Local ecosystems affected by damage to the Bay Park Sewage Treatment Plant during Hurricane Sandy

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Abstract

As a result of Hurricane Sandy, the Bay Park Sewage Treatment Plant was damaged leading to the introduction of wastewater to local ecosystems. Did the presence of wastewater have a negative effect on the biodiversity of plants and invertebrates nearby in the Marine Nature Study Area in Oceanside and Hewlett Point Park? Our objective was to collect samples of plants and invertebrates, to analyze which species were affected by the wastewater pollution, and to mark their locations using a GPS. We then extracted DNA from these samples, performed PCR and gel electrophoresis and sent the samples for sequencing to determine which species we had collected. At the conclusion of this project, we found multiple species of plants and invertebrates that may be adapted to survive and grow in polluted areas.

Introduction

Wastewater has many negative effects. As more organic material (sewage) is added to fresh water ecosystems, more oxygen in used up in breaking the organic material down. Animals in the water can die as a result of too little dissolved oxygen in the water. Another negative effect of sewage pollution is the toxic material it may contain. The waste can block sunlight necessary for plant growth. Chemicals in wastewater can harm fish and make the reproduction of offspring impossible. Pathogens introduced in sewage can harm the ecosystem's health[5,6].

During Hurricane Sandy, the Bay Park Sewage Treatment Plant was damaged. This resulted in the release of untreated and partially treated wastewater into the surrounding communities. The plant is currently being repaired but the damage will have lasting effects on the local ecosystem[2]. Bay Park Sewage Treatment Plant treats the waste of approximately 550,000 homes in Nassau County[4].

Collecting Samples

Materials and Methods

Part I: We collected 11 samples in total. Five samples from Hewlett Point Park (3 plant samples and 2 invertebrate samples) and six samples from Oceanside (4 plant samples and 2 invertebrate samples). Once a specimen was located, we used a smartphone with a camera to document pictures of the specimen and the exact GPS coordinates of the samples. The samples were frozen until we could extract the DNA in the lab[10].

Part II: Back in the lab, we then extracted the DNA from our samples following the Barcode LI DNA extraction protocol[10].

Part III: A PCR reaction was set up and run for each sample using the appropriate primers (plant or invertebrate) and PCR program following the Barcode LI PCR protocol[10].

Part IV: The results of the PCR reactions were analyzed by gel electrophoresis following the Barcode LI gel electrophoresis protocol[10]. One change that was made to the protocol was to load 5 µl of DNA ladder in the gel that already contained Sybr Green dye, instead of 10 µl.

Part V: The remaining volume of the PCR samples that had given clear, bright, single bands on the gel were sent to the DNA Learning Center so that the samples could be submitted for sequencing

Part VI: We then analyzed the results of the sequencing using the DNA Subway computer application[10]. (http://dnasubway.iplantcollaborative.org/)

Results

Species	Common Name	Location	Plant or Invertebrate
Enchytraeus albidus	White Worm	Hewlett	Invertebrate
Ilyanassa obsoleta	Mud Snail	Hewlett	Invertebrate
Chamobates sp.	Soil Mites	Oceanside	Invertebrate
Melampus bidentatus	Salt March Snail	Oceanside	Invertebrate
Spartina anglica	Cord Grass	Oceanside	Plant
Panicum amarum	Bitter Panic Grass	Hewlett	Plant
Eragrostis walteri	Love Grass	Oceanside	Plant
Salicornia europaea	Glasswort	Oceanside	Plant
Blidingia sp.	Species of seaweed	Hewlett	Plant

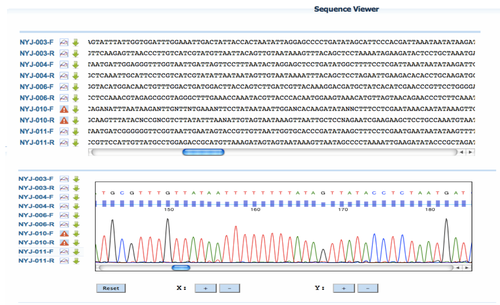
Results

Ilyanassa obsoleta ***Eragrostis walteri***

Hewlett Point Park, East Rockaway, NY

Marine Nature Study Preserve, Oceanside, NY

Examples of Sequencing Files



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Discussion

We found many species of invertebrates and plants that are very hardy organisms and can survive in areas where pollution may occur in Hewlett Point Park. *Enchytraeus albidus* is involved in regulating the degradation of organic matter and improving the pore structure of soil[15]. *Ilyanassa obsolete* has been known to show male characteristics induced on female mud snails when affected by pollution[14,16]. *Panicum amarcum* had the highest survival rate in an experimental dune building and vegetative stabilization in a sand-deficient barrier island setting on the Louisiana Coast, USA[12,16].

In the Marine Nature Study Preserve of Oceanside, we also found numerous invertebrate and plant samples. *Chamobates sp*. have been known to remain resistant to moderate sulfur pollutants and emissions with nitrogen compounds prevailing[17]. *Salicornia europaea* is one of the most salt-tolerant plant species. It does not have special salt-secreting structures like a salt gland or salt bladder[13]. Lastly, *Spartina anglica* has a rapid rate of growth, high fecundity, and aggressive colonization[11,16].

It is difficult to assess impact from Hurricane Sandy on these ecosystems, but it is helpful to know about biodiversity of an area at risk for wastewater pollution for future conservation purposes. In the future, we can compare the biodiversity of these locations to other similar wetland areas on Long Island.

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