# PRELIMINARY: 2025 Analysis of Chlorophyll in Bed Sediment of the Salish Sea

Stella Lindberg, Kayden Edgeworth, Fatuma Ali, Julie Masura (Faculty Advisor)

## Introduction

Chlorophyll-a, an indicator for marine productivity in the environment, is responsible for absorbing light, which is key for photosynthesis. This is significant for gathering information on the climate and monitoring how changes in the environment affect biodiversity and marine environments.

The sediments were collected from the Department of Ecology's Marine Sediment Monitoring Team collected sediments utilizing a Van Veen grabber (WSDOE 2023) and analyzed for chlorophyll concentrations from 12 data stations in the Salish Sea.

This is a continuation of research done by the University of Washington Tacoma in partnership with Washington State Department of Ecology (PSEMP).

## Background Information

**Chlorophyll-a, Chl-a, is a crucial indicator of biological activity amongst marine environments. Being the primary component of photosynthesis, Chl-a concentrations affect the entire food web. Research conducted in the Pacific Ocean has shown that environmental disturbances such as El Niño events, marine heatwaves, and "The Blob" are found to be a cause of substantial differences in Chl-a concentrations. During the 2016 El Niño event, surface Chl-a concentrations declined by 40% along the equatorial Pacific Ocean, showcasing how strongly it responds to changes in oceanic conditions (Arteaga and Rousseaux 2023). With the evidence citing the importance of chlorophyll-a as an indicator to the welfare of the oceans, there is a need for more localized and collaborative information on Chl-a concentrations found within the Puget Sound. Previous research has established the severity of response chlorophyll-a concentrations has towards environmental changes, establishing a local baseline provides information for continued monitoring. Ultimately, this study contributes to the efforts of better understanding of spatial and temporal patterns found within the Puget Sound (Fig. 1).**

## Methods

- Samples were transferred to UWT, stored at 4 degrees Celsius in the dark
- 40 mL of 90% acetone was added to 5 mL of sediment
- Sediment was frozen for 12 hours to extract pigments
- After thawing, samples were centrifuged for 25 minutes
- Chlorophyll concentrations were measured with Fluorometer Turner Trilogy Module
- Raw fluorescence (RFU) of prepared samples was measured
  - Total amount of active chlorophyll before acidification
- Samples were acidified with to convert active chlorophyll-a into phaeophytin
  - Distinguish active chlorophyll from degraded phaeopigments (CalCOFI Technical Group, 2011)
- Resulting data was utilized to calculate chlorophyll concentrations in µg/L of bed sediment

## Results

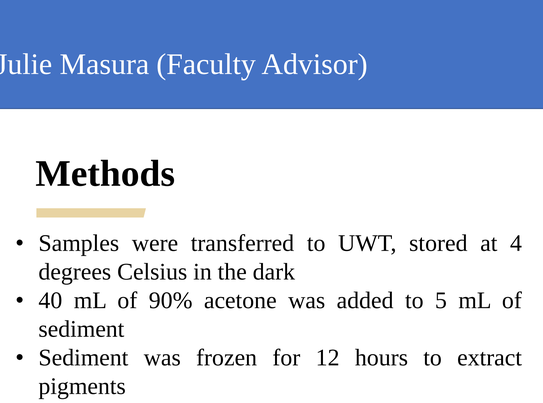


Figure 1. Chlorophyll concentration in wet sediment in ug/L (upper Puget Sound)

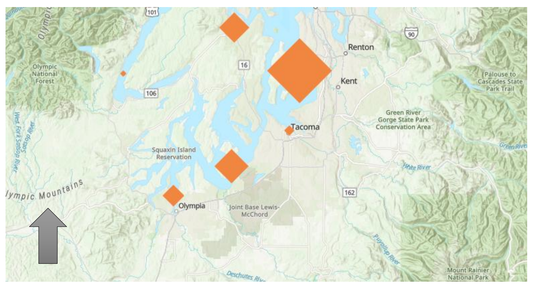


Figure 2. Chlorophyll concentration in wet sediment in ug/L (lower Puget Sound)

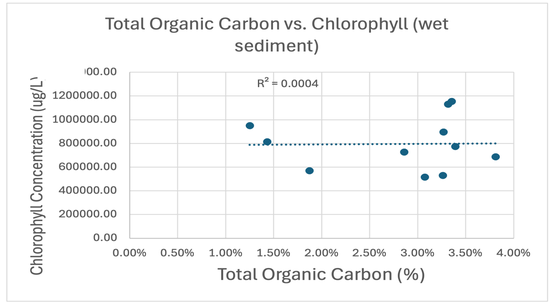


Figure 5. Graph of TOC vs. Chlorophyll (wet)

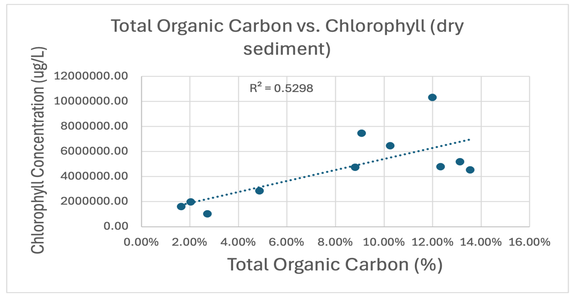


Figure 6. Graph of TOC vs. Chlorophyll (dry)

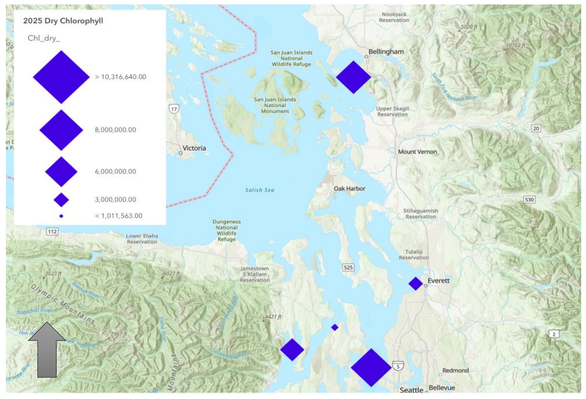


Figure 3. Chlorophyll concentration in dry sediment in ug/L (upper Puget Sound)

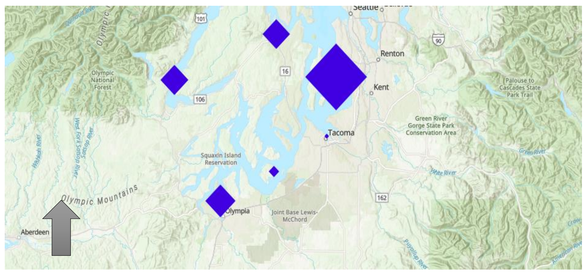


Figure 4. Chlorophyll concentration in wet sediment in ug/L (lower Puget Sound)

## Discussion

- The data shows higher levels of wet chlorophyll around the Seattle, Renton, and Kent areas, indicating higher productivity in that region of the Puget Sound. The lowest wet chlorophyll levels are near Tacoma's ports, showing lower productivity (Fig. 1 and 2).
- Dry chlorophyll data resembles that of the wet chlorophyll (Fig. 3 and 4).
- When comparing chlorophyll levels to total organic carbon within wet sediment, there's no significant correlation (Fig. 5).
- Comparing chlorophyll levels to total organic carbon with dry sediment shows a moderate correlation, with an increase in carbon being linked to an increase in chlorophyll, and thus productivity (Fig. 6).

## Conclusion

- Chlorophyll-a is a relatively unexplored aspect of marine research. In the past, there have been very few studies that have gone in depth on how chlorophyll affects the Salish Seas.
- This creates opportunities for various studies to be done. Future research should continue to monitor these 12 stations along with collecting more data across the region.
- Future research should look at nutrient concentrations over time to determine patterns that may influence chlorophyll productivity.
- Chlorophyll levels should continue to be monitored and observed for fluctuations as this indicates changes within the environment.

## References