Summer 2006 Indiana Bat Surveys at the Proposed Clayton Wind Project in Clayton, New York

Draft Report

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November 2006

Table of Contents

1.0 INTRODUCTION 1
2.0 METHODS 3
2.1 Study Site 3
2.2 Mist-netting 3
2.3 Radio Telemetry 5
3.0 RESULTS 5
3.1 Diurnal Roosts 6
3.2 Nocturnal activity 6
4.0 DISCUSSION 13
4.1 Diurnal roosts 13
4.2 Nocturnal activity 14
5.0 CONCLUSIONS AND RECOMMENDATIONS 15
6.0 LITERATURE CITED 16

List of Appendices

Appendix A Bat Trapping and Radio Telemetry Data Tables

List of Tables

Table 1 Summary of radio telemetry information for three Indiana bats (*Myotis sodalis*) actively radio tracked at the Clayton Wind Project, including foraging range fixed kernel estimate, MCP range estimate, maximum linear distance from roost, number of nights tracked, and number of telemetry locations.

Table 2 Habitats used by three *M. Sodalis* trapped and actively radio tracked during summer 2006 in Clayton, New York, using fixed kerneling and 95% minimum convex polygons.

Table 3 Habitats used by pooling foraging range estimates of three *M. Sodalis* trapped and actively radio tracked during summer 2006 in Clayton, New York, using fixed kerneling and 95% minimum convex polygons.

List of Figures

Figure 1 2005 Radio Telemetry Locations of Indiana Bats by NY DEC
Figure 2 Study Area and Trapping Area Location Map
Figure 3 Roost Site Locations for Tagged Indiana Bats in 2006
Figure 4 Foraging Range Estimates for Bat 5309 During 2006
Figure 5 Foraging Range Estimates for Bat 5311 During 2006
Figure 6 Foraging Range Estimates for Bat 5312 During 2006

1.0 Introduction

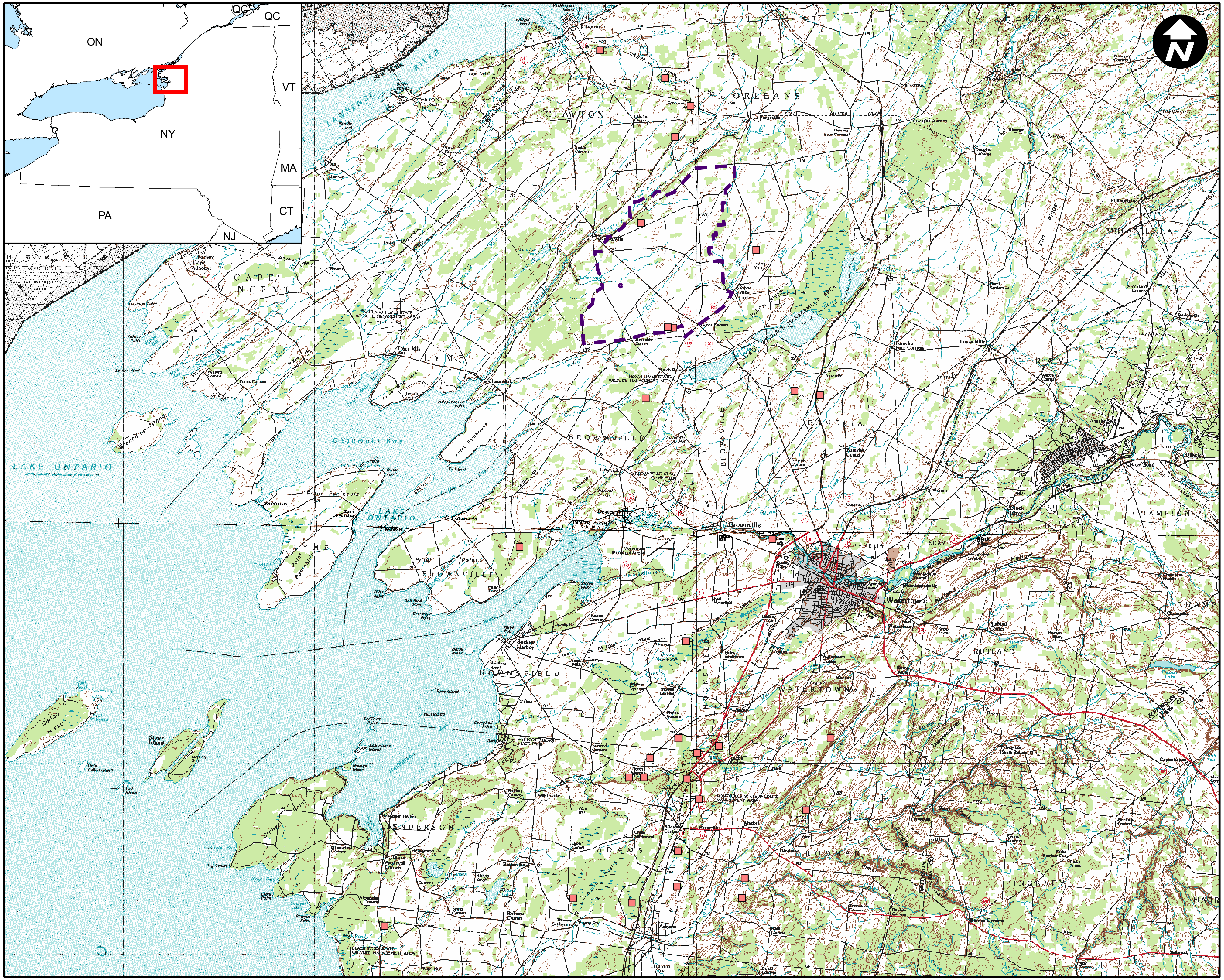
PPM Atlantic Renewable (PPM) has proposed the construction of a wind project to be located in Clayton, Orleans, and Brownville, in Jefferson County, New York. The project would include approximately 54 2.75-megawatt (MW) wind turbines that could generate up to 150 MW of power annually. Turbines would have a maximum height of approximately 150 meters (m) (492') and would be located predominantly in active agricultural fields being used for hay and crop production, as well as for pasturing.

The project area is located within the Eastern Ontario Plain ecozone of New York (Andrle and Carroll 1988). This is a relatively flat region with open grasslands, patches of woodlands, and active agricultural fields, with elevation ranging from approximately 76 m to 152 m (250' to 500'). Forest communities in the area are dominated by American elm (*Ulmus americana*), red maple (*Acer rubrum*), and northern hardwoods on soils of lake sediments that overlie limestone bedrock. The proximity of Lake Ontario helps moderate the local climate, which has resulted in the widespread development of agricultural land uses, predominantly dairying.

The Indiana bat (*Myotis sodalis*) is a state-listed and federally listed Endangered species. The population in New York State is among the largest in the Northeast, probably the fourth largest in the nation (Hicks 2005). There are 10 known hibernacula in the state, located in Albany (1), Essex (2), Jefferson (1), Onondaga (1), Ulster (4), and Warren (1) Counties (NYNHP 2006).

In 2005, the New York Department of Environmental Conservation (NYDEC) conducted a radio telemetry study of Indiana bats in the Jefferson County hibernaculum (Glens Falls Park Cave), which is located in Watertown. That work documented that most of the 28 radio-tagged Indiana bats flew south from Watertown following their exodus in mid-April until mid-May, when the battery life of their radio transmitters ended. However, that work documented that a number of bats flew north, including several individuals that traveled to and resided in and near the Clayton Wind Project area (Figure 1).

Based on these results, PPM undertook field investigations to further investigate Indiana bats within the Clayton Wind Project area. The goal of the investigations was to collect additional data on the habitat use, distribution, and duration of residency of Indiana bats within the project area for use in the assessment of the potential risk of the project to this species. The survey focused field effort on the forest stand within the project area that the most number of bats were found to be using in 2005. The survey consisted of mist-netting near and around 2005 and new 2006 roost trees and radio-tagging Indiana bats to document their daily roost trees, follow their movement to other portions of the project area, and examine patterns in their habitat use at night.



Clayton Windpower Project
Indiana Bat Survey

FIGURE 1 - 2005 Radio Telemetry Locations of Indiana Bats by NYDEC

Legend

2005 NYDEC Indiana Bat Roost Locations

Clayton Wind Power Project Area

Data Sources

2005 Indiana Bat Roost Locations provided by the New York Department of Environmental Conservation.

0 3 6 Miles

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2.0 Methods

2.1 Study Site

The study site was a forest stand located along Morris Track Road near the southeast corner of Clayton, New York (Figure 2). This stand was approximately 15.6 hectares in size and comprised of mixed-age hardwood trees with a significant component of large, mature and over-mature sugar maple (*Acer saccharum*), American elm, and black cherry (*Prunus serotina*).

The site was surrounded by large agricultural fields used predominantly for corn and hay production. Occasional hedgerows of trees and shrubs separated these fields. To the west, several parcels of old field habitat dominated by shrubs and low trees occurred. Species composition of these areas was variable and largely dependant on drainage. A similar old field parcel was located south of the site, which graded into a forested wetland associated with Horse Creek. Further south, mixed agriculture and wet forest patches extend to the Perch River Wildlife Management Area, located approximately 2.25 kilometers (km) away.

This site was found to be used by several female Indiana bats that were radio-tagged and tracked from the Glen Falls Park Cave in Watertown by the NYDEC in 2005. At least nine different roost trees were used by those bats by the time they left their hibernacula in late-April to mid-May. These roost tree locations were provided by the NYDEC to target early spring and summer 2006 mist-netting surveys.

2.2 Mist-netting

Mist-netting was conducted during four 1- to 3-week periods from late April to August 2006. Netting periods were April 21 to May 15, June 1 to June 15, July 6 to July 12, and July 22 to August 11. These periods were based on the known or suspected exodus of bats from the hibernacula, activity periods of the bats, and on-site observations of habituation of the bats to the mist nets.

Mist nets were 3 m by 6, 9, 12, and 16 m. The location of net sites varied but included areas of mixed trees and shrubs around the periphery of the forest stand, over ATV trails within the stand, and around roost trees documented and flagged during the 2005 NYDEC telemetry work and during the present study. The number of nets deployed each night was typically 6 to 8, though as many as 12 nets were deployed on some nights. Nets were deployed in a variety of configurations, including single, double-stacked, and triple-stacked nets.

Nets were set on nights of suitable weather, such as no precipitation, relatively calm ground wind conditions, and relatively mild temperatures (during the early part of the season). Nets were set prior to sunset and typically run until midnight (3 to 4 hours). Night vision goggles were used each night to investigate the overall level of bat activity in the area, which helped to determine when to curtail netting.

Nets were checked every 15 to 20 minutes. All bats caught were removed from the nets and identified. Information recorded for each bat included species, sex, age, reproductive status, forearm length, ear length, tragus length, thumb length, and weight. All Indiana bats were fitted with a lipped aluminum wind band supplied by the NYDEC. Each bat that was large enough ($\geq$ 6 g) was also fitted with a 0.35-gram radio-transmitter (ATS- Model A2415). Each transmitter had its own unique frequency ranging from 151.000 to 151.999 MHZ. Transmitters were attached by trimming a small patch of fur in the midscapular area and gluing the transmitter in place using Torbot bonding cement. Following the attachment of the transmitter, each bat was retained in a fleece bag for approximately 30 minutes to allow the glue to dry adequately. All bats were released successfully and in good condition.

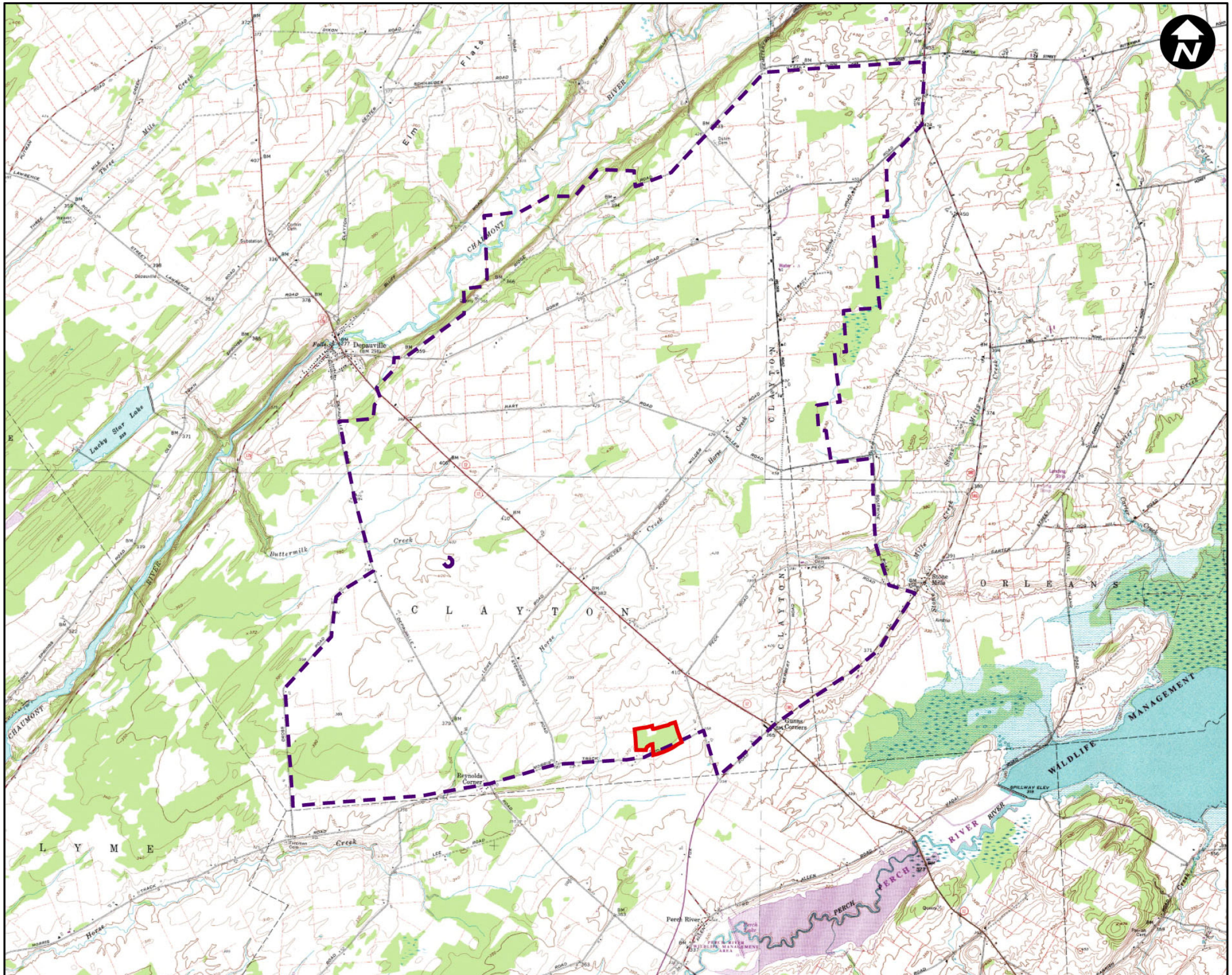

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FIGURE 2 - Study Area and Trapping Area Location Map

Legend

- Indiana Bat Trapping Area
- Clayton Wind Power Project Area

0 4,000 8,000 Feet

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2.3 Radio Telemetry

Tagged bats were located each morning using a Communication Specialists model R1000 receiver. A standard Yagi antenna and a Telonics three-element antenna were used to find and record the roost tree location and foraging range location. Additionally, during mist-netting, bearings to tagged bats were occasionally made to determine the general direction from the roost trees that bats were flying. Lotek auto data loggers with omni-directional whip antennas were placed in fields north of the netting area, the direction in which the majority of the Clayton Wind Project area lies. The auto loggers were placed near the middle of fields and were programmed to scan for the active transmitter frequencies for the nights they were deployed. The sensitivity was adjusted so that they would detect transmitters only within approximately 400 m in order to determine if tagged bats were readily crossing open fields.

Near the end of the season, radio-tagged bats with live transmitters were actively tracked by multiple hand-held receivers to document more specific movements of individual bats. Tracking was conducted largely from roadways and other accessible areas (some farm field roads). Bats were located three to four times an hour, when possible, and both the bearing to the bat and the trackers location were recorded. The actual locations of bats were estimated using multiazimuth triangulations of the recorded tracker locations and bearings to bats. These telemetry azimuths were then converted into point data. Triangulation error was calculated and estimated to be 286 m.

Estimated locations of Indiana bats were used to develop 95 and 50 percent fixed kernel foraging range estimates with the least squares cross validation smoothing factor (h) of 40, as well as a 95 percent minimum convex polygon (MCP). The 95 percent fixed kernel contour uses the majority of telemetry locations and a smoothing parameter to obtain an area estimate around each point location. The 50 percent estimate uses concentrations of telemetry locations to identify the core areas used by individual bats. These estimates offer a more in-depth look at how bats spatially use foraging areas. A 95 percent MCP was also created to show the area bounded by the furthest telemetry locations. The MCP connects a line from the bounding radio telemetry locations to form a foraging range estimate of the enclosed area. The animal movement extension (Hooge *et al.* 1999, Worton 1989) in ArcGIS 9.1 was used for analysis for all radio-marked Indiana bats with sufficient telemetry locations. All bats used in the foraging analysis had greater than 63 locations.

A coarse scale habitat analysis was conducted to evaluate habitat use and area used for each foraging bat. Foraging range estimates (ha) of the bats locations were overlaid and digitally clipped to a landcover map. A digital landcover map was created using color aerial photos and field observations to classify habitats into six categories: active agriculture; early successional; forested; open water; other-low density development; and roads. The amount of each habitat type within a bat's foraging range was estimated using clipping tools in ArcGIS 9.1. Further, each roost tree was surrounded by a 3-km buffer (the farthest distance flown by any one bat). The habitat type within this buffer area was treated as available habitat and individual bats were considered independent sampling units.

3.0 Results

Mist-netting was conducted on a total of 46 nights. This included a total of approximately 1,018 net-hours of effort during which a total of 56 captures were made with a capture rate of 0.06 captures per net per hour (Appendix A, Table 1). Indiana bats were the most commonly captured species (17 captures), followed by big brown bats (*Eptesicus fuscus*, 15 captures), northern long-eared bats (*Myotis septentrionalis*, 12 captures), and little brown bats (*Myotis lucifugus*, 9 captures). Two eastern red bats (*Lasiurus borealis*) were captured and one bat escaped prior to identification.

The first bat capture occurred at the end of April, though no Indiana bats were captured until the night of June 2, when four individuals were netted. Captures of all species decreased near the end of July and ceased altogether at the beginning of August despite increased effort in mist-netting. Visual observations during this time noted less bat activity at roost trees and around the periphery of the study site.

A total of 17 Indiana bat captures occurred during mist-netting. Three of these captures were animals that were previously captured and tagged, resulting in a total of 14 unique individuals, including 4 males and 10 females. Seven of the females were pregnant, two were non-lactating, and one was lactating. Thirteen of the 14 individual Indiana bats captured were fitted with radio transmitters (Appendix A, Table 2). All Indiana bats (females and males) caught through mid-June were adult bats, while three of the four caught in July were sub-adult.

From the 14 Indiana bats tagged, the number of days the bats were relocated ranged from 1 to 15 days and averaged 7.5 days. Once a bat could no longer be tracked to the study site, searchers drove roads throughout the project area to search for the transmitter pulse and determine if animals were using roost sites in new forest stands.

3.1 Diurnal Roosts

All tagged bats were tracked to their respective roost trees using homing telemetry techniques (Figure 3). Seventeen roost trees were found within the study site. Some trends were noted for roost tree selection. Males and females generally had separate roost trees (i.e., maternity roosts); however, on two occasions a male was found roosting in a tree with one to several females. Females tended to cluster at two roost locations, one on the eastern and one on the western ends of the hardwood stand, with individual trees used for more consecutive days. Two trees were used as maternity roost sites.

Male roosts sites were spaced throughout the forested stand and males showed less tendency or fidelity to a particular roost. One individual male (5304) spent five days at one roost tree and six days at five different roost trees. However, in general males spent fewer days in individual trees and moved their diurnal roost location from day to day more frequently than females. Some of the diurnal roosts used in 2006 were the same as in the 2005 NYDEC telemetry study, though some of those 2005 sites that were netted did not result in any bat captures.

As indicated above, bats were relocated for periods of 1 to 15 days. Searches for bats that could no longer be found in the study site yielded no re-locations of animals in other forest stands. This is despite searches from roads and farm fields throughout the project area. These lost bats dispersed from the project area, roosted in forest stands too far from roads and fields to be detected by the telemetry receiver, or had transmitter batteries that died.

3.2 Nocturnal activity

Active radio-tracking (near the end of the survey period) was conducted on three bats (5309, 5311, and 5312) captured and radio-tagged at the end of July. These bats were radio-tracked nightly for 7 to 12 days until the end of transmitter life or dispersal from the project (Table 1). Nightly activity patterns have been summarized using only active radio-telemetry data collected through homing and multiazimuth triangulations for the analysis. The auto data loggers used within the project area did not provide results at the scale necessary for identifying bat locations within specific habitats and were not used in the analysis. Specifically the sensitivity of these units, combined with regular radio interference (perhaps from Fort Drum) could not be turned down far enough to limit detections to suitably close ranges.

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FIGURE 3 - Roost Site Locations for Tagged Indiana Bats in 2006

Legend

Male Roost Location
- 5304
- 5312
- 5399

Female Roost Location
- 5303
- 5305
- 5307
- 5309
- 5311
- 5398
- 5400

Maternity Roost

Indiana Bat Study Site

0 300 600 Feet

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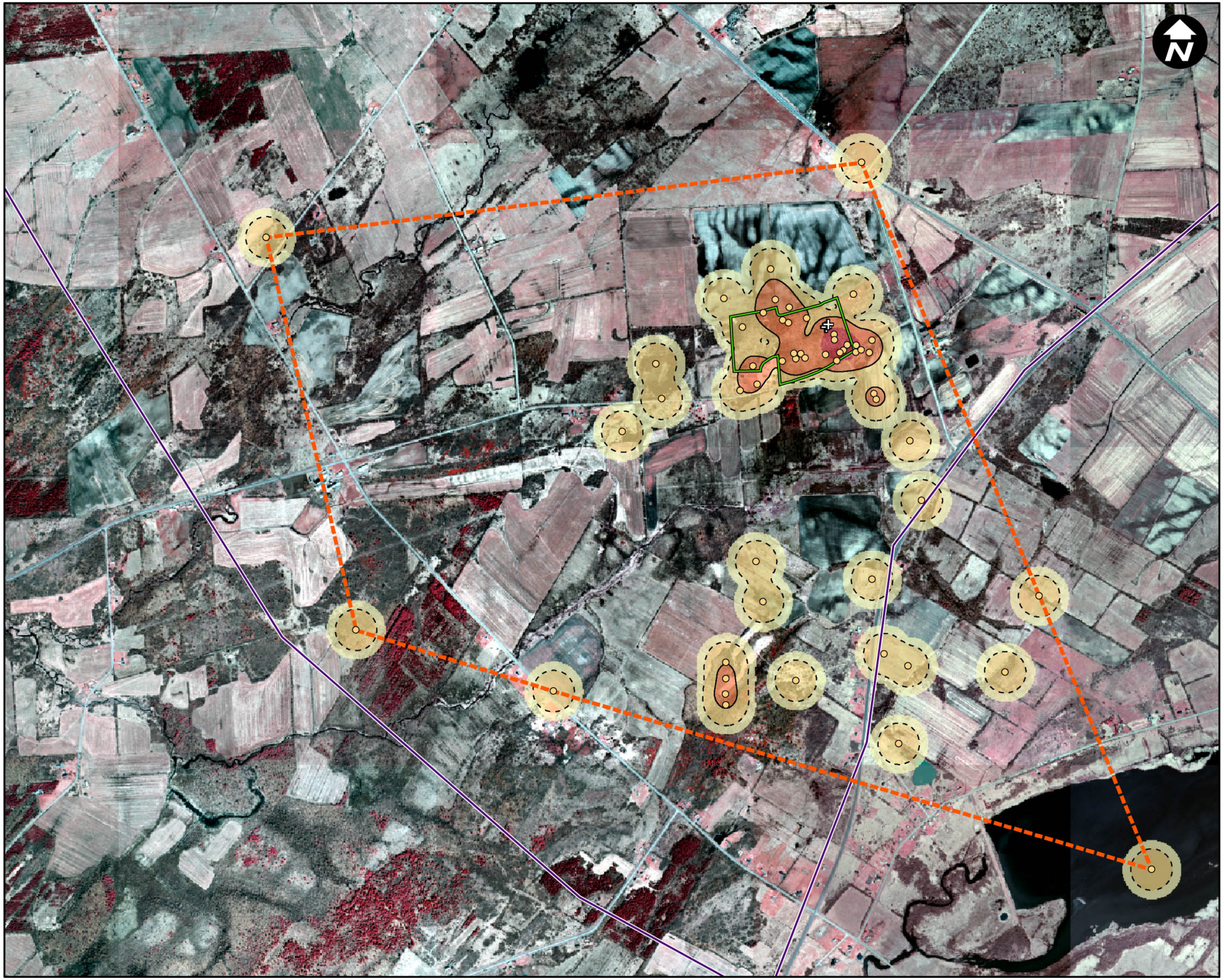
Table 1. Summary of radio telemetry information for three Indiana bats (*Myotis sodalis*) actively radio tracked at the Clayton Wind Project, including foraging range fixed kernel estimate, MCP range estimate, maximum linear distance from roost, number of nights tracked, and number of telemetry locations.

Bat ID and sex	95% Kernel (ha)	50% Core (ha)	MCP foraging range (ha)	Maximum distance (km)	Number of nights tracked	Number of locations
5309- F	107.9	19.4	821.5	2.99	7	64
5311- F	51.1	9.7	64.7	0.92	10	63
5312- M	163.7	33.9	534.0	2.75	12	92
Average	107.6	21.0	473.4	2.22	9.7	73

Bat 5309, a sub-adult female Indiana bat, was captured on July 24 and radio-tracked for 7 days until its last location on July 31. Bat 5309 had a fixed kernel foraging range size of 107.9 ha and a core area range of 19.4 ha (Table 1). Using an MCP estimate, foraging size was 821.5 ha (Figure 4). The average nightly distance traveled from roost tree to radio-telemetry locations was 801 m and ranged from 186 to 1,373 m. The maximum distance traveled from roost tree was 2,989 m. This bat used forested habitat 50 percent of the time, even though active agriculture landscapes were proportionally more available (Table 2).

Bat 5311, an adult female Indiana bat, was captured on July 26 and radio-tracked for 10 days until its last location on August 5. Bat 5311 had a fixed kernel 95 percent foraging range of 51.1 ha and a 50 percent core area of 9.7 ha. Using an MCP estimate, foraging size was 64.7 ha (Figure 5). The average nightly distance traveled from roost to radio-telemetry locations was 326 m and ranged from 223 to 1,373 m. The maximum distance traveled from roost tree was 917 m. Bat 5311 used forested habitat (58.7%) in a much greater proportion than other habitats available (Table 2) and used the study site and immediate vicinity much more frequently than the other bats tracked.

Bat 5312, a sub-adult male Indiana bat, was captured on July 27 and radio-tracked for 12 days until its last location on August 9. Bat 5312 had a fixed kernel 95 percent foraging range of 163.7 ha and a 50 percent core area of 33.9 ha. Using an MCP estimate, foraging range size was 534 ha (Figure 6). The average nightly distance traveled from roost to radio-telemetry locations was 1,077 m and ranged from 355 to 1,899 m. The maximum distance traveled from roost tree was 2,747 m. Bat 5312 did use active agricultural landscapes (41.3%) slightly more than forested areas (40.2%; Table 2), though use of agricultural areas was slightly less than the availability of that habitat and use of forested habitat was approximately twice its availability.



Clayton Windpower Project
Indiana Bat Survey

FIGURE 4 - Foraging Range Estimates for Bat 5309 during 2006

Legend

- Bat 5309
- Roost Location

Bat 5309 Density

- Low Density
- High Density
- 50% Volume Contour (19.4 Ha.)
- 95% Volume Contour (107.9 Ha.)
- MCP 5309 (821.5 Ha.)
- Indiana Bat Study Site
- Clayton Wind Power Project Area

0 1,500 3,000 Feet

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Indiana Bat Survey

FIGURE 5 - Foraging Range Estimates for Bat 5311 during 2006

Legend

Bat 5311

Roost Location

Bat 5311 Density

Low Density

High Density

50% Volume Contour (9.7 Ha.)

95% Volume Contour (51.1 Ha.)

MCP 5311 (64.7 Ha.)

Indiana Bat Study Site

Clayton Wind Power Project Area

0 1,000 2,000 Feet

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Clayton Windpower Project
Indiana Bat Survey

FIGURE 6 - Foraging Range Estimates for Bat 5312 during 2006

Legend

- Bat 5312
- Roost Location

Bat 5312 Density

- Low Density
- High Density
- 50% Volume Contour (33.9 Ha.)
- 95% Volume Contour (163.7 Ha.)
- MCP 5312 (534.0 Ha.)
- Indiana Bat Study Site
- Clayton Wind Power Project Area

0 1,500 3,000 Feet

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Table 2. Habitats used by three *M. Sodalis* trapped and actively radio tracked during summer 2006 in Clayton, New York using fixed kerneling and 95% minimum convex polygons.

	Kernel		MCP		Number of locations	% of time
	Ha	%	Ha	%		
Bat ID- 5309						
Active Agriculture	57.9	53.7%	482.2	58.8%	26	40.6%
Early Successional	7.7	7.1%	146.7	17.9%	3	4.7%
Forested	31.4	29.1%	135.6	16.5%	32	50.0%
Open Water	3.0	2.8%	17.7	2.2%	1	1.6%
Other- Low Density Development	5.0	4.7%	25.4	3.1%	2	3.1%
Road	2.8	2.6%	12.6	1.5%	0	0.0%
Total	**107.8**		**820.2**		**64**	
Bat ID-5311						
Active Agriculture	19.8	38.8%	31.2	48.3%	12	19.0%
Early Successional	7.9	15.4%	5.5	8.6%	12	19.0%
Forested	18.0	35.3%	21.9	33.9%	37	58.7%
Open Water	0.0	0.0%	0.0	0.0%	0	0.0%
Other- Low Density Development	4.2	8.2%	4.7	7.3%	2	3.2%
Road	1.2	2.3%	1.2	1.9%	0	0.0%
Total	**51.0**		**64.6**		**63**	
Bat ID- 5312						
Active Agriculture	75.4	46.1%	256.5	48.1%	38	41.3%
Early Successional	36.8	22.5%	150.8	28.3%	14	15.2%
Forested	42.6	26.1%	103.7	19.5%	37	40.2%
Open Water	0.0	0.0%	0.0	0.0%	0	0.0%
Other- Low Density Development	5.8	3.5%	14.8	2.8%	3	3.3%
Road	0.0	1.8%	7.3	1.4%	0	0.0%
Total	**160.6**		**533.1**		**92**	

When telemetry locations for all three tagged bats were pooled together, a foraging kernel estimate of 220.0 ha and MCP estimate of 976.2 ha was generated. As a whole, Indiana bats used forested landscapes more frequently than any other habitat type (Table 3). Forested landscapes only comprised between 10 and 18 percent of the total foraging range, but Indiana bats were located there 48.4 percent of the time. Active agriculture landscapes were used 35 percent of the time, but consisted of 20 to 55 percent of the foraging area. Early successional, open water, roads, and other-low density development landscapes were used substantially less.

Table 3. Habitats used by pooling foraging range estimates of three *M. Sodalis* trapped and actively radio tracked during summer 2006 in Clayton, New York using fixed kerneling and 95% minimum convex polygons.

	Ha	% of habitat	Number of locations	% of time
Kernel (*n* = 3)				
Active Agriculture	111.2	20.3%	76	34.7%
Early Successional	40.7	7.4%	29	13.2%
Forested	54.0	9.9%	106	48.4%
Open Water	2.4	0.4%	1	0.5%
Other - Low Density Development	8.3	1.5%	7	3.2%
Road	4.4	0.8%	0	0.0%
Total	**220.9**		**219**	
MCP (*n* = 3)				
Active Agriculture	532.4	54.5%	76	34.7%
Early Successional	200.7	20.6%	29	13.2%
Forested	173.4	17.8%	106	48.4%
Open Water	20.4	2.1%	1	0.5%
Other - Low Density Development	33.7	3.5%	7	3.2%
Road	15.6	1.6%	0	0.0%
Total	**976.2**		**219**	

4.0 Discussion

A total of approximately 1,018 net-hours were spent to capture 56 bats from 5 different species. Trapping began on April 21 and the first bat was trapped on April 30. Indiana bats and big brown bats were the most common species trapped. Fewer bats were captured than expected, based on the fact that 3 of 28 Indiana bats out of a wintering population in the hundreds were tracked from their hibernacula (in 2005 by NYDEC) not only to the project area but to the forest stand studied in 2006. The survey results indicate that forested stands intermixed in this landscape mosaic of agriculture, old field, and grassland are of high importance to these bats, which is a generally accepted characteristic of their natural history (Rommé *et al*. 1995, USFWS 1999).

4.1 Diurnal roosts

During the summer months, Indiana bats roost in trees and forage for flying insects in primarily riparian and upland forests. Tracking of these individuals did not yield new roost areas, although 17 roost trees were used by tagged bats over the course of the survey periods. All roost sites were located in a forested stand of hardwoods. This data is consistent with other studies (Carter *et al*. 2002).

This study documented Indiana bats using the same roosting area from year to year, a sign of roost fidelity (Gumbert *et al*. 2002). This does not mean they didn't move, but that they moved far enough away (out of our search area) or too deep into forest stands (i.e., too far from roads, deep into tree cavities) to detect them (greater than 1 to 1.5 km) with the radio receivers. Daily locations did not yield movements to other forest stands to roost; however, it is likely that other stands are probably used. Bats likely find new roost sites during foraging activities or when moving from roost areas to foraging areas (Kurta *et al.* 2002).

Telemetry documented that females formed maternity colonies under the exfoliating bark of live, dead, or dying trees. Reproductive and pregnant females were captured through mid-June and bats captured near the end of July were either lactating or non-reproductive. Some bats, mostly males, used multiple diurnal roosts. Two maternity roosts were documented and some bats switched roosts, which coincides with other research on Indiana bat colonies documenting multiple roost sites per colony and switching behavior (Brack 2006, Kurta *et al.* 2002). On July 28, four tagged bats (three females and one male) roosted in the same tree. Some bats did roost there for more consecutive days than others.

Exodus counts at roost trees were made periodically through the season with night vision equipment and typically documented one to only several individual bats. In no instance were more than 10 individuals observed exiting a roost tree. Visual observations at roost trees surrounded by mist nets documented several times that Indiana bats and northern long-eared bats used the same roost trees.

4.2 Nocturnal activity

In general, radio-tracked bats used foraging areas near their respective roost sites. Each bats' core area was in the general vicinity of their respective roost trees. Average distance from diurnal roost to foraging grounds ranged from 186 m to 1899 m, with a maximum distance of almost 3 km. The average foraging range size was approximately 107 ha (MCP = 473 ha). This is generally consistent with other published ranges and flight distances for this species. For example, Menzel *et al.* (2005) documented a mean home range size (95% kernel) of 145 ha for both sexes in Illinois, with female home ranges being slightly larger (161 ha) than male home ranges (115 ha). In Missouri, Rommé *et al.* (1995) documented a mean spring home range of 208 ha, with male home ranges (255 ha) more than twice the size of female home ranges (113 ha), though their method of determining home range was slightly different than most reported ranges.

Butchkoski and Hassinger (2002) documented foraging ranges of 39 to 112 ha in west-central Pennsylvania. Sparks *et al.* (2005) documented an average nightly flight distance from roosts of 3.02 km, with a range of 0.51 to 7.4 km. In general the foraging ranges and nightly dispersal distances at Clayton were comparable to other similar studies in the region and across its range.

Re-located bats were typically south, west, and in the immediate vicinity of their respective roost sites. The area to the south where most bats were tracked was predominantly wetland and consisted of forested and shrub wetlands and reverting old fields associated with Horse Creek and the Perch River Wildlife Management Area. The area to the north of the study site was mostly grasslands and active agricultural fields, which are generally less suitable habitat for Indiana bats. However, some telemetry locations fell within active fields.

Habitat use was generally consistent with other published habitat use studies (Rommé *et al.* 1995, USFWS 1999, Menzel *et al*. 2005, Brack 2006). Indiana bats foraged more frequently in forested environments (106 of 219 telemetry locations) than in active agricultural landscapes, although open landscapes such as grasslands, agricultural, and old fields dominate the project study area. One bat (5312) foraged in agricultural landscapes slightly more than forested areas. Woodlands with open canopies, which are present in the project area, provide a greater foliage area for foraging Indiana bats (Brack 2006). Canopy openings may also provide a greater number of insects (Tibbels and Kurta 2003).

The total residency period for bats in the study site was shorter than expected. The first Indiana bat was trapped on June 2 (although a gap in netting activities indicates that bats could have been present in late-

May) and the last radio telemetry location occurred on August 9. After July 31, capture rates significantly decreased. The decrease in capture rates indicates possible movement to the vicinity of hibernacula (off-site) for swarming and pre-hibernation activities. If the observed activity at the study site is consistent across the Clayton Wind Project area, then this could indicate that the duration of the presence of this species in the project area is relatively short, though that activity time (summer pup-rearing) is a critical time period. A shorter than expected residency in the project area may help to reduce the potential risk of the proposed project on the species, as a shorter residency results in overall less exposure to proposed wind turbines then a longer residency period.

5.0 Conclusions and Recommendations

Indiana bats used forest field edges, forested wetlands, and agricultural mosaics of old fields to grasslands during foraging and roosting events during the summer 2006 reproductive season. Despite movements between daytime roost trees, tagged bats were not tracked to roost trees within any other forest stands within the Clayton Wind Project area. Indiana bats showed roost site fidelity and returned to the same roosting area during summers of 2005 and 2006.

The home range size and apparent habitat use documented during the study was generally very consistent with patterns documented by other researchers. In general, Indiana bat habitat use was most commonly associated with presumed high productive foraging habitat, which included upland forest, wet forests, and open-canopied old fields. Nightly foraging areas used typically included a water body, most commonly Horse Creek. While bats were tracked up to 7 km away from their roost tree on any given night, nightly dispersal was typically much less than that and nightly use was much more common in the immediate vicinity of the study site.

The results of this field survey provide important information on the potential use of the project area by Indiana bats and some insight into the potential risk of the project to these bats. Additionally, this information can be used during the ongoing design phase of the project. Because the patterns in habitat use observed in the project area are consistent with other published surveys, that other survey data can be used to strengthen any conclusions or assessments of use of the project area by this species. Based on this, it is likely that upland forest stands with large-diameter mature trees within the project area provide potential summer roosting habitat, including maternity roosts, for this species.

Dispersal and habitat use around potential roost sites is likely to be limited to the closest areas of suitable foraging habitat. This includes upland and wetland forests along low-gradient streams and creeks. Old field habitat near these areas is likely to be used as well, depending upon the vegetation structure and open agricultural fields will likely be used much less than their availability (percent occurrence in home range) to these bats.

The results of the survey are encouraging, as it appears that patterns in habitat use and distribution of this species documented here, and in other parts of its range, may help define a potential level of risk of the proposed project to this colony of bats. A range of additional investigations could be conducted at the site and these options should be discussed with the NYDEC. Possible investigations or assessments include, but are not limited to, a project-wide habitat assessment of the project area to identify and quantify high quality habitat for this species, investigations of apparently high quality roost sites throughout the project area for the presence of this species, further investigations of habitat use or flight characteristics (flight heights) in the project area, and integration of any applicable or useful information from post-construction studies at the nearby Maple Ridge wind farm into an assessment of collision risks within the Clayton Wind Project area.

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Appendix A

Bat Trapping and Radio Telemetry Data Tables

Appendix A Table 1. Summary of mist netting results of bats at Clayton Wind Farm, New York during the spring and summer of 2006.

Date	Number of Nets	Number of Hours	Net-hours	Big brown bat	Indiana bat	Little brown bat	N. long-eared bat	Eastern red bat	Unknown	Total	Captures/ net-hour
21-Apr	3	2.5	7.5							0	0.00
23-Apr	3	3.25	9.75							0	0.00
27-Apr	4	3	12							0	0.00
28-Apr	4	3	12							0	0.00
29-Apr	4	3	12							0	0.00
30-Apr	6	2	12	1						1	0.08
1-May	6	2.5	15							0	0.00
2-May	6	3.25	19.5							0	0.00
4-May	6	4	24							0	0.00
5-May	6	1.5	9				1			1	0.11
8-May	6	4.5	27				1			1	0.04
10-May	6	3.5	21	1						1	0.05
13-May	6	4	24				1		1	2	0.08
15-May	6	1.5	9			2	3			5	0.56
1-Jun	6	3.3	19.8				1			1	0.05
2-Jun	6	3.75	22.5		4		1			5	0.22
4-Jun	6	4	24			1	1			2	0.08
6-Jun	6	3.5	21			1	1			2	0.10
7-Jun	6	3.5	21		2					2	0.10
8-Jun	6	3.5	21		1					1	0.05
12-Jun	6	3.5	21		2					2	0.10
13-Jun	6	3.5	21		1	1				2	0.10
14-Jun	6	4	24		1					1	0.04
15-Jun	6	3.3	19.8		1					1	0.05
6-Jul	4	3.25	13							0	0.00
7-Jul	4	3	12							0	0.00
8-Jul	4	3.25	13							0	0.00
10-Jul	6	3.25	19.5				1			1	0.05
11-Jul	6	3.25	19.5							0	0.00
12-Jul	6	3.5	21							0	0.00
22-Jul	6	3.3	19.8	1						1	0.05
23-Jul	6	3.3	19.8	1						1	0.05
24-Jul	7	3.3	23.1	4	1					5	0.22
25-Jul	7	3.3	23.1	1	1			1		3	0.13
26-Jul	8	4	32		1					1	0.03
27-Jul	10	4	40		1		1			2	0.05
28-Jul	12	4	48	3		1				4	0.08
29-Jul	11	3.3	36.3			1				1	0.03
30-Jul	12	3.3	39.6	2	1	2		1		6	0.15
31-Jul	12	3.3	39.6	1						1	0.03
1-Aug	8	3.3	26.4							0	0.00
7-Aug	8	4	32							0	0.00
8-Aug	8	3.3	26.4							0	0.00
9-Aug	8	3.3	26.4							0	0.00
10-Aug	8	3.3	26.4							0	0.00
11-Aug	8	4	32							0	0.00
Total	**301**	**153.15**	**1017.75**	**15**	**17**	**9**	**12**	**2**	**1**	**56**	**0.06**

Appendix A Table 2. Morphometrics of Indiana bats trapped at Clayton Wind Farm in New York during spring and summer 2006.

Species	Sex	Reproductive Status	Age	FA (mm)	Thumb (mm)	Ear (mm)	Tragus (mm)	Weight (g)	Time Captured	Date Captured	Wingband number	Transmitter frequency	Number of days radiotracked
Myotis sodalis	F	Pregnant	Adult	37	5	11	6	7.5	2050	6/2/2006	5305	150.271	12
Myotis sodalis	M	Non-reproductive	Adult	35	5	10	5	6	2050	6/2/2006	5304	150.543	12
Myotis sodalis	F	Pregnant	Adult	37	5	10	4	8	2050	6/2/2006	5303	150.421	12
Myotis sodalis	M	Non-reproductive	Adult	39	5	11	5	7	2050	6/2/2006	5306	150.754	1
Myotis sodalis	F	Pregnant	Adult	38	5	11	5	8.5	2130	6/7/2006	5400	150.361	15
Myotis sodalis	M	Non-reproductive	Adult	39	5	11	4	7.5	2330	6/7/2006	5399	150.573	7
Myotis sodalis	F	Pregnant	Adult	38	5	11	5	8.5	2115	6/8/2006	5398	150.691	6
Myotis sodalis	F	Pregnant	Adult	38	5	11	5	9	2050	6/12/2006	5397	150.122	1
Myotis sodalis	F	Pregnant	Adult	Recap	Recap	Recap	Recap	Recap	2050	6/12/2006	5398 *	150.691	6
Myotis sodalis	F	Pregnant	Adult	39	5	11	6	8.5	2050	6/13/2006	5307	150.092	1
Myotis sodalis	F	Pregnant	Adult	Recap	Recap	Recap	Recap	Recap	2100	6/14/2006	5305 *	150.243	12
Myotis sodalis	F	Pregnant	Adult	37	5	11	5	9	2110	6/15/2006	5308	150.334	1
Myotis sodalis	F	Non-lactating	Sub-adult	35.3	5.4	10.3	5	6	2135	7/24/2006	5309	150.153	7
Myotis sodalis	F	Non-lactating	Sub-adult	35	5	10	4	5	2110	7/25/2006	5310	Not tagged	Not tagged
Myotis sodalis	F	Lactating	Adult	39	6	10	4	7	2145	7/26/2006	5311	150.302	10
Myotis sodalis	M	Non-reproductive	Sub-adult	35.3	5.4	10.1	5	6	2105	7/27/2006	5312	150.454	12
Myotis sodalis	F	Lactating	Adult	Recap	Recap	Recap	Recap	Recap	2145	7/30/2006	5311 **	150.302	10

* Bats were recaptured and a new radio-transmitter attached.
** Bat recaptured on July 30th but was not outfitted with a new transmitter.