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Summary of Phosphorus Research
Fall 2004

How I Got Started

My research began in tenth grade, when my Honors Chemistry teacher, Tom Mikulka, required each of his students to carry out a yearlong independent research project that involved chemistry. From a list of 21 possible topics, I chose to measure phosphorus in the surface water and sediment of the local Watervliet Reservoir. (Because it can spur excessive plant growth, phosphorus is a primary water-quality concern.) Throughout the school year, I read studies on my topic, contacted experts in the field, formed hypotheses, designed an experiment, collected samples, and made arrangements to perform my lab work at Rensselaer Polytechnic Institute. In June, I presented my findings, both to my chemistry class and to members of the community who were interested in water quality.

Soon thereafter, I decided that I wanted to continue my research over the summer. Dr. Mikulka suggested that instead of simply measuring surface phosphorus, I should take samples throughout the water column to see whether or not the sediment is releasing phosphorus into the lower-level water. I collected and tested new samples over the summer and analyzed the results with Dr. Mikulka that fall, but unfortunately, a strange pattern in my data indicated that my results were probably invalid. I therefore resolved to modify the experiment and try it again the next summer.

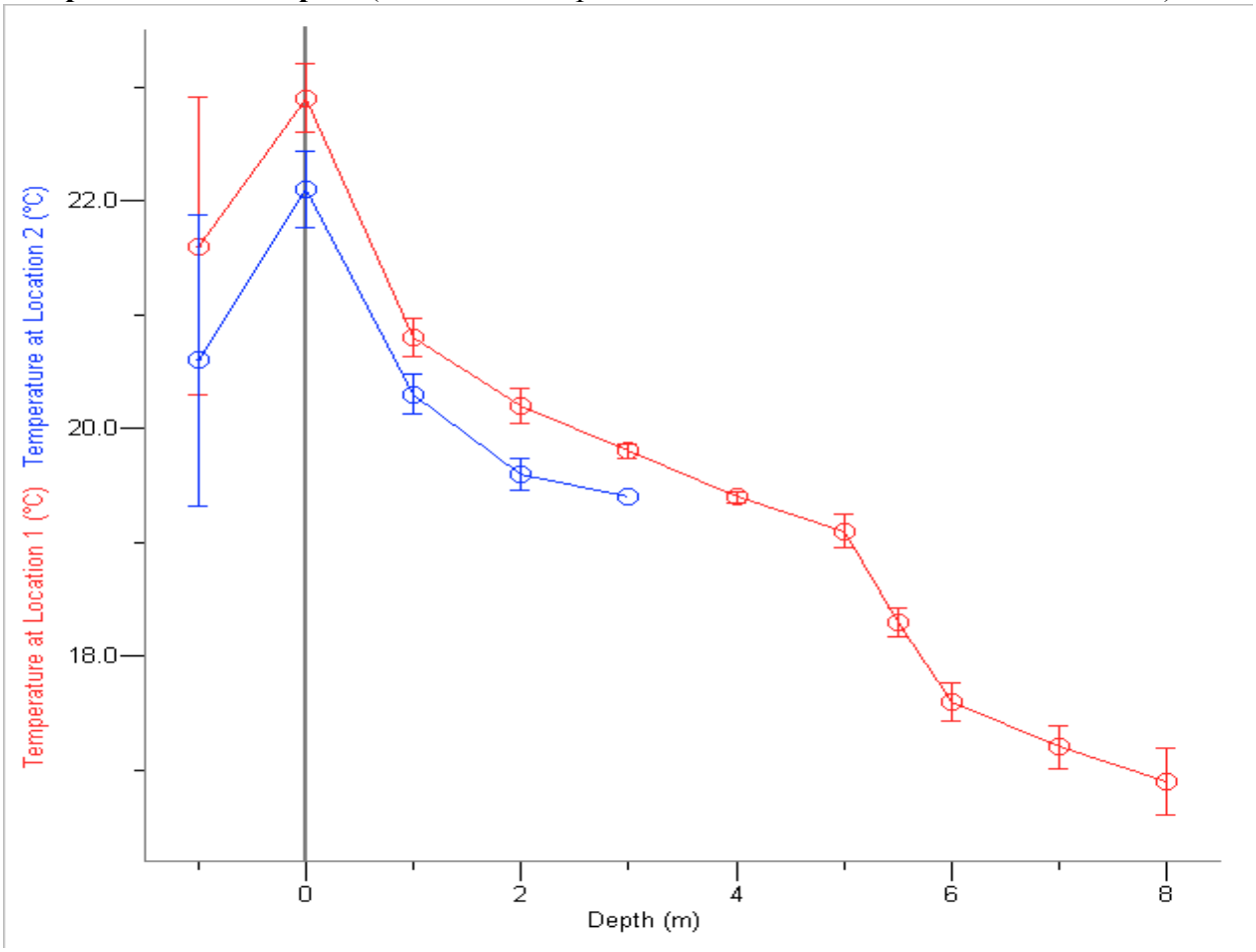
This third study was the one that I submitted to the Intel Science Talent Search. The abstract and graphs from the report are included below.

Abstract

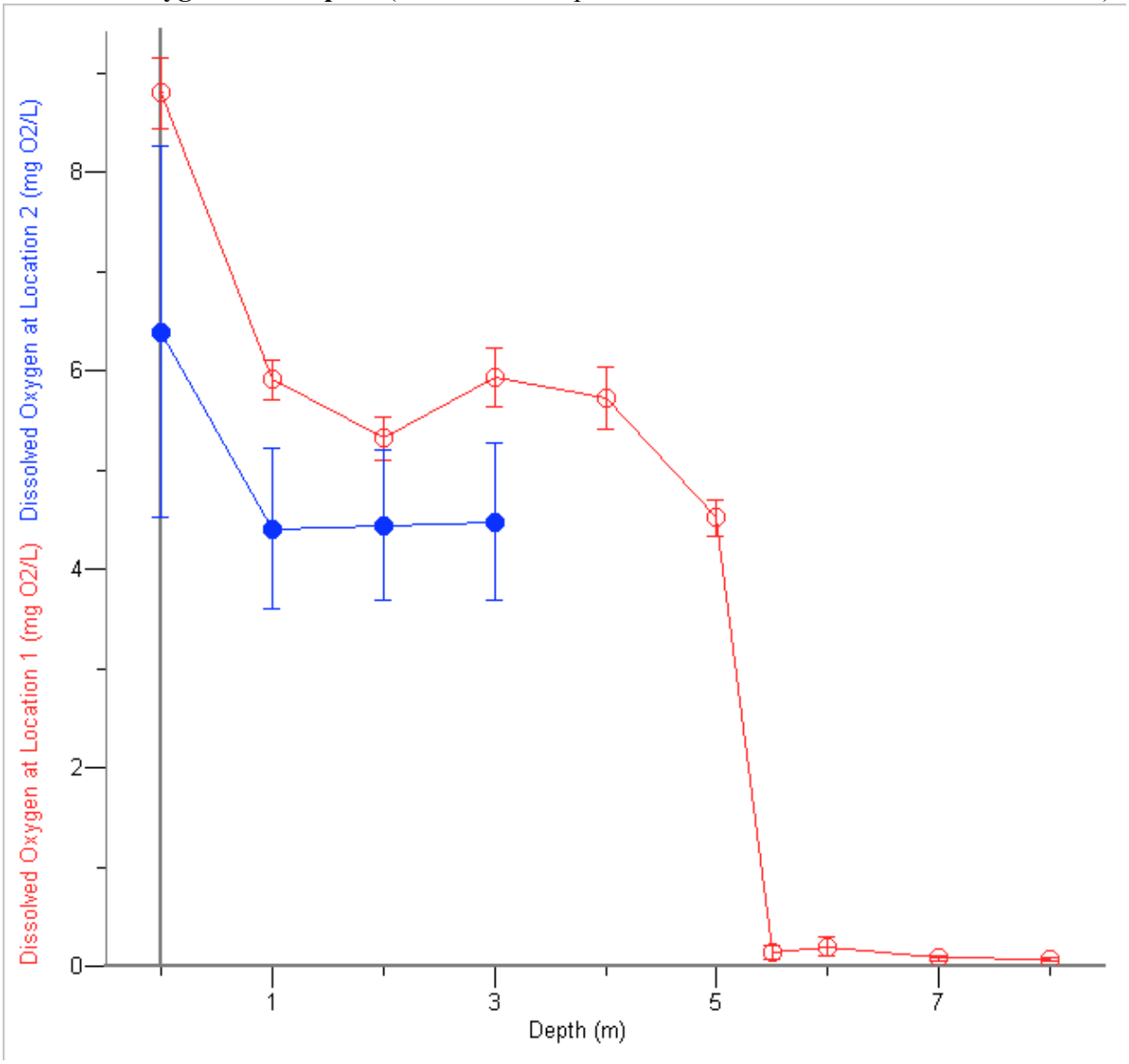
This study examined internal phosphorus release in a thermally stratified fresh water body in upstate New York. Temperature, dissolved oxygen, and total dissolved phosphorus were measured at regular intervals to the bottom of a shallow site and a deep site on the Watervliet Reservoir in mid-August 2004. Both temperature and dissolved-oxygen readings at the deeper sampling location closely matched the general pattern of a thermally stratified lake. Beneath the surface of the reservoir's epilimnion, which extended from 0.0 m to 5.0 m, dissolved oxygen was

consistently between 4 and 6 mg O_2/L. However, beginning at the metalimnion—which lay between 5.0 m and 6.0 m—and continuing throughout the hypolimnion—which ranged from 6.0 m to the bottom—dissolved-oxygen concentrations fell close to zero. The water at the shallower sampling location, which was not significantly stratified, did not exhibit a similar plunge in dissolved oxygen. Even though metalimnetic and hypolimnetic dissolved-oxygen concentrations at the deeper sampling location were well below the 1-mg O_2/L threshold at which sediment-bound phosphorus typically begins to dissolve in earnest, no significant phosphorus mobilization was detected.

Temperature with Depth. (Vertical bars represent ± 1 standard deviation from the mean.)



Dissolved Oxygen with Depth. (Vertical bars represent ± 1 standard deviation from the mean.)



Total Dissolved Phosphorus with Depth. (Vertical bars represent ± 1 standard deviation from the mean.)