

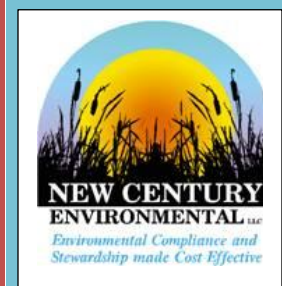
FAGEN, INC.

GRANITE FALLS, MINNESOTA

# Palmer's Creek Wind Farm

## Acoustic Bat Summary Report

2017



NEW CENTURY ENVIRONMENTAL LLC, COLUMBUS, NE

## Table of Contents

Executive Summary .....	3
Introduction.....	4
Study Area .....	4
Methods .....	6
Results .....	7
Discussion .....	10
References .....	11
Appendix.....	12
Summary Graphs .....	12
Kaleidoscope Data .....	14
Species Descriptions .....	17

## List of figures

**Figure 1:** Vicinity map of study area.

**Figure 2:** Project map with bat monitor locations

**Figure 3:** Summary of species diversity and abundance, monitor 1

**Figure 4:** Summary of species diversity and abundance, monitor 2

**Figure 5:** Summary of species diversity and abundance, monitor 3

**Figure 6:** Summary of species diversity and abundance, monitor 4

**Figure 7:** Summary of species diversity and abundance, monitor 5

**Figure 8:** Minnesota bat species and federal/state status.

**Palmer's Creek WRA Acoustic Bat Monitoring Study**  
**Fagen, Inc.**  
**Granite Falls, Minnesota**

Prepared By  
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**Executive Summary**

In early summer of 2016, Mike Rutledge of Fagen Engineering contacted Mike Gutzmer of New Century Environmental, LLC (NCE) to aid in the effort of completing a bat report that would capture the diversity/abundance of bat species within the study area of Palmer's Creek to meet due diligence with regulatory agencies, which was done through acoustic monitoring. The client proposed to develop a wind farm within the study area of Chippewa County, Minnesota (just north across the Minnesota River from Granite Falls). The study area lies within the Des Moines Lobe Western Corn Belt Plains (47b) ecoregion of Minnesota. Staff of Fagen Engineering deployed five separate ANABAT systems to record bat activity throughout the study area, the first deployment was done with two of the ANABAT recorders during the fall of 2015 and continued through 15 October 2016. Three more ANABAT recorders were launched on 03 August, 2016. The data collected from Fagen Engineering was sent to NCE via Procore Portal. NCE then took the data and processed in zero-crossing through Kaleidoscope version 3.1.8 to confirm presence diversity and abundance of bat species. The software uses a presence/absent indicator by giving each species of bat a p-value. The lower the p-value, the more likely the species of bat is present. Bat presence, in the form of vocalization, was detected, identified by species, and catalogued, thereby allowing us to estimate species occurrences, distribution and relative abundance.

## Introduction

In early summer of 2016, Mike Rutledge of Fagen Engineering, LLC contacted Mike Gutzmer of New Century Environmental, LLC (NCE) to aid in the effort of completing a bat report that would capture the diversity/abundance of bat species within the study area of Palmer's Creek to meet due diligence with regulatory agencies. The client proposed to develop a wind farm in Chippewa County, Minnesota (just north across the Minnesota River from Granite Falls). Bat fatalities result from wind turbine strikes as they feed on insects at night. The heat from the wind turbines attract insects and therefore bring the bats close to the wind turbine. With decreasing bat populations, the gathering of necessary bat data is crucial for this proposed site. Threatened and Endangered bat species become at risk in wind farm areas. Populations of bat species are experiencing long-term declines, due in part to habitat loss and fragmentation, invasive species, and numerous anthropogenic impacts, increasing the concern over the potential effects of energy development. All studies of bat impacts have demonstrated that fatalities peak in late summer and early fall, coinciding with the migration of many species (Johnson 2005; Kunz et al. 2007a; Arnett et al. 2008). A smaller spike in bat fatalities occurs during spring migration for some species at some facilities (Arnett et al. 2008). However, the seasonal fatality peaks noted above may change as more facilities are developed and studied.

## Study Area

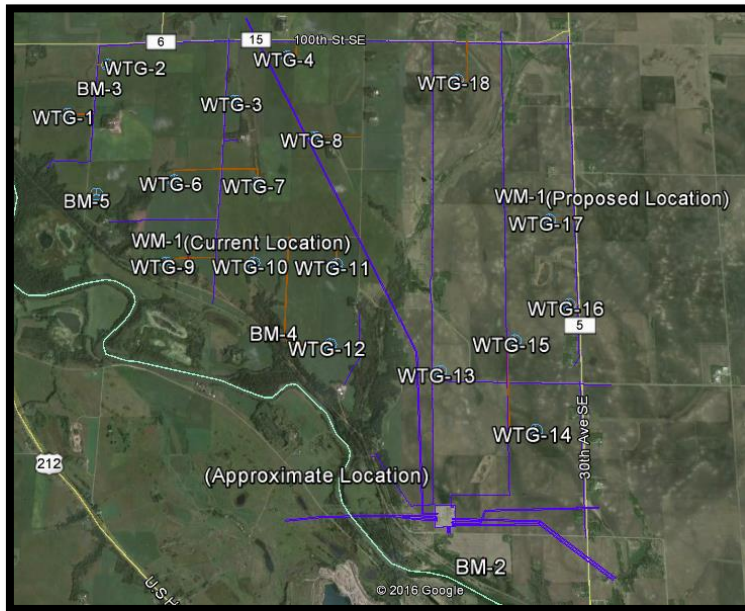
The study area is located within Chippewa County, Minnesota (just north across the Minnesota River from Granite Falls). The study area lies within the Des Moines Lobe Western Corn Belt Plains (47b) ecoregion of Minnesota. This ecoregion consists of fast fertile plain of deep soils dominated by row crops. The boundaries of the Minnesota River Prairie Subsection coincide with large till plains flanking the Minnesota River. The unit is bounded to the southwest by the Prairie Coteau. A series of moraines define the eastern boundary, the Alexandria Moraine to the northeast and the Bemis moraine to the southeast (Minnesota 2016).

The Minnesota River Prairie is a large subsection that includes part of northwestern Iowa and spreads across southwestern Minnesota into eastern South Dakota. The Minnesota River forms a broad valley, dividing the area in half. This valley once had a continuous band of floodplain forest that extended upstream as far as Lac Qui Parle, with highly unique bedrock exposures. There are 150 lakes larger than 160 acres in the subsection, most of which are shallow. Before settlement by people of European descent, the predominant vegetation was tallgrass prairie and wetlands. Fire was once a common natural disturbance and critical to maintaining native prairie communities (Minnesota, 2016).

Today, row-crop agriculture is the predominant land use, and prairie remnants and floodplain forests are rare. A major concern is impacts on water quality from intensive agricultural activities, including use of fertilizers and pesticides, expanding use of pattern tiling, and ditching and draining of small wetlands. Continued loss of the small amount of native upland habitat and over-intensive grazing remain a concern (Minnesota, 2016).



**Figure 1:** Vicinity map of study area. Chippewa county is located in southwestern Minnesota.



**Figure 2:** Project location along with bat monitor (BM) locations. BM-1 is not shown on the map but lies next to BM-2.

## Methods

Data was gathered in the field by Fagen Engineering, LLC within the study area from five different Anabat acoustic recorders (map in Study Area section shows locations of monitors). Monitors 1 & 2 gathered data throughout the fall of 2015 and were deployed again in May of 2016. Monitors 3-5 were added in September of 2016.

Monitors 1 & 2 were deployed on September 13, 2015 and removed on October 11, 2015. They were deployed again on April 12, 2016 then removed on October 15. Monitor 3, monitor 4 and monitor 5 were deployed on August 3<sup>rd</sup>, 2016 then removed on October 15<sup>th</sup>, 2016. The monitors were deployed for 287 trap nights

The data was uploaded through the Procore portal where New Century Environmental staff could access the data to download and process through a program called Kaleidoscope Pro version 3.1.8. The Kaleidoscope classifier uses a source library of user submitted reference calls to compare to recordings. It accepts and displays full-spectrum signals, to match with the calls known bat species. The software uses a presence/absence indicator by giving each species of bat a p-Value of 0 to 1. The lower the P-Value, the more likely the species is present. Variability in the quality of recordings and variations in calls among individual bats creates challenges to acoustic bat classification.

Kaleidoscope Pro has been approved by the U.S. Fish & Wildlife Service for use for presence/absence analysis for Indiana bats (*Myotis sodalis*). Similarly, the approved programs may also be used for presence/absence analysis for northern long-eared bats (*Myotis septentrionalis*). The U.S Geological Survey also tested acoustic matching programs and Kaleidoscope Pro passed their standard validation process (USFWS 2016).

## Results

From the five Anabat recording systems, 232,116 sound files were recorded. Visual examination and filtering of files to eliminate extraneous noise (e.g., wind, insects, etc.) resulted in a total of 14,442 bat detections.

Monitor 1 recorded 3,181 files that Kaleidoscope Pro was able to classify as bat passes. The silver haired bat was the most common species at this site being 62% of total detections. The big brown bat was the second most common being 13% of total detections. The federally threatened northern long-eared myotis was detected 4 times (0.001%), but had a P-value of 1 which almost certainly means it was nonexistent at this site. The eastern pipistrelle had a total of 55 (2%) detections.

Code	Common name	Scientific Name	Conservation status	P-Value	# of passes
LANO	Silver-Haired Bat	<i>Lasionycteris noctivagans</i>	Least concern	0	1971
EPFU	Big-Brown Bat	<i>Eptesicus fuscus</i>	Least concern	0	427
LACI	Hoary Bat	<i>Lasiurus cinereus</i>	Least concern	0	347
LABO	Eastern Red Bat	<i>Lasiurus borealis</i>	Least concern	0	158
MYLU	Little Brown Bat	<i>Myotis lucifugus</i>	Least concern	0	219
MYSE	Northern long-eared myotis	<i>Myotis septentrionalis</i>	Federally threatened	1	4
PESU	Eastern pipistrelle	<i>Perimyotis subflavus</i>	MN species of concern	0	55

**Figure 3:** Summary of species diversity and abundance for monitor 1.

Monitor 2 recorded 3,004 files that Kaleidoscope Pro was able to classify as bat passes. The silver haired bat was the most common species at this site being 57% of total detections. The second most common was the hoary bat at 30% of detections. The federally threatened northern long eared myotis only had a total of 2 (0.0007%) detections but had a P-value of 1. The eastern pipistrelle had a total of 14 (0.005%) detections.

Code	Common name	Scientific Name	Conservation status	P-Value	# of passes
LANO	Silver-Haired Bat	<i>Lasionycteris noctivagans</i>	Least concern	0	1717
EPFU	Big-Brown Bat	<i>Eptesicus fuscus</i>	Least concern	0	167
LACI	Hoary Bat	<i>Lasiurus cinereus</i>	Least concern	0	887
LABO	Eastern Red Bat	<i>Lasiurus borealis</i>	Least concern	0	165
MYLU	Little Brown Bat	<i>Myotis lucifugus</i>	Least concern	0.14	52
MYSE	Northern long-eared myotis	<i>Myotis septentrionalis</i>	Federally threatened	1	2
PESU	Eastern pipistrelle	<i>Perimyotis subflavus</i>	MN species of concern	0.01	14

**Figure 4:** Summary of species abundance and diversity for monitor 2

Monitor 3 recorded 4,870 files that Kaleidoscope Pro was able to classify as bat passes. The hoary bat was the most common species at this site being 75% of total detections. The second most common was the silver haired bat being 8% of total detections. The northern long eared bat had only 1 (0.0002%) detections with a p-value of 1. The eastern pipistrelle had a total of 64 (1%) detections.

Code	Common name	Scientific Name	Conservation status	P-Value	# of passes
LANO	Silver-Haired Bat	<i>Lasionycteris noctivagans</i>	Least concern	0.34	401
EPFU	Big-Brown Bat	<i>Eptesicus fuscus</i>	Least concern	0	263
LACI	Hoary Bat	<i>Lasiurus cinereus</i>	Least concern	0	3672
LABO	Eastern Red Bat	<i>Lasiurus borealis</i>	Least concern	0	306
MYLU	Little Brown Bat	<i>Myotis lucifugus</i>	Least concern	0	163
MYSE	Northern long-eared myotis	<i>Myotis septentrionalis</i>	Federally threatened	1	1
PESU	Eastern pipistrelle	<i>Perimyotis subflavus</i>	MN species of concern	0	64

**Figure 5:** Summary of species diversity and abundance for monitor 3



Monitor 4 recorded 1,512 files Kaleidoscope Pro classified as bat passes. The most common species at this site was the silver-haired bat being 46% of total detections. The second most common was the hoary bat being 26% of total detections. The northern long-eared myotis was not recorded at this site. The eastern pipistrelle had a total of 59 (4%) detections.

Code	Common name	Scientific Name	Conservation status	P-Value	# of passes
LANO	Silver-Haired Bat	<i>Lasionycteris noctivagans</i>	Least concern	0	688
EPFU	Big-Brown Bat	<i>Eptesicus fuscus</i>	Least concern	0	143
LACI	Hoary Bat	<i>Lasiurus cinereus</i>	Least concern	0	390
LABO	Eastern Red Bat	<i>Lasiurus borealis</i>	Least concern	0	129
MYLU	Little Brown Bat	<i>Myotis lucifugus</i>	Least concern	0	103
MYSE	Northern long-eared myotis	<i>Myotis septentrionalis</i>	Federally threatened	1	0
PESU	Eastern pipistrelle	<i>Perimyotis subflavus</i>	MN species of concern	0	59

**Figure 6:** Summary of species diversity and abundance for monitor 4

Monitor 5 recorded 1,875 files Kaleidoscope Pro classified as bat passes. The most common species at this site was the silver haired bat being 46% of total detections. The second most common was the hoary bat with being 21%) of total detections. The northern long-eared myotis had a total of 2 (0.001%) detections. The eastern pipistrelle had a total of 70 (4%) detections.

Code	Common name	Scientific Name	Conservation status	P-Value	# of passes
LANO	Silver-Haired Bat	<i>Lasionycteris noctivagans</i>	Least concern	0	871
EPFU	Big-Brown Bat	<i>Eptesicus fuscus</i>	Least concern	0	316
LACI	Hoary Bat	<i>Lasiurus cinereus</i>	Least concern	0	403
LABO	Eastern Red Bat	<i>Lasiurus borealis</i>	Least concern	0	138
MYLU	Little Brown Bat	<i>Myotis lucifugus</i>	Least concern	0	75
MYSE	Northern long-eared myotis	<i>Myotis septentrionalis</i>	Federally threatened	1	2
PESU	Eastern pipistrelle	<i>Perimyotis subflavus</i>	MN species of concern	0	70

**Figure 7:** Summary of species diversity and abundance for monitor 5.

## Discussion

There are seven species of bats that occur regularly in Minnesota; our most common species, the little brown myotis, occurs over most of North America. Along with the Northern myotis and big brown bat, it hibernates in Minnesota caves and mines. In summer, they roost in caves, mines, hollow trees, and buildings. Large groups of these bats hang upside-down in caves. The eastern pipistrelle is the smallest species, weighing only two-tenths of an ounce. It is found in the same Minnesota caves and mines, though it is less common and in fewer numbers.

The silver-haired bat and Eastern red bat are forest dwellers that usually live near water and feed among the trees. Usually a red bat pair will repeatedly fly the same route in search of food. Another woodland species is the hoary bat. It is the largest Minnesota bat, weighing an ounce or more. All three species are somewhat solitary, roost in trees, and migrate south for the winter (Minnesota, 2016).

In early July 2016, a species previously not known to be native to Minnesota, the evening bat, was discovered. Researchers from the DNR Nongame Wildlife Program and Central Lakes College were conducting a survey as part of a project to study summer breeding habits of the state’s forest bats. The bat was captured at the Minnesota Army National Guard’s Training Site in Arden Hills.

All seven bat species that occur in Minnesota may be found throughout the state.

Common name	Scientific Name	State Status	Federal Status
Northern long-eared myotis	<i>Myotis septentrionalis</i>	Threatened	Threatened
Eastern Pipistrelle	<i>Pipistrellus subflavus</i>	MN species concern	Not listed
Little brown bat	<i>Myotis lucifugus</i>	Not listed	Not listed
Big brown bat	<i>Eptesicus fuscus</i>	Not listed	Not listed
Silver-haired bat	<i>Lasionycteris noctivagans</i>	Not listed	Not listed
Eastern red bat	<i>Lasiurus borealis</i>	Not listed	Not listed
Hoary bat	<i>Lasiurus cinereus</i>	Not listed	Not listed
Evening bat	<i>Nycticeius humeralis</i>	Newly discovered	Not listed

**Figure 8:** Bat species found in Minnesota with federal and state conservation status.

There were a total of six bat species documented throughout the course of the study (September-October 2015 and 2016). The eastern pipistrelle (*Pipistrellus subflavus*) was documented at this site and is listed as a species of concern in the state of Minnesota. It was detected in small numbers but was found at every monitor except for monitor 1. The northern long-eared myotis (*Myotis septentrionalis*) is a federally threatened species whose home range lies within the study site. However no confirmed documentation was recorded here. Even though a total of five clicks of which Kaleidoscope classified as MYSE (northern long-eared myotis) the P-value was given a 1 for every monitor indicating the likelihood of presence is near non-existent. All other species documented are of least concern. Of the six species documented the silver-haired bat (*Lasionycteris noctivagans*), hoary bat (*Lasiurus cinereus*) and big brown bat (*Eptesicus fuscus*) were among the most common followed by the little brown bat (*Myotis lucifugus*) and eastern red bat (*Lasiurus borealis*).

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## Appendix

### Summary Graphs

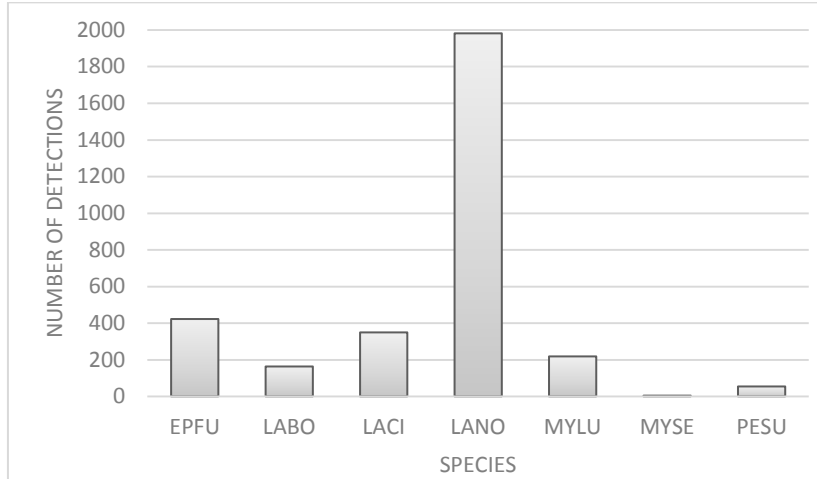


Figure 9.1: Total number of bat detections by species for monitor 1

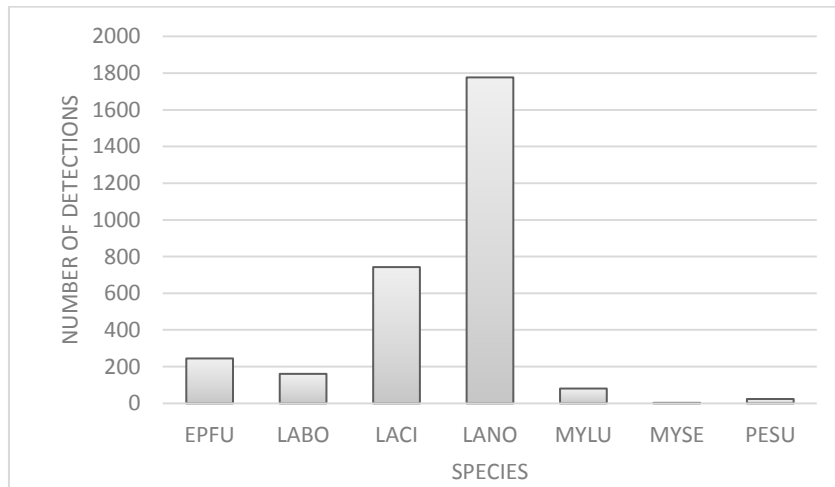
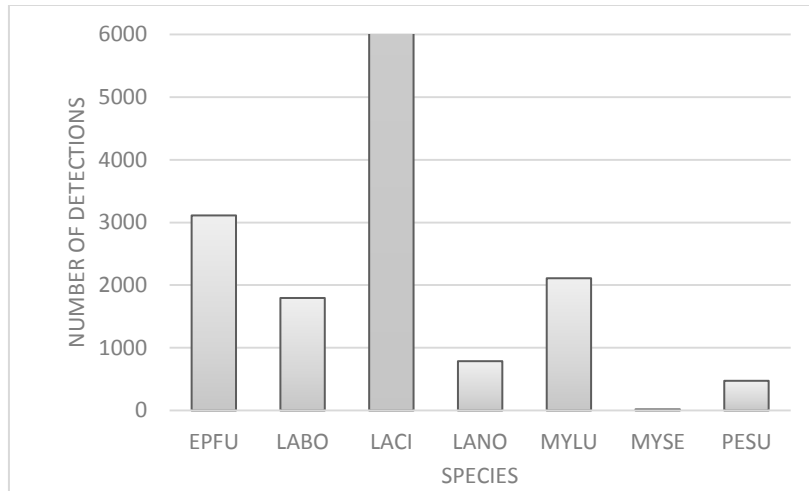
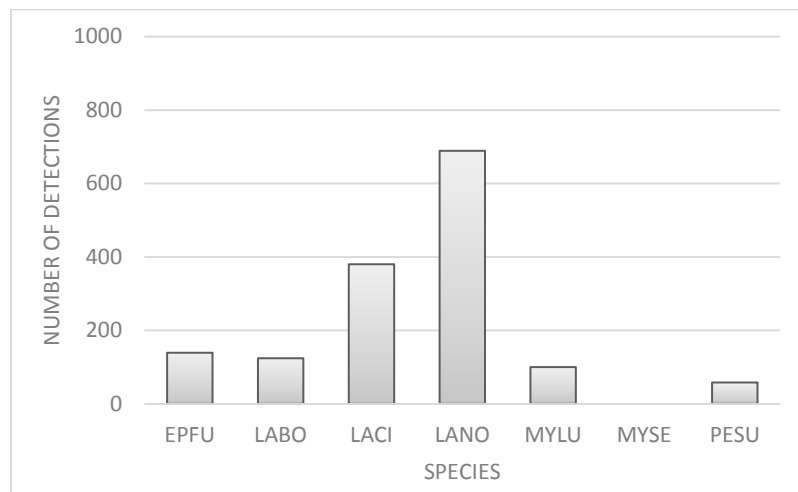


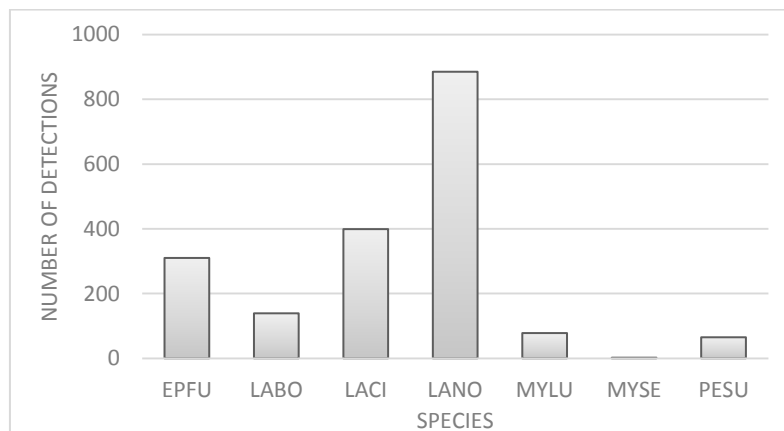
Figure 9.2: Total number of bat detections by species for monitor 2



**Figure 9.3:** Total number of bat detections by species for monitor 3



**Figure 9.4:** Total number of bat detections by species for monitor 4



**Figure 9.5:** Total number of bat detections by species for monitor 5

## Kaleidoscope Data

KALEIDOSCOPE 3.1.8

Bats of North America 3.1.0 S/A:+1

Monitor 1			
	Species	Detections	Presence p-value
Fall 2015	EPFU	123	0.95
	LABO	41	0
	LACI	144	0
	LANO	725	0
	MYLU	45	0
	MYSE	0	1
	PESU	10	0
5/28/2016	EPFU	118	0.77
	LABO	34	0
	LACI	104	0
	LANO	670	0
	MYLU	39	0
	MYSE	0	1
	PESU	8	0
9/2/2016	EPFU	91	0
	LABO	46	0
	LACI	53	0
	LANO	194	0
	MYLU	96	0
	MYSE	2	1
	PESU	23	0
10/7/2016	EPFU	92	0
	LABO	34	0
	LACI	38	0
	LANO	377	0
	MYLU	39	0
	MYSE	0	1
	PESU	14	0
10/15/2016	EPFU	3	0.33
	LABO	3	0
	LACI	8	0
	LANO	5	0.46
	MYLU	0	1
	MYSE	0	1
	PESU	0	1

Monitor 2			
	Species	Detections	Presence p-value
Fall 2015	EPFU	33	0.22
	LABO	31	0
	LACI	38	0
	LANO	148	0
	MYLU	15	0
	MYSE	1	1
	PESU	0	1
5/28/2016	EPFU	9	1
	LABO	8	0
	LACI	29	0
	LANO	167	0
	MYLU	9	0
	MYSE	0	1
	PESU	2	0.08
9/2/2016	EPFU	108	1
	LABO	84	0
	LACI	631	0
	LANO	1085	0
	MYLU	20	0
	MYSE	1	1
	PESU	9	0.01
10/7/2016	EPFU	17	1
	LABO	41	0
	LACI	189	0
	LANO	313	0
	MYLU	8	0.14
	MYSE	0	1
	PESU	3	0.33
10/15/2016	EPFU	0	1
	LABO	1	0.10
	LACI	0	1
	LANO	4	0
	MYLU	0	1
	MYSE	0	1
	PESU	0	1

Monitor 3			
	Species	Detections	Presence p-value
9/2/2016	EPFU	2	1
	LABO	0	1
	LACI	208	0
	LANO	0	1
	MYLU	0	1
	MYSE	0	1
	PESU	0	0
10/7/2016	EPFU	260	0
	LABO	303	0
	LACI	3463	0
	LANO	399	1
	MYLU	163	0
	MYSE	1	1
	PESU	69	0
10/15/2016	EPFU	1	0.77
	LABO	3	0
	LACI	1	0.09
	LANO	2	0.34
	MYLU	0	1
	MYSE	0	1
	PESU	0	1

Monitor 4			
	Species	Detections	Presence p-value
9/2/2016	EPFU	96	0
	LABO	82	0
	LACI	309	0
	LANO	289	0
	MYLU	85	0
	MYSE	0	1
	PESU	34	0
10/7/2016	EPFU	46	1
	LABO	47	0
	LACI	84	0
	LANO	397	0
	MYLU	18	0
	MYSE	0	1
	PESU	25	0
10/15/2016	EPFU	1	0.69
	LABO	0	1
	LACI	0	1
	LANO	2	0.16
	MYLU	0	1
	MYSE	0	1
	PESU	0	1

<b>Monitor 5</b>			
	Species	Detections	Presence p-value
9/2/2016	EPFU	130	0
	LABO	79	0
	LACI	162	0
	LANO	427	0
	MYLU	58	0
	MYSE	2	1
	PESU	40	0
10/7/2016	EPFU	186	0
	LABO	58	0
	LACI	239	0
	LANO	444	0
	MYLU	17	0
	MYSE	0	1
	PESU	27	0
10/15/2016	EPFU	1	1
	LABO	0	0.61
	LACI	2	0
	LANO	0	1
	MYLU	0	1
	MYSE	0	1
	PESU	3	0



## Species Descriptions

### Silver Haired Bat

The silver-haired bat (*Lasionycteris noctivagans*) is a solitary migratory species and the only member of the genus *Lasionycteris*. They are found in Bermuda, Canada, Mexico and the United States. They often roost in tree cavities or in bark crevices on tree trunks, especially during migration. This medium-sized bat is mostly black (including the wings, ears, interfemoral membrane, and fur) with white-tipped hairs. The basal upper half of its tail membrane is densely furred. This gives the bat a frosted appearance for which it is named. This species has a flattened skull with a broad rostrum. This species weighs around 8–12 g, has a total length of ~100 mm, a tail length of 40 mm, and a forearm length of 37–44 mm. Silver-haired bats consume primarily soft-bodied insects, such as moths, but will also take spiders and harvestmen. This species will forage low, over both still and running water, and also in forest openings. Silver-haired bats are slow but maneuverable flyers that typically detect prey only a short distance away. In addition to the hoary bat (*Lasiurus cinereus*) and eastern red bat (*Lasiurus borealis*), the silver-haired bat is one of the three tree bat species most commonly killed at wind energy facilities (over 75% of the mortalities).

### Big Brown Bat

The big brown bat (*Eptesicus fuscus*) is native to North America, Central America, the Caribbean, and extreme northern South America. This medium-sized bat ranges from 10–13 cm in body length, with a wingspan 28-33, and weighs between 14-16 g. The fur is moderately long and shiny brown. The wing membranes, ears, feet, and face are dark brown to blackish in color. Big brown bats roost during the day in hollow trees, beneath loose tree bark, in the crevices of rocks, or in man-made structures such as attics, barns, old buildings, eaves and window shutters. Big brown bats are insectivorous, eating many kinds of night-flying insects including moths, beetles, and wasps.

### Hoary Bat

The hoary bat (*Lasiurus cinereus*) is a species of bat in the vesper bat family, Vespertilionidae. It occurs throughout most of North America and much of South America. The hoary bat averages 13-14.5 cm long with a 40 cm wingspan and a weight of 26 g. Its coat is dark brown and the hairs on the back are frosted with silver. The body is covered in fur except for the undersides of the wings. This species normally roosts alone on trees, hidden in the foliage, but on occasion has been seen in caves with other bats. It prefers woodland, mainly coniferous forests, but hunts over open areas or lakes. It hunts alone and its main food source is moths. The bat is migratory and may travel from Canada as far south as the southern United States or Bermuda.

### Eastern Red Bat

The eastern red bat (*Lasiurus borealis*) is widespread across eastern North America, with additional records in Bermuda. This is a medium-sized bat, averaging weights of 9.5-14 g and measurements of 112.3 mm in total length. Adults are usually dimorphic: males have red hair while females are chestnut-colored with whitish frosting on the tips of the fur. Moths form the majority of the diet, but red bats also prey on beetles, flies, and other insects.

### Eastern Pipistrelle

The Eastern Pipistrelle (*Perimyotis subflavus*) is found commonly in the eastern portion of the United States, but extends into southeastern Nebraska. This reddish, yellowish and brownish bat is one of the smallest bats in the eastern part of the US. The forearms are orange to red while the wing membrane is black. Adults weigh between 4-10g and reach a forearm length of 30-35mm. These bats feed on small insects on the edges of forested areas, rivers, streams or open water.

### Little Brown Bat

The Little Brown Bat (*Myotis lucifugus*) is found throughout much of North America. It is most common in the northern half of the continental United States and Southern Canada. The bat's fur is dark brown and glossy on the back with slightly paler, greyish fur underneath. Wing membranes are dark brown on a typical wingspan of 22–27 cm. Ears are small and black with a short, rounded tragus. Adult bats are typically 6–10 cm long and weigh 5–14g. Since many of their preferred meals are insects with an aquatic life stage, such as mosquitoes, they prefer to roost and forage near water.