Species Identification of Bats on Long Island and Their Associated Habitats.

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Abstract

Bats (Order Chiroptera) are nocturnal mammals that fill important roles in the habitats in which they live and forage. There is little historical information about the species present on Long Island and the habitats in which they live. The purpose of this study is to determine what species of bats are currently present in central and eastern Long Island and the habitats they are associated with. The study area included the Pine Barrens region with a focus on bodies of water such as the Peconic River and Carmans River that run through central and eastern Long Island. Four, twenty-mile driving routes spanning this area were monitored a total of four times each. While driving on these routes, bat calls were detected by a method known as binary acoustic monitoring. This method obtains a call by detecting the sonar pulses using an f/125 monitoring device on top of a vehicle that is traveling along a road at twenty miles per hour. Four species of bat were detected from these surveys. These were *Eptesicus fuscus* (big brown bat), *Lasiurus cinereus* (hoary bat), *Perimyotis subflavus* (tri-colored bat), *Myotis septentrionalis* (northern long-eared bat), and *Lasiurus borealis* (red bat). Bat calls were detected in habitats consisting of wooded areas, street intersections with street lamps, rivers and ponds. From this study, future researchers will now have data to compare and track the different species of bats present on Long Island and any change in the association of their habitats.

Introduction

There are approximately 850 different species of bats (Order Chiroptera) which makes up about twenty percent of the living species of mammals (Simmons, and Stein 7). Despite these large numbers, there is little knowledge of which species currently reside on Long Island, NY and what habitats they prefer. In order to define appropriate conservation approaches, identity and habitat preference for each species currently populating Long Island must be determined (Russo, and Jones 6).

New York State is home to nine different species of bats including the *Lasiurus boreal* (red bat), *Lasiurus cinereus* (hoary bat), *Lasyionicterius noctivagans* (silver-haired bat), *Myotis septentrionalis* (northern long-eared bat), *Myotis lucifugus* (little brown bat), *Myotis sodalist* (indiana bat), *Perimyotis subflavus* (tri-colored bat), *Eptesicus fuscus* (big brown bat), and *Myotis leibii* (eastern small-footed bat) (Stegemann, and Hicks 8). All of these species are classified as Microchiropteran bats, or true bats, and use echolocation to navigate around obstacles and, in most cases, to locate insect prey. By recording the sonar pulses emitted by the bats and analyzing their frequency patterns, we can determine which species are present. Until now, it was not clear which species exist on Long Island, but it is important that this information is gathered. Bats are major consumers of nocturnal insects, making them extremely valuable components to terrestrial ecosystems (Agosta 1). With population density decreasing from environmental factors such as the introduction of wind turbines, deforestation, and the fungal disease white-nose syndrome, species identification research is needed on Long Island in order to advance conservation efforts.

Methods and Materials

Four, twenty-mile routes were created that allow for a car to drive 18-20 miles per hour along the designated roads. The four routes used in the study were concentrated around the Carmans River, Peconic River, the Pine Barrens region in Central and Eastern Long Island, and the north fork's agricultural lands. The four routes are entitled Manorville, North Street, Carmans River, and Sound Avenue. Each survey was initiated thirty minutes after sunset. (Herzog 4) While driving along these routes an f/125 acoustic monitoring device is used to detect bat sonar pulses and deliver them to the Spect'R III© software running on a laptop inside the vehicle. This process transforms the sonar pulse into an audible sound that the driver and navigator can hear while proceeding through the routes. The Spect'R III© software measures the frequency in kilohertz and records the time in milliseconds of each pulse while the vehicle is in motion. Simultaneously, the Delorme® GPS navigation software is logging coordinates, via a USB GPS unit mounted on the vehicle and also connected to the laptop, that enables the crew to record a location for each positive bat call. The files are then transferred to another program called ScanR© in order to separate the positive bat calls from any background noise the Spect'R III© software recorded. (Herzog 4)

The ScanR© software was designed to separate background sounds from positive sonar pulses. It enables the user to amplify the size of a single pulse in order to analyze the minimum frequency of the pulse sequence. The minimum frequency determines what species emitted that pulse sequence. The trace screen allows the user to examine the spaces in time between each pulse to differentiate between evenly spaced search calls and narrowing spaces or approach calls. It is important to utilize the search calls when analyzing minimum frequency since approach

calls can emit a higher frequency pulse and will provide an inaccurate species identification. (Herzog 5)

During this study these steps were repeated a total of four times for each of the four routes. The routes were performed three times forward and one time in reverse. The routes were performed in reverse to detect bats that may have been missed by the time the end of the route was reached due to the bats returning to night roosts for digestion. (Herzog 4)

In addition to the mobile surveys, four, one hour static surveys were conducted on Brookhaven National Laboratory's (BNL) grounds along with a single survey at The Nature Conservancy's Calverton Ponds Preserve. The four surveys conducted on BNL property were along the North Fire Break, Peconic River near the sewage treatment plant, Blue's Pond, and a Recharge Basin located south of East Princeton Avenue. Each survey was started thirty minutes after sunset. The Calverton Ponds and East Princeton Avenue surveys were monitored for thirty minutes.

A Geographic information system (GIS) was used in order to associate habitat to each positive bat call. The GIS allowed for vegetation, large bodies of water and stream maps to be examined while viewing the positive calls along all four routes.

Results

While driving along the roads of our mobile survey routes, bat calls were predominately detected when the vehicle drove by street lights, illuminated intersections, and bodies of water. From the mobile routes, five species of bats were identified from a total of one hundred and sixty three positive bat calls. Of these one hundred and sixty three positive bat calls, one hundred and twenty six were attributed to big brown bats, twenty two attributed to red bats, two to tri-colored

bats, two to hoary bats, and one northern long-eared bat. The remaining ten calls did not provide enough data in order to accurately identify them to the species level and will remain as an unknown *Myotis* bat.

Approximately seventy seven percent of all the bats detected were of the big brown bat. The red bat was responsible for fourteen percent of all calls detected. Six percent of the calls were from unknown *Myotis*. The hoary, tri-colored, and northern long-eared bats each constitute only one percent of the positive bat calls detected from the mobile surveys (Figure 1).

In addition to mobile surveys, the static surveys on the BNL property yielded similar data. Big brown and hoary bats were predominantly responsible for the identifiable calls. However the eastern small footed bat was also detected on the BNL property.

Based on the GIS results, positive bat calls were found in seven types of vegetation. As shown in figure two, forty one percent of positive calls were located in oak/pitch pine forests. Eighteen percent were found in oak forests. Grass Lawns accounted for fifteen percent of all positive bat calls. Figure two demonstrates that the majority of calls detected were located in forested habitats of the central pine barrens of Long Island.

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Along with the vegetation, larger bodies of water such as the Carmans and Peconic Rivers, and smaller streams were also examined using GIS. The GIS concluded that thirty positive bat calls were detected within one hundred meters of a New York State Department of Environmental Conservation classified wetland, and twenty three positive bat calls were detected within one hundred meters of a stream.

Discussion

"In general, bat species with high wing loadings and large bodies are less maneuverable in flight, have a lower frequency echolocation calls, and tend to forage over less structurally cluttered, open environments"(Brooks, and Ford 2). This supports the results of seventy eight percent of all positive bat calls along the roads of our mobile surveys, near the edges of densely wooded areas attributed to the big brown bat, which weighs approximately fourteen to twenty one grams and has a wingspan of thirteen to sixteen inches (Organization 9).

"Species with low wing loadings and smaller bodies are more maneuverable, have higher frequency echolocation calls, and utilize more cluttered, close canopy forest habitats" (Brooks, and Ford 2). The eastern small footed bat, which was detected during a static survey at BNL under a dense canopy with an emitted echolocation frequency of over forty five kilohertz, supports the concept that bats with higher frequency echolocation calls tend to forage in more cluttered environments. This may be a reason why this bat was not detected during our road surveys.

During the study, ten short call sequences appeared to have characteristics of a *Myotis* bat. Unfortunately, due to the inability to transfer data to a bat identifier program we did not have enough call sequences required to identify the species. Despite there being ten short sequences, this is still alarming when compared with Paul F. Connor's data, who in 1971 after completing his research of "The Mammals of Long Island, New York" documented that the little Brown *Myotis* was the most numerous summer bat (Connor 3). This summer's study which was limited to central and eastern Long Island could possibly at its maximum only have detected the *Myotis*

bat at six percent of all bats detected. This is supporting evidence that conservation efforts need to be established for bats on Long Island.

Throughout the duration of this study there were several complications that slowed its progression. Issues with the GPS, incompatible programs, failure to test run the routes prior to beginning the surveys, and weather all influenced the collection and analyzing of data.

The weather proved to be a major obstacle. As per the NYDEC's protocol, any amount of precipitation and the study must be aborted. The month of June had many days of rain and the study only ran until July fourth. Despite the attempt to run additional survey nights the rain persisted day after day some weeks and in order to complete four surveys of each route the last survey had to be conducted on July sixth. The Calverton Ponds static survey was monitored for only a half hour due to extreme wind gusts which were thought to be keeping bats from foraging.

All the data was collected with Spect'r III© and prepared with ScanR© to be analyzed by the program Bat ID© in order to identify species monitored. However the bat detector records data as a *.wav file and Bat ID© was an incompatible program with the type of bat detector and file format being used. This left no alternative but to use a rubric provided by the NYSDEC to manually interpret each positive sequence file. Unfortunately in order to use this rubric for an accurate identification only the search calls of the search, approach, and feeding buzz call phases can be used. To use these search calls, a pulse sequence of five or more must have been detected (Herzog 4). This left approximately six percent of our detected calls as unknowns. Despite having a rubric to follow with the minimum call frequencies that each bat should emit, Carl Herzog of the NYDEC still felt on many of cases that certain bat calls can have overlapping call frequencies when engaging in certain activities. The process of manually identifying each

positive bat detection allowed for too many human errors and could have be completed more accurately and efficiently by using bat identification software.

Conclusion

Until now, no research had been conducted on species identification or their associated habitats on Long Island. The survey data supports the presence of four species of bats on Long Island in particular habitats that had previously not been identified. Now that preliminary research has been able to identify bats and their habitats, further experiments can be conducted such as mist netting, research into white-nose syndrome on Long Island, and further conservation efforts in an effort to keep the bats that are currently living on Long Island safe and healthy.

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Figure One:

This pie chart depicts the percentage of all the positive bat calls detected from all the mobile survey routes.

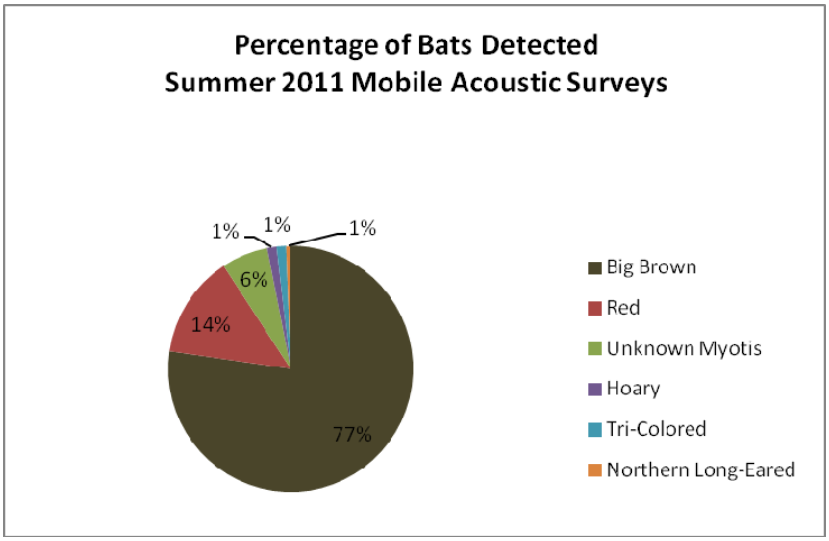
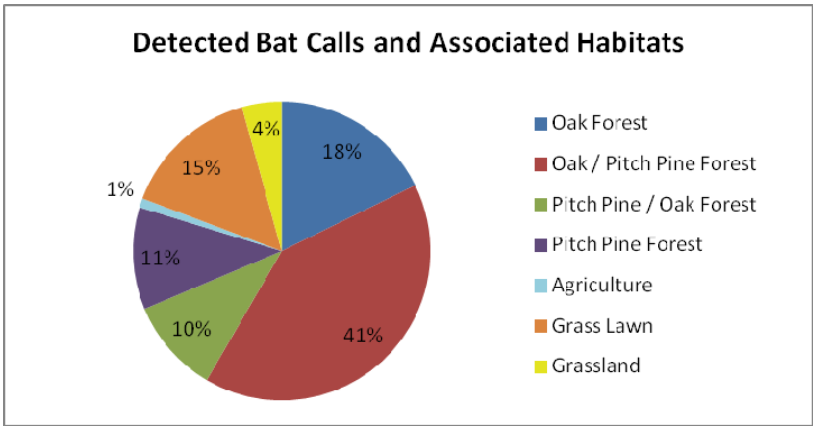
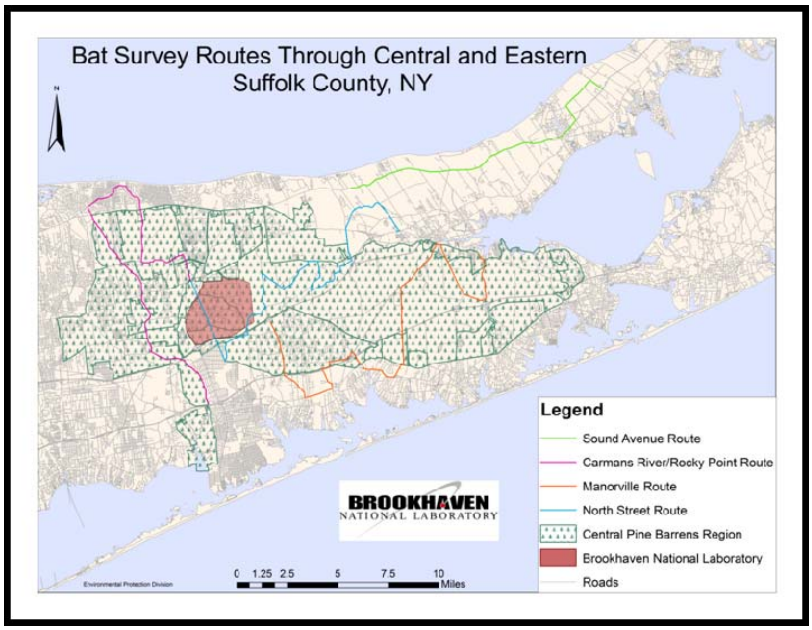


Figure Two: This pie chart depicts the location of all the positive bat calls from all the mobile survey routes and their associated vegetation types.




Bat Survey Routes Through Central and Eastern Suffolk County, NY
BROOKHAVEN NATIONAL LABORATORY
0 1.25 2.5 5 7.5 10 Miles
Environmental Protection Division
Legend
Sound Avenue Route
Carmans River/Rocky Point Route
Manorville Route
North Street Route
Central Pine Barrens Region
Brookhaven National Laboratory
Roads