



# Beetle Biodiversity in Long Island, NY



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Funded by the  
Thompson Family  
Foundation

## Abstract

Beetles are the largest order of insects and play important ecological roles as pollinators, decomposers, and predators, while some invasive species of beetles negatively affect ecosystems. This study used DNA barcoding and visual identification with iNaturalist to determine beetle species variation and assess biodiversity within a sample of thirty beetles collected at Farmingdale State College on Long Island, New York. Specimens were collected, preserved in ethanol, photographed, and initially identified using iNaturalist. DNA was extracted using the Chelex protocol, amplified by PCR, and visualized through gel electrophoresis. Sequencing results were analyzed with DNA Subway and BLAST to confirm species identification. The identified species were classified by taxonomic family and ecological function. Results showed that the specimens represented eleven different beetle families, indicating substantial biodiversity despite the relatively small sample size.

## Introduction

- The order of beetles, Coleoptera, is the largest and most diverse order of insects.
- The United States is home to nearly 30,000 species of beetles, each with a specific role in their ecosystems with their roles include decomposers, pollinators, and pest predators.
- iNaturalist, an online platform where citizen scientists come together to identify living things, was used to initially identify our beetles based on uploaded photographs.
- DNA barcoding, a molecular biology tool used to identify species, was used to provide an additional identification. It is based on comparison of short DNA sequence of given species to DNA database (for example, BLAST) which we used to finalize our identifications alongside iNaturalist.
- 30 Beetle samples were collected on the Farmingdale State College campus using Malaise traps in July of 2022.
- We hypothesized that the collected beetle specimens will represent multiple taxonomic families and ecological functional groups, thus indicating biodiversity within the beetle population of the Farmingdale State College Campus.

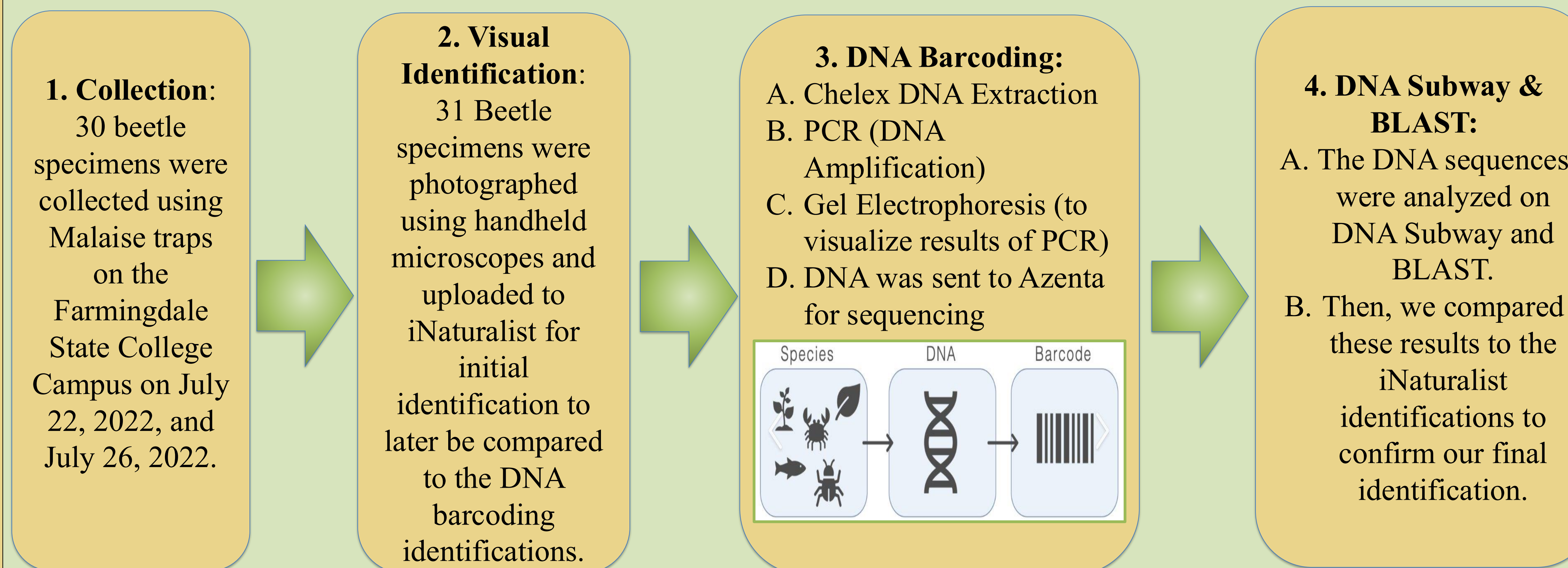


Figure 1. Map of Long Island. Red anchor marks position of Farmingdale State College campus area.



Figure 2. Beetle Specimen #31: Ground beetle (*Cymindis limbata*)-identified with DNA Barcoding and iNaturalist



Figure 3. Beetle Specimen #17: Gray-winged Neoclyt-Borer (*Neoclytus scutellaris*)-identified with iNaturalist

## Results, Tables & Figures

- We were able to identify 16 specimens to the level of species, and 14 specimens were identified at least to the level of family using iNaturalist.
- We were unable to use 11 specimens out of 30 for barcoding due to low quality DNA sequences.
- Out of 19 specimens that were identified by both iNaturalist and DNA Barcoding, 18 were identified as the same family by both methods (see figure 4).
- Out of these 18 specimens, 5 ecological roles of beetles were found (see figure 5).
- These 18 specimens belonged to 11 families under Order Coleoptera (see figure 6).

Sample Number	Family according to DNA barcoding (Susanna)	Genus according to DNA barcoding	DNA Barcode Analysis/BLAST ID	Family according to iNaturalist (Sophia)	Genus according to iNaturalist	iNaturalist ID	Final Identification	Role in ecosystem as an adult
1	Lampyridae	Photinus	<i>Photinus pyralis</i>	Lampyridae	Photinus	<i>Photinus pyralis</i>	<i>Photinus pyralis</i>	Detritivore
14	Cerambycidae	Urgleptes	<i>Urgleptes signatus</i>	Cerambycidae	Urgleptes	<i>Urgleptes signatus</i>	<i>Urgleptes signatus</i>	Pollinator
21	Tetatomidae	Penthe	<i>Penthe obliquata</i>	Tetatomidae	Penthe	<i>Penthe obliquata</i>	<i>Penthe obliquata</i>	Fungivore
24	Cerambycidae	Xylotrechus	<i>Xylotrechus colonus</i>	Cerambycidae	Xylotrechus	<i>Xylotrechus colonus</i>	<i>Xylotrechus colonus</i>	Pollinator
28	Cupedidae	Tenomerga	<i>Tenomerga trabecula</i>	Cupedidae	Tenomerga	<i>Tenomerga cinerea</i>	<i>Tenomerga cinerea</i>	Detritivore
31	Carabidae	Cymindis	<i>Cymindis limbata</i>	Carabidae	Cymindis	<i>Cymindis limbata</i>	<i>Cymindis limbata</i>	Detritivore

Figure 4: Table showing portion Blast/BOLD and iNaturalist Identifications

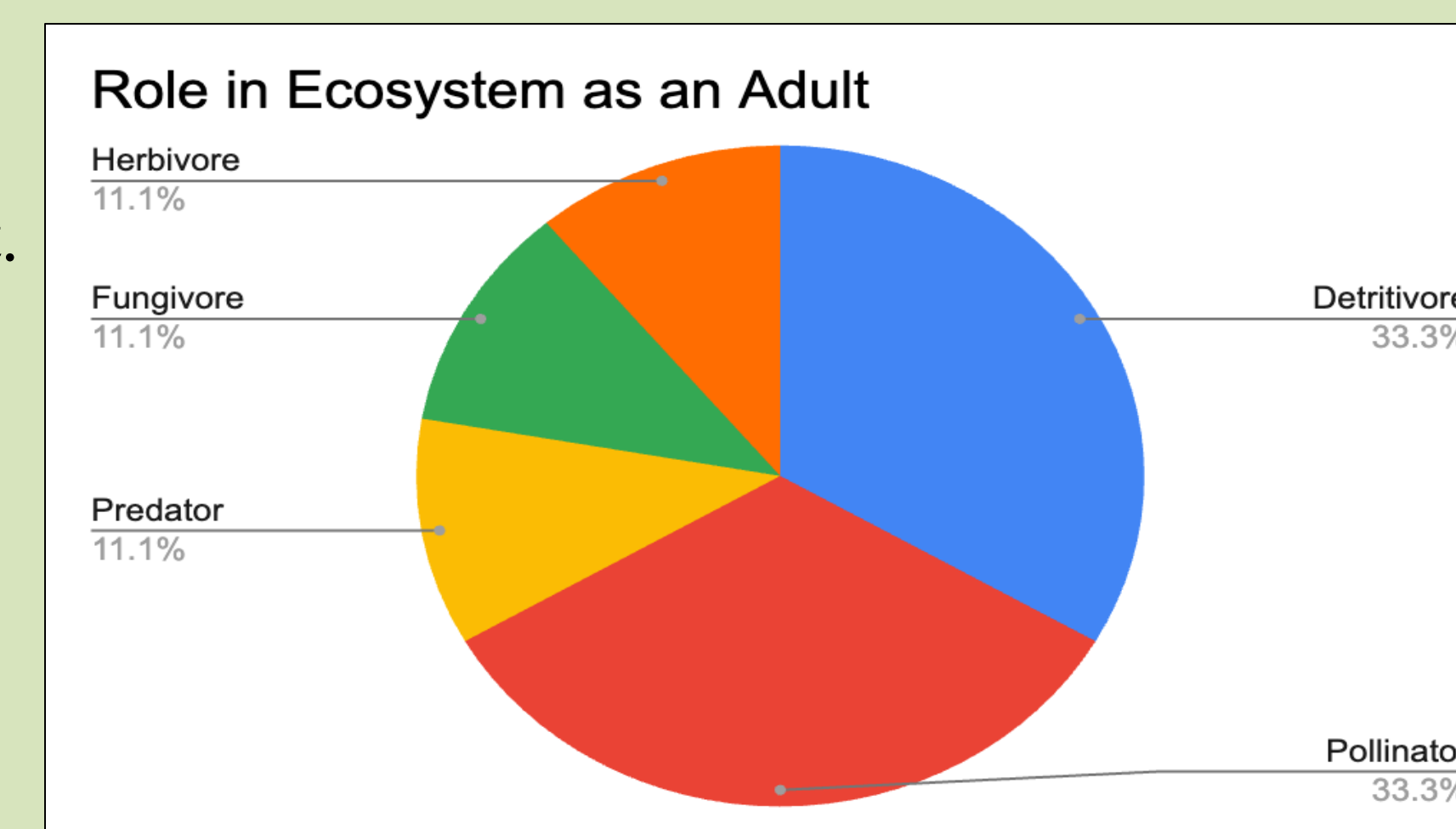


Figure 5: Graph showing the distribution of the beetle specimens that iNaturalist and DNA Barcoding corroborated on by ecological role

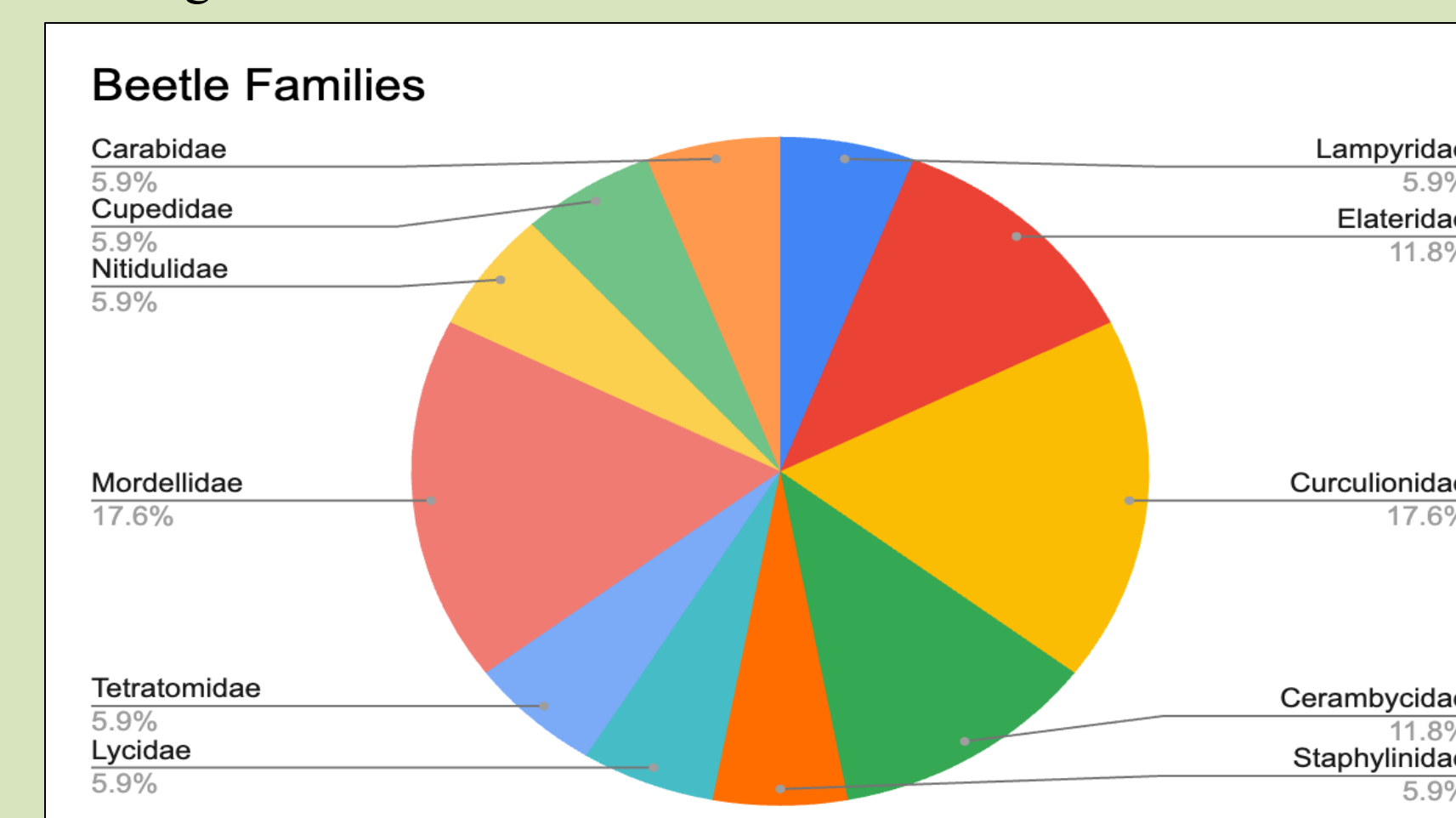


Figure 6: Graph displaying number of beetle specimens out of 18 that belong to each family in Order Coleoptera

## Discussion

- Out of 30 beetle specimens, 29 specimens fell under three suborders of beetles (Adephaga, Polyphaga, and Archostemata) and 1 specimen fell under suborder of true bugs (Auchenorrhyncha).
- On iNaturalist, 11 of our specimens received Research Grade identifications (this means that at least one expert entomologist confirmed our identification).
- DNA Barcoding improved the precision of six iNaturalist identifications (specimens 2, 13, 15, 20, 22, 26) by providing a more specific identification within the family or suborder.
- DNA barcoding was determined to be a more reliable and specific form of identification.
- Among the 18 specimens that were successfully barcoded on the Farmingdale State College campus, five distinct ecological roles were identified: herbivore, pollinator, fungivore, predator, and detritivore.
- Specimen 3, *Maladera formosae*, and specimen 27, *Cyrtopistomus castaneus*, were identified to be invasive species, both native to Asia.

## References

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## Acknowledgements

Thank you to our mentors for guiding and supporting us, and for Carly Tribull for collecting our specimens. Thank you to Jeff Petracca and Dr. Carol Hanger at the Cold Spring Harbor Laboratory and the Thompson family for making this research possible!