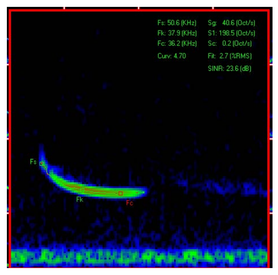

Acoustic identification of Chiroptera species in eastern Suffolk County and Brookhaven National Laboratory using full spectrum call analysis.

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Abstract

First discovered in Albany, New York in 2006, white-nose syndrome (WNS) has decimated bat populations throughout North America. WNS is caused by the cold-loving fungus *Pseudogymnoascus destructans,* which is native to Europe. Acoustic surveys were conducted along routes within eastern Long Island and Brookhaven National Laboratory (BNL) in order to note trends among bat populations as a result of WNS. Six out of 9 native Chiroptera species were identified. The data collected were compared with 2 previous years of collected data and indicated a substantial decrease in the big brown bat (*Eptesicus fuscus*) and increase in eastern red bat (*Lasiurus borealis*). Acoustic surveys were also conducted within BNL in order to determine differences between the solar farm and a recently burned forest when compared to a control site. This research is helping to get a better idea of population trends and niche changes as WNS spreads across North America.

Introduction

Chiroptera is the second most numerous order of mammals, composed of nearly 1,300 species commonly referred to as bats. Chiroptera are the only mammals capable of true flight and may travel distances of up to 50 km a night to forage, consuming nearly 50% of their body weight in insects per night (5). As one of the few nocturnal predators of flying insects, they provide pest-control services valued as high as 53 billion dollars that save crops and help to control the spread of insect-borne diseases (3).

In 2006, a psychrophilic fungus commonly referred to as white-nose syndrome, recently reclassified from *Geomyces destructans* to *Pseudogymnoascus destructans (Pd)*, was found within hibernacula in upstate New York (8,7). Since that time, WNS has spread throughout the United States and killed over 5.7 million bats (8). WNS infects the wing, ear, tail and muzzle tissue of hibernating cave bats, destroying tissue and increasing arousal from torpor to once every 10-20 days to as often as every 3-4 days (8).

The purpose of this study was to continue ongoing population surveys within eastern Long Island in order to note any population trends among Chiroptera species as a result of WNS. We hypothesized that a continued decline in cave bat species would lead to an increase in tree species as more resources, such as habitat and obtainable food, became available.

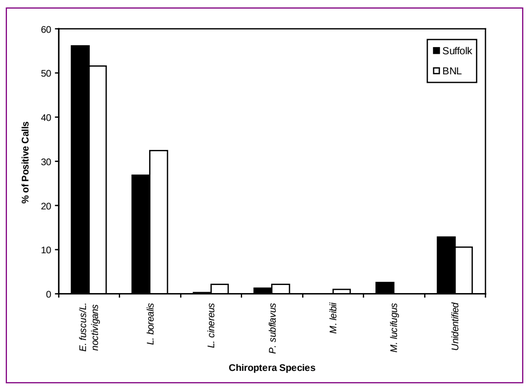

Figure 3. Chiroptera species identified within eastern Suffolk County and Brookhaven National Laboratory.

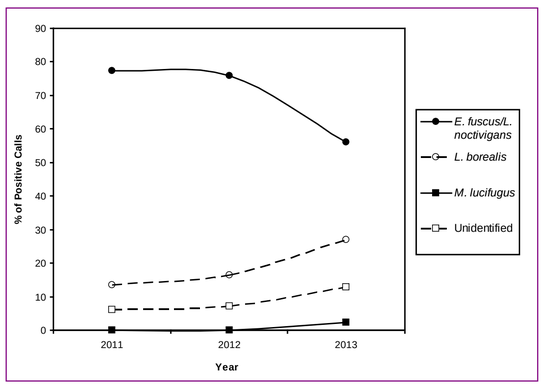

Figure 4. Population changes in prominent Chiroptera species within eastern Suffolk County.

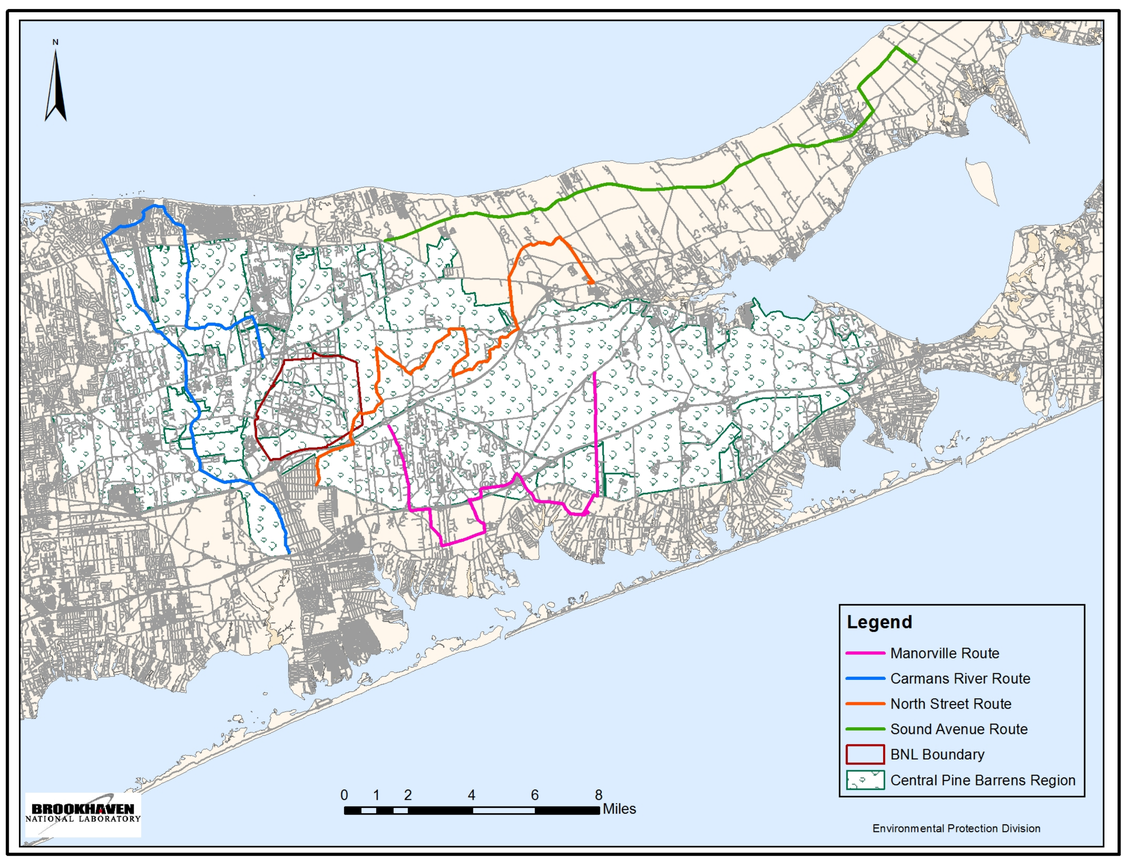

Figure 1. Mobile survey routes through eastern Suffolk County, New York.

Discussion

The results of this study indicate a decline in the number of *E. fuscus* calls recorded over the last two years (Figure 4). Correlating with this is the prevalence of *L. borealis* compared to previous years, having increased by nearly 10%. The number of unidentified bat calls has also increased but not significantly enough to have had an impact on these trends. *M. lucifigus* was the only other *Myotis* species encountered in the Suffolk County surveys, showing a 2.24% increase since 2011. This is the first time that *M. lucifigus* was recorded during these surveys and these preliminary results suggest the possibility of a population increase correlating with the NYDEC winter survey of upstate hibernacula. Continuing studies are needed to determine if populations are in fact growing and whether or not these changes are associated with migration or reproductive success in native bats (4).

Bat surveys at BNL showed the most concentrated number of calls within and immediately adjacent to the burned forest. Of the 5 species recorded on-site, 4 were recorded in the wildfire area, including 2 individuals of *M. leibii.* This result suggests that burned forest may contain more usable habitat than healthy forest, particularly due to the low canopy density, increased sun exposure and high availability of roosts (2).

A stationary survey in close proximity to the Long Island Solar Farm yielded twice as many bat calls when compared to a control. A comparison of these results to an internal solar farm survey site would be beneficial to identify bat usage of solar farm land.

Additional acoustic surveying should be conducted on-site in order to provide an adequate comparison of these unique areas. Since acoustic surveys, particularly static surveys, introduce some bias regarding populations, mist-netting should also be employed in appropriate areas to estimate population density.

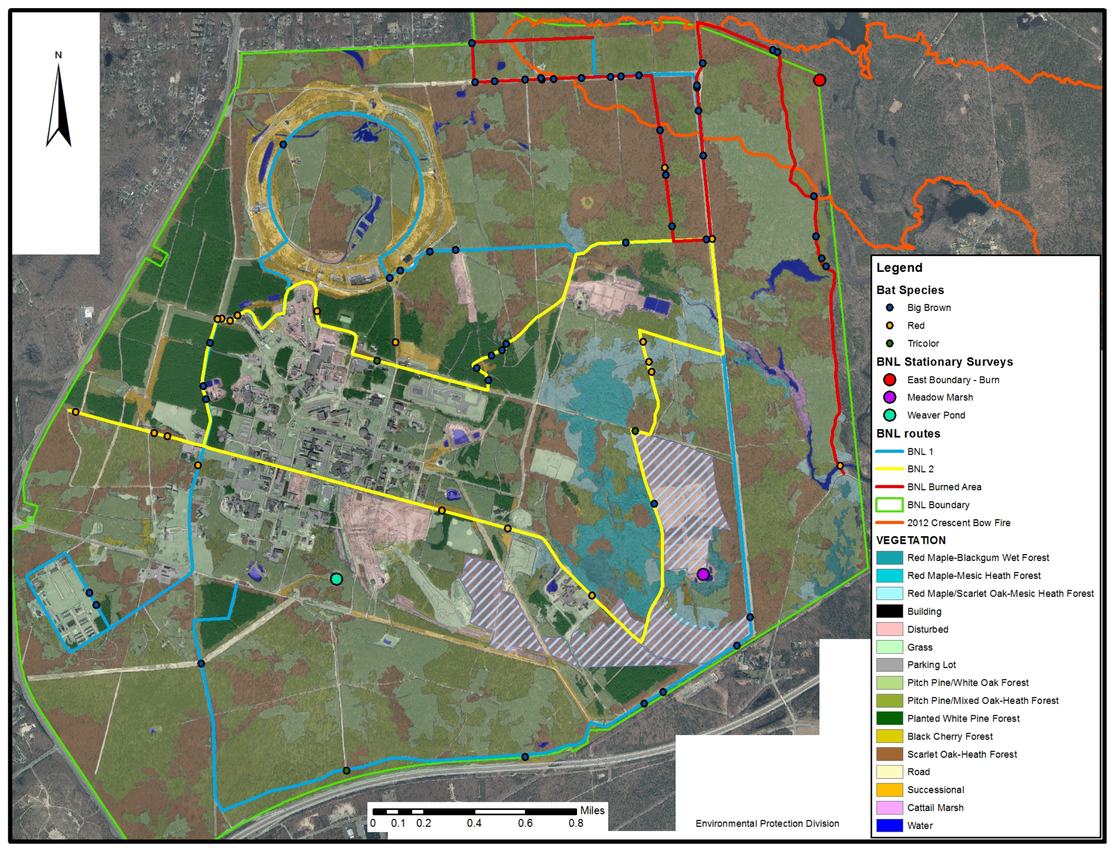

Figure 2. Mobile survey routes with associated Chiroptera species recorded and stationary survey points within Brookhaven National Laboratory.

Methods

Route Selection

Four routes within eastern Suffolk County were plotted using DeLorme 2012© (Figure 1). Three mobile routes and 3 stationary locations were also plotted at BNL in areas of the Long Island Solar Farm and a recently burned forest to compare to a control (Figure 2). One additional stationary survey was conducted in Manorville, NY at a private residence.

Survey Conditions and Setup

Surveys were conducted from June 5th through July 23rd. Mobile surveys began 30 minutes after sunset and stationary surveys ran from 20:00-21:30 EST. Weather data was collected prior to recording and surveys were conducted if sustained winds were less than 15 mph and temperature was greater than 55º F with no rain. Mobile surveys in Suffolk County were conducted at a speed of 18-20 mph while surveys on-site at BNL were reduced to speeds between 10-15 mph due to road conditions (6).

Calls were recorded using an acoustic monitoring device mounted by magnet to the vehicle's roof. The program Spect' R III© was used to record full-spectrum bat calls with a tuner that allowed for conversion of ultrasonic frequencies to audible levels and a sonographic analyzer used to visualize the call (1). The coordinates traveled and their associated times were logged using Delorme 2012© in conjunction with a GPS unit attached to the roof of the vehicle (6). Each Suffolk County route was run 4-5 times and BNL surveys were conducted once.

Identification

Calls were analyzed using the program Scan' R© and manually deciphered based on characteristic frequency and slope. In order to identify species using this method, the search phase call was used, defined by a minimum of 5 evenly-spaced pulses occurring approximately every 100 ms. Due to the difficulty in differentiating *E. fuscus* and *L. noctivagans* by Fc, all calls fitting the criteria for these species were lumped into one category and referred to as *E. fuscus* (6).

Results

In eastern Suffolk county, a total of 312 positive Chiroptera calls were recorded, with 12.82% attributed to unidentified species. The mobile surveys showed a substantial decrease in *E. fuscus* calls and a significant increase in *L. borealis* since 2012 (Figure 4). *E. fuscus* was the most commonly encountered species representing 56.09% of positive calls. Also encountered were *L. borealis*, *M.lucifugus, P. subflavus* and *L. cinereus* (Figure 3).

In surveys at BNL, 198 calls were recorded and *E. fuscus* was the most commonly encountered species (51.60%) followed by *L. borealis* (32.45%). Also recorded were *P. subflavus, M. leibii* and *L. cinereus*. Unidentified bats composed 10.63% of the calls recorded (Figure 3).

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