

**Post-construction Monitoring Study for the  
Rosewater Wind Farm  
White County, Indiana**

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**Final Report  
April 1 – October 15, 2021**



**Prepared for:**  
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## EXECUTIVE SUMMARY

Rosewater Wind Farm, LLC is operating the Rosewater Wind Farm (Project) in White County, Indiana. The Project became operational in 2020 and consists of 20, 4.2 megawatt (MW) Vestas V136 wind turbines that have a 105-meter (m; 344-foot [ft]) hub height and a 150-m (492-ft) rotor diameter, and five, 3.6 MW Vestas V150 3.6 MW wind turbines that have a 105-m hub height and a 136-m (446-ft) rotor diameter. This report details the post-construction monitoring studies conducted in 2021, consistent with Section 6.6 of the Project's Habitat Conservation Plan (HCP) and the Incidental Take Permit (ITP; ESPE0003552) for Indiana bats and northern long-eared bats (Covered Species). Turbines were feathered below manufacturer cut-in speed in the spring, and 5.0 m (16.4 ft) per second in fall to minimize impacts to Covered Species.

Post-construction monitoring was completed in accordance with the study plan, which was approved by the US Fish and Wildlife Service (USFWS) on March 10, 2021. The study plan was designed to achieve a probability of detection, or  $g$ , of 0.20. The overall goal of this post-construction fatality monitoring study was to generate fatality estimates for the Covered Species and to evaluate compliance with the incidental take authorization granted under the Project's ITP. More specifically, the objectives of this study were to: 1) estimate take of Covered Species using the Evidence of Absence (EoA) framework as outlined in the HCP, 2) provide the necessary data to determine if adaptive management is triggered, and 3) determine overall bat fatality rates for the study, as requested by the USFWS for the first year of monitoring.

Standardized carcass searches were completed for bat carcasses at three plot types: cleared plots, uncleared plots, and roads and pads. Technicians searched all 25 turbines as roads and pads to a distance of 100 m (328 ft) from the turbine, every other week during spring (April 1 – May 15). In the fall (August 1 – October 15), a technician searched 17 turbines as roads and pads to a distance of 100 m from the turbine, weekly. Dog-handler teams searched four turbines as cleared plots with a 70-m (230-ft) radius and four turbines as uncleared plots with a 70 m-radius, twice weekly during the fall. Searcher efficiency and carcass persistence trials were also conducted during each season to correct for detection and scavenger bias.

No Covered Species were found at the Project. Four hundred seven bats were found during the study. The most commonly found bat species were silver-haired bat (41.52%) and eastern red bat (33.91%), followed by hoary bat (15.97%) and big brown bat (6.88%). One tri-colored bat, a state-endangered species, was recorded at the Project on August 26, 2021. Four evening bats, which are also state-endangered, were documented at the Project on August 2, September 2, September 6, and September 28, 2021. The overall bat fatality rate, calculated using a generalized estimator of fatality (commonly, GenEst), was 12.57 bats per MW (90% confidence interval [CI]: 9.75–21.15).

The overall  $g$  value was 0.26 (90% CI: 0.25–0.28). The EoA model estimated the mean annual fatality rate at the Project was 1.9 Indiana bats and 1.9 northern long-eared bats. No adaptive management was triggered.

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## **REPORT REFERENCE**

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## **INTRODUCTION**

Rosewater Wind Farm, LLC (Rosewater), a subsidiary of Northern Indiana Public Service Company, is operating the Rosewater Wind Farm (Project) in White County, Indiana. Rosewater obtained an Incidental Take Permit (ITP; ESPE0003552) for the federally listed as endangered Indiana bat (*Myotis sodalis*) and the federally listed as threatened northern long-eared bat (*M. septentrionalis*; hereafter Covered Species) from the US Fish and Wildlife Service (USFWS) dated March 8, 2021. Compliance monitoring is required by the ITP to determine if the level of take is in compliance with the authorized take and to evaluate the need for adaptive management measures.

Western EcoSystems Technology, Inc. (WEST) completed a post-construction monitoring study designed to achieve a probability of detection, or *g*, of 0.20. The objectives of this study were to: 1) estimate take of Covered Species using the Evidence of Absence (EoA) framework as outlined in the Habitat Conservation Plan (HCP), 2) provide the necessary data to determine if adaptive management is triggered, and 3) determine overall bat fatality rates for the study as requested by the USFWS for the first year of monitoring. This report presents the results of the post-construction fatality monitoring conducted within the Project from April 1 – May 15 and August 1 – October 15, 2021.

## **STUDY AREA**

The Project is located in White County, Indiana, 1.6 kilometers (1.0 mile) northwest of Reynolds, Indiana (Figure 1). The Project's Permit Area, defined as the Project's leased lands in which all turbines are located, covers approximately 2,582 hectares (6,381 acres). Approximately 98% of the Permit Area is composed of cultivated cropland and developed areas (Table 1).

The Project became fully operational in December 2020, and consists of 20, 4.2 megawatt (MW) Vestas V136 wind turbines that have a 105-meter (m; 344-foot [ft]) hub height and a 150-m (492-ft) blade length, and five, 3.6 MW Vestas V150 3.6 MW wind turbines that have a 105-m hub height and a 136-m (446-ft) blade length. All turbines are within the migratory range of the Covered Species. During the spring migration period (April 1 – May 15), Rosewater feathered blades on nights when temperatures were above 10 degrees Celsius (°C; 50° Fahrenheit) and wind speeds were below the manufacturer's minimum speed of 3.0 m per second (mps; 9.8 ftps); during the fall migration (August 1 – October 15), Rosewater feathered turbine blades when wind speeds were below 5.0 mps (16.4 ftps) on nights when temperatures were above 10°C at all turbines to minimize impacts to the Covered Species during migration.

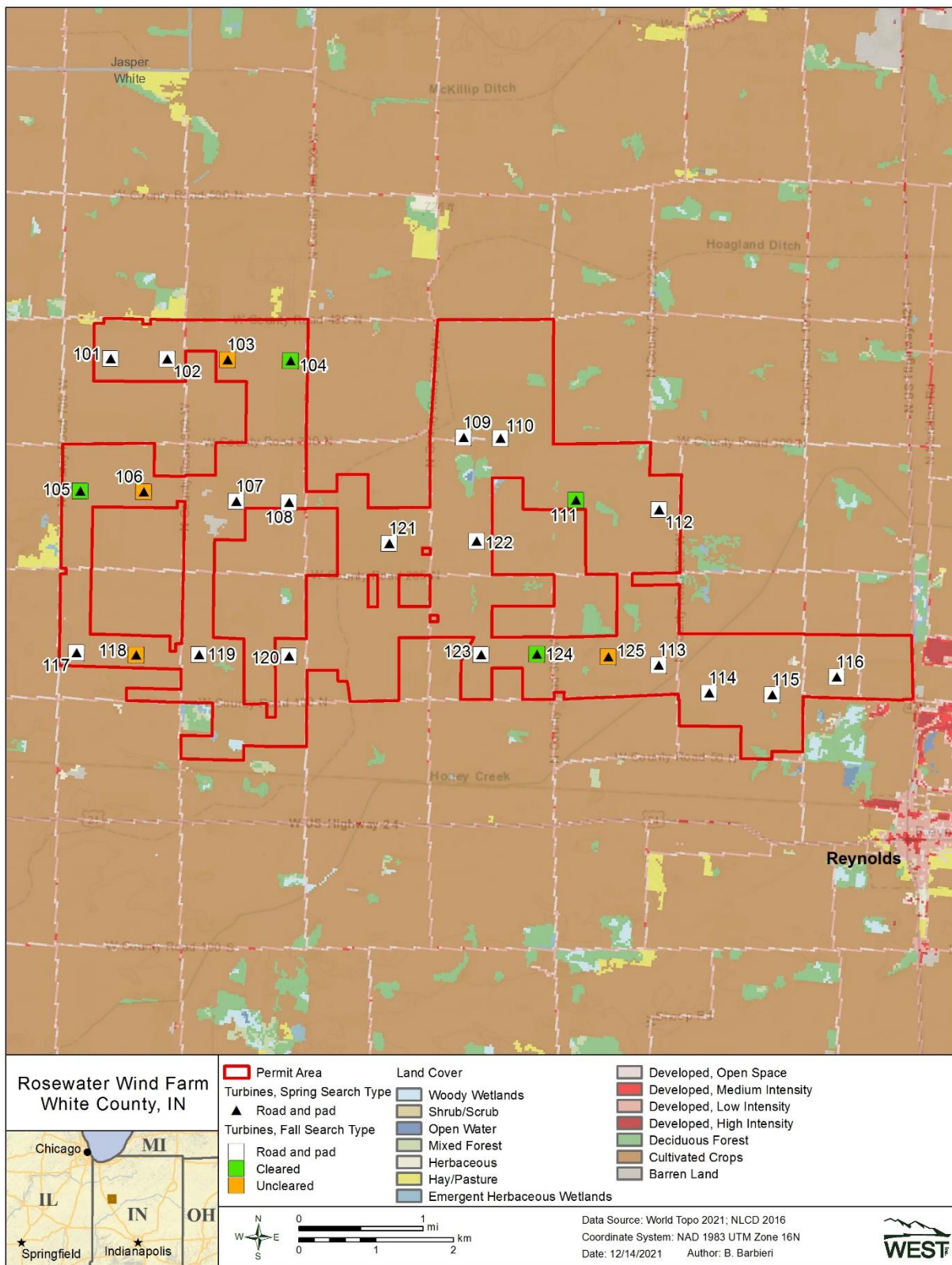


Figure 1. Turbine locations by search type and surrounding land cover at the Rosewater Wind Farm in White County, Indiana.



**Table 1. Land cover types and percent (%) composition within the Rosewater Wind Farm’s Permit Area, White County, Indiana.**

Habitat	Hectares	Acres	% Composition
Cultivated Crops	2,451.9	6,058.8	95.0
Developed*	83.4	206	3.3
Deciduous Forest	32	79.1	1.2
Barren Land	5.4	13.3	0.2
Woody Wetlands	3.7	9.1	0.1
Emergent Herbaceous Wetlands	1.5	3.6	0.1
Herbaceous	1.4	3.5	0.1
Mixed Forest	1.2	2.9	<0.1
Hay/Pasture	1.1	2.8	<0.1
Open Water	0.7	1.8	<0.1
<b>Total</b>	<b>2,582.3</b>	<b>6,380.9</b>	<b>100</b>

\* Includes high intensity, medium intensity, low intensity, and open space.

Data from National Land Cover Database (2016).

## METHODS

To meet the monitoring commitments in the HCP, WEST developed a study plan that targeted a  $g$  of 0.20 using values for searcher efficiency, carcass persistence (CP), and area correction from data collected in 2019 from the adjacent Meadow Lake Wind Farm V and from publicly available data from the Headwaters Wind Farm (Rodriguez et al. 2020a, 2020b). WEST submitted the study plan to the USFWS on February 17, 2021, and received approval on March 10, 2021 (M. Reed, USFWS, pers. comm.).

### Standardized Carcass Searches

#### *Number of Turbines Sampled, Search Frequency, and Plot Size*

Technicians and dog-handler teams conducted standardized carcass searches from April 1 – May 15 and August 1 – October 15, 2021. Search effort varied by season (Table 2), and was designed to maximize effort when take of the Covered Species was considered mostly likely to occur.

**Table 2. Search Effort by Season and Plot Type at Rosewater Wind Farm in White County, Indiana.**

Season	Plot Type	Search Interval	Number of Turbines	Search Team
Spring (April 1 – May 15)	100-m road and pad	14.0 days	25	Humans
Fall (August 1 – October 15)	100-m road and pad	7.0 days	17	Humans
	70-m cleared plot	3.5 days	4	Dog-handler
	70-m uncleared plot	3.5 days	4	Dog-handler

m = meter.

A technician searched the gravel road and pad areas under all 25 turbines to a distance of 100 m (328 ft; 100-m roads and pads) from the turbine, every other week during the spring (April 1 – May 15; Table 2, Figure 2).

A technician searched 17 turbines as roads and pads to a distance of 100 m from the turbine once a week in the fall (Table 2, Figure 2). Dog-handler teams searched four turbines where crops were regularly mowed within 70-m (230-ft) radius (70-m cleared plots; Figure 3) and four turbines as uncleared plots with a 70-m radius (70-m uncleared plots; Figure 4) twice per week in the fall.

During the fall, vegetation at 70-m cleared plots was mowed and maintained by Project staff within 10 to 15 centimeters (four to six inches) in height to enhance detectability of carcasses. Uncleared plots were vegetated with soybeans (*Glycine max*; Figure 4). A cross pattern approximately 1.5 m (4.9 ft) wide was mowed into the uncleared soy plots to assist with plot access.



**Figure 2. Representative photo of conditions of a 100-meter road and pad plot at Rosewater Wind Farm in White County, Indiana.**



Figure 3. Representative photo of vegetation conditions in a 70-meter cleared plot at Rosewater Wind Farm in White County, Indiana.



Figure 4. Representative photo of vegetation conditions in a 70-meter uncleared plot at Rosewater Wind Farm in White County, Indiana.

### *Search Methods*

All personnel were trained to follow the Project search protocol, including proper handling and reporting of carcasses. Carcass searches were conducted during the day, beginning as early as first light.

### Human Searchers

Technicians walked transects spaced five m apart at a rate of approximately 45–60 m per minute (m/min; 148–197 ft/min) on all gravel road and pad areas within 100 m of the turbine. Technicians scanned the area for fatalities on both sides of the transects out to approximately 2.5 m (8.2 ft) to ensure full visual coverage of each search area.

### Dog-handler Teams

Detection dog teams searched 70-m cleared and uncleared plots for bat carcasses. Detection dogs were considered candidates for carcass searches if they met temperament, basic obedience, ability to detect bird and/or bat carcasses requirements. Temperament characteristics sought after are high-energy dogs, with a high food or toy drive. Prior to conducting searches at the Project, handlers trained their detection dogs on the scent of bat carcasses following methods derived from search and rescue programs and drug detection (Kay 2012, Helfers 2017). Dogs were initially trained on cotton scent swabs that had been rubbed on or stored in a container with bat carcasses and progressed to bat carcasses at increasing distances over a period of three to four weeks. Once the dog achieved a passing grade of 80% or higher in a scent recognition test, consisting of 10 blind trial lineups using bat carcasses, the dog and handler were evaluated in the field to measure their performance. The detection dog coordinator conducted a 2-day field evaluation of each dog-handler team; after teams achieved a searcher efficiency of 75% or greater for 30 bats during evaluation trials, they were approved to conduct standardized carcass searches. Because the objective of the study was to document bat carcasses, dogs were not explicitly trained on native bird carcasses; however, all detection dogs alerted on birds in the field, and handlers rewarded bird finds in the field to encourage future alerts to bird carcasses. Breeds of detection dogs used at the Project included Australian Cattle Dog, Beagle mix, and Belgian Malinois.

Prior to each search, handlers determined the survey start points and the number of transects needed to cover the plot after taking into account wind speed and direction, as well as crop row direction and density (when applicable). Handlers oriented dogs to start searches perpendicular to the wind to maximize scent detection. Both windspeed and crop density can affect scent dispersal across the search area. Transect width varied by plot type to maximize detection and was ranged from approximately 10 m (33 ft) apart in 70-m uncleared plots, and 15 m (49 ft) in 70-m cleared plots. The handler placed a marker by the carcass and rewarded the dog with either a food reward or a short play session when a detection dog correctly alerted to a bird or bat carcass.

### *Data Collection*

For each scheduled search, technicians recorded the date, start and end times, technician name, turbine number, weather data, type of search and if any fatalities were found. When a fatality was found, technicians placed a flag near it and continued the search. After searching the entire plot, the technician returned to record information for each fatality on a fatality data sheet, including the date and time, species, sex and age (when possible), technician name, turbine number, measured distance from turbine, azimuth from turbine, location of carcass as Universal Transverse Mercator or decimal degree coordinates, land cover surrounding carcass, condition of carcass (i.e., intact, scavenged, dismembered, feather spot [for birds only], injured), and estimated time of death (e.g., less than one day, two days). Technicians took digital photographs of each fatality, including any visible injuries, and surrounding habitat. The technician also plotted the location of each fatality on a map of the search area. Carcasses found in non-search areas (e.g., outside of a plot boundary) or outside of the scheduled study period, were recorded as incidental discoveries and documented following the same protocol for those found during standard searches.

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

- Intact—a complete carcass, not badly decomposed, and shows no sign of being fed upon by a predator or scavenger.
- Scavenged—an entire carcass that 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), or a carcass that has been heavily infested by insects.
- Dismembered—an entire carcass found in multiple pieces distributed more than 1.0 m (3.3 ft) apart from one another due to scavenging or other reasons.
- Injured—a bat or bird found alive.

For bird carcasses, the following category was also used:

- Feather spot—10 or more feathers (excluding down), or two or more primary feathers at one location indicating predation or scavenging of a bird carcass.

Bat carcasses were collected under the Project's ITP (ESPER0003552), WEST's Federal Native Endangered and Threatened Species Recovery Permit (TE234121-9), and WEST's Special Purpose Salvage Permit (2137). Technicians placed all bat carcasses in a re-sealable plastic bag labeled with the unique carcass identification number, turbine number, and date, for storage in a freezer on site. Cut-resistant leather and rubber gloves were used to handle all bat carcasses to eliminate possible transmission of rabies or other diseases. Bird carcasses were recorded, but left in place. Injured bats were left in place per the Project's study plan, to avoid the potential to transmit SARS-CoV-2 to North American bat populations.

Tissue samples were collected from heavily scavenged or decomposed carcasses that could not be positively identified and had potential to be a Covered Species were submitted to a USFWS-approved laboratory, Northern Arizona University School of Forestry and Center for Microbial Genetics and Genomics, for identification.

Heavily scavenged bat carcasses that did not have potential to be a Covered Species (i.e., fur was present on the wing or forearms measured less than 41 millimeters) were identified to the closest genus or group possible and were not sent off for further identification.

Large bird carcasses that were heavily scavenged but did not have potential to be an eagle species (i.e., skull length and width dimensions were smaller than those of eagle species) were identified to the closest genus or group possible.

#### *Carcass Identification and Agency Notification*

Identifications of bird carcasses were verified by biologists with significant field experience in identification of birds and their feathers. WEST had protocols in place to notify the USFWS and the Indiana Department of Natural Resources within 24 hours of positive identification any species listed as endangered or threatened under the Endangered Species Act, or any state-listed endangered species. A permitted bat biologist (TE19208C-0) verified the identifications of all bat carcasses in hand at the end of the surveys and delivered the carcasses to the USFWS Indiana Field Office in Bloomington, Indiana, on December 17, 2021.

### **Bias Trials**

#### *Searcher Efficiency Trials*

The objective of the searcher efficiency trials was to estimate the percentage of bat fatalities found by observers. Searcher efficiency trials were conducted in the same areas where carcass searches occurred. Personnel conducting carcass surveys did not know when searcher efficiency trials were being conducted or the location of the trial carcasses. Trial carcasses consisted of big brown bats (*Eptesicus fuscus*) provided by Indiana State University, and eastern red bats (*Lasiurus borealis*) and silver-haired bats (*Lasionycteris noctivagans*) that had previously been found on site. A minimum of 20 bat carcasses were placed and confirmed available per plot type and per season. Multiple trials were conducted in each season to measure potential changes in plot conditions on searcher efficiency over time.

Each trial carcass was discreetly marked with a black zip-tie or black electrical tape around the upper forelimb for identification as a study carcass after it is found. Carcasses were dropped from waist-height or higher and allowed to land in a random posture. The number and location of trial carcasses found during the subsequent search were recorded, and the number of trial carcasses available for detection during each search was determined immediately after each trial by the person responsible for distributing the carcasses. Searchers had one chance to locate trial carcasses during the first search after carcass placement. The trial administrator walked in a meandering path and dropped trials for detection dogs the night prior to the next search to allow time for the scent to pool and disperse prior to scheduled searches. Following searches, any

carcasses that were not detected were checked to confirm availability. Sixty trial carcasses were left in place and used for CP trials (CPT).

### *Carcass Persistence Trials*

The objective of CPT was to estimate the length of time (in days) a carcass would persist, or be available for detection, in the field. Carcasses could be removed by scavenging or rendered undetectable by typical farming activities. Fifteen trial carcasses were placed in each season and plot type to incorporate the effects of varying weather and climatic conditions on CP. CPT were conducted across all plot types to incorporate the effects of varying weather and scavenger densities. No more than two trial carcasses were placed on a plot to avoid potential over-seeding and attracting scavengers.

Technicians monitored the trial carcasses over a 14-day period in the fall. Carcasses were checked daily for the first four days, then on day 7, 10, and 14. In the spring, due to the longer search interval, trial carcasses were monitored over a 28-day period, and two additional checks were conducted on days 21 and 28. Trial carcasses were monitored until they were completely removed or the trial period ended. Detection dogs were used on the 70-m cleared and uncleared plots to determine when carcasses were removed.

### **Search Area Mapping**

Technicians recorded the boundaries of 100-m roads and pads and 70-m cleared plots using a Trimble submeter global positioning satellite unit. Unsearchable areas within plot boundaries were also mapped. The plot boundaries were used to verify if carcasses were found inside the search areas, and to inform the distribution of carcasses around turbines to estimate the number of carcasses that fell inside or outside of search areas. A 72-m (236-ft) radius projection was applied to 70-m uncleared plots. The additional 2.0 m (6.6 ft) were added to the radius to account for the width of the turbine tower.

### **Quality Assurance and 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, technicians were responsible for inspecting data forms for completeness, accuracy, and legibility. Potentially erroneous data were identified using a series of database queries. Irregular codes or data suspected as questionable were discussed with the technician 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 and measures were implemented. A Microsoft® SQL database was developed to store, organize, and retrieve survey data. All data forms and electronic data files were retained for reference.

### **Statistical Analysis**

The EoA (Dalthorp et al. 2017) modeling framework was used to estimate take of the Covered Species. To estimate take, EoA used the arrival distribution of bats (described below), the number of Covered Species detections, and the estimated overall probability of detecting a bat fatality

based on the data collected in the field. Data used in the EoA model included number of Covered Species fatalities, fatality spatial data from all bats found during surveys, and the results of searcher efficacy and CPT.

### *Fatality Rate Estimation*

To meet the USFWS's request for an estimate of the all-bat fatality rate in the first year of monitoring, WEST calculated an all-bat fatality estimate using GenEst (a generalized estimator of fatality; Dalthorp et al. 2018, Simonis et al. 2018). Carcasses included in the fatality rate estimation were found within the search areas (plots) and had an estimated time of death within the study period. Fatality estimates were calculated by season and plot type. To obtain an overall estimate of fatality, each carcass included in the analysis was adjusted for searcher efficiency, CP, a detection reduction factor (also referred to as " $k$ "; see below), and a search area adjustment. Estimates and confidence intervals (CIs) were calculated using a parametric bootstrap (Dalthorp et al. 2018).

Ninety percent CIs were calculated for each estimate using parametric bootstrapping (Manly 1997, Dalthorp et al. 2018). Bootstrapping is a computer simulation technique that is useful for calculating variances and CIs for complicated test statistics. One thousand bootstrap samples were used. The lower 5<sup>th</sup> and upper 95<sup>th</sup> percentiles of the 1,000 bootstrap estimates were estimates of the lower limit and upper limit of 90% CIs. To obtain overall fatality estimates, statisticians calculated a weighted average across plot types (i.e., 70-m cleared and uncleared plots and 100-m road and pad plots). The number of turbines sampled as a cleared plot, uncleared plot, or a road and pad was used as a weight in the averaging calculation.

### *Searcher Efficiency Estimation*

In both the all-bat fatality estimates and EoA, searcher efficiency was estimated separately for humans and dog-handler teams to account for different modes of detection (i.e., humans use sight, dogs use scent). EoA uses raw searcher efficiency data (e.g., number of found and available trial carcasses) to inform overall probability of detection. However, to determine if searcher efficiency data should be pooled or separated by strata such as season and/or plot type, we modeled searcher efficiency using logistic regression while accounting for the detection reduction factor  $k$  (Dalthorp et al. 2018). Searcher efficiency was modeled using logistic regression, with plot type and season as potential covariates. For both of the human and dog-handler team models, selection was completed using an information theoretic approach known as AICc, or corrected Akaike Information Criterion (Burnham and Anderson 2002). The best model was selected as the most parsimonious model within two AICc units of the model with the lowest AICc value. Searcher efficiency values were input into the EoA software according to the model selection results.

The change in searcher efficiency between successive searches was defined by a parameter called the detection reduction factor ( $k$ ) that can range from zero to one. When  $k$  is zero, it implies a carcass that was missed on the first search would never be found on subsequent searches. A  $k$  of one implies searcher efficiency remained constant no matter how many times a carcass was missed. Huso et al. (2017) estimated a value of  $k = 0.67$  for bats, and this value was used to



calculate both the all-bat fatality estimates in GenEst and estimates for the Covered Species in EoA.

#### *Carcass Persistence Rate Estimation*

CPT data were used to estimate the amount of time, in days, that carcasses remained available to be located by the searcher. CP was also estimated separately for plots searched by humans versus dog teams to account for differences in modes of detection (i.e., humans use sight, dogs use scent). The average probability that a carcass persisted through the search interval (i.e., the time between scheduled searches) was estimated using an interval-censored survival regression with four potential distributions: exponential, log-logistic, lognormal, and Weibull distributions (Kalbfleisch and Prentice 2002, Dalthorp et al. 2018). Potential covariates were fit to all parameters of the candidate distributions; the only covariates considered were season or plot type (70-m cleared plot, and 70-m uncleared plot). The best model for EoA and the all-bat fatality estimate was selected as the most parsimonious model within two AICc units of the model with the lowest AICc value. The parameter estimates of the selected model ( $\alpha$  [ $\alpha$ ; shape] and  $\beta$  [ $\beta$ ; scale], including the 95% CI of  $\beta$ ) were used as inputs in the EoA Single Class module.

#### *Area Adjustment*

The search area adjustment accounted for unsearched areas beneath turbines, and was calculated as a probability that ranged from zero to one. The area adjustment was estimated as the product of the searched area around each turbine and a carcass-density distribution. A truncated weighted maximum likelihood (TWL) modeling approach (Khokan et al. 2013) was used to estimate the carcass-density distribution using site-specific fatality locations. The TWL approach uses weight based probability of detection and the proportion of area searched in each 1.0-m annulus around the turbine. Distributions considered were normal, gamma, Gompertz, Rayleigh and Weibull (parameterized according to R Development Core Team [2016] and Yee [2015]). The best-fit model was selected as the most parsimonious model within two AICc units of the model with the lowest AICc value. The proportion of area searched was calculated in a Geographic Information System as the amount of area searched divided by the total area searched at each 1.0-m annulus around the turbine.

#### *Carcasses Excluded from Fatality Estimates*

Fatalities were excluded from both EoA and the all-bat fatality estimates when the carcass was discovered outside of the spatial and temporal scope of the survey design. For example, carcasses found outside a designated plot were not included in the analysis because the area adjustment accounts for the carcass by adjusting for unsearched areas. Carcasses found prior to the start of surveys (e.g., a carcass found on a plot in the summer that is not searched until the fall) were also excluded because the carcass occurred outside of the study period. Note that carcasses found on a plot incidentally were included in the analysis if that plot had a scheduled search in the future. If a fatality of a Covered Species had been found outside of the spatial or temporal scope of the survey design it would have been excluded from the all-bat fatality estimate, but would have been included in the EoA fatality estimate following Dalthorp et al. (2020).

*Evidence of Absence Framework*

EoA was used to estimate the mean annual take rate ( $\lambda$ ) for the Covered Species and the probability of detection ( $g$ ). Estimates were calculated using the EoA method (Dalthorp et al. 2017), using the Single Class and Multiple Class modules of EoA.

The probability of detection ( $g$ ) was estimated using the bias corrections for searcher efficiency, CP, and area searched, as well as the assumed seasonality of risk for the Covered Species, which was 11% in spring and 89% in fall per the Project’s study plan. The EoA Single Class module was used to estimate the distribution of detection probability in each search stratum. Area correction was included in the Single Class module for each stratum. This resulted in alpha and beta parameters that defined the Beta distribution of detection probability in each stratum. The EoA Multiple Class module was then used to combine detection probability distributions across strata (70-m cleared plots, 70-m uncleared plots, and 100-m roads and pads), with weights for each class defined by the sampling fraction and arrival proportions. Per the HCP, adaptive management triggers will not be evaluated using EoA until Year 3.

**RESULTS**

**Standardized Carcass Searches**

One hundred searches were completed in the spring, and 361 searches were completed in the fall (Table 3). Three searches (0.7%) were missed due to turbine maintenance, weather constraints, and/or safety hazards. Four hundred seven bat carcasses and 57 bird carcasses were found during surveys and incidentally (Appendix A).

**Table 3. Number of searches per plot type at the Rosewater Wind Farm, White County, Indiana, April 1 – May 15, 2021, and August 1 – October 15, 2021.**

Season	Plot Type	Search Interval	Number of Searches
Spring (April 1 – May 15)	100-m road and pad	14.0 days	100
Fall (August 1 – October 15)	100-m road and pad	7.0 days	185
	70-m full plot	3.5 days	176
<b>Overall</b>	–	–	<b>461</b>

m = meter.

*Species Composition*

No Covered Species were found. Four evening bats (*Nycticeius humeralis*) and one tri-colored bat (*Perimyotis subflavus*) were found; both species are state-endangered. Five bats were found in the spring, and 402 bats were found in the fall (Appendix A). The most commonly found bat species were silver-haired bat (169 carcasses; 41.5%) and eastern red bat (138 carcasses; 34.0%), followed by hoary bat (*Lasiurus cinereus*; 65 carcasses; 16.0%) and big brown bat (28 carcasses; 6.9%). Four evening bats (1.0%), two unidentified non-*Myotis* bats (0.5%), and one tri-colored bat (0.3%) were also found. (Table 4, Appendix A). Over the course of the monitoring period, three heavily scavenged bats (e.g., wing membrane only, bones, or partial

carcasses) were sent off for identification via deoxyribonucleic acid (commonly, DNA) analysis; they were identified as two silver-haired bats and one big brown bat. The majority of bat carcasses were recorded on plots searched by dog-handler teams (Table 5).

**Table 4. Number and percent (%) of bat carcasses found at the Rosewater Wind Farm, White County, Indiana, April 1 – May 15, 2021, and August 1 – October 15, 2021.**

Species	Included in Area Correction and all-bat fatality estimate		Outside Search Area*		Outside Study Period*		Total	
	Total	%	Total	%	Total	%	Total	%
silver-haired bat	163	42.7	6	46.2	0	0.00	169	41.5
eastern red bat	129	33.8	4	30.8	5	41.7	138	34.0
hoary bat	61	16.0	1	7.7	3	25.0	65	16.0
big brown bat	25	6.5	1	7.7	2	16.7	28	6.9
evening bat	3	0.8	1	7.7	0	0.0	4	1.0
unidentified non-myotis	0	0.0	0	0.0	2	16.7	2	0.5
tri-colored bat	1	0.3	0	0.0	0	0.0	1	0.3
<b>Total</b>	<b>382</b>	<b>100</b>	<b>13</b>	<b>100</b>	<b>12</b>	<b>100</b>	<b>407</b>	<b>100</b>

\* Carcasses not included in analysis.

**Table 5. Species composition by plot type for bat carcasses<sup>1</sup> found at the Rosewater Wind Farm, White County, Indiana, April 1 – May 15, 2021, and August 1 – October 15, 2021.**

Species	Spring		Fall					
	100-m Road and Pad		100-m Road and Pad		70-m Cleared Plot		70-m Uncleared Plot	
	Total	%	Total	%	Total	%	Total	%
silver-haired bat	4	80.0	26	33.8	80	47.1	53	40.8
eastern red bat	0	0.0	20	26.0	56	32.9	53	40.8
hoary bat	1	0.0	19	24.7	25	14.7	16	12.3
big brown bat	0	0.0	11	14.3	7	4.1	7	5.4
evening bat	0	0.0	1	1.3	2	1.2	0	0.0
tri-colored bat	0	20.0	0	0.0	0	0.0	1	0.8
<b>Total</b>	<b>5</b>	<b>100</b>	<b>77</b>	<b>100</b>	<b>170</b>	<b>100</b>	<b>130</b>	<b>100</b>

<sup>1</sup>. This table only includes bat carcasses included in the area correction and all-bat fatality estimates.

Sums of percentages may not equal total values shown due to rounding.

m = meter.

*Carcasses for Area Correction Analysis and All-bat Fatality Estimate*

Twenty-five of the 407 bats found were excluded from modeling the area correction for EoA and the all-bat estimate. Thirteen bat carcasses were excluded from analysis because they were found off plot. Another 12 bats were excluded because their estimated time of death was prior to the start of surveys (Appendix A).

## Bias Trials

### Searcher Efficiency Trials

One hundred twenty-one bats were placed for searcher efficiency trials on eight separate dates (April 16, May 14, August 9, August 25, September 9, September 16, October 6, and October 11, 2021), and 103 were available for search teams to find across all plot types. Searcher efficiency rates ranged from 96.2 to 100% on 100-m roads and pads, and from 71.4% on 70-m uncleared soy plots to 82.6% on 70-m cleared plots (Table 6). The best-fit model for searcher efficiency on 70-m plots did not support the inclusion of plot type as a covariate, meaning there was not a statistically meaningful difference between searcher efficiency rates on 70-m uncleared and 70-m cleared plots (Appendix B). The best-fit model for searcher efficiency on 100-m roads and pads did not support the inclusion of season as a covariate (Appendix B). Thus, the total number of available and found searcher efficiency trials were summed across season and plot type, but the stratification of plots searched by dog teams (70-m cleared and uncleared plots) versus human technicians (100-m roads and pads) remained.

**Table 6. Searcher efficiency results by plot type at the Rosewater Wind Farm, White County, Indiana, April 1 – May 15, 2021, and August 1 – October 15, 2021.**

Season	Plot Type	Number Placed	Number Available	Number Found	% Found
Spring	100-m Roads and Pads	25	23	23	100
	70-m Uncleared plots	39	28	20	71.4
Fall	70-m Cleared plots	28	26	18	82.6
	100-m Roads and Pads	29	26	25	96.2
<b>Overall 70-meter Plots (Cleared and Uncleared)</b>		<b>67</b>	<b>54</b>	<b>38</b>	<b>70.4</b>
<b>Overall Roads and Pads</b>		<b>54</b>	<b>49</b>	<b>48</b>	<b>98.0</b>
<b>Overall</b>		<b>121</b>	<b>103</b>	<b>86</b>	<b>84.0</b>

m = meter.

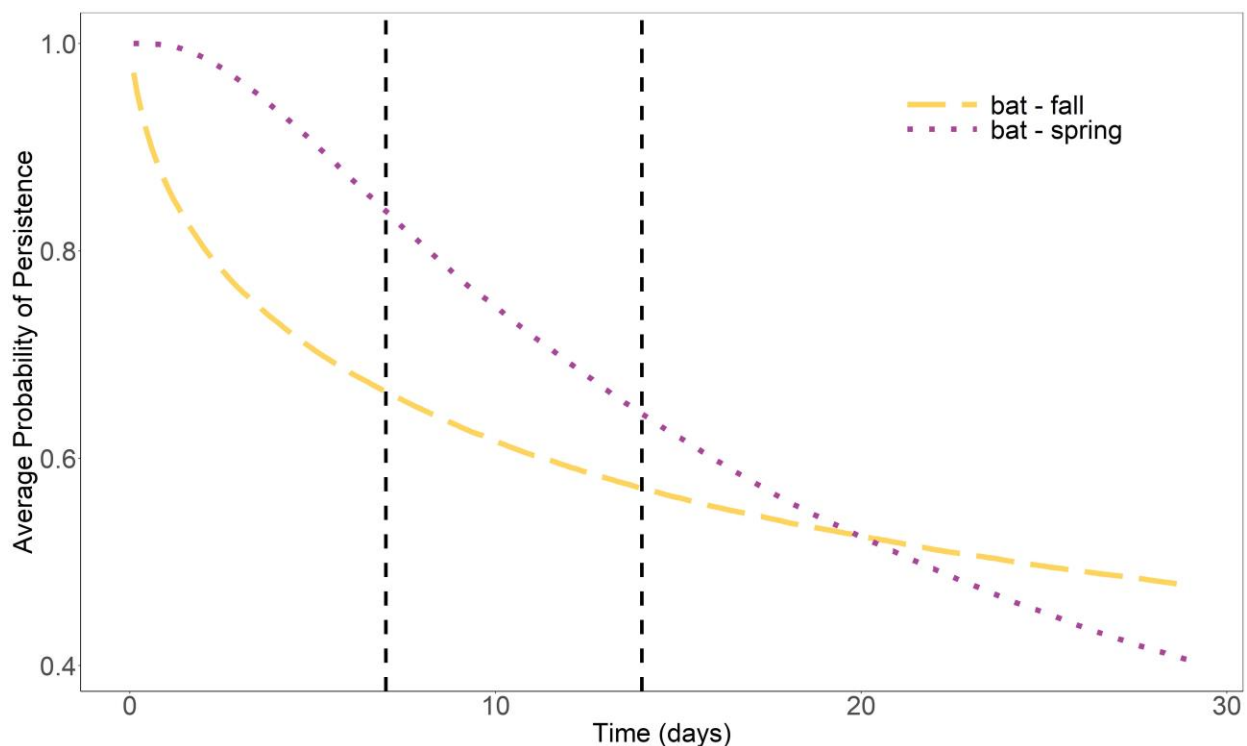
### Carcass Persistence Trials

Sixty carcasses were placed to estimate CP. The best-fit model for CP rates on 70-m plots had a Weibull distribution and included plot type as a scale covariate, which suggests CP rates varied by plot type (Appendix B). The best-fit model for CP rates at 100-m roads and pads had a lognormal distribution and included season as a scale covariate (Appendix B). Median CP times ranged from 20.08 days on 70-m cleared plots in the fall to 9.18 days on 100-m roads and pads in both seasons (Table 7). Although median persistence times were the same for both spring and fall on 100-m roads and pads, variance between the two seasons was substantial enough to support inclusion of season as a covariate on the scale parameter of the fitted carcass distribution. The average probability that a carcass persisted through a 14-day search interval on 100-m roads and pads in the spring was 0.65 (90% CI: 0.52–0.77; Figure 5). In the fall, the average probability that a carcass persisted through a 7.0-day search interval on 100-m roads and pads was 0.67 (90% CI: 0.59–0.77; Figure 5). The average probability that a carcass persisted through the 3.5-day search interval on full plots was 0.75 (90% CI: 0.62–0.88) on 70-m uncleared soy plots, and 0.99 (90% CI: 0.93–1.00) on 70-m cleared plots (Figure 6).

**Table 7. Carcass persistence top models with covariates, distributions, and model parameters for the Rosewater Wind Farm, White County, Indiana, April 1 – May 15, 2021, and August 1 – October 15, 2021.**

Plot Search Type	Season	Distribution <sup>1</sup>	Estimated Median		
			Removal Times (days)	Parameter 1 <sup>2</sup>	Parameter 2
70-m cleared plots	Fall	Weibull	20.08	1.9084	24.3371
70-m uncleared plots	Fall	Weibull	10.62	0.4421	24.3371
100-m roads and pads	Fall	lognormal	9.18	2.217	2.766
100-m roads and pads	Spring	lognormal	9.18	2.217	0.888

1. Parameterization follows the base R parameterization for this distribution.
2. Parameters 1 and 2 for the Weibull distribution are shape and scale, respectively. Parameters 1 and 2 for the lognormal distribution are mean and standard deviation, respectively.



**Figure 5. The average probability of persistence of bats on 100-meter roads and pads over time (in days) at Rosewater Wind Farm, White County, Indiana, April 1 – May 15, 2021, and August 1 – October 15, 2021.**

Note: The vertical dotted lines indicates the 7 and 14 day search intervals for this plot type.

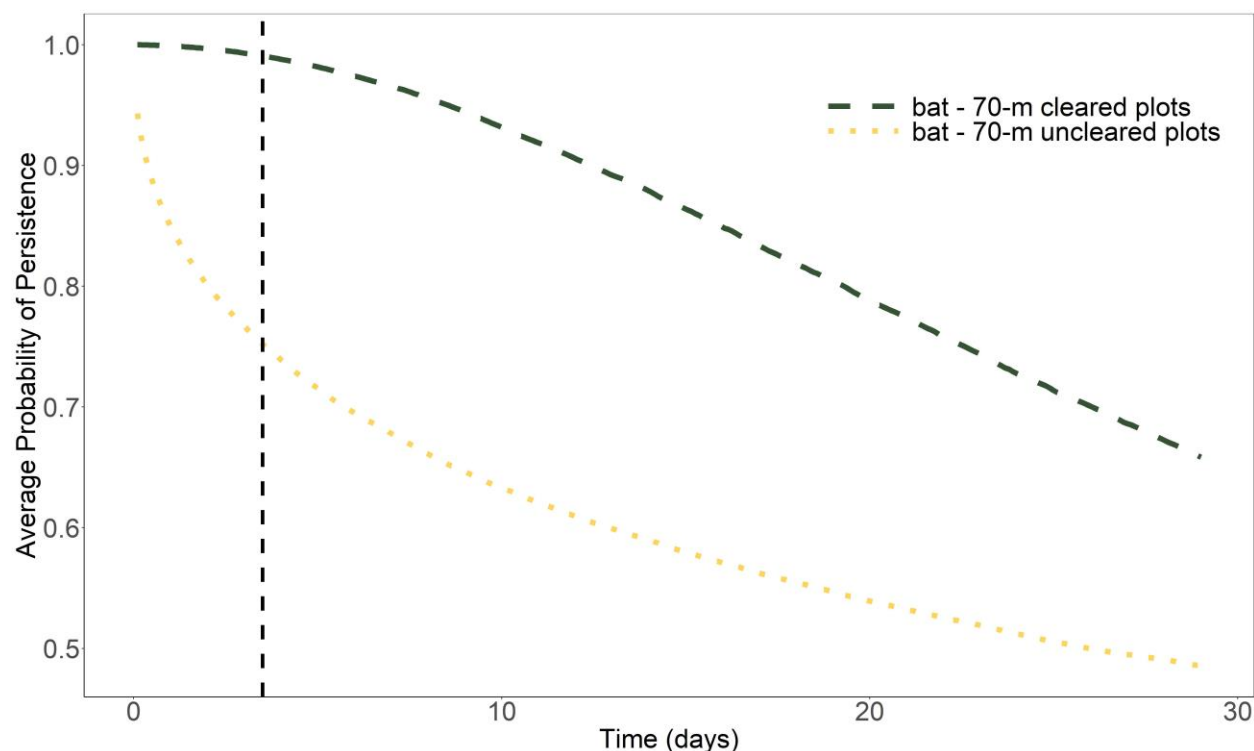


Figure 6. The average probability of persistence of bats on full plots over time (in days) at Rosewater Wind Farm, White County, Indiana, August 1 – October 15, 2021.

Note: The vertical dotted line indicates the 3.5 day search interval for these plot types.

## Statistical Analysis

### Area Adjustment

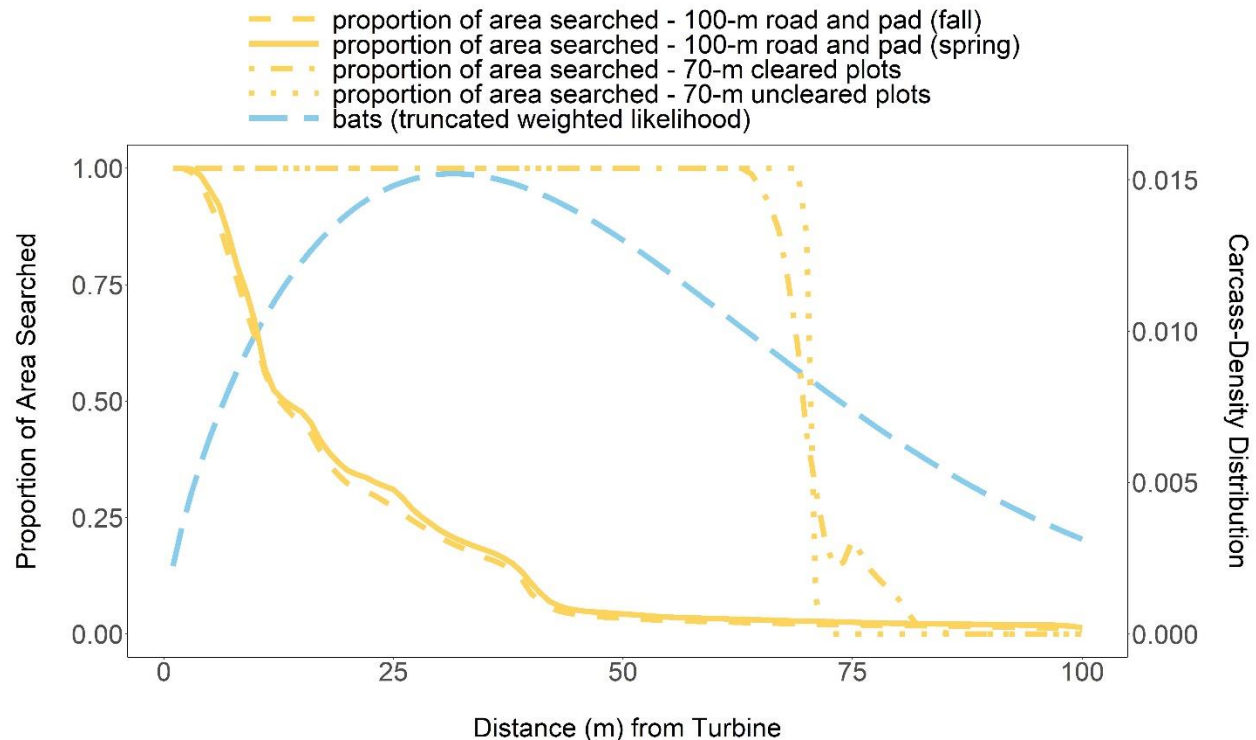
The best-fit model for the distribution of bats with respect to distance from turbine base was a gamma distribution (Appendix B). The estimated TWL area adjustment for bats in the spring was 0.19 for 100-m roads and pads (Appendix B, Figure 7). In the fall, the estimated TWL area adjustment for bats was 0.17 for 100-m roads and pads and 0.81 for 70-m plots (Appendix B, Figure 7).

### Adjusted Overall Bat Fatality Estimates

The overall bat fatality rate was estimated as 12.57 bats per MW (90% CI: 9.75–21.15; Table 8). Fatality rates by plot type and season are presented in Appendix C.

Table 8. Overall bat fatality rates per megawatt and per turbine for studies conducted at the Rosewater Wind Farm, White County, Indiana, April 1 – May 15, 2021, and August 1 – October 15, 2021.

Plot Search Type	Bat Fatality Estimate per Turbine	90% Confidence Limits	Bat Fatality Estimate per Megawatt	90% Confidence Limits
Spring	1.85	0.68–4.05	0.45	0.16–1.00
Fall	48.99	37.95–82.31	12.12	9.38–20.32
<b>Overall</b>	<b>50.90</b>	<b>39.48–85.54</b>	<b>12.57</b>	<b>9.75–21.15</b>



**Figure 7. Density of bat carcasses per area searched at 100-meter (m) roads and pads, 70-m cleared plots, and 70-m uncleared plots at the Rosewater Wind Farm, White County, Indiana, April 1 – May 15, 2021, and August 1 – October 15, 2021.**

### Indiana Bat and Northern Long-eared Bat Take Estimates

#### Evidence of Absence Framework

No Covered Species carcasses were found during the study, thus, the adaptive management trigger for Years 1–2 was not met and no adaptive management was necessary. The overall  $g$  achieved for the 2021 monitoring period had a mean of 0.26 (95% CI: 0.25–0.28). Mean annual take rates were estimated to be 1.9 (95% CI = 0.002–9.54) Indiana bats and northern long-eared bats per year from April 1 – May 15 and August 1 – October 15, 2021. Inputs required to run the EoA Single Class module and stratum-specific  $g$  distribution values and inputs required for the Multiple Class module are described in Appendix D.

### Conclusions

The overall  $g$  achieved for the 2021 monitoring period puts the Project on track to exceed the minimum average  $g$  of 0.2 for Years 1–3. The monitoring completed during 2021 provided evidence that the rate of take of Covered Species is compatible with ITP compliance over the duration of the permit term. Adaptive management triggers will not be formally evaluated using the EoA results until Year 3; however, no adaptive management actions were triggered this year because no Covered Species were found.

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**Appendix A. Carcasses found during the 2021 Post-construction Monitoring Surveys  
at the Rosewater Wind Farm**

**Appendix A. Carcasses found at the Rosewater Wind Farm, White County, Indiana, April 1 – May 15, 2021, and August 1 – October 15, 2021.**

<b>Found Date</b>	<b>Common Name</b>	<b>Turbine</b>	<b>Search Type</b>	<b>Plot Type</b>	<b>Physical Condition</b>	<b>Longitude*</b>	<b>Latitude*</b>
<b>Bat carcasses</b>							
4/30/2021	silver-haired bat	105	carcass search	100-m road and pad	scavenged	40.78889	-87.002
4/30/2021	silver-haired bat	114	carcass search	100-m road and pad	scavenged	40.76627	-86.9058
4/30/2021	silver-haired bat	122	carcass search	100-m road and pad	intact	40.78340	-86.9416
5/14/2021	hoary bat	113	carcass search	100-m road and pad	scavenged	40.76946	-86.9133
5/14/2021	silver-haired bat	110	carcass search	100-m road and pad	scavenged	40.79557	-86.9383
8/2/2021	big brown bat	115	carcass search	100-m road and pad	scavenged	40.76598	-86.8961
8/2/2021	big brown bat	125	carcass search	70-m uncleared plot	scavenged	40.77038	-86.9213
8/2/2021	eastern red bat	124	carcass search	70-m cleared plot	scavenged	40.77048	-86.9318
8/2/2021	evening bat	112	carcass search	100-m road and pad	intact	40.78729	-86.9133
8/2/2021	unidentified non-myotis	118	carcass search	70-m uncleared plot	scavenged	40.76965	-86.9935
8/2/2021	unidentified non-myotis	125	carcass search	70-m uncleared plot	scavenged	40.77035	-86.9212
8/3/2021	eastern red bat	101	carcass search	100-m road and pad	scavenged	40.80415	-86.9978
8/3/2021	eastern red bat	101	carcass search	100-m road and pad	scavenged	40.80423	-86.9979
8/3/2021	eastern red bat	105	carcass search	70-m cleared plot	scavenged	40.78865	-87.0023
8/3/2021	eastern red bat	106	carcass search	70-m uncleared plot	scavenged	40.78878	-86.993
8/3/2021	hoary bat	101	carcass search	100-m road and pad	scavenged	40.80441	-86.9982
8/3/2021	hoary bat	104	carcass search	70-m cleared plot	scavenged	40.80427	-86.9709
8/3/2021	hoary bat	105	carcass search	70-m cleared plot	scavenged	40.78863	-87.0026
8/5/2021	big brown bat	110	incidental	100-m road and pad	scavenged	40.79542	-86.9383
8/5/2021	eastern red bat	109	carcass search	100-m road and pad	scavenged	40.79538	-86.9438
8/5/2021	eastern red bat	124	carcass search	70-m cleared plot	scavenged	40.77011	-86.9317
8/5/2021	silver-haired bat	124	carcass search	70-m cleared plot	scavenged	40.77052	-86.9322
8/6/2021	big brown bat	104	carcass search	70-m cleared plot	intact	40.80419	-86.9703
8/6/2021	hoary bat	104	carcass search	70-m cleared plot	dismembered	40.80475	-86.9704
8/6/2021	hoary bat	106	carcass search	70-m uncleared plot	scavenged	40.78869	-86.9932
8/7/2021	eastern red bat	105	carcass search	70-m cleared plot	scavenged	40.78825	-87.0025
8/7/2021	eastern red bat	105	carcass search	70-m cleared plot	scavenged	40.78873	-87.0023
8/9/2021	big brown bat	106	incidental	70-m uncleared plot	scavenged	40.78892	-86.9926
8/9/2021	big brown bat	118	carcass search	70-m uncleared plot	intact	40.77001	-86.993
8/9/2021	eastern red bat	118	carcass search	70-m uncleared plot	intact	40.76968	-86.9936
8/9/2021	eastern red bat	124	carcass search	70-m cleared plot	intact	40.77075	-86.932
8/9/2021	eastern red bat	124	carcass search	70-m cleared plot	intact	40.7706	-86.9327
8/9/2021	hoary bat	124	carcass search	70-m cleared plot	intact	40.77041	-86.9323
8/10/2021	eastern red bat	103	carcass search	70-m uncleared plot	scavenged	40.80402	-86.9807
8/10/2021	eastern red bat	103	carcass search	70-m uncleared plot	scavenged	40.80428	-86.9797

**Appendix A. Carcasses found at the Rosewater Wind Farm, White County, Indiana, April 1 – May 15, 2021, and August 1 – October 15, 2021.**

<b>Found Date</b>	<b>Common Name</b>	<b>Turbine</b>	<b>Search Type</b>	<b>Plot Type</b>	<b>Physical Condition</b>	<b>Longitude*</b>	<b>Latitude*</b>
8/10/2021	eastern red bat	103	carcass search	70-m uncleared plot	scavenged	40.80406	-86.9796
8/10/2021	eastern red bat	103	carcass search	70-m uncleared plot	scavenged	40.80452	-86.9806
8/10/2021	eastern red bat	105	carcass search	70-m cleared plot	scavenged	40.78892	-87.0027
8/10/2021	eastern red bat	105	carcass search	70-m cleared plot	scavenged	40.78881	-87.0026
8/10/2021	eastern red bat	105	carcass search	70-m cleared plot	scavenged	40.78912	-87.0027
8/10/2021	eastern red bat	105	carcass search	70-m cleared plot	scavenged	40.78891	-87.003
8/10/2021	eastern red bat	105	carcass search	70-m cleared plot	scavenged	40.78872	-87.0024
8/10/2021	eastern red bat	113	carcass search	100-m road and pad	scavenged	40.7695	-86.9132
8/10/2021	eastern red bat	114	carcass search**	100-m road and pad	scavenged	40.76596	-86.9057
8/10/2021	eastern red bat	116	carcass search**	100-m road and pad	scavenged	40.76825	-86.8863
8/10/2021	hoary bat	102	carcass search	100-m road and pad	scavenged	40.80427	-86.9894
8/10/2021	hoary bat	103	carcass search	70-m uncleared plot	scavenged	40.80428	-86.9803
8/10/2021	hoary bat	104	carcass search	70-m cleared plot	scavenged	40.80449	-86.9705
8/10/2021	hoary bat	104	carcass search	70-m cleared plot	scavenged	40.80441	-86.9706
8/10/2021	hoary bat	105	carcass search	70-m cleared plot	scavenged	40.78851	-87.0024
8/10/2021	hoary bat	113	carcass search	100-m road and pad	scavenged	40.7696	-86.9136
8/11/2021	hoary bat	101	carcass search	100-m road and pad	scavenged	40.80424	-86.9981
8/11/2021	hoary bat	108	carcass search	100-m road and pad	scavenged	40.78785	-86.9707
8/12/2021	eastern red bat	124	carcass search	70-m cleared plot	scavenged	40.77011	-86.9329
8/13/2021	big brown bat	103	carcass search**	70-m uncleared plot	scavenged	40.80472	-86.981
8/13/2021	big brown bat	125	carcass search	70-m uncleared plot	intact	40.77024	-86.9213
8/13/2021	eastern red bat	104	carcass search	70-m cleared plot	scavenged	40.80471	-86.9701
8/13/2021	eastern red bat	104	carcass search	70-m cleared plot	scavenged	40.80462	-86.9705
8/13/2021	eastern red bat	106	carcass search	70-m uncleared plot	scavenged	40.78909	-86.9927
8/13/2021	eastern red bat	118	carcass search	70-m uncleared plot	scavenged	40.77002	-86.9931
8/13/2021	eastern red bat	125	carcass search	70-m uncleared plot	intact	40.77085	-86.9215
8/13/2021	hoary bat	105	carcass search	70-m cleared plot	scavenged	40.78883	-87.003
8/14/2021	big brown bat	122	carcass search	100-m road and pad	scavenged	40.78354	-86.9418
8/14/2021	big brown bat	122	carcass search	100-m road and pad	scavenged	40.7836	-86.9417
8/14/2021	hoary bat	109	carcass search	100-m road and pad	scavenged	40.79541	-86.9441
8/14/2021	hoary bat	120	carcass search	100-m road and pad	scavenged	40.77004	-86.97
8/16/2021	big brown bat	110	incidental	100-m road and pad	scavenged	40.79539	-86.9382
8/16/2021	big brown bat	124	carcass search	70-m cleared plot	scavenged	40.7706	-86.9322
8/16/2021	eastern red bat	103	carcass search	70-m uncleared plot	scavenged	40.8048	-86.9802
8/16/2021	eastern red bat	103	carcass search	70-m uncleared plot	scavenged	40.8046	-86.9799

**Appendix A. Carcasses found at the Rosewater Wind Farm, White County, Indiana, April 1 – May 15, 2021, and August 1 – October 15, 2021.**

<b>Found Date</b>	<b>Common Name</b>	<b>Turbine</b>	<b>Search Type</b>	<b>Plot Type</b>	<b>Physical Condition</b>	<b>Longitude*</b>	<b>Latitude*</b>
8/16/2021	eastern red bat	103	carcass search	70-m uncleared plot	scavenged	40.80456	-86.9809
8/16/2021	eastern red bat	116	carcass search	100-m road and pad	scavenged	40.76823	-86.8859
8/16/2021	eastern red bat	124	carcass search	70-m cleared plot	intact	40.77035	-86.9324
8/16/2021	eastern red bat	125	carcass search	70-m uncleared plot	scavenged	40.77017	-86.9209
8/16/2021	hoary bat	102	carcass search	100-m road and pad	scavenged	40.80428	-86.9896
8/16/2021	hoary bat	110	incidental	100-m road and pad	scavenged	40.79563	-86.9387
8/16/2021	hoary bat	124	carcass search	70-m cleared plot	scavenged	40.77035	-86.932
8/16/2021	hoary bat	125	carcass search	70-m uncleared plot	scavenged	40.76988	-86.9211
8/16/2021	silver-haired bat	124	carcass search	70-m cleared plot	scavenged	40.77053	-86.9328
8/17/2021	big brown bat	114	carcass search	100-m road and pad	scavenged	40.76607	-86.9058
8/17/2021	eastern red bat	104	carcass search	70-m cleared plot	scavenged	40.80454	-86.9699
8/17/2021	eastern red bat	105	carcass search	70-m cleared plot	scavenged	40.78887	-87.0018
8/17/2021	eastern red bat	105	carcass search	70-m cleared plot	scavenged	40.78899	-87.0024
8/17/2021	eastern red bat	105	carcass search	70-m cleared plot	scavenged	40.78895	-87.0031
8/17/2021	eastern red bat	105	carcass search	70-m cleared plot	scavenged	40.78911	-87.0027
8/17/2021	eastern red bat	118	carcass search	70-m uncleared plot	scavenged	40.76976	-86.9929
8/17/2021	hoary bat	104	carcass search	70-m cleared plot	unknown	40.80437	-86.9704
8/17/2021	hoary bat	105	carcass search	70-m cleared plot	scavenged	40.7889	-87.0026
8/17/2021	hoary bat	108	carcass search	100-m road and pad	unknown	40.7876	-86.9704
8/19/2021	eastern red bat	111	carcass search	70-m cleared plot	intact	40.78848	-86.9267
8/19/2021	eastern red bat	111	carcass search	70-m cleared plot	scavenged	40.78868	-86.9266
8/19/2021	hoary bat	110	carcass search	100-m road and pad	intact	40.79546	-86.9383
8/20/2021	big brown bat	120	carcass search	100-m road and pad	intact	40.76998	-86.97
8/23/2021	eastern red bat	111	carcass search	70-m cleared plot	dismembered	40.78844	-86.927
8/23/2021	eastern red bat	112	carcass search	100-m road and pad	scavenged	40.78727	-86.9136
8/23/2021	eastern red bat	116	carcass search	100-m road and pad	scavenged	40.7683	-86.886
8/23/2021	eastern red bat	124	carcass search	70-m cleared plot	scavenged	40.77024	-86.9325
8/23/2021	eastern red bat	125	carcass search	70-m uncleared plot	dismembered	40.77036	-86.922
8/23/2021	eastern red bat	125	carcass search	70-m uncleared plot	scavenged	40.77034	-86.922
8/23/2021	hoary bat	124	carcass search	70-m cleared plot	scavenged	40.77044	-86.9321
8/24/2021	big brown bat	102	carcass search	100-m road and pad	scavenged	40.80442	-86.9893
8/24/2021	big brown bat	105	carcass search	70-m cleared plot	scavenged	40.78869	-87.0024
8/24/2021	big brown bat	107	carcass search	100-m road and pad	scavenged	40.78774	-86.979
8/24/2021	eastern red bat	101	carcass search	100-m road and pad	scavenged	40.80438	-86.9977
8/24/2021	eastern red bat	101	carcass search	100-m road and pad	scavenged	40.80439	-86.9982

**Appendix A. Carcasses found at the Rosewater Wind Farm, White County, Indiana, April 1 – May 15, 2021, and August 1 – October 15, 2021.**

<b>Found Date</b>	<b>Common Name</b>	<b>Turbine</b>	<b>Search Type</b>	<b>Plot Type</b>	<b>Physical Condition</b>	<b>Longitude*</b>	<b>Latitude*</b>
8/24/2021	eastern red bat	103	carcass search	70-m uncleared plot	scavenged	40.80406	-86.9803
8/24/2021	eastern red bat	103	carcass search**	70-m uncleared plot	scavenged	40.80429	-86.9811
8/24/2021	eastern red bat	103	carcass search	70-m uncleared plot	scavenged	40.80426	-86.9803
8/24/2021	eastern red bat	103	carcass search	70-m uncleared plot	scavenged	40.80405	-86.9806
8/24/2021	eastern red bat	104	carcass search	70-m cleared plot	scavenged	40.80391	-86.9709
8/24/2021	eastern red bat	104	carcass search	70-m cleared plot	scavenged	40.80426	-86.9707
8/24/2021	eastern red bat	105	carcass search	70-m cleared plot	scavenged	40.78941	-87.0025
8/24/2021	eastern red bat	105	carcass search	70-m cleared plot	scavenged	40.78879	-87.0023
8/24/2021	eastern red bat	108	carcass search	100-m road and pad	scavenged	40.78778	-86.9708
8/26/2021	big brown bat	109	carcass search	100-m road and pad	scavenged	40.7954	-86.9437
8/26/2021	eastern red bat	111	carcass search	70-m cleared plot	scavenged	40.78853	-86.9264
8/26/2021	eastern red bat	111	carcass search	70-m cleared plot	scavenged	40.78842	-86.9268
8/26/2021	eastern red bat	118	carcass search	70-m uncleared plot	scavenged	40.76975	-86.994
8/26/2021	eastern red bat	125	carcass search	70-m uncleared plot	scavenged	40.7702	-86.9212
8/26/2021	hoary bat	118	carcass search	70-m uncleared plot	scavenged	40.76946	-86.9934
8/26/2021	tri-colored bat	125	carcass search	70-m uncleared plot	scavenged	40.77001	-86.9212
8/27/2021	big brown bat	105	carcass search	70-m cleared plot	scavenged	40.78878	-87.0022
8/27/2021	eastern red bat	106	carcass search	70-m uncleared plot	scavenged	40.78882	-86.9933
8/27/2021	eastern red bat	124	carcass search	70-m cleared plot	scavenged	40.77046	-86.9319
8/27/2021	hoary bat	106	carcass search	70-m uncleared plot	scavenged	40.78883	-86.9929
8/27/2021	hoary bat	119	carcass search	100-m road and pad	scavenged	40.77007	-86.9843
8/30/2021	big brown bat	111	carcass search	70-m cleared plot	scavenged	40.78879	-86.9264
8/30/2021	big brown bat	124	carcass search	70-m cleared plot	scavenged	40.77056	-86.9319
8/30/2021	big brown bat	125	carcass search	70-m uncleared plot	scavenged	40.77029	-86.9212
8/30/2021	eastern red bat	111	carcass search	70-m cleared plot	scavenged	40.78848	-86.9264
8/30/2021	eastern red bat	111	carcass search	70-m cleared plot	scavenged	40.78825	-86.9262
8/30/2021	eastern red bat	112	carcass search	100-m road and pad	scavenged	40.78737	-86.9142
8/30/2021	eastern red bat	112	carcass search	100-m road and pad	scavenged	40.78742	-86.9138
8/30/2021	eastern red bat	114	carcass search	100-m road and pad	scavenged	40.76613	-86.9054
8/30/2021	eastern red bat	118	carcass search	70-m uncleared plot	scavenged	40.76992	-86.9933
8/30/2021	eastern red bat	118	carcass search	70-m uncleared plot	scavenged	40.76965	-86.9939
8/30/2021	eastern red bat	125	carcass search	70-m uncleared plot	scavenged	40.77034	-86.9218
8/30/2021	eastern red bat	125	carcass search	70-m uncleared plot	scavenged	40.7701	-86.9214
8/30/2021	eastern red bat	125	carcass search	70-m uncleared plot	scavenged	40.77031	-86.9213
8/30/2021	hoary bat	111	carcass search	70-m cleared plot	scavenged	40.7886	-86.9269

**Appendix A. Carcasses found at the Rosewater Wind Farm, White County, Indiana, April 1 – May 15, 2021, and August 1 – October 15, 2021.**

<b>Found Date</b>	<b>Common Name</b>	<b>Turbine</b>	<b>Search Type</b>	<b>Plot Type</b>	<b>Physical Condition</b>	<b>Longitude*</b>	<b>Latitude*</b>
8/30/2021	hoary bat	111	carcass search	70-m cleared plot	scavenged	40.78873	-86.9265
8/30/2021	hoary bat	111	carcass search	70-m cleared plot	scavenged	40.78841	-86.9262
8/30/2021	hoary bat	113	carcass search	100-m road and pad	scavenged	40.7696	-86.9138
8/30/2021	hoary bat	118	carcass search	70-m uncleared plot	scavenged	40.76975	-86.9937
8/30/2021	hoary bat	124	carcass search	70-m cleared plot	scavenged	40.77059	-86.9327
8/30/2021	hoary bat	125	carcass search	70-m uncleared plot	scavenged	40.77015	-86.9209
8/30/2021	hoary bat	125	carcass search	70-m uncleared plot	injured	40.77026	-86.9214
8/30/2021	hoary bat	125	carcass search	70-m uncleared plot	scavenged	40.77027	-86.9213
8/31/2021	big brown bat	106	carcass search	70-m uncleared plot	injured	40.78895	-86.9931
8/31/2021	eastern red bat	102	carcass search	100-m road and pad	scavenged	40.80433	-86.9895
8/31/2021	eastern red bat	103	carcass search	70-m uncleared plot	scavenged	40.80395	-86.9799
8/31/2021	eastern red bat	104	carcass search	70-m cleared plot	scavenged	40.80459	-86.9711
8/31/2021	eastern red bat	105	carcass search	70-m cleared plot	scavenged	40.78888	-87.0019
8/31/2021	eastern red bat	106	carcass search	70-m uncleared plot	dismembered	40.78882	-86.9926
8/31/2021	hoary bat	103	carcass search	70-m uncleared plot	injured	40.80442	-86.9803
8/31/2021	hoary bat	105	carcass search	70-m cleared plot	scavenged	40.78874	-87.0025
8/31/2021	hoary bat	106	carcass search	70-m uncleared plot	injured	40.78895	-86.9932
8/31/2021	hoary bat	108	carcass search	100-m road and pad	scavenged	40.78778	-86.9706
8/31/2021	silver-haired bat	105	carcass search	70-m cleared plot	injured	40.78881	-87.0025
9/2/2021	big brown bat	125	carcass search	70-m uncleared plot	scavenged	40.77014	-86.9214
9/2/2021	eastern red bat	118	carcass search	70-m uncleared plot	scavenged	40.77005	-86.9938
9/2/2021	eastern red bat	118	carcass search	70-m uncleared plot	scavenged	40.76999	-86.9936
9/2/2021	evening bat	124	carcass search	70-m cleared plot	scavenged	40.77024	-86.9319
9/2/2021	hoary bat	118	carcass search**	70-m uncleared plot	scavenged	40.76992	-86.9928
9/2/2021	silver-haired bat	110	carcass search	100-m road and pad	scavenged	40.79541	-86.9392
9/2/2021	silver-haired bat	124	carcass search	70-m cleared plot	scavenged	40.77026	-86.932
9/2/2021	silver-haired bat	124	carcass search	70-m cleared plot	scavenged	40.77038	-86.9322
9/2/2021	silver-haired bat	124	carcass search	70-m cleared plot	scavenged	40.77045	-86.9322
9/3/2021	big brown bat	104	carcass search	70-m cleared plot	scavenged	40.80403	-86.9707
9/3/2021	eastern red bat	103	carcass search	70-m uncleared plot	scavenged	40.80429	-86.9804
9/3/2021	eastern red bat	104	carcass search	70-m cleared plot	scavenged	40.80414	-86.9703
9/3/2021	eastern red bat	105	carcass search	70-m cleared plot	scavenged	40.78871	-87.0029
9/3/2021	hoary bat	119	carcass search	100-m road and pad	scavenged	40.76987	-86.984
9/3/2021	silver-haired bat	103	carcass search	70-m uncleared plot	scavenged	40.80415	-86.9801
9/3/2021	silver-haired bat	104	carcass search	70-m cleared plot	scavenged	40.80426	-86.9707

**Appendix A. Carcasses found at the Rosewater Wind Farm, White County, Indiana, April 1 – May 15, 2021, and August 1 – October 15, 2021.**

<b>Found Date</b>	<b>Common Name</b>	<b>Turbine</b>	<b>Search Type</b>	<b>Plot Type</b>	<b>Physical Condition</b>	<b>Longitude*</b>	<b>Latitude*</b>
9/3/2021	silver-haired bat	119	carcass search	100-m road and pad	scavenged	40.76985	-86.984
9/6/2021	big brown bat	116	carcass search	100-m road and pad	scavenged	40.76816	-86.8863
9/6/2021	eastern red bat	111	carcass search	70-m cleared plot	scavenged	40.78857	-86.926
9/6/2021	eastern red bat	114	carcass search	100-m road and pad	scavenged	40.7663	-86.9055
9/6/2021	eastern red bat	118	carcass search	70-m uncleared plot	scavenged	40.76981	-86.9932
9/6/2021	eastern red bat	124	carcass search	70-m cleared plot	scavenged	40.77017	-86.9327
9/6/2021	eastern red bat	124	carcass search	70-m cleared plot	dismembered	40.77046	-86.9327
9/6/2021	eastern red bat	125	carcass search	70-m uncleared plot	scavenged	40.77026	-86.9219
9/6/2021	evening bat	111	carcass search	70-m cleared plot	scavenged	40.78831	-86.9264
9/6/2021	silver-haired bat	111	carcass search	70-m cleared plot	scavenged	40.78851	-86.9267
9/6/2021	silver-haired bat	111	carcass search	70-m cleared plot	scavenged	40.78842	-86.9262
9/6/2021	silver-haired bat	114	carcass search	100-m road and pad	scavenged	40.76613	-86.9054
9/6/2021	silver-haired bat	115	carcass search	100-m road and pad	scavenged	40.76603	-86.8959
9/6/2021	silver-haired bat	116	carcass search	100-m road and pad	scavenged	40.76832	-86.8858
9/6/2021	silver-haired bat	116	carcass search	100-m road and pad	scavenged	40.76817	-86.8862
9/6/2021	silver-haired bat	118	carcass search	70-m uncleared plot	scavenged	40.76967	-86.9942
9/6/2021	silver-haired bat	124	carcass search	70-m cleared plot	scavenged	40.77035	-86.9326
9/6/2021	silver-haired bat	124	carcass search	70-m cleared plot	scavenged	40.77035	-86.9325
9/7/2021	big brown bat	103	carcass search	70-m uncleared plot	scavenged	40.80405	-86.9803
9/7/2021	eastern red bat	103	carcass search	70-m uncleared plot	scavenged	40.80467	-86.9803
9/7/2021	eastern red bat	105	carcass search	70-m cleared plot	scavenged	40.78851	-87.0028
9/7/2021	hoary bat	108	carcass search	100-m road and pad	scavenged	40.78778	-86.9708
9/7/2021	silver-haired bat	102	carcass search	100-m road and pad	scavenged	40.80424	-86.9892
9/7/2021	silver-haired bat	103	carcass search	70-m uncleared plot	scavenged	40.80432	-86.98
9/7/2021	silver-haired bat	103	carcass search	70-m uncleared plot	scavenged	40.80402	-86.9804
9/7/2021	silver-haired bat	103	carcass search	70-m uncleared plot	scavenged	40.80393	-86.9805
9/7/2021	silver-haired bat	103	carcass search	70-m uncleared plot	scavenged	40.80427	-86.9799
9/7/2021	silver-haired bat	103	carcass search	70-m uncleared plot	scavenged	40.80414	-86.9803
9/7/2021	silver-haired bat	103	carcass search	70-m uncleared plot	scavenged	40.80414	-86.98
9/7/2021	silver-haired bat	103	carcass search	70-m uncleared plot	scavenged	40.80402	-86.9796
9/7/2021	silver-haired bat	103	carcass search	70-m uncleared plot	scavenged	40.80399	-86.9804
9/7/2021	silver-haired bat	103	carcass search	70-m uncleared plot	scavenged	40.80461	-86.9808
9/7/2021	silver-haired bat	104	carcass search**	70-m cleared plot	scavenged	40.80349	-86.9707
9/7/2021	silver-haired bat	104	carcass search	70-m cleared plot	scavenged	40.80408	-86.9699
9/7/2021	silver-haired bat	106	carcass search	70-m uncleared plot	scavenged	40.78857	-86.993
9/7/2021	silver-haired bat	107	carcass search	100-m road and pad	scavenged	40.78774	-86.9787



**Appendix A. Carcasses found at the Rosewater Wind Farm, White County, Indiana, April 1 – May 15, 2021, and August 1 – October 15, 2021.**

<b>Found Date</b>	<b>Common Name</b>	<b>Turbine</b>	<b>Search Type</b>	<b>Plot Type</b>	<b>Physical Condition</b>	<b>Longitude*</b>	<b>Latitude*</b>
9/7/2021	silver-haired bat	107	carcass search	100-m road and pad	scavenged	40.78768	-86.9787
9/7/2021	silver-haired bat	108	carcass search	100-m road and pad	scavenged	40.78797	-86.9705
9/9/2021	eastern red bat	109	carcass search	100-m road and pad	scavenged	40.7954	-86.9436
9/9/2021	eastern red bat	111	carcass search	70-m cleared plot	scavenged	40.78841	-86.9262
9/9/2021	eastern red bat	111	carcass search	70-m cleared plot	dismembered	40.78803	-86.9266
9/9/2021	eastern red bat	124	carcass search	70-m cleared plot	scavenged	40.77063	-86.9319
9/9/2021	eastern red bat	124	carcass search	70-m cleared plot	scavenged	40.77083	-86.9327
9/9/2021	hoary bat	111	carcass search	70-m cleared plot	scavenged	40.78849	-86.9268
9/9/2021	hoary bat	124	carcass search	70-m cleared plot	scavenged	40.7705	-86.9321
9/9/2021	hoary bat	125	carcass search	70-m uncleared plot	scavenged	40.7706	-86.9214
9/9/2021	silver-haired bat	111	carcass search	70-m cleared plot	scavenged	40.7882	-86.926
9/9/2021	silver-haired bat	111	carcass search	70-m cleared plot	scavenged	40.78856	-86.926
9/9/2021	silver-haired bat	118	carcass search	70-m uncleared plot	scavenged	40.77018	-86.9935
9/9/2021	silver-haired bat	118	carcass search	70-m uncleared plot	scavenged	40.76994	-86.9931
9/9/2021	silver-haired bat	123	carcass search	100-m road and pad	scavenged	40.77034	-86.9407
9/9/2021	silver-haired bat	124	carcass search	70-m cleared plot	scavenged	40.77075	-86.9322
9/9/2021	silver-haired bat	124	carcass search	70-m cleared plot	dismembered	40.77018	-86.9322
9/9/2021	silver-haired bat	125	carcass search	70-m uncleared plot	scavenged	40.76989	-86.9211
9/10/2021	eastern red bat	104	carcass search	70-m cleared plot	scavenged	40.80393	-86.9702
9/10/2021	silver-haired bat	103	carcass search	70-m uncleared plot	scavenged	40.804	-86.9803
9/10/2021	silver-haired bat	103	carcass search	70-m uncleared plot	scavenged	40.80402	-86.9803
9/10/2021	silver-haired bat	103	carcass search	70-m uncleared plot	scavenged	40.80409	-86.9801
9/10/2021	silver-haired bat	103	carcass search	70-m uncleared plot	scavenged	40.80376	-86.98
9/10/2021	silver-haired bat	104	carcass search	70-m cleared plot	scavenged	40.80459	-86.9705
9/10/2021	silver-haired bat	105	carcass search	70-m cleared plot	scavenged	40.78846	-87.0023
9/10/2021	silver-haired bat	106	carcass search	70-m uncleared plot	scavenged	40.78872	-86.9926
9/13/2021	eastern red bat	125	carcass search	70-m uncleared plot	scavenged	40.7701	-86.9215
9/13/2021	hoary bat	118	carcass search	70-m uncleared plot	scavenged	40.76984	-86.9941
9/13/2021	silver-haired bat	105	carcass search	70-m cleared plot	scavenged	40.78913	-87.0025
9/13/2021	silver-haired bat	125	carcass search	70-m uncleared plot	scavenged	40.76998	-86.9213
9/14/2021	hoary bat	124	carcass search	70-m cleared plot	scavenged	40.77053	-86.9329
9/14/2021	silver-haired bat	103	carcass search	70-m uncleared plot	intact	40.80482	-86.9807
9/14/2021	silver-haired bat	103	carcass search	70-m uncleared plot	scavenged	40.80438	-86.9798
9/14/2021	silver-haired bat	107	carcass search	100-m road and pad	scavenged	40.78776	-86.9789
9/14/2021	silver-haired bat	124	carcass search	70-m cleared plot	dismembered	40.77058	-86.9315
9/16/2021	eastern red bat	110	carcass search	100-m road and pad	scavenged	40.79542	-86.9382

**Appendix A. Carcasses found at the Rosewater Wind Farm, White County, Indiana, April 1 – May 15, 2021, and August 1 – October 15, 2021.**

<b>Found Date</b>	<b>Common Name</b>	<b>Turbine</b>	<b>Search Type</b>	<b>Plot Type</b>	<b>Physical Condition</b>	<b>Longitude*</b>	<b>Latitude*</b>
9/16/2021	eastern red bat	118	carcass search	70-m uncleared plot	intact	40.76972	-86.9936
9/16/2021	eastern red bat	118	carcass search	70-m uncleared plot	scavenged	40.76971	-86.9929
9/16/2021	eastern red bat	124	carcass search**	70-m cleared plot	scavenged	40.76976	-86.932
9/16/2021	silver-haired bat	111	carcass search	70-m cleared plot	scavenged	40.7887	-86.9265
9/16/2021	silver-haired bat	124	carcass search	70-m cleared plot	dismembered	40.77054	-86.9318
9/16/2021	silver-haired bat	125	carcass search	70-m uncleared plot	scavenged	40.77028	-86.9204
9/17/2021	eastern red bat	104	carcass search	70-m cleared plot	scavenged	40.80456	-86.9707
9/17/2021	eastern red bat	117	carcass search	100-m road and pad	scavenged	40.77006	-87.0026
9/17/2021	hoary bat	104	carcass search	70-m cleared plot	scavenged	40.80389	-86.9707
9/17/2021	hoary bat	105	carcass search	70-m cleared plot	scavenged	40.78857	-87.0032
9/17/2021	hoary bat	117	carcass search	100-m road and pad	scavenged	40.76996	-87.0027
9/17/2021	silver-haired bat	103	carcass search	70-m uncleared plot	intact	40.80447	-86.9803
9/17/2021	silver-haired bat	103	carcass search	70-m uncleared plot	intact	40.80436	-86.9805
9/17/2021	silver-haired bat	103	carcass search	70-m uncleared plot	intact	40.80482	-86.9806
9/17/2021	silver-haired bat	104	carcass search	70-m cleared plot	scavenged	40.8038	-86.9706
9/17/2021	silver-haired bat	105	carcass search	70-m cleared plot	scavenged	40.78861	-87.0023
9/17/2021	silver-haired bat	105	carcass search	70-m cleared plot	scavenged	40.78831	-87.003
9/20/2021	big brown bat	114	carcass search	100-m road and pad	scavenged	40.76593	-86.9055
9/20/2021	eastern red bat	111	carcass search	70-m cleared plot	scavenged	40.78853	-86.9271
9/20/2021	eastern red bat	114	carcass search	100-m road and pad	scavenged	40.76618	-86.9056
9/20/2021	eastern red bat	124	carcass search	70-m cleared plot	scavenged	40.77072	-86.9327
9/20/2021	eastern red bat	125	carcass search	70-m uncleared plot	scavenged	40.76995	-86.9218
9/20/2021	hoary bat	111	carcass search	70-m cleared plot	scavenged	40.78827	-86.9266
9/20/2021	hoary bat	114	carcass search	100-m road and pad	scavenged	40.76604	-86.9057
9/20/2021	hoary bat	118	carcass search	70-m uncleared plot	dismembered	40.76968	-86.9939
9/20/2021	silver-haired bat	111	carcass search	70-m cleared plot	scavenged	40.78833	-86.9265
9/20/2021	silver-haired bat	115	carcass search	100-m road and pad	scavenged	40.766	-86.8958
9/20/2021	silver-haired bat	118	carcass search	70-m uncleared plot	scavenged	40.77002	-86.9937
9/20/2021	silver-haired bat	118	carcass search	70-m uncleared plot	scavenged	40.76984	-86.9943
9/20/2021	silver-haired bat	124	carcass search	70-m cleared plot	scavenged	40.77086	-86.9321
9/20/2021	silver-haired bat	124	carcass search	70-m cleared plot	scavenged	40.77084	-86.9328
9/20/2021	silver-haired bat	124	carcass search	70-m cleared plot	scavenged	40.77039	-86.9328
9/20/2021	silver-haired bat	124	carcass search	70-m cleared plot	scavenged	40.77016	-86.9327
9/20/2021	silver-haired bat	125	carcass search	70-m uncleared plot	scavenged	40.76996	-86.9209
9/20/2021	silver-haired bat	125	carcass search	70-m uncleared plot	scavenged	40.77024	-86.9209
9/20/2021	silver-haired bat	125	carcass search	70-m uncleared plot	dismembered	40.77037	-86.9213

**Appendix A. Carcasses found at the Rosewater Wind Farm, White County, Indiana, April 1 – May 15, 2021, and August 1 – October 15, 2021.**

<b>Found Date</b>	<b>Common Name</b>	<b>Turbine</b>	<b>Search Type</b>	<b>Plot Type</b>	<b>Physical Condition</b>	<b>Longitude*</b>	<b>Latitude*</b>
9/21/2021	eastern red bat	112	carcass search	100-m road and pad	scavenged	40.78727	-86.9137
9/21/2021	hoary bat	101	carcass search	100-m road and pad	scavenged	40.80418	-86.998
9/21/2021	hoary bat	104	carcass search	70-m cleared plot	scavenged	40.80454	-86.9707
9/21/2021	hoary bat	104	carcass search	70-m cleared plot	scavenged	40.80446	-86.9703
9/21/2021	hoary bat	107	carcass search	100-m road and pad	scavenged	40.78777	-86.9787
9/21/2021	silver-haired bat	103	carcass search	70-m uncleared plot	scavenged	40.80444	-86.9804
9/21/2021	silver-haired bat	103	carcass search	70-m uncleared plot	scavenged	40.80425	-86.981
9/21/2021	silver-haired bat	104	carcass search	70-m cleared plot	scavenged	40.80396	-86.9705
9/21/2021	silver-haired bat	104	carcass search	70-m cleared plot	scavenged	40.80427	-86.9712
9/21/2021	silver-haired bat	104	carcass search	70-m cleared plot	scavenged	40.80454	-86.9712
9/21/2021	silver-haired bat	107	carcass search	100-m road and pad	scavenged	40.7878	-86.9788
9/21/2021	silver-haired bat	108	carcass search	100-m road and pad	scavenged	40.78788	-86.9708
9/21/2021	silver-haired bat	112	carcass search	100-m road and pad	scavenged	40.78731	-86.9137
9/23/2021	eastern red bat	111	carcass search	70-m cleared plot	scavenged	40.78858	-86.9259
9/23/2021	silver-haired bat	109	carcass search	100-m road and pad	intact	40.79548	-86.9439
9/23/2021	silver-haired bat	111	carcass search	70-m cleared plot	scavenged	40.78812	-86.9268
9/23/2021	silver-haired bat	111	carcass search	70-m cleared plot	intact	40.78809	-86.9268
9/23/2021	silver-haired bat	118	carcass search**	70-m uncleared plot	intact	40.76992	-86.9928
9/23/2021	silver-haired bat	118	carcass search	70-m uncleared plot	scavenged	40.76958	-86.9933
9/23/2021	silver-haired bat	121	carcass search	100-m road and pad	scavenged	40.78331	-86.9546
9/23/2021	silver-haired bat	123	carcass search	100-m road and pad	intact	40.77052	-86.9405
9/23/2021	silver-haired bat	124	carcass search	70-m cleared plot	intact	40.77058	-86.9319
9/23/2021	silver-haired bat	124	carcass search	70-m cleared plot	intact	40.7703	-86.9317
9/23/2021	silver-haired bat	124	carcass search	70-m cleared plot	intact	40.77066	-86.9321
9/23/2021	silver-haired bat	125	carcass search	70-m uncleared plot	intact	40.77025	-86.9206
9/24/2021	eastern red bat	103	carcass search	70-m uncleared plot	scavenged	40.80435	-86.9801
9/24/2021	eastern red bat	103	carcass search	70-m uncleared plot	intact	40.80418	-86.9809
9/24/2021	eastern red bat	105	carcass search	70-m cleared plot	scavenged	40.78841	-87.0029
9/24/2021	silver-haired bat	103	carcass search	70-m uncleared plot	intact	40.80446	-86.9802
9/24/2021	silver-haired bat	103	carcass search	70-m uncleared plot	scavenged	40.80406	-86.9808
9/24/2021	silver-haired bat	104	carcass search	70-m cleared plot	intact	40.80443	-86.9702
9/24/2021	silver-haired bat	104	carcass search	70-m cleared plot	intact	40.80426	-86.9704
9/24/2021	silver-haired bat	104	carcass search	70-m cleared plot	dismembered	40.80436	-86.9702
9/24/2021	silver-haired bat	104	carcass search	70-m cleared plot	dismembered	40.80427	-86.9698
9/24/2021	silver-haired bat	105	carcass search	70-m cleared plot	scavenged	40.78868	-87.0024
9/24/2021	silver-haired bat	105	carcass search	70-m cleared plot	intact	40.789	-87.0024

**Appendix A. Carcasses found at the Rosewater Wind Farm, White County, Indiana, April 1 – May 15, 2021, and August 1 – October 15, 2021.**

<b>Found Date</b>	<b>Common Name</b>	<b>Turbine</b>	<b>Search Type</b>	<b>Plot Type</b>	<b>Physical Condition</b>	<b>Longitude*</b>	<b>Latitude*</b>
9/24/2021	silver-haired bat	105	carcass search**	70-m cleared plot	scavenged	40.78891	-87.0016
9/24/2021	silver-haired bat	105	carcass search	70-m cleared plot	intact	40.78846	-87.0018
9/24/2021	silver-haired bat	106	carcass search	70-m uncleared plot	scavenged	40.78875	-86.9923
9/24/2021	silver-haired bat	106	carcass search	70-m uncleared plot	scavenged	40.7891	-86.9925
9/24/2021	silver-haired bat	107	incidental	100-m road and pad	scavenged	40.7876	-86.9783
9/24/2021	silver-haired bat	107	incidental	100-m road and pad	scavenged	40.78758	-86.9783
9/24/2021	silver-haired bat	117	carcass search	100-m road and pad	dismembered	40.77004	-87.0029
9/24/2021	silver-haired bat	119	carcass search	100-m road and pad	scavenged	40.76988	-86.984
9/24/2021	silver-haired bat	120	carcass search	100-m road and pad	scavenged	40.77	-86.9691
9/27/2021	eastern red bat	106	carcass search	70-m uncleared plot	scavenged	40.78868	-86.9924
9/27/2021	eastern red bat	111	carcass search	70-m cleared plot	scavenged	40.78867	-86.9267
9/27/2021	eastern red bat	115	carcass search	100-m road and pad	scavenged	40.76583	-86.8959
9/27/2021	eastern red bat	118	carcass search	70-m uncleared plot	scavenged	40.76983	-86.993
9/27/2021	hoary bat	118	carcass search	70-m uncleared plot	scavenged	40.76962	-86.9938
9/27/2021	hoary bat	118	carcass search	70-m uncleared plot	scavenged	40.7697	-86.9934
9/27/2021	silver-haired bat	106	carcass search	70-m uncleared plot	dismembered	40.78874	-86.9924
9/27/2021	silver-haired bat	111	carcass search	70-m cleared plot	scavenged	40.78869	-86.9262
9/27/2021	silver-haired bat	111	carcass search	70-m cleared plot	scavenged	40.78841	-86.9256
9/27/2021	silver-haired bat	111	carcass search	70-m cleared plot	intact	40.78825	-86.9261
9/27/2021	silver-haired bat	111	carcass search	70-m cleared plot	scavenged	40.78907	-86.9265
9/27/2021	silver-haired bat	111	carcass search	70-m cleared plot	scavenged	40.78812	-86.926
9/27/2021	silver-haired bat	111	carcass search	70-m cleared plot	scavenged	40.78875	-86.9262
9/27/2021	silver-haired bat	111	carcass search	70-m cleared plot	scavenged	40.78833	-86.9266
9/27/2021	silver-haired bat	114	carcass search	100-m road and pad	scavenged	40.76625	-86.9058
9/27/2021	silver-haired bat	118	carcass search	70-m uncleared plot	scavenged	40.7697	-86.9933
9/27/2021	silver-haired bat	118	carcass search	70-m uncleared plot	scavenged	40.76938	-86.9938
9/27/2021	silver-haired bat	118	carcass search	70-m uncleared plot	scavenged	40.77016	-86.994
9/27/2021	silver-haired bat	118	carcass search	70-m uncleared plot	scavenged	40.76968	-86.9932
9/27/2021	silver-haired bat	118	carcass search	70-m uncleared plot	scavenged	40.76957	-86.9936
9/27/2021	silver-haired bat	124	carcass search	70-m cleared plot	scavenged	40.77058	-86.9316
9/27/2021	silver-haired bat	124	carcass search	70-m cleared plot	scavenged	40.77063	-86.9322
9/27/2021	silver-haired bat	124	carcass search	70-m cleared plot	scavenged	40.77095	-86.9319
9/27/2021	silver-haired bat	124	carcass search	70-m cleared plot	dismembered	40.77063	-86.9319
9/28/2021	eastern red bat	125	carcass search	70-m uncleared plot	scavenged	40.77016	-86.9207
9/28/2021	eastern red bat	125	carcass search	70-m uncleared plot	scavenged	40.77062	-86.9216
9/28/2021	eastern red bat	125	carcass search	70-m uncleared plot	intact	40.77013	-86.9219

**Appendix A. Carcasses found at the Rosewater Wind Farm, White County, Indiana, April 1 – May 15, 2021, and August 1 – October 15, 2021.**

<b>Found Date</b>	<b>Common Name</b>	<b>Turbine</b>	<b>Search Type</b>	<b>Plot Type</b>	<b>Physical Condition</b>	<b>Longitude*</b>	<b>Latitude*</b>
9/28/2021	eastern red bat	125	carcass search	70-m uncleared plot	scavenged	40.76996	-86.9207
9/28/2021	evening bat	105	carcass search**	70-m cleared plot	scavenged	40.78893	-87.0017
9/28/2021	silver-haired bat	104	carcass search	70-m cleared plot	scavenged	40.8045	-86.9702
9/28/2021	silver-haired bat	104	carcass search	70-m cleared plot	scavenged	40.80375	-86.9705
9/28/2021	silver-haired bat	104	carcass search	70-m cleared plot	scavenged	40.80439	-86.9703
9/28/2021	silver-haired bat	104	carcass search	70-m cleared plot	scavenged	40.80386	-86.9707
9/28/2021	silver-haired bat	104	carcass search	70-m cleared plot	scavenged	40.8046	-86.9704
9/28/2021	silver-haired bat	104	carcass search	70-m cleared plot	scavenged	40.80453	-86.9697
9/28/2021	silver-haired bat	104	carcass search	70-m cleared plot	scavenged	40.80384	-86.9707
9/28/2021	silver-haired bat	105	carcass search	70-m cleared plot	scavenged	40.78911	-87.0023
9/28/2021	silver-haired bat	105	carcass search	70-m cleared plot	scavenged	40.78875	-87.0021
9/28/2021	silver-haired bat	105	carcass search	70-m cleared plot	scavenged	40.78825	-87.0028
9/28/2021	silver-haired bat	105	carcass search	70-m cleared plot	scavenged	40.7889	-87.0026
9/28/2021	silver-haired bat	105	carcass search	70-m cleared plot	scavenged	40.78933	-87.0022
9/28/2021	silver-haired bat	125	carcass search	70-m uncleared plot	scavenged	40.77013	-86.9213
9/29/2021	silver-haired bat	103	carcass search	70-m uncleared plot	scavenged	40.80428	-86.98
9/29/2021	silver-haired bat	103	carcass search	70-m uncleared plot	dismembered	40.80394	-86.9809
9/29/2021	silver-haired bat	103	carcass search**	70-m uncleared plot	scavenged	40.80409	-86.9793
9/30/2021	eastern red bat	110	carcass search	100-m road and pad	scavenged	40.79558	-86.9389
9/30/2021	eastern red bat	111	carcass search	70-m cleared plot	scavenged	40.78804	-86.9267
9/30/2021	eastern red bat	118	carcass search	70-m uncleared plot	scavenged	40.76981	-86.9936
9/30/2021	eastern red bat	118	carcass search	70-m uncleared plot	scavenged	40.77016	-86.994
9/30/2021	eastern red bat	125	carcass search	70-m uncleared plot	scavenged	40.76987	-86.9213
9/30/2021	silver-haired bat	111	carcass search	70-m cleared plot	scavenged	40.78822	-86.926
9/30/2021	silver-haired bat	111	carcass search	70-m cleared plot	scavenged	40.78884	-86.9265
9/30/2021	silver-haired bat	118	carcass search	70-m uncleared plot	scavenged	40.77002	-86.9933
9/30/2021	silver-haired bat	118	carcass search	70-m uncleared plot	scavenged	40.76967	-86.9936
9/30/2021	silver-haired bat	124	carcass search**	70-m cleared plot	scavenged	40.77067	-86.933
9/30/2021	silver-haired bat	124	carcass search	70-m cleared plot	intact	40.77082	-86.9318
10/1/2021	eastern red bat	104	carcass search	70-m cleared plot	scavenged	40.80394	-86.9707
10/1/2021	eastern red bat	104	carcass search	70-m cleared plot	scavenged	40.80391	-86.9706
10/1/2021	silver-haired bat	104	carcass search	70-m cleared plot	scavenged	40.80454	-86.9699
10/1/2021	silver-haired bat	104	carcass search	70-m cleared plot	scavenged	40.80476	-86.9701
10/1/2021	silver-haired bat	117	carcass search**	100-m road and pad	scavenged	40.7701	-87.0016
10/4/2021	eastern red bat	118	carcass search	70-m uncleared plot	dismembered	40.77025	-86.994
10/4/2021	eastern red bat	118	carcass search	70-m uncleared plot	dismembered	40.76996	-86.9944

**Appendix A. Carcasses found at the Rosewater Wind Farm, White County, Indiana, April 1 – May 15, 2021, and August 1 – October 15, 2021.**

<b>Found Date</b>	<b>Common Name</b>	<b>Turbine</b>	<b>Search Type</b>	<b>Plot Type</b>	<b>Physical Condition</b>	<b>Longitude*</b>	<b>Latitude*</b>
10/4/2021	silver-haired bat	124	carcass search	70-m cleared plot	scavenged	40.77069	-86.9325
10/4/2021	silver-haired bat	124	carcass search	70-m cleared plot	scavenged	40.7705	-86.9319
10/5/2021	silver-haired bat	111	carcass search	70-m cleared plot	scavenged	40.78894	-86.9269
10/7/2021	silver-haired bat	125	carcass search	70-m uncleared plot	scavenged	40.77818	-86.9865
10/8/2021	eastern red bat	103	carcass search	70-m uncleared plot	scavenged	40.8043	-86.9801
10/8/2021	eastern red bat	104	carcass search	70-m cleared plot	scavenged	40.80387	-86.9712
10/8/2021	eastern red bat	124	carcass search	70-m cleared plot	intact	40.77004	-86.9324
10/8/2021	silver-haired bat	104	carcass search	70-m cleared plot	scavenged	40.80376	-86.971
10/8/2021	silver-haired bat	104	carcass search	70-m cleared plot	scavenged	40.80389	-86.9701
10/11/2021	hoary bat	124	carcass search	70-m cleared plot	scavenged	40.77058	-86.9331
10/11/2021	hoary bat	124	carcass search	70-m cleared plot	intact	40.77058	-86.9321
10/11/2021	silver-haired bat	112	carcass search	100-m road and pad	scavenged	40.78728	-86.914
10/14/2021	eastern red bat	118	carcass search	70-m uncleared plot	scavenged	40.76979	-86.9938
10/14/2021	silver-haired bat	124	carcass search	70-m cleared plot	intact	40.77063	-86.9317
10/15/2021	silver-haired bat	103	carcass search	70-m uncleared plot	scavenged	40.80454	-86.9795
10/15/2021	silver-haired bat	104	carcass search	70-m cleared plot	intact	40.80448	-86.9703
<b>Bird carcasses</b>							
4/1/2021	northern flicker	102	carcass search	100-m road and pad	intact	40.80438	-86.9894
4/30/2021	American redstart	102	carcass search	100-m road and pad	scavenged	40.80457	-86.9884
4/30/2021	northern flicker	102	carcass search	100-m road and pad	scavenged	40.80438	-86.9892
5/14/2021	Baltimore oriole	122	carcass search	100-m road and pad	scavenged	40.78362	-86.9419
8/3/2021	turkey vulture	104	carcass search	70-m cleared plot	scavenged	40.80386	-86.9706
8/3/2021	turkey vulture	106	carcass search	70-m uncleared plot	scavenged	40.78869	-86.9928
8/6/2021	turkey vulture	119	carcass search**	100-m road and pad	scavenged	40.76998	-86.9845
8/7/2021	killdeer	105	carcass search	70-m cleared plot	scavenged	40.78888	-87.0028
8/9/2021	unidentified passerine	111	carcass search	70-m cleared plot	feather spot	40.7883	-86.9272
8/9/2021	unidentified woodpecker	111	carcass search	70-m cleared plot	scavenged	40.78817	-86.9269
8/13/2021	yellow warbler	118	carcass search	70-m uncleared plot	scavenged	40.7702	-86.9941
8/16/2021	belted kingfisher	111	carcass search	70-m cleared plot	scavenged	40.78851	-86.9268
8/16/2021	rose-breasted grosbeak	111	carcass search	70-m cleared plot	unknown	40.78859	-86.9265
8/17/2021	mourning warbler	114	carcass search	100-m road and pad	unknown	40.76603	-86.9057
8/17/2021	yellow-rumped warbler	114	carcass search	100-m road and pad	unknown	40.76609	-86.9053
8/20/2021	horned lark	105	carcass search	70-m cleared plot	intact	40.78889	-87.0023
8/24/2021	horned lark	104	carcass search	70-m cleared plot	scavenged	40.80417	-86.9709
8/24/2021	horned lark	105	carcass search	70-m cleared plot	scavenged	40.78881	-87.0023
8/26/2021	killdeer	111	carcass search	70-m cleared plot	scavenged	40.7888	-86.9271

**Appendix A. Carcasses found at the Rosewater Wind Farm, White County, Indiana, April 1 – May 15, 2021, and August 1 – October 15, 2021.**

<b>Found Date</b>	<b>Common Name</b>	<b>Turbine</b>	<b>Search Type</b>	<b>Plot Type</b>	<b>Physical Condition</b>	<b>Longitude*</b>	<b>Latitude*</b>
8/27/2021	unidentified warbler	103	carcass search	70-m uncleared plot	dismembered	40.80443	-86.9805
8/30/2021	unidentified raptor	114	carcass search	100-m road and pad	scavenged	40.76604	-86.9056
8/31/2021	horned lark	105	carcass search	70-m cleared plot	scavenged	40.78907	-87.0026
9/2/2021	mourning dove	111	carcass search	70-m cleared plot	feather spot	40.78862	-86.9263
9/2/2021	pine warbler	111	carcass search	70-m cleared plot	scavenged	40.78851	-86.9263
9/3/2021	horned lark	104	carcass search	70-m cleared plot	dismembered	40.80418	-86.9704
9/6/2021	Tennessee warbler	113	carcass search	100-m road and pad	scavenged	40.76942	-86.9132
9/7/2021	horned lark	105	carcass search	70-m cleared plot	dismembered	40.78909	-87.0032
9/9/2021	red-eyed vireo	123	carcass search	100-m road and pad	scavenged	40.77045	-86.9403
9/9/2021	ruby-throated hummingbird	124	carcass search	70-m cleared plot	scavenged	40.77035	-86.9321
9/9/2021	unidentified passerine	124	carcass search	70-m cleared plot	dismembered	40.77054	-86.932
9/10/2021	unidentified passerine	105	carcass search	70-m cleared plot	dismembered	40.7887	-87.0018
9/13/2021	American redstart	111	carcass search	70-m cleared plot	dismembered	40.78806	-86.9267
9/13/2021	golden-winged warbler	105	carcass search	70-m cleared plot	dismembered	40.78912	-87.0021
9/13/2021	horned lark	105	carcass search	70-m cleared plot	scavenged	40.78908	-87.0026
9/14/2021	horned lark	124	carcass search	70-m cleared plot	scavenged	40.77042	-86.9327
9/14/2021	red-eyed vireo	103	carcass search	70-m uncleared plot	scavenged	40.80464	-86.9808
9/16/2021	ruby-throated hummingbird	118	carcass search	70-m uncleared plot	scavenged	40.77002	-86.9932
9/17/2021	killdeer	106	carcass search	70-m uncleared plot	scavenged	40.78866	-86.9929
9/17/2021	red-breasted nuthatch	104	carcass search	70-m cleared plot	scavenged	40.80423	-86.97
9/21/2021	mourning warbler	104	carcass search	70-m cleared plot	scavenged	40.80431	-86.9708
9/23/2021	Baltimore oriole	111	carcass search	70-m cleared plot	scavenged	40.78822	-86.9272
9/23/2021	Tennessee warbler	111	carcass search	70-m cleared plot	intact	40.78786	-86.9267
9/29/2021	mourning warbler	103	carcass search	70-m uncleared plot	scavenged	40.80411	-86.9795
10/1/2021	unidentified passerine	104	carcass search	70-m cleared plot	dismembered	40.80425	-86.9708
10/1/2021	unidentified passerine	105	carcass search	70-m cleared plot	scavenged	40.78939	-87.0025
10/1/2021	unidentified warbler	105	carcass search	70-m cleared plot	dismembered	40.78936	-87.0028
10/4/2021	unidentified warbler	104	carcass search	70-m cleared plot	dismembered	40.80429	-86.971
10/4/2021	unidentified warbler	124	carcass search	70-m cleared plot	scavenged	40.77024	-86.9327
10/4/2021	yellow-billed cuckoo	118	carcass search	70-m uncleared plot	dismembered	40.77034	-86.9938
10/7/2021	unidentified passerine	118	carcass search	70-m uncleared plot	scavenged	40.76943	-86.9932
10/8/2021	golden-crowned kinglet	103	carcass search	70-m uncleared plot	scavenged	40.80405	-86.9802
10/8/2021	ruby-crowned kinglet	124	carcass search	70-m cleared plot	scavenged	40.77011	-86.9328
10/8/2021	ruby-crowned kinglet	124	carcass search	70-m cleared plot	scavenged	40.77066	-86.933
10/8/2021	yellow-rumped warbler	124	carcass search	70-m cleared plot	intact	40.77076	-86.9326

**Appendix A. Carcasses found at the Rosewater Wind Farm, White County, Indiana, April 1 – May 15, 2021, and August 1 – October 15, 2021.**

<b>Found Date</b>	<b>Common Name</b>	<b>Turbine</b>	<b>Search Type</b>	<b>Plot Type</b>	<b>Physical Condition</b>	<b>Longitude*</b>	<b>Latitude*</b>
10/11/2021	golden-crowned kinglet	124	carcass search	70-m cleared plot	scavenged	40.77057	-86.9324
10/12/2021	golden-crowned kinglet	103	carcass search	70-m uncleared plot	intact	40.80436	-86.9802
10/12/2021	unidentified small bird	102	carcass search**	100-m road and pad	scavenged	40.80458	-86.99

\*These coordinates were collected in WGS84.

\*\* Carcass was found outside the search area.

m = meters.



**Appendix B. Searcher Efficiency, Carcass Persistence, and Truncated Weighted  
Likelihood Area Adjustment Estimate Model Fitting Results**

**Appendix B1. Searcher efficiency models for 70-meter plots at the Rosewater Wind Farm, White County, Indiana, August 1 – October 15, 2021.**

<b>Covariates</b>	<b>k Value</b>	<b>AICc</b>	<b>Delta AICc</b>
No covariates	0.67	67.71	0*
Plot search type	0.67	69.83	2.12

\* Selected model.

AICc = corrected Akaike Information Criterion.

n = 54.

**Appendix B2. Searcher efficiency models for 100-meter roads and pads at the Rosewater Wind Farm, White County, Indiana, April 1 – May 15, 2021, and August 1 – October 15, 2021.**

<b>Covariates</b>	<b>k Value</b>	<b>AICc</b>	<b>Delta AICc</b>
No covariates	0.67	11.85	0*
Season	0.67	13.75	1.90

\* Selected model.

AICc = corrected Akaike Information Criterion.

n = 49.

**Appendix B3. Carcass persistence models with covariates and distributions for 70-meter plots at the Rosewater Wind Farm, White County, Indiana, August 1 – October 15, 2021.**

<b>Location Covariates</b>	<b>Scale Covariates</b>	<b>Distribution</b>	<b>AICc</b>	<b>Delta AICc</b>
No Covariates	PlotSearchType	Weibull	86.06	0*
No Covariates	PlotSearchType	lognormal	86.54	0.48
No Covariates	PlotSearchType	loglogistic	87.02	0.96
PlotSearchType	PlotSearchType	lognormal	87.65	1.59
PlotSearchType	No Covariates	lognormal	87.75	1.69
PlotSearchType	PlotSearchType	loglogistic	88.10	2.04
PlotSearchType	PlotSearchType	Weibull	88.37	2.31
PlotSearchType	No Covariates	loglogistic	88.40	2.34
PlotSearchType	-	exponential	89.11	3.05
PlotSearchType	No Covariates	Weibull	89.38	3.32
No Covariates	No Covariates	Weibull	91.63	5.57
No Covariates	No Covariates	loglogistic	91.73	5.67
No Covariates	No Covariates	lognormal	91.89	5.83
No Covariates	-	exponential	92.17	6.11

\* Selected model.

AICc = corrected Akaike Information Criterion.

n = 30.

**Appendix B4. Carcass persistence models with covariates and distributions for roads and pads at the Rosewater Wind Farm, White County, Indiana, April 1 – May 15, 2021, and August 1 – October 15, 2021.**

Location Covariates	Scale Covariates	Distribution	AICc	Delta AICc
No Covariates	Season	lognormal	109.48	0*
No Covariates	Season	loglogistic	109.96	0.48
Season	Season	lognormal	112.13	2.65
Season	Season	loglogistic	112.58	3.1
No Covariates	Season	Weibull	113.35	3.87
No Covariates	-	exponential	113.72	4.24
No Covariates	No Covariates	loglogistic	115.11	5.63
No Covariates	No Covariates	Weibull	115.31	5.83
Season	Season	Weibull	115.55	6.07
No Covariates	No Covariates	lognormal	115.58	6.1
Season	-	exponential	115.94	6.46
Season	No Covariates	loglogistic	117.55	8.07
Season	No Covariates	Weibull	117.63	8.15
Season	No Covariates	lognormal	117.87	8.39

\* Selected model.

AICc = corrected Akaike Information Criterion.

n = 30.

**Appendix B5. Search area adjustment models for bats from the Rosewater Wind Farm, White County, Indiana, April 1 – May 15, 2021, and August 1 – October 15, 2021.**

Distribution	AICc	Delta AICc
gamma	11,254.38	0*
Weibull	11,255.67	1.29
Rayleigh	11,295.56	41.19
normal	11,301.75	47.37
Gompertz	11,347.19	92.81

\* Selected model.

AICc = corrected Akaike Information Criterion.

**Appendix B6. Truncated weighted maximum likelihood search area adjustment estimates for the Rosewater Wind Farm, White County, Indiana, April 1 – May 15, 2021, and August 1 – October 15, 2021.**

Plot Type	Area Correction
70-m cleared	0.81
70-m uncleared	0.81
100-m road and pad (fall)	0.17
100-m road and pad (spring)	0.19

The carcass density followed a truncated gamma distribution with the following parameters: 2.1269 (parameter 1) and 0.0407 (parameter 2) and a left-truncation bound at zero meters (m).

n = 384.

**Appendix C. Bat Fatality Rates at Rosewater Wind Farm Using the GenEst Fatality Estimator**

**Appendix C1. Estimated fatality rates with 90% confidence intervals (CI) for all plots types and season for studies conducted at the Rosewater Wind Farm, White County, Indiana, April 1 – May 15, 2021, and August 1 – October 15, 2021.**

Plot Type	Spring		Fall	
	Estimate	90% CI	Estimate	90% CI
<b>Searcher Efficiency</b>				
100-m road and pad	0.98	0.90–1.00	0.98	0.90–1.00
70-m uncleared	–	–	0.70	0.59–0.79
70-m cleared	–	–	0.70	0.59–0.79
<b>Average Probability of a Carcass Persisting Through the Search Interval**</b>				
100-m road and pad	0.64	0.50–0.76	0.66	0.59–0.76
70-m uncleared	–	–	0.75	0.61–0.89
70-m cleared	–	–	0.99	0.94–1.00
<b>Probability of Available and Detected</b>				
100-m road and pad	0.67	0.55–0.79	0.56	0.51–0.63
70-m uncleared	–	–	0.55	0.46–0.67
70-m cleared	–	–	0.79	0.68–0.87
<b>Estimated Fatality Rates (Fatalities/Turbine/Season)</b>				
100-m road and pad	1.85	0.68–4.05	42.20	30.43–72.70
70-m uncleared	–	–	63.31	47.03–109.22
70-m cleared	–	–	64.04	50.37–109.49
<b>Overall</b>	<b>1.85</b>	<b>0.68–4.05</b>	<b>48.99</b>	<b>37.95–82.31</b>
<b>Estimated Fatality Rates (Fatalities/Megawatt/Seasons)</b>				
100-m road and pad	0.45	0.16–1.00	10.51	7.56–18.18
70-m uncleared	–	–	15.07	11.20–26.00
70-m cleared	–	–	15.89	12.55–27.34
<b>Overall</b>	<b>0.45</b>	<b>0.16–1.00</b>	<b>12.11</b>	<b>9.38–20.32</b>

\*CI were not calculated when the number of observed carcasses was less than five.

\*\*In the spring the search interval was 14 days on roads and pads and weekly on full plots. In the fall, the search interval was weekly on roads and pads and twice a week on full plots.

m = meter.

**Appendix D. Inputs for Single Class and Multiple Class Modules in Evidence of Absence**

**Appendix D1. Inputs needed to run Evidence of Absence (EoA): Single Class Module for the Rosewater Wind Farm, White County, Indiana, April 1 – May 15, 2021, and August 1 – October 15, 2021.**

Season	Plot Type	Search interval (I)	Number of searches <sup>2</sup>	Spatial Coverage (a)	Searcher Efficiency		Carcass Persistence <sup>1</sup>			
					Carcasses available	Carcasses found	Shape (α)	Scale (β)	Scale Lower Limit (β)	Scale UpperLimit (β)
spring	100-m road and pad	14.5	5	0.188	49	48	0.789	2.217	1.771	2.663
fall	100-m road and pad	7	12	0.173	49	48	7.651	2.217	1.771	2.663
fall	70-m cleared	3.5	23	0.839	54	38	1.908	24.337	12.541	47.229
fall	70-m uncleared	3.5	23	0.839	54	38	0.442	24.337	12.541	47.229

<sup>1</sup>. A lognormal distribution was used for the road and pad carcass persistence distribution. A Weibull distribution was used for the cleared and uncleared plot carcass persistence distribution.

<sup>2</sup>. Includes one additional search beyond what was conducted in the field to account for the EoA GUI assumption that a clearing search is included in the number of searches.

m = meters.

**Appendix D2. Inputs needed to run Evidence of Absence: Multiple Class Module for the Rosewater Wind Farm, White County, Indiana, from April 1 – May 15, 2021, and August 1 – October 15, 2021.**

Season	Plot Type	Ba	Bb	Sampling factor	Temporal Coverage (v)	Weights (ρ)
spring	100-m road and pad	59.338	447.504	1.0	0.11	0.11
fall	100-m road and pad	407.703	3189.37	0.68	0.89	0.606
fall	70-m cleared	127.261	45.242	0.16	0.89	0.142
fall	70-m uncleared	101.571	85.967	0.16	0.89	0.142

m = meter.

**Appendix D3. Inputs needed to run Evidence of Absence: Multiple Years Module for the Rosewater Wind Farm, White County, Indiana, from 2021.**

Year	g	90% Confidence Interval	Ba	Bb	Weights (ρ)
2021	0.264	(0.248–0.279)	825.19	2304.68	1.0

EoA, v2.0.7 - Single Class Module

Edit Help

Detection Probability (g)

**Search Schedule**

Start of monitoring (yyyy-mm-dd)

Formula

Search interval (I)

Number of searches

Custom

span = 182, I (mean) = 7

Spatial coverage (a)

Temporal coverage (v)

**Searcher Efficiency**

Carcasses available for several searches

95% CIs: p ∈ [0.53, 0.681], k ∈ [0.653, 0.816]

p̂ = 0.62, k = 0.736

Carcasses removed after one search

Carcasses available

Carcasses found

p̂ = 0.98, with 95% CI = [0.909, 0.998]

Factor by which searcher efficiency changes with each search (k)

**Persistence Distribution**

Use field trials to estimate parameters

Distribution: Lognormal with shape (α) = 4.078 and scale (β) = 1.171

r = 0.401 for Ir = 14.5, with 95% CIs: r = [0.293, 0.519], β = [0.488, 1.854]

Enter parameter estimates manually

**Parameters**

Exponential

Weibull

Log-Logistic

Lognormal

shape (α)

scale (β)  lvr  upr

r = 0.636 for Ir = 14.5, with 95% CI: r ∈ [0.486, 0.775]

**Fatality estimation (M, λ)**

Carcass Count (X)    One-sided CI (M\*)  Two-sided CI

Credibility level (1 - α)

Estimated detection probability (g)

Summary statistics for estimation of detection probability (g)

=====

Results:

Full site for full year

Estimated g = 0.0128, 95% CI = [0.00993, 0.016]

Fitted beta distribution parameters for estimated g: Ba = 67.7592, Bb = 5238.4344

Full site for monitored period, 01-Apr-2021 through 12-Jun-2021

Estimated g = 0.116, 95% CI = [0.0898, 0.145]

Fitted beta distribution parameters for estimated g: Ba = 59.2137, Bb = 450.8701

Temporal coverage (within year) = 0.11

Searched area for monitored period, 01-Apr-2021 through 12-Jun-2021

Estimated g = 0.618, 95% CI = [0.467, 0.757]

Fitted beta distribution parameters for estimated g: Ba = 25.6071, Bb = 15.8607

=====

Input:

Search parameters

trial carcasses placed = 49, carcasses found = 48

estimated searcher efficiency: p = 0.98, 95% CI = [0.909, 0.998]

k = 0.67

Search schedule: Search interval (I) = 14.5, number of searches = 5, span = 72.5

spatial coverage: 0.188      temporal coverage: 0.11

Carcass persistence:

Lognormal persistence distribution

shape (α) = 0.789 and scale (β) = 2.217

95% CI β = [1.771, 2.663]

r = 0.636 for Ir = 14.5 with 95% CI = [0.486, 0.775]

Parameters entered manually

Uniform arrivals

Appendix D4. Spring 2021, 100-meter road and pad searches at 25 turbines, searched at a 14.5-day interval.



EoA, v2.0.7 - Single Class Module

Edit Help

### Detection Probability (g)

**Search Schedule**

Start of monitoring (yyyy-mm-dd)

Formula

Search interval (I)

Number of searches

Custom

span = 182, I (mean) = 7

Spatial coverage (a)

Temporal coverage (v)

**Searcher Efficiency**

Carcasses available for several searches

95% CIs: p = [0.522, 0.68], k = [0.643, 0.82]

$\hat{p} = 0.62, \hat{k} = 0.735$

Carcasses removed after one search

Carcasses available

Carcasses found

$\hat{p} = 0.704$ , with 95% CI = [0.574, 0.813]

Factor by which searcher efficiency changes with each search (k)

**Persistence Distribution**

Use field trials to estimate parameters

Distribution: Lognormal with shape ( $\alpha$ ) = 4.078 and scale ( $\beta$ ) = 1.171

r = 0.653 for Ir = 3.5, with 95% CIs: r = [0.538, 0.771],  $\beta$  = [0.488, 1.854]

Enter parameter estimates manually

**Parameters**

shape ( $\alpha$ )

scale ( $\beta$ )  lwr  upr

r = 0.992 for Ir = 3.5, with 95% CI: r = [0.971, 0.998]

---

**Fatality estimation (M,  $\lambda$ )**

Carcass Count (X)    One-sided CI (M\*)  Two-sided CI

Credibility level (1 -  $\alpha$ )

Estimated detection probability (g)

Summary statistics for estimation of detection probability (g)

=====

Results:

Full site for full year

Estimated g = 0.657, 95% CI = [0.599, 0.712]

Fitted beta distribution parameters for estimated g: Ba = 177.6752, Bb = 92.8369

Full site for monitored period, 01-Aug-2021 through 20-Oct-2021

Estimated g = 0.738, 95% CI = [0.673, 0.799]

Fitted beta distribution parameters for estimated g: Ba = 136.9286, Bb = 48.6157

Temporal coverage (within year) = 0.89

Searched area for monitored period, 01-Aug-2021 through 20-Oct-2021

Estimated g = 0.88, 95% CI = [0.795, 0.944]

Fitted beta distribution parameters for estimated g: Ba = 62.4065, Bb = 8.5416

=====

Input:

Search parameters

trial carcasses placed = 54, carcasses found = 38

estimated searcher efficiency: p = 0.704, 95% CI = [0.574, 0.813]

k = 0.67

Search schedule: Search interval (I) = 3.5, number of searches = 23, span = 80.5

spatial coverage: 0.839 temporal coverage: 0.89

-----

Carcass persistence:

Weibull persistence distribution

shape (a) = 1.908 and scale (B) = 24.337

95% CI B = [12.541, 47.229]

r = 0.992 for Ir = 3.5 with 95% CI = [0.971, 0.998]

Parameters entered manually

Uniform arrivals

-----

**Appendix D5. Fall 2021, 70-meter cleared plot searches at four turbines, searched at a 3.5-day interval.**

EoA, v2.0.7 - Single Class Module

Edit Help

Detection Probability (g)

Search Schedule

Start of monitoring (yyyy-mm-dd) 2021-08-01

Formula

Search interval (I) 3.5

Number of searches 23

Custom Edit/View

span = 182, I (mean) = 7

Spatial coverage (a) 0.839

Temporal coverage (v) 0.89

Estimate g

Searcher Efficiency

Carcasses available for several searches

95% CIs:  $p \in [0.522, 0.68]$ ,  $k \in [0.643, 0.82]$

$\hat{p} = 0.62$ ,  $k = 0.735$  View Edit

Carcasses removed after one search

Carcasses available 54

Carcasses found 38

$\hat{p} = 0.704$ , with 95% CI = [0.574, 0.813]

Factor by which searcher efficiency changes with each search (k) 0.67

Persistence Distribution

Use field trials to estimate parameters View/Edit

Distribution: Lognormal with shape ( $\alpha$ ) = 4.078 and scale ( $\beta$ ) = 1.171

$r = 0.653$  for  $I_r = 3.5$ , with 95% CIs:  $r = [0.529, 0.774]$ ,  $\beta = [0.488, 1.854]$

Enter parameter estimates manually View

Parameters

Exponential

Weibull 0.442

Log-Logistic

Lognormal

shape ( $\alpha$ ) 0.442

scale ( $\beta$ ) 24.337 lwr 12.541 upr 47.229

$r = 0.748$  for  $I_r = 3.5$ , with 95% CI:  $r \in [0.68, 0.805]$

Fatality estimation (M,  $\lambda$ )

Carcass Count (X) 0 Estimate M

Credibility level (1 -  $\alpha$ ) 0.9 Estimate  $\lambda$

One-sided CI (M\*) Two-sided CI

Close

Estimated detection probability (g)

Summary statistics for estimation of detection probability (g)

Results:

Full site for full year

Estimated  $g = 0.479$ , 95% CI = [0.418, 0.541]

Fitted beta distribution parameters for estimated  $g$ :  $B_a = 122.1358$ ,  $B_b = 132.6835$

Full site for monitored period, 01-Aug-2021 through 20-Oct-2021

Estimated  $g = 0.539$ , 95% CI = [0.47, 0.607]

Fitted beta distribution parameters for estimated  $g$ :  $B_a = 108.3707$ ,  $B_b = 92.8562$

Temporal coverage (within year) = 0.89

Searched area for monitored period, 01-Aug-2021 through 20-Oct-2021

Estimated  $g = 0.642$ , 95% CI = [0.558, 0.722]

Fitted beta distribution parameters for estimated  $g$ :  $B_a = 84.0438$ ,  $B_b = 46.8865$

Input:

Search parameters

trial carcasses placed = 54, carcasses found = 38

estimated searcher efficiency:  $p = 0.704$ , 95% CI = [0.574, 0.813]

$k = 0.67$

Search schedule: Search interval (I) = 3.5, number of searches = 23, span = 80.5

spatial coverage: 0.839 temporal coverage: 0.89

Carcass persistence:

Weibull persistence distribution

shape ( $\alpha$ ) = 0.442 and scale ( $\beta$ ) = 24.337

95% CI  $\beta = [12.541, 47.229]$

$r = 0.748$  for  $I_r = 3.5$  with 95% CI = [0.68, 0.805]

Parameters entered manually

Uniform arrivals

Appendix D6. Fall 2021, 70-meter uncleared plot searches at four turbines, searched at a 3.5-day interval.

EoA, v2.0.7 - Single Class Module

Edit Help

### Detection Probability (g)

**Search Schedule**

Start of monitoring (yyyy-mm-dd)

Formula

Search interval (I)

Number of searches

Custom

span = 182, I (mean) = 7

Spatial coverage (a)

Temporal coverage (v)

**Searcher Efficiency**

Carcasses available for several searches

95% CIs:  $p \in [0.522, 0.68]$ ,  $k \in [0.643, 0.82]$

$\hat{p} = 0.62$ ,  $k = 0.735$

Carcasses removed after one search

Carcasses available

Carcasses found

$\hat{p} = 0.98$ , with 95% CI = [0.909, 0.998]

Factor by which searcher efficiency changes with each search (k)

**Persistence Distribution**

Use field trials to estimate parameters

Distribution: Lognormal with shape ( $\alpha$ ) = 4.078 and scale ( $\beta$ ) = 1.171

$r = 0.531$  for  $I_r = 7$ , with 95% CIs:  $r \in [0.416, 0.656]$ ,  $\beta \in [0.488, 1.854]$

Enter parameter estimates manually

**Parameters**

shape ( $\alpha$ )

scale ( $\beta$ )  lwr  upr

$r = 0.665$  for  $I_r = 7$ , with 95% CI:  $r \in [0.607, 0.719]$

---

**Fatality estimation (M,  $\lambda$ )**

Carcass Count (X)    One-sided CI (M\*)  Two-sided CI

Credibility level (1 -  $\alpha$ )

Estimated detection probability (g)

---

Summary statistics for estimation of detection probability (g)

=====

Results:

Full site for full year

Estimated  $g = 0.101$ , 95% CI = [0.0922, 0.11]

Fitted beta distribution parameters for estimated  $g$ :  $B_a = 442.1619$ ,  $B_b = 3937.8949$

Full site for monitored period, 01-Aug-2021 through 24-Oct-2021

Estimated  $g = 0.113$ , 95% CI = [0.104, 0.124]

Fitted beta distribution parameters for estimated  $g$ :  $B_a = 436.0118$ ,  $B_b = 3408.017$

Temporal coverage (within year) = 0.89

Searched area for monitored period, 01-Aug-2021 through 24-Oct-2021

Estimated  $g = 0.656$ , 95% CI = [0.597, 0.712]

Fitted beta distribution parameters for estimated  $g$ :  $B_a = 169.7417$ ,  $B_b = 89.1526$

=====

Input:

Search parameters

trial carcasses placed = 49, carcasses found = 48

estimated searcher efficiency:  $p = 0.98$ , 95% CI = [0.909, 0.998]

$k = 0.67$

Search schedule: Search interval (I) = 7, number of searches = 12, span = 84

spatial coverage: 0.173      temporal coverage: 0.89

---

Carcass persistence:

Lognormal persistence distribution

shape ( $\alpha$ ) = 7.651 and scale ( $\beta$ ) = 2.217

95% CI  $\beta$  = [1.771, 2.663]

$r = 0.665$  for  $I_r = 7$  with 95% CI = [0.607, 0.719]

Parameters entered manually

Uniform arrivals

---

Appendix D7. Fall 2021, 100-meter road and pad searches at 17 turbines, searched at a 7-day interval.

Edit Help

Options

Overall

Estimate total mortality (M)

Credibility level (1 -  $\alpha$ )

One-sided CI (M\*)

Two-sided CI

Estimate overall detection probability (g)

Individual classes

Calculate g parameters from monitoring data

Enter g parameters manually

Actions

Class	dwp	X	Ba	Bb	ĝ	95% CI
unsearched	0	0	---	---	0	[0, 0]
Spring Road/Pad	0.11	0	59.338	447.504	0.1171	[0.0906, 0.146]
Fall Road/Pad	0.606	0	407.703	3189.37	0.1133	[0.103, 0.124]
Fall Cleared	0.142	0	127.261	45.242	0.7377	[0.67, 0.8]
Fall Uncleared	0.142	0	101.571	85.967	0.5416	[0.47, 0.612]

Estimated mortality (M) & detection probability (g) for multiple classes

---

Summary statistics for multiple class estimate

---

Input: Detection probability, by search class  
Search coverage = 1

Class	DWP	X	Ba	Bb	ghat	95% CI
unsearched	0	0	---	---	0	[ 0, 0]
Spring Road/Pad	0.11	0	59.34	447.5	0.117	[0.091, 0.146]
Fall Road/Pad	0.606	0	407.7	3189	0.113	[0.103, 0.124]
Fall Cleared	0.142	0	127.3	45.24	0.738	[0.670, 0.800]
Fall Uncleared	0.142	0	101.6	85.97	0.542	[0.470, 0.612]

---

Results for full site

---

Detection probability  
Estimated g = 0.263, 95% CI = [0.248, 0.279]  
Fitted beta distribution parameters for estimated g: Ba = 826.3571, Bb = 2312.9462

Mortality  
M\* = 2 for credibility 1 - alpha = 0.8, i.e., P(M <= 2) >= 80%  
Estimated annual fatality rate: lambda = 1.9, 95% CI = [ 0.00189, 9.558]

Test of assumed relative weights (rho)

Class	Assumed	Fitted (95% CI)
unsearched	0.000	NA
Spring Road/Pad	0.110	[0.003, 0.946]
Fall Road/Pad	0.606	[0.006, 0.941]
Fall Cleared	0.142	[0.000, 0.600]
Fall Uncleared	0.142	[0.000, 0.707]

p = 1 for likelihood ratio test of H0: assumed rho = true rho

Mortality rates (lambda) by class

Class	Median	IQR	95% CI
unsearched	---	---	---
Spring Road/Pad	1.97	[ 0.44, 5.74]	[ 0.00, 22.11]
Fall Road/Pad	2.01	[ 0.45, 5.85]	[ 0.00, 22.25]
Fall Cleared	0.31	[ 0.07, 0.90]	[ 0.00, 3.42]
Fall Uncleared	0.42	[ 0.09, 1.23]	[ 0.00, 4.68]

Posterior distribution of M

m	p(M = m)	p(M > m)
0	0.5547	0.4453
1	0.1693	0.2760
2	0.0957	0.1803
3	0.0595	0.1208
4	0.0386	0.0822
5	0.0257	0.0565
6	0.0174	0.0391
7	0.0120	0.0271
8	0.0083	0.0188
9	0.0058	0.0130
10	0.0041	0.0090
11	0.0029	0.0061
12	0.0020	0.0041
13	0.0014	0.0026
14	0.0010	0.0016
15	0.0007	0.0009
16	0.0005	0.0004
17	0.0004	0.0000

Appendix D8. Spring and Fall 2021, searches at 25 turbines per season.