# Post-construction Monitoring Study for the California Ridge Wind Farm Champaign and Vermilion Counties, Illinois

Year 3 Final Report August 22 – October 13, 2023



#### Prepared for:

#### California Ridge Wind Energy, LLC

3619 East 2350 North Road #2567 Armstrong, Illinois 61812

#### Prepared by:

#### Karl DuBridge, Grace Wilson, and Jason Ritzert

Western EcoSystems Technology, Inc. 150 Corporate Center Drive, Suite 106 Camp Hill, Pennsylvania 17011

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Confidential Business Information

# EXECUTIVE SUMMARY

California Ridge Wind Energy, LLC, is operating the California Ridge Wind Farm (Project) in Champaign and Vermilion counties, Illinois. The Project became operational in 2012 and consists of 134 turbines, each with a capacity of 1.6 megawatts (MW) that have a 100-meter (m; 328-foot [ft]) hub height and a 50-m (164-ft) blade length. This report details the post-construction monitoring (PCM) studies conducted in fall 2023, consistent with Section 7.3 of the Project's Habitat Conservation Plan (HCP), United States Fish and Wildlife Service (USFWS) Incidental Take Permit (ITP; ESPER0018464) and Illinois Department of Natural Resources (IDNR) Incidental Take Authorization (ITA; ITA222) for the Indiana bat, northern long-eared bat<sup>1</sup>, little brown bat and tricolored bat<sup>2</sup> (collectively, Covered Species). Note that the state permit only covers the Indiana bat and northern long-eared bat at this time given that neither the tricolored bat or little brown bat are listed in the state of Illinois.

Western EcoSystems Technology, Inc. (WEST), followed PCM methods outlined in the Project's HCP, which targeted a probability of detection (g) of 0.061 for Indiana bats and northern longeared bats and 0.043 for little brown bats and tricolored bats. The objectives of this study were to produce estimates of bat mortality as outlined in the HCP, and to evaluate the need for adaptive management measures.

The third-year year PCM was completed by WEST from August 22 – October 13, 2023<sup>3</sup>. Standardized carcass searches were completed for bat carcasses at road and pad plots. Across fall, technicians searched road and pad plots at all 134 turbines out to 95 m (311 ft) from each turbine once per week. Searcher efficiency and carcass persistence trials were also conducted to correct for detection and scavenger bias.

No Covered Species were found during the 2023 searches. The most commonly found species were eastern red bat (75.6%) and silver-haired bat (9.8%), followed by hoary bat (7.3%) and big brown bat (7.3%). The overall bat fatality rate, calculated using a generalized estimator of fatality (commonly, GenEst), was 9.86 bats per MW.

The overall *g* was 0.013 (90% CI: 0.011–0.015) for Indiana bat and northern long-eared bat and 0.009 (90% CI: 0.080–0.010) for little brown bat and tricolored bat. No adaptive management triggers were met under the ITP.

<sup>&</sup>lt;sup>1</sup> On November 29, 2022, the USFWS published the final rule to list the northern long-eared bat as endangered under the Endangered Species Act. The effective date of the final rule took effect March 31, 2023.

<sup>&</sup>lt;sup>2</sup> On September 14, 2022, the USFWS proposed to list the tricolored bat as endangered under the Endangered Species Act. The final listing decision is expected in 2024.

<sup>&</sup>lt;sup>3</sup> Searches began August 22 rather than on August 1 due to unforeseen project delays.

#### STUDY PARTICIPANTS

Karl DuBridge Jason Ritzert Grace Wilson Ted Owen Angela Medina Garcia Meredith Hoggatt Pallavi Sirajuddin Chazz Coleman Andy Valencia Danielle Alba	Project Manager Senior Reviewer Field Coordinator and Report Compiler Lead Client Analyst Statistician Permitted Bat Biologist Permitted Bat Biologist GIS Technician Technical Editor
•	
Olivia Moline	Field Technician Field Technician

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# INTRODUCTION

California Ridge Wind Energy, LLC (California Ridge) is operating the California Ridge Wind Farm (Project) in Champaign and Vermilion counties, Illinois. The Project became operational in 2012 and consists of 134 General Electric 1.6-megawatts (MW) wind turbines that have a 100-meter (m; 328-foot [ft]) hub height and a 50-m (164-ft) blade length. California Ridge obtained a United States Fish and Wildlife Service (USFWS) Incidental Take Permit (ITP; ESPER0018464) for the federally listed as endangered Indiana bat (*Myotis sodalis*), federally listed as endangered northern long-eared bat<sup>4</sup> (*M. septentrionalis*), as well as two species that were not protected by the federal Endangered Species Act at the time of the ITP issuance; little brown bat (*M. lucifugus*) and tricolored bat<sup>5</sup> (*Perimyotis subflavus*; collectively, Covered Species) dated August 6, 2021. California Ridge also obtained Incidental Take Authorization (ITA) from the Illinois Department of Natural Resources (IDNR) for Indiana and northern long-eared bat on January 20, 2022. Both the USFWS ITP and IDNR ITA require the Project to minimize impacts to Covered Species and conduct post-construction monitoring (PCM).

Western EcoSystems Technology, Inc. (WEST) completed the third-year annual PCM in accordance with Section 7.3 of the Project's Habitat Conservation Plan (HCP; Stantec Consulting Services, Inc. 2021). The objectives of this study were to produce estimates of bat mortality and evaluate the need for adaptive management measures. This report presents the results of the 2023 year of monitoring conducted at the Project from August 22 – October 13.

# STUDY AREA

According to the National Land Cover Dataset (2021), the primary land cover type within the Permit Area (a 1.0-kilometer [0.6-mile] buffer around the outermost turbines) is cultivated crops (95.2%), followed by developed areas (4.2%; Figure 1). The remaining land cover types make up less than 1.0% of the area individually.

All turbines are within the migratory range of the Indiana bat, northern long-eared bat, little brown bat, and tricolored bat. California Ridge adjusted turbine operations during the fall (August 1 – October 15) to minimize impacts to the Covered Species (Table 1).

<sup>&</sup>lt;sup>4</sup> On November 29, 2022, the USFWS published the final rule to list the northern long-eared bat as endangered under the Endangered Species Act. The status change took effect on January 30, 2023.

<sup>&</sup>lt;sup>5</sup> On September 14, 2022, the USFWS proposed to list the tricolored bat as endangered under the Endangered Species Act. The final listing decision is expected in late 2024.

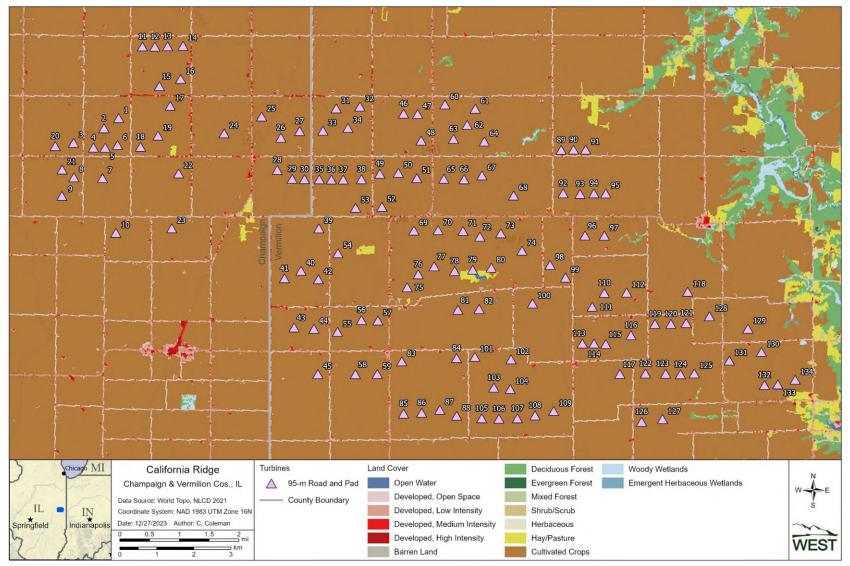


Figure 1. Turbines by plot type and surrounding land cover at the California Ridge Wind Farm, Champaign and Vermilion counties, Illinois.

Table 1.	Seasonal curtailment regime at the California Ridge Wind Farm, Champaign and
	Vermilion counties, Illinois.

	-	-	Cut-In	Feathering	Temperature
Season	Turbines	Time of Day	Speed <sup>1</sup>	Below Cut-In <sup>2</sup> ?	Threshold <sup>3</sup>
Fall: August 1 – October 15	All	Sunset to sunrise	5.0 m/s	Yes	Above 10°C (50°F)

<sup>1.</sup> The manufacturer's cut-in wind speed is 3.0 meters per second (m/s; 9.8 feet/s) across the Project turbines.

<sup>2.</sup> Feathering means that turbine blades will be pitched into the wind such that they spin at less than one rotation per minute.

<sup>3.</sup> Turbines will be feathered below cut-in when temperatures are above the threshold.

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

# METHODS

WEST followed PCM methods outlined in the Project's HCP, which targeted a probability of detection (g) of 0.061 for Indiana bats and northern long-eared bats and 0.043 for little brown bats and tricolored bats to meet the monitoring commitments.

#### **Standardized Carcass Searches**

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

Standardized carcass searches were completed once weekly on roads and pads at all turbines from August 22 – October 13, 2023. The HCP defines the fall bat migratory period as August 1 – October 15 yearly. Searches began August 22 due to unforeseen project delays. Road and pad searches at all 134 Project turbines included searching the entire gravel road and pad area within a 95-m (311-ft) radius of the turbine base once per week (Table 2). If vegetation (weeds, grass, and/or crops) was present, vegetation was maintained by operations and maintenance staff. Areas of dense and high vegetation were noted on carcass search forms.

Table 2.	Search effort at the California Ridge Wind Farm, Champaign and Vermilion counties,
	Illinois.

Fall Technicians Road and pads – 95 m 134 Once weekly	Season	Search Team	Plot Type	Number of Plots	Search Interval
	Fall	Technicians	Road and pads – 95 m	134	Once weekly

m = meters.

#### Search Methods

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

During 95-m road and pad searches, the technician started at 95 m from the turbine and walked the access road at a rate of approximately 45–60 m (148–197 ft) per minute 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 (Figure 2).



Figure 2. Representative photo of conditions of a 95-meter road and pad plot.

# 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. When a carcass was found, technicians placed a flag near it and continued the search. After searching the entire plot, the technician returned to record information for each carcass on a carcass data sheet, including the date and time, species, technician name, turbine number, measured distance from turbine, azimuth from turbine, location of carcass as Universal Transverse Mercator coordinates, habitat surrounding carcass, carcass condition, and estimated time of death (i.e., 0–1 days, 2–3 days, 4–7 days, 8–14 days, 15–30 days, or more than 30 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), 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 (i.e., scattered within a 1.0-m radius) indicating predation or scavenging of a bird carcass.

Technicians took digital photographs of each carcass, including any visible injuries, and surrounding habitat. No bird carcasses were collected. Bat carcasses were collected under the Project's USFWS ITP ESPER0018464, WEST's Federal Native Endangered and Threatened Species Recovery Permit ES234121, WEST's State Endangered and Threatened Species Scientific Permit 16988, and individual state salvage permits: NH23.7024, NH23.6419, NH23.6968, NH23.6689, and NH23.6426. Technicians placed all bat carcasses in a re-sealable plastic bag labeled with the unique carcass identification number, turbine number, and date, for storage in a freezer on site. Leather and rubber gloves were used to handle all bat carcasses to eliminate possible transmission of rabies or other diseases. Protocols were for any live, injured bats to be recorded and considered fatalities for analysis purposes if observed in search areas and handled in accordance with permit conditions (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 statistical analysis.

#### Carcass Identification and Agency Notification

Field identification of bird carcasses were verified by WEST biologists with extensive field experience in identification of birds and their feathers. A WEST federally permitted bat biologist (Meredith Hoggatt ESPER0039249; Pallavi Sirajuddin TE62046D-0) identified all bat carcasses via photos and/or in hand at the end of the surveys. The USFWS and the IDNR were notified within 24 hours of positive identification any state- or federally listed species.

If any fragments or highly decomposed bat carcasses were found that could not be identified, tissue samples were collected and submitted to the East Stroudsburg University Wildlife Genetics Institute for identification via deoxyribonucleic acid (DNA) analysis.

#### **Bias Trials**

#### Searcher Efficiency Trials

The objective of searcher efficiency trials was to estimate the probability that a carcass was found by technicians. Searcher efficiency trials were conducted in the same areas where carcass searches occurred. Technicians conducting carcass surveys 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*), big brown bats (*Eptesicus fuscus*), evening bats (*Nycticeius humeralis*), and silver-haired bats (*Lasionycteris noctivagans*) that had previously been found on site. Forty carcasses were placed within search areas during the fall 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 study carcass after it is found. Carcasses were dropped from waist-height or higher and allowed to land in a random posture.

Technicians 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 responsible for distributing the carcasses. Following searches, any carcasses that were not detected were checked to confirm availability. The forty 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. Only one carcass was placed at a turbine during each trial to avoid potential over seeding or attracting an increased number of scavengers.

Technicians monitored the trial carcasses over a 30-day period according to the following schedule, as closely as possible. Carcasses were checked daily for the first 7 days, then on days 10, 14, 21, and 30. Trial carcasses were monitored by technicians until they were completely removed or the trial period ended and they were then picked up. Due to time constraints of the study, carcasses placed during the final persistence trial were not left out for the full 30 days.

#### Search Area Mapping

During studies on site in 2022, technicians recorded the boundaries of 95-m road and pads using a Trimble R1 GNSS Receiver unit. The plot boundaries were used to verify if carcasses were found inside the search areas and to inform the distribution of carcasses around turbines to estimate the number of carcasses that fell inside or outside of search areas. Due to no changes to the road and pads since 2022, last year's search area mapping was used for the 2023 study.

# **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<sup>®</sup> 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 Evidence of Absence (EoA; Dalthorp et al. 2017) modeling framework was used to estimate the probability of detecting each Covered Species. Additionally, per the Project's HCP, the all-bat fatality estimate was calculated using GenEst (a generalized estimator of fatality; Dalthorp et al. 2018, Simonis et al. 2018).

#### Bias Trials

#### Searcher Efficiency Estimation

Searcher efficiency was modeled using logistic regression, while accounting for the detection reduction factor (k; Dalthorp et al. 2018).

The results of searcher efficiency model selection are used differently in GenEst and EoA. The logistic regression model was used with GenEst to estimate the all-bat fatality rate. EoA uses raw searcher efficiency data (e.g., number of found and available trial carcasses) to inform overall probability of detection.

#### Detection Reduction Factor

The change in searcher efficiency between successive searches was defined by a parameter called the detection reduction factor (k) that ranged from zero to one. When k is zero it implied that a carcass missed on the first search would never be found. A k of one implied searcher efficiency remained constant no matter how many times a carcass is missed. The detection reduction factor was a required parameter for GenEst; however, data were not collected to estimate k. A value for k of 0.8 was assumed for bats per the HCP.

#### 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. 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). Selection was completed using an information theoretic approach known as AICc, or corrected Akaike Information Criterion (Burnham and Anderson 2002). The best-supported model for EoA and the all-bat fatality estimate was selected as the most parsimonious model within two AICc units of the model with the lowest AICc value. The parameter estimates of the selected model ( $\alpha$  [shape] and  $\beta$  [scale], including the 90% Confidence Interval [CI] of  $\beta$ ) were used as inputs in the EoA Single Class module.

#### Search Area Adjustment/Density Weighted Proportion

The search area adjustment accounted for unsearched areas beneath turbines and was calculated as a probability that ranged from zero to one. For example, an area adjustment of 0.75 meant that an estimated 75% of carcasses fell within the search area. Unsearched areas were due to survey obstacles such as terrain, or areas where carcasses fell outside the search area (e.g., a carcass landed within the agricultural land off the searched road and pad area). The area adjustment was estimated as the product of the relative proportion of searched area around each turbine and a carcass-density distribution. The carcass-density distribution predicts the likelihood a carcass fell a given distance from the turbine base.

The method used to estimate the carcass-density distribution was specified in Section 7.3.3.3 of the HCP which states:

"GenEst does not currently have a module for estimating the area adjustment, but it may become available during the permit term. Meanwhile, the area adjustment will be calculated using density-weighted proportions, placing each carcass found into a 10-meter distance band, and calculating the percent of each distance band that was searched sitewide, and the weighted searcher efficiency for that distance band. If other methods for modeling search area adjustment become available during the permit term, California Ridge will seek written USFWS approval to use them in fatality estimates."

The method outlined above corresponds to an adaptation of the "Cake Method" described in Maurer et al. (2020) in which the number of fatalities found in a 10-m (33-ft) concentric annulus around the turbine is divided by the probability of detection and the proportion of area searched in each 10-m annulus to develop an "effective number of carcasses" within each annulus (Maurer et al. 2020). The effective number of carcasses within each annulus is divided by the sum of effective number of carcasses in all annuli to calculate the relative carcass density within each 10-m annulus. This method is not able to account for carcasses that may occur beyond the maximum search radius. Although the HCP specifies that a 'weighted searcher efficiency,' will be used in the calculation of density weighted proportion, the quantity that is relevant to the effective number of carcasses is actually the carcass detection probability (which includes the searcher efficiency as a component). For this study, the detection probability for each carcass was multiplied by the proportion of searched area within each annulus and used as the overall probability of detection as in Maurer et al. (2020).

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-m annulus around the turbine. The area adjustment was estimated by combining the carcass-density for each 10-m annulus with the proportion of area searched for each 10-m annulus for each plot type across the search area and summarizing across the distances.

In EoA, the search area adjustment is the aggregate of this across all 134 turbines; for GenEst, each turbine is assigned a turbine-specific Density Weighted Proportion (DWP) based on the specific road and pad layout at that turbine.

#### Carcasses Excluded from Area Correction Calculations

Fatalities were excluded from the area correction estimate when the carcass was discovered outside of the spatial and temporal scope of the survey design. For example, carcasses found outside a designated plot were not included in the analysis because the area adjustment accounts for the carcass by adjusting for unsearched areas. Carcasses found with an estimated time of death before August 1 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 surveys.

#### Detection Probability Estimates

Estimates of the probability of detecting each Covered Species were calculated using EoA using the Single Class, Multiple Class, and Multiple Years modules. Appendix A shows details on how the detection probabilities were calculated using the EoA Graphical User Interface, which are also summarized below.<sup>6</sup>

The probability of detection (*g*) was estimated using the bias corrections for searcher efficiency, carcass persistence, and area searched, and the assumed seasonality of risk for the Covered Species. The seasonality of risk (expressed as relative proportion of the species arriving at the Project in each season) per the HCP, was 0.017 in the spring, zero in the summer, and 0.983 in the fall for Indiana bat and northern long-eared bat, and 0.065 in the spring, 0.255 in the summer, and 0.680 in the fall for little brown bat and tricolored bat. Within the fall period, a seasonality of 28.8% was assigned to August 1 – August 21 and a seasonality of 71.2% was assigned to August 22 – October 13 based on the number of days within each period. This assumed that the risk within the fall period was uniform throughout that period.

The EoA Single Class module was used to estimate detection probability for the second part of fall. Based on the bias correction data input, an alpha ( $\alpha$ , defined Ba in EoA) and beta ( $\beta$ , defined Bb in EoA) parameters are estimated that define the beta distribution of detection probability. A beta distribution with parameters set to Ba = 0.01 and Bb = 1,000 was used to indicate the unsearched time periods of spring, summer, and the first part of fall (August 1 – August 21).

The EoA Multiple Class module was then used to combine detection probability distributions across strata (95-m roads and pads in the second part of fall and unsearched plots during the rest of the year), with weights for each class defined by the sampling fraction and seasonality of risk. The Multiple Years module was used to estimate the cumulative beta distribution of detection probability for all years at the project (Ba and Bb parameters for the detection probability to date). The Multiple Years module requires the beta distribution parameters for detection probability in each year and weights ( $\rho$ ), which were all assumed to be one because there were no changes in facility operations (such as cut-in speed) between years that would have resulted in different weights.

<sup>&</sup>lt;sup>6</sup> There may be very minor differences between screen shots and the results in the main text because EoA is a stochastic estimator, leading to slightly different estimates each time the modules are run.

### Fatality Rate Estimation

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 for all bats. To obtain an overall estimate of fatality, each carcass included in the analysis was adjusted for searcher efficiency, carcass persistence, a detection reduction factor (also referred to as "k"; see above), and a search area adjustment. Estimates and 90% CIs were calculated using a parametric bootstrap (Dalthorp et al. 2018).

## Assessment of Adaptive Management Triggers

As specified in the Project's HCP, the need for adaptive management during the initial five years of the ITP is based upon the number of Covered Species carcasses found during compliance monitoring. Adaptive management would only be triggered by discovery of two or more Indiana bat carcasses, four or more northern long-eared bat carcasses, nine or more little brown bat carcasses, or 13 or more tricolored bat carcasses during the first five years of PCM.

#### Covered Species Take Estimates

Section 7.3.3.5 of the Project's HCP specifies Covered Species take estimates to be calculated and reported using the Multiple Years Module; however, these estimates are not used to assess compliance during the initial five years of the ITP. These estimates include the median cumulative take to-date ( $M^*$ ), the median cumulative take within the current monitoring year ( $M^*_{2022}$ ), the projected mortality ( $M_{Projected}$ ), and the mean annual take rate ( $\lambda$ ) for each of the Covered Species and are presented in Appendix B.

# RESULTS

#### Standardized Carcass Searches

Overall, 1,056 searches were completed during the study period. Forty-eight searches (4.5%) were missed due to turbine maintenance, weather constraints, and/or safety hazards. No surveys were completed prior to August 22, 2023; however, the statistical analysis accounted for the missed surveys.

#### **Overall Carcasses**

Thirty-nine bat carcasses were found during carcass searches (Appendix C). An additional bat carcass was found outside the search area and another was determined to have died prior to the study period; these two were not included in analysis (Table 3). Thirteen bird carcasses were found during surveys (Appendix C); however, no birds were included in the analysis.

#### Species Composition

Four bat species were recorded during carcass searches (Table 3; Appendix C). The most commonly found species were eastern red bat (31 carcasses; 75.6%) and silver-haired bat (four carcasses; 9.8%), followed by hoary bat (three carcasses; 7.3%), and big brown bat (three carcasses; 7.3%; Appendix C). No DNA analysis was necessary to identify the carcasses found. Additionally, no carcasses of Covered Species were discovered during the fall 2023 study.

Table 3.	Number and percent (%) of carcasses by species included and excluded from analysis
	at the California Ridge Wind Farm, Champaign and Vermillion counties, Illinois, from
	August 22 – October 13, 2023.

		ded in Estimate	Outs Search		Outside Peri	-	Oth	er*	То	tal
Species	Total	%	Total	%	Total	%	Total	%	Total	%
eastern red bat	30	76.92	1	100	0	0	0	0	31	75.6
silver-haired bat	4	10.26	0	0	0	0	0	0	4	9.8
big brown bat	3	7.69	0	0	0	0	0	0	3	7.3
hoary bat	2	5.13	0	0	1	100	0	0	3	7.3
Overall Bats	39	100	1	100	1	100	0	0	41	100

\* Carcasses not included in analysis/excluded from fatality estimate.

#### Timing and Distribution of Bat Carcasses

Most bat carcasses were found between August 22 and September 8 (Figure 3; Appendix C). Thirty-five bats (85% of casualties) were found between August 22 and September 8, with most bats found between September 5 and September 8, 2023 (Figure 3).

Bat carcasses were found at 36 of the 134 study turbines. Turbines 20, 44,52, and 82 had two casualties found at each search location, while 31 other turbines each had one bat carcass found within their search areas (Figure 4).

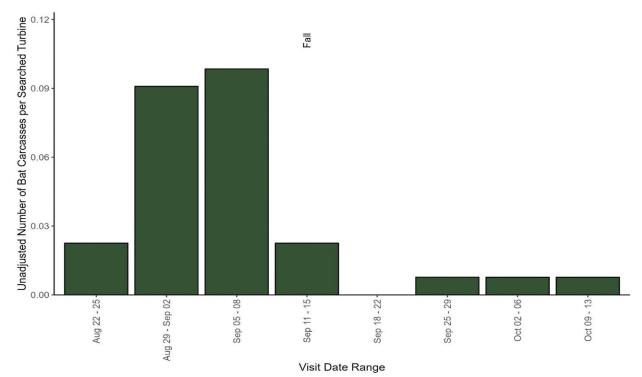
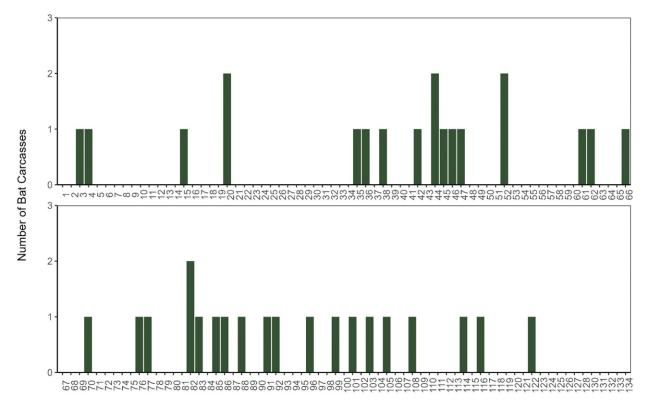


Figure 3. Timing of bat carcasses found on roads and pads for carcasses included in the GenEst fatality estimates at the California Ridge Wind Farm, Champaign and Vermilion counties, Illinois, from August 22 – October 13, 2023.



#### Turbine Number

# Figure 4. Number of bat carcasses found per turbine at the California Ridge Wind Farm, Champaign and Vermillion counties, Illinois, from August 22 – October 13, 2023.

#### **Statistical Analysis**

#### Bias Trials

#### Searcher Efficiency Trials

Forty bats were placed for searcher efficiency trials on three separate dates, and 32 were available for searchers to find. The overall searcher efficiency rate was 71.9% (Table 4). Searcher efficiency decay was modeled with a k value of 0.8.

# Table 4.Searcher efficiency results at the California Ridge Wind Farm, Champaign and<br/>Vermilion counties, Illinois, from August 22 – October 13, 2023.

Plot Type	Number Placed	Number Available	Number Found	% Found
95-meter road and pad	40	32	23	71.9

#### Carcass Persistence Trials

The same forty carcasses used for searcher efficiency trials were also monitored to estimate carcass persistence. The best-fit model for carcass persistence had an exponential distribution The average probability of a carcass persisting through the 7.0-day search interval was 0.77 (90%

CI: 0.70–0.82) (Figure 5). Estimated median carcass persistence times for the 7-day search interval was 8.86 days (Figure 5; Appendix D).

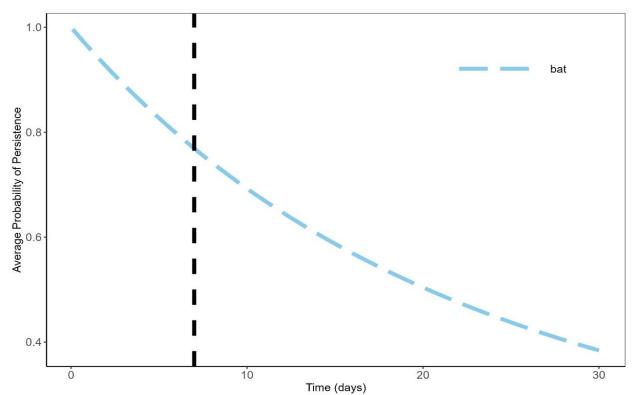


Figure 5. Average probability of carcass persistence as a function of time (days) for bat carcasses placed at the California Ridge Wind Farm, Champaign and Vermillion counties, Illinois, from August 22 – October 13, 2023. Average search interval was seven days and represented by a vertical line on the figure.

#### Search Area Adjustment

Two of the 41 bats found were excluded from modeling the carcass-density because one was found outside of the search area and the other had an estimated time of death prior to the start of carcasses searches. All fatalities included fell within 95 m of the base of the turbine (Table 5). The mean area adjustment was 0.03 for roads and pads (Table 6, Figure 6), meaning that an estimated 3% of bats fell within the search areas of the roads and pads.

Table 5.	Results of relative carcass-density estimation using the using the "Cake Method"
	(Maurer et al. 2020), at the California Ridge Wind Farm, Champaign and Vermilion
	counties, Illinois, from August 22 – October 13, 2023.

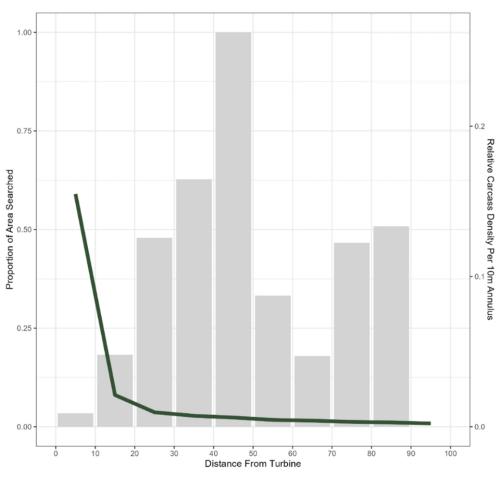
	0		
Number of	Average Detection	Proportion of 10-m	Relative Carcass Density
Carcasses	Пораршку	Annulus Searcheu	Density
7	0.639	0.590	0.009
5	0.624	0.081	0.048
6	0.624	0.037	0.126
6	0.631	0.028	0.165
8	0.627	0.023	0.263
2	0.633	0.017	0.087
	Number of Carcasses 7 5 6 6 8 2	CarcassesProbability70.63950.62460.62460.63180.627	CarcassesProbabilityAnnulus Searched70.6390.59050.6240.08160.6240.03760.6310.02880.6270.023

Table 5.Results of relative carcass-density estimation using the using the "Cake Method"<br/>(Maurer et al. 2020), at the California Ridge Wind Farm, Champaign and Vermilion<br/>counties, Illinois, from August 22 – October 13, 2023.

10-meter (m) Annulus	Number of Carcasses	Average Detection Probability	Proportion of 10-m Annulus Searched	Relative Carcass Density
70	1	0.660	0.016	0.047
80	2	0.637	0.012	0.122
90	2	0.653	0.011	0.133
100	0	0	0.008	0

Table 6.Area adjustment estimate for the California Ridge Wind Farm, Champaign and Vermilion<br/>counties, Illinois, from August 22 – October 13, 2023. Estimate was calculated using the<br/>"Cake Method" (Maurer et al. 2020).

Size Class	Search Area Type	Area Adjustment
Bat	Road and pad	0.03



Plot Search Type 💻 Road and Pad

Figure 6. Density of bat carcasses per area searched at all 95-meter road and pads at the California Ridge Wind Farm, Champaign and Vermilion counties, Illinois, from August 22 – October 13, 2023.

#### Detection Probability Estimates – Evidence of Absence

The overall probability of detection achieved for the 2023 monitoring period was 0.013 (90% CI: 0.011-0.015) for Indiana bat and northern long-eared bat and 0.009 (90% CI: 0.008-0.010) for little brown bat and tricolored bat (Table 7). The cumulative *g* over the past three years of monitoring was 0.073 (90% CI: 0.070-0.076) for Indiana bat and northern long-eared bat and 0.069 (90% CI: 0.067-0.071) for little brown bat and tricolored bat (Table 7). Differences in the arrival proportions used for Indiana bat/northern long-eared bat and little brown bat/tricolored bat (see *Methods*) resulted in slightly different *g* distributions for these species. Inputs required to run the EoA Single Class module and stratum-specific *g* distribution values and inputs required for the Multiple Class and Multiple Years modules are described in Appendix A.

Table 7.	Probability of detection (g), Ba, and Bb for the California Ridge Wind Farm, Champaign
	and Vermilion counties, Illinois, from July 19 - October 14, 2021, April 1 -
	October 15, 2022, and August 22 – October 13, 2023.

Year	Species Group	Ba*	Bb*	g	90% CI
2021	INBA/NLEB	29.295	2,295.992	0.013	0.009-0.017
2021	LBBA/TRBA	27.782	3,157.140	0.009	0.006-0.012
2022	INBA/NLEB	1,200.049	4,992.981	0.194	0.186-0.202
2022	LBBA/TRBA	2,547.059	10,889.440	0.190	0.184-0.195
2023	INBA/NLEB	117.607	8,967.292	0.013	0.011–0.015
2023	LBBA/TRBA	118.046	13,059.497	0.009	0.008-0.010
Cumulative for ITP	INBA/NLEB	1,394.23	17,677.14	0.073	0.070-0.076
monitoring to date	LBBA/TRBA	2,697.73	36,353.84	0.069	0.067-0.071

CI = Confidence Interval; ITP = Incidental Take Permit; INBA = Indiana bat; NLEB = northern long-eared bat; LBBA = little brown bat; TRBA = tricolored bat.

\* =  $\alpha$  and  $\beta$  parameters of beta distribution describing detection probability as defined in Evidence of Absence.

#### Adjusted Overall Bat Fatality Estimates – GenEst

The overall bat fatality estimate for the 2023 study was 9.86 bats per MW (90% CI: 7.08–13.41; Table 8). Inputs used to calculate fatality estimates are presented in Appendix E.

Table 8.Seasonal and overall bat fatality rates per turbine and megawatt (MW) using GenEst for<br/>studies conducted at the California Ridge Wind Farm, Champaign and Vermilion<br/>counties, Illinois, from August 22 – October 15, 2023.

Season	Bat Fatality Estimate	90% Confidence	Bat Fatality Estimate	90% Confidence	
	per Turbine	Interval	per MW	Interval	
Fall	15.78	11.32–21.46	9.86	7.08–13.41	

#### Assessment of Adaptive Management Triggers

During year three of PCM, no Covered Species were recorded. During the previous two years of PCM, a single Indiana bat and single little brown bat carcass have been found. No northern longeared bat or tricolored bat carcasses have been recorded under the ITP or ITA. No adaptive management triggers have been met as the number of carcasses recorded were below the adaptive management triggers for the initial five years of the ITP for all Covered Species (Table 9).

Table 9.	Summary of adaptive management evaluations based upon the results from the first
	three years of compliance monitoring at the California Ridge Wind Farm, Champaign and
	Vermilion counties, Illinois.

Compliance Metric	Species	Adaptive Management Trigger	Number of Carcasses Discovered (2021 – 2023)	Adaptive Managemen t Required?
Number of Covered	Indiana bat	2	1	No
Number of Covered Species found during initial five years	northern long-eared bat	4	0	No
	little brown bat	9	1	No
	tricolored bat	13	0	No

# CONCLUSIONS

One Indiana bat carcass and one little brown bat carcass, both HCP Covered Species, were recorded in 2022 and no additional covered species were found during 2023 monitoring (and none were found in 2021). Although Covered Species carcasses have been found at the Project, the number of Covered Species carcasses found during the initial three years of ITP monitoring were below the levels that would trigger adaptive management, and thus no adaptive management actions were triggered. Annual monitoring will occur again during the fall 2024 season, and no changes are proposed to the protocols at this time.

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Appendix A. Inputs for Single Class, Multiple Class, and Multiple Year Modules in Evidence of Absence for the 2023 Post-construction Monitoring at the California Ridge Wind Farm, Champaign and Vermilion Counties, Illinois, from August 22 – October 13, 2023

# Appendix A1. Inputs needed to run Evidence of Absence (EoA): Single Class Module for the California Ridge Wind Farm, Champaign and Vermilion counties, Illinois, from August 22 – October 13, 2023.<sup>1</sup>

		-	-	-	-	Searcher Efficiency		Carcass Persistence <sup>3</sup>	
Species			Search	Number of	Spatial	Carcasses	Carcasses		
Group	Season	Plot Type	Interval (I)	Searches <sup>2</sup>	Coverage (a)	Available	Found	Shape (α)	Scale (β)
INBA/NLEB	Fall	95-m road and pad	7	8	0.03	32	23	NA	12.78
LBBA/TRBA	Fall	95-m road and pad	7	8	0.03	32	23	NA	12.78

<sup>1</sup> Inputs in each row apply to both species identified.

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

<sup>3</sup> An exponential distribution was used for carcass persistence distribution.

INBA = Indiana Bat; NLEB = northern long-eared bat; LBBA = little brown bat; TRBA = tricolored bat; m = meter.

Appendix A2. Indiana bat/northern long-eared bat and little brown bat/tricolored bat species group inputs needed to run Evidence of Absence: Multiple Class Module<sup>1</sup> for the California Ridge Wind Farm, Champaign and Vermilion counties, Illinois, from August 22 – October 13, 2023.<sup>2</sup>

Species					Within-season	Within-season	
Group	Season	Plot Type	Ва	Bb	<b>Sampling Fraction</b>	<b>Risk Fraction</b>	DWP
INBA/NLEB	Spring	Unsearched	0.01	1,000	1.000	1.000	1.0
LBBA/TRBA	Spring	Unsearched	0.01	1,000	1.000	1.000	1.0
INBA/NLEB	Summer	Unsearched	0.01	1,000	1.000	1.000	1.0
LBBA/TRBA	Summer	Unsearched	0.01	1,000	1.000	1.000	1.0
INBA/NLEB	Fall	Unsearched	0.01	1,000	1.000	0.303	0.3
LBBA/TRBA	Fall	Unsearched	0.01	1,000	1.000	0.303	0.3
INBA/NLEB	Fall	Road and pad	116.919	6,101.647	0.993	0.712	0.7
LBBA/TRBA	Fall	Road and pad	116.919	6,101.647	0.993	0.712	0.7

<sup>1</sup> Module was run twice, once using the Indiana bat/northern long-eared bat (INBA/NLEB) inputs and once using the little brown bat/tricolored bat (LBBA/TRBA) inputs.

<sup>2</sup> The inputs in each row apply to both species identified.

m = meters.

Appendix A3. Indiana bat/northern long-eared (INBA/NLEB) and little brown bat/tricolored bat (LBBA/TRBA) species groups inputs needed to run Evidence of Absence: Multiple Class Module for the California Ridge Wind Farm, Champaign and Vermilion counties, Illinois, from August 22 – October 13, 2023.

Season	Species Group	Ва	Bb	Weights (DWP)
Spring	INBA/NLEB	0.010	1,000	0.017
Spring	LBBA/TRBA	0.010	1,000	0.065
Summer	INBA/NLEB	0.010	1,000	0
	LBBA/TRBA	0.010	1,000	0.255
Fall	INBA/NLEB	117.577	8,810.738	0.983
Fall	LBBA/TRBA	117.577	8,810.738	0.680

Appendix A4. Indiana bat/northern long-eared bat species group inputs needed to run Evidence of Absence: Multiple Years Module for the California Ridge Wind Farm, Champaign and Vermilion counties, Illinois.

Year	g	90% Confidence Interval	Ba	Bb	Weights (ρ)
2021	0.0130	(0.009–0.017)	29.295	2,295.992	1.0
2022	0.1940	(0.186–0.202)	1,200.049	4,992.981	1.0
2023	0.0129	(0.011–0.015)	117.607	8,967.292	1.0

Appendix A5. Little brown bat/tricolored bat species group inputs needed to run Evidence of Absence: Multiple Years Module for the California Ridge Wind Farm, Champaign and Vermilion counties, Illinois.

Year	g	90% Confidence Interval	Ва	Bb	Weights (ρ)
2021	0.009	(0.006–0.012)	27.782	3,157.140	1.0
2022	0.190	(0.184–0.195)	2,547.059	10,889.440	1.0
2023	0.009	(0.008–0.010)	118.046	13,059.497	1.0

Detection Probability (g)		
Search Schedule	Searcher Efficiency	Persistence Distribution
Start of monitoring (yyyy-mm-dd) 2023-08-22	C Carcasses available for several searches	C Use field trials to estimate parameters View/Edit
Formula     Search interval (I)     Number of searches	95% Cls: $p \in [0.535, 0.67]$ , $k \in [0.66, 0.813]$ $\hat{p} = 0.62$ , $\hat{k} = 0.735$ View Edit	Distribution: Lognormal with shape (α) = 4.078 and scale (β) = 1.171 r = 0.531 for lr = 7, with 95% Cls: r = [0.416, 0.657], β = [0.488, 1.854]
	Carcasses removed after one search	Enter parameter estimates manually     View
C Custom Edit/View	Carcasses available 32	Exponential
span = 182, I (mean) = 7	Carcasses found 23 $\hat{p} = 0.719$ , with 95% CI = [0.549, 0.851]	Weibull rate 0.0782
Spatial coverage (a) 0.03 Temporal coverage (v) 1	Factor by which searcher efficiency changes with 0.8 each search (k)	Log-Logistic         scale (β)         12.78         lwr         9.07         upr         17.99           Lognormal         r = 0.77 for lr = 7, with 95% Cl: r ∈ [0.697, 0.828]         r         10.697, 0.828]
Estimate g		
atality estimation (M, $\lambda$ )		
		10
Carcass Count (X) 0 Estimate		ed Cl Close
Credibility level (1 - α) 0.9 Estimat	eλ	
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Immary statistics for estimat esults: all site for full year Estimated $g = 0.0187$ , 95% C Fitted beta distribution pa all site for monitored period Estimated $g = 0.0187$ , 95% C Fitted beta distribution pa Temporal coverage (within y earched area for monitored pe Estimated $g = 0.624$ , 95% CI Fitted beta distribution pa trial carcasses placed = 32 estimated searcher efficien k = 0.8 Search schedule: Search int spatial coverage: 0.03 arcass persistence: Exponential persistence dis scale ( $\beta$ ) = 12.78 95% CI $\beta$ = [9.07, 17.99]	<pre>I = [0.0155, 0.0223] rameters for estimated g: Ba = 114.54 (, 22-Aug-2023 through 17-Oct-2023 I = [0.0154, 0.0223] rameters for estimated g: Ba = 110.97 ear) = 1 riod, 22-Aug-2023 through 17-Oct-2023 = [0.509, 0.733] rameters for estimated g: Ba = 43.583 rameters for estimated g: Ba = 43.583 (, carcasses found = 23 cy: p = 0.715, 95% CI = [0.549, 0.853 erval (I) = 7, number of searches = 4 temporal coverage: 1 tribution and r = 0.77 for Ir = 7 with 95% CI = 1 tribution</pre>	D37, Bb = 5997.5237 788, Bb = 5812.9127 3 2, Bb = 26.2148 1] 3, span = 56
ummary statistics for estimat esults: ull site for full year Estimated g = 0.0187, 95% C Fitted beta distribution pa ull site for monitored period Estimated g = 0.0187, 95% C Fitted beta distribution pa Temporal coverage (within y earched area for monitored pe Estimated g = 0.624, 95% CI Fitted beta distribution pa nput: earch parameters trial carcasses placed = 32 estimated searcher efficien k = 0.8 Search schedule: Search int spatial coverage: 0.03 arcass persistence: Exponential persistence dis scale (β) = 12.78	<pre>I = [0.0155, 0.0223] rameters for estimated g: Ba = 114.54 (, 22-Aug-2023 through 17-Oct-2023 I = [0.0154, 0.0223] rameters for estimated g: Ba = 110.97 ear) = 1 riod, 22-Aug-2023 through 17-Oct-2023 = [0.509, 0.733] rameters for estimated g: Ba = 43.583 rameters for estimated g: Ba = 43.583 (, carcasses found = 23 cy: p = 0.715, 95% CI = [0.549, 0.853 erval (I) = 7, number of searches = 4 temporal coverage: 1 tribution and r = 0.77 for Ir = 7 with 95% CI = 1 tribution</pre>	D37, Bb = 5997.5237 788, Bb = 5812.9127 3 2, Bb = 26.2148 1] 3, span = 56
ummary statistics for estimat esults: ull site for full year Estimated g = 0.0187, 95% C Fitted beta distribution pa ull site for monitored period Estimated g = 0.0187, 95% C Fitted beta distribution pa Temporal coverage (within y earched area for monitored pe Estimated g = 0.624, 95% CI Fitted beta distribution pa nput: earch parameters trial carcasses placed = 32 estimated searcher efficien k = 0.8 Search schedule: Search int spatial coverage: 0.03 arcass persistence: Exponential persistence dis scale (β) = 12.78 95% CI β = [9.07, 17.99] Parameters entered manual	<pre>I = [0.0155, 0.0223] rameters for estimated g: Ba = 114.54 (, 22-Aug-2023 through 17-Oct-2023 I = [0.0154, 0.0223] rameters for estimated g: Ba = 110.97 ear) = 1 riod, 22-Aug-2023 through 17-Oct-2023 = [0.509, 0.733] rameters for estimated g: Ba = 43.583 rameters for estimated g: Ba = 43.583 (, carcasses found = 23 cy: p = 0.715, 95% CI = [0.549, 0.853 erval (I) = 7, number of searches = 4 temporal coverage: 1 tribution and r = 0.77 for Ir = 7 with 95% CI = 1 tribution</pre>	D37, Bb = 5997.5237 788, Bb = 5812.9127 3 2, Bb = 26.2148 1] 3, span = 56

Appendix A6. Screenshot of Evidence of Absence (v2.0.7) Graphical User Interface, Single Class Module inputs and output for fall 2023, road and pad searches.

Individual classes       Immer_unsearch       0       0.01       1000       1e-5       52e-164, 4.7.         Individual classes       Immer_unsearch       0       0       0.01       1000       1e-5       52e-164, 4.7.         Individual classes       Immer_unsearch       0       0       0.01       1000       1e-5       52e-164, 4.7.         Immer_unsearch       0.0983       0       117.539       8554.714       0.01355       [0.0112, 0.01         R Estimated detection probability (g) for multiple classes       Immer_unsearch       0       0       1000       1e-5       52e-164, 4.7.         Summary statistics for multiple classes       Immer_unsearch       0       0       0.0112, 0.01       0.01       0.012, 0.01       10.01       0.01       10.01       0.01       10.00       0.000       0.000]       117.55       555       0.01       10.01       0.01       10.01       0.01 <t< th=""><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th></t<>								
C Estimate total mortality (M) Credibility level (1 - a)       0.3       C One-sided CI (M*) C Two-sided CI         C Estimate overall detection probability (g) Individual classes       C Two-sided CI (M*) C Calculate g parameters from monitoring data         C Calculate g parameters from monitoring data       C Calculate g parameters from monitoring data         C Calculate g parameters manually       Fail         R Estimate detection probability, (g) for multiple classe estimate         Summary statistics for multiple class estimate         Individual classes         Class       DWP         X       Ba         Bb       g data         Search coverage = 1         Class       DWP         X       Ba         Bb       g data         Search coverage = 1         Class       DWP         Class       DWP         Search coverage = 1         Class       As	Options	Actions						
Credibility level (1 - 0)       0.8       C One-sided CI (M*)       C Class       dvp       X       Ba       Bb       g       95% CI         Individual classes       C Calculate g parameters from monitoring data       0       0       0.01       1000       1e-5       52e-164, 4.7.         'C Calculate g parameters from monitoring data       C       Enter g parameters manually       0       0.011       1000       1e-5       52e-164, 4.7.         'E Enter g parameters manually       C       Eass       0       0       0.011       1000       1e-5       52e-164, 4.7.         'E Enter g parameters manually       C       Eastimated detection probability (g) for multiple classes       immer_unsearch       0       0       0       117.539       8554.714       0.01355       [0.0112, 0.01         R Estimated detection probability (g) for multiple classes       Immer_unsearch       0       0       0	Overall	Add class Cal	culate	Clear	Close			
Credibility level (1 - a)       0.8       C One-sided CI (M')         C Two-sided CI       Two-sided CI         * Estimate overall detection probability (g)       individual classes         * Calculate g parameters from monitoring data         * Enter g parameters from multiple classe         * Estimated detection probability (g) for multiple classe         * Estimated detection probability, by search class         Search coverage = 1         Class       DNP         Class       DNP         Septing_unsearch       0.01         0       0.01         111       0.983         0       0         0       0         Class       DNP         Search coverage = 1         Class       DNP         0       0         0       0         111       0.983         0       0.01         1215       0.01         1216       0         1217       0         1218       One-sided CI (M')         1219       0.01         1210       0.983         1210       0.983         1210       0.01         1210       0.011	C Estimate total mortality (M)	Chart	4	v	0-	DL	4	059/ 01
Closently (Ed) (1 d) (1	Gradibility Javal (1 - a) 0.9 One-sided CI (M*)					1		
Individual classes       fall       0.983       0       117.539       8554.714       0.01355       [0.0112,0.01]         C Calculate g parameters from monitoring data       image: constraint of the second seco	C Two-sided Cl		-				-	.52e-164, 4.72e
<pre>C Calculate g parameters from monitoring data     for full site  eterection probability Estimated getage of a sumed filted (95% CI) unsearched double of assumed filted for summer_unsearch 0.017 [0.003, 0.996] summer_unsearch 0.017 [0.003, 0.996] summer_unsearch 0.017 [0.003, 0.996] summer_unsearch 0.017 [0.003, 0.096] summer_unsearch 0.017 [0.003, 0.996] summer_unsearch 0.017 [0.003, 0.996] summer_unsearch 0.017 [0.003, 0.096] summer_unsearch 0.017 [0.003, 0.096] </pre>	<ul> <li>Estimate overall detection probability (g)</li> </ul>	ummer_unsearch	0	0	0.01	1000	1e-5	.52e-164, 4.72e
<pre>C Enter g parameters manually R Estimated detection probability (g) for multiple classes Summary statistics for multiple class estimate Input: Detection probability, by search class Search coverage = 1 Class DNP X Ba Bb ghat 95% CI unsearched 0 0 0 0 [ 0, 0] symtmg_unsearch 0.017 0 0.01 1000 0.000 [0.000, 0.000] fall 0.993 0 117.5 8555 0.014 [0.011, 0.016] Results for full site Detection probability Estimated g = 0.013, 95% CI = [0.011, 0.016] Fitted beta distribution parameters for estimated g: Ba = 117.5694, Bb = 8706.8336 Mortality Rest of assumed relative weights (rho) Class Assumed Fitted (95% CI) unsearched 0.000 [0.003, 0.996] summer_unsearch 0.017 [0.003, 0.996] summer_unsearch 0.000 [0.000, 0.014] </pre>	Individual classes	fall	0.983	0	117.539	8554.714	0.01355	[0.0112, 0.016]
<pre>R Estimated detection probability (g) for multiple classes Summary statistics for multiple class estimate</pre>	C Calculate g parameters from monitoring data							
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_unsearch 0.017 0 0.01 1000 0.000 [0.000, 0.000] summer_unsearch 0 0 0.01 1000 0.000 [0.000, 0.000] fall 0.983 0 117.5 8555 0.014 [0.011, 0.016] Fall 0.983 0 117.5 8555 0.014 [0.011, 0.016] Petection probability Estimated g = 0.013, 95% CI = [0.011, 0.016] Fitted beta distribution parameters for estimated g: Ba = 117.5694, Bb = 8706.8336 Mortality Petection summer interve weights (rho) Class Assumed Fitted (95% CI) unsearched 0.000 NA spring_unsearch 0.017 [0.003, 0.996] summer_unsearch 0.000 NA spring_unsearch 0.000 [0.002, 0.995] fall 0.983 [0.000, 0.014]	<ul> <li>Enter g parameters manually</li> </ul>							
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_unsearch 0.017 0 0.01 1000 0.000 [0.000, 0.000] fall 0.983 0 117.5 8555 0.014 [0.011, 0.016] Results for full site Detection probability Estimated g = 0.013, 95% CI = [0.011, 0.016] Fitted beta distribution parameters for estimated g: Ba = 117.5694, Bb = 8706.8336 Mortality Pest of assumed relative weights (rho) Class Assumed Fitted (95% CI) unsearched 0.000 NA spring_unsearch 0.017 [0.003, 0.996] summer_unsearch 0.000 [0.002, 0.995] fall 0.993 [0.000, 0.014]								
Aummary statistics for multiple class estimate mput: Detection probability, by search class Search coverage = 1 Class DWP X Ba Bb ghat 95% CI unsearched 0 0 0 [ 0, 0] spring_unsearch 0.017 0 0.01 1000 0.000 [0.000, 0.000] fall 0.983 0 117.5 8555 0.014 [0.011, 0.016] fall 0.983 0 117.5 8555 0.014 [0.011, 0.016] results for full site Detection probability Estimated g = 0.013, 95% CI = [0.011, 0.016] Fitted beta distribution parameters for estimated g: Ba = 117.5694, Bb = 8706.8336 Hortality Pet of assumed relative weights (rho) Class Assumed Fitted (95% CI) unsearched 0.000 NA spring_unsearch 0.017 [0.003, 0.996] summer_unsearch 0.000 [0.002, 0.995] fall 0.983 [0.000, 0.014]								
<pre>input: Detection probability, by search class Search coverage = 1 Class DWP X Ba Bb ghat 95% CI unsearched 0 0 0 [ 0, 0] spring_unsearch 0.017 0 0.01 1000 0.000 [0.000, 0.000] summer_unsearch 0 0 0.01 1000 0.000 [0.000, 0.000] fall 0.983 0 117.5 8555 0.014 [0.011, 0.016] class Compositive Estimated g = 0.013, 95% CI = [0.011, 0.016] Fitted beta distribution parameters for estimated g: Ba = 117.5694, Bb = 8706.8336 fortality eet of assumed relative weights (rho) Class Assumed Fitted (95% CI) unsearched 0.000 NA spring_unsearch 0.017 [0.003, 0.996] summer_unsearch 0.000 [0.002, 0.995] fall 0.983 [0.000, 0.014]</pre>	Estimated detection probability (g) for multiple classes							
nput: Detection probability, by search class Search coverage = 1 Class DWP X Ba Bb ghat 95% CI unsearched 0 0 0 [ 0, 0] spring_unsearch 0.017 0 0.01 1000 0.000 [0.000, 0.000] fall 0.983 0 117.5 8555 0.014 [0.011, 0.016] esults for full site etection probability Estimated g = 0.013, 95% CI = [0.011, 0.016] Fitted beta distribution parameters for estimated g: Ba = 117.5694, Bb = 8706.8336 Nortality est of assumed relative weights (rho) Class Assumed Fitted (95% CI) unsearched 0.000 NA spring_unsearch 0.017 [0.003, 0.996] summer_unsearch 0.000 [0.002, 0.995] fall 0.983 [0.000, 0.014]								
Class DWF X Ba Bb ghat 95% CI unsearched 0 0 0 [ 0, 0] spring_unsearch 0.017 0 0.01 1000 0.000 [0.000, 0.000] summer_unsearch 0 0 0.01 1000 0.000 [0.000, 0.000] fall 0.983 0 117.5 8555 0.014 [0.011, 0.016] metection probability Estimated g = 0.013, 95% CI = [0.011, 0.016] Fitted beta distribution parameters for estimated g: Ba = 117.5694, Bb = 8706.8336 Mortality West of assumed relative weights (rho) Class Assumed Fitted (95% CI) unsearched 0.000 NA spring_unsearch 0.017 [0.003, 0.996] summer_unsearch 0.000 [0.002, 0.995] fall 0.983 [0.000, 0.014]				-				
unsearched       0       0        0       [0, 0]         spring_unsearch       0.017       0       0.01       1000       0.000       [0.000, 0.000]         summer_unsearch       0       0       0.01       1000       0.000       [0.010, 0.000]         fall       0.983       0       117.5       8555       0.014       [0.011, 0.016]         esults       for full site              betection probability       Estimated g = 0.013, 95% CI = [0.011, 0.016]            Fitted beta distribution parameters for estimated g: Ba = 117.5694, Bb = 8706.8336								
spring_unsearch       0.017       0       0.01       1000       0.000       0.000]         summer_unsearch       0       0       0.01       1000       0.000       0.000]         fall       0.983       0       117.5       8555       0.014       [0.011, 0.016]         essults for full site								
summer_unsearch       0       0       0.01       1000       0.000       0.000]         fall       0.983       0       117.5       8555       0.014       [0.011, 0.016]         tesults for full site								
fall       0.983       0       117.5       8555       0.014       (0.011, 0.016)         Results for full site								
Detection probability Estimated g = 0.013, 95% CI = [0.011, 0.016] Fitted beta distribution parameters for estimated g: Ba = 117.5694, Bb = 8706.8336 Mortality Mest of assumed relative weights (rho) Class Assumed Fitted (95% CI) unsearched 0.000 NA spring_unsearch 0.017 [0.003, 0.996] summer_unsearch 0.000 [0.002, 0.995] fall 0.983 [0.000, 0.014]								
Detection probability Estimated g = 0.013, 95% CI = [0.011, 0.016] Fitted beta distribution parameters for estimated g: Ba = 117.5694, Bb = 8706.8336 Mortality Test of assumed relative weights (rho) Class Assumed Fitted (95% CI) unsearched 0.000 NA spring_unsearch 0.017 [0.003, 0.996] summer_unsearch 0.000 [0.002, 0.995] fall 0.983 [0.000, 0.014]	Results for full site			-				
Estimated g = 0.013, 95% CI = [0.011, 0.016] Fitted beta distribution parameters for estimated g: Ba = 117.5694, Bb = 8706.8336 Mortality Test of assumed relative weights (rho) Class Assumed Fitted (95% CI) unsearched 0.000 NA spring_unsearch 0.017 [0.003, 0.996] summer_unsearch 0.000 [0.002, 0.995] fall 0.983 [0.000, 0.014]				_				
Fitted beta distribution parameters for estimated g: Ba = 117.5694, Bb = 8706.8336         Mortality         Test of assumed relative weights (rho)         Class       Assumed         Nesearched       0.000         NA         spring_unsearch       0.017         0.000       [0.002, 0.995]         fall       0.983	Detection probability							
State         State <th< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></th<>								
Class       Assumed       Fitted (95% CI)         unsearched       0.000       NA         spring_unsearch       0.017       [0.003, 0.996]         summer_unsearch       0.000       [0.002, 0.995]         fall       0.983       [0.000, 0.014]								
Class         Assumed         Fitted (95% CI)           unsearched         0.000         NA           spring_unsearch         0.017         [0.003, 0.996]           summer_unsearch         0.000         [0.002, 0.995]           fall         0.983         [0.000, 0.014]	Fitted beta distribution parameters for estimated	g: Ba = 117.5694, Bb	= 8706					
unsearched         0.000         NA           spring_unsearch         0.017         [0.003, 0.996]           summer_unsearch         0.000         [0.002, 0.995]           fall         0.983         [0.000, 0.014]		g: Ba = 117.5694, Bb	= 8706					
spring_unsearch         0.017         [0.003, 0.996]           summer_unsearch         0.000         [0.002, 0.995]           fall         0.983         [0.000, 0.014]	fortality	g: Ba = 117.5694, Bb	= 8706					
summer_unsearch 0.000 [0.002, 0.995] fall 0.983 [0.000, 0.014]	fortality Test of assumed relative weights (rho) Class Assumed Fitted (95% CI)	g: Ba = 117.5694, Bb	= 8706					
	Aortality Test of assumed relative weights (rho) Class Assumed Fitted (95% CI) unsearched 0.000 NA	g: Ba = 117.5694, Bb	= 8706					
p - 1 for fikefinood facto test of no. assumed fino - true fino	fortality Test of assumed relative weights (rho) Class Assumed Fitted (95% CI) unsearched 0.000 NA spring_unsearch 0.017 [0.003, 0.996] summer_unsearch 0.000 [0.002, 0.995]	g: Ba = 117.5694, Bb	= 8706					
	fortality Test of assumed relative weights (rho) Class Assumed Fitted (95% CI) unsearched 0.000 NA spring_unsearch 0.017 [0.003, 0.996] summer_unsearch 0.000 [0.002, 0.995] fall 0.983 [0.000, 0.014]		= 8706					
	Nortality Test of assumed relative weights (rho) Class Assumed Fitted (95% CI) unsearched 0.000 NA spring_unsearch 0.017 [0.003, 0.996] summer_unsearch 0.000 [0.002, 0.995] fall 0.983 [0.000, 0.014]		= 8706					
	ortality est of assumed relative weights (rho) Class Assumed Fitted (95% CI) unsearched 0.000 NA spring_unsearch 0.017 [0.003, 0.996] summer_unsearch 0.000 [0.002, 0.995] fall 0.983 [0.000, 0.014]		= 8706					
	est of assumed relative weights (rho) Class Assumed Fitted (95% CI) unsearched 0.000 NA spring_unsearch 0.017 [0.003, 0.996] summer_unsearch 0.000 [0.002, 0.995] fall 0.983 [0.000, 0.014]		= 8706					
	Nortality Test of assumed relative weights (rho) Class Assumed Fitted (95% CI) unsearched 0.000 NA spring_unsearch 0.017 [0.003, 0.996] summer_unsearch 0.000 [0.002, 0.995] fall 0.983 [0.000, 0.014]		= 8706					
	fortality Test of assumed relative weights (rho) Class Assumed Fitted (95% CI) unsearched 0.000 NA spring_unsearch 0.017 [0.003, 0.996] summer_unsearch 0.000 [0.002, 0.995] fall 0.983 [0.000, 0.014]		= 8706					
	fortality Test of assumed relative weights (rho) Class Assumed Fitted (95% CI) unsearched 0.000 NA spring_unsearch 0.017 [0.003, 0.996] summer_unsearch 0.000 [0.002, 0.995] fall 0.983 [0.000, 0.014]		= 8706					
	Nortality Test of assumed relative weights (rho) Class Assumed Fitted (95% CI) unsearched 0.000 NA spring_unsearch 0.017 [0.003, 0.996] summer_unsearch 0.000 [0.002, 0.995] fall 0.983 [0.000, 0.014]		= 8706					
	Nortality Test of assumed relative weights (rho) Class Assumed Fitted (95% CI) unsearched 0.000 NA spring_unsearch 0.017 [0.003, 0.996] summer_unsearch 0.000 [0.002, 0.995] fall 0.983 [0.000, 0.014]		= 8706					
	ortality est of assumed relative weights (rho) Class Assumed Fitted (95% CI) unsearched 0.000 NA spring_unsearch 0.017 [0.003, 0.996] summer_unsearch 0.000 [0.002, 0.995] fall 0.983 [0.000, 0.014]		= 8706					

Appendix A7. Screenshot of Evidence of Absence (v2.0.7) Graphical User Interface, Multiple Class Module inputs for 2023 for Indiana and northern long-eared bats.

```
EoA, v2.0.7 - Multiple Class Module
                                                                                                                                ×
                                                                                                                  _
Edit Help
 Options
                                                                Actions
 Overall
                                                                 Add class Calculate
                                                                                      Clear
                                                                                             Close
  C Estimate total mortality (M)
                                                                              dwp
                                                                                               Ba
                                                                                                                           95% CI
                                    One-sided CI (M*)
                                                                 unsearched
                                                                                0
                                                                                       0
                                                                                                                  0
                                                                                                                            [0, 0]
      Credibility level (1 - a) 0.8
                                                                                               ....
                                                                                                        ---
                                    C Two-sided Cl
                                                                                       0
                                                                                              0.01
                                                                                                        1000
                                                                                                                       .52e-164, 4.72e-0
                                                                ring_unsearch0.0 0.065
                                                                                                                 1e-5
  · Estimate overall detection probability (g)
                                                                ummer_unsearch 0.255
                                                                                       0
                                                                                              0.01
                                                                                                        1000
                                                                                                                 1e-5
                                                                                                                       .52e-164, 4.72e-0
 Individual classes
                                                                     fall
                                                                               0.68
                                                                                       0
                                                                                             117.539
                                                                                                    8554.714 0.01355 [0.0112, 0.0161]
  C Calculate g parameters from monitoring data
  Enter g parameters manually
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
                                                 Bb ghat
                                                                95% CI
                                          Ba
 unsearched 0 0 -
spring_unsearch0.065 0.065 0 0.01
summer_unsearch 0.255 0 0.01
0.68 0 117.5
                                                                          01
                                                         0
                                                            1
                                                                 0,
                                                  ---
                                                1000 0.000 [0.000, 0.000]
                                                1000 0.000 [0.000, 0.000]
                                                8555 0.014 [0.011, 0.016]
            Results for full site
Detection probability
  Estimated g = 0.009, 95% CI = [0.008, 0.011]
  Fitted beta distribution parameters for estimated g: Ba = 118.0272, Bb = 12683.8164
Mortality
Test of assumed relative weights (rho)
                Assumed Fitted (95% CI)
  Class
  unsearched
                              0.000
                                         NA
  spring_unsearch0.065
                             0.065
                                        [0.005, 0.992]
                                      [0.005, 0.994]
[0.000, 0.011]
  summer_unsearch 0.255
  fall
                             0.680
  p = 1 for likelihood ratio test of HO: assumed rho = true rho
```

Appendix A8. Screenshot of Evidence of Absence (v2.0.7) Graphical User Interface, Multiple Class Module inputs for 2023 for little brown bats and tricolored bats.

@ EoA, v2.0.7 - Mult	inle Vearc N	todule					- 0 X
Edit Help	apre rears is	loudie					^
cuit Heip							Options
Past monitoring ar	nd operation	ns data					Fatalities
Year	ρ	х	Ba	Bb	ĝ	95% CI	<ul> <li>Estimate M Credibility level (1 - α) 0.5</li> </ul>
2021	1	0	29.295	2295.992		[0.00848, 0.0175]	Creationity rever (1 + d)     One-sided CI (M*)
2022	1	1	1200.049	4992.981	0.1938	[0.184, 0.204]	C Total mortality C Two-sided Cl
2023	1	0	117.569	8706.834	0.01332	[0.011, 0.0158]	Project parameters
							Total years in project 6
							Mortality threshold (T) 18
							<ul> <li>Track past mortality</li> </ul>
							C Projection of future mortality and estimates
							Future monitoring and operations
							g and p unchanged from most recent year
							C g and p constant, different from most recent year
							g 0.08 95% CI: 0.07 0.09 p 1
							C g and p vary among future years
							Average Rate
							C Estimate average annual fatality rate (λ)
							Annual rate theshold (τ) 2
							Credibility level for Cl (1-α) 0.9
							( Short-term rate $(\lambda > \tau)$ Term: 3 $\alpha$ 0.01
							C Reversion test ( $\lambda < \rho \tau$ ) $\rho$ 0.6 $\alpha$ 0.1
							Actions
							Calculate Close
							Calculate
R Mortality over 3 ye	ars						
Results	ars						
		, i.e	e., P(M <=	= 16) >=	50%		
Results M* = 16 for 1 - Estimated overa	- α = 0.5 all detec	tion				95% CI = [0.0	^
Results M* = 16 for 1 - Estimated overa Ba = 1395.2,	- α = 0.5 all detec . Bb = 17	tion 657	probabili	ity: g =	0.0732,		^
Results M* = 16 for 1 - Estimated overa Ba = 1395.2, Estimated basel	- α = 0.5 all detec Bb = 17 Line fata	tion 657 lity	probabili rate (for	ity: g =	0.0732,		<b>6</b> 96, 0.077]
Results M* = 16 for 1 - Estimated overa Ba = 1395.2,	- α = 0.5 all detec Bb = 17 Line fata	tion 657 lity	probabili rate (for	ity: g =	0.0732,		<b>6</b> 96, 0.077]
Results M* = 16 for 1 - Estimated over Ba = 1395.2, Estimated basel Cumulative Mort Year	$-\alpha = 0.5$ all detec . Bb = 17 line fata cality Es ( g	tion 657 lity timat M*	probabili rate (for ces median	ity: g = r rho = 1 95% CI	0.0732, ): lamb mean lambda	da = 6.833, 95 95% CI	<pre>696, 0.077] % CI = [0.491, 21.3]</pre>
Results M* = 16 for 1 - Estimated over Ba = 1395.2, Estimated basel Cumulative Mort Year 2021 0	$-\alpha = 0.5$ all detec . Bb = 17 line fata cality Es ( g 0 0.013	tion 657 lity timat M* 17	probabili rate (for ces median 17	ity: g = r rho = 1 95% CI [0, 160]	0.0732, ): lamb mean lambda 41.78	da = 6.833, 95 95% CI [0.03998, 2	▲ CI = [0.491, 21.3]
Results M* = 16 for 1 - Estimated overa Ba = 1395.2, Estimated basel Cumulative Mort Year 2 2021 0 2022 1	$-\alpha = 0.5$ all detec . Bb = 17 line fata cality Es ( g	tion 657 lity timat M*	probabil: rate (for ces median 17 11	ity: g = r rho = 1 95% CI [0, 160]	0.0732, ): lamb mean lambda 41.78	da = 6.833, 95 95% CI	<pre>^</pre>
Results M* = 16 for 1 - Estimated overa Ba = 1395.2, Estimated basel Cumulative Mort Year 2 2021 0 2022 1	$-\alpha = 0.5$ hll detec Bb = 17 line fata cality Es ( g 0.013 1.0.103	tion 657 lity timat M* 17 11	probabil: rate (for ces median 17 11	ity: g = r rho = 1 95% CI [0, 160] [1, 36]	0.0732, ): lamb mean lambda 41.78 14.55	da = 6.833, 95 95% CI [0.03998, 2 [1.046, 45.3	<pre>^</pre>
Results M* = 16 for 1 - Estimated overa Ba = 1395.2, Estimated basel Cumulative Mort Year 2 2021 0 2022 1	$\alpha = 0.5$ All detec Bb = 17 line fata cality Es ( g 0.0.013 0.103 1.0.073	tion 657 lity timat M* 17 11 16	probabil: rate (for ces median 17 11	ity: g = r rho = 1 95% CI [0, 160] [1, 36]	0.0732, ): lamb mean lambda 41.78 14.55 20.5	da = 6.833, 95 95% CI [0.03998, 2 [1.046, 45.3	<pre>^</pre>
Results M* = 16 for 1 - Estimated over Ba = 1395.2, Estimated basel Cumulative Mort Year 2 2021 0 2022 1 2023 1 Annual Mortalit	$-\alpha = 0.5$ all detec Bb = 17 line fata cality Es ( g 0 0.013 1 0.103 1 0.073 cy Estima	tion 657 lity timat 17 11 16 tes	probabil: rate (for ces median 17 11 16	ity: g = r rho = 1 [0, 160] [1, 36] [2, 59]	0.0732, ): lamb mean lambda 41.78 14.55 20.5 mean	da = 6.833, 95 95% CI [0.03998, 2 [1.046, 45.3 [1.474, 63.9	<pre>^</pre>
Results M* = 16 for 1 - Estimated over Ba = 1395.2, Estimated basel Cumulative Mort Year 2 2021 0 2022 1 2023 1 Annual Mortalit Year 2	$-\alpha = 0.5$ all detec Bb = 17 line fata cality Es ( g 0 0.013 1 0.103 1 0.073 cy Estima	tion 657 lity timat M* 17 11 16	probabil: rate (for ces median 17 11 16	<pre>ity: g = r rho = 1 95% CI [0, 160] [1, 36] [2, 59] 95% CI [0, 160]</pre>	0.0732, ): lamb mean lambda 41.78 14.55 20.5 mean lambda 41.780	da = 6.833, 95 95% CI [0.03998, 2 [1.046, 45.3 [1.474, 63.9 95% CI 0 [0.0400, 2	^ 696, 0.077] ♠ CI = [0.491, 21.3] 13.6] 7] 2]
Results M* = 16 for 1 - Estimated over Ba = 1395.2, Estimated basel Cumulative Mort Year 2 2021 0 2022 1 Annual Mortalit Year 2 2021 0 2022 1 0 2022 1 0 2021 0 0 2023 1 0 2023 1 0 2021 1 0 2022 1 0 2022 1 0 2022 1 0 2022 1 0 2022 1 0 0 2022 1 0 0 0 0 0 0 0 0 0 0 0 0 0	- α = 0.5 all detec . Bb = 17 line fata cality Es ( g 0 0.013 1 0.103 1 0.003 cy Estima ( g 0 0.0194	tion 657 lity timat 17 11 16 tes M* 18 6	probabil: rate (for median 17 11 16 median 18 6	<pre>ity: g = r rho = 1 95% CI [0, 160] [1, 36] [2, 59] 95% CI [0, 160] [1, 19]</pre>	0.0732, ): lamb mean lambda 41.78 14.55 20.5 mean lambda 41.780 7.7470	da = 6.833, 95 95% CI [0.03998, 2 [1.046, 45.3 [1.474, 63.9 95% CI 0 [0.0400, 2 [0.5569, 24.	<pre>^</pre>
Results M* = 16 for 1 - Estimated over Ba = 1395.2, Estimated basel Cumulative Mort Year 2021 00 2022 10 Annual Mortalit Year 2021 00 2021 00 2022 10	- α = 0.5 all detec Bb = 17 line fata cality Es ( g 0 0.013 l 0.103 l 0.073 cy Estima ( g 0 0.013	tion 657 lity timat 17 11 16 tes M* 18	probabil: rate (for es median 17 11 16 median 18	<pre>ity: g = r rho = 1 95% CI [0, 160] [1, 36] [2, 59] 95% CI [0, 160]</pre>	0.0732, ): lamb mean lambda 41.78 14.55 20.5 mean lambda 41.780 7.7470	da = 6.833, 95 95% CI [0.03998, 2 [1.046, 45.3 [1.474, 63.9 95% CI 0 [0.0400, 2 [0.5569, 24.	<pre>^</pre>
Results M* = 16 for 1 - Estimated over Ba = 1395.2; Estimated basel Cumulative Mort Year 2 2021 0 2022 1 2023 1 Annual Mortalit Year 2 2021 0 2022 1 2023 0 2023 0	- $\alpha = 0.5$ hll detec . Bb = 17 line fata cality Es (	tion 657 lity timat 17 11 16 tes M* 18 6 17	probabil: rate (for es median 17 11 16 median 18 6 17	<pre>ity: g = r rho = 1 95% CI [0, 160] [1, 36] [2, 59] 95% CI [0, 160] [1, 19] [0, 145]</pre>	0.0732, ): lamb mean lambda 41.78 14.55 20.5 mean lambda 41.780 7.7470 37.990	da = 6.833, 95 95% CI [0.03998, 2 [1.046, 45.3 [1.474, 63.9 95% CI 0 [0.0400, 2 [0.5565, 24. 0 [0.0371, 1]	<pre>^</pre>
Results M* = 16 for 1 - Estimated over Ba = 1395.2, Estimated basel Cumulative Mort Year 2 2021 0 2022 1 2023 1 Annual Mortalit Year 2 2021 0 2022 1 2023 0 Test of assumed	- $\alpha = 0.5$ hll detec . Bb = 17 line fata cality Es (	tion 657 lity timat 17 11 16 tes M* 18 6 17 	probabil: rate (for es median 17 11 16 median 18 6 17	<pre>ity: g = r rho = 1 95% CI [0, 160] [1, 36] [2, 59] 95% CI [0, 160] [1, 19] [0, 145]</pre>	0.0732, ): lamb mean lambda 41.78 14.55 20.5 mean lambda 41.780 7.7470 37.990	da = 6.833, 95 95% CI [0.03998, 2 [1.046, 45.3 [1.474, 63.9 95% CI 0 [0.0400, 2 [0.5565, 24. 0 [0.0371, 1]	<pre>^</pre>
Results M* = 16 for 1 - Estimated over Ba = 1395.2 Estimated basel Cumulative Mort Year 2 2021 0 2022 1 2023 1 Annual Mortalit Year 2 2021 0 2022 1 2023 0 Test of assumed	- α = 0.5 11 detec . Bb = 17 Line fata cality Es ( g 0 0.013 1 0.103 1 0.073 	tion 657 Lity ttimat 17 11 16 tes M* 18 6 17 e wei 0	probabil: rate (for es median 17 11 16 median 18 6 17	<pre>ity: g = r rho = 1 95% CI [0, 160] [1, 36] [2, 59] 95% CI [0, 160] [1, 19] [0, 145]</pre>	0.0732, ): lamb mean lambda 41.78 14.55 20.5 mean lambda 41.780 7.7470 37.990	da = 6.833, 95 95% CI [0.03998, 2 [1.046, 45.3 [1.474, 63.9 95% CI 0 [0.0400, 2 [0.5565, 24. 0 [0.0371, 1]	<pre>^</pre>
Results M* = 16 for 1 - Estimated over Ba = 1395.2, Estimated basel Cumulative Mort Year 2021 0 2022 1 2023 1 Annual Mortalit Year 2021 0 2022 1 2023 0 Test of assumed rho 1 [0.	- α = 0.5 All detect Bb = 17 line fata cality Es ( g 0 0.013 1 0.103 1 0.073 cy Estima ( g 0 0.013 1 0.194 0 0.013 i relativ Fitted rh 95% CI 012, 2.8 ( 012, 2.8) ( 01	tion 657 lity timat 17 16 16 18 6 17 e wei 0 30]	probabil: rate (for es median 17 11 16 median 18 6 17	<pre>ity: g = r rho = 1 95% CI [0, 160] [1, 36] [2, 59] 95% CI [0, 160] [1, 19] [0, 145]</pre>	0.0732, ): lamb mean lambda 41.78 14.55 20.5 mean lambda 41.780 7.7470 37.990	da = 6.833, 95 95% CI [0.03998, 2 [1.046, 45.3 [1.474, 63.9 95% CI 0 [0.0400, 2 [0.5565, 24. 0 [0.0371, 1]	<pre>^</pre>
Results M* = 16 for 1 - Estimated over Ba = 1395.2, Estimated basel Cumulative Mort Year 2021 0 2022 1 2023 1 Annual Mortalit Year 2021 0 2022 1 2023 0 Test of assumed Assumed rho 1 [0.	- α = 0.5 11 detect 2b = 17 1ine fata cality Es ( g 0.0.013 0.013 1.0.103 1.0.103 0.0.13 1.0.194 0.0.013 1.0.194 0.0.013 1.0.194 1.0.013 1.0.194 1.0.013 1.0.194 0.0.013 1.0.194 0.0.013 1.0.194 0.0.013 1.0.194 0.0.013 1.0.194 0.0.013 1.0.194 0.0.013 1.0.22, 2.3 0.22, 2.3 0.23, 2.3 0.23, 2.3 0.23, 2.3 0.23, 2.3 0.25, 2.5 0.25, 2.3 0.25, 2.3 0.25, 2.5 0.25, 2.5 0.5	tion 657 lity timat 17 16 tes M* 18 6 17 e wei 0 30] 82]	probabil: rate (for es median 17 11 16 median 18 6 17	<pre>ity: g = r rho = 1 95% CI [0, 160] [1, 36] [2, 59] 95% CI [0, 160] [1, 19] [0, 145]</pre>	0.0732, ): lamb mean lambda 41.78 14.55 20.5 mean lambda 41.780 7.7470 37.990	da = 6.833, 95 95% CI [0.03998, 2 [1.046, 45.3 [1.474, 63.9 95% CI 0 [0.0400, 2 [0.5565, 24. 0 [0.0371, 1]	<pre>^</pre>
Results           M* = 16 for 1 -           Estimated over           Ba = 1395.2,           Estimated basel           Cumulative Mort           Year         2021           2022         1           2023         1           Annual Mortalit           Year         2021           2022         1           2023         0           Test of assumed rho         1           1         [0.1]           1         [0.1]	- α = 0.5 All detect Bb = 17 line fata cality Es ( g 0 0.013 1 0.103 1 0.103 1 0.073 cy Estima ( g 0 0.013 1 0.194 0 0.013 d relativ Fitted rh 95% (I 012, 2.8 0012, 2.8	tion 657 lity timat 17 11 16 tes M* 18 6 17 te wei 0 30] 82] 27]	probabil: rate (for res median 17 11 16 16 17 ghts (rho	<pre>ity: g = r rho = 1 95% CI [0, 160] [1, 36] [2, 59] 95% CI [0, 160] [1, 19] [0, 145] o) and po</pre>	0.0732, ): lamb mean lambda 41.78 14.55 20.5 mean lambda 41.780 7.7470 37.990 tential	<pre>da = 6.833, 95</pre>	<pre>^</pre>
Results M* = 16 for 1 - Estimated over Ba = 1395.2, Estimated basel Cumulative Mort Year 2021 0 2022 1 2023 1 Annual Mortalit Year 2 2021 0 2022 1 2023 0 Test of assumed 1 [0. 1 [0. 1 [0.]	- α = 0.5 11 detec . Bb = 17 line fata cality Es ( g 0 0.013 1 0.103 1 0.103 1 0.073 cy Estima ( g 0 0.013 1 0.194 0 0.013 1 0.195 1 0.195	tion 657 lity timat 17 11 16 tes M* 18 6 17 e wei 0 30] 82] 27] cood r	probabil: rate (for res median 17 11 16 median 18 6 17 ghts (rho	<pre>ity: g = r rho = 1 95% CI [0, 160] [1, 36] [2, 59] 95% CI [0, 160] [1, 19] [0, 145] o) and po</pre>	0.0732, ): lamb mean lambda 41.78 14.55 20.5 mean lambda 41.780 7.7470 37.990 tential	<pre>da = 6.833, 95</pre>	<pre>^</pre>
Results         M* = 16 for 1 -         Estimated over         Ba = 1395.2,         Estimated basel         Cumulative Mort         Year       2021         2022       12         2023       12         Annual Mortalit         Year       2021         2023       12         2021       02         2022       12         2023       02         Test of assumed rho       1         1       10         1       10         1       10         1       10         1       10         1       10         1       10	- α = 0.5 11 detec . Bb = 17 line fata cality Es ( g 0 0.013 1 0.103 1 0.103 1 0.073 cy Estima ( g 0 0.013 1 0.194 0 0.013 1 0.195 1 0.195	tion 657 lity timat 17 11 16 tes M* 18 6 17 e wei 0 30] 82] 27] cood r	probabil: rate (for res median 17 11 16 median 18 6 17 ghts (rho	<pre>ity: g = r rho = 1 95% CI [0, 160] [1, 36] [2, 59] 95% CI [0, 160] [1, 19] [0, 145] o) and po</pre>	0.0732, ): lamb mean lambda 41.78 14.55 20.5 mean lambda 41.780 7.7470 37.990 tential	<pre>da = 6.833, 95</pre>	<pre>^</pre>
Results M* = 16 for 1 - Estimated over Ba = 1395.2; Estimated basel Cumulative Mort Year 2 2021 0 2022 1 2023 1 Annual Mortalit Year 2 2021 0 2022 1 2023 0 Test of assumed 1 [0. 1 [0. 1 [0. 1 [0. p = 0.88208 for	- α = 0.5 11 detec . Bb = 17 line fata cality Es ( g 0 0.013 1 0.103 1 0.103 1 0.073 cy Estima ( g 0 0.013 1 0.194 0 0.013 1 0.195 1 0.195	tion 657 lity timat 17 11 16 tes M* 18 6 17 e wei 0 30] 82] 27] cood r	probabil: rate (for res median 17 11 16 median 18 6 17 ghts (rho	<pre>ity: g = r rho = 1 95% CI [0, 160] [1, 36] [2, 59] 95% CI [0, 160] [1, 19] [0, 145] o) and po</pre>	0.0732, ): lamb mean lambda 41.78 14.55 20.5 mean lambda 41.780 7.7470 37.990 tential	<pre>da = 6.833, 95</pre>	<pre>^</pre>
Results M* = 16 for 1 Estimated over Ba = 1395.2, Estimated basel Cumulative Mort Year 2021 0 2022 1 2023 1 Annual Mortalit Year 2021 0 2022 1 2023 0 Test of assumed rho 1 [0, 1 [	- \alpha = 0.5 111 detec . Bb = 17 line fata cality Es (	tion 657 lity timat 17 11 16 tes M* 18 6 17 e wei 0 30] 82] 27] 000d r bias: 	probabil: rate (for res median 17 11 16 median 18 6 17	<pre>ity: g = r rho = 1 95% CI [0, 160] [1, 36] [2, 59] 95% CI [0, 160] [1, 19] [0, 145] c) and po t of H0: Bb gha</pre>	0.0732, ): lamb mean lambda 41.782 14.55 20.5 mean lambda 41.780 7.7470 37.990 tential assumed	<pre>da = 6.833, 95</pre>	<pre>^</pre>
Results         M* = 16 for 1 -         Estimated over         Ba = 1395.2         Estimated basel         Cumulative Mort         Year         2021         2022         2023         Annual Mortalit         Year         2021         2022         2023         Cumulative Mortalit         Year         2021         2022         2023         Color         Assumed rho         1         0         1         0         1         0         1      1	- α = 0.5 11 detec . Bb = 17 Line fata cality Es ( g 0 0.013 1 0.103 1 0.103 1 0.073 . y Estima ( g 0 0.013 1 0.194 0 0.013 1 0.194 0 0.013 1 0.194 0 0.013 1 0.194 2 .3 0 0.013 1 0.195 1	tion 657 lity timat 17 11 16 tes 18 6 17 18 6 17 0 30] 82] 27] 000d r blas: 27]	probabil: rate (for res median 17 11 16 median 18 6 17	<pre>ity: g = r rho = 1 95% CI [0, 160] [1, 36] [2, 59] 95% CI [0, 160] [1, 19] [0, 145] p) and po t of H0: Bb gha 2296 0.01</pre>	0.0732, ): lamb mean lambda 41.78 14.55 20.5 mean lambda 41.780 7.7470 37.990 tential assumed 	<pre>da = 6.833, 95</pre>	<pre>^</pre>
Results M* = 16 for 1 Estimated over Ba = 1395.2, Estimated basel Cumulative Mort Year 2021 0 2022 1 2023 1 Annual Mortalit Year 2021 0 2022 1 2023 0 Test of assumed rho 1 [0, 1 [	- α = 0.5 hll detect Bb = 17 line fata cality Es ( g 0 0.013 1 0.103 1 0.103 1 0.073 cy Estima ( g 0 0.013 1 0.194 0 0.013 1 relative fitted rh 95% CI 0.012, 2.8 clikelih relative 1 ikelih relative 1 ikelih relative 1 ikelih 1.000	tion 657 11ity timat 17 11 16 tes M* 18 6 17 * * * * * * * * * * * * * * * * * *	probabil: rate (for res median 17 11 16 median 18 6 17	<pre>ity: g = r rho = 1 95% CI [0, 160] [1, 36] [2, 59] 95% CI [0, 160] [1, 19] [0, 145] c) and po c of H0: Bb gha 2296 0.01 9930 0.19</pre>	0.0732, ): lamb mean lambda 41.78 14.55 20.5 mean lambda 41.780 7.7470 37.990 tential assumed 	<pre>da = 6.833, 95</pre>	<pre>^</pre>
Results         M* = 16 for 1 -         Estimated over         Ba = 1395.2,         Estimated basel         Cumulative Mort         Year         2021         2022         2023         Annual Mortalit         Year         2021         2022         2023         Cumulative Mortalit         Year         2021         2022         1         2023         C         Test of assumed         Assumed rho         1         1         0         1 <td>- α = 0.5 hll detect Bb = 17 line fata cality Es ( g 0 0.013 1 0.103 1 0.103 1 0.073 cy Estima ( g 0 0.013 1 0.194 0 0.013 1 relative fitted rh 95% CI 0.012, 2.8 clikelih relative 1 ikelih relative 1 ikelih relative 1 ikelih 1.000</td> <td>tion 657 11ity timat 17 11 16 tes M* 18 6 17 * * * * * * * * * * * * * * * * * *</td> <td>probabil: rate (for res median 17 11 16 median 18 6 17</td> <td><pre>ity: g = r rho = 1 95% CI [0, 160] [1, 36] [2, 59] 95% CI [0, 160] [1, 19] [0, 145] c) and po c of H0: Bb gha 2296 0.01 9930 0.19</pre></td> <td>0.0732, ): lamb mean lambda 41.78 14.55 20.5 mean lambda 41.780 7.7470 37.990 tential assumed </td> <td><pre>da = 6.833, 95</pre></td> <td><pre>^</pre></td>	- α = 0.5 hll detect Bb = 17 line fata cality Es ( g 0 0.013 1 0.103 1 0.103 1 0.073 cy Estima ( g 0 0.013 1 0.194 0 0.013 1 relative fitted rh 95% CI 0.012, 2.8 clikelih relative 1 ikelih relative 1 ikelih relative 1 ikelih 1.000	tion 657 11ity timat 17 11 16 tes M* 18 6 17 * * * * * * * * * * * * * * * * * *	probabil: rate (for res median 17 11 16 median 18 6 17	<pre>ity: g = r rho = 1 95% CI [0, 160] [1, 36] [2, 59] 95% CI [0, 160] [1, 19] [0, 145] c) and po c of H0: Bb gha 2296 0.01 9930 0.19</pre>	0.0732, ): lamb mean lambda 41.78 14.55 20.5 mean lambda 41.780 7.7470 37.990 tential assumed 	<pre>da = 6.833, 95</pre>	<pre>^</pre>

Appendix A9. Screen shot of Evidence of Absence (v2.0.7) Graphical User Interface, Multiple Years Module inputs for estimation of cumulative detection probability, annual fatality rate ( $\lambda$ ), cumulative mortality (*M*\*) for 2021, 2022, and 2023 for Indiana bats.

EoA, v2.0.7 - Multiple Years Module	– 🗆 X
Edit Help	Options
Past monitoring and operations data	
Year p X Ba Bb ĝ 95% Cl	Fatalities
2021 1 0 29.295 2295.992 0.0126 [0.00848, 0.0175]	Festimate M Credibility level (1 - α) 0.5
2022 1 0 1200.049 4992.981 0.1938 [0.184, 0.204]	One-sided CI (M*)     Total mortality
2023 1 0 117.569 8706.834 0.01332 [0.011, 0.0158]	C Two-sided Cl
	Project parameters
	Total years in project 6
	Mortality threshold (T) 18
	• Track past mortality
	C Projection of future mortality and estimates
	Future monitoring and operations
	G and p unchanged from most recent year
	g and p constant, different from most recent year
	g 0.08 95% CI: 0.07 0.09 p 1
	C g and p vary among future years
	Average Rate
	C Estimate average annual fatality rate (λ)
	Annual rate theshold (τ) 2
	Credibility level for CI (1-α) 0.9
	Short-term rate (λ > τ) Term: 3 α 0.01
	C Reversion test ( $\lambda < \rho \tau$ ) $\rho$ 0.6 $\alpha$ 0.1
	Actions
	Calculate Close
(	
R Mortality over 3 years	
Results	
Results	
Results $M^* = 3 \text{ for } 1 - \alpha = 0.5, \text{ i.e.}, P(M <= 3) >= 50\%$	^
Results $M^{\star} = 3 \text{ for } 1 - \alpha = 0.5, \text{ i.e., } P(M <= 3) >= 50\%$ Estimated overall detection probability: g = 0.0732, 95% CI = [0.0690 Ba = 1395.2, Bb = 17657	6, 0.077]
Results $M^* = 3 \text{ for } 1 - \alpha = 0.5, \text{ i.e., } P(M <= 3) >= 50\%$ Estimated overall detection probability: g = 0.0732, 95% CI = [0.0690]	6, 0.077]
Results $M^{\star} = 3 \text{ for } 1 - \alpha = 0.5, \text{ i.e., } P(M <= 3) >= 50\%$ Estimated overall detection probability: g = 0.0732, 95% CI = [0.0690 Ba = 1395.2, Bb = 17657	6, 0.077]
Results $M^* = 3 \text{ for } 1 - \alpha = 0.5, \text{ i.e., } P(M <= 3) >= 50\%$ Estimated overall detection probability: $g = 0.0732, 95\%$ CI = $[0.0690]$ Ba = 1395.2, Bb = 17657 Estimated baseline fatality rate (for rho = 1): lambda = 2.277, 95\% (Cumulative Mortality Estimates mean	6, 0.077]
<pre>Results M* = 3 for 1 - α = 0.5, i.e., P(M &lt;= 3) &gt;= 50% Estimated overall detection probability: g = 0.0732, 95% CI = [0.069] Ba = 1395.2, Bb = 17657 Estimated baseline fatality rate (for rho = 1): lambda = 2.277, 95% C Cumulative Mortality Estimates</pre>	<pre>^</pre>
Results         M* = 3 for 1 - α = 0.5, i.e., P(M <= 3) >= 50%         Estimated overall detection probability: g = 0.0732, 95% CI = [0.0690         Ba = 1395.2, Bb = 17657         Estimated baseline fatality rate (for rho = 1): lambda = 2.277, 95% CI         Cumulative Mortality Estimates         Year       X         Year       X         2021       0.013       17         17       [0, 160]       41.78         2022       0.0103       2         [0, 17]       4.849       [0.004755, 24.3]	<pre>^</pre>
Results         M* = 3 for 1 - α = 0.5, i.e., P(M <= 3) >= 50%         Estimated overall detection probability: g = 0.0732, 95% CI = [0.069         Ba = 1395.2, Bb = 17657         Estimated baseline fatality rate (for rho = 1): lambda = 2.277, 95% CI         Cumulative Mortality Estimates         Year       X         Year       X         M* median       95% CI         2021       0.013         17       [0, 160]         41.78       [0.03998, 213]	<pre>^</pre>
Results         M* = 3 for 1 - α = 0.5, i.e., P(M <= 3) >= 50%         Estimated overall detection probability: g = 0.0732, 95% CI = [0.0690         Ba = 1395.2, Bb = 17657         Estimated baseline fatality rate (for rho = 1): lambda = 2.277, 95% CI         Cumulative Mortality Estimates         Year       X         Year       X         2021       0.013       17         17       [0, 160]       41.78         2022       0.0103       2         [0, 17]       4.849       [0.004755, 24.3]	<pre>^</pre>
Results         M* = 3 for 1 - α = 0.5, i.e., P(M <= 3) >= 50%         Estimated overall detection probability: g = 0.0732, 95% CI = [0.069/ Ba = 1395.2, Bb = 17657         Estimated baseline fatality rate (for rho = 1): lambda = 2.277, 95% CI         Cumulative Mortality Estimates         Year       X         Year       X         M* median       95% CI         2021       0.013         0.013       17         17       [0, 160]         2022       0.0103         2       [0, 17]         4.849         [0.006694, 34.3]         2023       0.0073         3       [0, 25]         6.832       [0.006694, 34.3]         Annual Mortality Estimates	<pre>^</pre>
Results         M* = 3 for 1 - α = 0.5, i.e., P(M <= 3) >= 50%         Estimated overall detection probability: g = 0.0732, 95% CI = [0.0690         Ba = 1395.2, Bb = 17657         Estimated baseline fatality rate (for rho = 1): lambda = 2.277, 95% CI         Cumulative Mortality Estimates         Year       X         Year       X         2021       0.013       17         17       [0, 160]       41.78         2022       0.0.103       2       [0, 17]         2023       0.0.073       3       [0, 25]       6.832	<pre>^</pre>
Results         M* = 3 for 1 - α = 0.5, i.e., P(M <= 3) >= 50%         Estimated overall detection probability: g = 0.0732, 95% CI = [0.069/ Ba = 1395.2, Bb = 17657         Estimated baseline fatality rate (for rho = 1): lambda = 2.277, 95% C         Cumulative Mortality Estimates         Year       X         Year       X         Annual Mortality Estimates         Year       X	<pre>^</pre>
Results         M* = 3 for 1 - α = 0.5, i.e., P(M <= 3) >= 50%         Estimated overall detection probability: g = 0.0732, 95% CI = [0.069         Ba = 1395.2, Bb = 17657         Estimated baseline fatality rate (for rho = 1): lambda = 2.277, 95% C         Cumulative Mortality Estimates         Year       X g         Year       X g         M* median       95% CI         2021       0.013         2022       0.0103         2023       0.0073         3       [0, 25]         Annual Mortality Estimates         mean         Year       X g         Year       X g         Year       X g         Year       X g         M* median       95% CI         2021       0.013         2023       0.013         Subscience       mean         Year       X g         M* median       95% CI         2021       0.013         18       [0, 160]         10, 8]       2.820         2021       0.013         11       [0, 8]       2.820	<pre>^</pre>
Results         M* = 3 for 1 - α = 0.5, i.e., P(M <= 3) >= 50%         Estimated overall detection probability: g = 0.0732, 95% CI = [0.069/ Ba = 1395.2, Bb = 17657         Estimated baseline fatality rate (for rho = 1): lambda = 2.277, 95% C         Cumulative Mortality Estimates         Year       X         Year       X         Annual Mortality Estimates         Year       X	<pre>^</pre>
Results         M* = 3 for 1 - α = 0.5, i.e., P(M <= 3) >= 50%         Estimated overall detection probability: g = 0.0732, 95% CI = [0.069%         Ba = 1395.2, Bb = 17657         Estimated baseline fatality rate (for rho = 1): lambda = 2.277, 95% C         Cumulative Mortality Estimates         Year       X g         Year       X g         Mortality Estimates         Manual Mortality Estimates         Mean         Year       X g         M* median       95% CI         2023       0.013         Mortality Estimates         Mean         Year       X g         M* median       95% CI         2021       0.013         18       [0.160] 41.7800         2021       0.013         2021       0.013         2021       0.013         2021       0.013         2021       0.013         2021       0.013         2022       0.194         2023       0.013         2023       0.013 </td <td><pre>^</pre></td>	<pre>^</pre>
Results         M* = 3 for 1 - α = 0.5, i.e., P(M <= 3) >= 50%         Estimated overall detection probability: g = 0.0732, 95% CI = [0.069         Ba = 1395.2, Bb = 17657         Estimated baseline fatality rate (for rho = 1): lambda = 2.277, 95% C         Cumulative Mortality Estimates         Year       X g         Year       X g         M* median       95% CI         2021       0.013         2022       0.0103         2023       0.0073         3       [0, 25]         Annual Mortality Estimates         mean         Year       X g         Year       X g         Year       X g         Year       X g         M* median       95% CI         2021       0.013         2023       0.013         Subscience       mean         Year       X g         M* median       95% CI         2021       0.013         18       [0, 160]         10, 8]       2.820         2021       0.013         11       [0, 8]       2.820	<pre>^</pre>
<pre>Results M* = 3 for 1 - α = 0.5, i.e., P(M &lt;= 3) &gt;= 50% Estimated overall detection probability: g = 0.0732, 95% CI = [0.069/ Ba = 1395.2, Bb = 17657 Estimated baseline fatality rate (for rho = 1): lambda = 2.277, 95% C Cumulative Mortality Estimates</pre>	<pre>^</pre>
Results         M* = 3 for 1 - α = 0.5, i.e., P(M <= 3) >= 50%         Estimated overall detection probability: g = 0.0732, 95% CI = [0.069/ Ba = 1395.2, Bb = 17657         Estimated baseline fatality rate (for rho = 1): lambda = 2.277, 95% CI         Cumulative Mortality Estimates         Year       X         Year       X         Year       X         M* median       95% CI         2021       0.0.013       17         17       [0, 160]       41.78         2022       0.0.103       2       2         2023       0.0.073       3       [0, 25]         Annual Mortality Estimates       mean         Year       X       M* median         Year       X       M* median         Year       X       M* median         95% CI       1ambda       95% CI         2023       0.0.013       18       18       [0, 160]         2021       0.0.013       17       17       [0, 145]         2022       0.103       17       17       [0, 0025, 12.950]         2023       0.0.013       17       17       [0, 145]       37.9900       [0.0371, 151]         Test of assumed relative weights (rho) and	<pre>^</pre>
<pre>Results M* = 3 for 1 - α = 0.5, i.e., P(M &lt;= 3) &gt;= 50% Estimated overall detection probability: g = 0.0732, 95% CI = [0.069/ Ba = 1395.2, Bb = 17657 Estimated baseline fatality rate (for rho = 1): lambda = 2.277, 95% C Cumulative Mortality Estimates</pre>	<pre>^</pre>
<pre>Results M* = 3 for 1 - α = 0.5, i.e., P(M &lt;= 3) &gt;= 50% Estimated overall detection probability: g = 0.0732, 95% CI = [0.069/ Ba = 1395.2, Bb = 17657 Estimated baseline fatality rate (for rho = 1): lambda = 2.277, 95% C Cumulative Mortality Estimates Year X g M* median 95% CI lambda 95% CI 2021 0 0.013 17 17 [0, 160] 41.78 [0.03998, 213 2022 0 0.103 2 2 [0, 17] 4.849 [0.004755, 24.3 2023 0 0.073 3 3 [0, 25] 6.832 [0.006694, 34.3 Annual Mortality Estimates Year X g M* median 95% CI lambda 95% CI 2021 0 0.013 18 18 [0, 160] 41.7800 [0.0400, 213 2022 0 0.194 1 1 [0, 8] 2.5820 [0.0025, 12.9800 2023 0 0.013 17 17 [0, 145] 37.9900 [0.0371, 191 Test of assumed relative weights (rho) and potential bias Fitted rho Assumed rho 95% CI 1 [0.017, 2.957] 1 [0.013, 2.943]</pre>	<pre>^</pre>
Results         M* = 3 for 1 - α = 0.5, i.e., P(M <= 3) >= 50%         Estimated overall detection probability: g = 0.0732, 95% CI = [0.069/ Ba = 1395.2, Bb = 17657         Estimated baseline fatality rate (for rho = 1): lambda = 2.277, 95% C         Cumulative Mortality Estimates         Year       X         Mnual Mortality Estimates         Year       X         Year       X<	<pre>^</pre>
Results $M^* = 3 \text{ for } 1 - \alpha = 0.5, \text{ i.e., } P(M <= 3) >= 50\%$ Estimated overall detection probability: $g = 0.0732, 95\%$ CI = [0.069/Ba = 1395.2, Bb = 17657         Estimated baseline fatality rate (for rho = 1): lambda = 2.277, 95\% C         Cumulative Mortality Estimates         Year       X         Year       X         Year       X         0.013       17         17       [0, 160]         2021       0.0.013         2022       0.0.103         2023       0.0.073         3       [0, 25]         Annual Mortality Estimates         Year       X         Year       X         Year       X         Year       M* median         95% CI       lambda         2023       0.0.013         18       [0, 160]         19       0.013         2021       0.0.013         10       [0, 017]         2023       0.0.013         11       [0, 160]         2024       0.0.013         2025       0.0.025, 12.960         2023       0.0.013         2024       0.0.013         17	<pre>^ ^ * 6, 0.077] CI = [0.00223, 11.4] .6] 37] 34] .6000] 0] .7000]</pre>
Results         M* = 3 for 1 - α = 0.5, i.e., P(M <= 3) >= 50%         Estimated overall detection probability: g = 0.0732, 95% CI = [0.069/ Ba = 1395.2, Bb = 17657         Estimated baseline fatality rate (for rho = 1): lambda = 2.277, 95% C         Cumulative Mortality Estimates         Year       X         Year       X <td><pre>^ ^ * 6, 0.077] CI = [0.00223, 11.4] .6] 37] 34] .6000] 0] .7000]</pre></td>	<pre>^ ^ * 6, 0.077] CI = [0.00223, 11.4] .6] 37] 34] .6000] 0] .7000]</pre>
Results         M* = 3 for 1 - α = 0.5, i.e., P(M <= 3) >= 50%         Estimated overall detection probability: g = 0.0732, 95% CI = [0.069/ Ba = 1395.2, Bb = 17657         Estimated baseline fatality rate (for rho = 1): lambda = 2.277, 95% C         Cumulative Mortality Estimates         Year       X         Year       Y         Y       median         Year       Y         Y       median         Year       X         Y       M* <td><pre>^ ^ * 6, 0.077] CI = [0.00223, 11.4] .6] 37] 34] .6000] 0] .7000]</pre></td>	<pre>^ ^ * 6, 0.077] CI = [0.00223, 11.4] .6] 37] 34] .6000] 0] .7000]</pre>
Results         M* = 3 for 1 - α = 0.5, i.e., P(M <= 3) >= 50%         Estimated overall detection probability: g = 0.0732, 95% CI = [0.069/ Ba = 1395.2, Bb = 17657         Estimated baseline fatality rate (for rho = 1): lambda = 2.277, 95% C         Cumulative Mortality Estimates         Year       X         Year       X         Year       X         M* median       95% CI         2021       0.0133       17         17       [0, 160]       41.78         2022       0.0103       17         2023       0.0073       3         10.017       1.4.849       [0.004755, 24.3]         2021       0.0.013       18       18       [0, 160]       41.7800       [0.0400, 213]         2021       0.0.013       18       18       [0, 160]       41.7800       [0.0400, 213]         2021       0.0.013       17       17       [0, 145]       37.9900       [0.0371, 191]         Test of assumed relative weights (rho) and potential bias       Fitted rho         Assumed rho       5% CI       1       [0.00371, 191]         Test of assumed relative weights (rho) and potential bias       Fitted rho         Assumed rho       5% CI       1       [0.013, 2	<pre>^ ^ * 6, 0.077] CI = [0.00223, 11.4] .6] 37] 34] .6000] 0] .7000]</pre>
Results         M* = 3 for 1 - α = 0.5, i.e., P(M <= 3) >= 50%         Estimated overall detection probability: g = 0.0732, 95% CI = [0.069/ Ba = 1395.2, Bb = 17657         Estimated baseline fatality rate (for rho = 1): lambda = 2.277, 95% C         Cumulative Mortality Estimates         Year       X       g         M* median       95% CI       1ambda       95% CI         2021       0 0.013       17       17       [0, 160]       41.78       [0.03996, 213]         2022       0 0.103       17       17       [0, 160]       41.78       [0.03996, 213]         2023       0 0.013       17       17       [0, 160]       41.78       [0.00695, 24.3]         2023       0 0.013       17       17       [0, 17]       4.649       [0.00695, 24.3]         2023       0 0.013       18       18       [0, 160]       41.7800       [0.0460, 213]         2021       0 0.013       18       18       [0, 160]       41.7800       [0.0025, 12.9600]         2023       0 0.013       17       17       [0, 145]       37.9900       [0.0371, 191]         Test of assumed relative weights (rho) and potential bias       Fitted rho       Assumed rho       95% CI       1       [0.017, 2.957]	<pre>^ ^ * 6, 0.077] CI = [0.00223, 11.4] .6] 37] 34] .6000] 0] .7000]</pre>
Results         M* = 3 for 1 - α = 0.5, i.e., P(M <= 3) >= 50%         Estimated overall detection probability: g = 0.0732, 95% CI = [0.069/ Ba = 1395.2, Bb = 17657         Estimated baseline fatality rate (for rho = 1): lambda = 2.277, 95% CI         Cumulative Mortality Estimates         Year       X         Year       X         Year       X         0       0.013         17       [0, 160]         2021       0.013         0       0.033         2022       0.013         2023       0.0073         3       [0, 25]         6.832       [0.004755, 24.2]         2023       0.0.03         Year       X         Mortality Estimates       mean         Year       X       M* median         95% CI       lambda       95% CI         2021       0.0.013       18       18       [0, 160]       41.7800       [0.0400, 213]         2022       0.0.154       1       1       [0, 8]       12.560       [0.0025, 12.560]         2021       0.0013       17       17       [0, 145]       37.9900       [0.0371, 191]         Test of assumed relative weights (rho) and potential bias	<pre>^ ^ * 6, 0.077] CI = [0.00223, 11.4] .6] 37] 34] .6000] 0] .7000]</pre>

Appendix A10. Screen shot of Evidence of Absence (v2.0.7) Graphical User Interface, Multiple Years Module inputs for estimation of cumulative detection probability, annual fatality rate ( $\lambda$ ), cumulative mortality (*M*\*) for 2021, 2022, and 2023 for northern long-eared bats.

EoA, v2.0.7 - Multiple Years Module	- 🗆 X
Edit Help	
	Options
Past monitoring and operations data	Fatalities
Year ρ X Ba Bb ĝ 95% Cl	Estimate M Credibility level (1 - α) 0.5
2021         1         0         27.782         3157.140         0.008723         [0.0058, 0.0122]           2022         1         1         2547.059         10889.437         0.1896         [0.183, 0.196]	C Total mortality
2023 1 0 118.027 12683.816 0.00922 [0.00764, 0.0109]	C Two-sided Cl
-	Project parameters
	Total years in project 6
	Mortality threshold (T) 18
	<ul> <li>Track past mortality</li> </ul>
	C Projection of future mortality and estimates
	Future monitoring and operations
	G g and ρ unchanged from most recent year
	C g and p constant, different from most recent year
	g 0.08 95% CI: 0.07 0.09 p 1
	C g and p vary among future years
	Average Rate
	C Estimate average annual fatality rate (λ)
	Annual rate theshold (τ) 2
	C Credibility level for Cl (1-α) 0.9
	( Short-term rate ( $\lambda > \tau$ ) Term: 3 $\alpha$ 0.01
	C Reversion test ( $\lambda < \rho \tau$ ) $\rho$ 0.6 $\alpha$ 0.1
	Actions
	Calculate Close
Mortality over 3 years	
R Mortality over 3 years	
Results	
Results $M^* = 17 \ \text{for} \ 1 \ - \ \alpha = \ 0.5, \ \text{i.e.}, \ P(M <= 17) \ >= \ 50\%$	^
Results $M^* = 17 \text{ for } 1 - \alpha = 0.5, \text{ i.e., } P(M <= 17) >= 50\%$ Estimated overall detection probability: g = 0.0692, 95% CI = [0.066] Ba = 2697, Bb = 36295	7, 0.0717]
Results $M^* = 17 \mbox{ for } 1 - \alpha = 0.5, \mbox{ i.e., } P(M <= 17) >= 50\%$ Estimated overall detection probability: g = 0.0692, 95% CI = [0.066'	7, 0.0717]
Results $M^* = 17 \text{ for } 1 - \alpha = 0.5, \text{ i.e., } P(M <= 17) >= 50\%$ Estimated overall detection probability: g = 0.0692, 95% CI = [0.066] Ba = 2697, Bb = 36295	7, 0.0717]
Results $M^{\star} = 17 \text{ for } 1 - \alpha = 0.5, \text{ i.e., } P(M <= 17) >= 50\%$ Estimated overall detection probability: g = 0.0692, 95% CI = [0.066'] Ba = 2697, Bb = 36295 Estimated baseline fatality rate (for rho = 1): lambda = 7.231, 95% (Cumulative Mortality Estimates mean	7, 0.0717]
Results $\begin{aligned} M^* &= 17 \text{ for } 1 - \alpha = 0.5, \text{ i.e., } P(M <= 17) >= 50 \$ \\ \text{Estimated overall detection probability: } g = 0.0692, 95 \$ CI = [0.066] \\ \text{Ba} &= 2697, \text{ Bb} = 36295 \\ \text{Estimated baseline fatality rate (for rho = 1): lambda = 7.231, 95 \$ G \\ \text{Cumulative Mortality Estimates} \\ Team of the median of the set o$	7, 0.0717] CI = [0.52, 22.5]
$ \begin{array}{llllllllllllllllllllllllllllllllllll$	7, 0.0717] CI = [0.52, 22.5]
Results $\begin{aligned} M^* &= 17 \text{ for } 1 - \alpha = 0.5, \text{ i.e., } P(M <= 17) >= 50 \$ \\ \text{Estimated overall detection probability: } g = 0.0692, 95 \$ CI = [0.066] \\ \text{Ba} &= 2697, \text{ Bb} = 36295 \\ \text{Estimated baseline fatality rate (for rho = 1): lambda = 7.231, 95 \$ G \\ \text{Cumulative Mortality Estimates} \\ Team of the median of the set o$	7, 0.0717] CI = [0.52, 22.5]
Results         M* = 17 for 1 - α = 0.5, i.e., P(M <= 17) >= 50%         Estimated overall detection probability: g = 0.0692, 95% CI = [0.066'         Ba = 2697, Bb = 36295         Estimated baseline fatality rate (for rho = 1): lambda = 7.231, 95% CI         Cumulative Mortality Estimates         mean         Year       X         Year       X         M* median       95% CI         2021       0.009       25         2022       10.009       12         2023       10.069       17         17       [2, 61]       21.69         [1.56, 67.62]	7, 0.0717] CI = [0.52, 22.5]
Results M* = 17 for 1 - $\alpha$ = 0.5, i.e., P(M <= 17) >= 50% Estimated overall detection probability: g = 0.0692, 95% CI = [0.0667 Ba = 2697, Bb = 36295 Estimated baseline fatality rate (for rho = 1): lambda = 7.231, 95% CI Cumulative Mortality Estimates Year X g M* median 95% CI lambda 95% CI 2021 0 0.009 25 25 [0, 233] 60.53 [0.05786, 309 2022 1 0.099 12 12 [1, 38] 15.13 [1.088, 47.18] 2023 1 0.069 17 17 [2, 61] 21.69 [1.56, 67.62] Annual Mortality Estimates mean	7, 0.0717] CI = [0.52, 22.5]
Results         M* = 17 for 1 - α = 0.5, i.e., P(M <= 17) >= 50%         Estimated overall detection probability: g = 0.0692, 95% CI = [0.0667         Ba = 2697, Bb = 36295         Estimated baseline fatality rate (for rho = 1): lambda = 7.231, 95% CI         Cumulative Mortality Estimates         Year       X         Year       X         M* median       95% CI         2021       0.009       25         2021       0.009       25         2022       10.009       12         2023       1       0.069         2023       1       0.069         2023       1       0.069         Year       X       g         M* median       95% CI         Annual Mortality Estimates       mean         Year       X       M* median       95% CI	7, 0.0717] CI = [0.52, 22.5] .8]
$ \begin{array}{llllllllllllllllllllllllllllllllllll$	<pre>^ ^ 7, 0.0717] CI = [0.52, 22.5] .8] .8000] 00]</pre>
Results         M* = 17 for 1 - α = 0.5, i.e., P(M <= 17) >= 50%         Estimated overall detection probability: g = 0.0692, 95% CI = [0.0667         Ba = 2697, Bb = 36295         Estimated baseline fatality rate (for rho = 1): lambda = 7.231, 95% CI         Cumulative Mortality Estimates         Year       X         Year       X         M* median       95% CI         2021       0.009         2022       1         1       0.069         2023       1         2023       1         2023       1         2023       1         2023       1         2023       1         2024       0.069         205       12         205       10.099         205       1         205       1         2069       1         207       1         208       1         209       2         Manual Mortality Estimates       mean         Year       X       M* median         Year       X       M* median       95% CI         2021       0       0.009       26       26       [0, 23	<pre>^ ^ 7, 0.0717] CI = [0.52, 22.5] .8] .8000] 00]</pre>
Results         M* = 17 for 1 - α = 0.5, i.e., P(M <= 17) >= 50%         Estimated overall detection probability: g = 0.0692, 95% CI = [0.066'         Ba = 2697, Bb = 36295         Estimated baseline fatality rate (for rho = 1): lambda = 7.231, 95% CI         Cumulative Mortality Estimates         Year       X         Year       X         Year       X         M* median       95% CI         2021       0.009       25         2022       10.009       12         2023       1       0.069         2023       1       0.069         17       17       12, 61         2021       0.0099       26         2023       1       0.069         2023       1       0.069         2021       0.0099       26         2023       1       0.00578, 309         2021       0.0099       26         2021       0.0099       26         2021       0.0099       26         2021       0.0099       26         2021       0.0099       26         2022       10.190       6         2023       0.0.009       24 <tr< td=""><td><pre>^ ^ 7, 0.0717] CI = [0.52, 22.5] .8] .8000] 00]</pre></td></tr<>	<pre>^ ^ 7, 0.0717] CI = [0.52, 22.5] .8] .8000] 00]</pre>
$ \begin{array}{llllllllllllllllllllllllllllllllllll$	<pre>^ ^ 7, 0.0717] CI = [0.52, 22.5] .8] .8000] 00]</pre>
Results         M* = 17 for 1 - α = 0.5, i.e., P(M <= 17) >= 50%         Estimated overall detection probability: g = 0.0692, 95% CI = [0.066'         Ba = 2697, Bb = 36295         Estimated baseline fatality rate (for rho = 1): lambda = 7.231, 95% CI         Cumulative Mortality Estimates         mean         Year       X         Year       X         0       0.009       25         2021       0.009       25         2022       1       0.099         2023       1       0.069         2023       1       0.069         2023       1       0.069         2023       1       0.069         2023       1       0.069         2023       1       0.069         2021       0.009       26         2021       0.009       26         2021       0.009       26         2021       0.009       26         2021       0.0509       26         2021       0.0509       26         2021       0.0509       24         24       [0, 210]       54.9000         2023       0.0009       24       24       [0, 2	<pre>^ ^ 7, 0.0717] CI = [0.52, 22.5] .8] .8000] 00]</pre>
Results M* = 17 for 1 - $\alpha$ = 0.5, i.e., P(M <= 17) >= 50% Estimated overall detection probability: g = 0.0692, 95% CI = [0.0667 Ba = 2697, Bb = 36295 Estimated baseline fatality rate (for rho = 1): lambda = 7.231, 95% CI Cumulative Mortality Estimates Year X g M* median 95% CI lambda 95% CI 2021 0 0.009 25 25 [0, 233] 60.53 [0.05786, 309 2022 1 0.099 12 12 [1, 38] 15.13 [1.088, 47.18] 2023 1 0.065 17 17 [2, 61] 21.69 [1.56, 67.62] Annual Mortality Estimates Year X g M* median 95% CI lambda 95% CI 2021 0 0.009 26 26 [0, 233] 60.5300 [0.0579, 309 2022 1 0.190 6 6 [1, 15] 7.9150 [0.5693, 24.67/ 2023 0 0.009 24 24 [0, 210] 54.9000 [0.0536, 277] Test of assumed relative weights (rho) and potential bias Fitted rho Assumed rho 95% CI 1 [0.012, 2.843]	<pre>^ ^ 7, 0.0717] CI = [0.52, 22.5] .8] .8000] 00]</pre>
Results M* = 17 for 1 - $\alpha$ = 0.5, i.e., P(M <= 17) >= 50% Estimated overall detection probability: g = 0.0692, 95% CI = [0.0667 Ba = 2697, Bb = 36295 Estimated baseline fatality rate (for rho = 1): lambda = 7.231, 95% CI Cumulative Mortality Estimates Year X g M* median 95% CI lambda 95% CI 2021 0 0.009 25 25 [0, 233] 60.53 [0.05786, 309 2022 1 0.099 12 12 [1, 38] 15.13 [1.088, 47.18] 2023 1 0.065 17 17 [2, 61] 21.69 [1.56, 67.62] Annual Mortality Estimates Year X g M* median 95% CI lambda 95% CI 2021 0 0.009 26 26 [0, 233] 60.5300 [0.0579, 309 2022 1 0.190 6 6 [1, 15] 7.9150 [0.5693, 24.67/ 2023 0 0.009 24 24 [0, 210] 54.9000 [0.0536, 277] Test of assumed relative weights (rho) and potential bias Fitted rho Assumed rho 95% CI 1 [0.012, 2.843]	<pre>^ ^ 7, 0.0717] CI = [0.52, 22.5] .8] .8000] 00]</pre>
Results M* = 17 for 1 - $\alpha$ = 0.5, i.e., P(M <= 17) >= 50% Estimated overall detection probability: g = 0.0692, 95% CI = [0.0667 Ba = 2697, Bb = 36295 Estimated baseline fatality rate (for rho = 1): lambda = 7.231, 95% CI Cumulative Mortality Estimates Year X g M* median 95% CI lambda 95% CI 2021 0 0.009 25 25 [0, 233] 60.53 [0.05786, 309 2022 1 0.099 12 12 [1, 38] 15.13 [1.088, 47.18] 2023 1 0.065 17 17 [2, 61] 21.69 [1.56, 67.62] Annual Mortality Estimates Year X g M* median 95% CI lambda 95% CI 2021 0 0.009 26 26 [0, 233] 60.5300 [0.0579, 309 2022 1 0.190 6 6 [1, 19] 7.9150 [0.5693, 24.677 2023 0 0.009 24 24 [0, 210] 54.9000 [0.0536, 277 Test of assumed relative weights (rho) and potential bias Fitted rho Assumed rho 95% CI 1 [0.012, 2.888]	<pre>^ ^ 7, 0.0717] CI = [0.52, 22.5] .8] .8000] 00]</pre>
Results M* = 17 for 1 - $\alpha$ = 0.5, i.e., P(M <= 17) >= 50% Estimated overall detection probability: g = 0.0652, 95% CI = [0.0667 Ba = 2697, Bb = 36295 Estimated baseline fatality rate (for rho = 1): lambda = 7.231, 95% G Cumulative Mortality Estimates Year X g M* median 95% CI lambda 95% CI 2021 0 0.009 25 25 [0, 233] 60.53 [0.05786, 309 2022 1 0.099 12 12 [1, 38] 15.13 [1.088, 47.18] 2023 1 0.069 17 17 [2, 61] 21.69 [1.56, 67.62] Annual Mortality Estimates Year X g M* median 95% CI lambda 95% CI 2021 0 0.009 26 26 [0, 233] 60.5300 [0.0579, 309 2022 1 0.190 6 6 [1, 19] 7.9150 [0.5693, 24.67/ 2023 0 0.009 24 24 [0, 210] 54.9000 [0.0536, 277 Test of assumed relative weights (rho) and potential bias Fitted rho Assumed rho 95% CI 1 [0.011, 2.000]	<pre>^ ^ 7, 0.0717] CI = [0.52, 22.5] .8] .8000] 00]</pre>
Results M* = 17 for 1 - $\alpha$ = 0.5, i.e., P(M <= 17) >= 50% Estimated overall detection probability: g = 0.0692, 95% CI = [0.0667 Ba = 2697, Bb = 36295 Estimated baseline fatality rate (for rho = 1): lambda = 7.231, 95% CI Cumulative Mortality Estimates Year X g M* median 95% CI lambda 95% CI 2021 0 0.009 25 25 [0, 233] 60.53 [0.05786, 309 2022 1 0.069 12 12 [1, 38] 15.13 [1.088, 47.18] 2023 1 0.069 17 17 [2, 61] 21.69 [1.56, 67.62] Annual Mortality Estimates Year X g M* median 95% CI lambda 95% CI 2021 0 0.009 26 26 [0, 233] 60.5300 [0.0579, 309 2022 1 0.190 6 6 [1, 19] 7.9150 [0.5693, 24.67] 2023 0 0.009 24 24 [0, 210] 54.9000 [0.0536, 277 Test of assumed relative weights (rho) and potential bias Fitted rho Assumed rho 95% CI 1 [0.012, 2.863] 1 [0.021, 2.868] p = 0.91357 for likelihood ratio test of H0: assumed rho = true rho Quick test of relative bias: 0.41	<pre>^ ^ 7, 0.0717] CI = [0.52, 22.5] .8] .8000] 00]</pre>
Results M* = 17 for 1 - $\alpha$ = 0.5, i.e., P(M <= 17) >= 50% Estimated overall detection probability: g = 0.0692, 95% CI = [0.0667 Ba = 2697, Bb = 36295 Estimated baseline fatality rate (for rho = 1): lambda = 7.231, 95% CI Cumulative Mortality Estimates Year X g M* median 95% CI lambda 95% CI 2021 0 0.009 25 25 [0, 233] 60.53 [0.05786, 309 2022 1 0.099 12 12 [1, 38] 15.13 [1.088, 47.18] 2023 1 0.069 17 17 [2, 61] 21.69 [1.56, 67.62] Annual Mortality Estimates Year X g M* median 95% CI lambda 95% CI 2021 0 0.009 26 26 [0, 233] 60.5300 [0.0579, 309 2022 1 0.190 6 6 [1, 19] 7.9150 [0.5693, 24.670 2023 0 0.009 24 24 [0, 210] 54.9000 [0.0536, 277 Test of assumed relative weights (rho) and potential bias Fitted rho Assumed rho 95% CI 1 [0.012, 2.843] 1 [0.011, 2.000] 1 [0.021, 2.888] p = 0.91357 for likelihood ratio test of H0: assumed rho = true rho Quick test of relative bias: 0.41 	<pre>^</pre>
Results M* = 17 for 1 - $\alpha$ = 0.5, i.e., P(M <= 17) >= 50% Estimated overall detection probability: g = 0.0692, 95% CI = [0.0667 Ba = 2697, Bb = 36295 Estimated baseline fatality rate (for rho = 1): lambda = 7.231, 95% CI Cumulative Mortality Estimates Year X g M* median 95% CI lambda 95% CI 2021 0 0.009 25 25 [0, 233] 60.53 [0.05786, 309 2022 1 0.099 12 12 [1, 38] 15.13 [1.088, 47.18] 2023 1 0.069 17 17 [2, 61] 21.69 [1.56, 67.62] Annual Mortality Estimates Year X g M* median 95% CI lambda 95% CI 2021 0 0.009 26 26 [0, 233] 60.5300 [0.0579, 309 2022 1 0.190 6 6 [1, 19] 7.9150 [0.5693, 24.67] 2023 0 0.009 24 24 [0, 210] 54.9000 [0.0536, 277 Test of assumed relative weights (rho) and potential bias Fitted rho Assumed rho 95% CI 1 [0.012, 2.843] 1 [0.012, 2.843] 1 [0.021, 2.888] p = 0.91357 for likelihood ratio test of H0: assumed rho = true rho Quick test of relative bias: 0.41 	<pre>^</pre>
Results M* = 17 for 1 - $\alpha$ = 0.5, i.e., P(M <= 17) >= 50% Estimated overall detection probability: g = 0.0692, 95% CI = [0.0667 Ba = 2697, Bb = 36295 Estimated baseline fatality rate (for rho = 1): lambda = 7.231, 95% C Cumulative Mortality Estimates Year X g M* median 95% CI lambda 95% CI 2021 0 0.009 25 25 [0, 233] 60.53 [0.05786, 309 2022 1 0.099 12 12 [1, 38] 15.13 [1.088, 47.18] 2023 1 0.069 17 17 [2, 61] 21.69 [1.56, 67.62] Annual Mortality Estimates Year X g M* median 95% CI lambda 95% CI 2021 0 0.009 26 26 [0, 233] 60.5300 [0.0579, 309 2022 1 0.190 6 6 [1, 15] 7.9150 [0.5693, 24.670 2023 0 0.009 24 24 [0, 210] 54.9000 [0.0536, 277 Test of assumed relative weights (rho) and potential bias Fitted rho Assumed rho 95% CI 1 [0.012, 2.888] p = 0.91357 for likelihood ratio test of H0: assumed rho = true rho Quick test of relative bias: 0.41 	<pre>^</pre>
Results M* = 17 for 1 - $\alpha$ = 0.5, i.e., P(M <= 17) >= 50% Estimated overall detection probability: g = 0.0692, 95% CI = [0.0667 Ba = 2697, Bb = 36295 Estimated baseline fatality rate (for rho = 1): lambda = 7.231, 95% CI Cumulative Mortality Estimates Mean Year X g M* median 95% CI lambda 95% CI 2021 0 0.009 25 25 [0, 233] 60.53 [0.05786, 309 2022 1 0.099 12 12 [1, 38] 15.13 [1.088, 47.18] 2023 1 0.069 17 17 [2, 61] 21.69 [1.56, 67.62] Annual Mortality Estimates Mean Year X g M* median 95% CI lambda 95% CI 2021 0 0.009 26 26 [0, 233] 60.5300 [0.0579, 309 2022 1 0.190 6 6 [1, 19] 7.9150 [0.5693, 24.677 2023 0 0.009 24 24 [0, 210] 54.9000 [0.0536, 277 Test of assumed relative weights (rho) and potential bias Fitted rho Assumed rho 95% CI 1 [0.012, 2.863] 1 [0.011, 2.000] 1 [0.021, 2.868] p = 0.91357 for likelihood ratio test of H0: assumed rho = true rho Quick test of relative bias: 0.41 	<pre>^ 7, 0.0717] CI = [0.52, 22.5] .8] .8000] 00] .0000]</pre>
Results M* = 17 for 1 - $\alpha$ = 0.5, i.e., P(M <= 17) >= 50% Estimated overall detection probability: g = 0.0692, 95% CI = [0.0667 Ba = 2697, Bb = 36295 Estimated baseline fatality rate (for rho = 1): lambda = 7.231, 95% C Cumulative Mortality Estimates Year X g M* median 95% CI lambda 95% CI 2021 0 0.009 25 25 [0, 233] 60.53 [0.05786, 309 2022 1 0.099 12 12 [1, 38] 15.13 [1.088, 47.18] 2023 1 0.069 17 17 [2, 61] 21.69 [1.56, 67.62] Annual Mortality Estimates Year X g M* median 95% CI lambda 95% CI 2021 0 0.009 26 26 [0, 233] 60.5300 [0.0579, 309 2022 1 0.190 6 6 [1, 15] 7.9150 [0.5693, 24.670 2023 0 0.009 24 24 [0, 210] 54.9000 [0.0536, 277 Test of assumed relative weights (rho) and potential bias Fitted rho Assumed rho 95% CI 1 [0.012, 2.888] p = 0.91357 for likelihood ratio test of H0: assumed rho = true rho Quick test of relative bias: 0.41 	<pre>^</pre>

Appendix A11. Screen shot of Evidence of Absence (v2.0.7) Graphical User Interface, Multiple Years Module inputs for estimation of cumulative detection probability, annual fatality rate ( $\lambda$ ), cumulative mortality (*M*\*) for 2021, 2022, and 2023 for little brown bats.

EoA, v2.0.7 - Multiple Years Module	- 🗆 🗙
Edit Help	
	Options
Past monitoring and operations data	Fatalities
Year p X Ba Bb ĝ 95% Cl	Estimate M Credibility level (1 - α) 0.5
2021 1 0 27.782 3157.140 0.008723 [0.0058, 0.0122]	One-sided CI (M*)
2022 1 0 2547.059 10889.437 0.1896 [0.183, 0.196]	C Total mortality C Two-sided Cl
2023 1 0 118.027 12683.816 0.00922 [0.00764, 0.0109]	Project parameters
	Total years in project 6
	Mortality threshold (T) 18
	<ul> <li>Track past mortality</li> </ul>
	C Projection of future mortality and estimates
	Future monitoring and operations
	g and p unchanged from most recent year
	C g and p constant, different from most recent year
	g 0.08 95% CI: 0.07 0.09 ρ 1
	g and p vary among future years
	Average Rate
	C Estimate average annual fatality rate (λ)
	Annual rate theshold (t) 2
	Credibility level for Cl (1-α) 0.9
	( Short-term rate $(\lambda > \tau)$ Term: 3 $\alpha$ 0.01
	C Reversion test ( $\lambda < \rho \tau$ ) $\rho$ 0.6 $\alpha$ 0.1
	Actions
	Calculate Close
Mortality over 3 years	
Reference of the second	
Results	
Results $M^* = 3 \ \text{for} \ 1 \ - \ \alpha = \ 0.5, \ \text{i.e.}, \ P(M <= 3) \ >= \ 50\%$	A
Results $M^{\star} = 3 \text{ for } 1 - \alpha = 0.5, \text{ i.e., } P(M <= 3) >= 50\%$ Estimated overall detection probability: g = 0.0692, 95% CI = [0.0	^
Results $M^{\star} = 3 \text{ for } 1 - \alpha = 0.5, \text{ i.e., } P(M <= 3) >= 50\%$ Estimated overall detection probability: g = 0.0692, 95% CI = [0.0 Ba = 2697, Bb = 36295	667, 0.0717]
Results $M^* = 3$ for $1 - \alpha = 0.5$ , i.e., $P(M \le 3) \ge 50$ % Estimated overall detection probability: $g = 0.0692$ , 95% CI = [0.0 Ba = 2697, Bb = 36295 Estimated baseline fatality rate (for rho = 1): lambda = 2.41, 95%	667, 0.0717]
Results $M^* = 3 \text{ for } 1 - \alpha = 0.5, \text{ i.e., } P(M <= 3) >= 50\%$ Estimated overall detection probability: $g = 0.0692, 95\%$ CI = [0.0 Ba = 2697, Bb = 36295 Estimated baseline fatality rate (for rho = 1): lambda = 2.41, 95\% Cumulative Mortality Estimates	667, 0.0717]
Results $M^* = 3 \text{ for } 1 - \alpha = 0.5$ , i.e., $P(M <= 3) >= 50$ % Estimated overall detection probability: $g = 0.0692$ , 95% CI = [0.0 Ba = 2697, Bb = 36295 Estimated baseline fatality rate (for rho = 1): lambda = 2.41, 95% Cumulative Mortality Estimates mean	667, 0.0717]
Results $M^* = 3 \text{ for } 1 - \alpha = 0.5, \text{ i.e., } P(M <= 3) >= 50\%$ Estimated overall detection probability: $g = 0.0692, 95\%$ CI = [0.0 Ba = 2697, Bb = 36295 Estimated baseline fatality rate (for rho = 1): lambda = 2.41, 95\% Cumulative Mortality Estimates Year X g M* median 95\% CI lambda 95\% CI 2021 0 0.009 25 25 [0, 233] 60.53 [0.05786, 3]	<pre>^</pre>
Results         M* = 3 for 1 - α = 0.5, i.e., P(M <= 3) >= 50%         Estimated overall detection probability: g = 0.0692, 95% CI = [0.0         Ba = 2697, Bb = 36295         Estimated baseline fatality rate (for rho = 1): lambda = 2.41, 95%         Cumulative Mortality Estimates         Year       X g         Year       X g         2021       0 0.009       25         2022       0 0.099       2         [0, 03786, 3         2022       0 0.099         2       [0, 18]         5.044       [0.004948, 2	<pre>^</pre>
Results $M^* = 3 \text{ for } 1 - \alpha = 0.5, \text{ i.e., } P(M <= 3) >= 50\%$ Estimated overall detection probability: $g = 0.0692, 95\%$ CI = [0.0 Ba = 2697, Bb = 36295 Estimated baseline fatality rate (for rho = 1): lambda = 2.41, 95\% Cumulative Mortality Estimates Year X g M* median 95\% CI lambda 95\% CI 2021 0 0.009 25 25 [0, 233] 60.53 [0.05786, 3]	667, 0.0717] CI = [0.00236, 12.1] 09.8] 5.35]
Results         M* = 3 for 1 - α = 0.5, i.e., P(M <= 3) >= 50%         Estimated overall detection probability: g = 0.0692, 95% CI = [0.0         Ba = 2697, Bb = 36295         Estimated baseline fatality rate (for rho = 1): lambda = 2.41, 95%         Cumulative Mortality Estimates         Year       X g         Year       X g         N* median       95% CI         2021       0 0.009       25         2022       0 0.059       2         2023       0 0.069       3         2023       0 0.069       3	667, 0.0717] CI = [0.00236, 12.1] 09.8] 5.35]
Results         M* = 3 for 1 - α = 0.5, i.e., P(M <= 3) >= 50%         Estimated overall detection probability: g = 0.0692, 95% CI = [0.0         Ba = 2697, Bb = 36295         Estimated baseline fatality rate (for rho = 1): lambda = 2.41, 95%         Cumulative Mortality Estimates         Year       X         Year       X         Q21       0.009       25         2021       0.009       2         2022       0.0099       2         2023       0.0069       3         Q23       0.069       3         Q24       0.007081, 3         Annual Mortality Estimates	667, 0.0717] CI = [0.00236, 12.1] 09.8] 5.35]
Results         M* = 3 for 1 - α = 0.5, i.e., P(M <= 3) >= 50%         Estimated overall detection probability: g = 0.0692, 95% CI = [0.0         Ba = 2697, Bb = 36295         Estimated baseline fatality rate (for rho = 1): lambda = 2.41, 95%         Cumulative Mortality Estimates         Year       X         Year       X         M* median       95% CI         2021       0.0099       25         2022       0.0099       2         2023       0.0069       3         Annual Mortality Estimates       mean         Year       X       g         M* median       95% CI         2023       0.0069       3         Annual Mortality Estimates       mean         Year       X       g         M* median       95% CI         Annual Mortality Estimates       mean         Year       X       g         M* median       95% CI       lambda         Year       X       g         M*       median       95% CI	667, 0.0717] CI = [0.00236, 12.1] 09.8] 5.35] 6.33]
Results         M* = 3 for 1 - α = 0.5, i.e., P(M <= 3) >= 50%         Estimated overall detection probability: g = 0.0692, 95% CI = [0.0         Ba = 2697, Bb = 36295         Estimated overall detection probability: g = 0.0692, 95% CI = [0.0         Ba = 2697, Bb = 36295         Estimated baseline fatality rate (for rho = 1): lambda = 2.41, 95%         Cumulative Mortality Estimates         Year       X g         Year       X g         M* median       95% CI         2021       0.009       25         2023       0.0099       2         2023       0.0099       2         2023       0.0069       3         Annual Mortality Estimates       mean         Year       X g       M* median       95% CI         Year       X g       M* median       95% CI         2021       0.0009       26       26       [0, 233]	<pre>667, 0.0717] CI = [0.00236, 12.1] 09.8] 5.35] 6.33] 09.8000]</pre>
Results         M* = 3 for 1 - α = 0.5, i.e., P(M <= 3) >= 50%         Estimated overall detection probability: g = 0.0692, 95% CI = [0.0         Ba = 2697, Bb = 36295         Estimated baseline fatality rate (for rho = 1): lambda = 2.41, 95%         Cumulative Mortality Estimates         Year       X         Year       X         M* median       95% CI         2021       0.0099       25         2022       0.0099       2         2023       0.0069       3         Annual Mortality Estimates       mean         Year       X       g         M* median       95% CI         2023       0.0069       3         Annual Mortality Estimates       mean         Year       X       g         M* median       95% CI         Annual Mortality Estimates       mean         Year       X       g         M* median       95% CI       lambda         Year       X       g         M*       median       95% CI	<pre>^</pre>
Results         M* = 3 for 1 - α = 0.5, i.e., P(M <= 3) >= 50%         Estimated overall detection probability: g = 0.0692, 95% CI = [0.0         Ba = 2697, Bb = 36295         Estimated baseline fatality rate (for rho = 1): lambda = 2.41, 95%         Cumulative Mortality Estimates         Year       X         Year       X         M* median       95% CI         2021       0.0099       25         2023       0.0693       3         Annual Mortality Estimates       mean         Year       X       M* median         2021       0.009       26       26         10, 91       2.6380       [0.0026, 13.2	<pre>^</pre>
Results         M* = 3 for 1 - α = 0.5, i.e., P(M <= 3) >= 50%         Estimated overall detection probability: g = 0.0692, 95% CI = [0.0         Ba = 2697, Bb = 36295         Estimated baseline fatality rate (for rho = 1): lambda = 2.41, 95%         Cumulative Mortality Estimates         Year       X         Banual Mortality Estimates         Median       95% CI lambda         Year       X	<pre>^</pre>
Results         M* = 3 for 1 - α = 0.5, i.e., P(M <= 3) >= 50%         Estimated overall detection probability: g = 0.0692, 95% CI = [0.0         Ba = 2697, Bb = 36295         Estimated baseline fatality rate (for rho = 1): lambda = 2.41, 95%         Cumulative Mortality Estimates         Year       X         Year       X         M* median       95% CI         2021       0.0099       25         2023       0.0693       3         Annual Mortality Estimates       mean         Year       X       M* median         2021       0.009       26       26         10, 91       2.6380       [0.0026, 13.2	<pre>^</pre>
Results         M* = 3 for 1 - α = 0.5, i.e., P(M <= 3) >= 50%         Estimated overall detection probability: g = 0.0692, 95% CI = [0.0         Ba = 2697, Bb = 36295         Estimated baseline fatality rate (for rho = 1): lambda = 2.41, 95%         Cumulative Mortality Estimates         Year       X g M* median 95% CI lambda 95% CI         2021       0 0.009 25       25 [0, 233] 60.53 [0.05796, 3         2022       0 0.099 2       2 [0, 16] 5.044 [0.004940]         2023       0 0.069 3       3 [0, 26] 7.23 [0.007081, 3         Annual Mortality Estimates       mean         Year       X g M* median 95% CI lambda 95% CI         2023       0 0.069 26       26 [0, 233] 60.5300 [0.007081, 3         Annual Mortality Estimates       mean         Year       X g M* median 95% CI lambda 95% CI         2021       0 0.009 26 26 [0, 233] 60.5300 [0.0026, 13.2         2022       0 0.190 1 1 [0, 9] 2.6380 [0.00026, 13.2         2023       0 0.009 24 24 [0, 210] 54.9000 [0.0536, 2         Test of assumed relative weights (rho) and potential bias         Fitted rho       Assumed rho	<pre>^</pre>
<pre>Results M* = 3 for 1 - α = 0.5, i.e., P(M &lt;= 3) &gt;= 50% Estimated overall detection probability: g = 0.0692, 95% CI = [0.0 Ba = 2697, Bb = 36295 Estimated baseline fatality rate (for rho = 1): lambda = 2.41, 95% Cumulative Mortality Estimates Year X g M* median 95% CI lambda 95% CI 2021 0 0.009 25 25 [0, 233] 60.53 [0.05786, 3 2022 0 0.069 2 2 [0, 18] 5.044 [0.004948, 2 2023 0 0.0659 3 3 [0.26] 7.23 [0.007081, 3 Annual Mortality Estimates Year X g M* median 95% CI lambda 95% CI 2021 0 0.009 26 26 [0, 233] 60.5300 [0.0579, 3 2022 0 0.190 1 1 [0, 9] 2.6380 [0.0026, 13.2 2023 0 0.009 24 24 [0, 210] 54.9000 [0.0536, 2 Test of assumed relative weights (rho) and potential bias Fitted rho Assumed rho 95% CI 1 [0.015, 2.966]</pre>	<pre>^</pre>
Results         M* = 3 for 1 - α = 0.5, i.e., P(M <= 3) >= 50%         Estimated overall detection probability: g = 0.0692, 95% CI = [0.0         Ba = 2697, Bb = 36295         Estimated baseline fatality rate (for rho = 1): lambda = 2.41, 95%         Cumulative Mortality Estimates         Year       X g M* median 95% CI lambda 95% CI         2021       0 0.009 25       25 [0, 233] 60.53 [0.05796, 3         2022       0 0.099 2       2 [0, 16] 5.044 [0.004940]         2023       0 0.069 3       3 [0, 26] 7.23 [0.007081, 3         Annual Mortality Estimates       mean         Year       X g M* median 95% CI lambda 95% CI         2023       0 0.069 26       26 [0, 233] 60.5300 [0.007081, 3         Annual Mortality Estimates       mean         Year       X g M* median 95% CI lambda 95% CI         2021       0 0.009 26 26 [0, 233] 60.5300 [0.0026, 13.2         2022       0 0.190 1 1 [0, 9] 2.6380 [0.00026, 13.2         2023       0 0.009 24 24 [0, 210] 54.9000 [0.0536, 2         Test of assumed relative weights (rho) and potential bias         Fitted rho       Assumed rho	<pre>^</pre>
<pre>Results M* = 3 for 1 - α = 0.5, i.e., P(M &lt;= 3) &gt;= 50% Estimated overall detection probability: g = 0.0692, 95% CI = [0.0 Ba = 2697, Bb = 36295 Estimated baseline fatality rate (for rho = 1): lambda = 2.41, 95% Cumulative Mortality Estimates Year X g M* median 95% CI lambda 95% CI 2021 0 0.009 25 25 [0, 233] 60.53 [0.05786, 3 2022 0 0.099 2 2 [0, 18] 5.044 [0.004948, 2 2023 0 0.069 3 3 [0.26] 7.23 [0.007081, 3 Annual Mortality Estimates Year X g M* median 95% CI lambda 95% CI 2021 0 0.009 26 26 [0, 233] 60.5300 [0.0579, 3 2022 0 0.190 1 1 [0, 9] 2.6380 [0.0026, 13.2 2023 0 0.009 24 24 [0, 210] 54.9000 [0.0536, 2 Test of assumed relative weights (rho) and potential bias Fitted rho Assumed rho 95% CI 1 [0.000, 1.432] 1 [0.011, 2.958]</pre>	<pre>^</pre>
<pre>Results M* = 3 for 1 - α = 0.5, i.e., P(M &lt;= 3) &gt;= 50% Estimated overall detection probability: g = 0.0692, 95% CI = [0.0 Ba = 2697, Bb = 36295 Estimated baseline fatality rate (for rho = 1): lambda = 2.41, 95% Cumulative Mortality Estimates Year X g M* median 95% CI lambda 95% CI 2021 0 0.009 25 25 [0, 233] 60.53 [0.05786, 3 2022 0 0.099 2 2 [0, 18] 5.044 [0.004948, 2 2023 0 0.069 3 3 [0, 26] 7.23 [0.007081, 3] Annual Mortality Estimates Year X g M* median 95% CI lambda 95% CI 2021 0 0.009 26 26 [0, 233] 60.530 [0.0579, 3 2022 0 0.190 1 1 [0, 9] 2.6380 [0.0026, 13.2 2023 0 0.009 24 24 [0, 210] 54.9000 [0.0536, 2] Test of assumed relative weights (rho) and potential bias Fitted rho Assumed rho 95% CI 1 [0.015, 2.966] 1 [0.000, 1.432] 1 [0.011, 2.958] p = 1 for likelihood ratio test of H0: assumed rho = true rho</pre>	<pre>^</pre>
<pre>Results M* = 3 for 1 - α = 0.5, i.e., P(M &lt;= 3) &gt;= 50% Estimated overall detection probability: g = 0.0692, 95% CI = [0.0 Ba = 2697, Bb = 36295 Estimated baseline fatality rate (for rho = 1): lambda = 2.41, 95% Cumulative Mortality Estimates Year X g M* median 95% CI lambda 95% CI 2021 0 0.009 25 25 [0, 233] 60.53 [0.05786, 3 2022 0 0.069 2 2 [0, 18] 5.044 [0.004948, 2 2023 0 0.069 3 3 [0.26] 7.23 [0.007081, 3 Annual Mortality Estimates Year X g M* median 95% CI lambda 95% CI 2021 0 0.009 26 26 [0, 233] 60.5300 [0.0579, 3 2022 0 0.190 1 1 [0, 9] 2.6380 [0.0026, 13.2 2023 0 0.009 24 24 [0, 210] 54.9000 [0.0536, 2 Test of assumed relative weights (rho) and potential bias Fitted rho Assumed rho 95% CI 1 [0.015, 2.966] 1 [0.001, 1.432] 1 [0.011, 2.958] p = 1 for likelihood ratio test of H0: assumed rho = true rho Quick test of relative bias: 0.188</pre>	<pre>^^ 667, 0.0717] CI = [0.00236, 12.1] 09.8] 5.35] 6.33] 09.8000] 600] 77.0000]</pre>
<pre>Results M* = 3 for 1 - α = 0.5, i.e., P(M &lt;= 3) &gt;= 50% Estimated overall detection probability: g = 0.0692, 95% CI = [0.0 Ba = 2697, Bb = 36295 Estimated baseline fatality rate (for rho = 1): lambda = 2.41, 95% Cumulative Mortality Estimates</pre>	<pre>^^ 667, 0.0717] CI = [0.00236, 12.1] 09.8] 5.35] 6.33] 09.8000] 600] 77.0000]</pre>
Results         M* = 3 for 1 - α = 0.5, i.e., P(M <= 3) >= 50%         Estimated overall detection probability: g = 0.0692, 95% CI = [0.0         Ba = 2697, Bb = 36295         Estimated baseline fatality rate (for rho = 1): lambda = 2.41, 95%         Cumulative Mortality Estimates         Year       X g M* median 95% CI lambda 95% CI         2021       0 0.009 25       25 [0, 233] 60.53 [0.05766, 3         2022       0 0.099 2       2 [0, 18] 5.044 [0.00496, 2         2023       0 0.069 3       3 [0, 26] 7.23 [0.007081, 3         Annual Mortality Estimates       mean         Year       X g M* median 95% CI lambda 95% CI         2021       0 0.009 26       26 [0, 233] 60.5300 [0.00768, 3         2021       0 0.009 26       26 [0, 233] 60.5300 [0.0026, 13.2         2021       0 0.009 24       24 [0, 210] 54.9000 [0.0536, 2         2023       0 0.009 24       24 [0, 210] 54.9000 [0.0536, 2         2023       0 0.009 24       24 [0, 210] 54.9000 [0.0536, 2         Test of assumed relative weights (rho) and potential bias       Fitted rho         Assumed relative weights (rho) and potential bias       Fitted rho         Assumed rho       95% CI       1 [0.011, 2.958]         p = 1 for likelihood ratio test of H0: assumed rho = true rho       Quick test of relativ	<pre>^^ 667, 0.0717] CI = [0.00236, 12.1] 09.8] 5.35] 6.33] 09.8000] 600] 77.0000]</pre>
Results         M* = 3 for 1 - α = 0.5, i.e., P(M <= 3) >= 50%         Estimated overall detection probability: g = 0.0692, 95% CI = [0.0         Ba = 2697, Bb = 36295         Estimated baseline fatality rate (for rho = 1): lambda = 2.41, 95%         Cumulative Mortality Estimates         Year       X g M* median 95% CI lambda 95% CI         2021       0 0.009 25       25 [0, 233] 60.53 [0.05796, 3         2022       0 0.099 25       25 [0, 233] 60.53 [0.007081, 3         2023       0 0.069 3       3 [0, 26] 7.23 [0.007081, 3         Annual Mortality Estimates       mean         Year       X g M* median 95% CI lambda 95% CI         2021       0 0.009 26       26 [0, 233] 60.5300 [0.0026, 13.2         2022       0 0.190 1       1 [0, 91 2.6380 [0.00026, 13.2         2023       0 0.009 24       24 [0, 210] 54.9000 [0.0056, 2         2023       0 0.009 24       24 [0, 210] 54.9000 [0.0056, 2         2023       0 0.009 24       24 [0, 210] 54.9000 [0.0056, 2         Test of assumed relative weights (rho) and potential bias       Fitted rho         Assumed rho       5% CI         1       [0.001, 2.956]         2       1       [0.001, 2.956]         3       1       [0.011, 2.956]         9 = 1 f	<pre>^^ 667, 0.0717] CI = [0.00236, 12.1] 09.8] 5.35] 6.33] 09.8000] 600] 77.0000]</pre>
Results         M* = 3 for 1 - α = 0.5, i.e., P(M <= 3) >= 50%         Estimated overall detection probability: g = 0.0692, 95% CI = [0.0         Ba = 2697, Bb = 36295         Estimated baseline fatality rate (for rho = 1): lambda = 2.41, 95%         Cumulative Mortality Estimates         Year       X g       M* median         Year       X g       M* median         2021       0.009       25       25         2022       0.0099       2       2         2023       0.0069       3       10, 261         2021       0.0099       2       2         2022       0.0099       2       1, 161         2023       0.0099       2       2       10, 161         2021       0.0099       2       2       10, 161         2021       0.0099       2       2       10, 161         2021       0.0099       26       26       10, 233       60.5300       10.0256, 13.2         2023       0.0099       24       24       10, 210       54.9000       10.0536, 2         2023       0.0099       24       24       10, 210       54.9000       10.0536, 2          Imate       Imate<	<pre>^^ 667, 0.0717] CI = [0.00236, 12.1] 09.8] 5.35] 6.33] 09.8000] 600] 77.0000]</pre>
Results         M* = 3 for 1 - α = 0.5, i.e., P(M <= 3) >= 50%         Estimated overall detection probability: g = 0.0692, 95% CI = [0.0         Ba = 2697, Bb = 36295         Estimated baseline fatality rate (for rho = 1): lambda = 2.41, 95%         Cumulative Mortality Estimates         Year       X g M* median 95% CI lambda 95% CI         2021       0 0.009 25       25 [0, 233] 60.53 [0.05796, 3         2022       0 0.099 25       25 [0, 233] 60.53 [0.007081, 3         2023       0 0.069 3       3 [0, 26] 7.23 [0.007081, 3         Annual Mortality Estimates       mean         Year       X g M* median 95% CI lambda 95% CI         2021       0 0.009 26       26 [0, 233] 60.5300 [0.0026, 13.2         2022       0 0.190 1       1 [0, 91 2.6380 [0.00026, 13.2         2023       0 0.009 24       24 [0, 210] 54.9000 [0.0056, 2         2023       0 0.009 24       24 [0, 210] 54.9000 [0.0056, 2         2023       0 0.009 24       24 [0, 210] 54.9000 [0.0056, 2         Test of assumed relative weights (rho) and potential bias       Fitted rho         Assumed rho       5% CI         1       [0.001, 2.956]         2       1       [0.001, 2.956]         3       1       [0.011, 2.956]         9 = 1 f	<pre>^^ 667, 0.0717] CI = [0.00236, 12.1] 09.8] 5.35] 6.33] 09.8000] 600] 77.0000]</pre>
Results         M* = 3 for 1 - α = 0.5, i.e., P(M <= 3) >= 50%         Estimated overall detection probability: g = 0.0692, 95% CI = [0.0         Ba = 2697, Bb = 36295         Estimated baseline fatality rate (for rho = 1): lambda = 2.41, 95%         Cumulative Mortality Estimates         Year       X g       M* median         Year       X g       M* median         2021       0.009       25       25         2022       0.0099       2       2         2023       0.0069       3       10, 261         2021       0.0099       2       2         2022       0.0099       2       2         2023       0.0069       3       10, 261         2021       0.0099       2       2         2022       0.0099       2       2         2021       0.0099       26       26         2021       0.0099       24       24       [0, 210]         2023       0.0099       24       24       [0, 210]         2023       0.0099       24       24       [0, 210]         2023       0.0099       24       24       [0, 210]         Year       fstted rho       an	<pre>^</pre>

Appendix A12. Screen shot of Evidence of Absence (v2.0.7) Graphical User Interface, Multiple Years Module inputs for estimation of cumulative detection probability, annual fatality rate ( $\lambda$ ), cumulative mortality (*M*\*) for 2021, 2022, and 2023 for tricolored bats. Appendix B. Covered Species Evidence of Absence Take Estimates for the California Ridge Wind Farm, Champaign and Vermilion Counties, Illinois

# INTRODUCTION

Although the adaptive management triggers during the initial five years of the ITP are based solely on the number of Covered Species carcasses found, EoA was used to estimate additional metrics related to take of Covered Species as specified in Section 7.3.3.5 of the HCP, including the mean annual take rate ( $\lambda$ ), the median cumulative take to-date ( $M^*$ ), the median cumulative take within the current monitoring year ( $M^*_{2023}$ ), and the projected mortality ( $M_{\text{projected}}$ ) for each of the Covered Species.

# **METHODS**

The EoA Multiple Years Module was used with the number of fatalities to-date and the probability of detection to-date (i.e., from 2021, 2022, and 2023) for each Covered Species to compute the mean annual take rate ( $\lambda$ ) and cumulative take to-date ( $M^*$ ). The Multiple Years Module was used with the number of fatalities and the probability of detection specific to the 2023 monitoring year for each Covered Species to estimate cumulative annual take ( $M^*_{2023}$ ). Per the HCP,  $M^*_{2023}$  and  $M^*$  were estimated at a confidence level of  $\alpha = 0.5$  (using the median, or 50<sup>th</sup> credible bound, of the posterior distribution of estimated mortality).

The EoA Multiple Years Module was used in a Monte Carlo simulation approach to project future cumulative mortality ( $M_{Projected}$ ) based on data collected to date. Current estimated take was simulated as 1,000 samples from the posterior distribution for cumulative take to date ( $M^*$  from EoA). Future take was simulated using 1,000 samples from the posterior distribution of the annual take rate that was estimated using the previous three years of data (2021–2023). Each of the 1,000 annual take rate samples were extrapolated to the remaining 17 years of the permit term and mortality in each year was sampled from a Poisson distribution with the annual take rate specified as the rate parameter. Simulated mortality in each year were summed over the 17 projected years, resulting in 1,000 realizations of projected mortality from year 2023 to the end of the permit term. The vector of current take estimate samples and the vector of projected mortality at the end of the permit term. The median of this distribution was reported as the estimate of projected mortality.

# RESULTS

Mean annual take rates were estimated to be 10.27 Indiana bats (90% CI: 1.20–26.76), 3.42 northern long-eared bats (90% CI: 0.01-13.15), 10.86 little brown bats (90% CI: 1.27-28.30), and 3.62 tricolored bats (90% CI: 0.01-13.91) per year (Appendix B1). Cumulative take to-date,  $M^*$  at  $\alpha = 0.5$  (50<sup>th</sup> credible bound), was estimated to be 16 Indiana bats, 17 little brown bats, 3 northern long-eared bats, and 3 tricolored bats (Appendix B2). Annual take,  $M^*_{2023}$  at  $\alpha = 0.5$  (50<sup>th</sup> credible bound), was estimated to be 17 Indiana bats, 17 northern long-eared bat, 25 little brown bats, and 25 tricolored bats (Appendix B3).

The cumulative median 20-year mortality projection at a 50% credible interval was 115 Indiana bat fatalities, 25 northern long-eared bat fatalities, 126 little brown bat fatalities and 28 tricolored bat fatalities (Appendix B4), which are below the permitted take of individuals of each of these Covered Species described within the Project's HCP.

Appendix B1. Estimated annual take rates for studies conducted at the California Ridge Wind Farm, Champaign and Vermilion counties, Illinois, Incidental Take Permit Years 1–3 (2021–2023).

Species	Mean Annual Take Rate λ (90% CI)
Indiana bat	10.27 (1.20–26.76)
northern long-eared bat	3.42 (0.01–13.15)
little brown bat	10.86 (1.27–28.30)
tricolored bat	3.62 (0.01–13.91)

CI = Confidence Interval.

Appendix B2. Cumulative take estimate using Evidence of Absence for studies conducted within the Incidental Take Permit (ITP) term, to date, at the California Ridge Wind Farm, Champaign and Vermilion counties, Illinois, ITP Years 1–3 (2021–2023).

Species	Cumulative take (M*)	Permitted take (T)
Indiana bat	16	100
northern long-eared bat	3	280
little brown bat	17	460
tricolored bat	3	240

# Appendix B3. Cumulative take estimate for studies conducted within the 2023 monitoring period using Evidence of Absence for the California Ridge Wind Farm, Champaign and Vermilion counties, Illinois, from August 22 – October 13, 2023.

Species	Annual take (M*2023)	Permitted take (T)
Indiana bat	17	100
northern long-eared bat	17	280
little brown bat	25	460
tricolored bat	25	240

The cumulative median 20-year mortality projection at a 50% credible interval was 25 northern long-eared bat fatalities, 126 little brown bat fatalities and 28 tricolored bat fatalities (Appendix B4), which are below the permitted take of individuals of each of these three species described within the Project's HCP. The cumulative median 20-year mortality projection for the Indiana bat was 115 Indiana bat fatalities, which was greater than the permitted take of 100 Indiana bats. However, note that this projection is based off of only three years of PCM, and the projection will be monitored going forward to ensure that take remains within permitted levels.

Appendix B4. Cumulative median 20-year projected bat mortalities using Evidence of Absence (EoA;  $\alpha$  = 0.5) for studies conducted at the California Ridge Wind Farm, Champaign and Vermilion counties, Illinois.

	Carcass	Permitted	Cumulative Median Projected
Species	Count	Take (T)	Mortalities (20 years; <i>M</i> <sub>projected</sub> )
Indiana bat	1	100	115
northern long-eared bat	0	280	25
little brown bat	1	460	126
tricolored bat	0	240	28

Appendix C. Carcasses Found during the 2023 Post-construction Monitoring at the California Ridge Wind Farm, Champaign and Vermilion Counties, Illinois, from August 22 – October 13, 2023

		Distance from			Search Area	Physical
Found Date	Species	Turbine (meters)	Turbine	Search Type	Туре	Condition
Bat						
08/22/2023	big brown bat	1	20	carcass search	road and pad	scavenged
08/22/2023	eastern red bat	49	20	carcass search	road and pad	scavenged
08/22/2023	eastern red bat	40	66	carcass search	road and pad	scavenged
08/22/2023	eastern red bat	72	82	carcass search	road and pad	scavenged
08/22/2023	hoary bat	5	17	carcass search	road and pad	scavenged
08/23/2023	eastern red bat	104	83	incidental*	road and pad	scavenged
08/23/2023	eastern red bat	25	83	carcass search	road and pad	scavenged
08/23/2023	eastern red bat	22	86	carcass search	road and pad	intact
08/25/2023	big brown bat	45	122	carcass search	road and pad	intact
08/25/2023	eastern red bat	40	116	carcass search	road and pad	intact
08/29/2023	eastern red bat	31	3	carcass search	road and pad	intact
08/29/2023	eastern red bat	38	70	carcass search	road and pad	scavenged
08/29/2023	eastern red bat	2	82	incidental	road and pad	scavenged
08/29/2023	eastern red bat	35	91	carcass search	road and pad	intact
08/29/2023	eastern red bat	53	99	carcass search	road and pad	intact
08/31/2023	eastern red bat	73	46	carcass search	road and pad	intact
09/01/2023	eastern red bat	40	52	carcass search	road and pad	intact
09/01/2023	eastern red bat	17	52	carcass search	road and pad	scavenged
09/01/2023	hoary bat	24	77	carcass search	road and pad	scavenged
09/01/2023	silver-haired bat	43	61	carcass search	road and pad	scavenged
09/02/2023	eastern red bat	10	101	carcass search	road and pad	dismembered
09/02/2023	eastern red bat	22	85	carcass search	road and pad	scavenged
09/02/2023	silver-haired bat	48	88	carcass search	road and pad	intact
09/05/2023	big brown bat	18	47	carcass search	road and pad	scavenged
09/05/2023	eastern red bat	22	35	carcass search	road and pad	intact
09/05/2023	eastern red bat	5	38	carcass search	road and pad	scavenged
09/05/2023	eastern red bat	42	92	carcass search	road and pad	intact
09/06/2023	eastern red bat	5	15	carcass search	road and pad	scavenged
09/07/2023	eastern red bat	50	114	carcass search	road and pad	intact
09/07/2023	eastern red bat	87	42	carcass search	road and pad	scavenged
09/07/2023	eastern red bat	19	76	carcass search	road and pad	scavenged
09/08/2023	eastern red bat	1	103	carcass search	road and pad	intact
09/08/2023	eastern red bat	84	44	carcass search	road and pad	scavenged
09/08/2023	eastern red bat	50	44	carcass search	road and pad	dismembered

Appendix C. Complete listing of carcasses found at the California Ridge Wind Farm, Champaign and Vermillion counties, Illinois, from August 22 – October 13, 2023.

		Distance from			Search Area	Physical
Found Date	Species	Turbine (meters)	Turbine	Search Type	Туре	Condition
09/08/2023	silver-haired bat	6	108	carcass search	road and pad	scavenged
09/12/2023	hoary bat	18	96	carcass search	road and pad	intact
09/14/2023	eastern red bat	24	45	incidental	road and pad	intact
09/14/2023	eastern red bat	66	62	carcass search	road and pad	scavenged
09/26/2023	eastern red bat	43	36	carcass search	road and pad	scavenged
10/06/2023	eastern red bat	55	105	carcass search	road and pad	scavenged
10/09/2023	silver-haired bat	14	4	carcass search	road and pad	scavenged
Bird						
08/29/2023	cliff swallow	2	15	carcass search	road and pad	intact
08/30/2023	tree swallow	3	125	carcass search	road and pad	dismembered
09/07/2023	killdeer	73	76	carcass search	road and pad	scavenged
09/08/2023	killdeer	59	44	carcass search	road and pad	feather spot
09/12/2023	killdeer	64	47	carcass search	road and pad	feather spot
09/14/2023	killdeer	61	76	carcass search	road and pad	feather spot
09/19/2023	mourning dove	1	46	carcass search	road and pad	intact
09/19/2023	northern parula	83	38	carcass search	road and pad	intact
09/19/2023	red-winged blackbird	8	70	carcass search	road and pad	dismembered
09/22/2023	ring-necked pheasant	3	134	carcass search	road and pad	feather spot
10/06/2023	dickcissel	92	113	carcass search	road and pad	scavenged
10/09/2023	chimney swift	20	3	carcass search	road and pad	intact
10/12/2023	mourning dove	14	53	carcass search	road and pad	feather spot

Appendix C. Complete listing of carcasses found at the California Ridge Wind Farm, Champaign and Vermillion counties, Illinois, from August 22 – October 13, 2023.

\* Carcass was found outside the search area.

Appendix D. Searcher Efficiency and Carcass Persistence Model Fitting Results for the 2023 Post-construction Monitoring at the California Ridge Wind Farm, Champaign and Vermilion Counties, Illinois, from August 22 – October 13, 2023

# Appendix D1. Searcher efficiency models for 95-meter road and pads at the California Ridge Wind Farm, Champaign and Vermilion counties, Illinois, from August 22 – October 13, 2023 (n = 32).

Covariates	<i>k</i> Value	AICc	Delta AICc
No Covariates	<i>k</i> fixed at 0.8	40.16	0*

\* Selected model.

AICc = Corrected Akaike Information Criterion.

Delta AICc = Change in AICc.

Appendix D2. Carcass persistence models with covariates and distributions for 95-meter road and pads at the California Ridge Wind Farm, Champaign and Vermilion counties, Illinois, from August 22 – October 13, 2023 (n = 40).

Location Covariates	Scale Covariates	Distribution	AICc	Delta AICc
No Covariates	No Covariates	Weibull	188.54	0
No Covariates	_	exponential	190.06	1.52*
No Covariates	No Covariates	loglogistic	192.03	3.49
No Covariates	No Covariates	lognormal	192.68	4.14

\* Selected model.

AICc = Corrected Akaike Information Criterion.

Delta AICc = Change in AICc.

Appendix D3. Carcass persistence top models with covariates, distributions, and model parameters for the California Ridge Wind Farm, Champaign and Vermilion counties, Illinois, from August 22 – October 13, 2023.

Estimated Median				
Plot Search Type	Distribution	Removal Times (days)	Parameter 1	Parameter 2
95-meter road and pad	exponential*	8.86	rate_R = 0.0782	

\* Parameterization follows the base R parameterization for this distribution.

Appendix E. Bat Fatality Rates and Adjustment Factors Table for the California Ridge Wind Farm, Champaign and Vermilion Counties, Illinois, from August 22 – October13, 2023 Appendix E. Estimated fatality rates and adjustment factors, with 90% Confidence Intervals (CI) for bats on road and pad plots search areas for studies conducted at the California Ridge Wind Farm, Champaign and Vermillion counties, Illinois, from August 22 – October 13, 2023.

	Estimate	90% CI			
Search Area Adjustment					
Bat	0.03	0.03–0.03			
Searcher Efficiency					
Bat	0.72	0.57–0.83			
Average Probability of a Carcass Persisting Through the Search Interval*					
Bat	0.77	0.70–0.82			
Probability of Available and Detected					
Bat	0.62	0.52–0.71			
Estimated Fatality Rates (Fatalities/Turbine/Seasons(s))					
Bat	15.78	11.32–21.46			
Estimated Fatality Rates (Fatalities/Megawatt/Seasons(s))					
Bat	9.86	7.08–13.41			

\* The search interval was weekly.