Abstract:

This science project was done to learn more about the macroinvertebrates in the Boulder Creek, and how the numbers and species fluctuate according to alkalinity, temperature, dissolved oxygen (D.O.) and pH. Before collecting data, we hypothesized that the warmer the water got, the more pollution tolerant species would be present. This is because if the water was warmer, it would mean that the atmosphere outside was warmer, which would lead to snow melt. The snow would pick up the dirt and debris it passes on its way to the creek, therefore, polluting the water. Almost every Monday, we went down to the creek and collected macroinvertebrates using the kick and pick protocol. Our conclusions were that since the stream's water chemistry stayed healthy and balanced, there was little change in the macroinvertebrates numbers and species. The only change was between the spike in stoneflies and drop in the mayflies during the fall.

Title Page: How do the species of macroinvertebrates in the Boulder Creek compare with the water chemistry of the stream?

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Question:

How do the species of macroinvertebrate in Boulder Creek compare or relate with the water chemistry? How do the number of pollution sensitive, intermediate and tolerant macro-invertebrates relate to the water chemistry as well?

What prompted the research?

At the beginning of the school year, when we were taking water samples, we decided to collect macroinvertebrates as a fun activity. We had a lot of fun doing this and wanted to do it again. When we found out about the Globe science project we thought it would be a great idea to involve the macroinvertebrates with the water chemistry to learn more about the subject.

The importance of the research:

This project could be used in many useful ways, like being able to get a good sense of the water chemistry of a creek by only looking at macroinvertebrate. It may be hard for some people to test the health of a local stream without having all of the many tools used to find out the water chemistry. Instead they can get a good sense of the creek's health just by looking at the macroinvertebrate population, making it easier and less expensive. This could also help scientists to better understand increases and decreases in population. If there were threatening changes in the macroinvertebrate population, scientists would have a better idea of what caused them, and it would be easier to improve the health of the creek.

Information from literature review:

We used a chart that was separated in categories of sensitivity to pollution. They were split into three groups, pollution sensitive, pollution intermediate, and pollution tolerant. This chart described each macroinvertebrate, helping us to identify each one. This also allowed us to compare and contrast the different macroinvertebrates in their category.

Materials and Methods:

Materials:

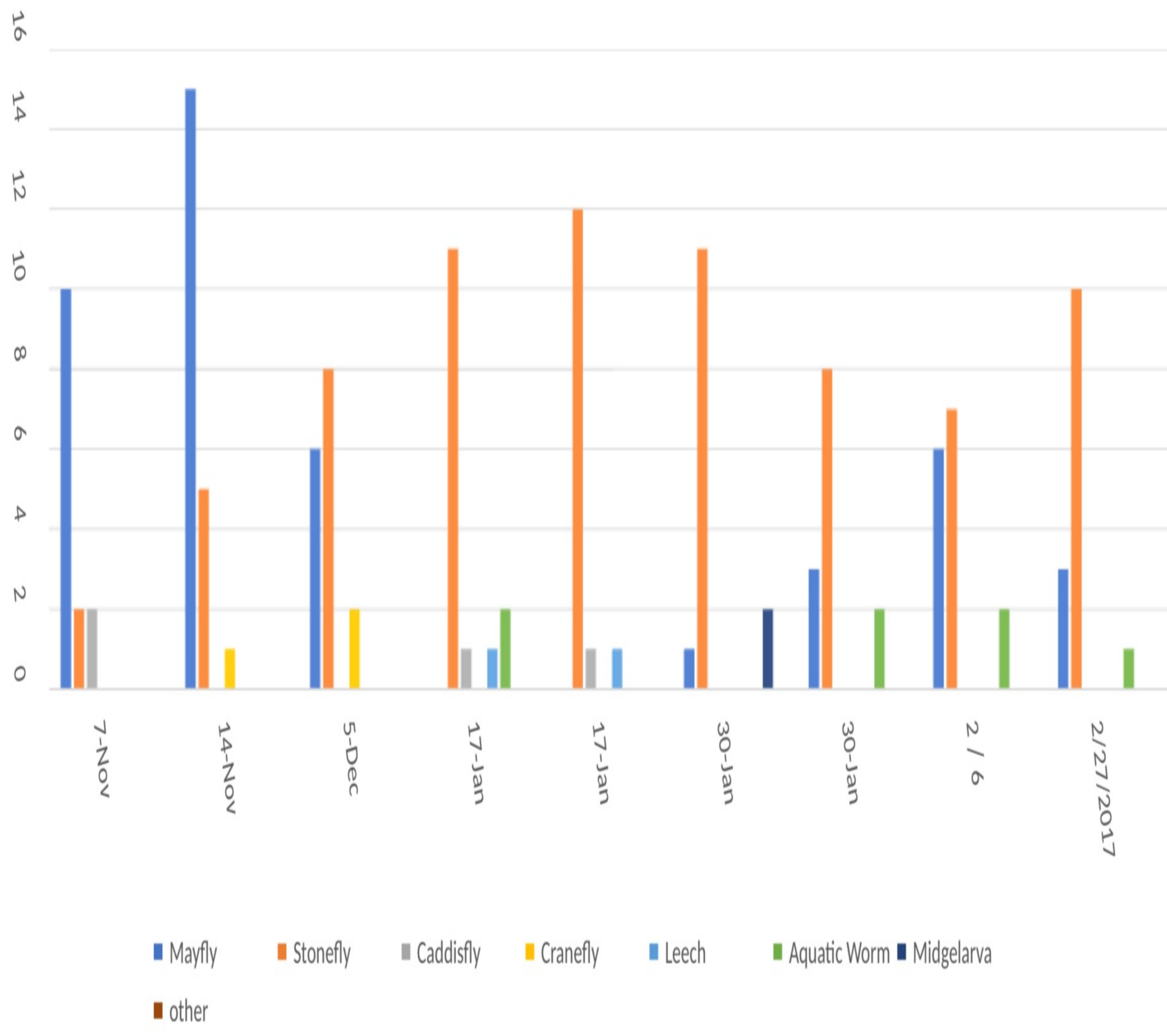
- Kick net
- Tweezers
- Ice cube tray
- Boots
- Macro Invertebrate Classification paper
- Water chemistry kit

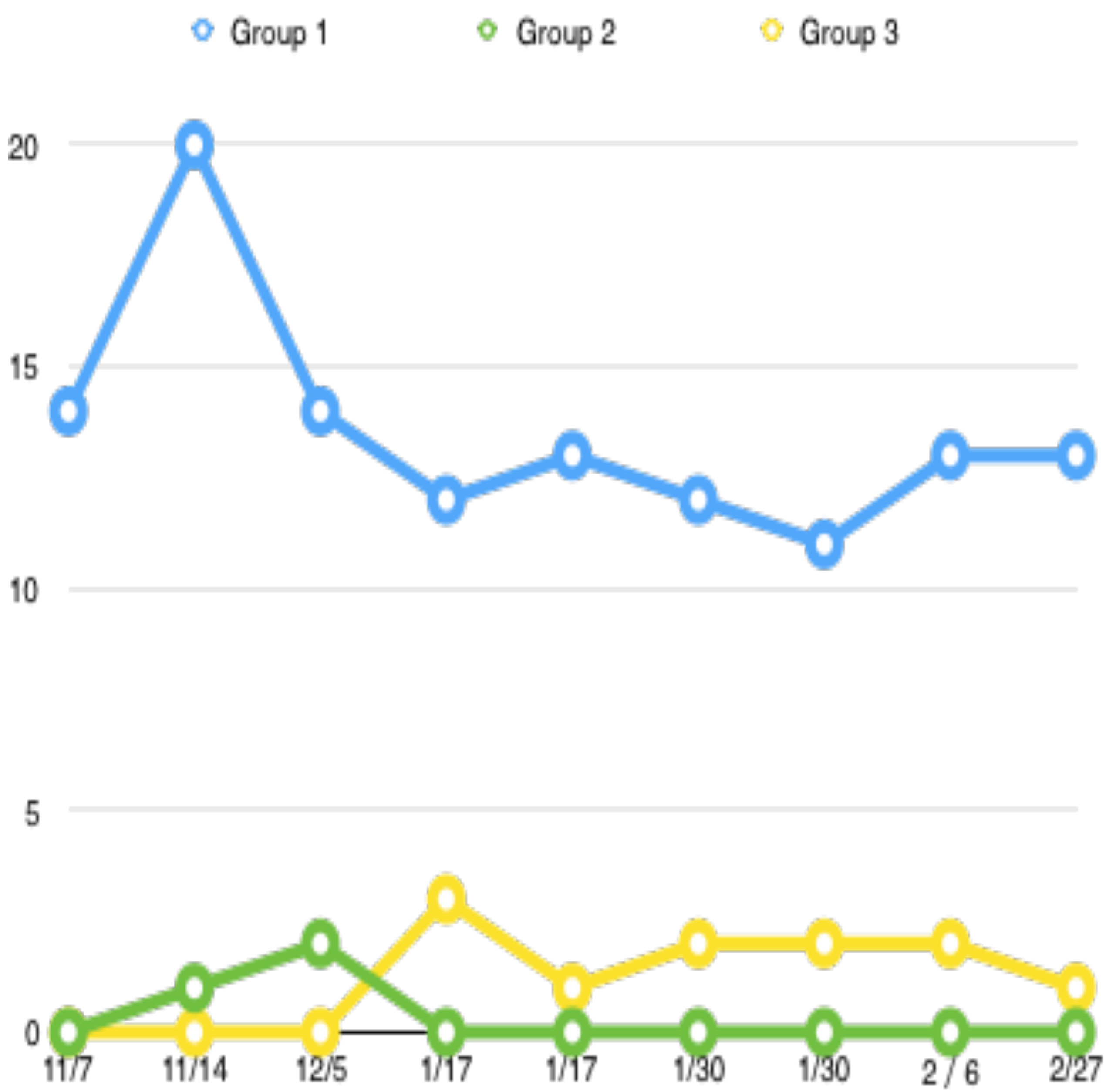
Method:

We followed the Globe Protocol for Water chemistry but we did not for collecting macroinvertebrates. Instead we used the kick and pick protocol. We collected data on two things, the water chemistry and the macroinvertebrates. We went down to the creek almost every week on Monday. We held a kick net in a spot with shallow water, then walked in a 2 meter area upstream of the net, kicking rocks for a total of 3 minutes. Then we randomly picked out macroinvertebrates and put them into two ice-cube trays. We used the macro invertebrate classification paper to identify the species of each and then recorded the species we found into a data table and stopped once we got to about 15 organisms. We also recorded the diversity of the macroinvertebrates.

Data Summary:

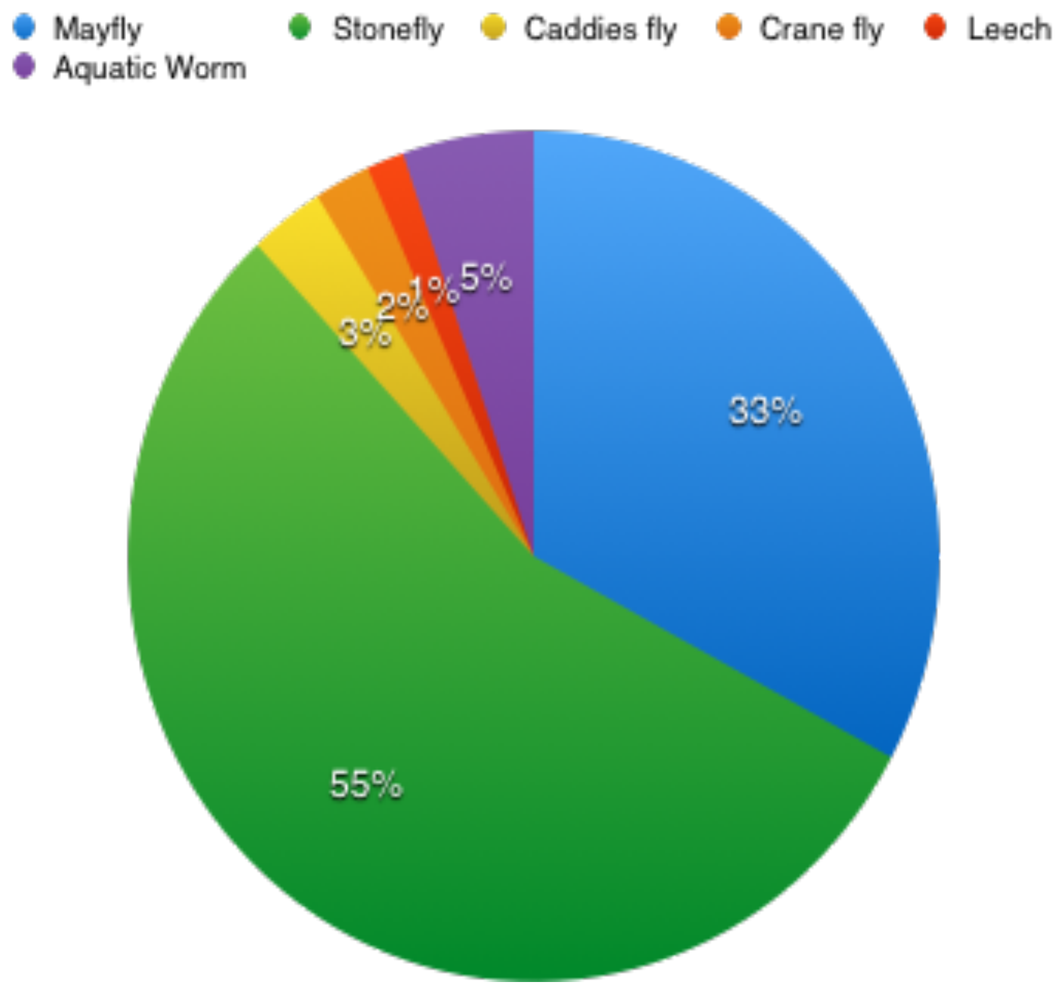
Macroinvertebrate Data

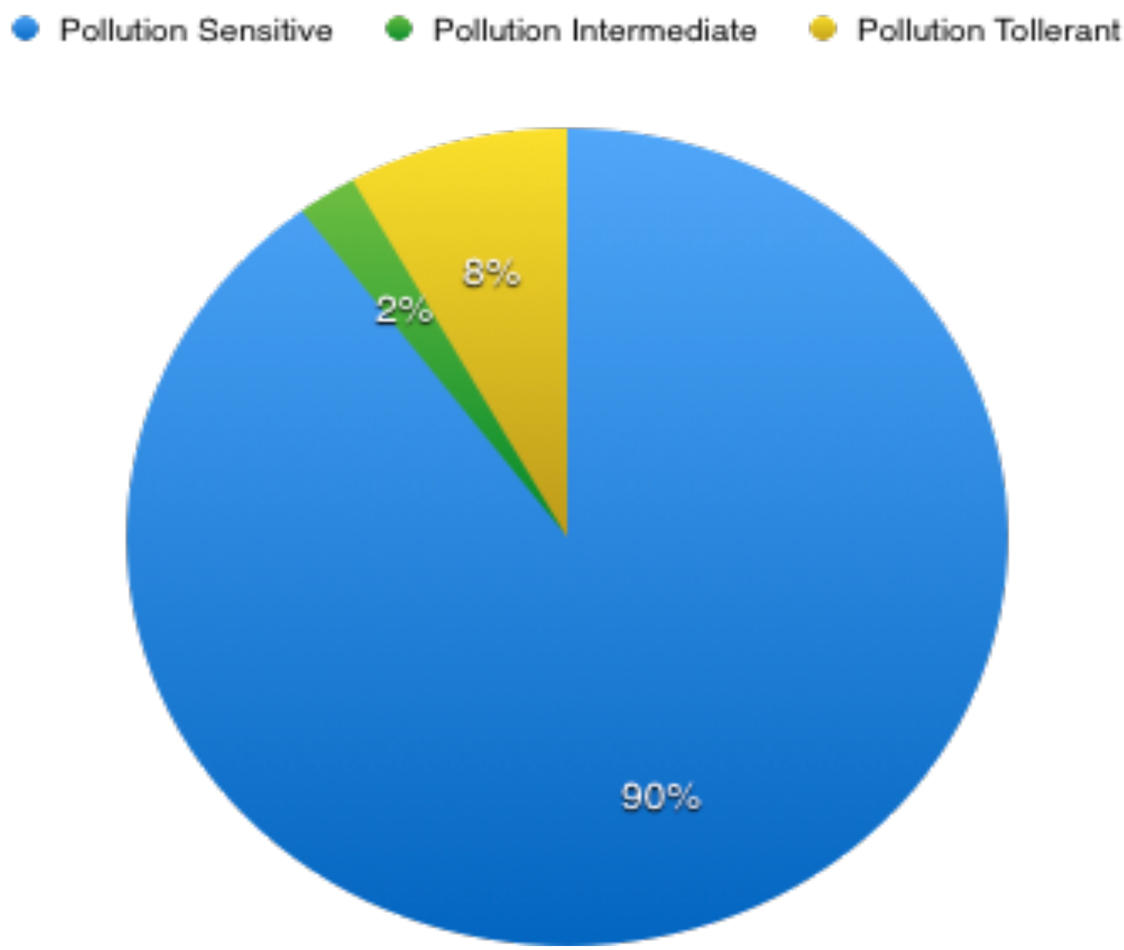




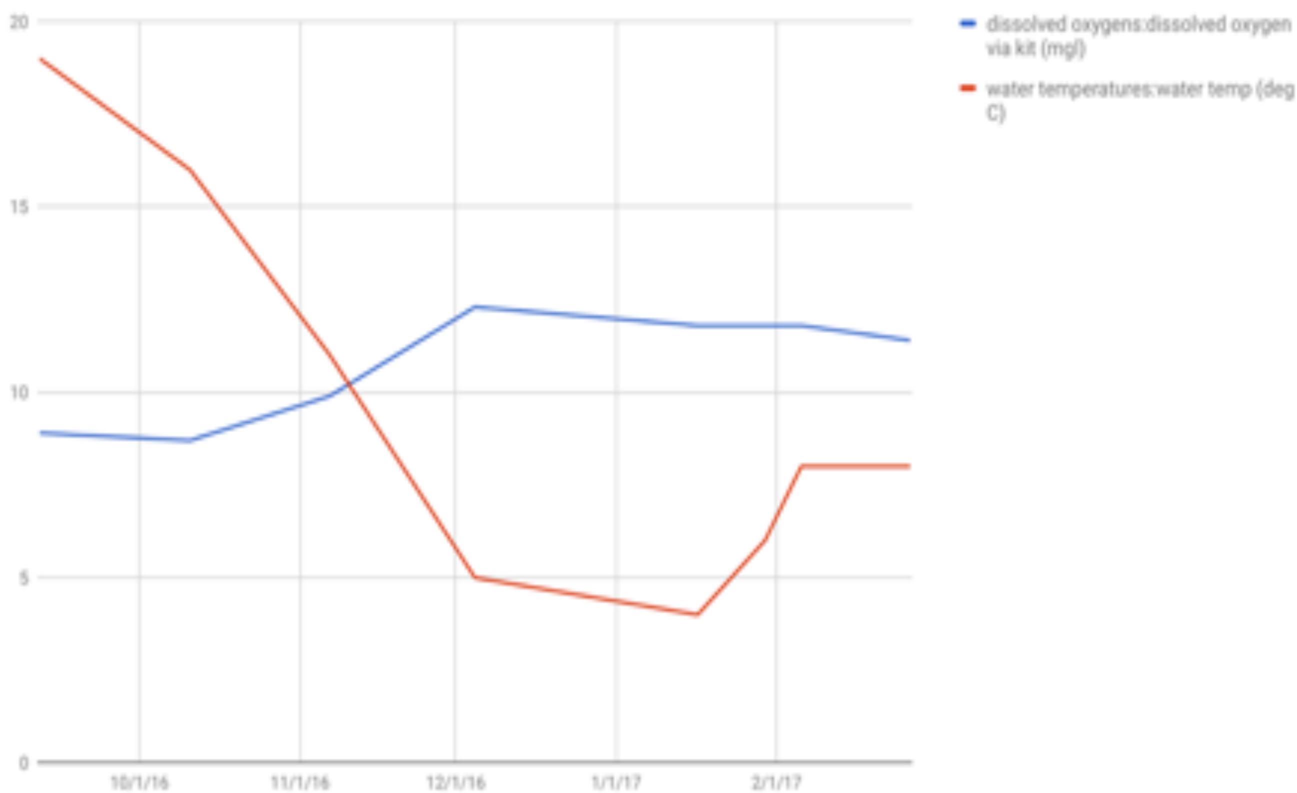
*Group 1 is pollution sensitive, group 2 is pollution intermediate, and group 3 is pollution tolerant

Total Percentage of Each Species

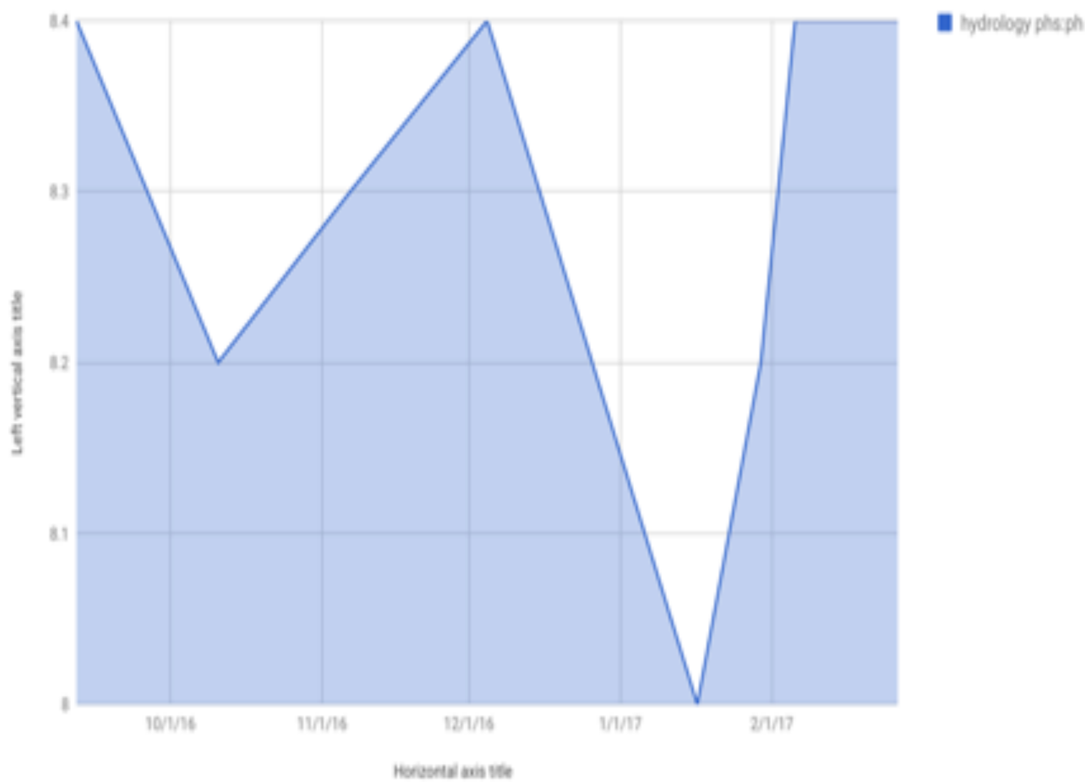



Pollution Sensitive
Pollution Intermediate
Pollution Tollerant
8%
2%
90%

Dissolved Oxygen and Water Temperature (C)



pH



Alkalinity (mg/L)

Analysis and Results:

An experimental error that took place when we collected our data was that there were so many macroinvertebrates that we just had to randomly select them. Also, when randomly selecting macroinvertebrates from the net, we were more likely to select the bigger ones that were easier to find than the smaller, more camouflaged ones, which likely impacted our data. Therefore, we could have possibly gotten very different data if we had collected information from all of the macroinvertebrates on the net. An uncertainty could be why the mayflies dropped so suddenly and why the stoneflies increased. We don't know if something happened to the mayflies that didn't happen annually, such as the decrease in temperature affecting them. The water chemistry stays balanced for most of the year, so that would not be a reason for change in macroinvertebrate species and numbers. When the pH was at its lowest, that was when there were the most pollution tolerant macroinvertebrates. However, the number of pollution sensitive stayed consistent so there was no solid evidence that the lower pH was harmful to the environment. The mayflies were more prominent in the beginning of the year, which might mean that they thrive better in warmer water. When the mayflies began to decrease, the stonefly nymphs increased. This could mean that they thrive better in colder water or that they thrive better without mayflies, as they could be competition to the stoneflies for food and shelter.

Conclusions:

Based off of the results of our experiment, we can conclude that the water chemistry and species of macroinvertebrates at Boulder Creek were healthy. By examining the water data, we were able to find the the measurements of the water were healthy and would not negatively affect life in the creek. When we examined the D.O and temperature, we found that they were both healthy and able to preserve life. The D.O in the water consistently stayed above five mg/L, meaning there was sufficient D.O for all of the macroinvertebrates in the water to live. When examining overhead photos of the creek we found that there were man-made structures upstream from our study site used to add D.O to the water. The pH and alkalinity of the water were also very healthy, staying more or less consistent throughout the year. A pH range from 6.8 to 8.5 is healthy, and the pH of the Boulder Creek stayed right in that area. When comparing these results to the macroinvertebrates, we found that because of the healthy water condition, the macroinvertebrates are healthy as well. There was a good balance of all three groups. The creek was made up of mostly pollution sensitive macroinvertebrates, which is good, because these would not be able to survive in polluted water. Although there was a small number of pollution tolerant organisms, this is not necessarily a bad thing. Even though they are tolerant to pollution, there is no reason to assume that they live better in polluted environments. Also, it is good to have a balance of organisms, because in case the water does become polluted, it is good to have organisms that can survive the pollution.

Discussion:

An improvement that could be made in this project would be going to two different streams; a healthy one, such as the stream near Alexander Dawson, and a stream that may not be as healthy. It would be good to compare a healthy stream and a non-healthy steam to see if this changes the numbers or species of the macroinvertebrates in the stream. This project could be used in many useful ways, like being able to get a good sense of the water chemistry of a creek by only looking at macroinvertebrate. It may be hard for some people to test the health of a local stream without having all of the many tools used to find out the water chemistry. Instead they can get a good sense of the creek's health just by looking at the macroinvertebrates, making it easier and less expensive. This could also help scientists to better understand increases and decreases in population. If there were threatening changes in the macroinvertebrate population, scientists would have a better idea of what caused them, and it would be easier to improve the health of the creek. To understand the relationship between the macroinvertebrates and the water chemistry better, we would want to take another year of data to see if the mayfly population increases and to see if they decrease again in the fall because of the drop of temperature.

Acknowledgements:

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References/Bibliography

- Division of Natural Areas and Preserves- Macroinvertebrate Identification Guide
- Colorado Division of Wildlife- Fall 1995- River Watch Network

Photos:

Study Site- The Boulder Creek from above