Permit Compliance Filing

Permittee:	Black Oak Wind, LLC and Getty Wind Company, LLC
Permit Type:	LWECS Site Permit
Project Location:	Stearns County, MN
Docket No.	MPUC Dkt Nos. IP6853/WS-10-1240 and IP6866/WS-11-831
Permit Section:	Site Permit Condition 13.3 – Site Specific Bat Study
Date of Submission:	December 17, 2012

Section 13.3 of the Site Permit for the Prairie Rose Wind Farm requires:

"The Avian and Bat Protection Plan in Section 6.7 shall include provision for a site-specific study characterizing bat activity and species present within the Project area developed in consultation with the Commission, DNR, and USFWS. The ABPP shall outline the monitoring protocol and data to be analyzed in the bat study. The Permittee shall submit a report summarizing the findings of the study and recommendations for further actions to the Commission no later than December 15, 2012. Need for additional studies shall be based on review of this compliance filing."

The attached "Acoustic Bat Studies for the Black Oak and Getty Wind Resources Area – Final Report" prepared by Hamer Environmental, L.P. summarizes results of the acoustical bat monitoring conducted at the Black Oak and Getty wind farms from April 16, 2012 – October 31, 2012.

ACOUSTIC BAT STUDIES FOR THE BLACK OAK AND GETTY WIND RESOURCE AREA – FINAL REPORT

Stearns County, Minnesota

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Executive Summary

In 2012, Hamer Environmental conducted studies to assess the potential impacts on resident and migratory bat communities by a proposed wind energy development near the townships of Ashley, Getty, Raymond, and Sauk Centre, Stearns County, Minnesota. Acoustic surveys were conducted using 3 Wildlife Acoustics' Song Meter SM2BAT+ Terrestrial ultrasonic bat detectors affixed on three meteorological towers within the wind resource area (WRA). Two of the towers had microphones located at 5m above ground level, while the third tower's microphone was located at 50m above ground level. Seasonal use of the proposed project area by resident and migratory bat populations was monitored from 16 April – 31 October 2012. Surveys recorded 3,499 identifiable bat calls over the course of 420 detector nights.

The overwhelming majority of the calls (63%) were made by the silver-haired/big brown bat species group, followed by calls from eastern red bats (17%), little brown bats (12%), and hoary bats (6%). The remaining 2% of detections came from northern myotis, evening bats, and tri-colored bats, though all in very low numbers. Detection rates of the four main species/species groups were similar to what was found at the nearby Paynesville-Zion WRA study, performed in 2009-2010 by Hamer Environmental. There seems to be an initial peak in activity in June, likely indicating that young bats are fledging. There is a second and more substantial peak in July and into early August during the normal migration period for bats in the area. The data suggests that migration started early in 2012, likely due to the warmer than average winter and spring. The east tower recorded the majority of detections (56%) between the three towers, most likely the result of being adjacent to a Wildlife Management Area/Waterfowl Protection Area (WMA/WPA). The proximity of the east tower to this WMA/WPA offers better resource availability (water, insects, etc.) to resident and migratory bats.

Table of Contents

Table of Figures

Introduction

Wind energy generates electricity without the negative ecological impacts associated with other forms of power generation (e.g., pollution and carbon emission). However, in recent years direct impacts to bat populations have been reported as a result of wind turbine operation. Though the precise behavioral or ecological causes are still unknown, in some cases, large numbers of bat fatalities have been reported at operational wind energy facilities throughout North America (Johnson et al 2003, Fielder 2004, Johnson 2005, Arnett et al. 2008). Similar to the bird fatalities reported at the same sites, many of the fatalities come as a result of strikes from turbine blades. While fatalities appear to happen year round, they tend to peak in late summer, indicating that individuals may be at the greatest risk during migration (Arnett et al. 2008). As a result of the biological impact coupled with the lack of information regarding its root cause, state and federal agencies in the United States often recommend that developers conduct studies to assess the risk of proposed developments to bat populations.

There are seven bat species of known to occur in or near Stearns County:

- Big brown bat (*Eptesicus fuscus*)[*]
- Silver-haired bat (*Lasionycteris noctivagans*)[*]
- Hoary bat (*Lasiurus cinereus*)[*]
- Red bat (*Lasiurus borealis*)[*]
- Little brown bat (*Myotis lucifugus*)[*]
- Northern bat (*Myotis septentrionalis*)[*1]
- Tri-colored bat (*Perimyotis subflavus,* previously known as *Pipistrellus subflavus*)[*1]

[1] Minnesota Department of Natural Resources species of concern; * species known to be migratory.

To determine bat species composition, use, and activity levels at a proposed wind-energy facility in Stearns County, Minnesota, Black Oak Wind and Getty Wind Company contracted Hamer Environmental, L.P. to conduct a baseline study of bat activity in the project area. Data collected for this study will be used to make siting and mitigation recommendations in order to reduce or eliminate the effects of the proposed wind-energy facility on resident and migratory bat populations.

Results of acoustic bat surveys conducted during the 2012 survey season are described in this report. The objectives of this report are to:

- Describe and quantify patterns of bat use within the proposed wind-resource area.
- Relate the findings of this study with those of other studies at proposed wind-energy developments where both pre- and post-construction bat activity and mortality studies have been conducted to predict post-construction risk of mortality at the proposed Stearns County wind-power development.

- Use these predictions in the context of relevant literature to make recommendations for post-construction studies and mitigation.

Study Area

The proposed wind resource area is located in Stearns County, Minnesota, within the townships of Ashley, Getty, Raymond, and Sauk Centre. The immediate topography of the proposed project is relatively flat, accented with low, rolling terrain. Vegetation in the immediate area consists primarily of crop lands (corn and soybeans), with several Waterfowl Protection Areas (WPA) and Wildlife Management Areas (WMA) (Figure 1) located nearby. The typical frost-free period in the region lasts from approximately mid-April through October. Annual precipitation in the region includes 76 cm of rain and 134 cm snow.

The proposed development will consist of up to 52 turbines, covering approximately 14,700 acres, and is estimated to have a nameplate capacity of up to 82 MW.

Methods

The protocol used for this study was adapted from those used for pre-construction monitoring of bat activity across the United States and Canada (e.g., Reynolds 2006, Arnett et. al. 2006, Arnett et. al. 2008). These studies were developed in forested regions where it is necessary to sample both at and above forest canopy height to fully describe local species composition and activity. However, the vegetation within the Black Oak and Getty WRA proposed project area provides no over-story or canopy vegetation. Three full-spectrum acoustic monitors (Song Meter SM2BAT+ Terrestrial ultrasonic acoustic monitors; Wildlife Acoustics, Inc.) were set up, one on each met tower. Microphones sampled the air space at ground level (roughly 5 m above ground) and turbine level (approx 50 – 90 m above ground). Each microphone was capable of detecting the echolocation calls of approaching bats up to 20m away with a potential sampling volume of $254m^3$ (Larson & Hayes, 2000). Each microphone was fitted with weatherproof directional attachments to make the sampled area comparable with that of zero-crossing acoustic monitors (i.e. ANABAT SD1). The met towers held the acoustic monitors at altitude, while the detectors were stored in a weatherproof box. Each detector housed a data processing and storage unit with 256-512 GB of SD storage capacity (this allowed us to store approximately 100,000 individual bat passes). Detectors were programmed to operate overnight from ½ hour before civil sunset to ½ hour after civil sunrise. The detectors were connected to a 12 volt power supply maintained by a 34W photovoltaic charging system. To minimize data loss that might occur as a result of machine failures (due to electrical storms, disk corruption, etc.), data were generally retrieved from the units every month and stored off-site for later analysis.

Bat calls, defined as a continuous series of two or more, clearly identifiable call notes produced by an individual with no pauses of longer than one second, were used as the unit measure of activity for this study. Calls were individually examined using the Sonobat 3.1.3 software package (Sonobat, Arcata, California). Each call was identified to the lowest taxonomic group possible, using quantitative analyses described by Patriquin and Barclay (2003), reference calls from other locales, and a species list compiled from GIS range maps (England 2003). Species that do not produce calls that can be reliably discriminated were lumped into functional groups. For example, big brown bats (*Eptesicus fuscus*) and silver-haired bats (*Lasionycteris noctivagans*) both produce calls with minimum frequencies of ~25KHz that are variable in shape, leading to a great deal of overlap in observed call signatures. The number of calls recorded per detector per night was used as an index of activity to make relative comparisons among time periods and towers. It is important to note that acoustic surveys cannot differentiate individuals within a species, and thus direct population estimates are not possible from these data. After call identification, Sonobat 3.1.3 (Sonobat, Arcata, California) and Microsoft Excel (2010) were used for data processing, summaries, and analyses.

The mean number of calls recorded per station per night was compared to studies already conducted at existing wind facilities where both pre-construction activity and post-construction mortality surveys have been completed. To date, five studies have examined both pre-construction activity and post-construction mortality at the same wind energy development (Young et al 2003, Johnson et al. 2004, Jain Fielder 2004, 2005, E.B. Arnett, Bat Conservation International, unpublished data).

Results

Bat activity was monitored at three stations from 16 April – 31 October 2012 (200 days). Equipment failure lessened the expected number of detector nights from 600 (3 detectors * 200 days) to 420. In total, 432,754 acoustic detections (files) were recorded, downloaded, and analyzed. Of these, 429,255 (99.2%) were noise (wind, rain, insect noise, etc.) and 3,499 (0.8%) were identifiable bat call files. Of the 3,499 files that could positively identified as bat calls, 1,555 (44.4%) were detected at low (5m) detectors and 1,944 (55.6%) were detected at the high (50m) detector (Figure 3). The upper detector on the east tower recorded the majority (55.6%) of the total bat detections throughout the study.

Seven species or species complexes were detected within the proposed wind resource area. Detections of the big brown/silver-haired bat complex (*Eptesicus fuscus*/*Lasionycteris noctavagans*) were by far the most common (63%), followed by eastern red bats (*Lasiurus borealis*) (17%), little brown bats (*Myotis lucifugus*) (12%), hoary bats (*Lasiurus cinereus*) (6%), northern myotis (*Myotis septentrionalis*) (0.8%), evening bats (*Nycticeius humeralis*) (0.5%), and tri-colored bats (*Perimyotis subflavus*) (0.3%). Over the duration of the study (~29 weeks), a mean of 8.3 bat calls were recorded per detector per night.

Table 1. Total number of detections of each bat species or species complex detected at each meteorological tower from 16 April – 31 October 2012 at the proposed Black Oak and Getty Wind Resource Area, Stearns County, Minnesota. Percentage in parentheses is the percent of detections of each species group at that tower.

	Big Brown/Silver Haired Bat	E. Red Bat	Little Brown Bat	Hoary Bat	Northern Myotis	Evening Bat	Tri-Colored Bat
East-high	1392	255	164	115	10	6	2
	(63%)	(42%)	(41%)	(53%)	(37%)	(33%)	(23%)
South-low	296	144	107	20	12	10	4
	(13%)	(24%)	(27%)	(9%)	(44%)	(56%)	(44%)
West-low	530	210	132	80	5	2	3
	(24%)	(34%)	(32%)	(38%)	(19%)	(11%)	(33%)
Total	**2218**	**609**	**403**	**215**	**27**	**18**	**9**

Bat activity at the proposed wind resource area was highest for all species groups in June and July 2012, though not all species peaked in activity during the same period (Figure 2). The big brown/silver-haired bat group were present on-site the longest and peaked in activity during the latter half of July (16^{th}-31^{st}) with a mean of 40.48 calls/night/detector being recorded (Figure 4). Hoary bats peaked in activity during the 1^{st} half of July (1^{st}-15th), with a mean of 3.4 calls/night/detector (Figure 7). Red bats peaked in activity during the 1^{st} half of August (1^{st}-15^{th}) with a mean of 4.97 bat calls/night/detector (Figure 6). Little brown bats peaked in activity the first half of July (1^{st}-15^{th}), with a mean of 6.07 bat calls/night/detector (Figure 5). The remaining three bat species detected during the survey period (northern myotis, evening bat, tri-colored bat) peaked between the latter half of June and the 1^{st} half of August, though detection rates were extremely low.

Overall, the east tower with the high microphone had the most bat detections (56% of total bat detections during study) while only being operational 60% of the time (due to equipment failure). The east tower is also located adjacent to a Wildlife Management Area/Waterfowl Protection Area (WMA/WPA). Of the two towers with the low microphones, the west tower had a greater rate of detections (27%) when compared to the south tower (17%). The big brown/silver haired bat complex, along with hoary bats, had greater frequencies of detection at the high detector (east tower) versus the low detectors, where eastern red and little brown bats had greater frequencies of detection.

Discussion

Predictions of bat mortality at wind energy developments based on pre-construction activity are currently complicated by the dearth of studies including both pre- and post-construction data from which to draw correlative inferences. This is further exacerbated by some of the challenges associated with post-construction mortality assessment and a lack of standardized use of correction factors for searcher efficiency and carcass removal (Kuntz et al. 2007). Though geographically disparate, the limited numbers of studies that are currently available suggest a rough correlation between pre-construction activity and post-construction mortality (Figure 5). In Iowa, Jain (2005) found pre-construction activity of 34.9 bat calls/detector/night from 15 April – 15 December to correspond to approximately 10 bats killed/MW/year post-construction. The Mountaineer, West Virginia development estimated 38 bats killed/turbine/year after recording an average of 38.2 calls/detector/night (E.B. Arnett, Bat Conservation International, unpublished data). Similarly, projects in Minnesota and Wyoming with pre-construction activity levels of 2.1 and 2.2 calls/detector/night reported an estimated 2.37 and 2.23 bats killed/MW/year, respectively (Johnson et al. 2004, Young et al 2003) (Figure 5).

The detectors at the proposed Black Oak and Getty WRA recorded a site-wide mean of 8.3 calls/detector/night, peaking during early July with 52.6 calls/detector/night. The mean number of calls recorded per detector per night during this study was somewhat similar to rates recorded at sites in Minnesota and Wyoming (Johnson et al. 2004, Young et al 2003), where mortality rates were lower than those recorded in eastern deciduous forests (e.g., Jain 2005). In comparison to the nearby Buffalo Ridge Wind Resource Area, this study recorded 11.5 calls/detector/night during the 15 June – 15 September migratory period. Studies completed by Johnson, et al. (2004) at Buffalo Ridge recorded a site-wide mean during the 15 June – 15 September migratory period of 48 calls/detector/night, and 2.2 calls/detector/night at functional wind turbines. Over this period, they estimated 3.02 bats were killed per turbine per year (Figure 5).

To date, many studies of post-construction bat mortality at wind energy sites have been conducted at wind energy developments across the United States and Canada. As with studies of pre-construction activity, temporal peaks in mortality tend to coincide with migration, leading researchers to conclude that migrating bats are at the highest risk for mortality (Johnson 2005, Kunz et al. 2007). In particular, migrating, tree-roosting bats, including silver-haired bats, hoary bats, and eastern red bats, tend to make up the highest proportion of bats killed at wind energy developments (Johnson 2005). The silver-haired bat/Big brown bat complex had the highest detection rates in the Black Oak and Getty WRA.

The higher rates of activity observed at the east detector station were likely a result of higher insect abundance and water availability from the nearby WMA and WPA (Figure 1). The public lands (WMA, WPA, etc.) near the project boundaries represent the only lands within the immediate region that are not actively managed for agriculture. Thus, resource availability (water, insects, etc.) is likely higher within these areas making them attractive to resident and migratory bats. The east tower was located less than 200 meters from a WPA, while the south and west towers are located approximately 1 mile from the nearest non-agricultural lands (Figure 1).

Spatial patterns of fatalities within operational wind energy developments tend to be site-specific. At wooded, ridgetop sites in Mountaineer, WV and Meyersdale, PA, Kerns et al. (2005) reported higher fatalities at specific turbines located at the end or center of the arrays. However, at another wooded, ridge-top site in Tennessee, Fielder et al. (2007) noted a general north-south trend in the number of bat fatalities, with slightly higher fatalities in the northern part of the WRA. Similarly, Brown and

Hamilton (2006) observed significantly more fatalities in the northern half of the studied wind energy development in Alberta than the south. To date, only three studies have evaluated the effects of specific landscape features (such as wooded areas and water sources) on fatalities at individual turbines. In Iowa, Jain et al. (2007) noted a weak negative relationship between fatalities and distance to wetlands; and Piorkowski (2006) noted a similar relationship with distances to woodlots in Oklahoma. When examining the Buffalo Ridge wind resource area in southwest Minnesota, Johnson et al. (2004) found no relationship between the number of fatalities at turbines and their distances to woodlots or wetlands. In a later review, Arnett et al. (2008) recommend that when siting turbines, one should avoid placement of turbines near water sources or open cave roosts, though they did not make specific recommendations for setback distances. At the proposed Black Oak and Getty wind resource area, more bat detections were recorded at the east meteorological tower, which is located approximately 200 meters from the nearest water source, than the south or west towers, located almost a mile from the nearest water source. Though the exact relationship between a turbine's proximity to water and its potential impact on bat mortality appears to be somewhat site-specific and unclear, the possibility exists that the siting of turbines near to permanent water sources within the Black Oak and Getty WRA may increase the risk they pose to resident and migrating bat populations. It is therefore the opinion of these authors that the setbacks from public land to turbines recommended by the Minnesota Department of Natural Resources (a minimum of at least 890 feet) should be adequate when siting the turbines within the project area.

The overwhelming majority of the calls recorded were from the big brown/silver-haired bat group and the peak activity levels were much higher in July than those recorded throughout the year, likely indicating that one or both of these species was migrating through the area at the time. Given this information, it is possible that this wind development could pose a higher risk to migrating bat populations during the approximately three-week peak of migration in late July and early August than in other seasons. However, as outlined above, the correlation between pre-construction activity and post-construction mortality is still somewhat vague.

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Figures

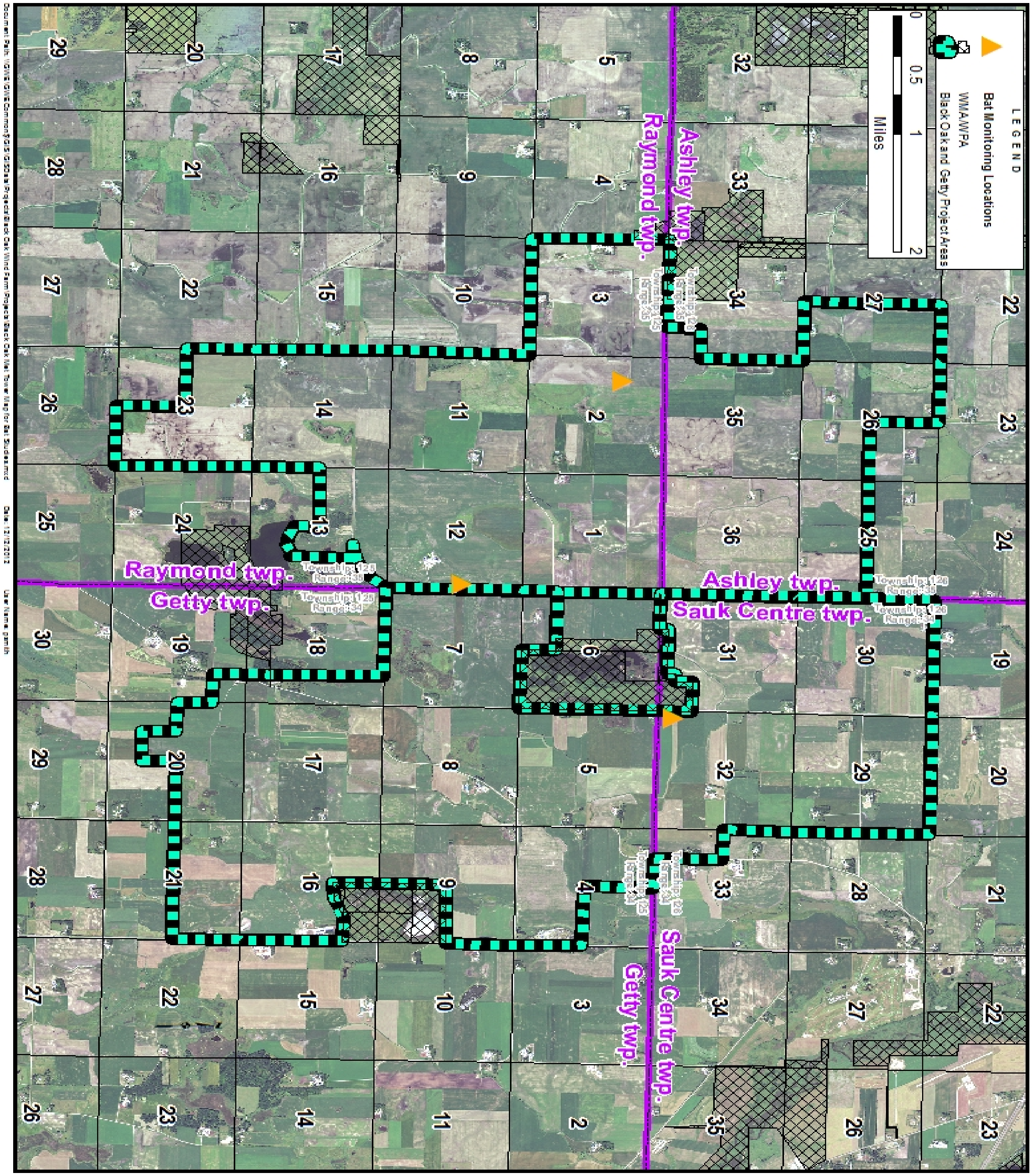

Figure 1. Aerial view of the Black Oak and Getty Wind Resource Area and associated met towers, Stearns County, Minnesota.

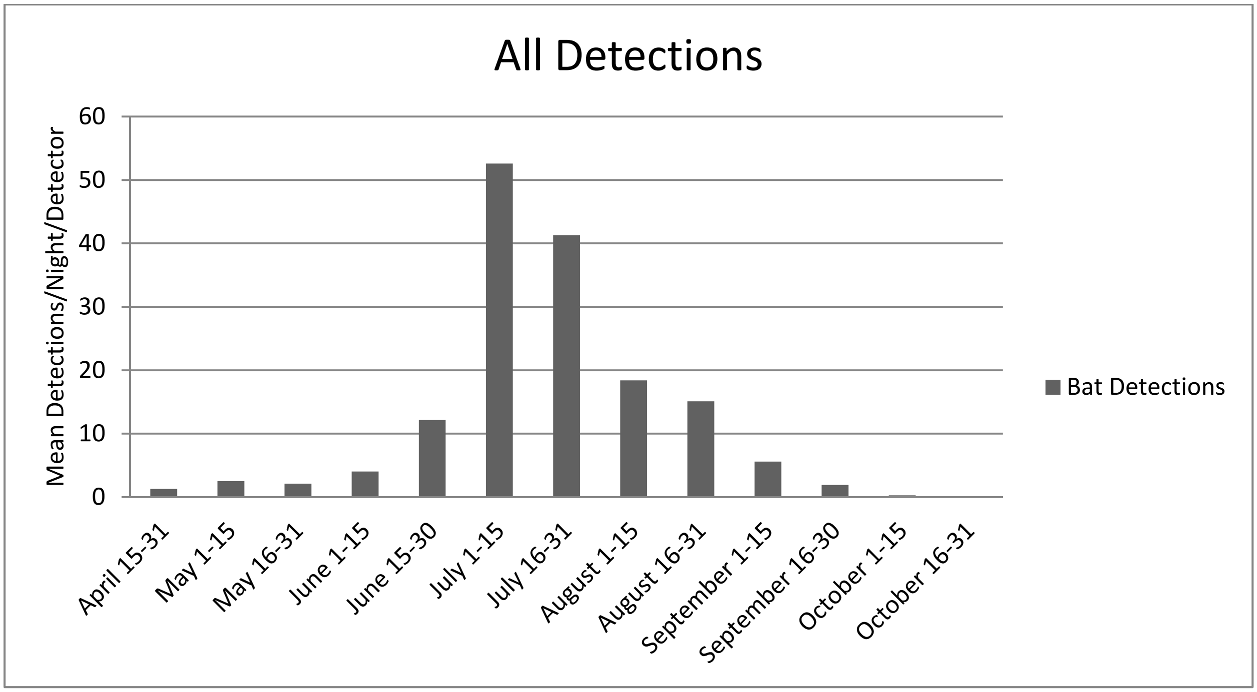

Figure 2. Mean number of calls recorded per detector per night 16 April – 31 October 2012 at the proposed Black Oak and Getty Wind Resource Area, Stearns County, MN.

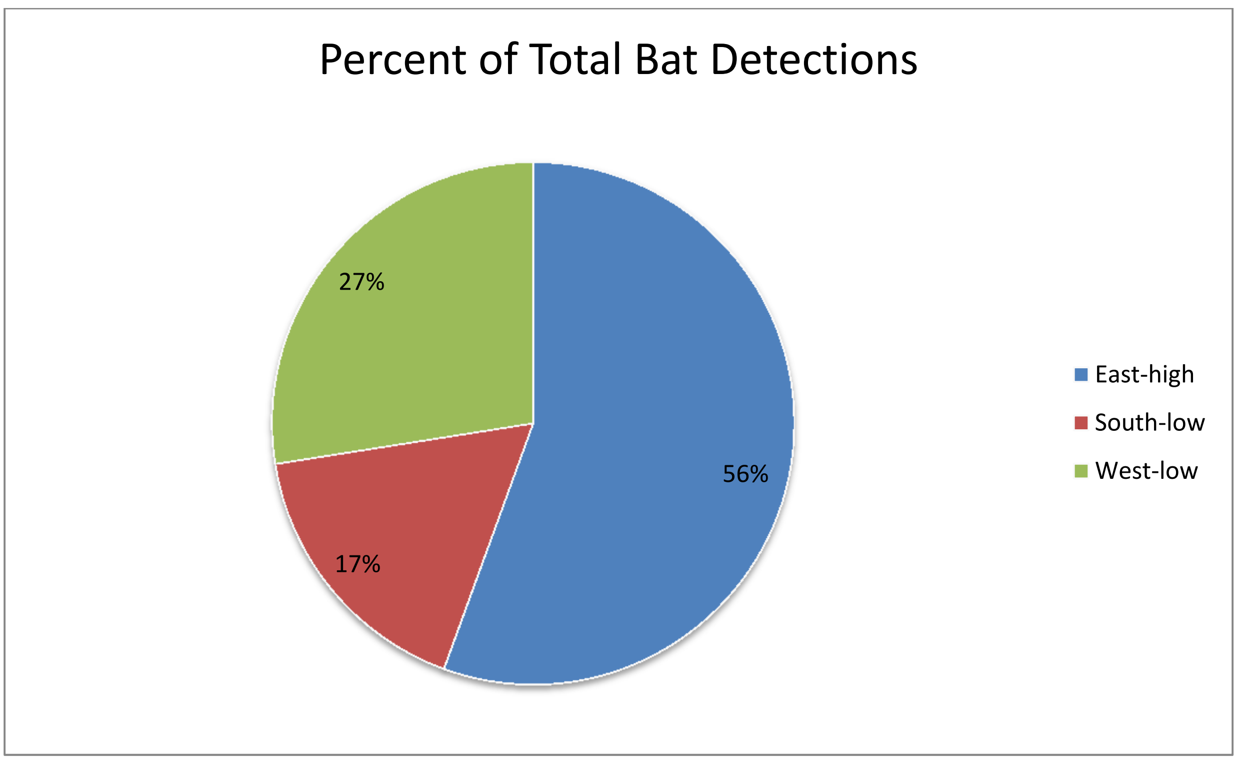

Figure 3. The proportion of the total number of bat calls recorded at each of the acoustic monitoring stations at the proposed Black Oak and Getty Wind Resource Area, Stearns County, MN from 16 April – 31 October 2012.

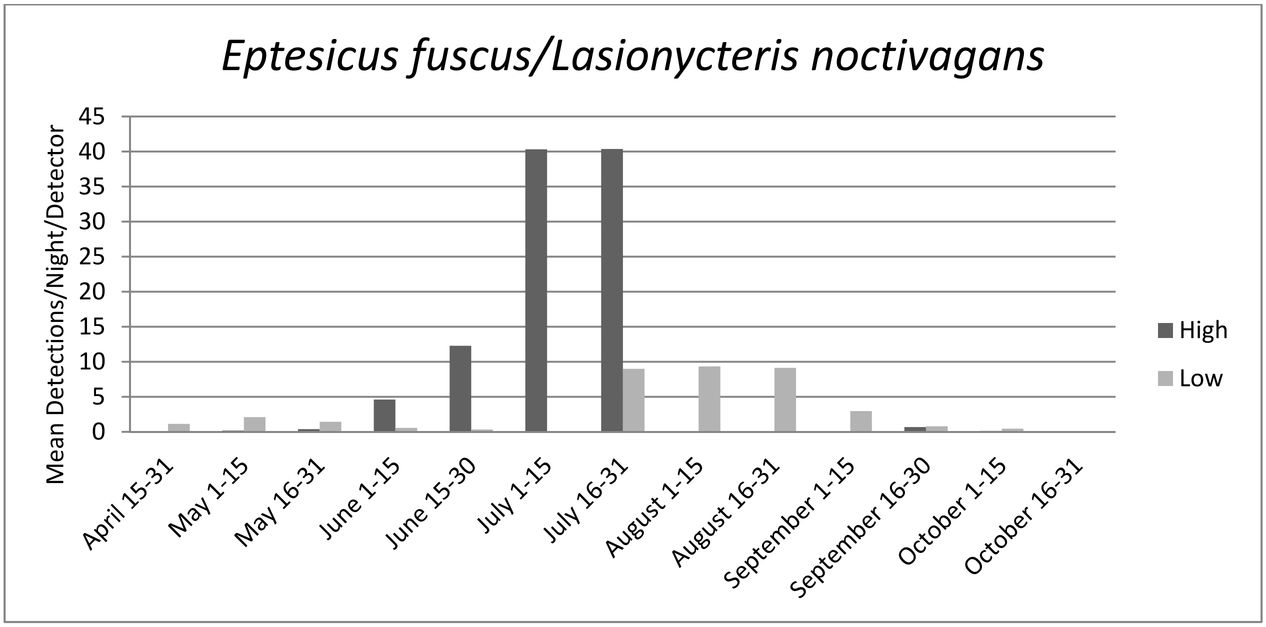

Figure 4. Mean number of calls recorded per detector per night for the big brown bat/silver-haired bat group at the Black Oak and Getty Wind Resource Area, Stearns County, MN from 16 April – 31 October 2012.

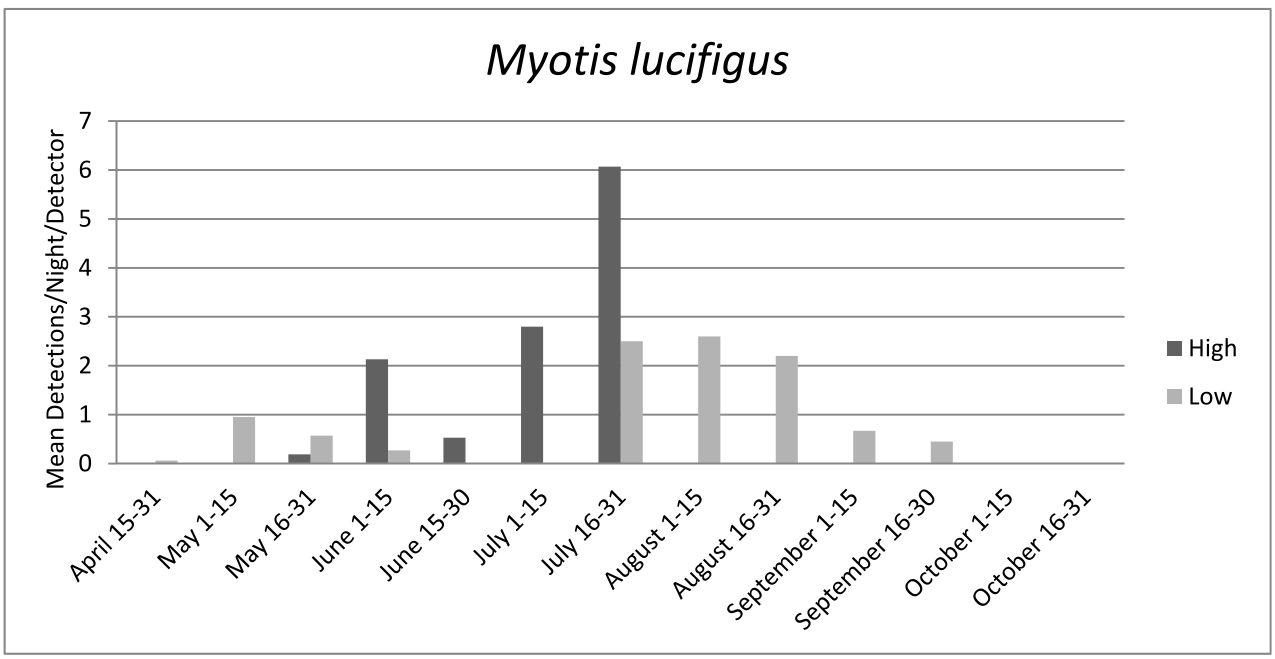

Figure 5. Mean number of calls produced by little brown bats recorded per detector per night at the proposed Black Oak and Getty Wind Resource Area, Stearns County, MN from 16 April – 31 October 2012.

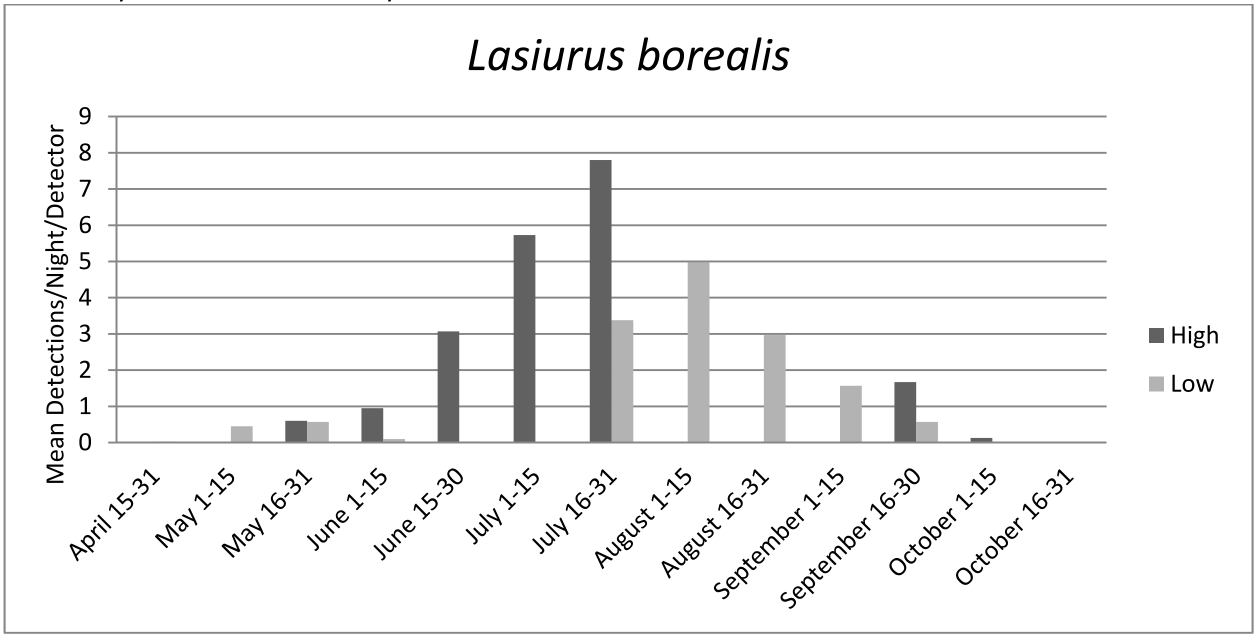

Figure 6. Mean number of calls recorded by eastern red bats per detector per night at the proposed Black Oak and Getty Wind Resource Area, Stearns County, MN from 16 April – 31 October 2012.

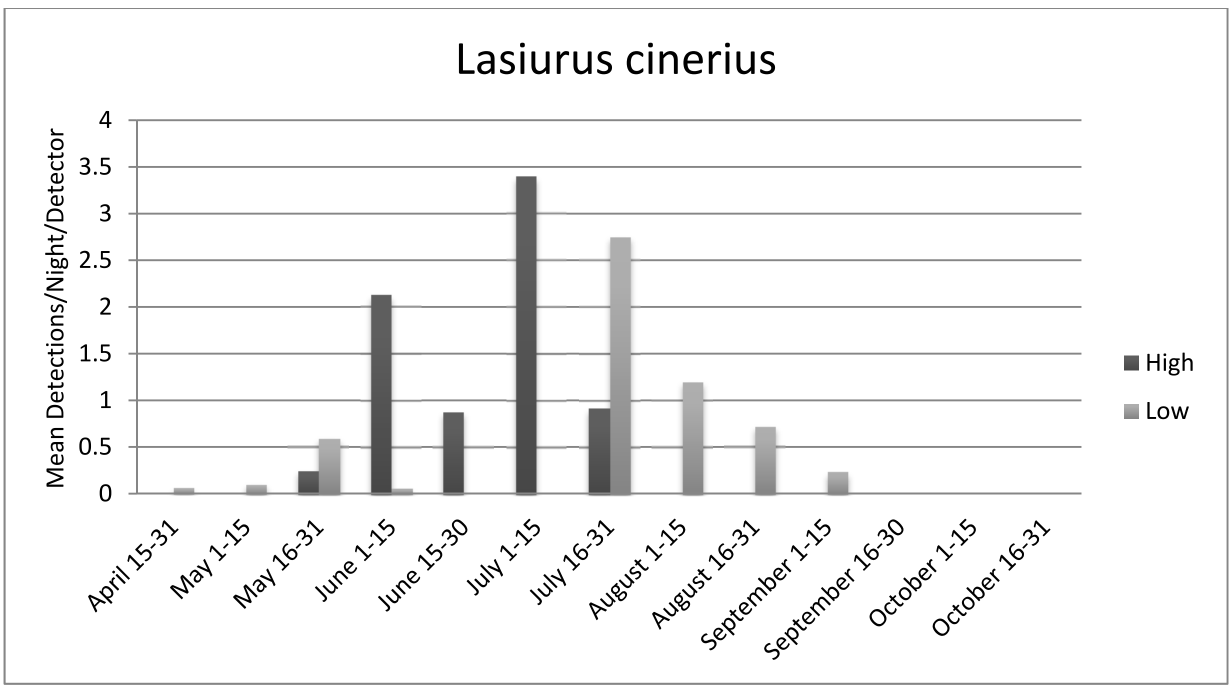

Figure 7. Mean number of calls recorded by hoary bats per detector per night at the proposed Black Oak and Getty Wind Resource Area, Stearns County, MN from 16 April – 31 October 2012.

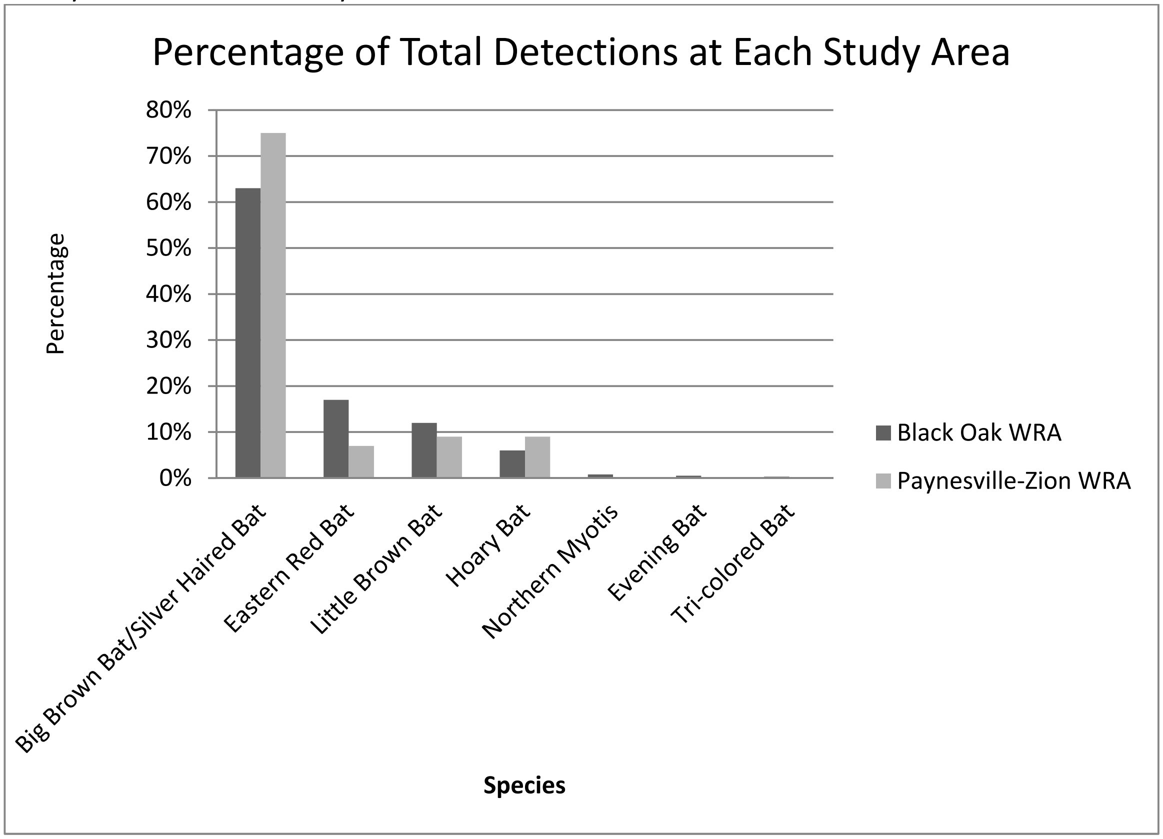

Figure 8. Percentage of total detections at each study area, per species.

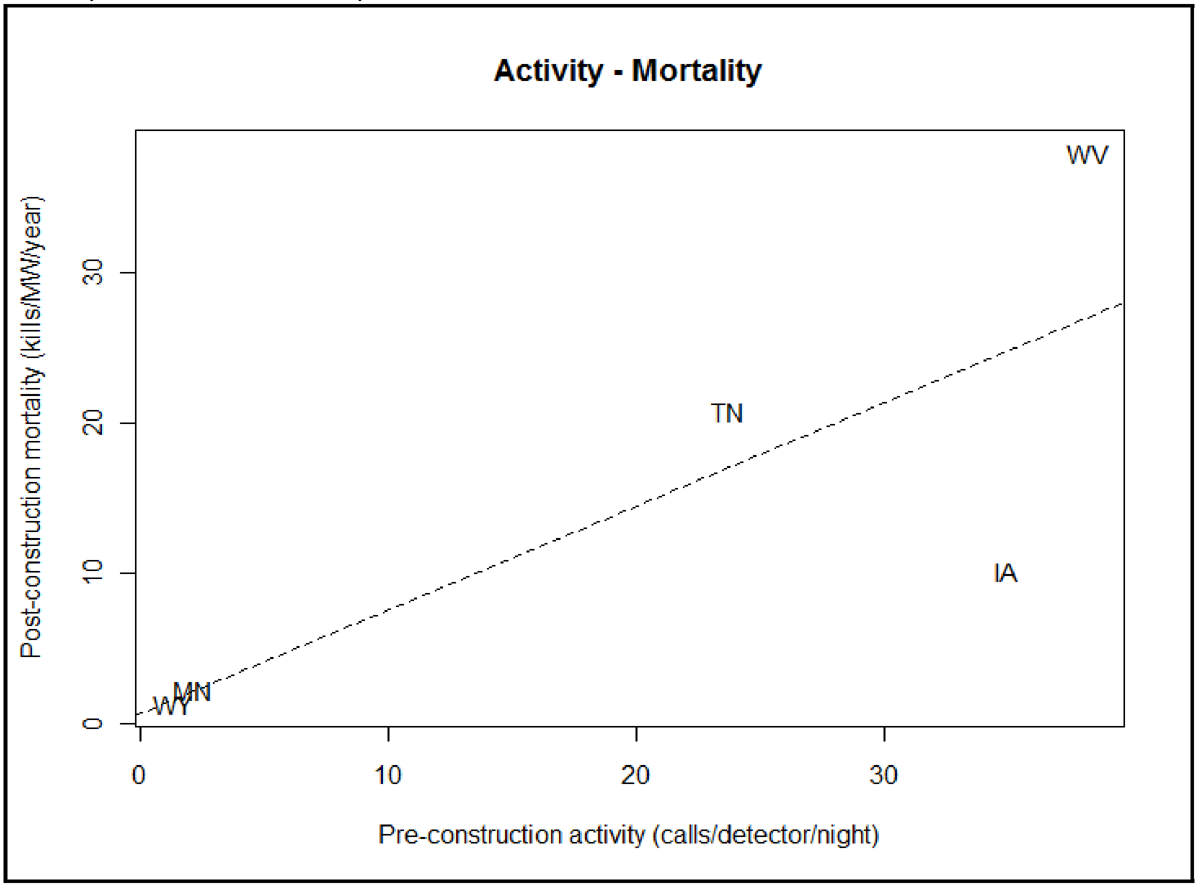

Figure 9. A synopsis of the relationship observed between pre-construction activity and post-construction bat mortality recorded at existing wind power developments where pre-construction activity surveys were conducted. Data points are labeled with the state in which the study took place. References: Johnson et al. 2004 (MN, Buffalo Ridge WRA), Young et al 2003 (WY), Jain 2005 (IA), Fielder 2004 (TN), E.B. Arnett, Bat Conservation International, unpublished data (WV).

Acknowledgements

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