A Strange Twist of Phosphate: Nutrients and Phytoplankton in Harpswell Sound, ME

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Tiny plant-like organisms called phytoplankton serve as the backbone of coastal ocean ecosystems like Harpswell Sound, ME, converting sunlight into biomass and energy that can be used by the whole ecosystem. But to survive—and thrive—phytoplankton require their waters to contain inorganic nutrients. The exact type and amount of these nutrients depends on the specific species of phytoplankton, though they commonly include nitrate, phosphate, and silicate. Moreover, the types of phytoplankton that dominate coastal waters can affect the whole ecosystem in myriad ways; for example, certain species known as dinoflagellates can cause toxic red tides that hurt both animals and humans living in and around the water. Accurately determining the specific species in the water at a given time, however, is difficult and labor intensive. So, can we use the easily-measured inorganic nutrients in the water as a proxy to determine the dominant populations of phytoplankton at a given time?

To answer this question, I collaborated with several other Bowdoin students and staff to collect data on numerous water properties in Harpswell Sound, ME. Water samples were taken at four stations along the Sound each week in June and July, and data was recorded for temperature, salinity, fluorescence, phytoplankton pigments, inorganic nutrients, and phytoplankton counts. Since I focused on nutrients, I processed water samples using a SmartCHEM nutrient autoanalyzer, which determines nutrient concentrations in a water sample by adding special dyes. Once the dye is added, the SmartCHEM records the color intensity of the water sample: the darker the sample turns, the more nutrients it contains. After processing, nutrient data for each station was then compiled into a time series to see how nutrient concentrations changed over the summer in Harpswell Sound (Figure 1). Each time series was then compared to another student's data on phytoplankton counts to determine if there was a correlation between nutrient concentrations and phytoplankton populations (Figure 2). While more data would be beneficial, we tentatively found that nitrate and phosphate concentrations rise in Harpswell Sound when the population of phytoplankton decreases; silicate concentrations appeared unaffected by phytoplankton population. Further analysis will investigate more specific correlations with distinct species of phytoplankton.

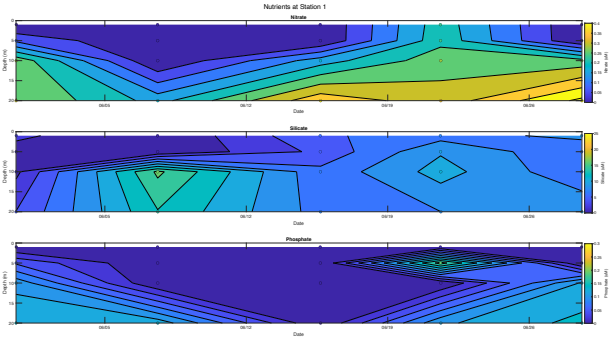

Figure 1. Time series of nitrate, silicate, and phosphate at Station 1 in Harpswell Sound, ME from May 31st to June 28th, 2022.

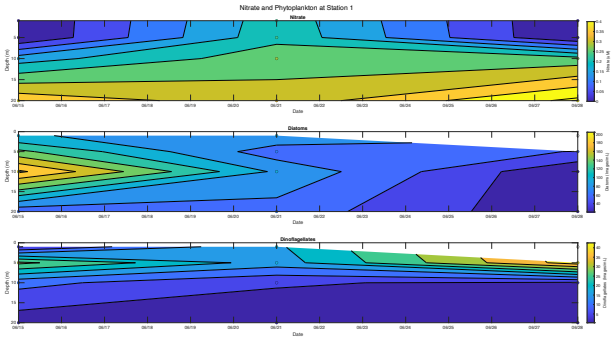

Figure 2. Time series of nitrate, diatom counts, and dinoflagellate counts at Station 1 in Harpswell Sound, ME from June 15th to 28th, 2022. Notice how nitrate spikes when diatom and dinoflagellate populations are at a minimum.

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