The Wonderful WIZ: Methods for In-Situ Measurement of Oceanic Nutrients
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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, silicate. Another nutrient, ammonium, is also often produced as phytoplankton decompose at the end of their lifespans. The amount of nutrients we find in a coastal environment can tell us important information about the phytoplankton composition of the area. Current methods of nutrient measurement, however, require researchers to directly sample the water they wish to measure. This is time and resource intensive, so this school year was spent was spent investigating hands-off methods of nutrient measurement with the state-of-the-art, in-situ WIZ probe.

The research conducted this year was a continuation of the calibration and validation work for the WIZ that was started during the summer. First, the validation work needed to be finished. This began by completing an in-lab validation: running dilution series for silicate, phosphate, and nitrate in the SmartChem nutrient autoanalyzer. These results were then compared to the same dilution series run in the WIZ to validate each method (Figure 1). Sadly, the ammonium protocol on the SmartChem was not yet up and running, so ammonium was not validated in the lab. Following in-lab validation, in-situ validation was conducted by sampling at the Schiller Coastal Studies Center and comparing values measured for each nutrient by both the WIZ and SmartChem. There was found to be a noticeable difference between the SmartChem and WIZ values. Patterns, however, remained roughly the same, so validations were empirically corrected.

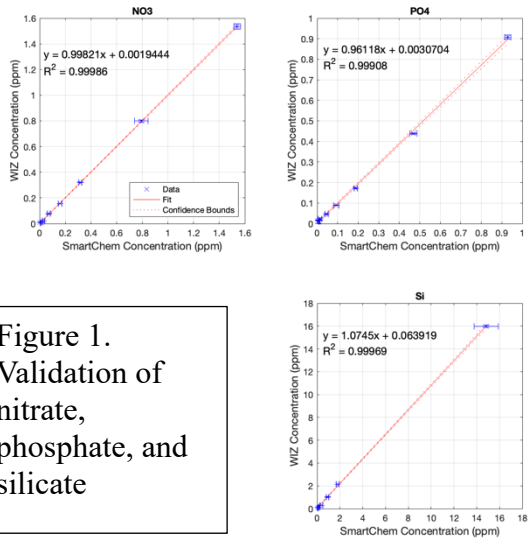

Figure 1. Validation of nitrate, phosphate, and silicate

After correcting in-situ validations, time series data of each nutrient were compared to changes in chlorophyll fluorescence to determine how nutrient concentrations related to phytoplankton. It was found that drops in nitrate, silicate, and phosphate were correlated with phytoplankton blooms. Ammonium was found to drop at the start of phytoplankton blooms and rise as the bloom ended. These findings were all in line with the major literature on phytoplankton and nutrient dynamics.

All findings were presented at the Geological Society of Maine Spring 2024 Meeting and as an end-of-year presentation with the EOS Department.

Faculty Mentor: Collin Roesler