Diatom Diversity in the Waterways of New York City

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Abstract

Diatoms are single-celled algae that play a key role in aquatic ecosystems. Because of their ecological importance, their abundance and diversity can provide valuable insights into water quality. This study aimed to expand understanding of New York City's aquatic ecosystems by identifying and quantifying diatom species using DNA barcoding. Results from this pilot study showed that no single diatom genus consistently dominated the site over time, likely due to tidal mixing of saltwater and freshwater in New York City's waterways. These findings suggest that diatom identification may serve as a useful tool for monitoring environmental change and ecosystem health. The detection of parasitoid protists, such as Pirsonia, further suggests that host–parasitoid interactions could act as indicators of diatom population dynamics. Future research should expand sampling across multiple locations and compare polluted and unpolluted areas to better understand these interactions and their environmental implications.

Introduction

- Diatoms are a diverse group of approximately 12,000 species of unicellular microalgae found in all bodies of water
- They contribute significantly to marine sediments and represent nearly half of all organic material in aquatic environments
- Research shows that diatoms are useful indicators of water quality and environmental conditions
- Due to their rapid life cycles, diatoms respond to changes in water quality faster than other aquatic organisms, such as fish
  - Region-specific data on diatom communities are often limited
- This study focused on identifying and quantifying diatom species in New York City waterways

Materials & Methods

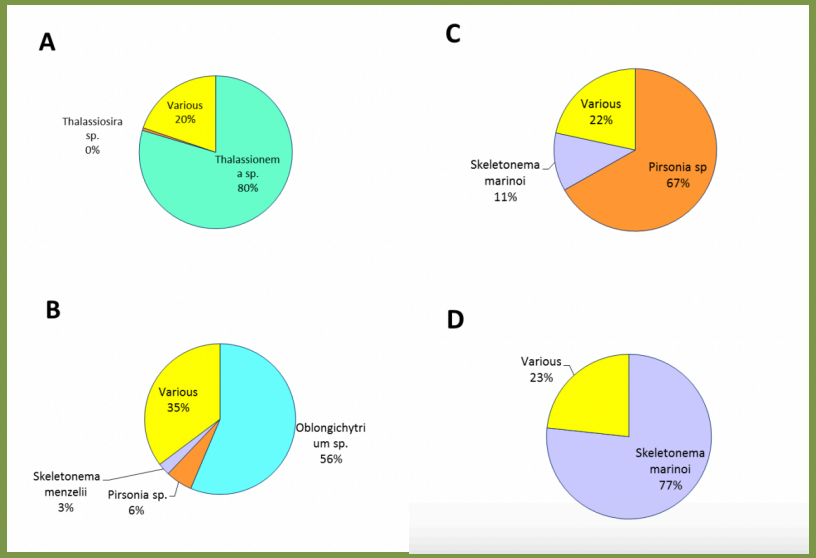
- Samples were previously collected on multiple days over a two-week period to account for temporal variation.
- DNA was extracted previously from the collected samples using the QIAamp DNA Micro Kit (QIAGEN).
- We targeted the V4 region of the diatom 18S rRNA gene
- PCR was performed with AmpliTaq Gold 360 PCR Master Mix (Thermo Fisher Scientific)
  - PCR products were visualized on a 1% agarose gel. Amplified products were sequenced using Amplicon-EZ NGS (Genewiz).
  - Resulting DNA sequences were analyzed with BLAST (Basic Local Alignment Search Tool) to identify diatom species.

Results

- We identified a diverse range of diatom species, with variation observed between samples
  - Sample A contained 104,800 sequences, with Thalassionema sp. being the most abundant species (Figure 1A).
  - Sample B had 96,310 sequences, dominated by Oblongichytrium sp. (Figure 1B).
  - Sample C included 104,336 sequences, with Pirsonia sp., a parasitoid protist, as the most abundant species (Figure 1C).
  - Sample D contained 108,838 sequences, with Skeletonema marinoi as the most prevalent diatom species (Figure 1D).
- These results indicate that no single species consistently dominates the site,reflecting the dynamic and diverse nature of the local diatom community.

Discussion

- No single diatom genus was consistently predominant at the site over time
  - This is likely due to New York City's waterways being a tidally influenced estuary, mixing of saltwater and freshwater
  - Identifying diatom species could be a valuable tool for investigating the effects of environmental changes and climate impacts
- Future research should involve additional sampling at more locations and direct comparisons between polluted and unpolluted areas
  - Examine how particular diatom species respond to varying levels of pollution
  - Examine parasitoid protists like Pirsonia
    - Parasitoid protists are considered an important factor influencing diatom populations in marine waters,[10] relatively few studies have investigated them
    - Host–parasitoid interactions in diatom populations could serve as a useful indicator for monitoring the health and dynamics of aquatic ecosystems



Diatom profiles identified in water samples from each collection: (A) Sample A, (B) Sample B, (C) Sample C, and (D) Sample D.

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