Bat Monitoring Studies at the Fowler Ridge Wind Energy Facility Benton County, Indiana

April 13 – October 15, 2010

Prepared for:

Fowler Ridge Wind Farm

Prepared by:

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January 28, 2011

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NATURAL RESOURCES ◆ SCIENTIFIC SOLUTIONS

EXECUTIVE SUMMARY

The Fowler Ridge Wind Farm (FRWF) is collectively owned by BP Wind Energy, Sempra Generation, and Dominion Energy, and is being developed in five separate phases for a total of 1,000 megawatts (MW). The project currently consists of 355 wind turbines in three phases in Benton County, Indiana. A post-construction casualty study of birds and bats was conducted within Phases I and III during 2009 by Western EcoSystems Technology, Inc (WEST). One carcass of an Indiana bat (*Myotis sodalis*), a federally endangered species, was found by wind plant personnel during the fall of 2009. As a result of this discovery, the US Fish and Wildlife Service (USFWS) Field Office in Bloomington, Indiana, has recommended that the FRWF develop a Habitat Conservation Plan (HCP). Consequently, the owners of the FRWF requested that WEST conduct further research of potential bat casualty and use rates at the FRWF during 2010 for use in completing a HCP and obtaining an Incidental Take Permit (ITP) from Region 3 of the USFWS. The results presented in this report were collected under a Scientific Research and Recovery Permit for the Indiana bat (TE15075A).

Studies at the FRWF were comprised of two components: a bat casualty study and an acoustical bat survey. The goals of the casualty study were: 1) to determine if Indiana bat fatalities were widespread and if fatalities occurred at levels that may reduce the viability of Indiana bat populations; and 2) determine if facility operation management can be utilized as an effective tool for reducing bat casualty rates. The goals of the bat use study were to: 1) measure the overall rates of use of the FRWF by Indiana bats and other bat species; and to 2) provide information that may help to better define periods when potential mitigation and minimization measures for Indiana bats may be most effective.

Casualty searches were conducted during the spring (April 13 – May 15, 2010) and fall (August 1 – October 15, 2010) migration periods. Casualty searches were completed on two types of plots: 1) 80 x 80-meter (m; 262 x 262-foot [ft]) square plots centered on 36 turbines and cleared of vegetation; and 2) roads and turbine gravel pads within 40 m (131 ft) of 100 additional turbines. Carcass searches were conducted daily at the 36 square plots, and weekly at the road and pad plots. During the spring, 128 turbines were sampled during the study. Surveys were unable to be completed on eight turbines originally selected for road and pad searches as part of the study plan due to construction activities. Surveys were completed at all 136 turbines in the fall.

Turbines were selected for carcass searches using a systematic sampling design with a random start. During the fall migration period the effectiveness of raising turbine cut-in speeds was tested at a sample of the daily searched turbines. Bat casualty rates were measured at two different cut-in speed adjustments or "treatments" and two sets of "control" or "reference" turbines with no turbine cut-in speed adjustment. Nine turbines were randomly selected from the sample of 36 daily searched turbines for use as a "control" sample, and had no treatments for the duration of the study. Treatments for cut-in speed adjustment and a second set of "control" turbines were rotated on a weekly basis between the remaining 27 daily search

turbines, with nine turbines assigned to each group. The treatments included turbines with cut-in speeds raised to a lower level (5 m/s), and turbines with cut-in speeds raised to higher level (6.5 m/s). Turbines were randomly assigned to control and treatment groups among the 27 turbines, and treatments were distributed to ensure each turbine received 3 - 4 weeks of each treatment or control status.

During the spring migration period (April 13, 2010 – May 15, 2010) 80 x 80-m square plots were surveyed 33 times for a total of 1,169 searches. A total of 423 surveys were completed at roads and pads during spring 2010. Thirty-six bat casualties (18 silver-haired bats [*Lasionycteris noctivagans*], 15 eastern red bats [*Lasiurus cinereus*], two hoary bats [*Lasiurus borealis*], and one big brown bat [*Eptesicus fuscus*]) were found during the spring. Of the 36 bat casualties found, 32 were found during scheduled searches and four were found incidentally. All fresh, non-myotis bat casualties were collected and utilized in searcher efficiency and carcass removal trials. Four raptor casualties (three red-tailed hawks [*Buteo jamaicensis*] and one rough-legged hawk [*Buteo lagopus*]), eight small bird casualties (two European starlings [*Sturnus vulgaris*], one horned lark [*Eremophila alpestris*], one Tennessee warbler [*Vermivora peregrina*], one common yellowthroat [*Geothlypis trichas*], one unidentified dove and two unidentified birds) were also found during spring migration searches.

During the fall 3,871 plot surveys were conducted during 110 visits to the study area at the 36 daily search turbines, with an additional 1,618 surveys being conducted during 17 visits to the facility at the 100 turbines selected for road and pad surveys. A total of 556 bats were found during regularly scheduled searches, with an additional 25 bats found incidentally at turbine search plots. The remaining 228 bat carcasses were found outside of the study period during clearing searches or not on scheduled search turbines and were not included in the casualty estimates. The most commonly found bat species during scheduled searches was eastern red bat (353 fatalities, 63.49% of fatalities), followed by silver haired bat (98 fatalities, 17.62%), hoary bat (84 fatalities, 15.11%), and big brown bat (16 fatalities, 2.88%). Two tri-colored bats (*Perimyotis subflavus*), two little brown bats (*Myotis lucifigus*) and one Indiana bat (*Myotis sodalis*) were also found during scheduled searches.

During these studies, some casualties may have been missed on search plots because either searchers missed them, or scavengers removed them prior to the search. Experimental trials were conducted to estimate these adjustment factors, including an estimate of the probability a carcass is available to be found during a search (i.e. not removed by scavengers) and is detected by observers. A total of 222 fresh bat carcasses were used in calculating an empirical estimate of the probability of availability and detection. These carcasses were allowed to remain where placed for a 28 day period and the date when searchers found the carcasses was noted. Of the 222 carcasses placed 77 were placed on turbines where only the road and pad was searched and 145 were placed on turbines where cleared plots were searched. The empirical estimate for the probability of available and detected on road/pad searches was 0.51 for weekly searches and 0.58 for cleared plot turbines (i.e. daily searches)

Two casualty estimators were used. The Schoenfeld method utilizes a formula to estimate the probability of a carcass being available and detected by search, and is typically used for studies with infrequent search intervals. The Schoenfeld estimate was calculated to ensure a casualty estimate could be compared to the 2009 bat casualty estimate. The 2nd estimator used, the empirical estimate, was based on daily checks of bat carcasses, and represents an actual measure of carcass availability and detectability.

The estimated number of bat fatalities per turbine (based on Shoenfeld"s pi estimates) was 0.91 for daily search plots and 0.43 for weekly search plots during the spring season. These estimates increased during the fall season, with 17.69 bat fatalities per turbine per season at daily search turbines and 15.73 bats per turbine at weekly searches. Adjusted casualty estimates based on empirical estimates for the probability of available and detected were 1.25 bats per turbine for daily search turbines and 0.55 bats per turbine for weekly searches in the spring and 24.17 bats per turbine for daily search turbines and 20.96 per turbine for weekly searches in the fall, with an overall adjusted casualty estimate of 22.20 bats per turbine for the study period.

Bat casualty rates were lower at turbines where cut-in speeds were adjusted. Bat casualty rates and corresponding 90% bootstrap confidence intervals of 14.0 (11.6 - 16.5), 7.0 (7.0 - 9.1), and 3.0 (1.8 - 4.2) bats/turbine/season were recorded at control, 5.0 m/s, and 6.5 m/s treatment conditions respectively. Non-overlapping confidence intervals for observed casualty rates under each cut-in speed condition indicate a significant difference between treatments. An approximate 50% reduction in overall bat mortality was realized by raising the cut-in speed by 1.5 m/s (from 3.5 m/s to 5.0 m/s). An approximate 78% reduction in overall bat mortality was realized by raising the cut-in speed by 3.0 m/s (from 3.5 m/s to 6.5 m/s).

Relationships between bat casualty rates and weather factors were evaluated utilizing Poisson regression during the fall migration period of 2010. Bat casualty rates were highest on nights with higher bat activity, lower mean wind speeds, higher mean temperature and increasing variance in temperature, and increasing barometric pressure. In other words, higher bat fatalities were associated with warmer, calmer evenings prior to or after the passage of weather fronts and increasing bat activity. Bat casualty rates were also related to turbine type, with higher bat casualty rates observed at turbines with greater rotor swept areas.

Bat activity was monitored at the base of four daily search turbines on 36 nights during the spring period of April 9 through May 14. Bat activity was monitored at ground locations previously monitored during 2007 on 95 nights during the fall period of July 15 through October 18, 2010. Turbine locations were monitored at the base from August 1 through October 18, 2010; and nacelle units from August 17 through October 18, 2010. Anabat units recorded 185 bat passes on 137 detector-nights during the spring, and 5,721 bat passes on 685 detector-nights during the fall. The average bat activity for ground stations was 1.34 ± 0.29 bat passes per detector-night in the spring, and 11.46 ± 1.29 at ground stations and 3.10 ± 0.42 at raised stations during the fall.

Calls were placed in three groups, based on call frequency. During the spring study season, passes by low-frequency bats (LF; 46.5% of all bat passes) outnumbered passes by mid-frequency bats (MF; 28.1%) and high-frequency bats (HF; 25.4%), and this pattern was consistent among ground stations. Temporal patterns of use were similar among all three species groups during the study period, with the highest periods of use occurring during the first two weeks in August. During the fall study season, passes by LF bats (55.2% of all bat passes) outnumbered passes by HF (22.4%), and MF (22.3%), and this pattern was consistent among ground stations. Among raised stations, LF bats comprised 71.6% of passes. LF and MF comprised a greater proportion, and HF comprised a lower proportion, of calls recorded on the nacelle of turbines compared to ground stations. Temporal patterns of use were similar among all three species groups during the study period.

Using a call library*, Myotis* bat calls were analyzed to determine if call characteristics resembled Indiana bat calls. Three methods were utilized to identify potential Indiana bat calls, including a Discriminant Function Analysis, the "Britzke" filter, and a qualitative analysis by WEST biologists. Thirty calls were identified by the Discriminant Function Analysis as resembling calls made by Indiana bats in 2010, two calls passed the Britzke filter, and WEST biologists identified all 30 calls as being made by *Myotis,* but were not able to conclusively determine if calls were made by Indiana or little brown bat. Most potential *Myotis* calls were identified as occurring on the evening of August 9-10, 2010 at a ground-based station located away from turbines. Based on the presence of multiple potential calls, *Myotis* were present on the evening of August 9-10 at Station 2 (located away from turbine locations), and some potential exists that these calls were made by Indiana bats. The recording of individual potential *Myotis sodalis* calls identified by the Discriminant Function Analysis on other nights and stations does not provide strong evidence of *Myotis sodalis* activity due to the potential for incorrect identifications.

Bat activity was also actively sampled during both the spring and fall study seasons by driving east-west transects across the study area twice per week and recording calls at water sources and other potential bat habitat features. During the spring study period (five detector nights), active bat monitoring efforts recorded five HF bat passes, one MF bat pass, and nine LF bat passes. During the fall study season (21 detector-nights), active bat monitoring efforts recorded 32 HF bat passes, 59 MF bat pass, and 43 LF bat passes. None of the passes were identified as Indiana bat.

Bat activity was positively correlated with observed casualty rates, although other factors, such as weather and turbine type also played a role in observed bat casualty rates. Correlation between bat activity (number of bat passes per detector night) recorded with Anabat units located on the nacelles of selected turbines and observed casualty rates of fresh bat carcass finds was stronger than the correlation of casualty rates to Anabat detectors located at the base of turbines (Pearson"s correlation coefficients; 0.45 and 0.07 respectively).

The primary goals of the 2010 casualty study were to: 1) determine if Indiana bat fatalities were widespread, and if fatalities occurred at levels that may reduce the viability of Indiana bat populations; and 2) determine if facility operation management can be utilized as an effective tool for reducing bat casualty rates. Despite the increased survey effort over studies conducted in 2009, and despite reasonable probabilities of detecting bat carcasses during the study, very few *Myotis* carcasses were found, with only one Indiana bat carcass found during the study. Very few *Myotis* calls were recorded during the course of the study, and multiple calls potentially resembling Indiana bat calls were recorded at a single station on one evening during the fall migration period. It is clear that Indiana bat casualties were not widespread and did not occur at a high rate during the spring and fall migration period of Indiana bats. The data collected during this study also provide a reasonable estimate of overall bat casualties within the FRWF. More detailed estimates of Indiana bat casualties for future operations of the FRWF will be calculated within a Habitat Conservation Plan, currently being prepared for the FRWF.

The data collected at the FRWF show bat casualty rates were affected by bat activity, weather, turbine types, and habitat. These observed relationships provide a baseline for developing additional hypotheses for implementing and testing measures to reduce bat casualty rates. The results also show that Indiana bat fatalities occur at the FRWF, albeit at an extremely low rate. While the low rate of Indiana bat fatalities likely indicate impacts of operation of the FRWF are also low, the low casualty rates also make it difficult to recommendations specific measures for Indiana bats. Thus, recommendations provided in this report are aimed at providing a basis for designing a strategy for reducing overall bat casualty rates under the assumption that Indiana bat casualty rates will also be reduced.

Raising turbine cut-in speeds showed a reduction in bat casualty rates at FRWF during the fall of 2010, and similar reductions in bat casualty rates have also been documented by researchers at other wind-energy facilities. However; correlations observed between weather variables and bat fatalities suggest that focusing or adjusting cut-in speeds during periods when bats may be at most risk, or at locations where bats may be more likely to be found as fatalities, may provide similar reductions in bat fatalities.

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INTRODUCTION AND BACKGROUND

The Fowler Ridge Wind Farm (FRWF) is collectively owned by BP Wind Energy North America (BPWENA), Sempra Generation, and Dominion Energy and is being developed in five separate phases for a total of 1,000 megawatts (MW). The project currently consists of 355 wind turbines in three phases in Benton County, Indiana (Figure 1). A post-construction casualty study of birds and bats was conducted within Phases I and III during 2009 by Western EcoSystems Technology, Inc (WEST, Inc.; Johnson et al. 2010a, 2010b). One carcass of an Indiana bat (*Myotis sodalis*), a federally endangered species, was reported by FRWF personnel during the fall of 2009 (Johnson et al. 2010b, USFWS 2010). As a result of this discovery, the US Fish and Wildlife Service (USFWS) Field Office in Bloomington, Indiana, recommended that the FRWF develop a Habitat Conservation Plan (HCP). Consequently, the owners of the FRWF requested that WEST conduct further research of Indiana bat use and potential casualty rates at the FRWF for use in completing a HCP and obtaining an Incidental Take Permit (ITP) from Region 3 of the USFWS. The results presented in this report were collected under a Scientific Research and Recovery Permit for the Indiana bat (TE15075A).

Studies at the FRWF were comprised of two components: a bat casualty study and an acoustical bat survey. The goals of the casualty study were to: 1) determine if Indiana bat fatalities were widespread, and if fatalities occurred at levels that may reduce the viability of Indiana bat populations; and 2) determine if facility operation management can be utilized as an effective tool for reducing bat casualty rates. The goals of the bat acoustic study were to: 1) measure the overall rates of use of the FRWF by Indiana bats and other bat species; and to 2) provide information that may help to better define periods when potential mitigation and minimization measures for reducing impacts to Indiana bats may be most effective.

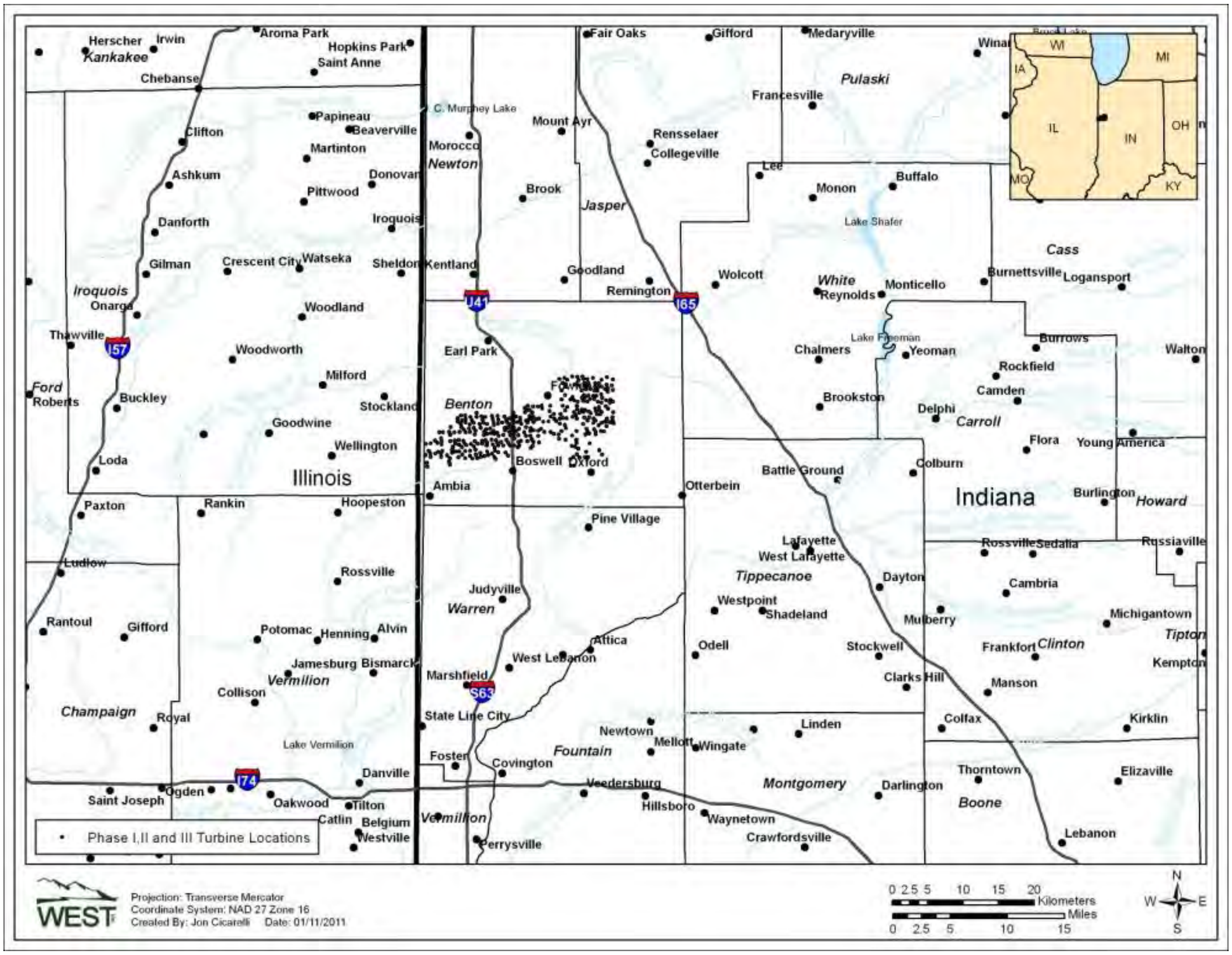

Figure 1. Location of the Fowler Ridge Wind Farm.

STUDY AREA

The FRWF currently has a total energy capacity of 600 megawatts (MW). Phase I consists of 122 Vestas V82 1.65-MW turbines and 40 Clipper C96 2.5-MW turbines for a total of 301 MW of energy capacity. Phase II consists of 133 1.5-MW General Electric (GE) SLE Turbines with a total capacity of 199.5 MW. Phase III consists of 60 Vestas V82 1.65-MW turbines (99 total MW of capacity). The three turbine types varied in size (Table 1).

Table 1. Turbine characteristics at the Fowler Ridge Wind Farm.

Turbine Model	MW	Turbine Height (m)	Rotor Diameter (m)	Standard cut-in speed (m/s)
GE SLE	1.5	80	77	3.5
Vestas V82	1.65	80	82	3.5
Clipper C96	2.5	80	96	3.5

Phases I and III were constructed in 2008 and became operational during January of 2009. Phase II was constructed in 2009 and became operational by December 31, 2009.

The FRWF is located in western Indiana in Benton County (Figure 1). The wind-energy facility lies within the Tipton Tall Plain physiographic region that includes much of central Indiana and lies within the Grand Prairie Natural Region that includes a small section of north central Indiana (Whitaker and Mumford 2009). The topography of the FRWF is mostly flat to slightly rolling (Figure 2). Elevations in the project area range from approximately 700-800 feet (ft; 213-244 meters [m]). The area averages 40 inches (102 centimeters [cm]) of precipitation per year and average temperatures range from 19 to 45 °F (-7.2 to 7.3 °C) in January to 65 to 86 °F (18 to 30 °C) in July. Soils in the FRWF are various combinations of silt loam, clay loam, loam, silty clay loam, sandy loams and sandy clays (USDA-NRCS 2006). Much of the area is classified as prime farmland based on soil type. The FRWF is dominated by tilled agriculture, with corn (*Zea mays*) and soybeans (*Glycine max*) being the dominant crops (Figure 3). Of the roughly 54,880 acres (about 86 square miles [mi^2]) within one half-mile (0.80 km) of turbine locations, row crops comprise about 93% of the land use for the study area (USGS NLCD 2001; Table 2; Figure 3). After tilled agriculture, the next most common land uses within the FRWF are developed areas (e.g., houses and buildings), which comprise 5.0% of the total, and pastures/hayfields, which comprise 1.4% of the total. There are 22.8 acres (0.04 mi^2) of grasslands which compose less than 0.1% of the study area. Grasslands in the study area are limited primarily to strips along drainages, railroad rights-of-way (ROW), and ROWs along county and state roads. There are also a few grass-lined waterways within cultivated fields in the area. Trees in the study area occur at homesteads, along some of the drainages and fencerows, and within some small, isolated woodlots. Forested areas are rare within the study area based on 2001 data (Homer et al. 2004), and the 249.3 acres (0.39 mi^2) of forest comprise 0.5% of the total area. Small amounts of barren ground, open water, and woody wetlands are also present.

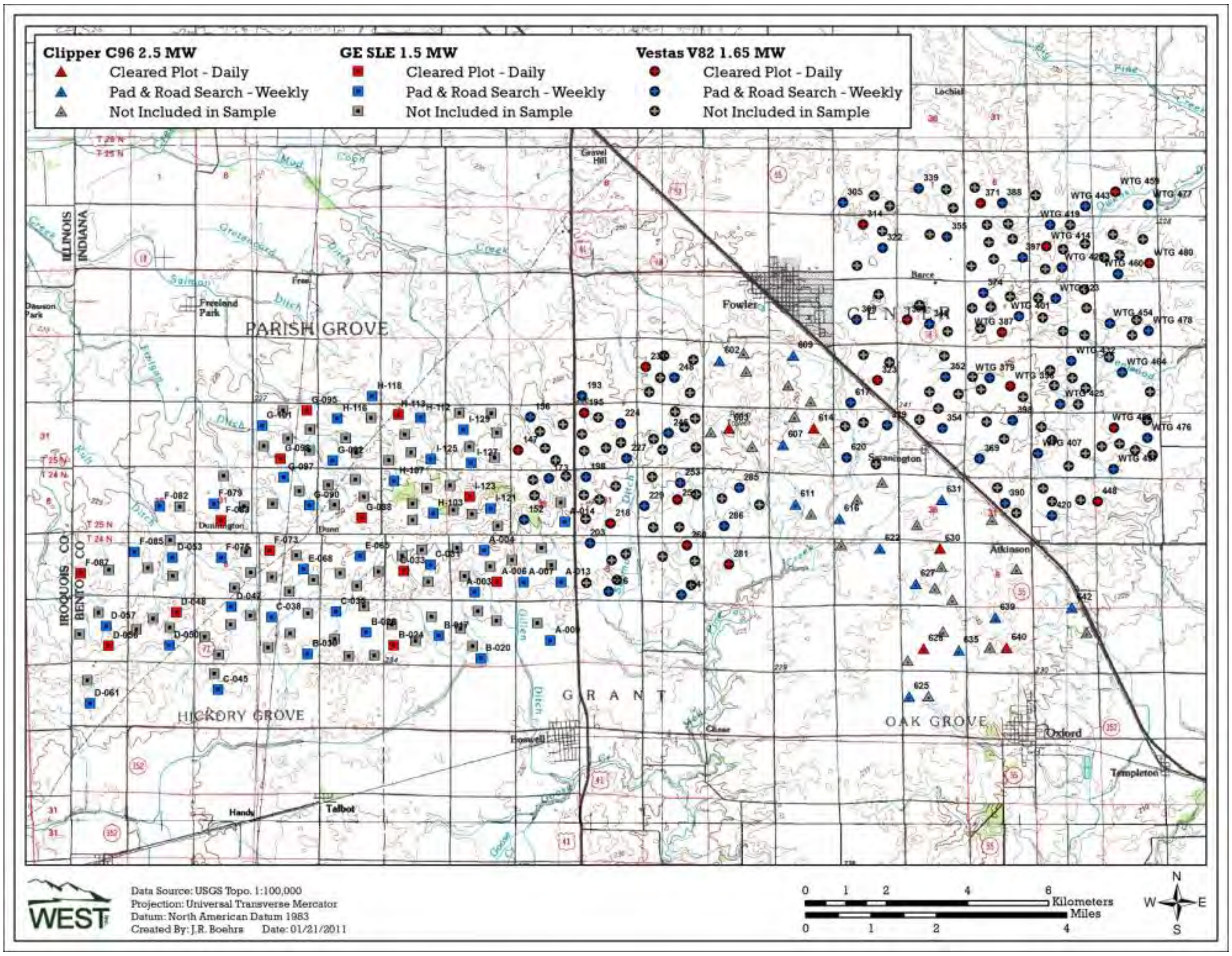

Figure 2. Elevation and topography of the Fowler Ridge Wind Farm.

Table 2. Land cover types within the Fowler Ridge Wind Farm.

Habitat Type	Acres	Percent Composition
Crops	51013.03	92.95%
Developed, Low Intensity	1505.60	2.74%
Developed, Open Space	1245.02	2.27%
Pasture/Hay	751.97	1.37%
Deciduous Forest	249.35	0.45%
Developed; Medium Intensity	47.60	0.09%
Grassland	22.79	0.04%
Open Water	17.02	0.03%
Developed, High Intensity	16.40	0.03%
Barren	10.02	0.02%
Emergent Wetlands	1.23	<0.01
Overall	**54,880.05**	**100**

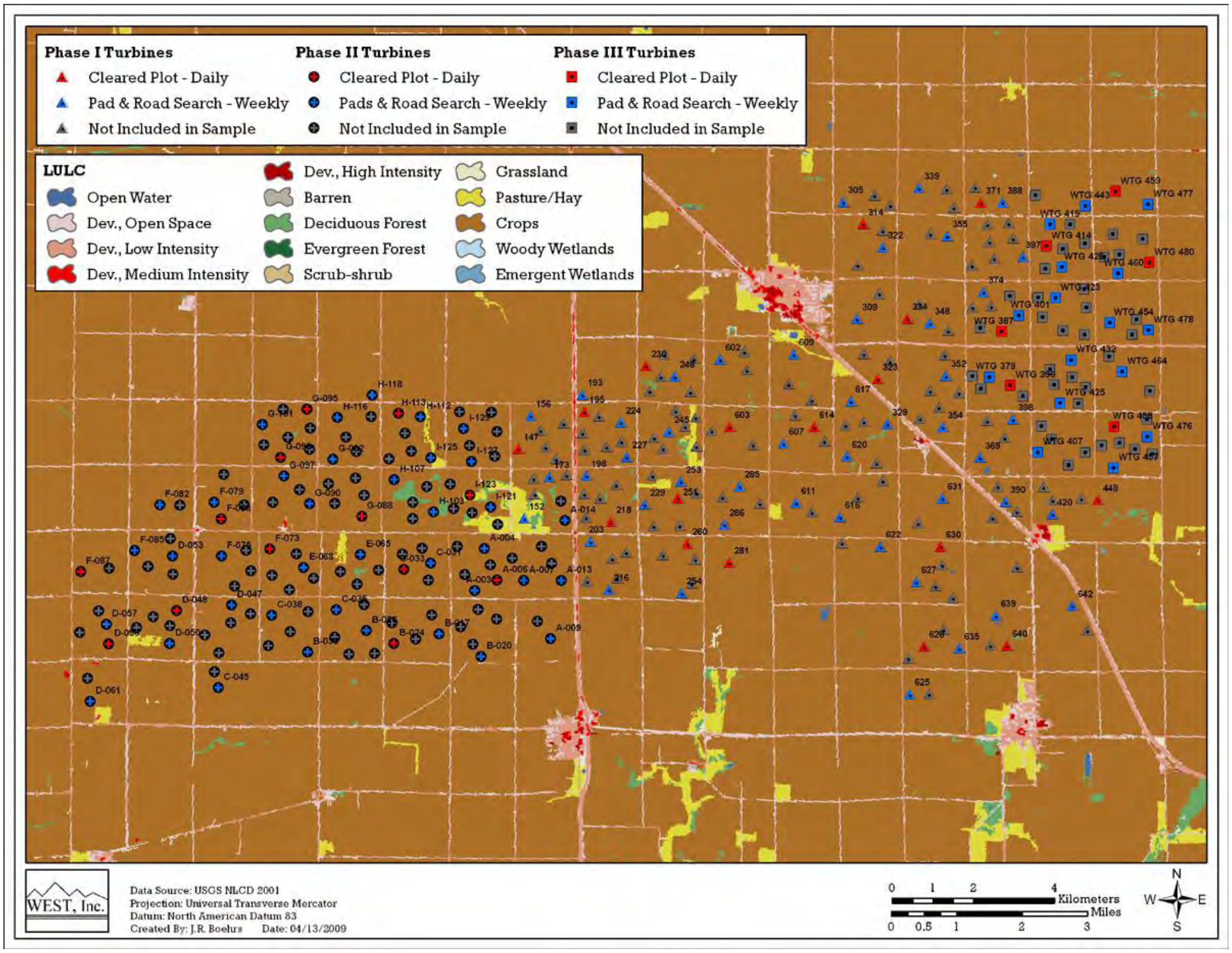

Figure 3. Land use/ land cover of the Fowler Ridge Wind Farm (USGS NLCD 2001).

METHODS

Bat Casualty Surveys

The primary objectives of the bat casualty study included:

1) Estimate the overall bat casualty rates within the FRWF in Phases I, II and III in order to make a scientifically defensible estimate of annual Indiana bat casualty rates.

2) Determine if statistical relationships exist between bat casualty rates and weather factors (e.g., wind speed, temperature).

3) Test the effectiveness of facility operations management for reducing bat casualty rates.

Seasons

The 2010 casualty study occurred during the spring (April 12 – May 15) and fall (August 1 – October 15) migration periods for Indiana bats (USFWS 2007). The FRWF is located within an area dominated by corn and soybean fields, and forest cover is rare. Based on the overall lack of forest cover, as well as an assessment of the project by the USFWS, Indiana bats were assumed to be absent during summer. The original Indiana bat carcass was found on September 11, 2009 (see USFWS 2010), and based on timing and land cover surrounding the carcass and turbine, the bat was assumed to have been a fall migrant. The vast majority of bat fatalities of other species at Fowler I and III, and at other wind-energy facilities have also been found during the fall migration period, with a smaller peak of fatalities occurring during the spring migration period (Arnett et al. 2008; Johnsonet al. 2010a, 2010b).

Search Plot and Sample Size

The FRWF is composed of 355 turbines. One-hundred-thirty-six turbines (about 38% of all turbines) were sampled during the study (Figure 2). Square 80 x 80 m plots at 36 turbines were maintained relatively free of vegetation in order to increase searcher efficiency rates (Figure 4). Plots were maintained throughout the study through the use of herbicides and mowing. The 80 x 80 m plot size was chosen based on the distances bats typically fall from turbines (Johnson et al. 2010b).

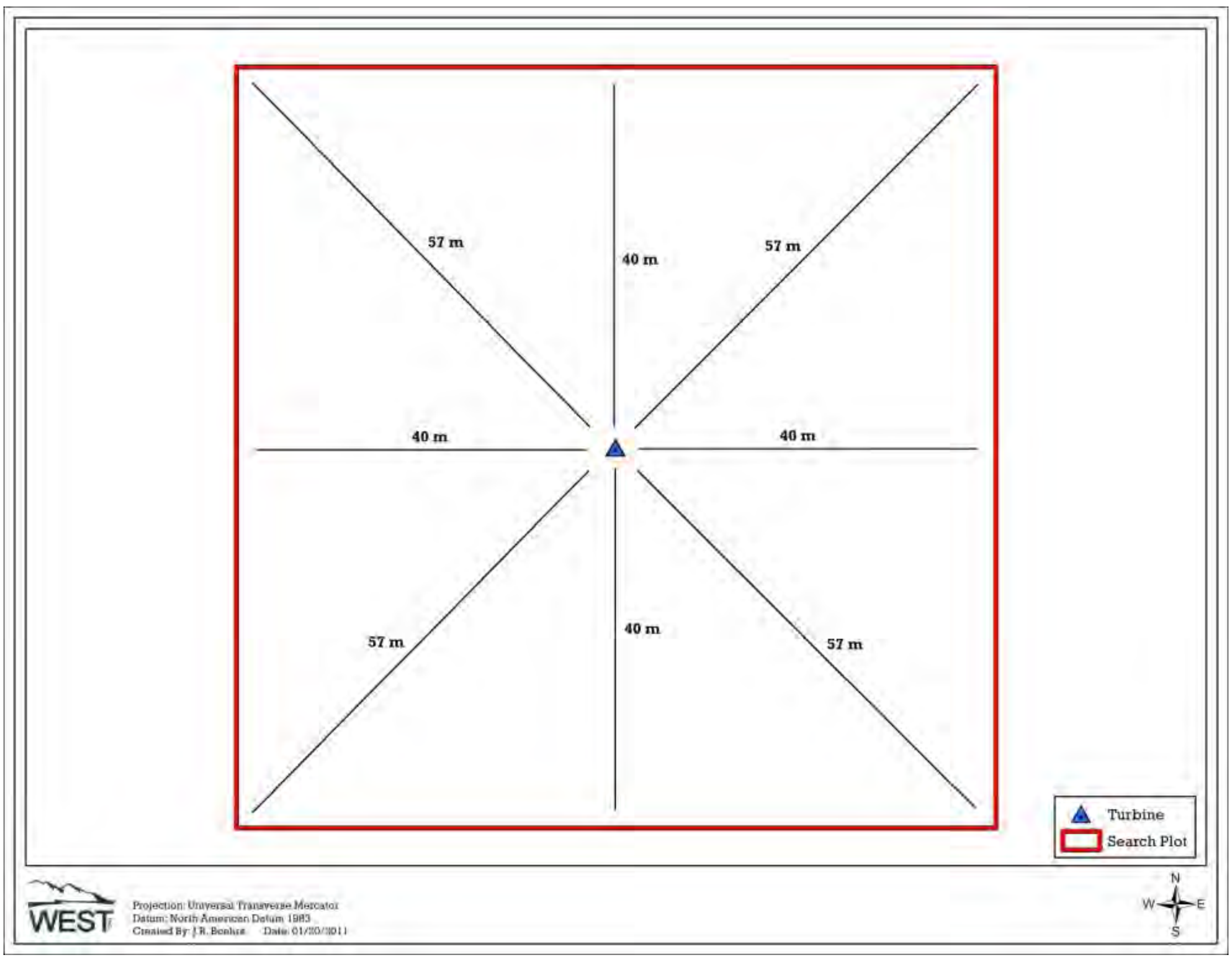

Figure 4. Example diagram of a search plot surrounding a turbine at the Fowler Ridge Wind Farm.

Carcass searches at an additional 100 turbines were conducted along access roads and turbine pads within 40 meters measured using sub-meter Global Positioning Systems (GPS). Roads and pads were searched at these additional turbines in order to increase the spatial coverage of sampling efforts and to increase the probability of detecting an Indiana bat casualty. This proposed sampling approach assumes that representative casualty rates can be calculated by searching only road and turbine pads. This assumption was tested using a double-sampling approach within the 36 cleared plots described above. The locations of carcasses within the cleared plots were recorded (i.e., on turbine pad and road versus off turbine pads and roads) for use in analyses.

The 36 turbines with cleared plots were searched daily throughout the sampling period. The remaining 100 turbines without cleared plots were searched on a weekly basis. The search intervals proposed for the 2010 study season were based on the results of the 2009 casualty study. During 2009, the average length of stay for bat carcasses at the FRWF was 6.1 days (Johnson et al. 2010b).

Turbines were selected for sampling using a systematic design with a random start from a sample of turbines where landowners were willing to participate in the study. In this fashion, the search effort was spread across the entire FRWF.

Facilities Management Study

The effectiveness of altering turbine cut-in speeds in reducing bat casualty rates was evaluated during the fall of 2010. Facility management studies were limited to the fall because few bat fatalities were expected during the spring of 2010 (see Johnson et al. 2010a), potentially reducing our ability to detect significant differences in casualty rates between treatments.

Bat casualty rates were measured at two different cut-in speed adjustments or “treatments” and two sets of “control” turbines with no cut-in speed adjustment. Nine turbines were randomly selected from the sample of 36 daily searched turbines for use as a “control” or “reference” sample for the duration of the study. Treatments for cut-in speed adjustment and a second set of “control” turbines were rotated on a weekly basis between the remaining 27 daily search turbines, with nine turbines assigned to each group. The treatments included turbines with cut-in speeds raised to 5 m/s, and turbines with cut-in speeds raised to 6.5 m/s. Turbines were randomly assigned to control and treatment groups among the 27 turbines, and treatments were distributed temporally to ensure each turbine received 3 - 4 weeks of treatment or control status.

Field Methods

Casualty Searches

Personnel trained in proper search techniques conducted the carcass searches. Searches occurred along transects within each search plot. Searchers walked at a rate of approximately 45 to 60 m per minute (about 148 to 197 ft per minute) along each transect looking for bat carcasses. Transects were spaced at approximately 5-m (16-ft) intervals, and searchers scanned the area on both side sides out to approximately 2.5 m (about eight ft) for casualties as they walked each transect. All bat carcasses were recorded and collected. Bird carcasses were recorded, but left in the field. Searches began after 7am each morning, and were completed by sunset, with most searches completed by early afternoon. The order of turbines searched, as well as the orientation of search transects, was changed on a daily basis.

The condition of each carcass found was recorded using the following categories:

- Intact - a carcass that is completely intact, is not badly decomposed, and shows no sign of being fed upon by a predator or scavenger.

- Scavenged - an entire carcass, which shows signs of being fed upon by a predator or scavenger, or a portion(s) of a carcass in one location (e.g., wings, skeletal remains, portion of a carcass, etc.), or a carcass that has been heavily infested by insects.

- Feather Spot (for bird carcasses only) - 10 or more feathers at one location indicating predation or scavenging.

Fresh bat carcasses found were collected, identified, and utilized during searcher efficiency and carcass removal trials (except for *Myotis*; see below for more details). Older or scavenged bat carcasses were identified to the extent possible, labeled with a unique number, and then bagged and frozen for future reference and possible necropsy. A copy of the data sheet for each carcass was maintained, bagged and kept with the carcass at all times. For all casualties found, data recorded included species, sex and age when possible, turbine identification number, date and time collected, GPS location, condition (intact, scavenged, feather spot), location within plot (road and turbine pad versus other areas), vegetation cover and any comments that may indicate cause of death. All bird and bat carcasses located were photographed as found and plotted on a detailed map of the study area showing the location of the wind turbines and associated facilities. Estimated time since death for bats was also recorded. Criteria used to determine time since death was based on daily observations of bat carcasses placed in plots during bias trials (Appendix A).

Casualties found outside the formal search area by searchers, or carcasses reported to searchers by FRWF maintenance personnel, were treated following the above protocol as closely as possible. Casualties found in non-search areas (e.g., near a turbine not included in the search area) were coded as incidental discoveries, collected, and documented in a similar fashion as those found during standard searches. In addition to carcasses, all injured bats and birds observed in search plots were recorded and treated as a casualty.

All *Myotis* carcasses found were identified to species by biologists trained in the identification of *Myotis* species, including Indiana bat, and were delivered to the USFWS office in Bloomington, Indiana. In order to verify field identifications of *Myotis* that could not be conclusively identified, skin samples were sent to Jan Zink at Portland State University for identification via deoxyribonucleic acid (DNA).

Field Bias Trials

Searcher efficiency and removal of carcasses by scavengers was quantified to adjust the estimate of total bat fatalities for detection bias. Bias trials were conducted throughout the entire study period. A list of random turbine numbers and random azimuths and distances (m) from turbines was generated for placement of each bat used in bias trials.

Only freshly killed bats conclusively identified as non-*Myotis* were used for searcher efficiency and carcass removal trials. At the end of each day"s search, the field crew leader gathered all bat carcasses located during that day"s surveys and then redistributed only the fresh bats at predetermined random points within any given turbine"s searchable area. Searchers had no knowledge of the number and placement of carcasses at turbines. Data recorded for each trial carcass prior to placement included date of placement, species, turbine number, distance and direction from turbine. Carcasses were identified as bias trials through the removal of the upper canine or placement of small, indistinct black zip ties on bat wings.

Each trial bat was left in place and checked daily by the field crew leader or an observer not involved with the casualty searches; thus, trial bats were available and could be found by observers on consecutive days during daily searches unless the carcasses were previously removed by a scavenger. The date that each bat was found by an observer was recorded to determine the amount of time the carcass remained in the scavenger removal trial. If, however, a carcass was removed by a scavenger before detection by an observer, it was removed from the searcher efficiency trial and used only in the removal data set. When a bat carcass was found, the observer inspected the canine teeth or wing to determine if a bias trial carcass had been found. If so, the observer contacted the field crew leader and the bat was left in place for the carcass removal trial. Carcasses were left in place until removed by a scavenger, until they became decomposed to a point beyond recognition, for a maximum of 28 days, at which time the number of days after placement was recorded.

Statistical Analysis

Casualty Estimates

Two methods were utilized to calculate overall bat casualty estimates: 1) Shoenfeld estimate of carcass availability (see Shoenfeld 2004), and 2) Empirical measure of carcass availability. The Shoenfeld estimate is typically used when search intervals are fairly wide, and the probability of a carcass being found by a searcher needs to be estimated. The Shoenfeld estimate was calculated to provide a comparable overall bat casualty estimate to the 2009 study results (Johnson et al. 2010b) and was based on carcass persistence and searcher efficiency results. For 2010 surveys, a second bat casualty rate was calculated utilizing an estimate of the probability of detection that doesn"t separate out the influence of scavenging versus searcher detection. This empirical estimate is based on the overall ratio of the number of trial carcasses found by searchers to the number placed. Only bats found at turbines with no cut-in speed adjustments were used to estimate total bat casualty estimates using both methods.

Estimates of the number of facility-related fatalities were based on:

1) Observed number of carcasses found during standardized searches during the monitoring period; and

2) The probability that a carcass was present during a scheduled carcass search and detected by searchers. This probability was estimated both empirically and using Shoenfeld"s estimator. Shoenfeld"s estimate for the probability of availability and detection was based on non-removal rates, expressed as the estimated average probability a carcass is expected to remain in the study area and be available for detection by the observers during removal trials; and searcher efficiency expressed as the proportion of planted carcasses found by searchers during searcher efficiency trials. Empirical estimates of the probability a carcass was available and detected were calculated based on the overall detection of planted carcasses over a 28 day period.

Definition of Variables

The following variables are used in the equations below:

c_i	the number of carcasses detected at plot *i* for the entire study period
n	the number of search plots
k	the number of turbines searched
$\bar{c}$	the average number of carcasses observed per turbine per monitoring period
s	the number of carcasses used in removal trials
s_c	the number of carcasses in removal trials that remain in the study area after 30 days
se	standard error (square of the sample variance of the mean)
t_i	the time (in days) a carcass remains in the study area before it is removed, as determined by the removal trials
$\bar{t}$	the average time (in days) a carcass remains in the study area before it is removed, as determined by the removal trials
d	the total number of carcasses placed in searcher efficiency trials
p	the estimated proportion of detectable carcasses found by observers, as determined by the searcher efficiency trials
I	the average interval between standardized carcass searches, in days
A	proportion of the search area of a turbine actually searched
$\hat{\pi}_{s}$	the Shoenfeld estimate for the probability that a carcass is both available to be found during a search and is found, as determined by the removal trials and the searcher efficiency trials
$\hat{\pi}_{e}$	the empirical estimate for the probability that a carcass is both available to be found during a search and is found, as determined by the ratio of trial carcasses found over a 28 day period to the number of carcasses placed
m	the estimated average number of fatalities per turbine per monitoring period, adjusted for removal and searcher efficiency bias

Observed Number of Carcasses

The estimated average number of carcasses ($\bar{c}$) observed per turbine per monitoring period was:

$$\bar{c} = \frac{\sum_{i=1}^{n} c_i}{k \cdot A} \qquad (1)$$

Estimation of Carcass Non-Removal Rates

Estimates of carcass non-removal rates were used to adjust carcass counts for removal bias. Mean carcass removal time ($\bar{t}$) is the average length of time a carcass remains in the study area before it is removed:

$$\bar{t} = \frac{\sum_{i=1}^{s} t_i}{s - s_c} \qquad (2)$$

Estimation of Searcher Efficiency Rates

Searcher efficiency rates were expressed as *p,* the proportion of trial carcasses that were detected by observers in the searcher efficiency trials.

Estimation of Facility-Related Casualty Rates

The estimated per turbine casualty rate (*m*) is calculated by:

$$m = \frac{\bar{c}}{\hat{\pi}} \qquad (3)$$

where $\hat{\pi}_S$ includes adjustments for both carcass removal (from scavenging and other means) and searcher efficiency bias. Data for carcass removal and searcher efficiency bias are pooled across the study to estimate $\hat{\pi}_S$.

$\hat{\pi}_S$ is calculated as follows:

$$\hat{\pi} = \frac{\bar{t} \cdot p}{I} \cdot \left[\frac{\exp\left(I / \bar{t} \right) - 1}{\exp\left(I / \bar{t} \right) - 1 + p} \right]$$

This formula has been independently verified by Shoenfeld (2004). Empirical estimates for the probability of availability and detected $\hat{\pi}_E$ are caculated by the following equation.

$$\hat{\pi} = \frac{number\ of\ trial\ carcasses\ detected}{number\ of\ trial\ carcasses\ placed} \pi \widehat{\pi}_E = \frac{number\ of\ trial\ carcasses\ detected}{number\ of\ trial\ carcasses\ placed}$$

The final reported estimates of *m* and associated standard errors and 90% confidence intervals (CI) were calculated using bootstrapping (Manly 1997). Bootstrapping is a computer simulation technique that is useful for calculating point estimates, variances, and confidence intervals for complicated test statistics.

For each bootstrap sample, $\bar{c}$, $\bar{t}$, p, $\hat{\pi}$, and m were calculated and a total of 5,000 bootstrap samples were used. The reported estimates are the mathematical means of the 5,000 bootstrap estimates. The standard deviation of the bootstrap estimates is the estimated standard error. The lower 5^{th} and upper 95^{th} percentiles of the 5,000 bootstrap estimates are estimates of the lower limit and upper limit of 90% confidence intervals.

Effects of Raising Cut-In Speeds

Casualty rates for each cut-in speed were calculated along with corresponding 90% bootstrap confidence intervals. Estimates without overlapping confidence intervals were considered significantly different. In addition to using adjusted casualty estimates differences in cut-in speed were examined by building a Poisson model to determine the relative difference in casualty rates based on cut-in speed. The magnitude of model coefficients represents the relative ratio of casualty rates between curtailed treatments and those with no cut-in speed adjustment. Tests for variable selection were used to assess the statistical significance of the cut-in speed covariates. The estimated time since death for each bat carcass found was evaluated to determine which curtailment condition the bat casualty occurred during. Carcasses of bats that were estimated to have died prior to the start of the fall casualty search survey were not included in the analysis along with carcasses where the length of time since death could not accurately be determined.

Correlation Analyses

Weather and Bat Casualty

Weather data from casualty search turbines and a meteorological (met) tower were used to assess fall mortality rates at the FRWF in relation to weather variables (Table 3). Wind speed, wind direction, ambient temperature, and humidity were obtained from the anemometers on the met towers, while rotor speed, active power production, barometric pressure and additional wind speed data were collected at turbines. These analyses are considered exploratory analyses since explicit hypotheses were not developed a priori. General hypotheses based on previous knowledge of bat fatalities at wind projects have suggested negative relationships between wind speed and bat fatalities, as well as factors related to passage of weather fronts (e.g. temperature, humidity and barometric pressure).

Table 3. Descriptions of predictor variables used in the analyses for associations between weather characteristics and mortality

Predictor Variable [abbreviation]	Description
Wind Speed (m/s)	
[mean.ws]	Mean nightly wind speed; measured at and averaged across turbines and met towers
[sd.ws]	Standard deviation of the mean nightly wind speed across the 5 minute intervals
Wind Direction	
[mean.wd]	Mean nightly wind direction. 0 represents wind blowing toward the north ; measured at and averaged across met towers
Ambient Temperature (ºc)	
[mean.at]	Mean temperature measured at the met tower taken every 5 minutes for the entire 24 hour period before corresponding searches
[sd.at]	Standard deviation of the temperature for the 24 hour pervious previous to corresponding searches
[mean.nat]	Mean nightly temperature measured at the met tower taken every 5 minutes for the night previous to corresponding searches
[sd.nat]	Standard deviation of the nightly temperature for the night previous to corresponding searches
Humidity	
[mean.hu]	Mean humidity measured at the met tower taken; every 5 minutes for the 24 hour period before corresponding searches
[sd.hu]	Standard deviation of the humidity for the 24 hour period previous to corresponding searches
[mean.nhu]	Mean nightly humidity measured at the met tower; taken every 5 minutes for the night previous to corresponding searches
[sd.nhu]	Standard deviation of the nightly humidity for the night previous to corresponding searches
Rotor Speed (rpm)	
[mean.rs]	Mean nightly rotor speed; measured at and averaged across turbines and the 5 minute intervals
[sd.rs]	Standard deviation of the mean nightly rotor speed across the 5 minute intervals
Active Power	
[mean.ap]	Mean active power generated nightly; measured at and averaged across turbines and the 5 minute intervals
[sd.ap]	Standard deviation of active power generated nightly across the 5 minute intervals

Table 3. Descriptions of predictor variables used in the analyses for associations between weather characteristics and mortality

Predictor Variable [abbreviation]	Description
Barometric Pressure	
[mean.bp]	Mean barometric pressure measured at the met tower; taken every 5 minutes for the 24 hour period before corresponding searches
[sd.bp]	Standard deviation of the barometric pressure for the 24 hour period previous to corresponding searches
[range.bp]	Range of the barometric pressure measures taken 24 hours previous to corresponding searches; A negative value implies a drop in barometric pressure; Positive values corresponding with increases in barometric pressure
[mean.nbp]	Mean nightly barometric pressure measured at the met tower; taken every 5 minutes for the night previous to corresponding searches
[sd.nbp]	Standard deviation of the barometric pressure for the night previous to corresponding searches
[range.nbp]	Range of the nightly barometric pressure measures; A negative value implies a drop in barometric pressure; Positive values corresponding with increases in barometric pressure

Associations between turbine and weather characteristics and fresh bat casualties were investigated using Poisson modeling with the response variable being the count of fresh bat casualties found during each fall survey date with an offset term for the corresponding number of turbines searched. The fitted Poisson models all had log link and were of the form:

$$\log(\mu) = \beta_0 + \beta_1 x_1 + \cdots + \beta_p x_p + \varepsilon$$

which related the behavior of the natural logarithm of the mean number of fresh bat mortalities per turbine, to a linear function of the set of predictor variables $x_1, \ldots, x_p$. The β_j's are the parameters that specify the nature of the relationship and ε is a random error term. The statistical software R was used to fit all possible Poisson models with 8 or fewer explanatory variables. Akaike's information criterion (AIC) was used to determine the best fitting Poisson models. To avoid the negative effects of colinearity, variables with pairwise correlations ≥ 0.6 were not allowed to be present in the models at the same time. Residuals of selected models were plotted to determine goodness of fit.

Quality Assurance/Quality Control

Quality assurance and quality control (QA/QC) measures were implemented at all stages of the study, including in the field, during data entry and analysis, and report writing. Following field surveys, observers were responsible for inspecting data forms for completeness, accuracy, and legibility. A sample of records from an electronic database was compared to the raw data forms and any errors detected were corrected. Irregular codes or data suspected as questionable were discussed with the observer and/or project manager. Errors, omissions, or problems identified in later stages of analysis were traced back to the raw data forms, and appropriate changes in all steps were made. A Microsoft® ACCESS database was developed to store, organize, and retrieve survey data. Data were keyed into the electronic database using a predefined format to facilitate subsequent QA/QC and data analysis. All data forms, field notebooks, and electronic data files were retained for reference.

Bat Acoustic Surveys

The objectives of the bat acoustic surveys included:

1) Develop predictive models of bat use by species or species groups, based on weather variables;
2) Determine if bat use rates by species or species group were related to bat casualty rates;
3) Determine if the Anabat ultrasonic bat detector was an effective tool for predicting bat casualty rates;
4) Determine periods of time during which minimization measures may be most effective; and
5) Determine if relatively large amounts of Indiana bat activity occurred during spring and fall migration.

Bat surveys were conducted utilizing passive sampling techniques at turbines and locations that were previously sampled in 2007, and surveys were also conducted utilizing active sampling within the general project area. Passive sampling occurred at the base of turbines during spring migration (Figure 5), and at the base and on top of nacelles of four turbines searched daily during the fall migration period, to explore relationships between bat pass rates, bat casualty rates, and weather variables (Figure 6). Monitoring at Anabat stations during the fall period began August 1 for stations located below turbines. Monitoring on nacelle units began 17 days later on August 18 due to equipment malfunctions. Bat use was also monitored at locations that were sampled in 2007 from July 15 – October 15 in order to determine if bat pass rates were similar before and after construction of the FRWF (Figure 6). Additional active acoustic bat sampling was conducted during the migration periods in order to increase the probability of detecting Indiana bat calls if Indiana bats were present.

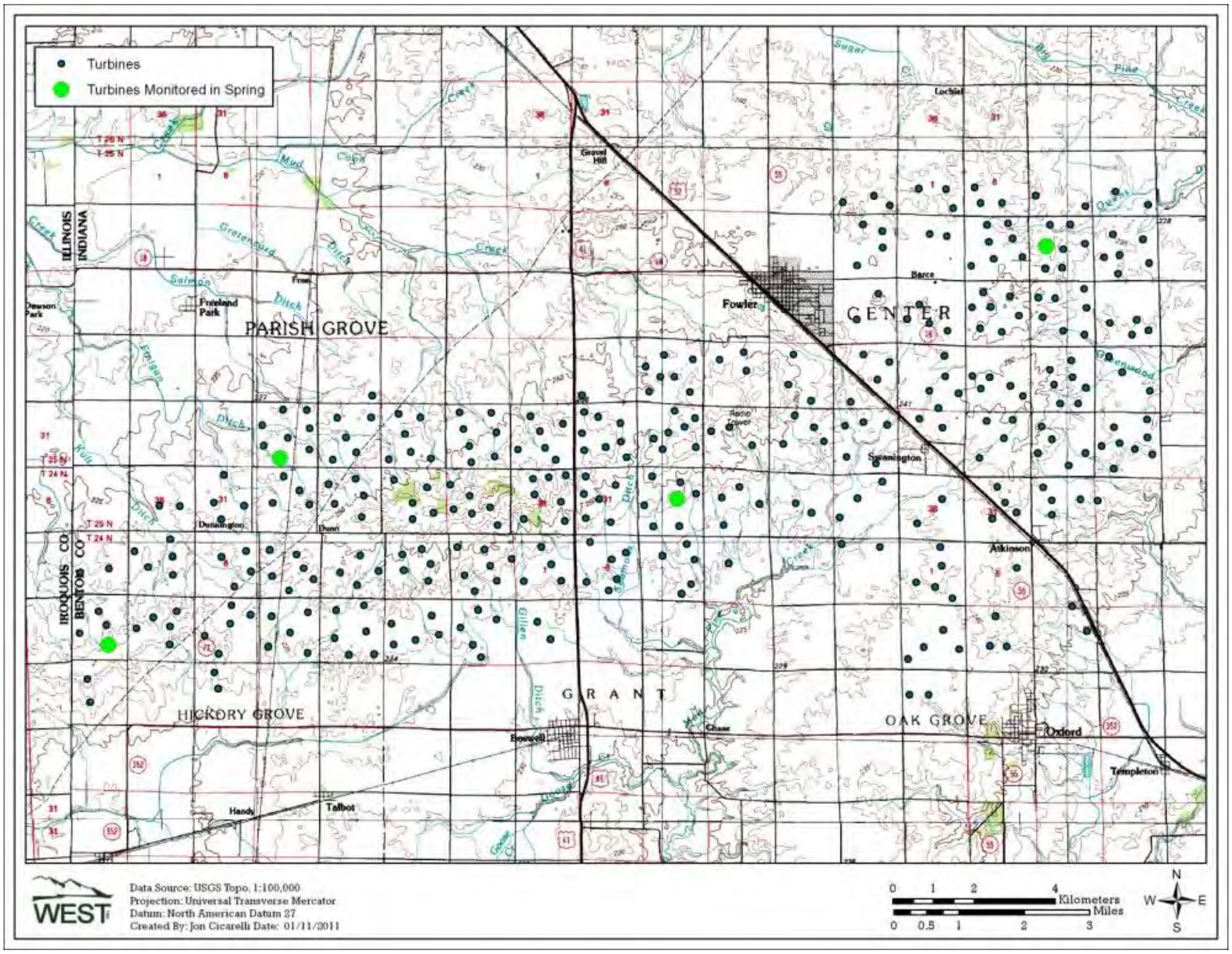

Figure 5. Study area map and Spring fixed Anabat sampling stations at the Fowler Ridge Wind Farm.

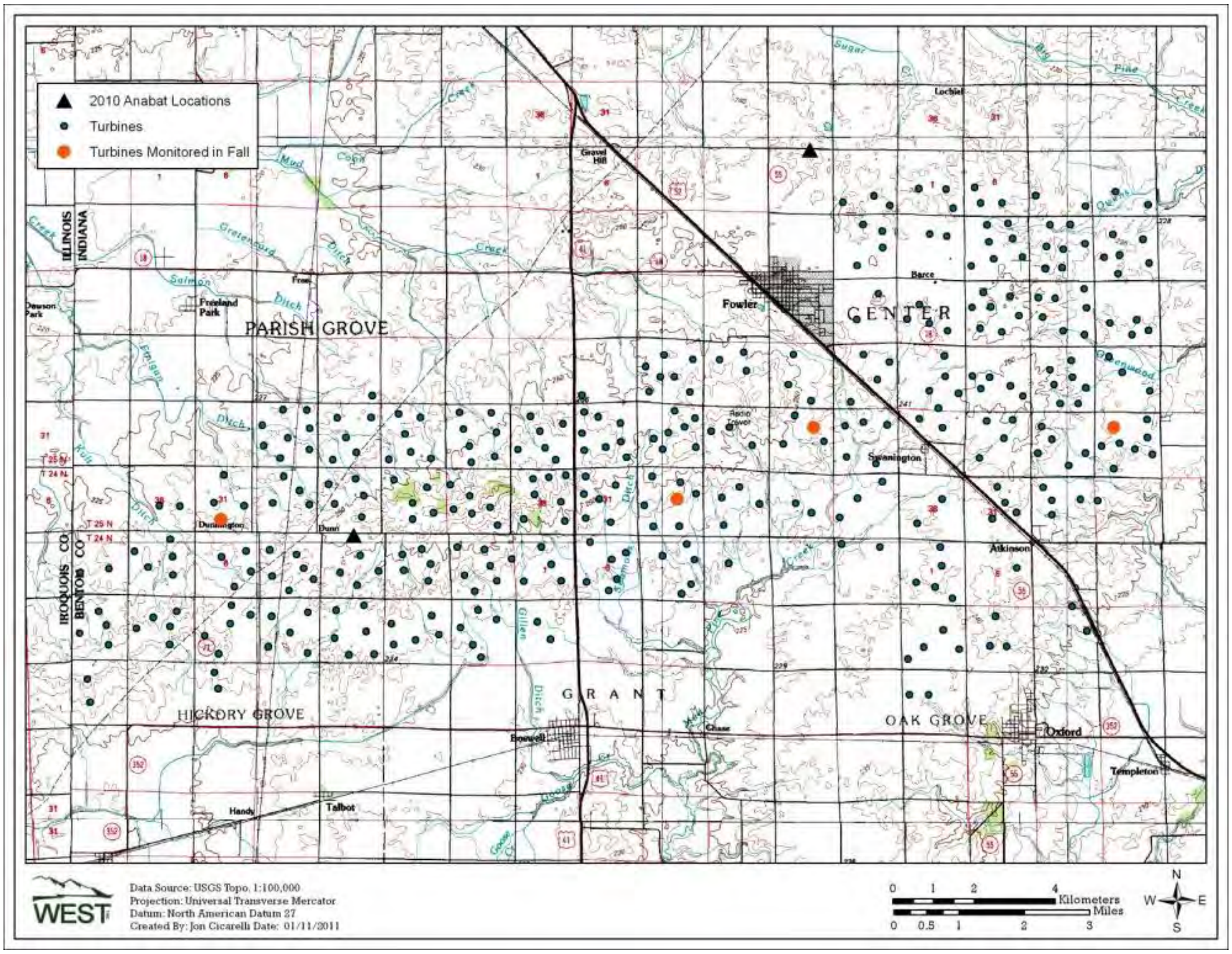

Figure 6. Study area map and Fall fixed Anabat sampling stations at the Fowler Ridge Wind Farm. Triangles depict locations that were monitored in 2007 and 2010.

Bats were surveyed using Anabat™ II bat detectors (Titley Scientific™, Australia) coupled with Zero Crossing Analysis Interface Modules (ZCAIM; Titley Scientific™, Australia), as well as Anabat SD1 detectors.

Anabat detectors record bat echolocation calls with a broadband microphone. The echolocation sounds are translated into frequencies audible to humans by dividing the frequencies by a predetermined ratio. A division ratio of 16 was used for the study. Bat echolocation detectors also detect other ultrasonic sounds, such as those sounds made by insects, raindrops hitting vegetation, and other sources. A sensitivity level of six was used to reduce interference from these other sources of ultrasonic noise. Calls were recorded to a compact flash memory card with large storage capacity. The detection range of Anabat detectors depends on a number of factors (e.g., echolocation call characteristics, microphone sensitivity, habitat, the orientation of the bat, atmospheric conditions; Limpens and McCracken 2004), but is generally less than 30 m (98 ft) due to atmospheric absorption (attenuation) on echolocation pulses (Fenton 1991). To ensure similar detection ranges among detectors, microphone sensitivities were calibrated using a BatChirp (Tony Messina, Las Vegas, Nevada) ultrasonic emitter as described in Larson and

Hayes (2000). All units were programmed to turn on each night approximately 30 minutes (min) before sunset and to turn off approximately 30 min after sunrise.

To minimize the potential for water damage due to rain, Anabat detectors were placed inside plastic weather-tight containers that had a hole cut in the side through which the microphone extended. The microphones were encased in poly-vinyl chloride (PVC) tubing that curved skyward at 45 degrees outside the container, and holes were drilled in the PVC tubing. Detectors protected in this manner have been found to detect similar numbers and quality of bat calls as detectors exposed to the environment, and to record twice as many species as detectors protected with Bat-Hat weatherproof housing (Britzke et al. 2010). Containers placed at the base of turbines were raised approximately 0.5 m (1.7 ft) off the ground to minimize echo interference and lift the unit above vegetation (Figure 7). Containers were also placed on nacelles, approximately 80 m (262 ft) above the ground (Figure 8). Anabat units on nacelles were connected to a GETMYLOG.com global data repository system (GML) and data were downloaded remotely.

Figure 7. Anabat unit placed at the base of a turbine at the Fowler Ridge Wind Farm.

Figure 8. Anabat unit mounted on the nacelle of a wind turbine at the Fowler Ridge Wind Farm.

Acoustic Surveys for Indiana Bats

Active Anabat surveys were conducted twice per week during the spring and fall. Surveys were conducted on relatively warm and calm nights, which focused survey efforts when bat activity was expected to be highest. The objective of the surveys was to provide additional information for understanding the extent of Indiana bat migration through the FRWF. Active surveys were conducted by driving east-west transects along county roads across the study area and recording bat calls utilizing Anabat technology. During each survey night, biologists stopped for 5 – 10 minutes and recorded bat calls at areas expected to attract bats, such as water sources, shelterbelts, and woodlots. Surveys were conducted for a total of at least five hours each survey night with surveys starting at sunset and ending five hours after sunset, the period when bat activity was expected to be highest. All bat passes were identified to species or species group, and potential calls made by Indiana bats were identified using methods described below.

Statistical Analysis

Bat Acoustic Surveys

Bat activity was measured by counting the number of bat passes (Hayes 1997), which was defined as a continuous series of two or more call notes (pulses) produced by an individual bat with no pauses between call notes of more than one second (White and Gehrt 2001, Gannon et al. 2003). The number of bat passes was determined by downloading the data files to a computer and tallying the number of echolocation passes recorded. Total number of passes was corrected for effort by dividing by the number of detector-nights. One detector collecting data for one night was a detector-night.

For each station, bat calls were sorted into three groups, based on their minimum frequency, that correspond roughly to species groups of interest. For example, most species of *Myotis* bats and the tri-colored bat (*Perimyotis subflavus*) echolocate at frequencies above 40 kilohertz (kHz), whereas species such as the eastern red bat (*Lasiurus borealis*) typically have echolocation calls that fall between 30 kHz and 40 kHz. Species such as big brown (*Eptesicus fuscus*), silver-haired (*Lasionycteris noctivagans*), and hoary bat (*Lasiurus cinereus*) have echolocation frequencies that fall at or below 25 kHz. Therefore, we classified calls as being given by high-frequency (HF; > 40 kHz), mid-frequency (MF; 30 kHz - 40 kHz), or low-frequency (LF; < 30 kHz) species. Although eastern red bat calls typically occur in the MF category, eastern red bat calls are variable, and may also occur within the HF category. To establish which species may have produced passes in each category, a list of species expected to occur in the study area was compiled from range maps (Table 4; Harvey et al. 1999, BCI 2011). Data determined to be noise (produced by a source other than a bat) or call notes that did not meet the pre-specified criteria to be termed a pass were removed from the analysis.

Table 4. Bat species with ranges that overlap with the Fowler Ridge Wind Farm, sorted by call frequency (Harveyet al. 1999, BCI 2011).

Common Name	Scientific Name
High-frequency (> 40 kHz)	
little brown bat[3]	*Myotis lucifugus*
northern long-eared bat[3]	*Myotis septentrionalis*
Indiana bat*[, 3]	*Myotis sodalis*
tri-colored bat (formerly eastern pipistrelle)[2,3]	*Perimyotis subflavus* (*Pipistrellus subflavus*)
Mid-frequency (30-40 kHz)	
eastern red bat[1,3]	*Lasiurus borealis*
evening bat[2,3]	*Nycticeius humeralis*
Low-frequency (< 30 kHz)	
big brown bat[3]	*Eptesicus fuscus*
silver-haired bat[1,3]	*Lasionycteris noctivagans*
hoary bat[1,3]	*Lasiurus cinereus*

1 = long-distance migrant
2 = species distribution on edge or just outside project area
3 = known casualty from wind turbines
*= Federally listed endangered species

All high-frequency (above 40 kilohertz (kHz)) bat calls were examined to determine if they were potentially made by Indiana bats. In order to identify calls potentially made by Indiana bat, call characteristics were entered into a Discriminant Function (DF) Model designed to statistically classify unknown echolocation calls based on comparison to a set of known echolocation calls. DF models have been used by other researchers to classify bat calls to species, including the Indiana bat (Britzke et al. 2002, Robbins et al. 2008, Wolf et al. 2009).

The DF Model has been developed based on a library of 663 known bat call files from 11 species that occur in the Midwest, including 93 known Indiana bat call files (Murray et al. 2001). The correct classification rate for Indiana bats based on this initial model is approximately 90%. A detailed description of the model assumptions, parameters, and classification rates can be found in Appendix B.

While the DF model is a useful tool, the potential exists for "false positive" and "false negative" results to occur. In order to increase confidence in call identifications, any calls potentially identified as made by Indiana bat by the DF model were: 1) analyzed utilizing the "Britzke" filter, and 2) identified to species or species group (e.g. Myotis) based on comparison of qualitative call characteristics to a known call library (Murrayet al. 2001, O‟Farrell et al. 1999, Yates and Muzika 2006). Call characteristics such as minimum frequency, slope, and structure were used to identify calls. Calls were considered to be made by Indiana bats if they were positively identified by all of the three methods.

Bat Acoustical Activity and Casualties

Acoustical bat activity (number of bat passes per detector night) taken from Anabat units located at the base and on nacelles of selected turbines was also investigated in relation to observed casualty rates at FRWF through the use of graphical methods, linear regression lines, and Pearson‟s correlation coefficients. Correlations between activity at ground and nacelle detectors and casualties were restricted to dates past the night of August 18, 2010 when nacelle units were in place. Acoustic activity rates for ground and combined ground and nacelle activity rates from the beginning of fall surveys (August 1, 2010) were also included with weather variables in the Poisson modeling process and a similar process was used to determine the effectiveness of predicting observed casualty rates by ground and/or nacelle Anabat detectors. Only bat fatalities occurring at turbines with no cut-in speed adjustments were used in these analyses.

RESULTS

The following sections contain the results of studies conducted under permit TE15075A. Per the requirements of this permit, information regarding the date, time, and locations of bats encountered (Appendices C and D), locations where no bats were encountered (Appendix E), detailed information in nightly operating parameters of each turbine searched and which specimens were salvaged at each turbine (Appendix E), and nightly wind speeds and weather (Appendix F). Other information required under permit TE15075A can be found below.

Bat Fatalities

A total of 3,871 plot surveys were conducted during 110 visits to the study area at the 36 daily search turbines, with an additional 1,618 surveys being conducted during 17 visits to the facility at the 100 turbines selected for road and pad surveys. A total of 809 bat carcasses were found, of which 556 bats were found during regularly scheduled searches, with an additional 25 bats being found incidentally at turbine search plots. The remaining 228 bat carcasses were found outside of the study period during clearing searches or not on scheduled search turbines and were not included in the casualty estimates (Table 5).

Table 5. Total number of bat carcasses and percent composition of carcasses discovered at the Fowler Ridge Wind Farm from April 13 – May 15, 2010 and July 30 – October 15, 2010.

Species	Scientific Name	Scheduled Search Fatalities	Incidental Fatalities During the Study[1]	Other Incidental Fatalities[2]	Total Fatalities	% Comp.
eastern red bat	*Lasiurus borealis*	353	15	147	515	63.66
hoary bat	*Lasiurus cinereus*	84	7	55	146	18.05
silver-haired bat	*Lasionycteris noctivagans*	98	0	13	111	13.72
big brown bat	*Eptesicus fuscus*	16	3	12	31	3.83
tri-colored bat	*Perimyotis subflavus*	2	0	1	3	0.37
Indiana bat	*Myotis sodalis*	1	0	0	1	0.12
little brown bat	*Myotis lucifugus*	2	0	0	2	0.25
Overall	***7 species***	**556**	**25**	**228**	**809**	**100**

[1] Bat carcasses found that were estimated to have been killed during the course of the study, and were found within search plot boundaries, but were not found during scheduled carcass searches

[2] Bat carcasses found that were estimated to have been killed prior to the start of the study, or carcasses that were found outside of plot boundaries.

Species Composition

The most commonly found bat species was eastern red bat (515 fatalities, 63.66% of fatalities), followed by hoary bat (146 fatalities, 18.05%), silver haired bat (111 fatalities, 13.72%), and big brown bat (31 fatalities, 3.83%). Three tri-colored bats, two little brown bats, and one Indiana bat carcass were also found (Table 5). More male than female bat carcasses were found during 2010 casualty searches (Table 6).

Relative species composition varied between the spring and fall seasons. Silver-haired bats were the most commonly found species in the spring, while eastern red bats were the most common casualty in the fall (Table 7).

Table 6. Gender composition by species found during 2010 carcass searches at the Fowler Ridge Wind Farm.

Species	Scientific Name	Gender	Number of Individuals	% Total	% Comp.
big brown bat	*Eptesicus fuscus*	Female	7	0.9	22.6
big brown bat		Male	11	1.4	35.5
big brown bat		Unknown	13	1.6	41.9
Total			**31**	**3.8**	**100**
eastern red bat	*Lasiurus borealis*	Female	102	12.6	19.8
eastern red bat		Male	141	17.4	27.4
eastern red bat		Unknown	272	33.6	52.8
Total			**515**	**63.7**	**100**
hoary bat	*Lasiurus cinereus*	Female	32	4.0	21.9
hoary bat		Male	40	4.9	27.4
hoary bat		Unknown	74	9.1	50.7
Total			**146**	**18.0**	**100**
Indiana bat	*Myotis sodalis*	Female	1	0.1	100
Indiana bat		Male	0	0	0
Indiana bat		Unknown	0	0	0
Total			**1**	**0.1**	**100**

Table 6. Gender composition by species found during 2010 carcass searches at the Fowler Ridge Wind Farm.

Species	Scientific Name	Gender	Number of Individuals	% Total	% Comp.
little brown bat	*Myotis lucifugus*	Female	0	0	0
little brown bat		Male	0	0	0
little brown bat		Unknown	2	0.2	100
Total			**2**	**0.2**	**100**
silver-haired bat	*Lasionycteris noctivagans*	Female	28	3.5	25.2
silver-haired bat		Male	46	5.7	41.4
silver-haired bat		Unknown	37	4.6	33.3
Total			**111**	**13.7**	**100**
tri-colored bat	*Perimyotis subflavus*	Female	1	0.1	33.3
tri-colored bat		Male	0	0	0
tri-colored bat		Unknown	2	0.2	66.7
Total			**3**	**0.4**	**100**
Overall			**809**	**100**	

Table 7. Composition of species by season for all bat carcasses found or reported at the Fowler Ridge Wind Farm.

Species		Spring	Fall	Overall
eastern red bat	*Lasiurus borealis*	15	500	515
hoary bat	*Lasiurus cinereus*	2	144	146
silver-haired bat	*Lasionycteris noctivagans*	18	93	111
big brown bat	*Eptesicus fuscus*	1	30	31
tri-colored bat	*Perimyotis subflavus*	0	3	3
little brown bat	*Myotis lucifugus*	0	2	2
Indiana bat	*Myotis sodalis*	0	1	1
Total		**36**	**773**	**809**

Eastern red bats comprised a higher percentage of the bat fatalities in 2010 compared to data from 2009 at Phase I (63.7% vs. 35.9%). Hoary bats and silver-haired bats comprised a lower percentage of the bat fatalities in 2010 (18.05% and 13.72%) compared to 2009 (30.8% and 26.9%, respectively; Johnson et al. 2010a).

A total of 60 birds were also discovered during carcass searches in 2010 (Table 8). No bird species listed as threatened or endangered under the state of Indiana (INHDC 2010) or federal endangered species acts (ESA 1973, USFWS 2011) were found.

Table 8. Total number of bird carcasses found at the Fowler Ridge Wind Farm from April 13 – May 15, 2010 and July 30 – October 15, 2010.

Species	Scientific Name	Total Bird Carcasses	% Composition
killdeer	*Charadrius vociferus*	9	15.0
European starling	*Sturnus vulgaris*	5	8.3
golden-crowned kinglet	*Regulus satrapa*	5	8.3
unidentified bird		5	8.3
cliff swallow	*Petrochelidon pyrrhonota*	3	5.0
mourning dove	*Zenaida macroura*	3	5.0
red-tailed hawk	*Buteo jamaicensis*	3	5.0
American redstart	*Setophaga ruticilla*	2	3.3
chimney swift	*Chaetura pelagica*	2	3.3
common yellowthroat	*Geothlypis trichas*	2	3.3
horned lark	*Eremophila alpestris*	2	3.3
Nashville warbler	*Vermivora ruficapilla*	2	3.3
ruby-crowned kinglet	*Regulus calendula*	2	3.3
Tennessee warbler	*Vermivora peregrina*	2	3.3
unidentified dove		2	3.3
unidentified passerine		2	3.3
house sparrow	*Passer domesticus*	1	1.7
red-eyed vireo	*Vireo olivaceus*	1	1.7
rough-legged hawk	*Buteo lagopus*	1	1.7
ring-necked pheasant	*Phasianus colchicus*	1	1.7
rock pigeon	*Columba livia*	1	1.7
ruby-throated hummingbird	*Archilochus colubris*	1	1.7
red-winged blackbird	*Agelaius phoeniceus*	1	1.7
unidentified kinglet		1	1.7
yellow-throated vireo	*Vireo flavifrons*	1	1.7
Overall		**60**	**100**

Estimated Time since Death

Most of the bat casualties (64.92%) found during daily casualty searches were estimated to have been killed the previous night, 22.65% were estimated to have been killed 2-3 days prior to discovery, and 8.01% were estimated to be 4-7 days old (Table 9). The remaining 4.4% of bat fatalities found during daily searches were estimated to be greater than seven days old.

Table 9. Estimated time since death for bat casualties found at the Fowler Ridge Wind Farm from April 13 – October 15, 2010.

Estimated Time Since Death	Percentage during Daily Searches	Percentage during Weekly Searches
previous night	64.92	30.52
2-3 days	22.65	32.86
4-7 days	8.01	30.52
7-14 days	3.04	1.88
>2 weeks	0.83	0.47
>month	0.28	0
unknown	0.28	3.76

Timing of Bat Fatalities

Bat casualties occurred throughout the study period (Figure 9) with the majority being found during the month of August. Similarly, most bat fatalities recorded at FRWF during 2009 were recorded between August 1 – September 15 (Johnson et al. 2010b).

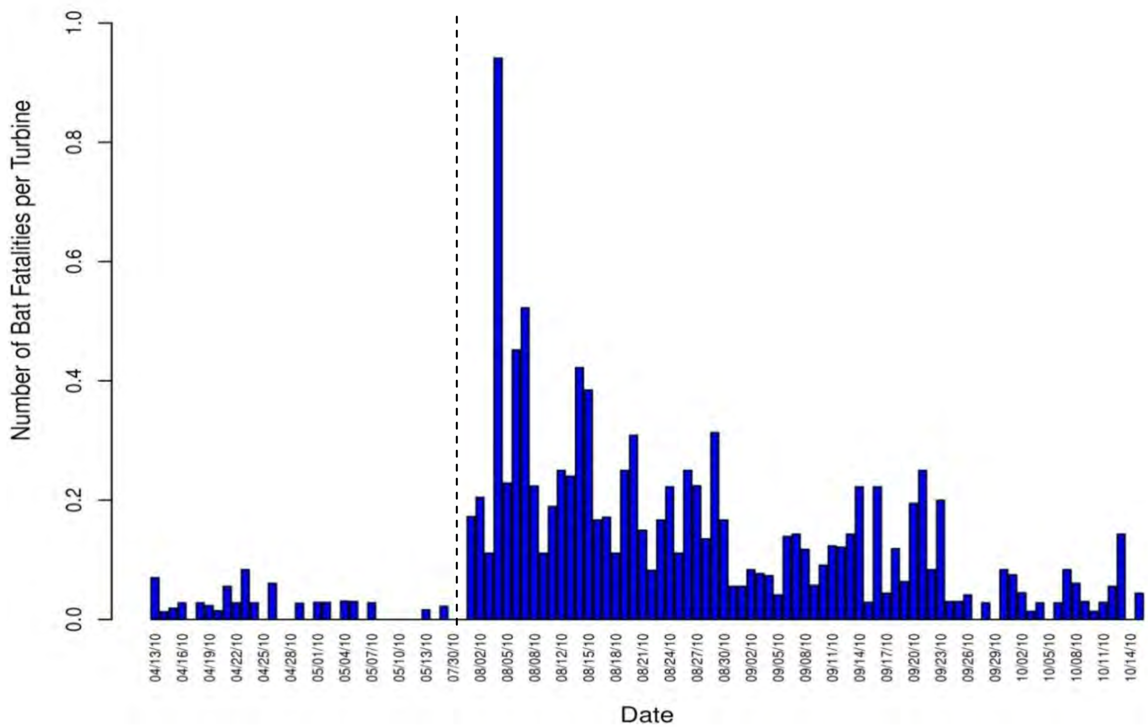

Figure 9. Timing of bat mortality at the Fowler Ridge Wind Farm from April 13 – May 15, 2010 and July 30 – October 15, 2010.

One Indiana bat casualty was recorded during the study on September 18, 2010. The only other Indiana bat found as a casualty at FRWF was recorded on September 11, 2009 (Johnson et al. 2010b). The Indiana bat casualty occurred later than the five other *Myotis or Perimyotis* casualties at the FRWF in 2010; the four other *Myotis* or *Perimyotis* were found on 7/31, 8/20, 8/22, and 8/26. Similarly, in 2009 the single Indiana bat casualty was found later than other *Myotis* casualties; the four other *Myotis or Perimyotis* casualties in 2009 were found on 5/5, 8/22, 8/25, and 8/27. The later date, and consistency between years, associated with the two Indiana bat casualties support the premise that the two Indiana bats found as casualties at the FRWF were fall migrants.

Locations of Bat Casualties

The 80 x 80 m plot size was chosen based on the distances bats were found from turbines during previous studies of the FRWF, when approximately 88% of all bat fatalities were found within 40 m of turbine locations (Johnson et al. 2010b). The vast majority of fatalities at the daily search turbines (89.29%) were found <u><</u>30 m from a turbine, while 94.67% of fatalities at roads and pads were found <u><</u>30 m from a turbine (Table 10, Figure 10).

Table 10. Distribution of distances of bat casualties from turbines at the Fowler Ridge Wind Farm from August 1 – October 1, 2010.

Distance to Turbine (m)	% Bat Casualties On Roads and Pads	% Bat Casualties Search Turbines	% Bat Casualties Incidentals
0 – 10	46.67	11.39	71.01
11 – 20	20.67	20.73	8.70
21 – 30	15.67	33.03	11.59
31 – 40	11.67	24.15	5.80
>40	5.33	10.71	2.90

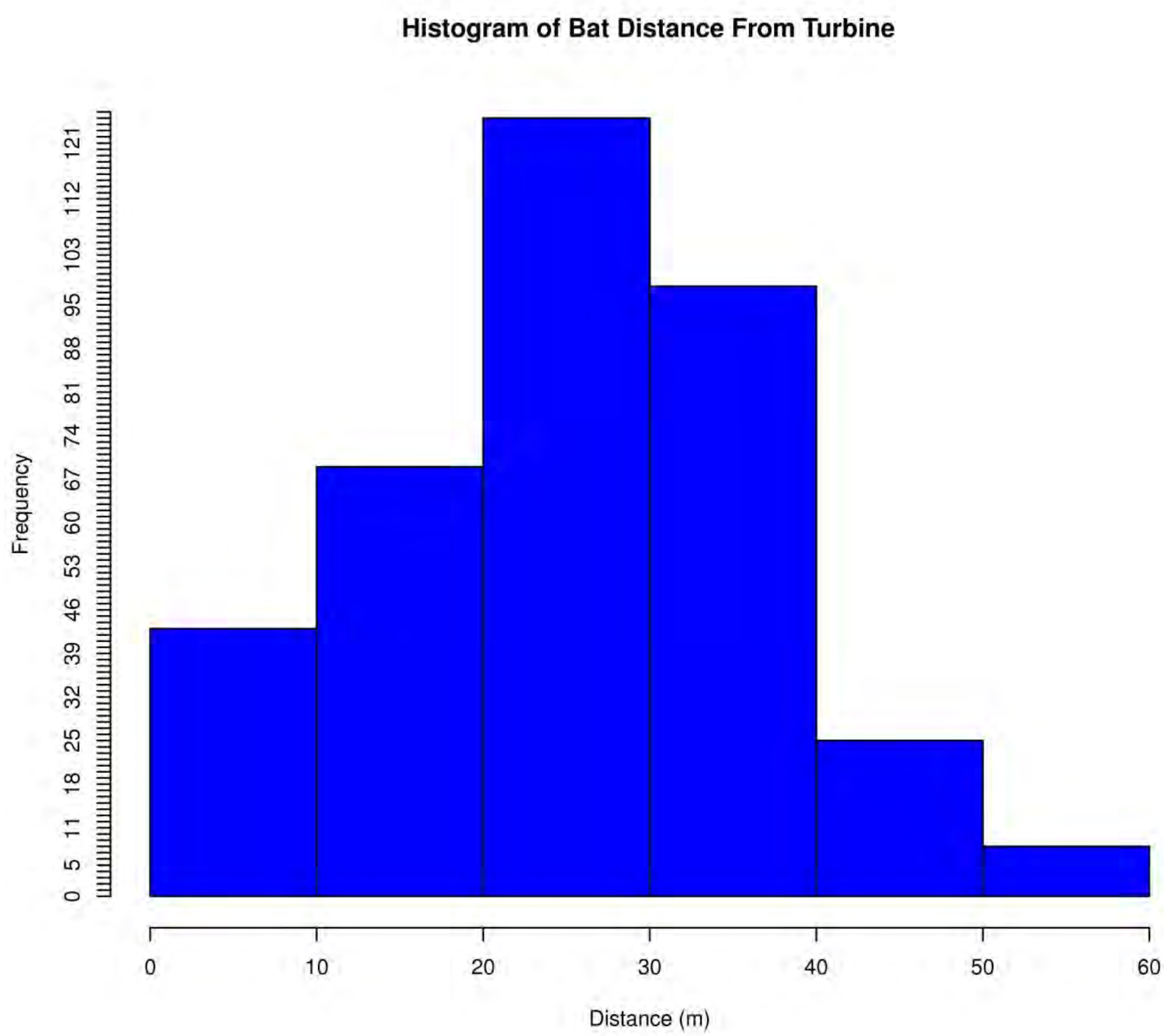

Figure 10. Distance from turbine for all bat casualties found at the Fowler Ridge Wind Farm.

The two turbines with the highest number of recorded bat fatalities were turbines 459 (33) and 628 (31). Both turbines were within the control group (i.e. no cut-in speed adjustments were made to either turbine throughout the study). The next highest total found at a turbine was 21, found at a turbine included in the curtailment experiment (turbine 640). The number of bat casualties found at other turbines and search plots ranged from zero to 18.

A visual examination of the number of bats found by turbine suggested that a relationship exists between geographic location and number of bat casualties, with a general trend of more bat casualties found in the central portion of the project (Figure 11). Trends in geographic location correspond to turbine models in those areas. In general, weekly observed casualty rates were higher for Clipper C96 turbines than for Vestas V82 turbines with both types of turbines having higher observed casualty rates than General Electric SLE turbines (Figure 12).

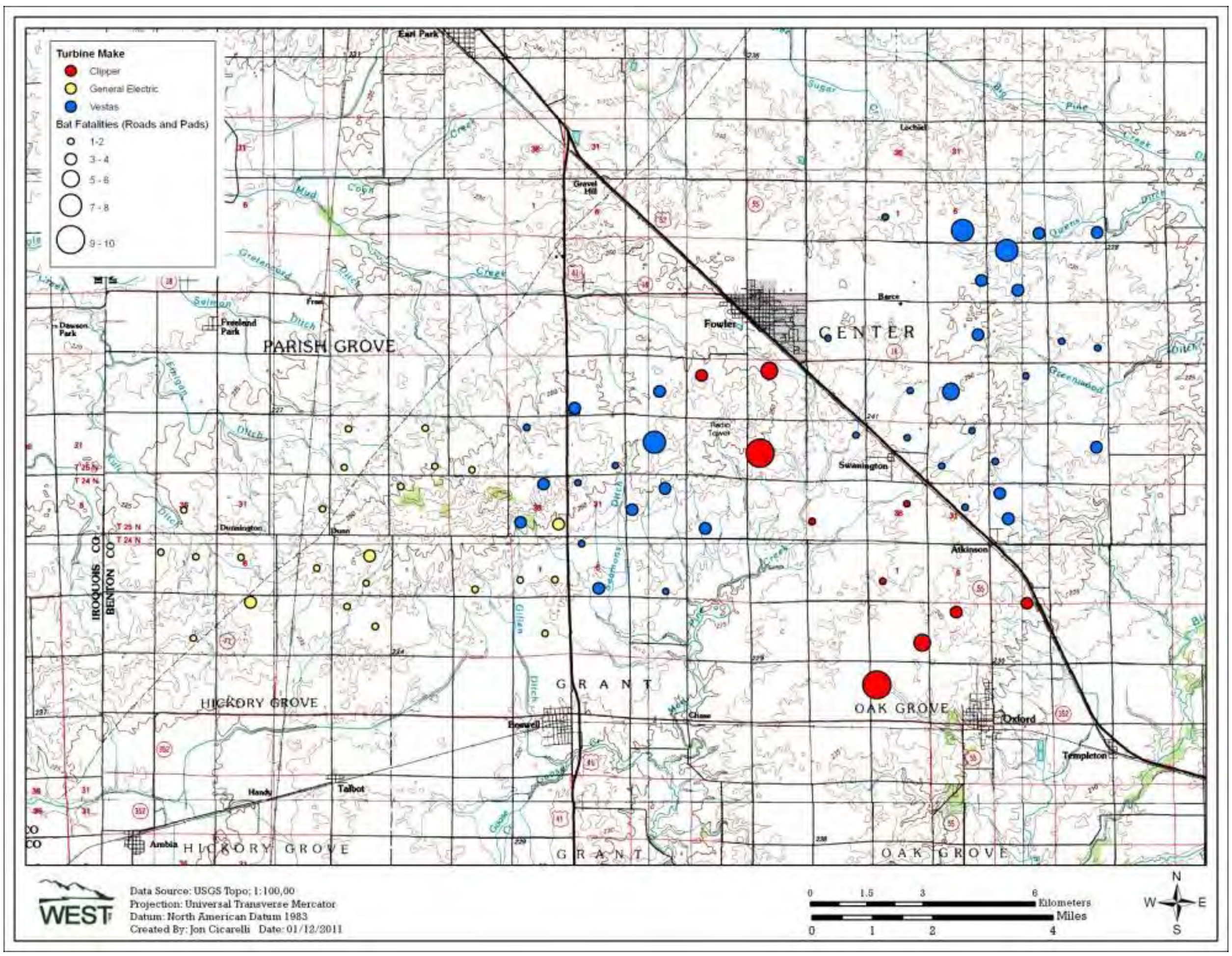

Figure 11. Number of bat casualties found at road and pad searches within the Fowler Ridge Wind Farm in 2010.

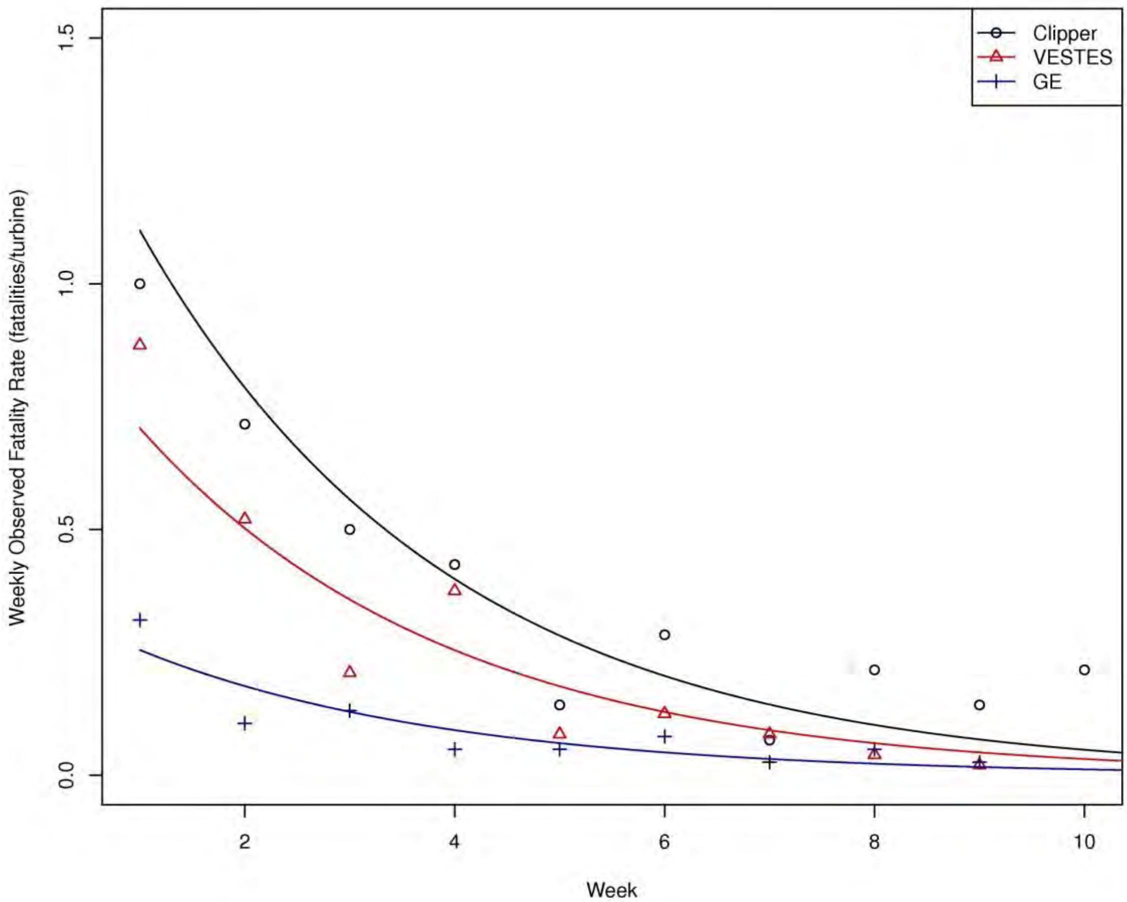

Figure 12. Fall weekly observed casualty rates at the Fowler Ridge Wind Farm by turbine model with Poisson regression lines based on model parameter estimates for the variable week.

The relationship between bat fatality rates at weekly road and pad only searches and proximity to potential bat habitat and other features was also investigated. Observed fatality counts by turbine were included in a Poisson model and analyzed against turbine type with covariates for the nearest water source (distWater), the nearest woodlot/shelterbelt (distance to forest), and the percent of area within 400 meters of turbines in a given crop type (pcCORN, pcSOY, pcOTHER). Week was also included in the model to account for temporal variation of observed fatality counts. An exhaustive variable selection process was conducted and all models contained significant variables for week and turbine type. All other covariates included in modeling were not significant after having adjusted for week and turbine type.

Model A

$$\log(\text{weekly fatality count per turbine}) = 0.52 - 0.46\, VESTAS - 1.48\, GE - 0.37\, week$$

Poisson regression coefficients suggest there were 1.59 times more fatalities at Clipper turbines than at VESTAS turbines and 4.41 times more than at GE turbines (Model A). Corresponding

90% confidence intervals for the multiplicative increase in fatality counts of Clipper turbines in relation to VESTAS (1.2, 2.1) and GE (3.1, 6.42) suggest that the effect of turbine type is significantly different from one even after adjusting for all other coefficients in the model. The observed fatality rates at different turbine types also follows differences in rotor diameter, with Clipper turbines having the largest rotor diameter, followed by Vestas and GE. The nacelle height of all three turbine types was 80 m.

Very few *Myotis* or *Perimyotis* were found as casualties at the FRWF, making it difficult to determine if any geographic patterns existed. While most *Myotis* and *Perimyotis* carcasses were found within Phase I, carcasses were found at all three turbine types, and Phase I covers a relatively large portion of the overall FRWF (Figure 13). Habitat characteristics were also similar when comparing between phases (Figure 14). *Myotis* and *Perimyotis* carcasses were found at varying distances from water and forested areas, and no clear patterns of carcass location in relation to land cover or habitat characteristics were apparent (Table 11).

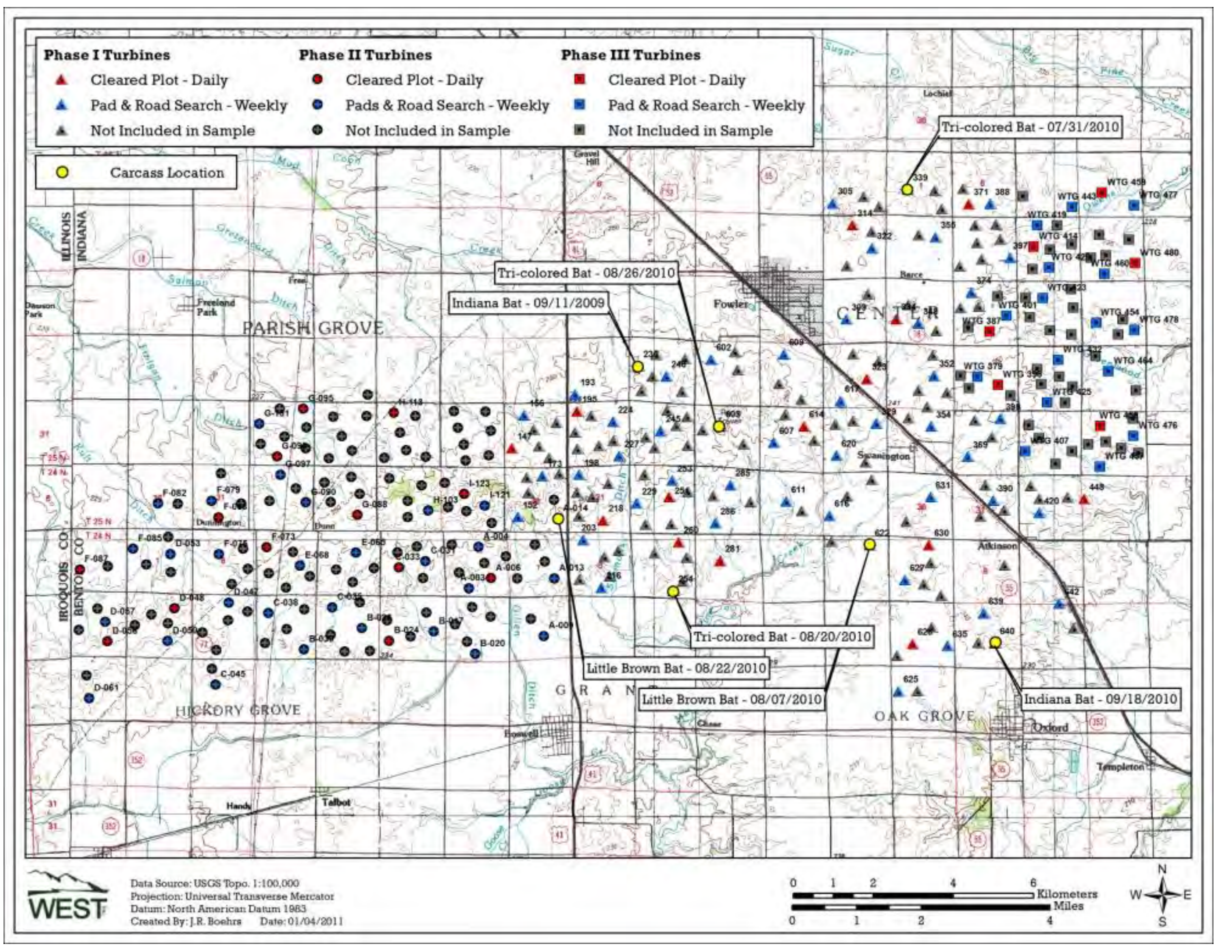

Figure 13. Locations of 2010 *Myotis/Perimyotis* carcasses and the 2009 Indiana bat carcass found at the Fowler Ridge Wind Farm.

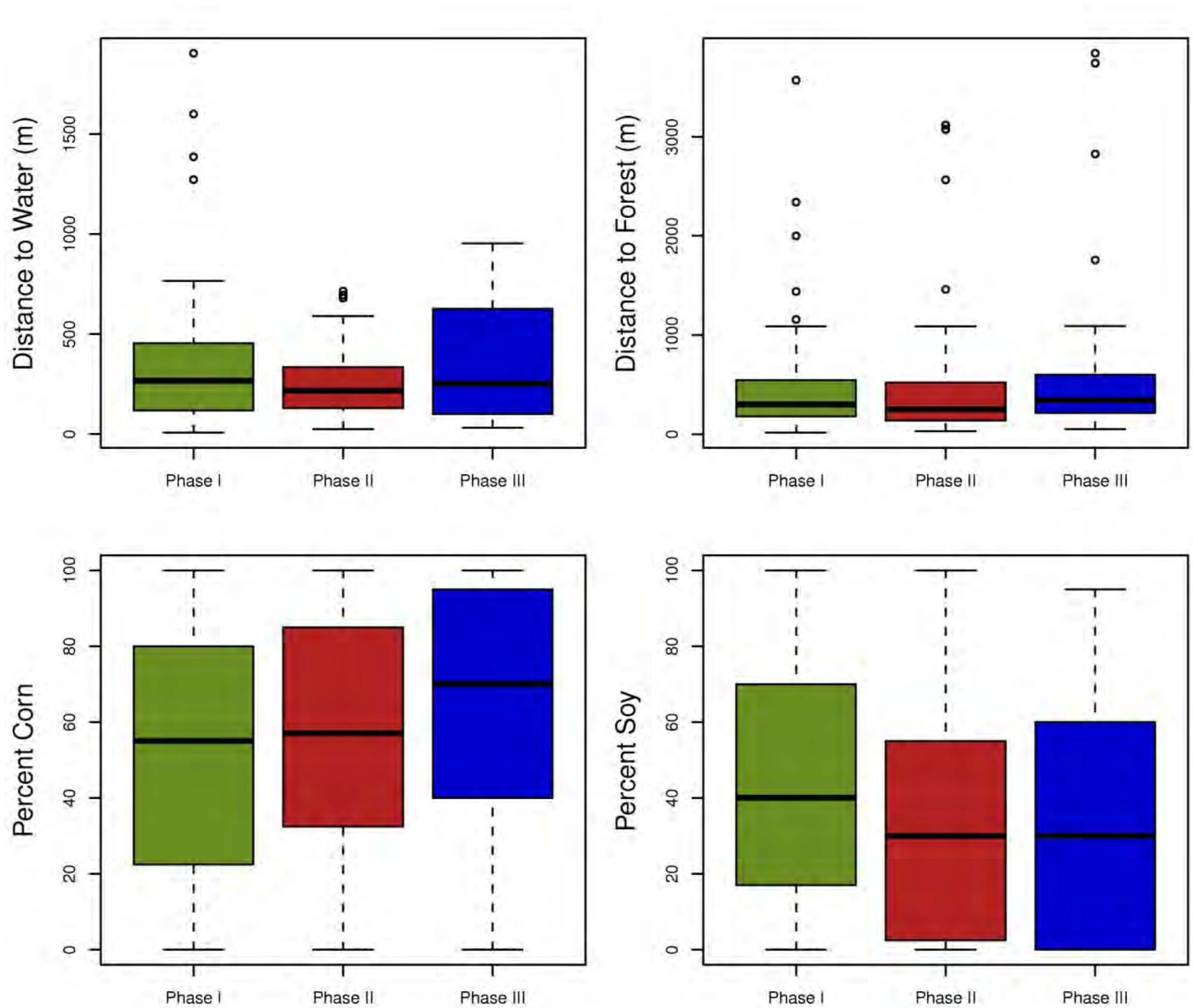

Figure 14. Box plots illustrating the similarity in habitat characteristics associated with turbines searched, by phase, at the Fowler Ridge Wind Farm during 2010.

Table 11. Turbine locations of 2010 *Myotis/Perimyotis* carcasses and the 2009 Indiana bat carcass found at the Fowler Ridge Wind Farm.

Date	Species	Age	Sex	Turbine	Model	Phase	Treatment	Estimated Time of Death	Distance to Water (m)	Distance to Forest (m)
9/11/2009	Indiana bat	A	F	230	Vestas	I	NA	2 to 3 days	180	598
8/7/2010	little brown bat	U	U	622	Clipper	I	Road & Pad	4 to 7 days	449	2000
7 /31/2010	tri-colored bat	U	U	339	Vestas	I	Road & Pad	2 to 3 days	150	2340
8 /20/2010	tri-colored bat	U	U	254	Vestas	I	Road & Pad	2 to 3 days	205	150
8 /22/2010	little brown bat	A	U	14	GE	II	Road & Pad	4 to 7 days	126	177
8 /26/2010	tri-colored bat	J	F	603	Clipper	I	5 m/s	Last Night	164	600
9 /18/2010	Indiana bat	A	F	640	Clipper	I	5 m/s	Last Night	45	45

Searcher Efficiency Trials

Searcher efficiency trials were conducted throughout the study period at both daily search turbines and the weekly turbine road and pad searches. A total of 192 carcasses were placed at daily search turbines, of which 55 were both available and found (31.79% efficiency) during the next search day. A total of 125 carcasses were placed at the weekly turbine road and pad plots, of which 77 were both available and found on the next search day (84.62% searcher efficiency; Table 12).

Table 12. Single day searcher efficiency results at the Fowler Ridge Wind Farm.

Plot Type	Placed	Available	Found	Percent Found
Plot	192	173	55	31.79
Road & Pad Only	125	91	77	84.62

Carcass Removal Trials

A total of 233 fresh bat carcasses and 53 mice were placed during carcass removal trials throughout the study period. Carcass removal trials for bats showed that by Day 3, approximately 50% of the bats remained, by Day 7, approximately 35% remained, and by Day 14, approximately 20% of the bats remained (Figure 15). The mean length of stay before removal or decomposition was 10.34 days.

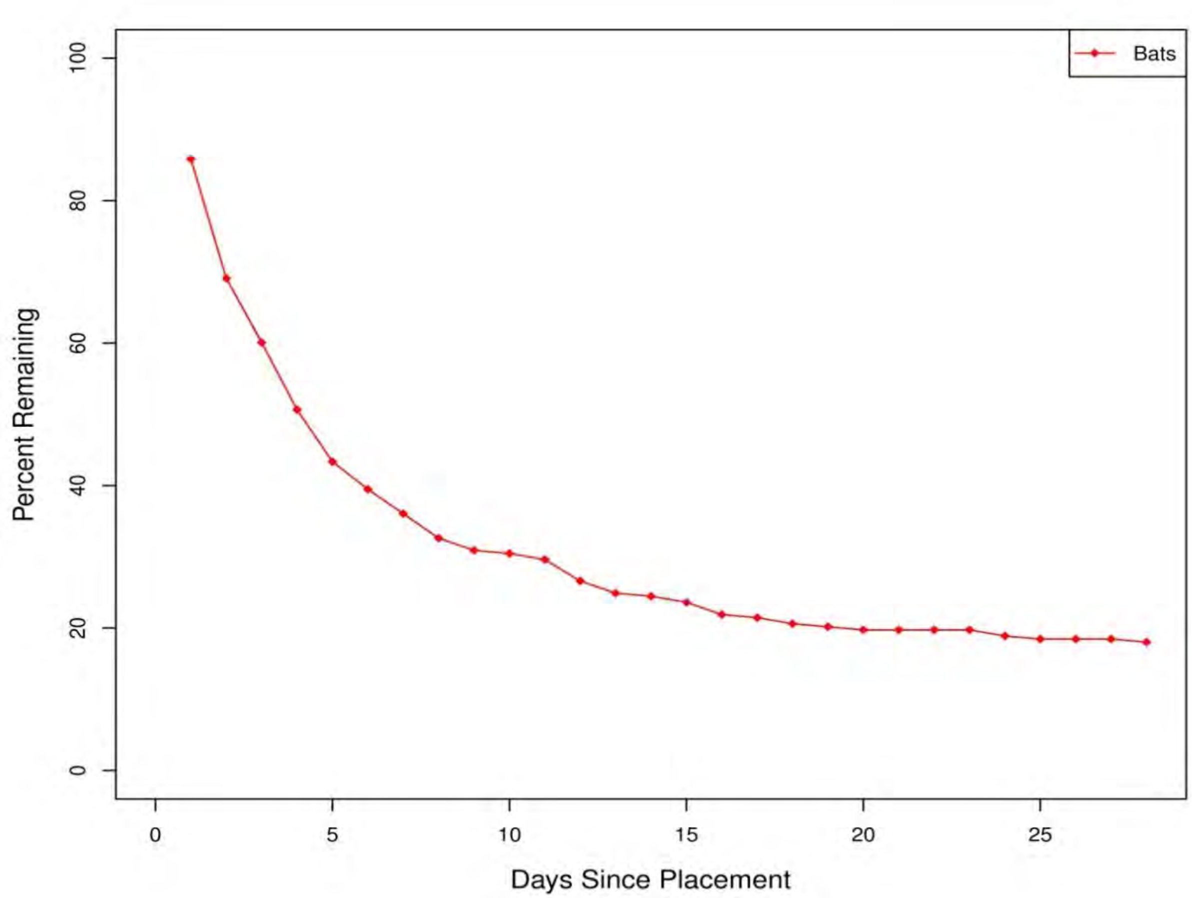

Figure 15. Removal rates for bats during carcass removal trials at the Fowler Ridge Wind Farm.

Empirical Estimate of the Probability of Carcass Availability and Detection

A total of 222 trial carcasses were used in calculating an empirical estimate of the probability of availability and detected. These carcasses were allowed to remain where placed for up to 28 days and the date when searchers found the carcasses was noted. Carcasses placed 10 days prior to survey completion were not included in these estimates due to insufficient time for predation to occur. This was based on the average carcass removal rate of 10.34 days.

Of the 222 carcasses placed 77 were placed on turbines where only the road and pad was searched and 145 were placed on turbines where cleared plots were searched. The empirical estimate for the probability of available and detected on weekly road/pad searches was 0.51 and 0.58 for cleared plot turbines respectively (Table 13).

Table 13. Empirical estimates for the probability of available and detected at the Fowler Ridge Wind Farm.

Plot Type	Placed	Found	Proportion Ever Found
Plot	145	84	0.58
Road & Pad Only	77	39	0.51

Adjusted Casualty Estimates

While searches at cleared plots encompassed an area where at least 88% of bat carcasses were expected to fall, searches at roads and pads occurred within only a portion of the area where a bat carcass could fall. Thus an adjustment factor was needed in order to calculate valid casualty estimates for searches on roads and pads. A double sampling approach (Thompson 2002) was used to calculate this adjustment. The locations of casualties found within cleared plots were marked as being on or off roads and pads. The double sampling approach utilized the ratio of total bats found at cleared plot turbines to the number of bats found on roads and pads of cleared plots (5.10; Table 14) as an adjustment factor for casualty estimates at road and pad only plots. Only bats found during the fall were used for this calculation, because roads and pads were not constructed and present at all search turbines during the spring.

We also examined the proportions of bats, by species, that fell within cleared plots versus roads and pads, to determine if bat species fell at similar distances from turbines. Differences were analyzed using a chi-square test for proportions which tests whether the ratios observed by species are significantly different from each other. Results did not indicate that the distance or location where bats fell varied between eastern red bats, hoary bats, and silver-haired bats. Sample sizes were too small to investigate if differences existed for other bat species. An overall area adjustment value of 5.10 was used based on no significant difference in bat casualty distribution by species (chisq=1.38, df=5, p-value=0.93; Table 14).

Table 14. Search area adjustment for road and pad only searches by species at the Fowler Ridge Wind Farm.

Species	On Road/Pad of Cleared Plot	Total Cleared Plot	Adjustment
big brown bat	1	8	8.00
eastern red bat	40	215	5.38
hoary bat	13	53	4.08
Indiana bat	0	1	--
little brown bat	0	0	--
silver haired bat	13	64	4.92
tri-colored bat	0	1	--
Overall	**67**	**342**	**5.10**

The 80 X 80 m cleared plots were established to ensure all areas within 40 m of a turbine were searched. The corners of each plot were 57 m (187 ft) away from the turbine. The search area covered (6,400 m^2;68,889 ft^2) on each plot and was equivalent to searching a circle with a radius of 45 m (484 ft). Johnson et al. (2010b) found approximately 88% of bat fatalities within 40 m of turbine locations, thus no search area adjustment factor was used for cleared plot searches. Average search intervals (1.02 days for daily searches and 7.45 days for weekly searches) were calculated for weekly road and pad searches (Table 15).

Based on searcher efficiency and the carcass removal rates at the site, the Shoenfeld estimated average probability that a bat casualty would remain in the plot until a scheduled search and would be found was 79% for daily searches (both spring and fall), 65% for spring weekly searches and 68% for fall weekly searches (Table 16). The estimated number of bat fatalities per turbine (based on Shoenfeld"s pi estimates) was 0.91 for daily search plots and 0.43 for weekly search plots during the spring season. These estimates increased during the fall season, with 17.69 bat fatalities per turbine per season at daily search turbines and 15.73 bats per turbine per season at weekly search turbines (Table 16).

Based on Shoenfeld estimates for the probability of carcass availability and detected the estimated number of bat fatalities per turbine per season was 0.586 during the spring and 16.830 during the fall with an overall adjusted casualty estimate for bat of 16.59 bats per turbine per study period (Table 16). The 2010 Shoenfeld overall bat casualty estimate for the FRWF was slightly higher than the 2009 estimate for Phase I (15.03 bats / turbine in 2009; see Johnson et al. 2010b).

Empirical estimates for the probability of carcass availability and detected were lower than Shoenfeld estimates resulting in higher adjusted casualty rates. Seasonal adjusted casualty estimates based on the empirical probability of available and detected were 0.74 bats per turbine in the spring and 21.45 bats per turbine in the fall with an overall adjusted casualty estimate of 22.20 bats per turbine per study period (Table 17).

Table 15. Bootstrap point estimates (mean) and lower (ll) and upper (ul) of 90% confidence intervals for bat observed casualty rates at the Fowler Ridge Wind Farm.

	Spring Estimates						Fall Estimates											
	Daily 80x80m Plot Searches			Weekly Road & Pad Searches			Daily Control 80x80m Plot Searches			Daily 5.0 m/s Cut-in 80x80m Plot Searches			Daily 6.5 m/s Cut-in 80x80m Plot Searches			Weekly Road & Pad Searches		
		90% CI			90% CI			90% CI			90% CI			90% CI			90% CI	
	mean	ll	ul	mean	ll	ul	mean	ll	ul	mean	ll	ul	mean	ll	ul	mean	ll	ul
Search Area Adjustment																		
Bats	1.00	--	--	5.10	--	--	1.00	--	--	1.00	--	--	1.00	--	--	5.10	--	--
Average Search Interval																		
Bats	1.02	--	--	7.45	--	--	1.03	--	--	1.03	--	--	1.03	--	--	6.76	--	--
Observer Detection																		
Bats	0.32	0.26	0.38	0.85	0.80	0.89	0.32	0.26	0.38	0.32	0.26	0.38	0.32	0.26	0.38	0.85	0.80	0.89
Average Removal Time																		
Bats	10.34	8.69	12.18	10.34	8.69	12.18	10.34	8.69	12.18	10.34	8.69	12.18	10.34	8.69	12.18	10.34	8.69	12.18
Observed Casualty Rates (fatalities/turbine/season)																		
Bats	0.72	0.47	1.00	0.05	0.02	0.10	14.00	11.56	16.50	7.00	5.11	9.11	3.00	1.78	4.22	2.08	1.75	2.42

Table 16. Bootstrap point estimates (mean) and lower (ll) and upper (ul) of 90% confidence intervals for bat casualty rate estimates using the Shoenfeld estimator for the probability a carcass is available and detected at the Fowler Ridge Wind Farm.

	Spring Estimates						Fall Estimates											
	Daily 80x80m Plot Searches			Weekly Road & Pad Searches			Daily Control 80x80m Plot Searches			Daily 5.0 m/s Cut-in 80x80m Plot Searches			Daily 6.5 m/s Cut-in 80x80m Plot Searches			Weekly Road & Pad Searches		
		90% CI			90% CI			90% CI			90% CI			90% CI			90% CI	
	mean	ll	ul	mean	ll	ul	mean	ll	ul	mean	ll	ul	mean	ll	ul	mean	ll	ul
Average Probability of Carcass Availability and Detected (Shoenfeld)																		
Bats	0.79	0.74	0.83	0.65	0.61	0.70	0.79	0.74	0.83	0.79	0.74	0.83	0.79	0.74	0.83	0.68	0.63	0.83
Adjusted Casualty Estimates (fatalities/turbine/search type/season)																		
Bats	0.91	0.60	1.27	0.43	0.16	0.77	17.69	14.62	21.30	8.84	6.32	11.51	3.79	2.27	5.50	15.73	13.34	18.43

Seasonal Adjusted Casualty Estimate (fatalities/turbine/season)

	Spring			Fall		
		90% Confidence Interval			90% Confidence Interval	
	mean	lower limit	upper limit	mean	lower limit	upper limit
Bats	0.56	0.32	0.82	16.03	13.95	18.33

Overall Adjusted Casualty Estimates

		90% Confidence Interval	
	mean	lower limit	upper limit
Bats	16.59	14.36	18.92

Table 17. Bootstrap point estimates (mean) and lower (ll) and upper (ul) of 90% confidence intervals for bat casualty rate estimates using an empirical estimate for the probability a carcass is available and detected at the Fowler Ridge Wind Farm.

	Spring Estimates						Fall Estimates											
	Daily 80x80m Plot Searches			Weekly Road & Pad Searches			Daily Control 80x80m Plot Searches			Daily 5.0 m/s ut-in 80x80m Plot Searches			Daily 6.5 m/s Cut-in 80x80m Plot Searches			Weekly Road & Pad Searches		
		90% CI			90% CI			90% CI			90% CI			90% CI			90% CI	
	mean	ll	ul	mean	ll	ul	mean	ll	ul	mean	ll	ul	mean	ll	ul	mean	ll	ul
Average Probability of Carcass Availability and Detected (multiple search p)																		
Bats	0.58	0.51	0.65	0.51	0.40	0.60	0.58	0.51	0.65	0.58	0.51	0.65	0.58	0.51	0.65	0.51	0.40	0.60
Adjusted Casualty Estimates (fatalities/turbine/search type/season)																		
Bats	1.25	0.82	1.74	0.55	0.21	1.07	24.17	19.50	30.02	12.08	8.63	16.11	5.18	3.12	7.53	20.96	17.52	28.78

Seasonal Adjusted Casualty Estimate (fatalities/turbine/season)						
		90% Confidence Interval			90% Confidence Interval	
	mean	lower limit	upper limit	mean	lower limit	upper limit
Bats	0.74	0.44	1.14	21.45	18.50	28.34

Overall Adjusted Casualty Estimates			
		90% Confidence Interval	
	mean	lower limit	upper limit
Bats	22.20	19.32	29.17

Effects of Raising Turbine Cut-In Speeds on Bat Casualty

Estimated time of death data were used to determine the curtailment condition that the casualty most likely occurred during. Two hundred fifty-two bat carcasses were determined to have occurred at turbines while under normal operational cut-in speeds of 3.5 m/s (control) throughout fall casualty searches. This compares to 63 dead bats found at turbines with cut-in speeds raised to 5.0 m/s and 27 dead bats found at turbines with cut-in speeds raised to 6.5 m/s (Table 18). This resulted in observed casualty rates and corresponding 90% bootstrap confidence intervals of 14.0 (11.6 - 16.5), 7.0 (7.0 - 9.1), and 3.0 (1.8 - 4.2) bats/turbine/season for control, 5.0 m/s, and 6.5 m/s treatment conditions respectively (Table 15). Non-overlapping confidence intervals for observed casualty rates under each cut-in speed condition indicate a significant difference between treatments. An approximate 50% reduction in overall bat mortality was realized by raising the cut-in speed by 1.5 m/s (from 3.5 m/s to 5.0 m/s). An approximate 78% reduction in overall bat mortality was realized by raising the cut-in speed by 3.0 m/s (from 3.5 m/s to 6.5 m/s).

Table 18. Distribution of bat casualties by turbine cut-in speed at the Fowler Ridge Wind Farm.

Species	Control Count	5.0 m/s Count	6.5 m/s Count	Total
big brown bat	7	1	0	8
eastern red bat	168	32	15	245
hoary bat	34	12	7	53
Indiana bat	0	1	0	1
silver-haired bat	43	16	5	64
tri-colored bat	0	1	0	1
Overall	**252**	**63**	**27**	**342**

Poisson modeling of observed casualty rates resulted in significant cut-in speed covariates and week effect covariate. Although blocking by week can potentially eliminate temporal effects, a definite trend was observed by week and therefore week was left as a fixed effect in the model to account for this variation. The parameter estimate for the 5.0 m/s cut-in speed was -0.69, which corresponds to a 0.5 = exp(-0.69) incident rate ratio (i.e. the ratio of the casualty rate occurring at turbines with cut in speeds of 5.0 m/s to the casualty rate occurring at turbines with cut in speeds of 3.5 m/s) confirming a 50.0% reduction in casualty rates when turbines have a cut-in speed of 5.0 m/s having adjusted for all other model variables. The corresponding 90% confidence interval for the 5.0 m/s incident rate ratio implies a reduction in casualty rates of between 37.3% and 60.6%.The parameter estimates for the 6.5 m/s cut in speed treatment were also significant with a value of -1.54 which corresponds to a 0.2 incident rate ratio. This implies a reduction of 78.6% in casualty rate for turbines curtailed below wind speeds of 6.5 m/s with a 90% confidence interval of 70.5% to 84.9%. Non-overlapping confidence intervals between cut-in speeds of 5.0 m/s and 6.5 m/s suggests a significant difference in casualty rates between these treatments. The incident rate ratio between treatment types Is 0.4 which corresponds to a 57.3% reduction in fatalities at 6.5 m/s cut-in speeds when compared to 5.0 m/s cut-in speeds. A visual of model fit and interpolation is shown in Figure 16.

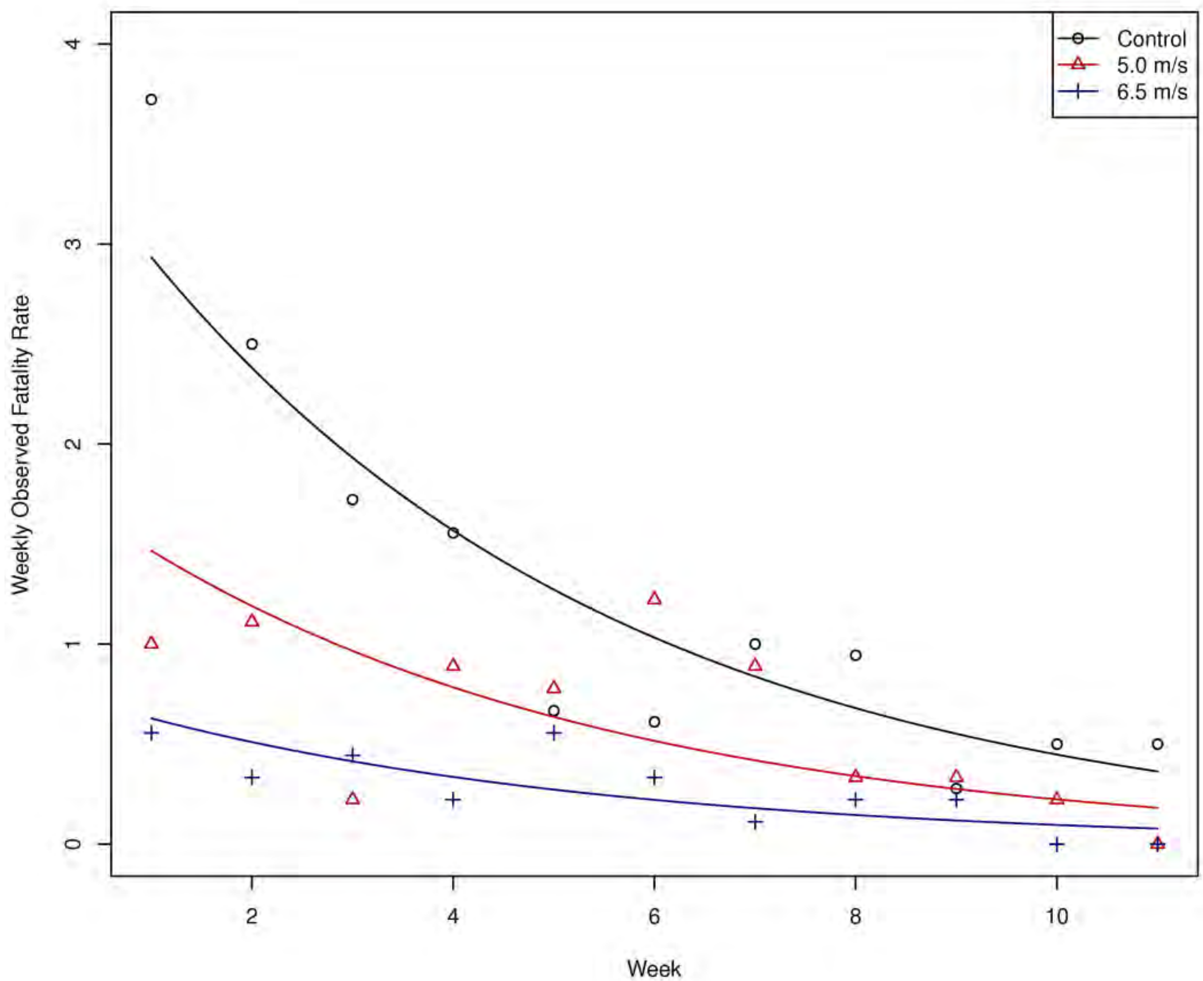

Figure 16. Weekly observed casualty rate at the Fowler Ridge Wind Farm by week with Poisson regression lines based on model parameter estimates for cut-in speed adjustments.

Based on weather data collected at casualty search turbines and an on-site meteorological tower during fall surveys at FRWF, the average nightly wind speed (between 7:00 pm and 7:00 am) at the FRWF was 5.70 m/s (18.69 ft/s) during the study period. Nightly wind speeds at the FRWF were below 5.0 m/s approximately 43.4% of the time, and were below 6.5 m/s approximately 63.7% of the time (Table 19). It is impossible to know exactly when each bat casualty occurred during a night, so it cannot be determined whether the cut-in speed restrictions were active at a particular turbine when the casualty occurred. However, the turbines were estimated to be operating approximately 21.6% less at the 5.0 m/s and 42.1% less at the 6.5 m/s treatments than turbines that were fully operational.

Table 19. Percentage of time the wind speed at the Fowler Ridge Wind Farm is below the given wind speed. Wind speed is based on the average of winds speeds collected at casualty search turbines and one on-site meteorological tower.

Wind Speed (m/s)	Percentage of Time Below
3.5	21.6
4.0	28.9
4.5	36.2
5.0	43.3
5.5	50.6
6.0	57.4
6.5	63.7

The Indiana bat carcass found in 2010 appeared to be fresh, and was likely killed the night before the date of discovery. The turbine had a cut-in speed adjustment of 5.0 m/s the night the bat was thought to be killed. Although the turbine was under a cut-in speed adjustment, wind speeds during the night of the casualty were over 5.0 m/s for much of the evening (Figure 17); thus the turbine was likely operating at wind speeds greater than 5.0 m/s when the Indiana bat casualty occurred.

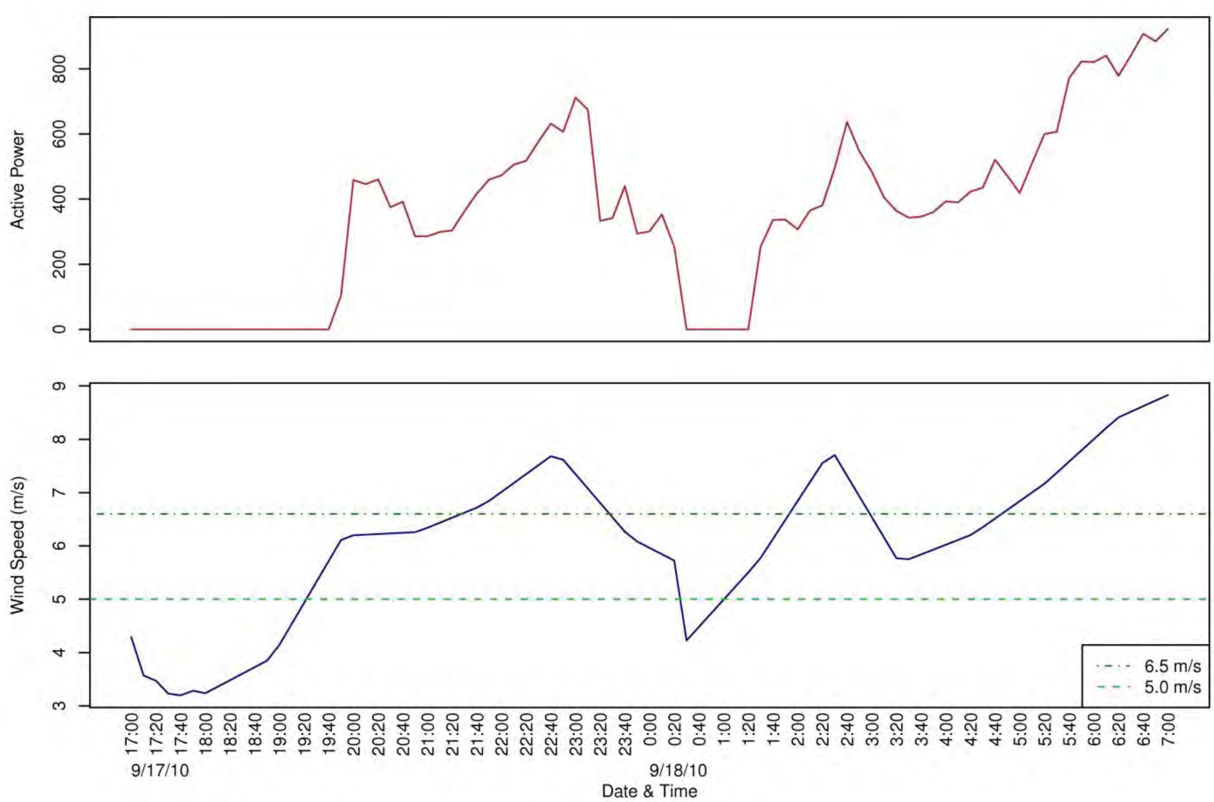

Figure 17. Wind speeds during the evening of September 17 and early morning of September 18 at the location of the Indiana bat casualty at the Fowler Ridge Wind Farm.

Correlation Analyses

Weather and Bat Casualty

All of the top ten Poisson models for explaining casualty rates by weather, chosen by AIC, contained the variables mean nightly wind speed (mean.ws) and mean nightly ambient temperature for the 24 hour period before corresponding searches (mean.nat; Table 20). The standard deviation of the ambient temperature (sd.at) and the mean humidity (mean.hu) for the 24 hour period before corresponding searches were also included in 9 of the 10 top models.

Table 20. Variables in the top Poisson regression models based on AIC for weather correlation analyses at the Fowler Ridge Wind Farm.

AIC	β_1	β_2	β_3	β_4	$\beta_5 \ldots$
270.0	mean.ws	mean.nat	sd.at	mean.hu	--
270.5	mean.ws	mean.nat	sd.at	mean.hu	mean.bp
271.1	mean.ws	mean.nat	sd.at	mean.hu	range.nbp
271.2	mean.ws	mean.nat	sd.at	mean.hu	mean.wd
271.3	mean.ws	mean.nat	sd.at	--	mean.nhu
271.4	mean.ws	mean.nat	sd.at	mean.hu	mean.nbp
271.9	mean.ws	mean.nat	--	mean.hu	mean.bp, range.nbp
271.9	mean.ws	mean.nat	sd.at	mean.hu	sd.nbp
272.0	mean.ws	mean.nat	sd.at	mean.hu	csd.ws
272.0	mean.ws	mean.nat	sd.at	mean.hu	sd.bp

The model with the lowest AIC contains all four of the previously discussed variables exclusively (Model B).

Model B

$$\log(mean(fresh\ bat\ fatalities\ per\ search))$$
$$= -6.69 - 0.15\ mean.ws + 0.14\ mean.nat + 0.38\ sd.at + 0.02\ mean.hu$$

This model indicates a significant negative effect for mean wind speed. Specifically, as mean wind speed increases by one meter per second the incident rate ratio of a casualty decreases by a factor of 0.86. In other words a 14% decrease in fatalities was realized for every one meter per second increase in wind speed. The corresponding 90% confidence interval for decreases in casualty due to mean wind speed ranged from 7% to 21% decrease for every one meter per second increase in wind speed. Mean nightly ambient temperature, the standard deviation of the ambient temperature (sd.at) and the mean humidity (mean.hu) for the 24 hour period before corresponding searches show a significant positive effect on bat casualty rates. Figure 18 shows this relationship for each variable when all other variables are held constant at their respective means. Larger casualty rates for temperature and humidity most likely correspond with the higher bat activity during the early fall period when temperatures are warmer with decreasing activity and casualty towards the end of fall when temperatures begin to cool. The positive relation of casualty rates to the standard deviation of the ambient temperature for the 24 hour period before corresponding searches may be attributed to the larger variance in temperatures on warm days followed by cooler nights, or may be associated with the passage of storm fronts and changes in temperature. Coefficients for these variables suggest increases of 15%, 47%, and 2% in fatalities with a one unit increases in mean nightly ambient temperature, standard deviation of the ambient temperature and mean humidity respectively. None of the corresponding 90% confidence intervals for the preceding variables included zero (mean.nat; 11% to 19%, sd.at; 22% to 75%, mean.hu; 1% to 3%). This implies these variables were significant in the Poisson model predicting casualty rates.

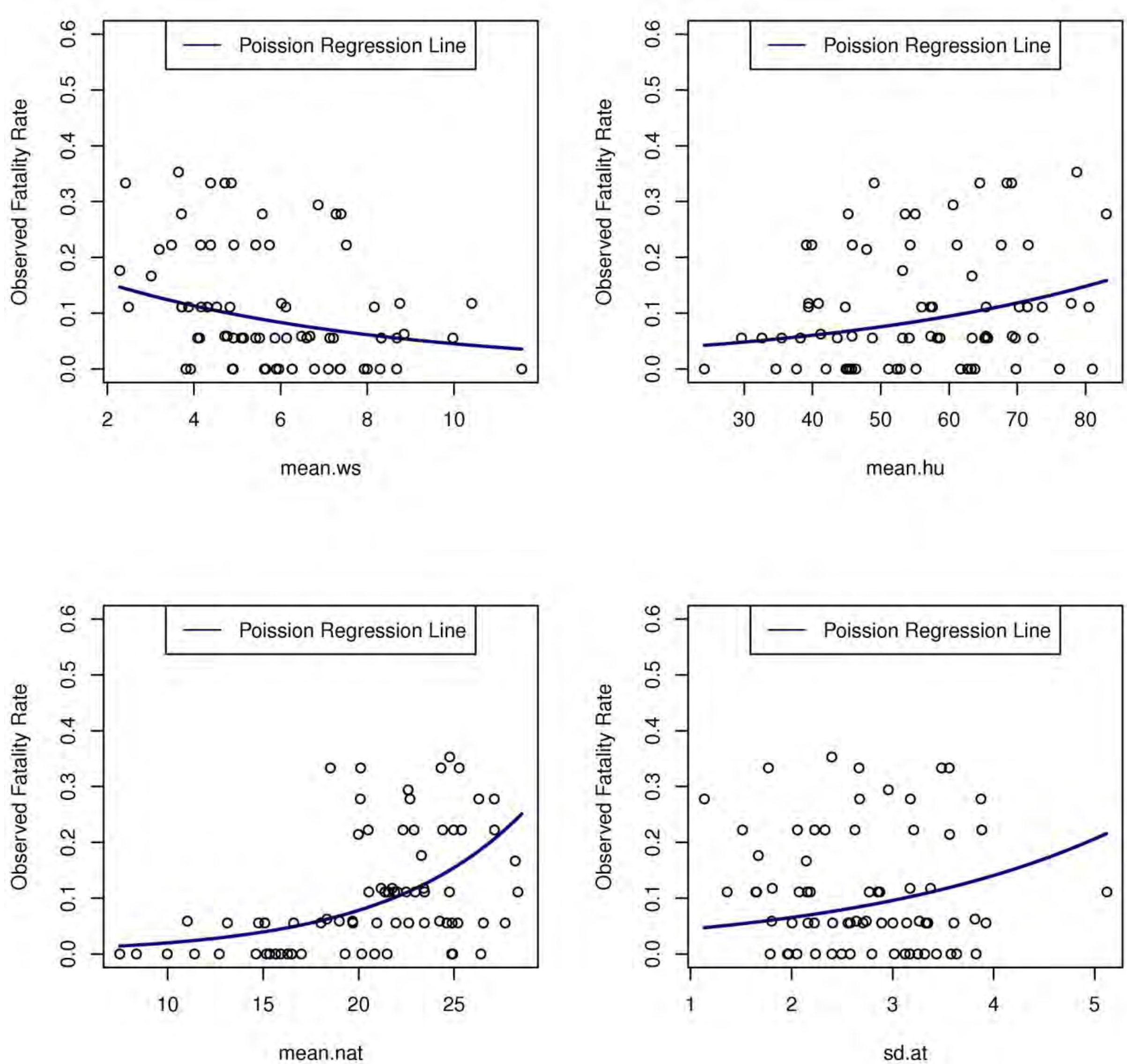

Figure 18. Daily casualty rates at the Fowler Ridge Wind Farm as explained by Poisson regression model covariates. Regression lines represent sequential values of the variable of interest while restraining all other covariates to their means.

<u>Bat Acoustical Activity and Casualties</u>

Correlation between bat activity (number of bat passes per detector night) taken from Anabat units located on the nacelles of selected turbines and observed casualty rates was stronger than the correlation of casualty rates to Anabat detectors located at the base of turbines

(Pearson‟s correlation coefficients; 0.45 and 0.07 respectively; Figure 19). Correlations between activity and casualty comparing ground and nacelle Anabat units were restricted to dates past the night of August 18, 2010 when both nacelle and ground units were in place. On average, nights with higher Anabat activity rates also had higher observed casualty rates, although weather variables also affected bat casualty rates.

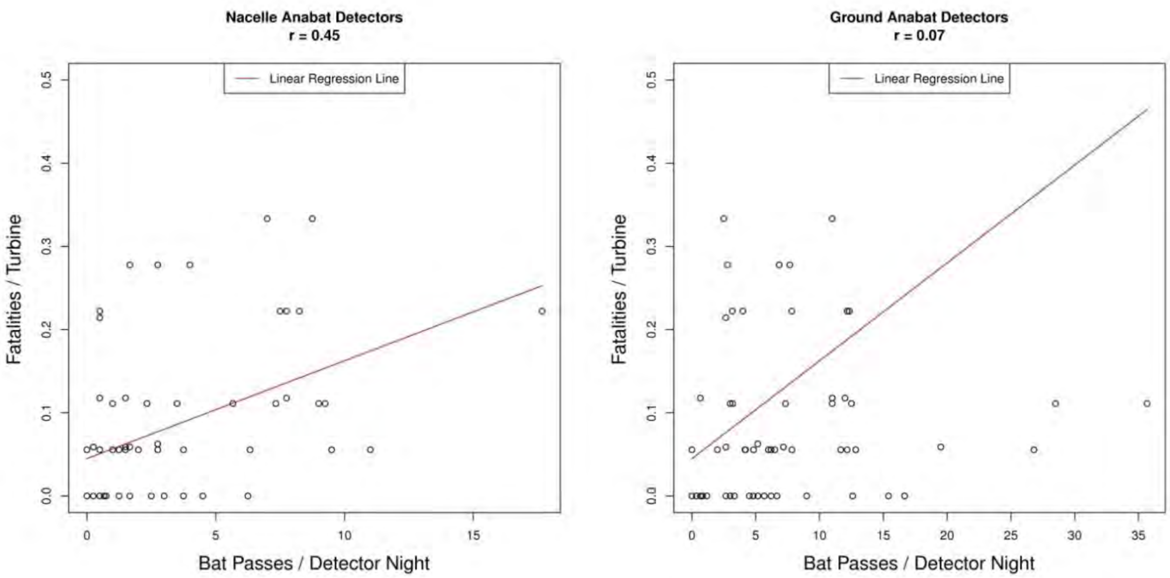

Figure 19. Correlation between activity rates by Anabat detector locations and observed casualty rates at the Fowler Ridge Wind Farm with Pearson's correlation coefficient (r).

To try to account for this variability, bat activity was included in the Poisson modeling process with weather variables and an exhaustive search for the model with lowest AIC resulted in the models shown in Table 21. The combined ground and nacelle activity rate (arate) appears in all of the top ten models. The lowest AIC value for any model including the activity rates from ground detectors only (grate) was 258.2 a difference of 3.4 in AIC from the best combined activity rate model. It is normally agreed that differences in AIC greater than 2 are significant. This implies that combining activity rates from the nacelle and ground Anabat units was a better predictor of bat casualty rates at the FRWF than ground units alone. Since nacelle units were not placed during the complete fall survey period a similar comparison of nacelle units was not included in Poisson modeling. Mean nightly wind speed, mean nightly ambient temperature, and the variance in the ambient temperature during the 24 hours previous to corresponding searches still appear as significant weather variables in each of the top 10 models. Mean humidity during the 24 hours previous to searches was selected in only four of the top 10 models and mean barometric pressure during the same 24-hour period was selected in eight out of the 10 top models (Table 21).

Table 21. Variables in the top Poisson regression models based on AIC for Anabat activity adjusting for weather at the Fowler Ridge Wind Farm.

AIC	β_1	β_2	β_3	β_4	β_5	$\beta_6\ldots$
254.8	arate	mean.ws	mean.nat	sd.at	mean.bp	--
255.0	arate	mean.ws	mean.nat	sd.at	mean.bp	mean.hu
255.5	arate	mean.ws	mean.nat	sd.at	mean.bp	mean.nhu
255.9	arate	mean.ws	mean.nat	sd.at	mean.bp	sd.bp
256.0	arate	mean.ws	mean.nat	sd.at	mean.bp	mean.wd
256.1	arate	mean.ws	mean.nat	sd.at	--	mean.nbp
256.4	arate	mean.ws	mean.nat	sd.at	mean.bp	mean.hu, sd.bp
256.4	arate	mean.ws	mean.nat	sd.at	mean.bp	sd.nhu
256.5	arate	mean.ws	mean.nat	sd.at	--	mean.hu, mean.nbp
256.6	arate	mean.ws	mean.nat	sd.at	mean.bp	mean.hu, sd.nhu

The model with the lowest AIC contains the variables for combined ground and nacelle Anabat activity (arate), mean nightly wind speed (mean.ws), mean nightly ambient temperature (mean.nat), and the variance of the ambient temperature and mean barometric pressure for the 24 hour period previous to searches (Model C).

Model C

$$\log\big(mean(fresh\ bat\ fatalities\ per\ search)\big)$$
$$= -66.65 + 0.04\ arate - 0.15\ mean.ws + 0.12\ mean.nat + 0.54\ sd.at + 0.06\ mean.bp$$

Coefficients for combined activity rates have an incident rate ratio of 1.04 implying a 4% increase in fatalities for each one unit increase in bat passes per detector night. The 90% confidence interval for decreases in casualty due to combined activity rate is 3% to 5% for each one unit increase in bat passes per detector night. Figure 20 shows the graphical interpretation of model coefficients unique to this model.

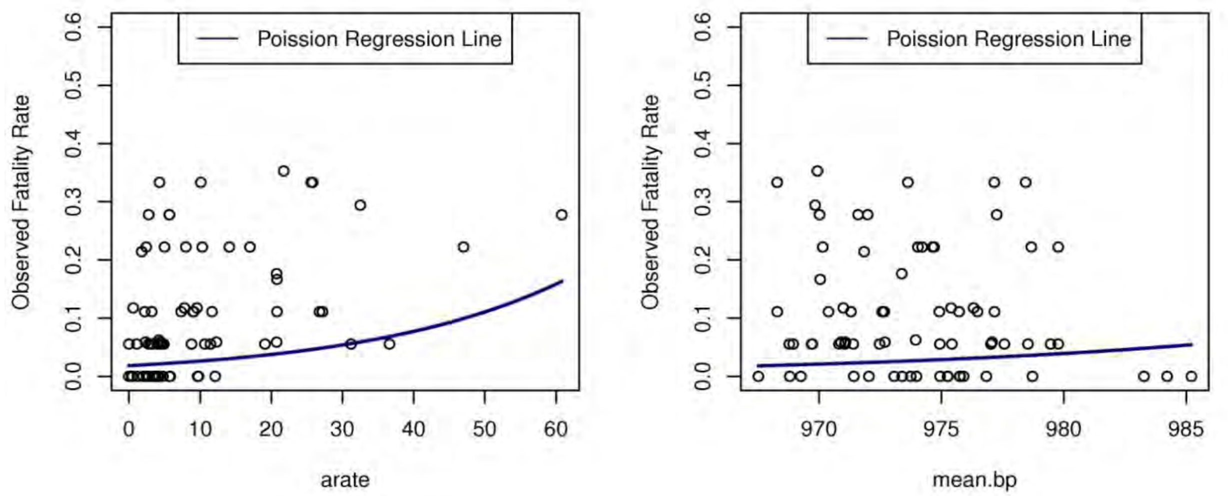

Figure 20. Daily casualty rates at the Fowler Ridge Wind Farm as explained by Poisson regression model covariates. Regression lines represent sequential values of the variable of interest while restraining all other covariates to their means.

Casualty rates varied throughout the study, with the highest rates occurring during the month of August. An especially large number of fresh bat carcasses were discovered on August 4, 2010, when observed casualty rates were twice as high as recorded on any other evening.

The months of August and September were warmer and drier than historical averages. La Nina weather patterns weakened or rerouted storm systems in August that were heading toward Indiana (Indiana Climate Center 2010), and relatively few, strong fronts associated with precipitation events crossed the FRWF. The evening of August 4 was unusual in that August 3 and 4 were one of the few days when stronger fronts associated with precipitation events occurred in the Fowler area.

On-site weather data collected on the evening of August 3, 2010 indicate that mean temperature and humidity were higher than normal, and wind speeds and barometric pressure were lower than normal, as compared to weather data collected during the fall migration period (Figure 21). Barometric pressure decreased from the morning of August 3 through the early morning of August 4, 2010, as a weather front passed through the area. Periods of rain and heavy wind associated with thunderstorms were present during periods of the day on August 3 and 4; however, wind speeds dropped during the evening, and temperatures were high, humidity was high, and wind speeds low throughout the evening of August 3-4, 2010. Bat activity rates were also very high during this night.

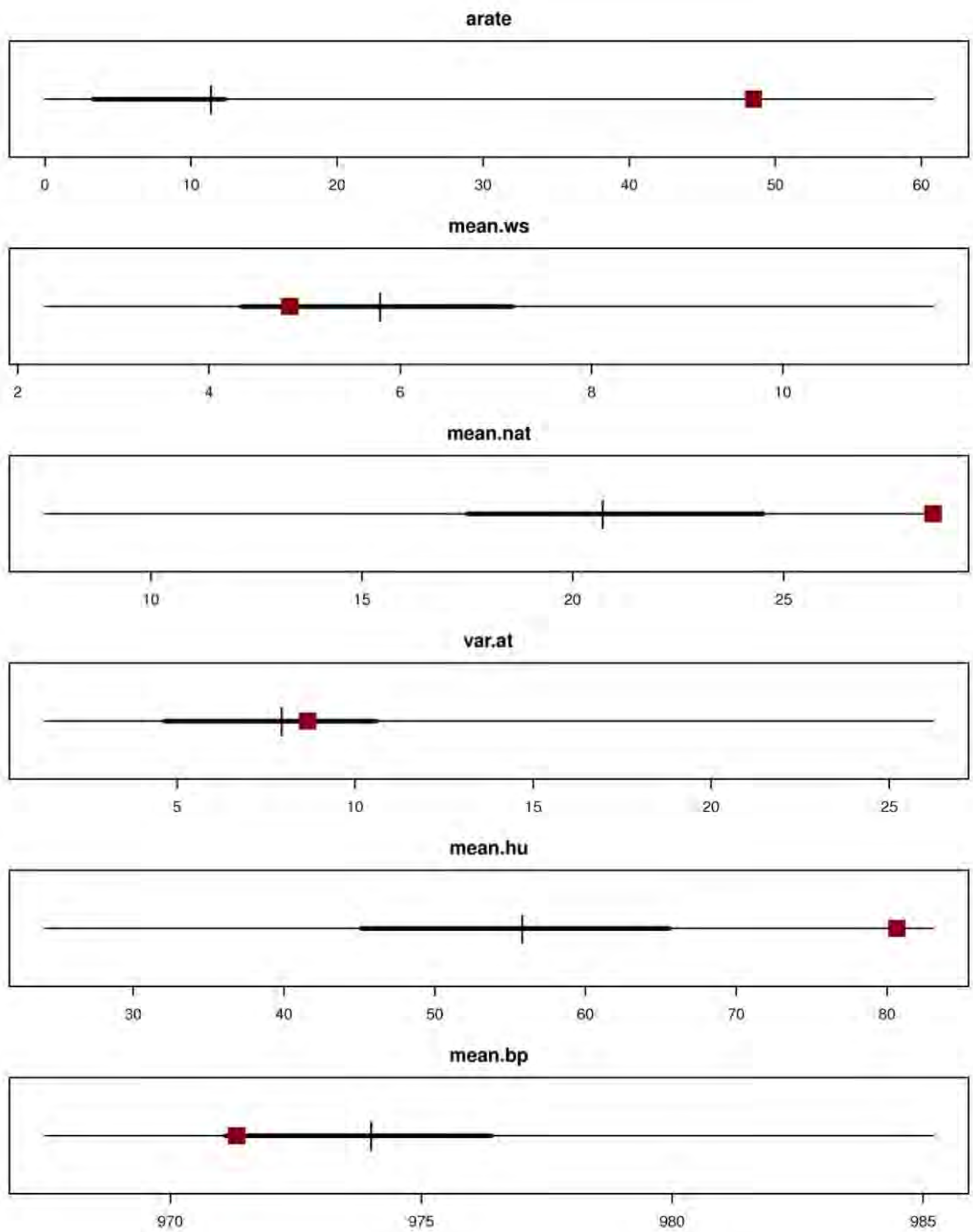

Figure 21. Average climate conditions on the night preceding August 4, 2010, the night prior to the date when the highest number of bat casualties were found.

Weather conditions during the night before the date the Indiana bat casualty was found were not typical of nights when most bat fatalities occurred. The Indiana bat was found on September 18, 2010. During the evening of September 17, bat activity rates were below the fall median values and mean barometric pressure was above median values. Mean temperature, and mean wind speed were at fall median values, and humidity and variation in air temperature were slightly below median values, but within the 1st and 3rd quartiles (Figure 22). No precipitation was present the day and night of September 17, and no large fronts were moving through the area.

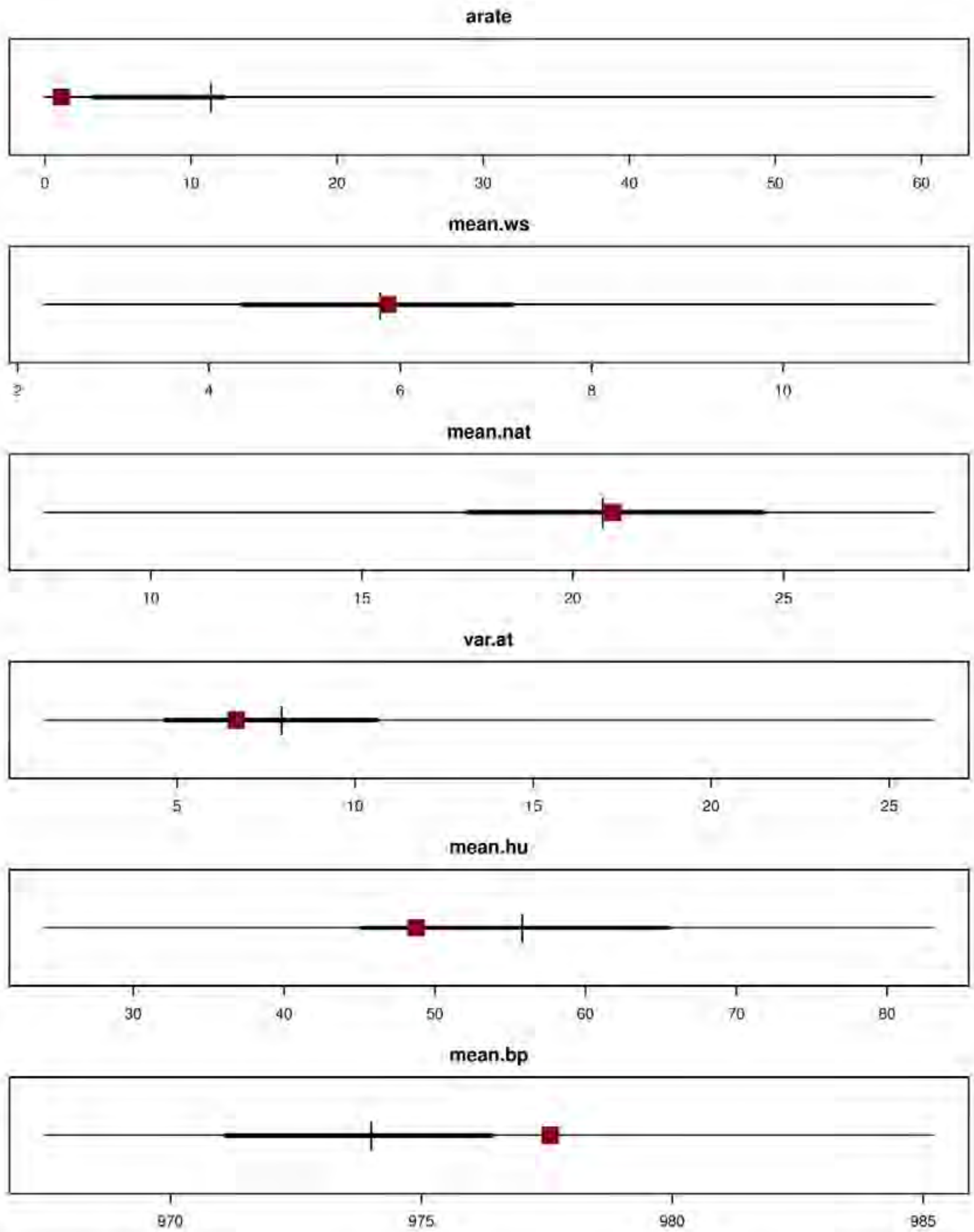

Figure 22. Average climate conditions on the night preceding September 18, 2010, the night prior to the date when the Indiana bat casualty was discovered.

Bat Acoustic Surveys

Bat activity was monitored at four fixed sampling locations on a total of 36 nights during the spring period of April 9 through May 14, and again at ten fixed sampling locations on a total of

95 nights during the fall period of July 15 through October 18, 2010. During the fall season, sampling began on July 15 for the two locations that were previously monitored in 2007, while monitoring at the base of turbines began August 1. Anabat units were operable for 93.5% of the spring sampling period, and 93.3% of the fall sampling period. Anabat units recorded 185 bat passes on 137 detector-nights during the spring (Table 22), and 5,721 bat passes on 685 detector-nights during the fall. The average bat activity for ground stations was 1.34 ± 0.29 bat passes per detector-night in the spring (Table 22), and 11.46 ± 1.29 at ground stations and 3.10 ± 0.42 at raised stations during the fall (Table 23).

Table 22. Results of spring acoustic bat surveys conducted at the Fowler Ridge Wind Farm, April 9 – May 14, 2010, separated by call frequency (HF = high frequency, MF = mid frequency, LF = low frequency).

Anabat Station	Location	# of HF Bat Passes	# of MF Bat Passes	# of LF Bat Passes	Total Bat Passes	Detector-Nights	Bat Passes/ Night*
FR056g	ground	13	16	23	52	36	1.44±0.46
FR098g	ground	14	9	23	46	36	1.28±0.28
FR251g	ground	9	9	13	31	29	1.07±0.34
FR414g	ground	11	18	27	56	36	1.56±0.34
Grand Total		**47**	**52**	**86**	**185**	**137**	**1.34±0.29**
Active		*5*	*1*	*9*	*15*	*5*	*3.00± NA*

Table 23. Results of fall acoustic bat surveys conducted at the Fowler Ridge Wind Farm, July 15 – October 18, 2010, separated by call frequency (HF = high frequency, MF = mid frequency, LF = low frequency). Stations FRr1g and FRr2g were previously monitored in 2007, and were located away from turbines. The other stations shown here were located at turbines.

Anabat Station	Location	# of HF Bat Passes	# of MF Bat Passes	# of LF Bat Passes	Total Bat Passes	Detector-Nights	Bat Passes/ Night*
FRr1g	ground	71	65	296	432	86	5.02±0.43
FRr2g	ground	173	59	93	325	93	3.49±0.85
FR083g	ground	220	205	436	861	68	12.66±1.62
FR083h	raised	11	26	75	112	61	1.84±0.32
FR251g	ground	193	189	495	877	68	12.90±1.59
FR251h	raised	24	50	133	207	61	3.39±0.63
FR458g	ground	476	505	1007	1988	76	26.16±4.12
FR458h	raised	22	27	154	203	48	4.23±0.97
FR614g	ground	88	118	331	537	63	8.52±1.19
FR614h	raised	6	33	140	179	61	2.93±0.60
Total Ground		**1,221**	**1,141**	**2,658**	**5,020**	**454**	**11.46±1.29**
Total Raised		**63**	**136**	**502**	**701**	**231**	**3.10±0.42**
Grand Total		**1,284**	**1,277**	**3,160**	**5,721**	**685**	**8.12±0.88**
Active		*32*	*59*	*43*	*134*	*21*	*6.38±2.08*

Species Composition

During the spring study season, passes by low-frequency bats (LF; 46.5% of all passes) outnumbered passes by mid-frequency bats (MF; 28.1%) and high-frequency bats (HF; 25.4%; Table 22), and this pattern was consistent among ground stations (Figure 23). Temporal patterns of use were similar among all three species groups during the study period (Figure 23).

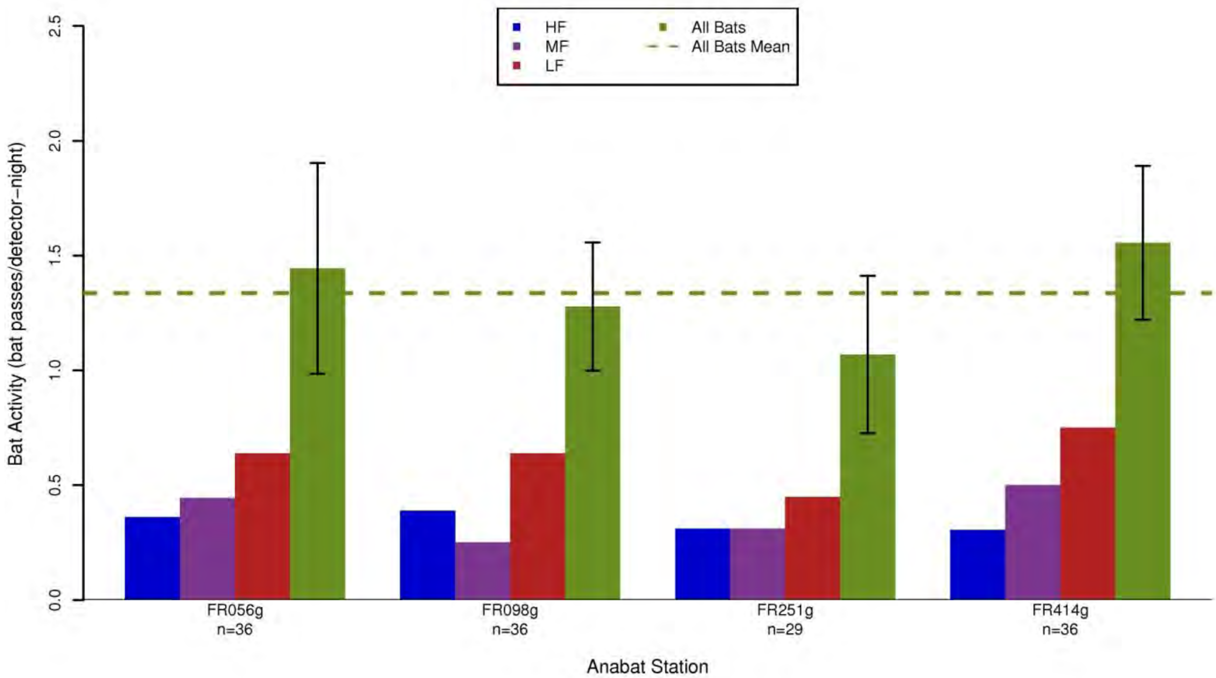

Figure 23. Number of bat passes per detector-night by Anabat station at the Fowler Ridge Wind Farm for the spring study period April 9 – May 14, 2010. The bootstrapped standard errors are represented by the black error bars on the 'All Bats' columns.

During the fall study season, passes by LF bats (55.2% of all passes) again outnumbered passes by HF bats (22.4%), and MF bats (22.3%; Table 23), and this pattern was consistent among ground stations (Figure 24). Among raised stations, LF bats comprised 71.6% of passes (Table 23). LF and MF bats comprised a higher proportion, and HF species comprised a lower proportion, of calls recorded at raised versus ground locations at turbines during the fall (Figures 25 and 26). Temporal patterns of use were similar among all three species groups during the study period (Figure 24).

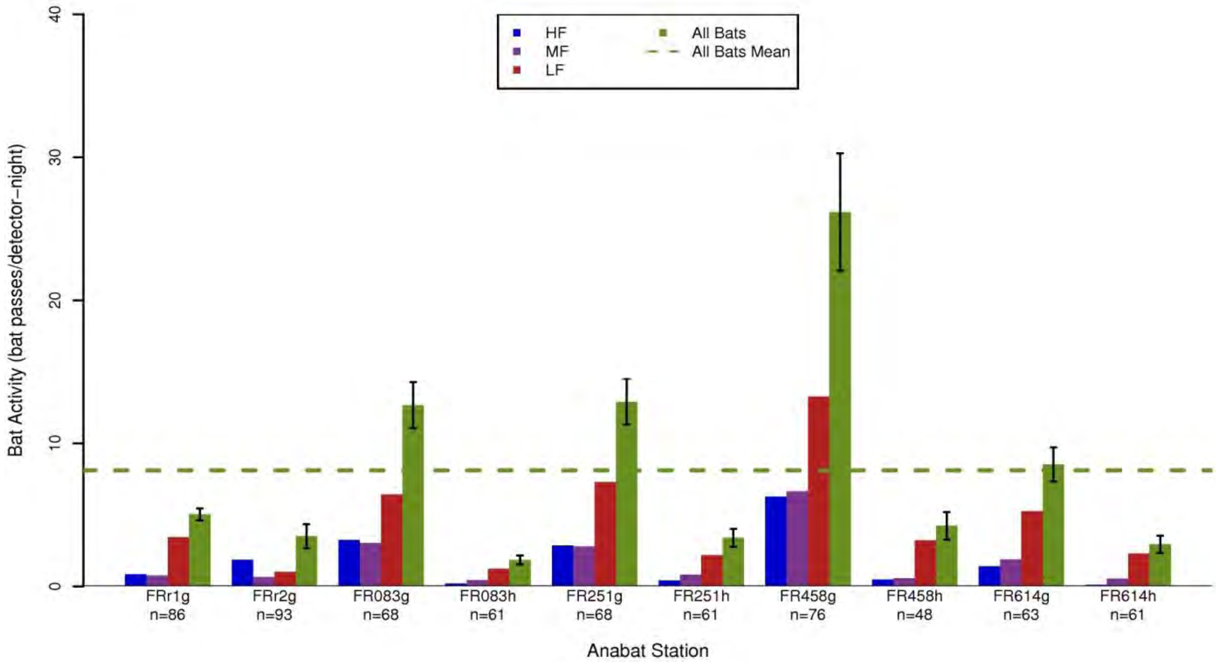

Figure 24. Number of bat passes per detector-night by Anabat station at the Fowler Ridge Wind Farm for the fall study period July 15 – October 18, 2010. The bootstrapped standard errors are represented by the black error bars on the 'All Bats' columns. Stations FRr1g and FRr2g were previously monitored in 2007, and were located away from turbines.

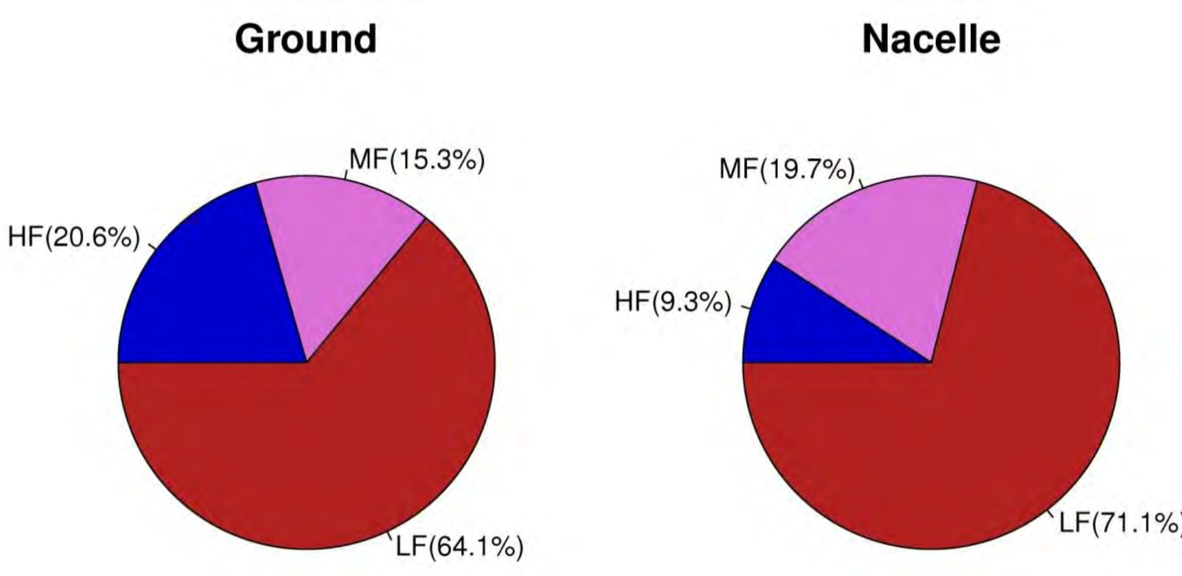

Figure 25. Percentage of bat calls, by frequency class, recorded at the Fowler Ridge Wind Farm at nacelles versus detectors at the base of turbines on nights when both units were operational during the fall migration period.

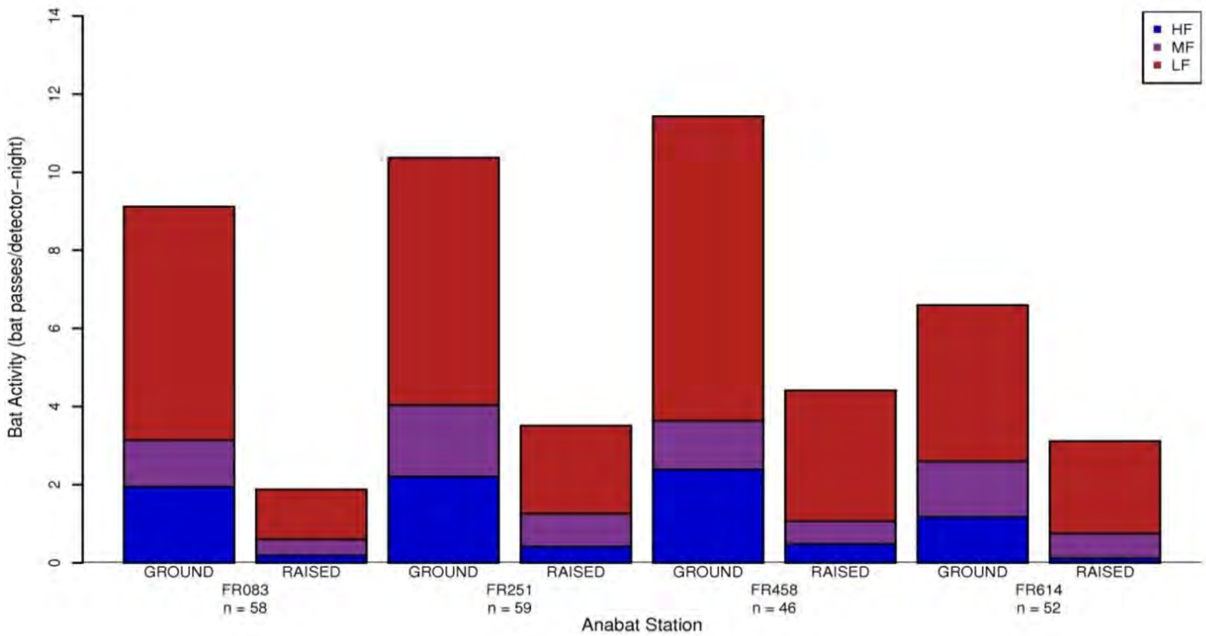

Figure 26. Bat activity at paired stations during the fall study period at the Fowler Ridge Wind Farm, August 18 – October 18, 2010 on nights when both ground and nacelle units were operational.

Data for HF bat passes were analyzed during both the spring and fall study period to look at temporal trends among species of interest (including Indiana bat). During the spring study season, HF bat activity was similar at each of the four sampling stations, as well as during active monitoring; the majority of HF bat passes occurred in late-April and early-May (Figure 27). During the fall study season, HF bat activity also showed similar temporal patterns across all stations, with most HF bat passes being recorded from early- to mid-August (Figure 28).

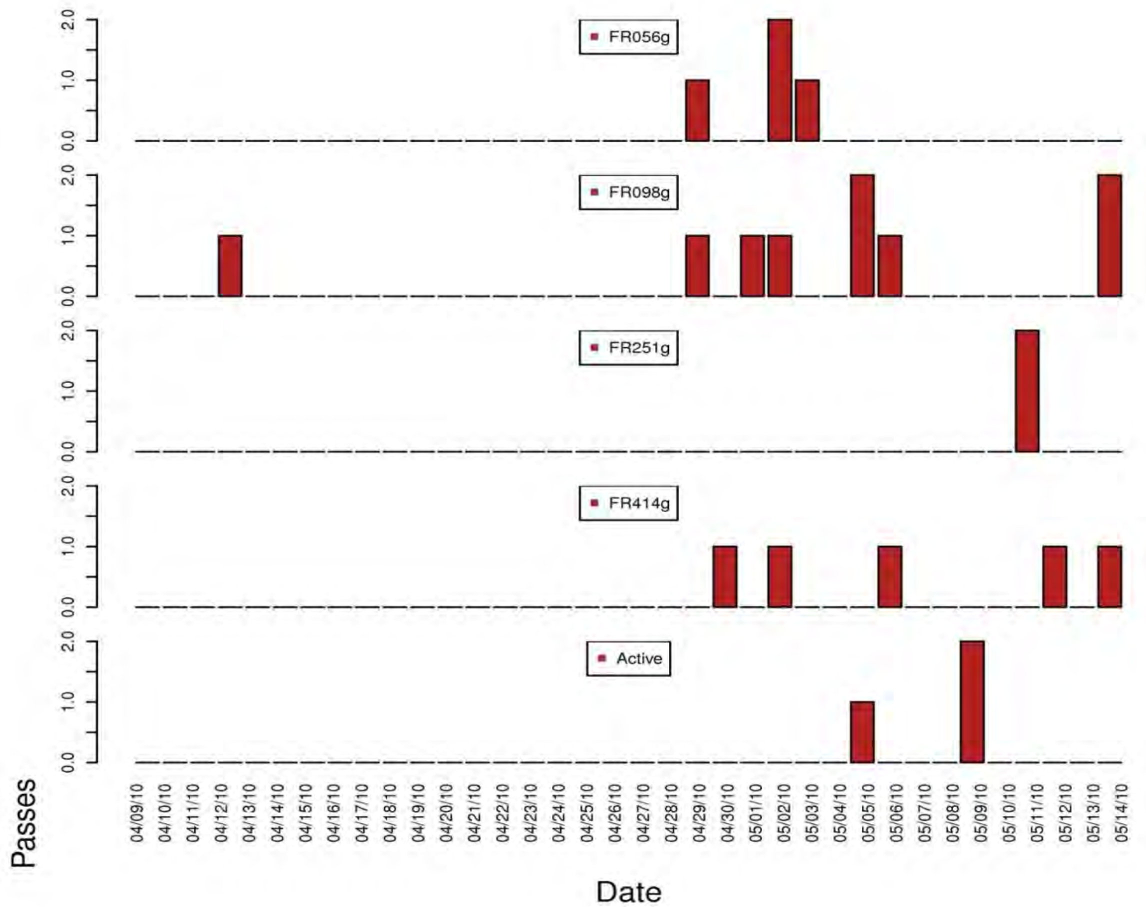

Figure 27. High-frequency bat passage rates during the Fowler Ridge Wind Farm spring study season, April 9 – May 14, 2010.

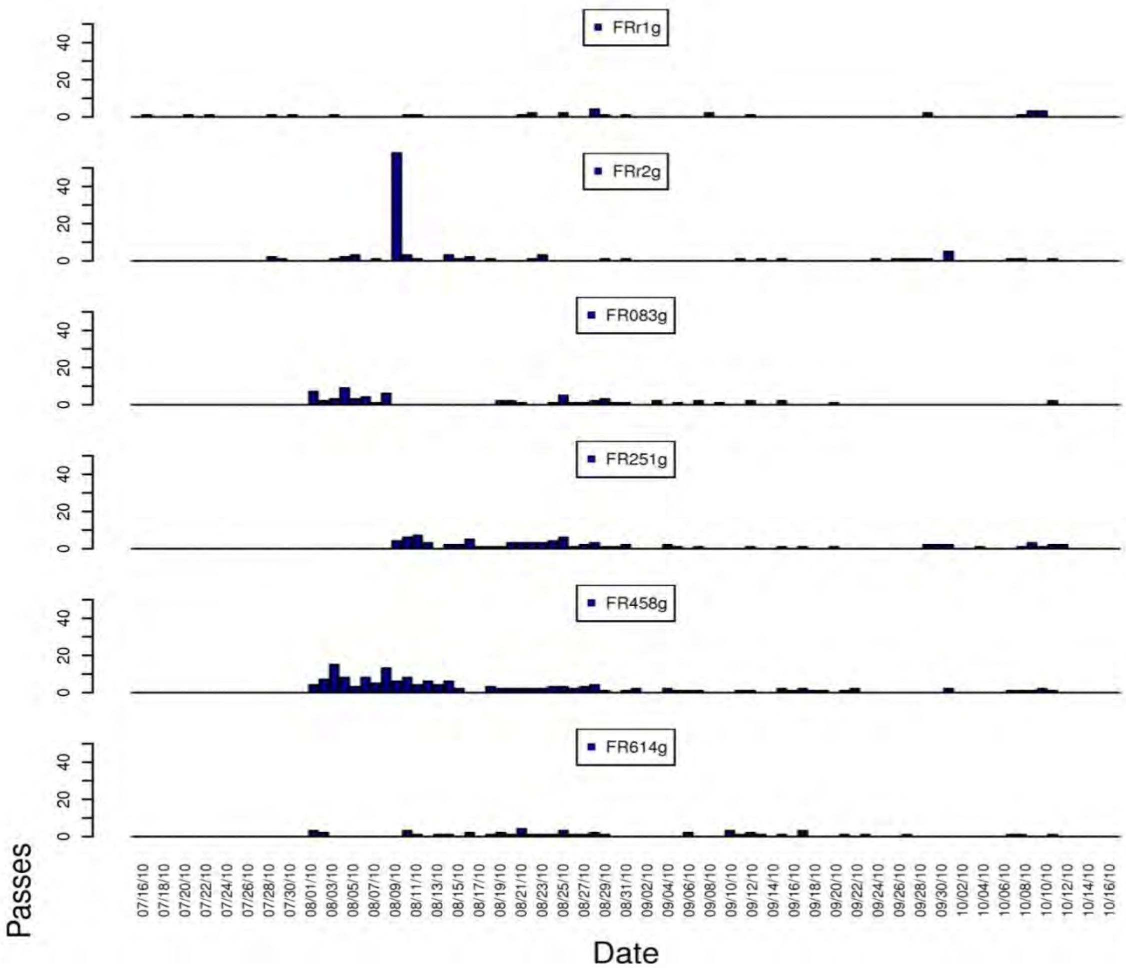

Figure 28. High-frequency bat passage rates during the Fowler Ridge Wind Farm fall study season, July 15 – October 18, 2010.

HF bat passes were further analyzed, to gain a better understanding of what species comprised calls in this category. Calls were analyzed by visually comparing call sonograms and characteristics to a set of known calls from a call library. *Myotis* comprised only 15% of calls that were good enough quality for identification in 2010 (Table 24). Based on this analysis, *Myotis* activity was low within the FRWF during the spring and fall of 2010, and the majority of calls identified within the HF category were comprised of non-myotis species, including red bats and tri-colored bats.

Table 24. Bat activity by bat species within the high-frequency (HF) category at the Fowler Ridge Wind Farm.

Species	Activity (bat passes/ detector night)	Percent Composition of identified bat activity
myotis	0.10	15.6%
eastern red bat	0.16	23.9%
tri-colored bat	0.05	7.3%
other non-myotis species	0.35	53.2%
unknown	0.84	55.9% of HF calls were unable to be identified

Myotis calls were analyzed, to determine if call characteristics resembled Indiana bat calls from a call library. Three methods were utilized to identify potential Indiana bat calls, including a Discriminant Function Analysis, the "Britzke" filter, and a qualitative analysis by WEST biologists. No potential Indiana bat calls were identified by the Discriminant Function Analysis from the 2007 data set. In 2008, five call files were identified by the Discriminant Function Analysis as Indiana bat calls. However, neither the "Britzke" filter nor qualitative analysis classified these calls as Indiana bats. Thirty calls were identified by the Discriminant Function Analysis as resembling calls made by Indiana bats in 2010, two calls passed the Britzke filter, and WEST biologists identified all 30 calls as either made by Indiana bats or little brown bats (Table 25). Most potential Myotis calls were identified as occurring on the evening of August 9-10, 2010 at reference Station 2, located away from turbines (FRr2g). Based on the presence of multiple potential calls, *Myotis* were present on the evening of August 9-10 at Station 2, and the potential exists that these calls were made by Indiana bats. The recording of individual potential Indiana bat calls on other nights do not provide as strong of evidence of Indiana bat activity due to the potential for incorrect identifications.

Table 25. Bat calls identified by the Discriminant Function (DF) Analysis in 2010 as potentially made by Indiana bats. MYSO = Indiana bat (*Myotis sodalis*) and MYLU = Little brown bat (*Myotis lucifugus*).

Station	Month	Date	Filename	Discriminant Function ID	WEST Biologist ID	Briztke ID
FR458g	Aug	11	k8120107.52#	MYSO	MYSO or MYLU	
FR458g	Sep	1	k9012343.46#	MYSO	MYSO or MYLU	
FR251g	Aug	10	k8110423.53#	MYSO	MYSO or MYLU	
FR083g	Aug	3	k8040517.29#	MYSO	MYSO or MYLU	
FR083g	Sep	10	k9110508.41#	MYSO	MYSO or MYLU	
FRr2g	Aug	5	k8060303.30#	MYSO	MYSO or MYLU	
FRr2g	**Aug**	**9**	**k8100138.40#**	**MYSO**	MYSO or MYLU	**MYSO**
FRr2g	Aug	9	k8100143.27#	MYSO	MYSO or MYLU	
FRr2g	Aug	9	k8100147.26#	MYSO	MYSO or MYLU	
FRr2g	Aug	9	k8100148.32#	MYSO	MYSO or MYLU	
FRr2g	Aug	9	k8100149.17#	MYSO	MYSO or MYLU	
FRr2g	Aug	9	k8100149.37#	MYSO	MYSO or MYLU	
FRr2g	Aug	9	k8100151.06#	MYSO	MYSO or MYLU	
FRr2g	Aug	9	k8100152.01#	MYSO	MYSO or MYLU	
FRr2g	Aug	9	k8100154.48#	MYSO	MYSO or MYLU	
FRr2g	Aug	9	k8100155.44#	MYSO	MYSO or MYLU	
FRr2g	Aug	9	k8100156.20#	MYSO	MYSO or MYLU	
FRr2g	Aug	9	k8100156.32#	MYSO	MYSO or MYLU	
FRr2g	Aug	9	k8100156.49#	MYSO	MYSO or MYLU	
FRr2g	Aug	9	k8100158.03#	MYSO	MYSO or MYLU	

Table 25. Bat calls identified by the Discriminant Function (DF) Analysis in 2010 as potentially made by Indiana bats. MYSO = Indiana bat (*Myotis sodalis*) and MYLU = Little brown bat (*Myotis lucifugus*).

Station	Month	Date	Filename	Discriminant Function ID	WEST Biologist ID	Briztke ID
FRr2g	Aug	9	k8100158.14#	MYSO	MYSO or MYLU	
FRr2g	**Aug**	**9**	**k8100158.36#**	**MYSO**	MYSO or MYLU	**MYSO**
FRr2g	Aug	9	k8100159.10#	MYSO	MYSO or MYLU	
FRr2g	Aug	9	k8100201.33#	MYSO	MYSO or MYLU	
FRr2g	Aug	9	k8100203.02#	MYSO	MYSO or MYLU	
FRr2g	Aug	9	k8100204.59#	MYSO	MYSO or MYLU	
FRr2g	Aug	9	k8100205.39#	MYSO	MYSO or MYLU	
FRr2g	Aug	9	k8100206.17#	MYSO	MYSO or MYLU	
FRr2g	Aug	9	k8100207.40#	MYSO	MYSO or MYLU	
FRr2g	Aug	10	k8110052.38#	MYSO	MYSO or MYLU	

Spatial Variation

During the spring studies at the FRWF, bat activity was similar among the four fixed stations in (Figures 23), ranging between 1.07 and 1.56 bat passes per detector-night among ground stations (Table 22). Overall, use was lowest at station FR251g (1.07 bat passes/detector night), and higher at stations FR098g (1.28), FR056g (1.44), and FR414g (1.56; Table 22)

During the fall study season, bat activity varied among the ten stations in the FRWF (Figure 24), ranging between 3.49 and 26.16 bat passes per detector-night among ground stations, and between 1.84 and 4.23 bat passes per detector-night among raised stations (Table 23). Ground stations previously monitored in 2007 recorded lower bat activity rates (3.49 and 5.02) in 2010 compared to detectors located at the base of wind turbines (8.52, 12.66, 19.90, 26,16; Figure 24, Table 23).

Temporal Variation

During the spring study season, bat activity increased from early-April through mid-May (Figure 29). The highest number of bat passes per detector-night (of all frequencies) within a single week were recorded on the week of April 30 through May 6 (2.57 bat passes per detector-night); the highest number of bat passes per detector-night of HF bats were recorded during the week of April 30 through May 6 (0.71); the highest number of MF bat passes per detector-night were recorded during the week of April 30 through May 6 (0.90); the highest number of LF bat passes per detector-night were recorded during the week of April 19 through April 27 (1.07;Table 26). HF bat passes were most commonly recorded after May 1 (Figure 27).

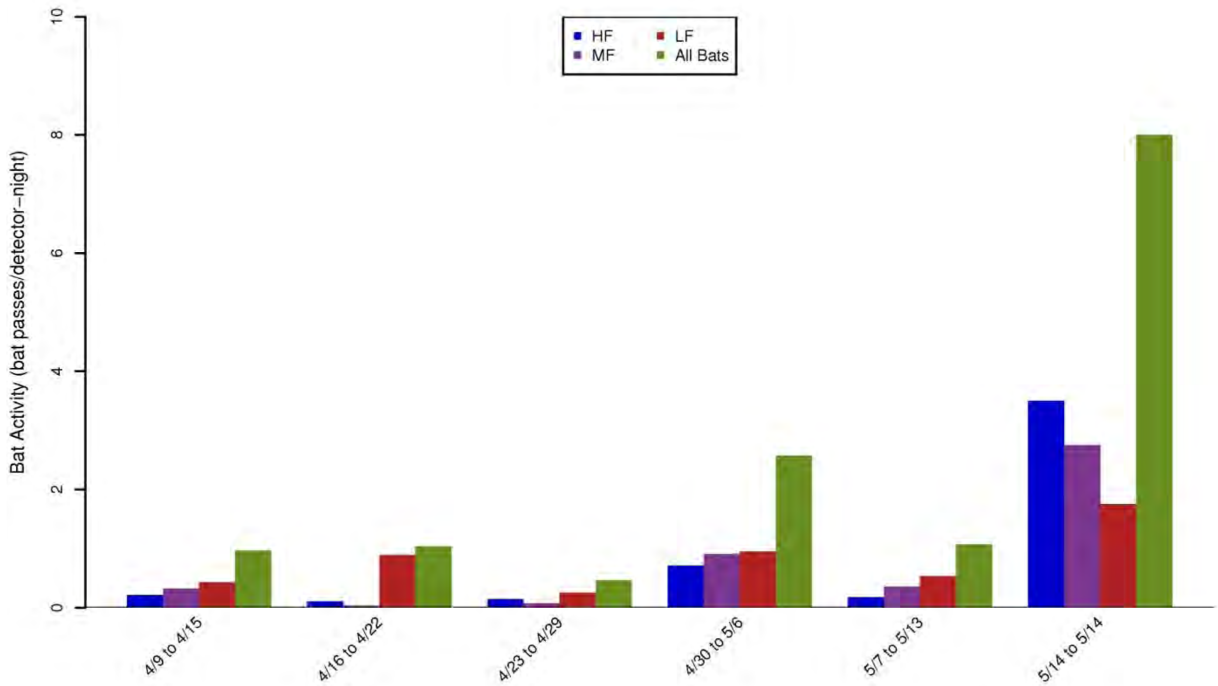

Figure 29. Bat activity, by week, during the spring migration period at the Fowler Ridge Wind Farm.

Table 26. Highest weekly activity rates (bat passes per detector-night), sorted by call frequency (HF=high frequency, MF=mid frequency, LF=low frequency), for the spring study period.

Period of Interest	Week(s) of Highest Passage Rate	Bat activity Rate
	All Bats	
Spring Study Period	04/30/10 to 05/06/10	2.57
	HF Bats	
Spring Study Period	04/30/10 to 05/06/10	0.71
	MF Bats	
Spring Study Period	04/30/10 to 05/06/10	0.90
	LF Bats	
Spring Study Period	04/19/10 to 04/27/10	1.07

During the fall study season, bat activity was highest from late-July through late-August, and then decreased through mid-October (Figure 30). The highest number of bat passes per detector-night (all frequencies) within a single week were recorded on the week of July 26 through August 1 (61.45 bat passes per detector night); the highest number of HF bat passes per detector-night were recorded during the week of August 4 through August 10 (10.84); the highest number of MF bat passes per detector-night were recorded during the week of July 29 through August 4 (12.62); the highest number of LF bat passes per detector-night were recorded during the week of July 26 through August 1 (44.37; Table 27). Few HF bat basses were recorded outside of the week of August 4-10 (Figure 28).

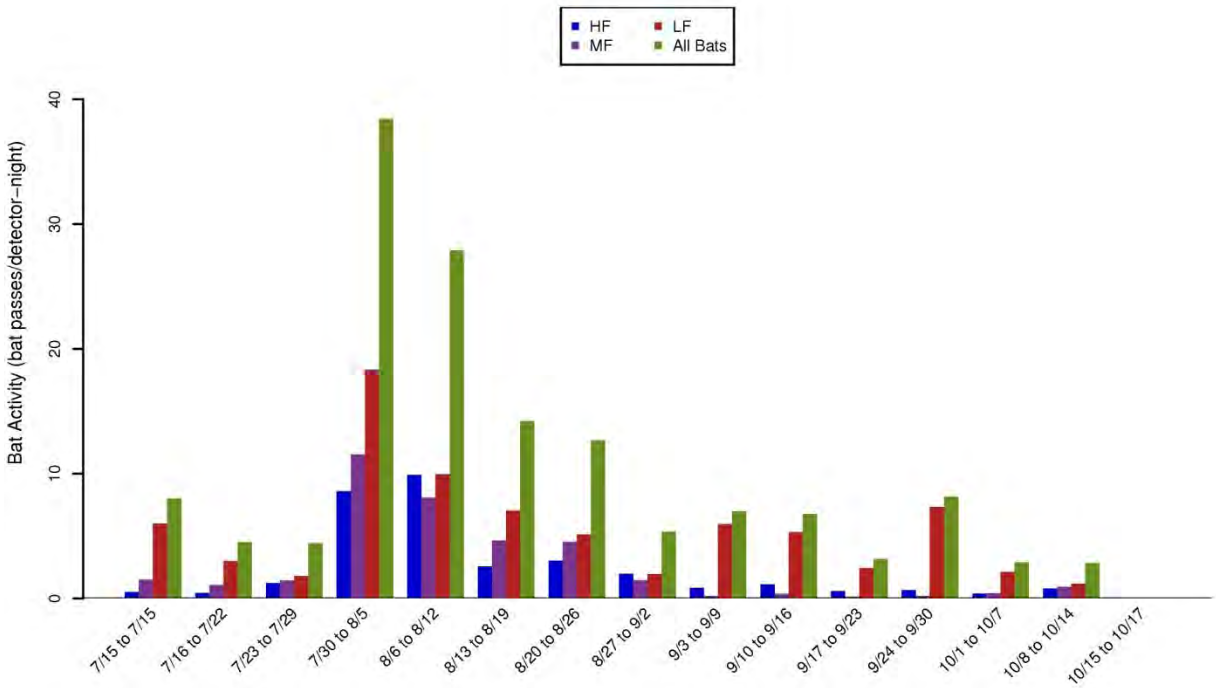

Figure 30. Bat activity, by week, during the fall migration period at the Fowler Ridge Wind Farm. Monitoring of bat activity began at two stations on July 15 that were previously monitored in 2007, while monitoring at the base of turbines began July 30.

Table 27. Highest weekly activity rates (bat passes per detector-night), sorted by call frequency (HF=high frequency, MF=mid frequency, LF=low frequency), for the fall study period.

Period of Interest	Week(s) of Highest Passage Rate	Bat activity Rate
	All Bats	
Overall	07/26/10 to 08/01/10	61.46
Fall Study Period	07/30/10 to 08/05/10	38.44
	HF Bats	
Overall	08/04/10 to 08/10/10	10.84
Fall Study Period	08/04/10 to 08/10/10	10.84
	MF Bats	
Overall	07/29/10 to 08/04/10	12.62
Fall Study Period	07/31/10 to 08/06/10	11.66
	LF Bats	
Overall	07/26/10 to 08/01/10	44.37
Fall Study Period	07/30/10 to 08/05/10	18.33

Most calls identified by the DF as resembling potential Indiana bat calls were recorded on the evening of August 9. This corresponds with the peaks in activity observed for LF, MF, and HF bats during the first two weeks in August.

Temporal patterns of bat activity between ground and raised stations were similar (Figure 31), and followed the overall trend. However, raised stations recorded more bat passes through late August, while ground stations recorded more activity through the remainder of the study period.

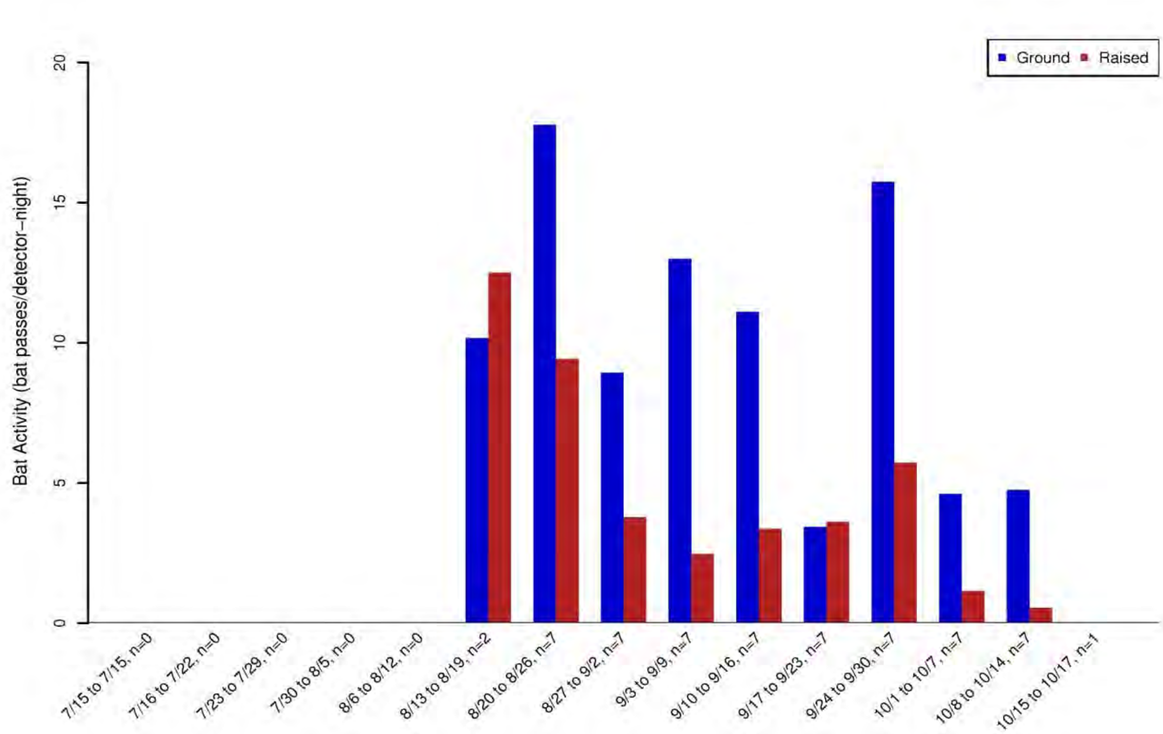

Figure 31. Number of bat passes per detector-night by ground and raised Anabat stations at the Fowler Ridge Wind Farm for the fall study period July 15 – October 18, 2010 when raised and ground units were operational on the same night.

Bat activity rates as a function of hour past sunset are shown in Figure 32. In general, bat activity was recorded throughout the night, with rates highest from 2 – 6 hours past sunset, Activity generally decreased in the latter part of the night.

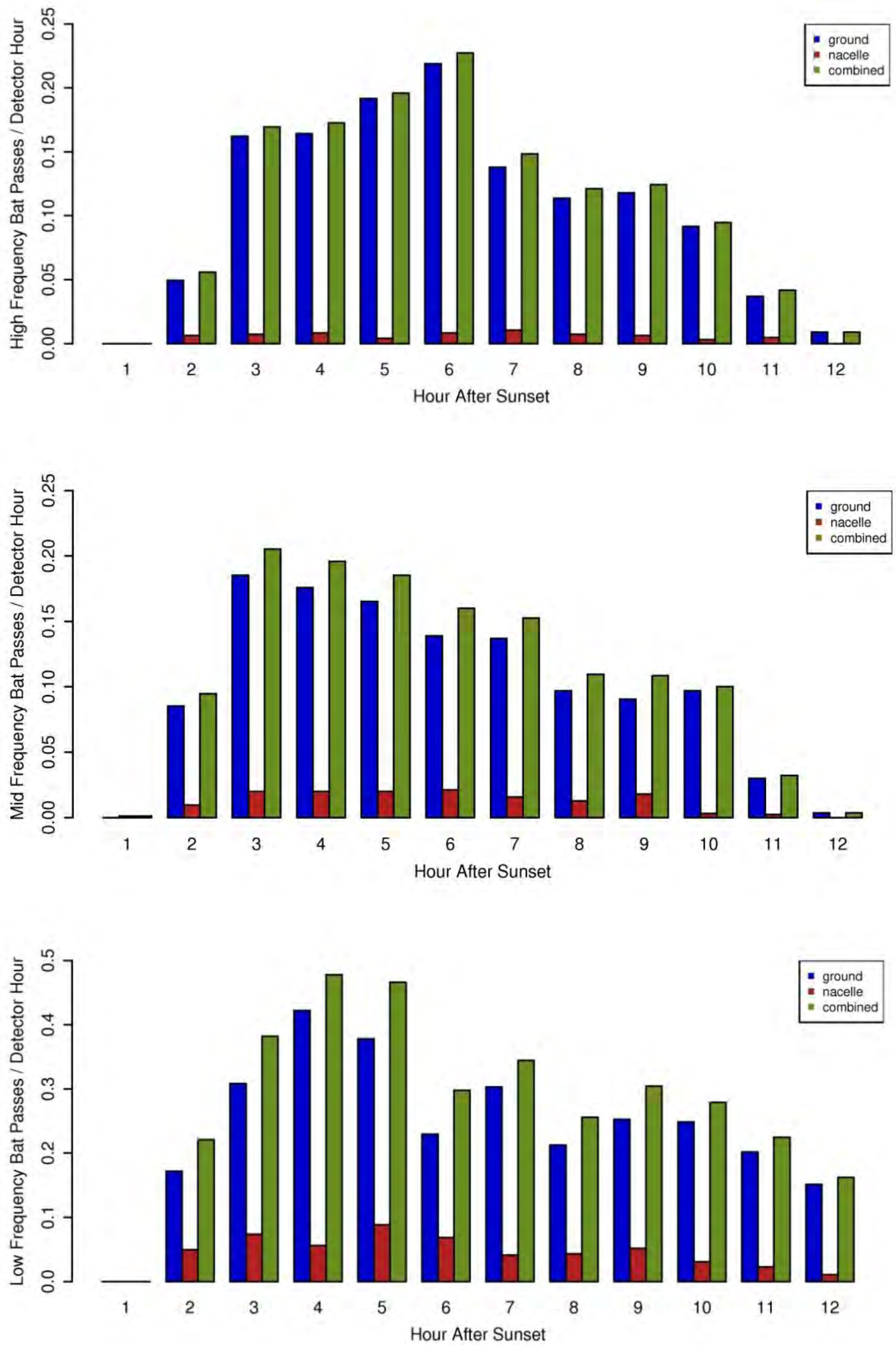

Figure 32. Bat activity rates as a function of hour past sunset at the Fowler Ridge Wind Farm.

Active Monitoring

Active monitoring was conducted during both the spring and fall study seasons. During the spring study period (five detector nights), active bat monitoring efforts recorded five HF bat passes, one MF bat pass, and nine LF bat passes (Table 22). During the fall study season (21 detector-nights), active bat monitoring efforts recorded 32 HF bat passes, 59 MF bat passes, and 43 LF bat passes (Table 23). No calls were identified as potential Indiana bat calls during the active monitoring surveys.

Weather and Anabat Activity Rates

Modeling Anabat activity rates (bat passes per detector night) resulted in different variables of importance for ground and nacelle detectors. Ground activity rates were best predicted by the mean and variability of barometric pressure and the standard deviation in the ambient temperature during the previous 24-hour period along with the mean nightly ambient temperature and mean and variability of nightly humidity (Table 28). Each variable was significant in the model with p-values less than 0.01, suggesting that each covariate has a significant effect on predicting ground activity having adjusted for all other model covariates. Nacelle activity rates were more dependent on the wind speed variables, mean nightly wind speed and standard deviation of nightly wind speed. Other significant covariates included the standard deviation of nightly barometric pressure, mean nightly humidity, mean ambient temperature for the 24 hour period previous to searches and the standard deviation of humidity during that same period. Poisson models predicting combined ground and nacelle detector activity had significant covariates for mean nightly wind speed, mean and standard deviation of the barometric pressure during the 24 hour period previous to searches, mean and standard deviation of the humidity either nightly or during the 24 hour period previous to searches, and the standard deviation of the nightly ambient temperature (Table 28).

Table 28. Significant variables (p-value < 0.05) in the top Poisson regression models based on AIC for weather correlation analyses at the Fowler Ridge Wind Farm.

AIC	β_1	β_2	β_3	β_4	β_5	β_6	β_7	β_8
Models for nacelle Anabat Activity (bat passes/detector night)								
834.7	mean.ws	sd.ws	--	sd.nbp	mean.nhu	sd.hu	mean.at	--
835.3	mean.ws	sd.ws	--	sd.nbp	mean.nhu	sd.hu	mean.nat	--
837.1	--	sd.ws	mean.nbp	sd.nbp	mean.nhu	sd.hu	mean.at	--
Models for ground Anabat Activity (bat passes/detector night)								
2467.6	--	--	mean.bp	sd.bp	mean.nhu	sd.nhu	mean.nat	sd.at
2474.2	--	sd.ws	mean.bp	sd.bp	mean.hu	sd.nhu	mean.nat	sd.at
2474.9	--	sd.ws	mean.bp	sd.bp	mean.hu	sd.hu	mean.nat	sd.nat
Models for combined nacelle & ground Anabat Activity (bat passes/detector night)								
3165.2	mean.ws	--	mean.bp	sd.bp	mean.nhu	sd.hu	mean.nat	sd.nat
3168.3	mean.ws	--	mean.bp	sd.bp	mean.hu	sd.hu	mean.nat	sd.nat
3170.0	mean.ws	--	mean.bp	sd.bp	mean.nhu	sd.hu	mean.nat	--

As with casualty rate predictions, nacelle and combined Anabat activity rates were negatively correlated with mean nightly wind speed. This implies that as wind speed increased activity decreased (Figure 33). Wind speed was not a significant variable for predicting ground Anabat activity. The standard deviation of nightly wind speed was also negatively correlated with nacelle activity but not significantly correlated with ground or combined activity rates. As the mean and standard deviation of barometric pressure decreased so did Anabat activity at ground and combined detectors. This relationship was not as strong for nacelle activity rates (Figure 33). Mean nightly humidity was a significant covariate for nacelle, ground, and combined activity rates where a positive correlation suggested that as mean nightly humidity increased so did the number of bat passes per detector night (Figure 34). The variability of humidity during the 24 hour period previous to searches had a positive correlation with nacelle activity rates but a negative correlation with ground and combined activity rates. This difference may be due to the reduced sampling period of detectors on turbine nacelles. As seen with observed casualty rates, nights with higher ambient temperature had higher nacelle, ground, and combined activity rates while the standard deviation of the nightly ambient temperature had a negative effect on ground and combined activity rates, showing that nights with larger variability in ambient temperatures had higher ground and combined activity rates (Figure 34). Standard deviation in ambient temperature was not a significant covariate in predicting nacelle activity rates.

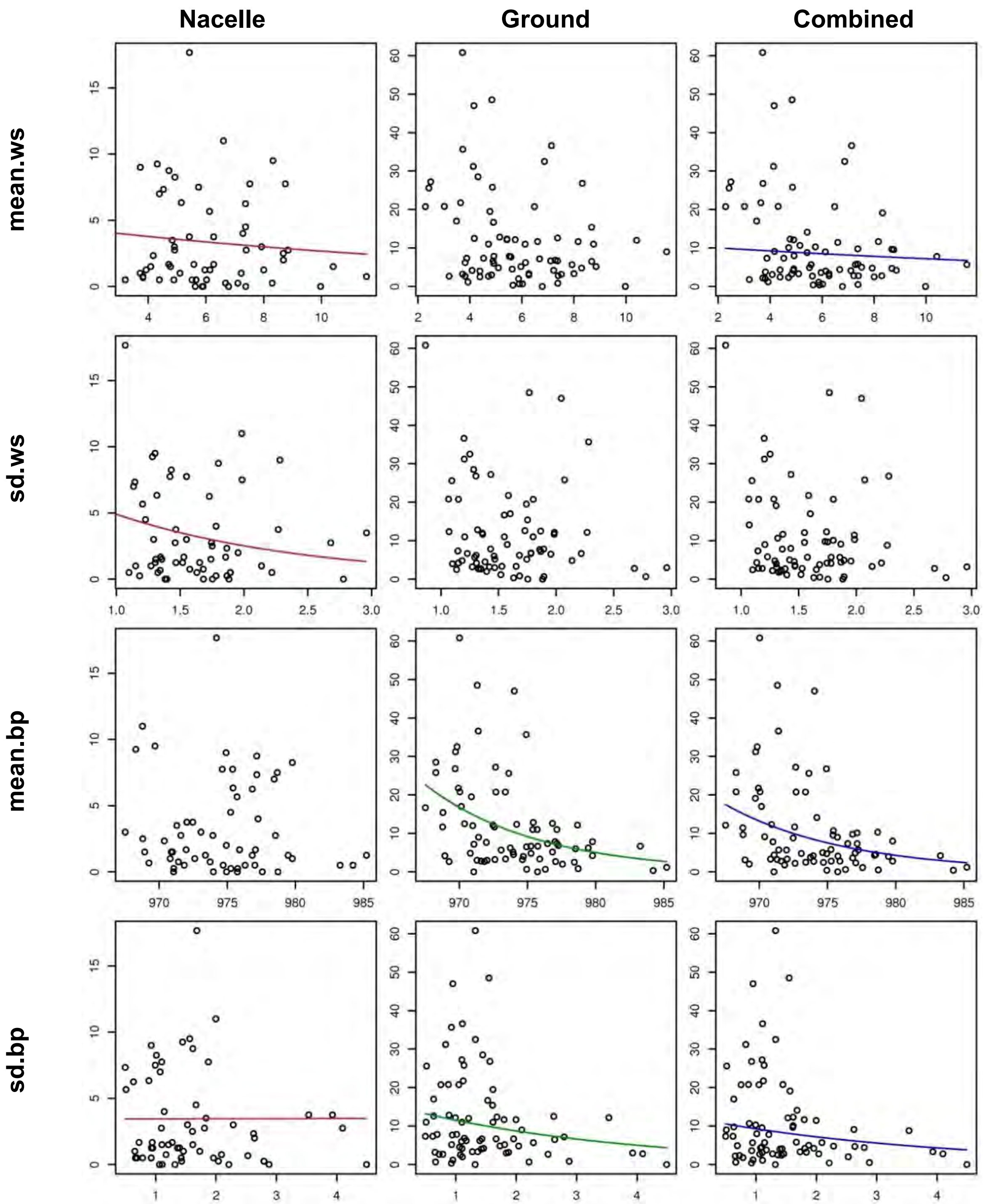

Figure 33. Nightly bat passes per detector at the Fowler Ridge Wind Farm as explained by Poisson regression model covariates. Regression lines represent sequential values of the variable of interest while restraining all other covariates to their means.

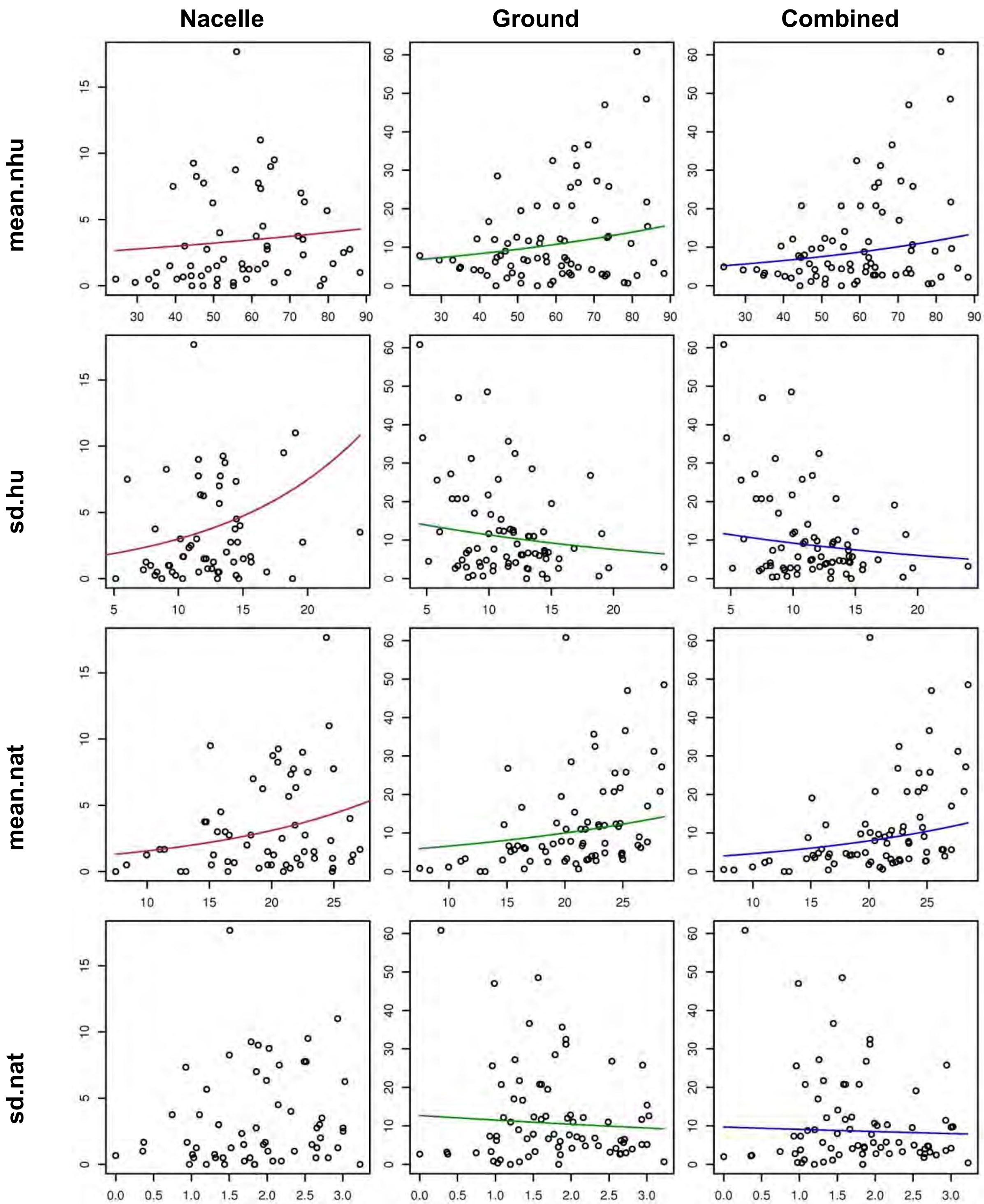

Figure 34. Nightly bat passes per detector at the Fowler Ridge Wind Farm as explained by Poisson regression model covariates. Regression lines represent sequential values of the variable of interest while restraining all other covariates to their means.

DISCUSSION

Were Indiana bat Casualties Widespread, and Did They Occur at High Levels?

The objective of the 2009 study was to determine if the number of bird and bat casualties within Phase I was low, moderate or high compared to other wind-energy projects; therefore methods differed from studies conducted to precisely quantify bat fatality rates or to detect rare fatality events. In 2010, the number of plots searched and the frequency at which plots were searched was greatly increased as compared to 2009. During 2009, the Phase I study protocol suggested that 32 turbines should be searched, of which 18 would have strips of crops mowed in order to sample the area under turbines where birds and bats could fall. However, due to lack of landowner participation, 25 turbines were searched, of which nine had crops cleared under turbines. Turbines were searched at varying intervals, from once every two weeks to twice per week, depending on season. Given the lack of landowner participation in 2009, and the discovery of an Indiana bat carcass outside of a scheduled carcass search, some uncertainty existed regarding the overall bat casualty estimate, as well as the number of Indiana bat casualties occurring at FRWF. One of the primary goals of the 2010 study was to determine if Indiana bat casualties were widespread, and if they occurred at levels that may impact Indiana bat populations; hence, the 2010 study was conducted with increased survey effort. During 2010, 36 plots were cleared of crops within three phases of study, and these turbines were searched on a daily basis during migration. Weekly searches were conducted at an additional 100 turbines in 2010.

In addition to daily searches, most fresh bat carcasses were placed in the field to estimate the probability of a carcass being found or missed due to removal by scavengers or missed by searchers. Estimates of probability of a carcass being available and detected by searchers was 0.51 and 0.58 for weekly road and pad searches and daily cleared plot searchers respectively. Thus, there was a reasonable probability of detecting bat carcasses during the study period.

Despite the increased survey effort over studies conducted in 2009, and despite reasonable probabilities of detecting bat carcasses during the study, very few *Myotis* carcasses were found, with only one Indiana bat carcass found during the study. Very few *Myotis* calls were recorded during the course of the study, and calls potentially resembling Indiana bat calls were only recorded at a single station on one evening during the fall migration period. The 2010 study was conducted during the Indiana bat spring and fall migration periods. It is clear that Indiana bat casualties were not widespread and did not occur at a high rate during the spring and fall migration period of Indiana bats. The data collected during this study can be used to calculate a defensible estimate of Indiana bat casualties that may occur at the FRWF in the future. More detailed estimates of Indiana bat casualties for future operations of the FRWF will be calculated within a Habitat Conservation Plan, currently being prepared for the FRWF.

Species Composition

Similar to other wind-energy projects in the Midwest and Northeast U.S., the vast majority of fatalities found at the FRWF were migratory tree bats, while *Myotis* and *Perimyotis* comprised less than 1% of bat carcasses recovered in 2010. Migratory tree bats comprised a similar proportion of fatalities in 2009 at Phase I when compared to the 2010 results; however; the relative proportion of species within the migratory tree bat group changed. Eastern red bats comprised a higher proportion of fatalities in 2010, and hoary bats and silver-haired bats comprised a lower proportion of fatalities in 2010. The reasons behind the changes in species composition are unclear, and may be a result of between-year variation. The fall of 2010 was abnormally warm and dry, and relatively few strong fronts associated with precipitation passed through the Benton County area (Indiana State Climate Center 2010). Little is known regarding migratory routes for bats, and the influence of weather on bat migration has not been well studied, complicating interpretation of between-year results.

Composition of bat species group activity recorded at FRWF generally mirrored the composition of bat casualties. LF and MF species groups, which include eastern red bat, hoary bat, and silver-haired bats, comprised the majority of bat activity recorded at ground stations. LF species groups comprised a higher proportion and HF a lower proportion of calls recorded at turbine nacelles, which indicate LF and MF bat species spend more time flying and echolocating at higher heights than HF species. This is further illustrated by the lack of *Myotis* calls recorded at nacelle detectors.

Cause of Indiana Bat Casualty

The Indiana bat casualty was found with a broken wing, and abrasions to the skin. A necropsy of the carcass was not performed, and it is not clear if the bat perished due to blunt force trauma associated with colliding with a blade, or if barotrauma played a role in the casualty (Baerwald et al. 2008).

Overall Bat Casualty Estimate

The 2010 Shoenfeld bat casualty estimate for Phases I,II and III of the FRWF was slightly higher than recorded at Phase I during 2009 (Johnson et al. 2010a). However; the 2010 study was designed to estimate bat fatalities during the Indiana bat migration periods, and hence casualty studies were only conducted during the spring and fall. Bat casualties also occur during the summer, and 102 bats were found while clearing plots of bats prior to the start of the study, or were estimated to have been killed prior to August 1, indicating that a substantial number of bat casualties may have occurred in late July. Thus the 2009 and 2010 estimates are not directly comparable, and the 2010 overall bat casualty estimate would have been higher if surveys were conducted during the summer. In 2009, Johnson et al. (2010a) found 7.5% of all casualties occurred during the months of June and July at Phase I of the FRWF.

While casualty rates of some bat species would have been higher during the summer, no Indiana bat casualties would be expected to occur in the summer. The FRWF generally lacks potential summer habitat and is comprised of only 249 acres of forested areas spread over

54,880 acres of project, or approximately 0.45% of the area within a half-mile of turbine locations. The timing of the two Indiana bat casualties discovered during 2009 and 2010 also strongly suggest that the Indiana bats discovered as casualties were migrating during the fall.

A growing number of bat casualty studies at wind farms are available from agricultural regions of the Midwest. When compared to other Midwest wind farms, the 2010 empirical rate for the FRWF was higher than reported at the Crescent Ridge, Illinois, Grand Ridge, Illinois, Top of Iowa, Iowa, and Buffalo Ridge, Minnesota, but lower than estimates from Blue Sky Green Field and Cedar Ridge in Wisconsin (Appendix G). It is important to note that the 2010 estimate for the FRWF only included the spring and fall migration seasons, while estimates from most other wind-energy facilities in the Midwest include spring, summer and fall seasons.

Patterns of Bat Activity

One of the objectives of the acoustic monitoring conducted at FRWF was to determine if the Anabat ultrasonic bat detector was an effective tool for predicting bat casualty rates. Bat activity was monitored at six stations over the course of two fall seasons from the ground, prior to construction of the FRWF. Two of the previously monitored stations were monitored again in 2010, to gain an understanding of how bat activity patterns may change over time. Bat activity at the two previously monitored stations averaged 5.02 and 3.49 bat passes per detector night during 2010, which was similar to the overall average bat pass rates recorded in 2007 (4.7 bat passes per detector night in 2007; Gruver et al. 2007) and 2008 (6.45 bat passes per detector night in 2008; Carder et al. 2009). While overall bat passes were similar between years for detectors placed at the same location, bat passes recorded at ground stations located below four wind turbines in 2010 recorded an average of 15.06 bat passes per detectors night in 2010, or approximately 3 – 5 times more activity than ground stations located away from turbines in 2007, 2008 and 2010 (Gruver et al. 2007, Carder et al. 2009). Cryan and Barclay (2009) hypothesized that relatively high bat casualty rates observed at wind-energy facilities were the result of bats being attracted to turbines. Acoustic data collected from the ground at FRWF may support this hypothesis.

One potentially confounding factor is the lack of bat activity data within the potential rotor swept heights of turbines prior to construction. Data collected in 2010 at FRWF, as well as data collected by other researchers (Baerwald et al. 2009), suggest that bat activity within rotor swept areas is more closely related to bat casualty rates than bat activity recorded on the ground.

Timing of Bat Fatalities

Similar to other studies of bat casualties and wind-energy projects, the vast majority of bat casualties at FRWF occurred during August and September (Johnson 2005, Arnettet al. 2008), which coincides with the fall migration period for migratory tree bats. Johnson et al. (2010a) also noted that most fatalities occurred within Phase I of the FRWF in 2009 from August through mid-September. Peaks in bat casualties in 2010 occurred primarily in early August, whereas Johnson et al. (2010a) noted peaks in bat casualties in early August and early September.

Peaks in bat fatalities also generally corresponded with peak bat activity recorded at FRWF in 2010, and bat activity rates were a significant variable in models predicting bat casualty rates at the FRWF.

Bat Fatalities and Weather

During the fall migration period of 2010, bat casualty rates were highest on nights with higher bat activity, lower mean wind speeds, higher mean temperature and increasing variance in temperature, and increase barometric pressure. In other words, higher bat fatalities were associated with warmer, calmer evenings prior to, or after, the passage of weather fronts and increasing bat activity.

Other researchers have also noted relationships between lower wind speeds and passage of weather fronts on bat activity and casualty rates in Tennessee, West Virginia, Iowa, and Wisconsin (Fiedler 2004, Kerns et al. 2005, Jain 2005, Arnettet al. 2008, and Gruver et al. 2009). The consistency of results across wind-energy facilities and regions suggests it is possible to predict when many of the bat casualties occur, which can serve as a basis for designing strategies to reduce bat casualty rates.

The reasons why lower bat fatalities occur on nights with higher wind speeds has not been well studied. Baerwald and Barclay (2009) suggested that silver-haired and hoary bats in Canada may not be killed as frequently on nights with higher wind speeds because these species may be flying at heights greater than turbines in higher wind speeds. Bats may also not migrate during nights of high wind speeds due to increased energetic costs (Arnettet al. 2008). The results of our models of bat activity and weather variables suggest that wind speed was a significant variable for predicting bat use on nacelles, but not for ground based units. This may indicate that bats continue to fly and echolocate in stronger winds, but do so at lower altitudes when winds are strong. We were not able to monitor bat use above the heights of turbines, and do not know if bats were migrating or flying above turbine heights in stronger winds, although it seems unlikely that bats would fly higher during stronger winds due to the higher energetic costs.

The Indiana bat carcass discovered in 2010 was discovered on a daily search plot, and was estimated to have been killed the night before, which allowed a closer examination of weather conditions. The evening preceding the Indiana bat casualty was largely unremarkable, with air temperature, wind speeds, and humidity within or near median values for the fall migration period. Bat activity was lower than typically observed during the fall, and barometric pressure was higher than typically recorded. A high pressure system was apparently present over northern Indiana the evening the casualty occurred, and no strong fronts associated with precipitation were recorded. Other bats were recorded as casualties on the evening the Indiana bat was killed; however, unusually large numbers of casualties were not recorded. Unlike the Indiana bat found in 2010, the 2009 Indiana bat casualty at FRWF was found on a day when the most bat casualties were found.

Bat Fatalities and Turbine Type

Barclay et al. (2007) examined patterns of turbine heights and rotor diameter on bird and bat fatalities at existing wind-energy facilities, and noted that bat casualty rates increased with increasing tower height, but seemed unaffected by increasing rotor diameter. However, we are unaware of any researchers that have examined casualty rates at turbines with the same nacelle height and varying rotor diameters during a concurrent casualty study. Three types of turbines were present within the FRWF. While all turbines had the same nacelle height, the three turbine types had differing rotor diameters. Observed bat casualty rates were not equal between turbine types, with higher bat casualty rates observed at turbines with greater rotor diameters. This pattern was potentially a function of increasing rotor swept area, and bats may have had an increased probability of colliding with turbines that had greater rotor swept areas.

One potentially confounding factor was turbine type. While all three turbines were of the same nacelle height, the turbines were produced by different manufacturers. It is not known if one turbine type may have emitted more sounds or had other characteristics that may have potentially attracted bats. However; differences in bat fatalities between turbine types are most likely explained by differences in rotor swept areas.

We also included potential habitat variables in models predicting bat casualty rates, to determine if habitat factors may have played a larger role than turbine, or were correlated with turbine type. Similar to patterns observed at other wind-energy facilities, bat fatality rates were not related to distance to wooded areas, water, or percent cover type within 400 m of turbines (Arnettet al. 2008).

Myotis and *Perimyotis* casualties were recorded at all three types of turbines. It was not possible to test if *Myotis or Perimyotis* casualty rates varied between turbine types due to the low overall number of *Myotis* or *Perimyotis* casualties.

Bat Casualty Rates and Habitat

Arnett et al. (2008) suggested that understanding bat fatalities in relation to habitat or topographic characteristics could provide a basis for designing effective strategies for reducing bat fatalities. However, few researchers have found any spatial variation in bat fatalities within a wind-energy facility, potentially due to a general lack in variation of habitat characteristics within wind-energy facilities (Johnson et al. 2004, Jain 2005, and Arnett et al. 2008). The results of this study do not indicate that bat fatality rates varied due to proximity to habitat features; however, the FRWF is dominated by tilled agriculture and has relatively low amounts of forest cover.

Land cover and water sources surrounding all *Myotis* and *Perimyotis* carcasses can be characterized as open corn and soybean fields located at varying distances from water sources and forested shelterbelts. Only two Indiana bat carcasses have been found over the course of two years of studies at FRWF, which limit inferences that can be made regarding the effects of habitat and other features on Indiana bat casualty rates. Turbines at which the two carcasses were discovered had differing land cover and water sources surrounding the turbines. In 2009, one Indiana bat carcass was discovered at a turbine on the northern edge of Phase I. The location of the 2009 carcass was within a large, open corn and soybean field, located relatively far (598 m) from any forested areas, and 180 m from the nearest water source. The 2010 carcass was located at a turbine on the southern edge of Phase I, and the turbine was located within a soybean field. The turbine was located closer to forest and water sources compared to the 2009 carcass location, approximately 45 m from a tree lined pond. Other linear shelterbelts were also present within 200 m of the turbine location.

Casualty and Curtailment Study

The study design utilized for the facility management study was similar to the study of cut-in speed adjustment conducted by Bat Conservation International (BCI) at the Casselman wind-energy facility in Pennsylvania (Arnett et al. 2009), and should allow comparison of study results. The largest difference between methods used by Arnett et al. (2009) and the 2010 FRWF study was the frequency at which cut-in speeds were changed. Arnett et al. (2009) switched the turbines selected for the cut-in speed adjustment on a nightly basis, whereas cut-in speeds were adjusted on a weekly basis during the 2010 FRWF study. By changing treatment turbines on a nightly basis, Arnett et al. (2009) assumed that the time of death was correctly classified for all bats found since the treatments were changed every day. Switching treatment turbines on a weekly basis reduced the potential for bats missed during prior carcass searches to be incorrectly assigned to the wrong cut-in speed treatment.

Baerwald (et al. 2009) and Arnett et al. (2010) demonstrated that raising cut-in speeds of turbines to between 5 – 6.5 m/s, or reducing rotor speeds on lower wind nights reduced bat fatalities between 57.5 – 82% over the course of single fall migration seasons in Alberta and Pennsylvania, respectively. However, both authors suggested that further tests of cut-in speed adjustment were needed in different geographic areas to determine if cut-in speed adjustments were effective in differing landscapes and for varying suites of bat species. The results of this study provide further evidence that raising wind turbine cut-in speeds is an effective measure to reduce bat casualty rates at operating wind energy facilities, and is effective for projects located in landscapes in the Midwest dominated by tilled agriculture. The results obtained during this study are comparable to results at the Casselman facility in Pennsylvania, a facility in Alberta, Canada, and a facility in Germany, where raising cut-in speeds to 5.0 – 6.5 m/s has resulted in reductions in bat mortality of 50% to 77.5% (Table 29).

Arnett et al. (2010) found no significant differences in bat casualty rates between turbines raised to 5.0 m/s and 6.5 m/s. The FRWF study is the first to demonstrate that bat casualty rates were not only significantly different between control and treatment turbines, but that bat casualty rates were significantly different between cut-in speeds raised to 5.0 m/s versus turbines with cut-in speeds raised to 6.5 m/s. The reasons for the significant differences at the FRWF versus the Casselman facility in Pennsylvania could be related to differences in wind regimes. Wind data collected at the FRWF suggest that wind speeds were between 5.0 m/s and 6.5 m/s for a significant amount of the fall survey period (19.4%). Wind speeds could have potentially been more common between 5.0 m/s and 6.5 m/s at the FRWF versus the Casselman facility;

however, data regarding the percentage of time wind speeds were within discreet ranges were not available within Arnett et al. (2010).

Table 29. Comparison of available data on effectiveness of changing turbine cut-in speeds on reducing bat mortality

Location	Turbine type	Cut-In Speed(s) Tested	Reduction in Bat Casualty (Percent)	Reference
Casselman, PA	GE 1.5-MW	5.0 m/s	77.5	Arnett et al. 2010
		6.5 m/s	75.0	
Alberta, Canada	Vestas V80 1.8-MW	5.5 m/s	60.0	Baerwald et al. 2009
		idled during low wind speeds	57.4	
Fowler Ridge, IN	Vestas V82 1.65-MW	5.0 m/s	50	This study
	Clipper C96 2.5-MW	6.5 m/s	78	
	GE SLE 1.5-MW			
Germany	Unknown	5.5 m/s	~50	O. Behr, unpubl. data

The 2010 Indiana bat was discovered at a turbine with a cut-in speed raised to 5 m/s. We caution against assuming that raising cut-in speeds to 5 m/s is not an effective measure for reducing Indiana bat casualties, based on a sample size of one. Additional data are needed before conclusions regarding cut-in speed adjustment and Indiana bat fatality rates can be made.

The different casualty rates observed between the three turbine types had some potential to confound the results of the curtailment experiment; however, our study design accounted for this potential difference. Curtailment treatments were sufficiently randomized across daily search turbines to eliminate any potential confounding factor due to turbine type. The composition by turbine type of daily search turbines where no curtailment treatment was employed (control turbines) was representative of the composition of turbine types across the project. This was confirmed with a non-significant chi-squared test of proportions (chisq = 1.08, df = 2, p-value=0.58).

RECOMMENDATIONS

The data collected at the FRWF provides a baseline for identifying and refining measures to reduce bat casualty rates. While the low rate of Indiana bat fatalities likely indicates impacts of operation of the FRWF are also low, the low casualty rates also make it difficult to recommend measures specific to Indiana bats. Thus, the following recommendations are aimed at providing a basis for designing a strategy for reducing overall bat casualty rates, under the assumption that Indiana bat casualty rates will also be reduced.

Raising cut-in speeds showed a reduction in bat casualty rates at FRWF during the Fall of 2010, and similar reductions in bat casualty rates have also been documented by researchers at other wind-energy facilities (Arnett et al. 2010, Baerwald et al. 2009). However, correlations observed between weather variables and bat fatalities suggest that focusing or adjusting cut-in speed adjustments during periods when bats may be at most risk, or at locations where bats may be more likely to be found, may optimize reductions in bat fatalities. Other measures such as bat deterrents could also potentially be used to reduce bat casualty rates in the future (Horn et al. 2008).

The following are recommendations for potentially reducing bat mortality at FRWF. These recommendations are based largely on a single year of study at FRWF, as well as the results of research from other wind-energy facilities, where applicable. Bat migration patterns can vary between years, and few research studies are available that examine patterns of bat fatalities in the Midwest. These recommendations could be utilized in an adaptive management framework to refine minimization strategies as additional data and results become available from FRWF and other wind-energy facilities. The following recommendations should be seen as a toolbox of potential measures for reducing bat casualty rates, but should not be seen as a directive to implement specific practices. Potential use of these recommendations will depend largely on the biological goals and objectives of a minimization and monitoring strategy, currently being developed for the FRWF:

- Develop an optimization model that attempts to maximize bat casualty reductions while balancing financial impacts to FRWF.

- Test additional cut-in speeds (e.g. 4.5 m/s) beyond those cited in this report (5.0 m/s and 6.5 m/s) that may potentially reduce fatalities to similar levels.

- To date, the vast majority of bat fatalities occur during the fall migration period for most bat species, and the only two Indiana bat fatalities discovered to date occurred during the first three weeks in September. However, potential *Myotis* activity was only recorded within the FRWF during the evening of August 9-10, 2010. The Indiana Bat Recovery Plan (USFWS 2007) defines that fall migration season for Indiana bats as August 1- October 15. Based on currently available information, we recommend focusing casualty minimization efforts during this critical time, under the assumption that Indiana bats are at most risk during this period.

- Within the fall migration period for Indiana bats, attention should be focused during specific weather conditions that were shown to have the greatest influence on bat casualty rates. For example:
    - ♦ Air Temperature: 91.13% of fatalities occurred on nights with mean nightly temperature above 20.08 degrees C (68.10 degrees Fahrenheit).
    - ♦ Passage of Fronts: The night with the most bat casualties appeared to be associated with the passage of one or more weather fronts, and bat casualty rates were associated with barometric pressure.
    - ♦ Humidity: Increasing humidity was shown to be a significant predictor of bat activity and bat casualty rates.

- Additional considerations when designing a plan should include:
    - ♦ Turbine type
    - ♦ Distance to water.
    - ♦ Areas with high concentrations of bat activity (Anabat supported)

The following are recommendations for future monitoring of bat casualty and activity at FRWF:

- Monitoring of spring fatalities may be considered for a limited period of time, to verify the assumption that Indiana bats are most at risk during the fall migration period.

- Cleared plots require relatively large crop loss payments to farmers, as well as vegetation maintenance costs. Searcher efficiency rates are also lower on cleared plots versus roads and pads. Future monitoring of bat casualty rates can be completed by searching roads and pads, which were shown to provide comparable overall casualty estimates as searches on cleared plots.

- The 2010 study was not designed to determine if bat casualty rates varied by turbine type or habitat features, although apparently significant patterns of bat fatalities by turbine type were recorded. Additional monitoring of FRWF could consider the influence of turbine type and habitat features.

- Comparable bat casualty estimates were obtained on weekly road and pad searches versus daily road and pad searches. Search intervals used for future monitoring should be based on study objectives. Studies designed to measure overall bat casualty rates may be completed utilizing less frequent search intervals, while studies designed to measure influence of weather on bat casualty rates may require daily searches.

- Patterns and estimates of bat fatality recorded at Phases I, II and III should be similar for Phases IV and V given their proximity, assuming that habitat and topographic characteristics are similar. We recommend verifying similarities in habitat and topography between future phases and Phases I, II, and III when assessing the risk of bat fatalities occurring at future phases of the FRWF.

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Appendix A. Estimated Time of Death Information Sheet

Previous Night

- Eyes will be round and fluid filled or slightly dehydrated
- No Decomposition
- No infestations other than flies and eggs
- Body may be more flexible

2 – 3 Days

- Eyes will be sunken or missing
- May be infested with maggots, beetles, flies, and ants
- Flesh and internal organs will begin to be scavenged by insects

4 – 7 Days

- Eyes will be completely gone
- Most internal organs will be missing
- Bat may look like a hallow shell
- Fur may begin to fall off the skin and bat may look like it expanded in size
- Few maggots may be present but not prevalent

7 – 14 Days

- There is almost no meat left on body
- Skin has conformed to the skeletal system
- Body cavity should be devoid of insects

> 2 Weeks to > **1 Month**

- Wing membrane is either gone or deteriorating
- Exposed bones are bleached in appearance

Appendix B. Wind-energy facilities in North America with casualty data for bats, grouped by geographic region.

WEST, Inc.
Western EcoSystems Technology
2003 Central Avenue Cheyenne, Wyoming 82001
Phone: (307) 634-1756 Fax: (307) 637-6981

Date: January 12, 2011

To: Rhett Good

Re: Discriminant Function Analysis Methods for Fowler

This memo summarizes the bat species discriminant function developed from a library of known bat calls obtained from Lynn Robbins (University of Missouri). There were 644 bat calls from 11 bat species used to develop the function. The average number of pulses per call is shown in Table 1. The "bnoise" filter was applied to the data in Analook (© Chris Corben) to remove extraneous data points, and pulse parameters were exported for analysis using standard Analook methods. The call parameters were summarized over all the pulses within a call, and a call was considered the sampling unit in the analysis. We use the median to summarize each call parameter, and in addition, the variance was used to summarize minimum frequency.

Methods

The call data were evaluated in context of the important assumptions of discriminant function analyses (Manly 2005). Four calls were outliers in multidimensional space and were removed. Four calls had extreme values for at least 3 variables, with extreme values defined as standardized scores greater than 3 (or less than -3). Because the data set had significantly different sample sizes for each of the species, the homogeneity of the variance-covariance matricies was investigated to improve classification. The test for the homogeneity within covariance matricies was rejected ($p<0.0001$), and separate covariance matricies were used during classification. The tests available for evaluating homogeneity within covariance matrices are notoriously sensitive, so a randomization test was used to evaluate the influence of the normality and homogeneity assumptions on the model (Manly 2005).

A canonical discriminate function was developed using a stepwise model selection procedure. There were 11 variables in the candidate variable list: median duration (Dur), median maximum frequency (Fmax), median minimum frequency (Fmin), variance of the minimum frequency (varFmin), median frequency (Fmean), median time to inflection point of pulse (Tk), median frequency at inflection point of pulse (Fk), median characteristic time (Tc), median characteristic frequency (Fc), median initial slope (S1), and median characteristic slope (Sc). Forward model selection was conducted with significance level to enter set at 0.15 and significance level to stay set at 0.15. Ten-fold cross-validation was used to determine classification rates of the model.

The randomization test (RT) was conducted to determine if the model selection procedure and discriminate function model results were purely a chance effect of observations in a random order (Manly 1997). To conduct the RT, the data were reordered 999 times with the bat species (response in the model) randomly assigned to each observation. The discriminant function was estimated for each reordered data set and 2 statistics were saved from each run: eigenvalues and Wilks' Lambda. The distribution of these 999 values was the randomization distribution and a randomization test statistic was calculated as the number of these values that are as or more extreme than the observed statistic from the model with the actual data. Small values of the test statistic indicate the null hypothesis of chance effects is not true.

The classification equations are used to assign calls to a species group. The classification score for a call is calculated for each classification equation and the call is assigned to the species group for which the classification score is the highest. In the application to the Fowler data, calls were only classified to a species if the classification score (i.e. posterior probability) was at least 0.95, otherwise calls were labeled as “Other”. Prior probabilities were assigned to inform the model predictions (Afifi and Clark 1996). Since two bat species, *Myotis grisescens* and *Myotis leibii* were not known to occur in the study area, the prior probability was set to zero. The remaining nine species were assigned equally probable values as prior probabilities. Note that this has the effect of modifying the dividing points between species calls but does not change the linear equations or correct classification rate of the original model.

Results

The model selection procedure resulted in 10 variables entering and staying in the model, all in the candidate variable list except variance of Fmin. The model had a correct classification rate of 89% across all 11 species. The correct classification rates for individual species are in Table 2. Wilks' lambda was used to test significance of the discriminant function as a whole. The statistic was significantly large ($p<0.0001$) indicating the model does discriminate among the 11 bat species. The randomization test of Wilks' Lambda also concluded that the model results were not a function of pure chance ($p=0.001$). When the model was rerun with equal sample sizes to determine the sensitivity of the model predictions to the homogeneity assumption, the model classified the bat calls to the same species 87% of the time.

The first eigenvalue accounted for 61% of the variance explained with the second accounting for 29% for a cumulative sum across the first two eigenvalues of 90%. The randomization test of the first three eigenvalues concluded that the model results were not a function of pure chance ($p=0.001$). The bat calls were plotted in the space of the first two canonical variates (discriminant functions) to show how they separate the groups (Figure 1). The first variable is positively correlated with minimum frequency, mean frequency and characteristic frequency and separates out the three low frequency species from the rest (EPFU, LACI, and LANO). The second and third variables are more important in separating the rest of the species (Figure 2). The second canonical variate is positively correlated with the characteristic slope. The third canonical variate is negatively correlated with mean frequency, inflection frequency, and maximum frequency.

The classification equations for this model are in Table 3. Each row in Table 3 represents an equation, with the constant and a coefficient for each variable in the model.

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Table 1. Number of calls and average number of pulses per call for each bat species used in the discriminant function analysis.

Species	Number of Calls	Mean Number of Pulses per Call	95% Confidence Interval	
			Lower	Upper
EPFU	110	33.17	29.18	37.17
LABO	46	34.70	27.88	41.51
LACI	32	22.78	17.46	28.10
LANO	34	23.24	16.92	29.55
MYGR	62	57.94	44.09	71.78
MYLE	12	37.50	29.87	45.13
MYLU	68	38.31	33.23	43.39
MYSE	50	36.88	31.12	42.64
MYSO	93	37.60	32.93	42.28
NYHU	15	26.00	21.19	30.81
PESU	118	27.89	24.09	31.69

Table 2. Percent correct classification rate for each species and all species combined.

Species	Total number of Calls	Number of Correctly Classified Calls	Percentage of Calls Correctly Classified
EPFU	110	98	0.89
LABO	46	32	0.70
LACI	32	25	0.78
LANO	34	27	0.79
MYGR	62	60	0.97
MYLE	12	8	0.67
MYLU	68	66	0.97
MYSE	50	45	0.90
MYSO	93	83	0.89
NYHU	15	12	0.80
PESU	118	115	0.97
Total	640	571	0.89

Table 3. Coefficients of the classification equations for the discriminant function.

Species	Constant	Fmin	Sc	Fmean	Dur	Tk	S1	Fk	Fc	Fmax	Tc
EPFU	-225.48	14.89	-0.02	0.52	9.61	6.77	-0.01	-0.56	-0.33	-0.04	-4.66
LABO	-396.93	21.14	-0.18	-1.90	10.74	2.80	0.00	-2.40	2.35	0.70	-3.63
LACI	-192.46	14.10	-0.01	-0.47	8.98	-2.97	0.01	-1.55	0.54	0.14	0.91
LANO	-197.82	15.11	-0.09	-1.04	7.94	-0.51	0.01	-1.76	1.27	0.30	-1.51
MYGR	-532.34	22.75	-0.24	-1.28	10.26	1.48	-0.01	-0.37	0.99	0.91	-3.18
MYLE	-530.11	22.37	0.15	-1.25	11.13	2.00	0.02	-3.42	3.62	0.45	-2.45
MYLU	-424.25	20.44	-0.10	0.57	11.29	3.57	-0.01	1.45	-2.79	0.35	-4.92
MYSE	-456.76	17.88	0.28	-0.46	10.02	1.71	-0.05	-3.81	4.62	1.28	-1.50
MYSO	-446.05	20.04	0.02	0.40	11.78	3.35	-0.02	-2.35	1.95	0.51	-4.97
NYHU	-362.23	20.28	-0.20	-2.21	8.16	0.96	0.01	-2.69	2.95	0.70	-1.19
PESU	-491.35	23.71	-0.27	-2.81	10.76	1.13	0.02	-4.08	4.74	0.75	-3.07

Figure 1. Bat calls in the space of the first two canonical variates.

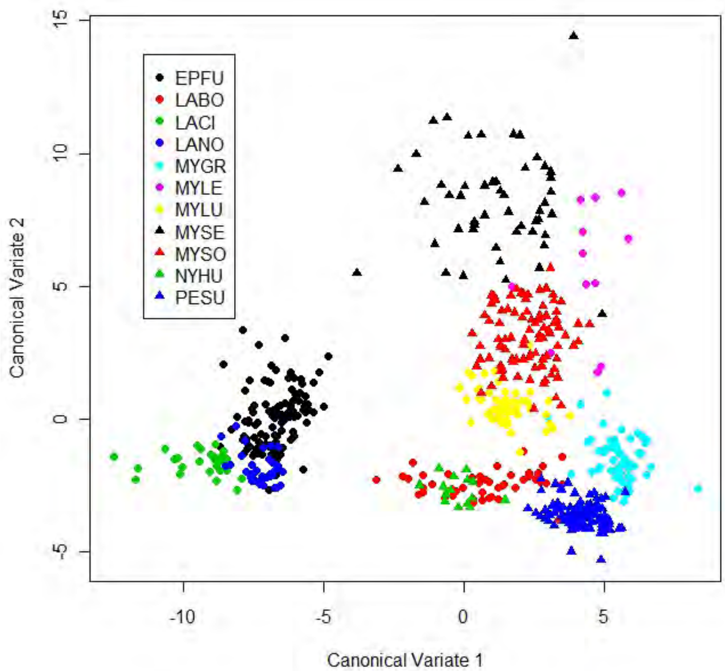
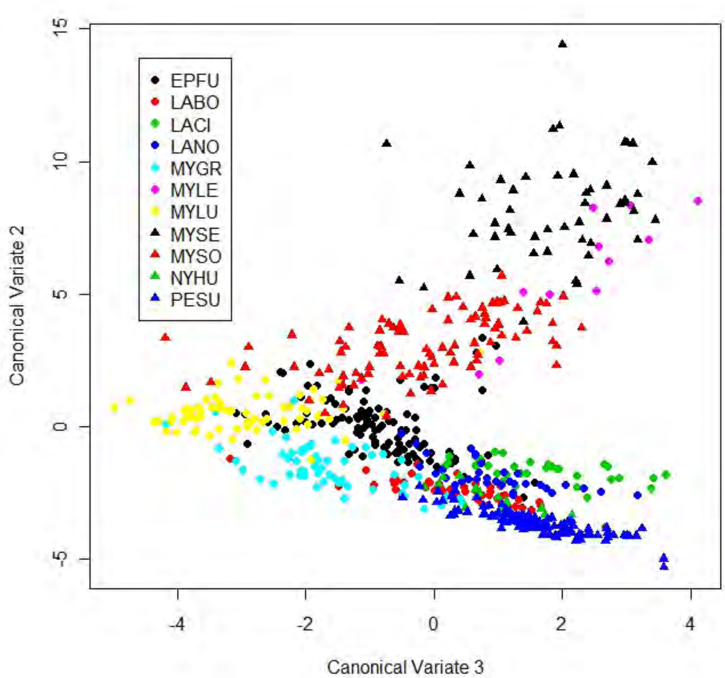


Figure 2. Bat calls in the space of the second and third canonical variates.



Appendix C. Carcasses found on or scheduled search turbines during the spring and fall migration periods at Fowler Ridge Wind Resource Area.

CarcassID	Date	Time	Species	Found
041310-ERBA-459-1	4 /13/2010	08:22	eastern red bat	carcass search
041310-SHBA-113-1	4 /13/2010	11:10	silver-haired bat	carcass search
041310-ERBA-458-1	4 /13/2010	12:30	eastern red bat	carcass search
041410-SHBA-640-1	4 /14/2010	10:46	silver-haired bat	carcass search
041510-SHBA-628-1	4 /15/2010	15:19	silver-haired bat	carcass search
041610-ERBA-281-1	4 /16/2010	11:24	eastern red bat	carcass search
041810-ERBA-628-1	4 /18/2010	11:30	eastern red bat	carcass search
041910-ERBA-387-1	4 /19/2010	11:20	eastern red bat	carcass search
041910-ERBA-397-1	4 /19/2010	11:57	eastern red bat	carcass search
042010-SHBA-640-1	4 /20/2010	10:35	silver-haired bat	carcass search
042110-HOBA-230-1	4 /21/2010	08:57	hoary bat	carcass search
042110-ERBA-260-1	4 /21/2010	15:12	eastern red bat	carcass search
042210-ERBA-480-1	4 /22/2010	15:56	eastern red bat	carcass search
042310-ERBA-334-1	4 /23/2010	09:50	eastern red bat	carcass search
042310-SHBA-323-2	4 /23/2010	11:00	silver-haired bat	carcass search
042310-SHBA-614-3	4 /23/2010	14:25	silver-haired bat	carcass search
042410-ERBA-640-1	4 /24/2010	11:00	eastern red bat	carcass search
042610-SHBA-640-1	4 /26/2010	10:19	silver-haired bat	carcass search
042610-SHBA-24-1	4 /26/2010	11:55	silver-haired bat	carcass search
042610-SHBA-88-1	4 /26/2010	12:40	silver-haired bat	carcass search
042610-SHBA-26-1	4 /26/2010	12:55	silver-haired bat	carcass search
042910-ERBA-396-1	4 /29/2010	12:00	eastern red bat	carcass search
050110-ERBA-480-1	5 /1 /2010	16:15	eastern red bat	carcass search
050210-SHBA-628-1	5 /2 /2010	13:10	silver-haired bat	carcass search
050410-SHBA-216-1	5 /4 /2010	10:10	silver-haired bat	carcass search
050410-SHBA-24-1	5 /4 /2010	12:50	silver-haired bat	carcass search
050510-SHBA-314-1	5 /5 /2010	14:30	silver-haired bat	carcass search
050510-SHBA-625-1	5 /5 /2010	15:39	silver-haired bat	carcass search
050710-SHBA-614-1	5 /7 /2010	14:00	silver-haired bat	carcass search
051310-ERBA-622-1	5 /13/2010	11:56	eastern red bat	carcass search
051510-ERBA-251-2	5 /15/2010	12:55	eastern red bat	carcass search
080110-ERBA-314-1	8 /1 /2010	07:55	eastern red bat	carcass search
080110-ERBA-407-2	8 /1 /2010	08:35	eastern red bat	carcass search
080110-ERBA-230-1	8 /1 /2010	09:36	eastern red bat	carcass search
080110-ERBA-390-1	8 /1 /2010	09:56	eastern red bat	carcass search
080110-HOBA-642-1	8 /1 /2010	10:23	hoary bat	carcass search
080110-ERBA-459-2	8 /1 /2010	13:18	eastern red bat	carcass search
080110-ERBA-459-1	8 /1 /2010	13:22	eastern red bat	carcass search
080110-ERBA-628-1	8 /1 /2010	14:16	eastern red bat	carcass search
080110-ERBA-609-1	8 /1 /2010	15:33	eastern red bat	carcass search
080110-ERBA-286-1	8 /1 /2010	15:59	eastern red bat	carcass search
080210-BBBA-617-1	8 /2 /2010	07:41	big brown bat	carcass search
080210-HOBA-459-1	8 /2 /2010	08:01	hoary bat	carcass search
080210-ERBA-459-3	8 /2 /2010	08:06	eastern red bat	carcass search
080210-ERBA-459-2	8 /2 /2010	08:06	eastern red bat	carcass search
080210-ERBA-459-4	8 /2 /2010	08:08	eastern red bat	carcass search
080210-HOBA-602-2	8 /2 /2010	08:45	hoary bat	carcass search

Appendix C. Carcasses found on or scheduled search turbines during the spring and fall migration periods at Fowler Ridge Wind Resource Area.

CarcassID	Date	Time	Species	Found
080210-ERBA-248-1	8 /2 /2010	09:03	eastern red bat	carcass search
080210-ERBA-480-1	8 /2 /2010	09:12	eastern red bat	carcass search
080210-HOBA-253-1	8 /2 /2010	09:42	hoary bat	carcass search
080210-ERBA-253-2	8 /2 /2010	09:53	eastern red bat	carcass search
080210-HOBA-245-3	8 /2 /2010	10:20	hoary bat	carcass search
080210-ERBA-229-1	8 /2 /2010	11:06	eastern red bat	carcass search
080210-HOBA-013-1	8 /2 /2010	11:59	hoary bat	carcass search
080210-ERBA-147-1	8 /2 /2010	13:45	eastern red bat	carcass search
080210-HOBA-314-1	8 /2 /2010	14:00	hoary bat	carcass search
080210-ERBA-047-1	8 /2 /2010	15:48	eastern red bat	carcass search
080210-ERBA-026-1	8 /2 /2010	15:50	eastern red bat	carcass search
080210-ERBA-065-1	8 /2 /2010	16:11	eastern red bat	carcass search
080310-ERBA-448-1	8 /3 /2010	12:51	eastern red bat	carcass search
080310-HOBA-281-1	8 /3 /2010	13:21	hoary bat	carcass search
080310-ERBA-281-2	8 /3 /2010	13:28	eastern red bat	carcass search
080310-ERBA-628-1	8 /3 /2010	15:45	eastern red bat	carcass search
080410-ERBA-459-2	8 /4 /2010	08:12	eastern red bat	carcass search
080410-ERBA-459-1	8 /4 /2010	08:12	eastern red bat	carcass search
080410-ERBA-087-1	8 /4 /2010	08:30	eastern red bat	carcass search
080410-ERBA-087-2	8 /4 /2010	08:36	eastern red bat	carcass search
080410-ERBA-087-3	8 /4 /2010	08:45	eastern red bat	carcass search
080410-ERBA-480-1	8 /4 /2010	09:20	eastern red bat	carcass search
080410-ERBA-056-1	8 /4 /2010	09:50	eastern red bat	carcass search
080410-ERBA-628-1	8 /4 /2010	09:51	eastern red bat	carcass search
080410-ERBA-628-2	8 /4 /2010	09:55	eastern red bat	carcass search
080410-ERBA-628-3	8 /4 /2010	10:00	eastern red bat	carcass search
080410-ERBA-628-4	8 /4 /2010	10:08	eastern red bat	carcass search
080410-ERBA-628-6	8 /4 /2010	10:20	eastern red bat	carcass search
080410-ERBA-048-1	8 /4 /2010	10:28	eastern red bat	carcass search
080410-ERBA-048-2	8 /4 /2010	10:30	eastern red bat	carcass search
080410-ERBA-480-1	8 /4 /2010	10:45	eastern red bat	carcass search
080410-BBBA-448-1	8 /4 /2010	10:55	big brown bat	carcass search
080410-ERBA-448-2	8 /4 /2010	10:55	eastern red bat	carcass search
080410-ERBA-448-3	8 /4 /2010	10:57	eastern red bat	carcass search
080410-ERBA-083-1	8 /4 /2010	11:13	eastern red bat	carcass search
080410-ERBA-073-1	8 /4 /2010	11:39	eastern red bat	carcass search
080410-ERBA-414-1	8 /4 /2010	12:00	eastern red bat	carcass search
080410-ERBA-281-1	8 /4 /2010	13:04	eastern red bat	carcass search
080410-ERBA-024-1	8 /4 /2010	14:07	eastern red bat	carcass search
080410-ERBA-387-1	8 /4 /2010	14:13	eastern red bat	carcass search
080410-ERBA-387-2	8 /4 /2010	14:17	eastern red bat	carcass search
080410-ERBA-371-1	8 /4 /2010	15:22	eastern red bat	carcass search
080410-ERBA-314-1	8 /4 /2010	15:44	eastern red bat	carcass search
080410-ERBA-314-2	8 /4 /2010	15:58	eastern red bat	carcass search
080410-ERBA-314-3	8 /4 /2010	16:01	eastern red bat	carcass search
080410-ERBA-314-4	8 /4 /2010	16:03	eastern red bat	carcass search
080410-HOBA-230-1	8 /4 /2010	16:06	hoary bat	carcass search

Appendix C. Carcasses found on or scheduled search turbines during the spring and fall migration periods at Fowler Ridge Wind Resource Area.

CarcassID	Date	Time	Species	Found
080410-HOBA-230-2	8 /4 /2010	16:10	hoary bat	carcass search
080510-ERBA-480-1	8 /5 /2010	10:55	eastern red bat	carcass search
080510-ERBA-048-1	8 /5 /2010	12:15	eastern red bat	carcass search
080510-ERBA-230-1	8 /5 /2010	12:44	eastern red bat	carcass search
080510-ERBA-056-1	8 /5 /2010	13:11	eastern red bat	carcass search
080510-ERBA-087-1	8 /5 /2010	13:45	eastern red bat	carcass search
080510-ERBA-314-1	8 /5 /2010	14:30	eastern red bat	carcass search
080510-ERBA-314-2	8 /5 /2010	14:35	eastern red bat	carcass search
080510-ERBA-314-3	8 /5 /2010	14:40	eastern red bat	carcass search
080610-BBBA-339-1	8 /6 /2010	07:51	big brown bat	carcass search
080610-ERBA-314-1	8 /6 /2010	08:20	eastern red bat	carcass search
080610-HOBA-355-1	8 /6 /2010	08:21	hoary bat	carcass search
080610-ERBA-056-1	8 /6 /2010	08:35	eastern red bat	carcass search
080610-ERBA-388-1	8 /6 /2010	08:40	eastern red bat	carcass search
080610-ERBA-388-2	8 /6 /2010	08:42	eastern red bat	carcass search
080610-ERBA-419-1	8 /6 /2010	09:18	eastern red bat	carcass search
080610-ERBA-323-1	8 /6 /2010	09:30	eastern red bat	carcass search
080610-ERBA-443-1	8 /6 /2010	09:42	eastern red bat	carcass search
080610-ERBA-426-1	8 /6 /2010	10:37	eastern red bat	carcass search
080610-ERBA-426-2	8 /6 /2010	10:38	eastern red bat	carcass search
080610-ERBA-095-1	8 /6 /2010	10:56	eastern red bat	carcass search
080610-ERBA-397-1	8 /6 /2010	11:19	eastern red bat	carcass search
080610-ERBA-088-1	8 /6 /2010	11:54	eastern red bat	carcass search
080610-ERBA-309-1	8 /6 /2010	12:06	eastern red bat	carcass search
080610-ERBA-309-2	8 /6 /2010	12:07	eastern red bat	carcass search
080610-ERBA-454-1	8 /6 /2010	13:11	eastern red bat	carcass search
080610-ERBA-123-1	8 /6 /2010	13:17	eastern red bat	carcass search
080610-ERBA-414-1	8 /6 /2010	13:30	eastern red bat	carcass search
080610-ERBA-628-1	8 /6 /2010	13:48	eastern red bat	carcass search
080610-ERBA-459-1	8 /6 /2010	14:15	eastern red bat	carcass search
080610-HOBA-398-1	8 /6 /2010	14:39	hoary bat	carcass search
080610-ERBA-379-1	8 /6 /2010	15:03	eastern red bat	carcass search
080610-ERBA-379-2	8 /6 /2010	15:04	eastern red bat	carcass search
080610-ERBA-379-3	8 /6 /2010	15:06	eastern red bat	carcass search
080610-ERBA-379-4	8 /6 /2010	15:08	eastern red bat	carcass search
080610-ERBA-448-1	8 /6 /2010	15:45	eastern red bat	carcass search
080610-ERBA-369-1	8 /6 /2010	16:28	eastern red bat	carcass search
080710-ERBA-476-1	8 /7 /2010	07:02	eastern red bat	carcass search
080710-ERBA-476-2	8 /7 /2010	07:04	eastern red bat	carcass search
080710-ERBA-476-3	8 /7 /2010	07:05	eastern red bat	carcass search
080710-ERBA-420-1	8 /7 /2010	08:04	eastern red bat	carcass search
080710-ERBA-420-2	8 /7 /2010	08:05	eastern red bat	carcass search
080710-ERBA-390-1	8 /7 /2010	08:38	eastern red bat	carcass search
080710-ERBA-639-1	8 /7 /2010	09:22	eastern red bat	carcass search
080710-ERBA-635-1	8 /7 /2010	09:47	eastern red bat	carcass search
080710-ERBA-414-1	8 /7 /2010	09:50	eastern red bat	carcass search
080710-ERBA-625-1	8 /7 /2010	10:10	eastern red bat	carcass search

Appendix C. Carcasses found on or scheduled search turbines during the spring and fall migration periods at Fowler Ridge Wind Resource Area.

CarcassID	Date	Time	Species	Found
080710-ERBA-625-2	8 /7 /2010	10:11	eastern red bat	carcass search
080710-ERBA-098-1	8 /7 /2010	10:31	eastern red bat	carcass search
080710-LBBA-622-1	8 /7 /2010	10:52	little brown bat	carcass search
080710-BBBA-622-2	8 /7 /2010	10:53	big brown bat	carcass search
080710-ERBA-083-1	8 /7 /2010	11:30	eastern red bat	carcass search
080710-ERBA-329-1	8 /7 /2010	12:00	eastern red bat	carcass search
080710-ERBA-230-1	8 /7 /2010	12:30	eastern red bat	carcass search
080710-BBBA-609-1	8 /7 /2010	12:40	big brown bat	carcass search
080710-ERBA-607-1	8 /7 /2010	13:08	eastern red bat	carcass search
080710-ERBA-607-3	8 /7 /2010	13:09	eastern red bat	carcass search
080710-HOBA-607-2	8 /7 /2010	13:09	hoary bat	carcass search
080710-HOBA-607-4	8 /7 /2010	13:10	hoary bat	carcass search
080710-ERBA-620-1	8 /7 /2010	13:57	eastern red bat	carcass search
080710-HOBA-253-1	8 /7 /2010	14:45	hoary bat	carcass search
080710-BBBA-628-1	8 /7 /2010	15:25	big brown bat	carcass search
080710-ERBA-216-1	8 /7 /2010	15:27	eastern red bat	carcass search
080710-ERBA-229-1	8 /7 /2010	15:57	eastern red bat	carcass search
080710-HOBA-245-1	8 /7 /2010	16:16	hoary bat	carcass search
080710-ERBA-245-2	8 /7 /2010	16:20	eastern red bat	carcass search
080710-ERBA-227-1	8 /7 /2010	16:46	eastern red bat	carcass search
080710-ERBA-198-1	8 /7 /2010	17:11	eastern red bat	carcass search
080710-HOBA-198-2	8 /7 /2010	17:12	hoary bat	carcass search
080710-ERBA-193-1	8 /7 /2010	17:35	eastern red bat	carcass search
080710-ERBA-193-2	8 /7 /2010	17:36	eastern red bat	carcass search
080710-ERBA-602-1	8 /7 /2010	18:19	eastern red bat	carcass search
080810-ERBA-045-1	8 /8 /2010	07:28	eastern red bat	carcass search
080810-ERBA-448-1	8 /8 /2010	08:19	eastern red bat	carcass search
080810-ERBA-448-2	8 /8 /2010	08:28	eastern red bat	carcass search
080810-ERBA-047-1	8 /8 /2010	08:45	eastern red bat	carcass search
080810-HOBA-035-1	8 /8 /2010	10:23	hoary bat	carcass search
080810-HOBA-065-1	8 /8 /2010	10:52	hoary bat	carcass search
080810-ERBA-090-1	8 /8 /2010	11:23	eastern red bat	carcass search
080810-ERBA-218-1	8 /8 /2010	12:08	eastern red bat	carcass search
080810-ERBA-152-1	8 /8 /2010	12:46	eastern red bat	carcass search
080810-SHBA-371-1	8 /8 /2010	12:52	silver-haired bat	carcass search
080810-BBBA-014-1	8 /8 /2010	13:07	big brown bat	carcass search
080810-ERBA-092-2	8 /8 /2010	13:18	eastern red bat	carcass search
080810-ERBA-007-1	8 /8 /2010	13:29	eastern red bat	carcass search
080810-ERBA-003-1	8 /8 /2010	14:12	eastern red bat	carcass search
080810-ERBA-173-1	8 /8 /2010	14:41	eastern red bat	carcass search
080810-ERBA-173-2	8 /8 /2010	14:44	eastern red bat	carcass search
080810-HOBA-127-1	8 /8 /2010	15:11	hoary bat	carcass search
080910-ERBA-480-1	8 /9 /2010	08:30	eastern red bat	carcass search
080910-ERBA-048-1	8 /9 /2010	09:25	eastern red bat	carcass search
080910-ERBA-281-1	8 /9 /2010	09:50	eastern red bat	carcass search
080910-HOBA-458-1	8 /9 /2010	12:38	hoary bat	carcass search
081110-ERBA-414-1	8 /11/2010	13:28	eastern red bat	carcass search

Appendix C. Carcasses found on or scheduled search turbines during the spring and fall migration periods at Fowler Ridge Wind Resource Area.

CarcassID	Date	Time	Species	Found
081110-ERBA-459-2	8 /11/2010	13:55	eastern red bat	carcass search
081110-ERBA-113-1	8 /11/2010	14:25	eastern red bat	carcass search
081110-ERBA-480-3	8 /11/2010	14:30	eastern red bat	carcass search
081110-ERBA-480-1	8 /11/2010	14:30	eastern red bat	carcass search
081110-ERBA-480-2	8 /11/2010	14:30	eastern red bat	carcass search
081110-ERBA-630-1	8 /11/2010	16:20	eastern red bat	carcass search
081210-ERBA-123-1	8 /12/2010	08:00	eastern red bat	carcass search
081210-ERBA-088-1	8 /12/2010	09:30	eastern red bat	carcass search
081210-HOBA-414-1	8 /12/2010	10:20	hoary bat	carcass search
081210-ERBA-414-2	8 /12/2010	10:25	eastern red bat	carcass search
081210-ERBA-260-1	8 /12/2010	13:36	eastern red bat	carcass search
081210-ERBA-251-1	8 /12/2010	14:34	eastern red bat	carcass search
081210-ERBA-459-1	8 /12/2010	15:15	eastern red bat	incidental find
081210-ERBA-609-1	8 /12/2010	16:04	eastern red bat	incidental find
081210-ERBA-609-2	8 /12/2010	16:11	eastern red bat	incidental find
081310-BBBA-609-1	8 /13/2010	08:54	big brown bat	incidental find
081310-ERBA-609-2	8 /13/2010	08:57	eastern red bat	incidental find
081310-ERBA-480-1	8 /13/2010	09:20	eastern red bat	carcass search
081310-HOBA-480-1	8 /13/2010	09:22	hoary bat	carcass search
081310-ERBA-230-1	8 /13/2010	10:36	eastern red bat	carcass search
081310-ERBA-230-2	8 /13/2010	10:46	eastern red bat	carcass search
081310-HOBA-448-1	8 /13/2010	10:52	hoary bat	carcass search
081310-HOBA-230-3	8 /13/2010	10:53	hoary bat	carcass search
081310-ERBA-396-1	8 /13/2010	12:00	eastern red bat	carcass search
081310-ERBA-260-1	8 /13/2010	12:54	eastern red bat	carcass search
081310-ERBA-414-1	8 /13/2010	13:10	eastern red bat	carcass search
081310-ERBA-388-1	8 /13/2010	13:54	eastern red bat	incidental find
081310-ERBA-085-1	8 /13/2010	15:13	eastern red bat	carcass search
081310-BBBA-047-1	8 /13/2010	15:41	big brown bat	carcass search
081310-ERBA-627-1	8 /13/2010	15:41	eastern red bat	incidental find
081310-ERBA-075-1	8 /13/2010	16:11	eastern red bat	carcass search
081310-ERBA-068-1	8 /13/2010	16:37	eastern red bat	carcass search
081310-BBBA-639-1	8 /13/2010	17:29	big brown bat	incidental find
081410-ERBA-642-1	8 /14/2010	07:30	eastern red bat	carcass search
081410-ERBA-628-1	8 /14/2010	08:45	eastern red bat	carcass search
081410-ERBA-611-1	8 /14/2010	08:54	eastern red bat	carcass search
081410-ERBA-459-1	8 /14/2010	08:54	eastern red bat	incidental find
081410-BBBA-628-2	8 /14/2010	08:56	big brown bat	carcass search
081410-ERBA-254-1	8 /14/2010	09:51	eastern red bat	carcass search
081410-ERBA-203-2	8 /14/2010	10:23	eastern red bat	carcass search
081410-ERBA-230-2	8 /14/2010	10:25	eastern red bat	incidental find
081410-HOBA-230-1	8 /14/2010	10:25	hoary bat	incidental find
081410-ERBA-152-1	8 /14/2010	11:05	eastern red bat	carcass search
081410-ERBA-407-2	8 /14/2010	11:15	eastern red bat	carcass search
081410-ERBA-260-1	8 /14/2010	11:20	eastern red bat	carcass search
081410-HOBA-048-1	8 /14/2010	11:22	hoary bat	carcass search
081410-ERBA-173-1	8 /14/2010	11:52	eastern red bat	carcass search

Appendix C. Carcasses found on or scheduled search turbines during the spring and fall migration periods at Fowler Ridge Wind Resource Area.

CarcassID	Date	Time	Species	Found
081410-ERBA-113-2	8 /14/2010	13:25	eastern red bat	carcass search
081410-HOBA-224-1	8 /14/2010	13:29	hoary bat	carcass search
081410-ERBA-113-3	8 /14/2010	13:30	eastern red bat	carcass search
081410-ERBA-224-2	8 /14/2010	13:31	eastern red bat	carcass search
081410-ERBA-113-1	8 /14/2010	13:35	eastern red bat	carcass search
081410-ERBA-387-1	8 /14/2010	13:40	eastern red bat	carcass search
081410-ERBA-193-1	8 /14/2010	13:58	eastern red bat	carcass search
081410-ERBA-607-1	8 /14/2010	14:53	eastern red bat	carcass search
081410-HOBA-414-1	8 /14/2010	15:10	hoary bat	carcass search
081410-ERBA-329-1	8 /14/2010	15:24	eastern red bat	carcass search
081410-ERBA-459-1	8 /14/2010	15:44	eastern red bat	carcass search
081410-ERBA-459-2	8 /14/2010	15:50	eastern red bat	carcass search
081410-ERBA-480-1	8 /14/2010	16:40	eastern red bat	carcass search
081510-ERBA-420-1	8 /15/2010	07:47	eastern red bat	carcass search
081510-ERBA-476-2	8 /15/2010	08:37	eastern red bat	carcass search
081510-ERBA-476-4	8 /15/2010	08:41	eastern red bat	carcass search
081510-ERBA-476-3	8 /15/2010	08:41	eastern red bat	carcass search
081510-ERBA-414-1	8 /15/2010	10:20	eastern red bat	carcass search
081510-ERBA-414-2	8 /15/2010	10:24	eastern red bat	carcass search
081510-ERBA-352-1	8 /15/2010	10:42	eastern red bat	carcass search
081510-ERBA-352-2	8 /15/2010	10:44	eastern red bat	carcass search
081510-HOBA-095-1	8 /15/2010	11:01	hoary bat	carcass search
081510-ERBA-095-2	8 /15/2010	11:11	eastern red bat	carcass search
081510-ERBA-379-1	8 /15/2010	11:15	eastern red bat	carcass search
081510-ERBA-095-3	8 /15/2010	11:16	eastern red bat	carcass search
081510-HOBA-098-1	8 /15/2010	11:58	hoary bat	carcass search
081510-ERBA-098-2	8 /15/2010	12:05	eastern red bat	carcass search
081510-ERBA-401-1	8 /15/2010	12:13	eastern red bat	carcass search
081510-ERBA-073-2	8 /15/2010	12:40	eastern red bat	carcass search
081510-HOBA-630-1	8 /15/2010	12:48	hoary bat	carcass search
081510-ERBA-426-1	8 /15/2010	13:00	eastern red bat	carcass search
081510-ERBA-426-3	8 /15/2010	13:00	eastern red bat	carcass search
081510-HOBA-056-1	8 /15/2010	13:50	hoary bat	carcass search
081510-ERBA-477-1	8 /15/2010	14:16	eastern red bat	carcass search
081510-ERBA-443-1	8 /15/2010	14:36	eastern red bat	carcass search
081510-ERBA-419-1	8 /15/2010	14:53	eastern red bat	carcass search
081510-ERBA-419-2	8 /15/2010	14:55	eastern red bat	carcass search
081510-HOBA-339-1	8 /15/2010	15:36	hoary bat	carcass search
081610-ERBA-630-1	8 /16/2010	09:05	eastern red bat	carcass search
081610-HOBA-630-1	8 /16/2010	09:12	hoary bat	carcass search
081610-ERBA-603-1	8 /16/2010	10:17	eastern red bat	carcass search
081610-ERBA-396-1	8 /16/2010	10:34	eastern red bat	carcass search
081610-HOBA-006-1	8 /16/2010	14:02	hoary bat	carcass search
081610-ERBA-006-2	8 /16/2010	14:10	eastern red bat	carcass search
081710-ERBA-056-1	8 /17/2010	08:34	eastern red bat	carcass search
081710-ERBA-048-1	8 /17/2010	09:07	eastern red bat	carcass search
081710-ERBA-073-1	8 /17/2010	10:02	eastern red bat	carcass search

Appendix C. Carcasses found on or scheduled search turbines during the spring and fall migration periods at Fowler Ridge Wind Resource Area.

CarcassID	Date	Time	Species	Found
081710-ERBA-396-2	8 /17/2010	10:40	eastern red bat	carcass search
081710-ERBA-396-1	8 /17/2010	10:45	eastern red bat	carcass search
081710-ERBA-396-3	8 /17/2010	10:50	eastern red bat	carcass search
081810-ERBA-630-1	8 /18/2010	08:45	eastern red bat	carcass search
081810-ERBA-230-1	8 /18/2010	09:15	eastern red bat	incidental find
081810-ERBA-083-1	8 /18/2010	10:20	eastern red bat	carcass search
081810-ERBA-095-1	8 /18/2010	11:27	eastern red bat	carcass search
081910-ERBA-459-1	8 /19/2010	08:00	eastern red bat	carcass search
081910-ERBA-459-1	8 /19/2010	08:25	eastern red bat	carcass search
081910-ERBA-048-1	8 /19/2010	12:10	eastern red bat	carcass search
081910-HOBA-281-1	8 /19/2010	13:18	hoary bat	carcass search
081910-ERBA-281-2	8 /19/2010	13:26	eastern red bat	carcass search
081910-HOBA-625-1	8 /19/2010	13:38	hoary bat	incidental find
081910-HOBA-625-2	8 /19/2010	13:47	hoary bat	incidental find
081910-HOBA-628-1	8 /19/2010	14:09	hoary bat	carcass search
081910-ERBA-630-1	8 /19/2010	14:43	eastern red bat	carcass search
082010-HOBA-602-1	8 /20/2010	08:03	hoary bat	carcass search
082010-ERBA-248-1	8 /20/2010	08:22	eastern red bat	carcass search
082010-ERBA-630-1	8 /20/2010	08:40	eastern red bat	carcass search
082010-HOBA-203-1	8 /20/2010	09:27	hoary bat	incidental find
082010-HOBA-281-1	8 /20/2010	09:27	hoary bat	carcass search
082010-HOBA-414-1	8 /20/2010	10:02	hoary bat	carcass search
082010-ERBA-251-1	8 /20/2010	10:40	eastern red bat	carcass search
082010-ERBA-116-1	8 /20/2010	10:49	eastern red bat	carcass search
082010-ERBA-620-1	8 /20/2010	10:57	eastern red bat	carcass search
082010-BBBA-603-1	8 /20/2010	11:30	big brown bat	carcass search
082010-ERBA-603-2	8 /20/2010	11:35	eastern red bat	carcass search
082010-ERBA-639-1	8 /20/2010	11:44	eastern red bat	carcass search
082010-ERBA-614-1	8 /20/2010	12:05	eastern red bat	carcass search
082010-ERBA-635-1	8 /20/2010	12:06	eastern red bat	carcass search
082010-ERBA-635-2	8 /20/2010	12:10	eastern red bat	carcass search
082010-ERBA-286-1	8 /20/2010	13:35	eastern red bat	carcass search
082010-HOBA-611-1	8 /20/2010	13:37	hoary bat	carcass search
082010-ERBA-480-1	8 /20/2010	13:45	eastern red bat	carcass search
082010-HOBA-459-1	8 /20/2010	14:24	hoary bat	carcass search
082010-ERBA-459-2	8 /20/2010	14:33	eastern red bat	carcass search
082010-TRBA-254-1	8 /20/2010	15:04	tricolored bat	carcass search
082110-HOBA-448-1	8 /21/2010	08:50	hoary bat	carcass search
082110-ERBA-354-1	8 /21/2010	09:40	eastern red bat	carcass search
082110-HOBA-459-1	8 /21/2010	10:43	hoary bat	carcass search
082110-ERBA-414-1	8 /21/2010	11:24	eastern red bat	carcass search
082110-BBBA-401-1	8 /21/2010	12:09	big brown bat	carcass search
082110-ERBA-388-1	8 /21/2010	13:39	eastern red bat	carcass search
082110-HOBA-419-1	8 /21/2010	13:58	hoary bat	carcass search
082110-ERBA-419-2	8 /21/2010	13:59	eastern red bat	carcass search
082110-HOBA-419-3	8 /21/2010	14:00	hoary bat	carcass search
082110-ERBA-477-1	8 /21/2010	14:57	eastern red bat	carcass search

Appendix C. Carcasses found on or scheduled search turbines during the spring and fall migration periods at Fowler Ridge Wind Resource Area.

CarcassID	Date	Time	Species	Found
082210-LBBA-014-1	8 /22/2010	11:14	little brown bat	carcass search
082210-ERBA-007-1	8 /22/2010	11:36	eastern red bat	carcass search
082210-ERBA-090-1	8 /22/2010	12:50	eastern red bat	carcass search
082210-BBBA-640-1	8 /22/2010	12:56	big brown bat	carcass search
082210-ERBA-230-1	8 /22/2010	13:14	eastern red bat	carcass search
082210-ERBA-082-1	8 /22/2010	13:31	eastern red bat	carcass search
082310-ERBA-195-1	8 /23/2010	09:25	eastern red bat	carcass search
082310-ERBA-230-1	8 /23/2010	10:03	eastern red bat	carcass search
082310-ERBA-113-1	8 /23/2010	11:20	eastern red bat	carcass search
082310-ERBA-113-2	8 /23/2010	11:25	eastern red bat	carcass search
082310-BBBA-281-1	8 /23/2010	11:31	big brown bat	carcass search
082310-ERBA-251-1	8 /23/2010	12:17	eastern red bat	carcass search
082410-ERBA-314-1	8 /24/2010	07:50	eastern red bat	carcass search
082410-ERBA-314-2	8 /24/2010	08:00	eastern red bat	carcass search
082410-ERBA-414-1	8 /24/2010	09:57	eastern red bat	carcass search
082410-SHBA-095-1	8 /24/2010	11:13	silver-haired bat	carcass search
082410-BBBA-095-2	8 /24/2010	11:21	big brown bat	carcass search
082410-ERBA-095-3	8 /24/2010	11:30	eastern red bat	carcass search
082410-SHBA-088-1	8 /24/2010	12:29	silver-haired bat	carcass search
082410-ERBA-006-1	8 /24/2010	13:37	eastern red bat	carcass search
082510-ERBA-024-1	8 /25/2010	08:50	eastern red bat	carcass search
082510-HOBA-371-1	8 /25/2010	11:30	hoary bat	carcass search
082510-ERBA-628-1	8 /25/2010	13:00	eastern red bat	carcass search
082510-HOBA-620-1	8 /25/2010	14:54	hoary bat	incidental find
082610-ERBA-459-1	8 /26/2010	08:30	eastern red bat	carcass search
082610-ERBA-459-3	8 /26/2010	08:35	eastern red bat	carcass search
082610-ERBA-459-2	8 /26/2010	08:35	eastern red bat	carcass search
082610-ERBA-630-1	8 /26/2010	08:43	eastern red bat	carcass search
082610-ERBA-630-2	8 /26/2010	08:49	eastern red bat	carcass search
082610-ERBA-628-1	8 /26/2010	09:17	eastern red bat	carcass search
082610-ERBA-628-2	8 /26/2010	09:25	eastern red bat	carcass search
082610-ERBA-314-1	8 /26/2010	10:30	eastern red bat	carcass search
082610-TRBA-603-1	8 /26/2010	10:40	tricolored bat	carcass search
082710-ERBA-477-1	8 /27/2010	07:47	eastern red bat	carcass search
082710-SHBA-314-1	8 /27/2010	08:16	silver-haired bat	carcass search
082710-ERBA-419-1	8 /27/2010	08:17	eastern red bat	carcass search
082710-HOBA-388-1	8 /27/2010	08:37	hoary bat	carcass search
082710-SHBA-388-2	8 /27/2010	08:38	silver-haired bat	carcass search
082710-ERBA-388-3	8 /27/2010	08:40	eastern red bat	carcass search
082710-ERBA-387-1	8 /27/2010	09:54	eastern red bat	carcass search
082710-ERBA-397-1	8 /27/2010	10:32	eastern red bat	carcass search
082710-ERBA-635-1	8 /27/2010	10:40	eastern red bat	incidental find
082710-ERBA-048-1	8 /27/2010	11:05	eastern red bat	carcass search
082710-HOBA-454-1	8 /27/2010	11:06	hoary bat	carcass search
082710-ERBA-478-1	8 /27/2010	11:29	eastern red bat	carcass search
082710-ERBA-379-1	8 /27/2010	13:03	eastern red bat	carcass search
082710-ERBA-459-1	8 /27/2010	13:57	eastern red bat	carcass search

Appendix C. Carcasses found on or scheduled search turbines during the spring and fall migration periods at Fowler Ridge Wind Resource Area.

CarcassID	Date	Time	Species	Found
082710-ERBA-628-2	8 /27/2010	15:28	eastern red bat	carcass search
082810-ERBA-448-1	8 /28/2010	08:19	eastern red bat	carcass search
082810-ERBA-628-1	8 /28/2010	08:50	eastern red bat	carcass search
082810-ERBA-640-1	8 /28/2010	09:00	eastern red bat	carcass search
082810-ERBA-458-1	8 /28/2010	09:40	eastern red bat	carcass search
082810-ERBA-224-1	8 /28/2010	11:10	eastern red bat	incidental find
082810-ERBA-414-1	8 /28/2010	11:37	eastern red bat	carcass search
082810-ERBA-033-1	8 /28/2010	11:55	eastern red bat	carcass search
082810-ERBA-050-1	8 /28/2010	12:51	eastern red bat	carcass search
082810-ERBA-478-1	8 /28/2010	13:42	eastern red bat	incidental find
082810-HOBA-009-1	8 /28/2010	15:03	hoary bat	carcass search
082910-ERBA-156-1	8 /29/2010	07:42	eastern red bat	carcass search
082910-ERBA-248-1	8 /29/2010	08:38	eastern red bat	incidental find
082910-HOBA-147-1	8 /29/2010	08:50	hoary bat	carcass search
082910-ERBA-602-1	8 /29/2010	09:02	eastern red bat	carcass search
082910-ERBA-448-1	8 /29/2010	09:40	eastern red bat	carcass search
082910-ERBA-033-1	8 /29/2010	09:47	eastern red bat	carcass search
082910-HOBA-607-1	8 /29/2010	10:15	hoary bat	carcass search
082910-ERBA-607-2	8 /29/2010	10:16	eastern red bat	carcass search
082910-ERBA-640-1	8 /29/2010	10:25	eastern red bat	carcass search
082910-ERBA-281-1	8 /29/2010	10:26	eastern red bat	carcass search
082910-BBBA-245-2	8 /29/2010	11:07	big brown bat	carcass search
082910-ERBA-245-1	8 /29/2010	11:07	eastern red bat	carcass search
082910-ERBA-245-3	8 /29/2010	11:08	eastern red bat	carcass search
082910-HOBA-414-1	8 /29/2010	11:28	hoary bat	carcass search
082910-HOBA-227-1	8 /29/2010	11:50	hoary bat	carcass search
082910-HOBA-371-1	8 /29/2010	12:04	hoary bat	carcass search
082910-ERBA-630-1	8 /29/2010	12:06	eastern red bat	carcass search
082910-ERBA-173-1	8 /29/2010	12:16	eastern red bat	carcass search
082910-ERBA-048-1	8 /29/2010	13:00	eastern red bat	carcass search
082910-ERBA-286-1	8 /29/2010	13:46	eastern red bat	carcass search
082910-ERBA-625-1	8 /29/2010	15:23	eastern red bat	carcass search
083010-ERBA-459-1	8 /30/2010	08:50	eastern red bat	carcass search
083010-ERBA-630-1	8 /30/2010	08:55	eastern red bat	carcass search
083010-ERBA-480-1	8 /30/2010	10:00	eastern red bat	carcass search
083010-HOBA-095-1	8 /30/2010	13:17	hoary bat	carcass search
083010-ERBA-147-1	8 /30/2010	13:18	eastern red bat	carcass search
083010-ERBA-024-1	8 /30/2010	13:42	eastern red bat	carcass search
083110-ERBA-628-1	8 /31/2010	08:15	eastern red bat	carcass search
083110-ERBA-218-1	8 /31/2010	11:58	eastern red bat	carcass search
090110-HOBA-024-1	9 /1 /2010	12:20	hoary bat	carcass search
090110-ERBA-334-1	9 /1 /2010	13:15	eastern red bat	carcass search
090210-ERBA-628-2	9 /2 /2010	08:45	eastern red bat	carcass search
090210-BBBA-628-1	9 /2 /2010	08:50	big brown bat	carcass search
090210-ERBA-112-1	9 /2 /2010	09:27	eastern red bat	incidental find
090310-ERBA-625-1	9 /3 /2010	08:17	eastern red bat	carcass search
090310-HOBA-216-1	9 /3 /2010	12:13	hoary bat	carcass search

Appendix C. Carcasses found on or scheduled search turbines during the spring and fall migration periods at Fowler Ridge Wind Resource Area.

CarcassID	Date	Time	Species	Found
090310-ERBA-245-1	9 /3 /2010	13:03	eastern red bat	carcass search
090310-HOBA-387-1	9 /3 /2010	13:04	hoary bat	carcass search
090310-HOBA-156-1	9 /3 /2010	13:58	hoary bat	carcass search
090410-SHBA-614-1	9 /4 /2010	08:05	silver-haired bat	carcass search
090410-ERBA-628-1	9 /4 /2010	09:00	eastern red bat	carcass search
090410-SHBA-048-1	9 /4 /2010	09:00	silver-haired bat	carcass search
090410-HOBA-098-1	9 /4 /2010	10:17	hoary bat	carcass search
090410-ERBA-443-1	9 /4 /2010	13:23	eastern red bat	carcass search
090510-HOBA-113-1	9 /5 /2010	10:05	hoary bat	carcass search
090510-HOBA-048-1	9 /5 /2010	12:20	hoary bat	carcass search
090510-ERBA-014-1	9 /5 /2010	14:16	eastern red bat	carcass search
090610-HOBA-614-1	9 /6 /2010	08:15	hoary bat	carcass search
090610-HOBA-281-1	9 /6 /2010	09:45	hoary bat	carcass search
090610-SHBA-640-1	9 /6 /2010	11:05	silver-haired bat	carcass search
090610-ERBA-459-1	9 /6 /2010	13:32	eastern red bat	carcass search
090610-SHBA-459-2	9 /6 /2010	13:37	silver-haired bat	carcass search
090710-SHBA-640-1	9 /7 /2010	09:30	silver-haired bat	carcass search
090710-ERBA-640-1	9 /7 /2010	11:10	eastern red bat	carcass search
090710-SHBA-448-1	9 /7 /2010	12:12	silver-haired bat	carcass search
090710-SHBA-614-1	9 /7 /2010	12:17	silver-haired bat	carcass search
090710-HOBA-630-1	9 /7 /2010	12:55	hoary bat	carcass search
090810-HOBA-260-1	9 /8 /2010	10:43	hoary bat	carcass search
090810-SHBA-195-1	9 /8 /2010	12:15	silver-haired bat	carcass search
090810-ERBA-048-1	9 /8 /2010	12:25	eastern red bat	carcass search
090810-HOBA-006-1	9 /8 /2010	13:10	hoary bat	carcass search
090910-SHBA-371-1	9 /9 /2010	10:50	silver-haired bat	carcass search
090910-SHBA-088-1	9 /9 /2010	12:10	silver-haired bat	carcass search
091010-ERBA-371-1	9 /10/2010	08:40	eastern red bat	carcass search
091010-HOBA-443-1	9 /10/2010	08:50	hoary bat	carcass search
091010-HOBA-477-1	9 /10/2010	09:07	hoary bat	carcass search
091010-SHBA-401-1	9 /10/2010	10:22	silver-haired bat	carcass search
091010-SHBA-401-2	9 /10/2010	10:22	silver-haired bat	carcass search
091010-ERBA-432-1	9 /10/2010	11:44	eastern red bat	carcass search
091110-ERBA-045-1	9 /11/2010	07:55	eastern red bat	carcass search
091110-HOBA-603-1	9 /11/2010	10:26	hoary bat	carcass search
091110-ERBA-260-1	9 /11/2010	11:45	eastern red bat	carcass search
091110-HOBA-088-1	9 /11/2010	12:18	hoary bat	carcass search
091110-HOBA-625-1	9 /11/2010	12:25	hoary bat	incidental find
091110-SHBA-125-1	9 /11/2010	12:31	silver-haired bat	carcass search
091110-SHBA-628-1	9 /11/2010	13:05	silver-haired bat	carcass search
091110-ERBA-628-2	9 /11/2010	13:10	eastern red bat	carcass search
091110-HOBA-116-1	9 /11/2010	13:22	hoary bat	carcass search
091210-ERBA-635-1	9 /12/2010	07:49	eastern red bat	carcass search
091210-SHBA-628-1	9 /12/2010	08:23	silver-haired bat	carcass search
091210-ERBA-622-1	9 /12/2010	08:52	eastern red bat	carcass search
091210-ERBA-088-1	9 /12/2010	10:22	eastern red bat	carcass search
091210-SHBA-607-1	9 /12/2010	10:33	silver-haired bat	carcass search

Appendix C. Carcasses found on or scheduled search turbines during the spring and fall migration periods at Fowler Ridge Wind Resource Area.

CarcassID	Date	Time	Species	Found
091210-ERBA-152-1	9 /12/2010	12:21	eastern red bat	carcass search
091210-ERBA-152-2	9 /12/2010	12:22	eastern red bat	carcass search
091210-SHBA-087-1	9 /12/2010	14:05	silver-haired bat	carcass search
091310-ERBA-625-1	9 /13/2010	09:05	eastern red bat	incidental find
091310-SHBA-458-1	9 /13/2010	09:15	silver-haired bat	carcass search
091310-ERBA-640-1	9 /13/2010	09:59	eastern red bat	carcass search
091310-SHBA-628-1	9 /13/2010	11:52	silver-haired bat	carcass search
091310-SHBA-371-1	9 /13/2010	12:00	silver-haired bat	carcass search
091410-SHBA-087-1	9 /14/2010	08:40	silver-haired bat	carcass search
091410-ERBA-630-1	9 /14/2010	08:44	eastern red bat	carcass search
091410-SHBA-056-1	9 /14/2010	09:02	silver-haired bat	carcass search
091410-SHBA-603-1	9 /14/2010	09:45	silver-haired bat	carcass search
091410-ERBA-048-1	9 /14/2010	10:22	eastern red bat	carcass search
091410-SHBA-281-1	9 /14/2010	10:40	silver-haired bat	carcass search
091410-SHBA-260-1	9 /14/2010	11:10	silver-haired bat	carcass search
091410-ERBA-448-1	9 /14/2010	13:10	eastern red bat	carcass search
091510-ERBA-387-1	9 /15/2010	12:23	eastern red bat	carcass search
091610-SHBA-056-2	9 /16/2010	08:25	silver-haired bat	carcass search
091610-SHBA-056-1	9 /16/2010	08:30	silver-haired bat	carcass search
091610-SHBA-614-1	9 /16/2010	08:39	silver-haired bat	carcass search
091610-HOBA-048-1	9 /16/2010	09:15	hoary bat	carcass search
091610-ERBA-640-1	9 /16/2010	09:40	eastern red bat	carcass search
091610-SHBA-640-2	9 /16/2010	09:50	silver-haired bat	carcass search
091610-SHBA-073-1	9 /16/2010	09:53	silver-haired bat	carcass search
091610-SHBA-033-1	9 /16/2010	12:50	silver-haired bat	carcass search
091710-SHBA-253-1	9 /17/2010	07:46	silver-haired bat	carcass search
091710-SHBA-229-1	9 /17/2010	09:15	silver-haired bat	carcass search
091710-ERBA-607-1	9 /17/2010	10:59	eastern red bat	carcass search
091810-ERBA-476-1	9 /18/2010	08:00	eastern red bat	carcass search
091810-ERBA-614-2	9 /18/2010	09:30	eastern red bat	carcass search
091810-SHBA-614-1	9 /18/2010	09:35	silver-haired bat	carcass search
091810-SHBA-281-1	9 /18/2010	11:12	silver-haired bat	carcass search
091810-SHBA-458-1	9 /18/2010	11:57	silver-haired bat	carcass search
091810-HOBA-218-1	9 /18/2010	12:20	hoary bat	carcass search
091810-SHBA-640-1	9 /18/2010	12:40	silver-haired bat	carcass search
091810-INBA-640-2	9 /18/2010	12:45	Indiana bat	carcass search
091810-SHBA-024-1	9 /18/2010	13:08	silver-haired bat	carcass search
091910-ERBA-419-1	9 /19/2010	09:31	eastern red bat	carcass search
091910-ERBA-087-1	9 /19/2010	13:10	eastern red bat	carcass search
091910-ERBA-087-2	9 /19/2010	13:22	eastern red bat	carcass search
091910-HOBA-628-1	9 /19/2010	13:42	hoary bat	carcass search
092010-HOBA-323-1	9 /20/2010	08:50	hoary bat	carcass search
092010-SHBA-414-2	9 /20/2010	10:19	silver-haired bat	carcass search
092010-SHBA-281-1	9 /20/2010	10:34	silver-haired bat	carcass search
092010-ERBA-218-1	9 /20/2010	11:38	eastern red bat	carcass search
092010-SHBA-218-2	9 /20/2010	11:43	silver-haired bat	carcass search
092010-SHBA-640-1	9 /20/2010	13:33	silver-haired bat	carcass search

Appendix C. Carcasses found on or scheduled search turbines during the spring and fall migration periods at Fowler Ridge Wind Resource Area.

CarcassID	Date	Time	Species	Found
092010-BBBA-107-1	9 /20/2010	17:00	big brown bat	incidental find
092110-SHBA-056-1	9 /21/2010	08:52	silver-haired bat	carcass search
092110-HOBA-006-1	9 /21/2010	08:55	hoary bat	carcass search
092110-SHBA-048-1	9 /21/2010	09:36	silver-haired bat	carcass search
092110-ERBA-083-1	9 /21/2010	10:07	eastern red bat	carcass search
092110-SHBA-640-2	9 /21/2010	11:20	silver-haired bat	carcass search
092110-SHBA-640-1	9 /21/2010	11:22	silver-haired bat	carcass search
092110-ERBA-033-1	9 /21/2010	13:07	eastern red bat	carcass search
092110-SHBA-628-1	9 /21/2010	13:15	silver-haired bat	carcass search
092110-ERBA-480-1	9 /21/2010	13:20	eastern red bat	carcass search
092210-SHBA-480-1	9 /22/2010	08:00	silver-haired bat	carcass search
092210-HOBA-095-1	9 /22/2010	10:05	hoary bat	carcass search
092210-HOBA-640-1	9 /22/2010	10:20	hoary bat	carcass search
092310-HOBA-611-1	9 /23/2010	08:30	hoary bat	incidental find
092310-SHBA-334-1	9 /23/2010	08:32	silver-haired bat	carcass search
092310-ERBA-371-1	9 /23/2010	09:35	eastern red bat	carcass search
092310-ERBA-640-1	9 /23/2010	12:18	eastern red bat	carcass search
092310-HOBA-480-1	9 /23/2010	13:40	hoary bat	carcass search
092310-SHBA-459-1	9 /23/2010	14:09	silver-haired bat	carcass search
092310-SHBA-459-2	9 /23/2010	14:13	silver-haired bat	carcass search
092410-SHBA-354-1	9 /24/2010	11:07	silver-haired bat	carcass search
092410-SHBA-420-1	9 /24/2010	12:32	silver-haired bat	carcass search
092510-SHBA-627-1	9 /25/2010	09:00	silver-haired bat	carcass search
092510-SHBA-616-1	9 /25/2010	09:58	silver-haired bat	carcass search
092610-HOBA-281-1	9 /26/2010	10:45	hoary bat	carcass search
092610-SHBA-053-1	9 /26/2010	13:03	silver-haired bat	carcass search
092610-SHBA-065-1	9 /26/2010	14:06	silver-haired bat	carcass search
092810-ERBA-218-1	9 /28/2010	11:17	eastern red bat	carcass search
093010-SHBA-630-1	9 /30/2010	08:25	silver-haired bat	carcass search
093010-SHBA-323-1	9 /30/2010	08:50	silver-haired bat	carcass search
093010-SHBA-459-1	9 /30/2010	13:30	silver-haired bat	carcass search
100110-SHBA-425-1	10/1 /2010	09:18	silver-haired bat	carcass search
100110-ERBA-448-1	10/1 /2010	09:45	eastern red bat	carcass search
100110-SHBA-113-1	10/1 /2010	11:37	silver-haired bat	carcass search
100110-ERBA-088-1	10/1 /2010	12:17	eastern red bat	carcass search
100110-SHBA-630-1	10/1 /2010	13:20	silver-haired bat	carcass search
100210-SHBA-611-1	10/2 /2010	10:10	silver-haired bat	carcass search
100210-SHBA-640-1	10/2 /2010	11:50	silver-haired bat	carcass search
100210-ERBA-616-1	10/2 /2010	12:46	eastern red bat	carcass search
100310-SHBA-014-1	10/3 /2010	14:10	silver-haired bat	carcass search
100410-SHBA-630-1	10/4 /2010	08:11	silver-haired bat	carcass search
100610-SHBA-056-1	10/6 /2010	11:48	silver-haired bat	carcass search
100710-SHBA-147-1	10/7 /2010	08:21	silver-haired bat	carcass search
100710-SHBA-195-1	10/7 /2010	09:15	silver-haired bat	carcass search
100710-SHBA-251-1	10/7 /2010	11:49	silver-haired bat	carcass search
100810-ERBA-371-1	10/8 /2010	09:30	eastern red bat	carcass search
100810-SHBA-625-1	10/8 /2010	12:41	silver-haired bat	carcass search

Appendix C. Carcasses found on or scheduled search turbines during the spring and fall migration periods at Fowler Ridge Wind Resource Area.

CarcassID	Date	Time	Species	Found
100810-ERBA-087-1	10/8 /2010	13:08	eastern red bat	carcass search
100810-SHBA-448-1	10/8 /2010	16:22	silver-haired bat	carcass search
100910-SHBA-083-1	10/9 /2010	10:12	silver-haired bat	carcass search
100910-SHBA-033-1	10/9 /2010	13:20	silver-haired bat	carcass search
101010-ERBA-281-1	10/10/2010	11:26	eastern red bat	carcass search
101110-ERBA-448-1	10/11/2010	11:42	eastern red bat	carcass search
101210-HOBA-056-1	10/12/2010	09:08	hoary bat	carcass search
101210-ERBA-083-1	10/12/2010	10:14	eastern red bat	carcass search
101310-ERBA-628-1	10/13/2010	08:01	eastern red bat	carcass search
101310-ERBA-642-1	10/13/2010	08:05	eastern red bat	carcass search
101310-ERBA-459-1	10/13/2010	08:10	eastern red bat	carcass search
101310-SHBA-631-1	10/13/2010	09:24	silver-haired bat	carcass search
101310-ERBA-098-1	10/13/2010	10:20	eastern red bat	carcass search
101310-SHBA-414-1	10/13/2010	11:14	silver-haired bat	carcass search
101510-ERBA-098-1	10/15/2010	09:53	eastern red bat	carcass search
101510-ERBA-459-1	10/15/2010	11:08	eastern red bat	carcass search
101510-ERBA-459-2	10/15/2010	11:10	eastern red bat	carcass search
Overall			**581 carcasses**	

Appendix D. Carcasses found at Fowler Ridge Wind farm during spring and fall migration periods that are incidental and are not included in fatality estimates.

CarcassID	Date	Time	Species	Reason not Included in Fatality Estimates
041510-ERBA-61-1	4 /15/2010	11:58	eastern red bat	Outside Plot Area
042710-BBBA-610-1	4 /27/2010	15:20	big brown bat	Not on Scheduled Search Turbine
051410-SHBA-26-1	5 /14/2010	15:20	silver-haired bat	Outside Plot Area
051510-HOBA-314-1	5 /15/2010	10:22	hoary bat	Outside Plot Area
051510-SHBA-251-1	5 /15/2010	12:50	silver-haired bat	Outside Plot Area
073010-BBBA-314-3	7 /30/2010	13:10	big brown bat	Clearing Search
073010-ERBA-314-4	7 /30/2010	13:10	eastern red bat	Clearing Search
073010-ERBA-314-1	7 /30/2010	13:10	eastern red bat	Clearing Search
073010-HOBA-314-2	7 /30/2010	13:10	hoary bat	Clearing Search
073110-TRBA-339-1	7 /31/2010	07:43	tricolored bat	Clearing Search
073110-HOBA-339-2	7 /31/2010	07:59	hoary bat	Clearing Search
073110-ERBA-628-1	7 /31/2010	08:03	eastern red bat	Clearing Search
073110-HOBA-480-1	7 /31/2010	08:05	hoary bat	Clearing Search
073110-ERBA-628-2	7 /31/2010	08:21	eastern red bat	Clearing Search
073110-ERBA-628-3	7 /31/2010	09:26	eastern red bat	Clearing Search
073110-ERBA-087-1	7 /31/2010	09:30	eastern red bat	Clearing Search
073110-HOBA-459-1	7 /31/2010	09:30	hoary bat	Clearing Search
073110-ERBA-388-1	7 /31/2010	09:31	eastern red bat	Clearing Search
073110-ERBA-628-4	7 /31/2010	09:36	eastern red bat	Clearing Search
073110-ERBA-087-2	7 /31/2010	09:41	eastern red bat	Clearing Search
073110-BBBA-459-2	7 /31/2010	09:44	big brown bat	Clearing Search
073110-ERBA-087-3	7 /31/2010	09:47	eastern red bat	Clearing Search
073110-ERBA-628-5	7 /31/2010	09:47	eastern red bat	Clearing Search
073110-ERBA-048-1	7 /31/2010	10:29	eastern red bat	Clearing Search
073110-HOBA-460-1	7 /31/2010	10:29	hoary bat	Clearing Search
073110-ERBA-048-2	7 /31/2010	10:35	eastern red bat	Clearing Search
073110-ERBA-048-4	7 /31/2010	10:40	eastern red bat	Clearing Search
073110-ERBA-048-3	7 /31/2010	10:44	eastern red bat	Clearing Search
073110-HOBA-426-1	7 /31/2010	10:52	hoary bat	Clearing Search
073110-ERBA-371-3	7 /31/2010	11:20	eastern red bat	Clearing Search
073110-ERBA-371-1	7 /31/2010	11:25	eastern red bat	Clearing Search
073110-ERBA-371-2	7 /31/2010	11:27	eastern red bat	Clearing Search
073110-ERBA-355-1	7 /31/2010	11:37	eastern red bat	Clearing Search
073110-BBBA-230-1	7 /31/2010	12:15	big brown bat	Clearing Search
073110-HOBA-083-1	7 /31/2010	12:17	hoary bat	Clearing Search
073110-HOBA-309-1	7 /31/2010	12:20	hoary bat	Clearing Search
073110-ERBA-396-1	7 /31/2010	12:36	eastern red bat	Clearing Search
073110-ERBA-230-2	7 /31/2010	12:36	eastern red bat	Clearing Search
073110-ERBA-396-2	7 /31/2010	12:41	eastern red bat	Clearing Search
073110-BBBA-230-3	7 /31/2010	12:43	big brown bat	Clearing Search
073110-ERBA-396-4	7 /31/2010	12:46	eastern red bat	Clearing Search
073110-HOBA-396-5	7 /31/2010	12:46	hoary bat	Clearing Search
073110-ERBA-230-4	7 /31/2010	12:51	eastern red bat	Clearing Search
073110-HOBA-401-1	7 /31/2010	12:54	hoary bat	Clearing Search
073110-ERBA-396-3	7 /31/2010	13:00	eastern red bat	Clearing Search
073110-ERBA-423-1	7 /31/2010	13:15	eastern red bat	Clearing Search

Appendix D. Carcasses found at Fowler Ridge Wind farm during spring and fall migration periods that are incidental and are not included in fatality estimates.

CarcassID	Date	Time	Species	Reason not Included in Fatality Estimates
073110-ERBA-095-1	7 /31/2010	13:20	eastern red bat	Clearing Search
073110-ERBA-095-2	7 /31/2010	13:27	eastern red bat	Clearing Search
073110-ERBA-454-1	7 /31/2010	13:44	eastern red bat	Clearing Search
073110-ERBA-454-2	7 /31/2010	13:55	eastern red bat	Clearing Search
073110-HOBA-454-3	7 /31/2010	13:56	hoary bat	Clearing Search
073110-ERBA-260-1	7 /31/2010	14:06	eastern red bat	Clearing Search
073110-BBBA-448-1	7 /31/2010	14:20	big brown bat	Clearing Search
073110-HOBA-448-2	7 /31/2010	14:22	hoary bat	Clearing Search
073110-ERBA-478-1	7 /31/2010	14:34	eastern red bat	Clearing Search
073110-ERBA-123-1	7 /31/2010	14:45	eastern red bat	Clearing Search
073110-HOBA-640-2	7 /31/2010	15:00	hoary bat	Clearing Search
073110-HOBA-640-1	7 /31/2010	15:02	hoary bat	Clearing Search
073110-ERBA-425-1	7 /31/2010	15:09	eastern red bat	Clearing Search
073110-HOBA-640-3	7 /31/2010	15:13	hoary bat	Clearing Search
073110-ERBA-425-2	7 /31/2010	15:20	eastern red bat	Clearing Search
073110-ERBA-398-1	7 /31/2010	15:53	eastern red bat	Clearing Search
073110-ERBA-147-1	7 /31/2010	16:04	eastern red bat	Clearing Search
073110-ERBA-352-1	7 /31/2010	16:26	eastern red bat	Clearing Search
073110-ERBA-352-2	7 /31/2010	16:35	eastern red bat	Clearing Search
073110-BBBA-354-1	7 /31/2010	16:54	big brown bat	Clearing Search
080110-SHBA-369-1	8 /1 /2010	07:54	silver-haired bat	Summer Time of Death
080110-HOBA-369-2	8 /1 /2010	08:08	hoary bat	Summer Time of Death
080110-HOBA-407-1	8 /1 /2010	08:25	hoary bat	Summer Time of Death
080110-ERBA-476-5	8 /1 /2010	09:04	eastern red bat	Summer Time of Death
080110-ERBA-476-6	8 /1 /2010	09:17	eastern red bat	Summer Time of Death
080110-ERBA-608-1	8 /1 /2010	11:00	eastern red bat	Not on Scheduled Search Turbine
080110-ERBA-608-2	8 /1 /2010	11:08	eastern red bat	Not on Scheduled Search Turbine
080110-HOBA-625-1	8 /1 /2010	11:12	hoary bat	Summer Time of Death
080110-ERBA-625-1	8 /1 /2010	11:27	eastern red bat	Summer Time of Death
080110-ERBA-625-3	8 /1 /2010	11:39	eastern red bat	Summer Time of Death
080110-HOBA-640-1	8 /1 /2010	11:51	hoary bat	Summer Time of Death
080110-ERBA-631-1	8 /1 /2010	12:36	eastern red bat	Summer Time of Death
080110-HOBA-622-1	8 /1 /2010	12:58	hoary bat	Summer Time of Death
080110-ERBA-622-2	8 /1 /2010	13:06	eastern red bat	Summer Time of Death
080110-HOBA-622-3	8 /1 /2010	13:15	hoary bat	Summer Time of Death
080110-ERBA-622-4	8 /1 /2010	13:25	eastern red bat	Summer Time of Death
080110-ERBA-616-2	8 /1 /2010	13:46	eastern red bat	Summer Time of Death
080110-ERBA-616-1	8 /1 /2010	13:46	eastern red bat	Summer Time of Death
080110-ERBA-458-1	8 /1 /2010	14:45	eastern red bat	Unknown Time of Death
080110-HOBA-607-1	8 /1 /2010	14:45	hoary bat	Summer Time of Death
080110-HOBA-458-2	8 /1 /2010	14:53	hoary bat	Summer Time of Death
080110-ERBA-607-2	8 /1 /2010	14:55	eastern red bat	Summer Time of Death
080110-ERBA-448-1	8 /1 /2010	15:53	eastern red bat	Summer Time of Death
080110-HOBA-285-1	8 /1 /2010	16:54	hoary bat	Summer Time of Death
080210-ERBA-602-1	8 /2 /2010	08:35	eastern red bat	Summer Time of Death
080210-ERBA-248-2	8 /2 /2010	09:17	eastern red bat	Summer Time of Death

Appendix D. Carcasses found at Fowler Ridge Wind farm during spring and fall migration periods that are incidental and are not included in fatality estimates.

CarcassID	Date	Time	Species	Reason not Included in Fatality Estimates
080210-ERBA-245-1	8 /2 /2010	10:17	eastern red bat	Summer Time of Death
080210-ERBA-448-1	8 /2 /2010	10:18	eastern red bat	Summer Time of Death
080210-ERBA-245-2	8 /2 /2010	10:18	eastern red bat	Summer Time of Death
080210-ERBA-014-1	8 /2 /2010	10:46	eastern red bat	Summer Time of Death
080210-HOBA-007-1	8 /2 /2010	11:14	hoary bat	Summer Time of Death
080210-ERBA-227-1	8 /2 /2010	11:34	eastern red bat	Summer Time of Death
080210-HOBA-224-1	8 /2 /2010	12:05	hoary bat	Summer Time of Death
080210-HOBA-414-2	8 /2 /2010	12:35	hoary bat	Summer Time of Death
080210-HOBA-414-3	8 /2 /2010	12:36	hoary bat	Summer Time of Death
080210-ERBA-414-1	8 /2 /2010	12:42	eastern red bat	Summer Time of Death
080210-ERBA-020-1	8 /2 /2010	13:26	eastern red bat	Summer Time of Death
080210-ERBA-112-1	8 /2 /2010	14:21	eastern red bat	Summer Time of Death
080210-ERBA-118-1	8 /2 /2010	14:40	eastern red bat	Summer Time of Death
080210-ERBA-118-2	8 /2 /2010	14:43	eastern red bat	Summer Time of Death
080210-ERBA-116-1	8 /2 /2010	15:23	eastern red bat	Summer Time of Death
080210-ERBA-047-2	8 /2 /2010	15:48	eastern red bat	Summer Time of Death
080210-HOBA-193-1	8 /2 /2010	17:53	hoary bat	Summer Time of Death
080310-ERBA-087-1	8 /3 /2010	16:30	eastern red bat	Summer Time of Death
080310-BBBA-453-1	8 /3 /2010	16:52	big brown bat	Not on Scheduled Search Turbine
080310-ERBA-453-2	8 /3 /2010	16:52	eastern red bat	Not on Scheduled Search Turbine
080410-ERBA-628-5	8 /4 /2010	10:15	eastern red bat	Summer Time of Death
080410-ERBA-113-1	8 /4 /2010	12:52	eastern red bat	Summer Time of Death
080410-HOBA-387-3	8 /4 /2010	14:29	hoary bat	Summer Time of Death
080510-ERBA-624-1	8 /5 /2010	08:56	eastern red bat	Not on Scheduled Search Turbine
080510-ERBA-624-2	8 /5 /2010	08:57	eastern red bat	Not on Scheduled Search Turbine
080510-HOBA-624-3	8 /5 /2010	08:57	hoary bat	Summer Time of Death
080510-ERBA-480-2	8 /5 /2010	10:30	eastern red bat	Unknown Time of Death
080510-ERBA-098-1	8 /5 /2010	10:52	eastern red bat	Summer Time of Death
080510-ERBA-371-1	8 /5 /2010	13:05	eastern red bat	Outside Plot Area
080610-HOBA-323-2	8 /6 /2010	09:40	hoary bat	Summer Time of Death
080610-ERBA-425-1	8 /6 /2010	14:01	eastern red bat	Summer Time of Death
080610-ERBA-459-2	8 /6 /2010	14:25	eastern red bat	Summer Time of Death
080810-ERBA-260-1	8 /8 /2010	10:27	eastern red bat	Unknown Time of Death
080810-ERBA-065-2	8 /8 /2010	10:52	eastern red bat	Outside Plot Area
080810-ERBA-092-1	8 /8 /2010	13:15	eastern red bat	Outside Plot Area
080910-ERBA-431-1	8 /9 /2010	13:30	eastern red bat	Not on Scheduled Search Turbine
081110-ERBA-337-1	8 /11/2010	12:28	eastern red bat	Not on Scheduled Search Turbine
081110-ERBA-337-2	8 /11/2010	12:28	eastern red bat	Not on Scheduled Search Turbine
081210-ERBA-321-1	8 /12/2010	14:17	eastern red bat	Outside Plot Area
081210-BBBA-321-2	8 /12/2010	14:18	big brown bat	Outside Plot Area
081310-HOBA-353-1	8 /12/2010	14:30	hoary bat	Not on Scheduled Search Turbine
081210-ERBA-104-1	8 /12/2010	15:36	eastern red bat	Not on Scheduled Search Turbine
081210-HOBA-104-2	8 /12/2010	15:41	hoary bat	Not on Scheduled Search Turbine
081310-HOBA-459-1	8 /13/2010	08:05	hoary bat	Outside Plot Area
081310-ERBA-014-1	8 /13/2010	09:32	eastern red bat	Outside Plot Area
081310-BBBA-643-2	8 /13/2010	09:35	big brown bat	Not on Scheduled Search Turbine

Appendix D. Carcasses found at Fowler Ridge Wind farm during spring and fall migration periods that are incidental and are not included in fatality estimates.

CarcassID	Date	Time	Species	Reason not Included in Fatality Estimates
081310-ERBA-643-4	8 /13/2010	09:35	eastern red bat	Not on Scheduled Search Turbine
081310-ERBA-643-3	8 /13/2010	09:35	eastern red bat	Not on Scheduled Search Turbine
081310-ERBA-643-5	8 /13/2010	09:35	eastern red bat	Not on Scheduled Search Turbine
081310-ERBA-643-1	8 /13/2010	09:35	eastern red bat	Not on Scheduled Search Turbine
081310-ERBA-003-1	8 /13/2010	13:18	eastern red bat	Outside Plot Area
081310-HOBA-003-2	8 /13/2010	13:19	hoary bat	Outside Plot Area
081310-ERBA-019-1	8 /13/2010	13:37	eastern red bat	Not on Scheduled Search Turbine
081310-HOBA-392-1	8 /13/2010	14:05	hoary bat	Not on Scheduled Search Turbine
081310-ERBA-045-1	8 /13/2010	14:29	eastern red bat	Outside Plot Area
081310-ERBA-374-1	8 /13/2010	14:57	eastern red bat	Outside Plot Area
081310-ERBA-632-1	8 /13/2010	15:04	eastern red bat	Not on Scheduled Search Turbine
081310-ERBA-632-2	8 /13/2010	15:05	eastern red bat	Not on Scheduled Search Turbine
081310-HOBA-632-3	8 /13/2010	15:06	hoary bat	Not on Scheduled Search Turbine
081310-ERBA-624-1	8 /13/2010	16:02	eastern red bat	Not on Scheduled Search Turbine
081310-BBBA-624-2	8 /13/2010	16:07	big brown bat	Not on Scheduled Search Turbine
081310-ERBA-624-3	8 /13/2010	16:13	eastern red bat	Not on Scheduled Search Turbine
081310-HOBA-624-4	8 /13/2010	16:21	hoary bat	Not on Scheduled Search Turbine
081310-ERBA-624-5	8 /13/2010	16:28	eastern red bat	Not on Scheduled Search Turbine
081310-BBBA-629-1	8 /13/2010	16:49	big brown bat	Not on Scheduled Search Turbine
081310-ERBA-629-2	8 /13/2010	16:56	eastern red bat	Not on Scheduled Search Turbine
081310-HOBA-319-1	8 /13/2010	16:58	hoary bat	Not on Scheduled Search Turbine
081310-HOBA-629-3	8 /13/2010	17:05	hoary bat	Not on Scheduled Search Turbine
081310-ERBA-339-1	8 /13/2010	17:29	eastern red bat	Outside Plot Area
081310-ERBA-625-1	8 /13/2010	17:31	eastern red bat	Outside Plot Area
081310-HOBA-637-1	8 /13/2010	17:38	hoary bat	Not on Scheduled Search Turbine
081310-ERBA-637-2	8 /13/2010	17:46	eastern red bat	Not on Scheduled Search Turbine
081310-ERBA-629-4	8 /13/2010	17:50	eastern red bat	Not on Scheduled Search Turbine
081410-HOBA-203-1	8 /14/2010	10:21	hoary bat	Outside Plot Area
081410-ERBA-156-1	8 /14/2010	14:14	eastern red bat	Outside Plot Area
081510-HOBA-417-1	8 /15/2010	08:05	hoary bat	Not on Scheduled Search Turbine
081510-ERBA-476-1	8 /15/2010	08:34	eastern red bat	Outside Plot Area
081310-ERBA-021-1	8 /15/2010	09:25	eastern red bat	Not on Scheduled Search Turbine
081510-ERBA-426-2	8 /15/2010	13:00	eastern red bat	Outside Plot Area
081610-ERBA-458-1	8 /16/2010	09:18	eastern red bat	Unknown Time of Death
081910-ERBA-281-3	8 /19/2010	13:31	eastern red bat	Unknown Time of Death
082010-ERBA-604-1	8 /20/2010	08:20	eastern red bat	Outside Plot Area
082010-ERBA-604-2	8 /20/2010	08:20	eastern red bat	Outside Plot Area
082010-ERBA-241-1	8 /20/2010	11:02	eastern red bat	Not on Scheduled Search Turbine
082010-HOBA-115-1	8 /20/2010	11:38	hoary bat	Outside Plot Area
082010-HOBA-102-1	8 /20/2010	11:48	hoary bat	Outside Plot Area
082110-ERBA-476-1	8 /21/2010	08:29	eastern red bat	Outside Plot Area
082110-ERBA-630-1	8 /21/2010	13:33	eastern red bat	Outside Plot Area
082210-ERBA-017-1	8 /22/2010	08:01	eastern red bat	Outside Plot Area
082210-ERBA-103-1	8 /22/2010	12:16	eastern red bat	Outside Plot Area
082310-ERBA-613-1	8 /23/2010	14:30	eastern red bat	Not on Scheduled Search Turbine
082410-SHBA-458-1	8 /24/2010	11:23	silver-haired bat	Unknown Time of Death

Appendix D. Carcasses found at Fowler Ridge Wind farm during spring and fall migration periods that are incidental and are not included in fatality estimates.

CarcassID	Date	Time	Species	Reason not Included in Fatality Estimates
082410-ERBA-349-1	8 /24/2010	16:05	eastern red bat	Not on Scheduled Search Turbine
082510-ERBA-311-1	8 /25/2010	13:33	eastern red bat	Not on Scheduled Search Turbine
082510-ERBA-438-1	8 /25/2010	13:50	eastern red bat	Not on Scheduled Search Turbine
082510-ERBA-438-2	8 /25/2010	13:50	eastern red bat	Not on Scheduled Search Turbine
082510-ERBA-438-3	8 /25/2010	13:55	eastern red bat	Not on Scheduled Search Turbine
082610-SHBA-469-1	8 /26/2010	14:54	silver-haired bat	Not on Scheduled Search Turbine
082610-ERBA-482-1	8 /26/2010	15:44	eastern red bat	Not on Scheduled Search Turbine
082610-HOBA-482-2	8 /26/2010	15:50	hoary bat	Not on Scheduled Search Turbine
082610-ERBA-477-1	8 /26/2010	16:00	eastern red bat	Outside Plot Area
082710-ERBA-387-2	8 /27/2010	10:11	eastern red bat	Outside Plot Area
082710-ERBA-464-1	8 /27/2010	13:59	eastern red bat	Outside Plot Area
082810-ERBA-107-1	8 /28/2010	08:35	eastern red bat	Outside Plot Area
082810-ERBA-014-1	8 /28/2010	09:32	eastern red bat	Outside Plot Area
082810-HOBA-081-1	8 /28/2010	11:08	hoary bat	Not on Scheduled Search Turbine
082810-ERBA-061-1	8 /28/2010	11:56	eastern red bat	Outside Plot Area
082810-ERBA-061-2	8 /28/2010	11:57	eastern red bat	Outside Plot Area
082810-ERBA-061-3	8 /28/2010	11:58	eastern red bat	Outside Plot Area
082910-ERBA-224-1	8 /29/2010	08:15	eastern red bat	Outside Plot Area
082910-SHBA-229-1	8 /29/2010	12:59	silver-haired bat	Outside Plot Area
082910-ERBA-622-2	8 /29/2010	14:25	eastern red bat	Outside Plot Area
082910-ERBA-622-1	8 /29/2010	14:27	eastern red bat	Outside Plot Area
082910-ERBA-629-1	8 /29/2010	15:39	eastern red bat	Not on Scheduled Search Turbine
083010-ERBA-459-2	8 /30/2010	08:40	eastern red bat	Outside Plot Area
083110-ERBA-624-1	8 /31/2010	07:39	eastern red bat	Not on Scheduled Search Turbine
083110-ERBA-403-1	8 /31/2010	16:42	eastern red bat	Not on Scheduled Search Turbine
090310-ERBA-625-2	9 /3 /2010	08:14	eastern red bat	Outside Plot Area
090310-HOBA-634-1	9 /3 /2010	08:37	hoary bat	Not on Scheduled Search Turbine
090510-ERBA-323-1	9 /5 /2010	09:50	eastern red bat	Outside Plot Area
090710-HOBA-389-1	9 /7 /2010	09:55	hoary bat	Not on Scheduled Search Turbine
091010-HOBA-637-1	9 /10/2010	12:05	hoary bat	Not on Scheduled Search Turbine
091410-SHBA-417-1	9 /14/2010	12:46	silver-haired bat	Not on Scheduled Search Turbine
091710-HOBA-249-1	9 /17/2010	14:02	hoary bat	Not on Scheduled Search Turbine
091810-SHBA-121-1	9 /18/2010	10:06	silver-haired bat	Outside Plot Area
091810-HOBA-026-1	9 /18/2010	13:39	hoary bat	Outside Plot Area
092010-HOBA-459-1	9 /20/2010	11:40	hoary bat	Outside Plot Area
092010-SHBA-117-1	9 /20/2010	17:10	silver-haired bat	Not on Scheduled Search Turbine
092410-ERBA-417-1	9 /24/2010	12:18	eastern red bat	Not on Scheduled Search Turbine
092410-SHBA-626-1	9 /24/2010	13:30	silver-haired bat	Not on Scheduled Search Turbine
092410-SHBA-626-2	9 /24/2010	13:32	silver-haired bat	Not on Scheduled Search Turbine
092410-ERBA-626-3	9 /24/2010	13:33	eastern red bat	Not on Scheduled Search Turbine
092410-ERBA-626-4	9 /24/2010	13:35	eastern red bat	Not on Scheduled Search Turbine
092610-ERBA-003-1	9 /26/2010	09:55	eastern red bat	Outside Plot Area
100310-SHBA-230-1	10/3 /2010	09:55	silver-haired bat	Outside Plot Area
101510-SHBA-352-1	10/15/2010	11:17	silver-haired bat	Outside Plot Area
Overall			**228 Carcasses**	

Appendix E. Turbine and cut-in speed treatment for carcasses found at Fowler Ridge Wind Energy Facility during 2010 surveys.

Turbine	Cut-in Treatment	Date	CarcassID	Species
3	control	8 /8 /2010	080810-ERBA-003-1	eastern red bat
3	control	9 /26/2010	092610-ERBA-003-1	eastern red bat
3	control	8 /13/2010	081310-HOBA-003-2	hoary bat
3	control	8 /13/2010	081310-ERBA-003-1	eastern red bat
4	control	No carcasses found		
6	5 m/s	8 /16/2010	081610-ERBA-006-2	eastern red bat
6	control	8 /16/2010	081610-HOBA-006-1	hoary bat
6	control	8 /24/2010	082410-ERBA-006-1	eastern red bat
6	6.5 m/s	9 /21/2010	092110-HOBA-006-1	hoary bat
6	5 m/s	9 /8 /2010	090810-HOBA-006-1	hoary bat
7	control	8 /22/2010	082210-ERBA-007-1	eastern red bat
7	control	8 /2 /2010	080210-HOBA-007-1	hoary bat
7	control	8 /8 /2010	080810-ERBA-007-1	eastern red bat
9	control	8 /28/2010	082810-HOBA-009-1	hoary bat
13	control	8 /2 /2010	080210-HOBA-013-1	hoary bat
14	control	8 /22/2010	082210-LBBA-014-1	little brown bat
14	control	9 /5 /2010	090510-ERBA-014-1	eastern red bat
14	control	8 /13/2010	081310-ERBA-014-1	eastern red bat
14	control	8 /8 /2010	080810-BBBA-014-1	big brown bat
14	control	8 /2 /2010	080210-ERBA-014-1	eastern red bat
14	control	10/3 /2010	100310-SHBA-014-1	silver-haired bat
14	control	8 /28/2010	082810-ERBA-014-1	eastern red bat
17	control	8 /22/2010	082210-ERBA-017-1	eastern red bat
19	control	8 /13/2010	081310-ERBA-019-1	eastern red bat
20	control	8 /2 /2010	080210-ERBA-020-1	eastern red bat
21	control	8 /15/2010	081310-ERBA-021-1	eastern red bat
24	control	8 /25/2010	082510-ERBA-024-1	eastern red bat
24	control	5 /4 /2010	050410-SHBA-24-1	silver-haired bat
24	5 m/s	9 /1 /2010	090110-HOBA-024-1	hoary bat
24	control	4 /26/2010	042610-SHBA-24-1	silver-haired bat
24	5 m/s	9 /18/2010	091810-SHBA-024-1	silver-haired bat
24	6.5 m/s	8 /4 /2010	080410-ERBA-024-1	eastern red bat
24	5 m/s	8 /30/2010	083010-ERBA-024-1	eastern red bat
26	control	8 /2 /2010	080210-ERBA-026-1	eastern red bat
26	control	9 /18/2010	091810-HOBA-026-1	hoary bat
26	control	4 /26/2010	042610-SHBA-26-1	silver-haired bat
26	control	5 /14/2010	051410-SHBA-26-1	silver-haired bat
30	control	No carcasses found		
31	control	No carcasses found		
33	control	10/9 /2010	100910-SHBA-033-1	silver-haired bat
33	control	8 /29/2010	082910-ERBA-033-1	eastern red bat
33	control	9 /16/2010	091610-SHBA-033-1	silver-haired bat
33	control	8 /28/2010	082810-ERBA-033-1	eastern red bat
33	control	9 /21/2010	092110-ERBA-033-1	eastern red bat
35	control	8 /8 /2010	080810-HOBA-035-1	hoary bat
38	control	No carcasses found		

Appendix E. Turbine and cut-in speed treatment for carcasses found at Fowler Ridge Wind Energy Facility during 2010 surveys.

Turbine	Cut-in Treatment	Date	CarcassID	Species
45	control	8 /8 /2010	080810-ERBA-045-1	eastern red bat
45	control	9 /11/2010	091110-ERBA-045-1	eastern red bat
45	control	8 /13/2010	081310-ERBA-045-1	eastern red bat
47	control	8 /8 /2010	080810-ERBA-047-1	eastern red bat
47	control	8 /13/2010	081310-BBBA-047-1	big brown bat
47	control	8 /2 /2010	080210-ERBA-047-1	eastern red bat
47	control	8 /2 /2010	080210-ERBA-047-2	eastern red bat
48	6.5 m/s	9 /16/2010	091610-HOBA-048-1	hoary bat
48	control	8 /5 /2010	080510-ERBA-048-1	eastern red bat
48	control	9 /14/2010	091410-ERBA-048-1	eastern red bat
48	control	8 /4 /2010	080410-ERBA-048-2	eastern red bat
48	control	8 /4 /2010	080410-ERBA-048-1	eastern red bat
48	6.5 m/s	9 /4 /2010	090410-SHBA-048-1	silver-haired bat
48	control	9 /8 /2010	090810-ERBA-048-1	eastern red bat
48	5 m/s	8 /27/2010	082710-ERBA-048-1	eastern red bat
48	5 m/s	8 /29/2010	082910-ERBA-048-1	eastern red bat
48	control	7 /31/2010	073110-ERBA-048-4	eastern red bat
48	control	7 /31/2010	073110-ERBA-048-1	eastern red bat
48	control	7 /31/2010	073110-ERBA-048-2	eastern red bat
48	control	8 /17/2010	081710-ERBA-048-1	eastern red bat
48	6.5 m/s	9 /5 /2010	090510-HOBA-048-1	hoary bat
48	5 m/s	9 /21/2010	092110-SHBA-048-1	silver-haired bat
48	control	7 /31/2010	073110-ERBA-048-3	eastern red bat
48	control	8 /19/2010	081910-ERBA-048-1	eastern red bat
48	control	8 /14/2010	081410-HOBA-048-1	hoary bat
48	control	8 /9 /2010	080910-ERBA-048-1	eastern red bat
50	control	8 /28/2010	082810-ERBA-050-1	eastern red bat
53	control	9 /26/2010	092610-SHBA-053-1	silver-haired bat
56	control	8 /17/2010	081710-ERBA-056-1	eastern red bat
56	control	8 /4 /2010	080410-ERBA-056-1	eastern red bat
56	control	8 /15/2010	081510-HOBA-056-1	hoary bat
56	control	9 /16/2010	091610-SHBA-056-1	silver-haired bat
56	control	9 /14/2010	091410-SHBA-056-1	silver-haired bat
56	control	8 /5 /2010	080510-ERBA-056-1	eastern red bat
56	control	9 /16/2010	091610-SHBA-056-2	silver-haired bat
56	control	10/6 /2010	100610-SHBA-056-1	silver-haired bat
56	control	8 /6 /2010	080610-ERBA-056-1	eastern red bat
56	control	9 /21/2010	092110-SHBA-056-1	silver-haired bat
56	control	10/12/2010	101210-HOBA-056-1	hoary bat
57	control	No carcasses found		
61	control	8 /28/2010	082810-ERBA-061-1	eastern red bat
61	control	8 /28/2010	082810-ERBA-061-2	eastern red bat
61	control	8 /28/2010	082810-ERBA-061-3	eastern red bat
61	control	4 /15/2010	041510-ERBA-61-1	eastern red bat
65	control	9 /26/2010	092610-SHBA-065-1	silver-haired bat
65	control	8 /8 /2010	080810-ERBA-065-2	eastern red bat

Appendix E. Turbine and cut-in speed treatment for carcasses found at Fowler Ridge Wind Energy Facility during 2010 surveys.

Turbine	Cut-in Treatment	Date	CarcassID	Species
65	control	8 /8 /2010	080810-HOBA-065-1	hoary bat
65	control	8 /2 /2010	080210-ERBA-065-1	eastern red bat
68	control	8 /13/2010	081310-ERBA-068-1	eastern red bat
73	5 m/s	8 /17/2010	081710-ERBA-073-1	eastern red bat
73	control	9 /16/2010	091610-SHBA-073-1	silver-haired bat
73	5 m/s	8 /15/2010	081510-ERBA-073-2	eastern red bat
73	6.5 m/s	8 /4 /2010	080410-ERBA-073-1	eastern red bat
75	control	8 /13/2010	081310-ERBA-075-1	eastern red bat
79	control	No carcasses found		
81	control	8 /28/2010	082810-HOBA-081-1	hoary bat
82	control	8 /22/2010	082210-ERBA-082-1	eastern red bat
83	control	10/9 /2010	100910-SHBA-083-1	silver-haired bat
83	5 m/s	8 /4 /2010	080410-ERBA-083-1	eastern red bat
83	control	10/12/2010	101210-ERBA-083-1	eastern red bat
83	5 m/s	8 /18/2010	081810-ERBA-083-1	eastern red bat
83	control	7 /31/2010	073110-HOBA-083-1	hoary bat
83	5 m/s	8 /7 /2010	080710-ERBA-083-1	eastern red bat
83	5 m/s	9 /21/2010	092110-ERBA-083-1	eastern red bat
85	control	8 /13/2010	081310-ERBA-085-1	eastern red bat
87	control	10/8 /2010	100810-ERBA-087-1	eastern red bat
87	control	9 /19/2010	091910-ERBA-087-2	eastern red bat
87	control	7 /31/2010	073110-ERBA-087-3	eastern red bat
87	control	9 /19/2010	091910-ERBA-087-1	eastern red bat
87	5 m/s	9 /12/2010	091210-SHBA-087-1	silver-haired bat
87	5 m/s	8 /5 /2010	080510-ERBA-087-1	eastern red bat
87	control	9 /14/2010	091410-SHBA-087-1	silver-haired bat
87	5 m/s	8 /4 /2010	080410-ERBA-087-2	eastern red bat
87	5 m/s	8 /4 /2010	080410-ERBA-087-3	eastern red bat
87	5 m/s	8 /4 /2010	080410-ERBA-087-1	eastern red bat
87	control	8 /3 /2010	080310-ERBA-087-1	eastern red bat
87	control	7 /31/2010	073110-ERBA-087-2	eastern red bat
87	control	7 /31/2010	073110-ERBA-087-1	eastern red bat
88	5 m/s	9 /12/2010	091210-ERBA-088-1	eastern red bat
88	5 m/s	9 /11/2010	091110-HOBA-088-1	hoary bat
88	6.5 m/s	10/1 /2010	100110-ERBA-088-1	eastern red bat
88	control	8 /12/2010	081210-ERBA-088-1	eastern red bat
88	control	8 /6 /2010	080610-ERBA-088-1	eastern red bat
88	5 m/s	9 /9 /2010	090910-SHBA-088-1	silver-haired bat
88	control	4 /26/2010	042610-SHBA-88-1	silver-haired bat
88	6.5 m/s	8 /24/2010	082410-SHBA-088-1	silver-haired bat
90	control	8 /8 /2010	080810-ERBA-090-1	eastern red bat
90	control	8 /22/2010	082210-ERBA-090-1	eastern red bat
92	control	8 /8 /2010	080810-ERBA-092-1	eastern red bat
92	control	8 /8 /2010	080810-ERBA-092-2	eastern red bat
95	6.5 m/s	8 /15/2010	081510-ERBA-095-2	eastern red bat
95	control	7 /31/2010	073110-ERBA-095-1	eastern red bat

Appendix E. Turbine and cut-in speed treatment for carcasses found at Fowler Ridge Wind Energy Facility during 2010 surveys.

Turbine	Cut-in Treatment	Date	CarcassID	Species
95	control	7 /31/2010	073110-ERBA-095-2	eastern red bat
95	6.5 m/s	8 /15/2010	081510-HOBA-095-1	hoary bat
95	6.5 m/s	8 /15/2010	081510-ERBA-095-3	eastern red bat
95	6.5 m/s	8 /6 /2010	080610-ERBA-095-1	eastern red bat
95	control	8 /24/2010	082410-SHBA-095-1	silver-haired bat
95	control	9 /22/2010	092210-HOBA-095-1	hoary bat
95	5 m/s	8 /24/2010	082410-BBBA-095-2	big brown bat
95	control	8 /18/2010	081810-ERBA-095-1	eastern red bat
95	6.5 m/s	8 /30/2010	083010-HOBA-095-1	hoary bat
95	5 m/s	8 /24/2010	082410-ERBA-095-3	eastern red bat
97	control	No carcasses found		
98	control	8 /15/2010	081510-ERBA-098-2	eastern red bat
98	control	10/13/2010	101310-ERBA-098-1	eastern red bat
98	control	8 /5 /2010	080510-ERBA-098-1	eastern red bat
98	control	10/15/2010	101510-ERBA-098-1	eastern red bat
98	control	8 /15/2010	081510-HOBA-098-1	hoary bat
98	control	9 /4 /2010	090410-HOBA-098-1	hoary bat
98	control	8 /7 /2010	080710-ERBA-098-1	eastern red bat
101	control	No carcasses found		
102	control	8 /20/2010	082010-HOBA-102-1	hoary bat
103	control	8 /22/2010	082210-ERBA-103-1	eastern red bat
104	control	8 /12/2010	081210-HOBA-104-2	hoary bat
104	control	8 /12/2010	081210-ERBA-104-1	eastern red bat
107	control	8 /28/2010	082810-ERBA-107-1	eastern red bat
107	control	9 /20/2010	092010-BBBA-107-1	big brown bat
112	control	9 /2 /2010	090210-ERBA-112-1	eastern red bat
112	control	8 /2 /2010	080210-ERBA-112-1	eastern red bat
113	5 m/s	8 /23/2010	082310-ERBA-113-2	eastern red bat
113	control	8 /14/2010	081410-ERBA-113-2	eastern red bat
113	5 m/s	10/1 /2010	100110-SHBA-113-1	silver-haired bat
113	5 m/s	9 /5 /2010	090510-HOBA-113-1	hoary bat
113	5 m/s	8 /23/2010	082310-ERBA-113-1	eastern red bat
113	control	8 /14/2010	081410-ERBA-113-1	eastern red bat
113	control	8 /4 /2010	080410-ERBA-113-1	eastern red bat
113	control	8 /11/2010	081110-ERBA-113-1	eastern red bat
113	control	4 /13/2010	041310-SHBA-113-1	silver-haired bat
113	control	8 /14/2010	081410-ERBA-113-3	eastern red bat
115	control	8 /20/2010	082010-HOBA-115-1	hoary bat
116	control	8 /2 /2010	080210-ERBA-116-1	eastern red bat
116	control	9 /11/2010	091110-HOBA-116-1	hoary bat
116	control	8 /20/2010	082010-ERBA-116-1	eastern red bat
117	control	9 /20/2010	092010-SHBA-117-1	silver-haired bat
118	control	8 /2 /2010	080210-ERBA-118-1	eastern red bat
118	control	8 /2 /2010	080210-ERBA-118-2	eastern red bat
121	control	9 /18/2010	091810-SHBA-121-1	silver-haired bat
123	control	7 /31/2010	073110-ERBA-123-1	eastern red bat

Appendix E. Turbine and cut-in speed treatment for carcasses found at Fowler Ridge Wind Energy Facility during 2010 surveys.

Turbine	Cut-in Treatment	Date	CarcassID	Species
123	5 m/s	8 /6 /2010	080610-ERBA-123-1	eastern red bat
123	control	8 /12/2010	081210-ERBA-123-1	eastern red bat
125	control	9 /11/2010	091110-SHBA-125-1	silver-haired bat
127	control	8 /8 /2010	080810-HOBA-127-1	hoary bat
129	control	No carcasses found		
147	control	8 /2 /2010	080210-ERBA-147-1	eastern red bat
147	5 m/s	10/7 /2010	100710-SHBA-147-1	silver-haired bat
147	5 m/s	8 /30/2010	083010-ERBA-147-1	eastern red bat
147	control	7 /31/2010	073110-ERBA-147-1	eastern red bat
147	control	8 /29/2010	082910-HOBA-147-1	hoary bat
152	control	9 /12/2010	091210-ERBA-152-2	eastern red bat
152	control	8 /14/2010	081410-ERBA-152-1	eastern red bat
152	control	9 /12/2010	091210-ERBA-152-1	eastern red bat
152	control	8 /8 /2010	080810-ERBA-152-1	eastern red bat
156	control	8 /14/2010	081410-ERBA-156-1	eastern red bat
156	control	8 /29/2010	082910-ERBA-156-1	eastern red bat
156	control	9 /3 /2010	090310-HOBA-156-1	hoary bat
173	control	8 /14/2010	081410-ERBA-173-1	eastern red bat
173	control	8 /8 /2010	080810-ERBA-173-1	eastern red bat
173	control	8 /29/2010	082910-ERBA-173-1	eastern red bat
173	control	8 /8 /2010	080810-ERBA-173-2	eastern red bat
193	control	8 /14/2010	081410-ERBA-193-1	eastern red bat
193	control	8 /7 /2010	080710-ERBA-193-1	eastern red bat
193	control	8 /7 /2010	080710-ERBA-193-2	eastern red bat
193	control	8 /2 /2010	080210-HOBA-193-1	hoary bat
195	5 m/s	9 /8 /2010	090810-SHBA-195-1	silver-haired bat
195	5 m/s	8 /23/2010	082310-ERBA-195-1	eastern red bat
195	control	10/7 /2010	100710-SHBA-195-1	silver-haired bat
198	control	8 /7 /2010	080710-HOBA-198-2	hoary bat
198	control	8 /7 /2010	080710-ERBA-198-1	eastern red bat
203	control	8 /14/2010	081410-ERBA-203-2	eastern red bat
203	control	8 /14/2010	081410-HOBA-203-1	hoary bat
203	control	8 /20/2010	082010-HOBA-203-1	hoary bat
216	control	8 /7 /2010	080710-ERBA-216-1	eastern red bat
216	control	9 /3 /2010	090310-HOBA-216-1	hoary bat
216	control	5 /4 /2010	050410-SHBA-216-1	silver-haired bat
218	control	9 /20/2010	092010-ERBA-218-1	eastern red bat
218	control	8 /31/2010	083110-ERBA-218-1	eastern red bat
218	5 m/s	9 /18/2010	091810-HOBA-218-1	hoary bat
218	5 m/s	9 /28/2010	092810-ERBA-218-1	eastern red bat
218	6.5 m/s	8 /8 /2010	080810-ERBA-218-1	eastern red bat
218	control	9 /20/2010	092010-SHBA-218-2	silver-haired bat
224	control	8 /29/2010	082910-ERBA-224-1	eastern red bat
224	control	8 /28/2010	082810-ERBA-224-1	eastern red bat
224	control	8 /14/2010	081410-ERBA-224-2	eastern red bat
224	control	8 /2 /2010	080210-HOBA-224-1	hoary bat

Appendix E. Turbine and cut-in speed treatment for carcasses found at Fowler Ridge Wind Energy Facility during 2010 surveys.

Turbine	Cut-in Treatment	Date	CarcassID	Species
224	control	8 /14/2010	081410-HOBA-224-1	hoary bat
227	control	8 /7 /2010	080710-ERBA-227-1	eastern red bat
227	control	8 /2 /2010	080210-ERBA-227-1	eastern red bat
227	control	8 /29/2010	082910-HOBA-227-1	hoary bat
229	control	8 /29/2010	082910-SHBA-229-1	silver-haired bat
229	control	8 /7 /2010	080710-ERBA-229-1	eastern red bat
229	control	8 /2 /2010	080210-ERBA-229-1	eastern red bat
229	control	9 /17/2010	091710-SHBA-229-1	silver-haired bat
230	control	8 /18/2010	081810-ERBA-230-1	eastern red bat
230	control	8 /22/2010	082210-ERBA-230-1	eastern red bat
230	control	8 /23/2010	082310-ERBA-230-1	eastern red bat
230	control	4 /21/2010	042110-HOBA-230-1	hoary bat
230	5 m/s	8 /14/2010	081410-HOBA-230-1	hoary bat
230	5 m/s	8 /13/2010	081310-HOBA-230-3	hoary bat
230	control	8 /4 /2010	080410-HOBA-230-1	hoary bat
230	5 m/s	8 /14/2010	081410-ERBA-230-2	eastern red bat
230	control	8 /4 /2010	080410-HOBA-230-2	hoary bat
230	control	8 /5 /2010	080510-ERBA-230-1	eastern red bat
230	control	7 /31/2010	073110-ERBA-230-2	eastern red bat
230	control	7 /31/2010	073110-ERBA-230-4	eastern red bat
230	control	7 /31/2010	073110-BBBA-230-1	big brown bat
230	control	10/3 /2010	100310-SHBA-230-1	silver-haired bat
230	control	8 /1 /2010	080110-ERBA-230-1	eastern red bat
230	control	7 /31/2010	073110-BBBA-230-3	big brown bat
230	control	8 /7 /2010	080710-ERBA-230-1	eastern red bat
230	5 m/s	8 /13/2010	081310-ERBA-230-1	eastern red bat
230	5 m/s	8 /13/2010	081310-ERBA-230-2	eastern red bat
232	control	9 /5 /2010	090510-ERBA-323-1	eastern red bat
241	control	8 /20/2010	082010-ERBA-241-1	eastern red bat
245	control	8 /29/2010	082910-BBBA-245-2	big brown bat
245	control	8 /2 /2010	080210-HOBA-245-3	hoary bat
245	control	9 /3 /2010	090310-ERBA-245-1	eastern red bat
245	control	8 /29/2010	082910-ERBA-245-1	eastern red bat
245	control	8 /7 /2010	080710-ERBA-245-2	eastern red bat
245	control	8 /2 /2010	080210-ERBA-245-1	eastern red bat
245	control	8 /2 /2010	080210-ERBA-245-2	eastern red bat
245	control	8 /7 /2010	080710-HOBA-245-1	hoary bat
245	control	8 /29/2010	082910-ERBA-245-3	eastern red bat
248	control	8 /29/2010	082910-ERBA-248-1	eastern red bat
248	control	8 /2 /2010	080210-ERBA-248-1	eastern red bat
248	control	8 /20/2010	082010-ERBA-248-1	eastern red bat
248	control	8 /2 /2010	080210-ERBA-248-2	eastern red bat
249	control	9 /17/2010	091710-HOBA-249-1	hoary bat
251	control	8 /23/2010	082310-ERBA-251-1	eastern red bat
251	control	5 /15/2010	051510-ERBA-251-2	eastern red bat
251	6.5 m/s	8 /20/2010	082010-ERBA-251-1	eastern red bat

Appendix E. Turbine and cut-in speed treatment for carcasses found at Fowler Ridge Wind Energy Facility during 2010 surveys.

Turbine	Cut-in Treatment	Date	CarcassID	Species
251	control	8 /12/2010	081210-ERBA-251-1	eastern red bat
251	control	5 /15/2010	051510-SHBA-251-1	silver-haired bat
251	5 m/s	10/7 /2010	100710-SHBA-251-1	silver-haired bat
253	control	8 /2 /2010	080210-ERBA-253-2	eastern red bat
253	control	8 /2 /2010	080210-HOBA-253-1	hoary bat
253	control	8 /7 /2010	080710-HOBA-253-1	hoary bat
253	control	9 /17/2010	091710-SHBA-253-1	silver-haired bat
254	control	8 /20/2010	082010-TRBA-254-1	tricolored bat
254	control	8 /14/2010	081410-ERBA-254-1	eastern red bat
260	control	8 /14/2010	081410-ERBA-260-1	eastern red bat
260	control	7 /31/2010	073110-ERBA-260-1	eastern red bat
260	5 m/s	9 /11/2010	091110-ERBA-260-1	eastern red bat
260	5 m/s	9 /8 /2010	090810-HOBA-260-1	hoary bat
260	control	4 /21/2010	042110-ERBA-260-1	eastern red bat
260	unknown	8 /8 /2010	080810-ERBA-260-1	eastern red bat
260	control	8 /12/2010	081210-ERBA-260-1	eastern red bat
260	control	8 /13/2010	081310-ERBA-260-1	eastern red bat
260	5 m/s	9 /14/2010	091410-SHBA-260-1	silver-haired bat
281	control	8 /19/2010	081910-HOBA-281-1	hoary bat
281	control	10/10/2010	101010-ERBA-281-1	eastern red bat
281	control	8 /20/2010	082010-HOBA-281-1	hoary bat
281	control	4 /16/2010	041610-ERBA-281-1	eastern red bat
281	control	9 /20/2010	092010-SHBA-281-1	silver-haired bat
281	control	8 /3 /2010	080310-HOBA-281-1	hoary bat
281	control	8 /23/2010	082310-BBBA-281-1	big brown bat
281	control	8 /19/2010	081910-ERBA-281-2	eastern red bat
281	control	8 /3 /2010	080310-ERBA-281-2	eastern red bat
281	control	9 /6 /2010	090610-HOBA-281-1	hoary bat
281	control	8 /4 /2010	080410-ERBA-281-1	eastern red bat
281	unknown	8 /19/2010	081910-ERBA-281-3	eastern red bat
281	control	9 /14/2010	091410-SHBA-281-1	silver-haired bat
281	control	9 /26/2010	092610-HOBA-281-1	hoary bat
281	control	8 /9 /2010	080910-ERBA-281-1	eastern red bat
281	control	9 /18/2010	091810-SHBA-281-1	silver-haired bat
281	control	8 /29/2010	082910-ERBA-281-1	eastern red bat
285	control	8 /1 /2010	080110-HOBA-285-1	hoary bat
286	control	8 /29/2010	082910-ERBA-286-1	eastern red bat
286	control	8 /1 /2010	080110-ERBA-286-1	eastern red bat
286	control	8 /20/2010	082010-ERBA-286-1	eastern red bat
305	control	No carcasses found		
309	control	7 /31/2010	073110-HOBA-309-1	hoary bat
309	control	8 /6 /2010	080610-ERBA-309-1	eastern red bat
309	control	8 /6 /2010	080610-ERBA-309-2	eastern red bat
311	control	8 /25/2010	082510-ERBA-311-1	eastern red bat
314	control	8 /5 /2010	080510-ERBA-314-2	eastern red bat
314	control	7 /30/2010	073010-BBBA-314-3	big brown bat

Appendix E. Turbine and cut-in speed treatment for carcasses found at Fowler Ridge Wind Energy Facility during 2010 surveys.

Turbine	Cut-in Treatment	Date	CarcassID	Species
314	control	8 /26/2010	082610-ERBA-314-1	eastern red bat
314	control	8 /4 /2010	080410-ERBA-314-4	eastern red bat
314	control	8 /6 /2010	080610-ERBA-314-1	eastern red bat
314	control	8 /4 /2010	080410-ERBA-314-3	eastern red bat
314	control	7 /30/2010	073010-ERBA-314-4	eastern red bat
314	control	8 /5 /2010	080510-ERBA-314-3	eastern red bat
314	control	8 /1 /2010	080110-ERBA-314-1	eastern red bat
314	control	8 /5 /2010	080510-ERBA-314-1	eastern red bat
314	control	8 /4 /2010	080410-ERBA-314-2	eastern red bat
314	control	8 /2 /2010	080210-HOBA-314-1	hoary bat
314	control	8 /4 /2010	080410-ERBA-314-1	eastern red bat
314	6.5 m/s	8 /24/2010	082410-ERBA-314-1	eastern red bat
314	control	7 /30/2010	073010-HOBA-314-2	hoary bat
314	control	7 /30/2010	073010-ERBA-314-1	eastern red bat
314	control	5 /15/2010	051510-HOBA-314-1	hoary bat
314	control	8 /24/2010	082410-ERBA-314-2	eastern red bat
314	control	8 /27/2010	082710-SHBA-314-1	silver-haired bat
314	control	5 /5 /2010	050510-SHBA-314-1	silver-haired bat
319	control	8 /13/2010	081310-HOBA-319-1	hoary bat
321	control	8 /12/2010	081210-ERBA-321-1	eastern red bat
321	control	8 /12/2010	081210-BBBA-321-2	big brown bat
322	control	No carcasses found		
323	control	4 /23/2010	042310-SHBA-323-2	silver-haired bat
323	control	8 /6 /2010	080610-ERBA-323-1	eastern red bat
323	6.5 m/s	9 /30/2010	093010-SHBA-323-1	silver-haired bat
323	control	8 /6 /2010	080610-HOBA-323-2	hoary bat
323	control	9 /20/2010	092010-HOBA-323-1	hoary bat
329	control	8 /14/2010	081410-ERBA-329-1	eastern red bat
329	control	8 /7 /2010	080710-ERBA-329-1	eastern red bat
334	control	4 /23/2010	042310-ERBA-334-1	eastern red bat
334	6.5 m/s	9 /1 /2010	090110-ERBA-334-1	eastern red bat
334	control	9 /23/2010	092310-SHBA-334-1	silver-haired bat
337	control	8 /11/2010	081110-ERBA-337-2	eastern red bat
337	control	8 /11/2010	081110-ERBA-337-1	eastern red bat
339	control	8 /13/2010	081310-ERBA-339-1	eastern red bat
339	control	7 /31/2010	073110-TRBA-339-1	tricolored bat
339	control	8 /15/2010	081510-HOBA-339-1	hoary bat
339	control	8 /6 /2010	080610-BBBA-339-1	big brown bat
339	control	7 /31/2010	073110-HOBA-339-2	hoary bat
348	control	No carcasses found		
349	control	8 /24/2010	082410-ERBA-349-1	eastern red bat
352	control	7 /31/2010	073110-ERBA-352-1	eastern red bat
352	control	7 /31/2010	073110-ERBA-352-2	eastern red bat
352	control	8 /15/2010	081510-ERBA-352-1	eastern red bat
352	control	10/15/2010	101510-SHBA-352-1	silver-haired bat
352	control	8 /15/2010	081510-ERBA-352-2	eastern red bat

Appendix E. Turbine and cut-in speed treatment for carcasses found at Fowler Ridge Wind Energy Facility during 2010 surveys.

Turbine	Cut-in Treatment	Date	CarcassID	Species
353	control	8 /12/2010	081310-HOBA-353-1	hoary bat
354	control	7 /31/2010	073110-BBBA-354-1	big brown bat
354	control	8 /21/2010	082110-ERBA-354-1	eastern red bat
354	control	9 /24/2010	092410-SHBA-354-1	silver-haired bat
355	control	7 /31/2010	073110-ERBA-355-1	eastern red bat
355	control	8 /6 /2010	080610-HOBA-355-1	hoary bat
369	control	8 /6 /2010	080610-ERBA-369-1	eastern red bat
369	control	8 /1 /2010	080110-SHBA-369-1	silver-haired bat
369	control	8 /1 /2010	080110-HOBA-369-2	hoary bat
371	5 m/s	8 /4 /2010	080410-ERBA-371-1	eastern red bat
371	5 m/s	9 /10/2010	091010-ERBA-371-1	eastern red bat
371	6.5 m/s	8 /29/2010	082910-HOBA-371-1	hoary bat
371	control	8 /5 /2010	080510-ERBA-371-1	eastern red bat
371	6.5 m/s	8 /25/2010	082510-HOBA-371-1	hoary bat
371	control	9 /13/2010	091310-SHBA-371-1	silver-haired bat
371	6.5 m/s	9 /23/2010	092310-ERBA-371-1	eastern red bat
371	5 m/s	8 /8 /2010	080810-SHBA-371-1	silver-haired bat
371	5 m/s	9 /9 /2010	090910-SHBA-371-1	silver-haired bat
371	control	7 /31/2010	073110-ERBA-371-2	eastern red bat
371	control	7 /31/2010	073110-ERBA-371-1	eastern red bat
371	control	10/8 /2010	100810-ERBA-371-1	eastern red bat
371	control	7 /31/2010	073110-ERBA-371-3	eastern red bat
374	control	8 /13/2010	081310-ERBA-374-1	eastern red bat
379	control	8 /6 /2010	080610-ERBA-379-1	eastern red bat
379	control	8 /27/2010	082710-ERBA-379-1	eastern red bat
379	control	8 /6 /2010	080610-ERBA-379-3	eastern red bat
379	control	8 /15/2010	081510-ERBA-379-1	eastern red bat
379	control	8 /6 /2010	080610-ERBA-379-2	eastern red bat
379	control	8 /6 /2010	080610-ERBA-379-4	eastern red bat
387	control	8 /4 /2010	080410-ERBA-387-1	eastern red bat
387	5 m/s	9 /15/2010	091510-ERBA-387-1	eastern red bat
387	control	8 /14/2010	081410-ERBA-387-1	eastern red bat
387	control	8 /27/2010	082710-ERBA-387-1	eastern red bat
387	control	8 /4 /2010	080410-ERBA-387-2	eastern red bat
387	control	8 /27/2010	082710-ERBA-387-2	eastern red bat
387	5 m/s	9 /3 /2010	090310-HOBA-387-1	hoary bat
387	control	4 /19/2010	041910-ERBA-387-1	eastern red bat
387	control	8 /4 /2010	080410-HOBA-387-3	hoary bat
388	control	8 /27/2010	082710-SHBA-388-2	silver-haired bat
388	control	7 /31/2010	073110-ERBA-388-1	eastern red bat
388	control	8 /21/2010	082110-ERBA-388-1	eastern red bat
388	control	8 /6 /2010	080610-ERBA-388-2	eastern red bat
388	control	8 /6 /2010	080610-ERBA-388-1	eastern red bat
388	control	8 /13/2010	081310-ERBA-388-1	eastern red bat
388	control	8 /27/2010	082710-HOBA-388-1	hoary bat
388	control	8 /27/2010	082710-ERBA-388-3	eastern red bat

Appendix E. Turbine and cut-in speed treatment for carcasses found at Fowler Ridge Wind Energy Facility during 2010 surveys.

Turbine	Cut-in Treatment	Date	CarcassID	Species
389	control	9 /7 /2010	090710-HOBA-389-1	hoary bat
390	control	8 /7 /2010	080710-ERBA-390-1	eastern red bat
390	control	8 /1 /2010	080110-ERBA-390-1	eastern red bat
392	control	8 /13/2010	081310-HOBA-392-1	hoary bat
396	control	7 /31/2010	073110-ERBA-396-4	eastern red bat
396	control	7 /31/2010	073110-ERBA-396-2	eastern red bat
396	control	7 /31/2010	073110-ERBA-396-3	eastern red bat
396	control	8 /13/2010	081310-ERBA-396-1	eastern red bat
396	control	8 /17/2010	081710-ERBA-396-3	eastern red bat
396	control	8 /17/2010	081710-ERBA-396-2	eastern red bat
396	control	8 /17/2010	081710-ERBA-396-1	eastern red bat
396	control	4 /29/2010	042910-ERBA-396-1	eastern red bat
396	control	8 /16/2010	081610-ERBA-396-1	eastern red bat
396	control	7 /31/2010	073110-ERBA-396-1	eastern red bat
396	control	7 /31/2010	073110-HOBA-396-5	hoary bat
397	control	8 /6 /2010	080610-ERBA-397-1	eastern red bat
397	control	8 /27/2010	082710-ERBA-397-1	eastern red bat
397	control	4 /19/2010	041910-ERBA-397-1	eastern red bat
398	control	8 /6 /2010	080610-HOBA-398-1	hoary bat
398	control	7 /31/2010	073110-ERBA-398-1	eastern red bat
401	control	9 /10/2010	091010-SHBA-401-2	silver-haired bat
401	control	8 /21/2010	082110-BBBA-401-1	big brown bat
401	control	8 /15/2010	081510-ERBA-401-1	eastern red bat
401	control	7 /31/2010	073110-HOBA-401-1	hoary bat
401	control	9 /10/2010	091010-SHBA-401-1	silver-haired bat
403	control	8 /31/2010	083110-ERBA-403-1	eastern red bat
407	control	8 /1 /2010	080110-ERBA-407-2	eastern red bat
407	control	8 /14/2010	081410-ERBA-407-2	eastern red bat
407	control	8 /1 /2010	080110-HOBA-407-1	hoary bat
414	control	8 /15/2010	081510-ERBA-414-2	eastern red bat
414	control	8 /15/2010	081510-ERBA-414-1	eastern red bat
414	control	8 /2 /2010	080210-HOBA-414-2	hoary bat
414	control	8 /7 /2010	080710-ERBA-414-1	eastern red bat
414	control	8 /29/2010	082910-HOBA-414-1	hoary bat
414	control	8 /6 /2010	080610-ERBA-414-1	eastern red bat
414	control	8 /2 /2010	080210-HOBA-414-3	hoary bat
414	control	8 /12/2010	081210-HOBA-414-1	hoary bat
414	control	8 /28/2010	082810-ERBA-414-1	eastern red bat
414	control	8 /24/2010	082410-ERBA-414-1	eastern red bat
414	control	8 /13/2010	081310-ERBA-414-1	eastern red bat
414	control	8 /21/2010	082110-ERBA-414-1	eastern red bat
414	control	8 /2 /2010	080210-ERBA-414-1	eastern red bat
414	control	10/13/2010	101310-SHBA-414-1	silver-haired bat
414	control	8 /12/2010	081210-ERBA-414-2	eastern red bat
414	control	8 /20/2010	082010-HOBA-414-1	hoary bat
414	control	9 /20/2010	092010-SHBA-414-2	silver-haired bat

Appendix E. Turbine and cut-in speed treatment for carcasses found at Fowler Ridge Wind Energy Facility during 2010 surveys.

Turbine	Cut-in Treatment	Date	CarcassID	Species
414	control	8 /11/2010	081110-ERBA-414-1	eastern red bat
414	control	8 /4 /2010	080410-ERBA-414-1	eastern red bat
414	control	8 /14/2010	081410-HOBA-414-1	hoary bat
417	control	8 /15/2010	081510-HOBA-417-1	hoary bat
417	control	9 /24/2010	092410-ERBA-417-1	eastern red bat
417	control	9 /14/2010	091410-SHBA-417-1	silver-haired bat
419	control	8 /6 /2010	080610-ERBA-419-1	eastern red bat
419	control	8 /21/2010	082110-ERBA-419-2	eastern red bat
419	control	8 /21/2010	082110-HOBA-419-3	hoary bat
419	control	9 /19/2010	091910-ERBA-419-1	eastern red bat
419	control	8 /21/2010	082110-HOBA-419-1	hoary bat
419	control	8 /15/2010	081510-ERBA-419-2	eastern red bat
419	control	8 /27/2010	082710-ERBA-419-1	eastern red bat
419	control	8 /15/2010	081510-ERBA-419-1	eastern red bat
420	control	8 /7 /2010	080710-ERBA-420-1	eastern red bat
420	control	8 /7 /2010	080710-ERBA-420-2	eastern red bat
420	control	9 /24/2010	092410-SHBA-420-1	silver-haired bat
420	control	8 /15/2010	081510-ERBA-420-1	eastern red bat
423	control	7 /31/2010	073110-ERBA-423-1	eastern red bat
425	control	7 /31/2010	073110-ERBA-425-1	eastern red bat
425	control	10/1 /2010	100110-SHBA-425-1	silver-haired bat
425	control	8 /6 /2010	080610-ERBA-425-1	eastern red bat
425	control	7 /31/2010	073110-ERBA-425-2	eastern red bat
426	control	8 /15/2010	081510-ERBA-426-2	eastern red bat
426	control	8 /15/2010	081510-ERBA-426-3	eastern red bat
426	control	8 /6 /2010	080610-ERBA-426-1	eastern red bat
426	control	7 /31/2010	073110-HOBA-426-1	hoary bat
426	control	8 /15/2010	081510-ERBA-426-1	eastern red bat
426	control	8 /6 /2010	080610-ERBA-426-2	eastern red bat
431	control	8 /9 /2010	080910-ERBA-431-1	eastern red bat
432	control	9 /10/2010	091010-ERBA-432-1	eastern red bat
438	control	8 /25/2010	082510-ERBA-438-3	eastern red bat
438	control	8 /25/2010	082510-ERBA-438-2	eastern red bat
438	control	8 /25/2010	082510-ERBA-438-1	eastern red bat
443	control	9 /4 /2010	090410-ERBA-443-1	eastern red bat
443	control	9 /10/2010	091010-HOBA-443-1	hoary bat
443	control	8 /6 /2010	080610-ERBA-443-1	eastern red bat
443	control	8 /15/2010	081510-ERBA-443-1	eastern red bat
448	control	8 /4 /2010	080410-ERBA-448-3	eastern red bat
448	control	7 /31/2010	073110-BBBA-448-1	big brown bat
448	control	8 /1 /2010	080110-ERBA-448-1	eastern red bat
448	control	8 /2 /2010	080210-ERBA-448-1	eastern red bat
448	control	8 /4 /2010	080410-ERBA-448-2	eastern red bat
448	control	8 /3 /2010	080310-ERBA-448-1	eastern red bat
448	control	9 /14/2010	091410-ERBA-448-1	eastern red bat
448	control	8 /8 /2010	080810-ERBA-448-1	eastern red bat

Appendix E. Turbine and cut-in speed treatment for carcasses found at Fowler Ridge Wind Energy Facility during 2010 surveys.

Turbine	Cut-in Treatment	Date	CarcassID	Species
448	control	8 /29/2010	082910-ERBA-448-1	eastern red bat
448	control	9 /7 /2010	090710-SHBA-448-1	silver-haired bat
448	control	8 /4 /2010	080410-BBBA-448-1	big brown bat
448	control	8 /8 /2010	080810-ERBA-448-2	eastern red bat
448	control	10/11/2010	101110-ERBA-448-1	eastern red bat
448	control	10/8 /2010	100810-SHBA-448-1	silver-haired bat
448	control	8 /21/2010	082110-HOBA-448-1	hoary bat
448	control	8 /13/2010	081310-HOBA-448-1	hoary bat
448	control	8 /28/2010	082810-ERBA-448-1	eastern red bat
448	control	10/1 /2010	100110-ERBA-448-1	eastern red bat
448	control	7 /31/2010	073110-HOBA-448-2	hoary bat
448	control	8 /6 /2010	080610-ERBA-448-1	eastern red bat
453	control	8 /3 /2010	080310-BBBA-453-1	big brown bat
453	control	8 /3 /2010	080310-ERBA-453-2	eastern red bat
454	control	7 /31/2010	073110-ERBA-454-2	eastern red bat
454	control	7 /31/2010	073110-HOBA-454-3	hoary bat
454	control	8 /6 /2010	080610-ERBA-454-1	eastern red bat
454	control	8 /27/2010	082710-HOBA-454-1	hoary bat
454	control	7 /31/2010	073110-ERBA-454-1	eastern red bat
458	control	9 /18/2010	091810-SHBA-458-1	silver-haired bat
458	unknown	8 /24/2010	082410-SHBA-458-1	silver-haired bat
458	control	4 /13/2010	041310-ERBA-458-1	eastern red bat
458	control	8 /1 /2010	080110-HOBA-458-2	hoary bat
458	unknown	8 /1 /2010	080110-ERBA-458-1	eastern red bat
458	unknown	8 /16/2010	081610-ERBA-458-1	eastern red bat
458	5 m/s	8 /28/2010	082810-ERBA-458-1	eastern red bat
458	control	9 /13/2010	091310-SHBA-458-1	silver-haired bat
458	5 m/s	8 /9 /2010	080910-HOBA-458-1	hoary bat
459	control	8 /13/2010	081310-HOBA-459-1	hoary bat
459	control	9 /30/2010	093010-SHBA-459-1	silver-haired bat
459	control	8 /20/2010	082010-ERBA-459-2	eastern red bat
459	control	9 /20/2010	092010-HOBA-459-1	hoary bat
459	control	8 /19/2010	081910-ERBA-459-1	eastern red bat
459	control	8 /14/2010	081410-ERBA-459-2	eastern red bat
459	control	8 /14/2010	081410-ERBA-459-1	eastern red bat
459	control	8 /19/2010	081910-ERBA-459-1	eastern red bat
459	control	8 /2 /2010	080210-HOBA-459-1	hoary bat
459	control	8 /14/2010	081410-ERBA-459-1	eastern red bat
459	control	8 /6 /2010	080610-ERBA-459-1	eastern red bat
459	control	9 /23/2010	092310-SHBA-459-1	silver-haired bat
459	control	10/15/2010	101510-ERBA-459-1	eastern red bat
459	control	10/13/2010	101310-ERBA-459-1	eastern red bat
459	control	8 /2 /2010	080210-ERBA-459-2	eastern red bat
459	control	8 /2 /2010	080210-ERBA-459-3	eastern red bat
459	control	4 /13/2010	041310-ERBA-459-1	eastern red bat
459	control	9 /23/2010	092310-SHBA-459-2	silver-haired bat

Appendix E. Turbine and cut-in speed treatment for carcasses found at Fowler Ridge Wind Energy Facility during 2010 surveys.

Turbine	Cut-in Treatment	Date	CarcassID	Species
459	control	8 /6 /2010	080610-ERBA-459-2	eastern red bat
459	control	10/15/2010	101510-ERBA-459-2	eastern red bat
459	control	8 /30/2010	083010-ERBA-459-2	eastern red bat
459	control	8 /21/2010	082110-HOBA-459-1	hoary bat
459	control	8 /20/2010	082010-HOBA-459-1	hoary bat
459	control	9 /6 /2010	090610-ERBA-459-1	eastern red bat
459	control	8 /4 /2010	080410-ERBA-459-2	eastern red bat
459	control	8 /4 /2010	080410-ERBA-459-1	eastern red bat
459	control	8 /2 /2010	080210-ERBA-459-4	eastern red bat
459	control	8 /1 /2010	080110-ERBA-459-2	eastern red bat
459	control	8 /1 /2010	080110-ERBA-459-1	eastern red bat
459	control	8 /26/2010	082610-ERBA-459-1	eastern red bat
459	control	8 /26/2010	082610-ERBA-459-3	eastern red bat
459	control	9 /6 /2010	090610-SHBA-459-2	silver-haired bat
459	control	8 /27/2010	082710-ERBA-459-1	eastern red bat
459	control	8 /11/2010	081110-ERBA-459-2	eastern red bat
459	control	8 /30/2010	083010-ERBA-459-1	eastern red bat
459	control	7 /31/2010	073110-BBBA-459-2	big brown bat
459	control	7 /31/2010	073110-HOBA-459-1	hoary bat
459	control	8 /26/2010	082610-ERBA-459-2	eastern red bat
459	control	8 /12/2010	081210-ERBA-459-1	eastern red bat
460	control	7 /31/2010	073110-HOBA-460-1	hoary bat
464	control	8 /27/2010	082710-ERBA-464-1	eastern red bat
469	control	8 /26/2010	082610-SHBA-469-1	silver-haired bat
476	control	8 /15/2010	081510-ERBA-476-2	eastern red bat
476	control	8 /7 /2010	080710-ERBA-476-2	eastern red bat
476	control	8 /7 /2010	080710-ERBA-476-3	eastern red bat
476	control	8 /15/2010	081510-ERBA-476-4	eastern red bat
476	control	8 /15/2010	081510-ERBA-476-3	eastern red bat
476	control	8 /1 /2010	080110-ERBA-476-5	eastern red bat
476	control	8 /1 /2010	080110-ERBA-476-6	eastern red bat
476	control	8 /7 /2010	080710-ERBA-476-1	eastern red bat
476	control	8 /15/2010	081510-ERBA-476-1	eastern red bat
476	control	8 /21/2010	082110-ERBA-476-1	eastern red bat
476	control	9 /18/2010	091810-ERBA-476-1	eastern red bat
477	control	8 /27/2010	082710-ERBA-477-1	eastern red bat
477	control	8 /21/2010	082110-ERBA-477-1	eastern red bat
477	control	8 /26/2010	082610-ERBA-477-1	eastern red bat
477	control	9 /10/2010	091010-HOBA-477-1	hoary bat
477	control	8 /15/2010	081510-ERBA-477-1	eastern red bat
478	control	8 /28/2010	082810-ERBA-478-1	eastern red bat
478	control	7 /31/2010	073110-ERBA-478-1	eastern red bat
478	control	8 /27/2010	082710-ERBA-478-1	eastern red bat
480	control	8 /11/2010	081110-ERBA-480-2	eastern red bat
480	control	8 /20/2010	082010-ERBA-480-1	eastern red bat
480	control	8 /11/2010	081110-ERBA-480-1	eastern red bat

Appendix E. Turbine and cut-in speed treatment for carcasses found at Fowler Ridge Wind Energy Facility during 2010 surveys.

Turbine	Cut-in Treatment	Date	CarcassID	Species
480	control	8 /11/2010	081110-ERBA-480-3	eastern red bat
480	control	4 /22/2010	042210-ERBA-480-1	eastern red bat
480	control	8 /9 /2010	080910-ERBA-480-1	eastern red bat
480	control	8 /13/2010	081310-ERBA-480-1	eastern red bat
480	control	8 /5 /2010	080510-ERBA-480-1	eastern red bat
480	control	8 /14/2010	081410-ERBA-480-1	eastern red bat
480	control	8 /30/2010	083010-ERBA-480-1	eastern red bat
480	control	7 /31/2010	073110-HOBA-480-1	hoary bat
480	6.5 m/s	9 /21/2010	092110-ERBA-480-1	eastern red bat
480	5 m/s	9 /22/2010	092210-SHBA-480-1	silver-haired bat
480	control	8 /2 /2010	080210-ERBA-480-1	eastern red bat
480	control	8 /4 /2010	080410-ERBA-480-1	eastern red bat
480	unknown	8 /5 /2010	080510-ERBA-480-2	eastern red bat
480	5 m/s	9 /23/2010	092310-HOBA-480-1	hoary bat
480	control	8 /13/2010	081310-HOBA-480-1	hoary bat
480	control	5 /1 /2010	050110-ERBA-480-1	eastern red bat
480	control	8 /4 /2010	080410-ERBA-480-1	eastern red bat
482	control	8 /26/2010	082610-HOBA-482-2	hoary bat
482	control	8 /26/2010	082610-ERBA-482-1	eastern red bat
602	control	8 /2 /2010	080210-ERBA-602-1	eastern red bat
602	control	8 /29/2010	082910-ERBA-602-1	eastern red bat
602	control	8 /7 /2010	080710-ERBA-602-1	eastern red bat
602	control	8 /20/2010	082010-HOBA-602-1	hoary bat
602	control	8 /2 /2010	080210-HOBA-602-2	hoary bat
603	control	8 /20/2010	082010-ERBA-603-2	eastern red bat
603	control	9 /11/2010	091110-HOBA-603-1	hoary bat
603	control	9 /14/2010	091410-SHBA-603-1	silver-haired bat
603	5 m/s	8 /16/2010	081610-ERBA-603-1	eastern red bat
603	control	8 /20/2010	082010-BBBA-603-1	big brown bat
603	5 m/s	8 /26/2010	082610-TRBA-603-1	tricolored bat
604	control	8 /20/2010	082010-ERBA-604-1	eastern red bat
604	control	8 /20/2010	082010-ERBA-604-2	eastern red bat
607	control	8 /14/2010	081410-ERBA-607-1	eastern red bat
607	control	8 /1 /2010	080110-ERBA-607-2	eastern red bat
607	control	8 /29/2010	082910-ERBA-607-2	eastern red bat
607	control	8 /7 /2010	080710-ERBA-607-3	eastern red bat
607	control	9 /12/2010	091210-SHBA-607-1	silver-haired bat
607	control	9 /17/2010	091710-ERBA-607-1	eastern red bat
607	control	8 /1 /2010	080110-HOBA-607-1	hoary bat
607	control	8 /7 /2010	080710-HOBA-607-2	hoary bat
607	control	8 /7 /2010	080710-HOBA-607-4	hoary bat
607	control	8 /29/2010	082910-HOBA-607-1	hoary bat
607	control	8 /7 /2010	080710-ERBA-607-1	eastern red bat
608	control	8 /1 /2010	080110-ERBA-608-1	eastern red bat
608	control	8 /1 /2010	080110-ERBA-608-2	eastern red bat
609	control	8 /7 /2010	080710-BBBA-609-1	big brown bat

Appendix E. Turbine and cut-in speed treatment for carcasses found at Fowler Ridge Wind Energy Facility during 2010 surveys.

Turbine	Cut-in Treatment	Date	CarcassID	Species
609	control	8 /13/2010	081310-BBBA-609-1	big brown bat
609	control	8 /12/2010	081210-ERBA-609-2	eastern red bat
609	control	8 /12/2010	081210-ERBA-609-1	eastern red bat
609	control	8 /1 /2010	080110-ERBA-609-1	eastern red bat
609	control	8 /13/2010	081310-ERBA-609-2	eastern red bat
610	control	4 /27/2010	042710-BBBA-610-1	big brown bat
611	control	10/2 /2010	100210-SHBA-611-1	silver-haired bat
611	control	9 /23/2010	092310-HOBA-611-1	hoary bat
611	control	8 /14/2010	081410-ERBA-611-1	eastern red bat
611	control	8 /20/2010	082010-HOBA-611-1	hoary bat
613	control	8 /23/2010	082310-ERBA-613-1	eastern red bat
614	control	9 /18/2010	091810-SHBA-614-1	silver-haired bat
614	6.5 m/s	8 /20/2010	082010-ERBA-614-1	eastern red bat
614	control	9 /18/2010	091810-ERBA-614-2	eastern red bat
614	control	4 /23/2010	042310-SHBA-614-3	silver-haired bat
614	control	9 /16/2010	091610-SHBA-614-1	silver-haired bat
614	control	9 /7 /2010	090710-SHBA-614-1	silver-haired bat
614	5 m/s	9 /6 /2010	090610-HOBA-614-1	hoary bat
614	5 m/s	9 /4 /2010	090410-SHBA-614-1	silver-haired bat
614	control	5 /7 /2010	050710-SHBA-614-1	silver-haired bat
616	control	9 /25/2010	092510-SHBA-616-1	silver-haired bat
616	control	10/2 /2010	100210-ERBA-616-1	eastern red bat
616	control	8 /1 /2010	080110-ERBA-616-1	eastern red bat
616	control	8 /1 /2010	080110-ERBA-616-2	eastern red bat
617	control	8 /2 /2010	080210-BBBA-617-1	big brown bat
620	control	8 /25/2010	082510-HOBA-620-1	hoary bat
620	control	8 /7 /2010	080710-ERBA-620-1	eastern red bat
620	control	8 /20/2010	082010-ERBA-620-1	eastern red bat
622	control	8 /1 /2010	080110-HOBA-622-1	hoary bat
622	control	8 /29/2010	082910-ERBA-622-2	eastern red bat
622	control	8 /1 /2010	080110-ERBA-622-4	eastern red bat
622	control	8 /1 /2010	080110-ERBA-622-2	eastern red bat
622	control	9 /12/2010	091210-ERBA-622-1	eastern red bat
622	control	8 /29/2010	082910-ERBA-622-1	eastern red bat
622	control	5 /13/2010	051310-ERBA-622-1	eastern red bat
622	control	8 /7 /2010	080710-BBBA-622-2	big brown bat
622	control	8 /7 /2010	080710-LBBA-622-1	little brown bat
622	control	8 /1 /2010	080110-HOBA-622-3	hoary bat
624	control	8 /13/2010	081310-HOBA-624-4	hoary bat
624	control	8 /31/2010	083110-ERBA-624-1	eastern red bat
624	control	8 /5 /2010	080510-HOBA-624-3	hoary bat
624	control	8 /5 /2010	080510-ERBA-624-2	eastern red bat
624	control	8 /13/2010	081310-ERBA-624-3	eastern red bat
624	control	8 /13/2010	081310-ERBA-624-1	eastern red bat
624	control	8 /5 /2010	080510-ERBA-624-1	eastern red bat
624	control	8 /13/2010	081310-ERBA-624-5	eastern red bat

Appendix E. Turbine and cut-in speed treatment for carcasses found at Fowler Ridge Wind Energy Facility during 2010 surveys.

Turbine	Cut-in Treatment	Date	CarcassID	Species
624	control	8 /13/2010	081310-BBBA-624-2	big brown bat
625	control	8 /13/2010	081310-ERBA-625-1	eastern red bat
625	control	9 /3 /2010	090310-ERBA-625-1	eastern red bat
625	control	8 /1 /2010	080110-HOBA-625-1	hoary bat
625	control	8 /19/2010	081910-HOBA-625-1	hoary bat
625	control	8 /1 /2010	080110-ERBA-625-1	eastern red bat
625	control	8 /1 /2010	080110-ERBA-625-3	eastern red bat
625	control	10/8 /2010	100810-SHBA-625-1	silver-haired bat
625	control	8 /19/2010	081910-HOBA-625-2	hoary bat
625	control	9 /13/2010	091310-ERBA-625-1	eastern red bat
625	control	9 /3 /2010	090310-ERBA-625-2	eastern red bat
625	control	9 /11/2010	091110-HOBA-625-1	hoary bat
625	control	8 /29/2010	082910-ERBA-625-1	eastern red bat
625	control	5 /5 /2010	050510-SHBA-625-1	silver-haired bat
625	control	8 /7 /2010	080710-ERBA-625-1	eastern red bat
625	control	8 /7 /2010	080710-ERBA-625-2	eastern red bat
626	control	9 /24/2010	092410-SHBA-626-2	silver-haired bat
626	control	9 /24/2010	092410-ERBA-626-4	eastern red bat
626	control	9 /24/2010	092410-SHBA-626-1	silver-haired bat
626	control	9 /24/2010	092410-ERBA-626-3	eastern red bat
627	control	8 /13/2010	081310-ERBA-627-1	eastern red bat
627	control	9 /25/2010	092510-SHBA-627-1	silver-haired bat
628	control	8 /27/2010	082710-ERBA-628-2	eastern red bat
628	control	8 /4 /2010	080410-ERBA-628-5	eastern red bat
628	control	8 /7 /2010	080710-BBBA-628-1	big brown bat
628	control	4 /18/2010	041810-ERBA-628-1	eastern red bat
628	control	4 /15/2010	041510-SHBA-628-1	silver-haired bat
628	control	7 /31/2010	073110-ERBA-628-5	eastern red bat
628	control	8 /6 /2010	080610-ERBA-628-1	eastern red bat
628	control	9 /21/2010	092110-SHBA-628-1	silver-haired bat
628	control	10/13/2010	101310-ERBA-628-1	eastern red bat
628	control	9 /2 /2010	090210-BBBA-628-1	big brown bat
628	control	8 /26/2010	082610-ERBA-628-2	eastern red bat
628	control	8 /25/2010	082510-ERBA-628-1	eastern red bat
628	control	8 /4 /2010	080410-ERBA-628-6	eastern red bat
628	control	9 /12/2010	091210-SHBA-628-1	silver-haired bat
628	control	9 /11/2010	091110-SHBA-628-1	silver-haired bat
628	control	8 /4 /2010	080410-ERBA-628-2	eastern red bat
628	control	8 /28/2010	082810-ERBA-628-1	eastern red bat
628	control	8 /1 /2010	080110-ERBA-628-1	eastern red bat
628	control	7 /31/2010	073110-ERBA-628-1	eastern red bat
628	control	9 /19/2010	091910-HOBA-628-1	hoary bat
628	control	8 /4 /2010	080410-ERBA-628-1	eastern red bat
628	control	7 /31/2010	073110-ERBA-628-2	eastern red bat
628	control	9 /2 /2010	090210-ERBA-628-2	eastern red bat
628	control	8 /26/2010	082610-ERBA-628-1	eastern red bat

Appendix E. Turbine and cut-in speed treatment for carcasses found at Fowler Ridge Wind Energy Facility during 2010 surveys.

Turbine	Cut-in Treatment	Date	CarcassID	Species
628	control	7 /31/2010	073110-ERBA-628-3	eastern red bat
628	control	5 /2 /2010	050210-SHBA-628-1	silver-haired bat
628	control	8 /4 /2010	080410-ERBA-628-3	eastern red bat
628	control	8 /4 /2010	080410-ERBA-628-4	eastern red bat
628	control	9 /4 /2010	090410-ERBA-628-1	eastern red bat
628	control	8 /14/2010	081410-ERBA-628-1	eastern red bat
628	control	9 /11/2010	091110-ERBA-628-2	eastern red bat
628	control	8 /31/2010	083110-ERBA-628-1	eastern red bat
628	control	8 /14/2010	081410-BBBA-628-2	big brown bat
628	control	7 /31/2010	073110-ERBA-628-4	eastern red bat
628	control	9 /13/2010	091310-SHBA-628-1	silver-haired bat
628	control	8 /3 /2010	080310-ERBA-628-1	eastern red bat
628	control	8 /19/2010	081910-HOBA-628-1	hoary bat
629	control	8 /13/2010	081310-BBBA-629-1	big brown bat
629	control	8 /29/2010	082910-ERBA-629-1	eastern red bat
629	control	8 /13/2010	081310-HOBA-629-3	hoary bat
629	control	8 /13/2010	081310-ERBA-629-2	eastern red bat
629	control	8 /13/2010	081310-ERBA-629-4	eastern red bat
630	control	8 /15/2010	081510-HOBA-630-1	hoary bat
630	control	9 /14/2010	091410-ERBA-630-1	eastern red bat
630	control	10/4 /2010	100410-SHBA-630-1	silver-haired bat
630	control	9 /7 /2010	090710-HOBA-630-1	hoary bat
630	control	8 /11/2010	081110-ERBA-630-1	eastern red bat
630	control	8 /19/2010	081910-ERBA-630-1	eastern red bat
630	control	8 /18/2010	081810-ERBA-630-1	eastern red bat
630	control	8 /29/2010	082910-ERBA-630-1	eastern red bat
630	control	10/1 /2010	100110-SHBA-630-1	silver-haired bat
630	control	8 /20/2010	082010-ERBA-630-1	eastern red bat
630	control	8 /21/2010	082110-ERBA-630-1	eastern red bat
630	control	8 /16/2010	081610-HOBA-630-1	hoary bat
630	control	8 /30/2010	083010-ERBA-630-1	eastern red bat
630	control	8 /26/2010	082610-ERBA-630-1	eastern red bat
630	control	8 /16/2010	081610-ERBA-630-1	eastern red bat
630	control	9 /30/2010	093010-SHBA-630-1	silver-haired bat
630	control	8 /26/2010	082610-ERBA-630-2	eastern red bat
631	control	10/13/2010	101310-SHBA-631-1	silver-haired bat
631	control	8 /1 /2010	080110-ERBA-631-1	eastern red bat
632	control	8 /13/2010	081310-HOBA-632-3	hoary bat
632	control	8 /13/2010	081310-ERBA-632-2	eastern red bat
632	control	8 /13/2010	081310-ERBA-632-1	eastern red bat
634	control	9 /3 /2010	090310-HOBA-634-1	hoary bat
635	control	8 /20/2010	082010-ERBA-635-1	eastern red bat
635	control	8 /7 /2010	080710-ERBA-635-1	eastern red bat
635	control	9 /12/2010	091210-ERBA-635-1	eastern red bat
635	control	8 /27/2010	082710-ERBA-635-1	eastern red bat
635	control	8 /20/2010	082010-ERBA-635-2	eastern red bat

Appendix E. Turbine and cut-in speed treatment for carcasses found at Fowler Ridge Wind Energy Facility during 2010 surveys.

Turbine	Cut-in Treatment	Date	CarcassID	Species
637	control	8 /13/2010	081310-ERBA-637-2	eastern red bat
637	control	8 /13/2010	081310-HOBA-637-1	hoary bat
637	control	9 /10/2010	091010-HOBA-637-1	hoary bat
639	control	8 /20/2010	082010-ERBA-639-1	eastern red bat
639	control	8 /13/2010	081310-BBBA-639-1	big brown bat
639	control	8 /7 /2010	080710-ERBA-639-1	eastern red bat
640	5 m/s	9 /18/2010	091810-INBA-640-2	Indiana bat
640	5 m/s	9 /16/2010	091610-ERBA-640-1	eastern red bat
640	control	4 /14/2010	041410-SHBA-640-1	silver-haired bat
640	control	4 /24/2010	042410-ERBA-640-1	eastern red bat
640	control	8 /28/2010	082810-ERBA-640-1	eastern red bat
640	6.5 m/s	9 /7 /2010	090710-SHBA-640-1	silver-haired bat
640	6.5 m/s	9 /6 /2010	090610-SHBA-640-1	silver-haired bat
640	control	8 /29/2010	082910-ERBA-640-1	eastern red bat
640	5 m/s	10/2 /2010	100210-SHBA-640-1	silver-haired bat
640	6.5 m/s	9 /7 /2010	090710-ERBA-640-1	eastern red bat
640	control	4 /26/2010	042610-SHBA-640-1	silver-haired bat
640	6.5 m/s	9 /13/2010	091310-ERBA-640-1	eastern red bat
640	5 m/s	9 /16/2010	091610-SHBA-640-2	silver-haired bat
640	5 m/s	9 /18/2010	091810-SHBA-640-1	silver-haired bat
640	control	9 /20/2010	092010-SHBA-640-1	silver-haired bat
640	control	8 /1 /2010	080110-HOBA-640-1	hoary bat
640	control	4 /20/2010	042010-SHBA-640-1	silver-haired bat
640	control	9 /22/2010	092210-HOBA-640-1	hoary bat
640	control	9 /23/2010	092310-ERBA-640-1	eastern red bat
640	control	9 /21/2010	092110-SHBA-640-1	silver-haired bat
640	control	9 /21/2010	092110-SHBA-640-2	silver-haired bat
640	control	7 /31/2010	073110-HOBA-640-2	hoary bat
640	control	7 /31/2010	073110-HOBA-640-1	hoary bat
640	control	8 /22/2010	082210-BBBA-640-1	big brown bat
642	control	10/13/2010	101310-ERBA-642-1	eastern red bat
642	control	8 /14/2010	081410-ERBA-642-1	eastern red bat
642	control	8 /1 /2010	080110-HOBA-642-1	hoary bat
643	control	8 /13/2010	081310-ERBA-643-1	eastern red bat
643	control	8 /13/2010	081310-ERBA-643-3	eastern red bat
643	control	8 /13/2010	081310-ERBA-643-5	eastern red bat
643	control	8 /13/2010	081310-ERBA-643-4	eastern red bat
643	control	8 /13/2010	081310-BBBA-643-2	big brown bat
650	control	7 /31/2010	073110-HOBA-640-3	hoary bat

Appendix F. Nightly weather variables recorded at casualty search turbines and one meteorological tower at the Fowler Ridge Wind Energy Facility

Date	mean. ws	var.ws	mean. at	var.at	mean. nat	var.nat	mean. hu	var.hu	mean. nhu	var.nh u	mean. wd	mean. bp	var.bp	range. bp	mean. nbp	var.nb p	range. nbp
08/01/10	3.7	0.8	20.3	1.3	20.1	0.1	83.1	19.7	81.2	14.4	52.3	970.0	1.8	5.7	971.1	0.7	5.7
08/02/10	2.4	1.2	24.2	3.1	24.3	0.9	64.5	33.9	63.9	4.7	96.4	973.6	0.3	2.9	973.9	0.2	2.9
08/03/10	4.2	4.2	25.9	2.3	25.4	1.0	67.6	56.9	72.8	32.0	194.9	974.0	0.9	4.1	973.6	0.5	3.7
08/04/10	4.8	3.1	27.8	8.7	28.5	2.5	80.7	97.3	83.7	47.7	235.1	971.3	2.4	6.1	970.2	0.3	2.2
08/05/10	3.6	2.5	25.9	5.8	24.8	1.7	78.7	98.6	83.8	49.6	315.8	969.9	1.3	5.3	969.6	0.2	3.2
08/06/10	6.9	1.6	24.7	8.8	22.6	3.7	60.6	146.0	59.2	26.6	329.5	969.8	1.8	5.3	970.3	1.3	5.3
08/07/10	2.3	1.3	23.8	2.8	23.3	1.2	53.2	55.7	55.1	19.1	319.4	973.4	0.6	4.3	973.7	0.3	4.3
08/08/10	6.5	3.2	24.7	3.3	24.2	2.6	57.3	49.5	60.2	33.5	203.9	972.7	1.1	4.2	972.1	0.2	2.3
08/09/10	7.1	1.4	25.7	5.0	25.2	2.1	65.7	21.8	68.4	4.9	183.9	971.4	1.2	5.4	971.4	0.5	3.9
08/11/10	2.5	2.1	28.1	4.3	28.3	1.6	71.5	48.1	70.8	15.7	176.8	972.7	1.2	5.9	972.0	0.8	3.9
08/12/10	3.0	1.1	28.5	4.6	28.2	2.5	63.4	66.2	64.2	45.9	342.7	970.0	0.8	4.2	969.8	0.2	2.3
08/13/10	4.1	1.4	28.7	4.0	27.7	3.7	63.4	73.5	65.4	81.4	107.7	969.7	0.7	3.0	969.3	0.3	2.0
08/14/10	4.9	4.3	27.4	12.1	25.3	8.7	68.5	115.2	73.9	81.0	197.8	968.3	1.3	4.9	967.9	0.8	3.9
08/15/10	3.5	2.6	26.7	4.2	27.1	1.6	71.6	78.0	70.3	40.9	202.3	970.2	0.4	3.0	970.4	0.3	3.0
08/16/10	8.2	1.9	25.5	8.3	23.0	2.6	57.3	99.5	52.8	14.5	312.7	972.6	3.2	6.9	974.1	1.1	6.9
08/17/10	3.9	1.3	23.8	2.7	23.5	1.0	44.8	70.0	44.5	9.1	282.6	976.5	0.4	-3.3	976.5	0.2	2.3
08/18/10	4.5	1.3	22.9	2.7	21.6	0.9	57.6	208.8	62.3	340.8	37.7	977.2	0.3	2.6	977.1	0.2	2.3
08/19/10	5.4	1.1	24.7	5.4	24.4	2.3	54.3	125.1	56.0	42.5	123.7	974.2	2.8	5.6	972.9	0.4	2.6
08/20/10	5.6	3.5	27.3	7.1	27.1	3.9	55.1	108.0	57.4	64.1	183.7	972.0	0.9	4.5	971.4	0.2	2.6
08/21/10	6.6	3.9	26.5	11.1	24.6	8.6	58.7	363.0	62.3	588.7	195.2	968.8	4.0	7.2	967.2	0.5	3.0
08/22/10	4.2	3.5	25.0	4.8	24.8	2.8	73.7	116.9	73.5	71.8	23.5	970.4	6.9	8.8	972.7	1.7	8.8
08/23/10	6.1	1.5	23.5	7.7	21.4	1.4	70.3	173.1	79.7	37.7	28.8	975.7	0.3	3.0	975.9	0.2	3.0
08/24/10	5.1	1.7	23.1	5.8	22.0	4.0	69.7	136.8	73.8	73.9	89.0	975.4	0.8	3.9	975.0	0.2	2.6
08/25/10	3.7	5.2	22.9	4.7	22.5	3.5	65.4	133.3	64.9	101.3	28.0	974.9	0.9	4.3	974.7	0.3	3.3
08/26/10	4.7	3.2	21.7	7.1	20.1	4.1	49.0	184.8	55.7	105.6	41.2	977.2	2.6	7.2	978.4	1.7	7.2
08/27/10	4.9	2.1	20.8	5.0	20.5	2.3	45.8	82.0	45.5	19.5	134.4	979.8	1.0	3.6	979.1	0.1	1.6
08/28/10	5.7	3.9	23.4	6.9	22.9	4.7	39.9	36.4	39.4	18.7	141.7	978.7	1.0	3.9	978.1	0.2	1.9
08/29/10	7.3	3.2	26.2	10.1	26.3	5.4	45.2	217.9	51.6	188.3	169.4	977.3	1.3	5.6	977.1	0.6	4.6
08/30/10	6.1	1.7	27.9	9.9	26.5	7.1	54.2	161.4	57.6	128.8	202.6	979.5	2.0	6.5	980.3	1.4	6.5
08/31/10	7.2	1.3	25.8	4.7	24.9	4.0	65.2	85.0	69.4	91.3	192.5	979.8	2.1	4.9	978.8	0.1	2.0
09/01/10	8.3	1.4	26.2	7.8	24.9	4.8	62.7	95.7	65.9	46.5	191.7	975.3	4.2	7.2	973.7	0.4	2.3
09/02/10	3.7	1.6	23.1	1.9	22.0	0.1	80.5	86.7	88.4	10.8	213.6	972.6	0.4	3.3	972.6	0.4	3.3
09/03/10	8.7	3.1	22.5	10.6	20.8	9.0	81.0	120.2	84.0	40.0	264.0	968.8	2.6	6.5	967.8	0.5	3.6
09/04/10	8.3	1.7	17.4	11.1	15.1	6.4	58.3	329.2	65.9	164.8	301.3	969.7	2.5	6.2	970.9	1.0	6.2
09/05/10	3.8	2.8	16.6	3.9	16.5	1.0	45.1	158.3	44.1	10.6	300.9	973.7	1.4	5.3	974.7	0.4	5.3
09/06/10	8.0	2.7	20.3	5.8	20.2	2.3	44.9	56.1	48.6	27.5	192.3	973.4	1.9	5.2	972.9	0.5	3.6
09/07/10	10.4	1.8	24.3	10.1	23.4	3.8	39.4	143.2	44.0	111.3	206.0	971.0	1.5	6.5	970.7	0.3	3.6
09/08/10	8.9	3.1	21.1	14.6	18.3	9.0	41.2	212.5	48.2	118.9	311.6	973.9	3.3	7.2	975.5	1.3	7.2

Appendix F. Nightly weather variables recorded at casualty search turbines and one meteorological tower at the Fowler Ridge Wind Energy Facility

Date	mean. ws	var.ws	mean. at	var.at	mean. nat	var.nat	mean. hu	var.hu	mean. nhu	var.nh u	mean. wd	mean. bp	var.bp	range. bp	mean. nbp	var.nb p	range. nbp
09/09/10	6.0	2.2	17.5	14.6	15.3	8.6	52.4	244.2	61.5	125.6	76.4	976.8	0.9	4.6	977.0	0.3	3.6
09/10/10	7.4	1.5	17.4	11.8	15.9	4.6	55.2	210.0	62.9	74.6	76.0	975.3	2.8	6.8	974.0	0.2	2.9
09/11/10	4.8	3.0	20.7	10.7	19.7	2.9	45.8	225.6	50.8	189.1	127.1	970.9	2.6	6.2	969.9	0.9	4.0
09/12/10	6.7	3.5	19.3	7.0	19.0	4.3	65.4	209.3	55.2	18.5	310.0	971.1	7.8	10.1	973.4	3.8	10.1
09/13/10	8.8	2.4	22.9	11.4	21.8	6.2	40.9	175.3	47.4	122.6	261.7	975.4	1.2	4.6	974.9	0.2	2.7
09/14/10	4.4	1.2	24.1	15.1	22.3	7.9	39.1	133.7	40.4	57.3	62.4	974.7	2.0	5.9	975.5	1.1	5.9
09/15/10	7.4	3.0	21.3	12.8	19.3	9.2	42.0	142.3	49.8	96.1	86.4	976.8	0.4	3.3	976.9	0.3	2.6
09/16/10	7.4	7.2	23.1	15.0	22.7	7.1	53.6	384.5	64.0	412.6	216.0	971.6	16.8	13.7	968.1	3.6	6.8
09/17/10	6.3	2.2	17.5	9.1	14.6	0.6	69.8	67.0	72.1	6.3	5.2	972.0	15.4	12.4	975.5	1.4	12.4
09/18/10	5.9	2.0	20.4	6.7	21.0	2.1	48.8	106.4	47.2	46.1	208.4	977.6	1.2	4.9	977.3	0.4	3.3
09/19/10	4.9	2.1	19.8	15.4	16.6	3.4	72.3	197.0	85.7	12.7	45.0	978.5	1.2	5.5	979.3	0.4	5.5
09/20/10	4.4	1.3	20.0	12.7	18.5	3.5	69.2	173.1	72.9	44.4	60.8	978.4	1.2	4.9	977.8	0.2	2.2
09/21/10	7.5	2.0	24.8	10.3	25.0	6.3	61.2	133.1	61.7	93.1	178.7	974.6	3.5	6.2	973.2	0.1	2.0
09/22/10	4.8	8.8	25.6	26.2	21.9	7.4	56.0	578.6	73.4	206.6	291.8	971.3	3.4	7.5	972.1	2.4	7.5
09/23/10	6.0	3.6	21.4	3.3	21.2	1.7	77.9	90.6	78.9	55.1	176.1	976.3	0.4	-3.6	976.4	0.4	3.3
09/24/10	11.6	2.5	27.5	9.8	26.4	1.7	45.8	150.2	46.8	16.7	208.9	971.4	4.4	8.5	970.0	1.3	3.6
09/25/10	7.9	1.7	18.6	13.2	15.7	7.3	63.3	130.1	64.0	62.8	301.6	973.1	5.2	9.5	975.1	0.6	9.5
09/26/10	4.7	1.8	13.1	7.5	11.0	0.1	69.3	242.7	81.3	27.8	33.5	977.1	0.5	3.6	977.2	0.4	3.6
09/27/10	6.3	2.3	12.5	3.2	11.4	0.9	61.7	107.0	63.5	11.2	47.9	975.9	1.6	4.9	975.1	0.5	2.6
09/28/10	3.8	1.8	16.0	4.2	17.0	0.0	45.4	53.0	42.0	0.0	340.0	969.3	6.4	9.1	967.4	1.6	3.9
09/29/10	4.9	2.4	17.7	5.0	16.3	1.9	37.7	102.9	42.4	80.9	93.1	967.5	2.3	6.1	968.8	0.5	6.1
09/30/10	4.3	1.7	20.7	8.1	20.5	3.2	39.4	180.8	44.7	108.3	281.4	968.3	2.1	5.6	967.7	0.2	2.7
10/01/10	5.4	5.2	17.6	11.2	14.8	1.2	53.2	206.8	61.1	13.9	28.9	972.5	12.5	11.4	975.7	2.8	11.4
10/02/10	5.9	7.7	17.5	11.0	16.5	10.4	46.4	354.5	50.9	414.6	292.6	974.9	4.9	8.8	973.4	1.2	4.9
10/03/10	7.4	2.8	9.5	5.0	7.5	1.0	76.2	75.8	77.9	48.2	10.3	978.7	8.3	9.8	981.3	1.2	9.8
10/04/10	5.7	2.7	9.5	3.8	8.4	1.1	52.9	69.4	58.6	11.6	37.9	984.2	0.9	4.5	984.9	0.3	4.5
10/05/10	3.9	2.3	10.8	6.2	10.0	1.1	51.1	203.7	59.3	44.5	16.0	985.2	0.9	4.9	985.2	0.3	4.2
10/06/10	4.9	4.9	15.2	7.8	15.2	2.0	34.6	172.7	33.0	27.3	326.5	983.3	3.8	7.1	981.9	0.9	3.2
10/07/10	8.7	3.8	18.7	13.0	18.0	7.3	43.6	188.0	52.6	111.3	309.3	974.9	7.0	9.5	973.2	1.0	4.9
10/08/10	5.5	3.6	20.0	9.0	19.7	3.1	29.6	283.3	24.3	22.5	321.5	977.0	0.5	3.9	977.1	0.1	3.3
10/09/10	7.1	3.2	22.3	6.7	21.5	2.9	24.2	66.9	29.4	30.4	264.4	975.8	2.1	5.2	974.9	0.2	2.3
10/10/10	5.6	1.9	25.3	10.1	24.9	3.4	34.7	26.4	34.8	7.6	282.7	974.0	1.1	4.6	973.7	0.1	2.6
10/11/10	5.1	4.6	24.9	7.3	23.4	5.6	32.6	61.5	35.0	79.0	267.8	970.8	3.0	6.1	969.8	0.1	2.2
10/12/10	4.1	1.7	23.7	8.4	22.6	6.7	35.5	147.4	38.5	164.1	333.2	968.9	1.2	4.6	969.3	0.4	4.2
10/13/10	3.2	1.8	21.5	12.7	20.0	7.0	47.9	170.4	51.0	102.5	129.5	971.8	0.6	4.2	972.4	0.2	4.2
10/14/10	6.8	3.1	14.2	3.8	12.7	1.4	63.8	215.1	55.2	178.0	342.2	975.7	1.7	5.2	976.9	0.2	5.2
10/15/10	10.0	3.5	14.0	6.5	13.1	3.4	38.2	169.4	44.3	147.0	290.2	971.1	20.2	14.7	967.4	3.6	6.5

Appendix G. Wind energy facilities in North America with activity and fatality data for bat species, grouped by geographic region. Bat activity estimates are included where available. To date, no studies or bat fatality estimates from southeastern facilities have been made public.

Wind Energy Facility	Bat Activity Estimate[A]	Fatality Estimate[B]	No. of Turbines	Total MW
Fowler, IN (2009)		8.09	162	301
Fowler, IN (2010)	***15.06***	***13.10***	***355***	***599***
	Midwest			
Blue Sky Green Field, WI	7.7[D]	24.57	88	145
Top of Iowa, IA (2004)	34.9[C]	10.27	89	80
Top of Iowa, IA (2003)	34.9[C]	7.16	89	80
Kewaunee County, WI		6.55	31	20
Ripley, Ont.		4.67	38	76
Buffalo Ridge, MN (Phases II&III; 2001)	2.2	4.03	281	210.75
Crescent Ridge, IL		3.27	33	49.5
Buffalo Ridge, MN (Phase III; 1999)		2.72	138	103.5
Buffalo Ridge, MN (Phase II; 1999)		2.59	143	107.25
Buffalo Ridge, MN (Phase II; 1998)		2.16	143	107.25
Grand Ridge, IL		2.10	66	99
Buffalo Ridge, MN (Phases II&III; 2002)	1.9	1.73	281	210.75
NPPD Ainsworth, NE		1.16	36	59.4
Buffalo Ridge, MN (Phase I; 1999)		0.76	73	25
	Rocky Mountains			
Summerview, Alb. (2006)	5.3	14.62	39	70.2
Summerview, Alb. (2005/2006)		10.27	39	70.2
Judith Gap, MT		8.93	90	135
Summerview, Alb. (2007)		8.23	39	70.2
Foote Creek Rim, WY (Phase I; 1999)		3.97	69	41.4
Foote Creek Rim, WY (Phase I; 2001/2002)		1.57	69	41.4
Foote Creek Rim, WY (Phase I; 2000)	2.2	1.05	69	41.4
	Western			
Stateline, OR/WA (2003)		2.52	454	300
High Winds, CA (2004)		2.51	90	162
Nine Canyon, WA		2.47	37	48
Dillon, CA		2.17	45	45
Biglow Canyon I, OR (2008)		1.99	76	125.4
Leaning Juniper, OR		1.98	67	100.5
Big Horn, WA		1.90	133	199.5
Combine Hills, OR		1.88	41	41
High Winds, CA (2005)		1.52	90	162
Stateline, OR/WA (2002)		1.20	454	300
Vansycle, OR		1.12	38	24.9
Klondike, OR		0.77	16	24
Hopkins Ridge, WA		0.63	83	150
Biglow Canyon I, OR (2009)		0.58	76	125.4
Klondike II, OR		0.41	50	75
Wild Horse, WA		0.39	127	229
Marengo II, WA		0.27	39	70.2
Marengo I, WA		0.17	78	140.4
SMUD, CA		0.07		15
Alta-Oak Creek Mojave, CA	2.5			

Appendix G. Wind energy facilities in North America with activity and fatality data for bat species, grouped by geographic region. Bat activity estimates are included where available. To date, no studies or bat fatality estimates from southeastern facilities have been made public.

Wind Energy Facility	Bat Activity Estimate[A]	Fatality Estimate[B]	No. of Turbines	Total MW
Southern Plains				
Oklahoma Wind Energy Center, OK		0.53	68	102
Buffalo Gap, TX		0.10	67	134
Northeastern				
Buffalo Mountain, TN (2006)		39.70	18	29
Mountaineer, WV	38.3	31.69	44	66
Buffalo Mountain, TN (2000-2003)	23.7	31.54	3	2
Cassleman, PA		18.91	23	34.5
Meyersdale, PA		18.00	20	30
Cohocton/Dutch Hill, NY		16.02	50	125
Casselman, PA (Curtailment)		15.66	23	34.5
Maple Ridge, NY (2006)		15.00	120	198
Noble Bliss, NY (2008)		14.66	67	100
Mount Storm, WV (2008)	35.2	12.11	82	164
Maple Ridge, NY (2007)		9.42	195	321.75
Noble Clinton, NY (2009)		6.48	67	100
Wolfe Island, Ont.		6.42	86	197.8
Noble Bliss, NY (2009)		5.50	67	100
Noble Ellenburg, NY (2008)		5.45	54	80
Noble Ellenburg, NY (2009)		5.34	54	80
Noble Clinton, NY (2008)		3.63	67	100.5
Mars Hill, ME (2007)		2.91	28	42
Stetson Mountain, ME	0.30	1.40	38	57
Munnsville, NY		0.46	23	34.5
Mars Hill, ME (2008)		0.45	28	42

A=bat passes per detector-night
B=number of bats fatalities per megawatt per study period
C=averaged across phases and/or study years, and may not be directly related to fatality estimates
D=bat activity not measured concurrently with bat fatality studies

Appendix G. Wind energy facilities in North America with activity and fatality data for bat species, grouped by geographic region. Bat activity estimates are included where available. To date, no studies or bat fatality estimates from southeastern facilities have been made public.

Data from the following sources:

Facility	Activity Estimate	Fatality Estimate	Facility	Activity Estimate	Fatality Estimate
Blue Sky Green Field, WI	Gruver 2008	Gruver et al. 2009	Klondike, OR		Johnson et al. 2003
Top of Iowa, IA (2004)	Jain 2005	Jain 2005	Hopkins Ridge, WA		Young et al. 2007
Top of Iowa, IA (2003)	Jain 2005	Jain 2005	Biglow Canyon I, (09)		Enk et al. 2010
Kewaunee County, WI		Howe et al. 2002	Klondike II, OR		NWC and WEST 2007
Ripley, Ont.		Jacques Whitford 2009	Wild Horse, WA		Erickson et al. 2008
Buffalo Ridge, MN (Phase II& III; 01)	Johnson et al. 2004	Johnsonet al. 2004	Marengo II, WA		URS Corporation 2010b
Crescent Ridge, IL		Kerlinger et al. 2007	Marengo I, WA		URS Corporation 2010a
Buffalo Ridge, MN (Phase III; 99)		Johnsonet al. 2004	SMUD, CA		URS et al. 2005
Buffalo Ridge, MN (Phase II; 99)		Johnsonet al. 2004	Alta-Oak Creek Mojave, CA	Erickson et al. 2009	
Buffalo Ridge, MN (Phase II; 98)		Johnsonet al. 2004	Oklahoma Wind Energy Center, OK		Piorkowski 2006
Grand Ridge, IL		Derby et al. 2010	Buffalo Gap, TX		Tierney 2007
Buffalo Ridge, MN (Phase II& III; 02)	Johnsonet al. 2004	Johnsonet al. 2004	Buffalo Mountain, TN (06)		Fiedler et al. 2007
NPPD Ainsworth, NE		Derby et al. 2007	Mountaineer, WV	Arnett (pers comm. 2005)	Kerns and Kerlinger 2004
Buffalo Ridge, MN (Phase I; 99)		Johnson et al. 2000	Buffalo Mountain, TN (00-03)	Fiedler 2004	Nicholson et al. 2005
Summerview, Alb. (06)	Baerwald 2008	Baerwald 2008	Casselman, PA		Arnett et al. 2009b
Summerview, Alb. (05/06)		Brown and Hamilton 2006	Meyersdale, PA		Arnett et al. 2005
Judith Gap, MT		TRC 2008	Cohocton/Dutch Hill, NY		Stantec 2010
Summerview, Alb. (07)		Baerwald 2008	Casselman, PA (Curtailment)		Arnett et al. 2009a
Foote Creek Rim, WY (Phase I; 99)		Young et al. 2003	Maple Ridge, NY (06)		Jain et al. 2007
Foote Creek Rim, WY (Phase I; 01/02)		Younget al. 2003	Noble Bliss, NY (08)		Jain et al. 2009c
Foote Creek Rim, WY (Phase I; 00)	Gruver 2002	Younget al. 2003	Mount Storm, WV (08)	Young et al. 2009	Younget al. 2009
Stateline, OR/WA (03)		Erickson et al. 2004	Maple Ridge, NY (07)		Jain et al. 2008
High Winds, CA (04)		Kerlinger et al. 2006	Noble Clinton, NY (09)		Jain et al. 2010b
Nine Canyon, WA		Erickson et al. 2003	Wolfe Island, Ont.		Stantec, Ltd. 2010
Dillon, CA		Chatfield et al. 2009	Noble Bliss, NY (09)		Jain et al. 2010a
Biglow Canyon I, OR (08)		Jeffrey et al. 2009	Noble Ellenburg, NY (08)		Jain et al. 2009a
Leaning Juniper, OR		Gritski et al. 2008	Noble Ellenburg, NY (09)		Jain et al. 2010c
Big Horn, WA		Kronner et al. 2008	Noble Clinton, NY (08)		Jain et al. 2009b
Combine Hills, OR		Young et al. 2006	Mars Hill, ME (07)		Stantec 2008a
High Winds, CA (05)		Kerlingeret al. 2006	Stetson Mountain, ME	Stantec 2009b	Stantec 2009b
Stateline, OR/WA (02)		Ericksonet al. 2004	Munnsville, NY		Stantec 2008b
Vansycle, OR		Erickson et al. 2000	Mars Hill, ME (08)		Stantec 2009a

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