Barcode LI: Investigating if the Pollution from Airports Alters 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 organisms 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 invertebrate 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. However, this was rejected. There was no difference in the biodiversity of organisms between each Marina. This concludes that airplane pollution does not affect biodiversity.

Introduction

The biodiversity of LI and specifically, of the aquatic organisms, is very divergent in different bodies of water. Oceans are 70% of our planet and have a higher diversity of organisms than terrestrial or freshwater ecosystems. (Briggs, 1994) 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. This happens when rainwater hits the de-icing agents at the airport and runs off into a drain or nearest body of water. The drain becomes filled up overwhelmingly and seeps off into groundwater which then eventually goes into the ocean. The toxic chemical was identified as tolytriazoles, which is also used as corrosion inhibitors in car antifreeze. After it was identified, this chemical was found in the groundwater beneath an airport in Milwaukee, Wisconsin. (Morin, 2015)

Painting chemicals, testing fire equipment, fuel leakage, and spills from refueling and storage are other pollutants that find its way from the airport to the nearby bodies of water. (Scott, 2005) These chemicals have a huge impact on the oceans and living aquatic organisms. 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. In addition, the World's Fair Marina is close to LaGuardia airport. 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 is understood that not all pollution was caused by the nearby airport, but until data was collected nothing was certain. It was assumed that if the World's Fair Marina had more pollution, it was because of the airport. What was hoped to cause a difference in the biodiversity of the water at the two sites is airplane fuels, and deicers from the World's Fair Marina. Before the samples were collected, the temperature, pH and salinity of the water were tested. Also, once the samples are obtained, the types of organisms collected were to be identified so finding the biodiversity between the two sites was tangible. The living aquatic organisms at these marinas may be different or very diverse, or the biodiversity may be very small. The purpose of this research project was to find the biodiversity of aquatic organisms in the LI Sound. The biodiversity of these two sites can be affected by airplane fuels, deicers, or other toxic chemicals that can kill these organisms. These plane fuels can also affect humans and our health. It has been seen that unregulated emissions when planes are flying above 3,000 feet have been responsible for most of the deaths in a year. (Barrett, 2010) Plane emissions kill about ten thousand people each year while crashes only kill a thousand.(Inman, 2010) These fuels are influencing the environment and is bringing up the risk factor of death. Any waters near airports can be very polluted and swimming in it can be very risky. World's Fair Marina and Glen Cove marina are the two marinas where collecting will be taking place. Since World's Fair Marina is near LaGuardia Airport, the water was inferred to show pollution due to the airplane fuels, deicers and other toxic chemicals from airplanes. Glen Cove Marina is on the North Shore and its water is in the Long Island Sound, as well as the World's Fair Marina. This means that they are in the same body of water and a difference in pollution should easily be shown.

The purpose of this overall study is to identify the organisms to see if they have been harmed by these toxic chemicals. Evolution allows biodiversity to accumulate over time as long as catastrophe is avoided.(Sepkoski, 1998) If some have been harmed but others not, there will be a different biodiversity in the two waters.

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, we were able to collect a lot of water samples from each marina. When the DNA from each sample was extracted and amplified, each sample was put through gel electrophoresis to make sure DNA was present. 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. If time permits, the same samples that did not show a DNA band will be used again in order to attempt to find a band of DNA to be sent for sequencing. The samples with the presence of DNA confirmed via gel electrophoresis will be sent for DNA sequencing in order to compare the species at both marinas and understand if airplane fuels could affect biodiversity of organisms.

Figure A

	Site 1	Site 2
Salinity	20 ppt	27 ppt
pH	6	6
Longitude	-73.641379	-73.858293
Latitude	40.856692	40.761314
Depth of Collection	5 ft	5 ft
Distance from Airport	23 miles	2 miles
Temperature of Water	52°F	53°F

Figure A 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 B

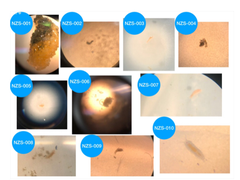


Figure B shows the 10 samples from the World's Fair Marina that have been sent for sequencing. The labels are based on the labels from the labeled bands on the gel electrophoresis. Many of the samples are different while some were inferred to be types of amphipods.

Figure C

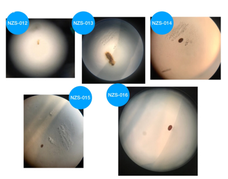


Figure C shows the 5 samples collected from the Glen Cove Marina. They have been sent for sequencing. The labels are based on the labels from the labeled bands on the gel electrophoresis. As seen, almost all of the samples seem to be different from each other.

Figure D

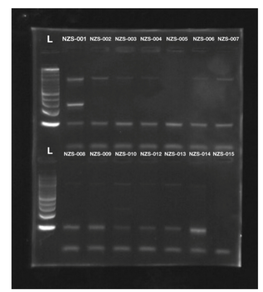


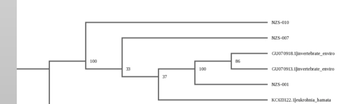
Figure D shows the gels after they were put through gel electrophoresis

Figure E

Figure F

Figures E and F both show the Phred Quality Score of sample NZS-001. Figure E shows the forward sequence and F shows the reverse of the same sequence. Each different color of the peaks represent a different DNA letter.

Figure G



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 the DNA sequence of NZS-002.

Figure H

This figure shows the forward and reverse DNA sequence of each organism. This is what they look like after they were trimmed.

Discussion

Once the samples were collected from the Marina's, they were taken to a lab in order to isolate the DNA sequences. They hypothesis being rejected or not is unknown due to the fact that the only samples accepted were all from the same Marina. After our project last year, the hypothesis was also rejected because there was no difference in pollution in the barnacles. 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. A gel electrophoresis was done to see the gel DNA samples. The samples were put into wells that were on gels using pipettes. The Gel Electrophoresis proved that the procedure was done correctly, and that there is DNA from some, but not all of the samples to put through DNA Subway. After the results are obtained from DNA Subway, the species of each sample will be known, and therefore the difference in biodiversity between each marina can be interpreted. 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.

References

(Barrett, 2010), (Briggs, 1994), (Inman, 2010), (Morin, 2015), (Sepkoski, 1998)

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