Environmental Quality: Restoring the Bronx River

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Rocking the Boat

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Introduction

There are many effects of water pollution including poisonous drinking water, poisonous food animals (due to the organisms having bio-accumulated toxins from the environment over their life span), unbalanced river and lake ecosystem that cannot fill biological diversity any longer, acid rain which leads to deforestation, and much more. However, this effect varies on the type of contaminants. The Bronx River is an example of a polluted body of water. Though, the Bronx River was not always polluted. Originally a twisty stream, the river had floodplains, marshland, ravines, beaver lakes, and salt-water marshes. During 1820's to 1830's, the Bronx River was so clean that many, including New York City Board of Alderman, considered the water should be drinking water for growing New York City's population. In the late 1800's, the river was straightened, dredged, and channelized, eliminating virtually all of the floodplains. Several dams were built, marshlands were drained, salt marshes were filled in, and the beavers are long gone.

The Bronx River is believed to come to formation before ice age. Before the Pleistocene Period, the river was a pre-glacier stream. It starts from Valhalla, New York, at the Kensico Reservoir. It flows about 15 miles southward through Bronx, where it runs into the East River, which is part of Long Island Sound, and eventually runs to Atlantic Ocean. There are three major dams that are over 8 feet, are along the Bronx section of the river. The north most is the Snuff Mill Dam, located in the New York Botanical Garden. To southward is the Bronx Zoo's double dam, located near the Bison exhibit at the equivalent 190th street. Approximately ¾ of a mile later is the 182nd Street Dam, and is bordered by River Park to the south and the Bronx Zoo to the North. The 182nd Street Dam roughly marks the end of the river's park-like surroundings. For approximately one mile south of the dam, the river is tidally influenced and is bordered by development, primarily industrial and dense residential. Further downstream, south of Westchester Avenue, it becomes a federally designated navigable waterway and is used by commercial barges. Expensive Soundview Park lies on the east bank of the estuarine section near the mouth of the river.

Our project is concentrated on three sites in the Estuary section of the river. The Estuary section that we look into of the river runs from the weir between 172nd and 173rd street near Starlight Park to the mouth of the river. The bank of this section is dominated significantly by industries, thus making the Estuary section of the river one of the most contaminated section. The Soundview Park, which falls in this section of the river, was build on landfill, and is the largest parkland in the area. Our second site is an abandoned Concrete Plant, which contaminated the water when the plant was active. The third site is the Starlight Park, where ground contamination from an old gas manufacturing plant was discovered recently. Even though these three sites are specifically contaminated, the Bronx River was generally polluted form the time railroad was built in New York City and when the New York City became industrialized all of a sudden. The construction of the New York central Railroad in the 1840's turned the valley into industrial corridor, and by the end of the 19th century Bronx River became known as an "open sewer."

Since the 1880's one of the most important efforts has been made to protect the Bronx River and make sure that human activities in the city do not affect it because the pollution of a community river affects everyone. In the summer 0f 2005, we launched a comprehensive study research project to clean up the Bronx river.

Mouth of the Bronx River.

Goal

Our goal is to help create the Bronx River to be a healthy body of water. We will analyze the data of this year and compare it with the data of last year to see the changes in the water.

Objective

To monitor the water quality of the Bronx River which includes finding the amount of salinity in the water, the pH level of the water, the oxygen level in the water, water temperature, and air temperature.

Hypothesis

We hypothesize that the body of water of this year is cleaner then last year.

Procedure

1. Water and Air Temperatures

Aquatic animals need a moderate stream temperature to live in; they become less abundant as the stream temperature falls outside the normal range. Seasonal and daily fluctuations, riparian cover and human impacts affect water temperature. We use a standard Celsius thermometer to measure the water and air temperature.

2. Turbidity

Turbidity is a measure of the amount of clarity or cloudiness in a stream. Turbidity levels increase as suspended solids (tiny particles in the water) and plankton (microscopic plants and animals) accumulate in the water column. The test we take is performed by comparing the turbidity of a measured amount of the sample with an identical amount of turbidity free water containing a measured amount of Standardized Turbidity Regents. We first fill one turbidity column to the 50 mL line with the sample water. If the black dot on bottom of the tube is not visible, we then pour out an amount so the black do is visible. Then we fill the second turbidity column with distilled water to the amount of the first tube. Then we place the two tubes side by side and compare the difference in clarity. If the black dot is equally visible in both tubes, the turbidity is zero. Is the black do in the sample water is less clear, then we .5 mL of Standard Turbidity Reagent to the distilled water tube. We then stir the liquid of both tubes to equally distribute turbid particles. We then check the black dot to find out the amount of turbidity. If the turbidity of the sample water is greater then the distilled water, meaning, if the black dot in the sample water is still not equally visible to the distilled water, then we continue the process of adding .5 mL of Standard Turbidity Reagent. We then record the amount of Standard Turbidity Reagent added. We record the data as JTU because each .5mL addition to the 50 mL is equal to 5 Jackson Turbidity Units or JTU.

3. Nitrates

Nitrates are a necessary nutrient for plant growth, so like phosphates; they can have a direct effect on the amount of algae and other aquatic plants present in a water body. Excessive nitrate levels, when in a drinking water supply, can also cause health problems. Fill sample tube with the water sample, swirl, discard, and then fill to the 5 mL line. Carefully add one Nitrate #1 tablet. Cap the tube and mix until the tablet disintegrates. Carefully add one Nitrate #2 tablet. Cap and mix until the tablet disintegrates. Wait three minutes. Insert the color slide into the Octa-Slide

Viewer. Match the sample color to a Color Standard by sliding the Color Bar through the Viewer. This reading is in ppm nitrate-nitrogen. To convert the ppm nitrate-nitrogen result to ppm nitrate, multiply the ppm nitrate-nitrogen result by 4.4.

4. Salinity

We use an instrument called the Salinity Refractometer. We apply several drops of water on to the surface of the prism and look through the eyepiece. This allows us to measure how much salt is in the water. We record the data for salinity as Parts per Thousands of ppt.

5. Dissolved Oxygen

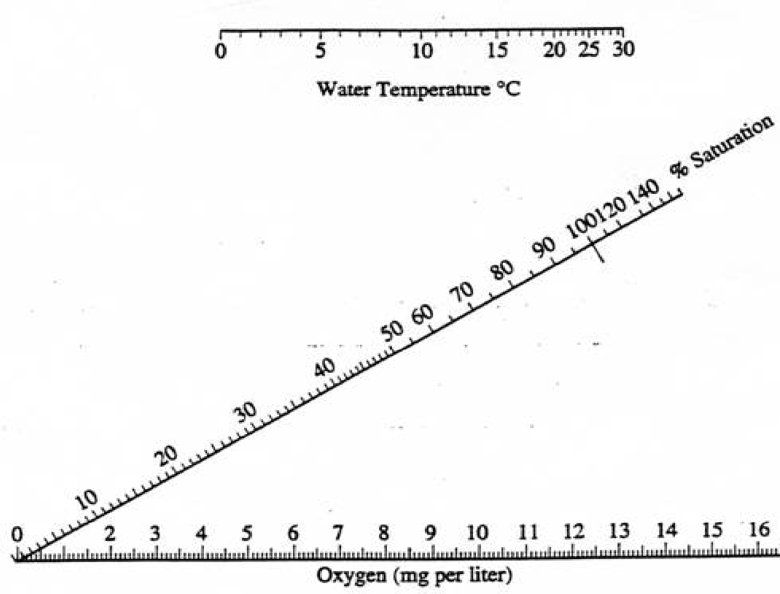
Low dissolved oxygen level is not only is a sign of pollution, it also may kill aquatic animals. Most sensitive aquatic critters require dissolved oxygen levels of at least 5-6 ppm. Less then 3 ppm is stressful to most aquatic species. Less then 2 ppm is fatal to most species. The oxygen found in the water comes from many sources including the oxygen absorbed form atmosphere. To find the level of dissolve oxygen, we first fill a water-sampling bottle. Then add 8 drops of Manganous Sulfate Solution. Then add 8 drops of Alkaline Potassium Iodide Azide. Then we mix it. These mixtures makes the water gel like solution, we let the gel settle down. Then we add 8 drops of sulfuric Acid. We cap the tube and mix until the reagent and precipitate dissolve. Then we fill a test tube to the 20 mL line. Then we fill a Titrator with Sodium Thiosulfate. We titrate until sample color is pale yellow. Then add 8 drops of Starch Indicator. We, then continue titration until blue color just disappears and solution is color less. We then take the results as parts per million-dissolved oxygen.

6. pH

pH is the measure of acids and bases dissolved in stream water. A water body with a pH outside of the 6.5 - 8.5 range is unable to support a diverse amount of aquatic animals. We use an instrument called Colorimetric pH test equipment. We fill a test tube to the 5.0 mL line with the sample water. Then, while holding dropper bottle vertically, we add the Wide Range Indicator solution. Then we cap bottle and mix the liquids. Then we insert the bottle into Octet Comparator. We try to match the mix liquids color to a color standard. We then record the pH the color matches.

7. Saturation of Oxygen in water

We use a nomograph such as the example shown below. To use the nomograph, we first have to find the ppm of water and the water temperature. Then we place a ruler with one end on water temperature and the other end on the oxygen level we found previously. This creates a diagonal line and the percent saturation can then be read directly off of the diagonal line.



Note: We take data keeping in mind about the circumstances such as weather. Cold water can hold more oxygen then warm water. Rain can reduce the salinity of water and make the pH more neutral.

Results

Analysis

Yearly Average	**pH**	**Dissolve Oxygen**	**Salinity**	**Air Temperature**	**Water Temperature**
2003	**7.6**	**7.3 ppm**	**16 ppt**	**23.9 °C**	**19.6 °C**
2004	**7.76**	**7.84 ppm**	**18 ppt**	**20.2 °C**	**17.5 °C**
2005	**7.76**	**9.4 ppm**	**15 ppt**	**19 °C**	**14.7 °C**

*The data for several tests are not shown for the year 2004 and 2005 as we did not conduct those experiments for the year 2003. This is due to our desire to show comparison among the data.

Discussion

The results of our research suggest that the water of the Bronx River is worse from year 2003. The water surprisingly is not getting acidic, but basic, the average pH level for water of the Bronx River for the year 2003 is 7.6 and for 2004 and 2005, the average is 7.76. Though this is a slight change, it is a critical finding. The average Dissolve Oxygen of the water for the year 2004 is about .5 ppm higher then the average Dissolve Oxygen for the year 2003, and 1.6 ppm higher in the year 2005 then 2004. This is perhaps the best findings for the Bronx River water; however, the temperature of the water and air may have scrutinized the result. The average temperature for air and water in 2003 is two to three °C higher then the average temperature for air and water in the year 2004, and one to three degree lower in the year 2005 then the year 2004. This maybe the fault of our sample taking time period, we have taken more data in the winter period then the summer period. As we know; cold water holds more oxygen then warm water. The salinity level of the water is 2 ppt higher in 2004 then the year 2003, however, it is 3 ppt lower in the year 2005 then 2004.

Project to Clean Up the River

To clean up the Bronx River, we have decided to reintroduce Oysters in the river. An Oyster is a shellfish with two uneven white shells that hook together at one end. It has strong muscles that hold the shell shut which makes it very difficult for predators to pry the shell open. Oysters are filter feeders, they absorb the water and in the process filters out the plankton and debris of dead plant as well as animal matter, to swallow. Afterwards they spit the water back out. They also accidentally filter out and collect poisons and bacteria that might be in the water. This cleans the water, although makes the oyster itself poisons.

The idea is to reintroduce oysters in the Oyster culturing is growing oysters in under suitable conditions. Several conditions must be met in order to properly "garden" oysters, such as oysters must live in water that is temperate and the turbidity has to be low. We received about 1000 single seed oysters as part of NRG, a subdivision of Parks. We placed them in lantern nets. Each lantern net has four layers and we placed seventy five in each layer, thus 300 in each net. There were three nets, therefore 900 oysters was placed in the nets. We placed these nets in three different sites of the river; the cement plant, the mouth of the river, and a site near the mouth of the river where we have spotted some oysters. This is a study project to see what difference these Oysters will make in the surrounding body of water. This will also allow us to obtain license form state to grow oysters in large scale. No results are included in this paper as we just started the research.

Lantern Net used to grow Oysters

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Acknowledgements

-Thanks to Dr. Sat Bhattacharya, of Harlem Children's Society, for his innovative research program and for believing in me.
-Ms. Kimberlin Vasquez, an outstanding mentor, friend, and person.
-Mr. Adam Green-Rocking the Boat
-Mr. Seth-Rocking the Boat
-Janine Harris- Natural Research Group, a division of Parks.
-St. John's University
-Manhattan Center for Science and Mathematics
-American Chemical Society
-The apprentices, the students of on Water Program, and the Boat-Building Department of Rocking the Boat.
-The students of Harlem Children's Society
-Students who has worked under me, including DeShaundra, Schaddie, and Haynes. The experience with you, I will carry for a long time.
-Friends who has worked with me and supported me through their amazing abilities, including Megha, Alberto, Rami, Oscar, Pankaj, and Anatasia.
-My family, for providing moral and financial support through out the exciting summer research. Thanks to my brother for listening to me of the exciting events on daily basis.