Assessment of Invertebrate Biodiversity in Polluted and Pristine Long Island Grasslands Using DNA Barcoding and Analysis of Cytochrome Oxidase 1 Marker

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Abstract

This study investigates the relationship between pollution and invertebrate biodiversity in Long Island grassland habitats using DNA barcoding and the COI genetic marker. Pitfall traps were set up in two locations: a construction site with pollutants and an undisturbed woodsy grassland area. DNA was extracted from these invertebrates, and the COI region was amplified and sequenced to identify the species and calculate biodiversity metrics such as species richness and the Shannon Index. Results indicated that biodiversity at the undisturbed site was higher, supporting the hypothesis that pollution has a negative relationship with invertebrate biodiversity.

Introduction

- Invertebrate Biodiversity can be a key indicator of environmental health as invertebrates play essential roles in ecosystems (Cardinale, 2012).
- Long Island has faced an influx of industrial development which has led to environmental contamination (EPA, 2011).
- DNA Barcoding is a method for identifying species by non-experts, allowing them to reliably assess biodiversity (Jinbo et al., 2011).
- CO1 (cytochrome c oxidase subunit I) is a vital genetic region located within mitochondria, and is utilized in the process of DNA Barcoding because of its large patterns of variation and relative ease of obtainment (Pentinsaari et. al, 2016).
- This project investigates biodiversity of insects in polluted and non polluted areas on Long Island.

Research Question and Hypothesis

Research Question:

Is invertebrate biodiversity associated with pollution in grassland environments?

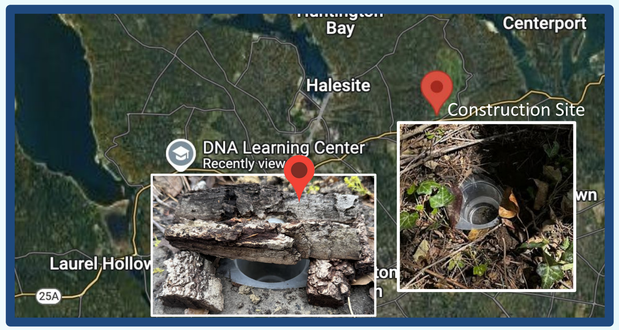
Hypothesis:

H0 Biodiversity of invertebrates is not associated with environmental pollution

H1 Invertebrate biodiversity has an inverse relationship with environmental pollution.

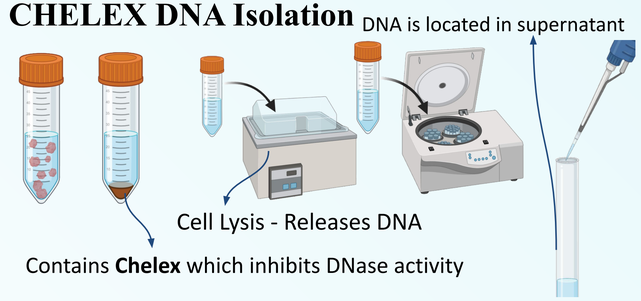
Methodology

Invertebrate Sample Collection

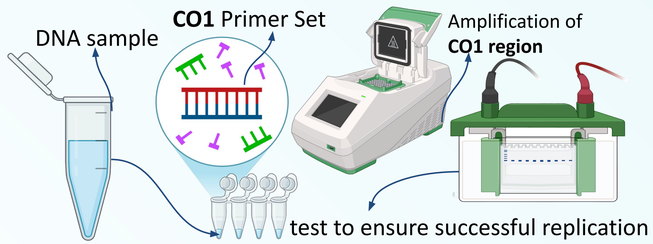


Pitfall traps were used for 24 hours to collect specimens.

CHELEX DNA Isolation



CO1 Region Amplification



Results

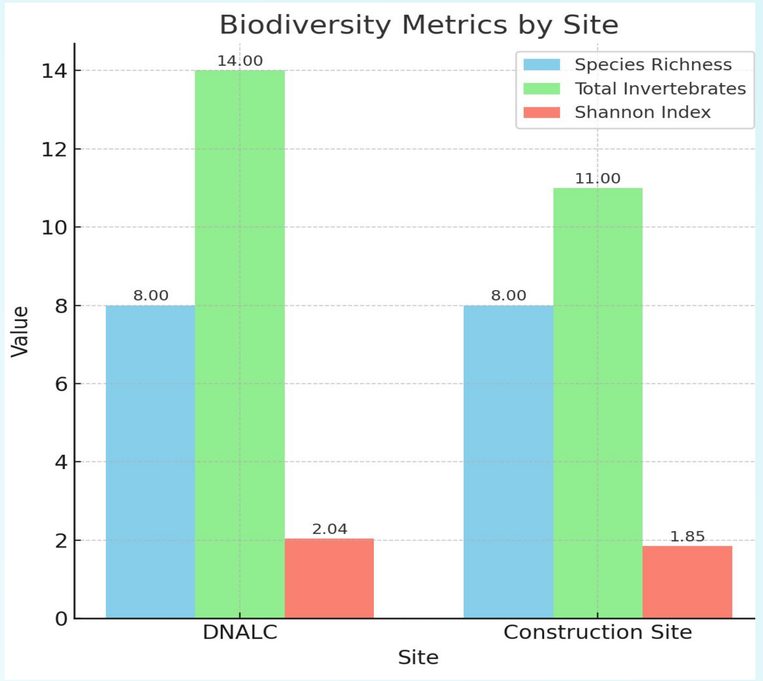


Figure 1: Depicts a comparison in Species Richness, Total Invertebrates and Shannon Index Score.

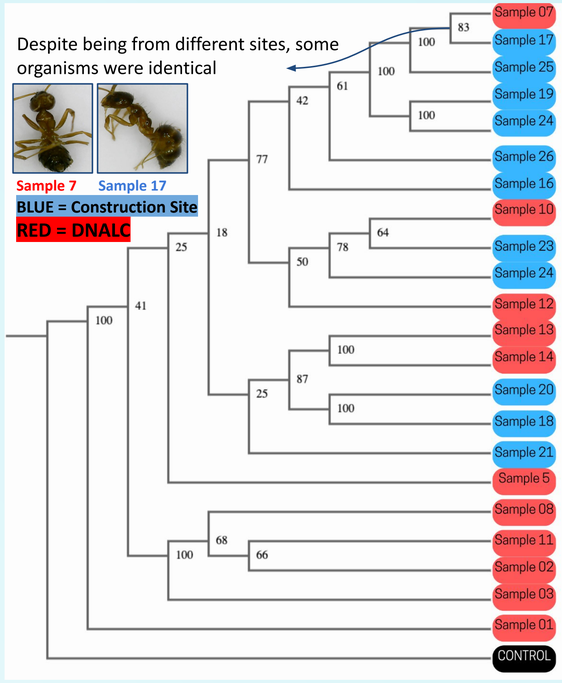


Figure 2: Phylogenetic tree which connects species with similar genetic makeup identifying closely related species.

Discussion

- A phylogenetic analysis revealed that some species were identical between both sites, indicating that environmental pollution may not always have a negative impact on all invertebrate species.
- These findings support Hypothesis H1 and also align with findings regarding the Impact of Pollution on Benthic Macroinvertebrates in Polish Rivers (Kownacki & Szarek-Gwiazda, 2022).
- The results from the study indicate that biodiversity is associated with pollution in Long Island grasslands, supporting my predicted hypothesis.

References