The Quality of The Ottawa River in Respect to Golf Courses in Lucas County

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THE GLOBE PROGRAM
Global Learning and Observations to Benefit the Environment

Abstract

The purpose of this project is to examine how golf course treatments affect the water quality of the Ottawa River. The information was obtained through several tests in multiple areas to determine the quality of the water in different locations using two separate golf courses, Sylvania Country Club's course as well as Ottawa Parks. The tests used in this experiment were dissolved oxygen, pH level of the water, and whether the samples contained harmful bacteria like E. coli. To compare a sample was taken from a wooded area away from golf courses. Golf courses often use fungicides and pesticides which can all in turn be harmful to water quality.

Research Question

Asking Questions

How is the quality of water in the Ottawa river affected by running through golf courses?

Introduction

Content Knowledge

In order to keep the lush green and perfectly smooth golf courses most commonly seen, different types of chemicals are often used on golf courses. Despite the beauty and neat edges of golf courses, the runoff that comes from golf courses can be catastrophic. The United States Environmental Protection Agency explains that runoff picks up fertilizer, pesticides and other forms of pollutants that harm the quality of water. This is why it is important to understand what can be found in the water running through neighborhoods.

Hampton Golf recommends the use of fungicides in golf course treatment, but what is in the fungicides that are being used? The National Pesticide Information Center explains that many fungicides stay on the top or cuticle layer of the plant and are not absorbed. While this is important for plants with fungal disease this makes fungicides more susceptible to run off seeing as they reside on the outer layer of a plant. Fungicides have a wide range of "ingredients" stemming from natural elements and biological agents as well as harsh chemicals. The synthetic chemicals used in fungicides are extremely harmful to the quality of water the same is true of the pesticides used to keep insects off of golf courses.

Being told that the water quality of a river is poor explains that the river is probably unswimmable but what makes the quality of a river poor? Extreme pH levels and dissolved oxygen levels can indicate that the biological ecosystem of the river is poor. Often when the dissolved oxygen levels are low there is significant algae bloom that is making it difficult for other organisms to survive. Extreme pH levels can indicate many things. An extreme pH level can increase the solubility of elements and compounds and make toxic elements more mobile. This is why taking the pH can be a good indicator of the health of a river.

In conclusion the quality of water is a precarious commodity. Runoff and pollution is already at an incredible high and the treatment of golf courses most likely doesn't help the river fair any better. Fungicides to pesticides are filled with synthetic chemicals that often end up polluting rivers and harming the ecosystem and help harmful bacteria grow. In order to test how golf courses in the Lucas County area affect the Ottawa River water quality, dissolved oxygen, pH and harmful bacteria tests were done at two separate golf courses taking three samples from each golf course. In order to compare a sample was taken from an area of the Ottawa river not found near a golf course. Hopefully the samples show that the Ottawa river's quality is healthy and sustainable..

Research Methods

Procedure:

1. Go to Sylvania Country Club golf course
2. Collect three separate samples of water from the river running through the golf course
3. With a part each sample test the dissolved oxygen (glasses must be worn to avoid glass in the eye)
4. Record the dissolved oxygen data
5. Repeat steps 2-4 at Ottawa Park golf course
6. Travel to a part of the Ottawa River separate from any golf course and test the dissolved oxygen as seen in steps 3 and 4
7. After collecting all samples, calibrate the pH meter and calculate all pH levels for all seven samples
8. After the pH is calculated, pour a fraction of the water samples into the E. coli detection kit and screw lid tight, then shaking vigorously for 30 seconds (wear gloves and shake with hands)
9. After 48 hours, see the results of the E. coli; if color differs from initial shake E. coli is present
10. Collect data
11. Put all data into a data table and create graphs

Ottawa Park

Sylvania Country Club

GLOBE Badges

Be a **Collaborator**

All team members are listed including students from the same school or schools from around the world, along with clearly defined roles, how these roles support one another, and descriptions of each student's contribution. The descriptions clearly indicate the advantages of the collaboration. If the students collaborated with students from another school, describe how working with other schools improved the research.

Make an Impact

The report clearly describes how a local issue led to the research questions or makes connections between local and global impacts. The students need to clearly describe or show how the research contributed to a positive impact on their community through making recommendations or taking action based on findings.

Results

Analyzing Data

After the data collection process, the results show that the control trial (water taken from the Ottawa River near no golf courses) had a higher pH and dissolved oxygen level than all the other trials. This means that the water near no golf courses is, on average, less acidic and more alkaline than water near golf courses. A more basic pH represents a lower concentration of hydrogen ions (H+) in the water. It is also important to note that the Ottawa Hills area and the surrounding area of the Ottawa River is supported by significant masses of Silurian and Devonian limestone and bedrock. These rock types will often lead to the surrounding water having a naturally higher pH, which supports our findings, as not one trial had a pH below 7.98. For all of the test trials, the dissolved oxygen measurement in milligrams per liter (mg/L) varied. The average dissolved oxygen level for both of the golf courses combined sits at around 5.3 mg/L, while the control test trial had a dissolved oxygen level at 8, significantly higher than the dissolved oxygen levels from test trials near golf courses. The higher a dissolved oxygen measurement is, the more oxygen is in that body of water. A higher measurement of dissolved oxygen supports organisms living in that water and is a sign of a healthy ecosystem. A lower dissolved oxygen level, however, means the body of water is hypoxic, which could potentially harm aquatic life. All test trials detected no E. coli concentration in the water. This is important, as E. coli indicates contamination and poor water quality and usually caused by runoff, which would mean that the water is extremely unsafe to ingest or swim in.

Figure #1

Comparison of pH Levels Across Sites

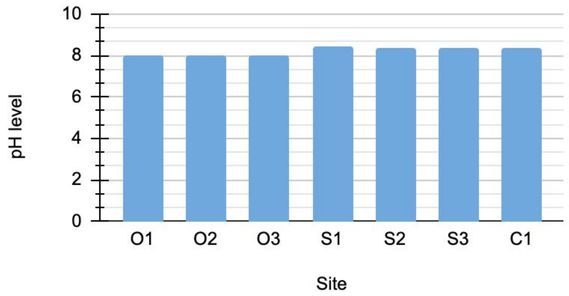
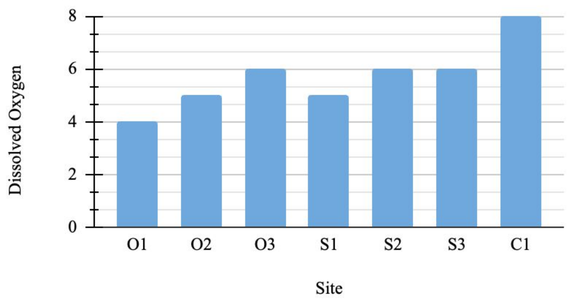


Figure #2

Comparison of D. O. Levels Across Sites



Discussion

Interpreting Data

The collected results supported our initial hypothesis. Originally, we believed that the overall water quality of the control sample taken from the Ottawa River not in the vicinity of golf courses would surpass that of trials with water taken by the golf courses. The results supported this, with the control trial's dissolved oxygen levels being an 8 and the pH being a slightly basic 8.40. The average of the trials taken from near the golf courses had a mean dissolved oxygen level of 5.3 and a slightly more acidic mean pH of 8.19. When these results were obtained, the outside temperature was quite cold, which might have led to heightened pH dissolved oxygen levels. However, with all test samples taken at around the same temperature, this can serve as a control variable. The slightly lower, more acidic pH in trials with water affected by golf courses makes sense as the fungicides put on golf courses often raise the pH of water around them. Experimental errors could include human error when interpreting qualitative data, such as the E. coli detection and the dissolved oxygen levels. If this experiment was done a second time, improvements could include getting all the data in one day instead of having to collect all samples three separate times to complete the tests needed and testing nitrate concentration to make our results even more credible with more data. This is incredibly important especially in Lucas County as the civilians are no stranger to water contamination. In August of 2014 Toledo experienced a three-day water crisis due to algae blooms. The data from this crisis showed the dissolved oxygen levels of Lake Erie to be around 2 mg/L. In comparison the levels of the Ottawa River were a much healthier level around 6-8 mg/L from the data collected during the duration of the experiment.

Conclusions

Drawing Conclusions & Next Steps

- Conclusions are supported by the results
- Gives a thorough and insightful explanation as to how the conclusion was reached
- Suggests improvements in the methods
- Discusses implications for future research
- Recommends follow-up research or actions to be taken
- Discusses possible future protocols that could be used
- Describes the impact of working with a project mentor

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