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Intro/Methods Rough Draft  
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## *E. coli* Levels of Lake Wingra and Nearby Springs

### Abstract:

The City of Madison Public Health Department examines regularly the levels of bacteria (specifically *E. coli*) of particular lakes to determine whether or not the lake is safe to swim in. The Vilas beach has been shut down because of the high levels of *E. coli*. Even though the beach has been shut down, the rest of the lake remains open. However, if part of the lake (the beach area) is considered couldn't the rest of the lake be considered unsafe as well? To fully understand how *E. coli* works and affects the lake we tested the lake water at various locations. After collecting our data, we compared it to previous studies. This allowed us to see whether there was a change (increase or decrease of *E. coli*). Also, we discussed why different locations may have a higher concentration of *E. coli* and all factors that could influence the amount of *E. coli*. Our results showed that right now the lake is safe to swim in and that the levels of *E. coli* have decreased from previous years.

### Introduction

Wisconsin has been known for its many lakes, but it has also been known for its pollution of the lakes. "40% of Wisconsin's waters still do not meet federal water quality standards (Kohler 2003)." There are many pollutants created (such as salt, waste from animals, sewers, etc) that can find its way to the lakes. Because of these unhealthy pollutants, beaches and lakes can become unsafe; making them unavailable for the public to use for recreation.

Coliform is a group of bacteria that is found on plants and animals. It is characterized by its rod shaped form. One type of coliform bacteria specifically is *E. coli* (Org.elon.edu 2005). *E. coli* is used as an indicator of the amount of bacteria in a lake because it is one of the easiest bacteria out of all of them to test for.

One of the many reasons that a beach can be shut down has to do with high levels of *E. coli* in the lake itself. *E. coli* is a bacterium that exists in many different strains. *E. coli* can be found in humans, but there is a specific strain (*E. coli* 0H157) that is harmful and can cause disease to people and animals. *E. coli* can get into the lake in many different ways. The sanitary sewer system that is outside of Mazzuchelli is extremely close to the lake. If a leak were to occur, this would cause the sewage to run into the lake. Also, *E. coli* makes it way into the lake due to the fecal matter created from different animals (EPA). If the level of this type of *E. coli* exceeds a certain amount, it will cause Vilas Beach on the lake to be shut down. This is a problem that everyone needs to know about because most people use a beach at some point in their lives. It is important for people to know what

lakes are posing health risks. If a human gets sick from *E. coli* it is entirely possible for them to have bloody diarrhea and severe stomach cramps. In children around the age of 5, *E. coli* can cause kidney failure and a risk of death (EPA). The beach on Lake Wingra, which is right down the street from the Edgewood Campus, has been known to be shut down due to these issues. Many studies have been conducted regarding the bacteria levels of the beach, but if the beach is considered unsafe, there is a possibility that the entire lake would become an issue too, which is why it is important to look at the overall trend of *E. coli* as well. Once one can see the bigger picture, finding a solution to such a problem is easier. We feel that since the beach has been shut down numerous times, that there are some preventative measures being taken to decrease the amount of *E. coli* and other forms of bacteria in Lake Wingra.

## Methods

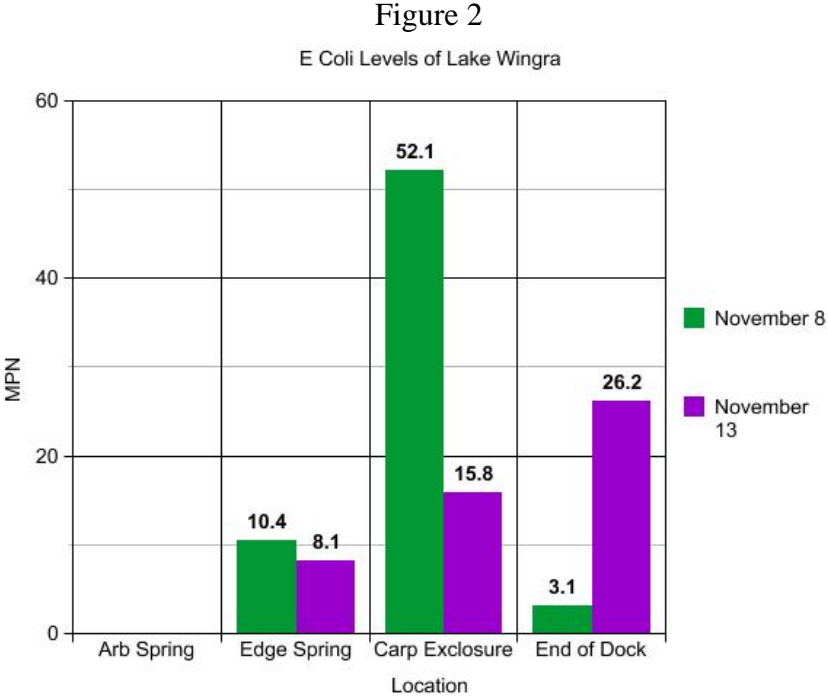
On November 8, 2007, we collected six samples from the 2 springs, the carp enclosure, and other parts of the lake to get a comparison of the *E. coli* levels in each of those parts on the lake. We put our samples in sealed, sterile containers we filled the container to the 100 ml mark and labeled the location of each sample we tested the samples by using the IDEXX Quanti-tray Colilert test. The IDEXX test is an enzyme assay for both general coliforms and *E. coli*.

## Results

*E. coli* & Coliform Levels of Lake Wingra (Figure 1)

	Nov. 8	Nov. 8	Nov. 13	Nov. 13
Location	Total Coliform (MPN)	<i>E. coli</i> (MPN)	Total Coliform (MPN)	<i>E. coli</i> (MPN)
Arb. Spring	198.9	< 1	691.0	< 1
Edge. Spring	2419.6	10.4	2419.6	8.1
Carp Exclo.	829.7	52.1	1299.7	15.8
End of Dock	2419.6	3.1	2419.6	26.2
Sping Ent.	2419.6	12.2	N/A	N/A
Middle Lake	2419.6	2	N/A	N/A

Data from Figure 1 is displayed in the form of a graph for the samples collected on November 8 and November 13 to better see the trends of the *E. coli* levels. (Figure 2)



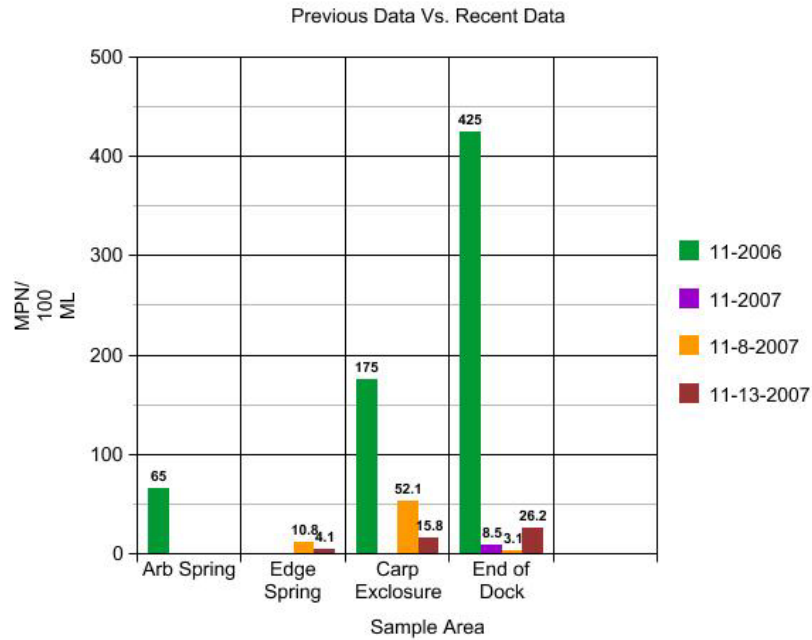
Data from previous years. (Figure 3)

Figure 3  
Previous *E. coli* Data for Lake Wingra

	Nov.07(Kane)	Nov.06(Kong and Koch)
Location	<i>E. coli</i> MPN	<i>E. coli</i> MPN
Dock(Pier)	8.5	425
Enclosure	N/A	175
NM Spring	N/A	65
Bridge	3	N/A
Beach	9.6	N/A
Park	42	N/A

Below is a graph of the previous data compared to our own findings of *E. coli* levels.(Figure 4)

Figure 4  
Previous Data Vs. Recent Data



## Discussion

Our results showed a tremendous decrease of *E. coli* when compared to the previous years. This led us to believe that preventative measures against *E. coli* were being taken.

In comparison to previous years it is very evident that the local community has identified the condition of the lake to be an issue and has been working to improve its quality. For example Kong and Koch sampled 425 MPN *E. coli* from the dock in 2006; just one year later our samples along with Lorman's only contained 3.1 and 26.2 MPN, a drastic change. It should be considered that the areas of samples had similar results. Both Kong and Koch's and our own had the highest sample readings for *E. coli* at the dock and enclosure. This could lead us to believe there is a factor that allows *E. coli* to reproduce well there such as poor water current, ample sun, or a mass of animals producing fecal matter.

An interesting aspect was the amount of *E. coli* present at the entrance of the Arboretum spring compared to the amount in the Edgewood Spring itself. The entrance had 11 MPN/100 ml compared to the actual spring of having zero positive, which could be due to the amount of water flowing and moving around in the spring. The movement of water could allow it to clean itself. However, in the entrance there was no movement in the water which means that the *E. coli* could form denser, populated colonies.

There are various factors that may explain why certain areas contain more *E. coli* than others. First, we thought that the carp enclosure would be extremely clean and free of the bacteria due to the lack of carp. However, after seeing the results, we decided high levels of *E. coli* could be due to the seagulls that rest on the outskirts of the area; dumping fecal matter into the enclosure. Also the lack of a strong current in the enclosure would allow the *E. coli* bacteria to form larger colonies.

Next, the Edgewood Spring samples taken by us and Lorman differed. This could be the result of because the great amount of sediment in our sample. Lorman managed to get a clean sample, which made the positive cells drop by half of what we came up with. This led us to believe that the plants and sediments themselves contained a lot of *E. coli* as well. Previous studies have shown that *E. coli* can reside in the soil. For instance, in lagoon one there is about 3700 MPN/100 of *E. coli* located in the sediment alone (Dvorak). Now we didn't test the lagoon area; however, this bit of data proves that sediment could've increased the amount of *E. coli* located in an area.

Why the Edgewood Spring contained more *E. coli* than the Arboretum spring caused much confusion. We concluded that the sewage system going underneath that general area could cause more *E. coli* contamination especially if there is any kind of leak.

Another important aspect to consider are the possible errors that occurred during our research. For example, when we counted the amount of yellow cells for the bacteria, we could have mistakenly included a few that were borderline (color wise) and didn't actually contain any bacteria. Also, a consistent, collecting system should have been

employed when gathering the samples. For instance, all samples should have been collected from an equal depth. In addition, more samples on different days would have allowed us to see if there were constant changes with the amount of *E. coli*; thus making our results more reliable. Comparing how *E. coli* levels differ throughout the year would allow us to understand the trend of *E. coli* even more, and an extension that could be pursued later.

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