

Surf to Turf

Nutrient Bioextraction in Budd Inlet

Bobbi Hudson, Pacific Shellfish Institute (PSI)
Deschutes Advisory Group (DAG) meeting on September 15, 2016



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Fostering sustainable shellfish resources & a healthy
marine environment through research & education.

Outline

1. Pacific Shellfish Institute: Who we are
2. Nutrient bioextraction in concept
3. Our pilot research
4. Outreach & education
5. Mussel growth in Budd Inlet
6. Compost trials
7. Growth and N content data
8. Items still being analyzed
9. Conclusions to date



Pacific Shellfish Institute (PSI): Who we are

- Washington-based 501(c)3
- Office/lab in Olympia, WA
- Established in 1995 with strong linkages to the Pacific Coast Shellfish Growers Association (PCSGA)
- In 2004, PSI Bylaws were changed to provide a clearer separation from PCSGA



Research Org.



Trade Assoc.



PSI Staff



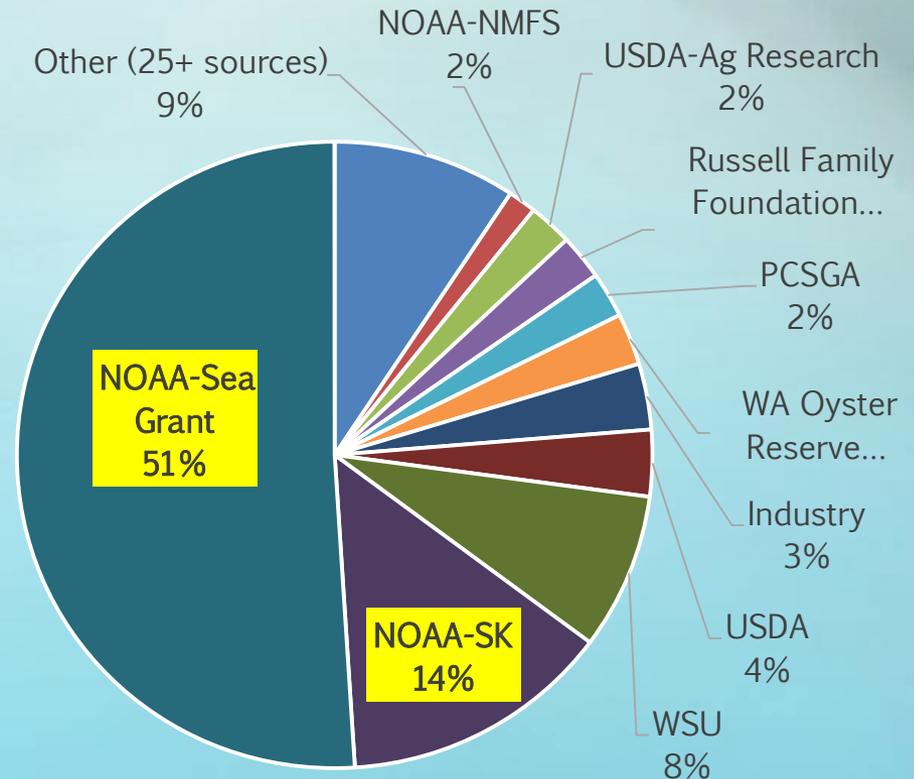
Bobbi Hudson, Aimee Christy, Andy Suhrbier, Steve Booth, Dan Cheney, Katie Houle, Mary Middleton



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PSI Funding & Partnership Significance

- PSI's funding source:
 - Largely competitive federal grants
 - Some private foundation grants
- High level of industry cooperation and in-kind support
- Partnerships are *very* important



\$8M: 1995 – June 2015



This Project's Funding & Partners

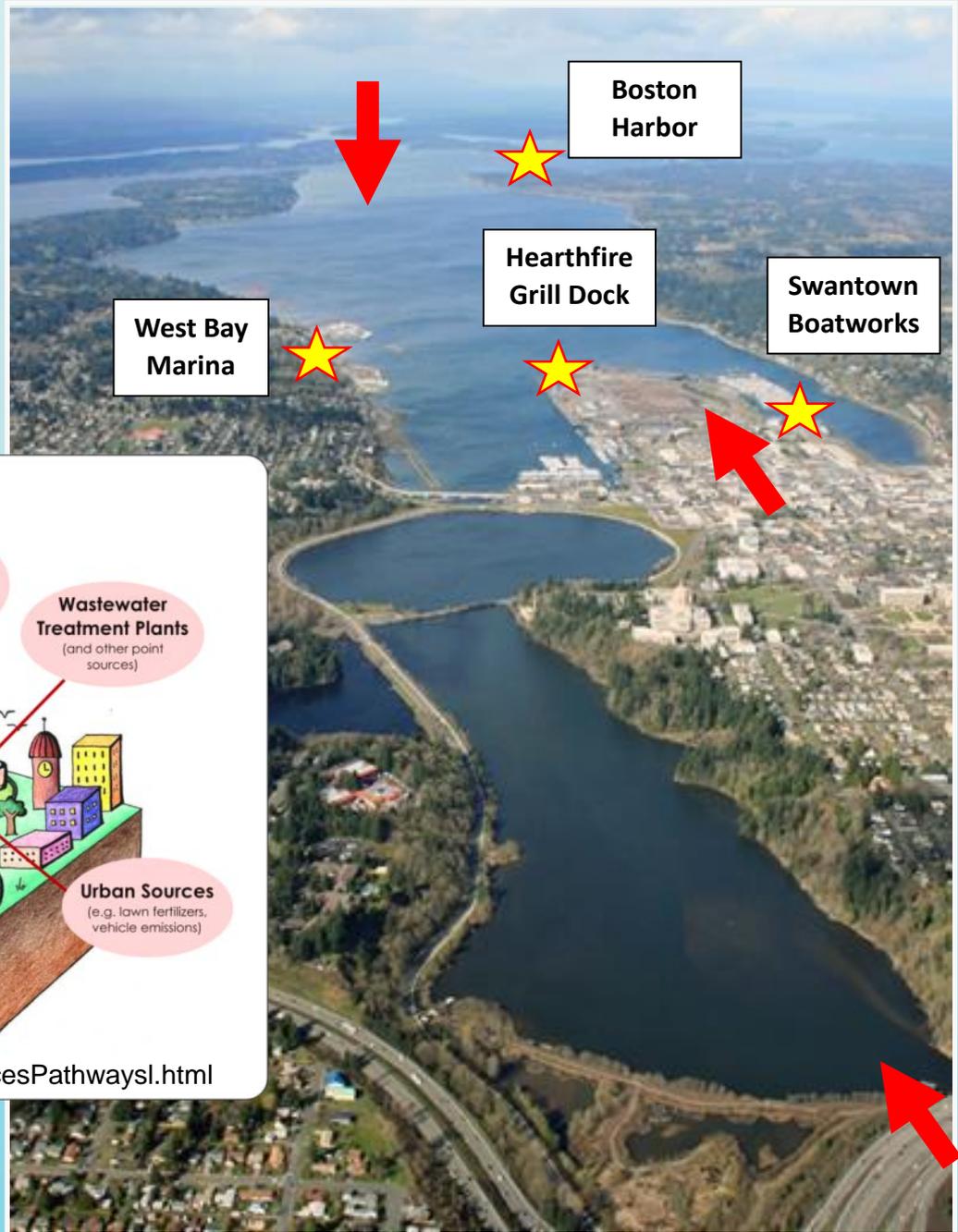
EPA's National Estuary Program (NEP) via WA Dept. of Ecology

Partners:

- City of Olympia, Stream Team
- LOTT Cleanwater Alliance, WET Science Center
- Port of Olympia
- Puget Sound Restoration Fund
- Squaxin Island Tribe
- The Evergreen State College
- Thurston County Conservation District, South Sound GREEN
- WA Dept. of Corrections
- Washington State University (Puyallup Extension Facility)
- West Bay and Boston Harbor Marinas

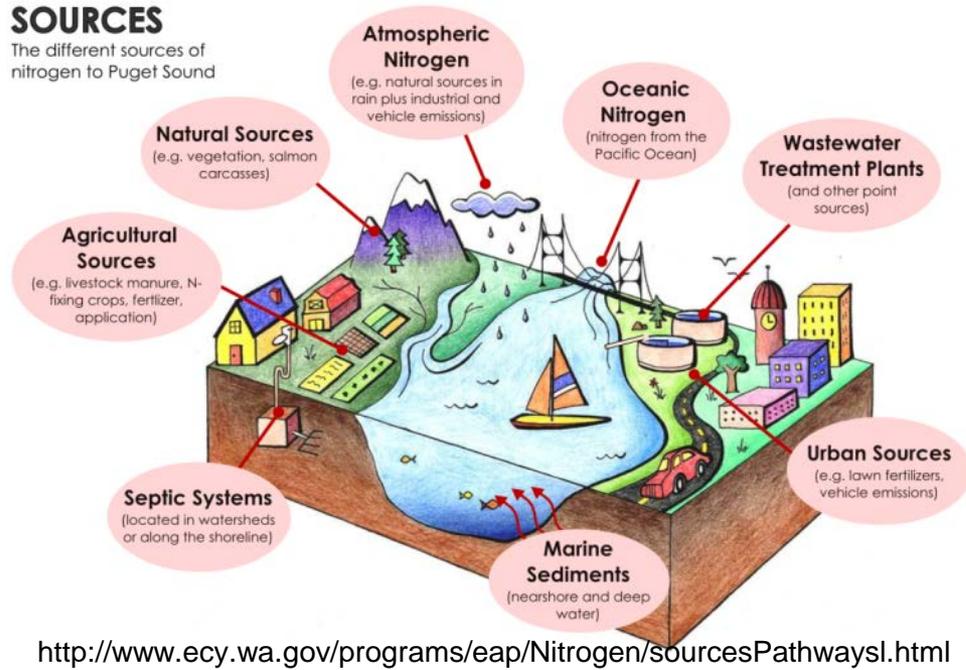


Budd Inlet



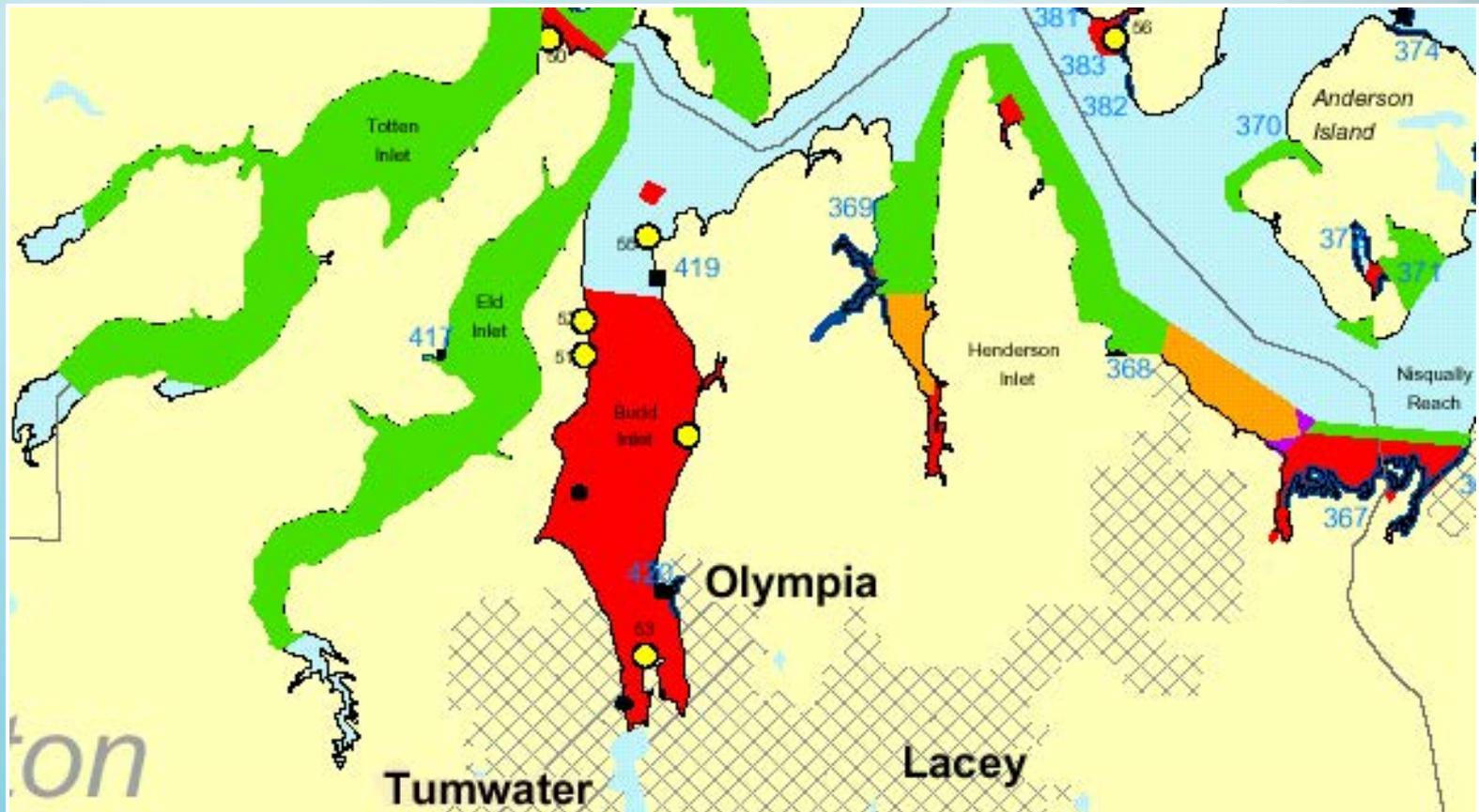
SOURCES

The different sources of nitrogen to Puget Sound



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WA Department of Health 2002 Closed Shellfish Growing Areas

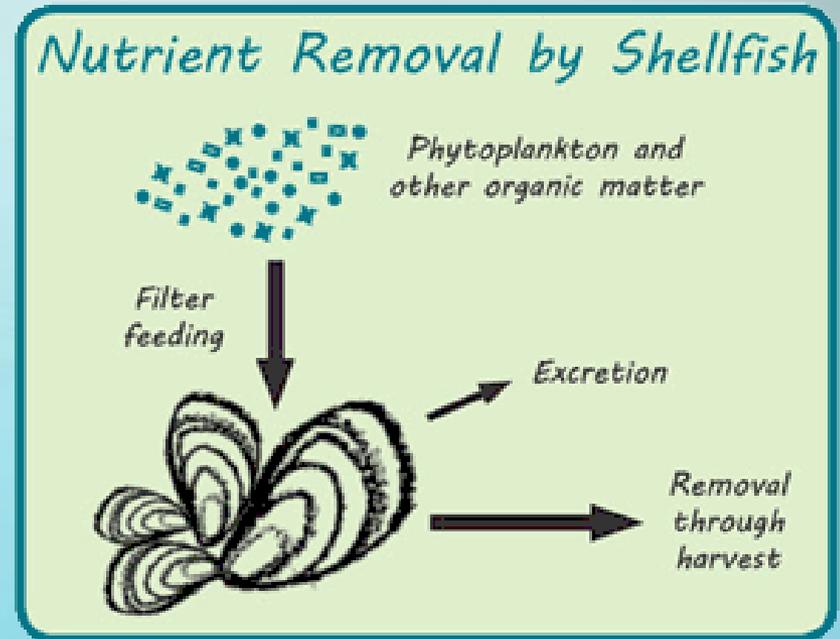


Nutrient bioextraction:

Growing and harvesting shellfish or seaweed to remove nutrients from natural water bodies.



Photos: Long Island Sound Study



Complement current nutrient removal efforts



Thurston County Incentive Program



City of Olympia Stream Team
Natural Lawn Care Program



LOTT Cleanwater Alliance
Denitrification April-October

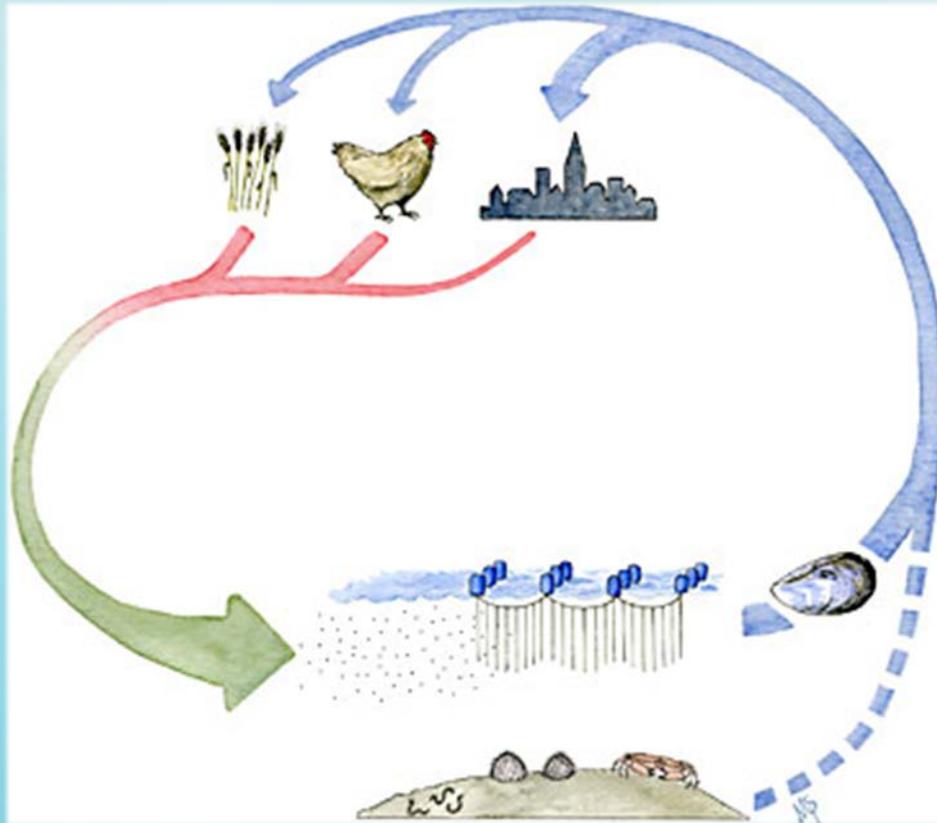


Nutrient Bioextraction



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Where has this idea been applied?



One mussel contains:

0.8 - 1.2 % N

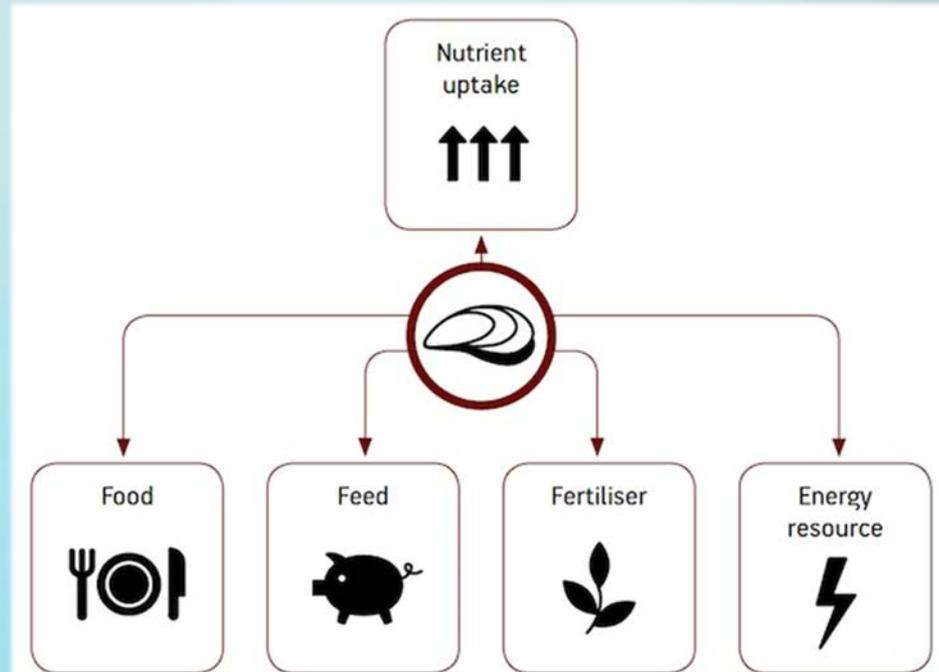
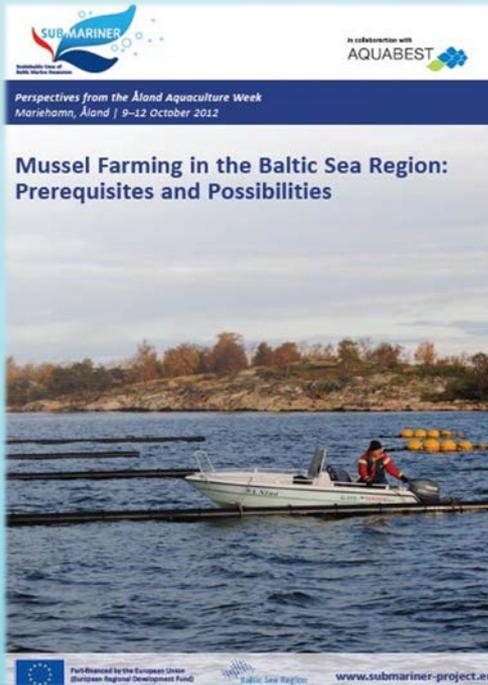
0.06 - 0.08 % P

Agro-Aqua recycling of nutrients using mussel farming as a recycling engine.

Odd Lindahl, 2008



SUBMARINER www.submariner-project.eu



100–150 t/ha mussel biomass harvested every 2nd year

1.2–1.8 t of N

0.08–0.12 t of P

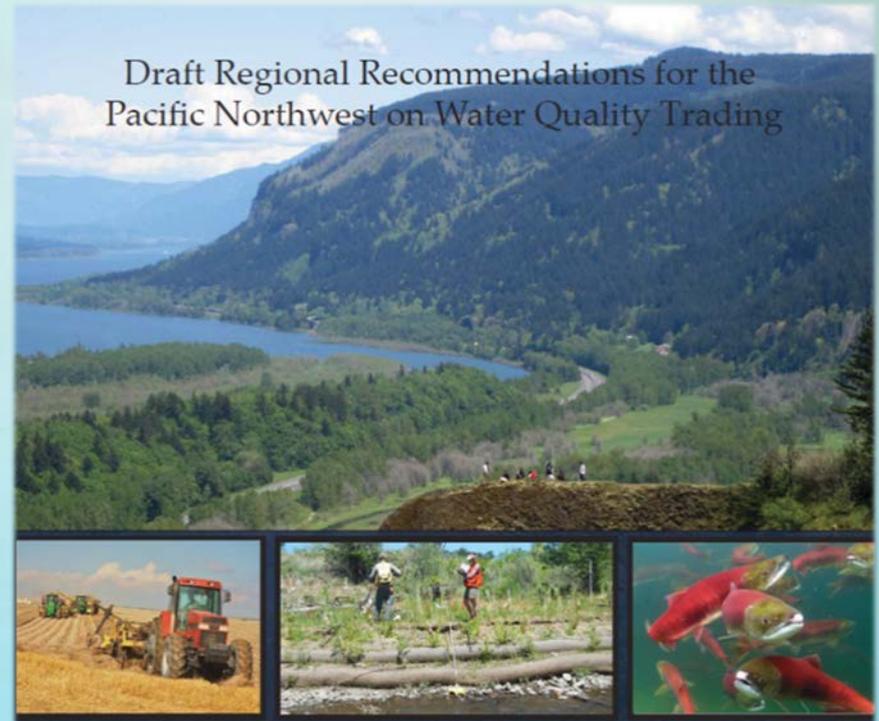
Baltic Sea Region Programme 2007–2013



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Water Quality Trading:

A voluntary market-based approach that, if used in certain watersheds, might achieve water quality standards more efficiently and at lower cost than traditional approaches.



Draft Regional Recommendations for the Pacific Northwest on Water Quality Trading

Prepared By:
Willamette Partnership
The Freshwater Trust

In Collaboration With:
Idaho Department of Environmental Quality
Oregon Department of Environmental Quality
Washington Department of Ecology

Under the USDA Conservation Innovation Grant Award
Willamette Partnership, November 2012
Multi-State Agency Guidance for Water Quality Trading: Joint Regional Water Quality
Trading Agreement (69-3A75-12-255)



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West Bay 101



May 2013

314 3-5 ft
weighted nylon straps

Boatworks 76



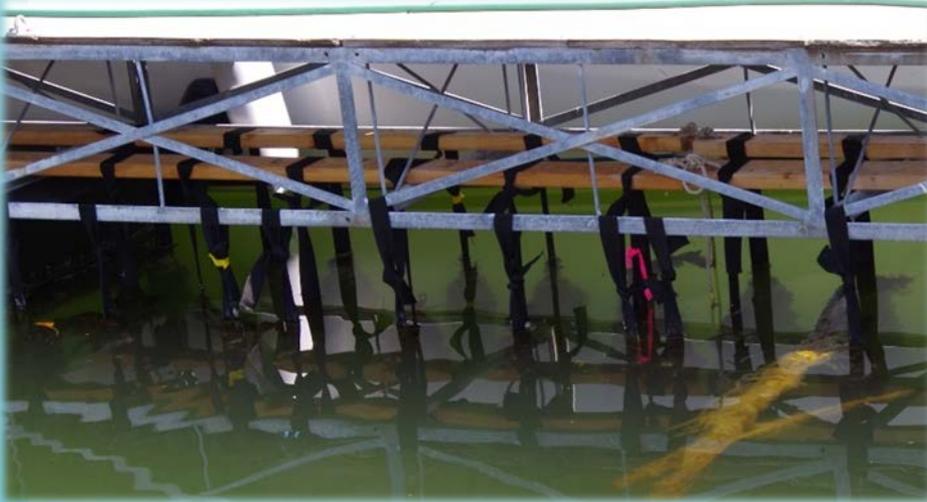
Hearthfire 56

Boston Harbor 81



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West Bay 134



May 2015

374 3-5 ft

weighted nylon straps



Boatworks 240



**Straps attached
to boards**



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Data Collection: June-October



Mussel Growth
Mussel Biomass
Temp, Salinity, pH
Dissolved oxygen
Phytoplankton/Secchi
Fouling/Diversity



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Community Outreach

Recording mussel lengths/weights
& community assemblages on lines



GoPro underwater video



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K-12 Education in Olympia & North Thurston SD



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August 2013

West Bay



Hearthfire



Boatworks



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August 2015

West Bay

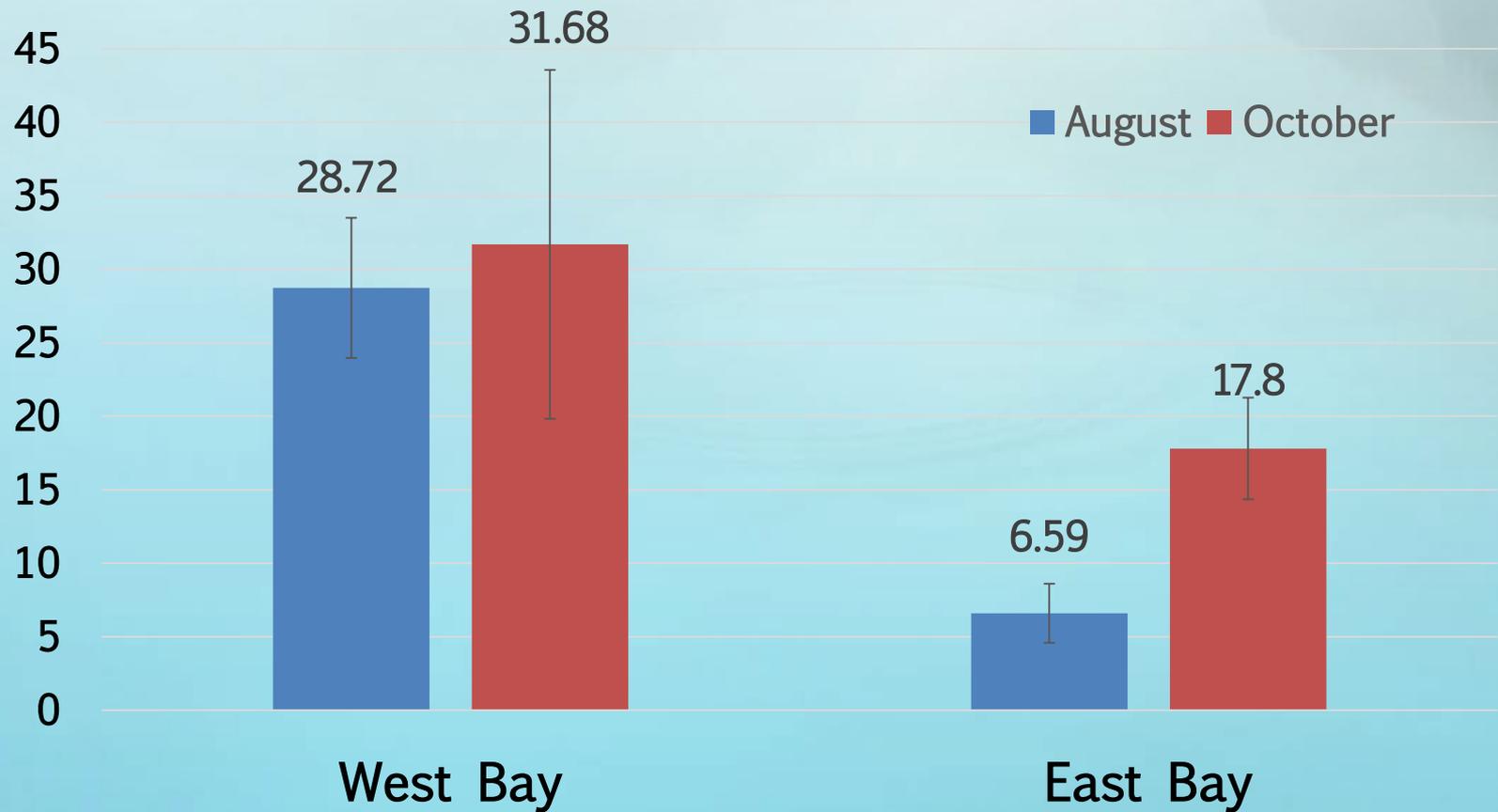


Boatworks



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Average Weight per Strap (lb) 2015



September
2013



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Surf-to-Turf Mussel Compost



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Washington State University (WSU)



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Dept. of Corrections - Cedar Creek Composting



In-Vessel Composting System
by DT-Environmental, Lynden, WA

ENVIRO-DRUM
In-Vessel Composting System By DT-Environmental
Lynden, WA



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2013/2014 Composting Trials

Secret Recipe:

Mussels

Compost

Green Waste

Wood Chips



Evergreen – 1200 lbs

WSU – 500 lbs

WA Dept. Corrections – 1300 lbs

Yards, Classes, Labs – 1300 lbs

Total – 4300 lbs



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Vegetative Growth Trials (July-Sept 2014)



Green Pet
dog waste compost

Quartermaster
mussel compost
vermicomposted

Budd Inlet
mussel compost

Cedar Grove
municipal compost

Sun Gro
potting soil



Surf-to-Turf Mussel Compost



Shellfish at Work: Nutrient Bioextraction

Nutrients flow into Puget Sound from many sources including paper factories, dairies, homes and animal wastes. Excess nutrients can fuel blooms of microscopic phytoplankton in food and marine waters. After plankton die, the decay process deposits organic matter in the water column, which can deplete marine life.

How it Works: Mussel shells are cleaned and broken into small pieces. These pieces are then mixed with a soil-like material and placed in a planter box. The shells break down over time, releasing nutrients into the soil. This process is called nutrient bioextraction.

Why it Matters: Mussel shells are a natural source of calcium and magnesium. These nutrients are essential for plant growth. By using mussel shells as a fertilizer, you can reduce the need for synthetic fertilizers and help improve soil health.

How to Use: Add 1-2 cups of mussel shell compost to your garden soil. Water thoroughly. Repeat every 4-6 weeks.

Benefits: Improves soil structure, increases water retention, and provides essential nutrients for plants.



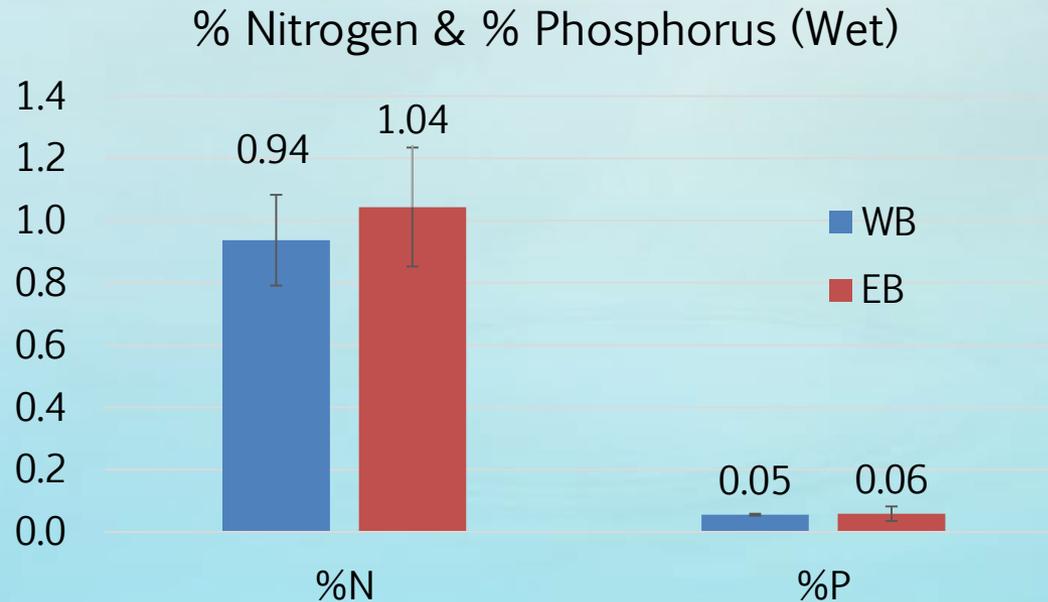
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Give Aways: Great Yards Get Together



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Mussel Composition & Nutrient Removal

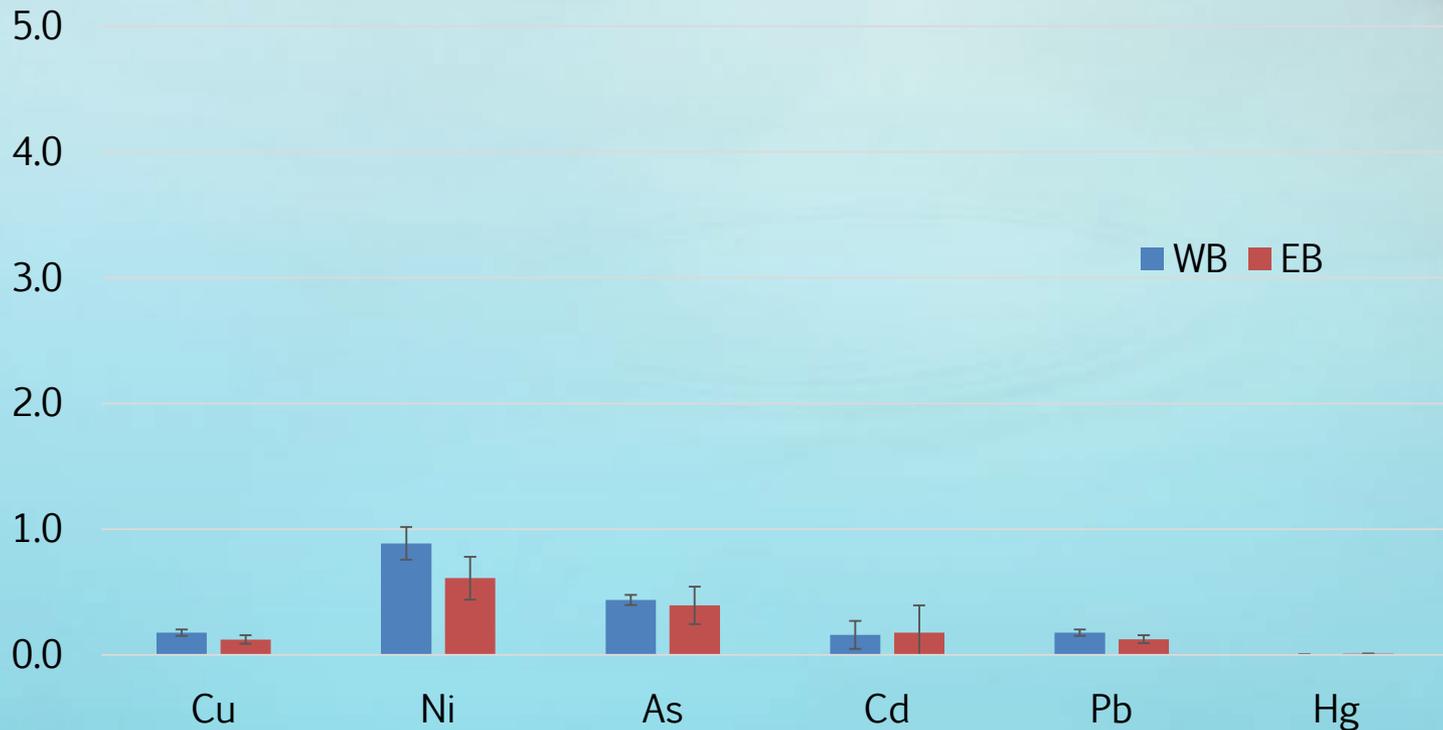


50,000 lbs. of mussels = 500 lbs. of nitrogen (N)
= annual N output of 50 people (10 lbs/year)



Metals Analysis: AmTest

2015 Trace Metals (ug/g - Wet)



In short, nothing of concern.



Weighted biodeposit collection unit & deposits



Detailed data analysis underway...



Scraping & Resettlement at Port of Olympia (2016)



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Conclusions

1. The community learned about local water quality issues
2. Nutrients were removed through nutrient bioextraction
3. The project generated a marketable product: Surf-to-Turf compost
4. Results may provide a framework for a potential nutrient-trading concept in Budd Inlet
5. Additional analysis is being conducted to better understand localized nutrient dynamics:
 - biodeposition
 - seston depletion
 - dissolved oxygen (DO)

