

The Effect of the Location of Bodies of Water in Mercer County on Water Quality

By: Lily Orn 8A
Science Fair 2022

Background Research

The purpose of my science fair project is to determine the effect of the location of bodies of water and what different environmental factors they have on its water quality. Some of the main environmental factors are animal life, human traffic, runoff, weather, and pollution. NJ Spotlight News states “But stormwater runoff continues to be a big source of impairment to water bodies because regulation only addresses new development.”, regarding water tests conducted in 2019. Stormwater runoff has been proven to be a leading issue of the declining water quality within the bodies of water of New Jersey. Runoff can allow different particles, and bacteria into the water which affects the water quality. Human activities such as farming, livestock, pest control, and various others use chemicals that have the potential to pollute drinking water. Human traffic within the area of the body of water can also affect the water quality. Whether or not the body of water is open to the public as a dock for kayaking, canoeing, or swimming can affect the water quality as well. It can also be affected by natural components such as arsenic, radon, and uranium. The New Jersey Integrated Water Quality Assessment Report also states that 43% of waters did not meet the standard drinking water.

Background Research

My science fair project is testing the pH, nitrates, nitrites, alkalinity, sodium chloride, sulfate, and what the water samples look like underneath a microscope. pH stands for “potential hydrogen” and it is the quantitative measure of the acidity or basicity of aqueous or liquid solutions. The U.S. Environmental Protection Agency recommends that the pH level of drinking water should be from 6.5-8.5 on a 0-14 scale. Nitrate is a compound that naturally occurs and has many man made sources. Nitrates can be found naturally in some lakes, rivers, and groundwater. The cause of nitrates are dead fish and fish waste. Consuming a large amount of nitrates can affect how blood carries oxygen. It can cause Methemoglobinemia (highest risk in babies under 6 months). Nitrites are caused by oxidation of ammonia by ammonia oxidizing bacteria. There is also nitrifying bacteria which converts ammonia to nitrites or nitrates which is part of the nitrogen system. Alkalinity is the buffering capacity of a water body; a measure of the water body to neutralize acids and bases and thus maintains a fairly stable pH level. Sodium chloride is a colorless crystalline compound naturally occurring in sea water and halite. Sulfate is a very common compound found in all water through the dissolution of the aquifer media. It consists of a single sulfur ion and 4 oxygen ions (SO_4). Some of the most common microorganisms are arthropods, bacteria, protozoa, hydra, and algae.

Testable Question

How does the location of a body of water affect its water quality (purity)?

Hypothesis

If the amount of animal life, human traffic, and runoff increases, a body of water's quality (purity) compared to tap water will decrease because those factors can negatively affect the quality of the water.

Materials

- Sample of water from Colonial Lake
- Sample of water from Pond Run
- Sample of water from Carnegie Lake
- Sample of water from Rosedale Lake
- Tap water sample (unfiltered)
- Varify Complete Water Test Kit (16 parameter water test strips)
- Wolfe Microscope
- Petri Dishes
- Pipettes
- Containers

Procedure

1. Collect water samples from each location and the tap water from your kitchen sink (not filtered). Make sure to collect each sample in separate containers. Be careful while collecting your samples not to touch your face or get any water in your eyes, nose, or mouth.
2. Take note of any environmental factors that may affect the water quality of your sample. (human activity, animal life, runoff, and pollution)
3. You can compare all samples based on appearance. (How dirty the water was on a scale of 1-5)
4. Once you complete step 3 take your water test strips and test all samples individually. Make sure to look at the directions for the test strips, most test strips need to be read within a certain amount of time to be the most accurate. Record the tests for all samples.
5. Then, take one of your samples and use a pipette to put a drop of your sample onto a petri dish. To obtain the clearest image underneath the microscope, adjust the level of focus and the size of the microscope. Make sure to take images of anything found. (optional step)
6. After, if you are looking at the samples underneath a microscope repeat step 5 for all samples.
7. Finally compare the data found of all water samples including any data taken from the test strips, images, and any other data recorded.

Safety Procedure

1. Be careful when collecting water sample to not touch your face.
2. Do not get any of the water samples in your mouth, ears, or nose.

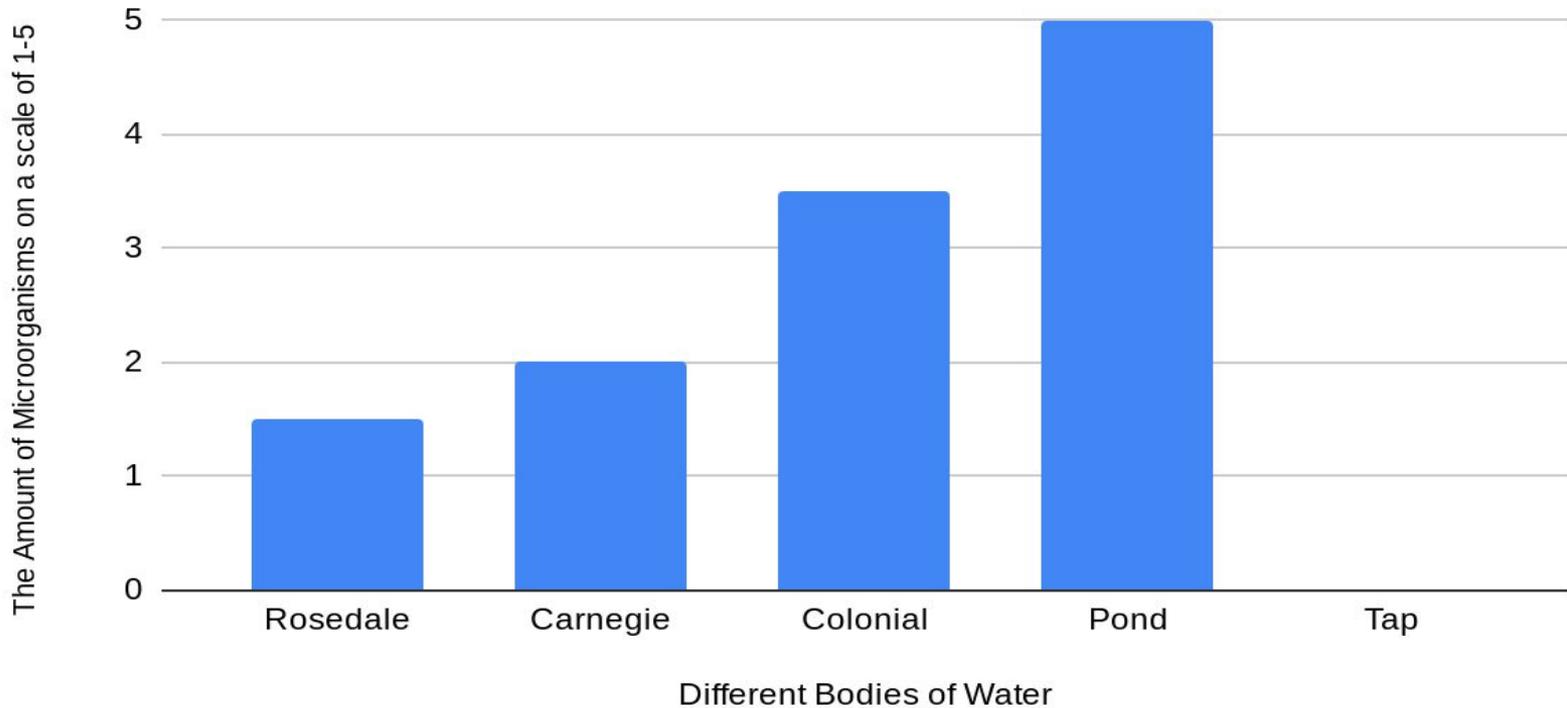
Different Bodies of Water	Rosedale Lake	Carnegie Lake	Colonial Lake	Pond Run	Tap Water
The Amount of Microorganisms on a scale of 1-5	1.5	2	3.5	5	0
How Dirty the Water was on a Scale of 1-5	2	3	3.5	5	0
pH level (0-14)	6.7	6.0	6.5	5.9	7.0
Nitrate Level (0-15)	0	10	10	10	0
Nitrite Level (0-80)	0	0	0	1	0
Sodium Chloride Level (0-2000)	100	250	100	100	0
Alkalinity (0-240)	60	30	40	20	80
Sulfate Level	0	250	0	100	0

Data Table (1) (data table made by student)

	Rosedale Lake	Carnegie Lake	Colonial Lake	Pond Run	Tap Water
Description	<ul style="list-style-type: none"> - Water was frozen when the sample was taken. - Sample was taken from further out in the lake from the boat dock. - The water had trash, leaves, and sticks frozen in the water. - The area has human activity because there is a park. The lake is also used for kayaking and canoeing during the summer. - The middle of the lake was still liquid and many geese were there. 	<ul style="list-style-type: none"> - Water was frozen when the sample was taken. - Some water further out from the shore was still flowing. - Sample was taken closer to the shore. - The water was clean for the most part, but had some trash in it. - There is a lot of human activity in the area because there is a trail nearby for walking. 	<ul style="list-style-type: none"> - Water was frozen when the sample was taken. - The sample was taken close to the shore. - The water had many sticks, leaves, and some trash. - There is a lot of human activity. There is a nearby park, tennis court, and walking trail. Colonial Lake is also sometimes used for fishing. - There is a high population of geese in the area. 	<ul style="list-style-type: none"> - Water was frozen when the sample was taken. - The sample was taken close to the shore. - The water had many small sticks, and leaves in the water. - There is a lot of human activity in the area. There is a large nearby park, and biking/walking trail. - There is a high population of different kinds of fish during the warmer months. 	<ul style="list-style-type: none"> - Sample was taken from the kitchen faucet. - The water is from Trenton Water Works.

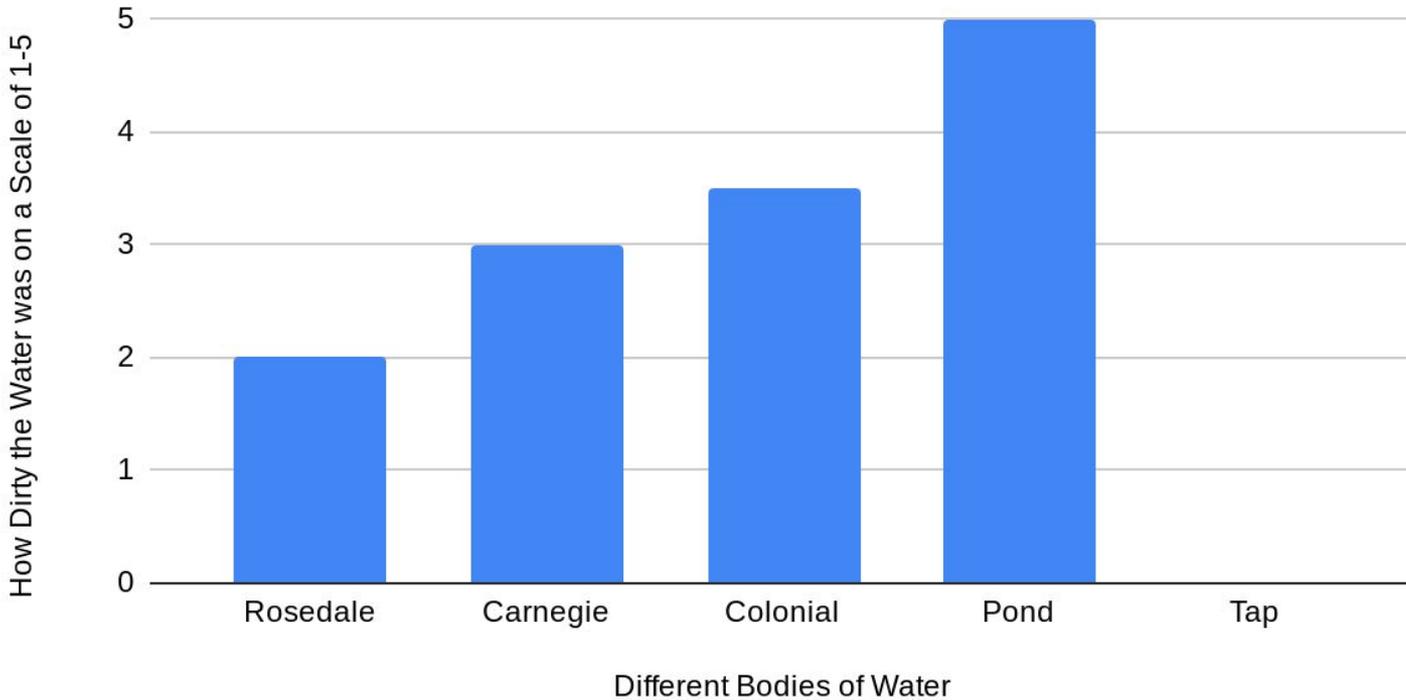
Data Table (2) (data table made by student)

The Amount of Microorganisms on a scale of 1-5 vs. Different Bodies of Water



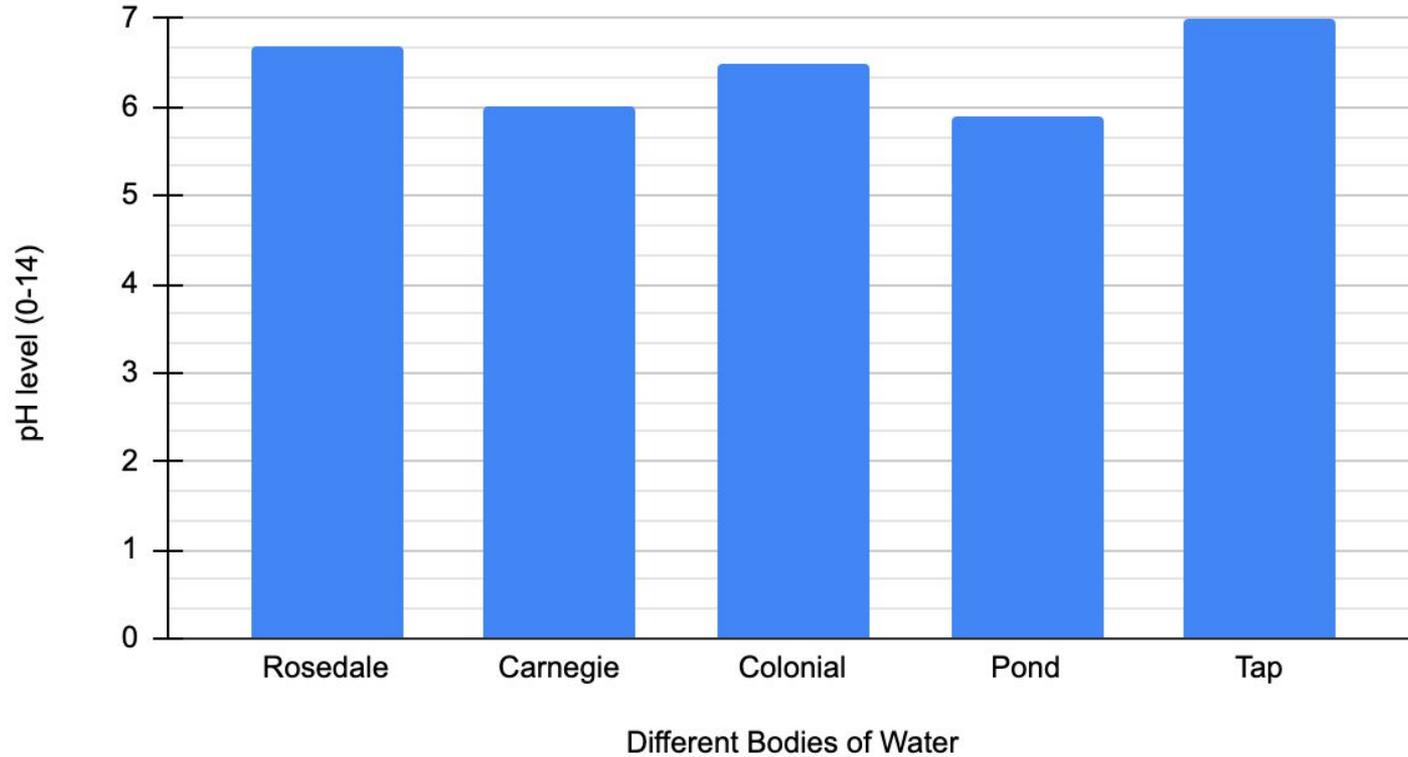
Data Chart 1 (chart made by student) - The Amount of Microorganisms on a scale of 1-5

How Dirty the Water was on a Scale of 1-5 vs. Different Bodies of Water



Data Chart 2 (chart made by student) - How Dirty the Water was on a scale of 1-5

pH level (0-14) vs. Different Bodies of Water



Analysis

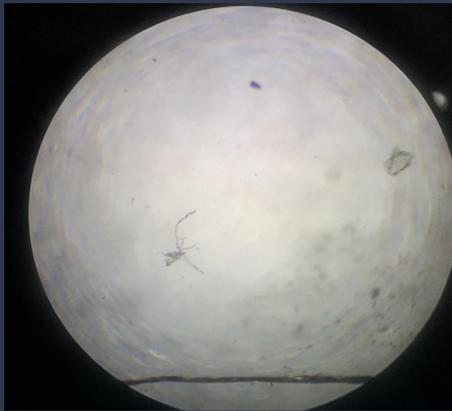
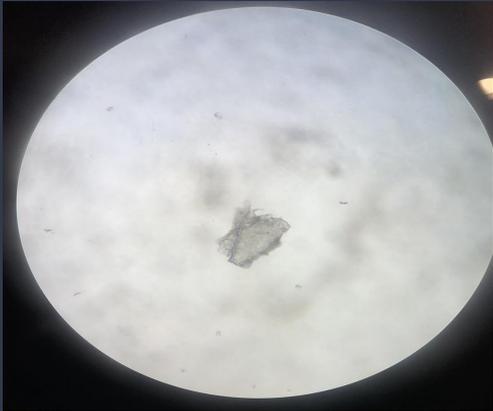
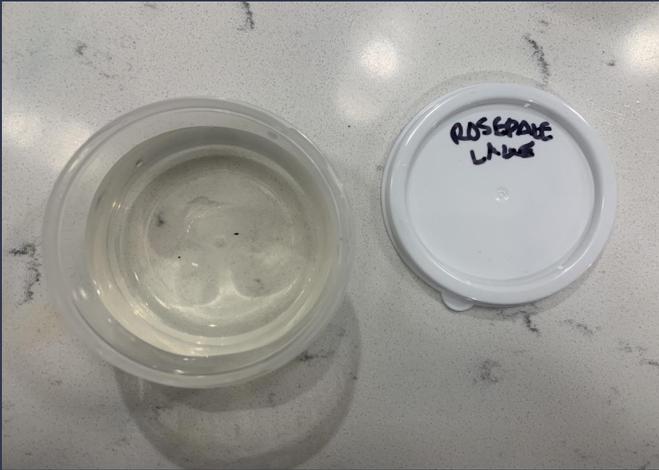
The location of a body of water does affect the water quality. My water samples were all taken from different lakes/ponds that have different environments. The body of water that the overall out of range test levels was Pond Run. Pond Run has a high amount of animal life in the area, which includes fish, snakes, birds, and squirrels. It has a high amount of human traffic within the area. It appears that there would also be a high level of runoff that goes into Pond Run. Additionally I found some trash around Pond Run. In comparison, my water sample that in general was closest to my tap water sample was Rosedale Lake. Rosedale did appear to have a high animal rate, but the only animals seen were geese that were further out in the lake. The area did have some human activity, but it was minimal. There seemed to be some runoff, but not in the area I collected my data from. There was some trash near the lake, but it was overall clean. My evidence supports my claim because it proves that my hypothesis was correct. Pond Run had higher levels of animal life, human traffic, runoff, and pollution compared to Rosedale Lake. The nitrite/nitrate levels of the water samples of both bodies of water corresponds with my background research. Pond Run had a nitrate level of 10 and nitrite level of 1 while Rosedale Lake had a nitrite and nitrate level of 0. Fish are more common in Pond Run that would result in more ammonia which would cause higher nitrite/nitrate levels. The pH levels of the 2 bodies of water were also different. Rosedale had a pH of 6.7 and Pond Run had a pH level of 5.9. Rosedale Lake's pH was within the recommended level of pH for drinking water while Pond Run was not. Overall the location of the body of water and the environmental factors did have an affect on the water quality.

Analysis- 2

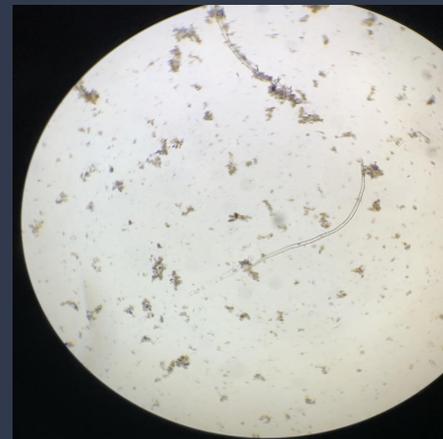
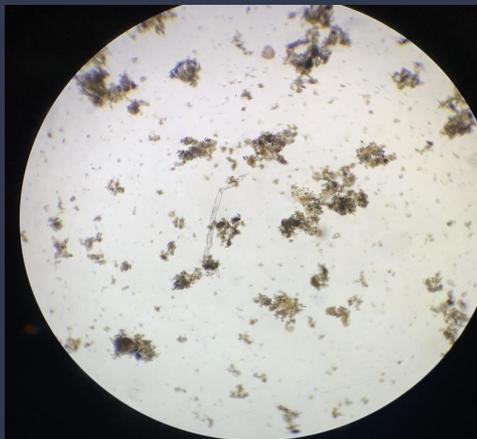
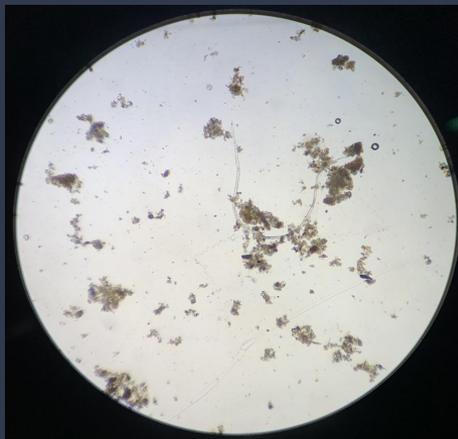
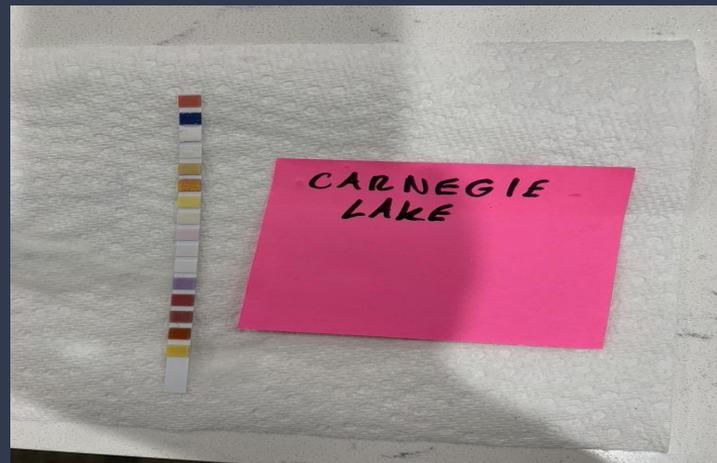
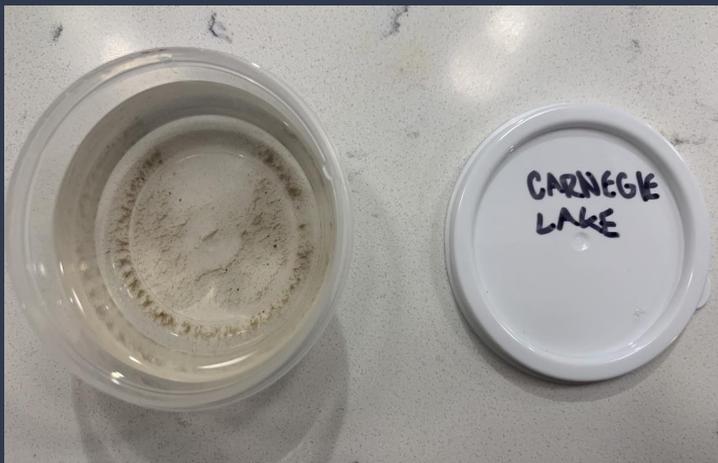
The water sample from Rosedale lake had very little microorganisms which was expected because the sample seemed mostly clean and had few visible particles. The only microorganisms seen underneath the microscope was algae. Overall Rosedale Lake was exceptionally clean, and had little trash. Carnegie Lake was moderately clean as well, but there was a much higher amount of human activity in the area. There also seemed to be some runoff, but specifically around the area I got my sample from.

Underneath the microscopes I only found minimal microorganisms such as algae. Colonial Lake's results fit with my hypothesis because the water sample was dirtier even to the naked eye. There is a high level of human activity, animal life, and runoff. In the area I collected my sample from there was a downhill slope which could cause stormwater runoff. Underneath the microscope I found small mobile microorganisms, a high level of algae, and what appeared to be bubbles of oxygen. Pond Run's results in general are very different from the other samples. The area surrounding Pond Run had a high level of animal life, human activity, runoff, and pollution. Pond Run has an exceedingly high level of stormwater runoff because of the weather in the area and the downhill slope going towards the water. The water sample I collected was very murky and contained some dirt. While looking at the sample underneath the microscope I found multiple arthropods, copepods to be specific. I also found a chironomidae larva, which is a bloodworm larva. A possible source of error in this experiment is, due to the lakes being frozen at the time, the sample collected from Rosedale Lake was taken from further out in the lake. While all other samples were collected closer to shore.

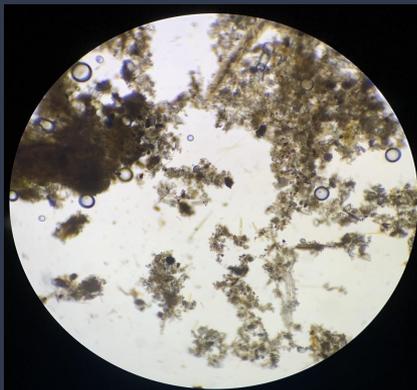
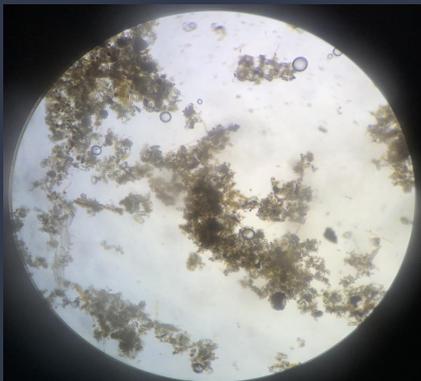
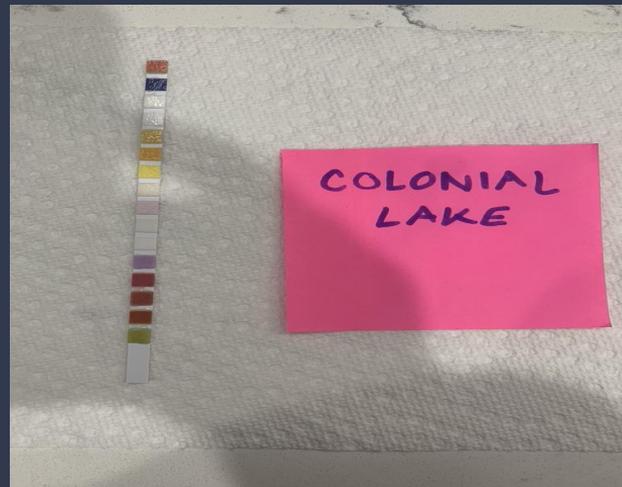
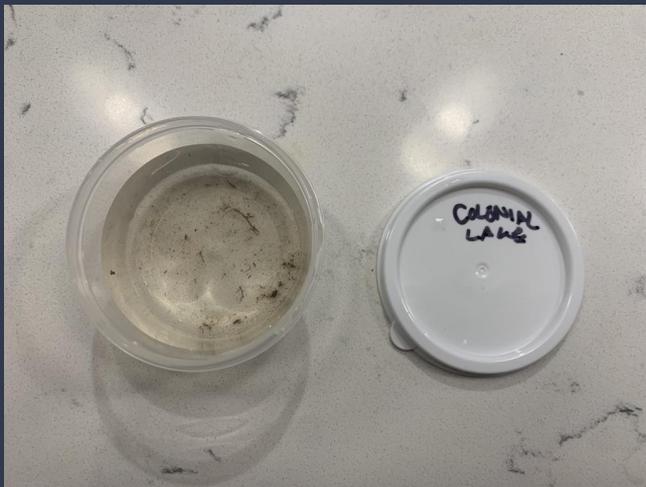
Rosedale Lake Photos (all photos taken by student)



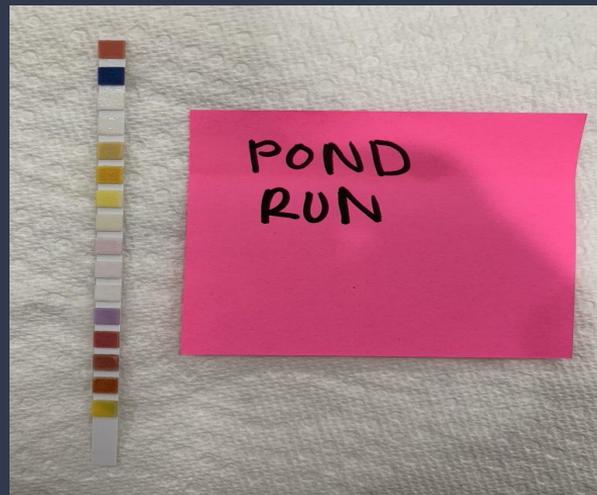
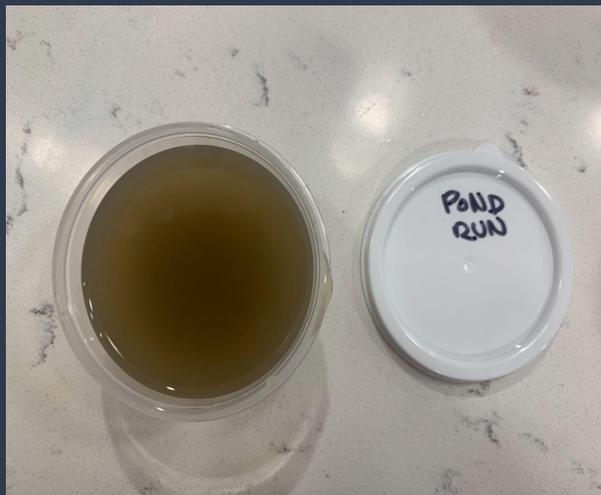
Carnegie Lake Photos (all photos taken by student)



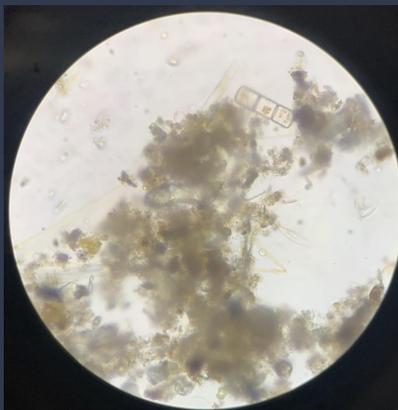
Colonial Lake Photos (all photos taken by student)



Pond Run Photos (all photos taken by student)

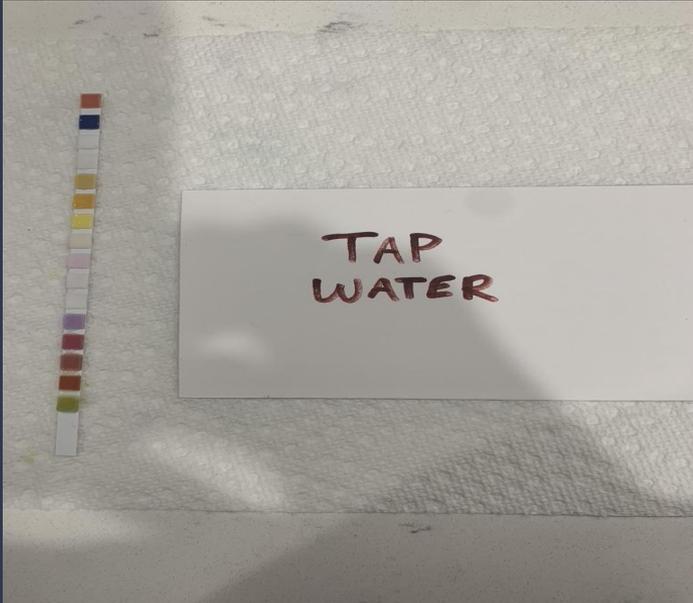


Chironomidae Larvae



Copepod

Tap Water Photos (all photos taken by student)



Conclusion

Based on a survey of differences between the sampled lake/pond areas within Mercer County, NJ, it is apparent that the level of human activity is correlated with the quality and purity of water from these areas, as compared to clean tap water. Rosedale Lake is a relatively unpolluted body of water in terms of human activity compared to Pond Lake. If I were to do this project again I would measure the water quality in the summer because this is more representative of wildlife impact on the water.