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

Final Report

April 1 – May 15 and August 1 – October 15, 2022

Prepared for:

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EXECUTIVE SUMMARY

Indiana Crossroads Wind Farm, LLC is operating the Indiana Crossroads Wind Farm (Project) in White County, Indiana. The Project became operational in 2021 and consists of seventy-two 4.2 megawatt (MW) Vestas V150 wind turbines that have a 105-meter (m; 344-foot [ft]) hub height and a 150-m (492-ft) rotor diameter. This report details the post-construction monitoring studies conducted in 2022, consistent with Section 6.6 of the Project's Habitat Conservation Plan (HCP) and the Incidental Take Permit (ITP; ESPER0036249) for Indiana bats and northern long-eared bats (Covered Species). Turbines were feathered below manufacturer cut-in speed (3.0 m [9.8 ft] per second) in the spring (April 1–May 15), and 5.0 m (16.4 ft) per second in fall (August 1– October 15), sunset to sunrise, when the temperature was above 10 degrees Celsius to minimize direct impacts to Covered Species.

Post-construction monitoring was completed in accordance with the study plan outlined in the Project's HCP. The study plan was designed to achieve a probability of detection, or *g*, of 0.20. The overall goal of this post-construction 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 US Fish and Wildlife Service for the first year of post-construction monitoring.

Standardized carcass searches were completed for bat carcasses at three plot types: cleared plots, uncleared plots, and roads and pads. Technicians searched all 72 turbines as roads and pads to a distance of 100 m (328 ft) from the turbine, weekly during the spring (April 1 – May 15). In the fall (August 1 – October 15), a technician searched 44 turbines as roads and pads to a distance of 100 m from the turbine, weekly. Dog-handler teams searched 15 turbines as cleared plots with a 70-m (230-ft) radius and 13 turbines as uncleared plots with a 70-m radius, once a week during the fall. Cleared turbine plots were typically located in corn fields and uncleared plots were located in soybean or alfalfa fields. 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 during 2022 spring and fall monitoring periods. Three hundred eighty-six bats were found during the study. The most commonly found bat species were silver-haired bat (31.1%), eastern red bat (30.6%), hoary bat (18.7%), big brown bat (17.9%) and evening bat (1.0%). Additionally, two bats were identified as eastern red or Seminole bats and one heavily scavenged bat was identified as *Lasiurus* spp. Four evening bats, a state-listed as endangered species, were documented at the Project on May 10, August 19, September 7 and 26. The overall *g* value was 0.201 (90% CI: 0.175–0.228). The EoA model estimated the mean annual take rate at the Project was 2.997 Indiana bats and 2.997 northern long-eared bats. No adaptive management was triggered.

STUDY PARTICIPANTS

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REPORT REFERENCE

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INTRODUCTION

Indiana Crossroads Wind Farm, LLC (Indiana Crossroads), a subsidiary of Northern Indiana Public Service Company, is operating the Indiana Crossroads Wind Farm (Project) in White County, Indiana. Indiana Crossroads obtained an Incidental Take Permit (ITP; ESPER0036249) for the federally endangered Indiana bat (*Myotis sodalis*) and northern long-eared bat (*M. septentrionalis*; hereafter Covered Species) from the US Fish and Wildlife Service (USFWS) dated March 2, 2022. Post-construction compliance monitoring is required by the ITP to determine if the level of take of the Covered Species 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 (PCM) study designed to achieve a probability of detection, or *g*, of 0.20 consistent with the Project's Habitat Conservation Plan (HCP). 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 period as requested by the USFWS for the first year of monitoring. This report presents the results of the first year of the post-construction monitoring conducted at the Project from April 1 – May 15 and August 1 – October 15, 2022.

STUDY AREA

The Project is located in White County, Indiana, 1.1 kilometers (0.7 mile) southwest 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 13,259 hectares (32,763 acres). Approximately 95% of the Permit Area is composed of cultivated cropland and developed areas (Figure 1).

The Project became fully operational in 2021, and consists of 72 4.2-megawatt (MW) Vestas 150 wind turbines that have a 105-meter (m; 344-foot [ft]) hub height and a 150-m (492-ft) rotor diameter. All turbines are within the migratory range of the Covered Species. During the spring, summer, and fall, Indiana Crossroads adjusted turbine operations to minimize impacts to the Covered Species (Table 1).
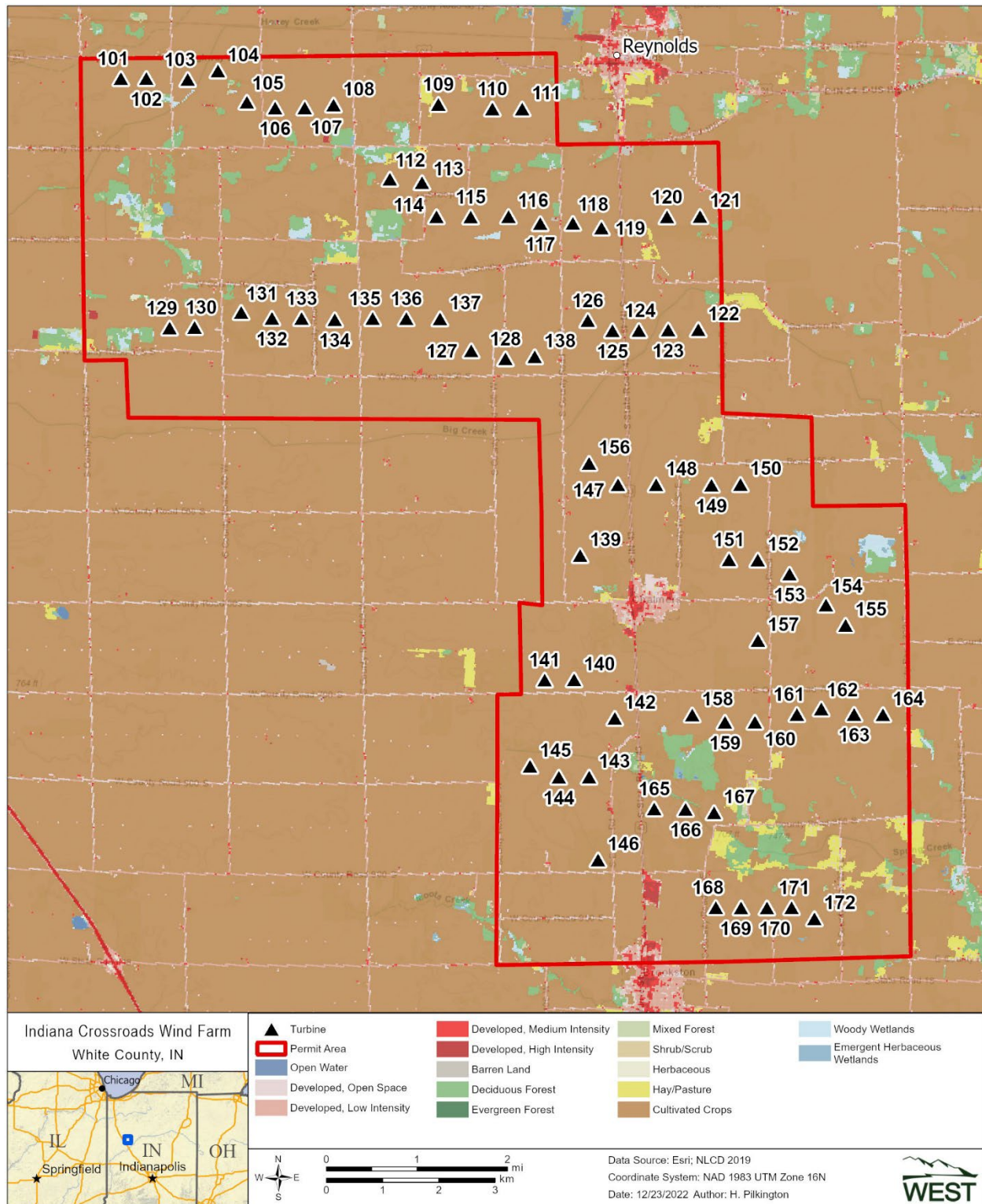
Figure 1.   Turbine locations at the Indiana Crossroads Wind Farm, White County, Indiana.

Table 1. **Seasonal curtailment regime at the Indiana Crossroads Wind Farm, White County, Indiana.**

Season	Turbines	Time of Day	Cut-In Speed	Feathering Below Cut-In[1]?	Temperature Threshold[2]
March 15 – July 31	All	Sunset to sunrise	Manufacturer's rated, minimum of 3.0 m/s (9.8 ft/s)[2]	Yes	10° C (50° F)
August 1 – October 15	All	Sunset to sunrise	5.0 m/s (16.4 ft/s)	Yes	10° C (50° F)
October 16 – November 15	All	Sunset to sunrise	Manufacturer's rated, minimum of 3.0 m/s (9.8 ft/s)2	Yes	10° C (50° F)
November 16 – March 14	All	N/A	Manufacturer's setting	No	None

[1] Feathering means that turbine blades will be pitched into the wind such that they spin at less than one rotation per minute.

[2] Turbines will be feathered below cut-in when temperatures are above the threshold.

m/s = meters per second; ft/s = feet per second; ° C = degrees Centigrade; ° F = degrees Fahrenheit.

METHODS

Indiana Crossroads developed a PCM protocol for the first year of PCM in the Project's HCP. The study plan was designed to target a *g* value of 0.2 across spring and fall seasons based on publicly available PCM data. Although the monitoring protocol was previously approved in the HCP, WEST prepared a study plan following the HCP's monitoring protocol for the first year of monitoring that was submitted to the USFWS on March 30, 2022; the study plan was approved by USFWS on April 5, 2022 (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, 2022. Search effort varied by season (Figure 2, Table 2), and was designed to maximize effort when take of the Covered Species was considered most likely to occur.
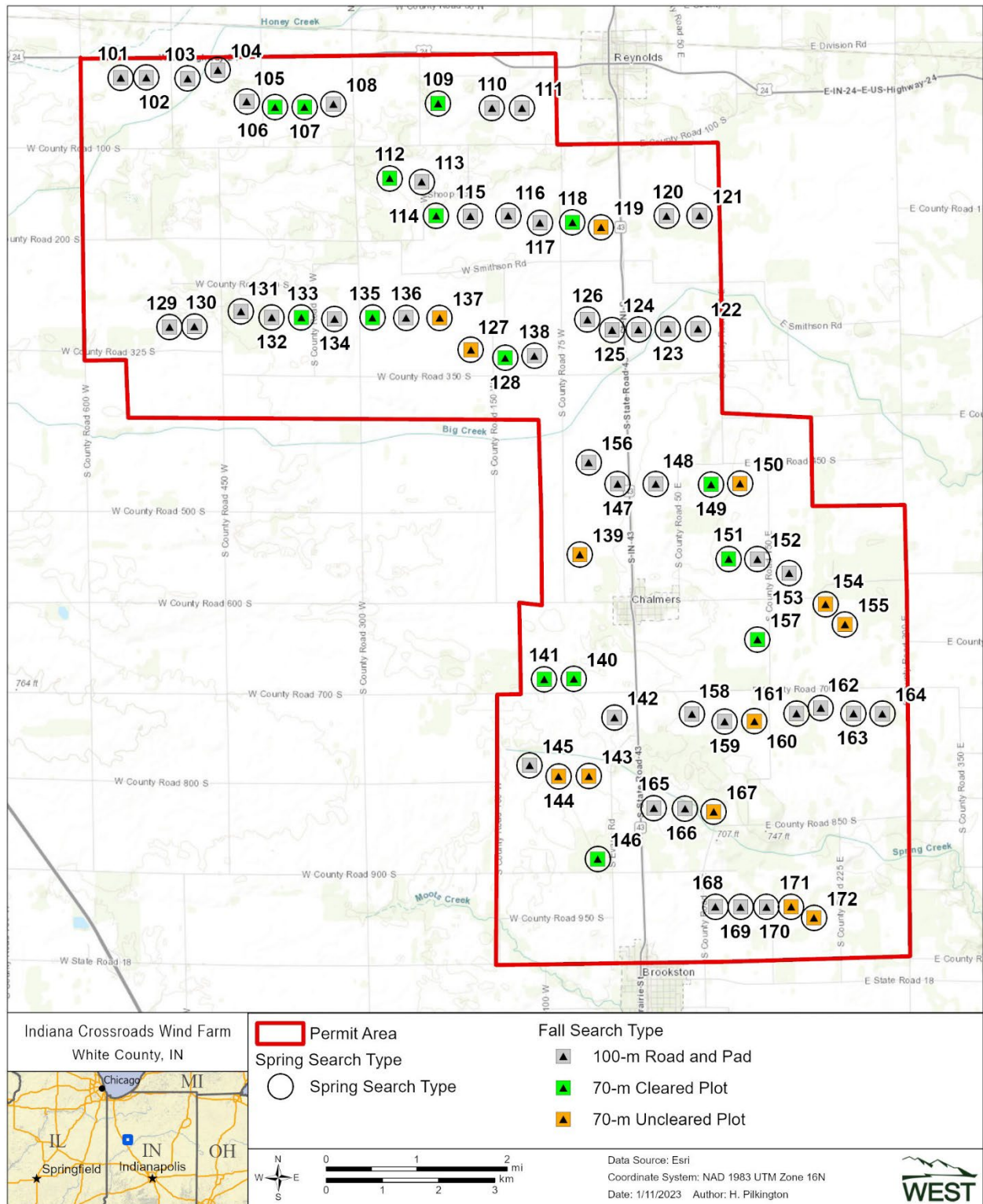
Figure 2. Turbine locations, search type, and surrounding land cover at the Indiana Crossroads Wind Farm, White County, Indiana.

Table 2. **Search effort by season and plot type at Indiana Crossroads Wind Farm, White County, Indiana.**

Season	Plot Type	Search Interval	Number of Turbines	Search Team
Spring (April 1 – May 15)	100-m road and pad	7 days	72	Technician
Fall (August 1 – October 15)	100-m road and pad	7 days	44	Technician
	70-m cleared plot	7 days	15	Dog-handler
	70-m uncleared plot	7 days	13	Dog-handler

m = meter.

During spring (April 1 – May 15; Table 2, Figure 3), a technician searched the gravel roads and pads weekly at all 72 turbines to a distance of 100 m (328 ft; 100-m roads and pads). During fall (August 1 – October 15), roads and pads were searched weekly by a technician at 44 turbines (Table 2, Figure 2). Dog-handler teams searched 70-m (230-ft) plots at 28 turbines weekly during fall. Fifteen turbines had crops cleared to a distance of 70 m (70-m cleared plots) and 13 turbines had standing soy (i.e., 70-m uncleared plots). Due to parcel boundary issues, 13 uncleared plots consisting of 11 full plots and two half plots were used to achieve the spatial coverage equivalent to twelve uncleared plots described in the HCP.

During fall, vegetation at 70-m cleared plots was mowed by Project staff to enhance detectability of carcasses (Figure 4). The 70-m uncleared plots were planted with soybean (*Glycine max*; Figure 5). A cross pattern approximately 1.5 m (4.9 ft) wide was mowed into the uncleared soy plots to assist dog handlers with plot access. All Project turbines were non-operational from October 1–14 due to construction; however, regularly scheduled searches continued as scheduled during that time.

Figure 3. **Representative photo of conditions of a 100-meter road and pad plot at Indiana Crossroads Wind Farm, White County, Indiana.**

Figure 4. Representative photo of vegetation conditions in a 70-meter cleared plot at Indiana Crossroads Wind Farm, White County, Indiana.
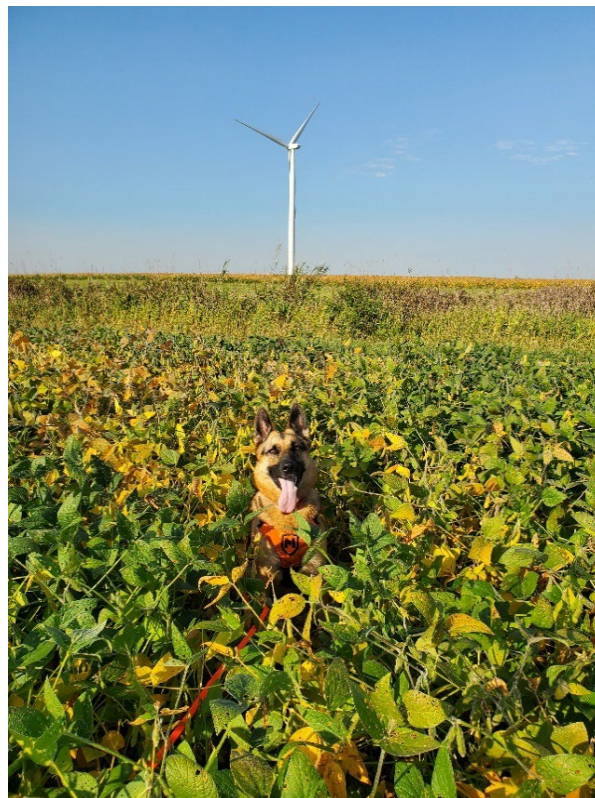
Figure 5. Representative photo of vegetation conditions in a 70-meter uncleared plot at Indiana Crossroads Wind Farm, White County, Indiana.

Search Methods

WEST used two types of search methods: a technician search, which was visual, and searches by a dog-handler team, which were olfactory, where the team consisted of one technician/handler and one dog. All personnel were trained to follow the Project's study plan, including proper handling and reporting of carcasses. Carcass searches were conducted during the day, beginning as early as first light.

Road and Pad Searches – Technician Searches

During road and pad searches, the technician started at 100 m from the turbine and walked the access road at a rate of approximately 45–60 m per minute (m/min; 148–197 ft/min) toward the turbine, around the turbine along the gravel pad, and back towards their vehicle. The technician searched out to 2.5 m (8.2 ft) on each side as they walked until the entire road/access pad was searched to ensure full visual coverage of each search area.

70-meter Plot Searches – Dog-handler Teams

Dog-handler teams searched 70-m cleared and uncleared plots for bat carcasses. Prior to each search, dog-handlers determined the search start point 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). Dog-handlers oriented the detection dog to start searches perpendicular to the wind to maximize scent detection. Both windspeed and crop density can affect dispersal of the target odor (i.e., bat carcasses) across the plot. To maximize detection rates during an olfactory search, transect width varied with vegetation density, ranging from five to 10 m (16–33 ft) apart in densely vegetated areas, to 10–15 m (33–49 ft) in shorter vegetation. Detection dogs were rewarded with either food or a short play session when they correctly alerted their handler to a bird or bat carcass.

Dog-handler Team Evaluation

Detection dogs were considered candidates for carcass searches if they met basic temperament and obedience criteria, and demonstrated the trainability to detect bird and/or bat carcasses requirements. Temperament characteristics that are 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). Detection 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 detection dog achieved a passing grade of 80% or higher in a scent recognition test, consisting of ten 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 two day field evaluation of each dog-handler team; after teams achieved a searcher efficiency of 75% or greater for 15–30 bats during evaluation trials, the teams were approved to conduct standardized carcass searches. Because the objective of the study was to document bat carcasses, detection 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. The primary detection dog used at the Project was a German shepherd mix.

Data Collection

Technicians and dog-handlers recorded the date, search start and end times, technician or dog-handler name, turbine number, type of search, and if any fatalities were found during each scheduled search. When a bird or bat fatality was found, technicians placed a flag near it and continued the search. After searching the entire plot, the technician or dog-handler returned to record information for each fatality on a carcass information form, including the date and time the carcass was found, species (or best possible field identification), sex and age (when possible), technician or dog-handler name, turbine number, measured distance from turbine (m), azimuth from turbine, location of carcass as latitude and longitude, habitat surrounding carcass, carcass condition, and estimated time of death (e.g., less than one day, two days).

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

- Intact—a carcass that is complete, 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, etc.), or a carcass that has been heavily infested by insects.

- Dismembered—a 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.

Digital photographs were taken of each fatality, including any visible injuries, and surrounding habitat. No bird carcasses were collected, but a marker was placed next to each bird carcass to avoid duplicate counting. Bat carcasses were collected under the Project's ITP (ESPER0036249), WEST's Federal Native Endangered and Threatened Species Recovery Permit (TE234121-9), and WEST's Special Purpose Salvage Permit (2229). Technicians or dog-handlers 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. Leather and rubber gloves were used to handle all bat carcasses to eliminate possible transmission of rabies or other diseases. Live, injured bats were recorded and considered fatalities for analysis purposes when observed in search areas, and were left in place.

Bird and bat 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, but were not included in analysis.

Carcass Identification and Agency Notification

Field identification of bird carcasses were reviewed by biologists with extensive field experience in identification of Midwestern birds and feathers. A federally permitted bat biologist (ESPER0039249) identified all bat carcasses in hand at the end of the searches. Bat carcasses that were heavily scavenged but did not have potential to be a Covered Species (i.e., fur was present on the wing and/or forearms measured greater than >41 millimeter [1.6 inches]) were identified to the closest genus or group possible and were not sent off for further identification. In accordance with the Project's ITP and WEST's state and federal salvage permits, the USFWS would have been notified within 24 hours of positive identification of a federally listed species, and the IDNR was notified within three working days of positive identification of state-listed species. At the end of the searches, bat carcasses and fur and tissue samples were delivered to the USFWS Indiana Field Office in Bloomington, Indiana.

Tissue samples were collected from heavily scavenged or decomposed bat carcasses that could not be positively identified and had potential to be a Covered Species based upon available identifiable physical characteristics and were submitted to a USFWS-approved laboratory, East Stroudsburg University Wildlife Genetics Institute for identification on September 22 and October 27, 2022.

Bias Trials

Searcher Efficiency Trials

The objective of searcher efficiency trials was to estimate the probability that a carcass was found by searchers. Searcher efficiency trials were conducted in the same areas where carcass searches occurred. Technicians conducting carcass searches did not know when searcher efficiency trials were being conducted or the location of the trial carcasses. Trial carcasses consisted of eastern red bats (*Lasiurus borealis*), big brown bats (*Eptesicus fuscus*), and silver-haired bats (*Lasionycteris noctivagans*) that had previously been found on site or provided by Indiana State University (ISU). One hundred carcasses were placed across all seasons and plot types to account for differences in search conditions by plot type and 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 around the upper forelimb for identification as a trial carcass after it was found. Carcasses were dropped from waist-height or higher and allowed to land in a random posture. The trial administrator walked in a meandering path and dropped trials for dog-handler teams the day prior to the next search to allow time for the scent to pool and disperse prior to scheduled searches.

Searchers had one chance to locate trial carcasses during the first search after carcass placement. 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 trial administrator. Following searches, any carcasses that were not detected were checked to confirm availability. Forty-three trials of the 100 placed trial carcasses were left in place and used for carcass persistence trials.

Carcass Persistence Trials

The objective of carcass persistence trials 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. A minimum of 15 trial carcasses were placed in each season and plot type to incorporate the effects of varying weather and scavenger densities on carcass persistence. No more than two trial carcasses were placed on a plot at a time to avoid potential over-seeding and attracting scavengers.

Technicians monitored the trial carcasses over a 14-day period according to the following schedule, as closely as possible. Carcasses were checked daily for the first four days, then on days 7, 10, and 14. Trial carcasses were monitored until they were completely removed or the trial period ended, whichever occurred first. Dog-handler teams were used on all 70-m plots to determine when carcasses were removed, while technicians determined the status of carcasses placed on 100-m roads and pads.

Search Area Mapping

Technicians recorded the boundaries of 70-m cleared plots and 100-m roads and pads using a Trimble sub-meter Global Positioning System unit. Unsearchable areas within plot boundaries were also mapped. 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 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 measures were implemented at all stages of the study, including in the field, during data entry and analysis, and report writing. Following field searches, 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 search 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. Data used in the EoA model included number of found Covered Species carcasses,

fatality spatial data from all bats found during searches, and the results of searcher efficiency and carcass persistence trials.

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 fatality estimate, each carcass included in the analysis was adjusted for searcher efficiency, carcass persistence, a detection reduction factor (also referred to as "*k*"; see below), and a search area adjustment. Estimates and 90% confidence intervals (CIs) were calculated using a parametric bootstrap (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 5th and upper 95th percentiles of the 1,000 bootstrap estimates were estimates of the lower limit and upper limit of 90% CIs. To obtain overall fatality estimates for the entire facility and study period, fatality rate estimates were averaged across plot types within a season (i.e., 70-m cleared and uncleared plots and 100-m road and pad plots) using the number of turbines searched in each plot type as a weight in the averaging. The seasonal fatality rate estimates were then summed across seasons to obtain an overall fatality rate estimate for the study period. Because turbines were non-operational in October, fall fatality estimates were calculated for only the period with potential collision risk (i.e., August 1 – October 1).

Searcher Efficiency Estimation

In the all-bat fatality estimate and EoA, searcher efficiency was estimated separately for technicians and dog-handler teams to account for different modes of detection (i.e., technicians use sight while 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. Season was included as a potential covariate for the technician model, and plot type was included as a potential covariate for the dog-handler model. For both the technician 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 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. 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 estimates for the Covered Species in EoA.

Carcass Persistence Rate Estimation

Data collected during carcass persistence trials were used to estimate the amount of time, in days, carcasses remained available to be located by the technician or dog-handler team. The average probability 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). As with searcher efficiency, carcass persistence models were estimated separately by search team (i.e., plots searched by technicians vs. plots searched by dog-handler teams) to account for different modes of detection. Season was included as a potential covariate for the technician model, and plot type was included as a potential covariate for the dog-handler model. The best-supported model 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 (shape and scale, including the 95% CI of scale) were used as inputs in the EoA Single Class module.

Search 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, and Weibull parameterized according to R Development Core Team [2016] and Yee [2010]). Although the spring and fall seasons have the potential to have different carcass density distributions due to differences in turbine operation, there was insufficient sample size in the spring to examine these effects. Therefore, the only models considered were those that pooled data from both turbine operation regimes and seasons. The best-supported model was selected using AICc. 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 the area adjustment used in EoA and the all-bat fatality estimates when the carcass was discovered outside of the spatial and temporal scope of the study 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 searches (e.g., a carcass found on a plot in the summer that was 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 during the next round of searches. If a fatality of a Covered Species had been found outside of the spatial or temporal scope of the study design it would still be

excluded from the area correction estimate, but would be included in the EoA fatality estimate following Dalthorp et al. 2020. Because turbines were not operational in October, fatalities found in October were also excluded from both of the fatality estimates and EoA in order to limit estimates to the period of time with collision risk.

Covered Species Take and Detection Probability Estimates

EoA was used to estimate the mean annual take rate (λ) 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, carcass persistence, 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 adjustment 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 within a season, with weights for each class defined by the sampling fraction for each stratum. The Multiple Class module was used again to combine the strata across seasons using seasonal arrival proportions to define the weights for each class to get a single annual beta distribution. All turbines were non-operational for two of the 11 weeks of the fall season (October 1 – 14). Therefore, the relative weight for the fall search period was adjusted by the number of missing turbine-days of risk to 0.818 when estimating the annual *g*, consistent with the EoA user guide guidance to incorporate weights based on the expected relative arrival rates of carcasses. When combined with the expected relative arrival rates, the relative risk of the entire 2022 search period represented only 0.838 of the risk of a fully operational year. Due to limitations with the EoA graphical user interface, for estimates of λ it will be necessary to rescale the EoA-produced estimates to represent a full year of operation, and for adaptive management triggers associated with λ, it will be necessary to scale the annual rate threshold (τ) to represent the level of operation in the moving average estimate of λ. The relative weight for the 2022 search period will therefore be set to 0.838 when combining detection probabilities in the estimation of λ and across years. Per the HCP, adaptive management triggers will not be evaluated using EoA until Year 3.

RESULTS

Standardized Carcass Searches

Four hundred twenty-eight searches were completed in the spring, and 749 searches were completed in the fall; sixty-five searches occurred during the period October 1–October 15, when turbines were non-operational. Fifty-five searches (4.7%) were missed due to turbine maintenance, weather constraints, and/or safety hazards. Three hundred eighty-six bat carcasses and 94 bird carcasses were found during searches and incidentally (Appendix A). No Covered Species were found. Four evening bats (*Nycticeius humeralis*), a state-endangered species, were

documented at the Project at turbines 127, 146, 159, and 125, on May 10, August 19, September 7, and 26, respectively. IDNR was notified within three working days of documenting the evening bat finds per permit conditions (on May 13, August 22, September 8 and 29, 2022). No other state -or federally listed species were recorded during the ITP monitoring effort.

Seventeen bats were found in the spring and 369 bats were found in the fall (Appendix A). The most commonly found bat species were silver-haired bat (120 carcasses; 31.1%) and eastern red bat (118 carcasses; 30.6%), followed by hoary bat (*Lasiurus cinereus*; 72 carcasses; 18.7%) and big brown bat (69 carcasses; 17.9%). Four evening bats (*Nycticeius humeralis* 1.0%), as well as two eastern red bat or Seminole bat (*L. seminolus*; 0.5%) and one unidentified *Lasiurus* sp. (0.3%) were also found. (Appendices A and B). Over the course of the monitoring period, 10 heavily scavenged bats (e.g., wing membrane only, bones, or partial carcasses) were sent off for identification via deoxyribonucleic acid (DNA) analysis; they were identified as two big brown bats, two eastern red bats, and six silver-haired bats. The majority of bat carcasses were recorded on 70-m plots by dog-handler teams (Appendix A).

Statistical Analysis

Bias Trials

Searcher Efficiency Trials

One hundred bats were placed for searcher efficiency trials on 12 separate dates across all plot types and months of the study; 85 were available to find. The best-supported model for searcher efficiency on 70-m plots did not support the inclusion of plot type as a covariate, meaning there was not a substantial difference between searcher efficiency rates on 70-m cleared and uncleared plots. The best-supported model for searcher efficiency on roads and pads did not support the inclusion of season as a covariate, meaning there was not a substantial difference in searcher efficiency rates for roads and pads between seasons. Searcher efficiency rates ranged from 60.5% on 70-m plots to 97.6% on roads and pads (Table 3).

Table 3.   Searcher efficiency results by plot type at the Indiana Crossroads Wind Farm, White County, Indiana, April 1 – May 15 and August 1 – October 15, 2022.

Plot Type	Number Placed	Number Available	Number Found	% Found
70-meter Plots	58	43	26	60.5
100-meter Roads and Pads	42	42	41	97.6

Carcass Persistence Trials

Sixty carcasses were placed to estimate carcass persistence. The best-fit model for carcass persistence rates on 70-m cleared and uncleared plots searched by dog-handler teams had an exponential distribution and did not include any covariates, which suggests carcass persistence rates did not vary by plot type (Appendix B). The best-fit model for carcass persistence rates on plots searched by technicians (i.e., 100-m roads and pads) had an exponential distribution and did not include any covariates, meaning that carcass persistence on roads and pads did not vary by season (Appendix B). Estimated median carcass persistence times were 5.96 days on 70-m plots and 6.23 days on roads and pads (Figure 6; Appendix B).
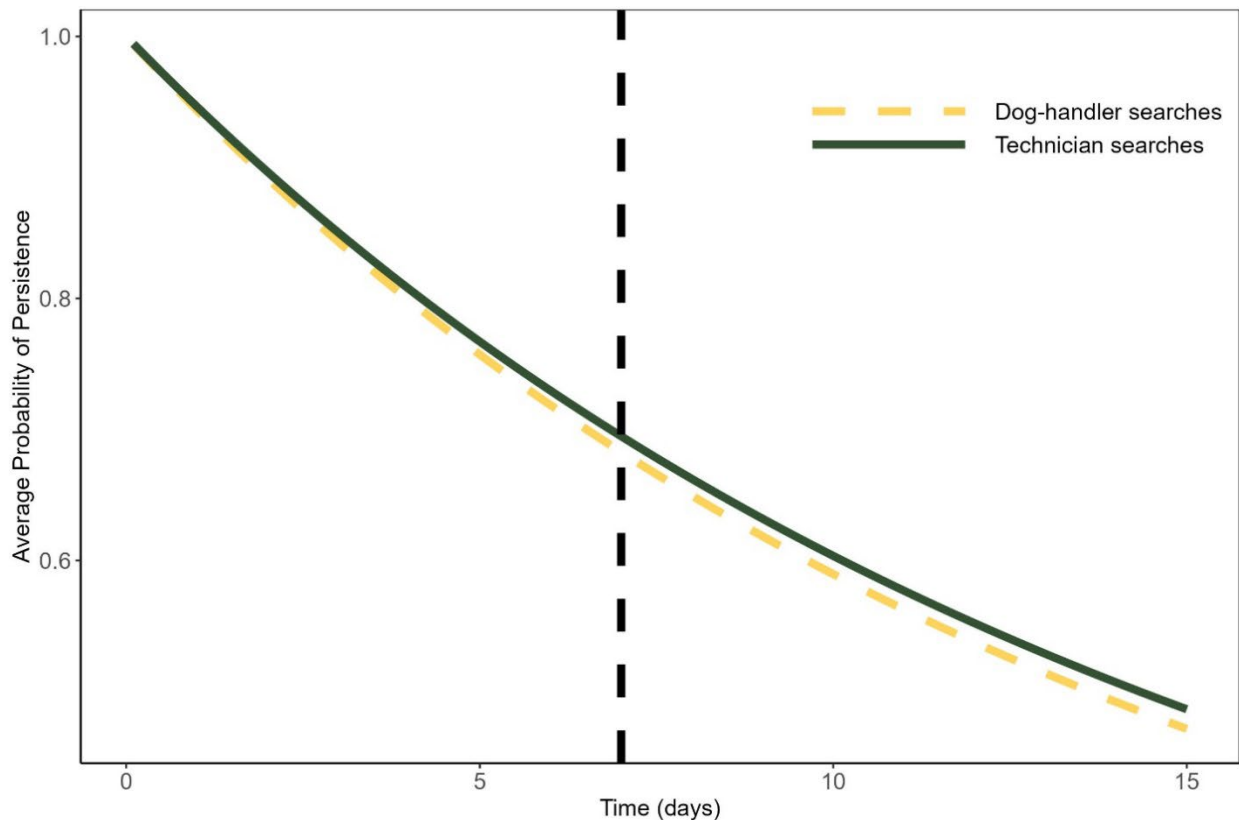
Figure 6.   The average probability of persistence of bats on over time (in days) at Indiana Crossroads Wind Farm, White County, Indiana, April 1 – May 15 and August 1 – October 15, 2022.

Note: The vertical dashed line indicates the 7-day search interval used in this study.

Area Adjustment

Forty of the 386 bats found were excluded from modeling the area correction for EoA. Two bat carcasses were excluded from analysis because they were found off plot. Another 23 bats were excluded because their estimated time of death was prior to the start of searches, and 15 bats were excluded because they were found while turbines were not operational (Appendix B).

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 was 0.20 for 100-m roads and pads (Appendix B, Figure 7). The estimated TWL area adjustment for bats was 0.70 for 70-m plots (Appendix B, Figure 7).
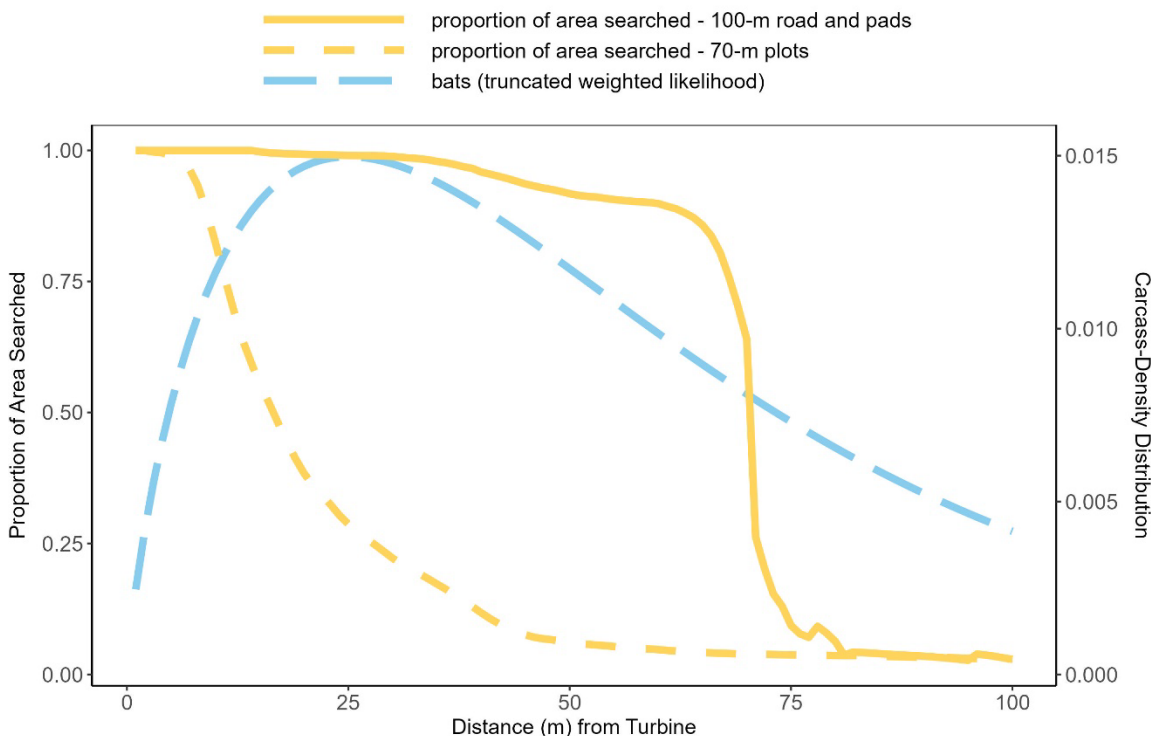
Figure 7. **Density of bat carcasses per area searched at all plots at the Indiana Crossroads Wind Farm, White County, Indiana, April 1 – May 15 and August 1 – October 15, 2022.**

Adjusted Overall Bat Fatality Estimates

The overall bat fatality rate was estimated as 5.23 bats per MW (90% CI: 3.84–9.56; Table 4). Fatality rates by plot type and season are presented in Appendix C.

Table 4. **Overall bat fatality rates per megawatt and per turbine for studies conducted at the Indiana Crossroads Wind Farm, White County, Indiana, April 1 – May 15 and August 1 – October 15, 2022.**

Season	Bat Fatality Estimate per Turbine	90% Confidence Limits	Bat Fatality Estimate per Megawatt	90% Confidence Limits
Spring	1.64	0.96–3.22	0.39	0.23–0.77
Fall	20.35	14.86–37.36	4.85	3.54–8.90
Overall	**21.97**	**16.14–40.15**	**5.23**	**3.84–9.56**

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 Year 1 was not met and no adaptive management is necessary. The overall *g* achieved for the 2022 monitoring period had a mean of 0.201 (95% CI: 0.175–0.228). Mean annual take rates were estimated to be 2.997 (95% CI: 0.003 – 15.108) Indiana bats and northern long-eared bats per year from April 1 – May 15 and August 1 – October 15, 2022. 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 2022 monitoring period keeps the Project on track to meet the minimum average *g* of 0.2 for Years 1–3. The ITP compliance monitoring completed during 2022 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 2022 Post-construction Monitoring Searches at the Indiana Crossroads Wind Farm

Appendix A. Carcasses found at the Indiana Crossroads Wind Farm, White County, Indiana, April 1 – May 15 and August 1 – October 15, 2022.

Found Date	Common Name	Turbine	Search Type	Plot Type	Physical Condition	Longitude[1]	Latitude[1]
Bat Carcasses							
14-Apr-22	hoary bat	171	carcass search	100-m road and pad	intact	40.61402	-86.83633
25-Apr-22	hoary bat	104	carcass search	100-m road and pad	intact	40.74838	-86.95752
25-Apr-22	hoary bat	111	carcass search	100-m road and pad	intact	40.7423	-86.89328
25-Apr-22	silver-haired bat	115	carcass search	100-m road and pad	intact	40.72482	-86.90354
26-Apr-22	hoary bat	126	carcass search	100-m road and pad	intact	40.70829	-86.87936
26-Apr-22	hoary bat	130	carcass search	100-m road and pad	intact	40.70732	-86.96229
26-Apr-22	hoary bat	152	carcass search	100-m road and pad	intact	40.67007	-86.84405
26-Apr-22	hoary bat	156	carcass search	100-m road and pad	intact	40.68506	-86.87933
27-Apr-22	eastern red bat	160	carcass search	100-m road and pad	intact	40.64397	-86.84466
27-Apr-22	hoary bat	166	carcass search	100-m road and pad	dismembered	40.63008	-86.85911
27-Apr-22	silver-haired bat	172	carcass search	100-m road and pad	intact	40.61246	-86.83216
02-May-22	hoary bat	108	carcass search	100-m road and pad	scavenged	40.74304	-86.93257
04-May-22	silver-haired bat	171	carcass search	100-m road and pad	scavenged	40.61432	-86.83725
10-May-22	evening bat	127	carcass search	100-m road and pad	intact	40.70369	-86.90415
10-May-22	big brown bat	153	carcass search	100-m road and pad	scavenged	40.66746	-86.83832
10-May-22	hoary bat	157	carcass search	100-m road and pad	intact	40.65699	-86.84393
11-May-22	silver-haired bat	166	carcass search	100-m road and pad	intact	40.63025	-86.85908
01-Aug-22	eastern red bat	103	carcass search	100-m road and pad	scavenged	40.74703	-86.96386
01-Aug-22	eastern red bat	105	carcass search	100-m road and pad	scavenged	40.74325	-86.95101
01-Aug-22	big brown bat	108	carcass search	100-m road and pad	scavenged	40.74286	-86.9328
01-Aug-22	big brown bat	109	carcass search	70-m cleared plot	intact	40.74297	-86.91104
01-Aug-22	hoary bat	109	carcass search	70-m cleared plot	scavenged	40.74338	-86.91048
02-Aug-22	eastern red bat	130	carcass search	100-m road and pad	intact	40.7075	-86.96207
02-Aug-22	big brown bat	142	carcass search	100-m road and pad	scavenged	40.64476	-86.8739
02-Aug-22	eastern red bat	145	carcass search	100-m road and pad	scavenged	40.63696	-86.89189
02-Aug-22	hoary bat	145	carcass search	100-m road and pad	dismembered	40.63711	-86.89192
02-Aug-22	eastern red bat	158	carcass search	100-m road and pad	intact	40.64487	-86.85784
02-Aug-22	hoary bat	158	carcass search	100-m road and pad	intact	40.64525	-86.85779
02-Aug-22	big brown bat	166	carcass search	100-m road and pad	dismembered	40.63002	-86.85894
02-Aug-22	big brown bat	166	carcass search	100-m road and pad	intact	40.63009	-86.85917
02-Aug-22	big brown bat	166	carcass search	100-m road and pad	intact	40.63031	-86.8586
02-Aug-22	eastern red bat	166	carcass search	100-m road and pad	dismembered	40.62993	-86.85904
02-Aug-22	eastern red bat	166	carcass search	100-m road and pad	injured	40.63027	-86.85946
08-Aug-22	hoary bat	101	carcass search	100-m road and pad	scavenged	40.74716	-86.97794
08-Aug-22	hoary bat	101	carcass search	100-m road and pad	intact	40.74734	-86.9778

Appendix A. Carcasses found at the Indiana Crossroads Wind Farm, White County, Indiana, April 1 – May 15 and August 1 – October 15, 2022.

Found Date	Common Name	Turbine	Search Type	Plot Type	Physical Condition	Longitude[1]	Latitude[1]
08-Aug-22	big brown bat	102	carcass search	100-m road and pad	scavenged	40.74711	-86.97253
08-Aug-22	hoary bat	102	carcass search	100-m road and pad	intact	40.74715	-86.97257
08-Aug-22	hoary bat	102	carcass search	100-m road and pad	injured	40.74704	-86.97264
08-Aug-22	hoary bat	104	carcass search	100-m road and pad	intact	40.74859	-86.95768
08-Aug-22	hoary bat	104	carcass search	100-m road and pad	injured	40.74824	-86.95751
08-Aug-22	big brown bat	107	carcass search	70-m cleared plot	intact	40.74233	-86.93908
08-Aug-22	big brown bat	107	carcass search	70-m cleared plot	intact	40.74265	-86.93975
08-Aug-22	eastern red bat	107	carcass search	70-m cleared plot	intact	40.74239	-86.93913
08-Aug-22	hoary bat	107	carcass search	70-m cleared plot	intact	40.74237	-86.93911
08-Aug-22	big brown bat	112	carcass search	70-m cleared plot	dismembered	40.73115	-86.92109
08-Aug-22	big brown bat	115	carcass search	100-m road and pad	intact	40.72492	-86.90437
08-Aug-22	eastern red bat or Seminole bat	116	carcass search	100-m road and pad	injured	40.72475	-86.89556
08-Aug-22	eastern red bat	117	carcass search	100-m road and pad	scavenged	40.72338	-86.88958
08-Aug-22	big brown bat	121	carcass search	100-m road and pad	scavenged	40.72487	-86.85566
08-Aug-22	eastern red bat	122	carcass search	100-m road and pad	intact	40.70686	-86.85604
08-Aug-22	big brown bat	123	carcass search	100-m road and pad	scavenged	40.70681	-86.86276
08-Aug-22	eastern red bat	126	carcass search	100-m road and pad	injured	40.70832	-86.87953
08-Aug-22	hoary bat	126	carcass search	100-m road and pad	intact	40.70833	-86.87959
08-Aug-22	hoary bat	126	carcass search	100-m road and pad	scavenged	40.7082	-86.87941
08-Aug-22	hoary bat	134	carcass search	100-m road and pad	scavenged	40.70836	-86.93305
09-Aug-22	big brown bat	118	carcass search	70-m cleared plot	intact	40.7236	-86.8831
09-Aug-22	eastern red bat	129	carcass search	100-m road and pad	intact	40.70722	-86.96752
09-Aug-22	big brown bat	154	carcass search	70-m uncleared plot	intact	40.6629	-86.82927
09-Aug-22	eastern red bat	155	carcass search	70-m uncleared plot	intact	40.65955	-86.82513
09-Aug-22	big brown bat	156	carcass search	100-m road and pad	intact	40.68528	-86.87941
09-Aug-22	big brown bat	170	carcass search	100-m road and pad	intact	40.61411	-86.84186
11-Aug-22	hoary bat	119	carcass search	incidental	scavenged	40.72297	-86.87703
11-Aug-22	eastern red bat	128	carcass search	70-m cleared plot	intact	40.70192	-86.89662
11-Aug-22	eastern red bat	139	carcass search	70-m uncleared plot	intact	40.67067	-86.88106
11-Aug-22	hoary bat	140	carcass search	70-m cleared plot	intact	40.65098	-86.88246
11-Aug-22	hoary bat	140	carcass search	70-m cleared plot	intact	40.65081	-86.8825
11-Aug-22	hoary bat	140	carcass search	70-m cleared plot	intact	40.65081	-86.88296
11-Aug-22	big brown bat	143	carcass search	70-m uncleared plot	intact	40.63545	-86.87915
11-Aug-22	eastern red bat	144	carcass search	incidental	intact	40.63541	-86.88506
11-Aug-22	eastern red bat	144	carcass search	70-m uncleared plot	intact	40.63531	-86.88527
11-Aug-22	eastern red bat	144	carcass search	incidental	scavenged	40.63564	-86.88537

Appendix A. Carcasses found at the Indiana Crossroads Wind Farm, White County, Indiana, April 1 – May 15 and August 1 – October 15, 2022.

Found Date	Common Name	Turbine	Search Type	Plot Type	Physical Condition	Longitude[1]	Latitude[1]
11-Aug-22	hoary bat	144	carcass search	70-m uncleared plot	intact	40.63534	-86.88527
11-Aug-22	hoary bat	144	carcass search	incidental	intact	40.63537	-86.88501
11-Aug-22	hoary bat	144	carcass search	70-m uncleared plot	intact	40.63527	-86.88576
11-Aug-22	hoary bat	144	carcass search	incidental	scavenged	40.63541	-86.88548
11-Aug-22	hoary bat	144	carcass search	70-m uncleared plot	intact	40.63509	-86.88592
11-Aug-22	hoary bat	146	carcass search	incidental	intact	40.62203	-86.87737
11-Aug-22	eastern red bat	148	carcass search	100-m road and pad	scavenged	40.68206	-86.86507
11-Aug-22	hoary bat	148	carcass search	100-m road and pad	scavenged	40.68196	-86.86511
11-Aug-22	big brown bat	149	carcass search	incidental	intact	40.68202	-86.85308
11-Aug-22	eastern red bat	152	carcass search	100-m road and pad	scavenged	40.67017	-86.84415
11-Aug-22	big brown bat	153	carcass search	100-m road and pad	scavenged	40.66768	-86.83768
11-Aug-22	eastern red bat	161	carcass search	100-m road and pad	intact	40.64518	-86.8362
12-Aug-22	eastern red bat	149	carcass search	incidental	intact	40.68218	-86.85352
12-Aug-22	big brown bat	151	carcass search	70-m cleared plot	intact	40.67021	-86.84946
12-Aug-22	eastern red bat	157	carcass search	incidental	intact	40.65706	-86.84394
12-Aug-22	hoary bat	171	carcass search	70-m uncleared plot	scavenged	40.61419	-86.8371
12-Aug-22	hoary bat	171	carcass search	70-m uncleared plot	intact	40.61428	-86.8365
12-Aug-22	big brown bat	172	carcass search	70-m uncleared plot	intact	40.61242	-86.83217
12-Aug-22	eastern red bat	172	carcass search	70-m uncleared plot	intact	40.61245	-86.83206
12-Aug-22	eastern red bat	172	carcass search	70-m uncleared plot	intact	40.61231	-86.83287
12-Aug-22	eastern red bat	172	carcass search[2]	70-m uncleared plot	intact	40.61224	-86.83313
12-Aug-22	eastern red bat	172	carcass search	70-m uncleared plot	intact	40.61233	-86.83285
12-Aug-22	hoary bat	172	carcass search	70-m uncleared plot	intact	40.61238	-86.83241
15-Aug-22	eastern red bat	104	carcass search	100-m road and pad	intact	40.74837	-86.95768
15-Aug-22	hoary bat	105	carcass search	100-m road and pad	injured	40.74334	-86.95131
15-Aug-22	eastern red bat	106	carcass search	70-m cleared plot	intact	40.74268	-86.94492
15-Aug-22	eastern red bat	107	carcass search	70-m cleared plot	intact	40.74238	-86.93957
15-Aug-22	eastern red bat	107	carcass search	70-m cleared plot	intact	40.74226	-86.93935
15-Aug-22	eastern red bat	107	carcass search	70-m cleared plot	intact	40.74248	-86.93981
15-Aug-22	big brown bat	119	carcass search	70-m uncleared plot	dismembered	40.723	-86.87699
15-Aug-22	big brown bat	121	carcass search	100-m road and pad	scavenged	40.72506	-86.85577
15-Aug-22	hoary bat	122	carcass search	100-m road and pad	scavenged	40.70684	-86.85641
15-Aug-22	hoary bat	138	carcass search	100-m road and pad	injured	40.70239	-86.89104
16-Aug-22	eastern red bat	114	carcass search	70-m cleared plot	intact	40.72501	-86.91149
16-Aug-22	big brown bat	115	carcass search	incidental	intact	40.72482	-86.90435
16-Aug-22	big brown bat	118	carcass search	70-m cleared plot	unknown	40.72369	-86.88302

Appendix A. Carcasses found at the Indiana Crossroads Wind Farm, White County, Indiana, April 1 – May 15 and August 1 – October 15, 2022.

Found Date	Common Name	Turbine	Search Type	Plot Type	Physical Condition	Longitude[1]	Latitude[1]
16-Aug-22	big brown bat	133	carcass search	70-m cleared plot	intact	40.70902	-86.93999
16-Aug-22	big brown bat	135	carcass search	70-m cleared plot	scavenged	40.70855	-86.925
16-Aug-22	eastern red bat	142	carcass search	100-m road and pad	scavenged	40.64461	-86.87379
16-Aug-22	hoary bat	153	carcass search	100-m road and pad	scavenged	40.66748	-86.83771
16-Aug-22	eastern red bat	155	carcass search	70-m uncleared plot	intact	40.6596	-86.82537
16-Aug-22	eastern red bat	161	carcass search	100-m road and pad	intact	40.64495	-86.83694
18-Aug-22	big brown bat	139	carcass search	70-m uncleared plot	intact	40.67069	-86.88127
18-Aug-22	hoary bat	144	carcass search	70-m uncleared plot	unknown	40.63509	-86.88598
18-Aug-22	big brown bat	149	carcass search	70-m cleared plot	intact	40.68166	-86.85381
18-Aug-22	hoary bat	149	carcass search	70-m cleared plot	intact	40.6823	-86.85426
18-Aug-22	hoary bat	149	carcass search	70-m cleared plot	intact	40.68216	-86.85374
18-Aug-22	big brown bat	157	carcass search	70-m cleared plot	intact	40.65711	-86.84401
18-Aug-22	big brown bat	157	carcass search	70-m cleared plot	intact	40.65678	-86.84441
19-Aug-22	eastern red bat	140	carcass search	70-m cleared plot	intact	40.65083	-86.88306
19-Aug-22	eastern red bat	140	carcass search	70-m cleared plot	intact	40.65061	-86.88258
19-Aug-22	eastern red bat	140	carcass search	70-m cleared plot	unknown	40.73108	-86.92123
19-Aug-22	hoary bat	140	carcass search	70-m cleared plot	intact	40.6506	-86.88259
19-Aug-22	big brown bat	146	carcass search	70-m cleared plot	intact	40.62219	-86.87757
19-Aug-22	big brown bat	146	carcass search	70-m cleared plot	intact	40.62206	-86.87697
19-Aug-22	eastern red bat	146	carcass search	70-m cleared plot	intact	40.6222	-86.87794
19-Aug-22	evening bat	146	carcass search	70-m cleared plot	intact	40.62199	-86.87826
19-Aug-22	eastern red bat	160	carcass search	70-m uncleared plot	scavenged	40.64406	-86.84458
19-Aug-22	eastern red bat	167	carcass search	70-m uncleared plot	intact	40.62926	-86.85296
19-Aug-22	eastern red bat	167	carcass search	70-m uncleared plot	intact	40.62912	-86.85303
22-Aug-22	big brown bat	102	carcass search	100-m road and pad	intact	40.74712	-86.97255
22-Aug-22	big brown bat	103	carcass search	100-m road and pad	intact	40.74686	-86.9637
22-Aug-22	big brown bat	107	carcass search	70-m cleared plot	intact	40.74235	-86.93915
22-Aug-22	eastern red bat	107	carcass search	70-m cleared plot	intact	40.74248	-86.93975
22-Aug-22	big brown bat	109	carcass search	70-m cleared plot	intact	40.74305	-86.91112
22-Aug-22	big brown bat	110	carcass search	100-m road and pad	injured	40.74221	-86.89946
23-Aug-22	big brown bat	114	carcass search	70-m cleared plot	scavenged	40.72443	-86.91114
23-Aug-22	eastern red bat or Seminole bat	114	carcass search	70-m cleared plot	intact	40.72511	-86.91174
23-Aug-22	big brown bat	130	carcass search	100-m road and pad	intact	40.70739	-86.9623
23-Aug-22	eastern red bat	133	carcass search	70-m cleared plot	intact	40.70881	-86.94004
23-Aug-22	eastern red bat	133	carcass search	70-m cleared plot	intact	40.70892	-86.94005
23-Aug-22	eastern red bat	147	carcass search	100-m road and pad	scavenged	40.68213	-86.8732

Appendix A. Carcasses found at the Indiana Crossroads Wind Farm, White County, Indiana, April 1 – May 15 and August 1 – October 15, 2022.

Found Date	Common Name	Turbine	Search Type	Plot Type	Physical Condition	Longitude[1]	Latitude[1]
23-Aug-22	hoary bat	150	carcass search	70-m uncleared plot	intact	40.68221	-86.8472
23-Aug-22	big brown bat	152	carcass search	100-m road and pad	scavenged	40.66992	-86.84409
23-Aug-22	eastern red bat	154	carcass search	70-m uncleared plot	intact	40.66269	-86.82952
23-Aug-22	big brown bat	156	carcass search	100-m road and pad	scavenged	40.68505	-86.87943
23-Aug-22	eastern red bat	163	carcass search	100-m road and pad	scavenged	40.64491	-86.82378
23-Aug-22	eastern red bat	165	carcass search	100-m road and pad	intact	40.63028	-86.86502
23-Aug-22	big brown bat	166	carcass search	100-m road and pad	scavenged	40.63012	-86.85891
23-Aug-22	eastern red bat	166	carcass search	100-m road and pad	intact	40.63	-86.85924
23-Aug-22	hoary bat	166	carcass search	100-m road and pad	scavenged	40.63024	-86.85892
25-Aug-22	eastern red bat	128	carcass search	70-m cleared plot	intact	40.70161	-86.89678
25-Aug-22	eastern red bat	139	carcass search	70-m uncleared plot	dismembered	40.67075	-86.88101
25-Aug-22	eastern red bat	149	carcass search	70-m cleared plot	intact	40.68182	-86.85341
25-Aug-22	big brown bat	151	carcass search	70-m cleared plot	scavenged	40.66972	-86.84965
26-Aug-22	big brown bat	140	carcass search	70-m cleared plot	scavenged	40.65042	-86.8824
26-Aug-22	hoary bat	167	carcass search	70-m uncleared plot	intact	40.62979	-86.85343
26-Aug-22	eastern red bat	172	carcass search	70-m uncleared plot	intact	40.61247	-86.832
26-Aug-22	eastern red bat	172	carcass search	70-m uncleared plot	intact	40.61245	-86.83227
26-Aug-22	eastern red bat	172	carcass search	70-m uncleared plot	dismembered	40.61257	-86.83224
26-Aug-22	eastern red bat	172	carcass search	70-m uncleared plot	intact	40.6125	-86.83239
28-Aug-22	eastern red bat	146	carcass search	incidental	intact	40.62221	-86.87736
29-Aug-22	big brown bat	103	carcass search	100-m road and pad	scavenged	40.74705	-86.96371
29-Aug-22	big brown bat	104	carcass search	100-m road and pad	scavenged	40.74833	-86.95764
29-Aug-22	silver-haired bat	104	carcass search	100-m road and pad	scavenged	40.7484	-86.95764
29-Aug-22	eastern red bat	106	carcass search[2]	70-m cleared plot	intact	40.74286	-86.94605
29-Aug-22	eastern red bat	106	carcass search	70-m cleared plot	intact	40.74249	-86.94589
29-Aug-22	hoary bat	106	carcass search	70-m cleared plot	intact	40.74205	-86.94572
29-Aug-22	hoary bat	106	carcass search	70-m cleared plot	intact	40.74218	-86.94576
29-Aug-22	silver-haired bat	106	carcass search	70-m cleared plot	intact	40.74282	-86.94567
29-Aug-22	silver-haired bat	106	carcass search	70-m cleared plot	intact	40.742	-86.94551
29-Aug-22	eastern red bat	107	carcass search	70-m cleared plot	intact	40.74183	-86.93928
29-Aug-22	big brown bat	112	carcass search	70-m cleared plot	intact	40.73071	-86.92077
29-Aug-22	hoary bat	119	carcass search	70-m uncleared plot	intact	40.72343	-86.87688
29-Aug-22	eastern red bat	121	carcass search	100-m road and pad	scavenged	40.72501	-86.85576
29-Aug-22	eastern red bat	125	carcass search	100-m road and pad	scavenged	40.70667	-86.87462
29-Aug-22	eastern red bat	137	carcass search	70-m uncleared plot	intact	40.70845	-86.91089
30-Aug-22	big brown bat	114	carcass search	70-m cleared plot	intact	40.72487	-86.91136

Appendix A. Carcasses found at the Indiana Crossroads Wind Farm, White County, Indiana, April 1 – May 15 and August 1 – October 15, 2022.

Found Date	Common Name	Turbine	Search Type	Plot Type	Physical Condition	Longitude[1]	Latitude[1]
30-Aug-22	big brown bat	118	carcass search	70-m cleared plot	intact	40.72381	-86.88262
30-Aug-22	silver-haired bat	132	carcass search	100-m road and pad	scavenged	40.70879	-86.94601
30-Aug-22	eastern red bat	133	carcass search	70-m cleared plot	intact	40.70878	-86.93989
30-Aug-22	eastern red bat	133	carcass search	70-m cleared plot	intact	40.70915	-86.9397
30-Aug-22	eastern red bat	133	carcass search	70-m cleared plot	scavenged	40.70864	-86.93984
30-Aug-22	hoary bat	133	carcass search	70-m cleared plot	intact	40.7088	-86.93995
30-Aug-22	hoary bat	133	carcass search	70-m cleared plot	scavenged	40.70886	-86.94013
30-Aug-22	silver-haired bat	136	carcass search	100-m road and pad	intact	40.70853	-86.91744
30-Aug-22	silver-haired bat	147	carcass search	100-m road and pad	intact	40.68229	-86.87345
30-Aug-22	silver-haired bat	150	carcass search	70-m uncleared plot	intact	40.68226	-86.84726
30-Aug-22	eastern red bat	154	carcass search	70-m uncleared plot	intact	40.66269	-86.82933
30-Aug-22	hoary bat	154	carcass search	70-m uncleared plot	intact	40.66265	-86.82951
30-Aug-22	big brown bat	169	carcass search	100-m road and pad	scavenged	40.61417	-86.84774
31-Aug-22	eastern red bat	159	carcass search	100-m road and pad	injured	40.64403	-86.85097
31-Aug-22	eastern red bat	163	carcass search	100-m road and pad	injured	40.64493	-86.82377
02-Sep-22	hoary bat	139	carcass search	70-m uncleared plot	scavenged	40.67053	-86.88113
02-Sep-22	silver-haired bat	139	carcass search	70-m uncleared plot	scavenged	40.67086	-86.88135
02-Sep-22	eastern red bat	143	carcass search	70-m uncleared plot	scavenged	40.6353	-86.87938
02-Sep-22	hoary bat	143	carcass search	70-m uncleared plot	scavenged	40.63513	-86.87935
02-Sep-22	big brown bat	144	carcass search	70-m uncleared plot	scavenged	40.63529	-86.88635
02-Sep-22	silver-haired bat	144	carcass search	70-m uncleared plot	scavenged	40.63545	-86.8855
02-Sep-22	silver-haired bat	144	carcass search	70-m uncleared plot	scavenged	40.63476	-86.88558
02-Sep-22	silver-haired bat	144	carcass search	70-m uncleared plot	scavenged	40.63524	-86.88588
02-Sep-22	silver-haired bat	144	carcass search	70-m uncleared plot	scavenged	40.63537	-86.88553
02-Sep-22	silver-haired bat	144	carcass search	70-m uncleared plot	scavenged	40.63527	-86.88551
02-Sep-22	eastern red bat	146	carcass search	incidental	scavenged	40.62193	-86.87693
02-Sep-22	silver-haired bat	146	carcass search	incidental	scavenged	40.62165	-86.87719
02-Sep-22	eastern red bat	149	carcass search	70-m cleared plot	intact	40.68195	-86.85411
02-Sep-22	silver-haired bat	149	carcass search	70-m cleared plot	intact	40.68166	-86.8537
02-Sep-22	silver-haired bat	149	carcass search	70-m cleared plot	intact	40.682	-86.85327
02-Sep-22	silver-haired bat	149	carcass search	incidental	intact	40.68171	-86.8534
02-Sep-22	eastern red bat	151	carcass search	70-m cleared plot	scavenged	40.67003	-86.8494
02-Sep-22	silver-haired bat	151	carcass search	70-m cleared plot	scavenged	40.67021	-86.85012
03-Sep-22	big brown bat	140	carcass search	70-m cleared plot	scavenged	40.65076	-86.8825
03-Sep-22	silver-haired bat	140	carcass search	70-m cleared plot	scavenged	40.65029	-86.88245
03-Sep-22	silver-haired bat	146	carcass search	70-m cleared plot	scavenged	40.62191	-86.87732

Appendix A. Carcasses found at the Indiana Crossroads Wind Farm, White County, Indiana, April 1 – May 15 and August 1 – October 15, 2022.

Found Date	Common Name	Turbine	Search Type	Plot Type	Physical Condition	Longitude[1]	Latitude[1]
03-Sep-22	silver-haired bat	146	carcass search	70-m cleared plot	scavenged	40.62179	-86.87726
03-Sep-22	silver-haired bat	146	carcass search	70-m cleared plot	scavenged	40.6215	-86.87768
03-Sep-22	eastern red bat	167	carcass search	70-m uncleared plot	scavenged	40.62938	-86.85316
03-Sep-22	eastern red bat	167	carcass search	70-m uncleared plot	scavenged	40.62961	-86.85305
03-Sep-22	eastern red bat	167	carcass search	70-m uncleared plot	scavenged	40.62932	-86.85302
03-Sep-22	eastern red bat	167	carcass search	70-m uncleared plot	scavenged	40.62947	-86.85359
03-Sep-22	hoary bat	167	carcass search	70-m uncleared plot	scavenged	40.62972	-86.8529
03-Sep-22	hoary bat	167	carcass search	70-m uncleared plot	scavenged	40.62972	-86.85356
03-Sep-22	eastern red bat	171	carcass search	70-m uncleared plot	scavenged	40.61421	-86.83739
03-Sep-22	eastern red bat	172	carcass search	70-m uncleared plot	scavenged	40.61234	-86.83206
03-Sep-22	eastern red bat	172	carcass search	70-m uncleared plot	scavenged	40.61226	-86.83242
03-Sep-22	silver-haired bat	172	carcass search	70-m uncleared plot	scavenged	40.61248	-86.8322
03-Sep-22	silver-haired bat	172	carcass search	70-m uncleared plot	scavenged	40.61261	-86.83201
03-Sep-22	unidentified *Lasiurus* bat	172	carcass search	70-m uncleared plot	scavenged	40.61238	-86.832
05-Sep-22	silver-haired bat	107	carcass search	70-m cleared plot	intact	40.7429	-86.93952
05-Sep-22	big brown bat	109	carcass search	70-m cleared plot	intact	40.7429	-86.91111
05-Sep-22	big brown bat	109	carcass search	70-m cleared plot	intact	40.74262	-86.91089
05-Sep-22	big brown bat	112	carcass search	70-m cleared plot	intact	40.73111	-86.92126
05-Sep-22	eastern red bat	112	carcass search	70-m cleared plot	intact	40.73124	-86.92127
05-Sep-22	eastern red bat	112	carcass search	70-m cleared plot	intact	40.73122	-86.92067
05-Sep-22	silver-haired bat	112	carcass search	70-m cleared plot	intact	40.73147	-86.92125
05-Sep-22	silver-haired bat	112	carcass search	70-m cleared plot	intact	40.73076	-86.92059
05-Sep-22	silver-haired bat	119	carcass search	70-m uncleared plot	intact	40.72265	-86.87646
06-Sep-22	silver-haired bat	101	carcass search	100-m road and pad	scavenged	40.74707	-86.97788
06-Sep-22	silver-haired bat	104	carcass search	100-m road and pad	scavenged	40.7484	-86.95758
06-Sep-22	silver-haired bat	104	carcass search	100-m road and pad	scavenged	40.74841	-86.95754
06-Sep-22	silver-haired bat	104	carcass search	100-m road and pad	scavenged	40.74835	-86.95753
06-Sep-22	silver-haired bat	105	carcass search	100-m road and pad	scavenged	40.74322	-86.95103
06-Sep-22	big brown bat	110	carcass search	100-m road and pad	intact	40.74217	-86.89963
06-Sep-22	big brown bat	114	carcass search	70-m cleared plot	intact	40.72463	-86.91109
06-Sep-22	big brown bat	114	carcass search	70-m cleared plot	unknown	40.65049	-86.88199
06-Sep-22	silver-haired bat	114	carcass search	70-m cleared plot	scavenged	40.72492	-86.91156
06-Sep-22	eastern red bat	133	carcass search	70-m cleared plot	scavenged	40.70876	-86.93914
06-Sep-22	big brown bat	150	carcass search	70-m uncleared plot	intact	40.68212	-86.84756
06-Sep-22	silver-haired bat	150	carcass search	70-m uncleared plot	intact	40.68202	-86.84709
06-Sep-22	hoary bat	155	carcass search	70-m uncleared plot	scavenged	40.65982	-86.82542

Appendix A. Carcasses found at the Indiana Crossroads Wind Farm, White County, Indiana, April 1 – May 15 and August 1 – October 15, 2022.

Found Date	Common Name	Turbine	Search Type	Plot Type	Physical Condition	Longitude[1]	Latitude[1]
07-Sep-22	eastern red bat	131	carcass search	100-m road and pad	injured	40.70912	-86.95243
07-Sep-22	eastern red bat	159	carcass search	100-m road and pad	scavenged	40.64412	-86.85118
07-Sep-22	evening bat	159	carcass search	100-m road and pad	scavenged	40.64386	-86.8509
07-Sep-22	silver-haired bat	165	carcass search	100-m road and pad	scavenged	40.63018	-86.86573
08-Sep-22	silver-haired bat	140	carcass search	incidental	intact	40.65068	-86.88253
08-Sep-22	silver-haired bat	143	carcass search	70-m uncleared plot	intact	40.63523	-86.8791
08-Sep-22	eastern red bat	149	carcass search	70-m cleared plot	intact	40.68173	-86.85342
09-Sep-22	eastern red bat	140	carcass search	70-m cleared plot	intact	40.65071	-86.8828
09-Sep-22	eastern red bat	140	carcass search	70-m cleared plot	intact	40.6509	-86.88301
09-Sep-22	eastern red bat	146	carcass search	70-m cleared plot	intact	40.62196	-86.87755
09-Sep-22	silver-haired bat	146	carcass search	70-m cleared plot	intact	40.62237	-86.87727
09-Sep-22	silver-haired bat	172	carcass search	70-m uncleared plot	intact	40.61253	-86.83291
12-Sep-22	eastern red bat	104	carcass search	100-m road and pad	scavenged	40.74837	-86.95754
12-Sep-22	hoary bat	110	carcass search	100-m road and pad	injured	40.74234	-86.89968
12-Sep-22	big brown bat	112	carcass search	70-m cleared plot	intact	40.73116	-86.92149
12-Sep-22	hoary bat	123	carcass search	100-m road and pad	scavenged	40.70688	-86.86263
13-Sep-22	silver-haired bat	130	carcass search	100-m road and pad	intact	40.70749	-86.96193
13-Sep-22	silver-haired bat	130	carcass search	100-m road and pad	intact	40.70723	-86.96206
13-Sep-22	silver-haired bat	131	carcass search	100-m road and pad	injured	40.70962	-86.95252
13-Sep-22	silver-haired bat	135	carcass search	70-m cleared plot	dismembered	40.70828	-86.92473
13-Sep-22	silver-haired bat	145	carcass search	100-m road and pad	scavenged	40.63722	-86.89202
13-Sep-22	silver-haired bat	166	carcass search	100-m road and pad	scavenged	40.63028	-86.85877
13-Sep-22	silver-haired bat	166	carcass search	100-m road and pad	scavenged	40.63021	-86.85952
13-Sep-22	silver-haired bat	170	carcass search	100-m road and pad	intact	40.61421	-86.84172
15-Sep-22	hoary bat	139	carcass search	70-m uncleared plot	intact	40.67093	-86.88086
15-Sep-22	eastern red bat	143	carcass search	70-m uncleared plot	intact	40.63514	-86.87947
15-Sep-22	silver-haired bat	155	carcass search	incidental	intact	40.65952	-86.82529
15-Sep-22	eastern red bat	157	carcass search	70-m cleared plot	intact	40.65709	-86.8441
15-Sep-22	silver-haired bat	157	carcass search	70-m cleared plot	intact	40.6568	-86.84458
16-Sep-22	silver-haired bat	141	carcass search	70-m cleared plot	intact	40.65076	-86.88867
16-Sep-22	silver-haired bat	146	carcass search	70-m cleared plot	intact	40.6222	-86.87717
16-Sep-22	eastern red bat	172	carcass search	70-m uncleared plot	intact	40.61265	-86.83213
16-Sep-22	hoary bat	172	carcass search	70-m uncleared plot	intact	40.6123	-86.83226
19-Sep-22	silver-haired bat	101	carcass search	100-m road and pad	scavenged	40.74737	-86.97785
19-Sep-22	silver-haired bat	101	carcass search	100-m road and pad	scavenged	40.7473	-86.97788
19-Sep-22	hoary bat	106	carcass search	70-m cleared plot	intact	40.74279	-86.94595

Appendix A. Carcasses found at the Indiana Crossroads Wind Farm, White County, Indiana, April 1 – May 15 and August 1 – October 15, 2022.

Found Date	Common Name	Turbine	Search Type	Plot Type	Physical Condition	Longitude[1]	Latitude[1]
19-Sep-22	silver-haired bat	106	carcass search	70-m cleared plot	intact	40.74261	-86.94598
19-Sep-22	silver-haired bat	106	carcass search	70-m cleared plot	intact	40.74288	-86.94557
19-Sep-22	silver-haired bat	106	carcass search	70-m cleared plot	intact	40.7429	-86.94559
19-Sep-22	silver-haired bat	106	carcass search	70-m cleared plot	intact	40.74232	-86.94566
19-Sep-22	silver-haired bat	106	carcass search	70-m cleared plot	intact	40.74224	-86.94614
19-Sep-22	eastern red bat	107	carcass search	70-m cleared plot	scavenged	40.74235	-86.94009
19-Sep-22	eastern red bat	107	carcass search	70-m cleared plot	intact	40.74228	-86.93886
19-Sep-22	silver-haired bat	107	carcass search	70-m cleared plot	intact	40.7427	-86.93897
19-Sep-22	silver-haired bat	107	carcass search	70-m cleared plot	intact	40.7425	-86.93925
19-Sep-22	big brown bat	109	carcass search	70-m cleared plot	scavenged	40.74268	-86.91105
19-Sep-22	silver-haired bat	112	carcass search	70-m cleared plot	intact	40.73109	-86.92127
19-Sep-22	hoary bat	123	carcass search	100-m road and pad	scavenged	40.70693	-86.86171
20-Sep-22	eastern red bat	114	carcass search	70-m cleared plot	intact	40.72526	-86.91175
20-Sep-22	eastern red bat	114	carcass search	70-m cleared plot	intact	40.72532	-86.91176
20-Sep-22	eastern red bat	114	carcass search	70-m cleared plot	intact	40.72466	-86.91199
20-Sep-22	hoary bat	114	carcass search	70-m cleared plot	intact	40.72546	-86.91161
20-Sep-22	silver-haired bat	114	carcass search	70-m cleared plot	intact	40.72529	-86.911
20-Sep-22	hoary bat	115	carcass search	incidental	intact	40.72494	-86.90413
20-Sep-22	eastern red bat	131	carcass search	100-m road and pad	intact	40.70921	-86.9524
20-Sep-22	hoary bat	133	carcass search	70-m cleared plot	intact	40.70919	-86.93953
20-Sep-22	silver-haired bat	142	carcass search	100-m road and pad	scavenged	40.64468	-86.87404
20-Sep-22	silver-haired bat	142	carcass search	100-m road and pad	scavenged	40.6447	-86.87389
20-Sep-22	eastern red bat	147	carcass search	100-m road and pad	intact	40.68216	-86.87315
20-Sep-22	silver-haired bat	148	carcass search	100-m road and pad	scavenged	40.68183	-86.86524
20-Sep-22	hoary bat	155	carcass search	70-m uncleared plot	scavenged	40.65971	-86.8251
20-Sep-22	eastern red bat	165	carcass search	100-m road and pad	intact	40.63006	-86.86554
22-Sep-22	hoary bat	139	carcass search	70-m uncleared plot	intact	40.67128	-86.88128
22-Sep-22	silver-haired bat	139	carcass search	70-m uncleared plot	intact	40.67073	-86.88126
22-Sep-22	silver-haired bat	143	carcass search	70-m uncleared plot	intact	40.63527	-86.8789
22-Sep-22	silver-haired bat	143	carcass search	70-m uncleared plot	intact	40.63535	-86.87884
22-Sep-22	silver-haired bat	144	carcass search	70-m uncleared plot	intact	40.63521	-86.88527
22-Sep-22	big brown bat	149	carcass search	70-m cleared plot	scavenged	40.68213	-86.85327
22-Sep-22	eastern red bat	149	carcass search	70-m cleared plot	intact	40.68257	-86.85379
22-Sep-22	eastern red bat	149	carcass search	70-m cleared plot	intact	40.6823	-86.85351
22-Sep-22	eastern red bat	149	carcass search	70-m cleared plot	intact	40.68222	-86.85394
22-Sep-22	silver-haired bat	149	carcass search	70-m cleared plot	intact	40.68182	-86.85336

Appendix A. Carcasses found at the Indiana Crossroads Wind Farm, White County, Indiana, April 1 – May 15 and August 1 – October 15, 2022.

Found Date	Common Name	Turbine	Search Type	Plot Type	Physical Condition	Longitude[1]	Latitude[1]
22-Sep-22	silver-haired bat	151	carcass search	70-m cleared plot	intact	40.67036	-86.85035
22-Sep-22	eastern red bat	157	carcass search	70-m cleared plot	intact	40.65669	-86.84443
23-Sep-22	silver-haired bat	141	carcass search	70-m cleared plot	scavenged	40.65084	-86.88901
23-Sep-22	silver-haired bat	141	carcass search	70-m cleared plot	intact	40.65047	-86.88871
23-Sep-22	silver-haired bat	160	carcass search	70-m uncleared plot	intact	40.64403	-86.84528
23-Sep-22	silver-haired bat	160	carcass search	70-m uncleared plot	scavenged	40.644	-86.84414
23-Sep-22	eastern red bat	167	carcass search	70-m uncleared plot	intact	40.62955	-86.85312
23-Sep-22	hoary bat	167	carcass search	70-m uncleared plot	intact	40.62953	-86.85296
23-Sep-22	silver-haired bat	167	carcass search	70-m uncleared plot	intact	40.62895	-86.85306
23-Sep-22	silver-haired bat	167	carcass search	70-m uncleared plot	intact	40.62987	-86.85315
24-Sep-22	big brown bat	146	carcass search	70-m cleared plot	intact	40.62213	-86.87801
24-Sep-22	big brown bat	146	carcass search	70-m cleared plot	intact	40.62192	-86.87752
26-Sep-22	silver-haired bat	105	carcass search	100-m road and pad	injured	40.7432	-86.95123
26-Sep-22	hoary bat	106	carcass search	70-m cleared plot	scavenged	40.74212	-86.94480
26-Sep-22	silver-haired bat	106	carcass search	70-m cleared plot	intact	40.74214	-86.946
26-Sep-22	silver-haired bat	106	carcass search	70-m cleared plot	intact	40.74192	-86.94539
26-Sep-22	silver-haired bat	106	carcass search	70-m cleared plot	intact	40.74198	-86.945
26-Sep-22	silver-haired bat	106	carcass search	70-m cleared plot	injured	40.74225	-86.94541
26-Sep-22	silver-haired bat	108	carcass search	100-m road and pad	scavenged	40.74304	-86.93262
26-Sep-22	eastern red bat	109	carcass search	70-m cleared plot	intact	40.74308	-86.91031
26-Sep-22	silver-haired bat	109	carcass search	70-m cleared plot	intact	40.74281	-86.91114
26-Sep-22	silver-haired bat	109	carcass search	70-m cleared plot	intact	40.7429	-86.91042
26-Sep-22	silver-haired bat	109	carcass search	70-m cleared plot	intact	40.74299	-86.91073
26-Sep-22	silver-haired bat	109	carcass search	70-m cleared plot	intact	40.74276	-86.91068
26-Sep-22	silver-haired bat	109	carcass search	70-m cleared plot	scavenged	40.74297	-86.91093
26-Sep-22	silver-haired bat	109	carcass search	70-m cleared plot	intact	40.74305	-86.91101
26-Sep-22	silver-haired bat	109	carcass search	70-m cleared plot	intact	40.74305	-86.91072
26-Sep-22	silver-haired bat	112	carcass search	70-m cleared plot	intact	40.73144	-86.92086
26-Sep-22	silver-haired bat	112	carcass search	70-m cleared plot	unknown	40.74229	-86.89936
26-Sep-22	silver-haired bat	123	carcass search	100-m road and pad	intact	40.70669	-86.86241
26-Sep-22	silver-haired bat	123	carcass search	100-m road and pad	intact	40.70673	-86.86238
26-Sep-22	evening bat	125	carcass search	100-m road and pad	scavenged	40.70669	-86.87458
26-Sep-22	eastern red bat	126	carcass search	100-m road and pad	intact	40.70846	-86.87915
26-Sep-22	silver-haired bat	150	carcass search	70-m uncleared plot	intact	40.68233	-86.84751
27-Sep-22	silver-haired bat	107	carcass search	70-m cleared plot	intact	40.74201	-86.93885
27-Sep-22	silver-haired bat	107	carcass search	70-m cleared plot	intact	40.74234	-86.93879

Appendix A. Carcasses found at the Indiana Crossroads Wind Farm, White County, Indiana, April 1 – May 15 and August 1 – October 15, 2022.

Found Date	Common Name	Turbine	Search Type	Plot Type	Physical Condition	Longitude[1]	Latitude[1]
27-Sep-22	silver-haired bat	118	carcass search	70-m cleared plot	intact	40.72384	-86.88248
27-Sep-22	silver-haired bat	156	carcass search	100-m road and pad	scavenged	40.68498	-86.87891
27-Sep-22	eastern red bat	159	carcass search	100-m road and pad	scavenged	40.64409	-86.85094
27-Sep-22	silver-haired bat	159	carcass search	100-m road and pad	intact	40.64396	-86.85079
27-Sep-22	silver-haired bat	168	carcass search	100-m road and pad	scavenged	40.61406	-86.85332
29-Sep-22	silver-haired bat	128	carcass search	70-m cleared plot	intact	40.70168	-86.89666
29-Sep-22	eastern red bat	143	carcass search	70-m uncleared plot	intact	40.63578	-86.87901
29-Sep-22	eastern red bat	144	carcass search	70-m uncleared plot	intact	40.63557	-86.88505
29-Sep-22	eastern red bat	144	carcass search	70-m uncleared plot	intact	40.6353	-86.88605
29-Sep-22	silver-haired bat	157	carcass search	70-m cleared plot	intact	40.65742	-86.84421
30-Sep-22	silver-haired bat	146	carcass search	70-m cleared plot	intact	40.62198	-86.87765
30-Sep-22	silver-haired bat	146	carcass search	70-m cleared plot	intact	40.62229	-86.87719
03-Oct-22	silver-haired bat	104	carcass search	100-m road and pad	scavenged	40.74832	-86.9575
03-Oct-22	eastern red bat	107	carcass search	70-m cleared plot	intact	40.74223	-86.93993
03-Oct-22	silver-haired bat	107	carcass search	70-m cleared plot	scavenged	40.74205	-86.93896
03-Oct-22	eastern red bat	112	carcass search	70-m cleared plot	dismembered	40.73143	-86.92158
03-Oct-22	silver-haired bat	112	carcass search	70-m cleared plot	intact	40.73078	-86.92107
03-Oct-22	silver-haired bat	123	carcass search	100-m road and pad	scavenged	40.70697	-86.86228
04-Oct-22	silver-haired bat	154	carcass search	70-m uncleared plot	intact	40.66233	-86.82898
05-Oct-22	silver-haired bat	142	carcass search	100-m road and pad	scavenged	40.64463	-86.87404
05-Oct-22	eastern red bat	159	carcass search	100-m road and pad	scavenged	40.64402	-86.85088
05-Oct-22	big brown bat	168	carcass search	100-m road and pad	intact	40.61403	-86.85287
06-Oct-22	silver-haired bat	149	carcass search	70-m cleared plot	intact	40.68227	-86.85409
07-Oct-22	silver-haired bat	160	carcass search	70-m uncleared plot	intact	40.64424	-86.84446
07-Oct-22	silver-haired bat	172	carcass search	70-m uncleared plot	intact	40.61223	-86.83253
10-Oct-22	silver-haired bat	109	carcass search	70-m cleared plot	scavenged	40.74279	-86.91147
13-Oct-22	big brown bat	144	carcass search	70-m uncleared plot	scavenged	40.6352	-86.88557
Bird Carcasses							
04-Apr-22	horned lark	105	carcass search	100-m road and pad	intact	40.74344	-86.95108
04-Apr-22	golden-crowned kinglet	113	carcass search	100-m road and pad	dismembered	40.72965	-86.91426
04-Apr-22	unidentified small bird	119	carcass search	100-m road and pad	dismembered	40.72259	-86.87628
05-Apr-22	golden-crowned kinglet	131	carcass search	100-m road and pad	intact	40.70976	-86.9524
05-Apr-22	unidentified small bird	139	carcass search	100-m road and pad	feather spot	40.67069	-86.88106
05-Apr-22	golden-crowned kinglet	150	carcass search	100-m road and pad	intact	40.68221	-86.84844
06-Apr-22	merlin	166	carcass search	100-m road and pad	intact	40.6303	-86.85962
06-Apr-22	red-tailed hawk	172	carcass search[2]	100-m road and pad	intact	40.6123	-86.83219

Appendix A. Carcasses found at the Indiana Crossroads Wind Farm, White County, Indiana, April 1 – May 15 and August 1 – October 15, 2022.

Found Date	Common Name	Turbine	Search Type	Plot Type	Physical Condition	Longitude[1]	Latitude[1]
11-Apr-22	northern flicker	103	carcass search	100-m road and pad	scavenged	40.74688	-86.96441
12-Apr-22	red-tailed hawk	133	carcass search[2]	100-m road and pad	scavenged	40.70902	-86.93979
18-Apr-22	golden-crowned kinglet	122	carcass search	100-m road and pad	intact	40.707	-86.85594
25-Apr-22	unidentified passerine	103	carcass search	100-m road and pad	feather spot	40.74693	-86.96369
25-Apr-22	sora	121	carcass search	100-m road and pad	intact	40.72498	-86.85586
03-May-22	red-tailed hawk	109	carcass search[2]	100-m road and pad	intact	40.74379	-86.91117
03-May-22	unidentified passerine	152	carcass search	100-m road and pad	intact	40.67005	-86.84415
10-May-22	turkey vulture	129	carcass search[2]	100-m road and pad	intact	40.70689	-86.96748
11-May-22	dickcissel	160	carcass search	100-m road and pad	intact	40.64403	-86.84441
11-May-22	red-eyed vireo	161	carcass search	100-m road and pad	intact	40.64522	-86.83616
05-Jul-22	horned lark	110	carcass search	100-m road and pad	unknown	40.72525	-86.91139
01-Aug-22	killdeer	103	carcass search	100-m road and pad	dismembered	40.74683	-86.96486
08-Aug-22	red-tailed hawk	107	carcass search	70-m cleared plot	intact	40.74208	-86.93954
08-Aug-22	purple martin	112	carcass search[2]	70-m cleared plot	intact	40.73112	-86.92148
09-Aug-22	unidentified swallow	109	carcass search	70-m cleared plot	intact	40.74295	-86.91063
09-Aug-22	turkey vulture	114	carcass search	70-m cleared plot	dismembered	40.72546	-86.91154
11-Aug-22	unidentified small bird	143	carcass search	incidental	scavenged	40.63526	-86.87939
11-Aug-22	unidentified swallow	144	carcass search	incidental	scavenged	40.63543	-86.88562
11-Aug-22	red-tailed hawk	149	carcass search	incidental	dismembered	40.68212	-86.85334
15-Aug-22	barn swallow	119	carcass search	70-m uncleared plot	intact	40.72357	-86.87708
16-Aug-22	mourning dove	118	carcass search	70-m cleared plot	feather spot	40.72335	-86.88232
16-Aug-22	American robin	148	carcass search	100-m road and pad	scavenged	40.68147	-86.86483
18-Aug-22	mourning dove	139	carcass search	70-m uncleared plot	intact	40.67074	-86.8809
18-Aug-22	unidentified passerine	144	carcass search	70-m uncleared plot	dismembered	40.63526	-86.88564
18-Aug-22	unidentified small bird	144	carcass search	70-m uncleared plot	feather spot	40.63545	-86.88565
22-Aug-22	unidentified empidonax	105	carcass search	100-m road and pad	injured	40.74351	-86.95053
22-Aug-22	yellow-billed cuckoo	107	carcass search[2]	70-m cleared plot	intact	40.74288	-86.93863
22-Aug-22	purple martin	112	carcass search	70-m cleared plot	intact	40.73144	-86.92123
23-Aug-22	unidentified passerine	114	carcass search	70-m cleared plot	dismembered	40.72495	-86.91122
25-Aug-22	common grackle	139	carcass search	70-m uncleared plot	intact	40.67078	-86.88147
25-Aug-22	purple martin	139	carcass search	70-m uncleared plot	intact	40.67056	-86.88073
25-Aug-22	unidentified warbler	144	carcass search	70-m uncleared plot	feather spot	40.63529	-86.88592
26-Aug-22	cliff swallow	140	carcass search	70-m cleared plot	intact	40.65058	-86.88299
26-Aug-22	unidentified raptor	172	carcass search	70-m uncleared plot	intact	40.61231	-86.83224
29-Aug-22	cedar waxwing	105	carcass search	100-m road and pad	scavenged	40.74334	-86.95094
29-Aug-22	American redstart	121	carcass search	100-m road and pad	scavenged	40.72509	-86.856

Appendix A. Carcasses found at the Indiana Crossroads Wind Farm, White County, Indiana, April 1 – May 15 and August 1 – October 15, 2022.

Found Date	Common Name	Turbine	Search Type	Plot Type	Physical Condition	Longitude[1]	Latitude[1]
30-Aug-22	Tennessee warbler	130	carcass search	100-m road and pad	intact	40.70748	-86.96173
30-Aug-22	horned lark	133	carcass search	70-m cleared plot	intact	40.70842	-86.93994
30-Aug-22	horned lark	133	carcass search	70-m cleared plot	intact	40.70874	-86.94025
02-Sep-22	Tennessee warbler	139	carcass search	70-m uncleared plot	scavenged	40.67068	-86.8807
02-Sep-22	unidentified passerine	144	carcass search	70-m uncleared plot	scavenged	40.63524	-86.88511
02-Sep-22	American redstart	149	carcass search	70-m cleared plot	intact	40.6821	-86.85332
02-Sep-22	horned lark	149	carcass search	70-m cleared plot	intact	40.68241	-86.85346
03-Sep-22	unidentified passerine	167	carcass search	70-m uncleared plot	feather spot	40.62981	-86.85268
05-Sep-22	horned lark	127	carcass search	70-m cleared plot	feather spot	40.7036	-86.90325
07-Sep-22	Tennessee warbler	163	carcass search	100-m road and pad	intact	40.64441	-86.82366
08-Sep-22	horned lark	149	carcass search	70-m cleared plot	intact	40.68214	-86.85322
08-Sep-22	horned lark	157	carcass search	70-m cleared plot	feather spot	40.65678	-86.84457
09-Sep-22	unidentified warbler	140	carcass search	70-m cleared plot	intact	40.65041	-86.88273
12-Sep-22	cedar waxwing	106	carcass search	70-m cleared plot	intact	40.74259	-86.94622
12-Sep-22	unidentified warbler	119	carcass search	70-m uncleared plot	intact	40.72314	-86.87595
12-Sep-22	Tennessee warbler	127	carcass search	70-m cleared plot	intact	40.70355	-86.90425
13-Sep-22	horned lark	133	carcass search	70-m cleared plot	dismembered	40.70866	-86.9399
15-Sep-22	horned lark	128	carcass search	70-m cleared plot	feather spot	40.70262	-86.89647
15-Sep-22	red-eyed vireo	143	carcass search	70-m uncleared plot	intact	40.63527	-86.87994
15-Sep-22	horned lark	151	carcass search	70-m cleared plot	dismembered	40.67041	-86.8501
15-Sep-22	horned lark	151	carcass search	70-m cleared plot	intact	40.66968	-86.85048
19-Sep-22	red-breasted nuthatch	112	carcass search	70-m cleared plot	intact	40.73139	-86.92071
20-Sep-22	unidentified passerine	114	carcass search	70-m cleared plot	intact	40.72507	-86.91206
20-Sep-22	unidentified warbler	114	carcass search	70-m cleared plot	intact	40.72549	-86.91138
20-Sep-22	unidentified small bird	142	carcass search	100-m road and pad	scavenged	40.64468	-86.87359
22-Sep-22	unidentified warbler	149	carcass search	70-m cleared plot	intact	40.68258	-86.85395
22-Sep-22	Tennessee warbler	151	carcass search	70-m cleared plot	intact	40.67036	-86.85019
23-Sep-22	blue-headed vireo	167	carcass search	70-m uncleared plot	intact	40.62916	-86.85357
26-Sep-22	killdeer	104	carcass search	100-m road and pad	dismembered	40.7485	-86.95744
26-Sep-22	red-breasted nuthatch	108	carcass search[2]	100-m road and pad	intact	40.74304	-86.93178
26-Sep-22	ruby-throated hummingbird	108	carcass search	100-m road and pad	scavenged	40.74308	-86.93306
26-Sep-22	Tennessee warbler	109	carcass search	70-m cleared plot	intact	40.74303	-86.91043
26-Sep-22	unidentified warbler	109	carcass search	70-m cleared plot	intact	40.74288	-86.91148
26-Sep-22	unidentified vireo	112	carcass search	70-m cleared plot	dismembered	40.73097	-86.92046
26-Sep-22	unidentified warbler	116	carcass search	100-m road and pad	scavenged	40.72491	-86.89688
27-Sep-22	ruby-throated hummingbird	107	carcass search	70-m cleared plot	intact	40.74231	-86.93946

Appendix A. Carcasses found at the Indiana Crossroads Wind Farm, White County, Indiana, April 1 – May 15 and August 1 – October 15, 2022.

Found Date	Common Name	Turbine	Search Type	Plot Type	Physical Condition	Longitude[1]	Latitude[1]
27-Sep-22	red-breasted nuthatch	129	carcass search	100-m road and pad	injured	40.70733	-86.96712
27-Sep-22	American redstart	156	carcass search	100-m road and pad	scavenged	40.685	-86.87874
29-Sep-22	unidentified warbler	149	carcass search	70-m cleared plot	intact	40.68171	-86.85331
03-Oct-22	golden-crowned kinglet	103	carcass search	100-m road and pad	scavenged	40.74701	-86.96406
03-Oct-22	unidentified vireo	106	carcass search	70-m cleared plot	intact	40.74192	-86.94511
03-Oct-22	unidentified small bird	107	carcass search	70-m cleared plot	dismembered	40.7427	-86.93928
03-Oct-22	killdeer	109	carcass search	70-m cleared plot	feather spot	40.74275	-86.91132
03-Oct-22	sharp-shinned hawk	112	carcass search	70-m cleared plot	intact	40.7308	-86.92179
04-Oct-22	golden-crowned kinglet	155	carcass search	70-m uncleared plot	intact	40.65975	-86.82566
06-Oct-22	golden-crowned kinglet	144	carcass search	70-m uncleared plot	intact	40.63486	-86.88569
06-Oct-22	unidentified empidonax	149	carcass search	70-m cleared plot	intact	40.68159	-86.8535
07-Oct-22	golden-crowned kinglet	160	carcass search	70-m uncleared plot	intact	40.64398	-86.84496
07-Oct-22	red-eyed vireo	167	carcass search	70-m uncleared plot	intact	40.62961	-86.85289
10-Oct-22	unidentified passerine	109	carcass search	70-m cleared plot	scavenged	40.74263	-86.91069
11-Oct-22	unidentified small bird	150	carcass search	70-m uncleared plot	scavenged	40.68153	-86.84728

[1] These coordinates were collected in WGS84.

[2] 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 Indiana Crossroads Wind Farm, White County, Indiana, August 1 – October 15, 2022.

Covariates	k Value	AICc	Delta AICc
No covariates	0.67	59.81	0*
Plot type	0.67	60.89	1.08

* Selected model.

AICc is corrected Akaike Information Criterion; Delta AICc is the difference between the AICc of a given model and the lowest AICc value.

Appendix B2. Searcher efficiency models for 100-meter roads and pads at the Indiana Crossroads Wind Farm, White County, Indiana, April 1 – May 15 and August 1 – October 15, 2022.

Covariates	k Value	AICc	Delta AICc
No covariates	0.67	11.55	0*
Season	0.67	13.26	1.71

* Selected model.

AICc is corrected Akaike Information Criterion; Delta AICc is the difference between the AICc of a given model and the lowest AICc value.

Appendix B3. Carcass persistence models with covariates and distributions for 70-meter plots at the Indiana Crossroads Wind Project, White County, Indiana, April 1 – May 15 and August 1 – October 15, 2022.

Location Covariates	Scale Covariates	Distribution	AICc	Delta AICc
No Covariates	-	exponential	124.00	0*
No Covariates	No Covariates	loglogistic	125.48	1.48
No Covariates	No Covariates	Weibull	125.74	1.74
No Covariates	No Covariates	lognormal	125.96	1.96
Plot Type	-	exponential	126.02	2.02
Plot Type	No Covariates	loglogistic	127.72	3.72
No Covariates	Plot Type	loglogistic	127.81	3.81
Plot Type	No Covariates	Weibull	127.96	3.96
Plot Type	No Covariates	lognormal	128.05	4.05
No Covariates	Plot Type	Weibull	128.06	4.06
No Covariates	Plot Type	lognormal	128.18	4.18
Plot Type	Plot Type	loglogistic	130.27	6.27
Plot Type	Plot Type	Weibull	130.48	6.48
Plot Type	Plot Type	lognormal	130.51	6.51

* Selected model.

AICc is corrected Akaike Information Criterion; Delta AICc is the difference between the AICc of a given model and the lowest AICc value.

Appendix B4. Carcass persistence top models with covariates, distributions, and model parameters for the Indiana Crossroads Wind Farm, White County, Indiana, April 1 – May 15 and August 1 – October 15, 2022.

Plot Search Type	Distribution[1]	Estimated Median Removal Times (days)	Parameter 1[2]	Parameter 2
70-meter plots	exponential	5.96	0.1164	--
100-meter roads and pads	exponential	6.23	0.1112	--

[1] Parameterization follows the base R parameterization for this distribution.

[2] The exponential distribution only uses one parameter.

Appendix B5. Carcass persistence models with covariates and distributions for 100-meter roads and pads at the Indiana Crossroads Wind Energy Project, White County, Indiana, April 1 – May 15 and August 1 – October 15, 2022.

Location Covariates	Scale Covariates	Distribution	AICc	Delta AICc
Season	-	exponential	122.10	0
No Covariates	-	exponential	122.40	0.30*
No Covariates	No Covariates	Weibull	122.63	0.53
Season	No Covariates	Weibull	122.97	0.87
No Covariates	Season	Weibull	123.71	1.61
Season	Season	Weibull	124.25	2.15
Season	No Covariates	loglogistic	125.51	3.41
Season	No Covariates	lognormal	125.74	3.64
No Covariates	No Covariates	loglogistic	125.91	3.81
No Covariates	No Covariates	lognormal	126.14	4.04
Season	Season	loglogistic	127.44	5.34
No Covariates	Season	loglogistic	127.71	5.61
Season	Season	lognormal	127.92	5.82
No Covariates	Season	lognormal	128.09	5.99

* Selected model.

AICc = Corrected Akaike Information Criterion.

Appendix B6. Number and percent (%) of bat carcasses found at the Indiana Crossroads Wind Farm, White County, Indiana, April 1 – May 15 and August 1 – October 15, 2022.

Species	Included in Fatality Estimate Total	%	Outside Search Area* Total	%	Outside Study Period* Total	%	Other* Total	%	Total Total	%
silver-haired bat	110	31.8	0	0	0	0	10	66.7	120	31.1
eastern red bat	103	29.8	2	100	10	43.5	3	20.0	118	30.6
hoary bat	65	18.8	0	0	7	30.4	0	0	72	18.7
big brown bat	61	17.6	0	0	6	26.1	2	13.3	69	17.9
evening bat	4	1.16	0	0	0	0	0	0	4	1.0
eastern red bat or Seminole bat	2	0.6	0	0	0	0	0	0	2	0.5
Lasiurus spp.	1	0.3	0	0	0	0	0	0	1	0.3
Total	**346**	**100**	**2**	**100**	**23**	**100**	**15**	**100**	**386**	**100**

* Carcasses listed in this column were found between October 1 – 15 and were not included in analysis.

Sums may not equal totals shown due to rounding.

Appendix B7. Search area adjustment models for bats from the Indiana Crossroads Wind Farm, White County, Indiana, April 1 – May 15 and August 1 – October 15, 2022.

Distribution	AICc	Delta AICc
gamma	12,698.76	0*
Weibull	12,699.33	0.58
normal	12,738.99	40.23
Gompertz	12,768.96	70.20

* Selected model.

AICc = corrected Akaike Information Criterion.

Appendix B8. Truncated weighted maximum likelihood search area adjustment estimates for the Indiana Crossroads Wind Farm, White County, Indiana, April 1 – May 15 and August 1 – October 15, 2022.

Plot Type	Area Correction
70-m plots	0.70
100-m road and pad	0.20

The carcass density followed a truncated gamma distribution with the following parameters: 1.7988 (Parameter 1) and 0.0319 (Parameter 2) and a left-truncation bound at zero meters (m).

n = 346.

Appendix C. Bat Fatality Rates at Indiana Crossroads Wind Farm Using the GenEst Fatality Estimator

Appendix C1. Estimated fatality rates with 90% confidence intervals (CI) for all plot types and seasons for studies conducted at the Indiana Crossroads Wind Farm, White County, Indiana, April 1 – May 15 and August 1 – October 15, 2022.

Plot Type	Spring		Fall	
	Estimate	90% CI	Estimate	90% CI
Searcher Efficiency				
100-m road and pad	0.98	0.89–1.00	0.98	0.90–1.00
70-m uncleared	–	–	0.60	0.48–0.72
70-m cleared	–	–	0.60	0.48–0.72
Average Probability of a Carcass Persisting Through the Search Interval*				
100-m road and pad	0.69	0.61–0.77	0.66	0.59–0.76
70-m uncleared	–	–	0.68	0.59–0.76
70-m cleared	–	–	0.68	0.59–0.76
Probability of Available and Detected				
100-m road and pad	0.65	0.55–0.73	0.56	0.51–0.63
70-m uncleared	–	–	0.44	0.34–0.55
70-m cleared	–	–	0.44	0.34–0.55
Estimated Fatality Rates (Fatalities/Turbine/Season)				
100-m road and pad	1.64	0.96–3.22	16.69	11.86–31.05
70-m uncleared	–	–	18.31	13.13–34.12
70-m cleared	–	–	33.16	23.52–62.76
Overall	**1.64**	**0.96–3.22**	**20.35**	**14.86–37.36**
Estimated Fatality Rates (Fatalities/Megawatt/Seasons)				
100-m road and pad	0.39	0.23–0.77	3.97	2.82–7.39
70-m uncleared	–	–	4.36	3.13–8.12
70-m cleared	–	–	7.90	5.60–14.94
Overall	**0.39**	**0.23–0.77**	**4.85**	**3.54–8.90**

* The search interval was weekly on all plot types in all seasons.

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 Indiana Crossroads Wind Farm, White County, Indiana, April 1 – May 15 and August 1 – October 15, 2022.

Season	Plot Type	Search Interval (I)	Number of Searches[2]	Spatial Coverage (a)	Searcher Efficiency Carcasses Available	Searcher Efficiency Carcasses Found	Carcass Persistence[1] Shape (α)	Carcass Persistence[1] Scale (β)	Carcass Persistence[1] Scale Lower Limit (β)	Carcass Persistence[1] Scale Upper Limit (β)
spring	100-meter road and pad	7	7	0.2	42	41	1	8.99	6.02	13.44
fall	100-meter road and pad	7	10	0.2	42	41	1	8.99	6.02	13.44
fall	70-meter plots	7	9	0.7	43	26	1	8.59	5.7	12.95

[1] An exponential distribution was used for the road and pad, cleared, and uncleared plot carcass persistence distributions.

[2] Includes one additional search beyond what was conducted in the field to account for the EoA graphical user interface assumption that a clearing search is included in the number of searches.

Appendix D2. Inputs needed to run Evidence of Absence: Multiple Class Module for the combination of plot types probabilities within a season at the Indiana Crossroads Wind Farm, White County, Indiana, April 1 – May 15 and August 1 – October 15, 2022.

Season	Plot Type	Arrival Proportion	Ba	Bb	Temporal Coverage (v)	Within-Season Weights (ρ)*
spring	100-meter road and pad	0.11	147.9	923.9	1	1
fall	70-meter plots	0.89	34.7	72.2	1	0.389
fall	100-meter road and pad	0.89	153.1	957.3	1	0.611

The spring season had a single plot type, and no combination of detection probabilities was required during this step for the spring. The spring road and pad strata information is included for transparency.

* Within-season weights are equal to the within season sampling fraction for each plot type in this analysis.

Appendix D3. Inputs needed to run Evidence of Absence: Multiple Class Module for the combination of seasonal detection probabilities at the Indiana Crossroads Wind Farm, White County, Indiana, April 1 – May 15 and August 1 – October 15, 2022.

Season	Plot Type	Ba	Bb	Sampling Fraction	Temporal Coverage (v)	Turbine Operation*	Weights (ρ)
spring	100-meter road and pad	147.896	923.896	1	0.11	1.0	0.131
fall	100-meter road and pad and 70-meter plots	100.554	377.179	1	0.89	0.818	0.869

* Turbine Operation column accounts for missing turbine-days of risk when turbines were non-operational.

Appendix D4. Inputs needed to run Evidence of Absence: Multiple Years Module for the Indiana Crossroads Wind Farm, White County, Indiana, from 2022.

Year	g	90% Confidence Interval	Ba	Bb	Weights (ρ)
2022	0.201	0.175–0.228	122.1	485.4	0.838

Appendix D5. Screen shot of Evidence of Absence (v2.0.7) graphical user interface, Single Class Module inputs for Spring 2022, 100-meter road and pad searches at 72 turbines, searched at a 7-day interval.

EoA, v2.0.7 - Single Class Module

Edit   Help

Detection Probability (g)

Search Schedule

Start of monitoring (yyyy-mm-dd): `2022-08-01`

○ Formula
- Search interval (I): `7`
- Number of searches: `10`

○ Custom   Edit/View
- span = 182, I (mean) = 7

Spatial coverage (a): `0.204`
Temporal coverage (v): `1`

[Estimate g]

Searcher Efficiency

○ Carcasses available for several searches
- 95% CIs: p ∈ [0.528, 0.675], k ∈ [0.65, 0.816]
- p̂ = 0.62, k̂ = 0.737   [View] [Edit]

● Carcasses removed after one search
- Carcasses available: `42`
- Carcasses found: `41`
- p̂ = 0.976, with 95% CI = [0.894, 0.997]
- 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 (α) = 4.078 and scale (β) = 1.171
- r = 0.531 for Ir = 7, with 95% CIs: r = [0.413, 0.649], β = [0.488, 1.854]

● Enter parameter estimates manually   [View]

| Exponential | Weibull | Log-Logistic | Lognormal |

Parameters
- shape (α): `0.111`
- scale (β): `8.99`   lwr `6.02`   upr `13.44`
- r = 0.695 for Ir = 7, with 95% CI: r ∈ [0.591, 0.779]

Fatality estimation (M, λ)

Carcass Count (X): `0`   [Estimate M]   ● One-sided CI (M*)   ○ Two-sided CI
Credibility level (1 - α): `0.9`   [Estimate λ]

[Close]

R Estimated detection probability (g)

```
Summary statistics for estimation of detection probability (g)
================================================================================
Results:

Full site for full year
   Estimated g = 0.138, 95% CI = [0.119, 0.159]
   Fitted beta distribution parameters for estimated g: Ba = 155.6265, Bb = 969.6833


Full site for monitored period, 01-Aug-2022 through 10-Oct-2022
   Estimated g = 0.138, 95% CI = [0.119, 0.159]
   Fitted beta distribution parameters for estimated g: Ba = 155.6265, Bb = 969.6833
   Temporal coverage (within year) = 1


Searched area for monitored period, 01-Aug-2022 through 10-Oct-2022
   Estimated g = 0.678, 95% CI = [0.576, 0.772]
   Fitted beta distribution parameters for estimated g: Ba = 58.387, Bb = 27.7392


================================================================================
Input:
Search parameters
   trial carcasses placed = 42, carcasses found = 41
   estimated searcher efficiency: p = 0.976, 95% CI = [0.894, 0.997]
   k = 0.67
   Search schedule: Search interval (I) = 7, number of searches = 10, span = 70
     spatial coverage: 0.204     temporal coverage: 1
   _____
Carcass persistence:
   Exponential persistence distribution
     scale (β) = 8.99
     95% CI β = [6.02, 13.44] and r = 0.695 for Ir = 7 with 95% CI = [0.591, 0.779]
     Parameters entered manually
   Uniform arrivals
   _____
```
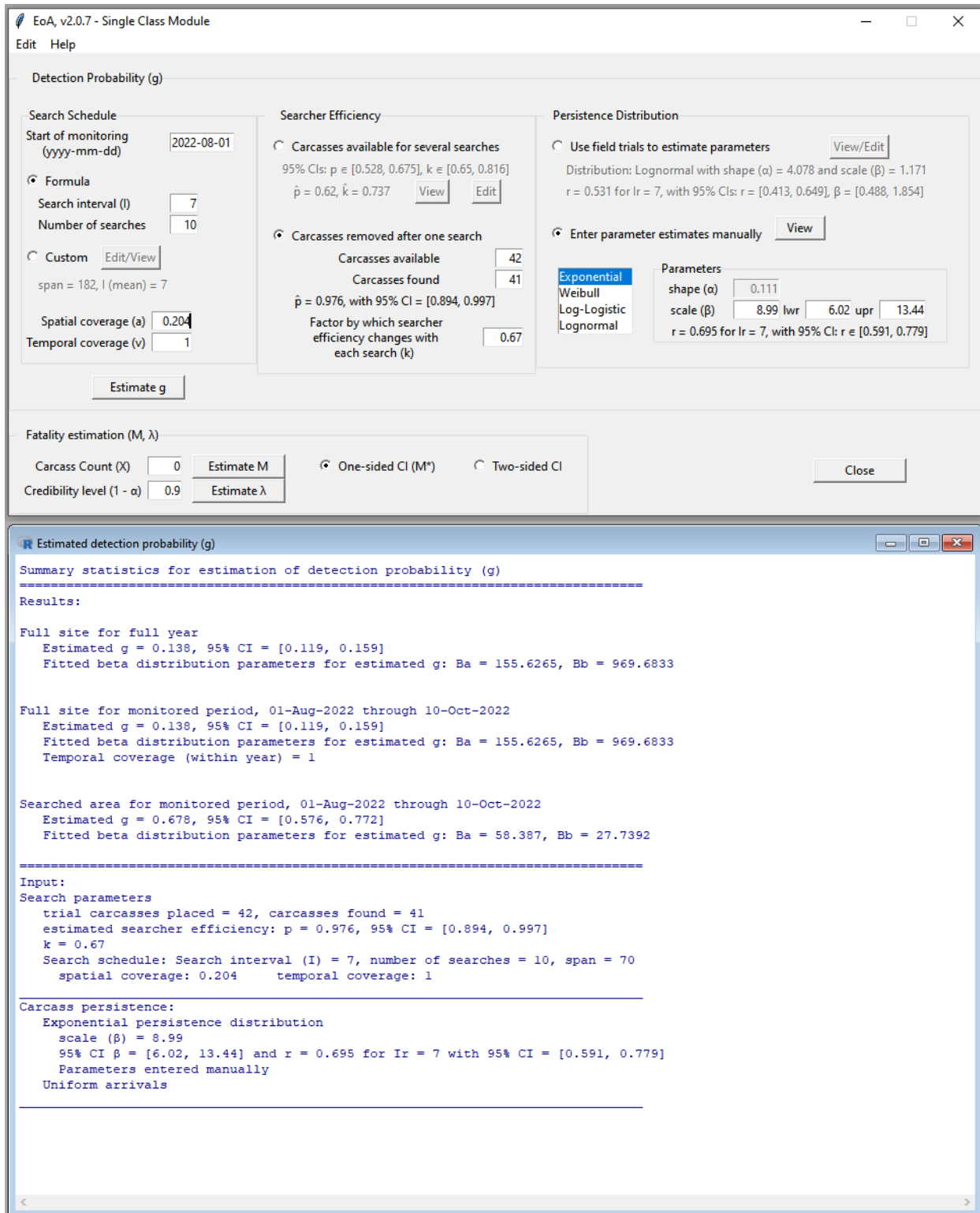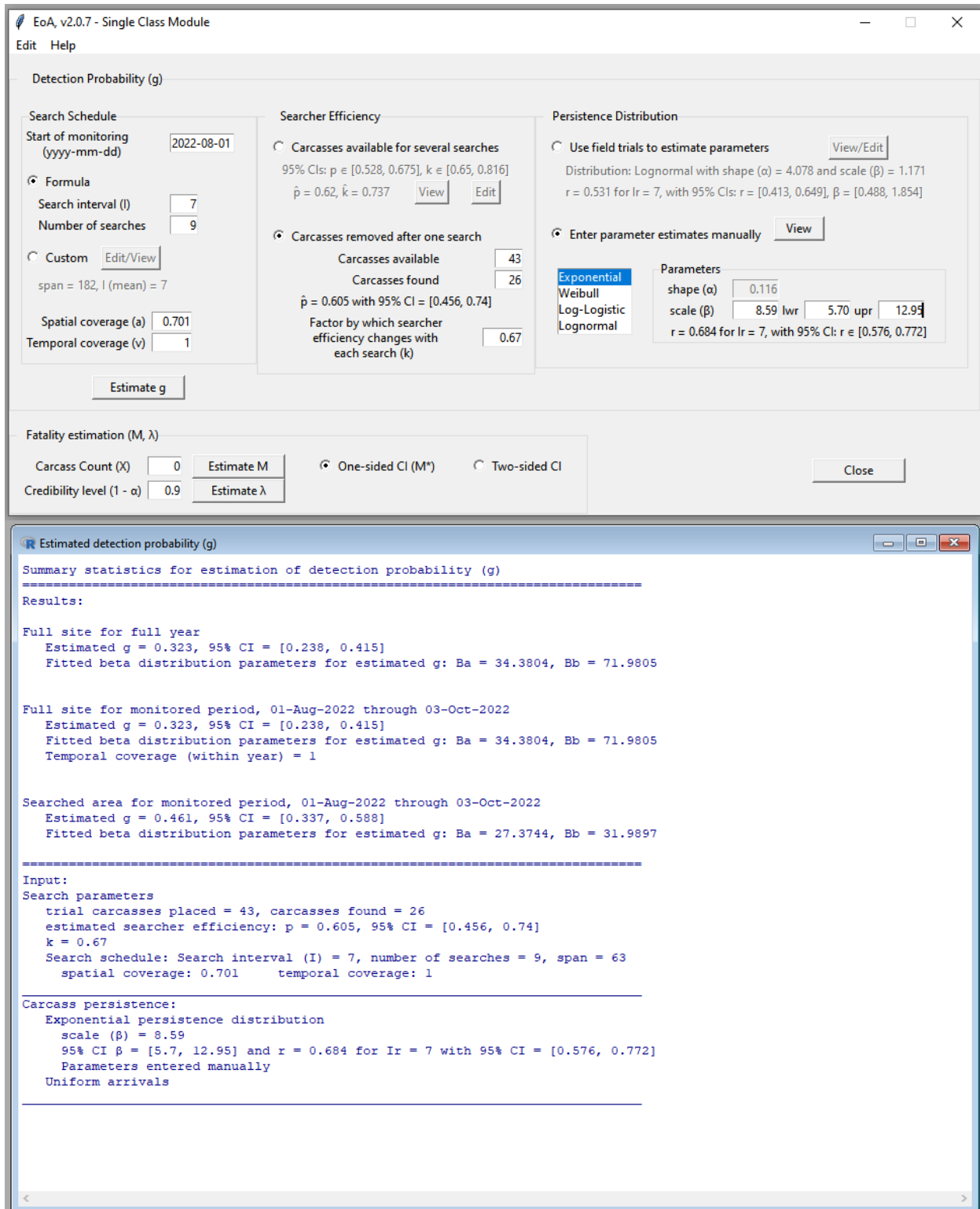
Appendix D6. Screen shot of Evidence of Absence (v2.0.7) graphical user interface, Single Class Module inputs for Fall 2022, 100-meter road and pad searches at 44 turbines searched at a 7-day interval.

EoA, v2.0.7 - Single Class Module

Edit   Help

Detection Probability (g)

Search Schedule

Start of monitoring (yyyy-mm-dd): 2022-08-01

○ Formula
  Search interval (I): 7
  Number of searches: 9

○ Custom   Edit/View
  span = 182, I (mean) = 7

Spatial coverage (a): 0.701
Temporal coverage (v): 1

Estimate g

Searcher Efficiency

○ Carcasses available for several searches
  95% CIs: p ∈ [0.528, 0.675], k ∈ [0.65, 0.816]
  p̂ = 0.62, k̂ = 0.737   View   Edit

● Carcasses removed after one search
  Carcasses available: 43
  Carcasses found: 26
  p̂ = 0.605 with 95% CI = [0.456, 0.74]
  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 (α) = 4.078 and scale (β) = 1.171
  r = 0.531 for lr = 7, with 95% CIs: r = [0.413, 0.649], β = [0.488, 1.854]

● Enter parameter estimates manually   View

| Exponential |
| Weibull |
| Log-Logistic |
| Lognormal |

Parameters
  shape (α): 0.116
  scale (β): 8.59   lwr 5.70   upr 12.95
  r = 0.684 for lr = 7, with 95% CI: r ∈ [0.576, 0.772]

Fatality estimation (M, λ)

Carcass Count (X): 0   Estimate M
Credibility level (1 - α): 0.9   Estimate λ

● One-sided CI (M*)   ○ Two-sided CI

Close

R Estimated detection probability (g)

```
Summary statistics for estimation of detection probability (g)
==============================================================
Results:

Full site for full year
   Estimated g = 0.323, 95% CI = [0.238, 0.415]
   Fitted beta distribution parameters for estimated g: Ba = 34.3804, Bb = 71.9805


Full site for monitored period, 01-Aug-2022 through 03-Oct-2022
   Estimated g = 0.323, 95% CI = [0.238, 0.415]
   Fitted beta distribution parameters for estimated g: Ba = 34.3804, Bb = 71.9805
   Temporal coverage (within year) = 1


Searched area for monitored period, 01-Aug-2022 through 03-Oct-2022
   Estimated g = 0.461, 95% CI = [0.337, 0.588]
   Fitted beta distribution parameters for estimated g: Ba = 27.3744, Bb = 31.9897


==============================================================
Input:
Search parameters
   trial carcasses placed = 43, carcasses found = 26
   estimated searcher efficiency: p = 0.605, 95% CI = [0.456, 0.74]
   k = 0.67
   Search schedule: Search interval (I) = 7, number of searches = 9, span = 63
     spatial coverage: 0.701    temporal coverage: 1
   _____
Carcass persistence:
   Exponential persistence distribution
     scale (β) = 8.59
     95% CI β = [5.7, 12.95] and r = 0.684 for Ir = 7 with 95% CI = [0.576, 0.772]
     Parameters entered manually
   Uniform arrivals
   _____
```

Appendix D7. Screen shot of Evidence of Absence (v2.0.7) graphical user interface, Single Class Module inputs for Fall 2022, 70-meter plot searches at 28 turbines searched at a 7-day interval.

EoA, v2.0.7 - Multiple Class Module

Edit   Help

Options

Overall

○ Estimate total mortality (M)

Credibility level (1 - α) | 0.8 |

● 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

Add class	Calculate	Clear	Close

Class	dwp	X	Ba	Bb	ĝ	95% CI
unsearched	0	0	---	---	0	[0, 0]
Full Plot	0.389	0	34.7	72.2	0.3246	[0.24, 0.416]
Road and Pad	0.611	0	153.1	957.3	0.1379	[0.118, 0.159]

R Estimated 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]
  Full Plot     0.389     0   34.7    72.2  0.325  [0.240, 0.416]
  Road and Pad  0.611     0  153.1   957.3  0.138  [0.118, 0.159]
================================================================================
Results for full site

_____

Detection probability
  Estimated g = 0.211, 95% CI = [0.175, 0.248]
  Fitted beta distribution parameters for estimated g: Ba = 100.5038, Bb = 376.9173

Mortality

Test of assumed relative weights (rho)
  Class           Assumed    Fitted (95% CI)
  unsearched        0.000      NA
  Full Plot         0.389     [0.003, 0.990]
  Road and Pad      0.611     [0.009, 0.997]
  p = 1 for likelihood ratio test of H0: assumed rho = true rho
```

Appendix D8. Screen shot of Evidence of Absence (v2.0.7) graphical user interface, Multiple Class Module inputs for fall plot types 2022, (n= 25), searched at a 7-day interval for 100-meter roads and pads, and a 3.5 day interval for 70-meter plots.

EoA, v2.0.7 - Multiple Class Module

Edit   Help

Options

Overall

○ Estimate total mortality (M)

      ◉ One-sided CI (M*)

Credibility level (1 - α)   0.8

      ○ Two-sided CI

◉ Estimate overall detection probability (g)

Individual classes

○ Calculate g parameters from monitoring data

◉ Enter g parameters manually

Actions

| Add class | Calculate | Clear | Close |

Class	dwp	X	Ba	Bb	ĝ	95% CI
unsearched	0	0	---	---	0	[0, 0]
Spring	0.131	0	147.896	923.896	0.138	[0.118, 0.159]
Fall	0.869	0	100.554	377.179	0.2105	[0.175, 0.248]

R Estimated 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     0.131    0  147.9  923.9 0.138 [0.118, 0.159]
  Fall       0.869    0  100.6  377.2 0.210 [0.175, 0.248]
===============================================================================
Results for full site
_____

Detection probability
  Estimated g = 0.201, 95% CI = [0.17, 0.234]
  Fitted beta distribution parameters for estimated g: Ba = 122.0377, Bb = 485.1686

Mortality

Test of assumed relative weights (rho)
  Class         Assumed    Fitted (95% CI)
  unsearched      0.000      NA
  Spring          0.131      [0.008, 0.996]
  Fall            0.869      [0.003, 0.991]
  p = 1 for likelihood ratio test of H0: assumed rho = true rho
```

Appendix D9. Screen shot of Evidence of Absence (v2.0.7) graphical user interface, Multiple Class Module inputs for seasonal detection probabilities 2022, (n = 25 in spring, 25 in fall), searched at a 14-day interval in the spring, a 7-day interval in the fall for 100-meter roads and pads, and a 3.5 day interval in the fall for 70-meter plots.

Appendix D10. Screen shot of Evidence of Absence (v2.0.7) graphical user interface (EoA GUI), Multiple Years Module inputs for estimation of annual fatality rate (λ) for 2022.

Note that although the weight (ρ) column of the Multiple Years Module is equal to 0.838, the EoA GUI produces a "year-adjusted λ", by calculating the average λ over the number of input rows (years) in the multi-year module of the GUI. Because the ρ values associated with each year in the GUI are scaled so that a rho of 1.0 is equivalent to a typical operations year for the wind farm (although 2022 was not under typical operations in 2022), we would like to calculate the "ρ-adjusted λ", but the GUI does not accommodate that calculation. The "ρ-adjusted λ",, 2.99, is equivalent to the "year-adjusted λ" (2.51 as seen in the output above) divided by ρ (0.838).