

Identification of bat species in Suffolk County

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Abstract

Bats produce ultrasonic calls that are used for foraging and navigation. These calls operate at different frequencies for different species of bats and can thus be used for identification. Acoustic surveys provide a relatively inexpensive and timely way to identify bat species covering a large area. Few surveys have been conducted in Suffolk County, New York and with the grim outlook for bats in the northeast attributed to the spread of white-nose syndrome, a fungal disease that is decimating bat populations, it is more important than ever to have information about the abundance and distribution of bats. Using binary acoustic technology, 16 acoustic surveys were performed between the months of May and July along four predetermined routes. Several bat species have been identified to roost in Suffolk County during summer months including: *Eptesicus fuscus*, *Lasiurus borealis*, *Perimyotis subflavus*, *Myotis septentrionalis*, and *Myotis lucifugus*. By knowing species abundance and distribution, future research will be able to track changes in population size, geographic changes and roosting behavior.

Introduction

Bats are members of the diverse order of mammals, Chiroptera. Over 1,000 species have been found to live in all habitats excluding extreme polar and desert climates.ⁱ Bats are an important component of the ecosystem. Herbivorous bats serve as pollinators and seed disseminators whereas insectivorous bats control insect populations.ⁱⁱ Approximately 70% of bats, including bats in New York are insectivorous.ⁱⁱⁱ According to the New York Department of Environmental Conservation New York has nine species of bats. Six species are cave bats that hibernate in caves during the winter while three

species are tree bats that migrate to warmer climates during the winter.^{iv} New York's nine species of bats are: *Myotis septentrionalis* (northern long-eared bat), *Myotis lucifugus* (little brown bat), *Myotis sodalis* (Indiana bat), *Perimyotis subflavus* (tri-colored bat), *Eptesicus fuscus* (big brown bat), *Myotis leibii* (small footed bat), *Lasiurus borealis* (red bat), *Lasiurus cinereus* (hoary bat) and *Lasiyonicterius noctivagans* (silver-haired bats).^v

Although a part of New York, little attention has been paid to bat populations on Long Island, specifically Suffolk County. During the summer of 2011 the Environmental Protection Division of Brookhaven National Laboratory conducted the first acoustic surveys through the Pine Barrens and the North Fork of Suffolk County. Surveys identified several bat species including: *E. fuscus*, *L. borealis*, *L. cinereus*, *P. subflavus*, *M. septentrionalis*, *M. leibii* as well as an unknown *Myotis* species.^{vi} With a preliminary identification of species in Suffolk County a baseline was established so researchers can track changes in summer bat activity.

Currently bats are facing many threats to their population including habitat destruction caused by development projects or natural causes like fire, the impact from wind turbines, and the emergence of the fungal disease white-nose syndrome (WNS).^{vii} WNS is a psychrophilic fungus characterized by white fungal growth on the muzzle, ears and/or wing membranes of hibernating bats.^{viii} WNS was first documents in Howe's Cave, west of Albany, New York in 2006 and within 2-years of its emergence surveys suggest that bat populations have declined by at least 75 percent.^{ix} Bats affected by WNS move to the entrance of the caves and come out during the winter months when they should be roosting.^x Scientists hypothesize that the interruptions in winter roosting causes

bats to lose their fat resources at an accelerated rate and does not leave them with enough to survive until spring.^{xi}

Research on bat populations in Suffolk County will allow scientists to document what species are being impacted most by population threats. Furthermore by understanding what bats are most affected, this research can be used to aid conservation efforts. Conservation efforts include determining how far the disease has spread and measuring the impact of the disease on bat populations. According to the New York State Department of Environmental Conservation species that have been hit the hardest by WNS are the little brown bat, northern long eared bat, and the tricolored bat that suffer population declines of more than 90 percent.^{xii} Indiana bats have also declined significantly by about 60 percent.^{xiii}

Study Area

Four survey routes were established for acoustical surveys: Carmans River, Manorville, North Street and Sound Avenue (Figure 1). Three of the routes ran through areas of Long Island's Central Pine Barrens. The Pine Barrens contains over 100,000 acres of terrestrial and marine environments that is protected by federal, state, local and other public agencies.^{xiv} The forests and woodlands of the Pine Barrens are pitch pine and oak communities with scattered wetlands.^{xv} The pitch pine-oak communities have over a 60% canopy cover with an understory comprised of scrub oak and ericaceous (heath) shrubs.^{xvi} Two of the routes established in the Pine Barrens were run along rivers. The Carmans River route was run along Carmans River while the North Street route was run close to the Peconic River. The Sound Avenue route along the North Fork was the only

route not run through the Pine Barrens. This route was designed to acquire an idea of bat activity in agricultural landscapes.

Materials and Methods

Four predetermined survey routes were chosen on the basis of three criteria. The route was thought to pass by summer roosts of bats, to avoid high trafficked and high-speed areas. Each route was run four times for a total of 16 surveys. Each of the four routes were driven three times forward and one time in reverse. Surveys were initiated thirty minutes after local sunset during peak bat activity.^{xvii} Vehicles drove between 18-20 mph towards the shoulder of the lane. When being overtaken by other cars, drivers were instructed to pull over as far right as possible until safely passed, a tally was taken to indicate how many times the vehicle was overtaken during the survey. Attached to the roof of the vehicle were an f/125 bat detector and a global positioning satellite (GPS) antenna. Both the detector and the GPS had cables with USB connectors to attach to a laptop. Installed on the laptop was a spectral analysis, digital tuning and recording software (SPECT'R®) and Delorme Street Atlas software. SPECT'R® software recorded high frequency ultrasonic bat calls and converted the sound down to a range audible to humans.^{xviii} The Delorme Street Atlas software was used to inform the driver the route of the survey as well as to track where each bat encountered was found.^{xix} Before and after each survey the temperature, humidity, dew point, wind speed, wind direction and cloud cover were recorded. Temperatures at the start of the survey needed to be 55°F or greater on a day that did not have steady winds over 15 mph with no chance of rain^{xx}.

After acoustic surveys, the recorded files were ran through an automated snapshot characterization and tool analysis program (SCAN'R®).^{xxi} SCAN'R® was used to

differentiate bat calls and other noises that may have been caused by insects, passing vehicles or other noise. The program separated files into two lists; a list of failed files that did not record any sound and a list of passed files. Passed files showed one or more sonogram thumbnail sections (pulses) that were used for visual species identification. Failed files were disregarded whereas passed files were archived in a separate folder. All passed files were manually sorted through to identify bat species based on their search phase calls. Each file needed to have at least five pulses to be considered for identification, files with less than five pulses were identified as unknown bats. The only exception to this rule is the hoary bat that can be identified by just a few pulses because of its distinctive search phase calls.^{xxii} Using a flow chart designed by New York State's Department of Environmental Conservation Wildlife Biologist, Carl Herzog bats were identified using the minimum frequency, constant frequency and slope of the call at critical frequency of incoming calls.

Results

After analyzing audio files recoded from mobile acoustic surveys, several bat species were identified in Suffolk County, Long Island during the summer months. Species identified include *Eptesicus fuscus* (big brown), *Lasiurus borealis* (red), *Perimyotis subflavus* (tri-colored), *Myotis septentrionalis* (northern long-eared), and an unidentified *Myotis* species. Of the positive bat calls *E. fuscus* represented 75.85% of the calls, *L. borealis* represented 16.48% of the calls, *P. subflavus* represented 0.28% of the calls, *M. septentrionalis* represented 0.28% of the calls and 7.1% of calls were unidentifiable (Figure 2). Compared to data obtained from the summer of 2011, there is an absence of identified *Myotis leibii* (small footed) and *Lasiurus cinereus* (hoary bat)

calls. Other than the absences of *M. leibii* and *L. cinereus* surveys from 2011 and 2012 yielded similar percentages of bat calls (Figure 3). However, the amount of bat calls recorded this summer is more than twice the number of calls recorded during summer surveys of 2011.

Discussion

Out of New York's nine species of bats, the search phase calls of four species of bats were recorded and analyzed. Several species of bats are absent from surveys including *M. lucifugus*, *M. leibii*, *L. cinereus* and *L. noctivagans*. In accordance with New York Department of Environmental Conservation *M. septentrionalis* and *P. subflavus* appear to be less abundant than other species of bats. At the same time *E. fuscus* and *L. borealis* bats seem to flourish in comparison to other species of bats. A few calls were tentatively identified as *M. sodalis* but since myotis bats have overlapping calls the files could not positively be identified. In order to have an accurate inventory of bat communities in an area one cannot rely on acoustic sampling alone. To have an accurate inventory of bat communities, acoustic sampling should be paired with various capture techniques.

Acoustic sampling was an appropriate sampling method because it is not as expensive, not as time consuming and covers broader areas than capture techniques like mist netting. There are intrinsic biases in using just one technique. While acoustic detectors allow sampling of a larger area than capturing techniques, these detectors may under represent bat species that have low intensity vocalizations.^{xxiii} Other problems that may be faced when performing acoustic surveys are: variable activity patterns, imperfect detections, background noise of vehicles and streams that can interfere with calls, map

problems and dense vegetation that can cause bats to produce less diagnostic calls within steeper call slopes and shorter call durations.^{xxiv} While analyzing bat calls recorded from acoustic surveys performed it was evident that background noise was a problem.

SCAN'R® would mistakenly sort background noise and other times background noise interfered with the bat call making species identification difficult. Although acoustic surveys have limitations there are also benefits. Acoustic surveys can be conducted over greater spatial and temporal extents in habitats that are not conducive to mist netting.^{xxv} Acoustic surveys are also beneficial because they do not cause undue stress on bats because they are not being captured or handled.

Several problems were encountered during the collection and analysis of data. The GPS was a source of several problems. At times the route highlighted would turn one way but the GPS would direct drivers to turn the other way. This led to making several wrong turns on the route. A second issue was encountered during the data collection phase was the weather. Since recording equipment was not waterproof surveys were cancelled on nights when there was rain. Other problems were encountered with software. During two of the surveys files were recorded in full bandwidth instead of autosnap mode. This meant that when processed through SCAN'R pulses were not sorted out by time. Due to a lack of proper .wav* splitting software bat identification was done by just looking at all of the calls in one file instead of separate files split by time. Finally due to a lack of a call inventory bat identification was done manually instead of being run through a program that compares the calls. Since bats calls of different species can be at overlapping frequencies it can be difficult to manually identify one species from another.

In order to obtain population information of bats- age, sex ratio, reproduction and

parasite load- mist netting and other capture techniques must be used.^{xxvi} Similarly to acoustic methods, mist netting has its limitations. Mist netting is time consuming to set up; it needs to be placed in flyways or by water sources with good canopy coverage.^{xxvii} Due to these limitations as well as the fact that nets need to be checked every 10 minutes after being deployed, only a small sample area can be covered.^{xxviii} In addition, mist netting can have biased species samples because the nets are out of some species flight path and more alert bats avoid the nets altogether.^{xxix} Finally, mist netting causes stress in bats.^{xxx} Some bats do not handle the stress of being in a net well and can have a heart attack. *L. borealis* are particularly susceptible to heart attacks when trapped in a net.

Although mist netting was not performed along survey routes some mist netting was performed on Brookhaven National Laboratory property and at the Wertheim National Wildlife Refuge. Mist netting of these areas in Suffolk County resulted in the capture of *E. fuscus*, *L. borealis* and *M. septentrionalis*.

In the future, researchers should try mist netting at areas along the survey routes to try and obtain a more accurate idea of the population. By combining different sampling strategies researchers will get a more holistic idea about summer bat populations. In addition researches can obtain this information by locating and visiting summer roosting areas. This will then allow researchers to track changes in bat populations.

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Notes

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Appendix

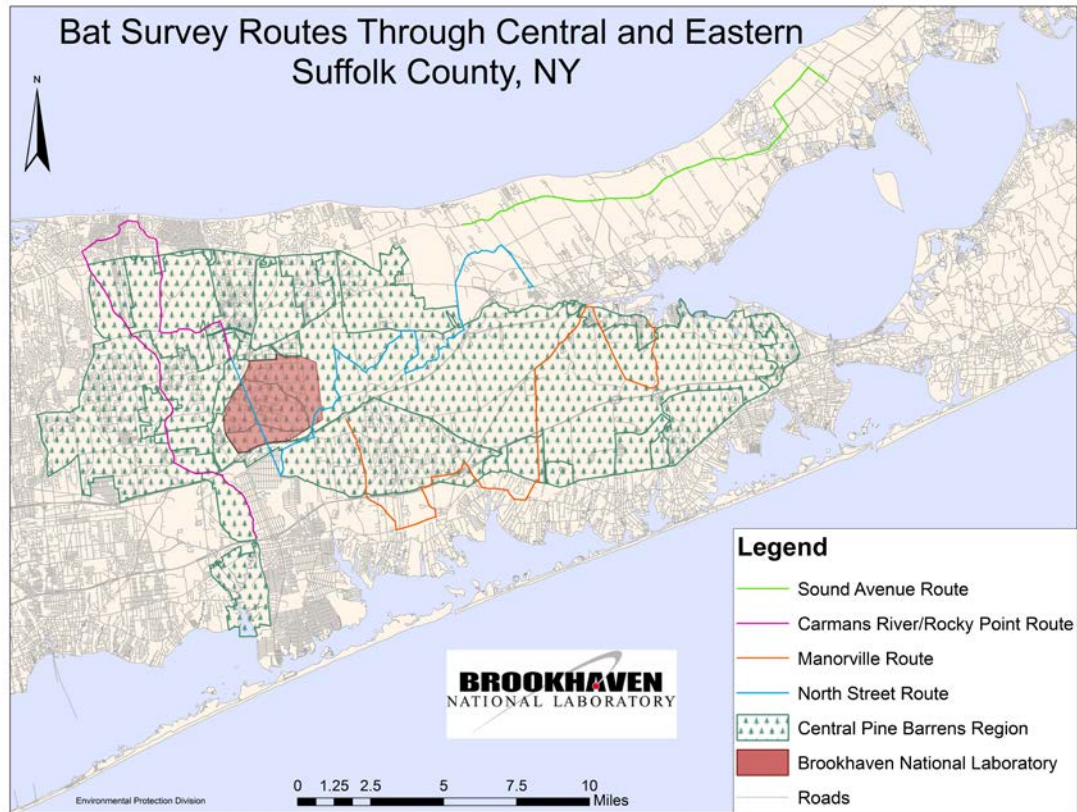


Figure 1. Map with Brookhaven National Laboratory, Central Pine Barrens and all four survey routes identified.

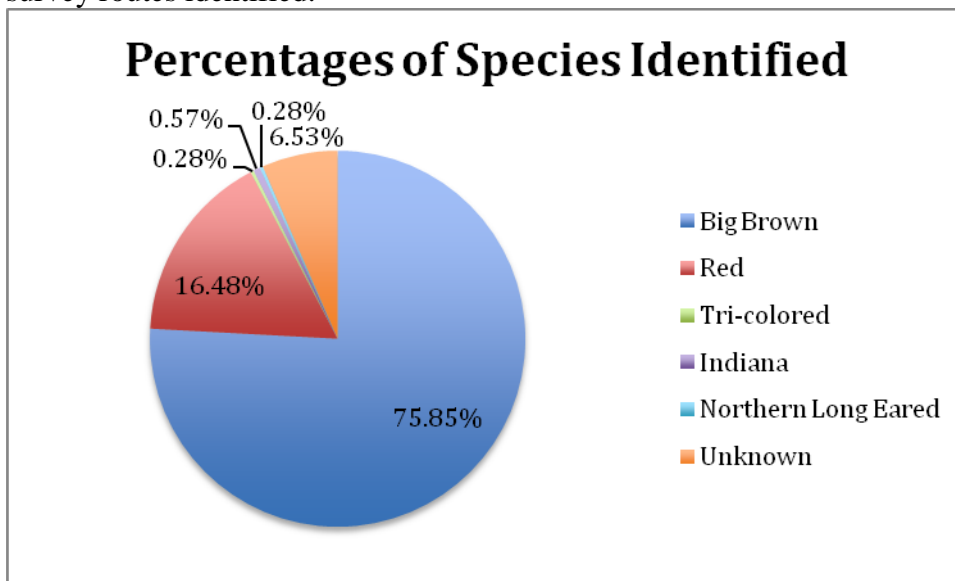


Figure 2. This pie chart depicts bats species identified on acoustic surveys as well as the percentage of search phase calls that were identified.

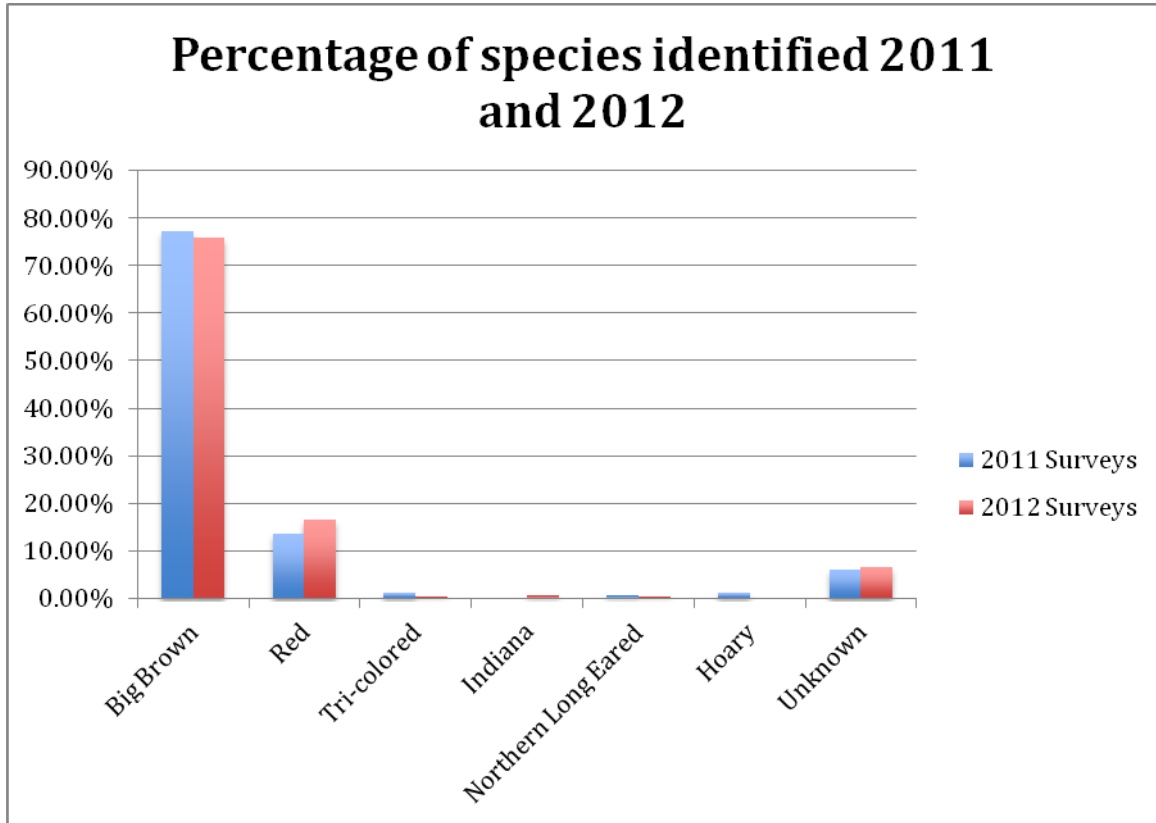


Figure 3. This bar graph shows a side by side comparison of percentage of species identified during surveys for summer of 2011 and 2012 by species