Apr 27th, 4:00 PM - 4:30 PM

# Plankton Presence and Gradients along the Merge between Estuary and River Water

Casandra Jade Laney
*Everett Community College*

# Plankton Presence in River v Estuary

**Casandra Laney**
**Ocean Research College Academy,**
**Everett Community College**

## Introduction

Located near Everett, Washington, Possession Sound includes the second largest source of freshwater in Puget Sound from the Snohomish River. This salt-wedge estuary serves as a home to a wide selection of phytoplankton, and water chemistry often determines where phytoplankton accumulate prior to their recycling as nutrients. Species richness has been proven to correlate with its location, whether the species are in a river habitat or an estuary. Species richness may be greater in estuary basins compared to river sources due to varying salinity levels (Chuwen et al., 2009). I will be investigating whether a relationship exists between plankton density, diversity and the varied fresh and saltwater influences at the mouth of the Snohomish River. I hypothesize that samples with greater exposure to river water will be similar, while samples with lesser exposure to river water will decrease in phytoplankton and chlorophyll levels.

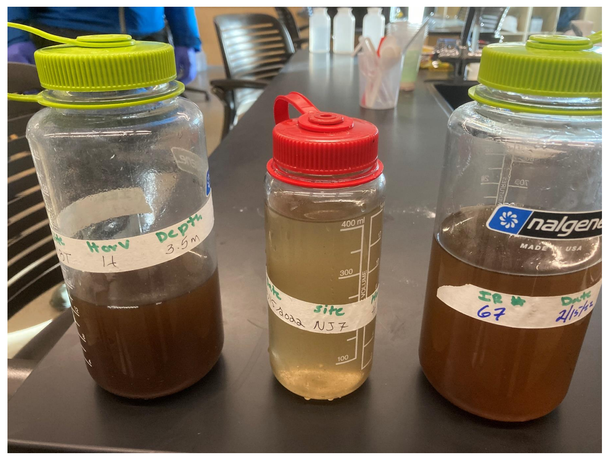


**Figure 1.** Plankton samples collected by GEOPATHs students on February 15, 2022 from MBT and straight from Snohomish River. The two bottles on the outside are the MBT/estuary samples and the bottle on the inside is the sample straight from the river.

## Study Site

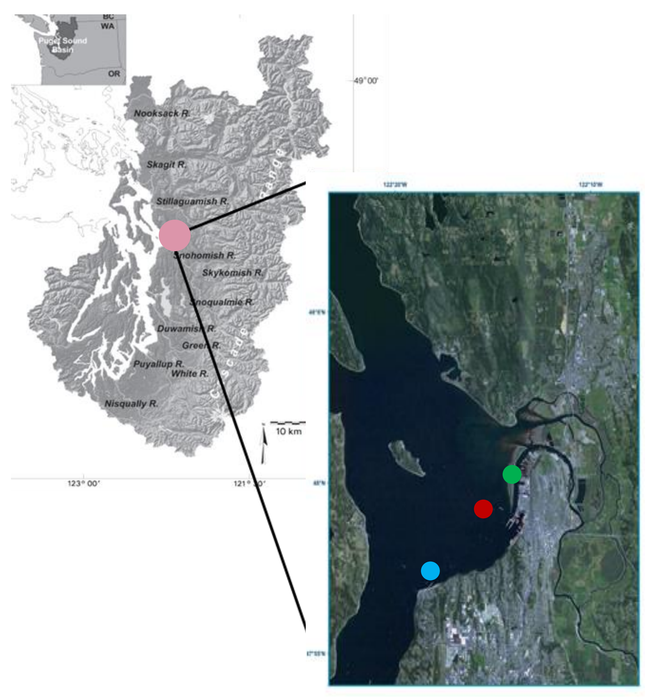


**Fig. 1** Map showing Puget Sound (bottom) with Possession Sound marked by an orange circle. The close up of the Snohomish River Estuary system in Possession Sound (top) shows the three study sites: Buoy, Everett Marina, and MBT.

## Methods

Data were collected from State of Possession Sound (SOPS) cruises conducted by Ocean Research College Academy (ORCA) students and staff. This study utilized data sourced from three sampling sites within Possession Sound: Buoy, Mount Baker Terminal (MBT), and Everett Marina from 2019 to 2021, with a focus on 2019 for phytoplankton samples. MBT samples represent estuary water with less river discharge, and Everett Marina and Buoy represent the greater exposure to river water from the Snohomish River. Data for temperature, salinity, and chlorophyll were collected across 2019 to 2021 at sites Everett Marina and MBT. Data were collected via CTD sensors. Data for chlorophyll at Everett Marina was missing between the end of July 2020 towards the beginning of September 2020. Data for chlorophyll and salinity were compared against each other and by site (Fig 2). Data for chlorophyll and temperature were compared against each other and by site (Fig 3). Phytoplankton samples were collected via 3-minute horizontal tows conducted at MBT and Buoy. The horizontal tows consisted of a 20µm plankton net held at the halocline for 3 minutes. (Fig 4).

## 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

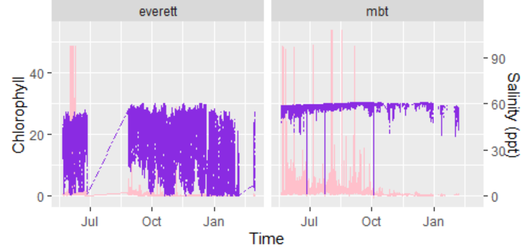


**Figure 2.** Chlorophyll (g/L) and salinity (ppt) of Everett Marina and MBT collected from 2019 to 2021 by ORCA students via CTD water sensors and Exo Sonde YSI water probes. Purple represents salinity while pink represents chlorophyll.

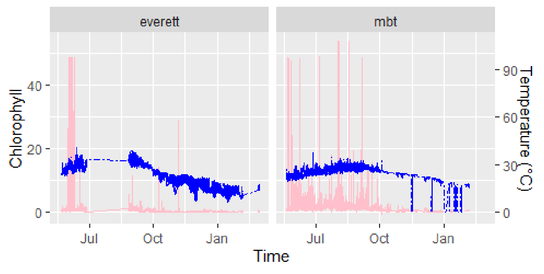


**Figure 3.** Chlorophyll (g/L) and temperature (°C) of Everett Marina and MBT collected from 2019 to 2021 by ORCA students via CTD water sensors and Exo Sonde YSI water probes. Blue represents temperature while pink represents chlorophyll.

Salinity patterns for MBT stay around 60 ppt while salinity at Everett Marina is more variable with a wider and variant range of 0 to 30 ppt. Chlorophyll profiles look similar across the timeline. Each site follows a similar curve and trend to each other. Chlorophyll and salinity do not appear to follow any similar trends compared to each other. Salinity does not hold a trend to itself when compared by sample site. (Fig 2).

Chlorophyll appears to follow a similar pattern to temperature, with their highs and lows aligning across the timeline for both sites. Everett Marina's chlorophyll and temperature both spike at the beginning of September, and follow a downward curve from the beginning of October to the middle of November. MBT faces a miniature peak towards the end of August. (Fig 3).

There is a huge variation in plankton prominence and density across the samples collected. From the five days plankton samples were collected at Buoy and MBT, there is not one day where the plankton samples from Buoy resemble trends or numbers from the plankton samples in MBT. When MBT has low or 0 values for plankton density, Buoy has random spikes in popular phytoplankton species. The same happens in reverse. The most diverse and abundant time for phytoplankton in both MBT and Buoy occurred on January 11. (Fig 4).

The most consistent and prominent phytoplankton species within the samples for both sites are Coscinodiscus and Chaetoceros. They are present consistently throughout the year, bouncing between MBT and Buoy. (Fig 4).

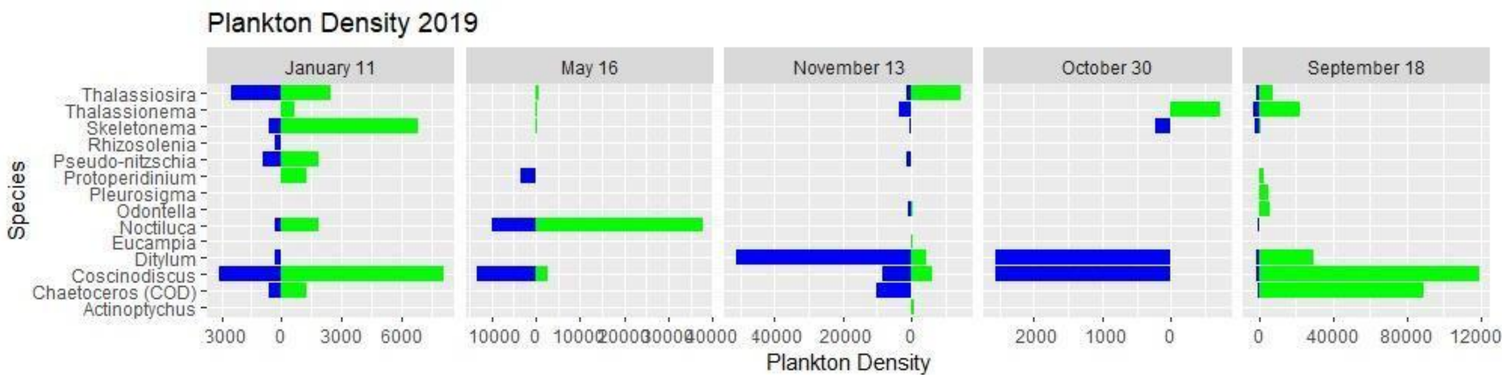


**Figure 4.** Plankton density by species of MBT and Buoy calculated from samples collected and counted by ORCA students in 2019. MBT samples are represented by green and Buoy samples are represented by blue.

## Conclusions

The results of this study point to a lack of correlation between chlorophyll and salinity themselves. However, the salinity data does point to drastically different water systems sustaining similar levels of chlorophyll. Since chlorophyll is a large indicator of phytoplankton presence, it could signify that the proximity of the test site to the river does not change the plankton makeup of the water. After comparing chlorophyll and temperature profiles, it is pretty apparent that the two factors go through highs and lows at a similar rate of change. This could point to water temperature playing a huge role in chlorophyll levels, or that the two parameters have the same controlling factor. (Fig. 3).

After examining the plankton densities of MBT and Buoy, it is apparent that the actual plankton population consists of widely different species of different magnitudes. Throughout the five days of sample comparisons, there is not one day where both sites have a similar trend happening at the same time. This proves that even though the amount of overall plankton my be similar as suggested by chlorophyll profiles, the plankton densities and diversity profiles are vastly different, suggesting that plankton densities and diversity profiles are being controlled by an outside factor that is causing them to be so different. The next steps will be to include plankton data from 2020 and beyond and incorporating river discharge data or tide stage data so we can fully see what specifically about the river is making the biodiversity of plankton so different at each site.

NSF Award #1801658