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Conditions in the Water Column - (Marine Flights)

2012

2012 - Monthly

Conditions in Puget Sound and Coastal bays

Anomaly Details

Monthly observations in historic context

Our Stations

Our stations in Puget Sound and Coastal bays

[Read more here](#)

Boundary Conditions

Meteorological conditions: Initially warm, but by mid-month the Puget Sound lowlands were getting cold and snowy. Most river flows started lower and ended the month high. Sunlight was strongest in the days after a storm when the wind came out of the north.

SUMMARY GREATER PUGET SOUND REGION - Higher salinity and density in the north; colder in the south of Puget Sound. Overall higher levels of DO, especially in the South Sound and Hood Canal. The water was clearer than expected.

- San Juan-North Sound Region:** Higher salinity and density inside Admiralty Reach and greater water clarity (only lower clarity in Bellingham Bay). In situ fluorescence was higher.
- Central Sound Region:** n.a.
- Whidbey Basin:** Higher salinity and density. Higher temperature confined to Possession Sound mid-depth. Coinciding with mid-layer DO minimum. Higher DO and cold water at depth. Water clarity higher.
- Hood Canal:** Lower temperatures, and unusual but variable salinity distribution. Fresher water at depth coinciding with much more oxygen (deep water flushed). Higher levels of DO, especially at depth in South Hood Canal. Clearer than expected conditions.
- South Sound:** Lower temperatures and higher DO levels everywhere except in Budd Inlet & Oakland Bay. Clearer water than typical for this time.

SUMMARY COASTAL BAYS REGIONS - Higher salinities and densities and elevated in situ fluorescence.

- Grays Harbor:** Salinity and density were variable. Stronger oceanic signal, but below typical saturated DO conditions. However, in situ fluorescence was much higher.
- Willapa Bay:** Higher salinity and density; in situ fluorescence very low.




[Read more here](#)

Boundary Conditions

Meteorological conditions: Warmer and sunnier weather turned colder and cloudy coinciding with initially lower river flows followed higher flows in the second part of the month. Precipitation was higher in Central Sound and lower in North and South Sound.

SUMMARY GREATER PUGET SOUND REGION - Water colder and denser; saltier water limited to Central Sound. Generally higher DO levels constrained to Puget Sound Proper.

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1. **San Juan-North Sound Region:** Colder and higher DO conditions in N. Puget Sound.
 2. **Central Sound Region:** Colder, saltier and denser water coinciding with higher DO levels. Water clearer.
 3. **Whidbey Basin:** Saltier and denser water
 4. **Hood Canal:** Colder denser water coinciding with higher DO levels, especially at depth where DO is at its highest level in 13 years.
 5. **South Sound:** Colder clearer water and higher DO levels, especially at depth.

SUMMARY COASTAL BAYS REGIONS - Water uniformly denser; saltier water limited to Willapa Bay. Lower DO in the coastal rivers and higher levels in the bays. Clearer water conditions.

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1. **Grays Harbor:** Lower DO levels in the river and higher levels in the bay.
 2. **Willapa Bay:** Colder, saltier denser water with lower DO levels in the river, higher levels in the bay. Water clarity much lower.

[Read more here](#)

Boundary Conditions

Meteorological conditions: In general cool, cloudy, and dry with a few sun breaks around the 7-8th and 23-24th March. River flows began above normal but went below normal in the north past mid-month. At the coast and in the South river flows stayed high.

SUMMARY GREATER PUGET SOUND REGION - Lower water temperature. Higher density restricted to deeper water in stratified water bodies. Higher DO levels. Water clarity higher in Central and South sound.

- 1. San Juan-North Sound Region:** Lower temperatures most pronounced in the surface layer. Fresher in Bellingham Bay. Overall, DO levels were higher. New maximum for in situ fluorescence at to some stations.
- 2. Central Sound Region:** Uniformly lower temperatures. Higher DO levels and water clarity.
- 3. Whidbey Basin:** Lower temperatures and higher density. Higher salinity confined to deeper water coinciding with higher DO.
- 4. Hood Canal:** Much lower temperatures resulting in higher density. Higher DO levels, especially at depth.
- 5. South Sound:** Lower temperatures and much higher water clarity. Lower density and salinity confined to southern bays of South Sound. Higher DO levels, especially at depth.

Greater Puget Sound

SUMMARY COASTAL BAYS REGIONS – Lower temperatures, density, salinities and DO levels restricted to river influenced stations. Otherwise, higher DO levels.

- 1. Grays Harbor:** Lower temperature and higher DO levels. Lower DO confined to in river stations.
- 2. Willapa Bay:** Lower temperatures and higher DO levels. Lower DO confined to in river stations.

Coastal Bays

[Read more here](#)

Boundary Conditions

Meteorological conditions: April got off to a cold start and finished generally warmer than average throughout Western Washington. Precipitation was above average everywhere and river flows became higher toward the end of the month due to high precipitation as well as snowmelt.

SUMMARY GREATER PUGET SOUND REGION - Lower temperatures and lower salinity confined to deeper water in Central Sound. Higher DO levels with new max values seen at multiple spots. Higher in situ fluorescence levels at the surface of many stations.

- 1. San Juan-North Sound Region:** Lower temperatures. Lower density and salinity confined to northern Admiralty Reach. Higher DO with new DO maxima recorded at Puget Sound entrance. Water clarity lower with new maximum surface in situ fluorescence levels recorded on North Sound station.
- 2. Central Sound Region:** Lower temperatures and lower salinity particularly at depth. Higher DO levels. In situ fluorescence higher at a few stations near the surface.
- 3. Whidbey Basin:** Lower temperatures in Southern Whidbey Basin, warmer at station near Skagit. Higher DO and higher in situ fluorescence levels.
- 4. Hood Canal:** Lower temperatures at depth, warmer temperatures at surface. Higher DO with new max values in S. Hood Canal. Levels generally above 5 mg/L. Uniformly higher in situ fluorescence.
- 5. South Sound:** Highly variable conditions at surface; southern shallow reaches less salty, less dense and warmer. Higher DO levels. Some restricted stations with higher in situ fluorescence at the surface.

SUMMARY COASTAL BAYS REGIONS – Higher temperature and generally higher DO levels.

- 1. Grays Harbor:** Warmer water, higher DO levels.
- 2. Willapa Bay:** Generally higher DO.



[Read more here](#)

Boundary Conditions

Meteorological conditions: May was cool and cloudy with a warm and sunny period mid-month. River flows were above normal with a mid-month freshet on snowmelt fed rivers, followed by a second spike in all rivers corresponding to precipitation.

SUMMARY GREATER PUGET SOUND REGION -

Ubiquitously fresher and less dense, lower temperatures confined to Central Sound. Higher DO concentrations and supersaturation everywhere with new maxima in S. Sound. Water clarity higher in the North Sound and San Juan Islands, lower in Hood Canal and expected in Central and South Sound. Hood Canal had higher sub-surface fluorescence values at all stations.

- 1. San Juan-North Sound Region:** Fresher and less dense with colder temperatures limited to the San Juan's. Higher levels of DO with supersaturation at 3 of 6 sites. Water clarity higher. Higher in situ fluorescence confined to the surface of two stations, lower values in the Strait of Georgia.
- 2. Central Sound Region:** Uniformly colder, fresher and less dense. Higher levels of DO with all stations experiencing supersaturation. Lower in situ fluorescence only at Admiralty Inlet at depth.
- 3. Whidbey Basin:** Fresher, less dense and higher DO levels, supersaturation everywhere. Higher water clarity.
- 4. Hood Canal:** Fresher and less dense. Higher DO levels with supersaturation everywhere. Lower water clarity at surface.
- 5. South Sound:** Fresher and less dense. Higher DO levels with supersaturation everywhere.

SUMMARY COASTAL BAYS REGIONS – Willapa Bay expected; Grays Harbor very salty and higher density. In situ fluorescent expected in Willapa bay and higher in Grays Harbor. Higher DO levels, super saturation and new maxima confined to non-river stations.

- 1. Grays Harbor:** Colder temperatures, saltier and higher water density. Higher DO levels and supersaturation at mid-bay & ocean stations. Higher water clarity. Higher in situ fluorescence at the surface.
- 2. Willapa Bay:** Higher DO levels and new maxima close to ocean. Supersaturation everywhere.



Greater Puget Sound



Coastal Bays

[Read more here](#)[Boundary Conditions](#)**Meteorological conditions:**

June was generally cool, cloudy and wet, especially in the South Puget Sound where a persistent marine layer prevailed for much of the daytime.

SUMMARY GREATER PUGET SOUND REGION –

Conditions were cooler and fresher than normal. Higher DO levels at depth in North, Central and South Sound. Higher DO levels in Hood Canal and Whidbey Basin.

- 1. San Juan-North Sound Region:** Cooler than normal and lower water clarity. Higher DO levels at Georgia Basin and Admiralty Station.
- 2. Central Sound Region:** Fresher than normal and cooler in the north. Higher DO levels at depth. In situ fluorescence lower at the surface.
- 3. Whidbey Basin:** Cooler and fresher than normal and higher DO levels.
- 4. Hood Canal:** Cooler and fresher than normal and higher DO levels.
- 5. South Sound:** Cooler and fresher than normal and higher DO levels at depth.

SUMMARY COASTAL BAYS REGIONS – Cooler and fresher than normal. Higher DO levels with variability at Chehalis river-influenced sites. Higher than normal variability of in situ fluorescence.

- 1. Grays Harbor:** Fresher than normal. Variable DO levels - low in the river, high in mid-bay. In situ fluorescence also with higher than expected variability.
- 2. Willapa Bay:** Fresher than normal. Generally lower in situ fluorescence for this time of year.



Greater Puget Sound



Coastal Bays

[Read more here](#)[Boundary Conditions](#)

Meteorological conditions: July was mostly below average for temperature and sunlight with a persistent marine layer to blame. The second week in July was warm and sunny. River flows were generally above normal as was precipitation.

SUMMARY GREATER PUGET SOUND REGION - Cooler, fresher and less dense particularly in South Sound and southern Main Basin. Higher DO levels in deep layers. Lower DO levels confined to surface layers in San Juan Islands/North Sound. Supersaturation almost everywhere. Water was clearer in Central Sound.

- San Juan-North Sound Region:** Cooler, fresher-than-normal and lower density confined to Admiralty Reach. In situ fluorescence was variable with new minima at the Strait of Georgia.
- Central Sound Region:** Cooler, fresher and less dense conditions most strongly pronounced towards the southern portions. Higher DO levels at depth. Water clarity was higher while in situ fluorescence was variable with several stations experiencing much lower levels.
- Whidbey Basin:** Fresher and less dense with lower than expected temperatures confined to surface and to the north. Higher DO levels at depth.
- Hood Canal:** Fresher and colder. Lower density and higher DO levels at depth.
- South Sound:** Colder, much fresher and less dense with higher DO levels at depth.

SUMMARY COASTAL BAYS REGIONS – Cooler and fresher than normal and warmer temperatures confined to Willapa Bay. Higher DO levels only in rivers. In situ fluorescence lower than expected.

- Grays Harbor:** Fresher than normal. Higher DO levels near the river.
- Willapa Bay:** Fresher than normal. Higher DO levels near the river and highly variable in situ fluorescence.





Year 2012

Month

Jan

Feb

Mar

Apr

May

Jun

Jul

Aug

Sep

Oct

Nov

Dec

[Read more here](#)

Boundary Conditions

Meteorological conditions: The first half of August was warm and generally sunny with occasional blankets of marine air keeping the overnight temperature warm. In the second half, air temperatures were on average cooler because night time temperatures were cold. Precipitation was below normal and river flows dropped below normal.

SUMMARY GREATER PUGET SOUND REGION - Fresher, lower temperatures and lower density confined to Puget Sound. DO generally higher in deeper layers. Water clarity was higher, particularly in the South and North. Fluorescence in South Sound lower.

- San Juan-North Sound Region:** Lower temperatures and salinities both at surface and depth. Fluorescence variable with a new minimum at Bellingham station.
- Central Sound Region:** Lower temperatures, and uniformly lower salinities and density. Super-saturated DO conditions everywhere. Water clarity generally higher.
- Whidbey Basin:** Uniformly lower salinity and density. Higher DO levels, with super-saturations.
- Hood Canal:** Lower temperature and uniformly lower salinity and density. DO higher in deeper waters.
- South Sound:** Lower temperature and pronounced lower salinity and density. DO higher at depth. Water clarity was higher. Fluorescence lower.

SUMMARY COASTAL BAYS REGIONS – Higher water temperatures. Higher DO levels confined to Willapa Bay.

- Grays Harbor:** Warmer temperatures.
- Willapa Bay:** Higher DO confined to non-river stations.



Greater Puget Sound



Coastal Bays

[Read more here](#)

Boundary Conditions

Meteorological conditions: Dry conditions throughout Western Washington with rivers running below normal and trending lower. Upwelling-favorable winds out of the north. Skies mostly clear with warm sunny afternoons and cold nights. Air temperatures were cooler overall.

SUMMARY GREATER PUGET SOUND REGION - Fresher, cooler, especially South Sound at depth. Surface salinity and density confined to South Sound. Higher levels of DO in S. Hood Canal and Central Basin. Water clarity was higher.

- San Juan-North Sound Region:** Temperature lower at depth except at Georgia Basin station. Salinity and density also lower. Higher levels of DO. In situ fluorescence higher.
- Central Sound Region:** Lower salinity and density. Higher DO, water clarity and in situ fluorescence.
- Whidbey Basin:** Colder and t variable salinity and density. Higher levels of DO.
- Hood Canal:** Lower temperature, salinity and density at depth. Higher levels of DO.
- South Sound:** Lower salinity and density, expected temperature except Carr Inlet and near Nisqually where it was colder. Higher levels of DO, especially in the deep water. Water clarity was higher in Nisqually, Carr Inlet, and Gordon Passage.

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Greater Puget Sound

SUMMARY COASTAL BAYS REGIONS – Generally expected conditions. Higher levels of DO, with some exceptions in Grays Harbor. Water clarity was higher, in situ fluorescence was lower.

- Grays Harbor:** Variable density and salinity. DO lower in the river and at the ocean, Do higher in mid-bay. Water clarity was higher, in situ fluorescence was lower.
- Willapa Bay:** Higher DO particularly at the river-influenced stations. Water clarity higher and in situ fluorescence lower.

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Coastal Bays

[Read more here](#)[Boundary Conditions](#)

Meteorological conditions: Sunny, warm days alternating with cool cloudless nights resulting in cooler temperatures. On the 10th northern Puget Sound became warmer, and wetter. River flows initially running low changed to above normal levels with the exception of the Nisqually River.

SUMMARY GREATER PUGET SOUND REGION - Significantly fresher and less dense in the south, and significantly colder in the north. Higher DO levels, especially in deep layers; and predominantly in Central and eastern South Sound inlets. Super-saturation persisting in Hood Canal and shallow stations of Central Sound. Water clarity was higher in Central to South Sound. Fluorescence was generally lower.

- San Juan-North Sound Region:** Colder, higher DO levels in deep layers. Generally lower in situ fluorescence.
- Central Sound Region:** Fresher, less dense and higher DO levels. New high oxygen levels at several at deeper sites. Super-saturation still present in shallow bays. Water clarity was higher.
- Whidbey Basin:** Colder with high oxygen levels confined to deep waters. Water clarity was higher in Saratoga Passage. Fluorescence was much lower.
- Hood Canal:** Colder, fresher and less dense. Higher oxygen levels with super-saturation persist from previous month. Water clarity was higher, in situ fluorescence was lower.
- South Sound:** Much fresher, less dense with higher oxygen levels in eastern, deep inlets. Water clarity very low. Higher in situ fluorescence at the surface in Carr Inlet.

SUMMARY COASTAL BAYS REGIONS – n.a.

- Grays Harbor:** n.a.
- Willapa Bay: Water:** n.a.



[Read more here](#)

Boundary Conditions

Meteorological conditions: Air temperatures have been variable, but falling above normal. Sunshine has been generally below normal. Rivers varied but increased just after mid-month. Winds have been predominantly from the south.

SUMMARY GREATER PUGET SOUND REGION - Fresher, less dense. Colder temperatures in the north, Whidbey Basin & Hood Canal. Higher DO levels in deeper layers, while S. Sound had lower DO levels in the surface/shallow areas. Water clarity only high in Central Sound. Fluorescence was generally lower.

- San Juan-North Sound Region:** Less dense and fresher, colder. Higher DO levels persist especially in deeper layers. In situ fluorescence was lower.
- Central Sound Region:** Fresher and less dense. Higher DO levels persist, especially in deeper layers and particularly at north-central stations. Water clarity was higher and in situ fluorescence was variable.
- Whidbey Basin:** Fresher, colder, and less dense. Higher DO levels persist, especially in deeper layers. In situ fluorescence was lower.
- Hood Canal:** Colder with higher DO at depth. In situ fluorescence was lower.
- South Sound:** Much fresher, less dense, and warmer surface. Lower DO in the surface layers and shallow sites, higher in the deeper layers. In situ fluorescence lower.

SUMMARY COASTAL BAYS REGIONS – (Limited data)

- Grays Harbor:** (Limited data)
- Willapa Bay: Water:** (Limited data)





Year 2012

Month

Jan

Feb

Mar

Apr

May

Jun

Jul

Aug

Sep

Oct

Nov

Dec

[Read more here](#)

Boundary Conditions

Meteorological conditions: The first half of December was warmer than normal, but the last half was more typical. December was cloudy with higher than average precipitation. River flows were above normal to the south, trending to slightly below average to the north by the end of the month.

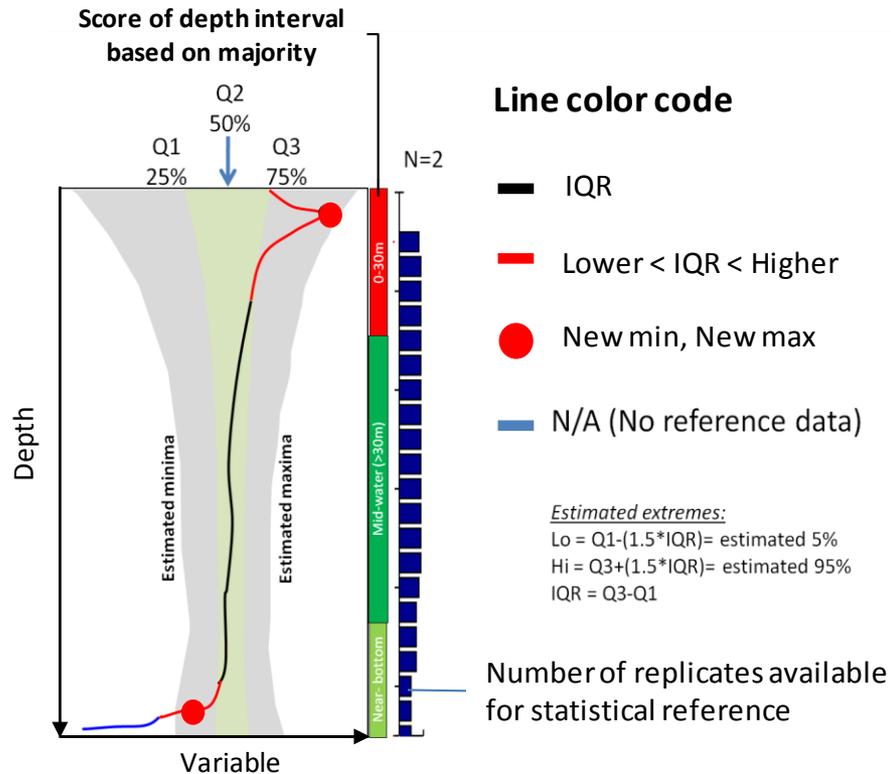
SUMMARY GREATER PUGET SOUND REGION - Lower density and salinity, warmer temperatures towards South Sound. Higher DO levels in the North and Central Sound. Trend of higher DO has disappeared from Hood Canal and S. Sound. Water clarity was generally higher with some local variability. Higher in situ fluorescence confined to N. Sound and a few sites in Central Basin.

- San Juan-North Sound Region:** Lower, density and salinity. Higher DO and in situ fluorescence.
- Central Sound Region:** Lower temperature, density and salinity. Higher DO levels with the exception of lower conc. in Sinclair Inlet. Water clarity was higher.
- Whidbey Basin:** n.a.
- Hood Canal:** Different vertical temperature pattern, lower, density and lower salinity. Pattern of higher DO levels has disappeared.
- South Sound:** Warmer, less dense and fresher. Pattern of higher DO levels has disappeared.

SUMMARY COASTAL BAYS REGIONS – Warmer water and variable DO. Water clarity was lower.

- Grays Harbor:** Warmer water. Variable DO levels - lower in river and higher toward ocean. Lower water clarity.
- Willapa Bay:** Warmer water and lower water clarity.





A wealth of historical data allows us to place new CTD observations into the historical context of Ecology's long-term data record.

We use an increasing temporal reference framework of 1999-present to statistically define anomalies. Conditions that fall outside of a 50% observation envelope (second and third quartile) are considered "**anomalies**".

Graphically you can explore current anomalies in our monthly data updates.

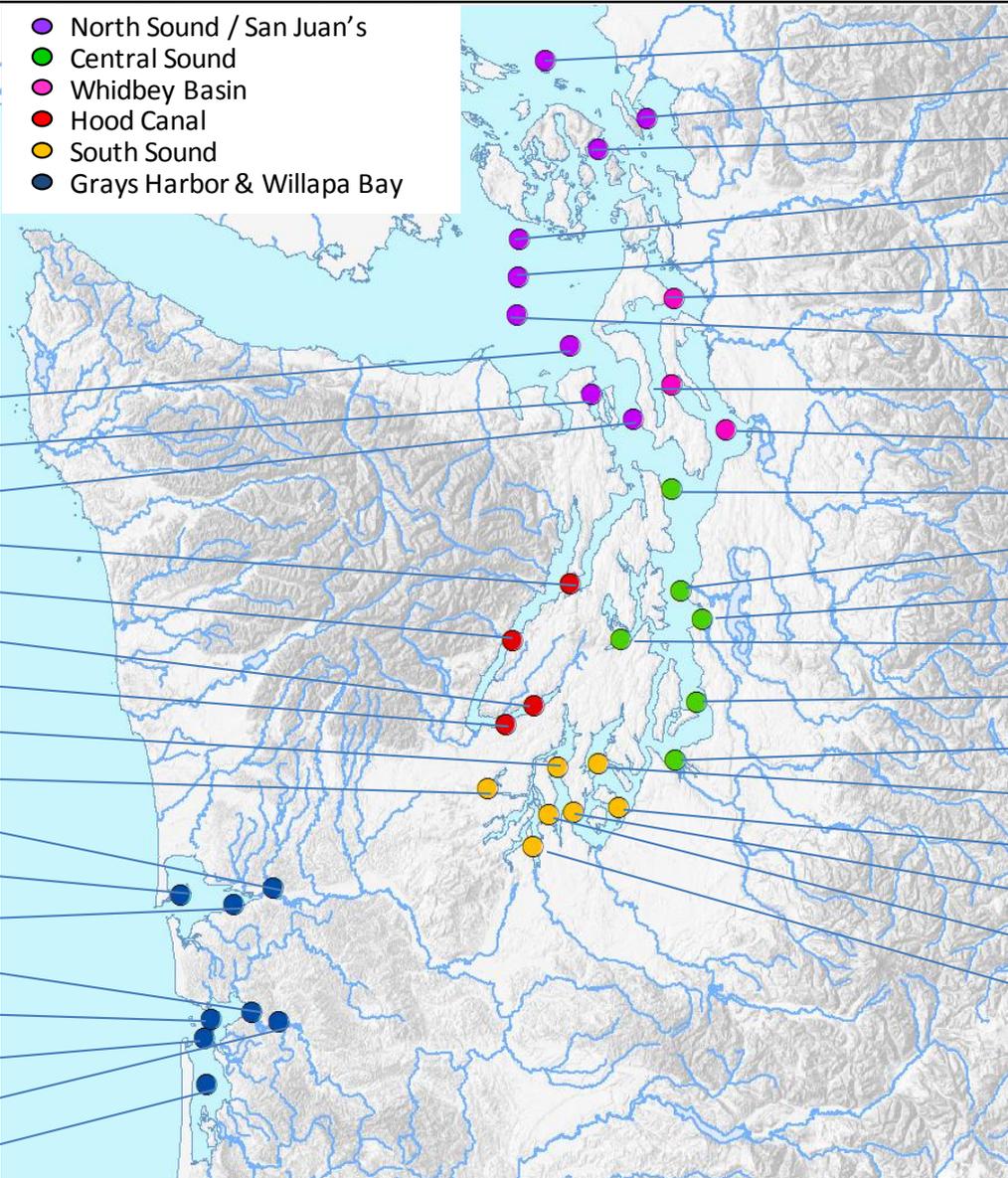
[Begin exploring anomalies, click here](#)

How to read our graphics:

A **green background** describes the range into which 50% of our historical recorded data fall. Grey shows the 99% data envelope that we estimate from the interquartile range multiplied by 1.5. Pieces of the data line falling within the 50% envelope are colored **black**, data falling outside the 50% envelope are colored **red**. New extrema are emphasized with a red dot. If we sample a depth deeper than previously sampled we give the data line the color **blue**. Bars (dark blue) on the right indicate the number of observations (e.g. N=2). To illustrate if the entire water column section (<10m, 10-30m, >30m) is on average a "normal" or "**anomalous**" condition, we included a color coded vertical line. **Red** indicates on **average anomalous conditions**; **green** indicates on **average normal conditions**.



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



Stations:

- ADM002
- PTH005
- ADM001
- HCB010
- HCB003
- HCB007
- HCB004
- CSE001
- OAK004
- GYS004
- GYS016
- GYS008
- WPA003
- WPA004
- WPA113
- WPA001
- WPA006

- GRG002
- BLL009
- RSR837
- SJF000
- SJF001
- SKG003
- SJF002
- SAR003
- PSS019
- ADM003
- PSB003
- ELB015
- SIN001
- EAP001
- CMB003
- CRR001
- GOR001
- NSQ002
- DNA001
- BUD005

For detailed station information [click here](#)



We use a float plane as a cost-effective means to collect marine samples throughout Washington's extensive marine waters.