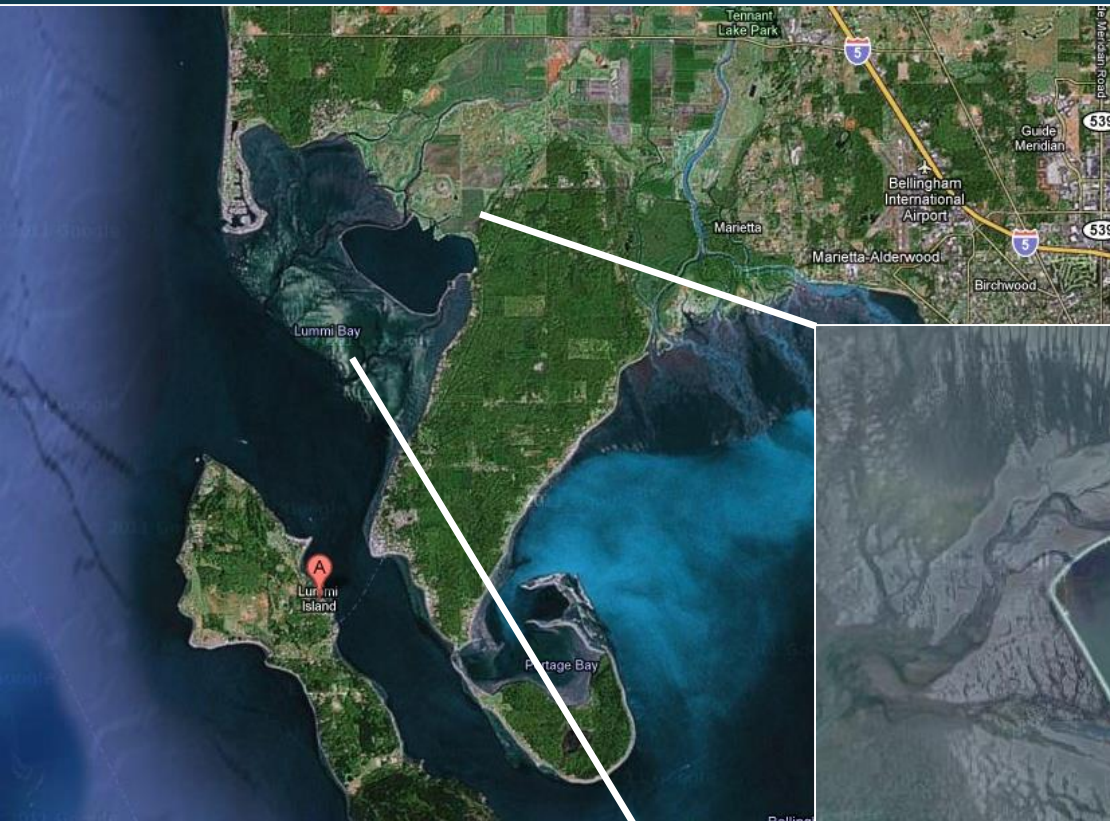
Nahcotta Site



- Long term monitoring
- Long term sampling

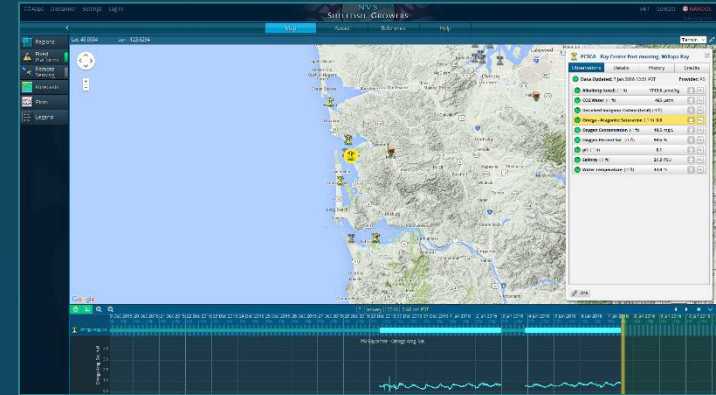


Lummi Hatchery



Hatchery Modifications

- Basic:
 - Chose best water
 - Clean Systems
- Moderate:
 - Monitor pH and buffer water
 - Sodium Carbonate (Na_2CO_3 or Soda Ash)
- Advanced:
 - Monitor Ω aragonite continuously and buffer
 - Long term multi-parameter sampling



Hatchery Modifications



Breeding Programs

- All Hatcheries
 - Hatchery success
 - Feedback from growers
 - MBP oysters
- UW, Taylor and PSI program
 - Larvae subjected to elevated pCO₂
 - Measure settlement and growth
 - Best, average and worst performing
 - Outplanted in Hood Canal
 - Next week: growth and survival!



Summary

- Shellfish industry on OA forefront
- Monitoring and Baseline Information
 - Tiers of practices
 - (pH to CO₂ sensors and bottle samples)
 - On the wall or online
- Buffering
 - Sodium Carbonate
 - pH or Ω aragonite based
- Moving and Diversification
- Breeding program
 - Selecting on performance
 - Hatchery through harvest



Thank You!

Many Thanks to:

- Ekone Oyster
- Wiegardt Brothers/Jolly Roger
- WDFW
- Lummi Hatchery
- Whiskey Creek Hatchery
- NANOOS - Emilio Mayogora
- Alan Barton
- The OA Center
- OSU
- UW
- WSU



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