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Estuary Acidification: A five-year perspective on pH in Possession Sound, Washington

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Introduction

Ocean acidification, the persistent lowering of pH in marine environments, is influenced by water chemistry, biological aspects, seasonal changes, and human activity. Low pH (acidic conditions) can contribute to hypoxia, coral bleaching, and other dangerous conditions for the environment.

This study investigates possible relationships between river discharge, dissolved oxygen, and pH in Possession Sound. . This site, being within the Snohomish River Estuary, is affected by both oceanic factors and the Snohomish River, including any runoff that comes through those waters.

Study Site

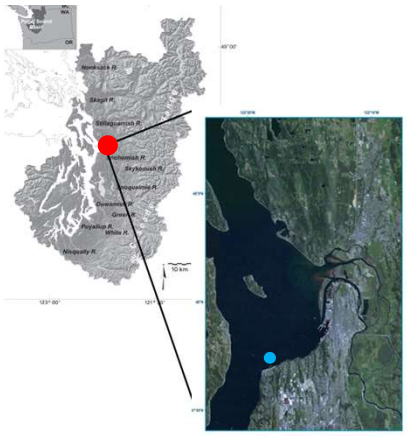

Fig. 1 Map showing Puget Sound (top) with Possession Sound marked by an orange circle (●) . The close up of the Snohomish River Estuary system in Possession Sound (bottom) shows the study site MBT (●). (47.9536246, -122.2867623).

Methods

Dissolved oxygen and pH measurements were collected using an EXO Sonde III tool with the pH and Dissolved Oxygen Smart Sensors. According to the manufacturer, it has a ±0.1 pH unit accuracy within ±10°C of the calibration temperature.

Data were collected on periodical State of Possession Sound Cruises conducted between January 13,, 2017 and August 12, 2021. The site is located at 47.9536246, -122.2867623. This site was chosen because of the multitude of data available, as well as ORCA's new continuous pH monitoring system at the site and its proximity to vital eelgrass habitat.

Snohomish river discharge data were accessed from the United States Geological Survey website for Station 12150800 near Monroe, WA. All river discharge data were checked by USGS staff using the standard methods. Data from both sources were compiled and combined by date.

ORCA

The Ocean Research College Academy is a dual enrollment program where high school juniors and seniors experience innovative, interdisciplinary and student-centered learning. A longitudinal study of the local estuary forms the backbone of the first-year experience, and leads students to conduct independent research in their second year of the program. ORCA has received grants for a research lab, research vessel, and summer research funded by the National Science Foundation.

Results

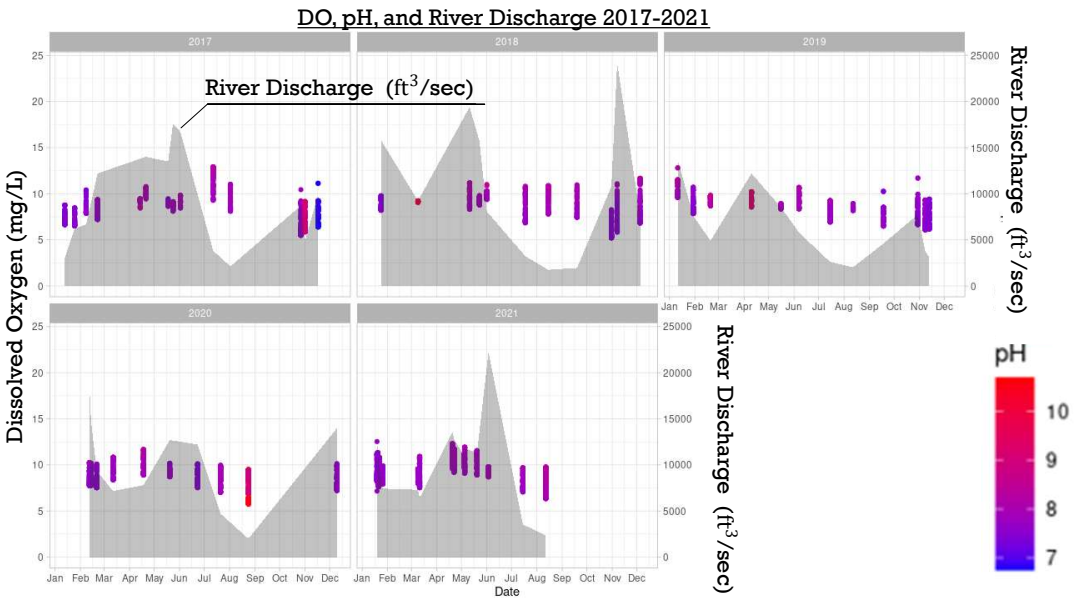

Figure 1. Scatterplot displaying pH and dissolved oxygen data from site MBT. Points represent dissolved oxygen level, color represents pH.

Normal pH Range	Normal DO Range	Normal RD Range
7.6-9.1 (basic)	5.2-12.5 mg/L	2000-24000 ft^3/sec

Conclusions

Early results from these data demonstrate a clear seasonal pattern without significant annual trends toward lower pH. On the graphs, we can observe consistent dissolved oxygen increases and slight pH increases during the spring months, which is when the largest plankton blooms typically occur. In addition, spring brings increased river discharge as snowmelt enters the river. This is an expected result, as it reflects patterns that can be observed elsewhere.

As climate change progresses, consistent monitoring of ocean pH will be essential to preserving the marine environment understanding the effects of ocean acidification and the ways we might combat them in the future. While this study was limited by its short timeframe, these results provide an important baseline for continued collection and analysis of these data. As we begin to continuously collect pH and dissolved oxygen data for the site, perhaps more robust patterns may be observed.

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