

Shellfish Culture in Puget Sound: High Quality Seafood & a Means of Enhancing Ecosystem Services



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Puget Sound Restoration Fund
Bainbridge Island, Washington

Restoration Aquaculture:

combines conservation genetics, state-of-the-art hatchery techniques, science & engagement to:

- Recover species & habitats that are imperiled or diminished
- Improve water quality through natural filtration
- Re-forged our connection to marine resources through harvest



Shellfish & Geographic Focus Areas

- Olympia oysters
- Pinto abalone
- Nutrient Mitigation
- Ocean acidification
- Community Shellfish Farms & Gardens

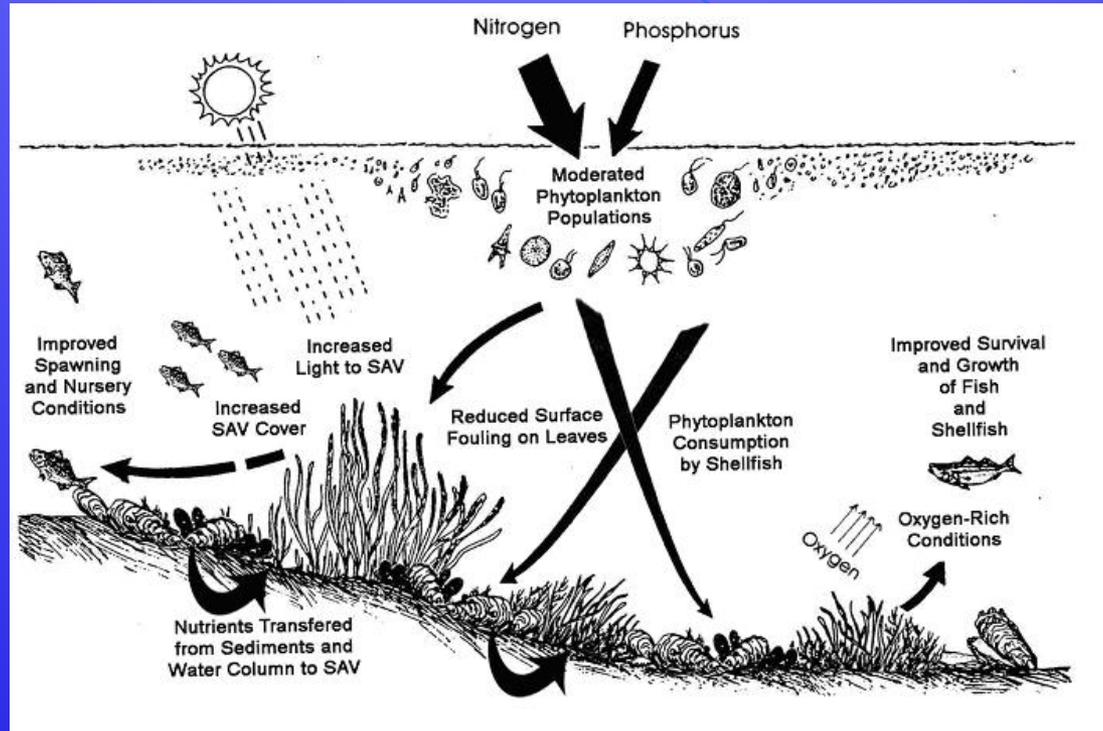


Shellfish Culture to Rebuild Olympia oysters



- Re-establish dense, self-sustaining native oyster beds that provide ecosystem services.
- Recover 100 acres of native oyster habitat by 2020.

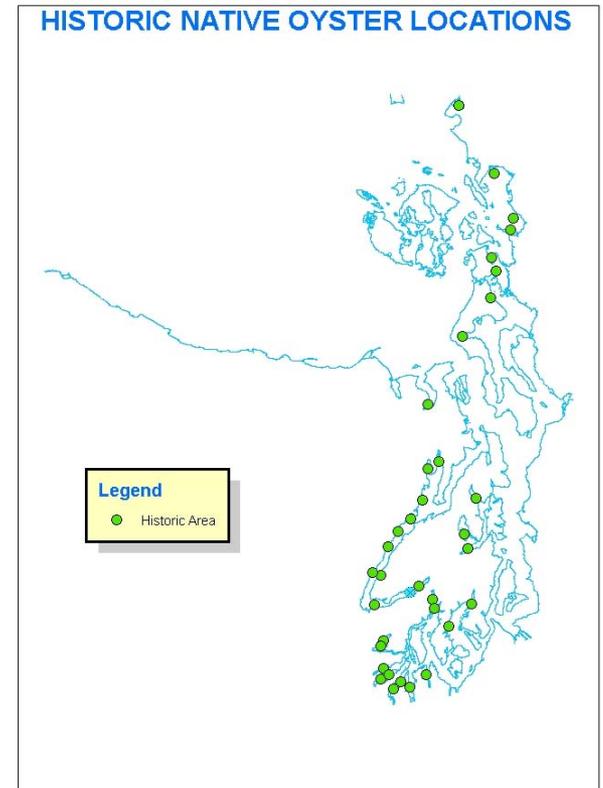
Restore Ecosystem Services



- Shellfish are ecosystem engineers that help maintain healthy estuaries
- Complex habitat
- Natural filtration
- Nitrogen cycling

Status of Population

- Less than 4% of historic core populations remain in P.S..
- Sparse numbers exist throughout historic range.
- Globally, 85% of oyster reefs have been completely lost.



Produce Restoration-grade seed

NOAA shellfish hatchery built as part of Washington Shellfish Initiative

MANCHESTER RESEARCH STATION - SHELLFISH HATCHERY BUILDING PLAN

7305 E. BEACH DRIVE, PORT ORCHARD, WA 98366

STRUCTURAL NOTES

1. IN THE DRAWINGS, ANY DISCREPANCY FOUND AMONG THE DRAWINGS, THESE NOTES, AND THE NOTES TO THE ENGINEER, WHO SHALL CORRECT SUCH DISCREPANCY IN WRITING. ANY WORK DONE BY OR SUCH DISCREPANCY SHALL BE DONE AT THE CONTRACTOR'S RISK.

2. COORDINATE THE DIMENSIONS AMONG ALL DRAWINGS PRIOR TO PROCEEDING WITH ANY WORK. SHALL COORDINATE BETWEEN THE ARCHITECTURAL DRAWINGS AND THE STRUCTURAL DRAWINGS. DIMENSIONS ARE TAKEN TO BE CORRECT WHEN IN CONFLICT WITH THE STRUCTURAL DRAWINGS. ON ALL BRACING AND SHOWING DURING CONSTRUCTION.

3. TO THE APPLICABLE PORTIONS OF THE 2009 OR LATEST EDITION OF THE INTERNATIONAL BUILDING CODE.

4. FLOOR(S) PER (KITAP COUNT)

5. FINISHES

6. EXPOSURE C @ ISMPS 3 SEC GUST

7. JOIST IRC 18 (18) S4 1.5 S3 @ 1650 SITE CLASS D, OCCUPANCY CAT 1, DESIGN CATEGORY II

8. 1-0.50/0.8-3 10-FT FRAMED WOOD SHEARWALLS

9. WINDS @ 75 MPH 18 ASD WIND = 1.3 SF, ASSUMED BEARING CAPACITY

10. PER THE 2009 IRC CHAPTER 10, TOLERANCES SHALL BE PER IRC CHAPTER 10, SECTION 07.01.01, AND INSPECTION SHALL BE PER SECTIONS 05.01.01, 05.01.02, AND 05.01.03.

11. ASTM A663 GRADE 60 EXCEPT AS SHOWN ON THE PLANS.

12. DISTANCE WITH ASTM 150.

13. AIR ENTRAINED.

14. SHALL BE #2 HEIM FIR, UNDO.

15. SHALL BE #2 HEIM FIR, UNDO.

16. BE KEIL DRIED AND STORED IN A DRY AREA PRIOR TO INSTALLATION.

17. WOOD SPAN RATED 24/0 OR BETTER, NAILED WITH 8DS AT 8" O.C. AT EDGES AND 12" O.C. IN THE MIDDLE (OVERSISE). PROVIDE FIRE RATED 1/2" WOOD SHEATHING WITHIN 4" OF EDGE ADJACENT TO WGS ABOVE FIRE WALL.

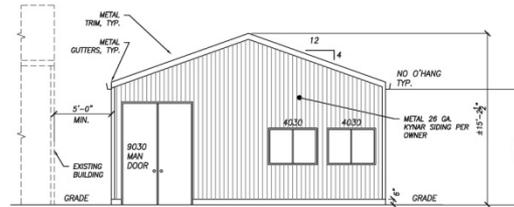
18. C TABLE 2304.8.3 - FASTENING SCHEDULE.

19. WEATHER OR CONCRETE SHALL BE PRESSURE TREATED FOR THE APPLICABLE EXPOSURE. WOOD OR PRESSURE TREATED LUMBER SHALL BE COMPATIBLE WITH THE TREATMENT TO RESIST USE SIMPSON 235 MAX OR HOT DIP GALVANIZED TREATMENT PER MANUFACTURER.

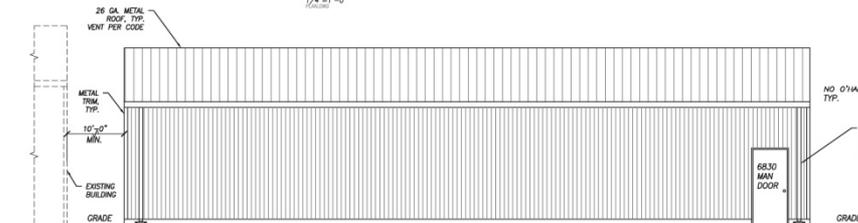
20. PER SIMPSON "STRONG TIE", CONNECTION HARDWARE EXPOSED TO THE PRESSURE TREATED TREATED AS IN STEEL ABOVE.

21. NOTATIONS AND ALL ELEVATIONS. COORDINATE FINISHED FLOOR ELEVATION WITH OWNER. SEE NOTE

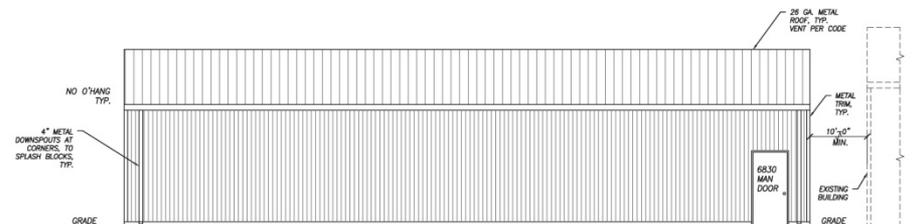
22. THESE DRAWINGS PERTAIN ONLY TO THE SPECIFIC SCOPE OF WORK OUTLINED IN ASSOCIATED APPROVAL, OR RESPONSIBILITY FOR ITEMS OUTSIDE OF THOSE SPECIFIC ITEMS. THIS SET OF PLANS AND SHALL ONLY BE USED FOR THIS SINGLE SPECIFIC SITE AND SHALL NOT BE RE-USED BY THE STRUCTURAL ENGINEER.



END ELEVATION
1/4" = 1'-0"



SIDE ELEVATION
1/4" = 1'-0"



SIDE ELEVATION
1/4" = 1'-0"



INDEX
AND NOTES
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ANS AND DETAILS

Enhance habitat with shell & seed

- Enhance substrate with shell to increase settlement in areas with natural larval production.
- Produce and spread genetically diverse seed where remnant populations are no longer present.



Monitor Ecosystem Services



- Epibenthic diversity
- Fish utilization
- Nitrogen removal

Shellfish Culture to Recover Pinto abalone



- Pinto abalone populations are functionally extinct in Washington.
- There are too few animals in the wild to reproduce effectively.

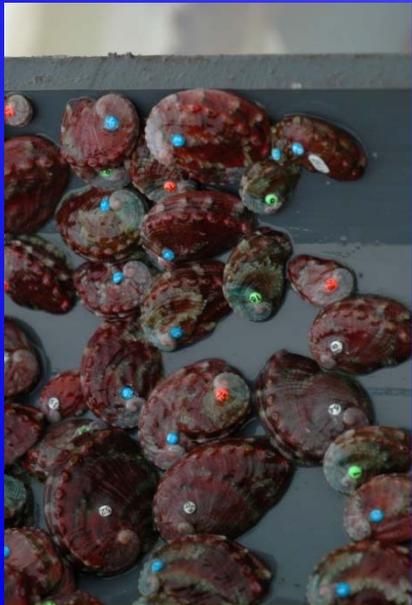
Captive breeding - only viable option

- Since 2003, a cross disciplinary team has built a proactive captive breeding program that safely produces larval and juvenile abalone for re-introduction to the San Juan Islands.
- The team spawns and produces abalone at a NOAA facility in Mukilteo, Washington.



Juvenile Abalone Outplants

- 1,200 juvenile abalone outplanted in 2009 at 4 sites in State's first restoration outplant.
- 2,100 abalone outplanted in 2010 at 6 sites.



2012 Larval Abalone Outplant



Abalone Outreach

PINTO ABALONE NEED YOU!

Pinto, or northern, abalone are declining at drastic rates. Since 1992, there has been a 77% decline in abundance and fewer young abalone are found. Local abalone populations are becoming rare and may face extinction within a few years.



YOU CAN HELP:

- Hunting pinto abalone is illegal; do not disturb or remove them.
- Anonymously report poachers (1-877-933-9847).
- Share this information.
- Report abalone sightings at www.reef.org.
- Learn more at www.pintoabalone.org.



Newly settled juvenile abalone, only a few hours old.



Juvenile abalone raised for restoration.



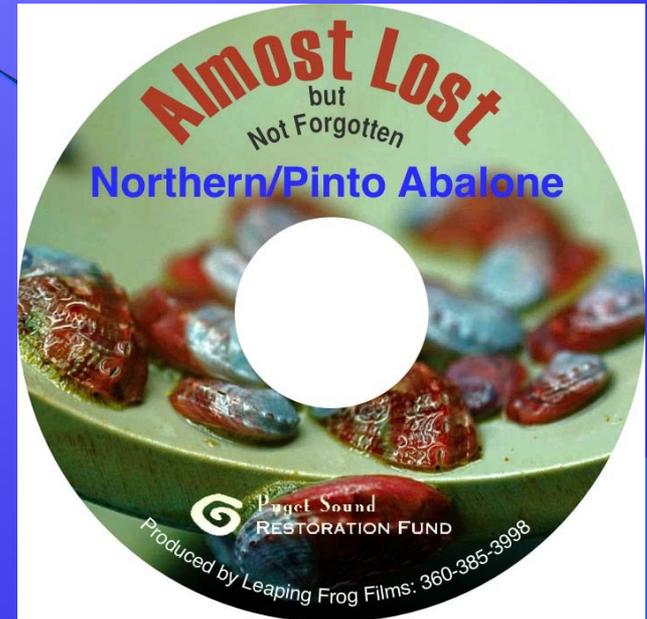
Pinto abalone in the wild.

Abalone fast facts:

- Abalone release sperm and eggs into the water, so they must be close together in sufficient numbers to reproduce.
- The pinto abalone is the only known species of abalone in Washington State.
- Washington State has never had a commercial fishery for abalone. Recreational fishing for abalone has been illegal since 1994.
- Partners around the Puget Sound are working together to restore local pinto abalone populations - but this will take time!



Printing paid for by Northwest Straits Initiative



SAVE OUR
ABALONE

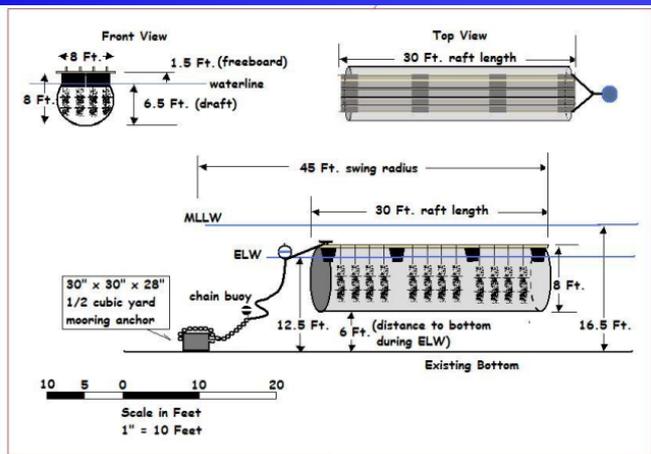


www.pintoabalone.org



Shellfish Culture also used to Mitigate Nutrient Pollution

- 2010 Pilot project to test concept of growing mussels to mitigate nutrient pollution
- Modeled after Swedish program
- Installed 8' x 30' raft with 75,000 mussels, 2011



Monitoring

- Measured nitrogen content of mussels
- Analyzed growth & community assemblage data
- Monitored water quality at input/output



Converted mussel biomass to compost

- Develop local compost product to recycle nutrients back into watershed
- Develop model for nutrient trading system

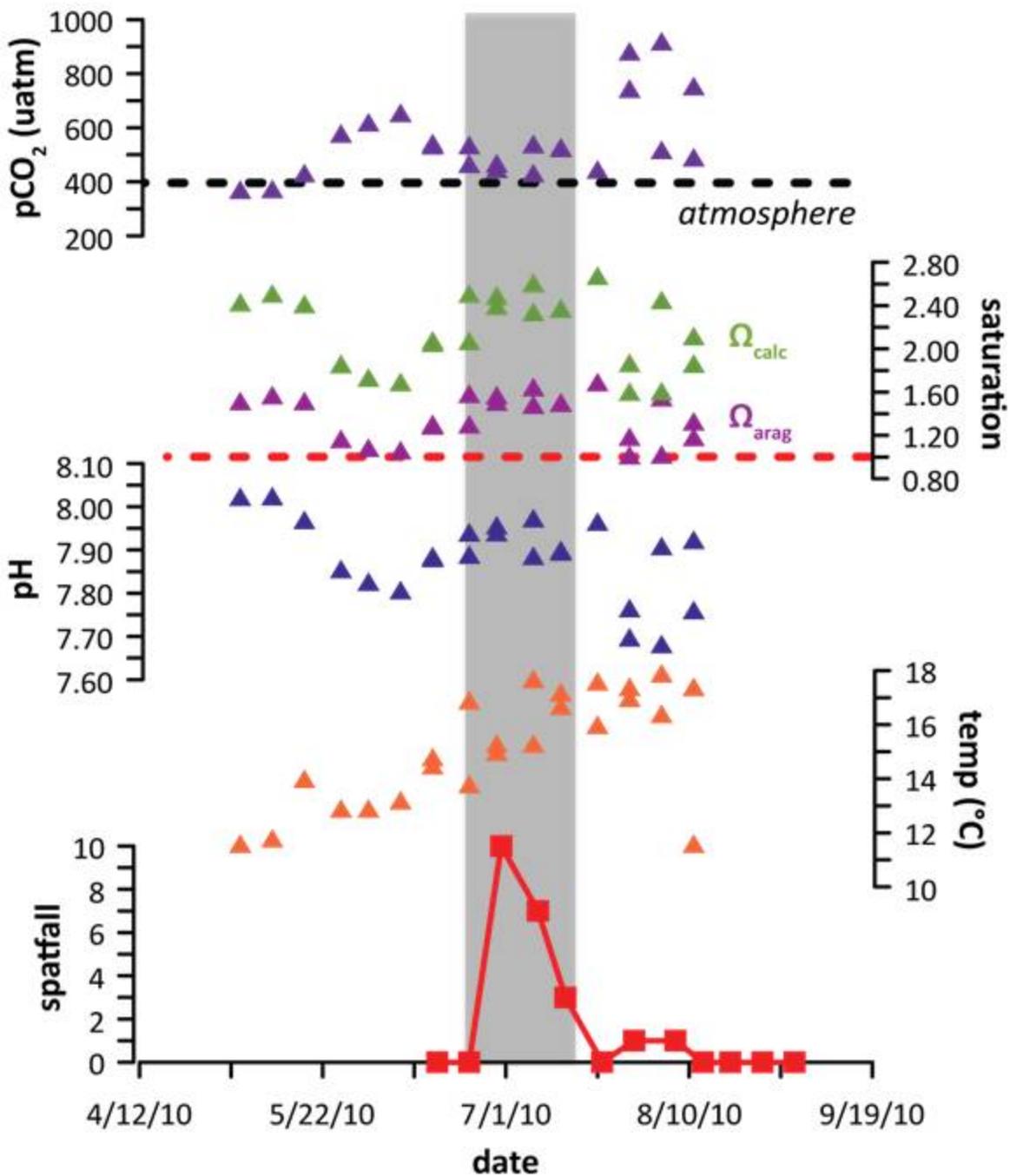
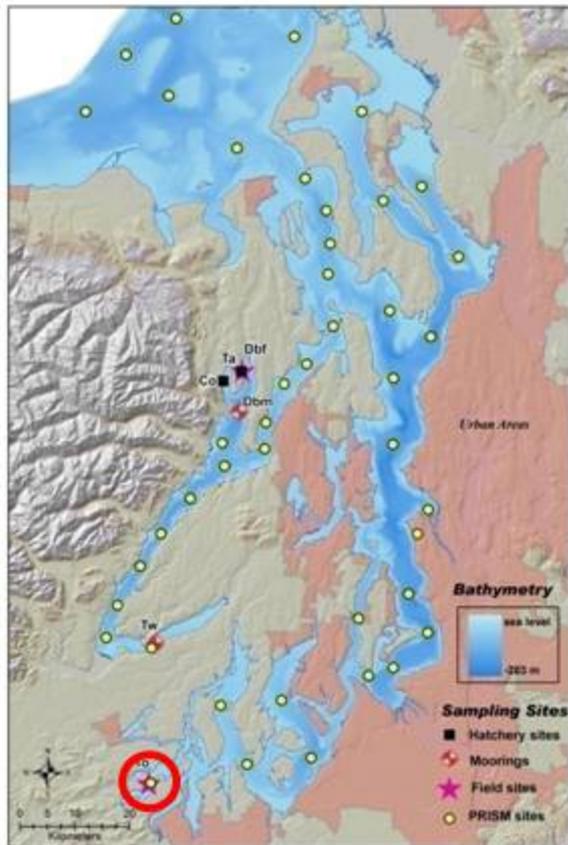


Shellfish Culture in the face of Ocean acidification (OA)

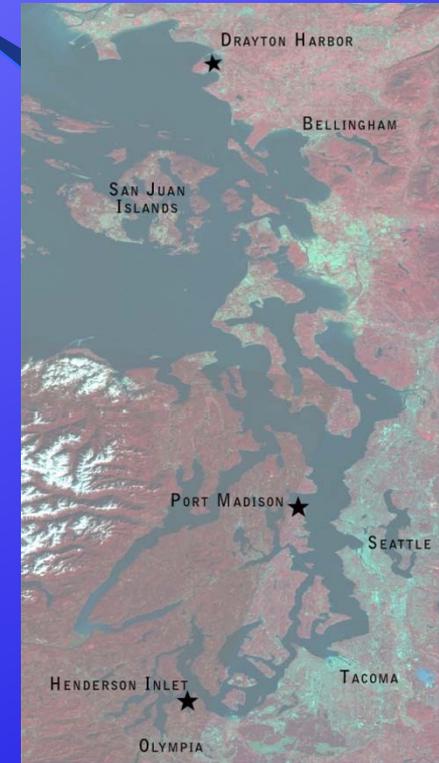


- Shellfish culture served as the canary in the coal mine.
- Shellfish, marine resources, healthy ecosystems are at risk.
- Governor's Blue Ribbon Panel engaged scientists, tribes, policy members, elected officials in developing actions.
- Maintaining shellfish culture was included as a remediative action to help combat local pollution sources that contribute to OA.

Totten Inlet Summer 2010



Shellfish culture to engage people in the health of resources



Community Shellfish Farms help maintain and restore clean water and shellfish harvesting in Puget Sound

Goals:

1. Invest the community in the health of local bays
2. Spur water quality improvement projects
3. Harness the power of filter feeders to combat nutrient pollution



Seed...Enjoy...Educate...Harvest



Celebrate



Engaging people makes a difference:

- Drayton Harbor: 575 acres conditionally reopened, 2004.
- Henderson Inlet: 340 acres fully restored 2010/ 2012.
- Public outreach plays a critical role in multi-faceted efforts to restore shellfish growing areas.



In summary, shellfish culture blending science & engagement helps to:

- Recover native species
- Rebuild habitat
- Restore ecosystem services
- Mitigate nutrient pollution
- Monitor & ameliorate ocean acidification
- Improve marine water quality
- Provide incentives for pollution control
- Re-connect people to marine resources

Vision



- A healthy, productive ecosystem
- Iconic food sources
- A “swimmable, fishable, diggable Puget Sound”

The resources we culture and restore:

1. have been around for millions of years;
2. have been providing ecosystem services;
3. have fed humans throughout our evolution.

- Bivalve fossils from Clallam Formation
Miocene, Oligocene rocks (10-40 MY)



Our goal is to keep them around....

Collaborators

- Washington Departments of Fish & Wildlife, Natural Resources, Health, Ecology
- Tribes (Suquamish, Skokomish, Squaxin, Lummi, Jamestown S'Klallam, Samish, Swinomish, Puyallup, Elwha)
- Commercial Growers (Taylor, Baywater, Seattle Shellfish, Oly Oyster, Little Skookum, Hood Canal Oyster, Hama Hama, Penn Cove)
- NOAA (CRP, Mukilteo Lab, Species of Concern, Aquaculture)
- U.S. Navy, U.S. Department of Agriculture & EPA
- The Nature Conservancy
- Universities (U. of Washington, Western Washington U.)
- National Fish & Wildlife Foundation
- The Russell Family Foundation
- Puget Sound Partnership
- Northwest Straits Commission (Marine Resources Committees)
- Pacific Shellfish Institute
- SeaDoc Society
- Public, tribal and Private tideland owners
- Local Governments (King, Skagit, Jefferson, Kitsap, Clallam)
- Reporters and writers (newspapers, magazines, TV, radio)