Cassadaga Wind Project
Bird and Bat Survey Report, 2013-2014

Chautauqua County, New York

Prepared for:

EverPower Wind Holdings, Inc.
1251 Waterfront Place, 3rd Floor
Pittsburgh, PA 15222

Prepared by:
Stantec Consulting
30 Park Drive
Topsham, ME 04086

15 January 2015

Executive Summary

EverPower Wind Holdings, Inc. (EverPower) is considering the construction of the Cassadaga Wind Project (Project) in Chautauqua County, New York. The proposed Project would include up to 70 wind turbines located west of Route 83 in the towns of Stockton, Charlotte, Cherry Creek, and Arkwright (Figure 1). The Project is in the early phase of development and the approximate size of the area of interest is 24,000 acres. The number and locations of turbines, access roads, and electrical corridors are preliminary. In 2013 and 2014, EverPower contracted Stantec to conduct the following:

- bird migration surveys (fall 2013)
- habitat assessment (fall 2013)
- raptor migration surveys (spring 2014)
- breeding bird surveys (spring 2014)
- acoustic bat surveys (2013–2014)
- eagle point count surveys (2013–2014)

Results of the habitat assessment are included in a separate memo report (*Cassadaga Wind Project – Habitat Assessment*; 11 February 2014) and results of the eagle point count surveys are included in a separate memo report (*Cassadaga Wind Project 2013-2014 Eagle Use Point Count Survey Results*; 26 November 2014).

Fall Migration Surveys

Stantec conducted migratory point count surveys at 14 survey locations once each week in September 2013 to assess species composition of songbird or waterfowl stopping over during migration. The 14 survey locations were the same points sampled during eagle point count surveys. Survey points were grouped into 3 habitat categories based on dominant vegetation cover and general habitat characteristics: agricultural, forest edge, and over-grown field. The biologist detected 27 species and 601 individual birds. In agricultural habitat, Canada goose (*Branta canadensis*) had the greatest relative abundance (RA = 4.69), followed by American crow (*Corvus brachyrhynchos*) (RA = 2.31). In forest edge habitat, cedar waxwing (*Bombycilla cedrorum*) had the greatest relative abundance (RA = 2.00), followed by blue jay (*Cyanocitta cristata*) and American crow, which both had RA values of 1.33. In over-grown field habitat, blue jay had the greatest relative abundance (RA = 2.00), followed by American crow (RA = 1.58). Diversity indexes among all 3 habitat types were similar, and ranged from 2.62–2.81. Stantec observed 3 large flocks of Canada geese during migration surveys: a flock of 42 on 4 September at point count 2, and 2 flocks of 32 and 55 on 11 September at point count 11. Stantec did not observe any state- or federally listed endangered or threatened species, or state species of special concern.

Spring Raptor Migration Surveys

To assess species composition and migration patterns of raptors during the spring migration season, Stantec conducted 8-hour surveys approximately once every 7 days from eagle point count 7, a centrally located point with good views of the surrounding airspace. Stantec conducted surveys on 13 days from 1 March to 26 May for a total of 96 survey hours. Stantec observed 11 raptor species. The seasonal passage rate was 1.64 and ranged from 0 raptors/hr on 7 May to 5.1 raptors/hr on 1 May. Stantec documented 1 golden eagle (*Aquila chrysaetos*), a state-listed endangered species, and 6 observations of bald eagles (*Haliaeetus leucocephalus*) and 1 northern harrier (*Circus cyaneus*), state-listed threatened species (NYSDEC 2014). Observers also documented 3 state species of special concern: osprey (*Pandion haliaetus*) (n = 3), red-shouldered hawk (*Buteo lineatus*) (n = 3) and sharp-shinned hawk (*Accipiter striatus*) (n = 4). The overall passage rate was at the low end of the range of passage rates and below the median rates documented in studies in New York and the Northeast[1]. The number of raptor species observed was also within the range, suggesting that raptor activity, passage rates, and species composition at the Project site is typical of the region.

Spring Breeding Bird Surveys

Stantec conducted breeding bird surveys along 16 transects at 85 bird point count locations: 59 survey points in close proximity to proposed turbine locations and 26 control points in areas where no impact is expected to occur. Points were chosen using aerial Project photos, and were positioned based on the following criteria to sample the habitats present. A Stantec biologist conducted a 5-minute survey at each point from sunrise until 10:00 a.m. Forest edge habitat had the most individuals observed and the highest species richness for both the survey points (n = 555, SR = 56) and the control points (n = 257, SR = 36). Agricultural habitat had the highest relative abundance among survey points (RA = 12.54), and over-grown field habitat had the highest relative abundance among control points (RA = 15.33). Forest edge habitat had the highest Shannon Diversity Index among survey points (SDI = 3.18), and mixed forest habitat had the highest Shannon Diversity Index among control points (SDI = 3.02). Excluding flyovers, the biologist recorded 67 species and 1,799 individuals within 100 m of the survey points. Excluding flyovers, the biologist recorded 67 species and 1,799 individuals within 100 m of the survey points. In the agricultural habitat, forest edge habitat, and over-grown field habitat, red-winged blackbird had the greatest relative abundance among both survey points (RA = 4.00) and control points (RA = 5.75). In mixed forest habitat, eastern towhee (*Pipilo erythrophthalmus*) had the highest relative abundance among only survey points (RA = 0.96). Eastern towhee (RA = 1.25) and red-eyed vireo (*Vireo olivaceus*) (RA = 0.58) had the greatest relative abundances among survey points. Stantec did not detect any state- or federally listed endangered or threatened species, or state species of special concern.

Acoustic Bat Surveys

Stantec conducted acoustic bat surveys to characterize activity, timing of activity, and when possible, species composition of bats in the vicinity of the Project area. Passive acoustic echolocation monitoring surveys were conducted during late summer emergence and fall migration periods (mid-August to mid-October in 2013 and 2014) and spring migration and

---

[1] Projects in the Northeast include those in the following states: Maine, New Hampshire, and Vermont.

activity period for bats (mid-April to mid-August in 2014). In fall 2013, Stantec deployed 2 Anabat model SDI detectors (Titley Electronics Pty Ltd.) in the single on-site met tower at that time at approximately 45 m above ground level (agl) and 3 m agl. Stantec deployed a third detector at approximately 3 m agl in a tree adjacent to a stream where bat activity was expected. The tree detector was deployed in 2013 because the second met tower had not yet been constructed. In April 2014 Stantec deployed 2 detectors in the second on-site met tower at approximately 45 m agl and 3 m agl.

Met detectors recorded 2,719 call sequences for a detection rate of 3.5 bat call sequences per detector-night (calls/detector-night). The tree detector recorded 52 call sequences for a detection rate of 0.8 calls/detector-night. There were 2,771 bat call sequences recorded by all detectors combined, for an overall detection rate of 3.3 calls/detector-night. The highest level of activity was recorded during August 2013 at Met 1 Low (n = 1,501 call sequences). Met 1 Low recorded a peak number of call sequences on 21 August (n = 599) and 22 August (n = 405) 2013, representing 36% of call sequences recorded by all 5 detectors throughout the 2013–2014 survey period.

For all met detectors combined, the 'big brown bat (*Eptesicus fuscus*) silver-haired bat (*Lasionycteris noctivagans*) Guild' (BBSH) guild represented the majority of calls (n = 1,595; 59%). Species composition was similar between the Met 1 and Met 2 detectors. The UNKN guild represented the majority of call sequences recorded by the met high detectors and the Met 2 Low detector (n = 171; 48% of call sequences recorded at Met 1 High; n = 149; 49% of call sequences recorded at Met 2 High; n = 136; 48% of call sequences recorded at Met 2 Low). The BBSH guild represented the majority of call sequences recorded by the Met 1 Low detector (n = 1,264; 71%). Detectors recorded only 39 *Myotis* calls sequences (1% of total calls recorded).

The UNKN guild represented the majority of calls (n = 42; 81%) recorded at the tree detector. Sixty-nine percent (n = 29) of call sequences were identified as high-frequency unknown (HFUN) and 31 % (n = 13) of call sequences were identified as low-frequency unknown (LFUN).

For all detectors combined, 73% of call sequences (n = 2,023) were recorded when mean nightly wind speeds were 6 m/s or less and 65% of call sequences (n = 1,809) were recorded when mean nightly temperatures were 18 °C or higher.

Table of Contents

LIST OF TABLES

LIST OF FIGURES

APPENDICES

CASSADAGA WIND PROJECT
BIRD AND BAT SURVEY REPORT, 2013-2014

Appendix D Acoustic Bat Survey Tables

1.0 Introduction

1.1 PROJECT BACKGROUND

EverPower Wind Holdings, Inc. (EverPower) is considering the construction of the Cassadaga Wind Project (Project) in Chautauqua County, New York. The proposed Project would include up to 70 wind turbines located west of Route 83 in the towns of Stockton, Charlotte, Cherry Creek, and Arkwright (Figure 1). The Project is in the early phase of development and the approximate size of the area of interest is 24,000 acres. The number and locations of turbines, access roads, and electrical corridors are preliminary.

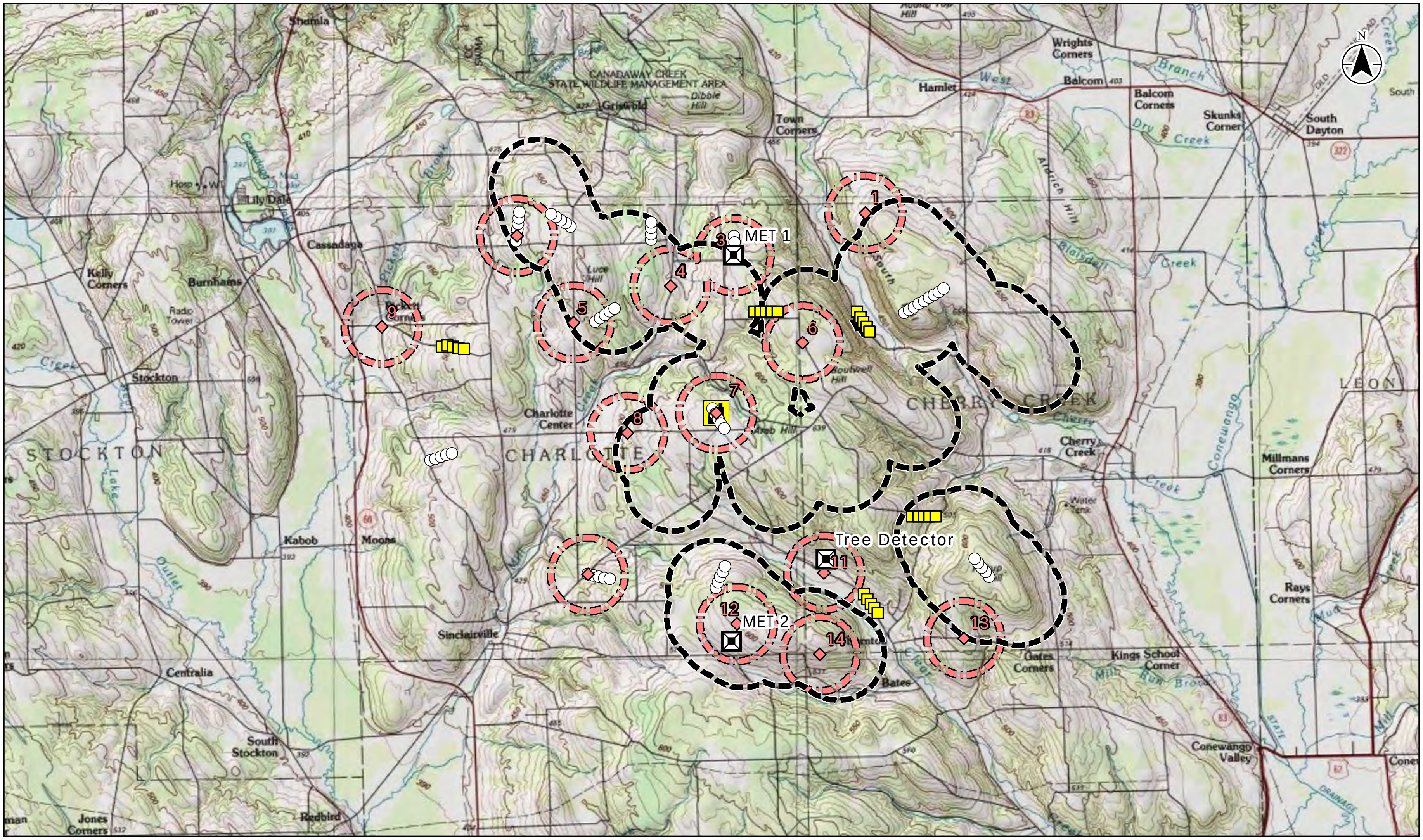
The planning and survey coordination history for this Project is as follows:

- In 2012, EverPower contracted TRC to conduct a Critical Issues Analysis for the Project.
- In 2013, EverPower contracted Stantec Consulting Services Inc. (Stantec) to prepare a Work Plan for Pre-Construction Avian and Bat Surveys (Work Plan; June 2013 REV July 2013) which was presented to biologists at the New York Regional Field Office of the US Fish and Wildlife Service (USFWS) in Cortland, New York on 18 June 2013 and to the New York State Department of Environmental Conservation (NYSDEC) via conference call on 27 June 2013; the Work Plan was subsequently revised based on agency feedback[2].
- In 2013 and 2014, EverPower contracted Stantec to conduct pre-construction bird and bat studies including surveys detailed in the NYSDEC's Guidelines for Conducting Bird and Bat Studies at Commercial Wind Energy Projects (NYSDEC Guidelines; NYSDEC 2009) and eagle point count surveys consistent with the USFWS's Land-based Wind Energy Guidelines (2012) and Eagle Conservation Plan Guidance (ECP Guidance; 2013). These surveys included:
  - bird migration surveys (fall 2013)
  - habitat assessment (fall 2013)
  - raptor migration surveys (spring 2014)
  - breeding bird surveys (spring 2014)
  - acoustic bat surveys (2013–2014)
  - eagle point count surveys (2013–2014)
- In spring 2014, Stantec requested information on known rare plant and animal species from the New York Natural Heritage Program (NYNHP) database. NYNHP responded on 22 May 2014 (NYNHP 2014).

This report presents the results of the fall 2013 bird migration surveys, spring 2014 raptor migration surveys, spring 2014 breeding bird surveys, and 2013-2014 acoustic bat surveys.

---

[2] For meeting minutes, please refer to the *March 28, 2014 Teleconference with NYSDEC to Discuss EverPower's Proposed Cassadaga Wind Project* (8 April 2014), *June 18, 2013 Meeting to Discuss EverPower's Proposed Cassadaga Wind Project* (17 July 2013), *June 27, 2013 Teleconference with NYSDEC to Discuss EverPower's Proposed Cassadaga Wind Project* (17 July 2013), and *March 24, 2014 Initial Conference for Northern Long-eared Bat and Fall 2013 Survey Results Review - Cassadaga Wind Project* (8 April 2014).



Legend

- Breeding Bird Survey Location
- Breeding Bird Survey Control
- Acoustic Bat Survey Location
- Raptor Survey Location
- Eagle Point Count Location and September Stopover Survey Location
- Eagle Point Count 800m Buffer
- General Project Area

0 — 2.5 Miles

1 inch = 2 miles (At page size of 8.5"x11")

Notes

1. Base map: ArcGIS Online USA Topo Maps

Stantec

Project Location 195600883
Chautauqua County, New York
Prepared by GAC on 2014-11-20
Reviewed by SB on 2014-11-20

Client/Project
EverPower Wind Holdings, Inc.
Cassadaga Wind Power

Figure No.
1

Title
Bird and Bat Survey Locations

V:\1956\active\195600883\drawing\mxd\883\00883_01_BirdBatSurvey.mxd Revised: 2014-11-21 By: gcarpentier

Results of the fall 2013 habitat assessment are included in a separate memo report (*Cassadaga Wind Project – Habitat Assessment*; 11 February 2014) and results of the 2013-2014 eagle point count surveys are included in a separate memo report (*Cassadaga Wind Project 2013-2014 Eagle Use Point Count Survey Results*; 26 November 2014).

1.2 PROJECT DESCRIPTION

The Project area is located in the central portion of Chautauqua County and has forest blocks located on the hilltops and steep slopes and agricultural land in the valleys. Existing development surrounding the Project area is mainly concentrated in the villages of Cassadaga and Sinclairville. Land use in the Project area consists of typical usage for Western New York State and consists mainly of agricultural land, forestland, rural residential areas and low intensity development. Agricultural land is used to support dairies, small beef farms, and hobby horse farms. Pastures, hayfields and cornfields comprise the majority of the agricultural land. Forestland is primarily used for timber production and recreation (TRC 2012).

The Project area is within the Northeastern Mixed Forest Province-Northern Glaciated Allegheny Plateau Ecological Subregion (McNab and Avers 1994 as cited in TRC 2012). Northern hardwood forests and Appalachian oak forests are found within this Ecological Subregion and are the defining vegetative community. More specifically, the Project Area is within the Cattaraugus Highlands Ecological Subzone (NYSDEC 1998 as cited in TRC 2012). Beech-Maple-Mesic forests are the dominate forest type within the Project area; dominant tree species are American beech (*Fagus grandifolia*) and sugar maple (*Acer saccharum*) or red maple (*Acer rubrum*). The shrubland communities are successional old fields that are abandoned farmland. They range from being dominated by goldenrods and other herbaceous vegetation with a few scattered shrubs to having a thick cover of shrubs. Common shrub species found in this community are arrowwood (*Viburnum recognitum*), hawthorn (*Crateagus sp.*) and honeysuckle (*Lonicera sp.*) (TRC 2012).

Stantec conducted a ground-based habitat assessment at each of the 14 eagle point count locations (Figure 1) to inform the Project of the presence of habitat with potential to support state- or federally listed species (i.e. grassland species such as Henslow's sparrow (*Ammodramus henslowii)*, sedge wren (*Cistothorus platensis*), and northern harrier (*Circus cyaneus*). We recorded data at each point including cover type, percent canopy cover, and notes of current or previous disturbance. Generally, the Project area contains a mixture of hardwood forest, mixed (hardwood and softwood) forest, and agricultural land. Stantec identified potential Henslow's sparrow habitat in 13 locations within the Project area (Stantec 2014a). These areas are fallow fields with dense cover of grass species and forbs estimated to be 2–4 ft in height with some standing dead herbaceous vegetation for perching. Stantec surveyed these areas in spring during the breeding bird surveys (Section 4.0) and did not detect Henslow's sparrow.

2.0 Fall Bird Migration Surveys

2.1 METHODS

2.1.1 Field Surveys

Stantec conducted migratory point count surveys at 14 survey locations once each week in September 2013. The 14 survey locations were the same points sampled during eagle point count surveys. They were chosen in order to sample the various available habitat types in the Project, and took into consideration proposed wind turbine locations and landowner participation (Figure 1).

A Stantec biologist conducted surveys from sunrise until no later than approximately 10:00 a.m., in weather conditions conducive to hearing birdsong and seeing birds move about in vegetation and in flight. All birds identified by sight or sound, including soaring raptors, waterfowl and other fly-overs, were recorded during a 5-minute session at each survey point. The biologist also recorded weather information and general habitat conditions at each survey point.

2.1.2 Data Summary and Analysis

Survey points were grouped into 3 habitat categories based on dominant vegetation cover and general habitat characteristics: agricultural, forest edge, and over-grown field.

The species and number of individuals documented during surveys were used to calculate species richness, relative abundance, frequency of occurrence, and community diversity, for all species for all habitats combined, and for each habitat classification. These indexes are described in more detail below.

- Species richness (SR) is the total number of species detected.
- Relative abundance (RA) is a way to quantify the number of individuals of a species in relation to other species observed. RA takes into account the total number of individuals detected, the number of times each point count location was surveyed, and the number of survey points.
- Frequency (Fr) of occurrence, expressed as a percentage, measures the percentage of points where a particular species is detected.
- Shannon Diversity Index (SDI) is a measure of species diversity in a community or habitat. SDI can provide more information about community composition than species richness alone because it takes into account relative abundance and the evenness of the distribution of species. It indicates not only the number of species, but also how abundance is distributed among all the species in the community or habitat.

2.2 RESULTS

2.2.1 Survey Effort and Weather Summary

Surveys were conducted on 3–4, 10–12, 17–18 and 25–26 September 2013. Surveys were not conducted when wind or rain adversely affected the auditory detection of birds. Wind speeds ranged from 1–12 miles per hour (mph; 0.45–5.36 m/s), average daily temperatures ranged from 3.9–25.2 degrees Celsius (°C), and sky conditions were typically clear to partly cloudy with occasional fog (Table 2-1).

Table 2-1. Summary of weather parameters during September migration surveys, Cassadaga Wind Project, Fall, 2013

Date	Wind Speed Code(s)	Average Temp (°C)	Sky Conditions
9/3/2013	2	14.9	mostly cloudy, fog
9/4/2013	2,3	15.6	partly cloudy
9/10/2013	2,3	22.5	partly cloudy
9/11/2013	1,2	25.2	partly cloudy
9/12/2013	1	21	fog
9/17/2013	1,2	3.9	clear
9/18/2013	2	5.5	clear
9/25/2013	1,2	4.6	clear to partly cloudy
9/26/2013	1,2	8.4	partly cloudy
wind speed codes 1 = 0-3 mph; **2** = 4-8 mph; **3** = 9-12 mph; **4** = 13-18 mph; **5** = 19-24 mph			

2.2.2 Species and Habitat Results

The biologist detected 27 species and 601 individual birds (Appendix A Table 1). Agricultural habitat had the most individuals observed (n = 400), the greatest relative abundance (RA = 12.50), the greatest species richness (SR = 21) and the highest diversity index (SDI = 2.81). **Error! Reference source not found.** summarizes the results of the surveys and analysis by habitat type classification.

Table 2-2. Summary of migration point count results by habitat type, Cassadaga Wind Project, Fall, 2013

Habitat Type	# Survey Points	Total Birds Observed	Relative Abundance	Species Richness	Shannon Diversity Index
Agricultural	8	400	12.50	21	2.81
Forest edge	3	108	9.00	14	2.72
Over-grown field	3	93	7.75	14	2.62
All points	**14**	**601**	**10.73**	**27**	**3.47**

2.2.3 Species Observed

In agricultural habitat, Canada goose (*Branta canadensis*) had the greatest relative abundance (RA = 4.69), followed by American crow (*Corvus brachyrhynchos*) (RA = 2.31). In forest edge habitat, cedar waxwing (*Bombycilla cedrorum*) had the greatest relative abundance (RA = 2.00), followed by blue jay (*Cyanocitta cristata*) and American crow, which both had RA values of 1.33. In over-grown field habitat, blue jay had the greatest relative abundance (RA = 2.00), followed by American crow (RA = 1.58). Diversity indexes among all 3 habitat types were similar, and ranged from 2.62–2.81. Appendix A Table 2 shows the relative abundance and frequency of each species observed by habitat type.

Stantec observed 3 large flocks of Canada geese during migration surveys: a flock of 42 on 4 September at point count 2, and 2 flocks of 32 and 55 on 11 September at point count 11. No flocks of migrating waterbirds or waterfowl were observed.

2.2.4 Rare, Threatened and Endangered Species

Stantec did not observe any state- or federally listed endangered or threatened species, or state species of special concern (NYSDEC 2014).

2.3 DISCUSSION

The objectives of the September migration point count surveys were to provide baseline data of songbird species occurring in the Project area during fall migration, to assess the likelihood that rare bird species occur in the Project area during fall migration, and to evaluate the degree to which the migratory bird community in the Project area is typical of the region.

There are several factors that can influence the detection probability of migratory song birds, including time of day, weather, bird behaviors, distance to the observer, and season. Drab plumage of songbirds in the fall may inhibit an observer's ability to differentiate among similar species, and lack of birdsong in the fall may inhibit auditory detection of songbirds. These factors may affect species composition and species richness estimates.

There were no state- or federally listed endangered or threatened species and no state species of special concern observed. No flocks of migrating waterbirds or waterfowl were observed. The species detected are generally common, regionally abundant and typical of the habitats in which they were observed.

The selected points sampled the various available habitats within the Project area, and have primary habitat characteristics representative of the Project and surrounding areas. The surveys were timed to coincide with the peak migration in September, targeted optimal weather conditions to facilitate the maximum detection of birds, and used standard point count survey methods. Therefore, the results of the surveys provide a suitable reflection of the fall bird community within the Project and surrounding areas.

3.0 Spring Raptor Migration Surveys

3.1 METHODS

3.1.1 Field surveys

Stantec conducted surveys approximately once every 7 days from eagle point count 7, a centrally located point that provided a good view of the Project area (Photos 1–4). As stated in the Work Plan (Stantec 2014b), since there is no specific migratory pathway for raptors near the southern shore of Lake Erie in the fall and based on the Project's location near the south shore of Lake Erie, fall raptor migration surveys were not conducted at the Project.

Photos 1-4. Views from Raptor Survey Location to North (upper left), South (upper right), east (lower left) and west (lower right), Cassadaga Wind Project, Spring, 2014

Surveys occurred between 9 a.m. and 5 p.m. and targeted days with suitable weather conditions to support migration (following wind, no precipitation). For each observation, a Stantec biologist recorded the species, number of individuals, sex and age class (if possible), behavior, flight height and direction, time of sighting, and location of each bird relative to the Project area. The biologist recorded hourly weather information, including temperature, wind speed and direction, percent cloud cover, cloud type and height, and general sky conditions. Incidental observations of other bird species also were recorded.

3.1.2 Data Summary and Analysis

Raptor observation data were summarized by survey day and for the entire survey period. Data analysis included a summary of:

- Daily and seasonal observation rates (raptors observed per hour)
- Total number by species observed
- Hourly observation totals
- Location
- Flight behaviors observed
- Average minimum flight height of birds inside and outside the Project area
- For those birds observed within proposed turbine areas (defined as turbine strings based on the most current project layout [28 April 2014] plus a 402-m radius [0.25 mile] buffer, the percentage of birds seen below 150 m (492 ft), the maximum height of the proposed turbines.

3.2 RESULTS

Stantec conducted surveys on 13 days from 1 March to 26 May 2014 for a total of 96 survey hours. See Table 3-1 for a results summary of the spring 2014 surveys.

Table 3-1. A summary of raptor survey effort and results, Cassadaga Wind Project, Spring, 2014

Range of survey dates	1 March–26 May
No. survey days	13
No. survey hours	96
No. raptor species observed	11
Raptor species observed (common name)	**Scientific name**
American kestrel	*Falco sparverius*
bald eagle	*Haliaeetus leucocephalus*
broad-winged hawk	*Buteo platypterus*
golden eagle	*Aquila chrysaetos*
northern harrier	*Circus cyaneus*
osprey	*Pandion haliaetus*
red-shouldered hawk	*Buteo lineatus*
red-tailed hawk	*Buteo jamaicensis*
rough-legged hawk	*Buteo lagopus*
sharp-shinned hawk	*Accipiter striatus*
turkey vulture	*Cathartes aura*
unidentified accipiter hawk	*Accipiter (sp)*
unidentified buteo hawk	*Buteo (sp)*
unidentified raptor	*Accipitridae (gen, sp)*
Total no. observations of raptors	157
Seasonal passage rate (raptor observations/hour)	1.64
Total no. observations of raptors within turbine area (1/4 mile buffer) (percent of total observations)	143 (91%)
Total no. of observations of raptors seen in turbine area and below 150 m turbine height (percent of total observations)	123 (78%)

3.2.1 Weather Summary

Temperatures ranged from -6°–28° C; the average hourly temperature among survey days was 11° C. Sky conditions were generally clear to partly cloudy, with periods of drizzle on 19 March, 14 April, and 7 May, periods of rain on 14 April, 13 May, and 20 May, and periods of fog and snow flurries on 23 April. Wind direction was predominantly from the south, southwest, and southeast. Wind speed ranged from 0–24 mph (0–10.7 m/s), and average daily wind speed among survey days was 4–12 mph (1.8–5.4 m/s) (Table 3-2).

Table 3-2. Wind direction and pressure systems during raptor surveys, Cassadaga Wind Project, Spring, 2014

Date	Wind Direction	Wind Speed Code(s)	Daytime Pressure System (High or Low)
3/1/2014	SW	3	high pressure leaving, low pressure building mid-morning
3/14/2014	S	3	high pressure leaving overnight, low pressure building
3/19/2014	S	4,5	low pressure building with mid-day rain
3/27/2014	S	2,3	low pressure building with storm system to the west
4/1/2014	S, SE	2,3	low pressure building
4/10/2014	S	3,4	high pressure
4/14/2014	S	3,4	low pressure with large storm system arriving in afternoon
4/23/2014	SW	1,2	high pressure building
5/1/2014	S, SW	2	low pressure
5/7/2014	E, SE	1,2	low pressure building with small storm system to the west
5/13/2014	NE, SE, SW	1,2	low pressure passing with storm system
5/20/2014	S, SE	1,2	low pressure
5/26/2014	W, SW	2	high pressure
wind speed codes 1 = 0-3 mph; **2** = 4-8 mph; **3** = 9-12 mph; **4** = 13-18 mph; **5** = 19-24 mph			

3.2.2 Raptor Observations and Passage Rates

Stantec recorded 157 raptor observations. The overall seasonal passage rate was 1.6 raptor observations per hour (raptors/hr). The daily passage rates ranged from 0 raptors/hr on May 7 to 5.1 raptors/hr on May 1. Figure 3-1 and Appendix B Table 1 show the daily totals and daily passage rates of raptors observed.

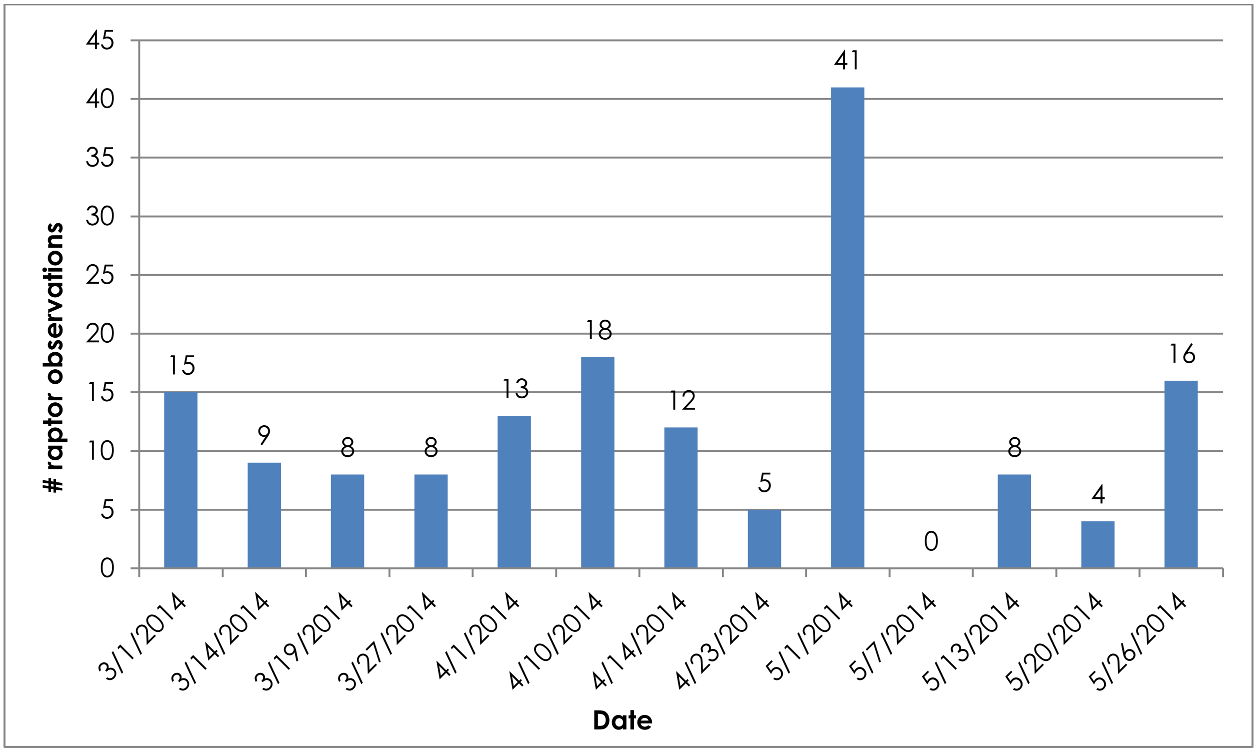


Figure 3-1. Survey day totals of raptor observations, Cassadaga Wind Project, Spring, 2014

Stantec recorded 11 raptor species over the course of the survey period. Observers also documented individuals that could not be identified to species due to limiting factors including the bird being too far from the observer, the bird being visible for only a brief period of time, weather conditions, lighting (time of day) and/or topography limiting the viewshed. Turkey vulture (*Cathartes aura*) was the most commonly observed species (n = 64, 41%), followed by red-tailed hawk (*Buteo jamaicensis*) (n = 34, 22%) and broad-winged hawk (*Buteo platypterus*) (n = 17, 11%) (Figure 3-2, Appendix B Table 1).

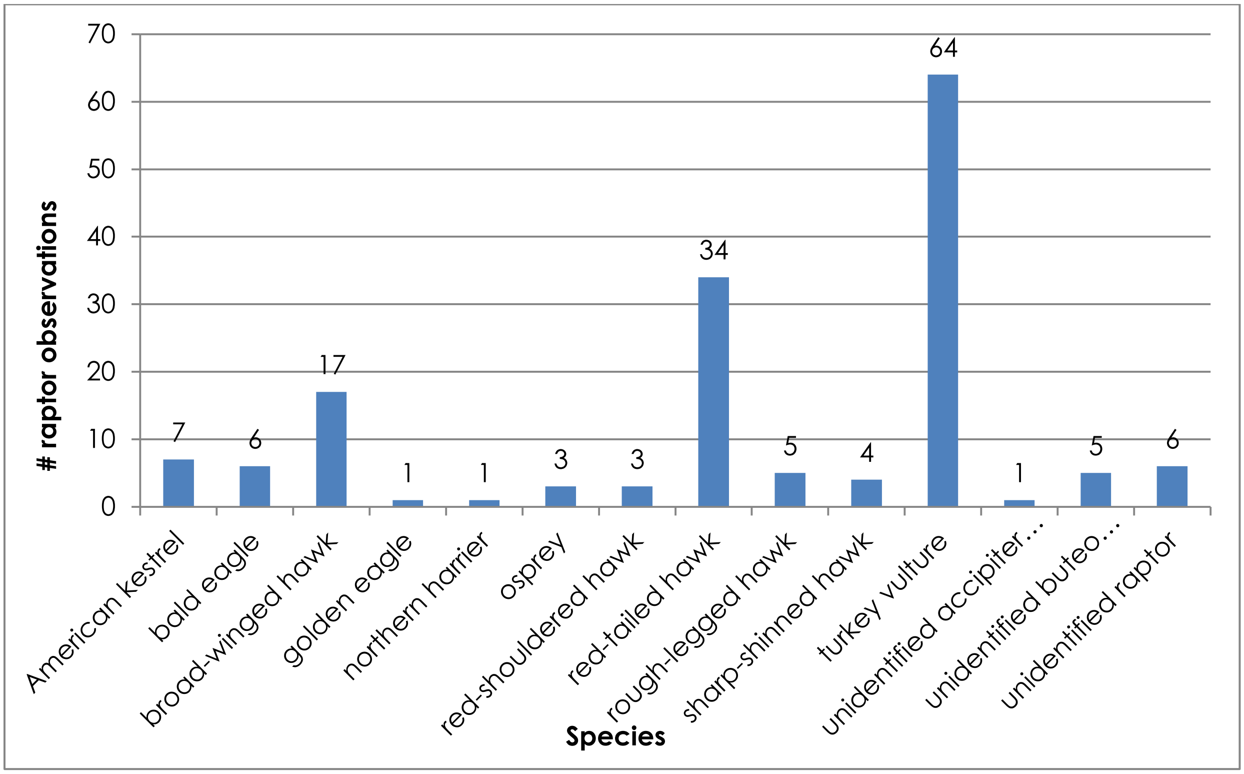


Figure 3-2. Number of observations of raptor species, Cassadaga Wind Project, Spring, 2014

Throughout the survey season, raptor observations were most numerous between 1:00–2:00 p.m. (Figure 3-3, Appendix B Table 2).

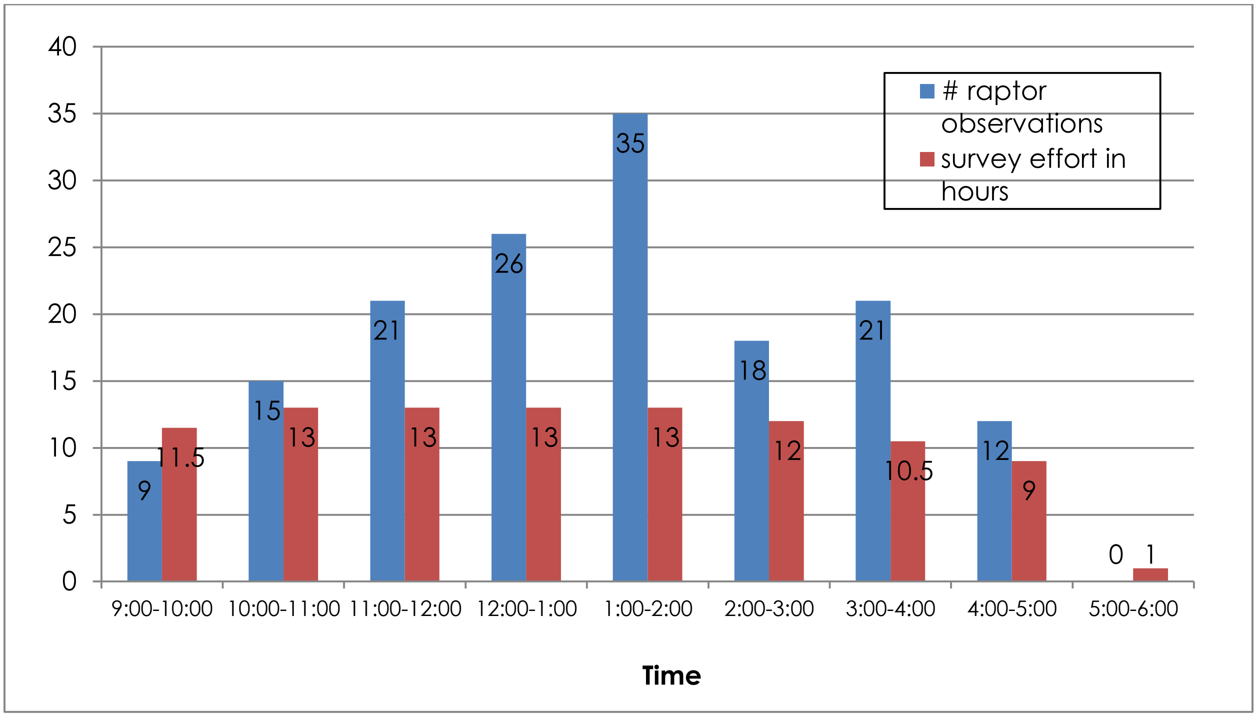


Figure 3-3. Number of observations of raptors per survey hour, Cassadaga Wind Project, Spring, 2014

3.2.3 Raptor Flight Heights and Behaviors

Of the 157 raptors observed, 143 (91%) occurred within the turbine area. The average minimum flight height of raptors within the turbine area was 60.1 m, compared to 100.4 m for raptors observed outside the turbine area (Table 3-3). Of the raptors observed within the turbine area, 123 (86% [78% of total observations]) occurred at flight heights below the proposed maximum turbine blade-tip height of 150 m (492 ft) for at least a portion of their flight. Turkey vultures represented the greatest number of observations below the maximum turbine blade-tip height (n = 63, 40% of total observations) (Figure 3-4, Appendix B Table 3).

Table 3-3. Summary of raptor locations in study area, Cassadaga Wind Project, Spring, 2014

Species	No. Inside Turbine Area [1]	No. Outside Turbine Area [2]	No. Crossed Ridge
American kestrel	7		
bald eagle	6		
broad-winged hawk	17		
golden eagle	1		
northern harrier	1		
osprey	3		
red-shouldered hawk	3		1
red-tailed hawk	27	7	3
rough-legged hawk	5		4
sharp-shinned hawk	4		
turkey vulture	63	1	2
unidentified accipiter		1	
unidentified buteo hawk	5		
unidentified raptor	1	5	1
Total	**143**	**14**	**11**
Percent of observations	**91%**	**9%**	**7%**
Average minimum flight height (m)	**60.1**	**100.4 [3]**	**70**

[1] Single observations inside turbine area may also have been seen outside turbine area.
[2] Single observations outside turbine area only.
[3] Includes minimum flight heights outside turbine area for raptors that flew both inside and outside turbine area.

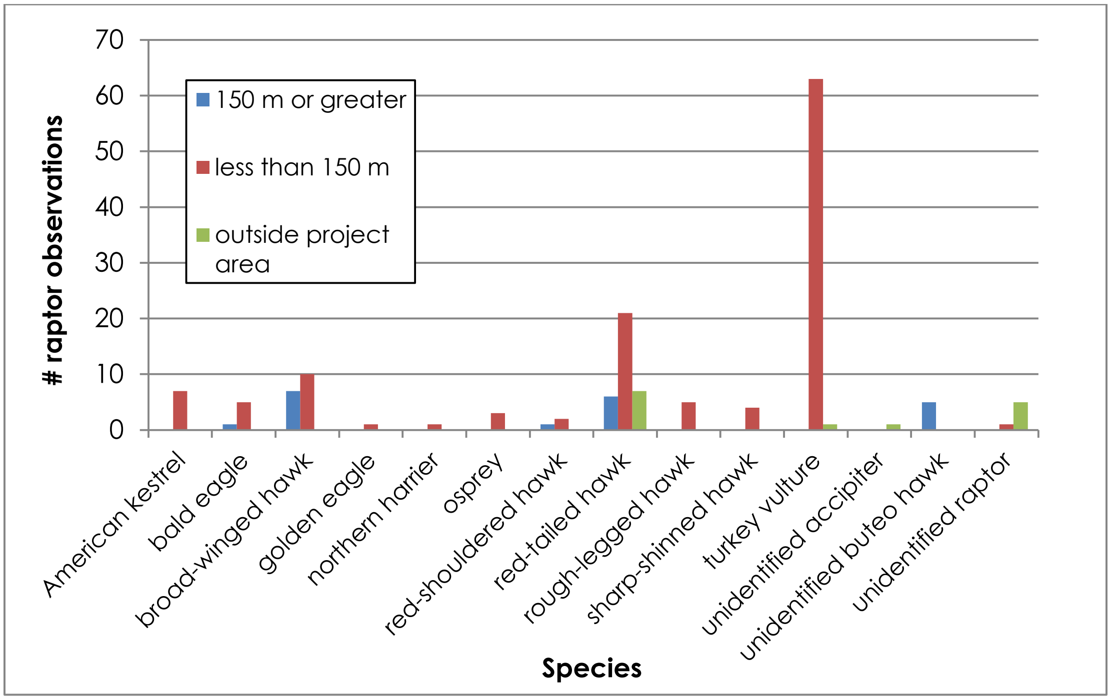


Figure 3-4. Number of raptors observed within the Project area at heights above and below 150 m, Cassadaga Wind Project, Spring, 2014

Observers documented 192 raptor behaviors during surveys, 156 (81%) of which occurred inside the turbine area. Note that there are more behavior observations than there are total raptors observed because some raptors exhibited multiple behaviors. Soaring or gliding behaviors were the most commonly observed (n = 153, 80%), followed by powered flight behaviors (n = 22, 11%) (Table 3-4). This same patterns holds true for observed behaviors inside and outside of the turbine area.

Table 3-4. Summary of raptor observations by behavior, Cassadaga Wind Project, Spring, 2014

Behavior	Inside Turbine Area	Outside Turbine Area	Total
soaring, gliding	125	28	153
powered flight	17	5	22
foraging	9	2	11
perched	3	1	4
aerial display	2	0	2
Total	**156**	**36**	**192**

3.2.4 Regional Data Comparisons

Table 3-5 shows the survey effort and results of comparable spring raptor surveys conducted in the northeastern U.S. These sites have habitat and topography characteristics similar to those of Cassadaga, and are located on forested ridges, agricultural plateaus, and are in Great Lakes regions. The passage rate at Cassadaga was 1.6 raptors/hr, which was near the lower range of passage rates documented in New York (0.1–25.6 raptors/hr), and within the range of passage rates documented in the northeastern U.S. (0.2–6.8 raptors/hour).

Table 3-5. Summary of publically available spring raptor data at proposed wind sites in New York and in the Northeast (1999-present, listed from lowest to highest passage rate)

Project Site	Season, Year	Landscape	Survey Period	# of Survey Days	# of Survey Hours	Total # Observed	# of Species Observed	Seasonal Average Passage Rate (raptors/ hr)	(Turbine Ht) and % Raptors Below Turbine Height	Reference
New York										
Clinton/ Ellenburg, Clinton Cty, NY	Spring 2005	Great Lakes plain/ADK foothills	April 18 to April 20	3	21	(2 non-migrant BWHA)	1	0.1*	n/a	New York State Department of Environmental Conservation. 2008. Publicly Available Raptor Migration Data for Proposed Wind Sites in NYS. Available at http://www.dec.ny.gov/docs/wildlife_pdf/raptorwinsum. Accessed November 7, 2008.
Wethersfield, Wyoming Cty, NY	Spring 2005	Agricultural and wooded plateau	April 22 to April 29	3	21	5	3	0.1	n/a	New York State Department of Environmental Conservation. 2008. Publicly Available Raptor Migration Data for Proposed Wind Sites in NYS. Available at http://www.dec.ny.gov/docs/wildlife_pdf/raptorwinsum. Accessed November 7, 2008.
Altona, Clinton Cty, NY	Spring 2005	Great Lakes plain/ADK foothills	May 5 to May 6	3	21	(4 non-migrant TUVU)	1	0.2*	n/a	New York State Department of Environmental Conservation. 2008. Publicly Available Raptor Migration Data for Proposed Wind Sites in NYS. Available at http://www.dec.ny.gov/docs/wildlife_pdf/raptorwinsum. Accessed November 7, 2008.
Bliss Wind Park, Eagle, Wyoming Cty, NY	Spring 2005	Agricultural and wooded plateau	April 21, 26, 28	3	21	19	3	0.9	n/a	New York State Department of Environmental Conservation. 2008. Publicly Available Raptor Migration Data for Proposed Wind Sites in NYS. Available at http://www.dec.ny.gov/docs/wildlife_pdf/raptorwinsum. Accessed November 7, 2008.
Cassadaga Wind Project, Cassadaga, NY	**Spring 2014**	**Agricultural plateau and forested ridge near Great Lakes**	**March 1 to May 26**	**13**	**96**	**157**	**11**	**1.6**	**(150 m) 81%[1]**	***This Report***
Allegany, Cattaraugus Cty, NY	Spring 2008	Forested ridge	March 23 to May 8	10	75	134	10	1.8	(150 m) 87%[2]	Stantec Consulting. 2008. Spring 2008 Bird and Bat Migration Survey Report: Visual, Radar, and Acoustic Bat Surveys for the Allegany Wind Project. Prepared for EverPower Renewables
Chateaugay, Franklin Cty, NY	Spring 2006	Great Lakes plain/ADK foothills	April 19 to April 28	3	21	47	12	1.9	(121 m) 3%[1]	New York State Department of Environmental Conservation. 2008. Publicly Available Raptor Migration Data for Proposed Wind Sites in NYS. Available at http://www.dec.ny.gov/docs/wildlife_pdf/raptorwinsum. Accessed November 7, 2008.
South Mountain, Delaware Cty, NY	Spring 2012	Forested ridge	March 6 to May 29	13	97	236	8	2.4	(150 m) 61%[2]	Stantec Consulting Services Inc. 2013. Spring 2012 Avian and Bat Survey Report for the South Mountain Wind Project in Delaware County, New York. Prepared for South Mountain Wind LLC.
South Mountain, Delaware Cty, NY	Spring 2013	Forested ridge	March 6 to May 29	13	97	236	8	2.4	(150 m) 61%[2]	Stantec Consulting Services Inc. 2013. Spring 2012 Avian and Bat Survey Report for the South Mountain Wind Project in Delaware County, New York. Prepared for South Mountain Wind LLC.
Dairy Hills, Clinton Cty, NY	Spring 2005	Great Lakes Shore	April 15 to April 26	5	20	50	6	2.5	(125 m) 94.7[1,**]	New York State Department of Environmental Conservation. 2008. Publicly Available Raptor Migration Data for Proposed Wind Sites in NYS. Available at http://www.dec.ny.gov/docs/wildlife_pdf/raptorwinsum. Accessed November 7, 2008.
Cohocton, Steuben Cty, NY	Spring 2005	Agricultural plateau	Spring 2005	10	60	164	11	2.7	(125 m) 77%[1]	Woodlot Alternatives, Inc. 2005. Avian and Bat Information Summary and Risk Assessment for the Proposed Cohocton Wind Power Project in Cohocton, New York. Prepared for UPC Wind Management, LLC.
Churubusco, Clinton Cty, NY	Spring 2005	Great Lakes plain/ADK foothills	Spring 2005	10	60	170	11	2.8	(120 m) 69%[1]	Woodlot Alternatives, Inc. 2005. A Spring Radar, Visual, and Acoustic Survey of Bird and Bat Migration at the Proposed Marble River Wind Project in Clinton and Ellenburg, New York. Prepared for AES Corporation.
Jericho Rise, Franklin Cty, NY	Spring 2007	Great Lakes plain/ADK foothills	April 4 to May 28	8	32	112	10	3.0	(125 m) 74.6%[1]	New York State Department of Environmental Conservation. 2008. Publicly Available Raptor Migration Data for Proposed Wind Sites in NYS. Available at http://www.dec.ny.gov/docs/wildlife_pdf/raptorwinsum. Accessed November 7, 2008.
High Sheldon, Wyoming Cty, NY	Spring 2005	Agricultural and wooded plateau	April 2 to May 14	7	37	119	7	3.2	n/a	New York State Department of Environmental Conservation. 2008. Publicly Available Raptor Migration Data for Proposed Wind Sites in NYS. Available at http://www.dec.ny.gov/docs/wildlife_pdf/raptorwinsum. Accessed November 7, 2008.
Wethersfield, Wyoming Cty, NY	Spring 1999	Agricultural plateau	April 20 - May 24	24	97	348	12	3.6	n/a (23 m mean flight height)	Cooper, B.A., and T.J. Mabee. 1999. Bird migration near proposed wind turbine sites at Wethersfield and Harrisburg, New York. Unpublished report prepared for Niagara–Mohawk Power Corporation, Syracuse, NY, by ABR, Inc., Forest Grove, OR. 46 pp.
Moresville, Delaware County, NY	Spring 2005	Forested ridge	March 28 to May 10	8	45	170	6	3.8	n/a	New York State Department of Environmental Conservation. 2008. Publicly Available Raptor Migration Data for Proposed Wind Sites in NYS. Available at http://www.dec.ny.gov/docs/wildlife_pdf/raptorwinsum. Accessed November 7, 2008.
New Grange, Chautauqua Cty, NY	Spring 2007	Great Lakes plain/ADK foothills	April 26 to May 22	5	n/a	n/a	n/a	4.4	n/a	New York State Department of Environmental Conservation. 2008. Publicly Available Raptor Migration Data for Proposed Wind Sites in NYS. Available at http://www.dec.ny.gov/docs/wildlife_pdf/raptorwinsum. Accessed November 7, 2008.
New Grange, Chautauqua Cty, NY	Spring 2005	Great Lakes plain/ADK foothills	April 16 to May	5	20	55	8	4.4	n/a	New York State Department of Environmental Conservation. 2008. Publicly Available Raptor Migration Data for Proposed Wind Sites in NYS. Available at http://www.dec.ny.gov/docs/wildlife_pdf/raptorwinsum. Accessed November 7, 2008.

Project Site	Season, Year	Landscape	Survey Period	# of Survey Days	# of Survey Hours	Total # Observed	# of Species Observed	Seasonal Average Passage Rate (raptors/ hr)	(Turbine Ht) and % Raptors Below Turbine Height	Reference
Stockton, Chautauqua Cty, NY	Spring 2006	Great Lakes plain/ADK foothills	n/a	n/a	n/a	n/a	n/a	4.7	n/a	New York State Department of Environmental Conservation. 2008. Publicly Available Raptor Migration Data for Proposed Wind Sites in NYS. Available at http://www.dec.ny.gov/docs/wildlife_pdf/raptor winsum. Accessed November 7, 2008.
Stockton, Chautauqua Cty, NY	Spring 2005	Great Lakes plain/ADK foothills	April 16 to May 15	5	20	122	8	4.7	n/a	New York State Department of Environmental Conservation. 2008. Publicly Available Raptor Migration Data for Proposed Wind Sites in NYS. Available at http://www.dec.ny.gov/docs/wildlife_pdf/raptor winsum. Accessed November 7, 2008.
Howard, Steuben Cty, NY	Spring 2006	Agricultural plateau	April 3 to May 19	9	52.5	260	11	5.0	(125 m) 64%[1]	Woodlot Alternatives, Inc. 2006. A Spring 2006 Survey of Bird and Bat Migration at the Proposed Howard Wind Power Project in Howard, New York. Prepared for EverPower Global.
Prattsburgh, Steuben Cty, NY	Spring 2005	Agricultural plateau	Spring 2005	10	60	314	15	5.2	(125 m) 83%[1]	Woodlot Alternatives, Inc. 2005. A Spring 2005 Radar, Visual, and Acoustic Survey of Bird and Bat Migration at the Proposed Windfarm Prattsburgh Project in Prattsburgh, New York. Prepared for UPC Wind Management, LLC.
Munnsville, Madison Cty, NY	Spring 2005	Agricultural plateau	April 5 to May 16	10	60	375	12	6.3	(118 m) 78%[1]	Woodlot Alternatives, Inc. 2005. A Spring 2005 Radar, Visual, and Acoustic Survey of Bird and Bat Migration at the Proposed Munnsville Wind Project in Munnsville, New York. Prepared for AES-EHN NY Wind, LLC.
Cape Vincent, Jefferson Cty, NY	Spring 2006	Great Lakes Shore	April 14 to May 12	4	12	79	10	6.5	(125 m) 72%[1]	New York State Department of Environmental Conservation. 2008. Publicly Available Raptor Migration Data for Proposed Wind Sites in NYS. Available at http://www.dec.ny.gov/docs/wildlife_pdf/raptor winsum. Accessed November 7, 2008.
St. Lawrence, Jefferson Cty, NY	Spring 2006	Great Lakes Shore	April 14 to May 12	4	12	91	8	7.5	(125 m) 81%[1,***]	New York State Department of Environmental Conservation. 2008. Publicly Available Raptor Migration Data for Proposed Wind Sites in NYS. Available at http://www.dec.ny.gov/docs/wildlife_pdf/raptor winsum. Accessed November 7, 2008.
Alabama, Genesee Cty, NY	Spring 2005	Great Lakes plain/ADK foothills	April 16-April 29	5	20	177	8	9.0	(125 m) 84.5%[1,**]	New York State Department of Environmental Conservation. 2008. Publicly Available Raptor Migration Data for Proposed Wind Sites in NYS. Available at http://www.dec.ny.gov/docs/wildlife_pdf/raptor winsum. Accessed November 7, 2008.
Cape Vincent, Jefferson Cty, NY	Spring 2007	Great Lakes Shore	March 21 to May 1	7	21	205	9	9.8	(125 m) 72%[1]	New York State Department of Environmental Conservation. 2008. Publicly Available Raptor Migration Data for Proposed Wind Sites in NYS. Available at http://www.dec.ny.gov/docs/wildlife_pdf/raptor winsum. Accessed November 7, 2008.
Clayton, Jefferson Cty, NY	Spring 2005	Agricultural plateau	March 30 - May 7	10	58	700	14	12.1	(150 m) 61%[1]	Woodlot Alternatives, Inc. 2005. A Spring 2005 Radar, Visual, and Acoustic Survey of Bird and Bat Migration at the Proposed Clayton Wind Project in Clayton, New York. Prepared for PPM Atlantic Renewable.
St Lawrence, Jefferson Cty, NY	Spring 2007	Great Lakes Shore	March 21 to May 1	7	21	232	8	15.4	(125 m) 81%[1,***]	New York State Department of Environmental Conservation. 2008. Publicly Available Raptor Migration Data for Proposed Wind Sites in NYS. Available at http://www.dec.ny.gov/docs/wildlife_pdf/raptor winsum. Accessed November 7, 2008.
Westfield, Chautauqua Cty, NY	Spring 2003	Great Lakes Shore	April 16 - May 15	50	100.7	2,578	17	25.6	n/a (278 m mean flight height)	Cooper, B.A., A.A. Stickney, J.J. Mabee. 2004. A visual and radar study of 2003 spring bird migration at the proposed Chautauqua wind energy facility, New York. 2004. Final Report prepared by ABR Inc. Chautauqua Windpower LLC.
Other States in the Northeast										
Granite Reliable Power, Coos County, NH (Dixville peak)	Spring 2010	Forested ridge	April 1 to May 11	10	67.52	14	8	0.2	(125 m) 64%[1]	Stantec Consulting. 2010. Fall 2009 and Spring 2010 Raptor Migration Surveys For the Granite Reliable Power Project. Prepared for Granite Reliable Power, LLC
Bingham, Somerset Cty, ME (Kingsbury Ridge)	Spring 2010	Forested ridge	March 19 to May 21	10	70	19	9	0.3	(152 m) 77%[2]	Stantec Consulting Services Inc. 2010. Spring 2010 Avian and Bat Survey Report for the Bingham Wind Project. Prepared for Blue Sky East Wind LLC.
Granite Reliable Power, Coos County, NH (Owl head mtn)	Spring 2010	Forested ridge	April 1 to May 11	10	62.45	29	8	0.5	(125 m) 76%[1]	Stantec Consulting. 2010. Fall 2009 and Spring 2010 Raptor Migration Surveys For the Granite Reliable Power Project. Prepared for Granite Reliable Power, LLC
Bull Hill, Hancock Cty, ME	Spring 2010	Forested ridge	March 19 to May 23	15	104.25	55	9	0.5	(145 m) 100%[2]	Stantec Consulting. 2010. Spring 2010 Avian and Bat Survey Report for the Bull Hill Wind Project. Prepared for Blue Sky East Wind, LLC
Stetson, Penobscot Cty, ME	Spring 2007	Forested ridge	April 26 to May 4	9	59	34	10	0.6	(125 m) 65%[1]	Woodlot Alternatives, Inc. 2007. A Spring 2007 Survey of Bird and Bat Migration at the Stetson Wind Project, Washington County, Maine. Prepared for Evergreen Wind V, LLC.
Groton Wind, Grafton Cty, NH	Spring 2013	Forested ridge	March 11 to May 30	11	146.75	96	6	0.7	(121 m) 33%[2]	Stantec Consulting Services Inc., Western EcoSystems Technology Inc. 2014. 2013 Post Construction Avian and Bat Survey Report Groton Wind Plant Grafton County New Hampshire. Prepared for Groton Wind LLC.
Oakfield, Aroostook Cty, ME	Spring 2008	Forested ridge	April 25-May 30	12	79	58	9	0.7	(120 m) 80%[2]	Stantec Consulting. 2008. Spring and Summer 2008 Bird and Bat Migration Survey Report Visual, Radar, and Acoustic Bat Surveys for the Oakfield Wind Project in Oakfield, Maine. Prepared for First Wind Management, LLC.
Passadumkeag, Grand Falls Twp, ME	Spring 2011	Forested ridge	Apr 29 to May 27	12	84	67	6	0.8	(140 m) 46%[1]	Stantec Consulting Services Inc. 2011. Spring and Summer 2011 Avian and Bat Survey Report for the Passadumkeag Wind Project in Grand Falls Township, Maine. Prepared for Noble Passadumkeag Windpark LLC.

Project Site	Season, Year	Landscape	Survey Period	# of Survey Days	# of Survey Hours	Total # Observed	# of Species Observed	Seasonal Average Passage Rate (raptors/hr)	(Turbine Ht) and % Raptors Below Turbine Height	Reference
Melvin Mountain, Grafton and Merrimack Counties, NH	Spring 2010	Forested ridge	April 15 to May 26	11 (simultaneous with Grants Pond Field)	75.5	62	9	0.8	(150 m) 83%[2]	Stantec Consulting Services Inc. 2013. 2010 Spring and Fall Raptor Migration Surveys for the Wild Meadows Wind Project, Grafton and Merrimack Counties, New Hampshire. Prepared for Atlantic Wind LLC.
Deerfield, Bennington Cty, VT (Western expansion)	Spring 2005	Forested ridge	April 9 to April 29	7	42	38	11 (for both sites combined)	0.9	(125 m) 83% (at both sites combined)[1]	Woodlot Alternatives, Inc. 2005. A Spring 2005 Radar, Visual, and Acoustic Survey of Bird and Bat Migration at the Proposed Deerfield Wind Project in Searsburg and Readsboro, Vermont. Prepared for PPM Energy/Deerfield Wind, LLC.
Deerfield, Bennington Cty, VT (Existing facility)	Spring 2005	Forested ridge	April 9 to April 29	7	42	44	11 (for both sites combined)	1.1	(125 m) 83% (at both sites combined)[1]	Woodlot Alternatives, Inc. 2005. A Spring 2005 Radar, Visual, and Acoustic Survey of Bird and Bat Migration at the Proposed Deerfield Wind Project in Searsburg and Readsboro, Vermont. Prepared for PPM Energy/Deerfield Wind, LLC.
Mars Hill, Aroostook Cty, ME	Spring 2006	Forested ridge	April 12 to May 18	10	60.25	64	9	1.1	(120 m) 48%[1]	Woodlot Alternatives, Inc. 2006. A Spring 2006 Radar, Visual, and Acoustic Survey of Bird Migration at the Mars Hill Wind Farm in Mars Hill, Maine. Prepared for Evergreen Windpower, LLC.
Bingham, Somerset Cty, ME (Johnson Ridge)	Spring 2010	Forested ridge	March 19 to May 21	5	35	37	9	1.1	(152 m) 95%[2]	Stantec Consulting Services Inc. 2010. Spring 2010 Avian and Bat Survey Report for the Bingham Wind Project. Prepared for Blue Sky East Wind LLC.
Rollins Mountain, Penobscot Cty, ME	Spring 2008	Forested ridge	Apr 3 to Jun 3	15	108	122	12	1.1	(125 m) 76%[2]	Stantec Consulting. 2008. Spring 2008 Bird and Bat Migration Survey Report: Visual, Radar and Acoustic Bat Surveys for the Rollins Wind Project. Prepared for First Wind, LLC.
Record Hill, Oxford Cty, ME	Spring 2008	Forested ridge	March 11 to May 27	15	97	118	12	1.2	n/a	Stantec Consulting. 2008. Spring 2008 Bird and Bat Migration Survey Report Breeding Bird, Raptor, and Acoustic Bat Surveys for the Record Hill Wind Project Roxbury, Maine. Prepared for Record Hill Wind, LLC.
Lempster, Sullivan County, NH	Spring 2006	Forested ridge	Spring 2006	10	78	102	n/a	1.3	(125 m) 56%[1]	The Louis Berger Group. 2006. Pre and Post-construction Avian Survey, Monitoring, and Mitigation at the Lempster, New Hampshire Wind Power Project. Prepared for Lempster Wind, LLC.
Groton Wind, Grafton Cty, NH	Spring 2009	Forested ridge	March 26 to May 23	11 [3]	125 [3]	175 [3]	11	1.4 [3]	(121 m) 25%[2]	Stantec Consulting Services Inc. 2009. 2009 Spring, Summer, and Fall Avian and Bat Surveys for the Groton Wind Project. Prepared for Groton Wind, LLC.
Bowers, Washington Cty, ME	Spring 2010	Forested ridge	April 21 to May 26	12	84	131	9	1.6	(131 m) 75%[2]	Stantec Consulting. 2010. 2010 Spring Avian and Spring/Summer Bat Surveys for the Bowers Wind Project. Prepared for Champlain Wind Energy, LLC
Sheffield, Caledonia Cty, VT	Spring 2005	Forested ridge	April to May	10	60	98	10	1.6	(125 m) 69%[1]	Woodlot Alternatives, Inc. 2006. Avian and Bat Information Summary and Risk Assessment for the Proposed Sheffield Wind Power Project in Sheffield, Vermont. Prepared for UPC Wind Management, LLC.
Kingdom Community, Orleans Cty, VT	Spring 2009	Forested ridge	April 15 to June 1	10	74	134	10	1.8	(125 m) 67%[1]	Stantec Consulting. 2009. Spring and Summer 2009 Raptor Surveys for the Kingdom Community Wind Project. Prepared for Vermont Environmental Research Associates
Highland, Somerset Cty, ME	Spring 2009	Forested ridge	March 25 to May 19	20	139	260	10	1.9	(130.5 m) Whitham 80% Briggs 86%[2]	Stantec Consulting Services Inc. 2009. Spring 2009 Ecological Surveys. Prepared for Highland Wind LLC.
Grants Pond Field, Grafton and Merrimack Counties, NH	Spring 2010	Field in valley	April 15 to May 26	11 (simultaneous with Melvin Mountain)	77	204	9	2.7	(150 m) 84%[2]	Stantec Consulting Services Inc. 2013. 2010 Spring and Fall Raptor Migration Surveys for the Wild Meadows Wind Project, Grafton and Merrimack Counties, New Hampshire. Prepared for Atlantic Wind LLC.
Antrim, Hillsborough Cty, NH	Spring 2011	Forested ridge	March 25 to May 15	9	65	441	11	6.8	(unknown) 37% between 50-500 ft above ground[1]	TRC Engineers and Stantec Consulting Services Inc. 2011. Avian and Bat Protection Plan for the Antrim Wind Energy Project. Prepared for Antrim Wind Energy, LLC.

[1] Percent below turbine height calculated for all observations within study area.

[2] Percent below turbine height calculated for those observations within project area (locations within study area where turbines could possibly be located).

[3] 5 of the 11 survey days were conducted simultaneously by 2 observers at 2 survey locations; however, results are combined for both sites which inflates the number of raptors observed for this site.

* Non-migrants were not included in seasonal passage rates in NYSDEC 2008 table but were included in passage rates here.

** Calculated for spring and fall combined.

*** Calculated for spring and fall 2006 and 2007 combined.

3.2.5 Rare, Threatened and Endangered Species

Stantec did not observe any federally listed endangered or threatened species. Stantec observed 1 golden eagle (*Aquila chrysaetos*), a state-listed endangered species, and state-listed threatened species bald eagles (*Haliaeetus leucocephalus;* n = 6) and northern harrier (*Circus cyaneus;* n = 1). The eagles were observed between 27 March and 1 May. The golden eagle exhibited powered flight in a northward direction. The bald eagle observations exhibited either powered flight or soaring/gliding flight behaviors in generally northward directions (n = 5) and on one occasion, a southward direction (n = 1). The northern harrier was observed on 1 May, circling at low altitudes, possibly foraging.

Observers also documented 3 state species of special concern: osprey (*Pandion haliaetus;* n = 3), red-shouldered hawk (*Buteo lineatus;* n = 3) and sharp-shinned hawk (*Accipiter striatus;*n = 4) (Figure 3-2, Appendix B Table 2) (NYSDEC 2014).

3.2.6 Incidental Observations

Stantec observed 54 non-raptor avian species during raptor surveys (Table 3-6). None were federally or state-listed endangered or threatened species, and none were state species of special concern (NYSDEC 2014).

Table 3-6. Non-raptor avian species observed incidentally during raptor surveys, Cassadaga Wind Project, Spring, 2014

Common Name	Scientific Name	Common Name (continued)	Scientific Name (continued)
alder flycatcher	*Empidonax alnorum*	herring gull	*Larus argentatus*
American crow	*Corvus brachyrhynchos*	indigo bunting	*Passerina cyanea*
American goldfinch	*Spinus tristis*	killdeer	*Charadrius vociferus*
American redstart	*Setophaga ruticilla*	mallard	*Anas platyrhynchos*
American robin	*Turdus migratorius*	mourning dove	*Zenaida macroura*
Baltimore oriole	*Icterus galbula*	northern cardinal	*Cardinalis cardinalis*
barn swallow	*Hirundo rustica*	northern flicker	*Colaptes auratus*
black-capped chickadee	*Poecile atricapillus*	northern shrike	*Lanius excubitor*
blue jay	*Cyanocitta cristata*	ovenbird	*Seiurus aurocapilla*
blue-winged warbler	*Vermivora cyanoptera*	pileated woodpecker	*Dryocopus pileatus*
bobolink	*Dolichonyx oryzivorus*	red-bellied woodpecker	*Melanerpes carolinus*
brown thrasher	*Toxostoma rufum*	red-winged blackbird	*Agelaius phoeniceus*
Canada goose	*Branta canadensis*	ring-billed gull	*Larus delawarensis*
cedar waxwing	*Bombycilla cedrorum*	rose-breasted grosbeak	*Pheucticus ludovicianus*
chestnut-sided warbler	*Setophaga pensylvanica*	ruby-throated hummingbird	*Archilochus colubris*
common grackle	*Quiscalus quiscula*	ruffed grouse	*Bonasa umbellus*
common yellowthroat	*Geothlypis trichas*	sandhill crane	*Grus canadensis*
dark-eyed junco	*Junco hyemalis*	song sparrow	*Melospiza melodia*
eastern bluebird	*Sialia sialis*	spotted sandpiper	*Actitis macularius*
eastern meadowlark	*Sturnella magna*	tree swallow	*Tachycineta bicolor*
eastern phoebe	*Sayornis phoebe*	tundra swan	*Cygnus columbianus*
eastern towhee	*Pipilo erythrophthalmus*	unidentified duck	*Anatinae (gen, sp)*
European starling	*Sturnus vulgaris*	unidentified gull	*Laridae (gen, sp)*
field sparrow	*Spizella pusilla*	white-breasted nuthatch	*Sitta carolinensis*
gray catbird	*Dumetella carolinensis*	wild turkey	*Meleagris gallopavo*
great blue heron	*Ardea herodias*	yellow warbler	*Setophaga petechia*
green heron	*Butorides virescens*	yellow-bellied sapsucker	*Sphyrapicus varius*

3.2.7 Raptor Observations during Eagle Point Count Surveys

Stantec conducted eagle point count surveys at 14 locations approximately once every 3 weeks from 30 July 2013–23 July 2014 in order to assess eagle use and behavior in the Project area[3]. Survey points were the same locations sampled during fall migration point count surveys (Figure 1). Observers scanned the sky for 1 hour at each point, and recorded locations, behaviors, age classes, flight directions and heights of eagles detected in the study area. Observers also recorded occurrences of raptors and other incidental birds, and recorded behavioral information of raptors observed at each point.

[3] For results of the eagle point count surveys, refer to the memo report (*DRAFT Cassadaga Wind Project 2013-2014 Eagle Use Point Count Survey Results*; 26 November 2014)

Observers detected 310 individual raptors and 9 raptor species during eagle point count surveys. Raptor behaviors included soaring, gliding, powered flight, foraging, and perching. Turkey vulture was the most commonly observed raptor species (n = 197, 64%), followed by red-tailed hawk (n = 75, 24%). Point count location 1 had the greatest number of raptor observations (n = 48, 15%), followed by point count location 11 (n = 41, 13%). Tables 3-7 and 3-8 summarize the raptor observations by point count number and by date.

Table 3-7. Summary of raptor observations by location during eagle point count surveys, Cassadaga Wind Project, July 2013 –July 2014

Species	Eagle Point Count Number														All Points
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	
American kestrel		1	5	2								1			9
broad-winged hawk	1							1		1				1	4
Cooper's hawk									1						1
northern harrier	6				1							1			8
red-shouldered hawk			1	1											2
red-tailed hawk	8	7	5	10	4	1		4	9	8	10	7		2	75
rough-legged hawk	2	1			1	1	1								6
sharp-shinned hawk			1		1	2	1					1			6
turkey vulture	31	14	17	22	8	2	6	9	10	17	31	21	3	6	197
unidentified buteo hawk														2	2
Total	**48**	**23**	**29**	**35**	**15**	**6**	**8**	**14**	**20**	**26**	**41**	**31**	**3**	**11**	**310**

Table 3-8. Summary of raptor observations by date during eagle point count surveys, Cassadaga Wind Project, July 2013–July 2014

Date	Species										Total
	American kestrel	broad-winged hawk	Cooper's hawk	northern harrier	red-shouldered hawk	red-tailed hawk	rough-legged hawk	sharp-shinned hawk	turkey vulture	unidentified buteo hawk	
7/30/2013						8			16		24
7/31/2013						2			11		13
8/1/2013						1			18		19
8/21/2013	4					6		1	18		29
8/22/2013						6			18		24
9/10/2013	3					1		1	19		24
9/11/2013						1			8		9
10/1/2013						5		2	20		27
10/2/2013		1				8			17		26
10/21/2013						2			11		13
10/22/2013						3			8		11
11/14/2013						3			2		5
12/5/2013				3		3					6
1/12/2014						1					1
1/13/2014				1		5		1			7
1/17/2014						4	2				6
1/18/2014							2				2
2/25/2014				1		1					2
3/15/2014						1	1				2
3/16/2014						4			2	2	8
4/8/2014						3			2		5
4/9/2014				2	2	2	1		5		12
5/2/2014		2				1			3		6
5/21/2014		1							1		2
5/22/2014									1		1
5/24/2014				1		2			2		5
6/10/2014	1					1			3		5
6/11/2014						1		1	2		4
7/1/2014									3		3
7/2/2014									4		4
7/22/2014	1								3		4
7/23/2014			1								1
Entire survey period	**9**	**4**	**1**	**8**	**2**	**75**	**6**	**6**	**197**	**2**	**310**

3.3 DISCUSSION

The objective of diurnal raptor migration surveys was to obtain baseline species composition, passage rate, and behavioral data of migratory and seasonally local raptors in the Project area. The surveys represent a subsample of the overall activity during the spring migration period. Results are limited to the number of days surveyed and the portions of the Project area visible from the survey point. The survey point was centrally located and provided good views of the turbine areas. Surveys targeted optimal weather conditions, and extended across the typical peak migration periods for common raptor species occurring in the northeastern region.

Of the 157 raptor observations, observers documented 143 (91%) inside the Project area. Turkey vulture was the most commonly observed species (n = 64, 41%). All turkey vultures and 78% of raptors observed within the turbine area (n = 143) were observed below the maximum turbine height of 150 m. During raptor migration, flight pathways and flight heights may vary seasonally, daily, or hourly. Weather and wind are major factors that influence migration paths and flight heights; in particular, wind, air temperature, and cloud cover influence the development of updrafts and thermals used by raptors making long-distance flights. The flight paths and passage rates of raptors observed at the Project varied among survey dates and were likely influenced by wind direction, weather and seasonal timing. The day with the highest passage rate (5.1 raptors/hr), May 1, was characterized by low pressure and southerly and southwesterly winds. Other survey days had similar weather characteristics, but 1 May coincided with the peak of migration for several species observed that day, including bald eagle, golden eagle, red-tailed hawk and broad-winged hawk.

Compared to the nearest Hawk Migration Association of North America's Hawk Watch sites, Cassadaga's overall passage rate was extremely low relative to the average passage rate at the Ripley Hawk Watch (116.6 raptors/hr) and Hamburg Hawk Watch (56.9 raptors/hr)[4] (HMANA 2014a, 2014b). These hawk watch sites are located less than 1 mile from the southern shore of Lake Erie, which is a migratory corridor for raptors migrating north in the spring. Since migrating raptors are reluctant to cross broad stretches of water such as the Great Lakes, raptors migrating northward through the region concentrate and move northeast along the edge of the Great Lakes' southern shores (Dunne 1984). The Cassadaga raptor survey site is over 14 miles from the lakeshore.

Survey effort and results are comparable to results of other recent studies at proposed wind sites in New York and in the northeastern U.S. (Table 3-5). The overall passage rate (1.6 raptors/hr) was at the low end of the range of passage rates documented in these studies (0.1–25.6 raptors/hr in New York and 0.2–6.8 raptors/hour in the Northeast) and below the medians (3.7 raptors/hr in New York and 1.9 raptors/hr in the Northeast). The number of raptor species observed at Cassadaga (n = 11) was within the range, suggesting that raptor activity, passage rates, and species composition at the Project site is typical of the region.

---

[4] The distance from Cassadaga to the Ripley Hawk Watch is 23 mi (37 km), and the distance from Cassadaga to Hamburg Hawk Watch is 36 mi (58 km).

4.0 Spring Breeding Bird Surveys

4.1 METHODS

4.1.1 Field Surveys

Stantec identified 85 breeding bird point count locations along 16 survey transects: 59 survey points were in close proximity to proposed turbine locations and 26 control points were chosen in areas where no impact is expected to occur. Points were spaced approximately 125 m (410 ft) apart, were chosen using aerial Project photos, and were positioned based on the following criteria:

1) to sample the various available habitats
2) available site access via roads and trails
3) proposed wind turbine locations
4) available site access via participating landowner parcels

A Stantec biologist conducted surveys from sunrise until 10:00 a.m. in weather conditions conducive to hearing birdsong and seeing birds move about in vegetation and in flight. All birds identified by sight or sound, including soaring raptors, waterfowl, and other fly-overs, were recorded during a 5-minute session at each survey point. The biologist also recorded weather information and general habitat conditions at each survey point.

4.1.2 Data Summary and Analysis

Survey points were grouped into 5 habitat categories based on dominant vegetation cover and general habitat characteristics: agricultural, forest edge, hardwood forest, mixed (hardwood and conifer) forest, and over-grown field.

The species and number of individuals documented during surveys were used to calculate SR, RA, Fr, and SDI. All indexes were calculated for each habitat classification, for all habitats combined, and separately for survey points and control points.

4.2 RESULTS

4.2.1 Survey Effort and Weather Summary

A Stantec biologist conducted 85 breeding bird point counts each week in May and in June 2014, for a total of 170 point counts. Each point was surveyed twice: once in May and once in June. Surveys were conducted on 5-6 May, 13-14 May, 22-23 May, 27 May, 4-6 June, 18-19 June, 24 June and 26 June. Wind speeds ranged from 1–12 miles per hour (mph; 0.45 to 5.36 m/s), average daily temperatures ranged from 3.2–20.4 degrees °C, and sky conditions were typically clear to partly cloudy. Periods of fog occurred on 22 May, 18 June, and 26 June, periods of light drizzle occurred on 14 May and 24 June, and brief periods of showers occurred on 19 June and 26 June (Table 4-1).

Table 4-1. Summary of weather parameters during breeding bird point count surveys, Cassadaga Wind Project, Spring, 2014

Date	Wind Speed Code(s)	Average Temp (°C)	Sky Conditions
5/5/2014	1,2	3.2	partly cloudy
5/6/2014	1,2	4.5	clear to partly cloudy
5/13/2014	2	14.0	cloudy
5/14/2014	1,2	17.2	partly cloudy, drizzle
5/22/2014	1,2	14.7	partly cloudy, fog
5/23/2014	1,2	11.4	clear to partly cloudy
5/27/2014	1	16.7	partly cloudy
6/4/2014	1,2	12.1	clear to partly cloudy
6/5/2014	1,2	9.4	clear to partly cloudy
6/6/2014	2	11.0	partly cloudy
6/18/2014	1,2	18.3	partly cloudy, fog
6/19/2014	1	20.0	mostly cloudy, showers
6/24/2014	2,3	20.4	cloudy, drizzle
6/26/2014	1	19.7	fog, showers
wind speed codes 1 = 0-3 mph; **2** = 4-8 mph; **3** = 9-12 mph; **4** = 13-18 mph; **5** = 19-24 mph			

4.2.2 Habitat Results

The survey points and control points had similar relative abundances (RA = 10.47 and 10.85) and Shannon Diversity Indexes (SDI = 3.30 and 2.89). Forest edge habitat had the most individuals observed and the highest species richness for both the survey points (n = 555, SR = 56) and the control points (n = 257, SR = 36). Agricultural habitat had the highest relative abundance among survey points (RA = 12.54), and over-grown field habitat had the highest relative abundance among control points (RA = 15.33). Forest edge habitat had the highest Shannon Diversity Index among survey points (SDI = 3.18), and mixed forest habitat had the highest Shannon Diversity Index among control points (SDI = 3.02) (Table 4-2).

Table 4-2. Summary of breeding bird point count results by habitat type, excluding observations of birds >100 m from the observer and flyovers, Cassadaga Wind Project, Spring, 2014

Habitat Type	# BBS Points	Total Birds Observed	Relative Abundance	Species Richness*	Shannon Diversity Index
Survey Points (59)					
Agricultural	12	301	12.54	31	2.34
Forest edge	23	555	12.07	56	3.18
Hardwood forest	6	96	8.00	30	3.11
Mixed forest	14	193	6.89	24	2.92
Over-grown field	4	90	11.25	18	2.43
All survey points	**59**	**1,235**	**10.47**	**63**	**3.30**
Control Points (26)					
Agricultural	2	55	13.75	9	1.68
Forest edge	12	257	10.71	36	3.00
Hardwood forest	0	n/a	n/a	n/a	n/a
Mixed forest	6	68	5.67	25	3.02
Over-grown field	6	184	15.33	19	2.05
All control points	**26**	**564**	**10.85**	**42**	**2.89**
*not including unidentified species					

4.2.3 Species Observed

Stantec detected 2,461 individual birds, including flyovers and individuals greater than 100 m from the observer. Seventy-two species were detected, excluding 1 flycatcher that could only be identified to genus. Appendix C Table 1 lists all species observed during surveys.

Excluding flyovers, the biologist recorded 67 species and 1,799 individuals within 100 m of the survey and control points (Appendix C Table 2). In agricultural habitat, red-winged blackbird (*Agelaius phoeniceus*) had the greatest relative abundance among both survey points (RA = 4.00) and control points (RA = 5.75), followed by bobolink (*Dolichonyx oryzivorus*) (RA = 3.04 and 3.00). In forest edge habitat, red-winged blackbird had the greatest relative abundance among both survey points (RA = 1.85) and control points (RA = 2.29), followed by song sparrow (*Melospiza melodia*) among survey points (RA = 1.33) and American robin (*Turdus migratorius*) among control points (RA = 1.13). In mixed forest habitat, ovenbird (*Seiurus aurocapillus*) had the same relative abundance in both survey points and control points (RA = 0.75), while eastern towhee (*Pipilo erythrophthalmus*) had the highest relative abundance among only survey points (RA = 0.96). In over-grown field habitat, red-winged blackbird had the highest relative abundance in both survey points (RA = 2.63) and control points (RA = 7.17), followed by common yellowthroat (*Geothlypis trichas*) among survey points (RA = 1.50) and song sparrow among control points (RA = 1.25). While no control points were established in hardwood forest habitat, eastern towhee (RA = 1.25) and red-eyed vireo (*Vireo olivaceus*) (RA = 0.58) had the greatest relative abundances among survey points (Appendix C Table 3).

4.2.4 Rare, Threatened and Endangered Species

Stantec did not detect any state- or federally listed endangered or threatened species, or state species of special concern (NYSDEC 2014).

4.3 DISCUSSION

The objectives of breeding bird point count surveys were to provide baseline data of songbird species occurring and breeding within the various habitats in the Project area, to assess the likelihood that rare bird species occur in the Project area, and to evaluate the degree to which the breeding bird community in the Project area is typical of the region. Surveys also aimed to compare the breeding bird community at points in close proximity to proposed turbine locations with the breeding bird community at control points in areas where no impact is expected to occur.

Species detected during breeding bird surveys are generally common, regionally abundant and typical of the habitats in which they were observed. Red-winged blackbird, a common grassland species, was the most commonly detected species and had the highest relative abundance values among survey points and control points in 3 of the 5 habitats surveyed: agricultural, forest edge, and over-grown field. Eastern towhee, ovenbird, and red-eyed vireo, all forest interior species, were commonly detected at hardwood forest and mixed forest points in the Project area. Stantec did not detect any state- or federally listed endangered or threatened species, or state species of special concern.

Comparison between survey points and control points shows similar relative abundance and diversity index values, and similar species compositions for individual habitat types. More survey points were established than control points, resulting in higher individual bird counts and a greater number of species recorded at survey points.

The selected points sampled the various available habitats within the Project area, and have primary habitat characteristics representative of the Project and surrounding areas. The surveys were timed to coincide with the peak breeding season in May and June, targeted optimal weather conditions to facilitate the maximum detection of birds, and used standard point count survey methods. Therefore, the results of the surveys provide a suitable reflection of the breeding bird community within the Project and surrounding areas.

5.0 Acoustic Bat Surveys

5.1 METHODS

5.1.1 Data Collection

Stantec conducted acoustic bat surveys consistent with the NYSDEC Guidelines to characterize activity, timing of activity, and when possible, species composition of bats in the Project area. Passive acoustic echolocation monitoring surveys were conducted during the late summer emergence and fall migration periods (mid-August to mid-October in 2013 and 2014) and the spring migration and activity period for bats (mid-April to mid-August in 2014).

Anabat model SDI detectors (Titley Electronics Pty Ltd.) were selected for data collection based upon their widespread use for this type of survey at other wind projects, their ability to be deployed for long periods of time, and their ability to detect a broad frequency range, which allows detection of all species of bats which could occur in the Project area. Anabat detectors are frequency division detectors, dividing the frequency of echolocation sounds made by bats by a factor of 16, and then recording these sounds onto removable compact flash cards for subsequent analysis.

Each Anabat detector was powered by 12-volt batteries charged by solar panels. Each solar-powered Anabat system was deployed in waterproof housing enabling the detector to record while unattended for the duration of the survey. The housing suspended the Anabat microphone downward to give maximum protection from precipitation. To compensate for the downward position, a curved plastic joint was used to funnel sound into the downward-facing microphone, allowing the microphone to record the airspace horizontally surrounding the detector.

Detectors were programmed to begin monitoring at 18:00 hours each night and end monitoring at 06:00 hours each morning. The audio sensitivity setting of each Anabat system was set between 6 and 7 (on a scale of 1 to 10) to maximize sensitivity while limiting ambient background noise and interference. Stantec made periodic visits (approximately every 3 weeks) to download data and maintain the detectors. During each visit, a Stantec biologist visually inspected each unit to ensure proper wiring and good battery charge, and downloaded data from the compact flash cards using CFCread© software.

5.1.2 Site Selection

We deployed 2 Anabat SD1 detectors (Titley Electronics Pty Ltd.) in the 2 on-site meteorological (met) towers at approximately 45 m and 3 m above ground level (agl), as recommended by NYSDEC Guidelines (Figure 5-1 and Figure 5-2, Table 5-1). In fall 2013, Stantec deployed 2 detectors in the single on-site met tower (the second met tower was erected in April 2014) and a third detector at approximately 3 m agl in a tree adjacent to a stream where bat activity was expected (Figure 5-3). When the second met tower was erected, this detector was moved to the met tower and a second detector was deployed to remain consistent with NYSDEC protocol of 2 bat detectors in each met tower.

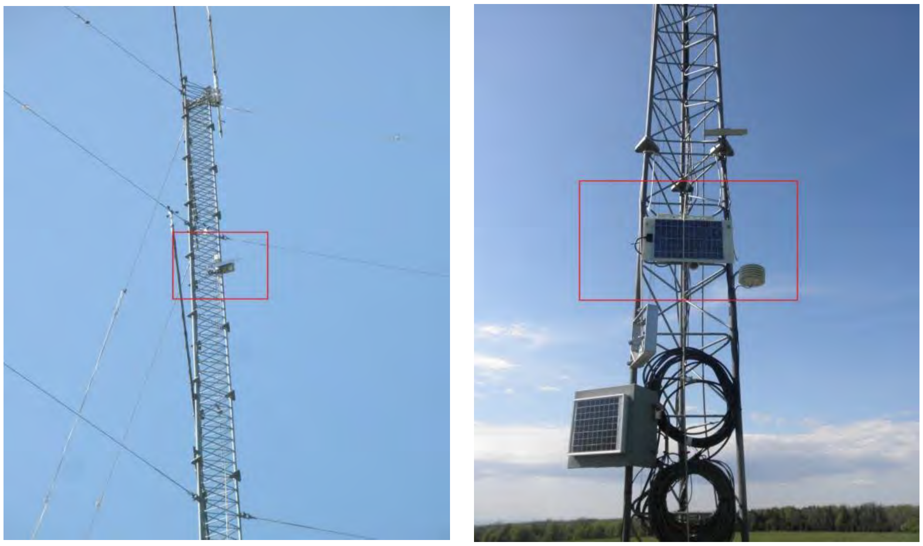


Figure 5-1. Met 1 High and Low detectors, Cassadaga Wind Project, 2013-2014

Figure 5-2. Met 2 High and Low detectors, Cassadaga Wind Project, 2014

Figure 5-3. Tree detector, Cassadaga Wind Project, 2013

Table 5-1. Habitat descriptions of locations sampled during acoustic bat surveys, Cassadaga Wind Project, 2013-2014

Detector Name	Elevation (m above ground level [agl])	Height (m agl)	Habitat Notes
Met 1 High	612	45	Met tower is located in the center of a recently harvested hay field, approximately 75 acres. Surrounding forest is mature mixed hardwood and conifer, and dominant species include sugar maple, red maple, green ash, and red pine . Very few snags are present, and understory is relatively dense.
Met 1 Low	612	3	
Met 2 High	582	45	Met tower is located next to border of 2 agricultural fields, approximately 200 acres each. At border of agricultural fields is an approximately 10-acre overgrown field with a small stream, dogwood trees and blackberry shrubs . Surrounding mixed hardwood forest is > 500 m away.
Met 2 Low	582	3	
Tree	518	3	Detector is located in a tree at the edge of a strip of mixed hardwood forest separating 2 fields. Forest is dominated by staghorn sumac, sugar maple, apple and blackberry. Forest has thick understory and small stream approximately 20 m from the detector. Detector faces large open grassland adjacent to corn field, approximately 22 acres.

5.1.3 Data Analysis

Ultrasound recordings of bat echolocation may be broken into recordings of a single bat call or recordings of bat call sequences. A call is a single pulse of sound produced by a bat, while a call sequence is a combination of 2 or more pulses recorded in an Anabat file. Recordings containing less than two calls were eliminated from analysis as has been done in similar studies (Arnett et al. 2006). Call sequences typically include a series of calls characteristic of normal flight or prey location ("search phase") and capture periods (feeding "buzzes").

Potential call files were extracted from data files using CFCread© software. The default settings for CFCread© were used during this file extraction process, as these settings are recommended for the calls that are characteristic of bats in the Northeast. This software screens all data recorded by the bat detector and extracts call files using a filter. Using the default settings for this initial screen also provides for comparability between data sets. Settings used by the filter include a max TBC (time between calls) of 5 seconds, a minimum line length of 5 milliseconds, and a smoothing factor of 50. The smoothing factor refers to whether or not adjacent pixels can be connected with a smooth line. The higher the smoothing factor, the less restrictive the filter and the more noise files and poor quality call sequences that are retained within the data set.

Following extraction of call files, each file was visually inspected for species identification and to determine that only bat calls were included in the data set. Insect activity, wind, and interference can sometimes produce Anabat files that pass through the initial filter and need to be visually inspected and removed from the data set. Call sequences are easily differentiated from other recordings, which typically form a diffuse band of dots at either a constant frequency or widely varying frequency.

Because bat activity levels are highly variable among individual nights and individual hours (Hayes 1997, Arnett et al. 2006), detection rates are summarized on both of these temporal scales. Hourly detection rates were summarized by hour after sunset, as recommended by Kunz et al. (2007).

Bat call sequences were individually marked and categorized by species group, or "guild" based on visual comparison to reference calls. Relatively accurate identification of bat species can be attained by visually comparing recorded call sequences of sufficient length to bat call reference libraries (O'Farrell et al. 1999, O'Farrell and Gannon 1999). Call sequences were classified to species whenever possible, based on criteria developed from review of reference calls collected by Chris Corben, the developer of the Anabat system, as well as other bat researchers. Each bat species is capable of expressing characteristic call types; however, overlap in certain call patterns is common in some species that call within the same frequency range. Additionally, calls from any species may lack sufficient detail needed for species level identification because of background noise, distance of the bat from the microphone, weather, or other environmental factors. To compensate for these limitations in the analysis process, the following guilds were created to account for ambiguous calls that could not be confidently identified to species:

- **Unknown (UNKN)** – All call sequences with less than 5 calls, or poor quality sequences (those with indistinct call characteristics or background static). These sequences were further identified as either:
    - "High frequency unknown" **(HFUN)** for sequences with a minimum frequency above 30–35 kilohertz (kHz) (for this region, HFUN most likely represents eastern red bat (*Lasiurus borealis*), tri-colored bat (*Perimyotis subflavus*), and *Myotis* species since these species typically produce ultrasound sequences of more than 30 kHz); or
    - "Low frequency unknown" **(LFUN)** for sequences with a minimum frequency below 30–35 kHz (big brown bat (*Eptesicus fuscus*), silver-haired bat (*Lasionycteris noctivagans*), and hoary bat (*Lasiurus cinereus*) would be the species in this region typically producing ultrasound sequences of less than 30 kHz).
- **Myotis (MYSP)** – All bats of the genus *Myotis*. While there are some general characteristics believed to be distinctive for several of the species in this genus, these characteristics are not sufficiently consistent to be relied upon for species identification at all times when using Anabat recordings.
- **Eastern red bat/tri-colored bat[5] (RBTB)** – Eastern red and tri-colored bats. These 2 species can produce distinctive calls; however, significant overlap between these species in the call pulse shape, frequency range, and slope can also occur.
- **Big brown bat/silver-haired bat (BBSH)** – Big brown and silver-haired bats. These species' call signatures commonly overlap and have therefore been included as one guild in this report.
- **Hoary bat (HB)** – Hoary bats. Calls of hoary bats can usually be distinguished from those of big brown and silver-haired bats by minimum frequency extending below 20 kHz or by calls varying widely in minimum frequency across a sequence.

This method of guild identification represents a conservative approach to bat call identification. Since some species sometimes produce calls unique only to that species, all calls were identified to the lowest possible taxonomic level before being grouped into the listed guilds. Tables and figures in this report will reflect those guilds. However, since species-specific identification did occur in some cases, each guild also will be briefly discussed with respect to potential species composition of recorded call sequences. Call results by guild and suspected species are presented in Appendix D of this report.

Once all of the call files were identified and categorized in appropriate guilds, nightly tallies of detected calls were compiled. Mean detection rates (calls/detector-night) for the entire

[5] The scientific and common name of the eastern pipistrelle (*Pipistrellus subflavus*) has been changed to the tri-colored bat (*Perimyotis subflavus*).

sampling period were calculated for each detector, for all met detectors combined and for all detectors combined. The sunset time was subtracted from the time of recording to determine the number of hours after sunset when each file was recorded.

5.1.4 Weather Data

Weather data during the fall 2013 survey period (14 August–21 October 2013) were collected from Met 1 located in the northern section of the Project area, and weather data during the 2014 survey period (16 April–15 October 2014) were collected from Met 1 and Met 2 located in the southern portion of the Project area (Appendix D Tables 1–5). Nightly mean temperature and wind speed were summarized for each night of survey.

5.2 RESULTS

5.2.1 Timing of Activity

Stantec deployed detectors from 14 August–21 October 2013, and from 16 April –15 October 2014. Met detectors recorded 2,719 call sequences during 774 detector-nights and the tree detector recorded 52 sequences during 69 detector-nights resulting in 2,771 bat call sequences recorded by all detectors combined for an overall detection rate of 3.3 bat call sequences per detector-night (calls/detector-night) (Table 5-2, Appendix D Tables 1-5).

Table 5-2. Summary of bat detector field survey effort and results, Cassadaga Wind Project, 2013-2014

Location	Dates Deployed	Calendar Nights	Detector-Nights*	Recorded Sequences	Detection Rate **	Maximum Sequences recorded ***
Met 1 High	26 August - 21 October 2013, 16 April - 15 October 2014	240	202	353	1.7	20
Met 1 Low	14 August - 21 October 2013, 16 April - 15 October 2014	252	248	1,780	7.2	599
Met 2 High	23 April - 15 October 2014	176	158	304	1.9	16
Met 2 Low	23 April - 15 October 2014	176	166	282	1.7	11
Overall Met Results		***844***	***774***	***2,719***	***3.5***	--
Tree	14 August - 21 October 2013	69	69	52	0.8	4
Overall Results		***913***	***843***	***2,771***	***3.3***	--
* One detector-night is equal to a one detector successfully operating throughout the night.						
** Number of bat echolocation sequences recorded per detector-night.						
*** Maximum number of bat passes recorded from any single detector for a detector-night.						

The highest level of activity was recorded during August 2013 by Met 1 Low (n = 1,501). Met 1 Low recorded the peak number of calls on 21 August (n = 599) and 22 August (n = 405) 2013, representing 36% of call sequences recorded by all 5 detectors throughout the 2013 – 2014 survey period (Figure 5-4, Appendix D Table 2). Met 1 Low recorded the highest detection rate in August 2013 (83.4 calls/detector-night). With the exception of Met 1 Low, Met I High had the highest night of activity on 6 September 2013 (n = 20). With the exception of Met 1 Low in August 2013, monthly detection rates at met tower detectors ranged from 0.0 calls/detector-night at Met 1 High, Met 1 Low, and Met 2 Low in April 2014 to 4.4 calls/detector-night at Met 2 High in September 2014. Not including Met 1 Low, Met I High had the highest night of activity on 6 September 2013 (n = 20). Monthly detection rates at the tree detector ranged from 0.2 calls/detector-night in October 2013 to 1.4 calls/detector-night in October 2013 (Figure 5-5).

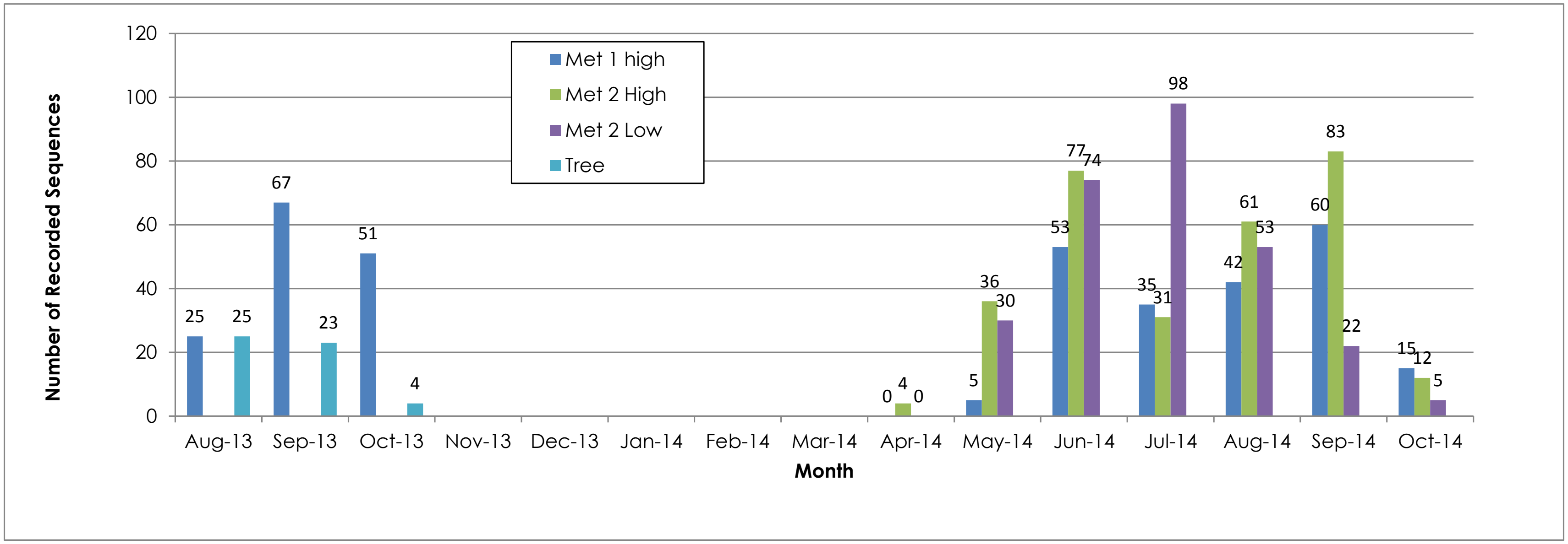


Figure 5-4. Total monthly bat call sequence detections recorded by five detectors (Met 1 Low is not shown due to the disproportionately high number of calls recorded in August 2013 by the single detector), Cassadaga Wind Project, 2013-2014

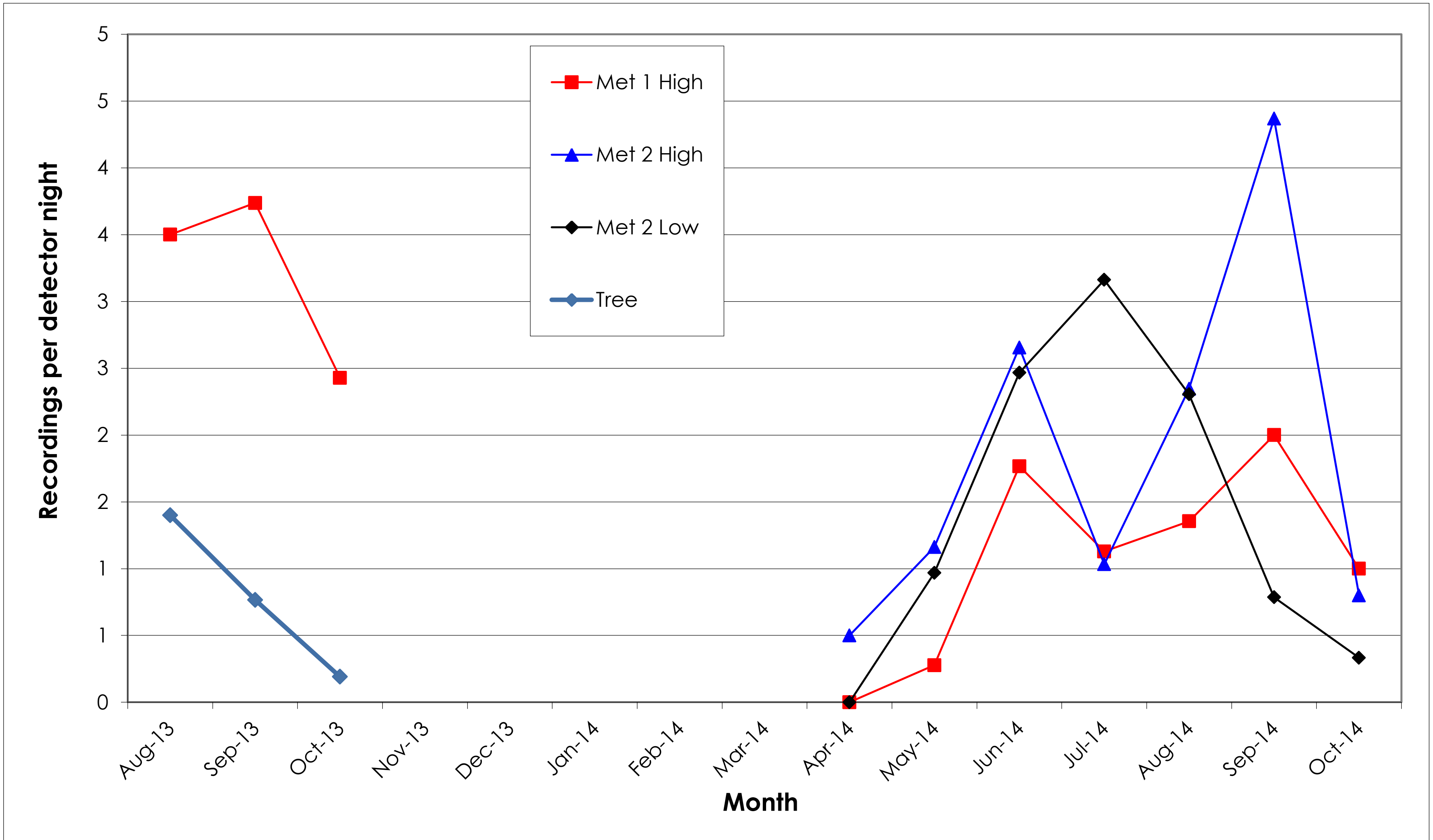


Figure 5-5. Total monthly detection rates recorded by 5 detectors (Met 1 Low is not shown due to the disproportionately high number of calls recorded in August 2013 by the single detector), Cassadaga Wind Project, 2013-2014

The timing of hourly peaks in acoustic activity recorded by the met tower detectors varied between detectors. Met 1 High and Met 2 High recorded the highest level of activity from sunset (hour = 0) until the beginning of the first hour after sunset. Met 1 Low and Met 2 Low recorded the highest level of activity during the first hour (hour = 1) after sunset. Combined, the greatest amount of activity recorded by the met tower detectors occurred within 3 hours after sunset (n = 1,645; 61%) (Figure 5-6). The tree detector recorded the highest level of activity from sunset until the first hour after sunset (Figure 5-7).

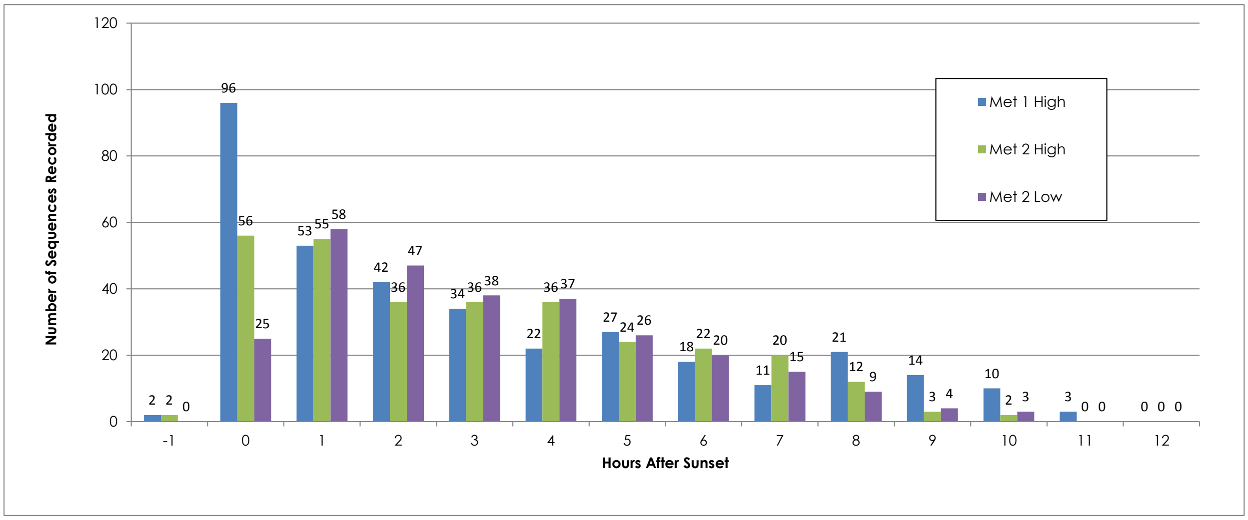


Figure 5-6. Number of call sequences recorded during each hour of the night at met tower detectors (Met 1 Low is not shown due to the disproportionately high number of calls recorded in August 2013 by the single detector), Cassadaga Wind Project, 2013-2014

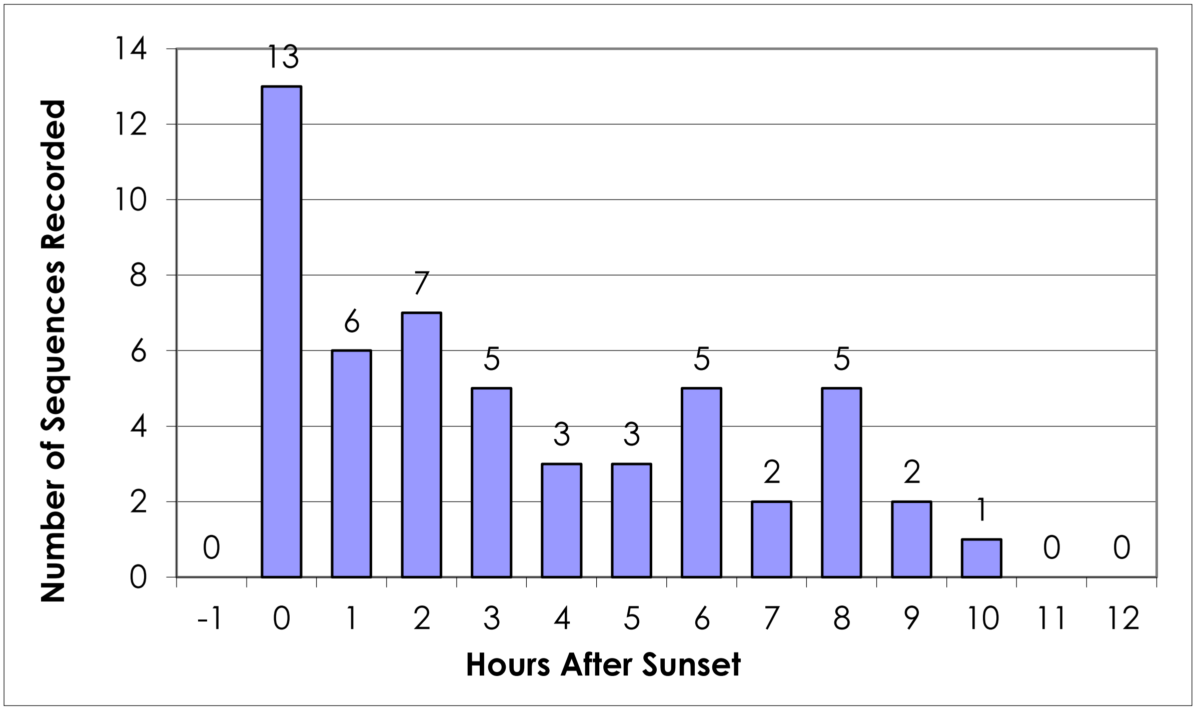


Figure 5-7. Number of call sequences recorded during each hour of the night at the tree detector, Cassadaga Wind Project, Fall, 2013

5.2.2 Species Composition

The greatest percentage of call sequences recorded at the met detectors was from BBSH (n = 1,595, 59%), followed by UNKN (n = 917, 34%; Table 5–3). Within the BBSH guild, 8% of call sequences were identified as silver-haired bats (n = 125), and 4% of calls sequences were identified as big brown bats (n = 64); the remaining call sequences within the BBSH guild (n = 1,406, 88%) lacked sufficient detail to be identified to species level (Appendix D Tables 1-4). Detectors recorded only 39 *Myotis* calls sequences (1% of total calls recorded) during the 2013-2014 surveys). High detectors recorded only 3 *Myotis* calls.

Species composition was similar between the Met 1 and Met 2 detectors. The majority of call sequences recorded by the high detectors and the Met 2 Low detector were identified as UNKN (n = 171; 48% of call sequences recorded at Met 1 High; n = 149; 49% of call sequences recorded at Met 2 High; n = 136; 48% of call sequences recorded at Met 2 Low). The majority of sequences recorded by the Met 1 Low detector were identified as BBSH (n = 1,264; 71% of call sequences recorded at Met 1 High; Table 5-3; Figure 5-8).

The greatest percentage of call sequences recorded at the tree detector was from UNKN (n = 42, 81%), followed by MYSP (n = 7, 13%) (Table 5–3). Within UNKN, 69% of call sequences were identified as HFUN (n = 29), and 31% of call sequences were identified LFUN (n = 13) (Figure 5-9).

Appendix D Tables 1–5 provide information on the number of call sequences by guild and suspected species, recorded at each detector for each night of survey, and weather conditions for that night.

Table 5–3. Distribution of detections by guild for all detectors, Cassadaga Wind Project, 2013-2014

Detector	Guild					Total
	BBSH	HB	MYSP	RBTB	UNKN	
Met 1 High	123	36	3	20	171	353
Met 1 Low	1,264	6	23	26	461	1,780
Met 2 High	96	50	0	9	149	304
Met 2 Low	112	6	6	22	136	282
Met Total	**1,595**	**98**	**32**	**77**	**917**	**2,719**
Met Guild Composition %	**59%**	**4%**	**1%**	**3%**	**34%**	--
Tree	3	0	7	0	42	**52**
Tree Guild Composition %	**6%**	**0%**	**13%**	**0%**	**81%**	--
Overall Total	**1,598**	**98**	**39**	**77**	**959**	**2,771**
Overall Guild Composition %	**58%**	**4%**	**1%**	**3%**	**35%**	

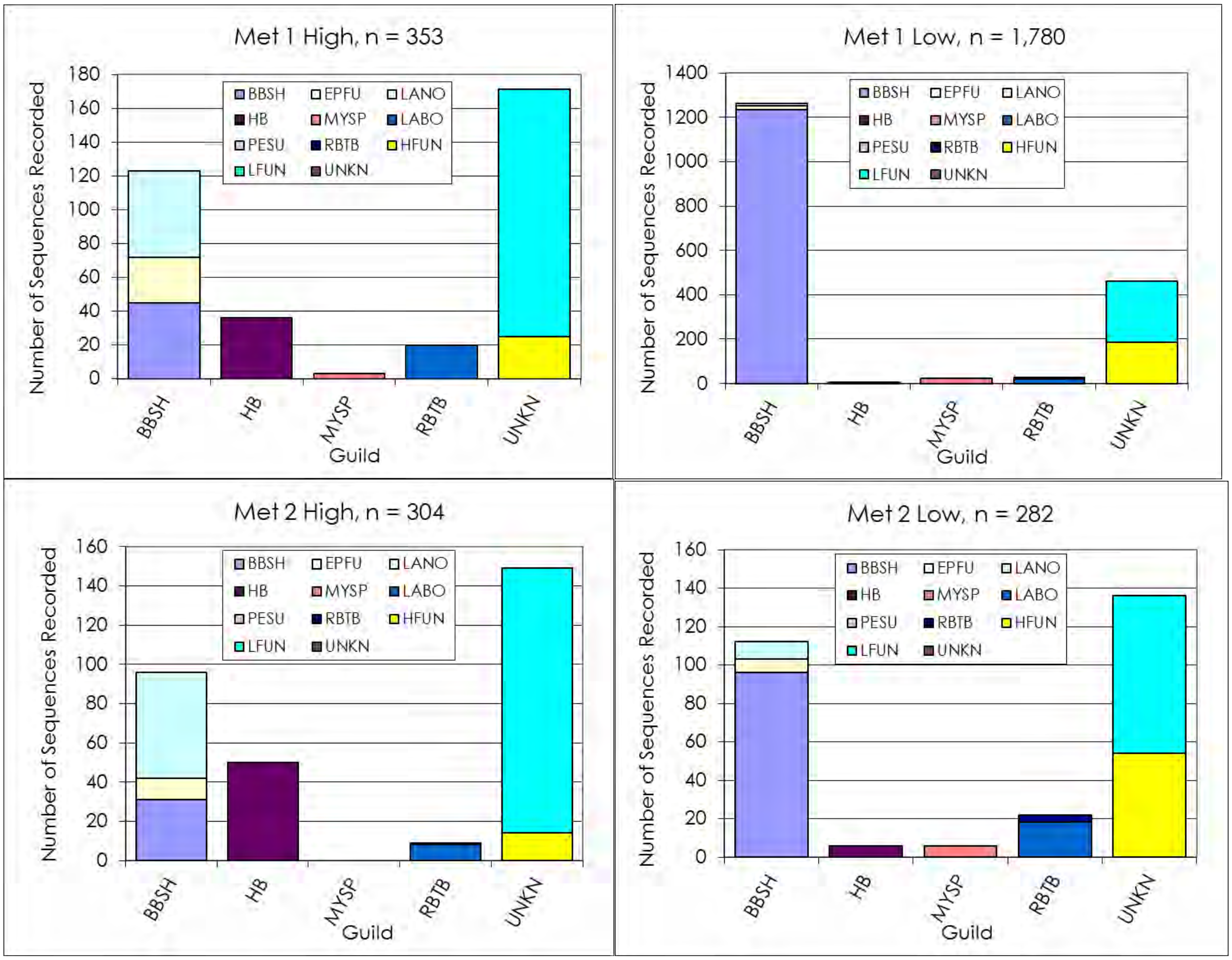


Figure 5-8. Histograms showing species composition of recorded bat call sequences from met detectors. BBSH = big brown/silver-haired, HB = hoary bat, MYSP = Myotis species, RBTB = red bat/tri-colored bat, UNKN = unknown, LFUN = low frequency unknown, HFUN = high frequency unknown, PESU = tri-colored bat, LABO = red bat, LANO = silver-haired bat, EPFU = big brown bat, Cassadaga Wind Project, 2013-2014

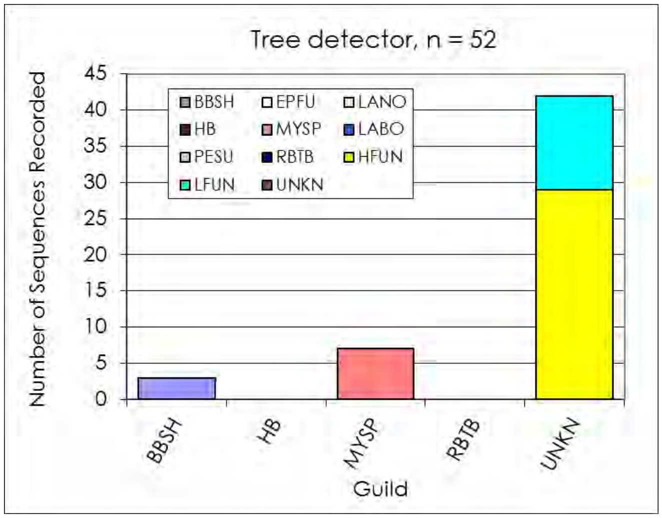


Figure 5-9. Histogram showing species composition of recorded bat call sequences from the tree detector. BBSH = big brown/silver-haired, HB = hoary bat, MYSP = Myotis species, RBTB = red bat/tri-colored bat, UNKN = unknown, LFUN = low frequency unknown, HFUN = high frequency unknown, PESU = tri-colored bat, LABO = red bat, LANO = silver-haired bat, EPFU = big brown bat, Cassadaga Wind Project, Fall, 2013

5.2.3 Activity and Weather

Mean nightly wind speeds at the Project area during the survey period varied between 1.4 and 11.6 m/s(Figure 5-10). Seventy-three percent of all call sequences (n = 2,023) were recorded when mean nightly wind speeds were 6 m/s or less (Figure 5-10). Mean nightly temperatures varied between -1.7 degrees °C and 24.5°C (Figure 5-11). Sixty-five percent of all call sequences (n = 1,809) were recorded on nights when mean nightly temperatures were 18°C or above (Figure 5-11). On 21 August, when the maximum number of call sequences was recorded in a single night, the mean nightly wind speed was 6.0 m/s and the mean nightly temperature was 20.5°C. Figure 5-12 and Figure 5-13 display scatterplots of overall acoustic activity versus mean nightly wind speed and temperature.

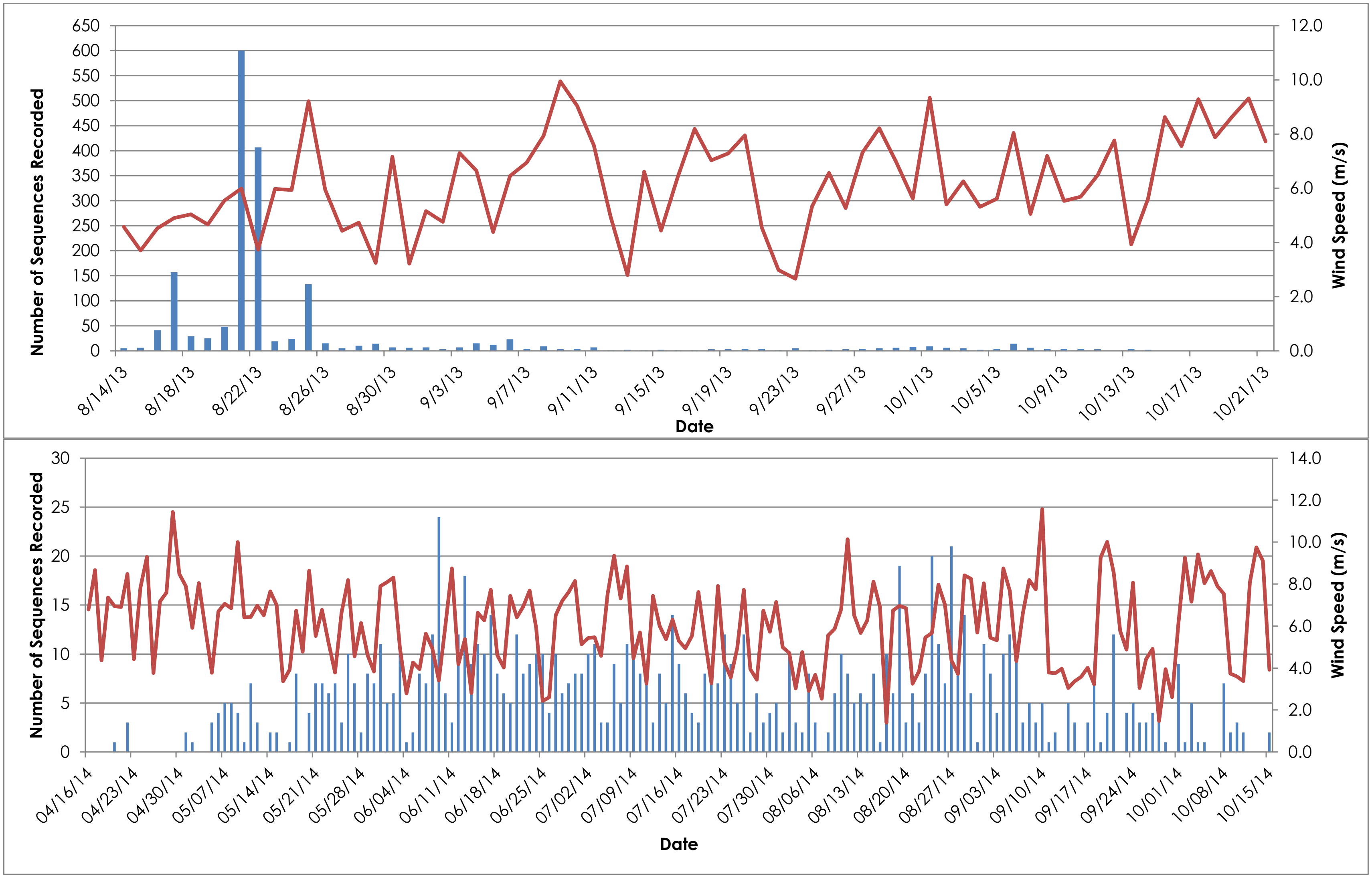


Figure 5-10. Nightly mean wind speed (m/s) (red line) and combined bat call sequence detections for detectors in 2013 (Tree, Met 1 High, and Met 1 Low; top graph) and detectors in 2014 (Met 1 High, Met 1 Low, Met 2 High, and Met 2 Low; bottom graph), Cassadaga Wind Project, 2013-2014

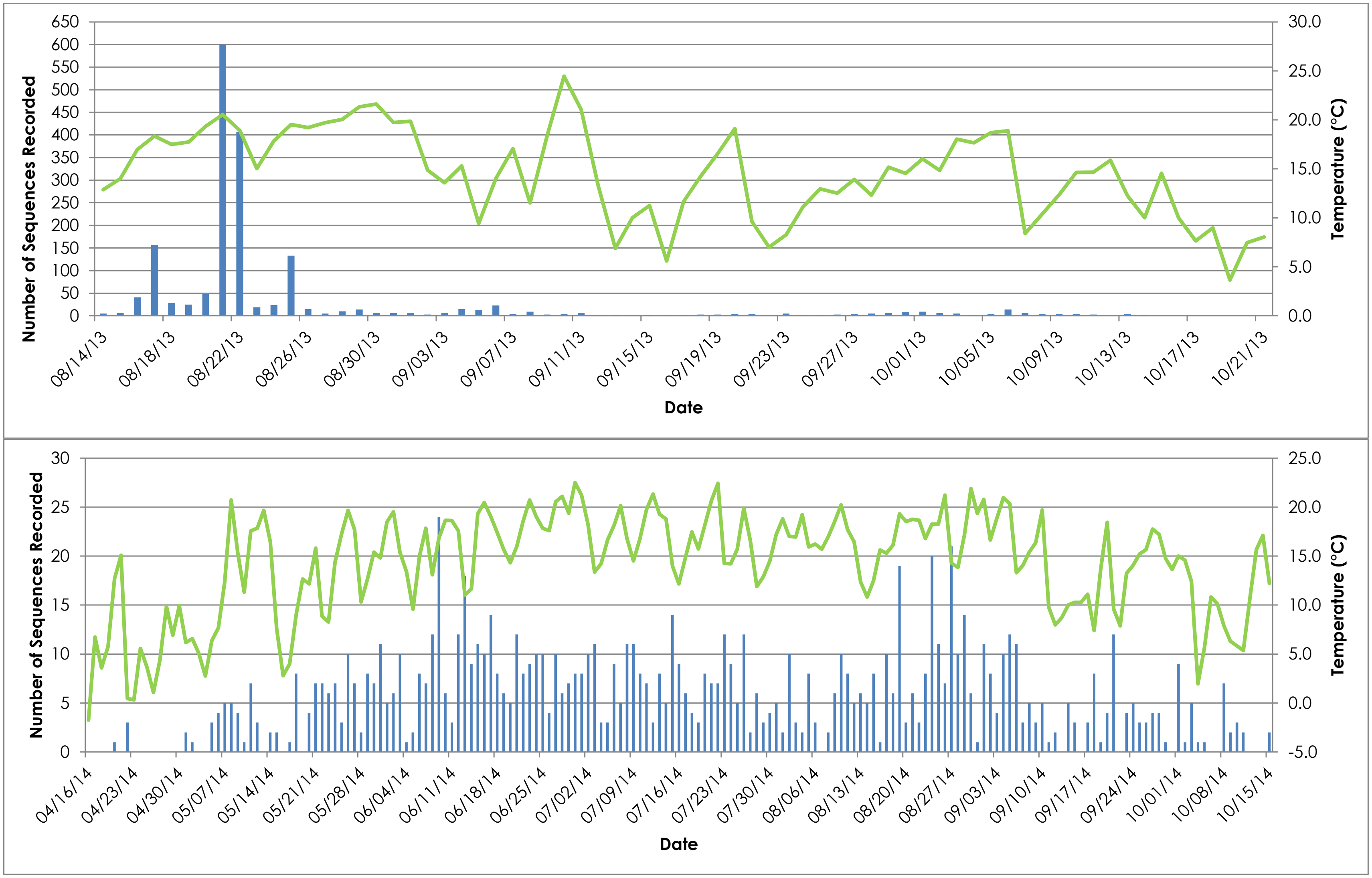
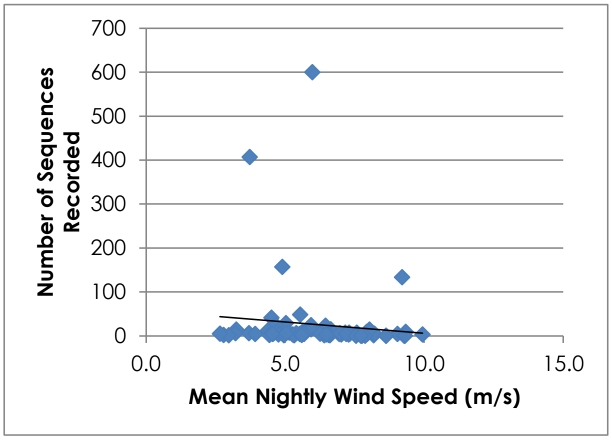


Figure 5-11. Nightly mean temperature (°C) (green line) and combined bat call sequence detections for detectors in 2013 (Tree, Met 1 High, and Met 1 Low; top graph) and detectors in 2014 (Met 1 High, Met 1 Low, Met 2 High, and Met 2 Low; bottom graph) Cassadaga Wind Project, 2013-2014



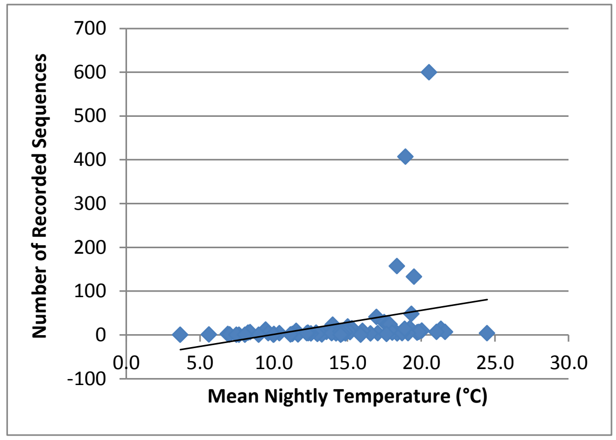
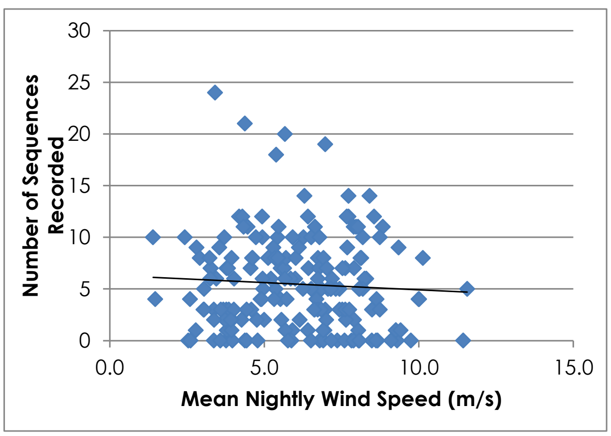


Figure 5-12. Nightly mean wind speed (left), and mean temperature (right) versus combined bat call sequence for detectors (Tree, Met 1 High, and Met 1 Low), Cassadaga Wind Project, Fall, 2013



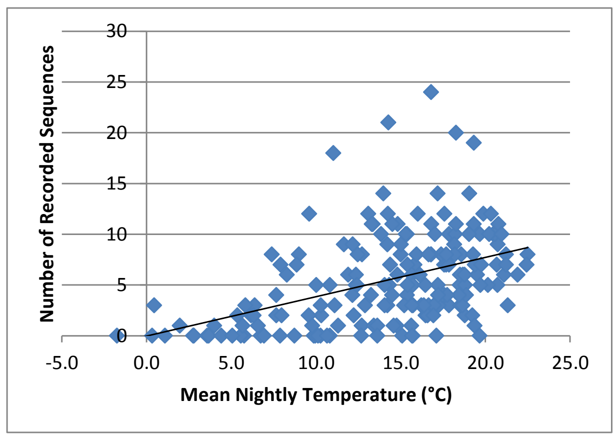


Figure 5-13. Nightly mean wind speed (left), and mean temperature (right) versus combined bat call sequence for detectors (Met 1 High, Met 1 Low, Met 2 High, and Met 2 Low), Cassadaga Wind Project, 2014

5.3 DISCUSSION

Overall activity was low throughout most of the survey period, with an overall detection rate of 3.3 calls/detector-night for all detectors combined. Overall activity was highest at the Met 1 Low detector (7.2 calls/detector-night) due to a disproportionately high number of calls between 16 August and 25 August 2013. Met 1 Low recorded 1,470 calls during this 10-day period, representing 83% of calls recorded by this detector throughout the entire survey period. The cause for this spike in activity is outside the scope of this survey, but since Met 1 High recorded only 16 calls during this same period and activity at Met 1 Low did not occur over the entire night (from 8:00 PM to 2:00 AM), we can infer that the activity in the vicinity of Met 1 Low was likely foraging, and not swarming. The call files at Met 1 Low were all very similar, visually, indicating that the activity was from the same species (either big brown bat or silver-haired bat).

It is possible that a single bat or a few bats made multiple passes by Met 1 Low while foraging. Acoustic data at the Project are fairly typical of passive acoustic bat survey data, where activity levels can be highly variable among detectors and nights sampled.

Well-known studies have found that bat activity patterns are influenced by weather conditions (Arnett et al. 2006, Arnett et al. 2008, Reynolds 2006). Acoustic surveys have documented a decrease in bat activity rates as wind speed increases and temperature decreases, and bat activity has been shown to correlate negatively to low nightly mean temperatures (Hayes 1997, Reynolds 2006). These patterns suggest that bats are more likely to migrate on nights with low wind speeds (less than 4–6 m/s) and generally warm temperatures. Several weather variables can individually affect bat activity, as does the interaction among variables (i.e., warm nights with low wind speeds). Despite the absence of a statistical correlation between the weather variables of wind speed and temperature and bat activity, overall bat activity appeared to be related to these weather variables at the Project. Seventy-three percent of bat activity occurred when mean nightly wind speeds were 6 m/s or less. Sixty-five percent of bat activity occurred when mean nightly temperatures were 18°C or above. On 21 August, when the greatest numbers of bat call sequences were recorded, mean wind speed was 6.0 m/s, and mean nightly temperature was 20.5°C. It should be noted that the number of call sequences recorded that night does not represent a significant number of sequences recorded across all detectors, as 99.8% of those call sequences (n = 599) were recorded by Met 1 Low.

Bat call sequences were identified to guild, although calls were provisionally categorized by species when possible during analysis. Certain species, such as the eastern red and hoary bat, have easily identifiable calls, whereas other species, such as the big brown bat and silver-haired bat, are difficult to distinguish acoustically. Similarly, species within the *Myotis* genus have very similar call characteristics, so Stantec did not make an attempt to differentiate call sequences within this genus. Detectors recorded only 39 *Myotis* calls sequences (1% of total calls recorded) during the 2013-2014 surveys. *Myotis* species have been particularly affected by white-nose syndrome (WNS) that has become widespread in the Northeast (Brooks 2011). *Myotis* are more commonly detected beneath canopy level (Arnett et al. 2006), and prior to WNS, *Myotis* call sequences often tended to dominate acoustic data collected from detectors deployed at canopy height (Brooks 2011). No pre-WNS acoustic data exists for the Project, making it difficult to determine whether these results represent a significant decline in *Myotis* activity levels from pre-WNS conditions.

Numbers of recorded bat call sequences cannot be correlated with the number of bats in an area because acoustic detectors cannot differentiate between individuals (Hayes 2000). Thus, results of acoustic surveys must be interpreted with caution. Methods surrounding acoustic bat surveys are continually evolving, and there is currently little data aiding in the interpretation of the number of calls/detector-nights. Results cannot be used to determine the number of bats and bat species inhabiting an area. Although interpretations are limited, the surveys represent a sample of activity and the general species groups that occur in the Project area. The timing of pulses of activity and species composition are similar to that observed at other proposed wind projects in New York and the Northeast.

6.0 Literature Cited

Arnett, E. B., J. P. Hayes, and M. M. P. Huso. 2006. An evaluation of the use of acoustic monitoring to predict bat fatality at a proposed wind facility in south central Pennsylvania. An annual report submitted to the Bats and Wind Energy Cooperative. Bat Conservation International. Austin, Texas, USA.

Arnett, E.B., W.K. Brown, W.P. Erickson, J.K. Fiedler, B.L. Hamilton, T.H. Henry, A. Jain, G.D. Johnson, J. Kerns, R.R. Koford, C.P. Nicholson, T.J. O'Connell, M.D. Piorkowski, and R.D. Takersley Jr. 2008. Patterns of bat fatalities at wind energy facilities in North America. Journal of Wildlife Management 72:61-78.

Brooks, R.T. 2011. Declines in summer bat activity in central New England 4 years following the initial detection of white-nose syndrome. Biodiversity Conservation 20: 2537-2541.

Dunne, P., D. Keller, and R. Kochenberger. 1984. Hawk Watch: A Guide for Beginners. Cape May Bird Observatory, Cape May, NJ. 2002 reprint.

HMANA (Hawk Migration Association of North America). 2014a. Hawkcount. Hawkwatch Site Profile - Hamburg. https://hawkcount.org/siteinfo.php?rsite=364. Accessed 1 October 2014.

HMANA. 2014b. Hawkcount. Hawkwatch Site Profile - Ripley. https://hawkcount.org/siteinfo.php?rsite=381. Accessed 1 October 2014.

Hayes, J. P. 1997. Temporal variation in activity of bats and the design of echolocation monitoring studies. Journal of Mammalogy 78:1-524.

Hayes, J.P. 2000. Assumptions and practical considerations in the design and interpretation of echolocation-monitoring studies. Acta Chiropterologica 2(2):225-236.

Kunz, T.H., E.B. Arnett, B.M. Cooper, W.P. Erickson, R.P. Larkin, T. Mabee, M.L. Morrison, M.D. Strickland, and J.M. Szewczak. 2007. Assessing impacts of wind-energy development on nocturnally active birds and bats: A guidance document. Journal of Wildlife Management 71:2449-2486.

NYNHP [New York Natural Heritage Program]. Letter response to Stantec dated 22 May 2014.

NYSDEC (New York State Department of Environmental Conservation). 2009. Guidelines for Conducting Bird and Bat Studies at Commercial Wind Energy Projects.

NYSDEC. 2014. List of endangered, threatened and special concern fish and wildlife species of New York State. http://www.dec.ny.gov/animals/7494.html.

O'Farrell, M.J., and W.L. Gannon. 1999. A comparison of acoustic versus capture techniques for the inventory of bats. Journal of Mammalogy 80(1):24–30.

O'Farrell, M.J., B.W. Miller, and W.L. Gannon. 1999. Qualitative identification of free-flying bats using the Anabat detector. Journal of Mammalogy 80(1):11–23.

Reynolds, D.S. 2006. Monitoring the potential impacts of a wind development site on bats in the Northeast. Journal of Wildlife Management 70(5):1219 – 1227.

Stantec Consulting Services Inc. 2013a. Cassadaga Wind Project — Habitat Assessment. Prepared for EverPower and NYSDEC.

Stantec Consulting Services Inc. 2013b. Work Plan for Avian and Bat Surveys. Prepared for EverPower Wind Holdings, Inc. June 2013 REV July 2013.

TRC. 2012. Cassadaga Wind Energy Project Critical Issues Analysis. Prepared for EverPower Wind Holdings, Inc. December.

USFWS (U.S. Fish and Wildlife Service)2012. U.S. Fish and Wildlife Service Land-Based Wind Energy Guidelines.

USFWS. 2013. Eagle Conservation Plan Guidance Module 1–Land-based Wind Energy Version 2.