Ecology of Plankton in Varying Areas of Salinity in the Great South Bay

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Abstract

Zooplankton are a primary food source in brackish food chains. This project aimed to identify zooplankton that grow in varying salinities through barcoding. It was hypothesized that species of zooplankton in an area of higher salinity will differ from those found in low salinity. The zooplankton were collected using a plankton net in different locations in the Great South Bay. The organisms were documented, DNA was extracted, PCR was conducted with CO1 gene primers and electrophoresis was performed before sending the samples for Sanger sequencing. Nine samples were successfully barcoded. The procedure was revised to extract DNA immediately after sample documentation rather than freezing which found better results. Organisms found included amphipods, crustaceans, and skeleton shrimp, as well as two potentially novel barcodes.

Introduction

- Zooplankton are microscopic organisms drifting in water, consisting of protozoa, small crustaceans, and the larval stages of larger animals (Lively, 1983). Different organisms feed on zooplankton and larger organisms feed on those organisms.
- As for scientific importance, if the zooplankton population is not diverse, then the organisms feeding on them could die or change location, creating a void in the food web that could have catastrophic results on biodiversity (Flemming, 2006).
- This research aimed to identify different zooplankton that live in varying salinities of the Great South Bay. This relates to biodiversity because part of the goal is to discover different species.
- It was hypothesized that species of zooplankton in an area of higher salinity will differ from those found in a lower salinity. This was hypothesized because organisms are adapted to their environment. Changes in environment, such as differences in salinity, will cause some zooplankton to be able to survive in those conditions while others cannot survive.

Methods

Sample Collection

Figure 1 – The places where zooplankton were gathered are marked with red dots

Figure 2 – Pictures of sample collection with plankton net at Heckscher Park.

Figure 3 – Images of organisms that may be novel barcodes (PNR-023, left and PNR-032, right).

Barcode Process

DNA Extraction

PCR of the CO1 Gene

Electrophoresis

Sanger Sequencing

Basic **L**ocal **A**lignment **S**earch **T**ool

Bit score | E-Value

Mismatch

Results

Table - Metadata and sequence data for all successfully sequenced zooplankton samples

MetaData				BLAST Data GenBank						BOLD Systems Data
Collection Location	Sample ID	Salinity (ppt)	Water Temp (ºC)	Bit Score	E-value	# of Mismatches	Scientific Name	Common Name	Lifecycle Stage	BOLD Systems
Gardener Park	PNR-017	26	7.1	976	0	1	Parcoblatta sp.	Wood Cockroach	n/a	n/a
Gardener Park	PNR-021	26	7.1	1150	0	1	Caprella penantis	Skeleton Shrimp	larval	n/a
Gardener Park	PNR-022	26	7.1	946	0	7	Caprella penantis	Skeleton Shrimp	larval	n/a
Gardener Park	PNR-023	26	7.1	646	0	100	n/a	n/a	n/a	no results
Gardener Park	PNR-025	26	7.1	333	1	35	n/a	n/a	n/a	not investigated due to e-value greater than 0
Gardener Park	PNR-027	26	7.1	589	2	79	n/a	n/a	n/a	
Gardener Park	PNR-028	26	7.1	973	0	1	Hargeria rapax	Common crustacean	n/a	n/a
Gardener Park	PNR-029	26	7.1	1160	0	0	Amphipoda	Side Swimmer	n/a	n/a
Gardener Park	PNR-032	26	7.1	845	0	24	Closest to Spionidae	n/a	n/a	no results
Gardener Park	PNR-035	26	7.1	697	0	19	Closest to Gemma gemma	Amethyst Gem Clam	larval?	no results

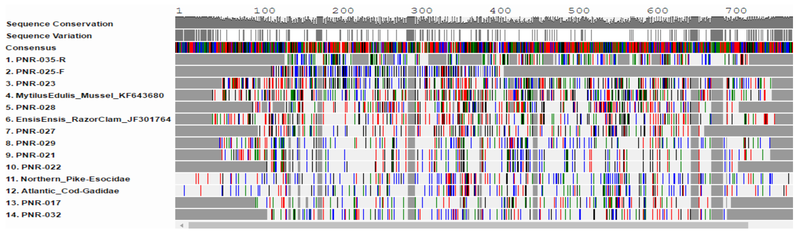

Figure 4 - The barcode of the successfully sequenced samples shows many differences between most of the samples.

Discussion and Conclusions

- The original question/aim of the research was to discover if varying salinities affected the ecology of zooplankton inhabiting the area. After researching, it was found that there was sufficient biodiversity in Gardners Park, which had a salinity of 26ppt, however there was not enough successful sequences from the other locations of varying salinity to decifer a correlation between the biodiversity of zooplankton and the salinity of the water they inhabit. The results could not prove nor disprove the hypothesis.
- This research found two potentially novel barcodes. If confirmed, these barcodes would help the scientific community identify zooplankton more efficiently.
- Many of the organisms collected were native to the area. However, it was found that sample EA-27 *Eumida merope* was only recorded in the BOLD system once in Croatia. In addition, according to WoRMS (World Registry of Marine Species), *Hargeria rapax*, sample PNR-028, was only ever recorded in the Gulf of Mexico. This could lead to allegations concerning the effect of climate change and rising water temperatures on the ecology and range of zooplankton.
- Water quality may have an effect on the types of organisms identified because pollution is highly deadly for all organisms. A few examples of pollution that can greatly harm zooplankton are storm water runoff which accumulates pollutants such as oil, grease, chemicals, and bacteria as it travels across land and into the water (Mathivanan, 2007). This can be a source of future research.

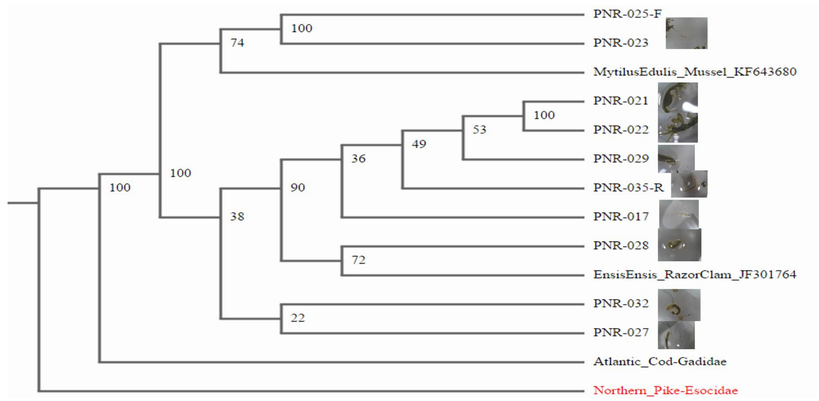

Figure 5- A phylogenetic tree of the samples shows similarities between samples such as PNR-021 and PNR-022 which are identified as the same species, but differences between samples such as PNR-029 which is an amphipod and PNR-035 which was identified as a type of clam.

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