Report on Bat Activity in Enfield, NY

Prepared for:

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Executive Summary

This study consisted of passive monitoring of bat activity in one location and during one season in the town of Enfield. Activity was monitored near the crossroads of Black Oak Road and Cayutaville Road from August 24, 2009 until October 9, 2009. The monitor was provided by IED and installed on the met tower by Prevailing Winds and John Rancich of Enfield Energy.

At least three bat species were documented at the site. The presence of a fourth species is highly likely, based on a small number of calls. The bats were most active at wind speeds varying from 3 to 7 meters per second (m/s). The most common species appear to be *Eptisicus fuscus* and *Myotis lucifugus*. For the entire monitoring period, bats were present on 39 of 69 monitoring nights. Bats were present on 28 of the first 32 nights of monitoring (August 24 to Sept 25).

Site Description

The Enfield met tower is in an exposed hay field at an elevation of approximately 580 meters. A buried pipeline transmission power line right of way is located in the same field less than 100 meters away at the closest point. A scrap and metal recycling center is somewhat over 100 m to the north west of the tower. Radio towers occupy the hilltop directly to the south, across Cayutaville Road. A portion of Robert H. Treman State Park shares a contiguous border with the area, also on the South side of Cayutaville road. To the west, the area shares a contiguous border with the Connecticut Hill State Wildlife Management Area. Both the state park and the wildlife management area are well forested with a mix of mature hemlocks, mixed hardwoods and some white pine.

The Enfield land cover and land use map classifies the immediate area around the tower as "agricultural". The NYS DEC has classified the stream that drains the property to the west, which enters a ravine and becomes a tributary of Cayuga Inlet. DEC and the NY Natural Heritage Program do not list any rare plants, rare animals, state registered wetlands or significant natural communities as residing in the immediate area or in the adjoining forests, according to the present data base.

According to the USGS Bat Population Database [1], bat species historically in residence in Tomkins county include: *Myotis leibii*, the rare, eastern small-footed bat, *Myotis lucifugus* the little brown bat, and *Perimyotis subflavans* (formerly *Pipistrellus subflavans*) the eastern pipistrelle. *Myotis leibii* is listed as a species of concern by the NY Natural Heritage Program. The endangered *Myotis sodalis* (Indiana Bat) has not been recorded in Tompkins County. The site is not within 40 miles of a known *M. sodalis* hibernaculum, the radius defined in the NYSDEC guidelines for wind energy projects.

Methods

An Anabat SD1 was used for this study. The SD1 detector was installed in a waterproof housing at the base of a 60 m met tower. It was continuously powered during the study period by a solar panel which charged a 12 V battery. A Hi-Mic microphone was installed at 50 meters while the tower was down for maintenance and connected to the SD1 by cable. The CF cards for the SD1 were programmed to collect data from 18:00 to 07:00 hours, EDT. The Anabat settings, in accordance with established protocols, were as follows: audio division 16, data division 8, sensitivity settings of 6 to 7.

The CF card was checked within 48 hours of installation and was operating optimally, based on the number and quality of recordings on the first two nights. CF cards were switched every two weeks through the bat activity period.

Raw data files from the SD1 are large and therefore were archived to an external disk. The cfcread program provided by Titley Scientific was used to produce Anabat files, which were in turn analyzed using the AnalookW software package, also from Titley Scientific. Both programs were produced by C. Corben. Software documentation was obtained from M. J. O'Farrell.

Based on recorded calls, bats were sorted into species groups. The five groups for which the recordings were examined are shown in Table 1. Calls distorted by environmental noise or other factors were classified as unknown species. The identification of individual species within some groups is not reliable with passive monitoring alone. Each recording event may contain multiple calls and is therefore referred to as a call sequence. In general, recordings that contained only one call were classified as unidentified bat species.

Table 1

Group number and ID	Species in group	Historically present
1 EfLnoct	*Eptisicus fuscus/Lasionycteris noctivagans*	N
2 My	*Myotis species*	Y
3 Pip	*Perimyotis subflavans*	Y
4 Lac	*Lasiurus cinereus*	N
5 Lab	*Lasiurus borealis*	N

Data from AnabatW recordings was matched with met tower data using R functions, producing a continuous data set for the period. The data set was analyzed using both R and excel functions.

Results

The monitoring period was sustained for 69 nights. Bat calls were recorded on 39 nights in a total of 166 call sequences. Fifty-three percent (53 %) of the calls could be placed in a species group while 47% of the calls could not be sorted into species due to environmental noise or distortion. Only three of the five species groups were observed. (Table 2). In addition to bat calls, environmental noise, especially high winds, triggered almost 70 thousand recording events. Eighty-seven percent (87%) of these noise events occurred between October 11 and October 31. Identifiable bat call sequences represent 1.7% of the recordings made between August 24 and October 10, but only 0.2% of recordings after October 10. Bat activity decreased sharply during high wind events in October.

On nights when bats were present, an average of 4.3 bat call sequences were recorded. For the entire measuring period, including nights without bat recordings, there were an average of 2.4 call sequences per night recorded. On twenty-one nights (30 % of the recording time), 2 or more species were present during the night-long recording period.

Table 2

Species group	**Number of recordings**	**Number of nights recorded**
Epitisicus fucus/ Lasionycterius noctivagans	53	24
Myotis spp.	24	9
Lasiurus cinerus	11	7
Bat calls not identified to species	78	28

Discussion

Seasonal Activity – Bat activity declined sharply after September twenty-fifth. Before September 26th, bat calls were absent on only four nights of monitoring. From the 26th onward, bats were detected only nine of thirty-six nights; bats calls were absent in monitoring on 75% of nights in late September and October. This coincides with a period of lower temperatures and generally rising wind speeds. All late season calls (after October tenth) were in the Big Brown group or were unidentifiable.

Figure 1 - Bat call sequences from August 24 (day 236) to October 24 (day 297)

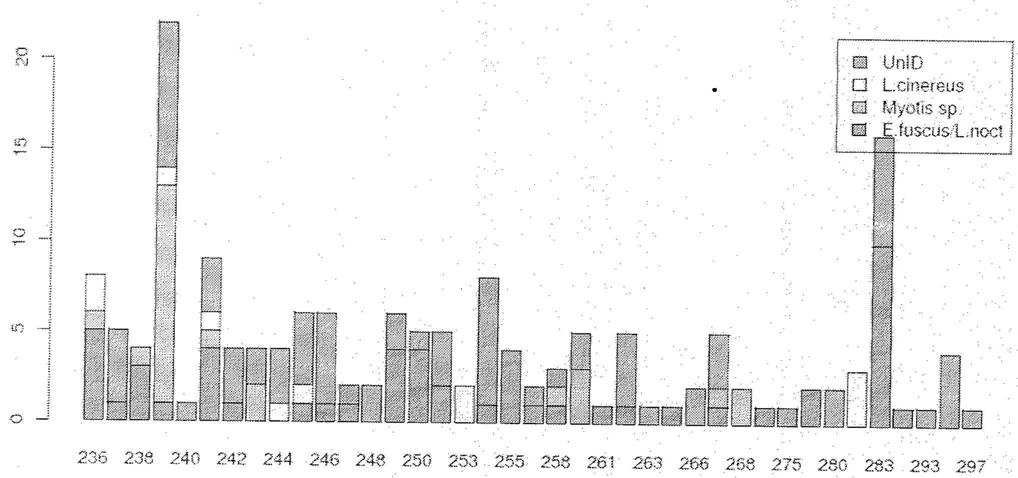


Figure 1 summarizes the day of year and number of call sequences recorded over the entire monitoring period.

Species of Interest – NYSDEC guidelines [3] have identified three species of special interest in wind turbine construction monitoring: the red *(Lasiurus borealis*), hoary (*Lasiurus cinereus*) , and silver-haired bats (*Lasionycteris noctivagans)*. In this study, the hoary bat was positively identified by call on 11 occasions. Although the silver bat was grouped with the big brown bat because of the overlap in their call frequencies, on two occasions it was possible to detect durations and inflections that are signatures of the silver bat and indicate its presence in the area.

The *Myotis* species complex also exhibits overlapping call frequency ranges, but the inflection and duration of the vast majority of calls indicates that *M. lucifugus* is the dominant *Myotis* species in the area. No *Myotis* calls in this study carried the signature of *M. sodalis*, the endangered Indiana bat. Some calls which were un-interpretable due to environmental distortion might have been of *M. sodalis*, but this is unlikely given the site location and history. Similarly, the presence or absence of *M. leibii,* a species of concern, cannot be inferred from this sampling method alone.

Although historically common in Tompkins county, no pipistrelle bats (*Perimyotis subflavus)* were observed during the monitoring period.

Weather and Bats – In general, bats were active at higher wind speeds in Enfield than might be expected from recent impact mitigation literature [2]. Figure 2 illustrates overall bat activity at increasing wind speeds. In order to illustrate the expected results of mitigation (e.g. curtailing turbine activity at wind speeds below 4 m/s), the horizontal axis of wind speeds shows the lowest value in the next data bin, in other words, "1 m/s" on the graph represents wind speeds of 0 to 0.99 m/s while "10 m/s" represents 9 to 9.99 m/s

Figure 2 – Changes in all bat activity at increasing wind speeds

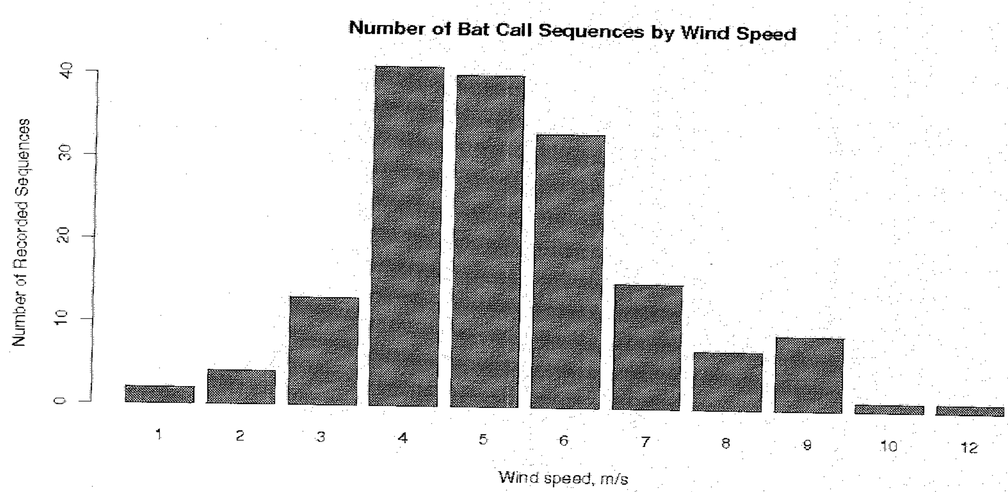
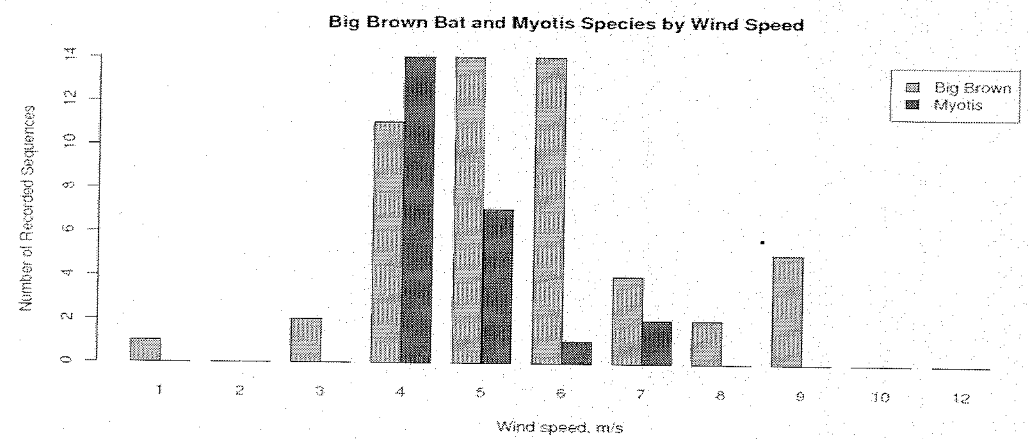


Figure 2 illustrates that bat activity peaks at speeds of 3 to 4 meters per second, however, the greatest total amount of activity occurs between 3 and 7 m/s.

Figure 3 – Effect of wind speed on bat activity



Activity of different species complexes is not uniform with changes in wind speed. Although Myotis spp. and the Big Brown bat group were both active at wind speeds between 3 and 7 m/s, the Myotis group appears to have a more narrow tolerance for wind variation (Figure 3). The Big Brown species group also persisted in the area later into the season when high wind events were more common. It cannot be determined from this study if this is the result of wind and weather tolerance alone or if the absence of prey species influenced the Myotis bats. Myotis bats might have been more commonly recorded if a second microphone had been used at a 2-3 meter height on the tower.

Figure 4 - Effect of wind speed on bat activity

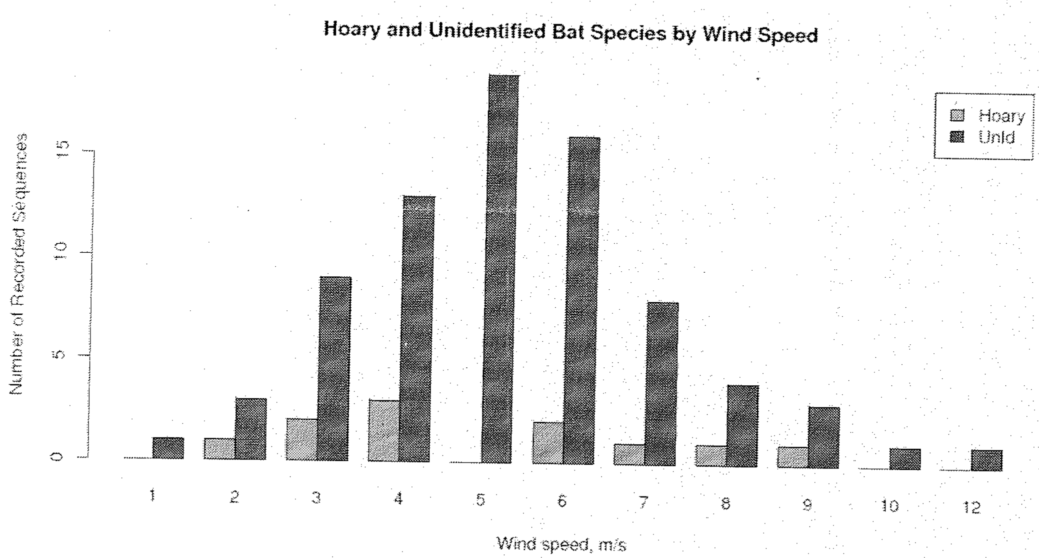
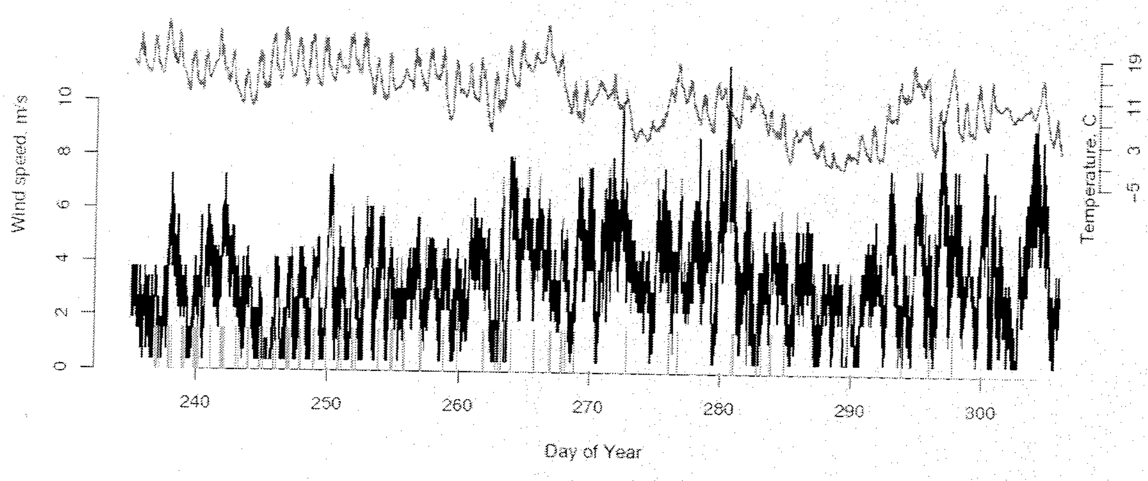


Figure 4 shows activity of the Hoary Bat and the unidentified bats in the study. Numbers of clear Hoary Bat call sequences were small. Like the Big Brown group, the Hoary bat is active at a wider range of wind speeds than the Myotis group. Many of the bat call sequences distorted by the wind also occur at higher wind speeds. It is likely, based on wind speed occurrence, that the larger species, the Big Brown Bat group and the Hoary Bat, are disproportionately represented among the unidentified group. The location of the microphone at hub height would also skew the collection of calls toward the larger species, especially toward the Hoary Bat. Unfortunately, the Hoary bat exhibits high variability of call characteristics in frequency, duration and inflection [4], making it difficult to identify this species with certainty unless a longer sequence of calls is captured. Wind speeds above 9 m/s make it unlikely such a sequence can be obtained.

Recent guidelines from the DEC describing bat monitoring protocols [3] underscore the importance and the problems associated with assessing vulnerability of migratory bats such as the Hoary bat. Lack of information about these species has caused a delay in protocol recommendations for tracking these bats, beyond listing them as of particular interest. This is expected to change as more data on bat mortality becomes available.

Figure 5 is a general summary of bat activity over the measurement period and superimposes that activity on graphs of the wind speed in meters per second (middle line in black) and temperature in degrees Celsius (top line in blue). The red bars at the bottom of the graph are times bat call sequences were recorded. Dates given are day of the year where day 240 is August 28 and day 300 is October 27.

Figure 5 - Summary of bat activity (red bars), wind speed and temperature



. Rainfall occurred on twenty-one of the thirty-nine nights when bat calls were recorded. Although bats did not call during heavy precipitation events, they did call before and after such events and also on nights of light rainfall.

Conclusions

1. Bat were present at the Enfield site on 57% of sampling nights and had an average of 4.3 call sequences per night. This bat activity level is similar to activity at other potential wind turbine generation sites in New York and New England. Bats are relatively common in August and September. Overall activity decreased sharply in October.
2. Bat species present include at least one species of concern, the hoary bat, *Lasiurus cinereus*. These call sequences account for 13% of identified calls.
3. Bat activity is common at wind speeds of 3 to 7 meters per second.

References

1. http://www.fort.usgs.gov/BPD/
2. Edward B. Arnett and Michael Schirmacher, Bat Conservation International, Manuela M. P. Huso, Oregon State University, John P. Hayes, University of Florida, April 2009, Effectiveness of Changing Wind Turbine Cut-in Speed to Reduce Bat Fatalities at Wind Facilities, 45 pp.
3. New York State Department of Environmental Conservation Division of Fish, Wildlife and Marine Resources, January 2009, GUIDELINES for CONDUCTING BIRD and BAT STUDIES at COMMERCIAL WIND ENERGY PROJECTS
4. O'Farrell, M.J., B.W. Miller, and W.L. Gannon. 2000, Geographic variation in the echolocation calls of the hoary bat (Lasiurus cinereus). Acta Chiroptera, 2(2):185-196