Surf to Turf
Nutrient Bioextraction in Budd Inlet

Bobbi Hudson, Pacific Shellfish Institute (PSI)

Deschutes Advisory Group (DAG) meeting on September 15, 2016

Pacific Shellfish Institute
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

Pacific Shellfish Institute

Research Org.

PCSGA

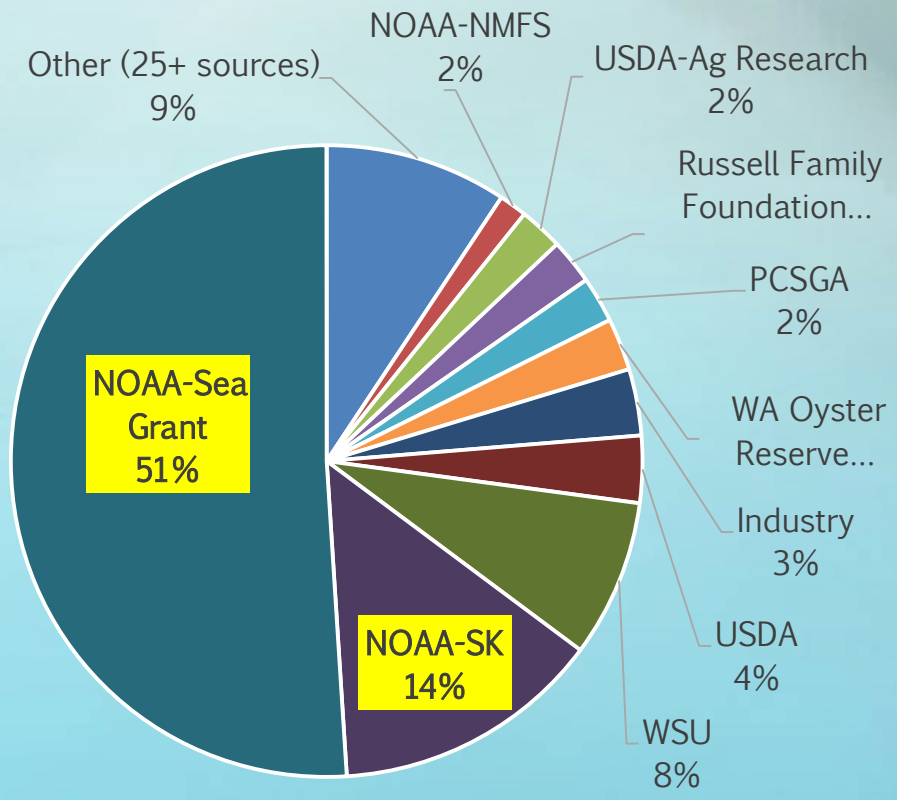
Trade Assoc.

PSI Staff

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

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

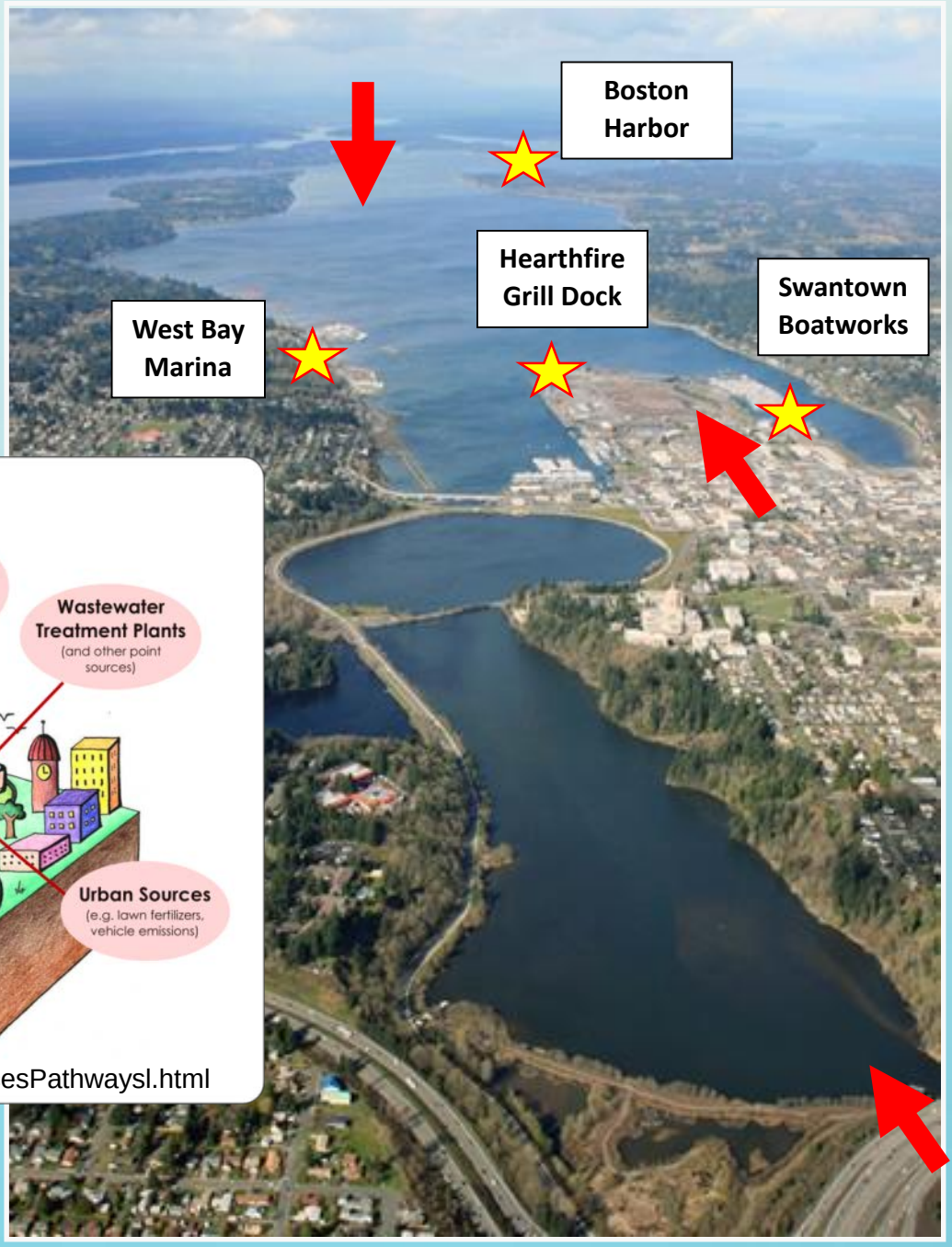
This Project's Funding & Partners

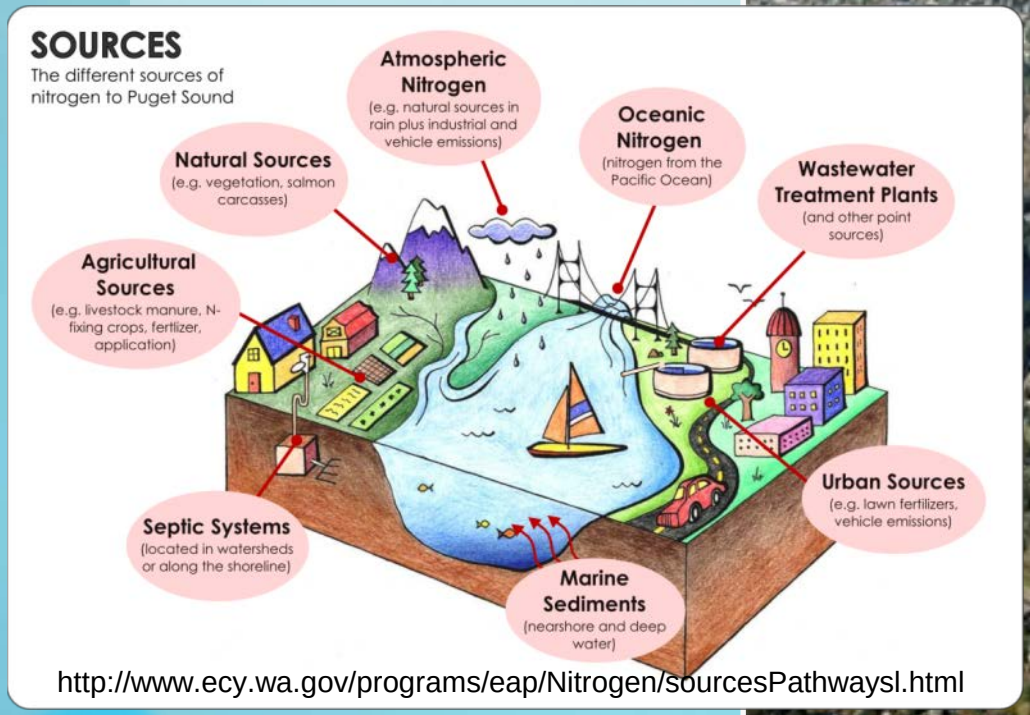
EPA's **National Estuary Program (NEP)** via WA Dept. of Ecology

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





http://www.ecy.wa.gov/programs/eap/Nitrogen/sourcesPathwaysl.html

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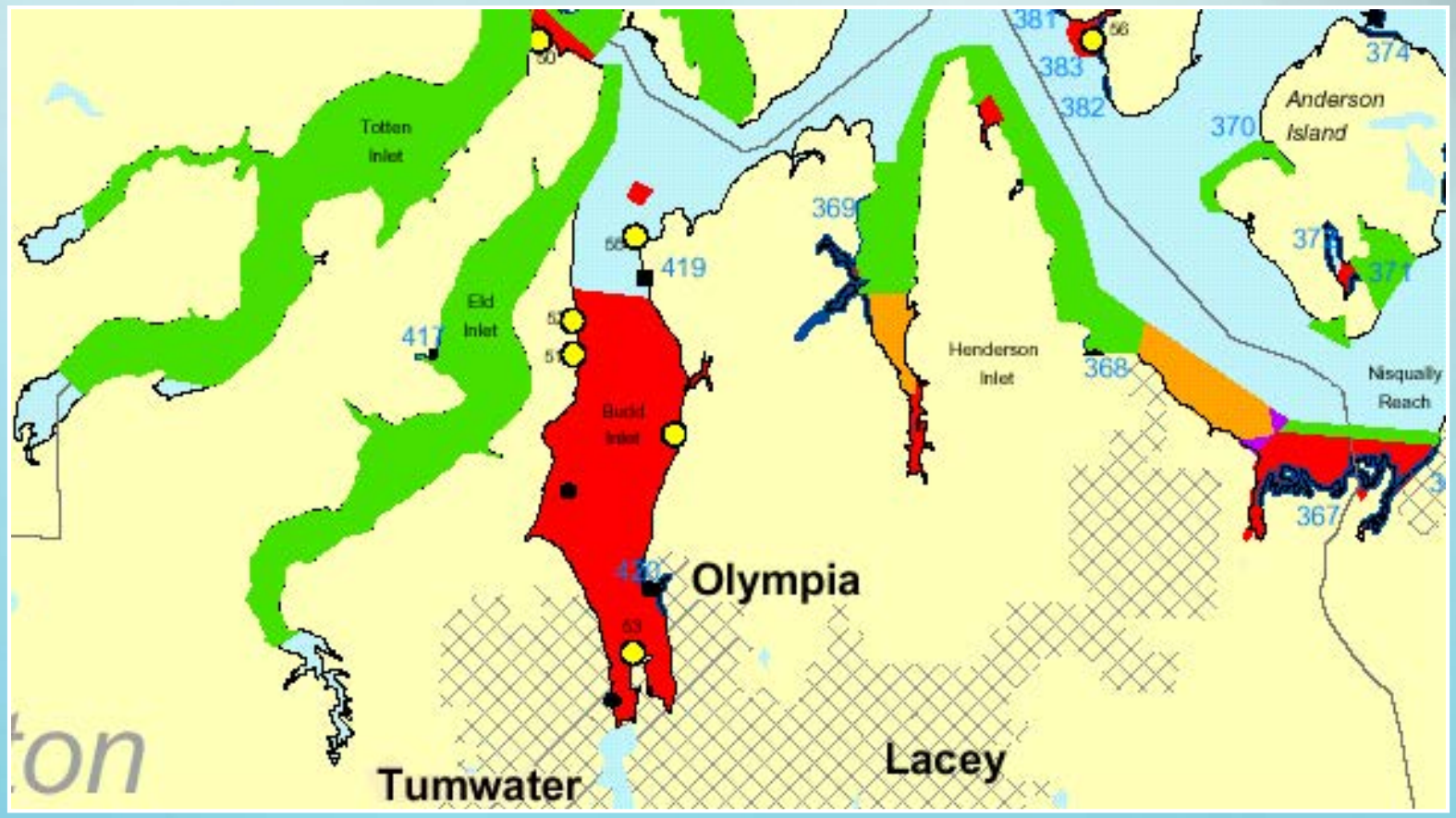
WA Department of Health

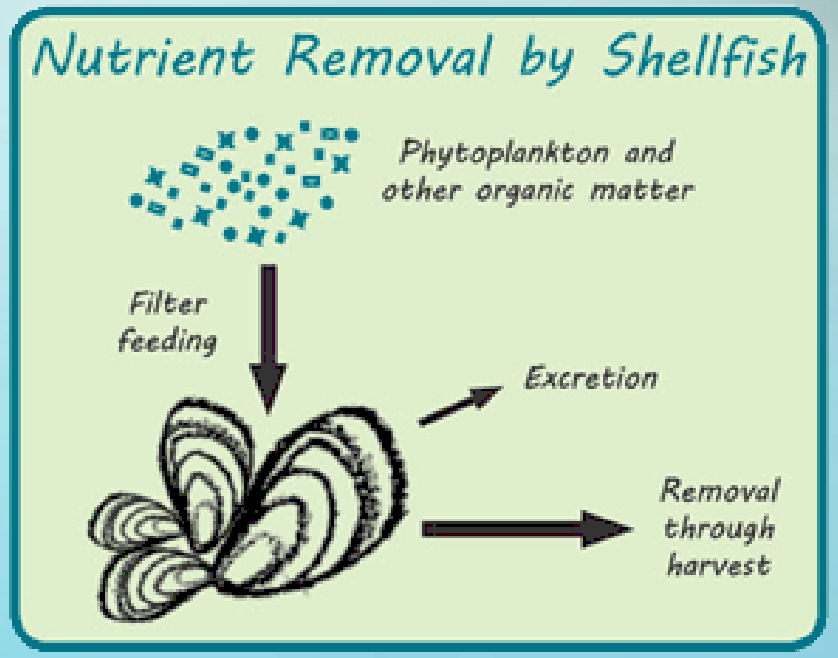
2002 Closed Shellfish Growing Areas



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

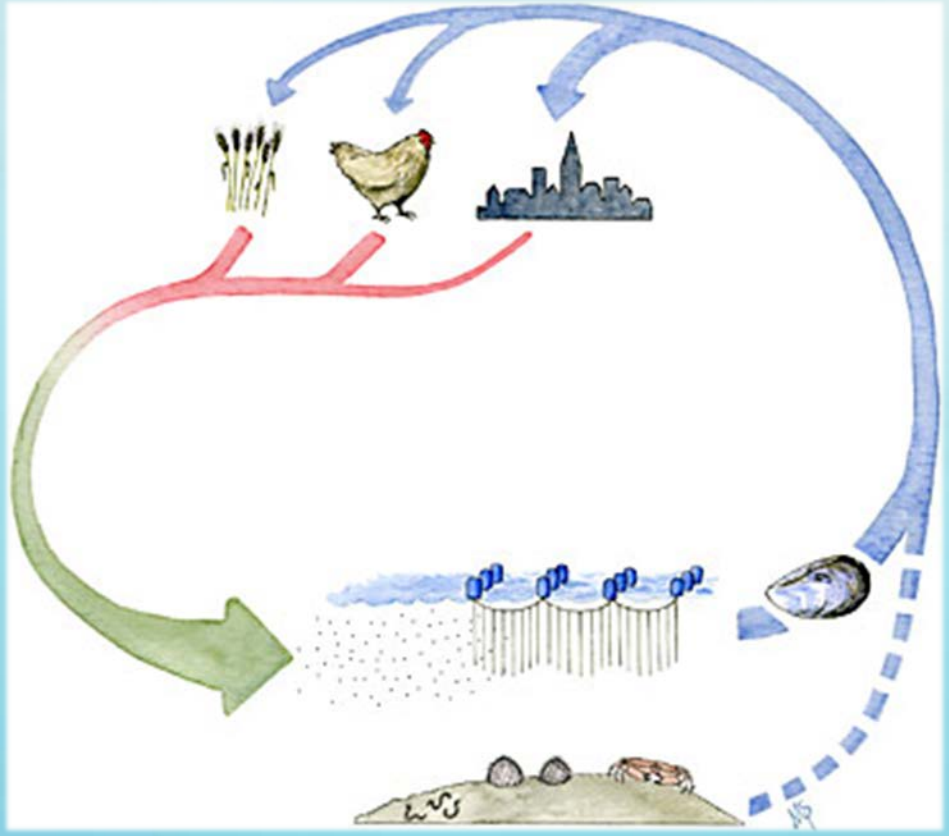
Thurston County Incentive Program

City of Olympia Stream Team
Natural Lawn Care Program

LOTT Cleanwater Alliance
Denitrification April-October

Nutrient Bioextraction

Where has this idea been applied?



One mussel contains:

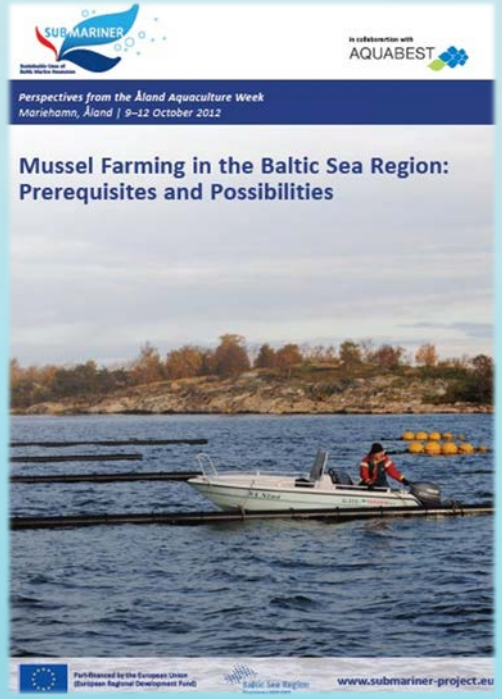
0.8 - 1.2 % N

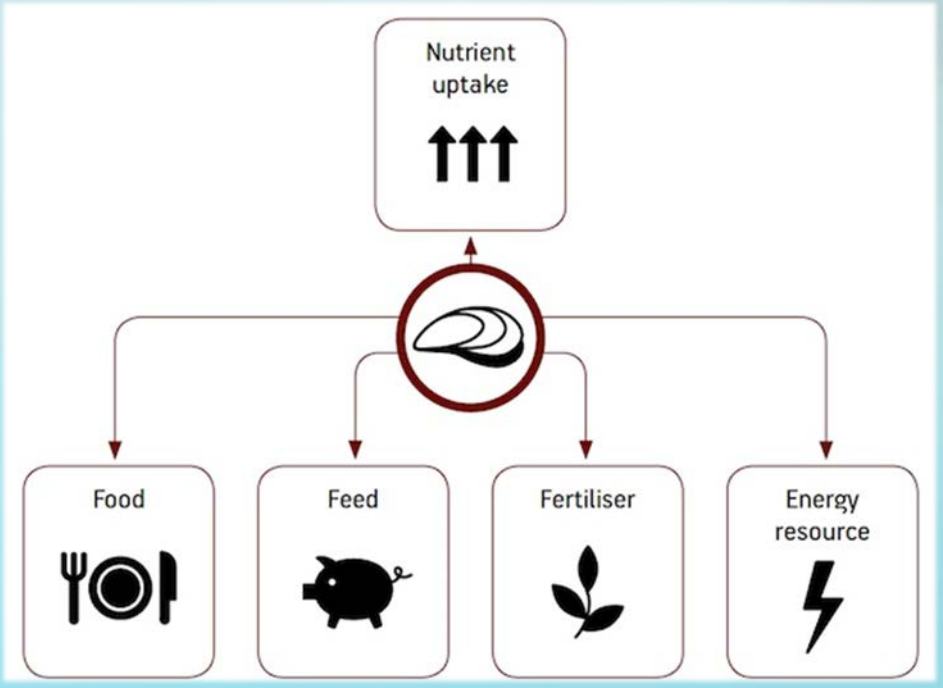
0.06 - 0.08 % P

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

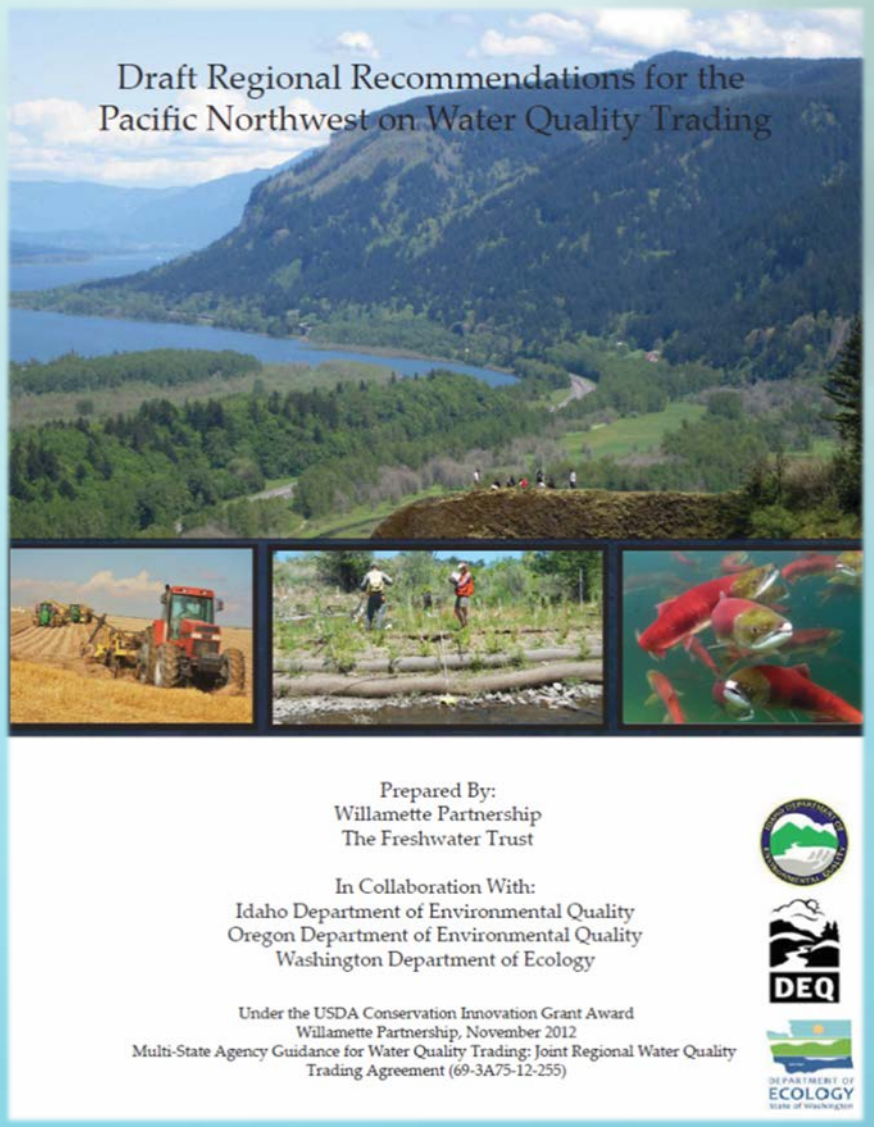
1.2–1.8 t of N

0.08–0.12 t of P

Baltic Sea Region Programme 2007-2013

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.



May 2013

314 3-5 ft
weighted nylon straps

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

Community Outreach

Recording mussel lengths/weights
& community assemblages on lines

GoPro underwater video

K-12 Education in Olympia & North Thurston SD

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August 2013

West Bay

Hearthfire

Boatworks

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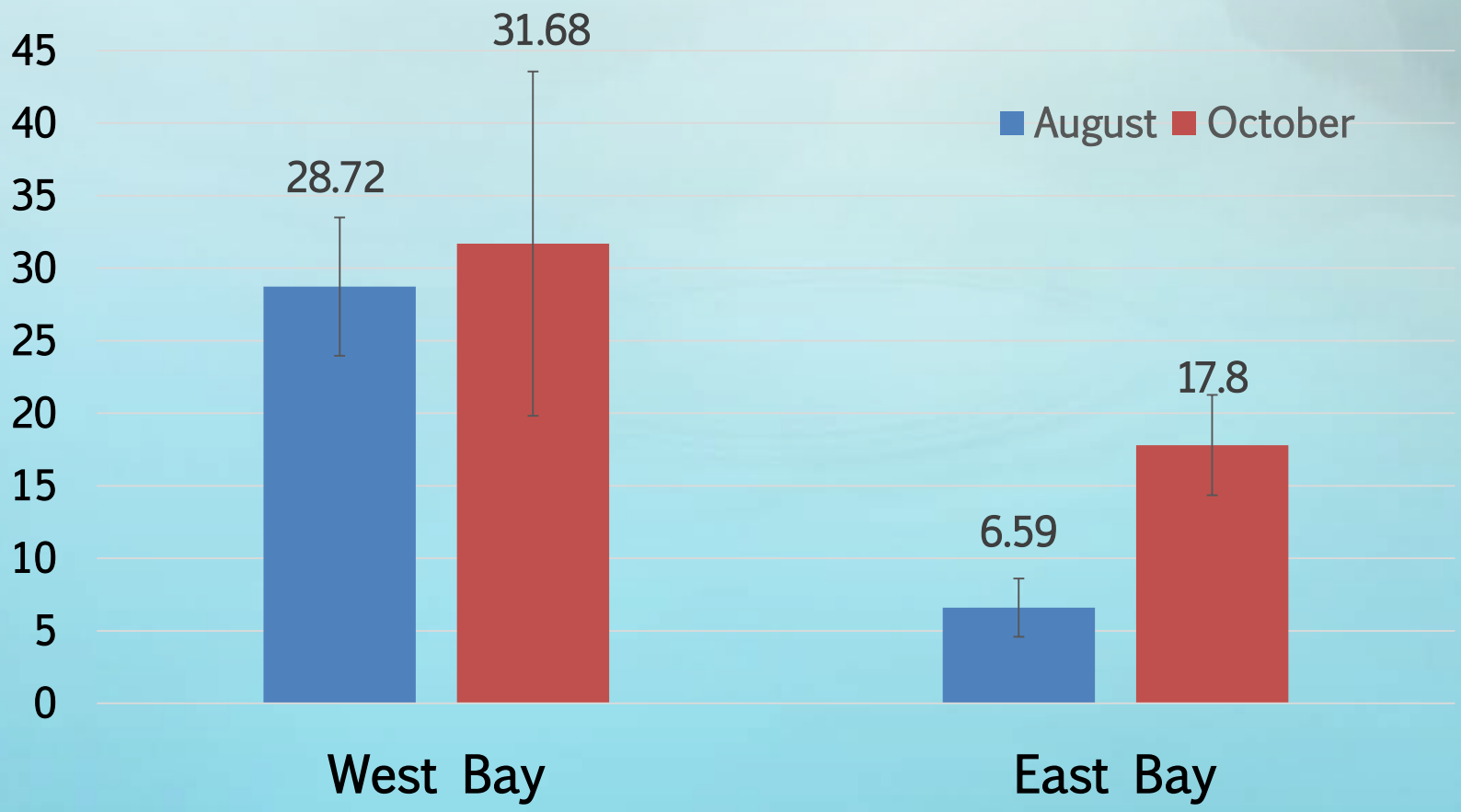
August 2015

West Bay

Boatworks

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)

Washington State University (WSU)

Dept. of Corrections - Cedar Creek Composting

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

2013/2014 Composting Trials

<u>Secret Recipe:</u>
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

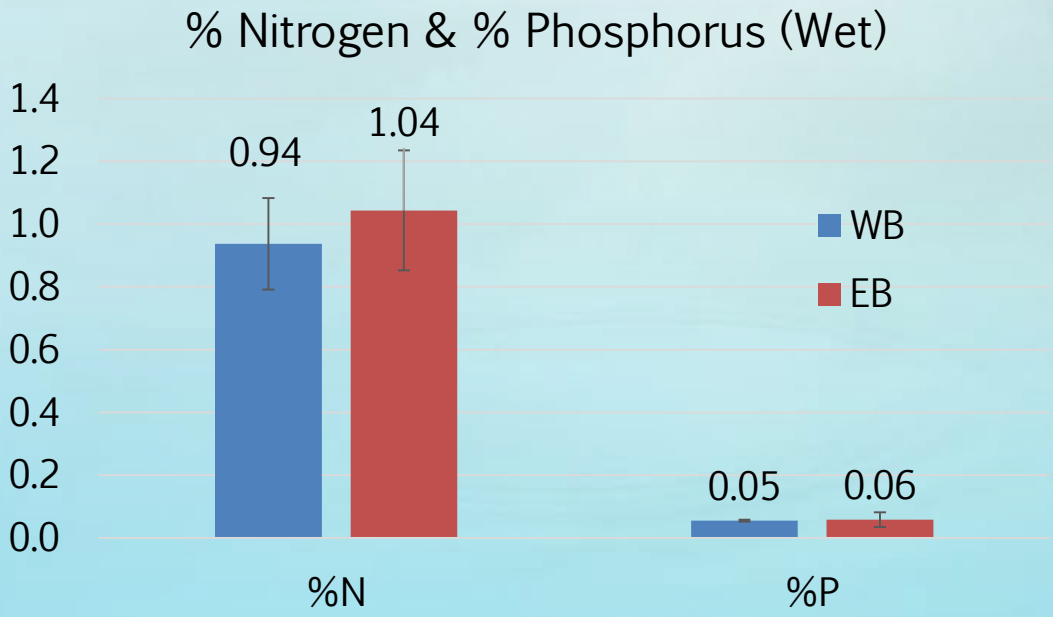
Vegetative Growth Trials (July-Sept 2014)

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

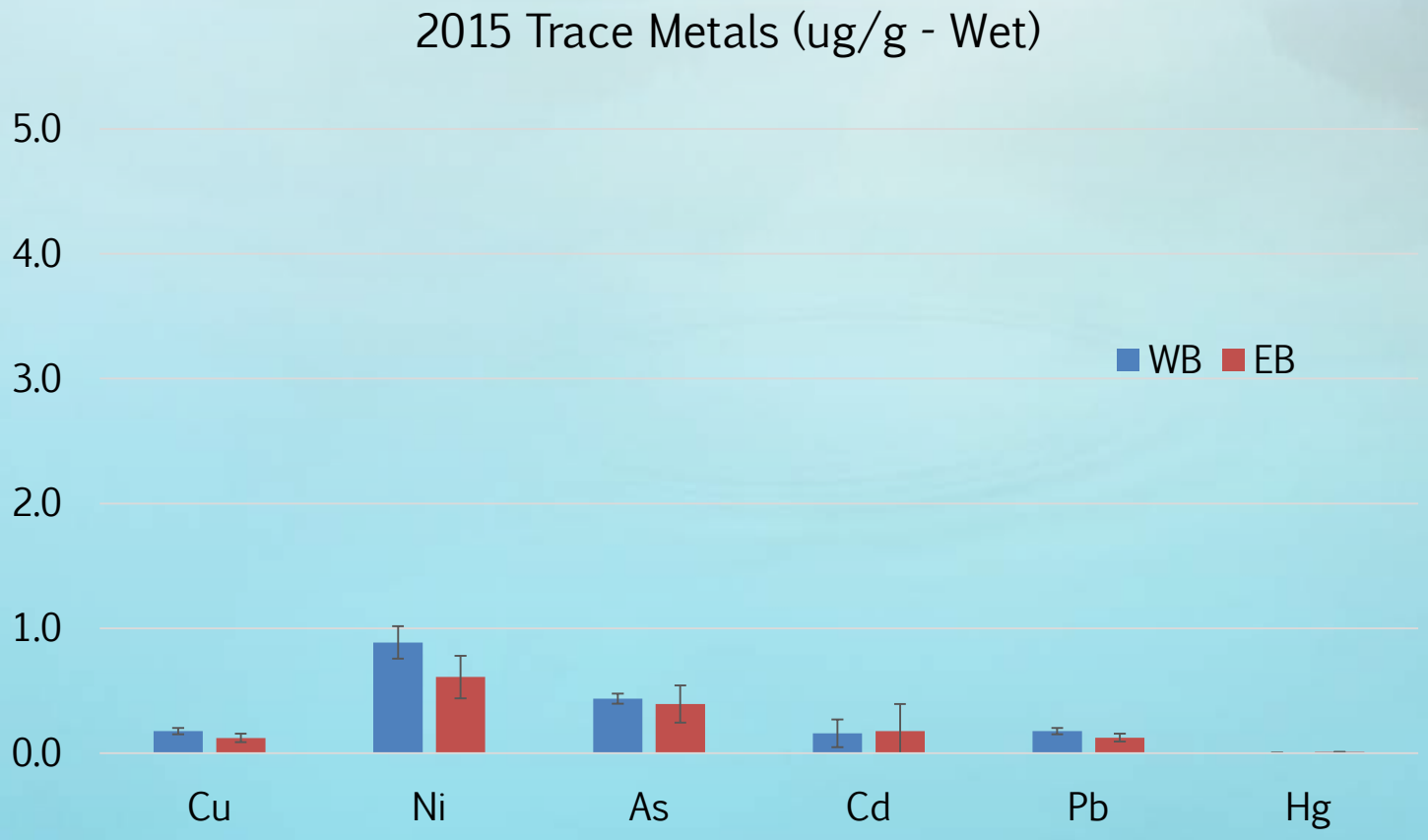
Give Aways: Great Yards Get Together

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



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)