

Variations in pH and Nutrients in Relation to Snohomish River Discharge in Possession Sound

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Introduction

pH plays a big role in how a marine ecosystem functions. In the case of Possession Sound estuary, the impacts are even greater. pH is affected by numerous variables, but in this case, the seasonal effect of river discharge are what I will be focusing on. The location of Possession Sound is an urban setting, meaning that river discharge can have negative impacts on factors like pH and nutrient levels. Nutrients support the lifecycles of marine organisms, making them an important factor in the health of an estuary. To maintain a hospitable environment in an estuary, the pH is required to stay within the range of 7.5-8.5. Certain nutrients have strong correlations to pH, such as silicates, whose production is driven by acidic rainwater. Rainwater is one of the key elements that drives the discharge of the Snohomish River. While seagrass beds help to filter out toxins and debris, they have been shrinking over time. As these environments become less hospitable, the likelihood of parasites increases, and the future of the marine organism becomes less guaranteed. Therefore, research and prevention of pH decrease and human contamination in estuaries is important, and it should be a priority when making policies regarding runoffs into rivers.



Study Site

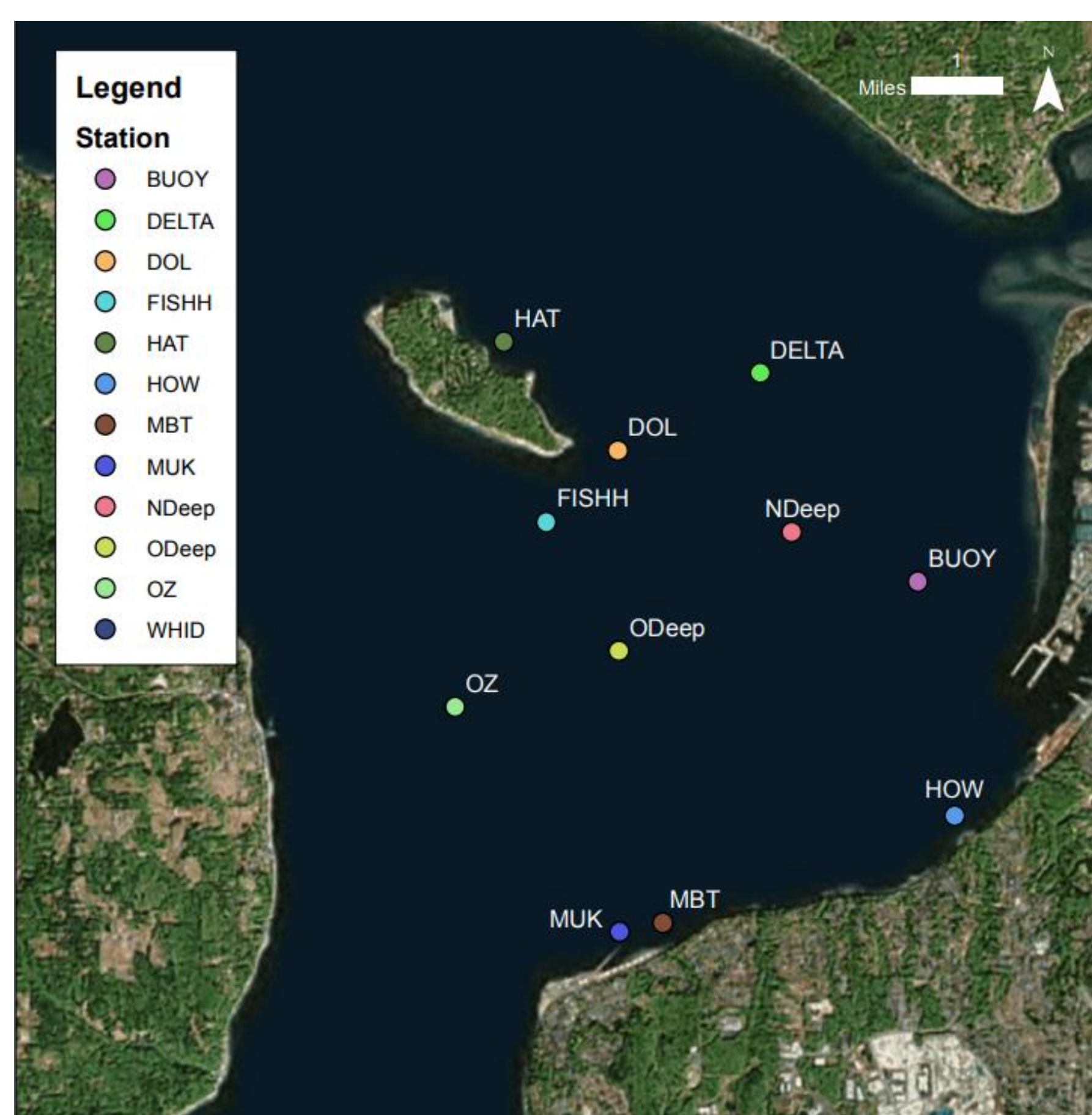


Fig. 1 Map showing Possession Sound and at the top right the Snohomish River Estuary system in Possession Sound. The study site: MBT

Methods

Samples were taken using an Exo Sonde for a vertical pH and temperature profile and Niskin Bottle for nutrients at deep, mid and surface depths.

Data was collected from "Mount Baker Terminal" station (47.950109° N, -122.283398° W), located 330 ft off the shoreline. Data from 2017 to 2020 was used because of vast amount of nutrient data at this site.

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

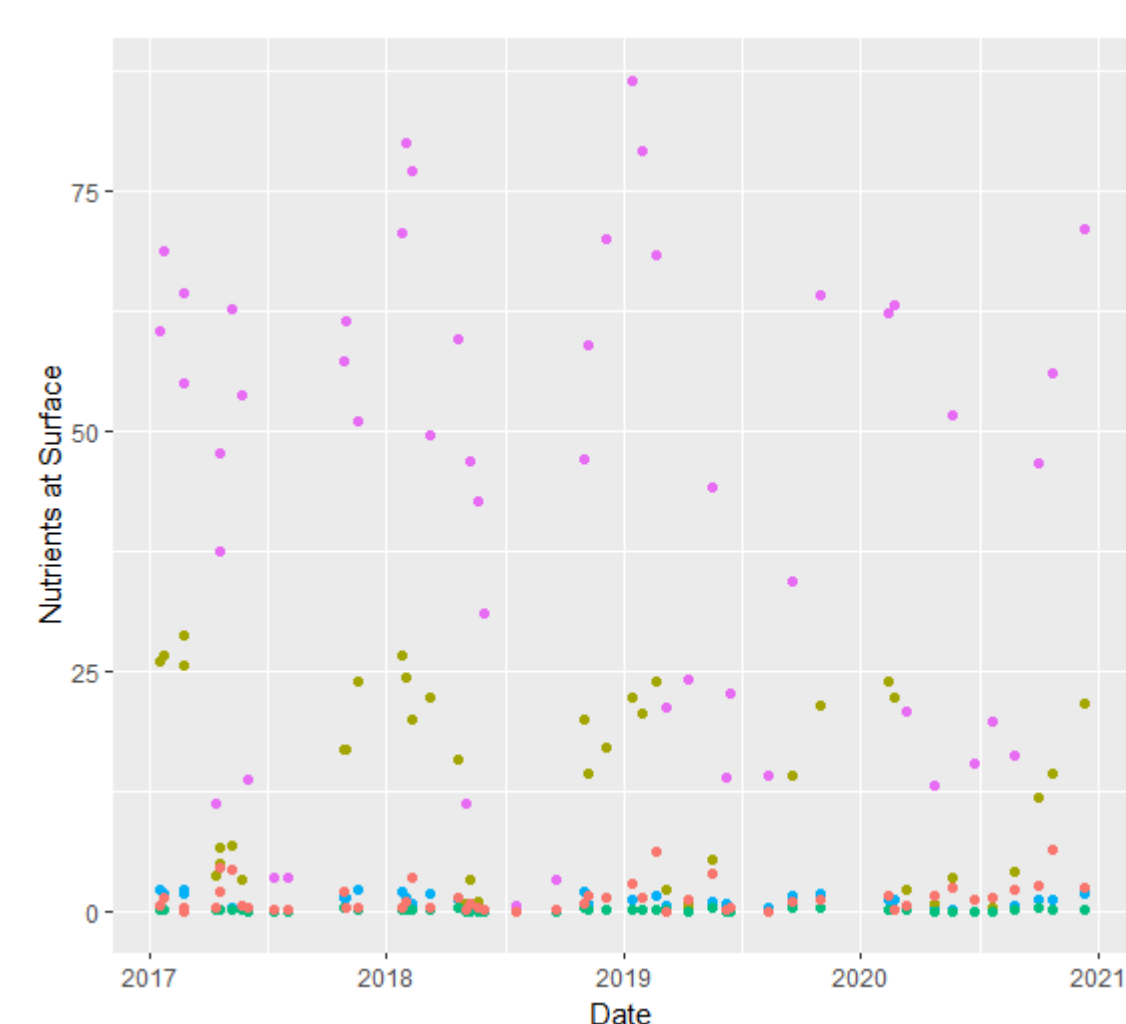


Fig. 2

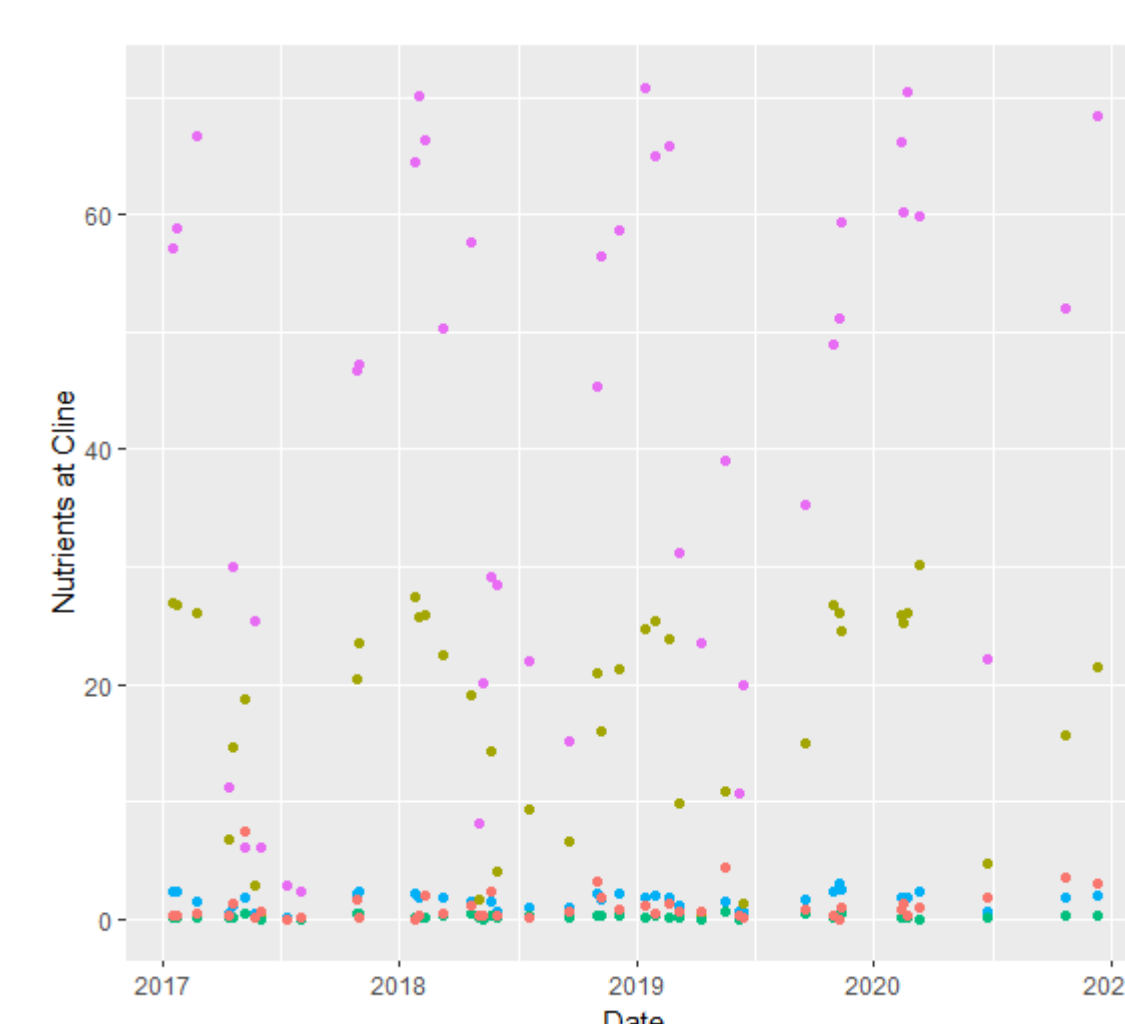


Fig. 3

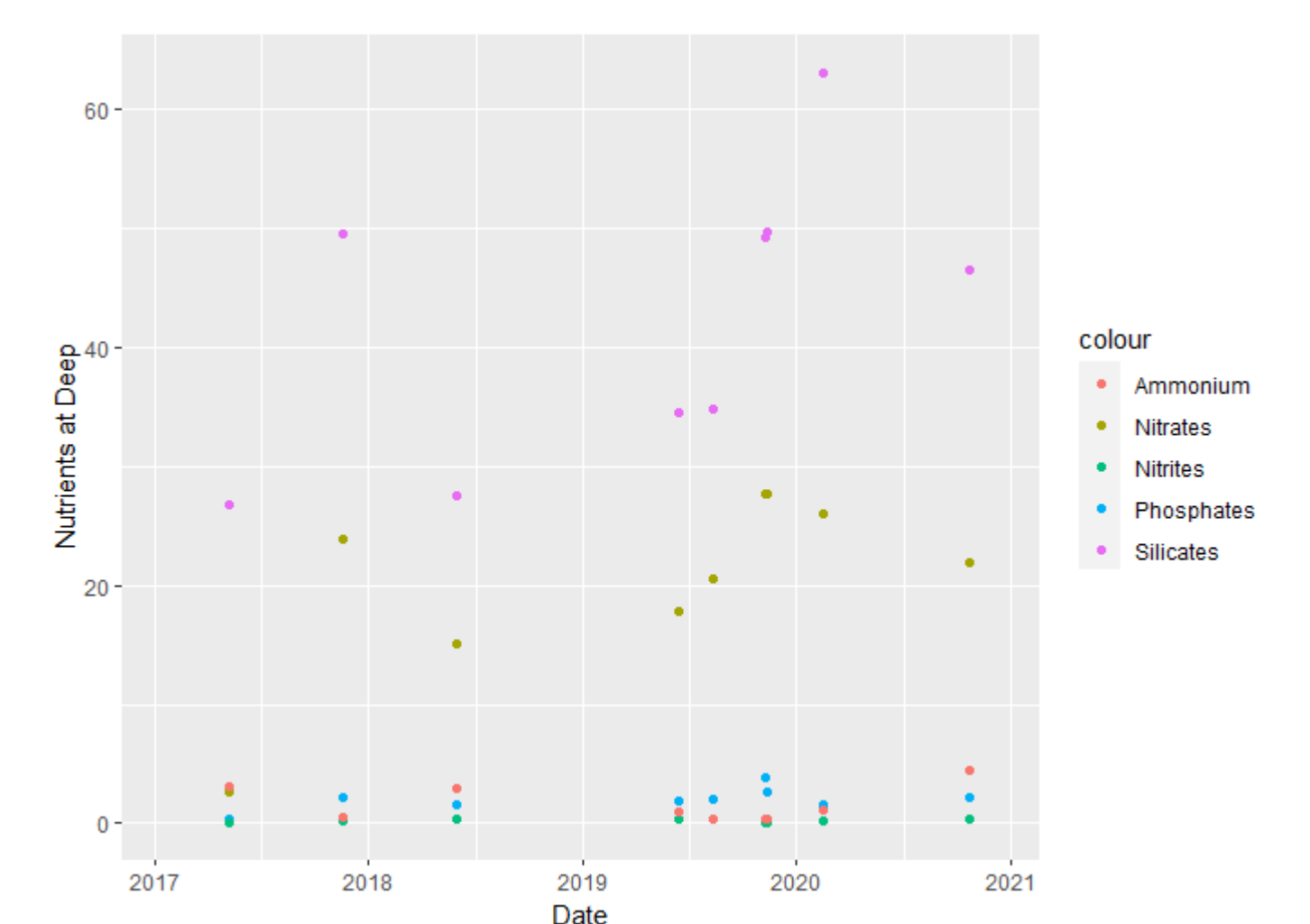


Fig. 4



Fig. 5

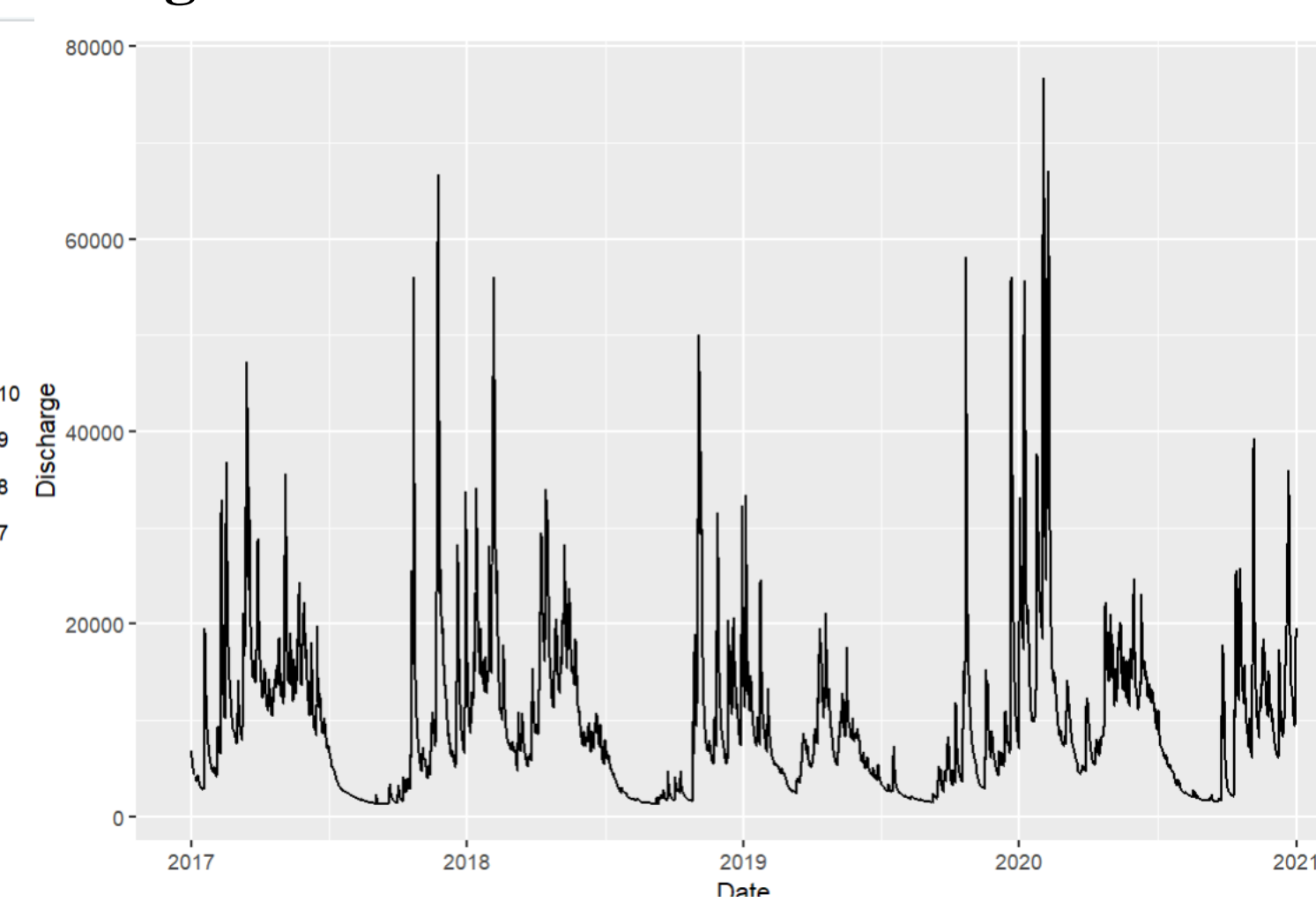


Fig. 6

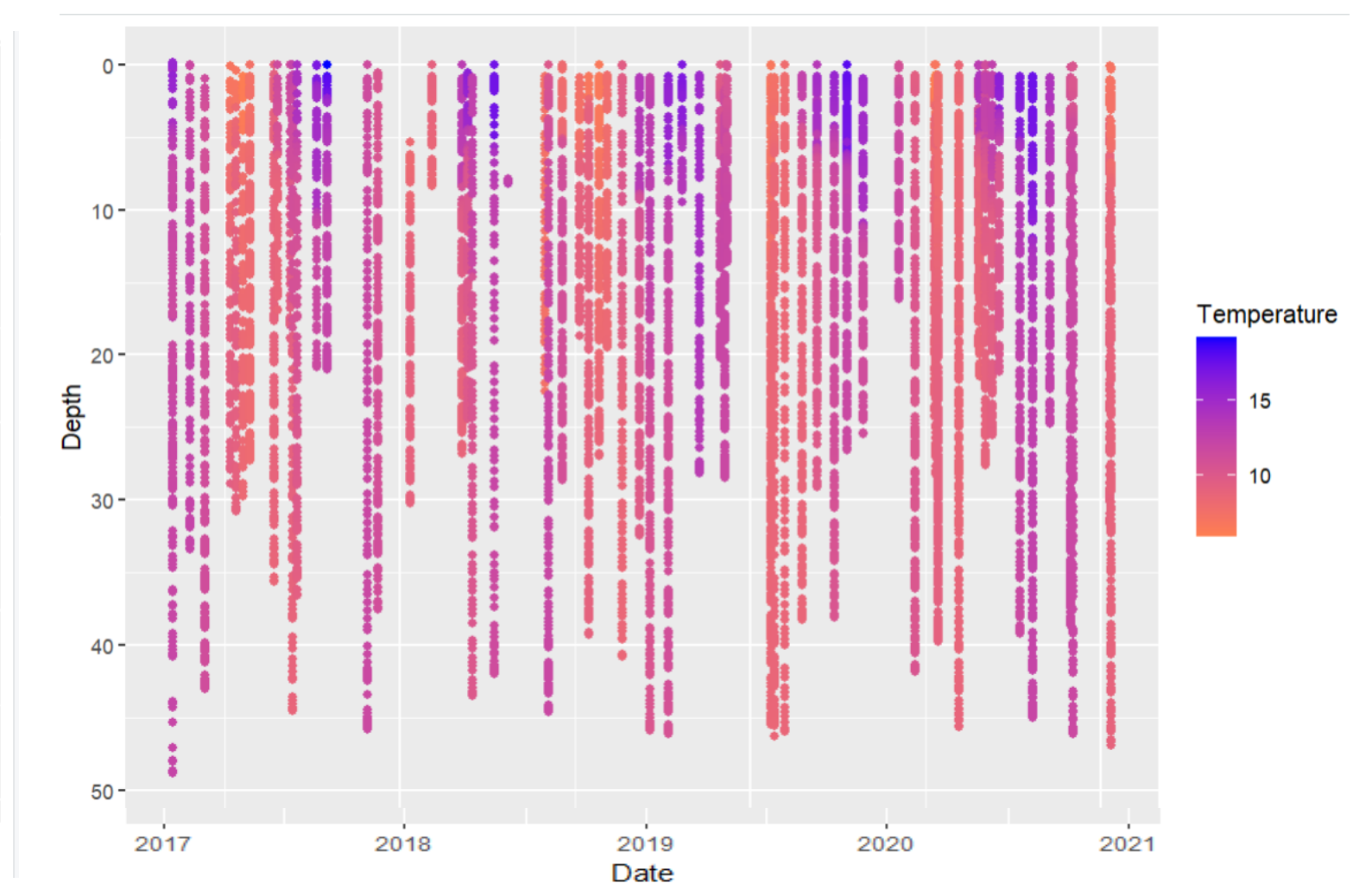


Fig. 7

When looking at the nutrient graphs, I can see high amounts of silicates and nitrates at the beginning and end of each year. This occurs after higher amounts of discharge from the river. These high amounts nutrients are mostly seen at the the surface and at the cline where there is mixing. In correlation to this pH and temperature tend to decrease during these occurrences. pH is showing a consistent trend over time. There are some high pH spikes that are shown in the spring and summer. During this time temperature is also increasing while river discharge is fluctuating but has a mean decrease over time.

Conclusions

My hypothesis of expecting high amounts of silicates was proven right. They are mainly being seen at surface and cline leading me to believe they are occurring as a result of river discharge and are a by product of seasonal and human contamination. The same being true for the high levels of nitrates observed. They are being seen at the cline due to mixing resulting from river discharge, tides and other movement within the sound. pH over all is showing normal seasonal changes due to photosynthesis and decomposition. However, the lower spikes at the beginning and end of the years lead me to believe that the river discharge is negatively affecting the environment. While most marine organisms living in estuaries are designed to withstand such fluctuations, if they were to get more extreme, the habitability of said estuary would become less likely and the estuary could even be experiencing acidification.