Spatial & Temporal Analysis of Phytoplankton in Clayoquot Sound, BC Canada – Fall 2019
Gibson French, Cheryl Greengrove, Erica Mortenson
Environmental Science Major

Introduction
Since 2001, the University of Washington Tacoma (UWT) has been collecting phytoplankton and water property data from Clayoquot Sound. Previous studies have focused on temporal and spatial variability of phytoplankton as affected by warm water retention within Clayoquot Sound, in which phytoplankton communities were found to vary greatly in short time and space intervals (Barry 2018). Another study found that there was a correlation between species diversity and the diatom to dinoflagellate ratio, diversity and species abundance, diatom to dinoflagellate ratio and silicate, and species abundance and nitrate at both the surface and in the thermocline (Fisonick 2020). This study examines the 2019 phytoplankton data in order to see if there was any correlation between phytoplankton (Simpson Diversity Index, total abundance, and diatom/dinoflagellate ratio) and nutrients (nitrate and silicate), which was then compared to 2018 data.

Methods
• Net phytoplankton samples were collected vertically from 10m to the surface using 20 μm mesh net.
• Surface and 10-meter phytoplankton and nutrient samples were collected using a closing bottle.
• All phytoplankton samples were fixed with 37% formaldehyde within 10 hours of collection.
• 10-meter and surface samples were allowed to settle for at least 24 hours and then decanted resulting in a 10 mL concentrate. Net samples were not decanted.
• Phytoplankton were then identified using “A Taxonomic Guide to Some Common Marine Phytoplankton” (Horn 2002) and counted using a 0.1 mL Palmer-Maloney slide with a compound microscope at 400x magnification.
• Phytoplankton species were sorted into diatoms and dinoflagellates to calculate a diatom to dinoflagellate ratio.
• Phytoplankton diversity was calculated using the Simpson Diversity Index (SDI): 1 − 1/n(n − 1).
• Phytoplankton data were then compared to nutrient data.
• The 2019 results were then compared to 2018 results.

Study Site
• Clayoquot Sound is a fjordic embayment on the western coast of Vancouver Island, British Columbia, Canada.
• The land around the sound includes steep mountains, coastal temperate rain forests, rivers, lakes, marine areas and beaches.
• The size of the region, both land and water, is about 860,000 acres and the maximum depth of the fjord is approximately 200 m (UNESCO 2015).
• In September 2019, data was collected at stations in Sydney, Shelter, Herbert, Bedwell, and Tofino Inlet with phytoplankton and nutrients collected at 18 select locations (figure 1).

Results

Figure 2. Higher SDI is correlated with lower diatom/dinoflagellate ratio.

Figure 4. Correlation between SDI and total abundance. No trend observed.

Figure 6. Silicates increase as diatom/dinoflagellate ratio decreases. (Unexpected outcome)

Figure 8. 2018 follows the expected trend, as silicate decreases, diatom/dinoflagellate ratio increases.

Figure 10. Dinoflagellate Alexandrium catenula. Channeled decisions. 2019 most common genus.

Spatial Analysis:
• Higher abundances were associated with 3 areas of inlets (figs. 1 &4).
• Heads of inlets (stations 40, 51)80)
• Mouth of inlets (stations 31, 59).
• Confluence zone in Sydney Inlet (station 63).
• Diversity was highest in Bedwell Inlet and Tofino Inlet.

Temporal Analysis:
Surface:
• 2019 had a higher concentration of diatoms and a higher diatom/dinoflagellate ratio (figs. 2 & 6).
• 2019 has a higher overall abundance (cc) (figs. 3 & 7).
• 2018 diatom/dinoflagellate ratio decreased with an increase in silicate (figs. 4 & 8).
• In 2018, as total abundance increased, nitrate decreased. 2019 did not follow this trend. 2019 may have been past blooming period, so nitrate may have been used up (figs. 5 & 9).
• Tofino 18 meters.
• In 2019, there were more dinoflagellates in the thermocline than in the surface.

Conclusion
There were significant changes between 2018 and 2019. There were differences observed in all the correlations between the two years, as well as some unexpected outcomes with the nutrients in 2019. More research should be done in order to better identify how the phytoplankton populations in Clayoquot sound continue to change.

Future Research
In order to better understand the unexpected outcomes with the nutrient related correlations, more time should be put into possible additional sources/sinks of nutrients in Clayoquot sound so that we may better understand these unexpected outcomes.

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References
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