Investigating if the Pollution from Airports Alters the Biodiversity of Organisms

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Abstract

The aim of the project was to a see if there is difference in the biodiversity of barnacles from two sites where one is closer to an airport and the other is further away. The Glen Cove and Worlds Fair Marina were decided on. After the barnacles were collected, they were split up into separate tubes and the data was analyzed and made into gel samples to obtain the DNA Sequences, in order to figure out what species each sample is . Although there are many pollutants in all bodies of water, only pollutants from airports will be specifically noted. The World's Fair Marina is inferred to have more airplane fuels and cause less biodiversity of that of the Glen Cove Marina. This was rejected, there was no difference in the biodiversity of barnacles between the two marinas. This concludes that airplane pollution does not have any specific affects on barnacles.

Introduction

The biodiversity of LI and specifically, of the aquatic organisms, is very divergent in different bodies of water. Many parts of the LI Sound have lots of harmful pollutants in them. For example, deicers are one of the biggest pollutant problems in bodies of water that near airports. They are used for removal of snow, ice of frost from a surface, which means they are used on planes. The projects collection sites are from 2 different marinas, Glen Cove and World's Fair. These marinas are both in the Long Island Sound, one on the North Shore and the other is in the Flushing Bay which connects to the LI Sound.

The plan was to see a difference in the biodiversity of the living aquatic organisms in the water by both marinas due to the pollution because of the airport. It was assumed that if the World's Fair Marina has more pollution, it is because of the airport. The type of organisms that were collected were barnacles. The type of barnacles found are most likely Northern Rock Barnacles aka Semibalanus balanoides. (Linnaeus, 1767) The biodiversity of these two sites can be effected by airplane fuels, deicers, or other toxic chemicals that can kill these organisms. Since World's Fair Marina is near LaGuardia Airport, the water is inferred to show pollution due to the airplane fuels, deicers and other toxic chemicals from airplanes. The purpose of this study was to identify the organisms to see if they have been harmed by these toxic chemicals. If some have been harmed but others not, there will be a different biodiversity in the two water.

Materials & Methods

The collection sites were the World's Fair and Glen Cove Marina, where permission was granted to collect. However, the World's Fair marina is close to an airport, approximately 1 mile, unlike the Glen Cove marina, which is far away from an airport, approximately 20 miles from LaGuardia airport. Water was collected using water jars, pictures were taken, and the pH using Hydrion pH strips, temperature, and salinity were tested for additional data. A metal spatula was brought to the marina to scrape the edges of posts and docks. A ruler was used to measure the depth of collection and a thermometer was placed into the water in order to test the temperature of it. In addition, the pH strips tested the water to show how acidic or basic the water is. There, 10 organisms were collected from each site. After the data collection, the jars and data were brought back to the lab and looked at under the microscope (organisms were filtered out using the use of filter screens). The species, using pictures, websites, books, and a taxonomic key, were then tried to be visually identified. When brought to the lab, DNA was isolated, amplified and analyzed by using PCR. The DNA were put into gels and run by gel electrophoresis.

Results

After visiting the Glen Cove and Worlds Fair Marina, barnacles, which were easy to scrape off of posts and docks, were collected. When the DNA from each sample was extracted and amplified, each sample was put through gel electrophoresis to make sure DNA was present. In every sample except for C009, C013, and C014, DNA was present. These samples were from the Worlds Fair Marina. It is not certain how DNA was lost, it could have happened in any step in the experiment, from the grinding of the tissue to putting it through the PCR. The pictures of the gels were sent to obtain a DNA sequence in order to compare the species at both marinas and understand if airplane fuels could affect biodiversity of barnacles. When the sequences were sent back, they were put through the DNA Subway website. As seen on the phylogenetic tree, there seems to be no difference in biodiversity between the barnacles from the two sites. It can be concluded that airplane pollution doesn't affect the amount of barnacle diversity. The phylogenetic tree is not separated in the samples from each marina.

	Site 1	Site 2
Salinity	24 ppt	26 ppt
pH	6	5.0
Longitude	-73.641806	-73.856968
Latitude	40.856930	40.763902
Depth of collection	3 ft	3ft
Distance from airport	23 miles	2 miles
Temperature of water	45°F	41°F

Figure 1: This is a chart showing important facts about the area of both sites from each marina during the collection of the samples. Site 1 is the Glen Cove Marina and Site 2 is the Worlds Fair Marina

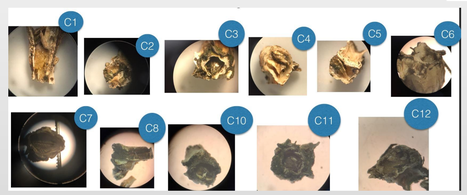

Figure 2: Samples 1-7 were collected from the Glenn Cove Marina. Samples 7-12 were collected from the World's Fair Marina. The labels are based on the labels from the labeled bands on the gel electrophoresis. As seen, sample C001 and C008 seemed to be pregnant due to the many eggs in the shell of the organism. It is predicted that these organisms are Northern Rock Barnacles.

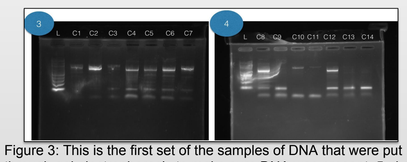

Figure 3: This is the first set of the samples of DNA that were put through gel electrophoresis to make sure DNA was present. 5 µl of a sample was loaded and run at 130v for 30 minutes. All seven samples in this first set showed a band of DNA, allowing for all seven to be sent for a DNA sequence.

Figure 4: This is the second set of samples of DNA that were put through gel electrophoresis. 5 µl of a sample was loaded and run at 130v for 30 minutes. Every sample except for C009, C013, and C014 showed a band of DNA, so those samples will not be sent for sequencing. The first band in each picture is the latter, which measures the size of each band.

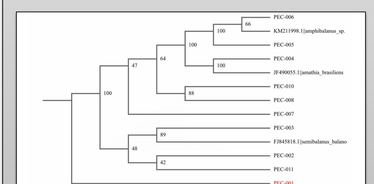

Figure 5: This is a phylogenetic tree, or a gene tree, and it analyzes similarities and differences in DNA sequences and compares them. In this tree, each sequence was compared to DNA sequence of organism C001. PEC-001 was selected as an out group because it was the first organism collected.

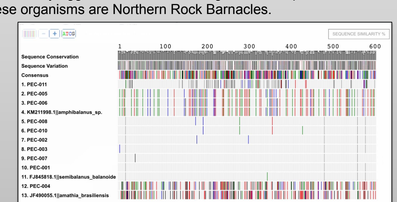

Figure 6: This chart aligns and compares the trimmed DNA sequences of each organism. It shows the sequence variation and conservation, and also provides the percent of how similar the sequences are.

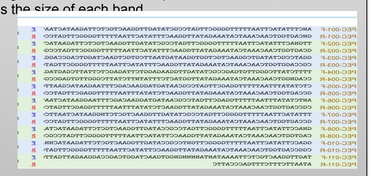

Figure 7: This figure just shows the forward and reverse DNA sequence of each organism

Discussion

After collecting the samples, they were taken to a lab in order to isolate the DNA sequences. The hypothesis has been rejected since there was no difference in the amount of biodiversity seen between the two sites. Since barnacles is what was collected from each Marina, they were scraped off the docks and poles a little bit above water. Both of these marinas could have pollution, but it may not be from airplane fuels or deicers. Other pollutants can cause errors in the project so fuels and deicers are the main type to be compared. One of the steps taken to make the sequences could've been done wrong and caused an error in the gels and an error in finding any DNA in it. Deicers and the airplane fuels from flying over these marinas are the main pollutants being compared between the 2 marinas. This means Worlds Fair Marina has planes flying very close over it so the fuels are more likely to spill into the waters here in the Flushing bay. There is a chance that this could happen in the Glen Cove Marina's water but it's a lot less likely since planes don't fly that close over it, and probably not as often. It was very important to be able to get barnacles from a Marina so close to the airport so it was more likely that it had airplane pollution. A gel electrophoresis was done to see the gel DNA samples. The samples were put into wells that were on gels using pipettes. Three of them were rejected while the rest clearly had DNA. Research and investigation can continue on to figure out if there is any type of pollution at that Marina since airplane fuels didn't affect it. We believed that the pollution at each Marina would be different, but realize now that it wasn't. Additionally, the idea that airport pollution affects the amount of biodiversity of barnacles, has been rejected completely. Hopefully we can continue on with this project in the future.

References

(Barrett, 2010), (Briggs, 1994), (Linnaeus, 1767), (Pederson, 2014), (Scott, 2005)

Acknowledgements

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