

# Mussel Watch Pilot Expansion Study: Toxic Contaminants in Nearshore Biota



Funded by EPA's National Estuary Program

Jim West, Jennifer Lanksbury, Laurie Niewolny, Andrea Carrey



# Mussel Monitoring in Puget Sound (timeline)

- 1976 - present: NOAA Mussel Watch monitors 19 locations in Puget Sound
- 2005 - present: Snohomish County partners with NOAA Mussel Watch to expand coverage in Sno. Co.
- 2009/10: DFW/PSEMP partners with NOAA MW and Snohomish County for sampling (via a PSP grant)
  - Assures continuity of NOAA MW series that year
  - Developed training material and tested utility of citizen science volunteers

# Timeline cont'd.....

- 2010: SWG approaches DFW/PSEMP for developing MW as a monitoring tool for RSMP
- 2011: Ecology contracts with DFW/PSEMP for feasibility studies
  - Desktop survey of native mussel availability
  - Statistical power analysis of existing mussel data (UGA vs. non-UGA)
- 2011/12: DFW funds PSEMP to perform NOAA MW field sampling again
  - Assure continuity of NOAA MW series that year
  - Utilized citizen scientist volunteers again

# Results from these studies tell us...

- Spatial and temporal distribution of native mussels in Puget Sound is insufficient to support broad scale monitoring
- UGA-scale stratification is too coarse to discriminate spatial trends in contaminants
  - Stratify the shoreline by land-use
  - Add watershed (drainage) component
- Large-scale synoptic sampling cost-prohibitive unless citizen science volunteers are used

# Mussel Watch Pilot Expansion (2012-13)

Funded by: WDFW/DNR Puget Sound Marine and Nearshore Protection and Restoration Grant Program

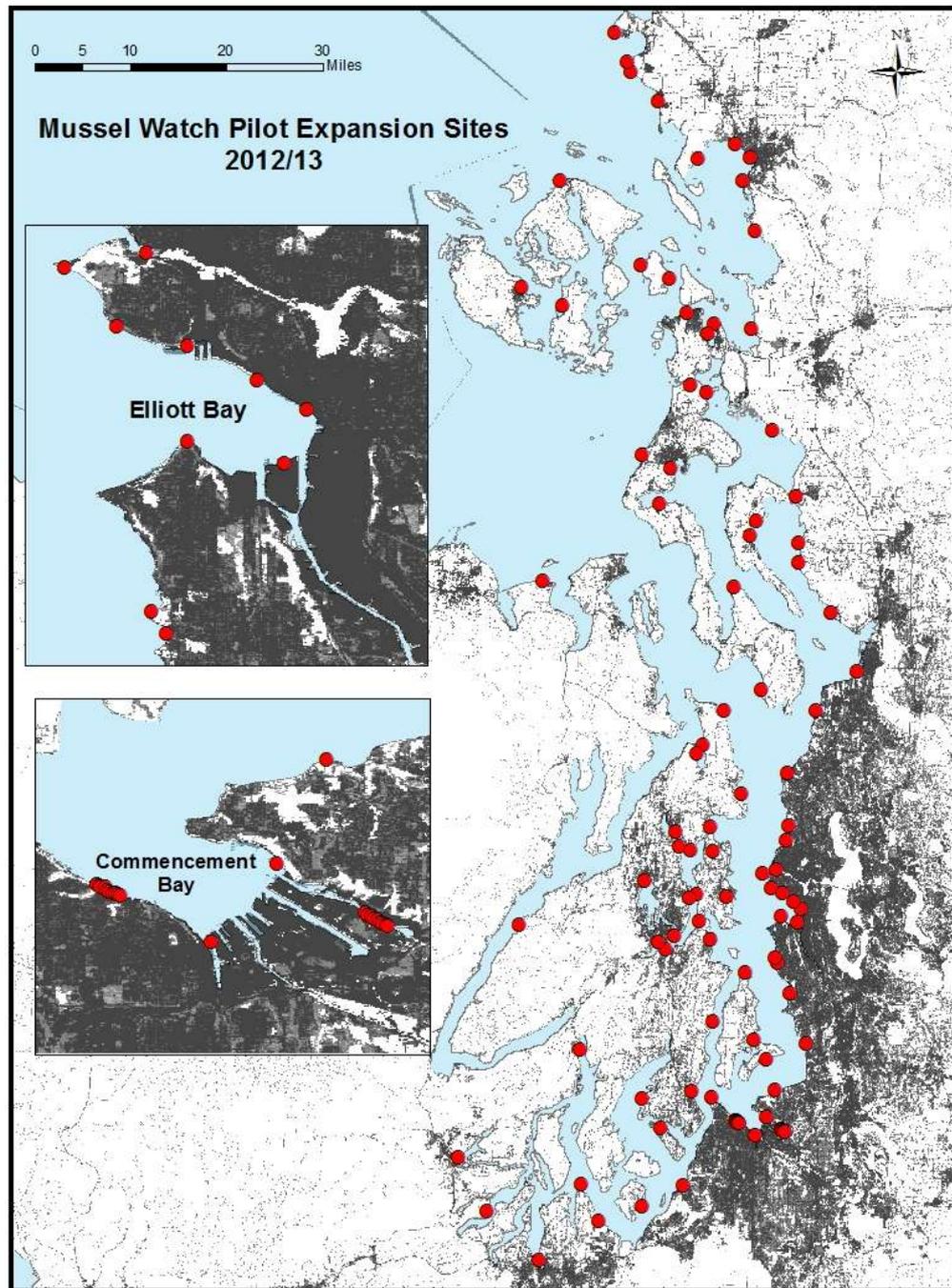
## Short term (project) goals:

- Evaluate extent and magnitude of contamination of nearshore organisms in Puget Sound
- Compare toxics in mussels across broad range of land use

# Mussel Watch Pilot Expansion

60 NEP-funded sites + 48  
additional sites funded by  
13 external partners

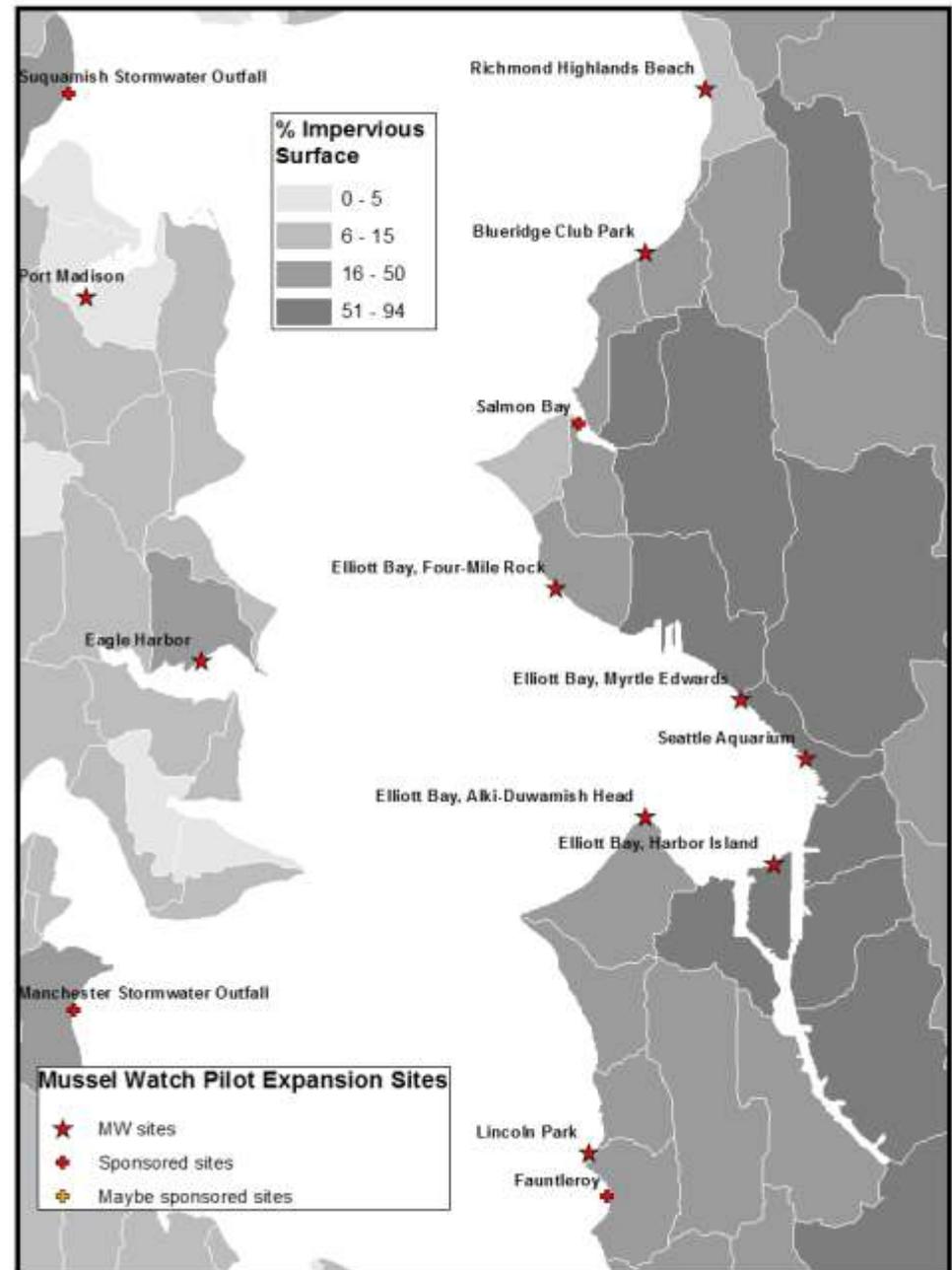
Well over 100 citizen  
science volunteers worked  
with DFW to conduct the  
field and lab work



# Impervious Surface as proxy for Urban Development

Based on non-point sources:

- *Assessment Units (AU)* - catchment/drainage units from Ecology
- Calculated mean % impervious surface in each AU
- Divided into four categories
- Placed replicate mussel sites in each category



# Mussel Cage Deployment/Retrieval

November 2012 - January 2013



# Partners and volunteers who participated in the Mussel Watch Pilot Expansion Study

Bainbridge Beach Naturalists

City of Bellingham - Natural Resources Department

Evergreen State College

Harbor Wildwatch

Highline Community College - Marine Science & Technology Center (MaST)

King County - Natural Resources and Parks

Kitsap County Public Works - Surface & Storm Water Management Program

Lummi Nation

Nisqually Reach Nature Center

Padilla Bay National Estuarine Research Reserve

Penn Cove Shellfish

Port Gamble S'Klallam Tribe

Port Madison Suquamish Tribe

Puget Creek Restoration Society

Puget Sound Partnership

Puget Soundkeeper Alliance

Samish Indian Nation

San Juan County Marine Resources Committee

Seattle Aquarium - Beach Naturalists

Skagit County Marine Resources Committee

Snohomish County Marine Resources Committee

SSA Marine

Stillaguamish River Clean Water District Advisory Board

Stillaguamish Tribe

Tacoma-Pierce County Health Department

Tulalip Tribes

US Navy - NW Space and Naval Warfare Systems Center

University of Puget Sound

UW-Tacoma

Washington Conservation Corps - Puget Sound Corps

Whatcom County Marine Resources Committee

Washington Department of Ecology

WDFW's Oil Spill Response Team

WDNR Aquatic Reserves Program

WDNR Nearshore Habitat Program

WSU Island County Beach Watchers

WSU Kitsap County Beach Watchers

WSU Skagit County Beach Watchers

WSU Snohomish County Beach Watchers

# Passive bio-monitoring with indigenous/wild mussels

## Advantages

- Mussels already on location
- Sampling costs minimal
- Less work intensive (no measuring, deployment/retrieval)
- Readily comparable with National MW dataset
- Relatively easy for volunteers to learn – some training involved

## Disadvantages

- Distribution - sampling locations restricted to natural populations
- Less statistical resolution power between sites (variability in species, age, size, vertical position)
- Exposure period and start condition unknown
- Loss of sites between years (pops. decline and/or disappear)
- Requires advanced scouting to find adequate mussel populations
- No growth measurements or mortality estimate possible (i.e. no bioeffects)

# Active bio-monitoring with caged/transplanted mussels

## Advantages

- Almost any sampling location possible
- Greater statistical resolution, uniform initial condition (species, age, size, vertical position)
- Exposure period known/clearly defined
- Bioeffects measurements possible (i.e. growth, mortality)
- Dependability of sites between years (reduced loss of sites from predation/pop. failure)
- Easier to co-locate sites with other studies (sediment, effectiveness monitoring, gradients)
- Easier for volunteers – less training
- Compatible with developing abiotic media e.g., membrane devices

## Disadvantages

- Logistically more complex:
  - Purchase, assemble cages & anchors
  - Sort, measure, bag mussels
  - Deploy/retrieve
  - HPA and other permits
- Costs higher (equipment, mussels)
- Study needed to determine comparability with native mussels from National MW dataset
- Difficult to reconcile tidal elevation with proximity to shore
- *Minor* attrition of cages - theft, storms (lost 3 of 108)

# \$\$\$ Factors to Consider

## “Native” mussel sampling

- Source (free on site)
- Minimal equipment – knives
- Staff time:
  - Permits, access permissions
  - Collect mussels (1x out)
  - Train/manage volunteers
- Processing harder:
  - Mussel sizes varied, small
- Chemical analysis

## Caged mussel sampling

- Source (from aquaculture)
- Equipment – cages & anchors
- Staff time:
  - Permits, access permissions
  - Assemble cages/anchors
  - Sort, measure, bag mussels
  - Deploy/retrieve cages (2x out)
  - Manage volunteers
- Processing easier:
  - Mussels of uniform size
- Chemical analysis
  - Include initial condition source pop

END