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Our research contribution to the G.L.O.B.E program determines the effect of runoff and if it significantly alters the water quality of Cove River in West Haven, CT waters over the time period of one year. This data is comparative data to other areas with similar characteristics to West Haven. West Haven becomes one small part of collective global data that analyzes how much runoff is contaminating our water. In addition, this data allows future scientists and students to assess over time West Haven's on contribution to environmental problems.

The research site used is West Haven's Cove River located on Jones Hill Road. Jones Hill is a high traffic road. It located directly behind West Haven High School and is less than a kilometer away from several restaurants and stores. The research and dig site was once the site of a home. It was donated to the West Haven Public by the owner who had found many Native-American artifacts.

Surface runoff occurs when the soil contains more liquids/water than its holding potential causing excess to run into nearby bodies of water (i.e. Cove River). The surface runoff tested is from a non-point source, where runoff collects before reaching the river. Because the runoff contains man-made contaminants from the buildings previously mentioned, it can be referred to as non-point source pollution. In addition, there is land body existing between the river and the buildings. Any pollutants in the ground may become a factor. Furthermore, the site is made public. Unfortunately, students from West Haven High School along with residents of West Haven, CT do have the ability to pollute the land/water.

Runoff can be measured through various molecules within the water. Sulfates and phosphates will be focused on greatly as these can affect other factors such as dissolved oxygen levels. Higher levels of phosphates and sulfates will lead to lower dissolved oxygen levels. If levels drop significantly, effects can be detrimental. For instance, Algae can accumulate and if too much develops (along with a few other factors) algal blooms can become prevalent. Another disadvantageous factor of low dissolved oxygen levels is the potential decrease in marine life. Without enough dissolved oxygen, many organisms may die. Additionally, we plan to test pH levels and temperature to determine if these are also caused alterations.

It is hypothesize that if runoff enters Cove River, then dissolved oxygen levels will decrease, and therefore will cause an increase in eutrophication. The independent variables used are the water quality components such as DO and phosphates. The dependent variables are the measurements obtained from each component. The control of our experiment is water at room temperature.

Materials

1. Vernier Probe Wear
2. Bucket
3. Aquarium Water Testing Kit
4. Water Sample Jar

5. Thermometer
6. Goggles

Procedures

1. Gather materials at the location site.
2. Observe the environment (weather, temperature, clouds, etc).
3. Take the bucket, drop it into the water, and fill it with water from the testing location.
4. Immediately take the temperature of the water (To avoid impact from the atmosphere's temperature)
5. Use the probe wear to immediately find out the amount of dissolved oxygen, conductivity, salinity, and pH.
6. Use the water sample jar to collect a sample of the water.
7. Use the water testing kit to find out the amount of ammonia, nitrate, nitrite, phosphate, and high range pH.
8. Repeat steps for each of the location sites being tested on different days for proper analysis.
9. Turn chemicals used over to safety officer or teacher for proper disposal.

Observations

9/30/11

It had rained the day before in West Haven at Cove River. The canopy is full. Also, it was a very sunny day. This was the first day of observing cove river, so Hurricane Irene had to be taken into consideration from about a month prior to this day. It was 20.2 °C this day.

10/21/11

This day it was very sunny, but it had rained two days prior. There was cumulus stratus/ nimbus clouds (the grey-white color ones) covering 5-10% of the sky. It had been very windy the past month and it was starting to feel like fall. It was 14.4°C this day.

11/18/11

This day it was very sunny and no clouds were in the sky. Almost all the leaves from the trees were gone and it was very windy. It rained the night before as well as many consecutive days before it. It was cold this day and it was about 12°C.

1/20/12

There was no cloud cover this day. It was very cold and was about -1°C.

2/17/12

It rained the night before this day and carried over into the morning. This morning it was also at 100% cloud covered but cleared up to about 60% cloud cover by 10:15am.

Water Testing	10/21/11	11/18/11	1/20/12	2/12/12
Temperature	14.4*C	9.7*C	1.2*C	6.7*C
Dissolved Oxygen	2.5 mg/L	12.7 mg/L	8 mg/L	9.3 mg/L
Conductivity	302.2	321.5	n/a	n/a
pH	6.4	7.35	7.2	7.2
High Range pH	7.6	n/a	7.4	n/a
Nitrate	5.0 ppm	0 ppm	5 ppm	3 ppm
Nitrite	0 ppm	0 ppm	0 ppm	1 ppm
Ammonia	0.5 ppm	n/a	n/a	2.0 ppm
Phosphate	0 ppm	n/a	0 ppm	n/a
Salinity	none	none	none	0.3ppt

Conclusion

It is hypothesized that if runoff enters Cove River, then dissolved oxygen levels will decrease, and therefore will cause an increase in eutrophication. Based on our data, we can conclude that this is not true and runoff in West Haven's Cove River has not caused an increase in dissolved oxygen levels. Therefore eutrophication has not increased. Majority of the data shows minimal change in any of the levels concerning dissolved oxygen, sulfates, phosphates, nitrates, nitrites, and pH. In addition, with our observations, we can imply that levels tend to increase more when it precipitates relatively close to the time of data collection.

There were a few experimental errors during this lab. First some water samples were taken back to West Haven High School to be tested rather than being tested at the Cove River site. This exposed the water samples to atmospheric conditions potentially causing changes in water quality measurements. Furthermore, the amount of time used for water quality solutions differed and were not accurately taken. These errors do not necessarily make the experiment invalid as the measurements are usually plotted in such a way that the average may be analyzed.

Recommendations for future research include collecting the data more quickly and efficiently. For example, water quality must be done as soon as the water sample is collected from Cove River. This especially goes for temperature and dissolved oxygen. Temperature may change quickly when the sample is exposed to the atmospheric temperatures. Additionally, dissolved oxygen measurements become less

accurate over time. This is because DO evaporates from the water. Also, heat hastens this process. To solve these issues, one may want to use a more heat efficient container.

This relates back to biology as eutrophication can potentially have detrimental effects on the environment. These effects first influence water quality which in turn affects life with the water of Cove River/ Estuary Sound. If population of such are harmed then species above that population in the food web are also harmed. Pristine water quality measurements are essential to a healthy living environment for all species.

Title: The Effect of the Different Runoff Chemicals in Cover River on How They Alter the Water Quality

Name: Christina Lavery

Date: 09 May 2012

Teacher: Mr. Dickson

Class: AP Biology

Introduction

The purpose of our research contribution to the G.L.O.B.E program is to determine whether runoff is significantly altering the water quality of West Haven. This becomes comparative data to areas similar to West Haven. Consequently, the data collected can be used to assess our contribution to global warming and other environmental problems. The area in West Haven used to conduct this experiment is a location called Cove River. West Haven's Cove River is located behind West Haven High School and relatively close to various restaurants and stores. It serves as a research and dig site. From September to March, an abundant amount of data was collected to determine if the runoff had any effect on Cove River or the surrounding environment. Prior to conducting this experiment, it was hypothesized that runoff would have a significant impact on the water quality because Cove River is surrounded by a socially active environment, which gives it access to a greater chance of pollution running-off into it. Each day at Cove River, the levels of phosphate, nitrate, ammonia, nitrite, dissolved oxygen, salinity, pH, and conductivity were tested; these were all different independent variables. The dependent variable has to do with measuring and observing if the IV changed from the last time it was tested as well as to gather new data. This will show if it has altered the water quality in any way.

Surface runoff occurs when the soil contains more liquids/water than its potential causing excess to run into nearby bodies of water (i.e. Cove River). The surface runoff tested is from a non-point source, where runoff collects before reaching the river. Because the runoff contains man-made contaminants from the buildings previously mentioned, it can be referred to as non-point source pollution. In addition, there is land body consisting between the river and the buildings. Any pollutants in the ground may become a factor. As previously stated, Cove River is located in an area surrounded by many restaurants, a school, gas stations, stores, and more. If any of these places encounter any type of chemical problem or dump waste from their businesses', then it could cause the pollution that will eventually runoff into the Cove River. Although this is a hypothetical situation, there is a great chance that the wastes from these places can potentially cause contamination in Cove River.

The runoff may be tested by measuring various molecules in the water. The main ones that signify runoff are sulfates and phosphates. These, in turn, alter many other aspects of water such as the dissolved oxygen levels, pH, and temperature. Heightened levels of sulfates and phosphates can also lead to environmental problems such as algal blooms. If the levels of any

of the nutrients/chemicals begin to rise, it will show that there is an excess amount of runoff coming into Cove River. It may be a source of the social environment surrounding Cover River, or it may have to do with the river itself.

Materials

1. Vernier Probe Wear
2. Bucket
3. Water Testing Kit
4. Water Sample Jar
5. Thermometer
6. Safety goggles

Procedures

1. Gather materials at West haven High School.
2. Walk to Cover River with the materials.
3. Observe the environment (weather, temperature, clouds, etc).

4. Split into the desired groups to conduct the experiment.
5. Take the bucket, drop it into the water, and fill it with water from the testing location.
6. Immediately take the temperature of the water.
7. Use the probe wear to find out the amount of dissolved oxygen, conductivity, salinity, and pH immediately after finding the temperature.
8. Use the water sample jar to collect a sample of the water.
9. Repeat steps for each of the location sites being tested.
10. Regather the materials and walk back to West Haven High School.
11. Get safety goggles.
12. Test the water sample to find out the amount of ammonia, nitrate, nitrite, phosphate, and high range pH.
13. Record all data gathered from the day in a log book.
14. Clean up the testing kits.

Observations

9/30/11

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Nitrite	0 ppm	0 ppm	0 ppm	1ppm
Ammonia	0.5 ppm	n/a	n/a	2.0 ppm
Phosphate	0 ppm	n/a	0 ppm	n/a

Salinity none none none 0.3ppt

Conclusion

The hypothesis of this experiment was runoff would have a significant impact on the water quality because Cove River is surrounded by a socially active environment, which gives it access to a greater chance of pollution running-off into it. This hypothesis turned out to be true. Overtime, there became noticeable changes in different chemicals running off into the water. Every time nitrite was tested prior to the February observation, there had been no

nitrite present in the water. Then on that day, the nitrite level went from being 0ppm-1ppm. This shows that there was some kind of factor effecting the runoff into Cove River which created a small amount of pollution. Also, prior to the February observation day, the amount of ammonia in the water only reached 0.5ppm. But on this day, the ammonia level in the water spiked to 2ppm. This also shows that there is some factor contributing to the runoff leading into Cove River. Also on this February day was the first time any salinity became present in the water.

This experiment, just as all, has many sources of error, both human and mechanical error. One source of error was when gathering a sample of water from one of the sites, too much time may have been taken between taking the water out from the river and getting the temperature. This produced an inaccurate reading of the temperature. This same error could have also been seen when taking the dissolved oxygen reading, because that too had to be taken immediately after retrieving the water sample. Once the water has been exposed to atmospheric conditions, the dissolved oxygen will start to evaporate. If the sample is left there for too long, the reading of the dissolved oxygen will not be accurate. Another source of error lies within the testing of the water for the runoff chemicals. There was a different way to test each chemical; this was done by using a pipette to insert the appropriate number of drops of the solution into the water sample. There is a possibility that one could have put in too many or too little drops of the tester. This will change the color of the sample which reads the amount of that chemical in the water. A third source of error would be when reading the color of the water sample to decide how much of that chemical is in the water, it could have been read wrong. This would give an inaccurate amount to how much of it is actually in the water. The mechanical error in this experiment lies in the fact that no piece of technology is 100% accurate, so the readings on the probe wear are not always accurate.

Although there was a fair amount of error in this experiment, it does not make it invalid. Every person involved in conducting the experiment took extreme care when performing every step in the procedure. If a mistake was made, it was made very infrequently. There was not enough error to conclude that this experiment was invalid. For the most part, every step was followed precisely exactly how it should be to produce the most accurate results possible. Plus, if there was an error it would not be so significant as to really alter any results let alone make the experiment invalid.

There are ways that this lab can be improved. One way to improve it would be to extend the time the experiment takes place. The time span used in this experiment was approximately 8 months. With an experiment like this, it could be very beneficial to expand the time frame to years. This will show more results and see if pollution occurred over a longer period of time because its harder to see when it is only an eight month period. Another way to

improve this lab would be to retrieve the water sample for quickly. What this would allow one to do is to reduce the amount of time there is before the temperature changes and the dissolved oxygen evaporates. This will improve the accuracy of the results in general because it allows for better readings that imply better results. Another way to improve this experiment would be to get another water testing kit that will show the frequency of different chemicals in addition to the ones already being tested. This will allow for more insight on our polluted Cove River really is and how much runoff is actually going into the river. This will allow for more efficient readings on the type of pollution in Cover River as well as the types of runoff and its source that is effecting the river.

There are many future research projects that can be designed to further knowledge on this topic. Other local, international, or even national biologists/scientists can locate themselves at an area similar to Cove River. The can perform a similar or even the same experiment as this is one, which can compare data around the world. Other bodies of water that produce a higher level of social activity can also be used for future research projects. This will allow biologists to see if this more social environment has any further effect on the amount of runoff altering the water quality. The size, temperature, location, and depth all are other factors that can be tested to perform a different research project to see if it will have any effect on the runoff. Also, one may want to experiment with the social environment surrounding the body of water to determine where the origin of the runoff begins. Also this will prove if the social environment actually has to do with the pollution of a body of water.

This entire experiment is very relevant to biology. It perfectly connects to the idea of eutrophication. Eutrophication is a process by which nutrients, particularly phosphorus and nitrogen, become high concentrated in a body of water, leading to increased growth of organisms such as algae or cyanobacteria. This entire experiment was based on certain chemicals and nutrients that were found in the water over time. The algae that is collected in the water overtime as a result of eutrophication is what produces the dissolved oxygen. As the results showed, there was a different amount of dissolved oxygen almost every time the water was tested. This proves that eutrophication had some of effect in Cove River.