Microorganisms in the Hudson and Bronx Rivers

Ben Altschuler, Lucas Janszky, Samantha Ratner, Aron Oogie Sohn, Kian Yoo-Sharifi
Dr. Adriana Andrade - ethical culture fieldston school, bronx, ny 10471

ABSTRACT

For our Urban Barcode Project we chose to investigate two of the rivers that surround the island of Manhattan, the Hudson and the Bronx rivers. We wanted to explore the similarities in the types and amounts of microorganisms in these two rivers. To attempt to find an accurate representation of what lives in the rivers, we collected water from multiple points along the river. We isolated DNA in the water, used the PCR process to amplify it, and found our results via DNA subway. We found that there were many similarities between the Bronx and Hudson rivers, mainly in two common plants, sunflower and ragweed.

INTRODUCTION

When we look at the rivers surrounding us, we rarely consider the creatures that lie below the surface. For the purposes of this project, we decided to do just that. We wanted to not only find what lives in the New York waterways, but to compare two of the biggest bodies of water in our city, the Bronx River and the Hudson River. To fully understand the organisms in these two rivers we tested for presence and concentration of fungus, plant and invertebrate DNA.

Of note is the fact that our group originated as a synthesis of two prior research groups- our research topics, were, however, very similar. We both sought to understand these fragile ecosystems, and to do so, we collected these samples. These rivers are rather similar- they are both estuaries, containing brackish water. This is, of course, a mix of both saltwater and freshwater, and this creates a unique environment where various creatures can thrive. In addition, they both are subject to the tides, and are geographically located in similar areas. One could conclude from the similar ecological conditions that these two bodies of water have similar ecosystems.

Our main objective for this project was to test this- by testing a large swath of DNA samples, we have attempted to uncover the ecological similarities between these two estuaries. We believe that by doing a partial biological analysis of points along the river, we can extrapolate a larger picture of the rivers. By doing so, we can compare the two ecosystems, and perhaps gain a greater understanding of the conditions that have created this. We plan to do this by utilizing our knowledge of the similarities and the differences in said systems. Our hypothesis is that the ecosystems will be almost identical in samples of DNA- while simplistic, we believe that the environments are similar enough that this hypothesis will be supported.

MATERIALS AND METHODS

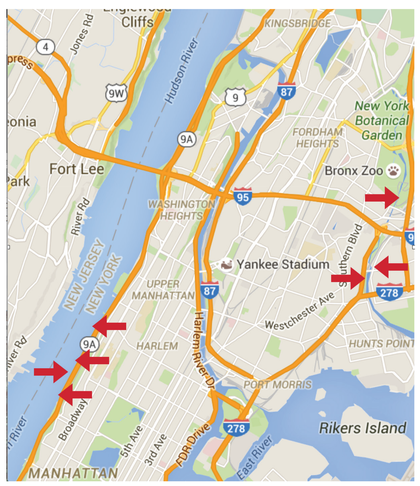
For our research, we utilized a variety of river samples. The only criteria we had was that they had to be from differing regions of the Bronx and Hudson River. This is broad by design; as our project is largely a wide analysis of a geographical location, we deliberately collected multiple samples of river water from a wide region of the northern Manhattan region of the Hudson River and from the Bronx river. We collected these samples in the fall of 2015, although we did not begin research until the beginning of winter. We collected approximately 4 bottles of river water, though we didn't utilize nearly all of it, as we only measured out a few µl of each.

To analyze this, we isolated DNA. Through lysing the cells in the sample and repeatedly treating and incubating the supernatant, we received a sample that we could amplify through PCR. After utilizing primer and a thermal cycler to amplify the DNA, we utilized gel electrophoresis to tell if we received DNA, using agarose gel as the medium in which we placed a portion of our DNA to make our DNA visible. We then sent the samples to the sequencers, after which we analyzed the sequences via DNA Subway. We looked at the sequences which received data, trimming our data pool down to only the valid sequences. After using these sequences to create base pairs, we utilized the tools to create a phylogenetic tree outlining the most likely species our samples could be. Of note in this process is that we tested our DNA using fungi, invertebrate, and plant primer (though not all concurrently), attempting to amplify any DNA within the river.

TABLES AND FIGURES

Tree Level (Similarity to sample)	Genus
Tree 1	Helianthus
Tree 2	Bahiopsis
Tree 3	Echinacea, Parthenium, Xanthium, Chromolepsis, Zinnia, Jacobea
Tree 4	Zinnia, Zaluzania, Chrysogonum
Tree 5	Ambrosia, Tithonia, Engelmannia, Rudbeckia, Borrichia, Silphium, Berlandiera
Tree 6	Stevia, Gaillardia, Perityle
Tree 7	Dahlia

Genus	Species	Number of appearances	Level on tree
Helianthus	annuus	7	1
Helianthus	tuberosus	3	1
Helianthus	pauciflorus	2	1
Silphium	integrifolium	2	5
Silphium	perfotalium	3	5



DISCUSSION

Our hypothesis was that the Bronx and Hudson river would have similar microorganisms. One can observe by looking at the tables that there was an abundance of sunflower species and many occurences of ragweed. The most occurring sunflower species is not native to the east coast, however it is the most cultivated sunflower, for both its flower and its seeds. Seeing as sunflower seeds happen to be fairly common, it is not surprising that there would be a lot of sunflower DNA in the river. The second most occurring species is the common ragweed, which is a weed common on the east coast, so it probably comes from the shore and gets swept in the current.

Ultimately, we cannot conclude that our samples were any one species of bacteria. Our phylogenetic tree easily shows too many samples to show conclusive data- as you can see from the chart, many samples show up. In addition, many of our samples simply did not process. We cannot make any conclusions, as it shows too many different matches for there to even process. We can only assume this- the rivers are wide, varied in contents, and both are much like this in a similar way.

REFERENCES

1. Instructions DNA Subway presented by Kaitlyn Espiritu. 7/20/15. Tenafly High School.
2. DNA Subway [Internet]. Place of Publication: Publisher; Cold Spring Harbor Laboratory (NY). Available from: http://dnasubway.iplantcollaborative.org/
3. Barcode Project Sample Database [Internet]. Cold Spring Harbor Laboratory (NY). Available from: https://sampledb.dnalc.org/barcoding/
4. Animation Quiz 6 - Polymerase Chain Reaction [Internet]. 2016. Available from: http://highered.mheducation.com/sites/0072556781/student_view0/chapter14/animation_quiz_6.html
5. Separating Fragments of DNA by Gel Electrophoresis [Internet]. 2010. Available from: http://www.sumanasinc.com/webcontent/animations/content/gelelectrophoresis.html
6. Genewiz Submission Guidelines [Internet]. 115 Corporate Boulevard, South Plainfield, NJ 07080 Available from: https://www.genewiz.com/Public/Resources/Sample-Submission-Guidelines/Sanger-Sequencing-Sample-Submission-Guidelines/Sample-Preparation

ACKNOWLEDGEMENTS

Dr. Adriana Andrade

The Ethical Culture Fieldston School

DNA Subway

Cold Spring Harbor Laboratory