Dissolved Oxygen as a Health Indicator of Local Estuary Waters Surrounding Governors Island New York, NY

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Introduction

Dissolved Oxygen is essential for almost all marine life on Earth. How do Dissolved Oxygen concentrations on Governors Island's Northwest Shore compare with Dissolved Oxygen concentrations at Governors Island's Pier 101. Varying degrees of tidal flow, partial pressure and water temperature have the potential to greatly affect the Dissolved Oxygen concentrations of any water body, including the local estuary waters surrounding Governors Island. If water temperature on Governors Island's Northwest Shore averages higher than at Governors Island's Pier 101 then Governors Island's Northwest Shore will as well, average higher Dissolved Oxygen concentrations than Governors Island's Pier 101.

Either free or chemically bound oxygen is required by nearly all forms of life on Earth. (Kornblum, 2013) Oxygen accounts for nearly half the mass of Earth's crust and more than four-fifths the mass of Earth's oceans, in terms of volume, oxygen makes up one-fifth of the air around us. (Whitmire, 2013) Plants utilize carbon dioxide as a source of carbon and return the oxygen to the atmosphere during photosynthesis, which is absorbed by all animals during respiration, which then converts it to back into carbon dioxide. (Kornblum, 2013) There remains a balance of oxygen in the atmosphere since oxygen is returned to the air by plants. (Whitmire, 2013) Oxygen dissolves into water according to partial pressure and temperature, (Allan, 1995) among other factors. Dissolved oxygen is required by aquatic organisms for their metabolic processes. (Kornblum, 2013) Because photosynthesis occurs only during daytime and respiration is continuous, large daily variations occur (EPA, 1986)

Project Design Chart

Problem
How will DO concentration on Governors Island NW Shore compare to Pier 101?
Hypothesis
DO concentrations will tend to be higher on Governors Island NW Shore.
Objectives
Formulate project.
Collect data.
Analysis data and make conclusions.
Independent Variable
Location.
Dependent Variable
Dissolved Oxygen.
Constants
Sampling sites.
Assumptions
The water quality of the samples being collected from the Harbor will be identical to the water in the harbor.
Limitations
Inability to monitor DO regularly.

Locality

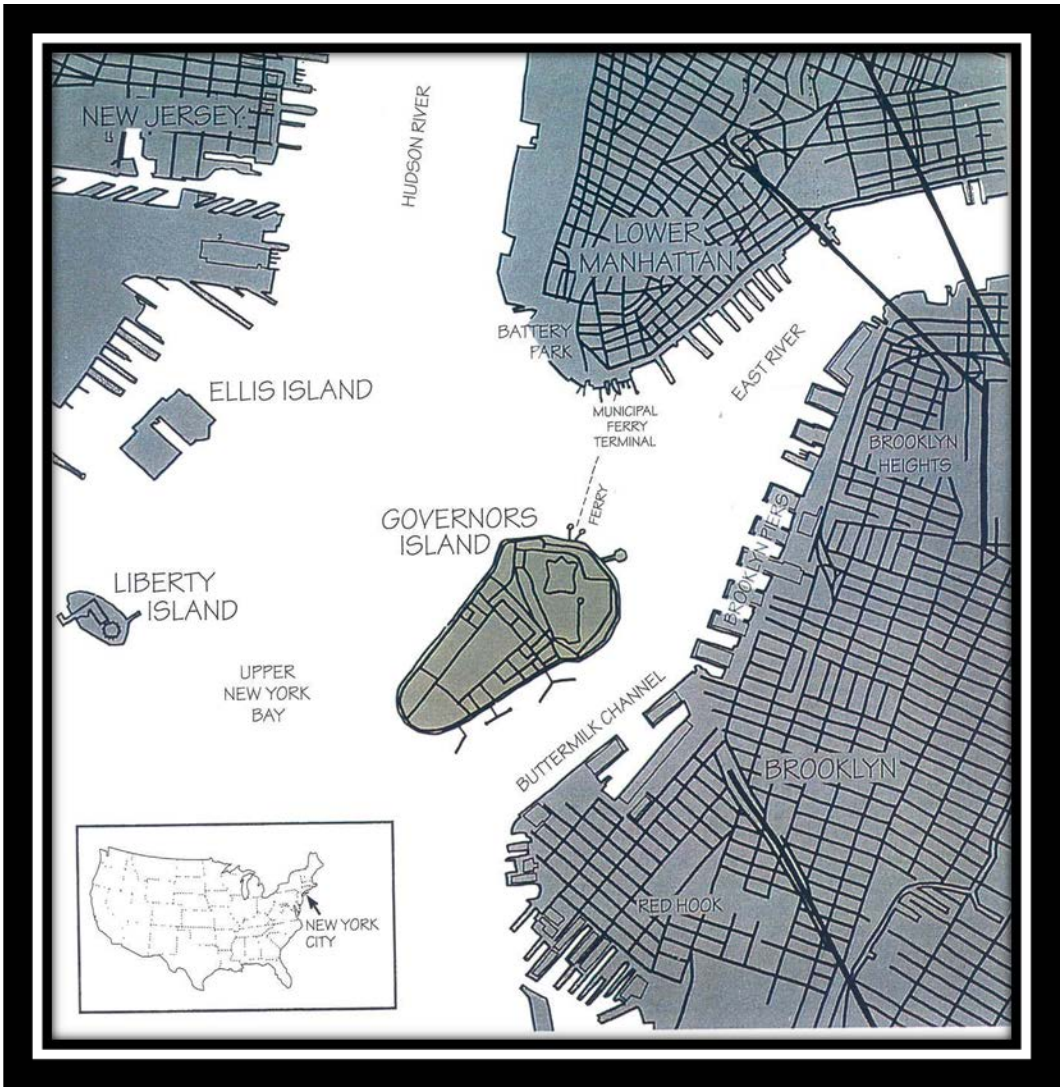

Figure 01 – Governors Island.

Materials

Materials	Quantity	Description
Sampling Bottle	1	Contains water samples.
Manganous Sulfate Solution	1	Forms precipitate.
Alkaline Potassium	1	Forms precipitate.
Sulfuric Acid	1	Oxidizes solution.
Test Tube	1	Contains Solution.
Tritrator	1	Gives test result.
Sodium Thiosulfate	1	Reacts with Iodine.
Starch Indicator	1	Enhances the final endpoint.
Waste Container	1	Contains chemical waste.
Thermometer	1	Measures temperature.

Procedures

Steps for Obtaining Dissolved Oxygen Data

1. Fill Water Sampling Data.
2. Add 8 Drops of Manganous Sulfate Solution.
3. Add 8 Drops of Alkaline Potassium.
4. Cap and Mix.
5. Allow Precipitate to Settle.
6. Add 8 Drops of Sulfuric Acid.
7. Cap and Mix Until Regent and Precipitate Dissolve.
8. Fill Test Tube to the 20 mL Line.
9. Fill Titrator with Sodium Thiosulfate.
10. Titrate until Sample Color is Pale Yellow.
11. Add 8 drops of Starch Indicator.
12. Continue Titration until Blue Color Just Disappears and Solution is Colorless.
13. Read Result in ppm Dissolved Oxygen.

Graphs and Images

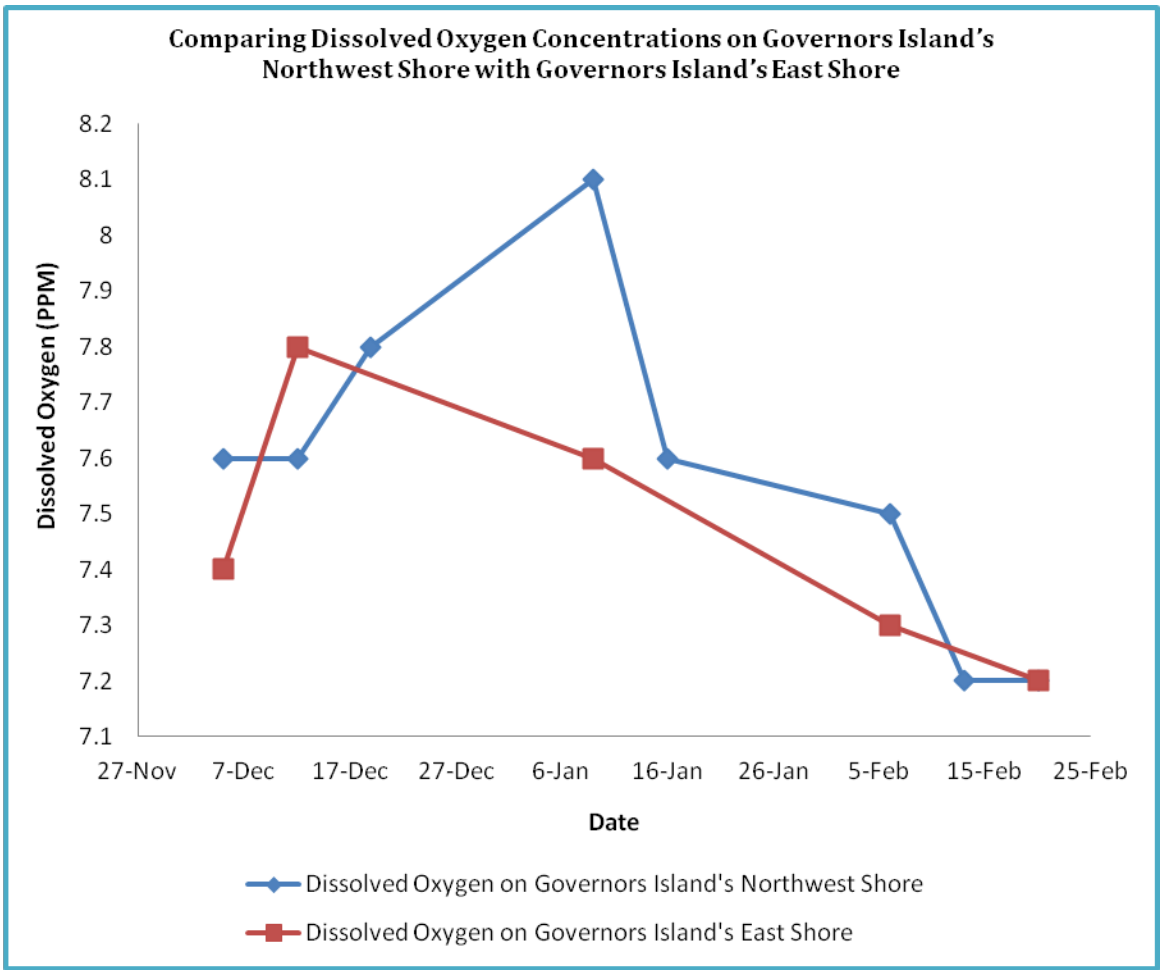

Figure 02 – Dissolved Oxygen on Governor Island's North West Shore and Governor's Island East Shore Between December 2012 and February 2013.

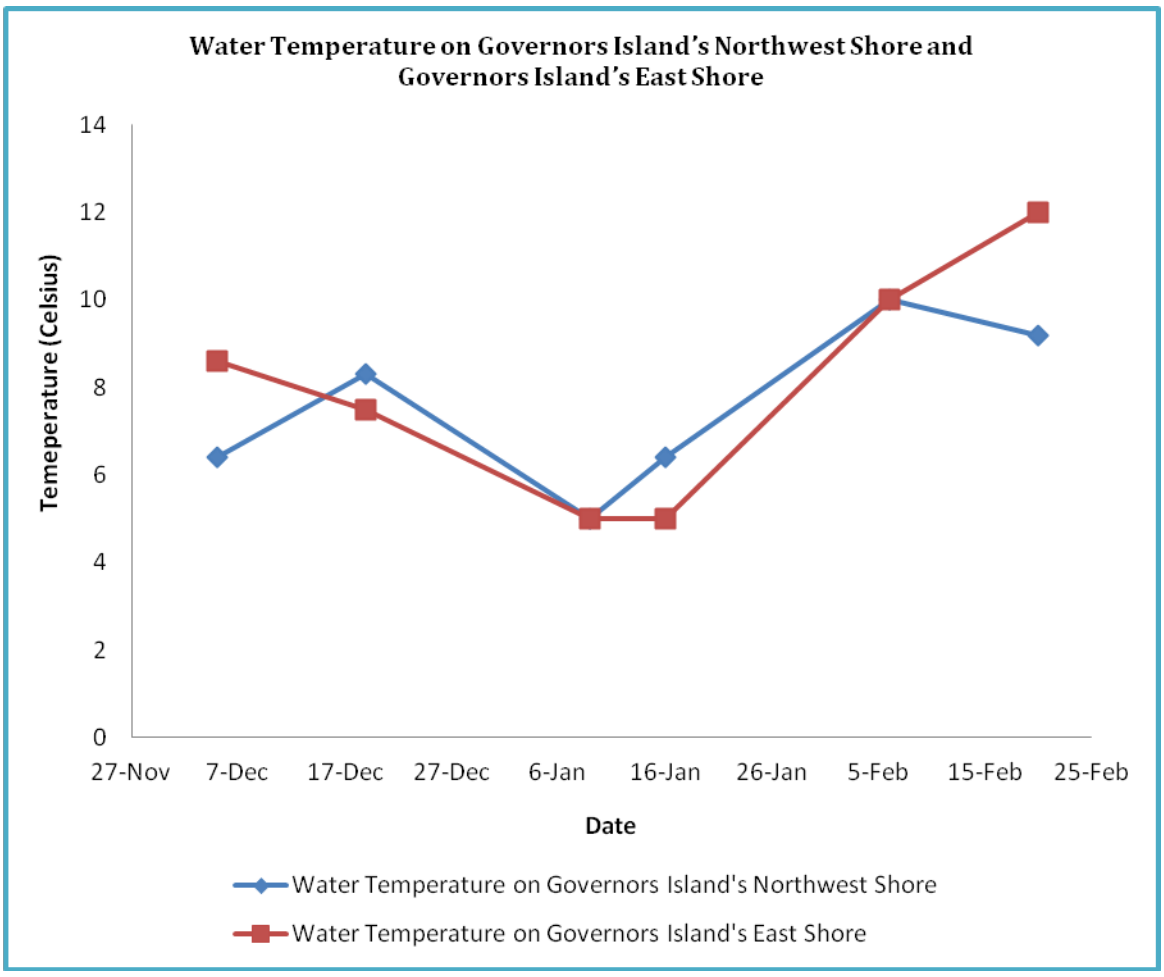

Figure 03 – Water Temperature on Governor Island's North West Shore and Governor's Island East Shore Between December 2012 and February 2013.

Analysis

Dissolved oxygen concentrations on Governors Island tended to be higher on its Northwest Shore than on its East Shore, as shown in Figure 02. Between December and February, there was a downward trend in Dissolved Oxygen concentrations on Governors Island's Northwest Shore, as seen in Figure 04, as well as on Governors Island's East Shore, as seen in Figure 05. Water temperature on Governors Island tended to be slightly higher on its East Shore than on its Northwest Shore, as shown in Figure 03. This may explain the trends seen in Figure 02. Between December and February, there was an upward trend in water temperature on Governors Island's Northwest Shore, as seen in Figure 06, as well as on Governors Island's East Shore, as seen in Figure 07. This may be explained in seasonal patterns that occur over the three month period.

Conclusion

The hypothesis was supported given the data stated in figures 02 through 07. Water temperature on Governors Island's Northwest Shore averaged higher than on Governors Island's East Shore, and likewise averaged higher Dissolved Oxygen concentrations.

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