Citizen Science Takes Flight:
A Case Study using Semipalmated Sandpiper sightings to assess restoration efforts in Jamaica Bay

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Fig. 1. Semipalmated sandpiper image. Licensed under CC-BY-NC.

Introduction

Citizen science has emerged as a powerful tool for engaging the public in scientific research, particularly in the context of biodiversity assessment and restoration initiatives. The presence of **Semipalmated Sandpipers** (*Calidris pusilla*), a migratory shorebird found in Jamaica Bay during its migrations, provided an ideal case study for the utilization of citizen science in assessing the impact of restoration efforts. This project examined the value of citizen science data as a means of evaluating the effectiveness of restoration initiatives.

Background

Semipalmated Sandpipers

Semipalmated sandpipers (see figure 1) breed in areas of the Arctic, follow an elliptical migration pattern throughout the central and eastern parts of North America, and winter along the northern coast of South America (Gratto-Trevor and Dickson). In coastal area of New York, they are regular summering nonbreeders**; stopover sites like the JBWF are vital areas of congregation for the birds** because the wetlands provide spawning habitats for horseshoe crab eggs, which are important sources of food (Botton et al.).

Jamaica Bay Wildlife Refuge

There have been varying attempts to offset substantial losses the wetlands have taken over the years. This project specifically focuses on native plant restoration efforts that took place from 2015 to 2017, during which project partners **reduced invasive plants while also restoring flood and salt-tolerant plants to the community to improve the habitat for migratory birds** (Jamaica Bay-Rockaway Parks Conservancy).

Citizen Science

The nature of CS lends itself to fields such as biology, ecology, and conservation research, where “CS [is utilized] mainly as a methodology of collecting and classifying data” (Kullenberg and Kasperowski). It is unsurprising, then, that the **most productive CS-utilizing projects relate to bird monitoring and observation** (12).

Hypothesis

The participation of citizen scientists in data collection yields meaningful insights into assessing biodiversity before and after restoration initiatives such as the one in Jamaica Bay, but the accuracy of the observations may pose a problem for evaluation.

Methods

- We used a data from iNaturalist, an application made for sharing biodiversity information, as our source of CS data
- Abundance of sandpipers in the JBWF area (as shown through iNaturalist observation counts) was the metric used to measure the impact of the 2015-2017 restoration
- After downloading the data of sandpiper observations in Jamaica Bay, we filtered the information to keep key columns identified for the analysis, which were **observed_on**, the date of observation, and **place_guess**, the location of the observation
- To gauge the abundance of sandpipers over the years, we narrowed our data to include observations from 6 years leading up to the restoration project (2006-2012) and 6 years after the restoration project (2018 – 2023)
- The aggregated data was visualized using a bar graph

Fig 2. Jamaica Bay Wildlife Refuge, Broad Channel, NY - Photo courtesy of the National Park Service

Results

Jamaica Bay Wildlife Refuge was restored during a project that took place from 2015 up until 2017. According to our graph, data in the years before restoration, prior to 2015, there were 15 sightings of Semipalmated Sandpipers. This number of sightings is significantly lower than the number of sightings in the years post 2017. In the years post restoration, there were about 106 sightings. This is approximately **7 times the amount of Semipalmated Sandpiper sightings prior to restoration.**

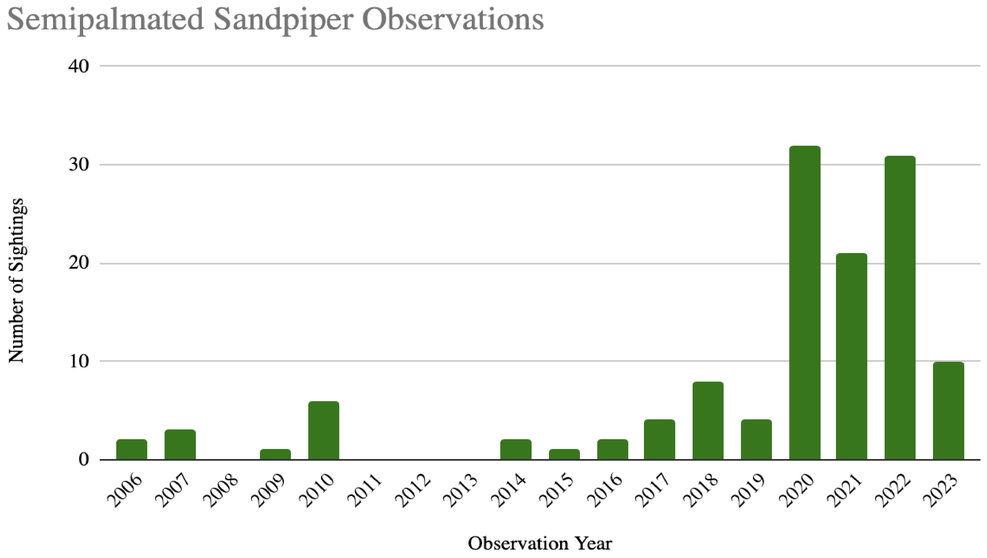

Table 1. Abundance of semipalmated sandpipers in Jamaica bay from 2006-2023

Discussion

The results of our study supported our hypothesis to a certain extent. Ultimately, the data was usable, and the observation counts of sandpipers **showed a clear increase in sightings that indicates an effectiveness of restoration efforts**. There were several factors that could have played a role in this uptick, of course, ranging from sandpiper population changes, migration patterns, the amount of users on iNaturalist, or even other restoration efforts that we did not account for. However, the purpose of this project was to test the viability of CS data as a conduit for collecting and analyzing ecological data.

What made iNaturalist data an accurate way to measure changes was its significant data filtering process. As our hypothesis indicated, we were concerned with the accuracy of the actual observations. However, the website had the ability to filter for **Research Grade data**, which are observations where “the community agrees on species-level ID or lower, i.e. when more than 2/3 of identifiers agree on a taxon” (Help - iNaturalist).

One caveat of using CS data, however, was the variability observed in the 'place_guess' field, often multiple formats written for a single location. And though we did not use the ‘observed_on_string’ field in our research, we noticed similar issues with multiple formats in this field as well. This variability underscores the **need for more standardized data entry practices on iNaturalist**, especially in the context of facilitating more streamlined data extraction for research purposes.

Works Cited

Botton, Mark L., et al. “Effects of a Beach Nourishment Project in Jamaica Bay, New York, on Horseshoe Crab (Limulus Polyphemus) Spawning Activity and Egg Deposition.” *Estuaries and Coasts*, vol. 41, no. 4, June 2018, pp. 974–87. *Springer Link*, https://doi.org/10.1007/s12237-017-0337-8.
Figure 1. Khustochka, Vitalii. *Semipalmated Sandpiper; Calidris Pusilla*. photo, 14 Aug. 2010. *Flickr*, https://www.flickr.com/photos/phenolog/4936537576/.
Figure 2. *Jamaica Bay Wildlife Refuge | TCLF*. https://www.tclf.org/jamaica-bay-wildlife-refuge. Accessed 8 Dec. 2023.
Figure 3. Various Authors, "Semipalmated Sandpiper Observations." INaturalist, https://www.inaturalist.org/observations?locale=en-US&order=asc&order_by=observed_on&place_id=170144&quality_grade=research&subview=table&taxon_id=3862&verifiable=any.
Gratto-Trevor, C. L., and H. L. Dickson. “Confirmation of Elliptical Migration in a Population of Semipalmated Sandpipers.” *The Wilson Bulletin*, vol. 106, no. 1, 1994, pp. 78–90. *JSTOR*, https://www.jstor.org/stable/4163387.
“Help · iNaturalist.” *iNaturalist*, https://www.inaturalist.org/pages/help#quality. Accessed 8 Dec. 2023.
“Jamaica Bay Wildlife Refuge | NYC Audubon.” *Nycaudubon.Com*, https://www.nycaudubon.org/events-birding/birding-resources/birding-in-nyc/birding-in-queens/jamaica-bay-wildlife-refuge. Accessed 1 Dec. 2023.
“Jamaica Bay Wildlife Refuge Restoration Projects.” *Jamaica Bay-Rockaway Parks Conservancy*, http://www.jbrpc.org/jamaica-bay-wildlife-refuge-restoration-projects. Accessed 1 Dec. 2023.
Kullenberg, Christopher, and Dick Kasperowski. “What Is Citizen Science? – A Scientometric Meta-Analysis.” *PLOS ONE*, edited by Pablo Dorta-González, vol. 11, no. 1, Jan. 2016, p. e0147152. *DOI.org (Crossref)*, https://doi.org/10.1371/journal.pone.0147152.