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# Marine Waters Monitoring Program, Strategy and Activities

[Our Strategy](#)

*Our focus and implementation of the monitoring strategy*

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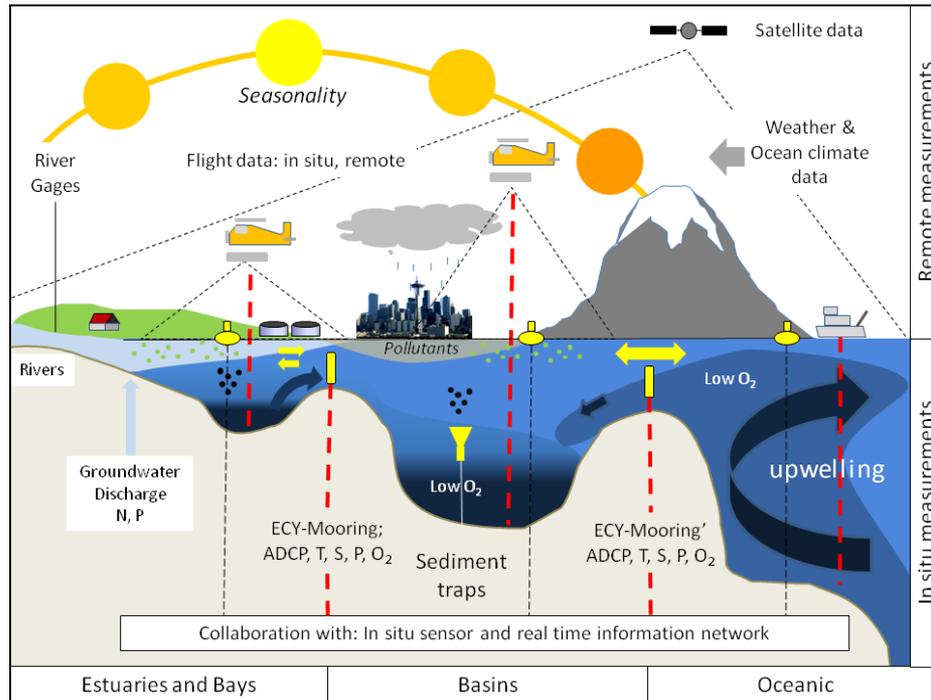
*Sampling and methods*

[Partnership Strategy](#)

*Our contribution*



# Approaches to measuring and communicating marine water quality



We assess **marine water quality** for the greater Puget Sound, Grays Harbor and Willapa Bay using a suite of environmental indicators. The program relies on a variety of physical, chemical and biological variables. It describes **long-term patterns and trends** related to estuarine physical processes and marine eutrophication, ([see PSAMP history](#)).

We communicate data and environmental marine conditions using the **Marine Water Condition Index**.

The Marine Monitoring Unit follows a **spatially-nested approach** using different sensor platforms to address the range of scales required to address marine water quality. **Moorings, ships, planes** and **satellite** data capture the spatial and temporal variability of water properties, on different scales.

## Spatially and temporally nested approach

### Discrete measurements:

**A sea plane** and CTD provide quick access to seasonal, regional and vertical patterns of physical, chemical, and biological indicators in the water column.



### Continuous measurements:

**Stationary sensors** provide temporal resolution on the transport of water and indicators.



**Moving sensors** measure temporal and spatial characteristics of surface gradients in water and for indicators.



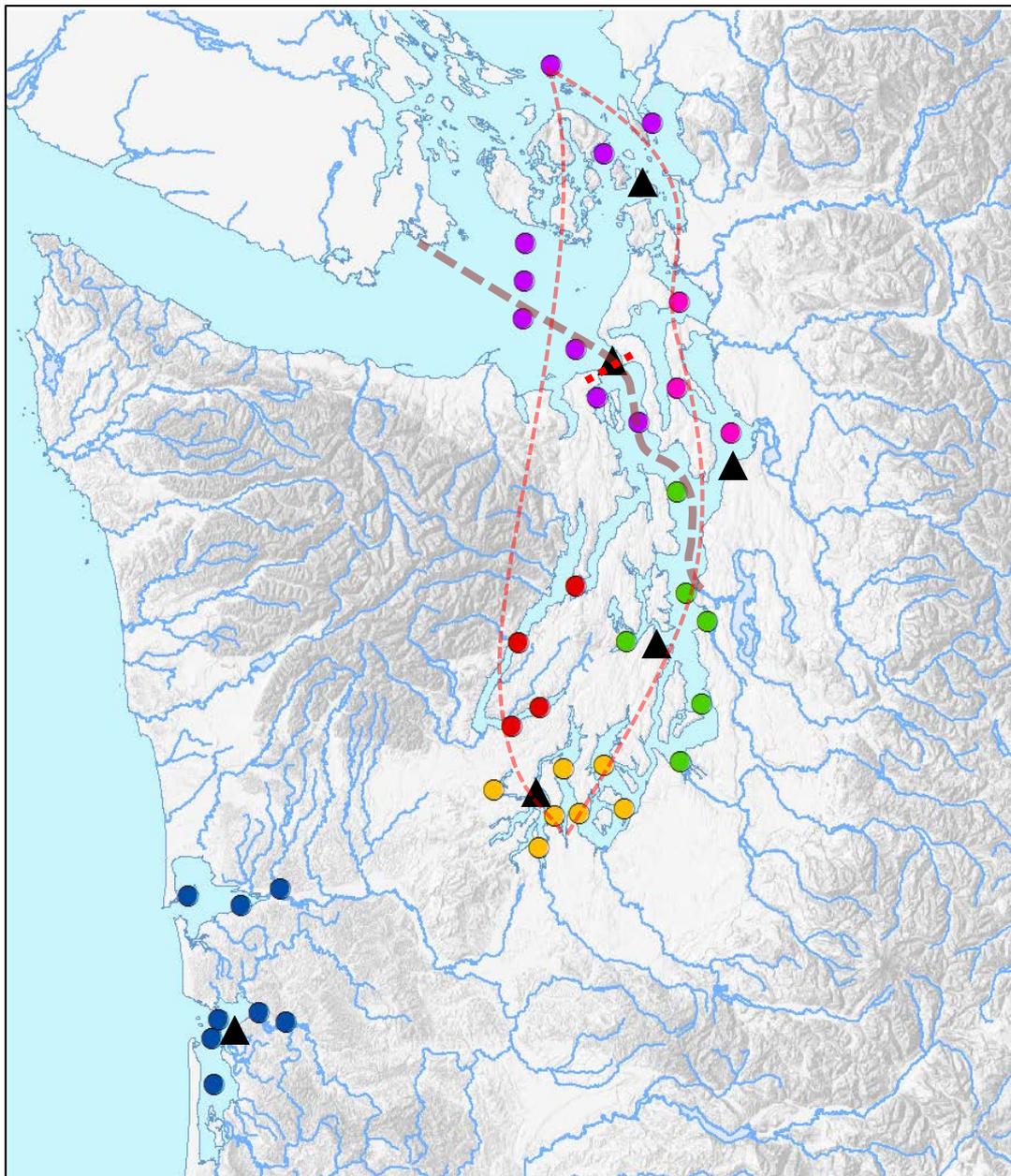
### Remote measurements:

**Aerial surveys** from planes document surface water conditions (e.g. algae blooms, oil sheens, floating debris).



**Satellite images** provide patterns and gradients of surface conditions (e.g. algae blooms, surface temperature and river plumes).





**We use a float plane as cost-effective means to collect marine samples**

- North Sound / San Juans
- Central Sound
- Whidbey Basin
- Hood Canal
- South Sound
- Grays Harbor & Willapa Bay

**Detailed information**

**We use transit flights for areal photography**

- - - Eyes Over Puget Sound Route

**We use ferry platforms to get at near-surface measurements twice per day**

— En route Victoria Clipper data  
- - - En route Salish DOT ferry data

**We use moored sensors to get continuous in situ data in strategic locations**

▲ Stationary moored sensors

To read more about our measured variables and methods, [click here](#)



Water samples



Aerial Photos



En Route Ferry Data



Moorings

Parameter	Flight CTD Profile	Flight Discrete	Mooring Continuous	Ferry Continuous
Ammonium (dissolved)		X		
Beam Attenuation	X			
Chlorophyll a		X		
Colored dissolved organic matter				X
Conductivity	X		X	X
Density	X		X	X
Dissolved Oxygen	X	X	X	
Dissolved Oxygen-Saturation	X		X	
Fecal Coliform		X		
Fluorescence	X			X
Light Transmission	X			
Nitrate (dissolved)		X		
Nitrite (dissolved)		X		
Ortho-Phosphate (dissolved)		X		
pH	X			
Pheopigments		X		
Photosynthetically-Active Radiation (PAR)	X			
Salinity	X	X	X	X
Secchi Depth		X		
Silicate (SiOH <sub>4</sub> ) (dissolved)		X		
Temperature, water	X		X	X
Turbidity	X			X

# Long-Term Marine Water Quality Monitoring

We conduct monthly marine water quality monitoring at stations in Puget Sound, Grays Harbor and Willapa Bay. [Find detailed information and referenced method papers used in our program.](#)



Noctiluca bloom



Algae bloom Whidbey Basin

## Why Monitor Marine Water Quality?

- What Features Are Monitored
- How Monitoring Is Conducted.

## How we monitor?

### COLLECTING FIELD SAMPLING

- CTD Profiler
- Secchi Disk
- Seawater Sampling

### CONDUCTING LABORATORY PROCEDURES

- Sensor performance and calibration
- Nutrients analysis
- Chlorophyll a/FCB analysis
- Dissolved oxygen analysis



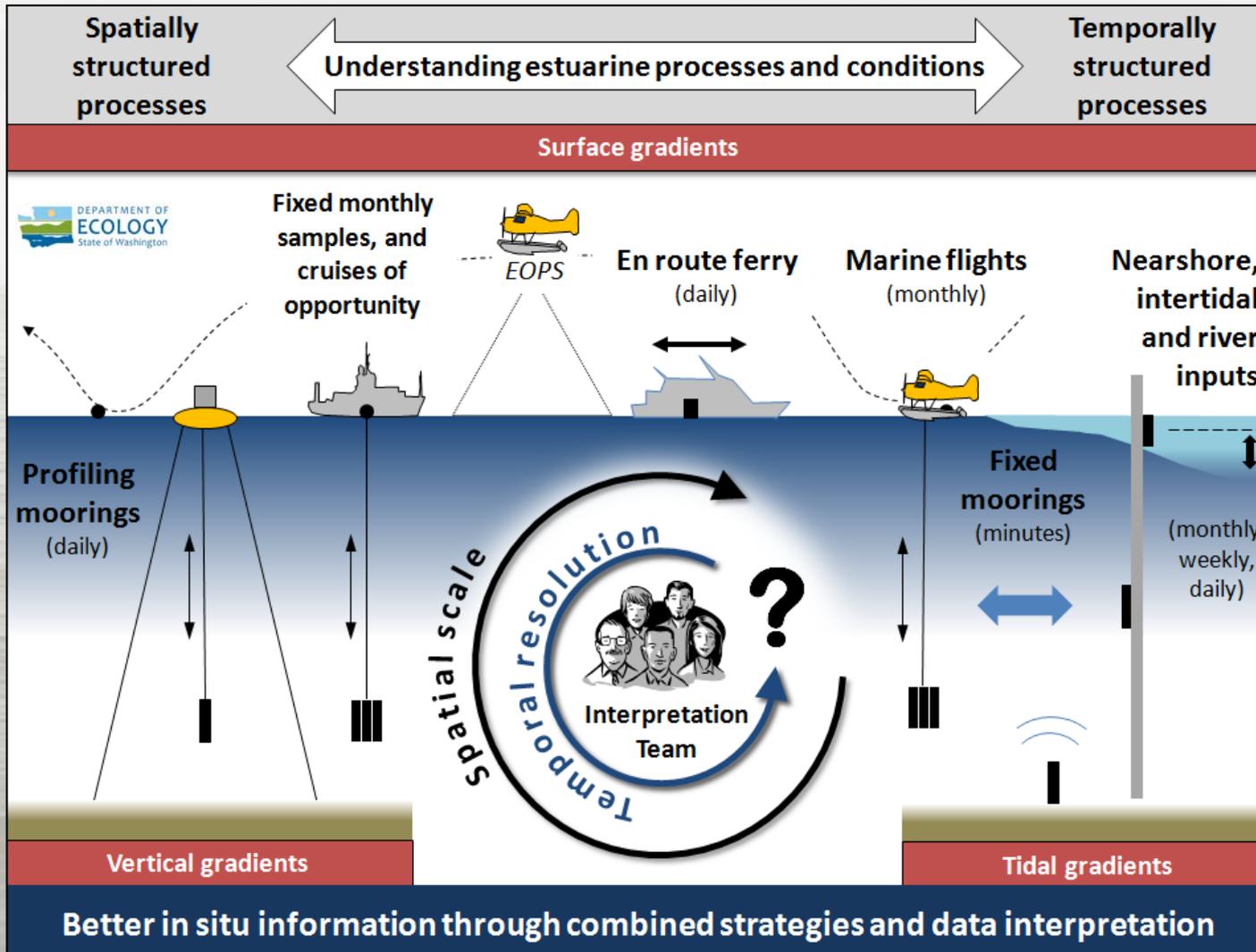
Reaching stations by plane



Sensor performance



Coordinated with the [Puget Sound Ecosystem Monitoring Program](#) we monitor, interpret and report on marine conditions of Puget Sound. Ecology contributes and shares data with other marine monitoring programs and PSEMP.



*We work within the context of a larger monitoring network of the Puget Sound Partnership.*

*We use complementary monitoring approaches to address processes and shifting baseline conditions.*

*We routinely make measurements on multiple temporal and spatial scales.*

*We report on present anomalies and long term trends.*