Water Quality Analysis In New York City's Public Waterways

Anaelle Amy[1], Akeem Dear[1], Inique Francois[1], Chris Young[1], David Johnston[1], Gregory Barord[2,3], Lilja Nielsen[2,3]

[1]Brooklyn Academy of Science and the Environment High School, [2]Brooklyn College, [3]CUNY Graduate Center

Abstract

A comparison was conducted of the water quality of public waterways in the five boroughs of New York City. The hypothesis was that the closed water systems would be more polluted than the open water systems due to size and the lack of continual inflow. One site was tested in each borough, with fourteen water quality tests conducted at each site. Parameters tested included nitrate, turbidity, pH, dissolved oxygen, etc. The research started with open water systems, which are water systems that flow in to the ocean. The open water systems considered were Brooklyn Bridge Park and Pier 40 in Manhattan. The last three sites, High Rock Park in Staten Island, Van Cortlandt Park in the Bronx, Flushing Meadows Park in Queens, were all closed water systems which don't flow into the ocean. Finally the data from sites was compared to each other to find out which site was the healthiest ecosystem and provided the best habitat for its living organisms. The result was that Brooklyn Bridge Park was the ecosystem with the best water quality and therefore would be the best living environment. Testing the pollution level in public waterways is important because many organisms depend on these habitats. If testing discovers that contamination levels are too high, then action can be taken to reduce the pollution to that area.

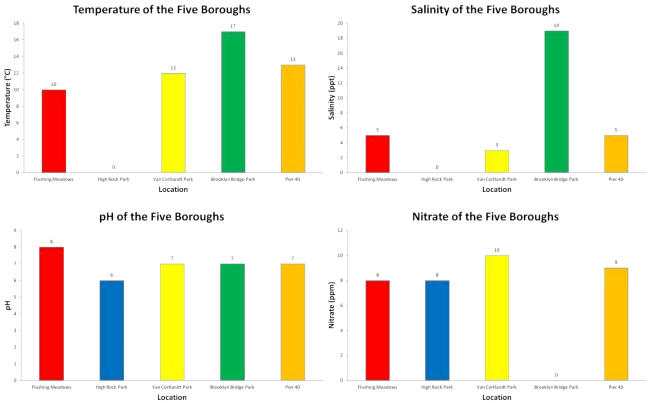
Introduction

Water quality is an important characteristic of an ecosystem to consider when assessing the health of a system, especially in such an urbanized area as New York City. New York City has a complex system of waterways that includes rivers, marshes, and the ocean; for example, salinities in these waterways can range from 0-35 ppt. The large amount of water in and around New York City provides many different advantages to the surrounding inhabitants but it also means that there are also many more possibilities of contamination in these waterways from nearly an infinite amount of sources. Developing a method to test different types of waterways is critical toward tracking levels of pollution and other sources of disturbances throughout time. Tracking the changes in water quality parameters will enable regulatory agencies to better predict and adapt to new developments in the different waterways and prepare for future fluctuations that may have significant impacts on the local environment and the organisms living in that environment, humans included.

Materials and Methods

The materials used to collect the water quality data included a HANNA test kit that included materials to analyze water quality parameters such as alkalinity, ammonia, acidity, carbon dioxide, copper, dissolved oxygen, nitrate, nitrite, and phosphate. A secchi disk was used to measure turbidity. Salinity was collected using a hydrometer and refractometer and was collected as specific gravity and ppt. A bucket and rope were used to collect water samples when the sampling location was not close enough to sample by hand. All waste chemicals were collected and disposed of properly. There were five different field sites that were selected for analysis: Flushing Meadows (Queens), High Rock Park (Staten Island), Van Cortlandt Park (Bronx), Brooklyn Bridge Park (Brooklyn), and Pier 40 (Manhattan). The sites were accessed using either the New York City subway system or a school bus. At each of the sites, Mr. Johnston's sophomore research class divided into four groups and each group tested three to four of the water quality parameters. The groups also ran different tests at each of the sites so that the entire class would be able to run each different test and understand the effect that each different parameter may have on the environment sampled. Each group recorded information on the weather and any other environmental factors that may have had an affect on the samples collected, such as garbage. After all of the parameters were tested and recorded, each group shared their findings with the other groups.

Water Quality Parameters



Results

Of the 14 parameters tested at each of the five sites, four were selected for between site comparisons because it was determined that these parameters may have significant impacts on the local organisms in and around the water. The temperature was similar in each of the sites, however the temperature in Brooklyn Bridge Park was greater than all of the other sites; there was a problem with the thermometer at High Rock Park so no value was recorded. The salinity was near 0 ppt at most sites but did reach 19 ppt at Brooklyn Bridge Park. The pH fluctuated from 6-8 and was 7 at most sites. Nitrates were present at all sites except Brooklyn Bridge Park.

Conclusions

The hypothesis that closed water systems would be more polluted than open water systems was supported by the data collected. Brooklyn Bridge Park was determined to be the healthiest waterway sampled, in part, because of zero nitrates. It can be more difficult for closed water systems to adapt to environmental changes quickly; freezing temperatures and increased rain fall can affect these systems significantly. Open water systems are more dynamic and may have a greater affinity towards remaining stable during environmental changes. There were factors in this experiment that could have biased some of our results such as the weather on the day of data collection which could have dramatically affected the samples collected. Additionally, strong winds may have caused more debris/waste to enter the waterways and this could have impacted our results as well. This experiment is important because water is the basis of life on this planet and having clean water in New York City is important for everyone. Pollution can affect the health of the waterways in many different ways and this will not only impact humans who drink the water, but pollution can also affect the organisms living in the water. From an economic standpoint, pollution can also negatively affect businesses if the pollution of the waterways is so severe that the water may be unusable by the businesses and they may have to spend more money on finding clean water elsewhere.

ACKNOWLEDGMENT: Special thanks to Mrs. Peterson for allowing the sophomore science research class to go on the field trips to the 5 boroughs and special thanks to our sophomore science research class for helping us collect our data. Project supported by GK-12 "City as Lab" NSF-DGE 0638718.