



Identification of the diversity of wild bees found on Governors Island, NY

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Abstract

Bees are one of the most economically and ecologically important insects globally, producing items such as honey, royal jelly, pollen, beeswax, propolis, and honeybee venom. Bees pollinate about one-third of the world's food. Bumblebees and Carpenter bees play an essential role as pollinators of many flowering plants. In Idaho, Maine, New Hampshire, North Dakota, Oregon, Rhode Island, Vermont, and Wyoming, populations of the Bumble Bee have vanished. Bumble bees, carpenter bees, and other bees, except honey bees, build nests above ground. Our research objective is to survey the diversity of wild bees on Governors Island, NY, through DNA barcoding. We hypothesized that there may be different species of wild bee populations on Governors Island, NY, some of which may not have yet been identified. Our DNA barcode result showed that four of the samples belong to bumble bees (*Bombus impatiens voucher*). Seventeen of the samples belong to honey bees, *Apis mellifera carnica*, and *Apis mellifera voucher*, and one of the samples belongs to the Eastern yellow jacket wasp (*Vespa maculifrons*).

Introduction

Over 20,00 different bee species worldwide have been identified, and approximately 450 species are found in New York. Among them, we have seen a 90% population decrease in Bumblebee (non-honey bee) in North America. Hence, from 2021, they have been put on the endangered list by the US Fish and Wildlife Service. Honey bees and Native bees habitats are allowed for visitors to explore by “The Bee Conservancy” of Governors Island, which focuses on honey bees and may have identified some wild bees. Our research objective is to survey the diversity of wild bees on Governors Island, NY, through DNA barcoding and identify different and unidentified wild bee species on the island. Our research questions are: "Is there a difference between the diversity of wild bees in Governors Island as compared to NYC parks?" Which species of wild bees are more common on the Governors' Islands? Could wild bees have been imported from other parts of New York or from around the world by the food vendors, park department workers, and tourists who visit Governors Island? We also hypothesized that bumble bee species may be attracted to the milkweed flowering plants on Governors Island.

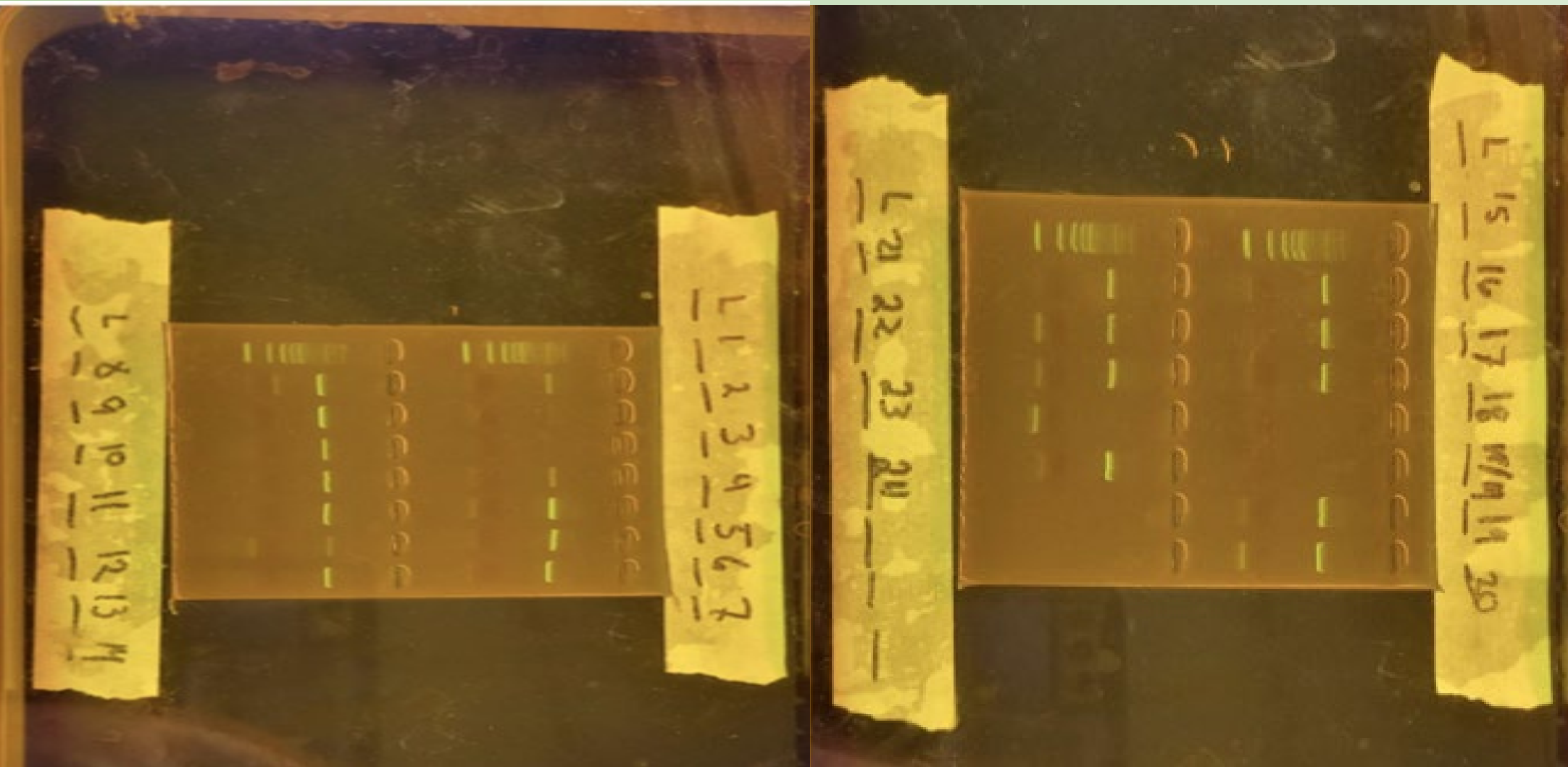
Materials & Methods

Our team collected 30 samples of bees from different areas of Governors Island, which we took to the DNA Learning Center for DNA extraction. We started with Chelex Isolation Protocol to isolate mitochondrial DNA. Next, we carefully transferred 30 microliters of supernatant to a clean tube with a label and used the COI primer set to amplify our DNA. Once our PCR products were ready, we ran the Gel electrophoresis to analyze our results. The PCR products were sent for sequencing by the DNA Lab. We then uploaded the sequences to the DNA Subway and chose the Blue Line to determine sequence relationships. After sequence trimming to remove low-quality sequence parts, pair building, and consensus-building, we used BLAST to analyze the sequences.

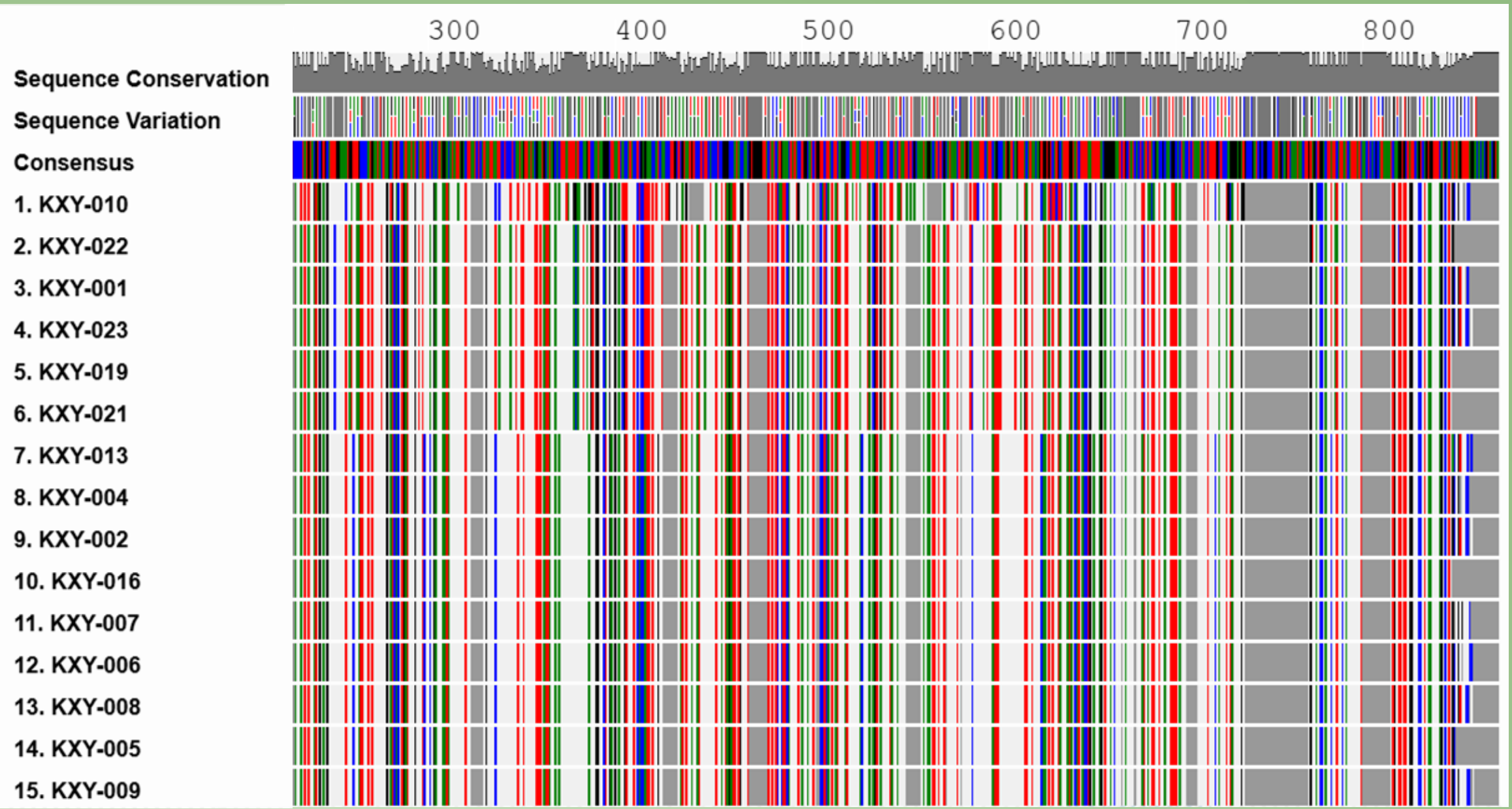
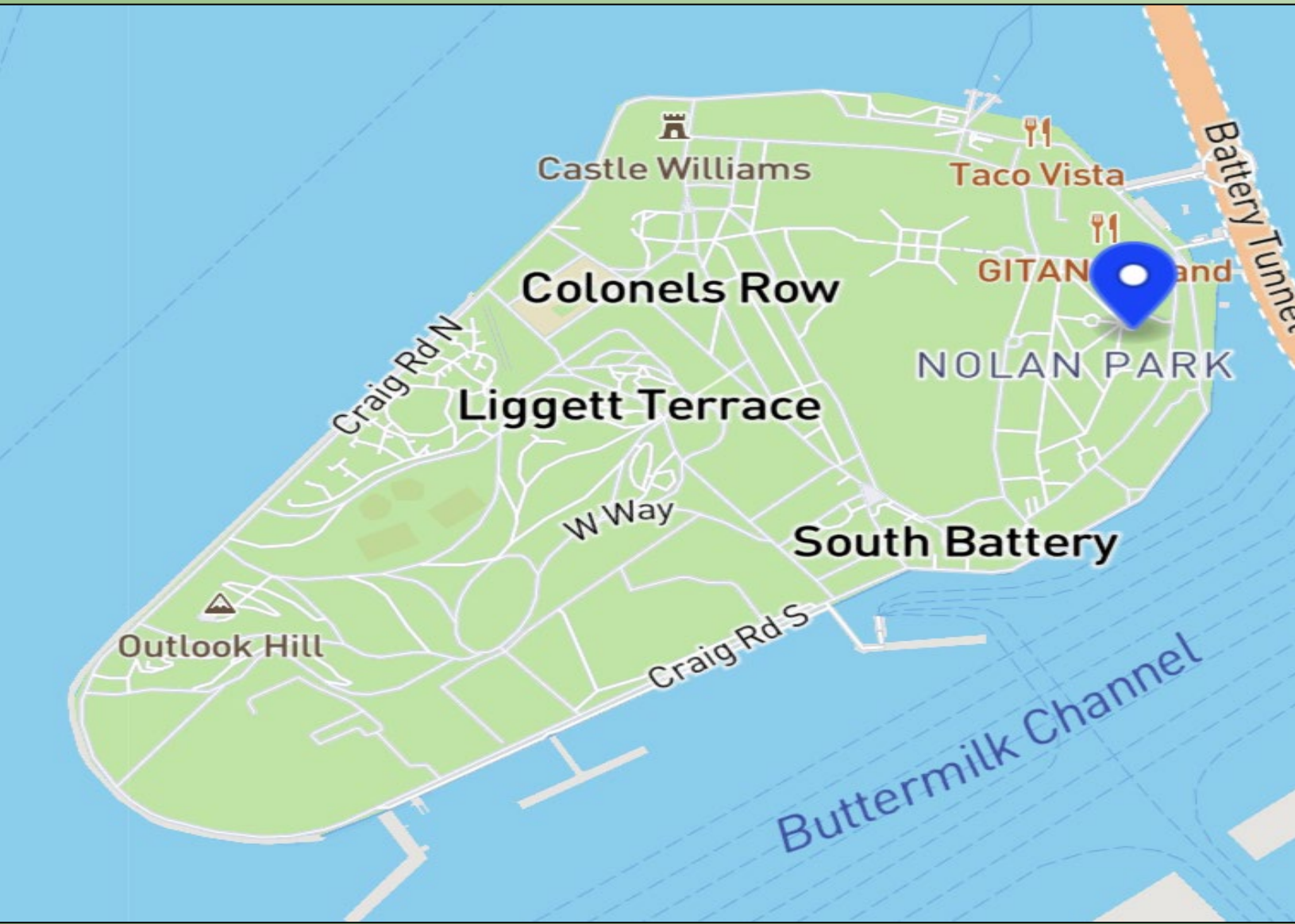
Results

The BLAST results showed that four samples belong to bumble bees (*Bombus Impatiens Voucher*). Seventeen of the samples belong to the honey bees *Apis mellifera carnica* and *Apis mellifera voucher*, and one of the samples belongs to the Eastern Yellow Jacket wasp (*Vespa maculifrons*).

GEL ELECTROPHORESIS THROUGH ALL SAMPLES

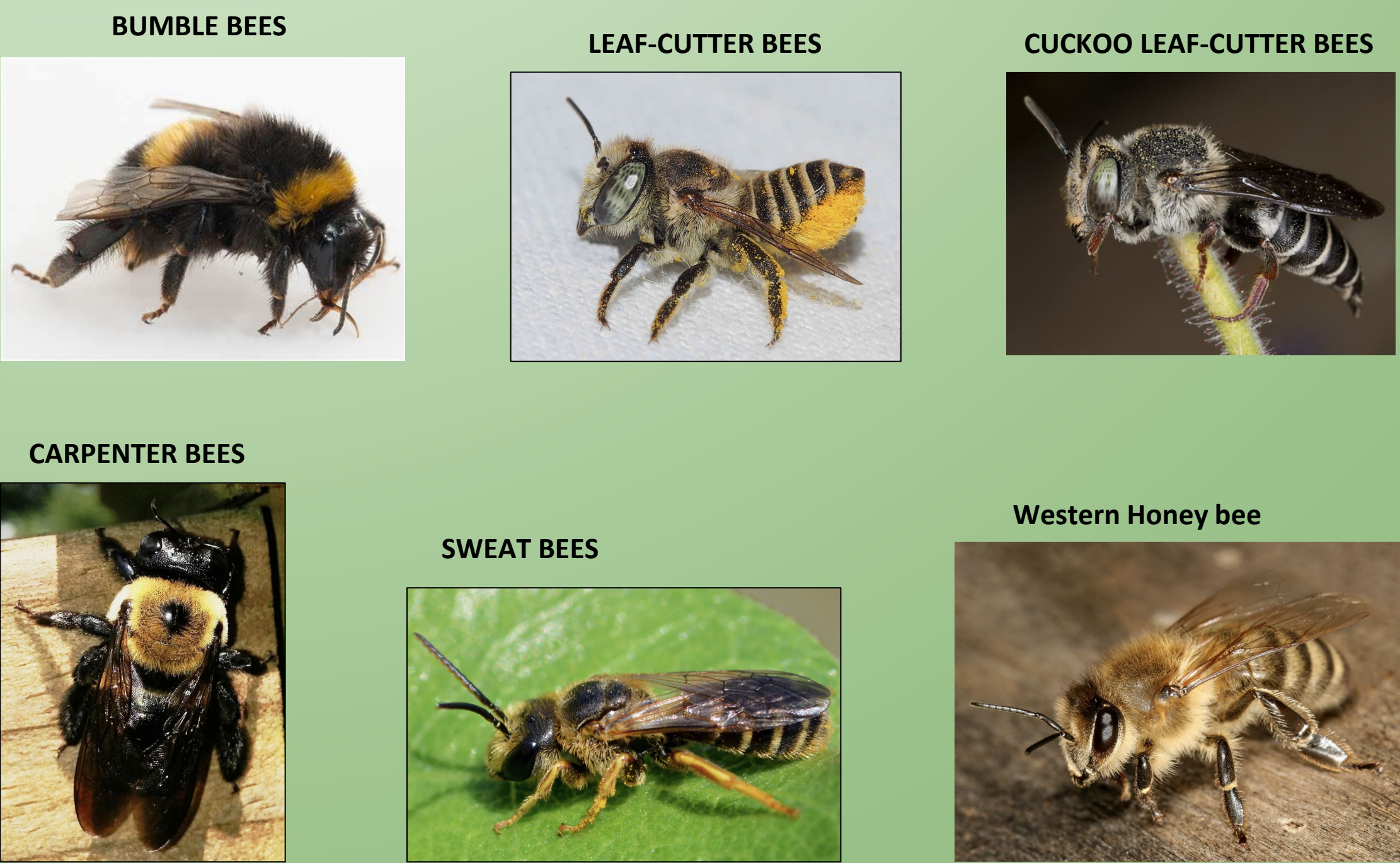


LOCATION OF BEE CAPTURE POINT



KXY-001 « back						
♣ #	Accession #	Details	Aln. Length	Bit Score	e	Mis-matches
1(1).	□ GU806805.1	Bombus impatiens voucher B10UC-CAN>08TTML-0290 cytochrome oxidase subunit 1 (COI) gene, partial cds - mitochondrial;MK037240.1 Bombus sp. SKate18-WP2 cytochrome oxidase subunit 1 (COI) gene,partial cds	658	1187	0.0	0
KXY-002 « back						
♣ #	Accession #	Details	Aln. Length	Bit Score	e	Mis-matches
1(1).	□ MF100917.1	Apis mellifera carpatica isolate 6-27 cytochrome oxidase subunit 1 (COI) gene, partial cds - Apis mellifera carpatica isolate 6-27 cytochrome oxidase subunit 1 (COI) gene, partial cds	663	1176	0.0	5
2(2).	□ MF100915.1	Apis mellifera isolate 6-12 cytochrome oxidase subunit 1 (COI) gene, partial cds - Apis mellifera isolate 6-12 cytochrome oxidase subunit 1 (COI) gene, partial cds	663	1176	0.0	5
KXY-016 « back						
♣ #	Accession #	Details	Aln. Length	Bit Score	e	Mis-matches
1(1).	□ KU601503.1	Apis mellifera voucher PHEL:4132 cytochrome oxidase subunit 1 (COI) gene, partial cds - Apis mellifera voucher PHEL:4132 cytochrome oxidase subunit 1 (COI) gene, partial cds	703	1260	0.0	0
2(2).	□ KU601504.1	Apis mellifera voucher PHEL:4132a cytochrome oxidase subunit 1 (COI) gene, partial cds - Apis mellifera voucher PHEL:4132a cytochrome oxidase subunit 1 (COI) gene, partial cds	702	1259	0.0	0
KXY-010 « back						
♣ #	Accession #	Details	Aln. Length	Bit Score	e	Mis-matches
1(1).	□ EF136415.1	Vespa maculifrons cytochrome oxidase subunit 1 (COI) gene, partial cds - Vespa maculifrons cytochrome oxidase subunit 1 (COI) gene, partial cds	684	1212	0.0	5
2(2).	□ KJ147253.1	Vespa maculifrons isolate VSPL2 cytochrome oxidase subunit 1 (COI) gene, partial cds - Vespa maculifrons isolate VSPL2 cytochrome oxidase subunit 1 (COI) gene, partial cds	684	1207	0.0	6

SOME COMMON BEE SPECIES IN NYC



Discussion

The BLAST result showed that the population of the Bumble bee(*Bombus Impatiens voucher*) is low on Governors Island despite an abundance of milkweed. As it is a voucher species, the collected bumble bees were intentionally preserved on the islands by the Governor's Island Bee Conservancy. We did not find other types of wild bumblebees. Therefore, our hypothesis is not supported by our results. The BLASTN result revealed that the wild bees we collected belonged to the honey bees, *Apis mellifera carnica*, and *Apis mellifera voucher*. Surveying bee diversity for a particular area requires time, resources, and weather conditions. Because of the time constraint and the small sample size, our barcode-based survey may not be conclusive. Nevertheless, the result can indicate the types of wild bees and honey bee species inhabiting parts of Governors Island, New York, and its biodiversity. This data may also contribute to the bee species database and the NYC biodiversity database.

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