The Effects of Nitrogen on Wetland Phytoplankton

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Abstract

The intention of this preliminary experiment in the Lake Waco Wetlands is to observe the differing levels of Nitrogen in each of the four cells and their effects on phytoplankton population levels. The experiments hypothesis stated that cell 1 would contain the highest nitrogen concentration due to the inflow of nutrient water from the Bosque River, and would result in the highest level of phytoplankton. Due to the natural filtration system that occurs in the Lake Waco Wetlands, a steady decrease in the Nitrogen and Chlorophyll levels as water moved towards the outflow was expected. In order to test this, four separate mesocosms of water representing each of the four cells of water at the Lake Waco Wetlands were built. Once a week for four weeks we tested the nitrogen and chlorophyll content of each mesocosm. This experiment tested chlorophyll to represent phytoplankton because the amount of chlorophyll production runs parallel to the amount of phytoplankton. The results after chlorophyll testing (Figure 1) showed a gradual decrease from cell one to cell four just like nitrogen did. Therefore in the Lake Waco Wetlands, the higher the nitrogen concentration, the more phytoplankton will grow.

Figure 1 shows Katharine Milburn and Amanda Miller doing the final testing for Chlorophyll.

Introduction

According to the Brazos River Authority, "The North Bosque River was included on the 1998 Texas Clean Water Act 303(d) list and judged to be impaired under water quality guidelines for nutrients and aquatic plant growth." Plants and phytoplankton are crucial elements of the wetlands, and according to the 1998 Texas Clean Water Act 303(d), "Excessive nutrient levels are entering the river from tributary watersheds and are contributing to excessive plankton growth. (Anonymous)." The goal of this preliminary study was to determine whether the wetlands caused an impact to the nutrients. The experiment examined the relationship between the levels of Nitrogen (Figure 2) and Chlorophyll. The biological and chemical process of nitrification/denitrification in the nitrogen cycle transforms the majority of nitrogen entering wetlands, causing between 70% and 90% to be removed (Turner). Chlorophyll a is the principal photosynthetic pigment and is common to all phytoplankton. Chlorophyll a can thus be used as a measure of phytoplankton ("Chlorophyll"). The hypothesis is that as the water flows through the wetland, the Nitrogen and Chlorophyll levels will decrease.

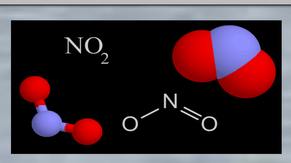

Figure 2 to the left shows a nitrogen molecule

Methods and Materials

To simulate the four different cells of the wetland, four mesocosms (29.2 cm x 29.2 cm x 101.6 cm) were filled with equal amounts of water from each of the corresponding cells. They were labeled C1, C2, C3, C4 representing their respective locations in the wetlands. Over four weeks, testing was done on each mesocom's nitrogen and chlorophyll levels. Nitrogen was tested each week using four different test tubes filled with 45mL of water from each mesocosm. The Center for Reservoir and Aquatic Research processed these samples. Chlorophyll was tested each week by filling four 500 mL bottles with water from each mesocom. They were filtrated and processed in the Baylor Biology Department.

Results

The data from the experiment showed that nitrogen levels degrease from cell one to the final cell 4 (Figure 3). The chlorophyll results showed only a slight decrease in amount from cell 1 to cell 4 (Figure 4). The results correspond with the hypothesis.

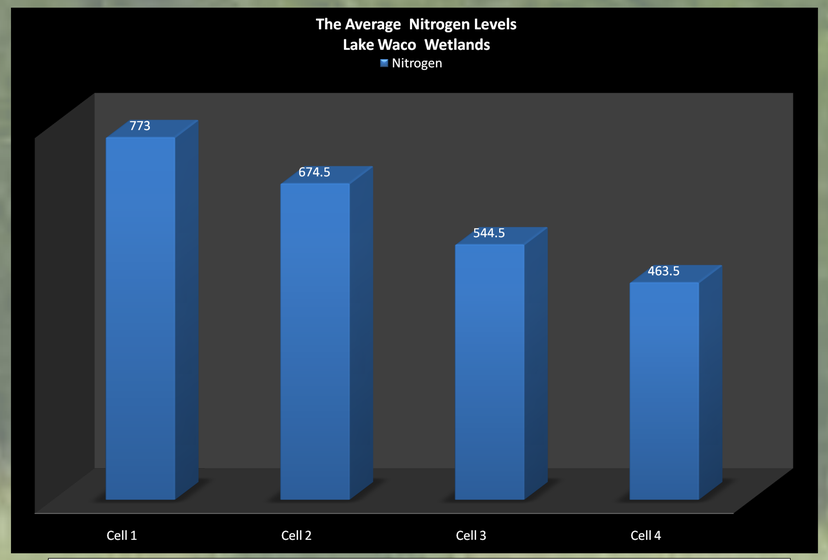

Figure 3: A graph showing the average nitrogen ug/L levels sampled.

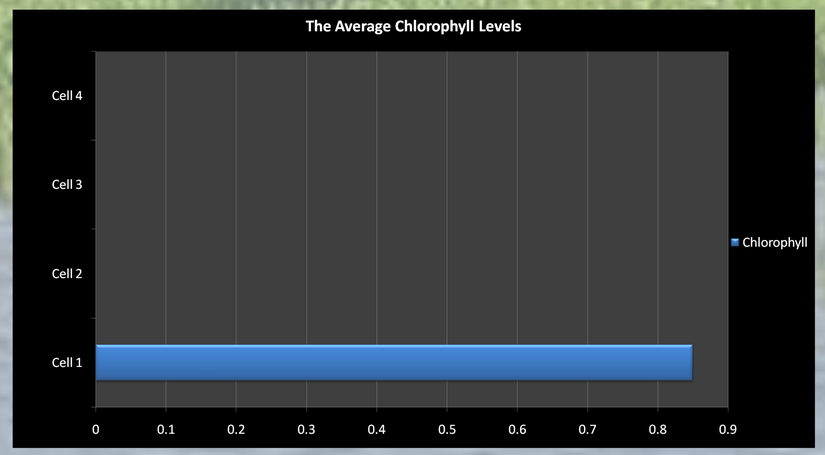

Figure 4: A graph showing the average chlorophyll ug/L levels sampled.

Discussion and Conclusion

From the preliminary test preformed on nitrogen, the data supports the hypothesis that cell 1 would contain the highest amounts of nitrogen and the following cells would show a steady decrease. The third week of nitrogen data collected differed compared to the other weeks due to weather elements that the mesocosms were exposed to. During the heavy winds and rain, plants and other substances were introduced into the mesocosums creating a very notable change in the levels of nitrogen. If this experiment were to be run again, covering the mesocosums with a protective roof might help to elevate other substances entering the mesocosums.

The chlorophyll test ran indicated a slight decrease in chlorophyll production from cell one to cell four thus supporting the hypothesis again. One observation made was that the levels of chlorophyll detected were extremely small. If this test were preformed again a suggestion would be to test a larger amount of chlorophyll. This experiment tested only 500mL bottles. After filtering and sampling, only a small amount of chlorophyll was present, therefore making an accurate computer test difficult. Another suggestion would be to filter and test the chlorophyll samples within a 48 hour time period. Over time daphnia ate away the chlorophyll causing only trace amounts to be detected. Though the experiment showed only small levels of chlorophyll, the levels detected still decreased from cell one to cell four, just as nitrogen did.

Lake Waco Wetlands are a natural filtering system . Excessive nutrient amounts that may be harmful to the community are being naturally filtered. The Lake Waco Wetlands is actively working to reduce the amounts of nitrogen, which in turn creates a healthy aquatic system and water safe for consumption.

Literature Cited

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* Turner, Marjut H., and Richard Gannon. "Functions of Wetlands." NCSU Water Quality Group. North carolina State. 7 May 2009.

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