Clarifying bobcat (*Lynx rufus*) Distribution in Westchester (NY) and Fairfield (CT) Counties: A Comprehensive Compilation of Existing Data and a Targeted Non-Invasive Camera-Trap Search in a Distribution Void

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Abstract

In Westchester (NY) and Fairfield (CT) counties, native large carnivores such as mountain lions, wolves and grizzly bears are now functionally extinct, and the bobcat (*Lynx rufus*) is now a top carnivore; its presence is indicative of healthy, relatively intact ecosystems. However, despite recorded verified bobcat sightings by citizen scientists in Westchester and Fairfield counties, the 2016 IUCN Red List currently does not include these regions as bobcat habitat. This study aimed to non-invasively demonstrate the presence of a residential bobcat population in the selected region through the use of citizen science data and a targeted camera trap search in which 22 camera traps were deployed throughout 5 study sites in Fairfield County. Over 2,024 trap nights, 53 individual bobcat sightings were captured by the camera traps and at least 4 individual bobcats were identified, including multiple sightings of a mother with 2 kittens. These sightings prove the existence of a residential bobcat population in an area previously thought to be void.

Introduction

The International Union For Conservation of Nature's (IUCN) Red List of Threatened Species is globally recognized as "the world's most comprehensive information source on the global conservation status of animal, fungi and plant species" (IUCN Red List), and keeping the Red List up-to-date is vital to informing future studies, policy changes, and wildlife conservation efforts. The bobcat (*Lynx rufus*) is a generalist species of wild felid with a distribution range that includes southern Canada, northern and central Mexico, and with the exception of Delaware, the contiguous United States. Provided that there is adequate cover such as broken terrain and thick vegetation, the bobcat is adaptable and has a wide habitat tolerance that ranges from desert to coastal habitat [and everywhere in between] (Hunter 2015). In terms of prey, bobcats tend to have a preference for lagomorphs, but they hunt a broad range of prey species depending on their surrounding habitat. However, in its habitat, the bobcat plays an important role as an indicator of habitat connectivity because despite being a generalist, bobcats are sensitive to habitat fragmentation (Ruell et al. 2009).

In Westchester (NY) and Fairfield (CT) counties, native large carnivores such as mountain lions, wolves and grizzly bears are now functionally extinct, and the bobcat is now a top carnivore; its presence is indicative of healthy, relatively intact ecosystems. In the area, bobcat habitat includes forest, grassland, marshland, swamp, coastal, rocky, and anthropogenic habitat like parks

and farmland, and available prey includes lagomorphs, small rodents, white-tail deer, and various bird species. However, despite recorded verified bobcat sightings by citizen scientists in Westchester and Fairfield counties, the 2016 IUCN Red List currently does not include these regions as bobcat habitat. Considering how updating IUCN Red List may open doors for new potential protections, protocols, and educational opportunities regarding bobcat conservation, through this study, I aim to non-invasively clarify if current bobcat territory has extended beyond its currently defined borders (as per the IUCN Red List) into Westchester and Fairfield counties.

Materials and Methods

Sampling Methods
I reviewed and consolidated three citizen-science databases (iNaturalist, the Connecticut Wildlife Sighting Public Viewer, and the Westmoreland Sanctuary Westchester County Bobcat Sightings map), that included geomaps of bobcat sightings in Westchester County, NY and Fairfield County, CT that border the 2016 Union For Conservation of Nature's (IUCN) Red List of Threatened Species Bobcat habitat map. I also conducted a structured internet review of local print media from 2016-2020 that reported bobcat sightings in the geography of interest. All data was merged into a single database (Microsoft Excel), with care taken to ensure that each bobcat sighting was unique.

In an effort to identify strategic locations for camera trap deployment, the merged geomap database was overlaid onto neighborhood maps to identify wooded void areas within the target counties that contained suitable bobcat habitat (identified using the 2016 National Land Cover Database). The camera traps themselves were spaced out as evenly as possible within their designated study sites based on proximity to favorable or unfavorable geographic features. Camera trap data was collected every 2-3 weeks from August 2020 - October 2020, sifted through to detect presence, and entered into my Excel database. I also recorded all other species captured by the cameras so that it would be available in the future for any researchers with an interest in the other species seen on the traps. Out of the total 23 camera traps (model: Browning Strike Force HD Pro X) purchased for my study, 22 traps were deployed out in the field, with one kept as a precautionary replacement in the case that a trap in the field went missing or was damaged.

Study Area

All data was collected from within Westchester and Fairfield counties. Citizen science data was collected from the selected public online databases, while camera trap data was collected from void areas where there were no bobcat sightings at the time. Such deployment sites were chosen from properties protected by the Greenwich Land Trust (Fig. 1) which exhibited the characteristics of suitable bobcat habitat as described by the IUCN Red List: few roads, limited human development, high stream densities, and steep topography. I secured permission from the Greenwich Land Trust to work on these properties and was responsible for my own transportation to and from each site.
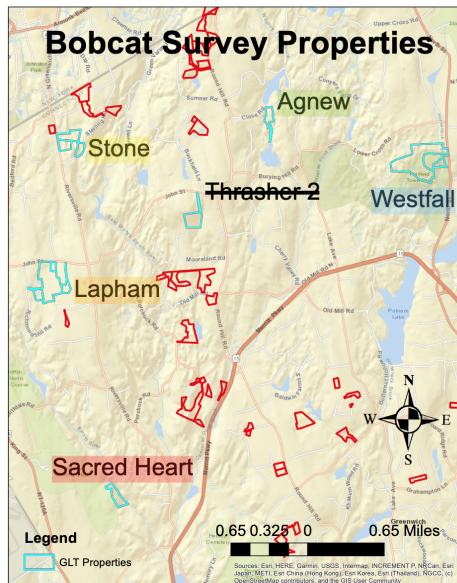

Fig. 1.—Map of the 5 study sites used for the camera trap survey: Sacred Heart, Lapham, Stone, Agnew, and Westfall.

Study Site	Camera Traps
Sacred Heart	CAM01 - CAM03
Lapham	CAM04 - CAM08
Stone	CAM09 - CAM13
Agnew	CAM14 - CAM17
Westfall	CAM18 - CAM22

Data Analysis

Camera trap data was constantly sited throughout the duration of the study, and quantified based on bobcat presence (present versus absent). I imported the data into Google Earth and ensured that all records were geo-referenced and importable into the IUCN's database. This also ensured that the data is useful for future use by any researchers wishing to access it. Using Google Earth, I calculated the new area of bobcat occupancy estimated by my methods and defined the current southern range limits of the bobcat in Westchester and Fairfield counties. I also examined exploratory analyses to investigate limiting factors to the bobcat's distribution.

Mentor's Role versus My Role

During my project, Dr. Luke Hunter (my mentor) has given me valuable insight when designing my study, recommending literature and modules, setting up my cameras, and submitting my grant proposal to the Marjot Foundation. He also helped me secure access to Greenwich Land Trust properties to use as the study sites for the camera trap portion of my project. In terms of my role, I have completed extensive background research on bobcats, their habitat, and the methods I used to study them. I also compiled, analyzed, and organized all data into Excel and Google Earth, and collected all new camera trap data every 2-3 weeks. Securing funding for the study was my responsibility, and I did so by applying to and receiving a $5000 grant from the Marjot Foundation.
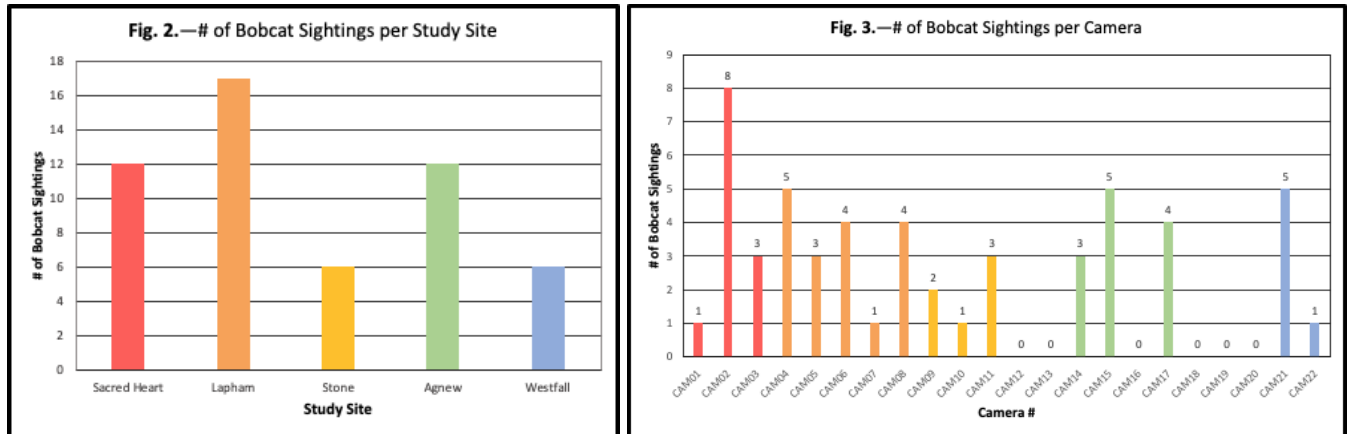
Results

Bobcat Sightings

Fig. 2.—Graph of the number of individual bobcat sightings per study site. The colors used are constant throughout all the graphs: Sacred Heart is always red, Lapham is always orange, Stone is always yellow, Agnew is always green, and Westfall is always blue. **Fig. 3.**—Graph of the number of individual bobcat sightings per camera trap.

Over the 2,024 trap nights the camera traps were deployed in the field, I was able to capture a total of 53 individual bobcat sightings. As seen in Fig. 2, out of the 5 sites, Lapham had the highest number of sightings (17), while Stone had the lowest (6). Additionally Fig. 3 displays how out of the 22 cameras deployed, CAM02 yielded the most bobcat sightings (8). The photographs obtained from the camera traps showed at least 4 identifiable individual animals at this time: 1 male bobcat, and 1 female bobcat with her 2 kittens (unknown sex). The male bobcat was seen at least once at the Sacred Heart site (Fig. 4), and the female and her 2 kittens were seen on 2 separate occasions (17 days apart) at 2 different study sites (Sacred Heart and Stone) (Fig. 5 and Fig. 6). Bobcats were seen at times throughout the day, but as displayed on Fig. 7, were most commonly seen at dawn and dusk between the times of 06:00 - 08:00 and 19:00 - 21:00.

Fig. 4.—Photo of male bobcat from CAM03 at the Sacred Heart site on 8/21/20 at 18:58.

Fig. 5.—First sighting of female bobcat and her 2 kittens. Photo from CAM02 at Sacred Heart site on 8/12/20 at 20:57.

Fig. 6.—Second sighting of female bobcat and her 2 kittens. Photo from CAM11 at Stone on 8/29/20 at 18:22, approximately 17 days after first sighting.

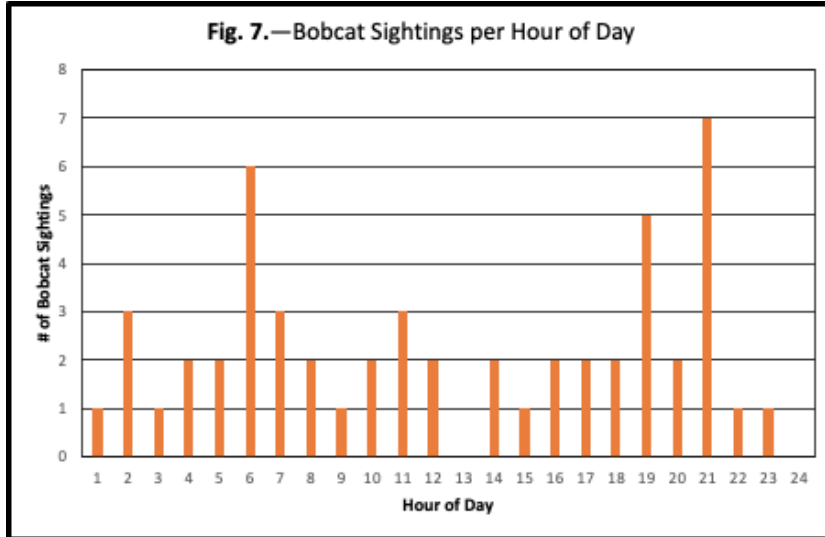**Fig. 7.**—Bobcat Sightings per Hour of Day

Fig. 6.—Graph portraying the number of bobcat sightings per hour of the day. Bobcats were seen at times throughout the day, but were most active at dawn and dusk between the times of 06:00 - 08:00 and 19:00 - 21:00.

Discussion

Bobcat Presence

Between the beginning of August 2020 and the end of October 2020, the 22 camera traps deployed throughout my 5 study sites (Fig. 1) were able to capture 53 individual bobcat sightings. From those 53 sightings, at least 4 individual cats were able to be identified: 1 male, and 1 female with 2 kittens of an unknown sex. The female and her 2 kittens were an exciting find, as their presence indicated that the mother bobcat had established a territory and proved that there is indeed a residential bobcat population in the area. The 53 sightings I captured on my camera traps were consistently spread out throughout the duration that the camera traps were deployed; there were no noticeable major gaps between the dates bobcats were seen. The existence of the mother bobcat and her kittens, paired with consistent sightings throughout the duration of the study provided ample evidence that at least a percentage of the bobcats seen on my camera traps were not transient or juveniles simply moving through the area, and that they were instead part of a residential population.

Bobcat Behavior

Bobcats are crepuscular and most active during dusk and dawn; however, this behavior has been known to variate between different populations depending on various factors, such as the habits of prey species and the levels of human disturbance. As seen in Fig. 7, the bobcats seen on my camera traps were captured at times all throughout the day, but my data demonstrates that there were two major spikes in sightings at times around sunrise and sunset. By showing that the bobcats in the area studied were most active at times around dusk and dawn, it can be inferred that this particular

bobcat population has been able to exhibit normal behavior for the species despite residing in a habitat with a heavy anthropogenic influence.

Conclusion

I was able to reach my goals for my study and clarify that bobcats do indeed have a residential population in Westchester (NY) and Fairfield (CT) counties.

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