Marine water quality refers to many aspects of water such as temperature, salinity, oxygen, nutrient levels, algae biomass, and pH. In much of Puget Sound, marine water quality is affected by many different factors including weather, climate and circulation patterns, offshore ocean conditions, inflow from rivers and streams, discharges from wastewater treatment plants and industries, erosion and stormwater runoff, ground water, and other pollution. This Vital Sign tells us about the combined impacts of global and local change and human-caused stresses on Puget Sound marine waters.

### Key Messages

- Marine water quality in Puget Sound continues to decline, as shown by the **Marine Water Condition Index** scores and contributions to the Marine Water Report. The decline in the MWCI is particularly notable in Bellingham Bay, Sinclair Inlet, Budd Inlet, Whidbey Basin, and Oakland Bay.

- One of the primary factors for the decline in the Marine Water Condition Index in recent years is temperature. Puget Sound waters remained warmer than normal in 2017 after record high temperatures influenced by the 2015 “blob” of warm water from the NE Pacific Ocean followed by the 2015-2016 super El Niño. Abnormally warm temperatures have had impacts on the Puget Sound food web: for example, warmer waters have created conditions for northern anchovies (a warmer-water fish species) to overwinter in South Puget Sound and persist at high abundances.

- Another factor for the decline in MWCI scores is a gradual 20-year increase in overall stratification of the water column. This is based on increases in the annual average stratification and more pronounced seasonal variability in stratification. Puget Sound experienced the wettest spring and driest summer on record in 2017, resulting in saltier waters by late summer. Dry summers allow for more mixing throughout the water column because of weaker density gradients, and reduces the water exchange and renewal in Puget Sound. This can cause food web impacts by impacting primary productivity and amplify human effects on water quality by increasing water residence time and time of exposure to human impacts.

- Measurements of dissolved oxygen levels in deep waters of Puget Sound were lower in 2017 than baseline (1999-2008) conditions, continuing a five-year declining oxygen trend.
Overall nitrate in Puget Sound surface water peaked in the mid-2000s, and has been decreasing since then. Yet, increasing trends in non-oceanic sources of nitrate (e.g., groundwater, stormwater, riverine inputs, or mediated by a longer residence time) in some areas suggest potential eutrophication (excessive nutrient input), with impacts on water quality and food web.

While harmful algae and the toxins they produce were evident in Puget Sound waters and shellfish in 2017, none of the blooms were exceptional nor caused human illnesses due to proactive biotoxin monitoring and closures.

Ocean acidification is a continuing problem for the Puget Sound region. Atmospheric CO₂ values in the Hood Canal region are higher than values measured off the Washington coast, and both Hood Canal and coast measurements are higher than global averages. Explore the contributions on OA in the Marine Waters report.

For more information about marine water quality and observations, please see the Marine Waters Review report. For recent preliminary data and observations, please visit our Marine Condition Update website.

## Strategies, Actions, And Effectiveness

- Development of a Marine Water Quality Implementation Strategy to define strategic recovery priorities addressing the Dissolved Oxygen target is a priority focus area for the Partnership's 2018 Action Agenda.
- **Actions proposed in the Action Agenda** that advance this Vital Sign *(let us know if we missed any!)*:
  - Respiration measurements in the Salish Sea
  - Pursue Long-Term Funding for Nonpoint Water Quality Specialists to Protect and Improve Fresh and Marine Water Quality
  - Roadway retrofit to include swales to reduce untreated stormwater going directly into marine waters
  - Shellfish Growing Area Water Quality Improvement
  - Shellfish Growing Area Water Quality Protection

## Background Documents

- Leadership Council Resolution 2011-10, Adopting a 2020 ecosystem recovery target for dissolved oxygen in marine waters
- Marine Water Quality Target Briefsheet

## Other Resources

- Articles related to water quality and hypoxia in the Encyclopedia Of Puget Sound
- Puget Sound Marine Waters Overview, by the PSEMP Marine Waters Workgroup
- Eyes Over Puget Sound

## Contributing Partners

![Department of Ecology](https://example.com/logo.png)

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