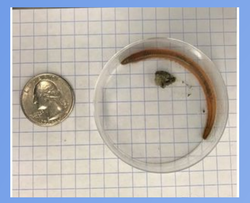
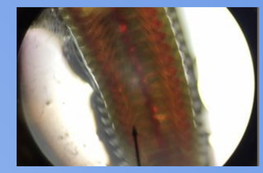


Marine Worms as an Indicator of Water Pollution on Long Island



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Abstract

The goal of this project was to see if the presence of specific marine worms could be directly linked to the presence of certain kinds of pollution. The group researched marine worms found around Long Island and amplified their DNA through DNA purification, polymerase chain reaction (PCR), and gel electrophoresis. Along with collecting the samples, the water where the samples were taken from was tested for hardness, pH, alkalinity, chlorine, nitrates, nitrites, copper, iron, hydrogen sulfide, and iron bacteria. This experiment indicated that both locations visited, Oyster Bay and Lloyd Harbor, had various forms of pollution and a link between the presence of Polychaeta sp. and elevated levels of nitrates and nitrites in the water at Oyster Bay. The results of this experiment mean that people should be wary of the marine worm populations near a body of water since a lack of biodiversity or a large population of a particular species of marine worms may indicate pollution in the water.

Introduction

97% of the earth's water is marine water, and maintaining the biodiversity within marine environments is extremely important. Even though most of it is unknown, marine water holds the largest amount of species on Earth. Each species has their own niche, and if one species is affected, collapse of other species that depend on that lost niche will begin a domino effect of mishaps.

The study of water pollution is vital when understanding indicators of pollution. Common sources of pollution include heavy metals, nitrates, nitrites, and water hardness.

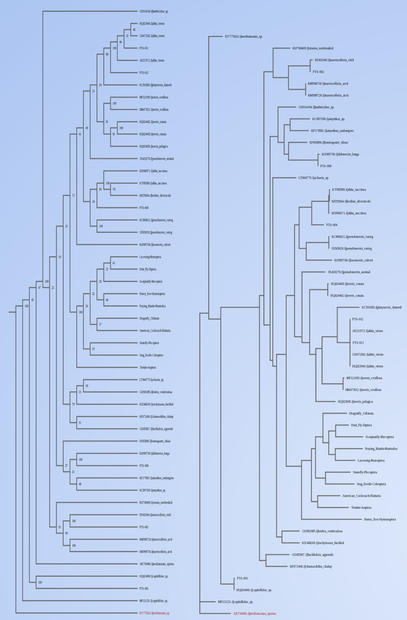
Marine worms can serve as pollution indicators in their habitat, which could lead to research of why a body of water is polluted and how it can be prevented. If a marine worm that serves as an indicator of pollution is found, then it can be concluded, along with water tests to show further proof of pollution, that something is affecting the water and something should be done to treat it. This would prevent further damage to the surrounding environment and human health that may be affected by contaminated water.

This experiment sought to investigate if there was a direct correlation between the presence of specific marine worms and certain types of water pollution. The group believed that a direct link could be established between marine worms and pollution. Additionally, the group believed that if polychaetes were present in the area, then there would be high levels of heavy metal pollution.

Acknowledgements

We would like to thank our teachers: Ms. Cipriano and Dr. Sharon Pepenella from Cold Spring Harbor Laboratory.

Results



Sample ID	Sample Name	Number of mismatches	Latitude	Longitude	Location	Nearby Water Pollutants
PTA-001	Capitellidae sp.	1	40.8757	-73.5397	Oyster Bay	Water hardness above 800 ppm; pH of 6; Nitrites above 10 ppm; Nitrates above 50 ppm
PTA-002	Marenzelleria viridis	1	40.8757	-73.5397	Oyster Bay	Water hardness above 800 ppm; pH of 6; Nitrites above 10 ppm; Nitrates above 50 ppm
PTA-003	Alitta virens	0	40.8757	-73.5397	Oyster Bay	Water hardness above 800 ppm; pH of 6; Nitrites above 10 ppm; Nitrates above 50 ppm
PTA-004	Polychaeta sp.	1	40.8757	-73.5397	Oyster Bay	Water hardness above 800 ppm; pH of 6; Nitrites above 10 ppm; Nitrates above 50 ppm
PTA-005	Polychaeta sp.	2	40.8757	-73.5397	Oyster Bay	Water hardness above 800 ppm; pH of 6; Nitrites above 10 ppm; Nitrates above 50 ppm
PTA-007	Capitellidae sp.	1	40.9094909994	-73.484351635	Lloyd Harbor	Water hardness above 800 ppm; pH of 4
PTA-008	Drilonereis longa	4	40.9094909994	-73.484351635	Lloyd Harbor	Water hardness above 800 ppm; pH of 4
PTA-011	Alitta virens	1	40.9094909994	-73.484351635	Lloyd Harbor	Water hardness above 800 ppm; pH of 4
PTA-012	Alitta virens	0	40.9094909994	-73.484351635	Lloyd Harbor	Water hardness above 800 ppm; pH of 4
PTA-014	Alitta virens	27	40.9094909994	-73.484351635	Lloyd Harbor	Water hardness above 800 ppm; pH of 4
PTA-016	N/A	N/A	40.9094909994	-73.484351635	Lloyd Harbor	Water hardness above 800 ppm; pH of 4

Materials and Methods

The group traveled to various Long Island coastal locations, specifically marine environments in Lloyd Harbor and Oyster Bay due to accessibility and ease for all the group members, and used tweezers to pick up marine worm samples to be stored in test tubes. Photographs were taken of the samples in their habitats, and pictures of the surrounding environment were taken as well. A total of 16 samples were collected, seven in Oyster Bay and nine in Lloyd Harbor, and all were taken in April; the tests on the water were done the same day. The water tests were run using simple household tests that could be purchased at a standard home improvement store for an inexpensive price, which was very convenient for the group. The testing kit included instructions and materials that were used to test for hardness, pH, alkalinity, chlorine, nitrates, nitrites, copper, iron, hydrogen sulfide, and iron bacteria.

After collection, all the samples were analyzed using the standard DNA barcoding procedure., which included DNA purification, polymerase chain reaction (PCR), and gel electrophoresis. Pictures of the gels were uploaded onto the sample database for approval to be sent for sequencing. Only five samples were deemed unfit for sending. The approved samples were prepared and then sent to the laboratory for sequencing.

The procedure was modified slightly in this experiment. The first two gels that were prepared were unsuccessful. When placed on the lightbox, no samples appeared and neither did the ladder, even though the gel had a slight blue and purple tinge to it, which indicated that the dye had traveled down the gel. Instead of preparing gels only once, gels were made twice. The second round of gels was much more successful, with the majority of samples becoming visible when the gel was placed on the lightbox.

Discussion

As indicated by the phylogenetic trees, very few samples were similar to each other. The maximum likelihood phylogenetic tree accounted for similarities between organisms such as PTA-011 and PTA-012, which are both Alitta virens. One potential source of error is the use of a store-bought water testing kit, which can be imprecise. This caused the group to have to infer what the level of pollution in the water were, causing inaccuracy in the results. Polychaeta sp. was only found in the Oyster Bay location, which had extreme nitrate and nitrite levels. This could mean that Polychaeta sp. is an indicator of elevated nitrite and nitrate levels in water. Overall, this experiment appears successful. It found that specific species of marine worms were concentrated in areas that had specific forms of pollution, but inaccuracies could affect this result. This experiment proved the hypothesis correct; it showed that polychaetes could be connected to heavy metal pollution. However, this also means that more precise studies are necessary to discover a direct relationship between water pollution and the presence of certain marine worms.

This experiment can be used in further study for human health affected by polluted water. With knowledge of indicator species, scientists and researchers can use this information to implement protection against contaminated water and create ways to help those who have become ill. Identifying the species found in Oyster Bay or Lloyd Harbor also allows people in other areas to exercise caution when they see certain marine worms. This leads to awareness about pollution in the water, encouraging people to find a different water source that has less pollution.

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