The Reflection of Water Quality on the SFX Pond

Piper Rohrbaugh

St. Francis Xavier Catholic School

Abstract

This experiment was conducted by measuring the quality of the SFXCS pond using LaMotte pH, dissolved oxygen, and phosphate kits, an alcohol filled thermometer, and transparency tube. This experiment focused on the question, how do pH, dissolved oxygen, water transparency, phosphate, and water temperature relate and reflect a healthy aquatic environment? The hypothesis states that if overtime the pH, dissolved oxygen, phosphate, water transparency, and water temperature levels are tested in the pond, then the pH levels should range between 6 and 8, the dissolved oxygen should range from 4.0 mg/L to 10.0 mg/L, the phosphate levels should be no more than 0.1 ppm, the water transparency levels should be determined when the bottom of the tube is not seen, and the water temperature should stay between 0℃ to 32℃ because these levels reflect good water quality that should come from the trees that provide shade and oxygen and the high grass that keeps runoff from getting into the pond. All procedures were taken from GLOBE protocols and phosphate procedures were taken from the LaMotte kit. The data supported the hypothesis because through research, the levels fell within the accepted range of a healthy aquatic environment except for phosphate. As the experiment is continued, the data collected will continue to be compared to other GLOBE data to compare the conditions of the water in the various locations.

Keywords: pH, dissolved oxygen, phosphate, water temperature, water transparency

Research Question

How do pH, dissolved oxygen, water transparency, phosphate, and water temperature relate and reflect a healthy aquatic environment?

Introduction

•Ponds are freshwater water sources that shelter many living things that need certain water quality levels to survive, which can change depending on weather, humans, or amount of animals living in the water (Hester, 2004)

•pH- defines how acidic or basic a body of water is along a scale. The lower the number, the more acidic- the higher the number, the more basic (Environmental, 2013)

•pH can stress animal systems and reduce hatching and survival rates Extreme pH levels most likely will increase the solubility of elements and compounds, making toxic chemicals more “mobile” and increasing the risk of absorption by aquatic life (Environmental, 2013)

•Dissolved oxygen (DO)- the molecules of oxygen gas that have dissolved in the water. Without sufficient levels of DO, aquatic life suffers (GLOBE, 2018)

•A fishkill occurs when a large number of fish in an area of water die. Excess nutrients carried to streams and lakes encourage abundant growth of algae, which leads to low oxygen in the water .

•Cold water can dissolve more oxygen than warm water because the pressure is greater in colder water and lower in warmer water (GLOBE, 2018).

•Water temperature is a measure of how hot or cold the water is. Temperature influences the amount and diversity of aquatic life. Ponds that are cold and have little plant life in winter, bloom in spring and summer when water temperatures rise and nutrient-filled bottom waters mix with upper waters. Water has a higher heat capacity than air (GLOBE, 2018).

•Phosphorus is necessary for the growth of plants and animals. Phosphate levels between 0.025 - 0.1 mg/L stimulate plant growth, 0.1 mg/L is the maximum level to avoid accelerated eutrophication. Levels that are more than 0.1 mg/L cause accelerated growth (Oram, 2014).

•Transparency decreases with the presence of molecules and particles that can absorb or scatter light. Sediments can come from natural and human sources” (GLOBE, 2018).

Research Methods

Map 1: This shows an aerial view of the pond study site at school.

Map 2: These are the locations the pond data is compared with in the graphs.

Image 1: This image shows the actual GLOBE pond study site.

Planning Investigations

- The site is at the edge of a pond beside our campus stream and Rock Creek beside our school. It has a muddy bottom with unmowed, vegetated banks on our property. There are some areas close to mowed grass. There are trees and a wooded area nearby. Our school is in a rural area with farms and pasture land on the north and west sides, a small housing development on the south side, and a forested area with a creek to the east side. We experience a humid, continental climate. The coordinates of this site are 39.85685, -77.22606 with an elevation of 147.6m.
- GLOBE protocols for pH, DO, phosphate, transparency, and water temperature will be followed.
- The GLOBE ADAT will be used to find other nearby locations to compare water quality.
- Testing will be done once a week.

Materials

•1 Alcohol Filled Thermometer
•1 Clock or Watch
•1 pair of Latex Gloves
•1 LaMotte Dissolved Oxygen Kit (5860-01)
•1 LaMotte pH kit (5858-01)
•3.8 Liters Great Value Distilled Water
•1 Blue Bic Cristal Stic Pen
•18.93 Liter Pitcher
•Waste Bottle with Cap
•1.5 meters piece of string
•1 LaMotte Phosphate Kit (4408-01)
•1 Transparency Tube
•1 Small Bucket

Carrying Out Investigations

- GLOBE protocols for pH, DO, phosphate, transparency, and water temperature were followed.
- The GLOBE ADAT was used to find other nearby locations to compare water quality, although not all parameters were found.
- Testing was done once a week, although, schedules, flooding, and the egg laying season for Canadian Geese prevented testing often.
- Testing was done with the help of classmates.

GLOBE Badges

Be a **Data Scientist**

My project was testing the water quality of the school pond and comparing my data to other GLOBE data. I think I qualify for this badge because I used other data to see whether my data is good compared to other data from the US and to see what we need to work on to improve the pond’s health. I learned that our pond is healthy compared to other data but we still need to keep it healthy. I collected data over many months, analyzed, used the ADAT system to retrieve data from other GLOBE schools and added my data to the record for our school tracking the health of the pond

Make an Impact

I believe I qualify for this badge because I wanted to help the pond’s health and I wanted to see if there is anything that I can do to improve or help it. The pond is surrounded by farms and houses and I wanted to see if these had an impact on the health of the pond. I am going to try to find a way to help the phosphate levels decrease and by doing that the pond will start to become healthier. My research is also being presented to the Chesapeake Bay Foundation because our water flows into the Chesapeake Bay.

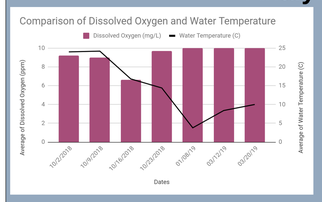
Be a **STEM Storyteller**

An IVSS judge awarded me this badge, stating: “She presented her project in an outstanding way via YouTube and I was impressed by her professional scientific reporting when she talked about dependent and independent variables. She has the potential to be a great science communicator.”

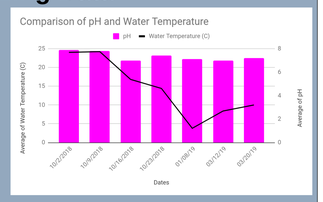
Results

Print Screen 1 and 2: These show the data entered into Globe’s site.

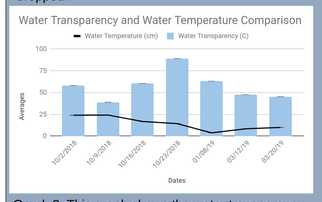
Analyzing Data



Graph 1: This graph shows the dissolved oxygen and water temperature averages for the 5 weeks that were tested. When the temperature was higher, the dissolved oxygen was lower and when the dissolved oxygen rose, the temperature dropped.

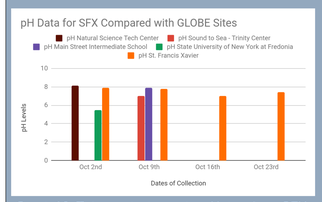


Graph 2: This graph shows the pH and water temperature averages for the 5 weeks that were tested. When the pH levels are higher, the water temperature levels are higher as well. When the pH dropped, the water temperature dropped as well.

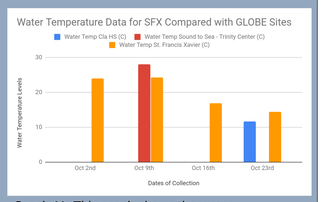


Graph 3: This graph shows the water transparency and water temperature averages for the 5 weeks that were tested. When the transparency levels are high, the water temperature levels are low.

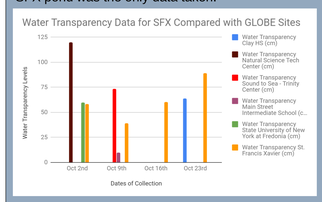
Graph 4: This graph shows the pH and phosphate averages for the 5 weeks that were tested. When the pH levels are high, the phosphate levels are low. Some dates are missing due to lack of reagents.



Graph 10: This graph shows the pH data from SFX compared with GLOBE sites on the dates that were collected at the SFX pond. On October 2nd, the pH data from the Natural Science Tech Center was the highest pH level compared to the State University of New York at Fredonia and the SFX pond. On October 9th, the pH data from Main Street Intermediate School was the highest pH level compared to the Sound to Sea Trinity Center and the SFX pond. On October 16th and 23rd, the SFX pond was the only data taken.



Graph 11: This graph shows the water temperature levels for SFX compared with GLOBE sites on the dates that were collected at the SFX pond. On October 2nd and 16th, the SFX pond was the only data taken. On October 9th, the Sound to Sea Trinity Center was the highest water temperature level compared to the SFX pond. On October 23rd, the SFX pond was the highest water temperature level compared to the Clay High School.



Graph 12: This graph shows the water transparency data for SFX compared with GLOBE sites on the dates collected from the SFX pond. On October 16th, the SFX pond was the only data collected. On October 2nd, the Natural Science Technology Center was the highest water transparency level compared to the State University of New York at Fredonia and the SFX pond. On October 9th, the Sound to Sea Trinity Center was the highest water transparency level compared to the Main Street Intermediate School and the SFX pond. On October 23rd, the SFX pond was the highest water transparency level compared to Clay High School.

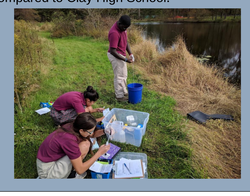


Image 2: This image shows another GLOBE student and classmate testing water quality at the pond study site.

Discussion

Interpreting Data

- In the first graph, the dissolved oxygen and water temperature shows that when the dissolved oxygen is low, the water temperature is high. When the dissolved oxygen rose, the water temperature dropped. Through research, the dissolved oxygen should be higher when the water temperature is colder because colder water can hold more oxygen. However, if there is a rapid temperature change in the water the dissolved oxygen will stay higher until the levels balance in the water which was the case on October 16.
- In the second graph, the pH and water temperature shows that when the pH was high, so was the water temperature. When the pH dropped, the water temperature dropped as well. Through research, when the water temperature increases or decreases the pH will shift as well. When the temperature increases, the pH will increase as well.
- In the third graph, the water temperature and water transparency shows that when the transparency levels are high, the water temperature levels are low. Through research, when the transparency levels are high, that means that the temperature levels should be low because there could be less rain and runoff and there is not much algae growing.
- In the fourth graph, the pH and phosphate shows that when the pH levels are high, the phosphate levels are low. Through research, when the pH levels are high, that means that the phosphate is not as toxic because it is less soluble. The data showed that the dissolved oxygen levels were good because a healthy dissolved oxygen level is between 4.0 mg/L and 10.0 mg/L, and the dissolved oxygen averages were between 6 mg/L and 10 mg/L.
- The data supports the hypothesis except for phosphate.
- The average of the phosphate for 5 weeks is 0.88 ppm which rounds to 1 ppm. There was an excessive growth of of water plants and algae which shows that the phosphate levels are not good. There was a mistake when writing it down but was realized and fixed.

Conclusions

- The research showed that the levels should be in a certain range to be considered healthy and they fell in that range, for our school and the schools that I found values for using the GLOBE ADAT.
- Weather and kits running out of different materials were a common problem during this project.
- This project applies to the real world because the quality of the water is important to every living thing. This is important because if the water quality is not good, then the things living in it and using it will suffer.

Image 3: This image shows the pond during the algal bloom.

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