


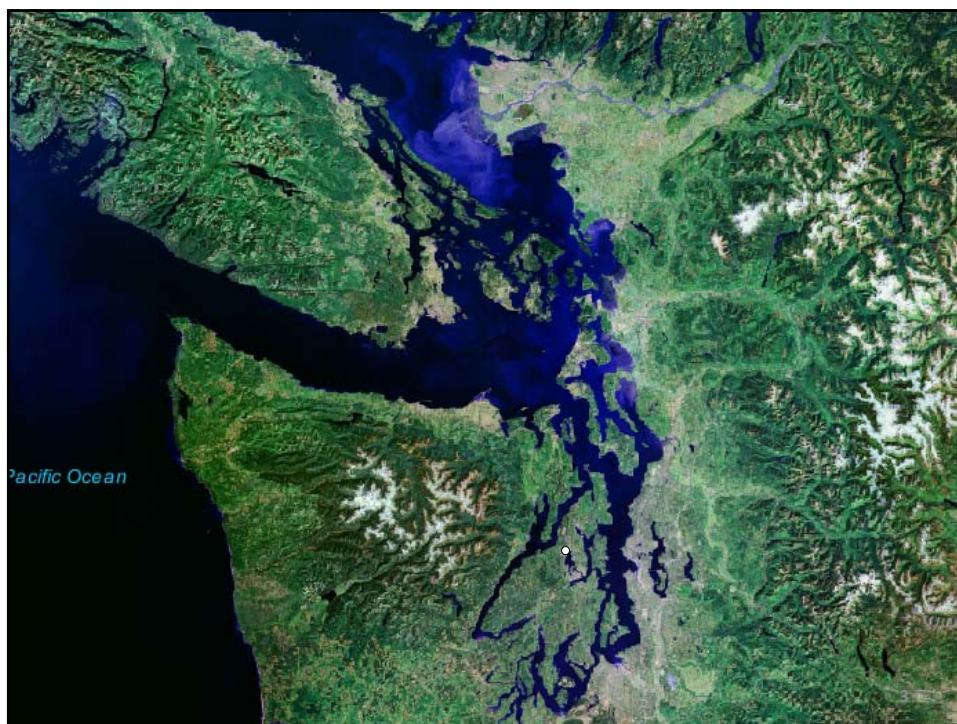
ENVVEST Mussel Watch Project: Monitoring Environmental Quality in Local Waters

Presentation for All Ports Meeting, Brownsville, WA
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Puget Sound Naval Shipyard & IMF
Project ENVironmental inVESTment (ENVVEST)

ENVVEST Mussel Watch Project

Outline of Talk

- Introduction
- Background
- Overview of ENVVEST Studies
- Mussel Watch Sampling
 - 2010 - 2016 Results
 - Comparison to Benchmarks
- Summary and Conclusions

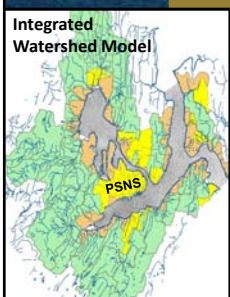




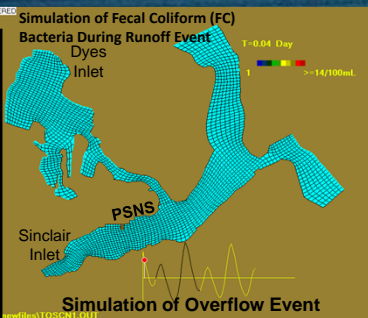
Puget Sound Naval Shipyard & IMF (PSNS&IMF) Project ENVVEST

- Final Project Agreement (Sep. 2000)
PSNS&IMF/EPA/Ecology
- Cooperative technical studies with local agencies and stakeholders for watershed monitoring and modeling
- Pool resources to solve environmental problems

Pay off – Goodwill from regulatory agencies, stakeholders and public, and real improvements in environmental quality



Integrated Watershed Model

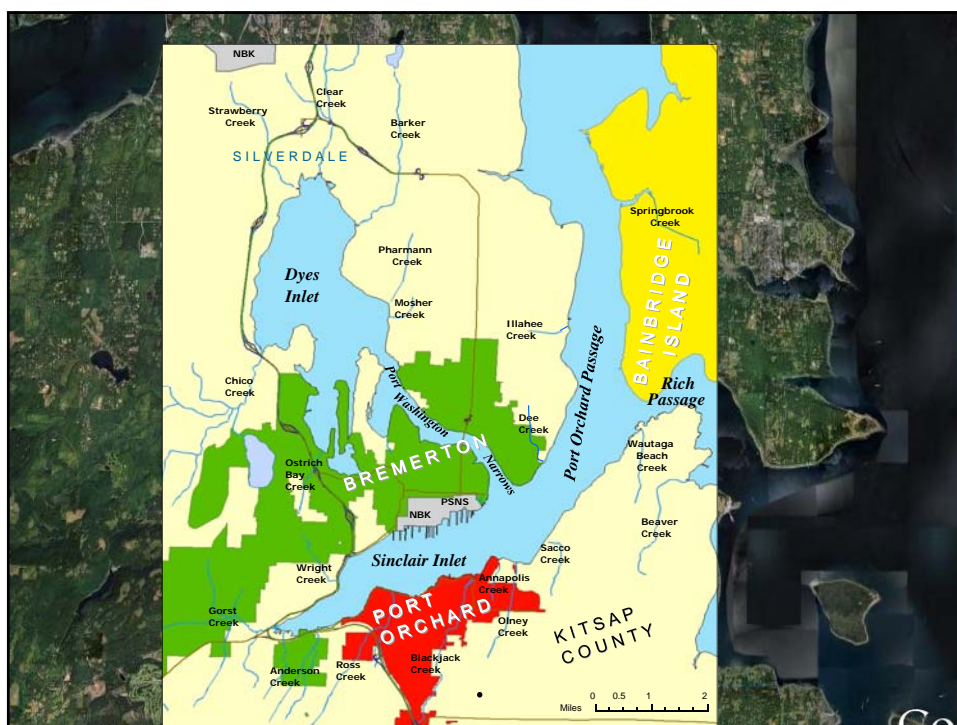


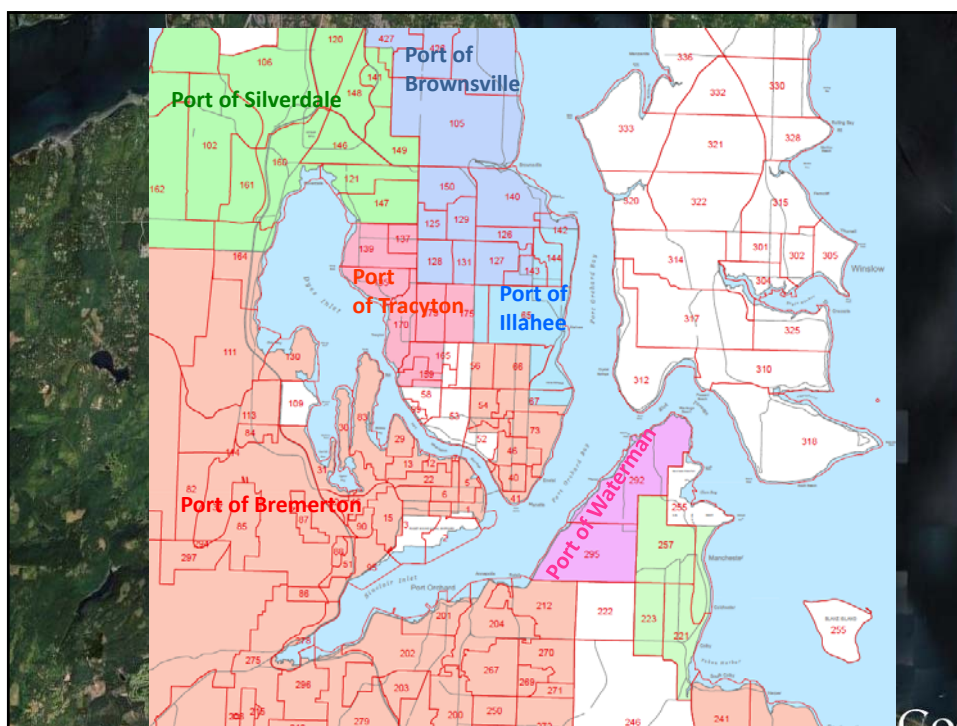
Simulation of Fecal Coliform (FC) Bacteria During Runoff Event

Simulation of Overflow Event

Major Accomplishments

- Developed model of watershed and Inlets
- Assessed contaminant loading from storm events and runoff
- Contributed to reopening of 1500 acres of shellfish beds in Dyes Inlet
- Technical Support for FC TMDL
- Providing science to inform NPDES permitting process

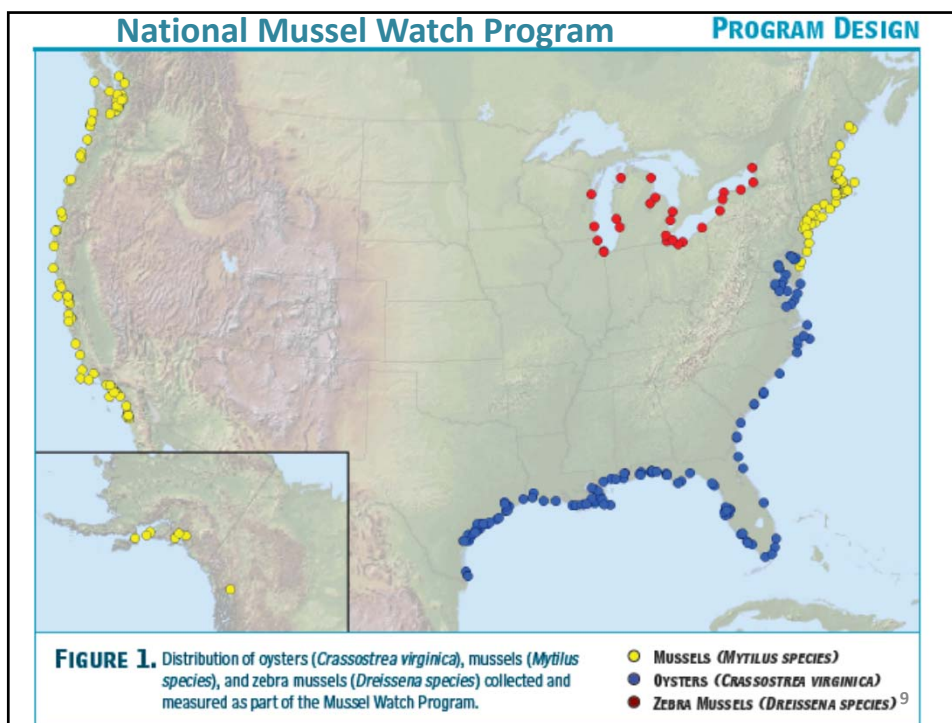




Two Main Sources of Impact

- Historical releases of pollutants
 - Past practices (Point Sources)
 - Legacy residual contamination
- Watershed Development
 - Loss of natural habitat
 - Increases in runoff from landscape
 - More Nonpoint Source Pollution

Image U.S. Geological Survey



ENVVEST Mussel Watch Sampling

Partnering with WDFW and Local Stakeholders

Coordinated with National Mussel Watch Program

West Coast Sampling Winter of Even Years (Winter 2010, 2012, 2014, 2016)

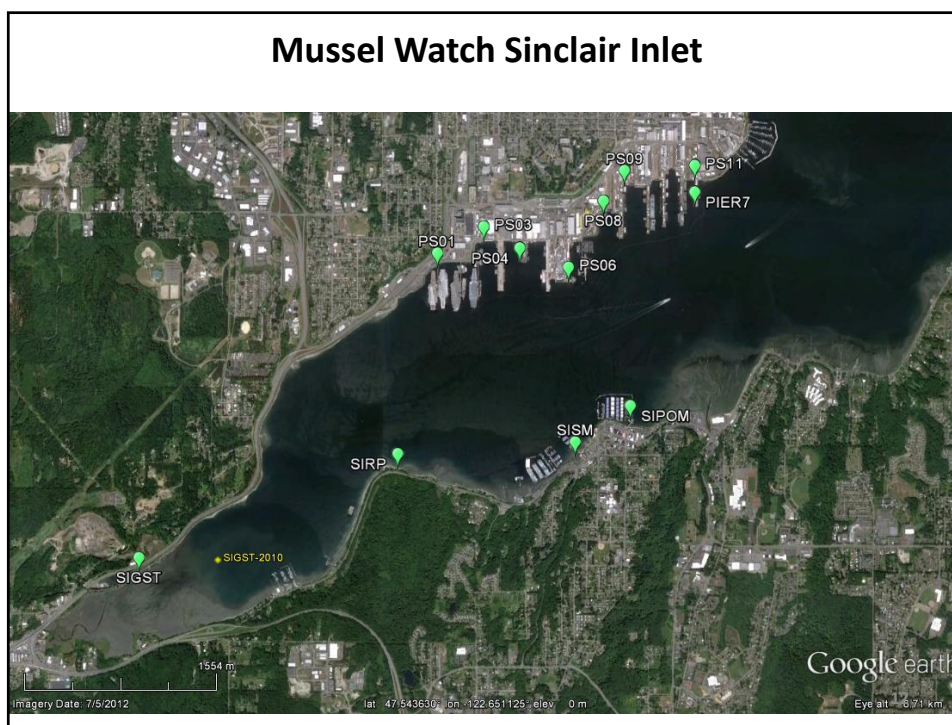
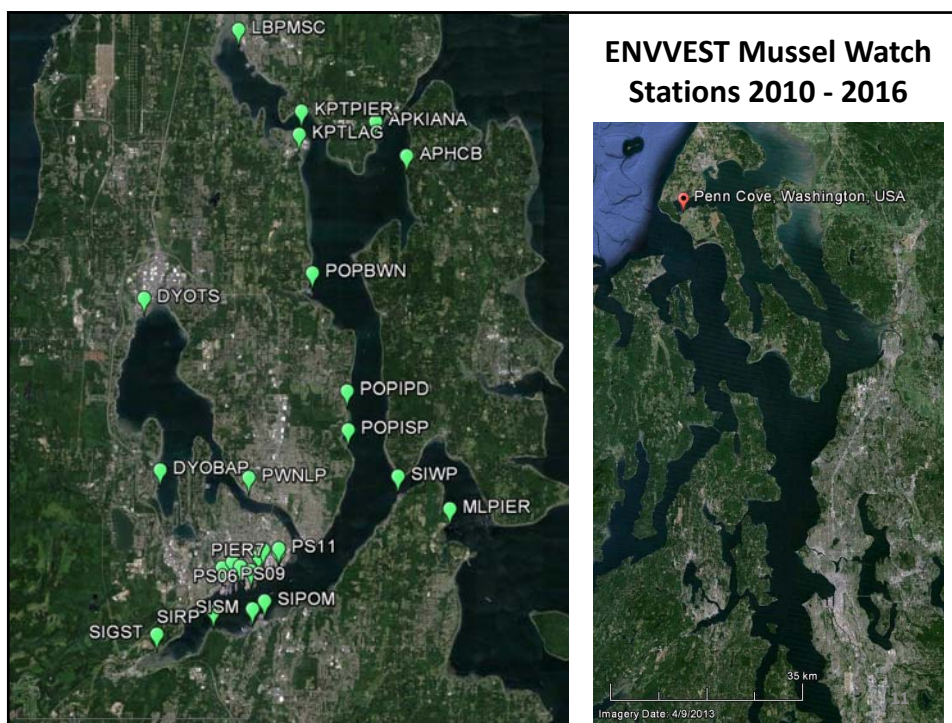
Representative Sampling Site Locations

- 3 Stations/Site, Size Distribution
- Composite Sample for Chemistry
 - Metals, PAHs, PCBs
 - $\delta^{13}\text{C}$, $\delta^{15}\text{N}$, and Lipids

Participating Jurisdictions

City of Bremerton Parks & Rec
 City of Bainbridge Island
 Port of Bremerton
 Port of Brownsville
 Port of Illahee
 Port of Poulsbo
 Port of Silverdale
 Private Landowner
 Suquamish Tribe
 US EPA/NOAA Manchester Lab
 US Navy Naval Base Kitsap (NBK)
 US Navy Naval Undersea Warfare Center
 US Navy Puget Sound Naval Shipyard & IMF
 Washington Department of Fish and Wildlife
 Washington State Parks Illahee

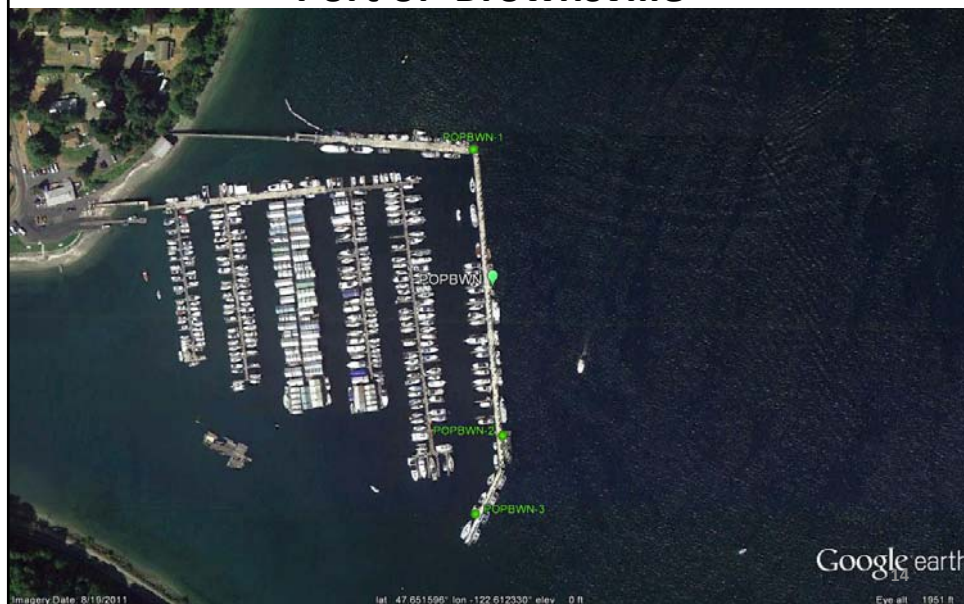




DYOTS – Dyes Inlet Old Town Silverdale Port of Silverdale



POPBWN – Port Orchard Passage Brownsville Port of Brownsville



Mussel Watch Sampling



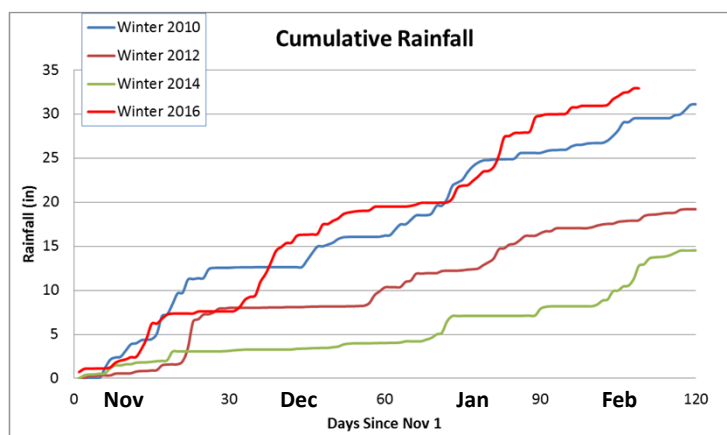
2016 Mussel Watch Sampling Port of Illahee

Photo by Jim Aho



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Winter Sampling Nov - Feb



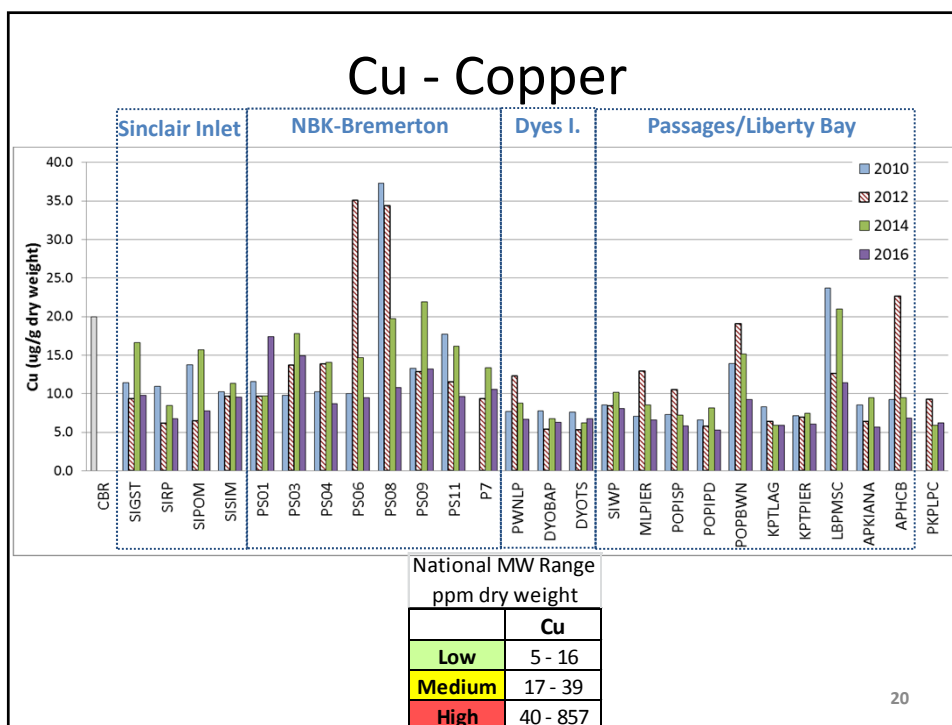
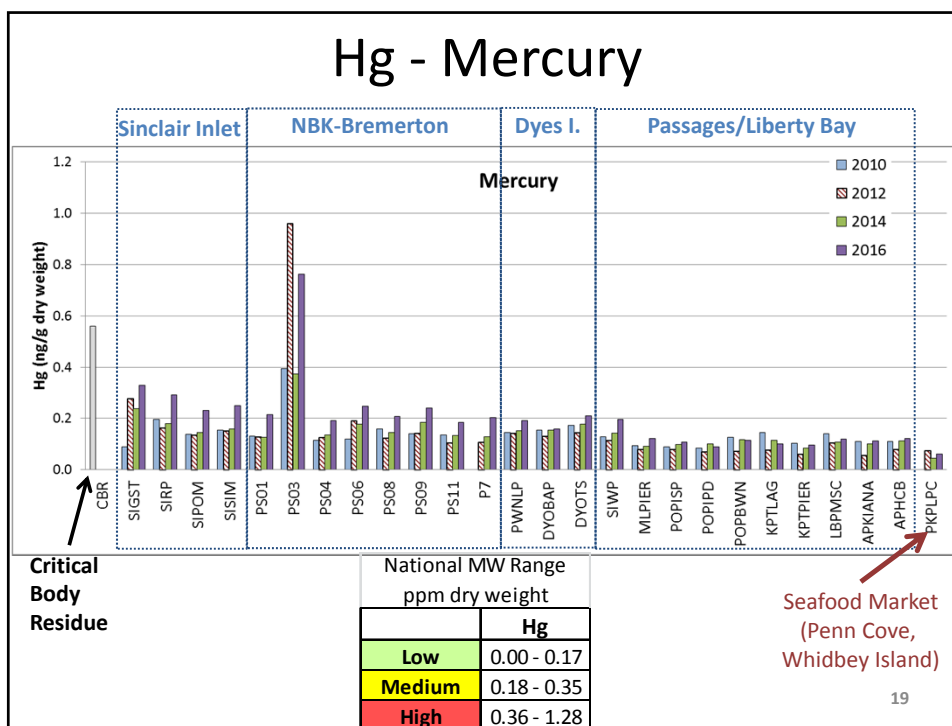
Sum of average daily rainfall reported from Kitsap County rain gauges (CoCoRaHS 2016)

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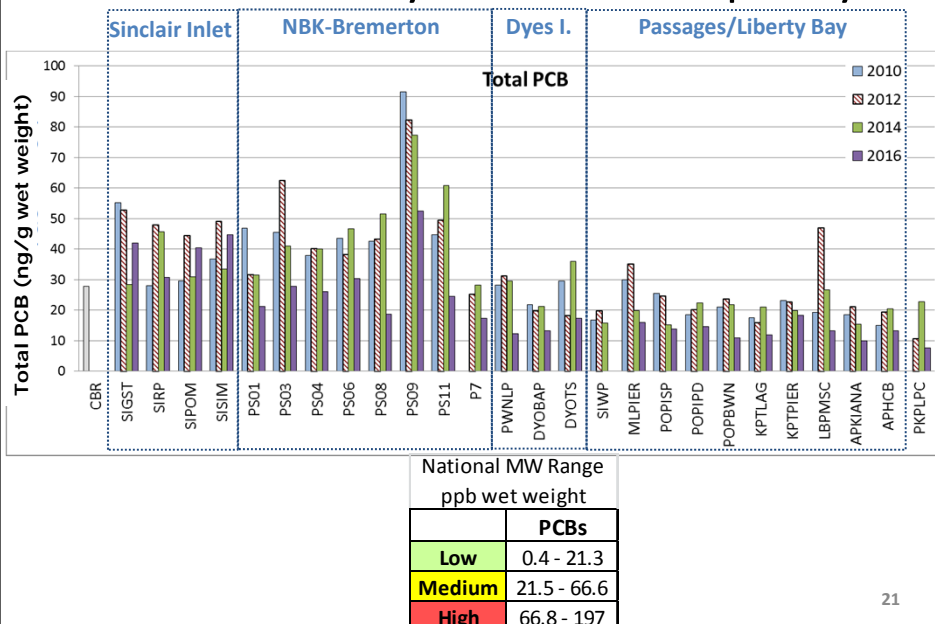
ENVVEST Mussel Watch 2010 and 2012 Data Evaluation

- Possible Trend
 - > 3x difference between years
- Possible Source
 - > 3x higher than other stations
- Possible Ecological Effect – Critical Body Residue
- Comparison to Seafood Market Sample
- Comparison to National Data Set
 - Low, Medium, and High Ranges

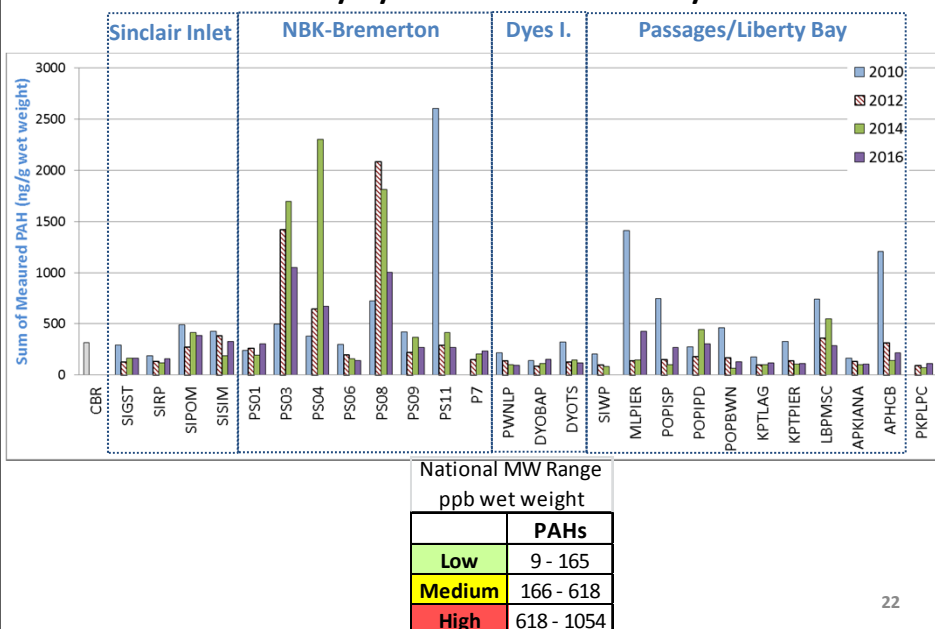
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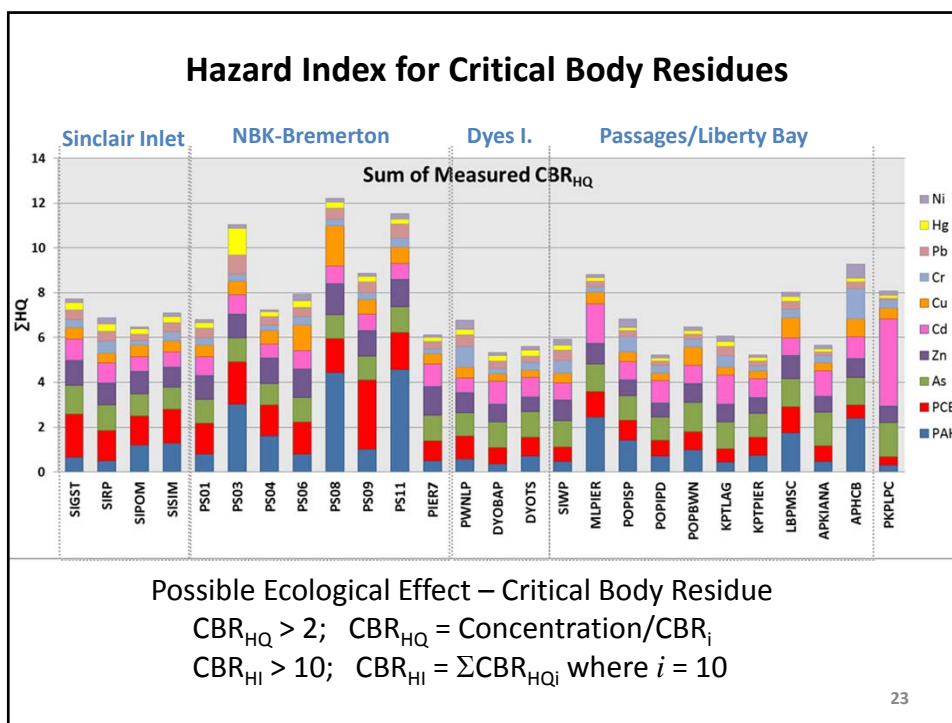


Total PCBs – Polychlorinated Biphenyls



Sum PAHs – Polycyclic Aromatic Hydrocarbons





Conclusions

- **Monitoring Program is focused on tracking environmental quality in the Inlets**
 - Can identify problems for further investigation and correction
 - Can be used to evaluate effectiveness of corrective actions
- **What are the Biota Telling Us?**
 - Some Areas were elevated with PAHs, PCBs, and metals
 - 3 of 24 sites had increased risk of ecological effects
 - Contaminants of concern were PAHs (3 sites), PCBs (2 sites), Hg (1 site), and Cu (1 site)
- **Overall decrease in contaminant levels indicates Improving Environmental Quality**
- **Monitoring framework provides context for interpretation**
 - Better information = better management

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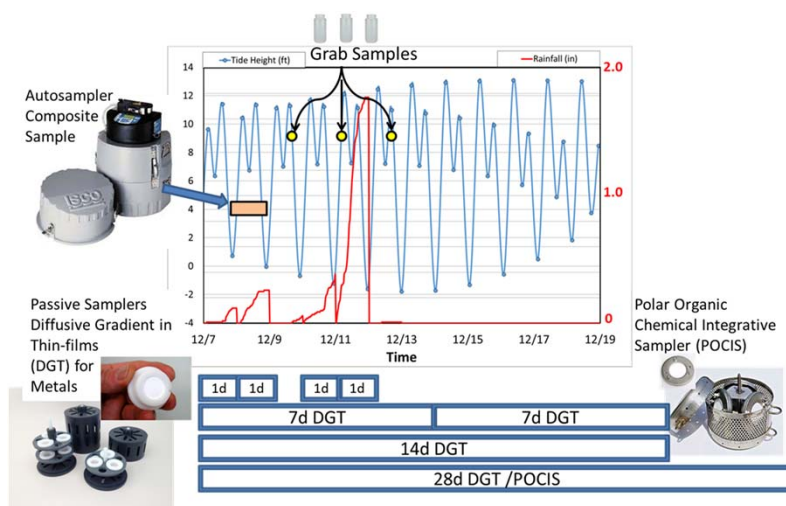
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Current Work: Incorporate Passive Samplers into Stormwater Monitoring Program



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Passive Samplers and Chemicals of Concern

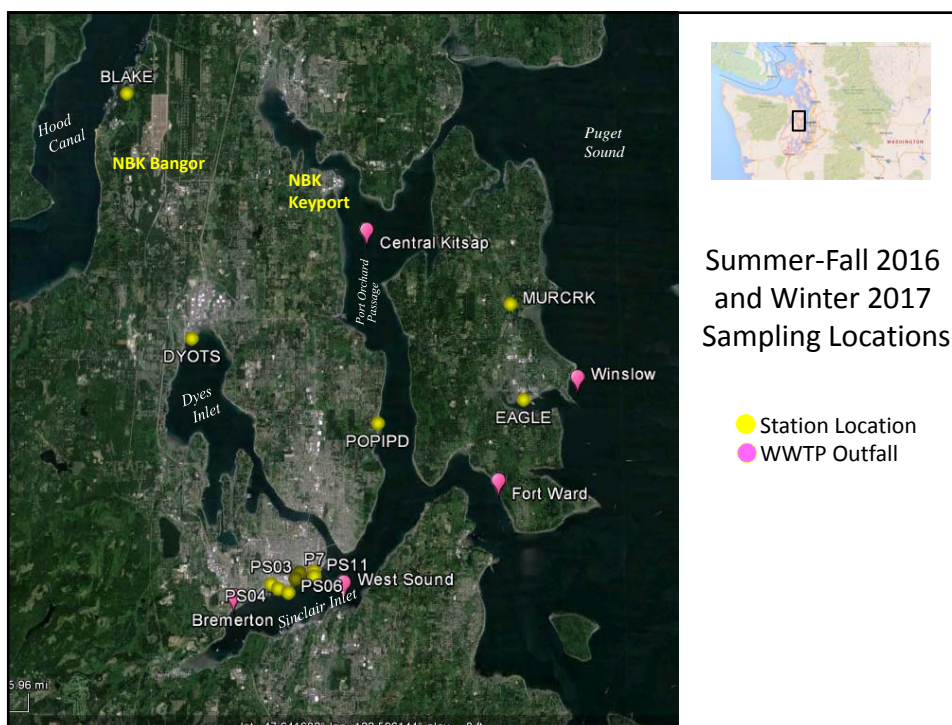
- Diffusive Gradient in Thin film (DGT) Metals
 - DGT Metals (Cd Cr Cu Ni Pb Zn)



- Polar Organic Chemical Integrative Sampler (POCIS)

- Human Activity (Wastewater) Markers

- Caffeine
- Nicotine
- Sweeteners
- Medicines
- Herbicides
- Flame Retardants



Stormwater Passive Sampling

Objectives:

1. Work with stakeholders to integrate passive sampling into existing stormwater monitoring.
2. Validate the use of passive sampling devices to capture pulse inputs from stormwater runoff and better identify sources
3. Optimize stormwater sampling designs to obtain better information with lower costs
4. Gain regulatory and public acceptance of technical approach