Bat Post-construction Monitoring Study
Sugar Creek Wind Project
Logan County, Illinois

Final Report
August 1 – October 15, 2024

Prepared for:

Sugar Creek Wind One LLC

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INTRODUCTION AND BACKGROUND

The Sugar Creek Wind Project (Project), located in Logan County, Illinois (Figure 1), is owned by Sugar Creek Wind One LLC (Sugar Creek), a subsidiary of Clearlight Energy. Sugar Creek obtained a US Fish and Wildlife Service (USFWS) Incidental Take Permit (ITP; ESPER0047644) for the federally listed as endangered Indiana bat (*Myotis sodalis*) and northern long-eared bat (*M. septentrionalis*; hereafter, Covered Species) dated July 15, 2022. Sugar Creek also obtained Incidental Take Authorization (ITA) from the Illinois Department of Natural Resources (IDNR) for the Covered Species on December 22, 2022. Both the USFWS ITP and IDNR ITA require the Project to minimize impacts to the Covered Species and conduct post-construction monitoring (PCM).

Western EcoSystems Technology, Inc. (WEST), completed the first year of the Annual Monitoring Phase of PCM from August 1 – October 15, 2024, per the commitments in Section 6.3 of the Project's Habitat Conservation Plan (HCP; Liberty Power 2022). The 2024 monitoring was the fourth year of PCM conducted at the Project, and the third year of monitoring conducted under the ITP. The objectives of this study were to: estimate take of Covered Species using the Evidence of Absence (EoA) framework as outlined in the HCP and provide the necessary data to determine if adaptive management is triggered.

PROJECT LOCATION

The Project is located approximately 13 kilometers (eight miles) west of the city of Lincoln, Illinois. Topography is categorized by gentle, rolling hills largely composed of cultivated croplands and developed areas (Liberty Power 2022). Land cover in the Project is dominated by agriculture (i.e., row crop and pasture) with small creeks and drainages interspersed throughout. Small areas of hay/pasture, woody wetlands, deciduous forest, and open water are also present within the Project (National Land Cover Database 2021; Figure 2).

The Project is a 202-megawatt (MW) wind energy facility that became operational in 2020 and consists of 57 wind turbines: 17 Vestas V110s 2.0-MW turbines that have a 95-meter (m; 312-foot [ft]) hub height and 54-m (177-ft) blade length, and 40 Vestas V150s 4.2-MW turbines that have a 110-m (361-ft) hub height and 75-m (246-ft) blade length. All turbines were within the migratory range of the Covered Species, therefore, to minimize the impacts, all turbines were feathered below wind speeds of 5.0 m/second (m/s; 16.4 ft/s) from sunset to sunrise when temperatures were above 10 degrees Celsius (°C; 50° Fahrenheit [F]) during the fall migration period (August 1 – October 15; Table 1). Additionally, all turbines were feathered below the manufacturers cut-in speed of 3.0 m/s (9.8 ft/s) from sunset to sunrise when temperatures were above 4°C (40 F) during the summer maternity season and spring migration period, and winter (March 15 – July 31 and October 16 – March 14, respectively; Table 1).

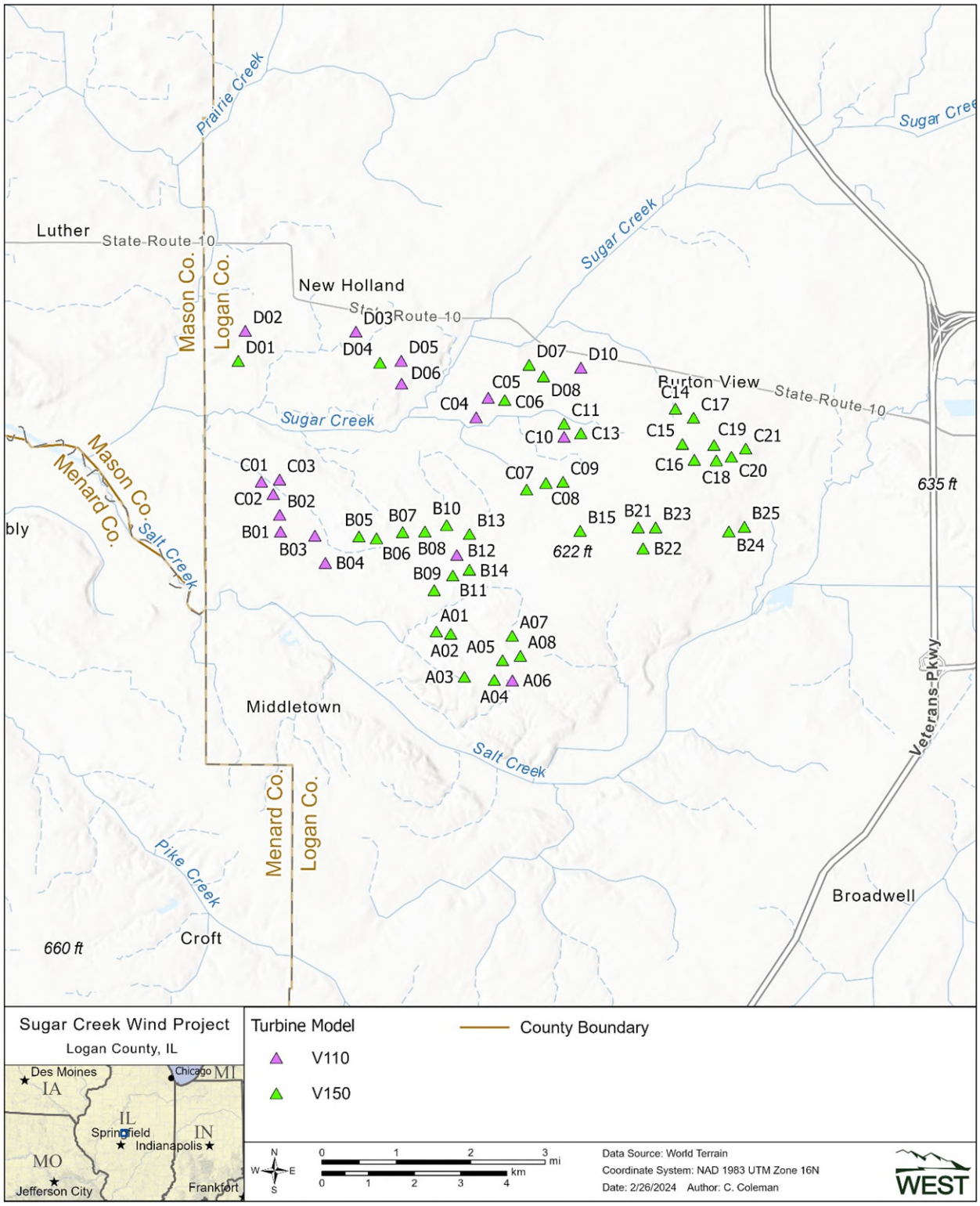

Figure 1. Location of turbines at the Sugar Creek Wind Project, Logan County, Illinois.

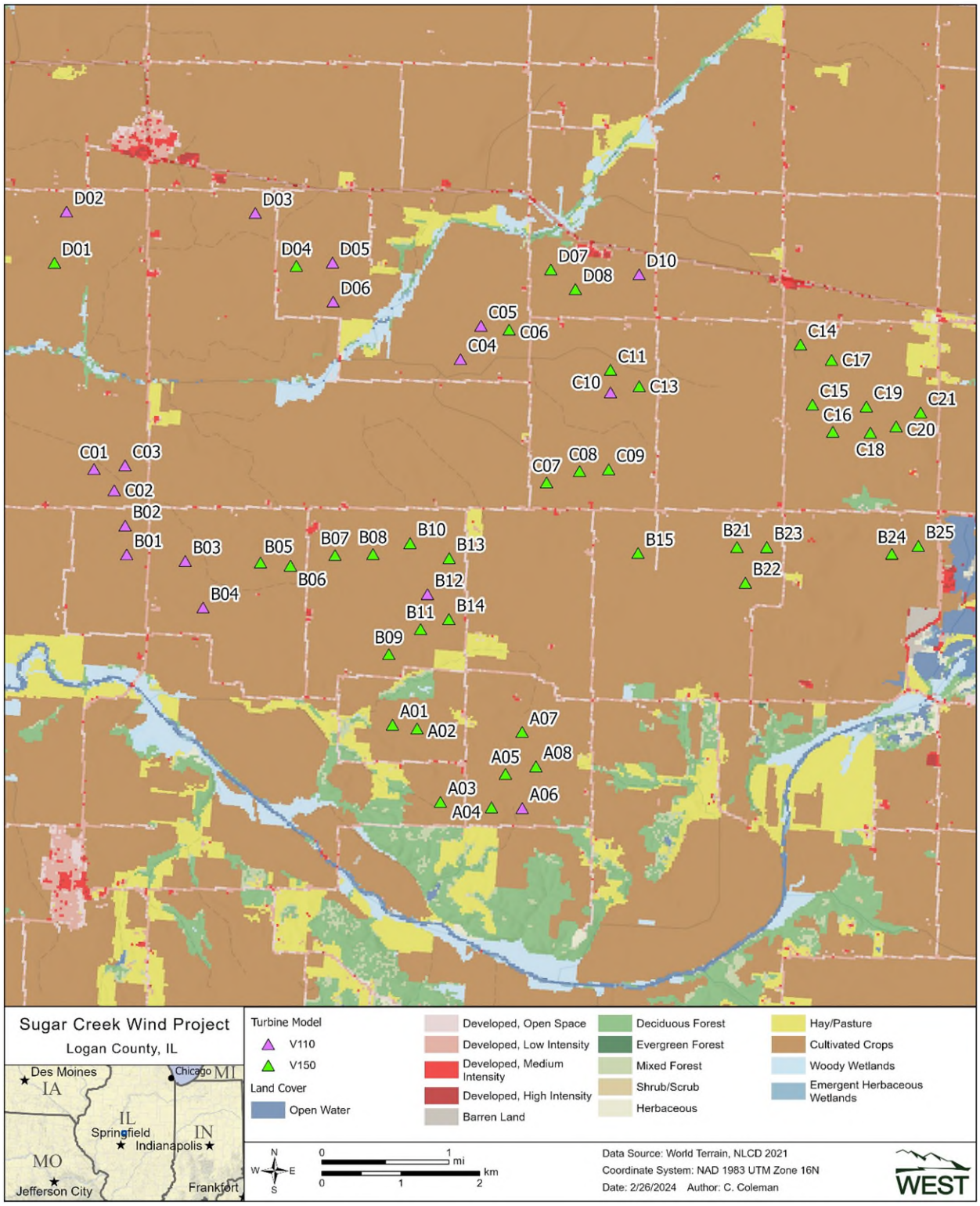

Figure 2. Land cover at the Sugar Creek Wind Project, Logan County, Illinois.

Table 1. Seasonal curtailment[1] regime at the Sugar Creek Wind Project, Logan County, Illinois.

Temperature	Spring and Summer: March 15 – July 31	Fall: August 1 – October 15	Winter: October 16 – March 14
Less than 4°C (40°F)	Uncurtailed	Uncurtailed	Uncurtailed
4–10°C (40–50°F)[2]	3.0 m/s	3.0 m/s	3.0 m/s
Greater than 10°C (50°F)	3.0 m/s	5.0 m/s	3.0 m/s

1. The manufacturer's cut-in wind speed is 3.0 meters per second (m/s; 9.8 feet [ft]/s) across the Project turbines.
2. Turbines will be feathered below cut-in when temperatures are above the threshold. Feathering means that turbine blades will be pitched into the wind such that they spin at less than one rotation per minute.

°C = degrees Celsius; °F = degrees Fahrenheit.

METHODS

WEST followed PCM methods outlined in Section 6.3 of the Project's HCP for the Annual Monitoring Phase, which targeted a probability of detection (*g*) above 0.08 for the Covered Species to meet the monitoring commitments.

Standardized Carcass Searches

Turbine Selection, Search Interval, and Search Plots

Technicians conducted standardized carcass searches at all 57 turbines from August 1 – October 15, 2024. Searches were conducted weekly on the gravel turbine access roads and pads within 100 m (328 ft) of the turbine bases.

Figure 3. Representative photograph of 100-meter road and pad plot at the Sugar Creek Wind Farm in Logan County, Illinois.

Search Methods

All technicians were trained to follow WEST casualty search protocols, including proper handling and reporting of carcasses. Standardized carcass searches were conducted during the day, beginning as early as first light. During searches, the technician started at 100 m from the turbine base and walked the access road at a rate of approximately 45–60 m per minute (m/min) toward the turbine, around the turbine along the gravel pad, and back towards their vehicle. The technician searched out to 2.5 m on each side as they walked, until the entire road/access pad was searched to ensure full visual coverage of each road and pad (Figure 3).

Data Collection

Technicians recorded the date, search start and end times, technician name, turbine number, type of search, and if any carcasses were found during each scheduled search. Although the Covered Species were the focal species of the study, all bird and bat carcasses were recorded and collected. When a carcass was found, technicians placed a flag near it and continued the search. After searching the entire road and pad, the technician returned to each carcass and recorded the date and time found, technician name, species, sex, and age of the carcass (when possible), turbine number, distance and azimuth from turbine, location of carcass using geographic coordinate system (latitude and longitude), habitat surrounding carcass, estimated time since death (i.e., zero to one day, two to three days, four to seven days, eight to 14 days, 15–30 days, or more than 30 days), and condition of carcass (e.g., intact, scavenged, dismembered).

Carcasses found outside of the scheduled search time, were coded as incidental discoveries and were documented following the same protocol for those found during standard searches.

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

- Intact—a carcass that was entirely in one piece, not badly decomposed, and showed no sign of being fed upon by a predator or scavenger
- Scavenged—a carcass that showed signs of being fed upon by a predator or scavenger but was otherwise complete; or a portion(s) of a carcass in one location (e.g., wings, skeletal remains, part of a carcass), or a carcass that has been heavily infested by insects
- Dismembered—all portions of a single carcass found in multiple pieces that are 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 but impaired in some way

For bird carcasses, the following category was also used if needed:

- 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 carcass, including any visible injuries, and surrounding habitat. Bat carcasses were collected under the Project's USFWS ITP ESPER0047644, WEST's Federal Native Endangered and Threatened Species Recovery Permit TE234121-10, WEST's

State Endangered and Threatened Species Scientific Permit 1531, and WEST's state specific salvage permits: NH24.5223. Bird carcasses were collected under the Project's Federal Migratory Bird Special Purpose – Utility Permit (MBPER1772639). Technicians placed all collected 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 carcasses to eliminate possible transmission of rabies or other diseases. Live, injured bats and birds were recorded and considered fatalities for analysis purposes when observed in search areas and were handled in accordance with permit conditions (left in place).

Carcass Identification and Agency Notification

A federally permitted bat biologist (Meredith Hoggatt ESPER0039249) identified all bat carcasses via photos and/or in hand at the end of the surveys. Identification of bird carcasses were verified by biologists experienced in identifying Midwestern bird species and their feathers. No federally or state-listed carcasses were discovered during the study period. In the event a federally or state-listed carcass was discovered, the USFWS and IDNR would have been informed within 24 hours of preliminary identification via phone and/or email.

Bias Trials

Searcher Efficiency Trials

The objective of searcher efficiency trials was to estimate the probability that a carcass was found by a technician. Searcher efficiency trials were conducted in the same areas where standardized carcass searches occurred. Technicians conducting standardized 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*), hoary bats (*L. cinereus*), and silver-haired bats (*Lasionycteris noctivagans*) that had previously been found at the Project. Forty-seven carcasses were placed across the season to account for differences in search conditions by season.

Multiple trials were conducted to measure potential changes in plot conditions on searcher efficiency over time. Each trial carcass was discreetly marked with a black zip-tie and/or a piece of electrical tape 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.

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 during each search was determined immediately after each trial.

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. Trial carcasses were placed throughout the study period 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. Forty searcher efficiency trial carcasses were left in place and used for carcass persistence trials.

Technicians monitored the trial carcasses over a 30-day period according to the following schedule, as closely as possible: every day for the first seven days, then on days 10, 14, 21, and 30. The condition of carcasses was recorded each time carcasses were checked. The schedule varied slightly depending on weather, turbine maintenance, and coordination with other survey work. Following the 30-day period, any remaining evidence of carcasses was removed.

Search Area Mapping

The boundaries of the roads and pads were recorded using a hand-held sub-meter Global Positioning System unit during surveys in 2023 (Ritzert et al. 2024) and boundaries were verified to be the same during the 2024 PCM. The boundaries were used to quantify the amount of area searched relative to distance to turbine and to inform the distribution of carcasses around turbines to estimate the number of carcasses that fell outside search plot boundaries (unsearched area correction) or within unsearchable areas (see *Search Area Adjustment*, below).

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 surveys, technicians were responsible for inspecting data forms for completeness, accuracy, and legibility. Potentially erroneous data were identified using a series of database queries. Irregular codes or data suspected as questionable were discussed with the technician and/or Project Manager. Errors, omissions, or problems identified in later stages of analysis were traced back to the raw data forms, and appropriate changes and measures were implemented. A Microsoft® SQL database was developed to store, organize, and retrieve survey data. All data forms and electronic data files were retained for reference.

Statistical Analysis

The EoA modeling framework (Huso et al. 2015, Dalthorp et al. 2017) was used with data collected in the field to estimate *g*, the take rate of Covered Species, the number of Covered Species fatalities that occurred, and to determine if take thresholds were exceeded. Data used in the EoA model included number of carcasses, the search area adjustment, the results of SEEF and CPTs, the seasonal arrival distribution, and the detection reduction factor (*k*), all described below.

Carcasses Included in the Evidence of Absence Analysis

For the annual take rate (λ) and for the estimate of total take to date (M*), Covered Species carcasses were included in the EoA analysis if the carcass was in the search area and estimated to occur within the study period, based on the estimated time of death. Note that Covered Species carcasses found in a search area incidentally (i.e., at a time other than a carcass search) would be included in the analysis if that search area had a scheduled search in the future.

Searcher Efficiency Estimation

EoA analysis uses raw SEEF data (i.e., number of found and available trial carcasses) to inform overall *g*. No covariates were considered for analysis as there was only one plot type and one season in this study. SEEF data were input directly into the EoA software.

Detection Reduction Factor (k)

The change in SEEF 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 SEEF remained constant no matter how many times a carcass was missed. A value for *k* of 0.65 was assumed in this study per the HCP.

Carcass Persistence Rate Estimation

Data collected during CPT were used to estimate the probability carcasses remained available to be detected by the technician, given the search interval (i.e., the time between carcass searches). The average probability a bat carcass persisted was estimated using an interval-censored survival regression with four potential distributions: exponential, loglogistic, lognormal, and Weibull distributions (Kalbfleisch and Prentice 2002, Dalthorp et al. 2018. 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 (α) and scale (β), including the 95% Confidence Interval [CI] of β) were used as inputs in the EoA Single Class module.

Search Area Adjustment

The search area adjustment accounted for carcasses that occurred in 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 proportion of searched area around each turbine and a carcass-density distribution; the proportion of area searched was calculated in a geographic information system as the amount of area searched divided by the total area searched in each 1.0-m annulus around the turbine.

A truncated weighted maximum likelihood (TWL) modeling approach (Khokan et al. 2013) was used to estimate the carcass-density distribution using site-specific bat carcass locations. Bat carcasses were included in the area adjustment analysis if the carcass was in the search area and estimated to occur within the study period, based on the estimated time of death. A bat carcass was excluded from the search area adjustment analysis when the carcass was discovered outside of the spatial or temporal scope of the monitoring design. The TWL approach assigns a weight to each bat carcass. Weights are the inverse of the product of the probability of detection and the proportion of area searched within the 1.0-m annulus (around the turbine) within which a carcass occurred. The distributions considered were normal, gamma, Gompertz, and Weibull parameterized according to the R Development Core Team (2016) and Yee and Moler (2023). The best-supported model was selected as the most parsimonious model within two AICc units of the model with the lowest AICc value.

Detection Probability, DWP, and Weights

The monitoring and bias trial data were separated into search strata, where each search stratum was defined by a number of turbines, a plot type, search method, a search frequency, and a weight that represented the relative risk within the stratum to estimate the detection probability denoted as $g_{stratum}$. Strata were defined to ensure that all the factors that defined them were identical within strata. The EoA Single Class module was used to estimate $g_{stratum}$, in each search stratum. This resulted in Ba and Bb parameters that defined the beta distribution of $g_{stratum}$ in each stratum. Unsearched time periods were treated as distinct stratum and assigned a detection probability of 10^{-5} by setting the beta distribution parameters to Ba = 0.01 and Bb = 1,000. For this analysis, there was only one stratum in each season, so $g_{stratum}$ is equal to g_{season}, which is the probability of detection within a season.

The Multiple Class module of the EoA Graphical User Interface (GUI) was then used to develop the distribution of *g* for the study period by combining g_{season}, using the appropriate weights. Weights ("DWP" in the software) represent the relative fatality risk within each search stratum or season and are used for combining detection probabilities. DWP for combining across seasons were the seasonal arrival proportions.

Arrival Proportions

The proportion of annual fatalities expected within a season is called the arrival proportion and was used to weight g_{season} in the overall *g* estimate. Per the HCP, The Midwest Multiple Species HCP arrival proportions for bats were used: 11% in spring and 89% in fall, assuming there was no summer risk (USFWS 2016).

Take Estimates

The Multiple Years module of EoA was used to estimate the median cumulative take to-date (*M**), mean annual take rate (λ), evaluate the probability that the estimated take rate (λ) exceeded the expected take rate, and evaluate the probability that the total permitted take has been exceeded for the Covered Species. In order to evaluate whether the estimated annual average take rate (λ) was larger than expected, two different take rates were considered following Section 6.4.1 of the HCP: The expected take rate based on the predicted take for the project ($\tau_{predicted}$) and the expected take rate based on the permitted take for the project ($\tau_{permitted}$). Projections of take for each species for the full permit term were also calculated for the short-term trigger evaluation, as described further below in the adaptive management triggers section.

The EoA Multiple Years Module requires the input ρ, which weights the years appropriately for combining beta distribution parameters and scaling the resulting lambda estimate to represent a single year. The results from the Multiple Years module (Ba and Bb parameters for the detection probability for the permit term to date) and the total carcass count were used to estimate *M* and* λ and evaluate the adaptive management triggers as described below.

Adaptive Management Triggers

The estimates from the EoA analysis were used to test multiple adaptive management triggers per Section 6.4.1 of the HCP. The first level of the short-term test was used to evaluate whether the estimated take rate exceeded the predicted take rate (1.3 Indiana bats per year and 0.9 northern long-eared bats per year) and whether the projected take for the full permit term exceeds the total predicted take (39 Indiana bats and 27 northern long-eared bats). The second level of the short-term test was used to evaluate whether the estimated take rate exceeded the permitted take rate (3.0 Indiana bats per year and 2.0 northern long-eared bats per year) and whether the projected take for the full permit term exceeds the total permitted take (90 Indiana bats and 60 northern long-eared bats. A long-term test was used to evaluate whether permitted take had been met (Dalthorp and Huso 2015). Both the short and long-term triggers were tested individually for each of the Covered Species.

Evidence of Absence Short-term Trigger

The EoA short-term trigger is designed as an early warning signal that the Project may be on a trajectory to exceed the total permitted take by the end of the permit term. The short-term trigger assessment in this HCP is designed to determine if an adaptive management response is needed to prevent the cumulative take estimate from exceeding the permitted take, and to confirm that mitigation stays ahead of the projected take. The short-term trigger tests if the estimated annual take rate (λ) exceeded the expected take rates based on total predicted and permitted take at a credible level of $\alpha = 0.1$. The Project's short-term trigger is designed to evaluate estimated take rates over all years of PCM (including monitoring that occurred pre-permit in 2021) and projected take using a combination of estimated take to date under the permit and a 3-year rolling window of PCM data collected during the permit term. If the estimated take rate exceeds the predicted take rate with 90% probability and the total projected take exceeds the predicted take at a credible level of $\alpha = 0.5$, the first level of short-term trigger would be met, indicating that an evaluation should occur to determine whether increased mitigation is necessary if take is projected to exceed already mitigated levels. If the estimated take rate exceeds the total permitted take rate with 90% probability and the total projected take exceeds the total permitted take at a credible level of $\alpha = 0.5$, the second level of short-term trigger would be met, indicating the minimization plan in the HCP may need to be adjusted to ensure the median cumulative take estimate (M^*) remains within the permitted limit over the ITP term.

Evidence of Absence Long-term Trigger

The EoA long-term trigger was designed to test if the cumulative take to date was greater than the permitted take ($T_{permitted}$). Per the HCP, cumulative take to date (M^*) was estimated at a credible level of $\alpha = 0.5$ (using the median, or 50^{th} credible bound, of the posterior distribution of estimated fatality). If the cumulative take to date at $\alpha = 0.5$ was less than or equal to the total permitted take ($M^* \leq T_{permitted}$), then the Project was in compliance with the ITP. If the cumulative take to date at $\alpha = 0.5$ was greater than the total permitted take ($M^* > T_{permitted}$), then the take limit has been exceeded and the Project must enact operational responses or amend their ITP.

RESULTS

Standardized Carcass Searches

There were 609 searches completed during the study. Sixteen searches were missed due to turbine and access road maintenance, vegetation height, or unsafe weather conditions.

Overall Carcasses Found

Eighty-five bat carcasses were found during the PCM (Table 2; Appendix A). Twenty bat carcasses were found outside the search areas, outside the study period (died prior to the study period), or found during plot setup, prior to the study starting; therefore, these carcasses were not included in analysis. Eleven bird carcasses were found during the monitoring period (Appendix A); however, no birds were included in the analysis.

Table 2. Number and percent (%) of bat carcasses by species included and excluded from analysis at the Sugar Creek Wind Project, Logan County, Illinois, from August 1 – October 15, 2024.

	Included in Fatality Estimate		Outside Search Area*		Outside Study Period*		Other*		Total	
Species	**Total**	**%**	**Total**	**%**	**Total**	**%**	**Total**	**%**	**Total**	**%**
Bat										
eastern red bat	36	55.4	2	66.7	8	57.1	1	33.3	47	55.3
silver-haired bat	15	23.1	0	0	1	7.1	1	33.3	17	20.0
big brown bat	6	9.2	0	0	4	28.6	1	33.3	11	12.9
hoary bat	7	10.8	0	0	1	7.1	0	0	8	9.4
unidentified *Lasiurus* bat	1	1.5	0	0	0	0	0	0	1	1.2
evening bat	0	0	1	33.3	0	0	0	0	1	1.2
Overall Bats	**65**	**100**	**3**	**100**	**14**	**100**	**3**	**100**	**85**	**100**

*Carcasses not included in analysis.

Sums may not equal total values shown due to rounding.

Species Composition

No federally or state-listed species were found during the study period. Eastern red bat (47 carcasses; 55.3%) was the most commonly found bat species during surveys and incidentally, followed by silver-haired bat (17; 20.0%), big brown bat (*Eptesicus fuscus*; 11; 12.9%), and hoary bat (eight; 9.4%). One evening bat (*Nycticeius humeralis*; 1.2%), and one unidentified *Lasiurus* bat (1.2%). were also found during surveys (Table 2; Appendix A).

Bias Trials

Searcher Efficiency Trials

Forty-seven bats were placed for searcher efficiency trials on four separate dates and 42 were available for searchers to find (Table 3). No covariates were included in the searcher efficiency model due to only having one search type and season of searches (Table 4). Technicians found 88.1% of bats available to be found (Table 3).

Table 3. Searcher efficiency results at the Sugar Creek Wind Project, Logan County, Illinois, from August 1 – October 15, 2024.

Search Area Type	# Placed	# Available	# Found	% Found
Road and Pad	47	42	37	88.1

Table 4. Searcher efficiency model for bats from the Sugar Creek Wind Project, Logan County, Illinois, from August 1 – October 15, 2024 (n = 42).

k Value	AICc	Delta AICc
k fixed at 0.65	32.76	0*

* Selected model.

k = detection reduction factor; AICc = corrected Akaike Information Criterion; Delta AICc = change in AICc.

Carcass Persistence Trials

Forty carcasses were placed to estimate carcass persistence in search areas throughout the duration of the study (Appendix B). The best-fit model for carcass persistence rates had a loglogistic distribution (Table 5; Appendix B). The median carcass persistence time was 3.18 days (Table 5). The average probability a carcass persisted through the weekly search interval was 0.52 (90% CI: 0.43–0.60; Figure 4).

Table 5. Carcass persistence top models with covariates, distributions, and model parameters for the Sugar Creek Wind Project, Logan County, Illinois, from August 1 – October 15, 2024.

Search Area Type	Distribution	Predicted Median Removal Time (days)	Parameter 1	Parameter 2
Road and pad	loglogistic*	3.18	shape = 0.631	scale = 1.158

* Parameterization follows the FAdist parameterization for this distribution.

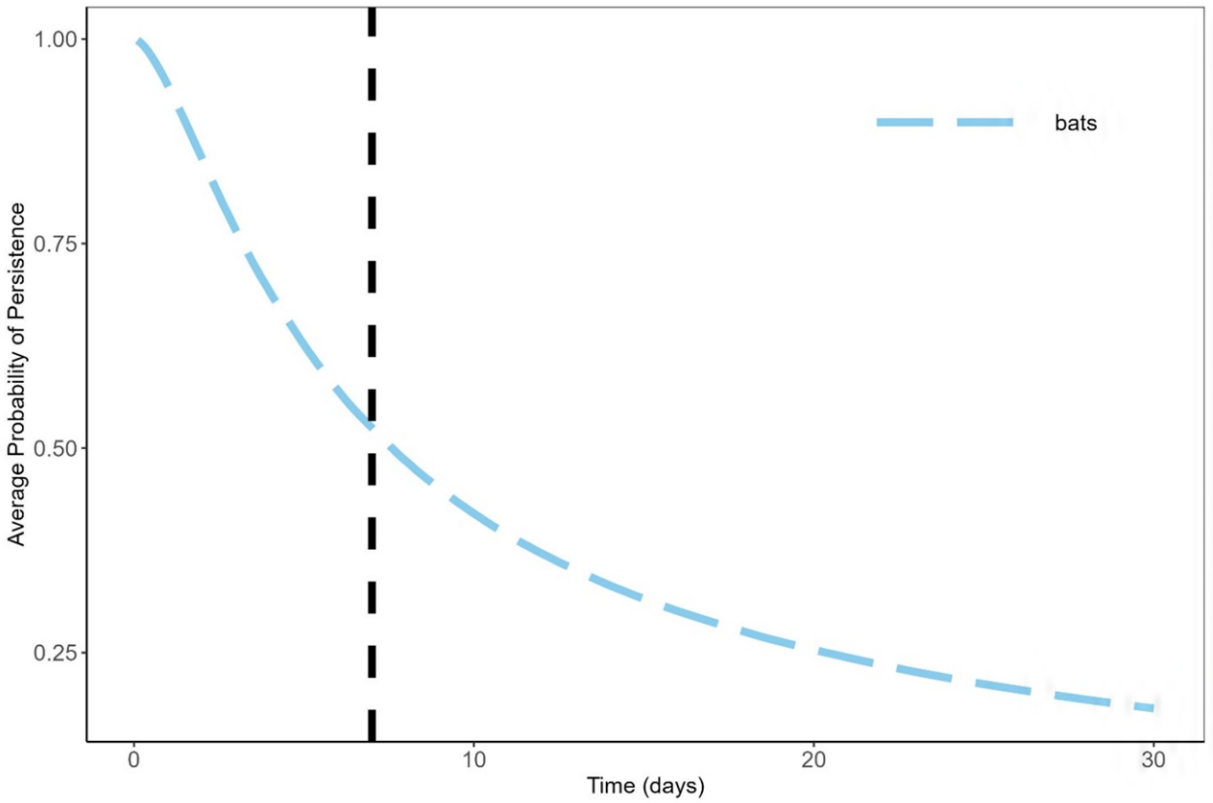

Figure 4. The average probability of carcass persistence as a function of time (days) at the Sugar Creek Wind Project, Logan County, Illinois, from August 1 – October 15, 2024.

Note: The vertical dashed line indicate the weekly search interval.

Search Area Adjustment

The best model selected by AICc for bat carcass-density distribution was a normal model (Appendix C). The average search area adjustment was estimated to be 0.13 (Table6; Appendix C).

Table 6. Truncated weighted maximum likelihood search area adjustment estimates for the Sugar Creek Wind Project, Logan County, Illinois, from August 1 – October 15, 2024, for bats (n = 65).

Search Area Size (m)	Season	Area Adjustment	Search Area Type	Distribution	Parameter 1	Parameter 2
100	fall	0.13	100-m road and pad	normal	39.0358	20.3389

Overall Fatality Estimates

The overall bat fatality estimate was 4.83 bats per MW (90% CI: 3.19–7.36; Table 7). Inputs used to calculate fatality estimates are presented in Appendix D.

Table 7. Overall fatality rate per megawatt (MW) and per turbine studies conducted at the Sugar Creek Wind Project, Logan County, Illinois, from August 1 – October 15, 2024.

Per MW Estimates		Per Turbine Estimates	
Estimate	**90% CI**	**Estimate**	**90% CI**
4.83	3.19–7.36	18.26	41.72–67.30

CI = confidence interval.

Covered Species Take Estimates and Probability of Detection (g)

No Indiana bat or northern long-eared bat carcass were found during the 2024 study. To date, one Indiana bat has been found during monitoring under the ITP and one was found in 2021. No northern long-eared bats have been found during PCM at the Project. The overall g achieved for the 2024 study period was 0.06 (90% CrI: 0.05–0.07; Table 8). 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 E. Appendix F includes representative screenshots of the inputs for the Single Class and Multiple Class Modules.[1]

Table 8. Probability of detection (g), Ba, and Bb, at the Sugar Creek Wind Project, Logan County, Illinois.

Year	Ba[1]	Bb[1]	*g*[1]	90% CrI[2]
2021	11354.71	80708.38	0.12	0.12–0.13
2022	49.13	424.60	0.10	0.08–0.13
2023	426.66	1552.00	0.22	0.20–0.23
2024	72.07	1212.84	0.06	0.05–0.07
Cumulative	571.86	4010.10	0.12	0.12–0.13

[1] Ba and Bb are the parameters for the beta distribution used to characterize the distribution of the probability of detection. The *g*-value is the mean of that distribution.

[2]CrI = credible interval of *g*.

Average annual take rates based on the combined 2021–2024 monitoring years were estimated to be 5.45 (90% CrI: 1.25–12.09) Indiana bats per year and 1.09 (90% CI: 0.01–4.19) northern long-eared bats per year. The expected average annual take rates reported in the HCP ranged between 1.3 Indiana bat fatalities per year at the predicted level and 3.0 Indiana bats per year at the permitted level. For northern long-eared bats, the expected average annual take rates reported in the HCP ranged between 0.9 per year at the predicted level and 2.0 per year at the permitted level.

Cumulative take under the ITP to date (2022–2024 monitoring years), *M*,* at $\alpha = 0.5$ (50^{th} credible bound), is estimated to be nine Indiana bats and one northern long-eared bat. The total take permitted by the ITP is 90 Indiana bats and 60 northern long-eared bats over the 30-year permit term.

[1] There may be very minor differences between screenshots (Appendix F) and the results in the main text because EoA is a stochastic estimator, leading to slightly different estimates each time the modules are run.

Adaptive Management Triggers

Evidence of Absence Short-term Trigger

Under the first level of the short-term trigger, the probability that the estimated annual take rate for Indiana bats, calculated from all monitoring years (2021–2024), exceeded the predicted take rate of 1.3 Indiana bats per year was 0.95 (Table 9). Additionally, the projected take for Indiana bats, calculated from a combination of estimated take to date under the permit and a projection of future take using the average take rate derived from the 3-year rolling window of PCM data (2022–2024), exceeded the total predicted take amount of 39 Indiana bats at a credible level of α = 0.5 (Table 10). Therefore, the first level of the short-term trigger was met for Indiana bats and the second level was evaluated. Under the second level of the short-term trigger, since the probability that the estimated annual take rate exceeded the permitted take rate of 3.0 Indiana bats per year was 0.74 (Table 11), the second level of the short-term trigger was not met despite the projected take of Indiana bats being higher than the total permitted take amount of 90 Indiana bats (Table 12).

For northern long-eared bats, the first level of the short-term trigger was not met: the probability that the estimated annual take rate exceeded the predicted take rate of 0.9 northern long-eared bats per year was 0.36 (Table 9) and the projected take was less than the total predicted take of 27 northern long-eared bats (Table 10). Therefore, the second level of the short-term trigger was not evaluated.

Table 9. First Level Short Term Trigger Assessment Part One: Probability the estimated take rates (λ) for the Covered Species exceeded the predicted take rate based on studies conducted at the Sugar Creek Wind Farm, Logan County, Illinois, from 2021 – 2024.

Species	Mean λ (90% CrI)	Predicted Take Rate	Pr(λ > $_{predicted}$)[1]	Short-Term Trigger First Level Fires at α = 0.1?
Indiana bat	5.45 (1.25 – 12.09)	1.3	0.95	yes
Northern long-eared bat	1.09 (0.01 – 4.19)	0.9	0.36	no

[1] Pr(λ > τpredicted) reads "the probability that λ (the annual take rate) is greater than τpredicted (the expected annual take rate based on the predicted take, used as a threshold for adaptive management)." If this probability is less than 0.9, (i.e., α = 0.1 for a 1-sided test), then the first level of the short-term trigger is not triggered because there is not sufficient evidence that the estimated annual take rate is greater than the expected annual take rate based on the predicted take CrI = Credible Interval; ITP = Incidental Take Permit.

Table 10. First Level Short Term Trigger Assessment Part Two: Probability the projected take over the 30-year permit term exceeded the total predicted take based on data collected[1] at the Sugar Creek Wind Project, Logan County, Illinois, from 2022 – 2024.

Species	Projected Take	Predicted Take ($T_{predicted}$)	Long-Term Trigger First Level Fires at α = 0.5?
Indiana bat (50th credible bound)	94.24	39.00	yes
Northern long-eared bat (50th credible bound)	17.39	27.00	no

[1] Evaluated using Evidence of Absence and studies conducted under the Incidental Take Permit term and a 3-year rolling window

Table 11. Second Level Short Term Trigger Assessment Part One: Probability the estimated take rate (λ) for the Indiana bats exceeded the permitted take rate based on studies conducted at the Sugar Creek Wind Project, Logan County, Illinois, from 2021 – 2024.

Species	Mean λ (90% CrI)[2]	Permitted Take Rate	Pr(λ > $\tau_{permitted}$)[1]	Short-Term Trigger Second Level Fires at α = 0.1?
Indiana bat	5.45 (1.25 – 12.09)	3.00	0.74	no

[1] Pr(λ > τpermitted) reads "the probability that λ (the annual take rate) is greater than τpermitted (the expected annual take rate based on the permitted take, used as a threshold for adaptive management)." If this probability is less than 0.9, (i.e., α = 0.1 for a 1-sided test), then the second level of the short-term trigger is not triggered because there is not sufficient evidence that the estimated annual take rate is greater than the expected annual take rate based on the permitted take

[2] CrI = credible interval

Table 12. Second Level Short Term Trigger Assessment Part Two: Probability the projected take over the 30-year permit term exceeded the total predicted take using data collected[1] at the Sugar Creek Wind Project, Logan County, Illinois, from 2022-2024 .

Species	Projected Take (M)	Permitted Take ($T_{permitted}$)	Long-Term Trigger Second Level Fires at α = 0.5?
Indiana bat (50th credible bound)	94.24	90.00	Yes

[1]Evaluated using Evidence of Absence and studies conducted within the Incidental Take Permit term to date at the Sugar Creek Wind Project, Logan County, Illinois, from 2022-2024

Evidence of Absence Long-term Trigger

The estimated cumulative take to date, *M** at α = 0.5 (50th credible bound), is below the total permitted take for both Covered Species (Table 13). The long-term trigger was not met, and the Project is in compliance for both species. Therefore, an avoidance response is not required.

Table 13. Cumulative take estimate to date using Evidence of Absence for studies conducted within the Incidental Take Permit term to date at the Sugar Creek Wind Project, Logan County, Illinois, from 2022-2024.

Species	Cumulative Take (M*)	Permitted Take (T)	Long-Term Trigger Fires at α = 0.5?
Indiana bat (50th credible bound)	9.00	90.00	No
Northern long-eared bat (50th credible bound)	1.00	60.00	No

CONCLUSION

During the 2024 monitoring period, Annual Monitoring was conducted per commitments in Section 6.3 of the Project's HCP, and no Covered Species carcasses were found. The 2024 PCM was the third year of monitoring under the ITP; therefore, adaptive management triggers were evaluated. The short-term trigger was not met for northern long-eared bats; however, the first level of the short-term trigger was met for Indiana bats, indicating that estimated annual take exceeded the predicted take rate. However, the second level of the short-term trigger was not met for Indiana bats and the long-term trigger was not met for either Covered Species. Due to the first level of the short-term trigger being met for Indiana bats, Sugar Creek will evaluate adaptive management responses per Section 6.4 of the HCP and coordinate with the USFWS.

PCM will continue at the Project in 2025 under the Annual Monitoring Phase, which will include searches on the gravel roads and pads of all 57 turbines from August 1 – October 15, 2025. To increase the detection probability (*g*), road and pad searches will be completed twice weekly in 2025.

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Appendix A. Carcasses Found during the 2024 Post-construction Monitoring Surveys at the Sugar Creek Wind Project, Logan County, Illinois, from August 1 – October 15, 2024

Appendix A1. Species found during carcasses searches and incidentally at Sugar Creek Wind Project, Logan County, Illinois, from August 1 – October 15, 2024.

Species	Scientific Name
Bat	
big brown bat	*Eptesicus fuscus*
eastern red bat	*Lasiurus borealis*
evening bat	*Nycticeius humeralis*
hoary bat	*Lasiurus cinereus*
silver-haired bat	*Lasionycteris noctivagans*
unidentified *Lasiurus* bat	–
Bird	
American redstart	*Setophaga ruticilla*
bay-breasted warbler	*Setophaga castanea*
cliff swallow	*Petrochelidon pyrrhonota*
golden-crowned kinglet	*Regulus satrapa*
mourning dove	*Zenaida macroura*
purple martin	*Progne subis*
unidentified vireo	–

Appendix A2. Complete listing of carcasses found at the Sugar Creek Wind Project, Logan County, Illinois, from August 1 – October 15, 2024.

Found Date	Species	Distance from Turbine (m)	Turbine	Search Type	Search Area Type	Physical Condition
Bats						
07/29/2024	big brown bat	14	C16	Incidental	n/a	intact
07/29/2024	eastern red bat	17	B21	carcass search	n/a	scavenged
08/05/2024	big brown bat	1	A04	carcass search	100-m road and pad	intact
08/05/2024	big brown bat	27	B13	carcass search	100-m road and pad	scavenged
08/05/2024	eastern red bat	31	A03	carcass search	100-m road and pad	scavenged
08/05/2024	eastern red bat	65	B05	carcass search	100-m road and pad	scavenged
08/05/2024	eastern red bat	30	B06	carcass search	100-m road and pad	dismembered
08/05/2024	hoary bat	15	B07	carcass search	100-m road and pad	scavenged
08/06/2024	eastern red bat	15	C06	carcass search	100-m road and pad	intact
08/06/2024	eastern red bat	6	D04	carcass search	100-m road and pad	scavenged
08/07/2024	big brown bat	25	B24	carcass search	100-m road and pad	intact
08/07/2024	big brown bat	9	C18	carcass search	100-m road and pad	scavenged
08/07/2024	big brown bat	21	C19	incidental	100-m road and pad	scavenged
08/07/2024	eastern red bat	1	C19	incidental	100-m road and pad	scavenged
08/07/2024	eastern red bat	49	C20	carcass search	100-m road and pad	scavenged
08/07/2024	eastern red bat	28	C20	carcass search	100-m road and pad	intact
08/07/2024	eastern red bat	33	D07	carcass search	100-m road and pad	intact
08/07/2024	evening bat	43	B24	carcass search**	100-m road and pad	scavenged
08/07/2024	silver-haired bat	7	B25	carcass search	100-m road and pad	intact
08/12/2024	eastern red bat	36	B10	carcass search	100-m road and pad	intact
08/12/2024	eastern red bat	9	B11	carcass search	100-m road and pad	scavenged
08/12/2024	hoary bat	19	A03	carcass search	100-m road and pad	scavenged
08/15/2024	hoary bat	9	C02	carcass search	100-m road and pad	scavenged
08/16/2024	eastern red bat	1	B21	carcass search	100-m road and pad	injured
08/16/2024	eastern red bat	28	B25	carcass search	100-m road and pad	scavenged
08/16/2024	eastern red bat	26	C16	carcass search	100-m road and pad	intact
08/19/2024	big brown bat	8	A03	carcass search	100-m road and pad	intact
08/19/2024	big brown bat	5	B07	carcass search	100-m road and pad	scavenged
08/19/2024	eastern red bat	15	A01	carcass search	100-m road and pad	scavenged
08/19/2024	eastern red bat	15	A01	carcass search	100-m road and pad	scavenged
08/19/2024	eastern red bat	12	A02	carcass search	100-m road and pad	dismembered
08/19/2024	eastern red bat	72	A02	carcass search	100-m road and pad	scavenged
08/19/2024	eastern red bat	7	A03	carcass search	100-m road and pad	scavenged
08/19/2024	eastern red bat	31	A08	carcass search	100-m road and pad	scavenged
08/19/2024	eastern red bat	7	B06	carcass search	100-m road and pad	intact

Appendix A2. Complete listing of carcasses found at the Sugar Creek Wind Project, Logan County, Illinois, from August 1 – October 15, 2024.

Found Date	Species	Distance from Turbine (m)	Turbine	Search Type	Search Area Type	Physical Condition
08/19/2024	eastern red bat	7	B07	carcass search	100-m road and pad	scavenged
08/21/2024	eastern red bat	44	C06	carcass search	100-m road and pad	scavenged
08/21/2024	eastern red bat	22	C07	incidental	100-m road and pad	scavenged
08/22/2024	silver-haired bat	12	B25	carcass search	100-m road and pad	intact
08/26/2024	eastern red bat	45	A02	carcass search	100-m road and pad	intact
08/26/2024	eastern red bat	107	A05	Incidental**	100-m road and pad	intact
08/26/2024	silver-haired bat	36	B09	carcass search	100-m road and pad	intact
08/27/2024	eastern red bat	144	B22	Incidental**	100-m road and pad	intact
08/27/2024	eastern red bat	31	C06	carcass search	100-m road and pad	scavenged
08/28/2024	eastern red bat	22	B21	incidental	100-m road and pad	scavenged
08/28/2024	eastern red bat	34	C13	carcass search	100-m road and pad	scavenged
08/28/2024	eastern red bat	7	C13	carcass search	100-m road and pad	intact
08/28/2024	eastern red bat	39	C18	carcass search	100-m road and pad	scavenged
08/28/2024	eastern red bat	15	D08	carcass search	100-m road and pad	scavenged
08/29/2024	eastern red bat	26	C14	incidental	100-m road and pad	intact
09/02/2024	big brown bat	1	B11	carcass search	100-m road and pad	intact
09/02/2024	eastern red bat	30	B11	carcass search	100-m road and pad	intact
09/02/2024	eastern red bat	6	B13	carcass search	100-m road and pad	scavenged
09/02/2024	hoary bat	9	B09	carcass search	100-m road and pad	intact
09/02/2024	silver-haired bat	37	C15	incidental	100-m road and pad	intact
09/02/2024	unidentified lasiurus bat	28	B08	carcass search	100-m road and pad	dismembered
09/03/2024	eastern red bat	40	C21	carcass search	100-m road and pad	scavenged
09/06/2024	eastern red bat	37	C08	carcass search	100-m road and pad	intact
09/06/2024	eastern red bat	22	C21	incidental	100-m road and pad	intact
09/06/2024	silver-haired bat	24	D07	incidental	100-m road and pad	scavenged
09/09/2024	big brown bat	42	B07	carcass search	100-m road and pad	intact
09/10/2024	hoary bat	50	C03	carcass search	100-m road and pad	scavenged
09/10/2024	hoary bat	30	C03	carcass search	100-m road and pad	intact
09/12/2024	eastern red bat	35	C10	carcass search	100-m road and pad	scavenged
09/12/2024	hoary bat	46	B22	carcass search	100-m road and pad	scavenged
09/12/2024	silver-haired bat	15	B25	carcass search	100-m road and pad	intact
09/19/2024	eastern red bat	6	B25	carcass search	100-m road and pad	scavenged
09/19/2024	hoary bat	4	C18	carcass search	100-m road and pad	scavenged
09/23/2024	eastern red bat	39	B08	carcass search	100-m road and pad	scavenged
09/24/2024	eastern red bat	30	D04	carcass search	100-m road and pad	intact
09/30/2024	silver-haired bat	28	B10	carcass search	100-m road and pad	scavenged

Appendix A2. Complete listing of carcasses found at the Sugar Creek Wind Project, Logan County, Illinois, from August 1 – October 15, 2024.

Found Date	Species	Distance from Turbine (m)	Turbine	Search Type	Search Area Type	Physical Condition
09/30/2024	silver-haired bat	13	B12	carcass search	100-m road and pad	scavenged
10/02/2024	big brown bat	40	C08	carcass search	100-m road and pad	scavenged
10/02/2024	silver-haired bat	30	C03	carcass search	100-m road and pad	intact
10/02/2024	silver-haired bat	40	D04	carcass search	100-m road and pad	intact
10/02/2024	silver-haired bat	6	D04	carcass search	100-m road and pad	scavenged
10/03/2024	silver-haired bat	56	C14	carcass search	100-m road and pad	intact
10/03/2024	silver-haired bat	53	C14	carcass search	100-m road and pad	intact
10/03/2024	silver-haired bat	15	D07	carcass search	100-m road and pad	scavenged
10/08/2024	eastern red bat	40	C06	carcass search	100-m road and pad	scavenged
10/08/2024	eastern red bat	10	C09	carcass search	100-m road and pad	scavenged
10/08/2024	silver-haired bat	0	D04	carcass search	100-m road and pad	injured
10/14/2024	eastern red bat	18	A03	carcass search	100-m road and pad	scavenged
10/14/2024	silver-haired bat	80	B07	carcass search	100-m road and pad	scavenged
10/15/2024	silver-haired bat	27	D07	carcass search	100-m road and pad	scavenged
Birds						
08/13/2024	cliff swallow	30	B07	incidental	100-m road and pad	injured
08/19/2024	purple martin	56	A03	carcass search	100-m road and pad	scavenged
09/03/2024	American redstart	82	B25	carcass search	100-m road and pad	intact
09/12/2024	unidentified vireo	13	B24	carcass search	100-m road and pad	scavenged
09/17/2024	American redstart	28	D01	carcass search	100-m road and pad	scavenged
09/19/2024	American redstart	33	B24	carcass search	100-m road and pad	scavenged
09/30/2024	bay-breasted warbler	96	A07	carcass search	100-m road and pad	scavenged
10/07/2024	golden-crowned kinglet	6	B08	carcass search	road and pad	intact
10/07/2024	golden-crowned kinglet	40	B08	carcass search	road and pad	intact
10/14/2024	mourning dove	1	D01	carcass search	road and pad	intact
10/15/2024	golden-crowned kinglet	95	C08	carcass search	road and pad	intact

[1] Fall road and pad search areas included a 5-m (16-ft) cleared buffer around each road and pad.

** Carcass was found outside the search area.

m = meter(s); n/a = not applicable.

Appendix B. Carcass Persistence Trial Information and Model Tables for the Sugar Creek Wind Project, Logan County, Illinois, from August 1 – October 15, 2024

Appendix B1. All carcasses placed for carcass persistence trials by date, season, species, and turbine at the Sugar Creek Wind Project, Logan County, Illinois, from August 1 – October 15, 2024.

Date Placed	Season	Species	Turbine	Before Removal*	After Removal**
8/11/2024	Fall	eastern red bat	A02	9/1/2024	9/10/2024
8/11/2024	Fall	eastern red bat	B14	8/21/2024	8/25/2024
8/11/2024	Fall	eastern red bat	B07	8/13/2024	8/15/2024
8/11/2024	Fall	hoary bat	A05	8/12/2024	8/12/2024
8/11/2024	Fall	hoary bat	A07	8/12/2024	8/12/2024
8/11/2024	Fall	hoary bat	B11	8/12/2024	8/13/2024
8/11/2024	Fall	hoary bat	B07	8/11/2024	8/11/2024
8/11/2024	Fall	hoary bat	B06	8/14/2024	8/15/2024
8/11/2024	Fall	silver-haired bat	A02	8/12/2024	8/14/2024
8/11/2024	Fall	silver-haired bat	B09	8/14/2024	8/15/2024
8/11/2024	Fall	silver-haired bat	B14	8/13/2024	8/13/2024
8/11/2024	Fall	silver-haired bat	B13	8/13/2024	8/15/2024
8/11/2024	Fall	silver-haired bat	B10	8/14/2024	8/15/2024
8/11/2024	Fall	silver-haired bat	B06	8/14/2024	8/15/2024
8/11/2024	Fall	silver-haired bat	B05	8/11/2024	8/13/2024
8/27/2024	Fall	eastern red bat	C19	8/28/2024	8/28/2024
8/27/2024	Fall	eastern red bat	C10	8/28/2024	8/29/2024
8/27/2024	Fall	eastern red bat	C14	8/27/2024	8/29/2024
8/27/2024	Fall	eastern red bat	C14	8/28/2024	8/29/2024
8/27/2024	Fall	eastern red bat	B21	8/28/2024	8/30/2024
8/27/2024	Fall	eastern red bat	D07	8/30/2024	8/30/2024
8/27/2024	Fall	eastern red bat	C21	9/2/2024	9/6/2024
8/27/2024	Fall	eastern red bat	B25	9/9/2024	9/17/2024
8/27/2024	Fall	eastern red bat	B22	9/25/2024	9/25/2024
8/27/2024	Fall	eastern red bat	D07	9/17/2024	9/25/2024
8/27/2024	Fall	hoary bat	B21	8/28/2024	8/28/2024
8/27/2024	Fall	silver-haired bat	B24	8/28/2024	8/28/2024
8/27/2024	Fall	silver-haired bat	C10	8/30/2024	8/30/2024
8/27/2024	Fall	silver-haired bat	D10	8/30/2024	8/30/2024
8/27/2024	Fall	silver-haired bat	C15	8/30/2024	8/31/2024
9/15/2024	Fall	eastern red bat	A07	9/22/2024	9/24/2024
9/15/2024	Fall	eastern red bat	A05	9/15/2024	9/16/2024
9/15/2024	Fall	eastern red bat	D01	9/16/2024	9/17/2024
9/15/2024	Fall	eastern red bat	A08	9/16/2024	9/17/2024
9/15/2024	Fall	eastern red bat	B09	9/16/2024	9/17/2024
9/15/2024	Fall	eastern red bat	B10	9/29/2024	10/6/2024
9/15/2024	Fall	eastern red bat	B14	9/16/2024	9/17/2024
9/15/2024	Fall	eastern red bat	B13	9/20/2024	9/22/2024
9/15/2024	Fall	eastern red bat	D06	9/20/2024	9/22/2024
9/15/2024	Fall	eastern red bat	B06	9/20/2024	9/22/2024

* Last date checked before removal.

** Date checked after removal.

Appendix B2. Carcass persistence models with covariates and distributions for bats at the Sugar Creek Wind Energy Project, Logan County, Illinois, from August 1 – October 15, 2024 (n = 40).

Location Covariates	Scale Covariates	Distribution	AICc	Delta AICc
No Covariates	No Covariates	loglogistic	188.13	0*
No Covariates	No Covariates	lognormal	188.59	0.46
No Covariates	-	exponential	193.20	5.07
No Covariates	No Covariates	Weibull	194.15	6.02

* Selected model.

AICc = corrected Akaike Information Criterion; Delta AICc = change in AICc.

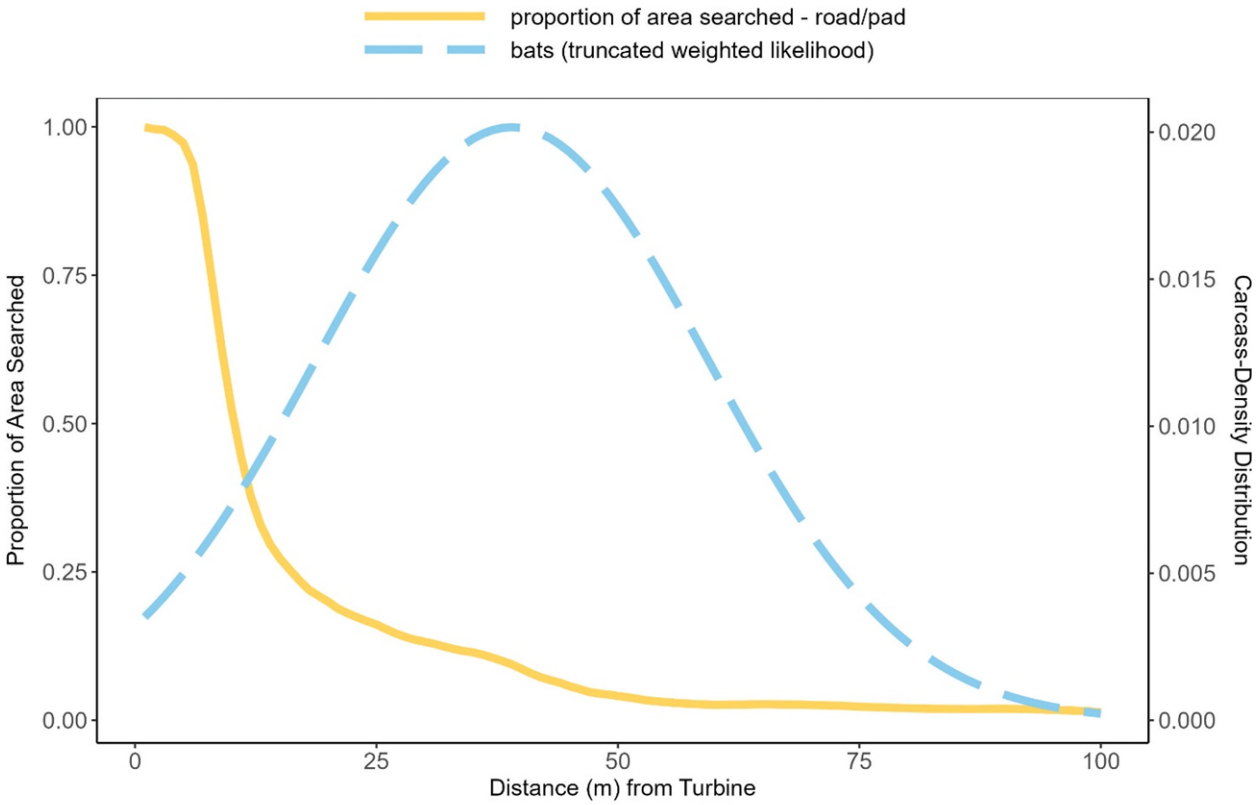
Appendix C. Truncated Weighted Likelihood Area Adjustment Estimate Model Fitting Results for the Sugar Creek Wind Project, Logan County, Illinois, from August 1 – October 15, 2024.

Appendix C1. Search area adjustment models for bats from the Sugar Creek Wind Energy Project, Logan County, Illinois, from August 1 – October 15, 2024.

Distribution	AICc	Delta AICc
Normal	8,998.32	0*
Weibull	9,007.68	9.36
Gompertz	9,057.22	58.90
Gamma	9,067.72	69.40

* Selected model.

AICc = corrected Akaike Information Criterion; Delta AICc = change in AICc.



Appendix C2. Estimated bat carcass-density distribution, and proportion of area searched by distance from turbine at Sugar Creek Wind Energy Project, Logan County, Illinois, from August 1 – October 15, 2024.

Appendix D. Bat Fatality Rates and Adjustment Factors Table for the Sugar Creek Wind Project, Logan County, Illinois, from August 1 – October 15, 2024.

Appendix D1. Estimated fatality rates and adjustment factors, with 90% confidence intervals at road and pad search areas for studies conducted at the Sugar Creek Wind Energy Project, Logan County, Illinois, from August 1 to October 15, 2024.

Estimate	90% CI
Search Area Adjustment	
0.13	0.10–0.18
Searcher Efficiency	
0.88	0.77–0.94
Average Probability of a Carcass Persisting Through the Search Interval*	
0.52	0.43–0.61
Probability of Available and Detected	
0.47	0.39–0.56
Estimated Fatality Rates (Fatalities/Turbine/Seasons(s))	
18.26	12.30–27.54
Estimated Fatality Rates (Fatalities/MW/Seasons(s))	
4.83	3.19–7.36

Appendix E. Inputs Required to Run the Evidence of Absence Single Class Module and Stratum-Specific *g* Distribution Values at the Sugar Creek Wind Project, Logan County, Illinois, from August 1 – October 15, 2024

Appendix E. Single Class Module Inputs for stratum *g* estimation.

Season	Search Area Type	# of Turbines	Search Interval	Sampling Fraction	Plot Shape	Plot Size (m)	Start Date	End Date
spring	unsearched	57	-	-	-	-	1-Apr	31-May
Fall	road and pad	57	7	1	circle	100	1-Aug	15-Oct

MW = megawatt; m = meters.

Appendix E. (*continued*) Single Class Module Inputs for stratum *g* estimation.

Season	Search Area Type	SEEF	# of SEEF-C Found	# of SEEF-C Placed	*k*	# of Searches	CPT Shape Parameter	CPT Scale Parameter	CPT Scale Parameter–Lower	CPT Scale Parameter–Upper
spring	unsearched	-	-	-	-	-	-	-	-	-
fall	road and pad	0.88	37	42	0.65	11	1.59	3.18	2.27	4.47

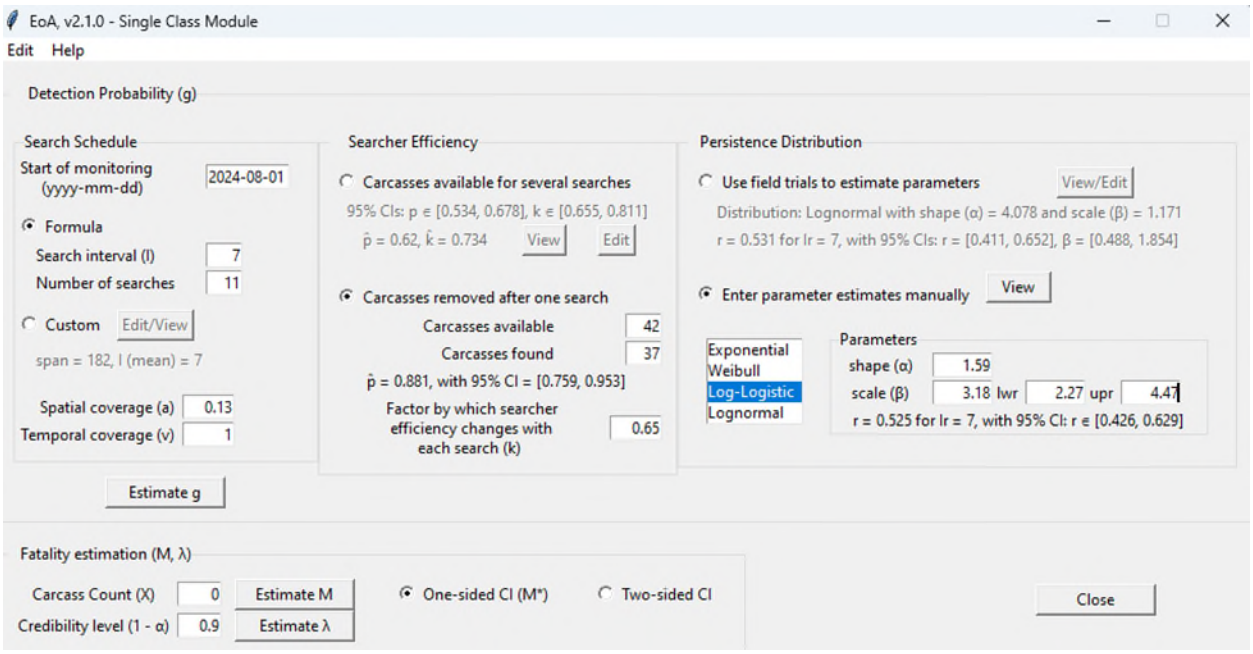
SEEF = searcher efficiency; SEEF-C = searcher efficiency carcasses; *k* = detection reduction factor; CPT = carcass persistence trials.

Appendix E. (*continued*) Single Class Module Inputs for stratum *g* estimation.

Season	Search Area Type	CPT Distribution	CPT Scale Parameter Confidence Level	Area Correction	*g* - Beta Distribution, Alpha Parameter	*g* - Beta Distribution, Beta Parameter	g	*g* - lower	*g* - upper
spring	unsearched	-	-	-	0.01	1,000	0.00	0.00	0.00
fall	road and pad	loglogistic	0.90	0.13	71.53	1,063.50	0.06	0.05	0.08

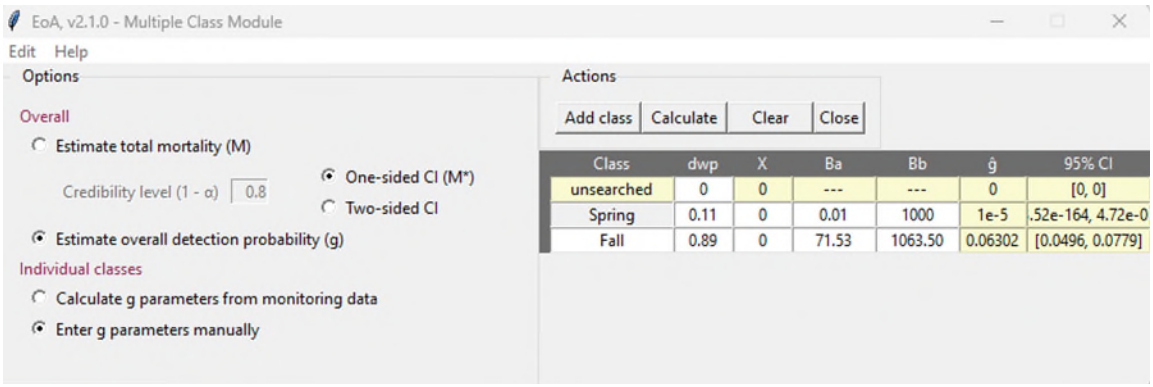
CPT = carcass persistence trials; *g* = detection probability.

Appendix F. Screenshots of Inputs for Single Class and Multiple Class Modules in Evidence of Absence.



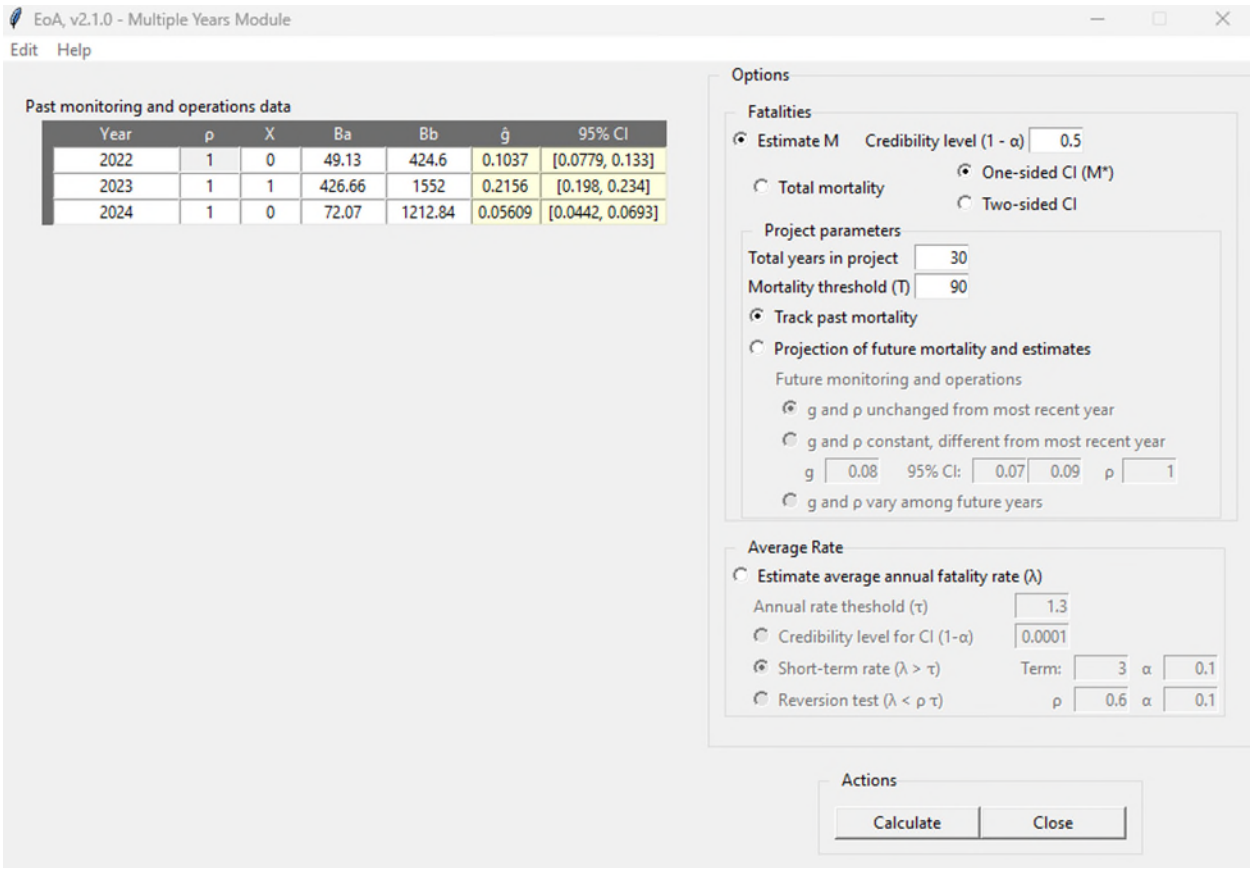

```
Summary statistics for estimation of detection probability (g)
================================================================================
Results:

Full site for full year
   Estimated g = 0.0611, 95% CI = [0.0482, 0.0754]
   Fitted beta distribution parameters for estimated g: Ba = 72.7893, Bb = 1118.2493


Full site for monitored period, 01-Aug-2024 through 17-Oct-2024
   Estimated g = 0.0611, 95% CI = [0.0482, 0.0754]
   Fitted beta distribution parameters for estimated g: Ba = 72.7893, Bb = 1118.2493
   Temporal coverage (within year) = 1


Searched area for monitored period, 01-Aug-2024 through 17-Oct-2024
   Estimated g = 0.47, 95% CI = [0.367, 0.575]
   Fitted beta distribution parameters for estimated g: Ba = 41.0614, Bb = 46.2813

================================================================================
Input:
Search parameters
   trial carcasses placed = 42, carcasses found = 37
   estimated searcher efficiency: p = 0.881, 95% CI = [0.759, 0.953]
   k = 0.65
   Search schedule: Search interval (I) = 7, number of searches = 11, span = 77
     spatial coverage: 0.13     temporal coverage: 1
________________________________________________________________________________
Carcass persistence:
   Log-Logistic persistence distribution
     shape (α) = 1.59 and scale (β) = 3.18
     95% CI β = [2.27, 4.47]
     r = 0.525 for Ir = 7 with 95% CI = [0.426, 0.629]
     Parameters entered manually
   Uniform arrivals
```

Appendix F1. Screenshots of Evidence of Absence (v2.0.7) graphical user interface, Single Class Module inputs for Indiana and northern-long eared bats. Sampling fraction and temporal coverage are accounted for in the Multiple Class Module weights. Detection probability estimates can be found in the *Covered Species Take Estimates and Probability of Detection (g)* section under *Results*.



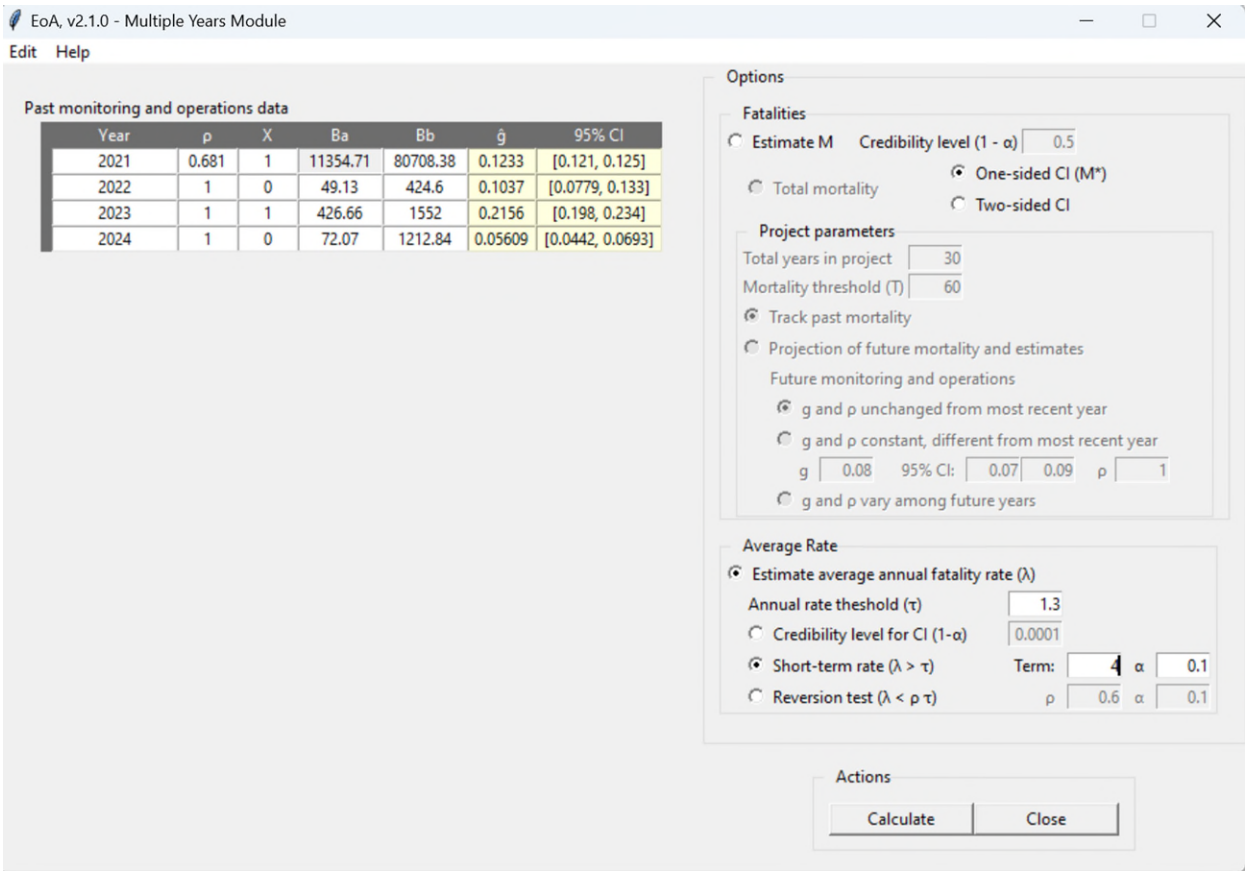

```
Summary statistics for multiple class estimate
================================================================================
Input: Detection probability, by search class
  Search coverage = 1

  Class          DWP     X    Ba     Bb   ghat    95% CI
  unsearched       0     0   ---    ---    0   [    0,     0]
  Spring        0.11     0  0.01   1000 0.000 [0.000, 0.000]
  Fall          0.89     0 71.53   1064 0.063 [0.050, 0.078]
================================================================================
Results for full site
--------------------------------------------------------------------------------

Detection probability
  Estimated g = 0.056, 95% CI = [0.044, 0.069]
  Fitted beta distribution parameters for estimated g: Ba = 72.0691, Bb = 1212.8327

Mortality

Test of assumed relative weights (rho)
  Class          Assumed   Fitted (95% CI)
  unsearched       0.000      NA
  Spring           0.110    [0.968, 1.000]
  Fall             0.890    [0.000, 0.029]
  p = 1 for likelihood ratio test of H0: assumed rho = true rho
```

Appendix F2. Screenshots of Evidence of Absence (v2.0.7) graphical user interface, Multiple Class Module inputs for Indiana and northern long-eared bats. Weights (DWP) were calculated as the temporal coverage (arrival proportion) across seasons. Detection probabilities estimates can be located in the *Covered Species Take Estimates and Probability of Detection (g)* section, under *Results*. Mortality estimates were calculated using the Multiple Years Module.




```
Results

M* = 9 for 1 - α = 0.5, i.e., P(M <= 9) >= 50%
Estimated overall detection probability: g = 0.125, 95% CI = [0.114, 0.137]
   Ba = 382.33, Bb = 2672.8
Estimated baseline fatality rate (for rho = 1): lambda = 4.008, 95% CI = [0.288, 12.5]

Cumulative Mortality Estimates
                                        mean
Year          X     g      M*  median  95% CI  lambda       95% CI
2022          0 0.104      2       2   [0, 18]  4.955   [0.00482, 25.13]
2023          1 0.160      7       7   [1, 23]  9.432   [0.6763, 29.48]
2024          1 0.125      9       9   [1, 30]  12.03   [0.8628, 37.56]


Annual Mortality Estimates
                                        mean
Year          X     g      M*  median  95% CI  lambda       95% CI
2022          0 0.104      2       2   [0, 18] 4.9550   [0.0048, 25.1300]
2023          1 0.216      5       5   [1, 17] 6.9740   [0.5007, 21.7800]
2024          0 0.056      4       4   [0, 34] 9.0900   [0.0088, 45.9800]


Test of assumed relative weights (rho) and potential bias
              Fitted rho
Assumed rho      95% CI
      1      [0.005, 2.521]
      1      [0.080, 2.852]
      1      [0.008, 2.703]

p = 0.57494 for likelihood ratio test of H0: assumed rho = true rho
Quick test of relative bias: 1.113
```

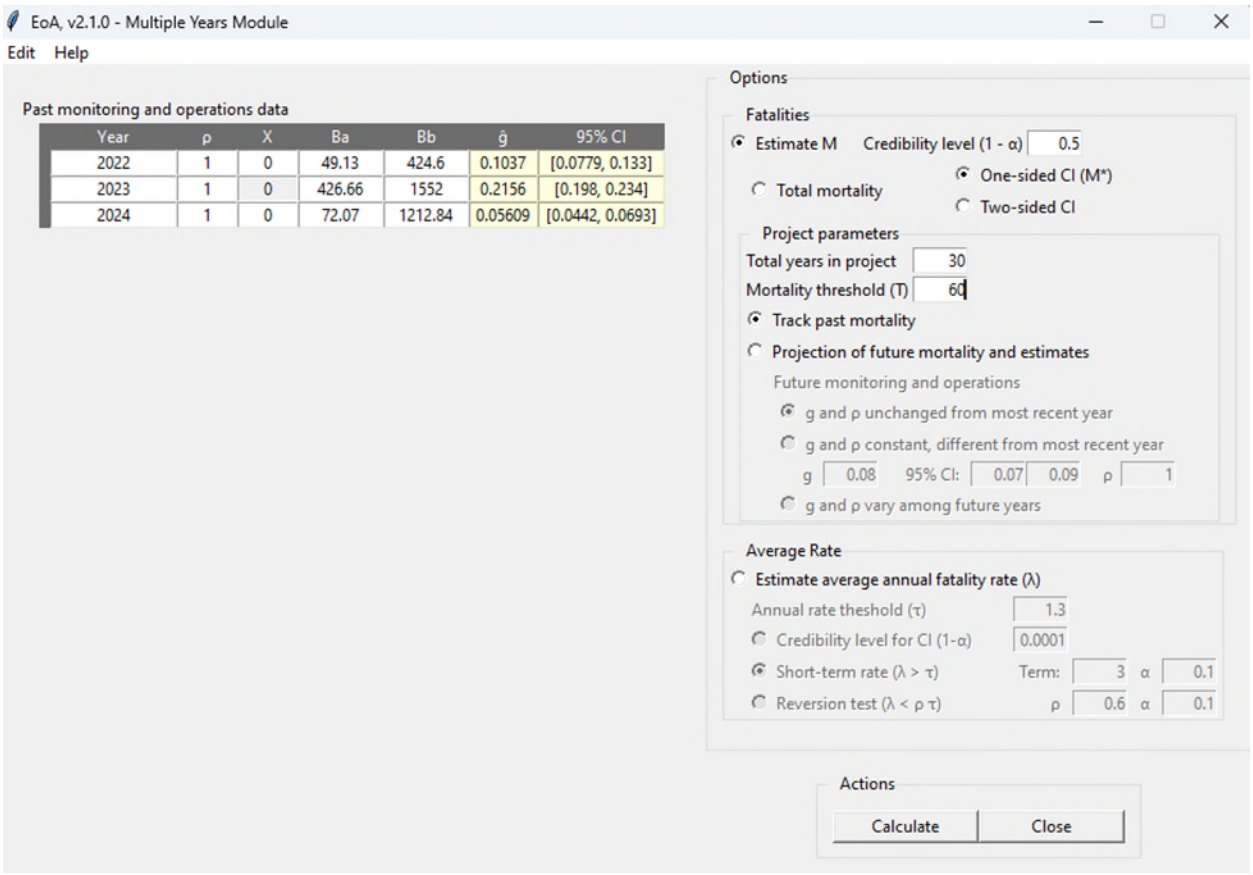
Appendix F3. Screenshots of Evidence of Absence (v2.0.7) graphical user interface, Multiple Years Module inputs for Indiana bats M* estimates. Years 2022-2024 were used for the M* estimates. Weights (ρ) were calculated to combine Beta distribution parameters across years, with a ρ of 1 representing a normal risk year.




```
Short-term trigger: Test of average fatality rate (lambda) over 4 years
Years: 2021 - 2024
================================================================================
Results
Estimated overall detection probability: g = 0.125, 95% CI = [0.115, 0.135]
   Ba = 571.86, Bb = 4010

Estimated annual fatality rate over the past 4 years: lambda = 5.018, 95% CI = [0.832, 12.9]
   P(lambda > 1.3) = 0.9351
   Exceedance: lambda > 1.3 with 90% credibility

--------------------------------------------------------------------------------
Input
Threshold for short-term rate (tau) =  1.3  per year

Period       rel_wt  X    Ba      Bb    ghat    95% CI
2021         0.681   1 1.135e+04 8.071e+04 0.123 [0.121, 0.125]
2022         1.000   0  49.13  424.6 0.104 [0.078, 0.133]
2023         1.000   1  426.7   1552 0.216 [0.198, 0.234]
2024         1.000   0  72.07   1213 0.056 [0.044, 0.069]
```

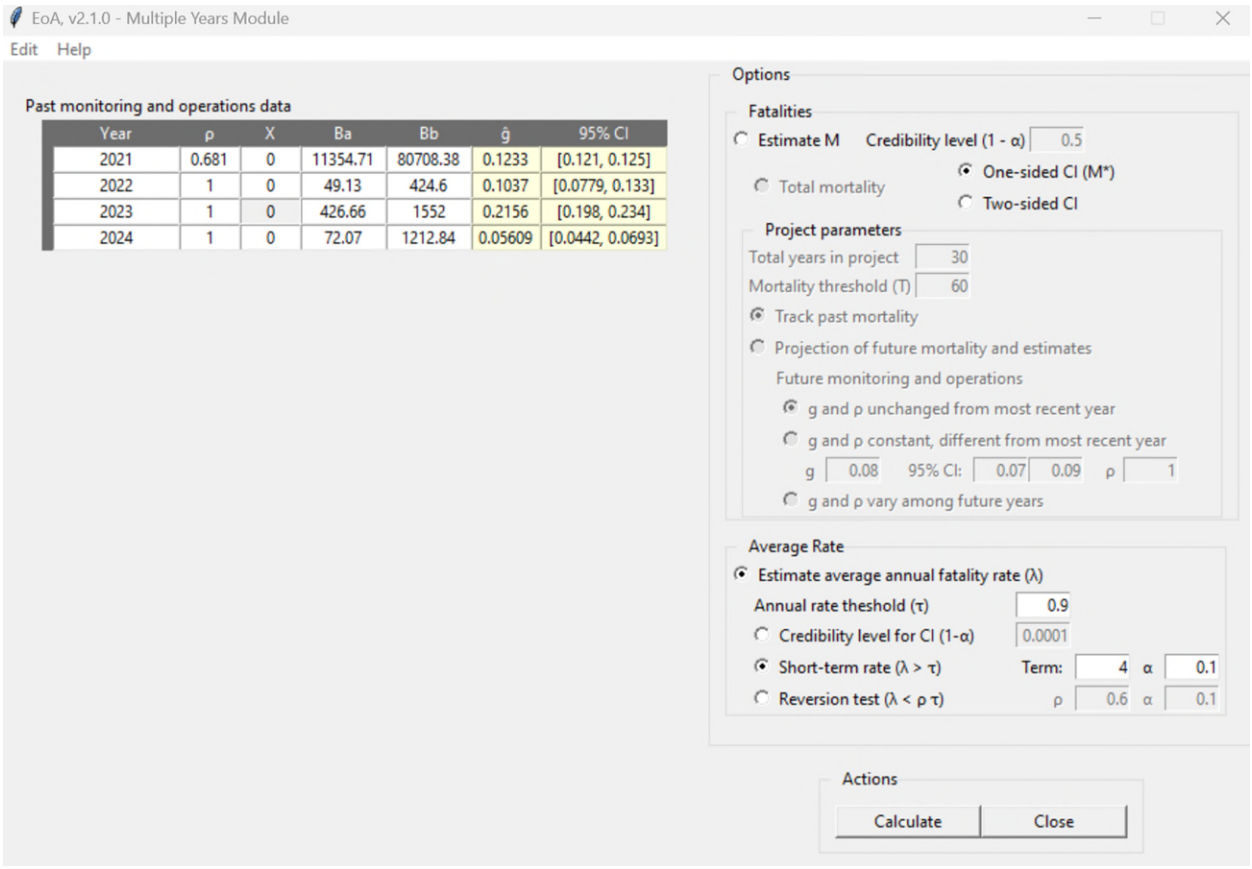
Appendix F4. Screenshots of Evidence of Absence (v2.0.7) graphical user interface (GUI), Multiple Years Module inputs for Indiana bats lambda estimates. Years 2021–2024 were used for the lambda estimates. Weights (ρ) were calculated to combine Beta distribution parameters across years, with a ρ of 1 representing a normal risk year.

Note: although the weight (ρ) column of the Multiple Years Module sums to 2.68, 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 "ρ" of 1.0 is equivalent to a typical operations year for the wind farm, we would like to calculate the "ρ-adjusted λ" but the GUI does not accommodate that calculation. Therefore, the "ρ-adjusted λ," 5.45, is equivalent to the "year-adjusted λ" (5.02, as seen in the output above) divided by the sum of ρ (3.68) multiplied by the number of years (4).




```
Results

M* = 1 for 1 - α = 0.5, i.e., P(M <= 1) >= 50%
Estimated overall detection probability: g = 0.125, 95% CI = [0.114, 0.137]
   Ba = 382.33, Bb = 2672.8
Estimated baseline fatality rate (for rho = 1): lambda = 1.336, 95% CI = [0.00131, 6.72]

Cumulative Mortality Estimates
                                          mean
Year          X    g     M*  median  95% CI  lambda       95% CI
2022          0 0.104    2     2     [0, 18]  4.955   [0.00482, 25.13]
2023          0 0.160    1     1     [0, 11]  3.144   [0.003066, 15.82]
2024          0 0.125    1     1     [0, 14]  4.008   [0.00392, 20.16]

Annual Mortality Estimates
                                          mean
Year          X    g     M*  median  95% CI  lambda       95% CI
2022          0 0.104    2     2     [0, 18] 4.9550   [0.0048, 25.1300]
2023          0 0.216    0     0     [0, 8] 2.3250   [0.0023, 11.6900]
2024          0 0.056    4     4     [0, 34] 9.0900   [0.0088, 45.9800]

Test of assumed relative weights (rho) and potential bias
              Fitted rho
Assumed rho     95% CI
      1     [0.006, 2.804]
      1     [0.004, 2.589]
      1     [0.016, 2.923]

p = 1 for likelihood ratio test of H0: assumed rho = true rho
Quick test of relative bias: 0.744
```

Appendix F5. Screenshots of Evidence of Absence (v2.0.7) graphical user interface, Multiple Years Module inputs for northern-long eared bats M* estimates. Years 2022-2024 were used for the M* estimates. Weights (ρ) were calculated to combine Beta distribution parameters across years, with a ρ of 1 representing a normal risk year.




```
Short-term trigger: Test of average fatality rate (lambda) over 4 years
Years: 2021 - 2024
================================================================================
Results
Estimated overall detection probability: g = 0.125, 95% CI = [0.115, 0.135]
   Ba = 571.86, Bb = 4010

Estimated annual fatality rate over the past 4 years: lambda = 1.004, 95% CI = [0.000982, 5.05]
   P(lambda > 0.9) = 0.3435
   Compliance: Cannot infer lambda > 0.9 with 90% credibility
--------------------------------------------------------------------------------
Input
Threshold for short-term rate (tau) =  0.9  per year

Period       rel_wt  X    Ba      Bb    ghat    95% CI
2021         0.681   0 1.135e+04 8.071e+04 0.123 [0.121, 0.125]
2022         1.000   0  49.13  424.6 0.104 [0.078, 0.133]
2023         1.000   0  426.7   1552 0.216 [0.198, 0.234]
2024         1.000   0  72.07   1213 0.056 [0.044, 0.069]
```

Appendix F6. Screenshots of Evidence of Absence (v2.0.7) graphical user interface, Multiple Years Module inputs for northern-long eared bats lambda estimates. Years 2021–2024 were used for the lambda estimates. Weights (ρ) were calculated to combine Beta distribution parameters across years, with a ρ of 1 representing a normal risk year.

Note: although the weight (ρ) column of the Multiple Years Module sums to 2.68, 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 "ρ" of 1.0 is equivalent to a typical operations year for the wind farm, we would like to calculate the "ρ-adjusted λ" but the GUI does not accommodate that calculation. Therefore, the "ρ-adjusted λ," 1.09, is equivalent to the "year-adjusted λ" (1, as seen in the output above) divided by the sum of ρ (3.68) multiplied by the number of years (4).