

## ABSTRACT

The experiment goals was to find a correlation between the amounts of different pollutants found in the Bronx River watershed and the different amount and relative EPTs of the macroinvertebrates found across four different locations. This was done by going into each of the different location (the Bronx River beneath the Old Stone Mill, a stream leading from the native plant garden through the Thain Forest to the Bronx River, a small stream that leads from the Twin Lakes to the Bronx River, and a small outlet of the Bronx River that leads from the River through a small pipeline that runs over a concrete bottom) and removing a small amount of water. The water is then put through a series of tests to look for pH, ammonia, phosphates,  $\text{NO}_2$  and  $\text{NO}_3$ . The animals were taken out and counted from among the leaves (oak, sweet gum, and beech). Then two bags were then left in each of the 4 sites tested for 3 weeks. When the bags were removed the macroinvertebrates found inside were counted and entered into the data. The results showed that there was a correlation between the different levels of pollutants and macroinvertebrate populations (particularly the amount of EPTs found).

## INTRODUCTION

One system of checking the health of a river that researchers often use is the use of leaf packs. Leaf packs, as defined by the Stroud Center(<http://www.stroudcenter.org/lpn/>) are mesh bags of 30 grams leaves put into a river, or other body of water, to sit for 3 weeks. Over this period macroinvertebrates colonize the pack due to the fact that they will be attracted to the safe environment and the abundance of food within. After the 3 weeks pass the leaf packs are removed from the body of water and the macroinvertebrates within counted and identified. The macroinvertebrates are categorized based on their pollution tolerance, the 3 least resistant are called the EPTs. EPTs (Ephemeroptera, Plecoptera and Trichoptera) are macroinvertebrates that have gills that are outside of their body and thus pollutants hurt them more. Based on the amounts of EPTs as a percentage of the leaf pack a quality assessment can be done, the higher the EPTs the better the water quality.

For this experiment the populations of different macroinvertebrates species is to be correlated with different amounts of 3 dissolvents found across 4 locations in the Bronx River watershed. The dissolvents that were tested were nitrates, phosphates, and ammonia.

The significance of the different chemicals and pH levels in the water is that they all have been proven to have an effect on aquarium life and in lakes and rivers around the world. Having high levels of pollutants in the water has two major impacts.

## MATERIALS & METHODS

- Locations were chosen that were viable for placing leaf packs and allowed by the New York Botanical Garden. Locations were selected where there was a shallow amount of water (less than a foot) and the water is not running very fast and where there is a place for the leaf packs to be attached.
- Leaf packs: ten grams of the three most dominant trees in the area were placed in mesh bags. A brick with the bag attached was attached to a stable object overlooking or next to the body of water that the bag was going to be put into.
- Two bags were placed at each location this was repeated four times for each of the four locations as there were two bag groups put twice into the same location with two weeks staggered between them.
- The packs were then tested and the different macroinvertebrates were removed and identified.
- Tests were done to find the pH, nitrates, phosphates, and ammonia levels in the regions the pH had strips that were put into water and then allowed to sit for one minute and then the pH was recorded. The phosphates were tested using CHEMets Kit Phosphate K-8510, after the test was done the amounts of phosphates were recorded.  $\text{NO}_2$  and  $\text{NO}_3$  were tested with the LaMotte Insta-Test Analytic Nitrite & Nitrate. Ammonia was tested with the Sentry Q Mardel "Ammonia Test Strips" Ammonia Indicator kit.

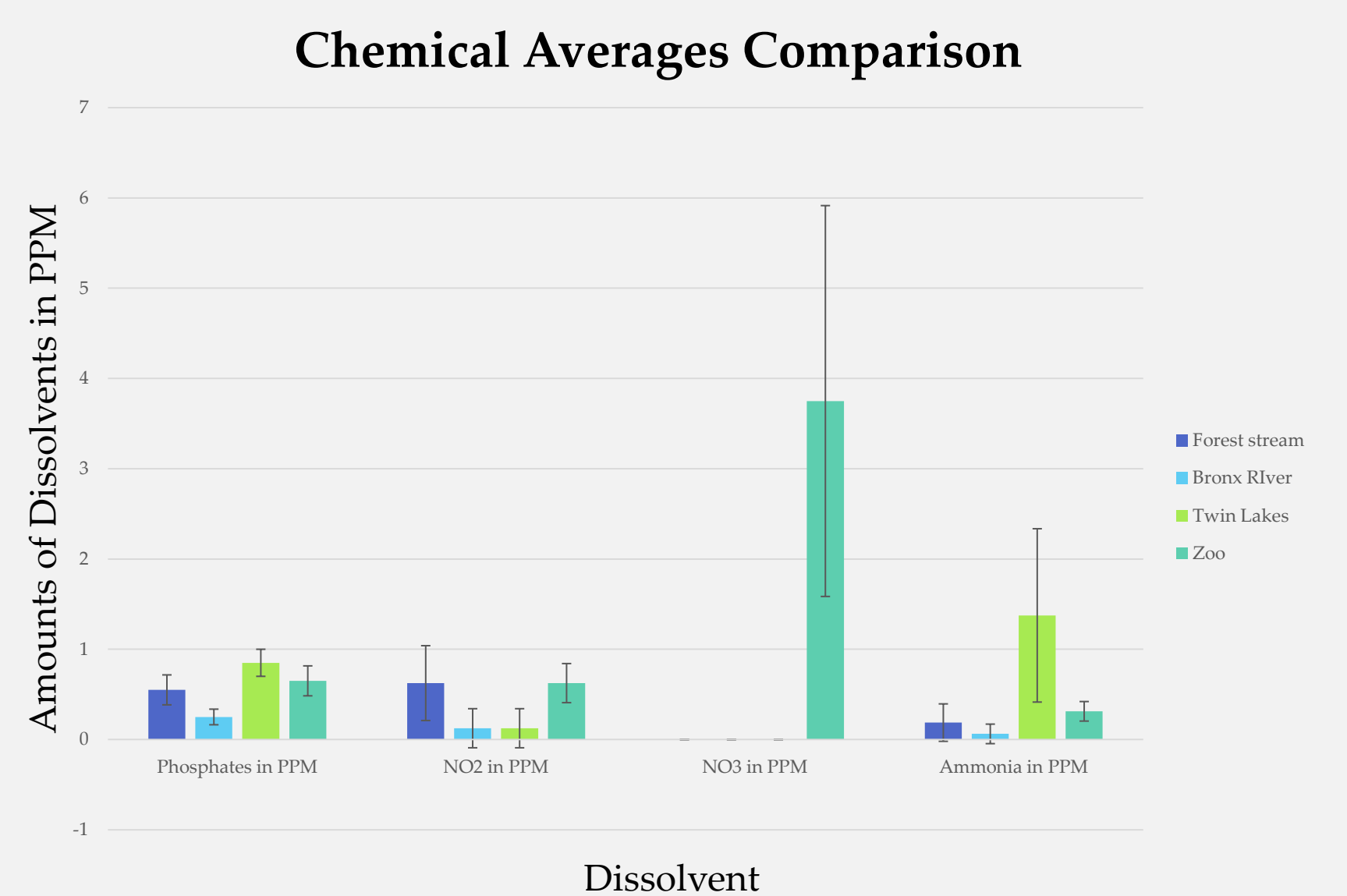
# Correlations between macroinvertebrate populations and phosphates/nitrate levels in the Bronx River

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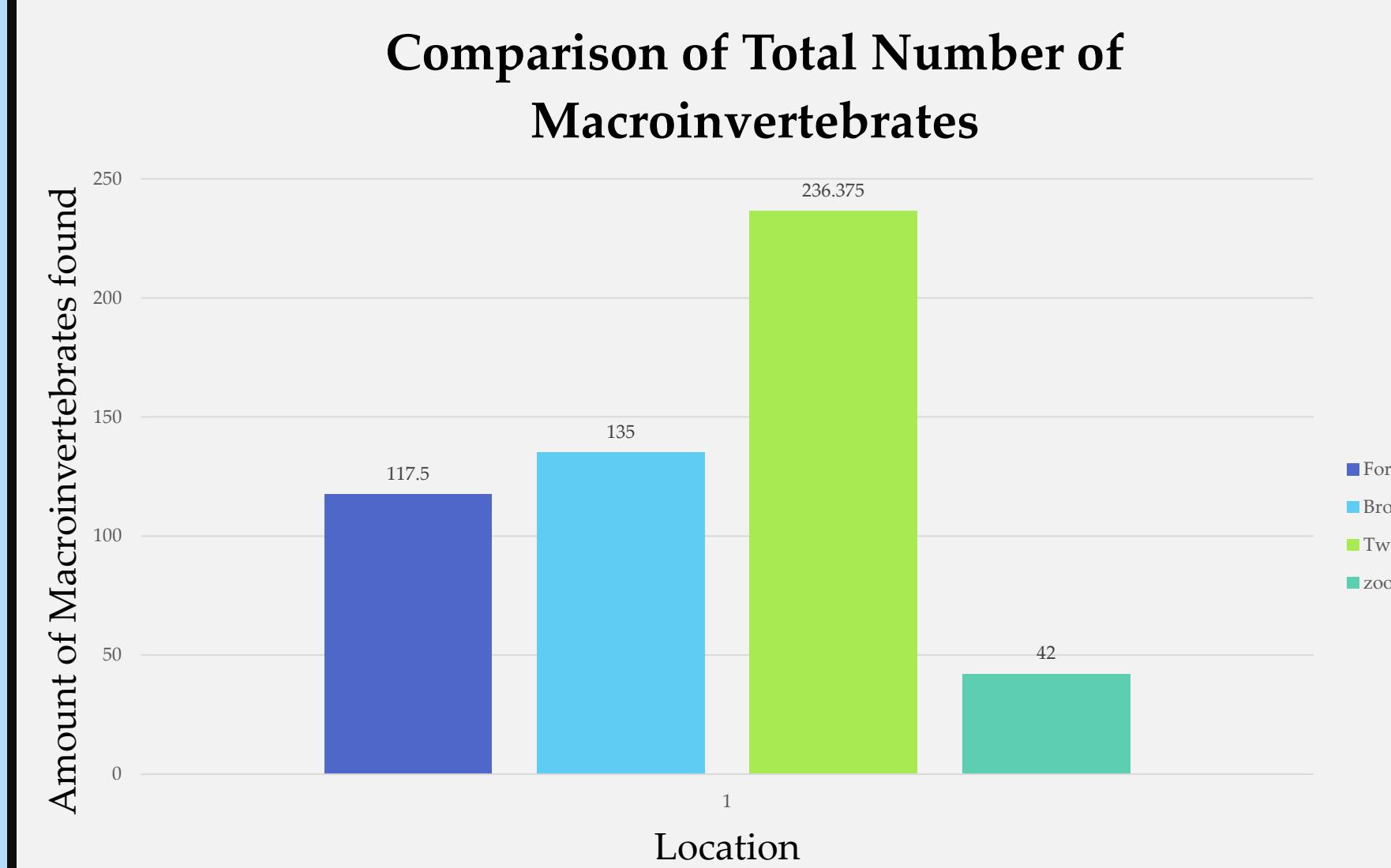
## Results



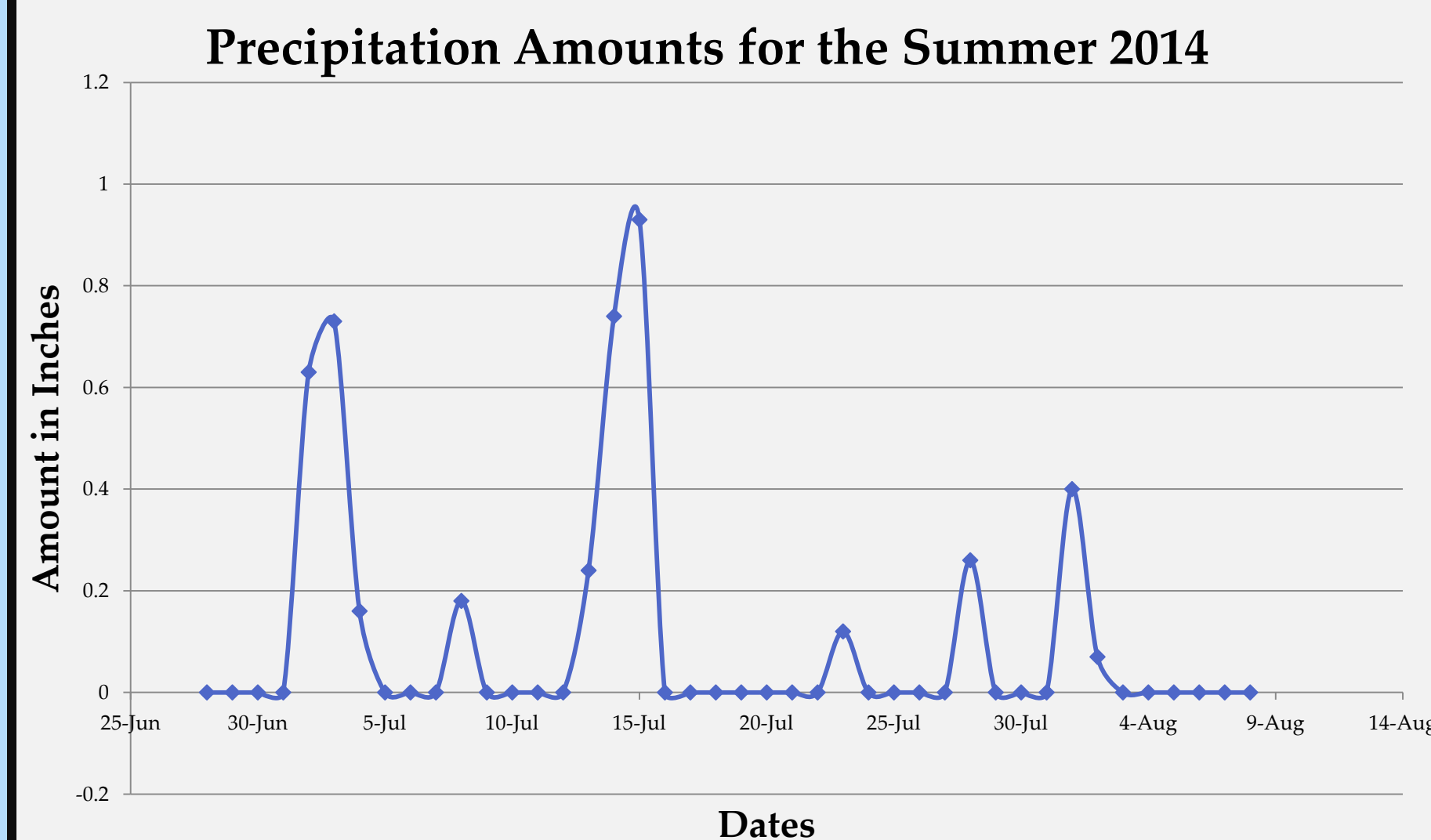
**Figure 1. Sampling Locations at the New York Botanical Garden.** The oval represents the Bronx River location. The triangle marks the location of the Forest Stream. The rectangle represents the location of the Twin Lakes. The Zoo location is about 1/4 of a mile away.



**Figure 2. Chemical Averages.** This shows the amounts of phosphates, NO<sub>2</sub>, NO<sub>3</sub> and Ammonia in PPM. From this we can see that the Bronx River had the over all lowest amounts.



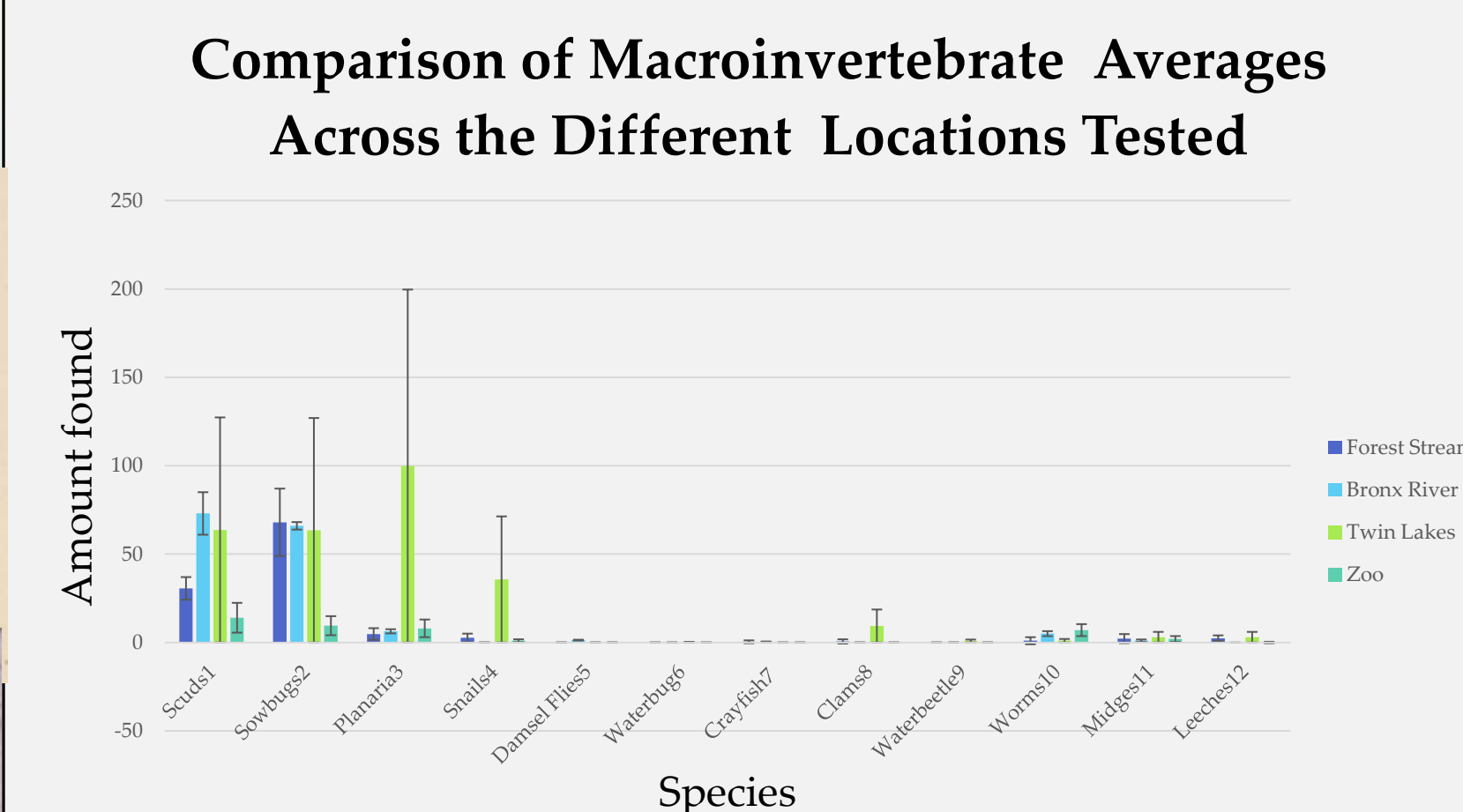
**Figure 3. Comparison of Total Number of Macroinvertebrates.** This shows the different total average amount of macroinvertebrates found per leaf pack. It can be seen that the Twin Lakes has the highest amounts of macroinvertebrates, but it should be noted that the Bronx River was the only location with EPTs.



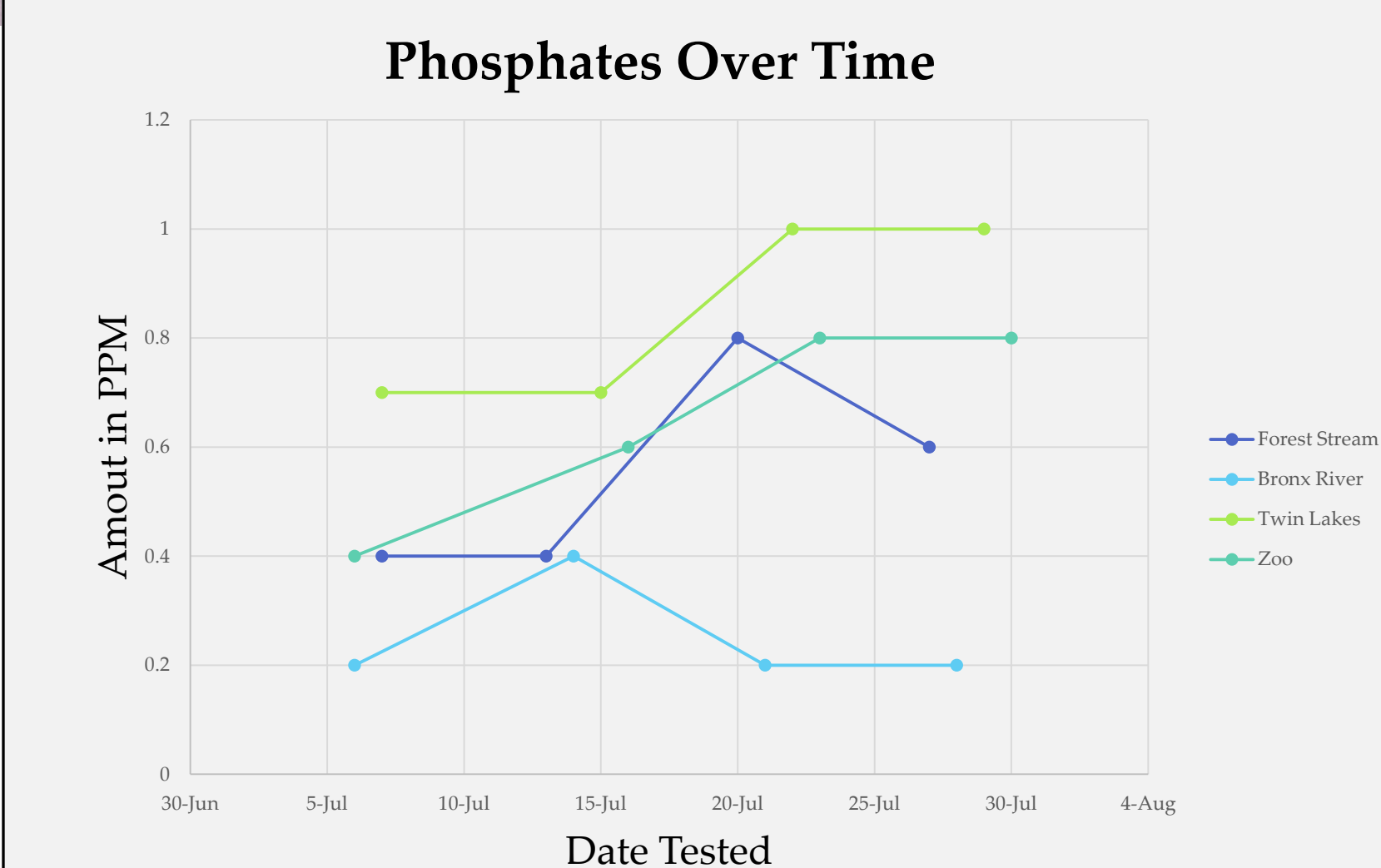
**Figure 4. Precipitation Amounts for the Summer 2014.** Note the largest storm in the days before July 15.



**Figure 5. Bronx Zoo Map.** This figure shows the location of the Zoo Inlet in respect to the zoo, it is represented by a star.



**Figure 6. Comparison of Macroinvertebrate Averages Across the Different Locations Tested-** This shows the different average amounts of macroinvertebrates found in each location, it is split up based on species and is color coded based on the location.



**Figure 7. Phosphates Over Time.** This shows how the phosphates in each locations had a rise after a rain storm that occurred on July 13<sup>th</sup>. The location of the Twin Lakes always had the highest amount and the Bronx River the lowest.



**Figure 8. NO<sub>2</sub> Over Time.** This graph shows how the amount of NO<sub>2</sub> changed over time across the 4 locations. There was a peak after the July 13 rain storm and then the amounts level again.

## DISCUSSION

The results seem to support the hypothesis in that there was a correlation between higher levels of pollutants and lack of EPTs found in the different sites.

The nitrates and phosphates found in particular tended to be found in higher amounts repeatedly in the same area and in small amounts the same. The areas where phosphates were found to be abundant were locations with streams that moved slowly through a part of the garden (or zoo), the reason for this is because rain probably caused the phosphates and nitrates in the fertilizer put into the soil to run off into the stream. Nitrates have the same general reasons for being in the water.

The pH's found also varied slightly from location to location.

The Bronx River had an average pH of 7.1, Twin Lakes and the Forest Stream has slightly lower pH meaning they are more acidic, and the Zoo had the highest average pH at 8.5 meaning the water was basic. The Bronx River water was found to have a pH very close to 7 this is likely because the dissolvent in the water were to be diluted by the massive amounts and relative (to the other streams looked at) speed were found in. The other two locations in the Garden (Twin Lakes and the Forest Stream) were found to have slightly acidic water. The Zoo outlet was found to have slightly basic water and has a pH of 8.4 this is most likely because the water runs over a bed rock of limestone before running through a ceramic pipe thus dissolving into the water raising the pH. Ammonia levels in the water were also tested, and were only found to be common in the Twin lakes in the other three locations it was almost nonexistent.

The macroinvertebrates found and the amounts of them also differed from location to location.

The Bronx River had both the second highest amount of macroinvertebrates found and was the only location to have EPTs present, there were a few damselfly larvae found. Twin Lakes had the most of any locations found and had the second most diversity after the Bronx River. The Forest Stream had very low diversity and simply contained a lot of amphipods, isopods and planaria. The location in the Zoo was lacking in almost everything and had very limited amounts of every species, only Scuds, Isopods, and Planaria were really found.

In every location the two most commonly found species, amphipods (scuds) and isopods (sowbugs) were found and in general in huge amounts.

Planaria were also often found in several locations and as with the two previous were often found in large amounts. The EPT species of damselfly, stonefly, and caddisfly larvae were all vacant in the locations of Twin Lakes, the Forest Stream and the zoo. Only one species the Damselfly larvae was ever found in any of the locations that location being the Bronx River. The most likely reason for this being true is the fact that the Bronx River had the lowest amounts of pollutants and also had the fastest moving water. The reason that the speed of the water affects what is found is that the faster the water the more dissolved oxygen found in it and EPT species (more than other macroinvertebrates species) require a lot of dissolved oxygen to survive.

## CONCLUSION

In conclusion it can be seen that there is a correlation between the different amounts of pollutants in the water and the amounts of macroinvertebrates found in those locations. From the data it can also be seen that the dissolvent NO<sub>3</sub> seems to have the most effect on the species found as it was only ever found in the Zoo location which was also the most devoid of life. This also shows that pH has an effect on the species found as the Zoo was also the only location with a significant difference in the pH.

## ACKNOWLEDGEMENTS

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