Phytoplankton are single-celled aquatic photosynthesizer, requiring nutrients from their environment to thrive. Nutrient dynamics are complicated, derived from the complex interplay between physics and biogeochemical cycles. However, by examining the major sources of inorganic nitrogen (in the form of nitrate, NO$_3^-$, and nitrite, NO$_2^-$), we explored the role nutrients play in the occurrences and blooms of *Alexandrium fundyense*, the harmful algal species that causes paralytic shellfish poisoning (PSP) in coastal Maine, colloquially known as red tide. We focused our study in Harpswell Sound, a sentinel site for *A. fundyense* appearance and early closure for PSP toxicity in shellfish.

Research aimed to accurately estimate the concentration of nitrate hourly using instruments deployed on the Harpswell Sound buoy. Specifically, we wanted to measure nitrate using the ultraviolet absorption spectrum. In the laboratory, we correlated absorption peak height to concentration by chemically reconstructing seawater to understand its complexities.

The sea water from Harpswell Sound contains many different compounds that absorb in the ultraviolet light region. To better understand sea water composition, we completed case studies involving pure water, artificial sea water (ASW), Sargasso Sea water (SSW), and Harpswell Sound water. Each study added more complexities in the uv-spectrum; pure water provided the background of water, while ASW included sea salts, and SSW introduced some organic matter. For the studies, known concentrations of nitrate (0.01 to 50 µM) were constructed with the water, and these were analyzed on a spectrophotometer in the UV range. In pure water the peak of nitrate occurred at 200, but when the salts are added into the picture the wavelength increases (Figure 1B).

With this knowledge, we hope to construct a model that can be applied to past measurements, and to build up to the real time measurements collected by the oceanographic buoy (Figure 2). This will allow for the determination of natural nutrient concentrations on the same temporal scale as phytoplankton observations in order to shed light on the role nutrient dynamics play.

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**Figure 1:** Steps towards quantifying a spectrophotometric calibration. A. The UV absorbance spectra for the standard nitrate curve in SSW (0.01 to 50 µM nitrate). B. UV absorbance curves as in part A with 0 µM nitrate baseline removed. C. Magnitude of absorbance height versus nitrate concentration.

**Figure 2:** Discrete sample concentrations of nitrate and nitrite collected during 2009 (blue dots). The red lines connect the samples together. With the model, hourly data would clarify the whole picture of nitrate dynamics.

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