

# Using photos and stories to connect people to water quality in Puget Sound



National Monitoring Conference - Denver, CO March 28, 2019

## Dilemma of long-term monitoring programs providing only data

- Data collection, management, QC, and instrument maintenance dominate the activities to the detriment of data workup and presentation.
- Providing only data limits the program support. → Few people that can advocate for the value of the program.
- Long term support hinges on perceived value and impact of the program

**The combination of data and stories let a program shine!**

# Measuring long-term trends in eutrophication, dissolved oxygen and physical variables

## Salish Sea - Greater Puget Sound region

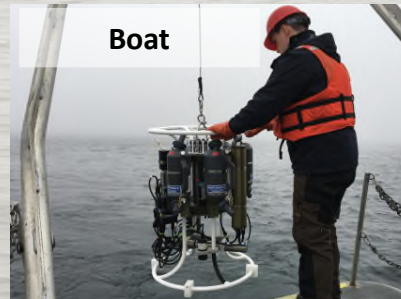


## Water Quality variables measured monthly at 31 stations

### Seaplane



### Boat



### Physical variables

- Temperature
- Salinity
- Density

### Chemical variables

- Oxygen
- Nitrate, nitrite
- Silicate
- Phosphate
- Ammonium
- Nutrient ratios
- pH, alkalinity, DIC

### Bio-optical variables

- Water clarity
- Chlorophyll a
- Euphotic depth, PAR

# How do you get attention?

## *The human scale*



- Images and stories resonate with people
- Create unique vantage points on their backyard environment
- Empower people with something they can leverage

Let me take you on some flights





# Eyes Over Puget Sound

[Flight log](#)[Weather](#)[Water column](#)[Aerial photos](#)[Ferry and Satellite](#)[Moorings](#)

## Surface Conditions Report

September 11,  
2013



Ozone sensors on board: [Donovan Rafferty, Ecology Air Quality Program \(here\)](#)

[Start here](#)

*Up-to-date observations of visible water quality conditions in Puget Sound and the Strait of Juan de Fuca*



# Eyes Over Puget Sound

[Field log](#)[Climate](#)[Water column](#)[Aerial photos](#)[Ferry and Satellite](#)[Moorings](#)

The drought meets the “The Blob” in Puget Sound as warm air temperatures have left little snow to feed the rivers.

An aerial photograph taken from an airplane window, showing a vibrant rainbow arching over a coastal town and forested area. The town is densely packed with houses, and the surrounding landscape is lush green. The water of the sound is visible in the foreground and background.

## Surface Conditions Report

April 29, 2015

[Start here](#)

*Up-to-date observations of visible water quality conditions in Puget Sound and the Strait of Juan de Fuca*

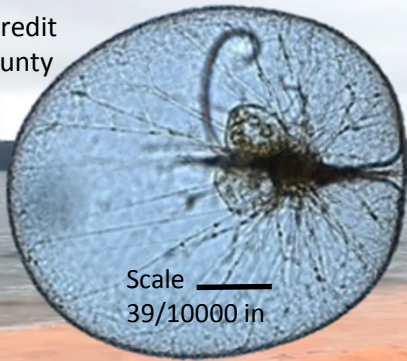


# Eyes Over Puget Sound

[Summary](#)[Stories](#)[Diving & critters](#)[Climate & streams](#)[Combined factors](#)[Marine water](#)[Aerial photos](#)[Info](#)

## Surface Conditions Report, May 22, 2018

Photo credit  
King County



Scale \_\_\_\_\_  
39/10000 in

*Noctiluca* is blooming, [read](#) at: [Encyclopedia of PUGET SOUND](#)



*Des Moines, Saltwater Park 6-4-2018*

Up-to-date observations of water quality conditions in Puget Sound and coastal bays

[Start here](#)



Field log

Weather

Water column

Aerial photos

Ferry and Satellite

Moorings



Large *Noctiluca* bloom in Central Sound. Location: Bainbridge Island (Central Sound), 8:08 AM

# Eyes Over Puget Sound

[Field log](#)[Climate](#)[Water column](#)[Aerial photos](#)[Ferry and Satellite](#)[Moorings](#)

## Surface Conditions Report

October 29, 2014

Guest: Gabriela Hannach

[Start here](#)

*Up-to-date observations of visible water quality conditions in Puget Sound and the Strait of Juan de Fuca*



Field log

Climate

Water column

Aerial photos

Continuous monitoring

Streams



*Strong red-brown bloom and abundant jellyfish patches and organic debris at surface.*  
Location: Budd Inlet (South Sound), 2:25 PM.



# Eyes Over Puget Sound

[Field log](#)[Climate](#)[Water column](#)[Aerial photos](#)[Continuous monitoring](#)[Streams](#)

## Surface Conditions Report, May 2, 2016

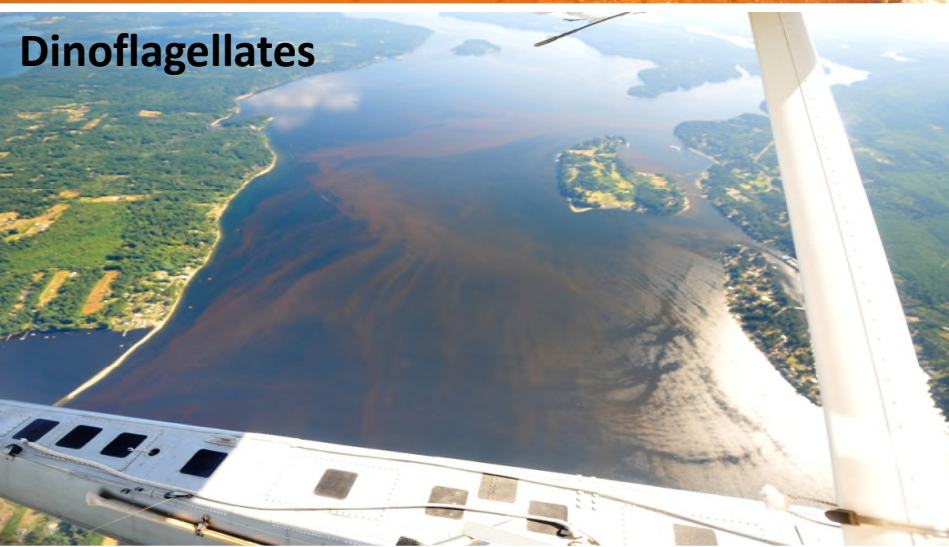
*Critter of the Month*

[Start here](#)

Sandra Weakland, Marine Monitoring, Ecology

**Up-to-date observations of visible water quality conditions in Puget Sound and the Strait of Juan de Fuca**

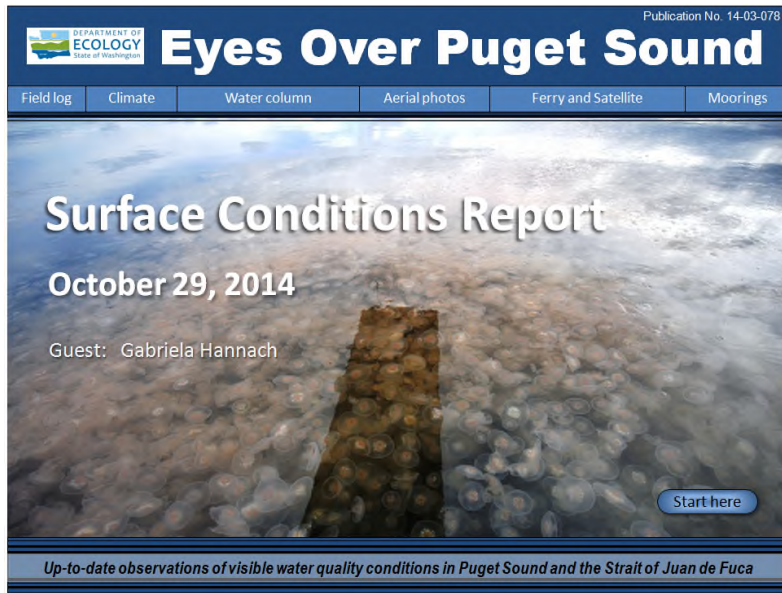
# Making a visually engaging pitch for eutrophication (qualitative observations, Eyes Over Puget Sound)



# Strategies to increase the impact and effectiveness of long-term marine monitoring programs (story material)

We humans like to think on human scales (time and space)

Image rich to engage more people



Headline driven information bits

- A large Noctiluca bloom spreads across central Sound.
- Patches of jellyfish are overwintering in finger inlets of South Sound.
- Puget Sound is a lot warmer going into the new year.
- Infra-red images show what the eye can't see.

Deliver on a time scale that humans like to think in (within a few days)



Multiple perspectives...

## Be informed within a few days



1. Everybody is informed about their backyard marine environment.
2. Free educational material.
3. Access for more information + data.

# Leveraging our flight time

- Empty transit flights with camera on board
- Document blooms, debris, animal aggregations, oil sheens, water boundaries
- Unique perspective, minimal extra cost

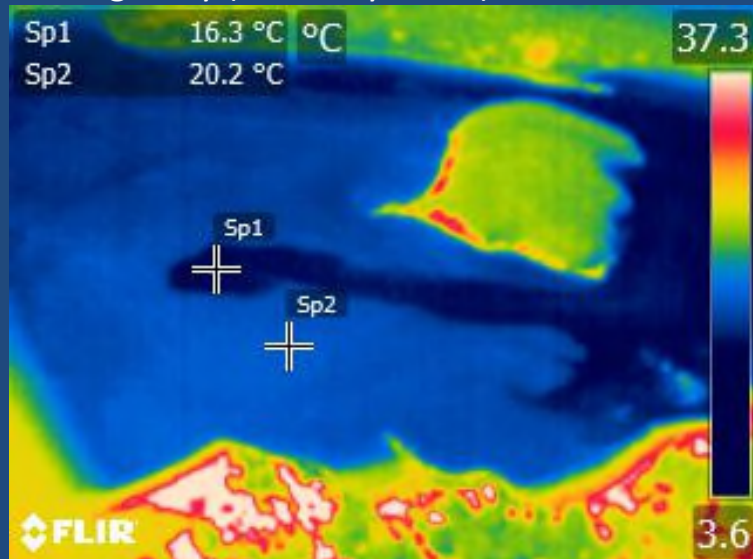


Over time we can establish maps of surface features

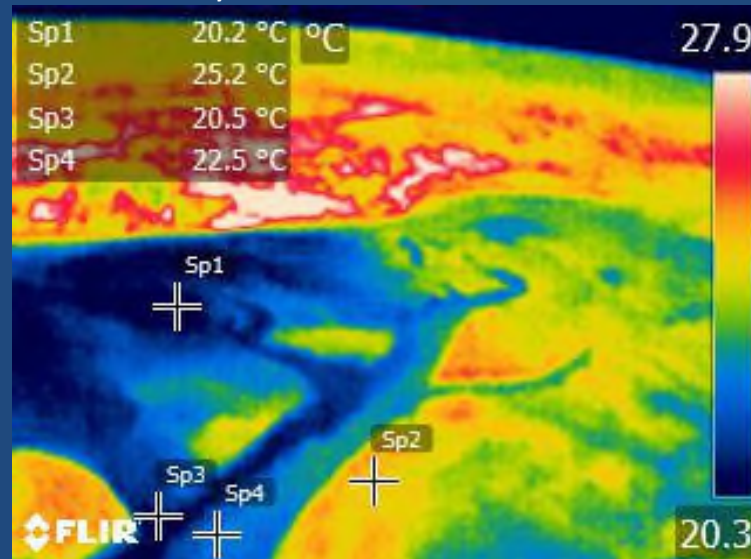
A. Marine surface waters can have very different temperatures, like this tidal eddy, 4 °C cooler than surrounding water.

**Disclaimer:** IR images are not corrected for sky condition, humidity, air temperature, emissivity, and subject distance.

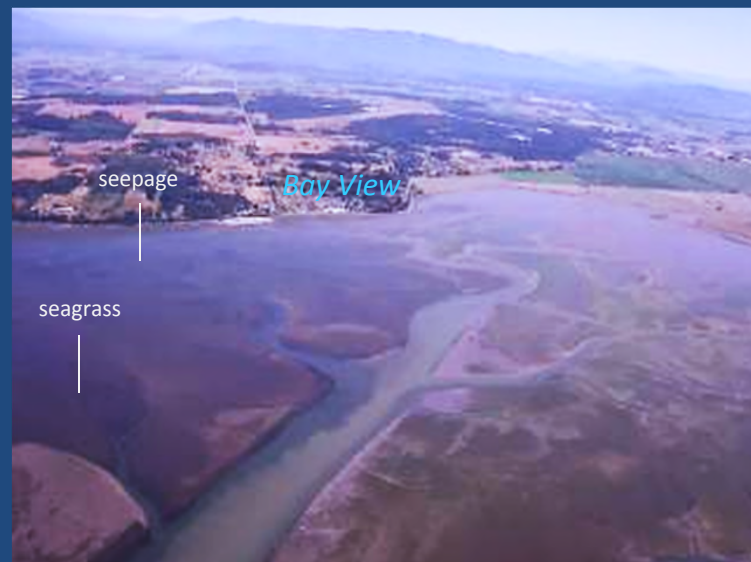
A. Skagit Bay (Whidbey Basin)

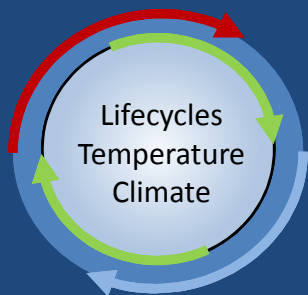


B. Padilla Bay



B. Seagrass beds are important rearing areas for fish. During sunny days, freshwater seepage can keep some areas 5 °C cooler.





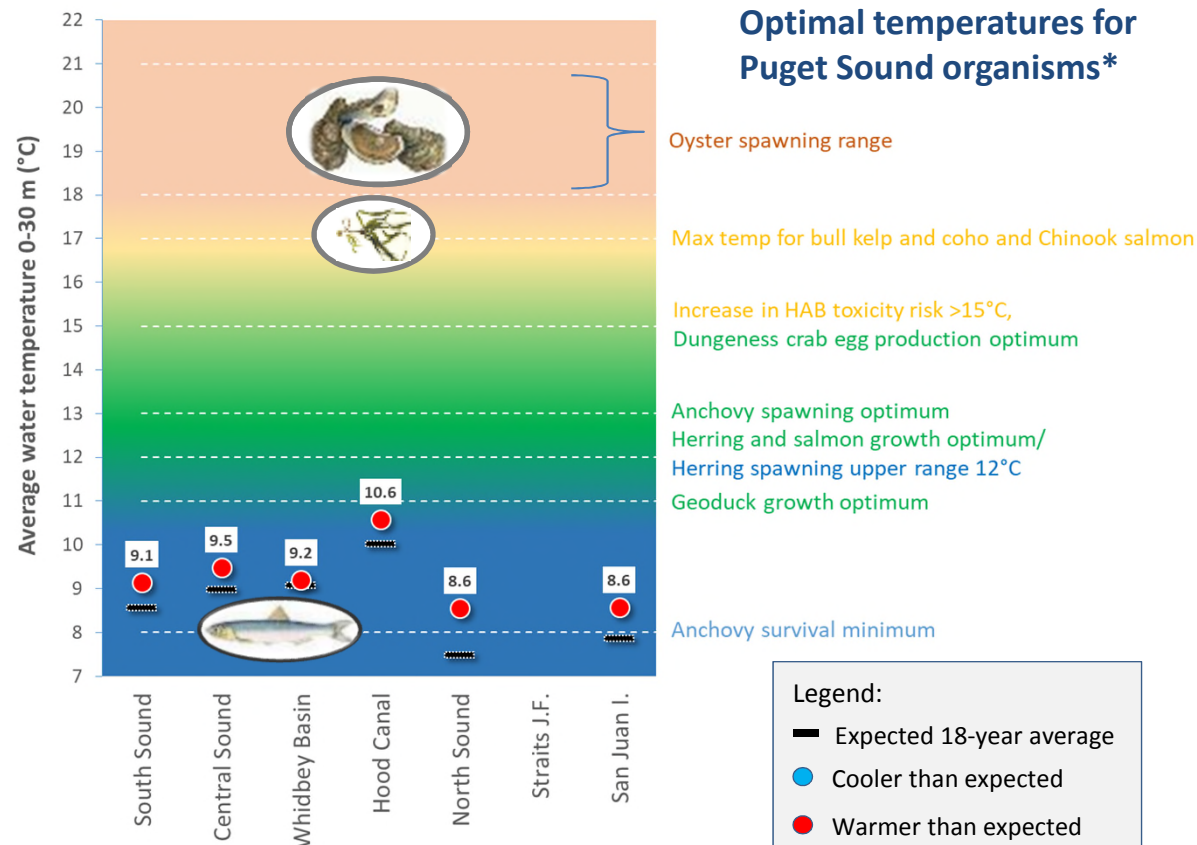
## Can organisms thrive and survive?

The life cycles of organisms respond to temperature. To be successful, the timing of early life stages must line up with good growth conditions.

Temperature is important for growth, but also dictates if certain organisms can overwinter in Puget Sound (e.g., northern anchovy).

\* Help us get these right. We scoured the literature for temperatures important to the success and survival of marine organisms.

**In January**, average water temperatures in surface water 0 – 30m were warmer than the baseline (1999 – 2016). Hood Canal remained the warmest, providing a thermal refuge for cold-water intolerant species. North Sound and San Juan Islands were cooler. If cooling continues, anchovies that only tolerate temperatures above 8 °C will be trapped in Hood Canal.



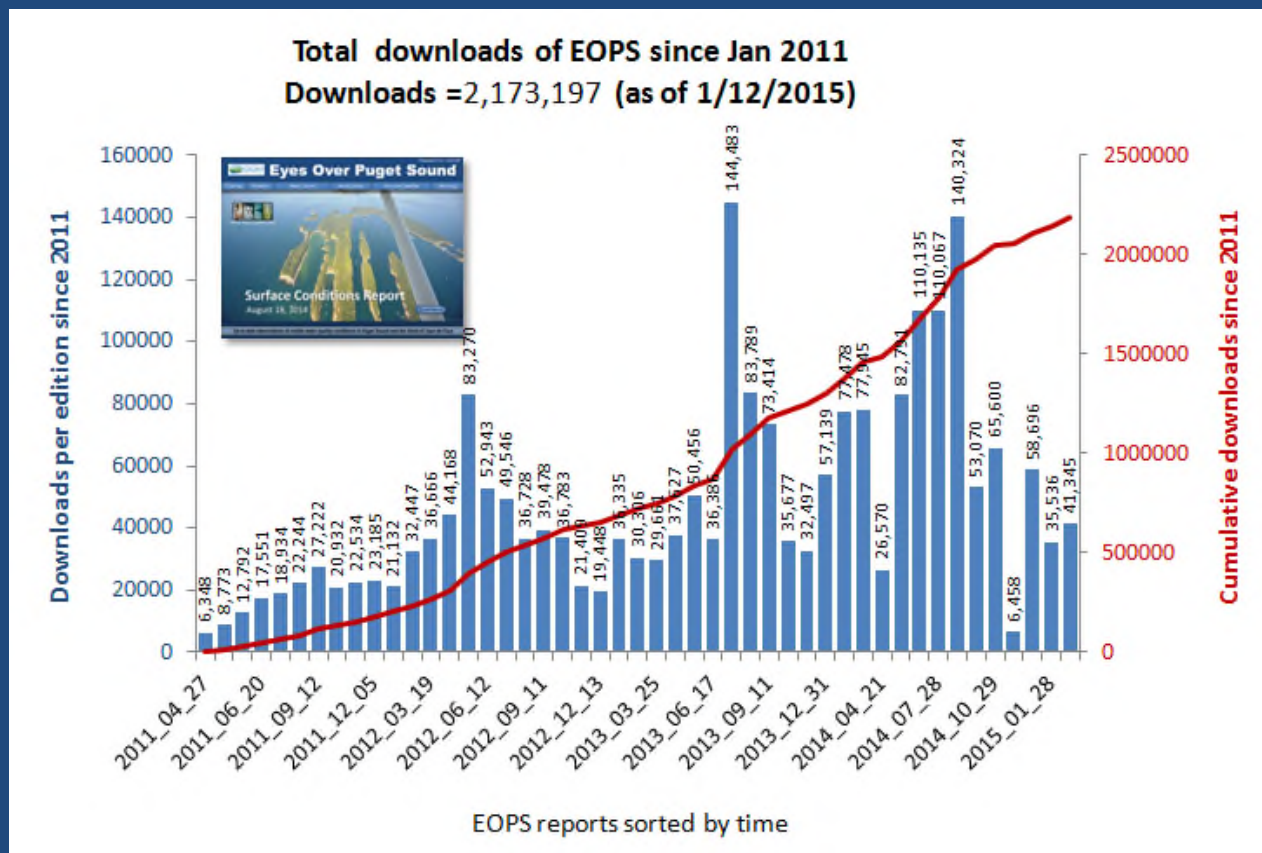
# EOPS high public resonance

Steady interest

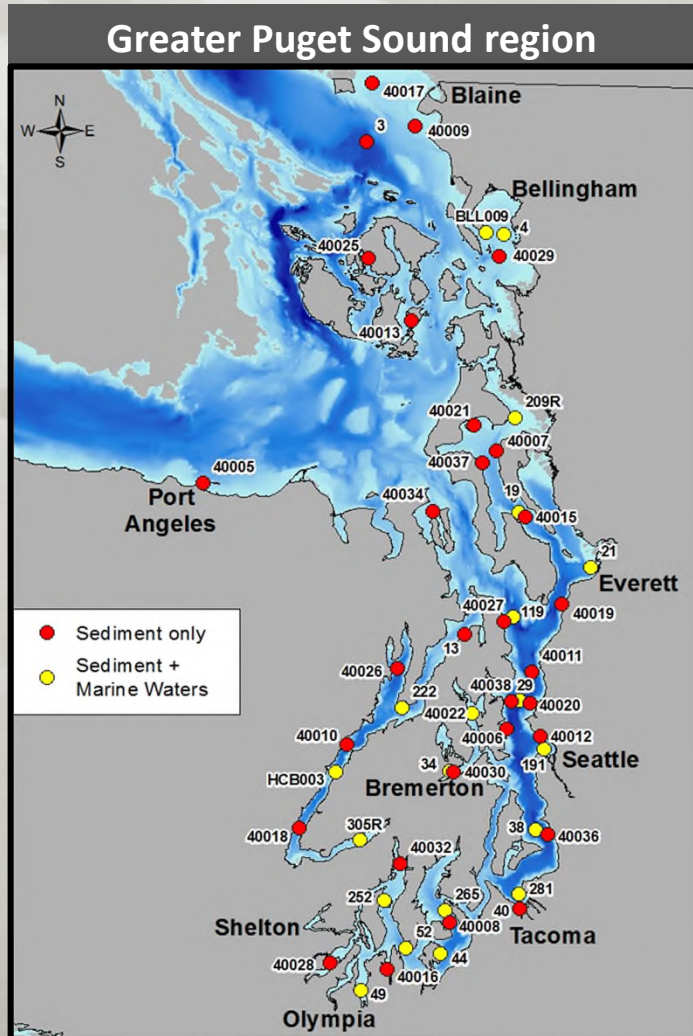
> 600 Listserve subscribers

General interest

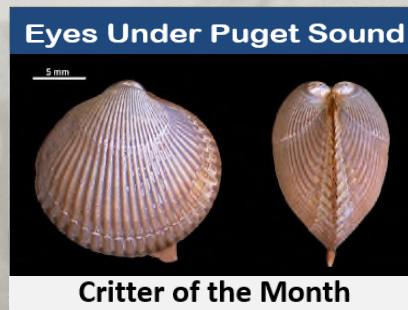
Over 2 million  
downloads!



# Measuring long-term trends in sediment quality and invertebrate community health



## Sediment Quality measured annually at 50 stations



## Sediment-dwelling inverts

- Count
- ID to genus & species
- Biomass

## Biogeochemistry

- Grain size
- Carbon
- Nutrients
- Sulfides

## Chemistry

- Metals
- PAHs, PCBs, PBDEs
- Phthalates

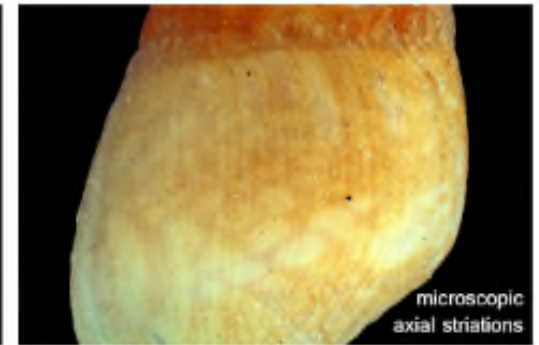
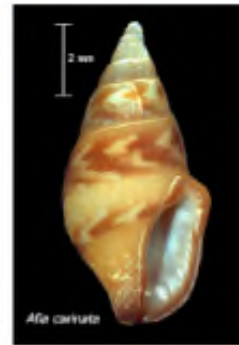
## Genetics

- eDNA

# Eyes Under Puget Sound - Monthly Blog

Wednesday, December 13, 2018

## Eyes Under Puget Sound: Critter of the month — dove snails



Left: White Dove by [Sander van der Wel](#) (Netherlands). Center: *Alia carinata* collected from Puget Sound. Right: Close-up of the shell of *Astyris gausapata*, showing microscopic vertical lines called axial striations.

The holidays are in full swing – and what could capture the spirit of the season better than the dove – the universal symbol for peace, love, and goodwill? You might not know it, but a different kind of beautiful dove lives under the wintry waters of Puget Sound.

### Birds of a feather?

Dove snails don't look much like their avian namesake – except for the teardrop shape of their shells (and the opening, or **aperture**, might be able to pass for a wing if you're feeling creative). Perhaps the diverse patterns of sculpture and color on their shells reminded some naturalist long ago of a dove's mottled feathers.

KINGDOM Animalia  
PHYLUM Mollusca  
CLASS Gastropoda  
ORDER Neogastropoda  
FAMILY Columbellidae



By Angela Eagleston & Dany Burgess

# Eyes Under Puget Sound - Monthly Blog

Thursday, February 14, 2019

Eyes Under Puget Sound: Critter of the month – the heart cockle



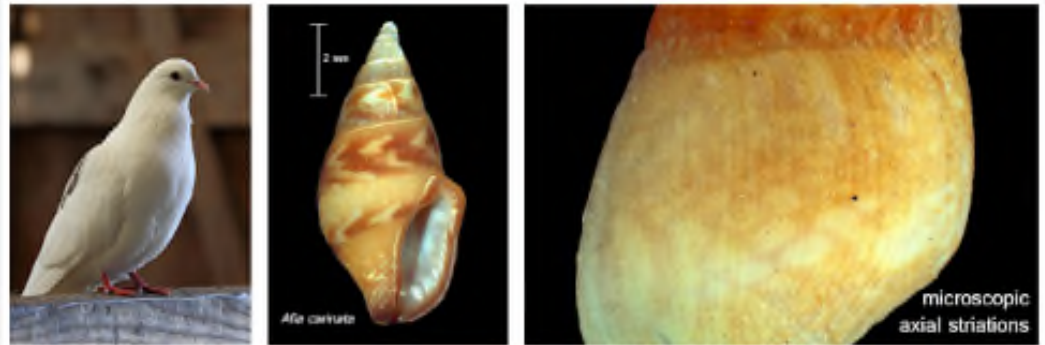
Left: Front view and side view of a small *Clinocardium nuttallii* specimen.  
Right: Side view of *Clinocardium nuttallii*. Photo courtesy of Dave Cowles, [wallawalla.edu](http://wallawalla.edu).



By Angela Eagleston & Dany Burgess

Wednesday, December 13, 2018

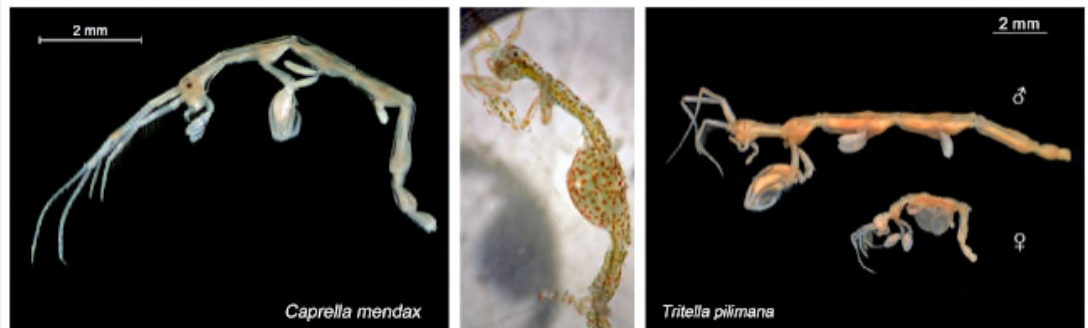
Eyes Under Puget Sound: Critter of the month – dove snails



Left: White Dove by Sander van der Wel (Netherlands). Center: *Alia carinata* collected from Puget Sound.  
Right: Close-up of the shell of *Astysris gausapata*, showing microscopic vertical lines called axial striations.

Monday, October 29, 2018

Eyes Under Puget Sound: critter of the month - the skeleton shrimp



Left: *Caprella mendax*.  
Center: A female *Tritella pilimana* broods her eggs in a special pouch. Image courtesy of Dave Cowles, [wallawalla.edu](http://wallawalla.edu).  
Right: *Tritella pilimana*.

# Draw attention back to our reports

## Sediment Quality in Puget Sound, 1989-2015



### Major Findings

- Chemical concentrations have remained largely unchanged in most areas of Puget Sound, with the exception of urban bays, where contaminant levels have decreased. This finding could be related to cleanup and source control.
- Sediment toxicity has increased throughout the Sound, likely unrelated to the presence of chemicals measured.
- Regional benthic invertebrate communities have been impacted, mostly in urban bays and shallow restricted inlets with poor circulation.
- No significant correlation between chemistry, toxicity, and benthic community indices has been found to date.

### A Key Part of the Ecosystem

The sea floor (benthic environment), which the organisms that inhabit this area, are key ecosystem. Some of the ecological functions, processing, storage, and release of nutrients, organisms can indicate responses of the ecosystem. This fact sheet highlights results from two habitat quality in Puget Sound through analytical toxicity measures, and invertebrate assemblages. Long-term stations sampled annually and regional stations sampled more widely but less often.

### Monitoring Sediments

The Department of Ecology has monitored since 1989 as part of the Puget Sound Ecosystem Monitoring Program. This sediment monitoring program evaluates status and trends Sound not at cleanup sites. Ten long-term stations different habitat types with distinct biological communities. Regional stations were randomly distributed over eight geographical regions Sound and five cross-region strata defined by waterbody type and human use. Benthic communities were evaluated by multiple indicators of ecosystem condition based on laboratory analyses, including:

- Chemistry - concentrations of potentially toxic chemicals
- Toxicity - sediment and porewater toxicity to test organisms
- Benthos - species and abundance of sediment-dwelling invertebrates

Ecology's website: [ecology.wa.gov/Research/Data/Monitoring/assessment/PugetSound](http://ecology.wa.gov/Research/Data/Monitoring/assessment/PugetSound)  
Environmental Assessment Program Publication #18-03-005

## Sediment Quality in Puget Sound: Changes in chemistry, toxicity, and benthic invertebrates at multiple geographic scales, 1989 – 2015

### Monitoring Sediment Quality

The Washington State Department of Ecology (Ecology) monitors sediment condition throughout Puget Sound, including Puget Sound proper and the embayments within the southern Strait of Georgia, eastern Strait of Juan de Fuca, and San Juan Islands (Figure 1). Sediment condition is evaluated with calculated indices based on outcomes of laboratory analyses including:

- Chemistry - concentrations of potentially toxic chemicals
- Toxicity - sediment and porewater toxicity to test organisms
- Benthos - presence of sediment-dwelling invertebrates
- Triad - overall sediment quality; combination of the chemistry, toxicity, and benthic indices

This report covers the results from 2004-2014, referred to as the Second Round survey, and makes comparisons to results from 1997-2003, referred to as the Baseline, as well as results from 10 Long-term sites sampled for nearly three decades, 1989-2015.

### Overall Results

Overall sediment quality, as measured with the Triad Index, decreased over the last decade (Figure 2). The Triad Index no longer meets the Puget Sound ecosystem recovery target value of 81 adopted by the Puget Sound Partnership (PSP). This was driven by both the Toxicity and Benthic Indices, which showed statistically significant declines from Baseline conditions. The Chemistry Index was statistically unchanged between the two sampling periods, and met the Puget Sound Partnership (PSP) ecosystem recovery target value.

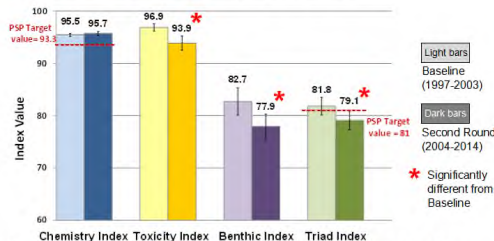


Figure 2. A comparison of weighted mean index values for Puget Sound, with 95% confidence intervals. PSP target values for the Chemistry and Triad Indices are shown as dashed red lines. Numerical values of the indices range from 0 (poor) to 100 (high quality).



Figure 1. Puget Sound sediment monitoring study area.

### Want more information?

Data and supporting information, including methods, are available for download. Link to reportXXXX

Companion Report: Information on annual monitoring of ten sentinel stations is provided by the Long-term program and is summarized in Partridge et al., 2018.

Ecology's website: [www.ecy.wa.gov/program/assessments](http://www.ecy.wa.gov/program/assessments)



## Sediment Quality in Puget Sound

### Changes in chemical contaminants and invertebrate communities at 10 sentinel stations, 1989–2015

February 2018  
Publication No. 18-03-005



# Eyes Over Puget Sound

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**Increased focus on the environment**

**...Others are more engaged**

**We connect people to our work...**

**...We create relevance**





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