What Are The Relations of Genetics in the Biodiversity of Aquatic Macroinvertebrates?

Our goals in this project is to compare the DNA of a variety of aquatic macroinvertebrates, by collecting samples in different ponds on Long Island NY.

Abstract

Biodiversity is the variety of life in the world or in a particular habitat or an ecosystem. By making an observation from each location that the DNA samples that were collected, we determined whether or not if the pond's ecosystem was polluted. Polluted locations result in less biodiversity in aquatic macroinvertebrates compared to the non-polluted locations.The Cold Spring Harbor Pond location is near the harbor, and is located in a natural ecosystem. Therefore, Cold Spring Harbor has a higher biodiversity than the ponds located in neighborhoods; the Heckscher Park pond and the Southards pond.

The most essential materials that were used to collect the samples from each location are plastic bags, containers, and a microscope to identify the aquatic macroinvertebrate. Our way of collecting the samples from the pond is to find where the algae is located, therefore there would be a majority of macroinvertebrates present. Then, we extracted the DNA of each aquatic macroinvertebrate and used the gel electrophoresis to determine the the relation of each species.

As a result, our determination of the biodiversity of the aquatic macroinvertebrates were invalid from the gel electrophoresis, provided that no bars from the gel electrophoresis were visible during this experiment. However, we were able to differentiate each macroinvertebrate, and supported our hypothesis that there is a high diversity in non-polluted areas than polluted areas. By observing the macroinvertebrates under the microscope, we distinguished the differences in species. For example, we have discovered scuds, damselflies, snails, water mite, and aquatic worms.

Introduction

In relevance to human health,

In revelance to human health, caddisflies (larvae), stoneflies (nymphs), water pennies, and hellgrammites (dobsonfly larvae) are highly sensitive to pollution, therefore the amount of pollution in one's habitat would affect the population of the macroinvertebrates. Some macroinvertebrates are somewhat tolerant to pollution, such as rifle beetles(larvae), fish flies, scuds, and dragonflies and damselflies (nymphs). The aquatic macroinvertebrates that are tolerant to pollution are, black flies (larvae), midge flies (larvae), and lunged snails,whereas their population will be less affected than the aquatic macroinvertebrates that are sensitive to pollution. In contrary, a high diversity in aquatic macroinvertebrates in a habitat determines how less of an area is polluted.

Discussion

After examining the gel electrophoresis there were no visible bars under ultraviolet light, therefore the results were inconclusive. However, we were able to identify many of the macroinvertebrates using the Stroud Water Research Center's identification key. By identifying the damselfly, scud, aquatic worm, snail, and water mite.

We concluded that the Cold Spring Harbor Mill Pond would have the most biodiversity. Our hypothesis was supported due to the four out of six different macroinvertebrates that were present in the pond. Due to the late collection of the samples in the year, our time was limited to process the experiment, therefore there is a possibility that we might have either skipped a step, or have not completed the procedure carefully and thoroughly. Provided that errors were made by showing no results from the gel electrophoresis.

Some macroinvertebrates are tolerant to pollution, such as the rifle beetles(larvae), fish flies, scuds, dragonflies and damselflies (nymphs). The aquatic macroinvertebrates that are tolerant to pollution are, black flies (larvae), midge flies (larvae), and lunged snails,whereas their population will be less affected than the aquatic macroinvertebrates that are sensitive to pollution. In contrary, a high diversity in aquatic macroinvertebrates in a habitat determines how less of an area is polluted.To further our results we would repeat the gel electrophoresis and manage our time wisely until we receive accurate results.

Materials & Methods

-Different samples of aquatic macroinvertebrates
-Pestles
-Waterbath
-Styrofoam rack for water bath
-thermometer
-mini transilluminator
- Plastic beakers
-White/blue microfuge tube racks
-Roll of tape
-Styrofoam Container (containing fridge/freezer supplies)
Cold packs
-80 tube racks
-Microcentrifuge
-Mini PCR or thermocycler
-Sharpies
-Gel electrophoresis chambers
-Gel electrophoresis trays, rubber dams, and combs
-Power supply
-Plastic bottle w/ 2% agrose gel
-Plastic bottle w/ electrophoreisis running buffer (1x or 10 TBE)
- Pipette tips (0.5 ul-10 ul, 10 ul-100ul,100ul-10000)
-Gray micropipettes (0.5 ul-10 ul)
-Yellow micropipettes (10 ul- 100 ul)
-Blue micropippettors
-1.5 ml tubes
-15 ml screw caps
-0.2 PCR tubes (+PCR beads)
-0.2 ml strip tubes (for samples to be sequenced)

- We will travel to multiple ponds around Long Island and take water samples from each area. Then, we will take three pictures of the samples; a close shot, a medium shot, and a far shot. Third,we will freeze the macroinvertebrates and extract DNA from each organism. Lastly, we will compare their genetics and quantify the biodiversity of the aquatic macroinvertebrates relations.

Conclusion

We believed that Cold Spring Harbor Mill Pond would have the most biodiversity. Our hypothesis was supported because 4 out of our 6 different macroinvertebrates were from there. Time was the main flaw with our study plan, we collected the samples too late year and we had little time to do the gel electrophoresis so mistakes were made causing lack of results from the gel electrophoresis. Some macroinvertebrates are somewhat tolerant to pollution, such as rifle beetles(larvae), fish flies, scuds, and dragonflies and damselflies (nymphs). The aquatic macroinvertebrates that are tolerant to pollution are, black flies (larvae), midge flies (larvae), and lunged snails,whereas their population will be less affected than the aquatic macroinvertebrates that are sensitive to pollution. In contrary, a high diversity in aquatic macroinvertebrates in a habitat determines how less of an area is polluted.To further our findings we could repeat the gel electrophoresis until we get results.

References

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"Macroinvertebrate Identification Key." Stroud Water Research Center, Stroud Water Research Center Https://Stroudcenter.org/Wp-Content/Uploads/2016/09/Lofty-Stream-Dave-Funk-1024x681.Jpg, stroudcenter.org/macros/key/.

Thanks to the town Huntington for giving us to permission to use the Heckscher Pond to retrieve samples.

Aquatic Macroinvertebrates Found From Ponds Around Long Island

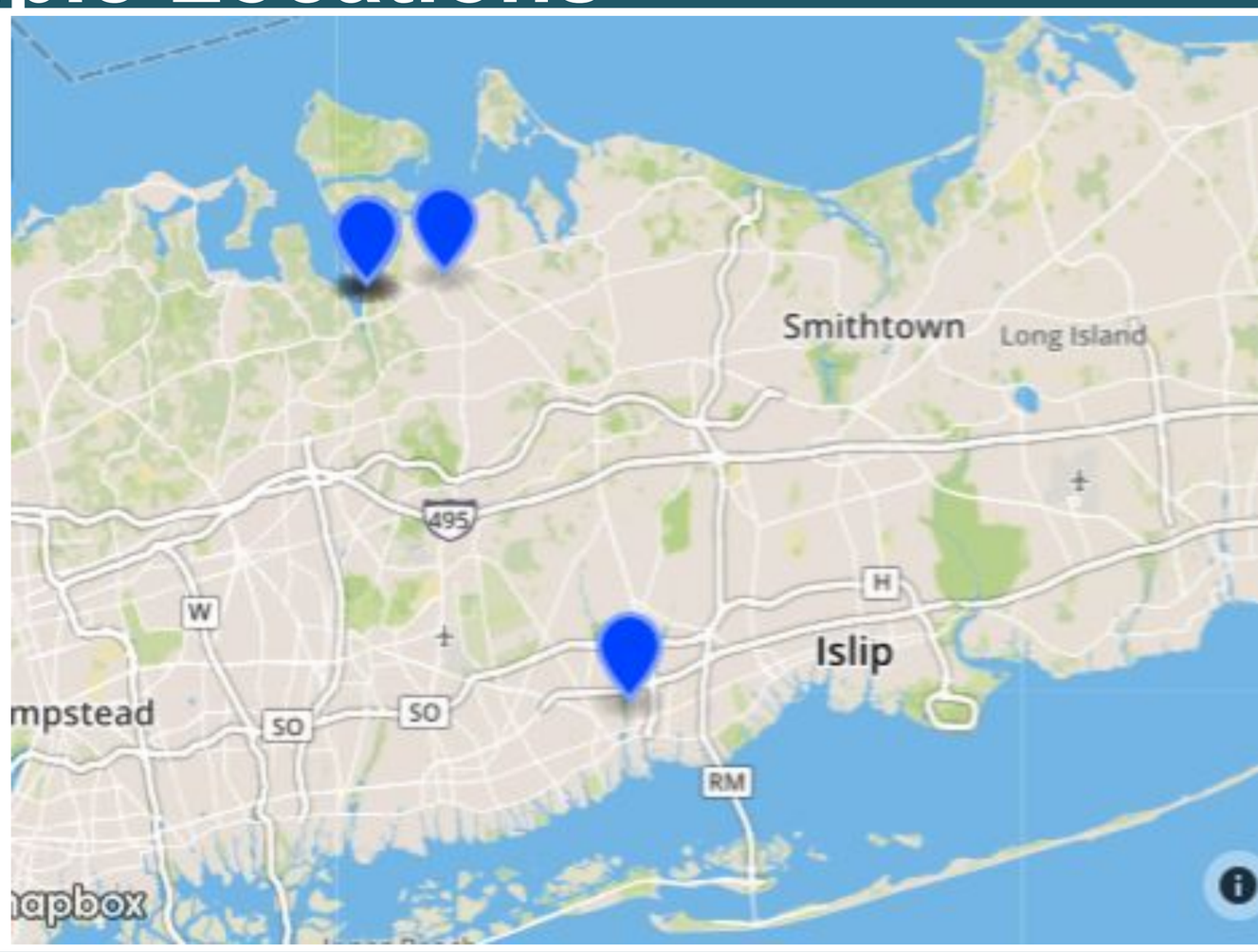
By Maegan Guzman & Bryce Vorbach

Map Of Sample Locations

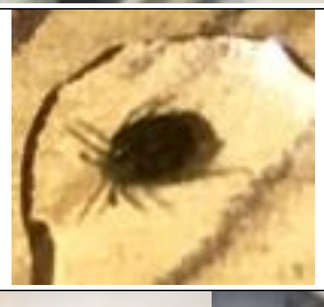
Heckscher Park

Southards Pond

Cold Spring Harbor



Data Table

Latitude and longitude organism was found.	Image of organism	Name of organism according to the Stroud Water Research Center's "Macroinvertebrate Identification Key"
Latitude: 40.8707 Longitude:-73.4615		damselfly, odanata
Latitude: 40.8756 Longitude: -73.421		scud, amphipoda
Latitude: 40.8707 Longitude: -73.4615		aquatic worm, annelidae
Latitude: 40.8707 Longitude: -73.4615		snail, mollusca
Latitude: 40.8707892825 Longitude: -73.4620956075		water mite, Arachinida
Latitude: 40.7102 Longitude: -73.3263		aquatic worm, annelidae