Post-Construction Monitoring Study for the Crescent Wind Project Hillsdale County, Michigan

Year 1 Report

April 1 – October 15, 2023

Prepared for:

Consumers Energy

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EXECUTIVE SUMMARY

Consumers Energy (Consumers) operates the Crescent Wind Project (Project) in Hillsdale County, Michigan. The Project began operating in February 2021 and consists of 60 wind turbines with a total generating capacity of 166 megawatts. This report details the compliance monitoring studies conducted in 2023, consistent with the Year 1 post-permit standardized monitoring outlined in the Project's Habitat Conservation Plan (HCP) for Indiana bat and northern long-eared bat (Covered Species). While the Project's Incidental Take Permit (ITP; ESPER0626970) was issued July 5, 2023, turbines operated with blades feathered under a cut-in speed of 3.5 meters per second from April 1 to May 14, 2023, and under a cut-in speed of 5.0 meters per second from May 15 until October 15, 2023, as outlined in the Project's HCP. This report presents the results of the first year of compliance monitoring conducted under the ITP.

Post-construction monitoring was completed in accordance with the study design discussed with the US Fish and Wildlife Service East Lansing Field Office on March 20, 2023. The study plan was designed to achieve a 25% probability of detection (*g* of 0.25), per the monitoring protocol commitments in Section 5.4 of the HCP. The overall goal of this post-construction fatality monitoring study was to generate reliable fatality estimates for the Covered Species and to evaluate compliance with the incidental take authorization granted under the Project's ITP. More specifically, the objectives of this study were to estimate take for the Covered Species using the Evidence of Absence (EoA) framework as outlined in the HCP. Data from the 2021 research study was used to inform the estimated annual take rate at the facility but will not be used to determine cumulative take to date under the ITP.

Standardized carcass searches for bat carcasses were completed at two plot types: cleared square plots and road and pad plots and were conducted by two types of searchers: a field technician and a detection dog team (consisting of one dog trained to detect carcasses and one handler). The frequency of searches varied across seasons, with more searches occurring when take of Covered Species was considered more likely to occur. Searcher efficiency and carcass persistence trials were also conducted during each season to correct for detection and scavenger bias.

During the study period, one Indiana bat was found within the summer season. No northern long-eared bats were found. No state-listed bat species (beyond the Indiana bat) were found. Overall, 551 bats were found during the study. Four species made up almost 99% of the bat carcasses found: big brown bat (37.6 %), eastern red bat (22.1 %), silver-haired bat (20.7 %), and hoary bat (18.5 %). One hundred and twenty-three bird carcasses were recorded; no federally or state-listed birds were found.

The overall detection probability (*g)* was 0.25 (90% confidence interval: 0.23 – 0.26). Based on the data collected in 2021 and in 2023, the EoA model estimated a mean annual fatality rate of 2.10 Indiana bats and 0.70 northern long-eared bats. The cumulative take estimates in 2023 (year 1 of the ITP) were five Indiana bat fatalities and zero northern long-eared bat fatalities. Therefore, the estimated levels of Indiana bat and northern long-eared bat take were below levels authorized

in the ITP. The adaptive management assessment based on annual take rates of Covered Species will not occur until Year 2 per the HCP.

STUDY PARTICIPANTS

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REPORT REFERENCE

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INTRODUCTION

Consumers Energy (Consumers) operates the Crescent Wind Project (Project) in Hillsdale County, Michigan. The Project began operating in February 2021 and consists of 60 wind turbines with a total generating capacity of 166 megawatts (MW). Two General Electric turbine models are installed, both with a hub height of approximately 89 meters (m; 291 feet [ft]). The 54 turbines with a 2.82-MW generating capacity have a rotor diameter of 127 m (417 ft) and a maximum height of approximately 152 m (499 ft). The six turbines with a 2.3-MW generating capacity have a rotor diameter of 116 m (381 ft) and a maximum height of 138 m (453 ft).

All turbines are within the migratory range of two species listed as endangered under the Endangered Species Act: Indiana bat (*Myotis sodalist* [INBA]) and northern-long eared bat (*M. septentrionalis* [NLEB]); hereafter collectively referred to as Covered Species. Consumers obtained an Incidental Take Permit (ITP; ESPER0626970, dated July 5, 2023) for the Covered Species from the US Fish and Wildlife Service (USFWS).

The Project operated under the terms of the ITP from April 1 – October 15, 2023, and turbine operations were adjusted to adhere to the Project's Habitat Conservation Plan (HCP; Consumers Energy Company 2022). This report presents the results of the first year of compliance monitoring conducted under the ITP. The objectives of this study were to estimate take of the Covered Species using the Evidence of Absence (EoA) framework as outlined in the HCP to determine if the level of take of the Covered Species complies with the authorized take. The adaptive management assessment based on annual take rates of Covered Species will not occur until Year 2, per the HCP.

STUDY AREA

The Project area encompasses approximately 15,508 hectares (38,320 acres) in northeast Hillsdale County. The dominant land cover type is cultivated crops, covering approximately 61% of the total study area (Table 1, Figure 1). Deciduous forest and woody wetlands are the next most abundant cover types, accounting for approximately 16% and 12% of the Project area, respectively.

Table 1. Land cover types, coverage, and percent composition within the Crescent Wind Project, Hillsdale County, Michigan.

Habitat	Acres	Percent Composition
Cultivated crops	23,214	60.6
Deciduous forest	6,011	15.7
Woody wetlands	4,618	12.1
Developed	2,145	5.6
Hay/Pasture	1,654	4.3
Mixed forest	261	0.7
Emergent herbaceous wetlands	214	0.6
Evergreen forest	72	0.2
Other (Shrub/Scrub, Herbaceous, Barren)	71	0.2
Open water	59	0.2
Total*	**38,319**	**100**

Data from National Land Cover Database. 2019

* Sums may not equal totals shown due to rounding.

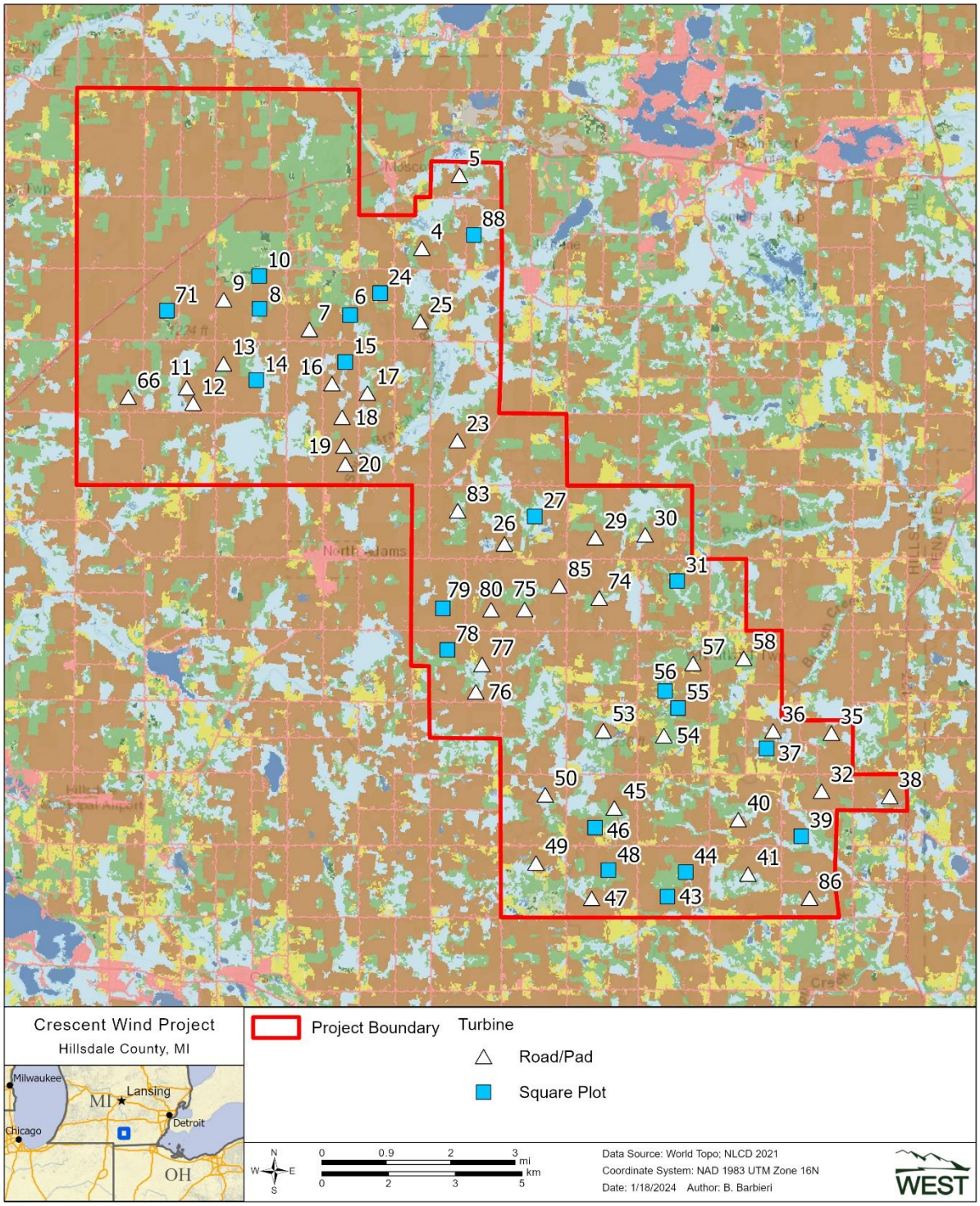

Figure 1. Turbine locations by search type and surrounding land cover at the Crescent Wind Project in Hillsdale County, Michigan. All turbines had a road and pad plot search type in the spring season.

METHODS

Western EcoSystems Technology Inc. (WEST) used Project-specific data from the 2021 post-construction monitoring (PCM) study at the Project to develop a study plan that targeted a *g* of 0.25 to meet the monitoring commitments in the HCP. Post-construction monitoring was completed in accordance with the study design discussed with the US Fish and Wildlife Service East Lansing Field Office.

Standardized Carcass Searches

Number of Turbines Sampled, Search Frequency, and Plot Size

Technicians and detection dog teams conducted standardized carcass searches (carcass searches) from April 1 – October 15, 2023. Search effort varied by season (Table 2) and was designed to maximize effort when the take of Covered Species was considered most likely to occur.

Table 2. Search effort by season and plot type at Crescent Wind Project in Hillsdale County, Michigan, from April 1 – Oct 15, 2023.

Season	Plot Type	Search Interval	Number of Turbines	Search Team
Spring (April 1– May 14)	100-m road and pad	7 days	60	Field technician
Summer (May 15 – July 31)	100-m road and pad	3.5 days	40	Field technician
	140 x 140-m cleared plot	3.5 days	20	Detection Dog Team
Fall (August 1 – October 15)	100-m road and pad	3.5 days	40	Field technician
	140 x 140-m cleared plot	3.5 days	20	Detection Dog Team

m = meter.

A technician searched the gravel road and pad areas (road and pad plot) under all 60 turbines out to a distance of 100 m (328 ft) from the turbine every week during the spring (Table 2, Figure 2). During the summer and fall, all turbines were searched on a twice weekly interval. Field technicians searched 40 road and pad plots out to a distance of 100 m from the turbine. Detection dog teams searched 20 turbines as cleared square plots within a 140 x 140-m (459 x 459-ft) area centered on the turbine (Table 2, Figure 3). Vegetation at full plots was maintained by WEST staff within 15 to 25 centimeters (six to ten inches [in]) in height to enhance detectability of carcasses (Figure 3).

Figure 2. Representative photo of conditions of a 100-meter (328-foot) road and pad plot at the Crescent Wind Project, Hillsdale County, Michigan.

Figure 3. Representative photo of vegetation conditions of a 140 x 140-meter (459 x 459-foot) full plot at the Crescent Wind Project, Hillsdale County, Michigan.

Search Methods

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

Road and Pad Searches — Field Technician

Field technicians walked transects spaced five m (16 ft) apart at a rate of approximately 45–60 meters per minute (m/min; 148–197-ft/min) on all gravel road and pad areas within 100-m of the turbine. The technicians scanned the area for carcasses on both sides of the transect out to approximately 2.5 m (8.2 ft) to ensure full visual coverage of each search area.

Square Plot Searches — Detection Dog Team

Detection dog teams searched 140 x 140-m cleared square plots for bat carcasses. Prior to each search, handlers determined the survey start point and the number of transects needed to cover the plot after taking into account wind speed, humidity and vegetation density. Handlers oriented the detection dog to start searches perpendicular to the wind to maximize the probability of scent detection. Wind speed and vegetation height and density can affect dispersal of the target odor (i.e., bat carcasses) across the search area. To maximize carcass detection rates during an olfactory search, transect width varied with wind speed and vegetation density, ranging from five to 10 m (16 to 33 ft) apart in areas of denser vegetation or during times of low wind speeds, to 10 to 15 m (49 ft) in shorter vegetation or during times of higher wind speeds. Detection dogs were rewarded with either a food reward or a short play session when they correctly alerted to a carcass.

Detection Dog Team Evaluation

Detection dogs were considered candidates for carcass searches if they met basic temperament and obedience criteria and demonstrated the trainability to detect bat and/or bird carcasses. Temperament characteristics sought after were high-energy, and a high food or toy drive. Prior to conducting searches at the Project, handlers trained their detection dogs on the scent of bat carcasses following methods derived from search and rescue programs and drug detection (Kay 2012, Helfers 2017). Dogs were initially trained with either cotton scent swabs that had been rubbed on bat carcasses, progressing to dehydrated bats, or directly with dehydrated bat carcasses, at increasing distances over a period of three to four weeks. Once the dog achieved a passing grade of 80% or higher in a scent recognition test, consisting of ten blind trial lineups using dehydrated bats, the dog and handler were evaluated in the field to measure their performance. The detection dog coordinator conducted a two-day field evaluation of each detection dog team; after teams achieved a searcher efficiency of 75% or greater for 15–30 dehydrated bats placed during double-blind evaluation trials, the teams were approved to conduct carcass searches. Because the objective of the study focused on detecting bat carcasses, dogs were not explicitly trained on native bird carcasses; however, all detection dogs alerted on bird carcasses in the field, and handlers rewarded bird finds in the field to encourage future alerts to bird carcasses. Two border collie breeds and one border collie mix were used at the Project as the primary detection dogs.

Data Collection

Technicians recorded the date, start and end times, technician name, turbine number, type of search and if any carcasses were found for 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 information data sheet, including the date and time, species, sex and age (when possible), technician name, turbine number, measured distance from turbine, azimuth from turbine, location of carcass using Geographic Coordinate System (latitude and longitude), habitat surrounding carcass, carcass condition (e.g., intact, scavenged, dismembered), and estimated time of death (e.g., less than one day, two days).

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

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

For bird carcasses, the following category was also used:

- Feather spot—Ten or more feathers (excluding down), or two or more primary feathers at one location 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, but a marker was placed next to each bird carcass to avoid duplicate counting. Bat carcasses were collected under the Project's ITP (ESPER0626970), WEST's Federal Native Endangered and Threatened Species Recovery Permit (ES234121), and WEST's state of Michigan Scientific Collection Permit (SC1483-1). Technicians placed each bat carcass in a re-sealable plastic bag labeled with a unique carcass identification number, turbine number, and date, for storage in a freezer on site. Leather gloves were used to handle all bat carcasses to eliminate possible transmission of rabies or other zoonotic diseases, and to reduce possible human scent bias on any carcasses used later in bias trials. Live, injured bats were recorded and considered fatalities for analysis purposes when observed in search areas and were left in place.

Carcasses found outside of the scheduled searches were recorded as incidental discoveries, documented following the same protocol for those found during standard searches, and were not included in analysis. Carcasses found in non-search areas (e.g., outside of a plot boundary) were not included in the analysis.

Carcass Identification and Agency Notification

Identification of bird carcasses was verified by biologists with significant field experience in identification of birds and their feathers. Federally permitted bat biologists (ESPER0039249, ES26854C-2, ES81968B-3, and TE21829B-3) identified all bat carcasses via photographs throughout the survey period, or in hand at the end of the surveys. The USFWS and the Michigan Department of Natural Resources were notified within 72 hours of the positive identification of any state or federally listed species.

Tissue samples collected from heavily scavenged or decomposed carcasses that could not be positively identified and had potential to be a Covered Species were submitted to a USFWS-approved laboratory, the East Stroudsburg University Wildlife Genetics Institute for identification. Bat carcasses that were heavily scavenged but did not have potential to be a Covered Species (i.e., fur was present on the wing, or the forearms measured more than 42 millimeters [1.7 in] long) were identified to the closest genus or group possible and were not sent off for further identification.

Bias Trials

Searcher Efficiency Trials

The objective of the searcher efficiency trials was to estimate the probability that a carcass was found by searchers. Searcher efficiency trials were conducted in the same areas where carcass searches occurred. Technicians conducting carcass 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*), silver-haired bats (*Lasionycteris noctivagans*), hoary bats (*Lasiurus cinereus*) and big brown bats (*Eptesicus fuscus*) that had previously been found on site. One hundred sixteen carcasses were placed across all seasons and plot types to account for differences in search conditions due to vegetation, topography, or weather.

Multiple trials were conducted in each season to measure potential changes in plot conditions on searcher efficiency over time. Each trial carcass was discreetly marked with a black zip-tie and/or a piece of electrical tape around the upper forelimb for identification as a study carcass. Carcasses were dropped from waist-height or higher and allowed to land in a random posture. The trial administrator walked in a meandering path and dropped trial carcasses for detection dogs the day prior to the next search to allow time for the scent to pool and disperse, and to eliminate a direct scent trail. For technician search trials, the trial administrator placed carcasses prior to the technician searching the plot, either the night before or the morning of searches depending on work schedules.

Searchers had one chance to locate trial carcasses during the first search after carcass placement. The number and location of trial carcasses found during the subsequent search were recorded, and the number of trial carcasses available for detection during each search was determined immediately after each trial by the person responsible for distributing the carcasses. Following searches, any carcasses that were not detected were checked to confirm availability. Sixty-five 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 average probability a carcass would persist, or be available for detection in the field, given the search interval. Carcasses could be removed by scavenging or rendered undetectable by typical farming activities. A minimum of 10 trial carcasses were placed in each season and plot type to incorporate the effects of varying weather and scavenger densities on carcass persistence. No more than two trial carcasses were

placed on a plot during the same trial period to avoid potential over-seeding and attracting 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 four days, then on day 7, 10, 14, 20, and 30. Trial carcasses were monitored until they were completely removed, or the trial period ended. Detection dogs determined the status of carcasses placed on full plots while technicians checked the status of carcasses on road and pad plots.

Search Area Mapping

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. Road and pad plot search areas were delineated in prior survey years. A technician recorded the boundaries of each full plot searched in the current study year, as well as any non-searchable areas within those plots, using a sub-meter global positioning satellite (GPS) unit.

Quality Assurance and Quality Control

Quality assurance and quality control measures were implemented at all stages of the study, including in the field, during data entry and analysis, and report writing. Following field surveys, technicians were responsible for inspecting data forms for completeness, accuracy, and legibility. Potentially erroneous data were identified using a series of database queries. Irregular codes or data suspected as questionable were discussed with the technician and/or Project manager. Errors, omissions, or problems identified in later stages of analysis were traced back to the raw data forms, and appropriate changes and measures were implemented. A Microsoft® SQL Server database was developed to store, organize, and retrieve survey data. All data forms and electronic data files were retained for reference.

Statistical Analysis

The EoA (Dalthorp et al. 2017) modeling framework was used to estimate take of Covered Species. EoA was used with data collected in the field to estimate the overall probability of detecting a bat carcass, the take rate of Covered Species, and the number of Covered Species fatalities that occurred. Data used in the EoA model included number of Covered Species fatalities, fatality spatial data from all bats found during surveys, the results of searcher efficiency and carcass persistence trials, the seasonal arrival distribution of bats (described below), and the detection reduction factor (*k*; described below).

Searcher Efficiency Estimation

Searcher efficiency was estimated separately for field technicians and detection dog teams to account for different modes of detection (i.e., technicians use sight, whereas dogs use olfaction). EoA uses raw searcher efficiency data (e.g. number of found and available trial carcasses) to inform overall probability of detection. However, to determine if searcher efficiency data should be pooled, or separated by strata season, SEEF was modeled using logistic regression. For both

field technicians and detection dog team models, model selection was completed using an information theoretic approach known as AICc, or corrected Akaike Information Criterion (Burnham and Anderson 2002). The best model was selected as the most parsimonious model within two AICc units of the model with the lowest AICc value. Searcher efficiency data were input into the EoA software according to the model selection results.

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

Carcass Persistence Rate Estimation

Data collected during carcass persistence trials were used to estimate the probability carcasses remained available to be located by the searcher, given the search interval (i.e., the time between scheduled searches). The average probability a carcass persisted was estimated using an interval-censored survival regression with four potential distributions: exponential, log-logistic, lognormal, and Weibull distributions (Kalbfleisch and Prentice 2002, Dalthorp et al. 2018). As with searcher efficiency, carcass persistence models were estimated separately for field technicians and detection dog teams to account for different modes of detection. Season was included as a potential covariate for both models. The best model was selected as the most parsimonious model within two AICc units of the model with the lowest AICc value. The parameter estimates of the selected model (α [shape] and β [scale], including the 95% confidence interval [CI] of β) were used as inputs in the EoA Single Class module.

Area Adjustment

The search area adjustment accounted for unsearched areas beneath turbines and was calculated as a probability that ranged from zero to one. The area adjustment was estimated as the product of the proportion of searched area around each turbine and a carcass-density distribution. A truncated weighted maximum likelihood (TWL) modeling approach (Khokan et al. 2013) was used to estimate the carcass-density distribution using site-specific fatality locations. The TWL approach uses weights based on probability of detection and the proportion of area searched in each 1.0-m annulus around the turbine. Due to the variation in turbine types at the Project (total turbine height ranged from 138 to 152 meters), carcass-density distribution models were fit for each turbine size separately and compared to additional models fit with data pooled across both turbine sizes. Distributions considered were normal, gamma, Gompertz, and Weibull (parameterized according to R Development Core Team [2016] and Yee [2015]). The best model was selected using AICc. The proportion of area searched was calculated in a GIS as the amount of area searched divided by the total area searched at each 1.0-m annulus around the turbine.

Carcasses Excluded from Analysis

Carcasses were excluded from analysis 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 TWL fitting procedure accounts for unsearched areas. Carcasses found prior to the start of surveys (e.g., a carcass found on a plot in the spring that was estimated to have died prior to April 1) were also excluded because the carcass occurred outside of the study period. Note that carcasses found on a plot incidentally (e.g. found by maintenance personnel) were included in the analysis if that plot had a scheduled search in the future. If a carcass of a Covered Species had been found outside of the spatial or temporal scope of the survey design, it would still be excluded from the area correction estimate but would be included in the EoA fatality estimate following Dalthorp et al. 2020.

Covered Species Take and Detection Probability Estimates

EoA was used to estimate the overall detection probability (*g*), the median cumulative take to-date (*M**), and the mean annual take rate (λ) for the Covered Species. Estimates were calculated using the EoA method (Dalthorp et al. 2017), using the Single Class, Multiple Class and Multiple Years modules of EoA.

The *g* was estimated using the bias corrections for searcher efficiency, carcass persistence, and area searched, as well as the assumed seasonality of risk the Covered Species, which per the HCP, was 0.07% in the spring, 0.36% in the summer and 0.57% in the fall. The seasonal risk is used to weight the contributions of detection probability from different seasons in the overall *g* estimate.

The EoA Single Class module is used to estimate the detection probability for each independent search stratum (e.g. season by plot type combination). This resulted in alpha (α) and beta (β) parameters that defined the beta distribution of detection probability in each stratum. The EoA Multiple Class module was then used twice to combine detection probability distributions across strata (i.e. once across plot types within seasons, and again across seasons within the study period). Weights for each class (density-weighted proportion, or "DWP" in the software) when combining across plot types within seasons were defined as the product of the within-season sampling fraction and relative turbine operations. Weights for each class when combining across seasons were defined as the product of the relative turbine operations and seasonal risk. The Multiple Class module of EoA requires weights (DWP) to sum to 1.0 (representing 100% of the risk to bats). When this module is used, unsearched strata are represented with near-zero detection probabilities and beta distribution parameters are set to Ba = 0.01 and Bb = 1,000 (a detection probability of 10^{-5}) for unsearched areas within each stratum. For this study, relative turbine operations were calculated as the number of visits in each season, during which turbines were operating, divided by the total number of visits in each season. Given that turbines at every project undergo routine maintenance, operations were considered normal unless the proportional of operational visits was less than 0.9 during the study period (Appendix D).

Furthermore, the Multiple Years Module was used to estimate the site-wide, cumulative detection probability for 2023, as well as the cumulative detection probability across the 2021 and 2023

study periods. The EoA Multiple Years Module requires the input ρ, which weights the years (i.e. 2021 and 2023) appropriately for combining Beta distribution parameters. In this module, the weights (ρ in the software) need not sum to 1.0, and a weight of 1.0 is assumed to represent a typical risk year. Weights may be more or less than 1.0 based on turbine operations that differ between years. During the 2021 PCM study, the facility was split into three treatment groups (each consisting of 20 turbines): one feathering below 3.0 m/s, one feathering below 5.0 m/s, and one operating under an Optimized Smart Curtailment regime (OSC). As per the results of the 2021 study, the treatment group curtailed to 5.0 m/s was assumed to have the same minimization efficacy as the OSC group (Fritchman et al. 2022). Additionally, a 40% risk reduction is expected for the curtailment strategy, when compared to blanket curtailment below 3.0 m/s (Consumers Energy Company 2022). To calculate the ρ for the entire 2021 study period, seasonal arrival proportions were multiplied by the relative risk associated with the curtailment regimes across the Project within that season (1.22 for summer and fall). These values were then summed across seasons. Risk associated with spring was not included in ρ because spring monitoring was not included as part of the 2021 study. The value for ρ in 2021 was 1.135, meaning that the Project turbines as operated during the summer and fall seasons in the 2021 study had 113.5% as much risk as the Project turbines assumed throughout the spring through fall seasons under a typical year operating under the minimization regime of the HCP. The value for ρ in 2023 was 1.00 for the entire study period meaning 2023 was a typical risk year.

The results from the Multiple Years module (Ba and Bb parameters for the detection probability for the permit term to date) were used to estimate *M** (the median cumulative take over the life of the permit), where, for this year 1 ITP report, only includes, monitoring data from the 2023 study. Estimates of λ (the underlying annual take rate using g values from 2021 and 2023 monitoring periods) and its 95% CI were calculated using monitoring data from the 2021 and 2023 study periods. Appendix D shows how the compliance metrics were calculated using the EoA Graphical User Interface[1].

RESULTS

Standardized Carcass Surveys

Sixty turbines were searched weekly as 100-m road and pad plots from April 1 – May 14, 2023. Twenty turbines were searched as 140 x 140-m cleared square plots, centered on the turbine and 40 turbines were searched as 100-m road and pad plots, twice weekly from May 15 – October 15, 2023. During the study period 2,853 searches were completed and 84 searches were missed (less than 3%) due to turbine maintenance, weather constraints, and/or safety hazards.

Five hundred and fifty-one bat carcasses and 123 bird carcasses were found during standardized searches and incidentally (Appendix A). One Indiana bat (male) was found on July 4, 2023 at turbine T44; no other federally or state-listed bat species were documented (Figure 4; Appendix A). No federally or state listed bird species were found. The most commonly found bat species were big brown bat (207 carcasses; 37.6%), eastern red bat (122 carcasses; 22.1%), silver-haired bat (114 carcasses; 20.7%), and hoary bat (102 carcasses; 18.5%), followed by two each of

Seminole bat and unidentified Lasiurus bat (0.8%), and one unidentified non-*Myotis* bat (0.2%; Appendix A).

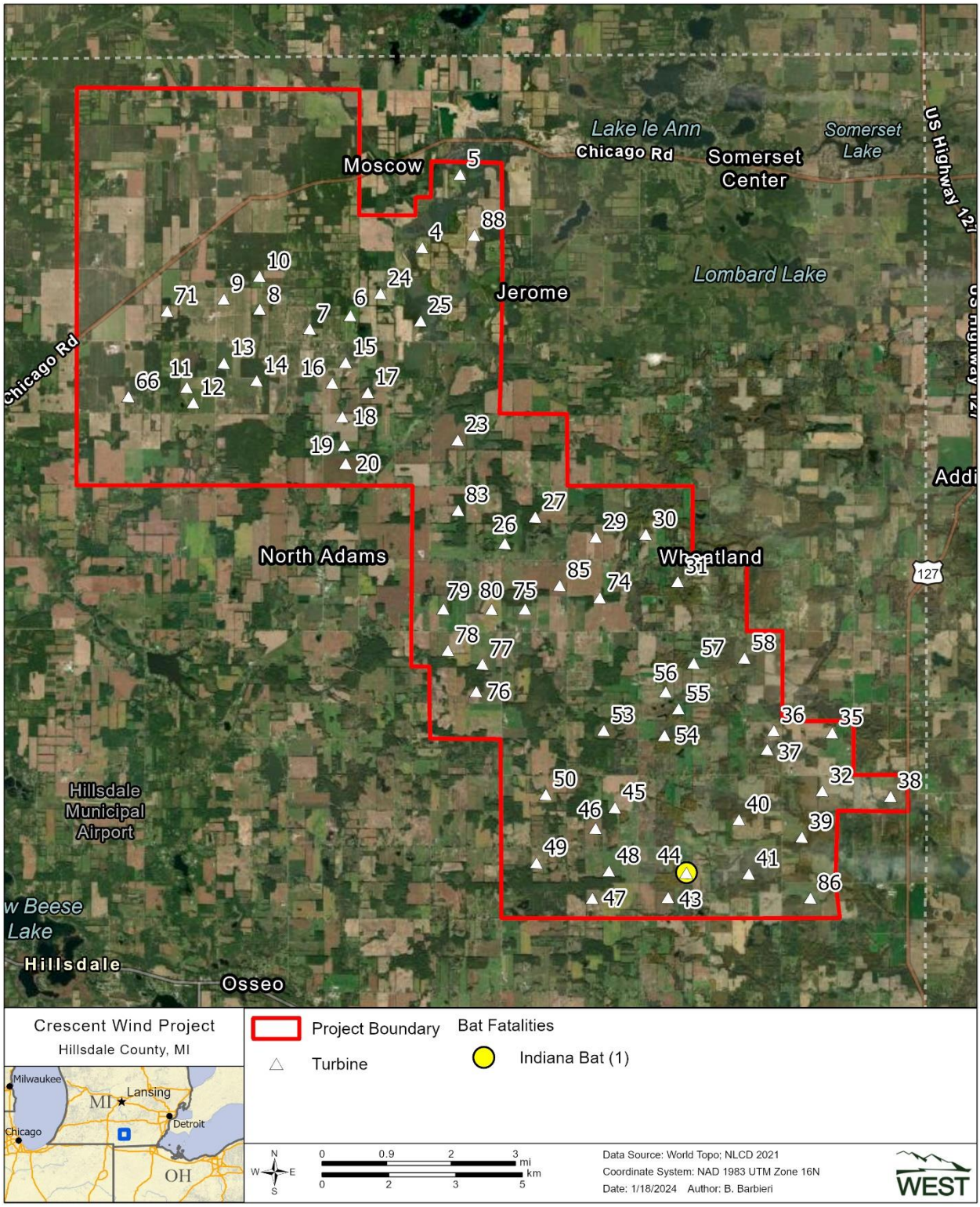

Figure 4. Location of the Indiana bat carcass at the Crescent Wind Project from April 1 – October 15, 2023.

Statistical Analysis

Bias Trials

Searcher Efficiency Trials

One hundred sixteen bat carcasses were placed for searcher efficiency trials on 15 separate dates; 48 remained available for technicians to find on 100-m road and pad plots and 45 were available for detection dog teams to find on 140 x 140-m cleared square plots. Overall searcher efficiency was 77.8% for detection dog teams on square plots and 89.6% for technicians on road and pad plots (Appendix B1). The best-fit model for searcher efficiency for either plot type did not support the inclusion of season as a covariate, meaning there was not a statistically meaningful difference between searcher efficiency rates across seasons (Appendices B2 & B3).

Carcass Persistence Trials

Sixty-five bat carcasses were placed to estimate carcass persistence, with 40 placed on 100-m road and pad plots and 25 placed on 140 x 140-m square plots. The best-fit model for carcass persistence rates for road and pad plots was a log-logistic distribution with no covariates suggesting that carcass persistence did not vary significantly across seasons (Figure 5; Appendix B4). The best-fit model for carcass persistence rates for detection dog teams was a Weibull distribution with no covariates, which suggests carcass persistence did not differ significantly between summer and fall (Figure 5; Appendix B5). The estimated median carcass persistence times were 2.8 days on road and pad plots and 11.3 days on square plots. The average probability that a carcass persisted on a road and pad plot through a 7-day search interval in the spring was 0.50 (90% CI: 0.40–0.60). The average probability that a carcass persisted on a road and pad plot through a 3.5-day search interval was 0.63 (90% CI: 0.53–0.74), and on a square plot was 0.80 (90% CI: 0.68–0.90; Figure 5).

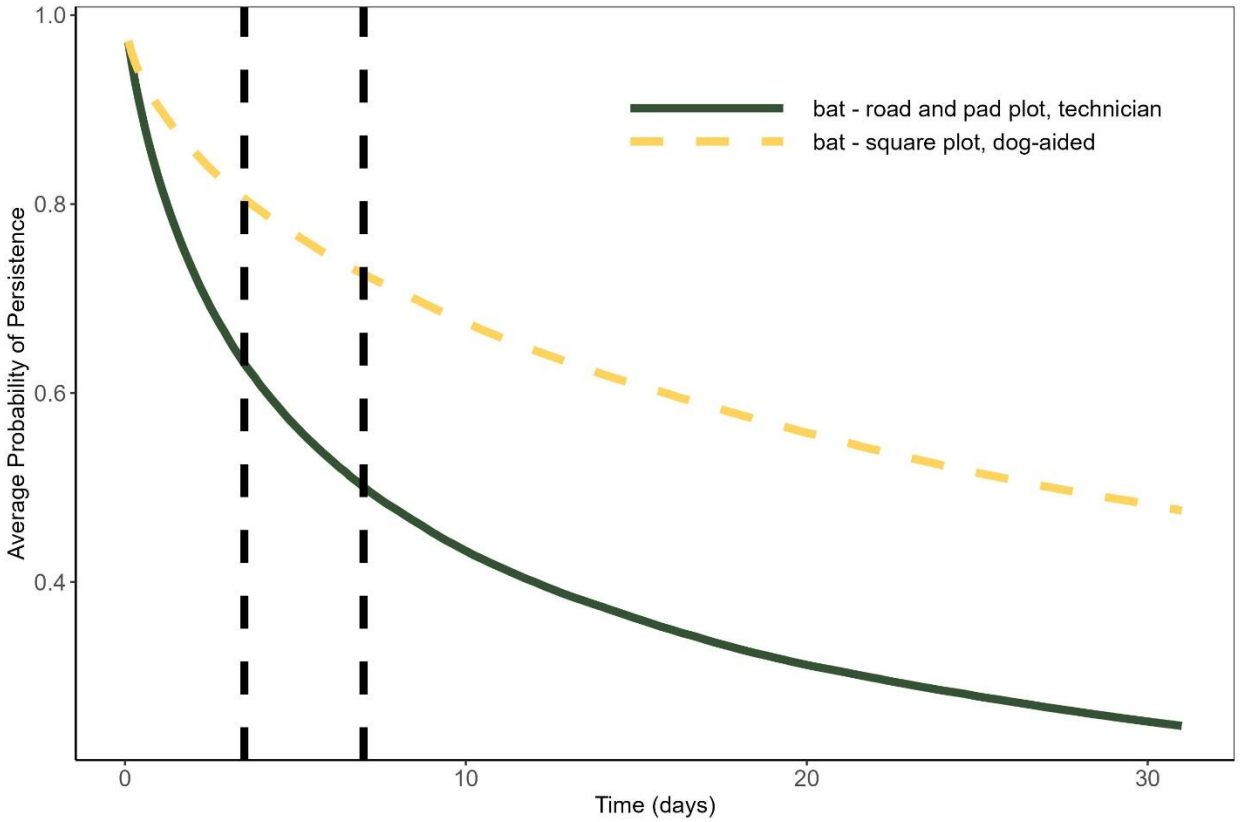

Figure 5. Average probability of persistence as a function of time (days) for bat carcasses at different search intervals and for different searcher types at Crescent Wind Project, Hillsdale County, Michigan, from April 1 – October 15, 2023.

Note: The vertical dotted lines indicate the 3.5 and 7 day search intervals used in this study.

Area Adjustment

Thirteen of the 551 bats found during the study were excluded from modeling the area adjustment for EoA. Three bats were excluded because they were found prior to the study period, and 10 bats were excluded because they were found off plot (Appendix C1).

The best-fit models for the distribution of bats with respect to distance from turbine base were models stratified by turbine type, both following a gamma distribution (Figure 6 and 7; Appendix C1). Area adjustments were calculated separately for bats on the road and pad plots and square plots. The TWL area adjustment for bats at 100-m road and pad plots at 2.3 and 2.8 MW turbines was 0.42 and 0.12 respectively. The TWL area adjustment for bats at square plots at 2.3 and 2.8 MW turbines was 0.98 and 0.80 respectively (Appendix C2).

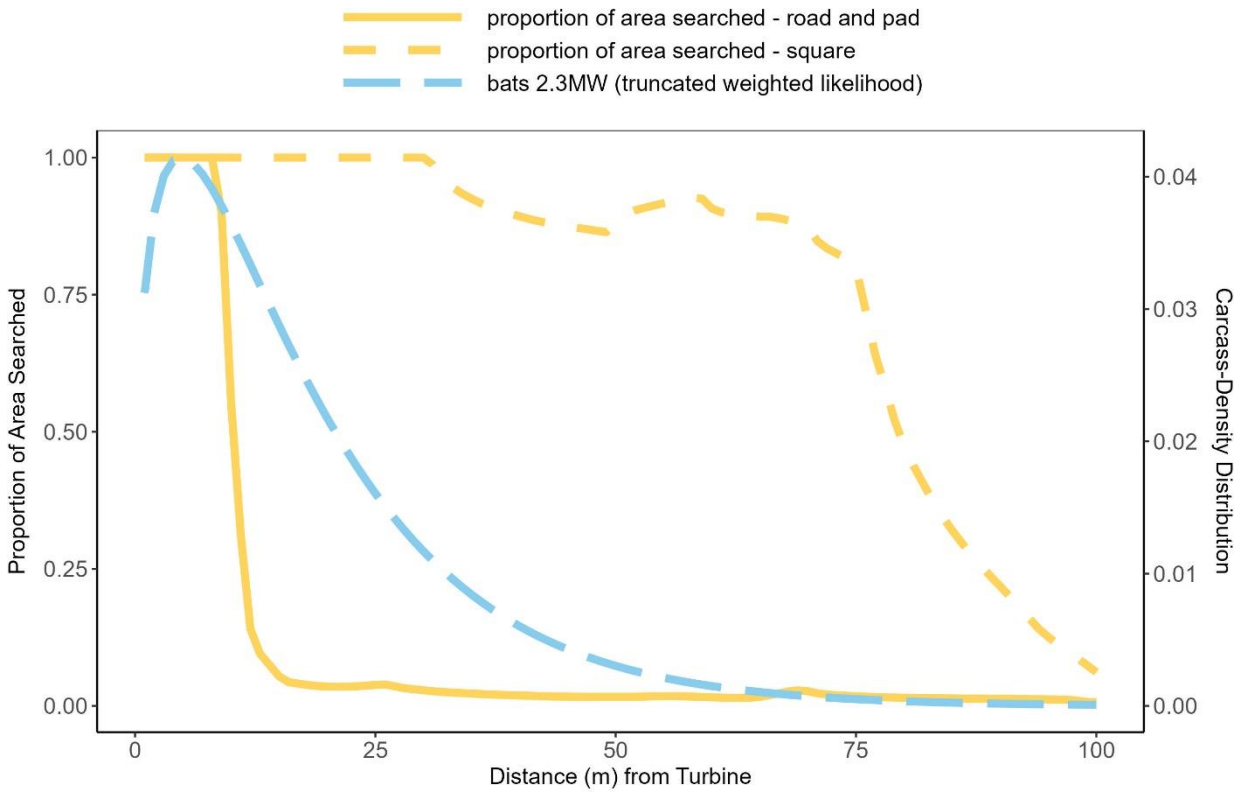

Figure 6. Density of bat carcasses per area searched at road and pad and square plots for 2.3 MW wind turbines at the Crescent Wind Project, Hillsdale County, Michigan, from April 1 – October 15, 2023.

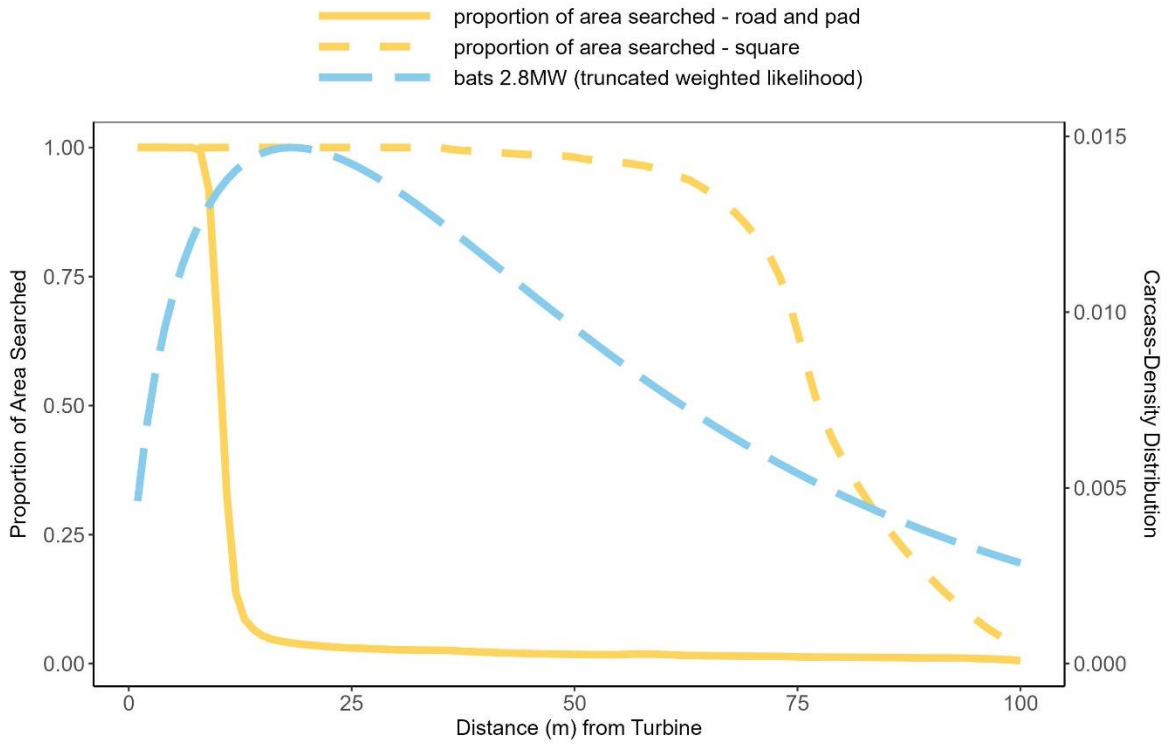

Figure 7. Density of bat carcasses per area searched at road and pad and square plots for 2.8 MW wind turbines at the Crescent Wind Project, Hillsdale County, Michigan, from April 1 – October 15, 2023.

Covered Species Take Estimates

One Indiana bat carcass was found during the 2023 study. Using EoA, the overall probability of detection (*g*) for 2023 was 0.25 (95% CI: 0.23–0.26; Table 3). Inputs required to run the EoA Single Class module and stratum-specific *g* distribution values and inputs required for the Multiple Class and Multi Years module are described in Appendix D.

Table 3. Annual probabilities of detection (*g*), Ba, Bb, and ρ for the Crescent Wind Project, Hillsdale County, Michigan, 2023.

Year	Ba[1]	Bb[1]	ρ	*g*	95% CI[2]
2021	272.38	386.10	1.135	0.41	0.38-0.45
2023	641.50	1958.39	1	0.25	0.23-0.26
λ (2021 and 2023)	624.984	1238.099	-	0.34	0.31-0.36
M* (2023)	641.50	1958.39	-	0.25	0.23-0.26

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

[2] CI = confidence interval.

Mean annual take rates were estimated to be 2.1 (95% CI: 0.15-6.54) Indiana bats per year and 0.7 (95% CI: 0.0-3.51) northern long-eared bats per year based on monitoring data from 2021 and 2023. The expected average annual take rates reported in the HCP were 3.20 Indiana bats per year and 1.63 northern long-eared bats per year.

Cumulative take under the ITP to-date (2023), *M*,* at α = 0.5 (50th credible bound), is estimated to be 5 Indiana bats and zero northern long-eared bats based on monitoring data from the 2023 study. The total take permitted by the ITP is 96 Indiana bats and 49 northern long-eared bats over the 30-year permit term.

CONCLUSIONS

This report presents the results of the first year of compliance monitoring conducted under the ITP. The PCM effort completed in 2023 was consistent with the HCP's monitoring requirements and the Project's 2023 study design. One Covered Species carcass was found with a high probability of detection in 2023. The adaptive management assessment based on annual take rates of Covered Species will not occur until Year 2, per the HCP

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Appendix A. Carcasses found during the 2023 Post-Construction Monitoring Surveys.

Appendix A. Carcasses found at the Crescent Wind Project, Hillsdale County, Michigan, from April 1 – October 15, 2023.

Found Date	Species	Distance from Turbine (m)	Turbine	Search Type	Search Area Type	Physical Condition	Aided Search
Bats							
04/18/2023	silver-haired bat	9	49	carcass search	road and pad	intact	no
04/19/2023	big brown bat	2	20	carcass search	road and pad	scavenged	no
04/19/2023	silver-haired bat	5	24	carcass search	road and pad	scavenged	no
05/15/2023	silver-haired bat	12	15	incidental[3]	full plot	scavenged	yes[1]
05/15/2023	silver-haired bat	30	15	carcass search	full plot	scavenged	yes[1]
05/15/2023	hoary bat	72	24	carcass search[3]	full plot	scavenged	yes[1]
05/15/2023	big brown bat	17	78	carcass search	full plot	scavenged	yes[1]
05/16/2023	big brown bat	27	31	carcass search[3]	full plot	scavenged	yes[1]
05/16/2023	big brown bat	8	36	carcass search	road and pad	scavenged	no
05/18/2023	silver-haired bat	14	15	carcass search	full plot	dismembered	yes[1]
05/22/2023	big brown bat	9	5	carcass search	road and pad	scavenged	no
05/25/2023	hoary bat	18	78	carcass search	full plot	scavenged	yes[1]
05/25/2023	silver-haired bat	45	88	carcass search	full plot	scavenged	yes[1]
06/01/2023	big brown bat	5	11	carcass search	road and pad	scavenged	no
06/01/2023	eastern red bat	4	75	carcass search	road and pad	intact	no
06/01/2023	big brown bat	17	78	carcass search	full plot	scavenged	yes[1]
06/01/2023	big brown bat	22	88	carcass search	full plot	scavenged	yes[1]
06/05/2023	silver-haired bat	15	15	carcass search	full plot	scavenged	yes[1]
06/05/2023	eastern red bat	46	71	carcass search	full plot	scavenged	yes[1]
06/05/2023	big brown bat	5	77	carcass search	road and pad	scavenged	no
06/08/2023	big brown bat	9	10	carcass search	full plot	scavenged	yes[1]
06/08/2023	silver-haired bat	48	24	carcass search	full plot	dismembered	yes[1]
06/09/2023	eastern red bat	54	37	carcass search	full plot	scavenged	yes[1]
06/12/2023	big brown bat	43	71	carcass search	full plot	scavenged	yes[1]
06/13/2023	eastern red bat	72	27	carcass search	full plot	scavenged	yes[1]
06/16/2023	silver-haired bat	44	56	carcass search	full plot	scavenged	yes[1]
06/19/2023	big brown bat	9	14	carcass search	full plot	scavenged	yes[1]
06/19/2023	silver-haired bat	26	88	carcass search	full plot	intact	yes[1]
06/20/2023	unidentified Lasiurus bat	85	27	carcass search	full plot	scavenged	yes[1]
06/20/2023	big brown bat	30	47	carcass search[2]	road and pad	scavenged	no
06/20/2023	silver-haired bat	1	86	carcass search	road and pad	scavenged	no
06/26/2023	silver-haired bat	15	15	carcass search	full plot	scavenged	yes[1]
06/26/2023	silver-haired bat	10	20	carcass search	road and pad	scavenged	no
06/26/2023	silver-haired bat	24	88	carcass search	full plot	scavenged	yes[1]
06/30/2023	big brown bat	32	14	carcass search	full plot	scavenged	yes[1]

Appendix A. Carcasses found at the Crescent Wind Project, Hillsdale County, Michigan, from April 1 – October 15, 2023.

Found Date	Species	Distance from Turbine (m)	Turbine	Search Type	Search Area Type	Physical Condition	Aided Search
06/30/2023	eastern red bat	40	15	carcass search	full plot	scavenged	yes[1]
06/30/2023	big brown bat	34	24	carcass search	full plot	scavenged	yes[1]
07/01/2023	hoary bat	43	37	carcass search	full plot	scavenged	yes[1]
07/01/2023	silver-haired bat	40	55	carcass search	full plot	scavenged	yes[1]
07/04/2023	big brown bat	17	6	incidental	full plot	scavenged	no
07/04/2023	big brown bat	10	27	carcass search	full plot	scavenged	yes[1]
07/04/2023	eastern red bat	6	43	carcass search	full plot	scavenged	yes[1]
07/04/2023	Indiana bat	17	44	carcass search	full plot	scavenged	yes[1]
07/04/2023	big brown bat	29	46	carcass search	full plot	scavenged	yes[1]
07/04/2023	eastern red bat	5	49	carcass search	road and pad	scavenged	no
07/06/2023	silver-haired bat	51	46	carcass search	full plot	scavenged	yes[1]
07/06/2023	eastern red bat	30	46	carcass search	full plot	scavenged	yes[1]
07/06/2023	eastern red bat	36	79	carcass search	full plot	scavenged	yes[1]
07/07/2023	eastern red bat	27	15	carcass search	full plot	scavenged	yes[1]
07/07/2023	big brown bat	12	15	carcass search	full plot	scavenged	yes[1]
07/07/2023	big brown bat	15	27	carcass search	full plot	scavenged	yes[1]
07/07/2023	silver-haired bat	29	37	carcass search	full plot	scavenged	yes[1]
07/07/2023	big brown bat	32	39	carcass search	full plot	scavenged	yes[1]
07/07/2023	big brown bat	10	40	carcass search	road and pad	scavenged	no
07/07/2023	eastern red bat	4	53	carcass search	road and pad	scavenged	no
07/10/2023	big brown bat	21	8	carcass search	full plot	scavenged	yes[1]
07/10/2023	big brown bat	5	9	carcass search	road and pad	scavenged	no
07/10/2023	big brown bat	46	14	carcass search	full plot	scavenged	yes[1]
07/10/2023	hoary bat	20	15	carcass search	full plot	scavenged	yes[1]
07/10/2023	big brown bat	27	24	carcass search	full plot	scavenged	yes[1]
07/10/2023	big brown bat	73	79	carcass search	full plot	scavenged	yes[1]
07/11/2023	eastern red bat	10	31	carcass search	full plot	scavenged	yes[1]
07/11/2023	big brown bat	38	31	carcass search	full plot	scavenged	yes[1]
07/11/2023	eastern red bat	46	31	carcass search	full plot	scavenged	yes[1]
07/11/2023	big brown bat	24	36	carcass search	road and pad	scavenged	no
07/11/2023	big brown bat	45	37	carcass search	full plot	scavenged	yes[1]
07/11/2023	hoary bat	8	38	carcass search	road and pad	scavenged	no
07/11/2023	big brown bat	27	43	carcass search	full plot	scavenged	yes[1]
07/11/2023	big brown bat	29	43	carcass search	full plot	scavenged	yes[1]
07/11/2023	big brown bat	24	44	carcass search	full plot	scavenged	yes[1]
07/11/2023	eastern red bat	23	44	carcass search	full plot	scavenged	yes[1]

Appendix A. Carcasses found at the Crescent Wind Project, Hillsdale County, Michigan, from April 1 – October 15, 2023.

Found Date	Species	Distance from Turbine (m)	Turbine	Search Type	Search Area Type	Physical Condition	Aided Search
07/11/2023	big brown bat	18	46	carcass search	full plot	scavenged	yes[1]
07/11/2023	big brown bat	8	49	carcass search	road and pad	scavenged	no
07/11/2023	hoary bat	0	50	carcass search	road and pad	scavenged	no
07/11/2023	big brown bat	42	53	carcass search	road and pad	scavenged	no
07/13/2023	big brown bat	17	8	carcass search	full plot	scavenged	yes[1]
07/13/2023	hoary bat	9	9	carcass search	road and pad	intact	no
07/13/2023	hoary bat	20	14	carcass search	full plot	scavenged	yes[1]
07/13/2023	hoary bat	9	14	carcass search	full plot	scavenged	yes[1]
07/13/2023	hoary bat	5	66	carcass search	road and pad	scavenged	no
07/13/2023	hoary bat	20	71	carcass search	full plot	scavenged	yes[1]
07/13/2023	hoary bat	21	79	carcass search	full plot	scavenged	yes[1]
07/14/2023	eastern red bat	21	27	carcass search	full plot	scavenged	yes[1]
07/14/2023	hoary bat	11	31	carcass search	full plot	scavenged	yes[1]
07/14/2023	hoary bat	11	39	carcass search	full plot	scavenged	yes[1]
07/14/2023	eastern red bat	56	46	carcass search	full plot	scavenged	yes[1]
07/14/2023	hoary bat	76	46	carcass search	full plot	scavenged	yes[1]
07/14/2023	big brown bat	54	48	carcass search	full plot	scavenged	yes[1]
07/14/2023	big brown bat	9	48	carcass search	full plot	scavenged	yes[1]
07/14/2023	big brown bat	0	55	carcass search	full plot	scavenged	no
07/14/2023	hoary bat	42	56	carcass search	full plot	scavenged	yes[1]
07/14/2023	big brown bat	5	58	carcass search	road and pad	scavenged	no
07/14/2023	hoary bat	46	78	carcass search	full plot	scavenged	yes[1]
07/17/2023	hoary bat	18	4	carcass search	road and pad	scavenged	no
07/17/2023	big brown bat	16	10	carcass search	full plot	scavenged	yes[1]
07/17/2023	big brown bat	30	10	carcass search	full plot	scavenged	yes[1]
07/17/2023	hoary bat	14	24	carcass search	full plot	scavenged	yes[1]
07/17/2023	eastern red bat	33	27	carcass search	full plot	scavenged	yes[1]
07/17/2023	eastern red bat	44	79	carcass search	full plot	scavenged	yes[1]
07/18/2023	silver-haired bat	38	31	carcass search	full plot	scavenged	yes[1]
07/18/2023	eastern red bat	49	31	carcass search	full plot	intact	yes[1]
07/18/2023	hoary bat	18	37	carcass search	full plot	scavenged	yes[1]
07/18/2023	eastern red bat	6	40	carcass search	road and pad	scavenged	no
07/18/2023	hoary bat	65	46	carcass search	full plot	scavenged	yes[1]
07/18/2023	big brown bat	48	46	carcass search	full plot	scavenged	yes[1]
07/18/2023	big brown bat	18	46	carcass search	full plot	scavenged	yes[1]
07/18/2023	eastern red bat	32	55	carcass search	full plot	scavenged	yes[1]

Appendix A. Carcasses found at the Crescent Wind Project, Hillsdale County, Michigan, from April 1 – October 15, 2023.

Found Date	Species	Distance from Turbine (m)	Turbine	Search Type	Search Area Type	Physical Condition	Aided Search
07/20/2023	hoary bat	44	6	carcass search	full plot	scavenged	yes[1]
07/20/2023	eastern red bat	45	6	carcass search	full plot	scavenged	yes[1]
07/20/2023	eastern red bat	9	13	carcass search	road and pad	scavenged	no
07/20/2023	eastern red bat	8	18	carcass search	road and pad	scavenged	no
07/20/2023	eastern red bat	8	20	carcass search	road and pad	scavenged	no
07/20/2023	hoary bat	13	23	carcass search	road and pad	scavenged	no
07/20/2023	hoary bat	41	44	carcass search	full plot	scavenged	yes[1]
07/20/2023	big brown bat	50	44	carcass search	full plot	scavenged	yes[1]
07/20/2023	eastern red bat	22	44	carcass search	full plot	scavenged	yes[1]
07/20/2023	hoary bat	21	71	carcass search	full plot	scavenged	yes[1]
07/21/2023	eastern red bat	45	31	carcass search	full plot	scavenged	yes[1]
07/21/2023	eastern red bat	13	31	carcass search	full plot	scavenged	yes[1]
07/21/2023	big brown bat	20	31	carcass search	full plot	scavenged	yes[1]
07/21/2023	big brown bat	20	37	carcass search	full plot	scavenged	yes[1]
07/21/2023	eastern red bat	20	39	carcass search	full plot	scavenged	yes[1]
07/21/2023	unidentified Lasiurus bat	49	43	carcass search	full plot	scavenged	yes[1]
07/21/2023	big brown bat	11	46	carcass search	full plot	scavenged	yes[1]
07/21/2023	big brown bat	46	48	carcass search	full plot	scavenged	yes[1]
07/21/2023	big brown bat	10	48	carcass search	full plot	scavenged	yes[1]
07/21/2023	big brown bat	27	48	carcass search	full plot	scavenged	yes[1]
07/21/2023	big brown bat	0	54	carcass search	road and pad	scavenged	no
07/21/2023	big brown bat	21	55	carcass search	full plot	scavenged	yes[1]
07/21/2023	big brown bat	17	55	carcass search	full plot	scavenged	yes[1]
07/21/2023	eastern red bat	3	58	carcass search	road and pad	scavenged	no
07/21/2023	big brown bat	3	86	carcass search	road and pad	scavenged	no
07/21/2023	eastern red bat	14	88	carcass search	full plot	scavenged	yes[1]
07/21/2023	hoary bat	28	88	carcass search	full plot	scavenged	yes[1]
07/24/2023	big brown bat	17	8	carcass search	full plot	scavenged	yes[1]
07/24/2023	hoary bat	35	14	carcass search	full plot	scavenged	yes[1]
07/24/2023	hoary bat	41	17	carcass search	road and pad	scavenged	no
07/24/2023	eastern red bat	14	24	carcass search	full plot	scavenged	yes[1]
07/24/2023	hoary bat	72	24	carcass search	full plot	scavenged	yes[1]
07/24/2023	big brown bat	18	71	carcass search	full plot	scavenged	yes[1]
07/24/2023	eastern red bat	30	71	carcass search	full plot	scavenged	yes[1]
07/24/2023	big brown bat	47	78	carcass search	full plot	scavenged	yes[1]
07/24/2023	big brown bat	11	80	carcass search[2]	road and pad	scavenged	no

Appendix A. Carcasses found at the Crescent Wind Project, Hillsdale County, Michigan, from April 1 – October 15, 2023.

Found Date	Species	Distance from Turbine (m)	Turbine	Search Type	Search Area Type	Physical Condition	Aided Search
07/25/2023	eastern red bat	9	31	carcass search	full plot	scavenged	yes[1]
07/25/2023	big brown bat	22	37	carcass search	full plot	scavenged	yes[1]
07/25/2023	big brown bat	16	37	carcass search	full plot	scavenged	yes[1]
07/25/2023	hoary bat	5	38	carcass search	road and pad	scavenged	no
07/25/2023	eastern red bat	2	43	carcass search	full plot	scavenged	yes[1]
07/25/2023	hoary bat	46	46	carcass search	full plot	scavenged	yes[1]
07/25/2023	hoary bat	20	46	carcass search	full plot	scavenged	yes[1]
07/25/2023	big brown bat	50	48	carcass search	full plot	scavenged	yes[1]
07/25/2023	hoary bat	6	53	carcass search	road and pad	scavenged	no
07/25/2023	hoary bat	59	56	carcass search	full plot	scavenged	yes[1]
07/25/2023	big brown bat	44	56	carcass search	full plot	scavenged	yes[1]
07/27/2023	big brown bat	17	4	carcass search	road and pad	intact	no
07/27/2023	big brown bat	35	6	carcass search	full plot	scavenged	yes[1]
07/27/2023	hoary bat	21	6	carcass search	full plot	scavenged	yes[1]
07/27/2023	eastern red bat	73	8	carcass search	full plot	scavenged	yes[1]
07/27/2023	big brown bat	26	10	carcass search	full plot	scavenged	yes[1]
07/27/2023	big brown bat	35	15	carcass search	full plot	scavenged	yes[1]
07/27/2023	hoary bat	10	17	carcass search	road and pad	injured	no
07/27/2023	hoary bat	30	27	carcass search	full plot	scavenged	yes[1]
07/27/2023	big brown bat	27	27	carcass search	full plot	scavenged	yes[1]
07/27/2023	eastern red bat	33	78	carcass search	full plot	scavenged	yes[1]
07/27/2023	eastern red bat	41	78	carcass search	full plot	scavenged	yes[1]
07/27/2023	big brown bat	74	78	carcass search	full plot	scavenged	yes[1]
07/27/2023	big brown bat	5	80	carcass search	road and pad	scavenged	no
07/27/2023	hoary bat	5	83	carcass search	road and pad	scavenged	no
07/27/2023	big brown bat	11	88	carcass search	full plot	scavenged	yes[1]
07/28/2023	big brown bat	17	30	carcass search	road and pad	scavenged	no
07/28/2023	big brown bat	48	31	carcass search	full plot	scavenged	yes[1]
07/28/2023	big brown bat	13	32	carcass search	road and pad	scavenged	no
07/28/2023	eastern red bat	8	32	carcass search	road and pad	scavenged	no
07/28/2023	hoary bat	2	36	carcass search	road and pad	scavenged	no
07/28/2023	big brown bat	44	37	carcass search	full plot	scavenged	yes[1]
07/28/2023	hoary bat	23	37	carcass search	full plot	scavenged	yes[1]
07/28/2023	hoary bat	13	39	carcass search	full plot	scavenged	yes[1]
07/28/2023	hoary bat	15	39	carcass search	full plot	scavenged	yes[1]
07/28/2023	eastern red bat	27	39	carcass search	full plot	scavenged	yes[1]

Appendix A. Carcasses found at the Crescent Wind Project, Hillsdale County, Michigan, from April 1 – October 15, 2023.

Found Date	Species	Distance from Turbine (m)	Turbine	Search Type	Search Area Type	Physical Condition	Aided Search
07/28/2023	hoary bat	11	39	carcass search	full plot	scavenged	yes[1]
07/28/2023	hoary bat	18	39	carcass search	full plot	scavenged	yes[1]
07/28/2023	eastern red bat	74	40	carcass search	road and pad	scavenged	no
07/28/2023	big brown bat	7	40	carcass search	road and pad	scavenged	no
07/28/2023	big brown bat	2	40	carcass search	road and pad	injured	no
07/28/2023	eastern red bat	38	43	carcass search	full plot	scavenged	yes[1]
07/28/2023	eastern red bat	30	43	carcass search	full plot	scavenged	yes[1]
07/28/2023	big brown bat	54	43	carcass search	full plot	scavenged	yes[1]
07/28/2023	hoary bat	44	44	carcass search	full plot	scavenged	yes[1]
07/28/2023	eastern red bat	42	44	carcass search	full plot	scavenged	yes[1]
07/28/2023	big brown bat	18	46	carcass search	full plot	scavenged	yes[1]
07/28/2023	big brown bat	40	46	carcass search	full plot	scavenged	yes[1]
07/28/2023	UINM	5	53	carcass search	road and pad	scavenged	no
07/28/2023	big brown bat	6	54	carcass search	road and pad	scavenged	no
07/28/2023	eastern red bat	8	54	carcass search	road and pad	intact	no
07/28/2023	eastern red bat	42	55	carcass search	full plot	scavenged	yes[1]
07/28/2023	big brown bat	24	55	carcass search	full plot	scavenged	yes[1]
07/28/2023	big brown bat	26	55	carcass search	full plot	scavenged	yes[1]
07/28/2023	eastern red bat	17	55	carcass search	full plot	scavenged	yes[1]
07/28/2023	big brown bat	29	55	carcass search	full plot	scavenged	yes[1]
07/28/2023	eastern red bat	35	56	carcass search	full plot	scavenged	yes[1]
07/28/2023	big brown bat	6	57	carcass search	road and pad	scavenged	no
07/31/2023	eastern red bat	1	8	carcass search	full plot	scavenged	yes[1]
07/31/2023	eastern red bat	25	8	carcass search	full plot	scavenged	yes[1]
07/31/2023	eastern red bat	23	8	carcass search	full plot	scavenged	yes[1]
07/31/2023	big brown bat	7	10	carcass search	full plot	scavenged	yes[1]
07/31/2023	eastern red bat	58	14	carcass search	full plot	scavenged	yes[1]
07/31/2023	big brown bat	25	14	carcass search	full plot	scavenged	yes[1]
07/31/2023	hoary bat	17	14	carcass search	full plot	scavenged	yes[1]
07/31/2023	big brown bat	5	14	carcass search	full plot	scavenged	yes[1]
07/31/2023	big brown bat	2	14	carcass search	full plot	scavenged	yes[1]
07/31/2023	eastern red bat	8	14	carcass search	full plot	scavenged	yes[1]
07/31/2023	big brown bat	6	14	carcass search	full plot	scavenged	yes[1]
07/31/2023	big brown bat	18	14	carcass search	full plot	scavenged	yes[1]
07/31/2023	hoary bat	8	23	carcass search	road and pad	injured	no
07/31/2023	big brown bat	17	75	carcass search	road and pad	scavenged	no

Appendix A. Carcasses found at the Crescent Wind Project, Hillsdale County, Michigan, from April 1 – October 15, 2023.

Found Date	Species	Distance from Turbine (m)	Turbine	Search Type	Search Area Type	Physical Condition	Aided Search
07/31/2023	eastern red bat	17	79	carcass search	full plot	scavenged	yes[1]
07/31/2023	eastern red bat	30	79	carcass search	full plot	scavenged	yes[1]
08/01/2023	big brown bat	14	27	carcass search	full plot	scavenged	yes[1]
08/01/2023	big brown bat	17	27	carcass search	full plot	scavenged	yes[1]
08/01/2023	big brown bat	8	30	carcass search	road and pad	scavenged	no
08/01/2023	hoary bat	27	31	carcass search	full plot	scavenged	yes[1]
08/01/2023	hoary bat	14	35	carcass search[2]	road and pad	scavenged	no
08/01/2023	hoary bat	17	37	carcass search	full plot	scavenged	yes[1]
08/01/2023	hoary bat	14	37	carcass search	full plot	scavenged	yes[1]
08/01/2023	hoary bat	15	43	carcass search	full plot	scavenged	yes[1]
08/01/2023	eastern red bat	5	45	carcass search	road and pad	scavenged	no
08/01/2023	eastern red bat	20	48	carcass search	full plot	scavenged	yes[1]
08/01/2023	big brown bat	11	56	carcass search	full plot	scavenged	yes[1]
08/01/2023	hoary bat	17	56	carcass search	full plot	scavenged	yes[1]
08/01/2023	eastern red bat	19	56	carcass search	full plot	scavenged	yes[1]
08/03/2023	hoary bat	29	6	carcass search	full plot	intact	yes[1]
08/03/2023	hoary bat	29	8	carcass search	full plot	scavenged	yes[1]
08/03/2023	eastern red bat	18	14	carcass search	full plot	scavenged	yes[1]
08/03/2023	eastern red bat	35	14	carcass search	full plot	scavenged	yes[1]
08/03/2023	big brown bat	16	15	carcass search	full plot	scavenged	yes[1]
08/03/2023	big brown bat	27	15	carcass search	full plot	scavenged	yes[1]
08/03/2023	big brown bat	40	39	carcass search	full plot	scavenged	yes[1]
08/03/2023	big brown bat	9	66	carcass search	road and pad	scavenged	no
08/04/2023	big brown bat	30	31	carcass search	full plot	scavenged	yes[1]
08/04/2023	hoary bat	21	41	carcass search	road and pad	scavenged	no
08/04/2023	eastern red bat	34	43	carcass search	full plot	scavenged	yes[1]
08/04/2023	big brown bat	45	44	carcass search	full plot	scavenged	yes[1]
08/04/2023	big brown bat	32	48	carcass search	full plot	scavenged	yes[1]
08/04/2023	big brown bat	24	55	carcass search	full plot	scavenged	yes[1]
08/04/2023	big brown bat	5	55	carcass search	full plot	scavenged	yes[1]
08/04/2023	big brown bat	8	55	carcass search	full plot	scavenged	yes[1]
08/04/2023	big brown bat	9	55	carcass search	full plot	scavenged	yes[1]
08/04/2023	eastern red bat	38	56	carcass search	full plot	scavenged	yes[1]
08/04/2023	hoary bat	28	56	carcass search	full plot	scavenged	yes[1]
08/04/2023	hoary bat	51	56	carcass search	full plot	scavenged	yes[1]
08/04/2023	hoary bat	35	56	carcass search	full plot	scavenged	yes[1]

Appendix A. Carcasses found at the Crescent Wind Project, Hillsdale County, Michigan, from April 1 – October 15, 2023.

Found Date	Species	Distance from Turbine (m)	Turbine	Search Type	Search Area Type	Physical Condition	Aided Search
08/04/2023	hoary bat	9	74	carcass search	road and pad	scavenged	no
08/07/2023	big brown bat	8	5	carcass search	road and pad	scavenged	no
08/07/2023	hoary bat	35	6	carcass search	full plot	intact	yes[1]
08/07/2023	hoary bat	35	6	carcass search	full plot	scavenged	yes[1]
08/07/2023	eastern red bat	34	8	carcass search	full plot	scavenged	yes[1]
08/07/2023	eastern red bat	48	8	carcass search	full plot	scavenged	yes[1]
08/07/2023	eastern red bat	9	10	carcass search	full plot	scavenged	yes[1]
08/07/2023	big brown bat	7	12	carcass search	road and pad	scavenged	no
08/07/2023	big brown bat	1	12	carcass search	road and pad	scavenged	no
08/07/2023	eastern red bat	40	14	carcass search	full plot	scavenged	yes[1]
08/07/2023	eastern red bat	50	15	carcass search	full plot	scavenged	yes[1]
08/07/2023	big brown bat	10	19	carcass search	road and pad	scavenged	no
08/07/2023	eastern red bat	53	71	carcass search	full plot	scavenged	yes[1]
08/07/2023	big brown bat	18	79	carcass search	full plot	scavenged	yes[1]
08/07/2023	eastern red bat	18	79	carcass search	full plot	scavenged	yes[1]
08/07/2023	big brown bat	20	79	carcass search	full plot	scavenged	yes[1]
08/08/2023	eastern red bat	57	24	carcass search	full plot	scavenged	yes[1]
08/08/2023	big brown bat	61	24	carcass search	full plot	scavenged	yes[1]
08/08/2023	hoary bat	27	27	carcass search	full plot	scavenged	yes[1]
08/08/2023	big brown bat	25	27	carcass search	full plot	scavenged	yes[1]
08/08/2023	big brown bat	29	31	carcass search	full plot	scavenged	yes[1]
08/08/2023	eastern red bat	5	32	carcass search	road and pad	scavenged	no
08/08/2023	big brown bat	6	35	carcass search	road and pad	scavenged	no
08/08/2023	eastern red bat	24	37	carcass search	full plot	scavenged	`
08/08/2023	big brown bat	35	39	carcass search	full plot	scavenged	yes[1]
08/08/2023	big brown bat	0	40	carcass search	road and pad	scavenged	no
08/08/2023	eastern red bat	44	48	carcass search	full plot	scavenged	yes[1]
08/08/2023	eastern red bat	10	56	carcass search	full plot	scavenged	yes[1]
08/10/2023	hoary bat	80	6	carcass search	full plot	scavenged	yes[1]
08/10/2023	hoary bat	11	10	carcass search	full plot	scavenged	yes[1]
08/10/2023	big brown bat	7	12	carcass search	road and pad	intact	no
08/10/2023	big brown bat	35	14	carcass search	full plot	scavenged	yes[1]
08/10/2023	hoary bat	30	24	carcass search	full plot	scavenged	yes[1]
08/10/2023	big brown bat	29	71	carcass search	full plot	scavenged	yes[1]
08/10/2023	hoary bat	37	71	carcass search	full plot	scavenged	yes[1]
08/10/2023	big brown bat	30	88	carcass search	full plot	scavenged	yes[1]

Appendix A. Carcasses found at the Crescent Wind Project, Hillsdale County, Michigan, from April 1 – October 15, 2023.

Found Date	Species	Distance from Turbine (m)	Turbine	Search Type	Search Area Type	Physical Condition	Aided Search
08/11/2023	hoary bat	56	27	carcass search	full plot	scavenged	yes[1]
08/11/2023	big brown bat	8	30	carcass search	road and pad	scavenged	no
08/11/2023	big brown bat	7	35	carcass search	road and pad	scavenged	no
08/11/2023	hoary bat	35	37	carcass search	full plot	scavenged	yes[1]
08/11/2023	big brown bat	17	39	carcass search	full plot	scavenged	yes[1]
08/11/2023	big brown bat	6	40	carcass search	road and pad	scavenged	no
08/11/2023	hoary bat	12	41	carcass search[2]	road and pad	scavenged	no
08/11/2023	big brown bat	14	44	carcass search	full plot	scavenged	yes[1]
08/11/2023	big brown bat	16	46	carcass search	full plot	scavenged	yes[1]
08/11/2023	big brown bat	12	53	carcass search	road and pad	scavenged	no
08/11/2023	eastern red bat	47	56	carcass search	full plot	scavenged	yes[1]
08/11/2023	hoary bat	51	56	carcass search	full plot	scavenged	yes[1]
08/11/2023	hoary bat	12	56	carcass search	full plot	scavenged	yes[1]
08/11/2023	eastern red bat	9	56	carcass search	full plot	scavenged	yes[1]
08/14/2023	hoary bat	29	8	carcass search	full plot	scavenged	yes[1]
08/14/2023	big brown bat	42	8	carcass search	full plot	scavenged	yes[1]
08/14/2023	big brown bat	28	10	carcass search	full plot	scavenged	yes[1]
08/14/2023	big brown bat	7	11	carcass search	road and pad	scavenged	no
08/14/2023	big brown bat	8	12	carcass search	road and pad	scavenged	no
08/14/2023	big brown bat	9	12	carcass search	road and pad	scavenged	no
08/14/2023	big brown bat	3	12	carcass search	road and pad	scavenged	no
08/14/2023	big brown bat	2	12	carcass search	road and pad	scavenged	no
08/14/2023	big brown bat	6	12	carcass search	road and pad	scavenged	no
08/14/2023	big brown bat	10	12	carcass search	road and pad	scavenged	no
08/14/2023	big brown bat	21	14	carcass search	full plot	scavenged	yes[1]
08/14/2023	hoary bat	34	15	carcass search	full plot	scavenged	yes[1]
08/14/2023	eastern red bat	35	15	carcass search	full plot	scavenged	yes[1]
08/14/2023	big brown bat	16	16	carcass search[2]	road and pad	scavenged	no
08/14/2023	big brown bat	8	17	carcass search	road and pad	scavenged	no
08/14/2023	hoary bat	23	24	carcass search	full plot	scavenged	yes[1]
08/14/2023	eastern red bat	36	24	carcass search	full plot	injured	yes[1]
08/14/2023	big brown bat	44	24	carcass search	full plot	scavenged	yes[1]
08/14/2023	eastern red bat	9	27	incidental	full plot	scavenged	no
08/14/2023	eastern red bat	15	71	carcass search	full plot	scavenged	yes
08/14/2023	big brown bat	38	78	carcass search	full plot	scavenged	yes[1]
08/14/2023	big brown bat	20	78	carcass search	full plot	scavenged	yes[1]

Appendix A. Carcasses found at the Crescent Wind Project, Hillsdale County, Michigan, from April 1 – October 15, 2023.

Found Date	Species	Distance from Turbine (m)	Turbine	Search Type	Search Area Type	Physical Condition	Aided Search
08/14/2023	big brown bat	26	79	carcass search	full plot	scavenged	yes[1]
08/14/2023	big brown bat	11	79	carcass search	full plot	scavenged	yes[1]
08/14/2023	eastern red bat	2	80	carcass search	road and pad	scavenged	no
08/14/2023	big brown bat	53	88	carcass search	full plot	scavenged	yes[1]
08/15/2023	big brown bat	11	27	carcass search	full plot	scavenged	yes[1]
08/15/2023	hoary bat	12	31	carcass search	full plot	scavenged	yes[1]
08/15/2023	eastern red bat	36	31	carcass search	full plot	scavenged	yes[1]
08/15/2023	big brown bat	19	31	carcass search	full plot	scavenged	yes[1]
08/15/2023	big brown bat	48	36	carcass search	road and pad	scavenged	no
08/15/2023	big brown bat	5	38	carcass search	road and pad	scavenged	no
08/15/2023	eastern red bat	30	39	carcass search	full plot	scavenged	yes[1]
08/15/2023	hoary bat	11	44	carcass search	full plot	scavenged	yes[1]
08/15/2023	big brown bat	14	48	carcass search	full plot	scavenged	yes[1]
08/15/2023	big brown bat	10	53	carcass search	road and pad	scavenged	no
08/15/2023	hoary bat	8	54	carcass search	road and pad	scavenged	no
08/15/2023	big brown bat	3	79	incidental	full plot	intact	yes[1]
08/17/2023	big brown bat	1	83	carcass search	road and pad	intact	no
08/18/2023	silver-haired bat	15	14	carcass search	full plot	scavenged	yes[1]
08/18/2023	silver-haired bat	8	18	carcass search	road and pad	intact	no
08/18/2023	eastern red bat	20	27	carcass search	full plot	scavenged	yes[1]
08/18/2023	hoary bat	54	27	carcass search	full plot	scavenged	yes[1]
08/18/2023	hoary bat	44	31	carcass search	full plot	scavenged	yes[1]
08/18/2023	silver-haired bat	11	37	carcass search	full plot	scavenged	yes[1]
08/18/2023	eastern red bat	35	37	carcass search	full plot	scavenged	yes[1]
08/18/2023	hoary bat	34	43	carcass search	full plot	scavenged	yes[1]
08/18/2023	big brown bat	1	43	carcass search	full plot	scavenged	yes[1]
08/18/2023	eastern red bat	55	48	carcass search	full plot	scavenged	yes[1]
08/18/2023	eastern red bat	20	50	carcass search	road and pad	scavenged	no
08/18/2023	eastern red bat	39	55	carcass search	full plot	scavenged	yes[1]
08/18/2023	eastern red bat	18	78	carcass search	full plot	scavenged	yes[1]
08/18/2023	eastern red bat	36	79	carcass search	full plot	scavenged	yes[1]
08/21/2023	big brown bat	24	6	carcass search	full plot	scavenged	yes[1]
08/21/2023	Seminole bat	21	14	carcass search	full plot	scavenged	yes[1]
08/21/2023	big brown bat	38	24	carcass search	full plot	scavenged	yes[1]
08/21/2023	eastern red bat	16	66	carcass search	road and pad	scavenged	no
08/21/2023	big brown bat	33	78	carcass search	full plot	scavenged	yes[1]

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Found Date	Species	Distance from Turbine (m)	Turbine	Search Type	Search Area Type	Physical Condition	Aided Search
08/21/2023	big brown bat	32	78	carcass search	full plot	scavenged	yes[1]
08/21/2023	big brown bat	32	78	carcass search	full plot	scavenged	yes[1]
08/22/2023	silver-haired bat	7	30	carcass search	road and pad	scavenged	no
08/22/2023	eastern red bat	26	31	carcass search	full plot	scavenged	yes[1]
08/22/2023	big brown bat	24	38	carcass search	road and pad	scavenged	no
08/22/2023	eastern red bat	59	43	carcass search	full plot	scavenged	yes[1]
08/22/2023	big brown bat	56	43	carcass search	full plot	scavenged	yes[1]
08/22/2023	eastern red bat	16	43	carcass search	full plot	scavenged	yes[1]
08/22/2023	silver-haired bat	24	43	carcass search	full plot	scavenged	yes[1]
08/22/2023	silver-haired bat	9	44	carcass search	full plot	scavenged	yes[1]
08/22/2023	silver-haired bat	9	45	carcass search	road and pad	scavenged	no
08/22/2023	hoary bat	56	46	carcass search	full plot	scavenged	yes[1]
08/22/2023	eastern red bat	21	49	carcass search	road and pad	scavenged	no
08/22/2023	big brown bat	6	50	carcass search	road and pad	scavenged	no
08/22/2023	big brown bat	6	53	carcass search	road and pad	scavenged	no
08/22/2023	big brown bat	10	55	carcass search	full plot	scavenged	yes[1]
08/22/2023	eastern red bat	11	56	carcass search	full plot	scavenged	yes[1]
08/22/2023	big brown bat	13	56	carcass search	full plot	intact	yes[1]
08/22/2023	eastern red bat	5	56	carcass search	full plot	scavenged	yes[1]
08/22/2023	silver-haired bat	24	56	carcass search	full plot	scavenged	yes[1]
08/21/2023	big brown bat	32	78	carcass search	full plot	scavenged	yes[1]
08/22/2023	big brown bat	6	57	carcass search	road and pad	scavenged	no
08/24/2023	silver-haired bat	13	14	carcass search	full plot	scavenged	yes[1]
08/24/2023	big brown bat	10	25	carcass search	road and pad	scavenged	no
08/24/2023	silver-haired bat	47	88	carcass search	full plot	scavenged	yes[1]
08/24/2023	eastern red bat	6	88	carcass search	full plot	scavenged	yes[1]
08/25/2023	hoary bat	8	30	carcass search	road and pad	intact	no
08/25/2023	big brown bat	8	30	carcass search	road and pad	intact	no
08/25/2023	silver-haired bat	14	31	carcass search	full plot	scavenged	yes[1]
08/25/2023	silver-haired bat	9	36	carcass search	road and pad	intact	no
08/25/2023	eastern red bat	80	38	carcass search	road and pad	scavenged	no
08/25/2023	eastern red bat	29	39	carcass search	full plot	scavenged	yes[1]
08/25/2023	eastern red bat	56	39	carcass search	full plot	scavenged	yes[1]
08/25/2023	silver-haired bat	48	39	carcass search	full plot	scavenged	yes[1]
08/25/2023	big brown bat	43	39	carcass search	full plot	scavenged	yes[1]
08/25/2023	big brown bat	53	39	carcass search	full plot	scavenged	yes[1]

Appendix A. Carcasses found at the Crescent Wind Project, Hillsdale County, Michigan, from April 1 – October 15, 2023.

Found Date	Species	Distance from Turbine (m)	Turbine	Search Type	Search Area Type	Physical Condition	Aided Search
08/25/2023	hoary bat	6	41	carcass search	road and pad	scavenged	no
08/25/2023	big brown bat	14	50	carcass search	road and pad	scavenged	no
08/25/2023	eastern red bat	3	56	carcass search	full plot	scavenged	yes[1]
08/26/2023	silver-haired bat	38	44	carcass search	full plot	scavenged	yes[1]
08/26/2023	big brown bat	41	46	carcass search	full plot	scavenged	yes[1]
08/28/2023	eastern red bat	32	6	carcass search	full plot	scavenged	yes[1]
08/28/2023	eastern red bat	19	8	carcass search	full plot	scavenged	yes[1]
08/28/2023	hoary bat	41	14	carcass search	full plot	scavenged	yes[1]
08/28/2023	eastern red bat	38	14	carcass search	full plot	scavenged	yes[1]
08/28/2023	silver-haired bat	22	14	carcass search	full plot	scavenged	yes[1]
08/28/2023	silver-haired bat	38	15	carcass search	full plot	scavenged	yes[1]
08/28/2023	silver-haired bat	35	15	carcass search	full plot	scavenged	yes[1]
08/28/2023	hoary bat	0	15	carcass search	full plot	scavenged	yes[1]
08/28/2023	silver-haired bat	2	15	carcass search	full plot	scavenged	yes[1]
08/28/2023	silver-haired bat	36	19	carcass search	road and pad	scavenged	no
08/28/2023	silver-haired bat	12	19	carcass search[2]	road and pad	scavenged	no
08/28/2023	hoary bat	17	24	carcass search	full plot	scavenged	yes[1]
08/28/2023	big brown bat	30	24	carcass search	full plot	scavenged	yes[1]
08/28/2023	silver-haired bat	9	24	carcass search	full plot	scavenged	yes[1]
08/28/2023	eastern red bat	11	71	carcass search	full plot	scavenged	yes[1]
08/28/2023	eastern red bat	45	71	carcass search	full plot	scavenged	yes[1]
08/28/2023	big brown bat	5	80	carcass search	road and pad	scavenged	no
08/29/2023	big brown bat	17	37	carcass search	full plot	scavenged	yes[1]
08/29/2023	big brown bat	9	37	carcass search	full plot	scavenged	yes[1]
08/29/2023	silver-haired bat	6	37	carcass search	full plot	scavenged	yes[1]
08/29/2023	big brown bat	51	39	carcass search	full plot	scavenged	yes[1]
08/29/2023	eastern red bat	24	39	carcass search	full plot	scavenged	yes[1]
08/29/2023	hoary bat	17	39	carcass search	full plot	scavenged	yes[1]
08/29/2023	silver-haired bat	6	40	carcass search	road and pad	scavenged	no
08/29/2023	silver-haired bat	17	44	carcass search	full plot	scavenged	yes[1]
08/29/2023	hoary bat	24	48	carcass search	full plot	scavenged	yes[1]
08/29/2023	big brown bat	20	48	carcass search	full plot	scavenged	yes[1]
08/29/2023	big brown bat	5	49	carcass search	road and pad	scavenged	no
08/29/2023	big brown bat	18	55	carcass search	full plot	scavenged	yes[1]
08/29/2023	big brown bat	9	55	carcass search	full plot	scavenged	yes[1]
08/29/2023	big brown bat	68	56	carcass search	full plot	scavenged	yes[1]

Appendix A. Carcasses found at the Crescent Wind Project, Hillsdale County, Michigan, from April 1 – October 15, 2023.

Found Date	Species	Distance from Turbine (m)	Turbine	Search Type	Search Area Type	Physical Condition	Aided Search
08/29/2023	big brown bat	65	79	carcass search	full plot	scavenged	yes[1]
08/29/2023	silver-haired bat	11	86	carcass search	road and pad	scavenged	no
08/30/2023	big brown bat	44	14	carcass search	full plot	scavenged	yes[1]
08/30/2023	silver-haired bat	23	14	carcass search	full plot	scavenged	yes[1]
08/30/2023	silver-haired bat	48	14	carcass search	full plot	scavenged	yes[1]
08/30/2023	silver-haired bat	6	35	carcass search	road and pad	scavenged	no
08/30/2023	silver-haired bat	83	66	carcass search	road and pad	injured	no
08/30/2023	silver-haired bat	9	71	carcass search	full plot	intact	yes[1]
08/31/2023	silver-haired bat	6	17	carcass search	road and pad	scavenged	no
08/31/2023	silver-haired bat	29	24	carcass search	full plot	scavenged	yes[1]
08/31/2023	big brown bat	47	27	carcass search	full plot	scavenged	yes[1]
08/31/2023	big brown bat	17	27	carcass search	full plot	scavenged	yes[1]
08/31/2023	silver-haired bat	14	31	carcass search	full plot	scavenged	yes[1]
08/31/2023	silver-haired bat	12	31	carcass search	full plot	scavenged	yes[1]
08/31/2023	hoary bat	44	31	carcass search	full plot	scavenged	yes[1]
08/31/2023	silver-haired bat	39	36	carcass search	road and pad	scavenged	no
08/31/2023	silver-haired bat	40	78	carcass search	full plot	scavenged	yes[1]
08/31/2023	big brown bat	6	78	carcass search	full plot	scavenged	yes[1]
08/31/2023	eastern red bat	32	78	carcass search	full plot	scavenged	yes[1]
09/01/2023	silver-haired bat	21	39	carcass search	full plot	scavenged	yes[1]
09/01/2023	silver-haired bat	3	40	carcass search	road and pad	scavenged	no
09/01/2023	big brown bat	12	41	carcass search	road and pad	scavenged	no
09/01/2023	big brown bat	33	43	carcass search	full plot	scavenged	yes[1]
09/01/2023	silver-haired bat	33	47	carcass search	road and pad	scavenged	no
09/01/2023	silver-haired bat	2	47	carcass search	road and pad	scavenged	no
09/01/2023	silver-haired bat	18	86	carcass search[2]	road and pad	scavenged	no
09/04/2023	silver-haired bat	10	7	carcass search	road and pad	scavenged	no
09/04/2023	silver-haired bat	39	8	carcass search	full plot	scavenged	yes[1]
09/04/2023	silver-haired bat	17	10	carcass search	full plot	scavenged	yes[1]
09/04/2023	silver-haired bat	9	13	carcass search	road and pad	scavenged	no
09/04/2023	eastern red bat	73	14	carcass search[2]	full plot	scavenged	yes[1]
09/04/2023	silver-haired bat	10	18	carcass search	road and pad	scavenged	no
09/04/2023	silver-haired bat	1	20	carcass search	road and pad	scavenged	no
09/04/2023	eastern red bat	18	27	carcass search	full plot	scavenged	yes[1]
09/04/2023	big brown bat	23	27	carcass search	full plot	scavenged	yes[1]
09/04/2023	big brown bat	36	27	carcass search	full plot	scavenged	yes[1]

Appendix A. Carcasses found at the Crescent Wind Project, Hillsdale County, Michigan, from April 1 – October 15, 2023.

Found Date	Species	Distance from Turbine (m)	Turbine	Search Type	Search Area Type	Physical Condition	Aided Search
09/04/2023	eastern red bat	59	27	carcass search	full plot	scavenged	yes[1]
09/04/2023	hoary bat	8	66	carcass search	road and pad	scavenged	no
09/04/2023	silver-haired bat	24	71	carcass search	full plot	scavenged	yes[1]
09/04/2023	big brown bat	32	71	carcass search	full plot	scavenged	yes[1]
09/04/2023	big brown bat	24	71	carcass search	full plot	scavenged	yes[1]
09/04/2023	big brown bat	22	71	carcass search	full plot	scavenged	yes[1]
09/05/2023	silver-haired bat	3	4	carcass search	road and pad	scavenged	no
09/05/2023	silver-haired bat	14	6	carcass search	full plot	scavenged	yes[1]
09/05/2023	silver-haired bat	23	24	carcass search	full plot	scavenged	yes[1]
09/05/2023	silver-haired bat	21	24	carcass search	full plot	scavenged	yes[1]
09/05/2023	silver-haired bat	37	24	carcass search	full plot	scavenged	yes[1]
09/05/2023	silver-haired bat	9	25	carcass search	road and pad	scavenged	no
09/05/2023	silver-haired bat	53	31	carcass search	full plot	scavenged	yes[1]
09/05/2023	big brown bat	47	31	carcass search	full plot	scavenged	yes[1]
09/05/2023	big brown bat	50	37	carcass search	full plot	scavenged	yes[1]
09/05/2023	silver-haired bat	21	37	carcass search	full plot	scavenged	yes[1]
09/05/2023	silver-haired bat	28	56	carcass search	full plot	scavenged	yes[1]
09/05/2023	hoary bat	35	56	carcass search	full plot	scavenged	yes[1]
09/05/2023	silver-haired bat	12	74	carcass search	road and pad	scavenged	no
09/05/2023	silver-haired bat	9	76	carcass search	road and pad	scavenged	no
09/05/2023	silver-haired bat	80	79	carcass search[2]	full plot	scavenged	yes[1]
09/06/2023	silver-haired bat	23	39	carcass search	full plot	scavenged	yes[1]
09/06/2023	big brown bat	47	43	carcass search	full plot	scavenged	yes[1]
09/06/2023	silver-haired bat	15	43	carcass search	full plot	scavenged	yes[1]
09/06/2023	hoary bat	47	43	carcass search	full plot	scavenged	yes[1]
09/06/2023	silver-haired bat	18	44	carcass search	full plot	scavenged	yes[1]
09/06/2023	silver-haired bat	8	44	carcass search	full plot	scavenged	yes[1]
09/06/2023	Seminole bat	41	44	carcass search	full plot	scavenged	yes[1]
09/06/2023	eastern red bat	62	50	carcass search	road and pad	scavenged	no
09/07/2023	eastern red bat	40	24	carcass search	full plot	scavenged	yes[1]
09/07/2023	silver-haired bat	17	71	carcass search	full plot	scavenged	yes[1]
09/07/2023	silver-haired bat	35	71	carcass search	full plot	scavenged	yes[1]
09/07/2023	eastern red bat	44	71	carcass search	full plot	scavenged	yes[1]
09/07/2023	eastern red bat	68	78	carcass search	full plot	scavenged	yes[1]
09/07/2023	big brown bat	32	79	carcass search	full plot	scavenged	yes[1]
09/07/2023	silver-haired bat	15	88	carcass search	full plot	scavenged	yes[1]

Appendix A. Carcasses found at the Crescent Wind Project, Hillsdale County, Michigan, from April 1 – October 15, 2023.

Found Date	Species	Distance from Turbine (m)	Turbine	Search Type	Search Area Type	Physical Condition	Aided Search
09/08/2023	silver-haired bat	33	27	carcass search	full plot	scavenged	yes[1]
09/08/2023	big brown bat	35	31	carcass search	full plot	scavenged	yes[1]
09/08/2023	silver-haired bat	32	31	carcass search	full plot	scavenged	yes[1]
09/08/2023	silver-haired bat	8	37	carcass search	full plot	scavenged	yes[1]
09/08/2023	silver-haired bat	50	43	carcass search	full plot	scavenged	yes[1]
09/08/2023	silver-haired bat	62	46	carcass search	full plot	scavenged	yes[1]
09/08/2023	hoary bat	10	48	carcass search	full plot	scavenged	yes[1]
09/08/2023	hoary bat	8	56	carcass search	full plot	scavenged	yes[1]
09/10/2023	big brown bat	56	6	carcass search	full plot	scavenged	yes[1]
09/10/2023	big brown bat	32	71	carcass search	full plot	scavenged	yes[1]
09/11/2023	silver-haired bat	6	77	carcass search	road and pad	scavenged	no
09/18/2023	silver-haired bat	5	71	carcass search	full plot	scavenged	yes[1]
09/18/2023	hoary bat	2	71	carcass search	full plot	scavenged	yes[1]
09/21/2023	hoary bat	8	6	carcass search	full plot	scavenged	yes[1]
09/21/2023	silver-haired bat	9	14	carcass search	full plot	scavenged	yes[1]
09/21/2023	silver-haired bat	3	77	carcass search	road and pad	scavenged	no
09/21/2023	silver-haired bat	38	79	carcass search	full plot	scavenged	yes[1]
09/22/2023	hoary bat	23	43	carcass search	full plot	intact	yes[1]
09/22/2023	hoary bat	24	43	carcass search	full plot	scavenged	yes[1]
09/22/2023	big brown bat	46	43	carcass search	full plot	scavenged	yes[1]
09/22/2023	silver-haired bat	56	56	carcass search	full plot	scavenged	yes[1]
09/25/2023	silver-haired bat	8	13	carcass search	road and pad	scavenged	no
09/25/2023	eastern red bat	1	23	carcass search	road and pad	scavenged	no
09/25/2023	eastern red bat	10	66	carcass search	road and pad	scavenged	no
09/25/2023	silver-haired bat	50	71	carcass search	full plot	scavenged	yes[1]
09/26/2023	silver-haired bat	34	27	carcass search	full plot	scavenged	yes[1]
09/26/2023	silver-haired bat	12	27	carcass search	full plot	scavenged	yes[1]
09/26/2023	silver-haired bat	15	30	carcass search[2]	road and pad	dismembered	no
09/26/2023	silver-haired bat	23	31	carcass search	full plot	scavenged	yes[1]
09/26/2023	hoary bat	9	31	carcass search	full plot	scavenged	yes[1]
09/26/2023	eastern red bat	8	50	carcass search	road and pad	scavenged	no
09/26/2023	silver-haired bat	6	54	carcass search	road and pad	scavenged	no
09/28/2023	silver-haired bat	33	6	carcass search	full plot	scavenged	yes[1]
09/29/2023	silver-haired bat	8	30	carcass search	road and pad	scavenged	no
10/01/2023	eastern red bat	61	24	carcass search	full plot	scavenged	yes[1]
10/02/2023	big brown bat	56	8	carcass search	full plot	scavenged	yes[1]

Appendix A. Carcasses found at the Crescent Wind Project, Hillsdale County, Michigan, from April 1 – October 15, 2023.

Found Date	Species	Distance from Turbine (m)	Turbine	Search Type	Search Area Type	Physical Condition	Aided Search
10/02/2023	silver-haired bat	11	71	carcass search	full plot	scavenged	yes[1]
10/05/2023	hoary bat	27	6	carcass search	full plot	scavenged	yes[1]
10/05/2023	eastern red bat	32	24	carcass search	full plot	scavenged	yes[1]
10/05/2023	hoary bat	46	88	carcass search	full plot	scavenged	yes[1]
10/06/2023	eastern red bat	35	39	carcass search	full plot	scavenged	yes[1]
10/06/2023	silver-haired bat	20	56	carcass search	full plot	scavenged	yes[1]
10/09/2023	silver-haired bat	8	4	carcass search	road and pad	intact	no
10/09/2023	silver-haired bat	19	10	carcass search	full plot	scavenged	yes[1]
10/09/2023	silver-haired bat	24	24	carcass search	full plot	scavenged	yes[1]
10/10/2023	silver-haired bat	45	43	carcass search	full plot	scavenged	yes[1]
10/10/2023	silver-haired bat	7	56	carcass search	full plot	scavenged	yes[1]
10/11/2023	silver-haired bat	32	14	carcass search	full plot	scavenged	yes[1]
10/12/2023	silver-haired bat	43	31	carcass search	full plot	scavenged	yes[1]
10/12/2023	silver-haired bat	11	74	carcass search	road and pad	scavenged	no
Birds							
04/03/2023	turkey vulture	45	76	carcass search[2]	road and pad	scavenged	no
04/03/2023	turkey vulture	54	78	carcass search[2]	road and pad	scavenged	no
04/10/2023	European starling	3	43	incidental	full plot	intact	no
04/10/2023	European starling	31	77	carcass search[2]	road and pad	intact	no
04/11/2023	red-tailed hawk	16	13	carcass search[2]	road and pad	intact	no
04/11/2023	turkey vulture	15	13	carcass search[2]	road and pad	dismembered	no
04/11/2023	red-tailed hawk	33	74	carcass search[2]	road and pad	dismembered	no
05/09/2023	red-tailed hawk	26	17	carcass search[2]	road and pad	scavenged	no
05/10/2023	turkey vulture	10	17	incidental	road and pad	intact	no
05/15/2023	unidentified passerine	27	8	carcass search	full plot	dismembered	yes[1]
05/15/2023	blue-gray gnatcatcher	12	15	incidental	full plot	scavenged	yes[1]
05/15/2023	golden-crowned kinglet	60	71	carcass search	full plot	dismembered	yes[1]
05/15/2023	ruby-crowned kinglet	50	78	carcass search	full plot	scavenged	yes[1]
05/16/2023	American crow	68	48	carcass search	full plot	feather spot	yes[1]
05/16/2023	unidentified passerine	51	55	carcass search	full plot	dismembered	yes[1]
05/19/2023	golden-crowned kinglet	47	39	carcass search	full plot	scavenged	yes[1]
05/22/2023	turkey vulture	61	88	carcass search	full plot	feather spot	yes[1]
05/23/2023	unidentified small bird	77	44	carcass search	full plot	scavenged	yes[1]
05/23/2023	Baltimore oriole	46	46	carcass search	full plot	dismembered	yes[1]
05/25/2023	mourning dove	20	8	carcass search	full plot	feather spot	yes[1]
05/25/2023	ruby-throated hummingbird	8	25	carcass search	road and pad	intact	no

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Found Date	Species	Distance from Turbine (m)	Turbine	Search Type	Search Area Type	Physical Condition	Aided Search
05/25/2023	unidentified raptor - non-eagle	78	14	carcass search	full plot	scavenged	yes[1]
05/25/2023	red-tailed hawk	47	20	carcass search[2]	road and pad	scavenged	no
05/26/2023	European starling	8	49	carcass search	road and pad	intact	no
05/26/2023	red-eyed vireo	46	55	carcass search	full plot	scavenged	yes[1]
05/29/2023	horned lark	36	19	carcass search	road and pad	scavenged	no
05/29/2023	unidentified blackbird	36	25	carcass search	road and pad	feather spot	no
05/30/2023	turkey vulture	60	37	carcass search	full plot	scavenged	yes[1]
06/01/2023	unidentified passerine	19	78	carcass search	full plot	dismembered	yes[1]
06/06/2023	red-tailed hawk	24	17	incidental[2]	road and pad	scavenged	no
06/06/2023	red-tailed hawk	30	75	carcass search[2]	road and pad	scavenged	no
06/08/2023	unidentified passerine	23	78	carcass search	full plot	scavenged	yes[1]
06/08/2023	unidentified passerine	24	79	carcass search	full plot	scavenged	yes[1]
06/08/2023	turkey vulture	51	13	carcass search[2]	road and pad	scavenged	no
06/12/2023	red-tailed hawk	44	76	carcass search[2]	road and pad	scavenged	no
06/12/2023	American robin	1	19	carcass search	road and pad	scavenged	no
06/12/2023	purple martin	44	24	carcass search	full plot	scavenged	yes[1]
06/15/2023	indigo bunting	8	14	carcass search	full plot	scavenged	yes[1]
06/15/2023	cliff swallow	46	79	carcass search	full plot	scavenged	yes[1]
06/16/2023	unidentified sparrow	43	31	carcass search	full plot	scavenged	yes[1]
06/20/2023	Baltimore oriole	14	43	carcass search	full plot	scavenged	yes[1]
06/20/2023	turkey vulture	41	45	carcass search[2]	road and pad	scavenged	no
06/20/2023	red-winged blackbird	25	55	carcass search	full plot	scavenged	yes[1]
06/27/2023	chimney swift	43	46	carcass search	full plot	scavenged	yes[1]
06/27/2023	red-winged blackbird	6	86	carcass search	road and pad	intact	no
06/30/2023	ruby-throated hummingbird	38	14	carcass search	full plot	scavenged	yes[1]
07/03/2023	mourning dove	43	24	carcass search	full plot	scavenged	yes[1]
07/04/2023	unidentified passerine	65	31	carcass search	full plot	scavenged	yes[1]
07/04/2023	ruby-throated hummingbird	6	41	carcass search	road and pad	scavenged	no
07/04/2023	red-bellied woodpecker	11	48	carcass search	full plot	scavenged	yes[1]
07/07/2023	red-winged blackbird	59	56	carcass search	full plot	scavenged	yes[1]
07/10/2023	red-winged blackbird	17	8	carcass search	full plot	scavenged	yes[1]
07/11/2023	tree swallow	16	27	carcass search	full plot	scavenged	yes[1]
07/11/2023	cedar waxwing	43	88	carcass search	full plot	scavenged	yes[1]
07/13/2023	Canada goose	53	24	carcass search	full plot	scavenged	yes[1]
07/13/2023	warbling vireo	5	6	carcass search	full plot	scavenged	yes[1]
07/14/2023	sharp-shinned hawk	26	26	carcass search[2]	road and pad	scavenged	no

Appendix A. Carcasses found at the Crescent Wind Project, Hillsdale County, Michigan, from April 1 – October 15, 2023.

Found Date	Species	Distance from Turbine (m)	Turbine	Search Type	Search Area Type	Physical Condition	Aided Search
07/17/2023	unidentified swallow	29	14	carcass search	full plot	scavenged	yes[1]
07/17/2023	cliff swallow	52	79	carcass search	full plot	scavenged	yes[1]
07/21/2023	unidentified hummingbird	50	46	carcass search	full plot	scavenged	yes[1]
07/25/2023	American goldfinch	11	39	carcass search	full plot	scavenged	yes[1]
07/25/2023	red-winged blackbird	20	46	carcass search	full plot	scavenged	yes[1]
07/31/2023	cedar waxwing	6	77	carcass search	road and pad	scavenged	no
08/02/2023	great blue heron	33	39	incidental	full plot	scavenged	no
08/03/2023	mourning dove	83	8	carcass search	full plot	feather spot	yes[1]
08/03/2023	killdeer	50	15	carcass search	full plot	scavenged	yes[1]
08/04/2023	barn swallow	42	32	carcass search	road and pad	scavenged	no
08/07/2023	horned lark	24	15	carcass search	full plot	scavenged	yes[1]
08/07/2023	turkey vulture	44	6	carcass search	full plot	scavenged	yes[1]
08/08/2023	unidentified passerine	15	31	carcass search	full plot	scavenged	yes[1]
08/08/2023	unidentified woodpecker	24	37	carcass search	full plot	scavenged	yes[1]
08/08/2023	purple martin	33	43	carcass search	full plot	scavenged	yes[1]
08/08/2023	unidentified passerine	1	57	carcass search	road and pad	scavenged	no
08/10/2023	unidentified passerine	59	15	carcass search	full plot	scavenged	yes[1]
08/11/2023	red-winged blackbird	21	56	carcass search	full plot	scavenged	yes[1]
08/14/2023	purple martin	0	5	carcass search	road and pad	scavenged	no
08/14/2023	unidentified passerine	44	6	carcass search	full plot	feather spot	yes[1]
08/14/2023	chimney swift	28	14	carcass search	full plot	scavenged	yes[1]
08/14/2023	chimney swift	32	25	carcass search	road and pad	scavenged	no
08/15/2023	unidentified passerine	23	44	carcass search	full plot	feather spot	yes[1]
08/15/2023	unidentified passerine	11	56	carcass search	full plot	scavenged	yes[1]
08/15/2023	unidentified passerine	42	56	carcass search	full plot	scavenged	yes[1]
08/17/2023	red-winged blackbird	47	88	carcass search	full plot	scavenged	yes[1]
08/21/2023	barn swallow	9	4	carcass search	road and pad	scavenged	no
08/22/2023	Tennessee warbler	5	38	carcass search	road and pad	scavenged	no
08/25/2023	unidentified warbler	21	31	carcass search	full plot	scavenged	yes[1]
08/26/2023	unidentified swallow	14	48	carcass search	full plot	scavenged	yes[1]
08/29/2023	unidentified passerine	42	37	carcass search	full plot	scavenged	yes[1]
08/29/2023	Cape May warbler	6	48	carcass search	full plot	scavenged	yes[1]
08/29/2023	red-tailed hawk	35	43	carcass search	full plot	scavenged	yes[1]
08/29/2023	ruby-throated hummingbird	7	58	carcass search	road and pad	scavenged	no
08/30/2023	cedar waxwing	27	8	carcass search	full plot	scavenged	yes[1]
08/31/2023	unidentified warbler	38	55	carcass search	full plot	scavenged	yes[1]

Appendix A. Carcasses found at the Crescent Wind Project, Hillsdale County, Michigan, from April 1 – October 15, 2023.

Found Date	Species	Distance from Turbine (m)	Turbine	Search Type	Search Area Type	Physical Condition	Aided Search
09/04/2023	black-billed cuckoo	39	27	carcass search	full plot	scavenged	yes[1]
09/05/2023	cedar waxwing	25	6	carcass search	full plot	feather spot	yes[1]
09/06/2023	bald eagle	71	46	carcass search	full plot	scavenged	yes[1]
09/06/2023	great blue heron	43	46	carcass search	full plot	scavenged	yes[1]
09/07/2023	rock pigeon	58	24	carcass search	full plot	scavenged	yes[1]
09/07/2023	unidentified passerine	38	15	carcass search	full plot	scavenged	yes[1]
09/07/2023	red-winged blackbird	4	18	carcass search	road and pad	scavenged	no
09/10/2023	Nashville warbler	6	11	carcass search	road and pad	scavenged	no
09/11/2023	horned lark	57	15	carcass search	full plot	scavenged	yes[1]
09/11/2023	unidentified passerine	59	56	carcass search	full plot	scavenged	yes[1]
09/12/2023	unidentified warbler	59	31	carcass search	full plot	scavenged	yes[1]
09/12/2023	black-throated green warbler	46	39	carcass search	full plot	scavenged	yes[1]
09/12/2023	unidentified vireo	51	43	carcass search	full plot	scavenged	yes[1]
09/13/2023	unidentified warbler	63	6	carcass search	full plot	scavenged	yes[1]
09/14/2023	turkey vulture	9	74	carcass search	road and pad	intact	no
09/14/2023	black-throated green warbler	23	24	carcass search	full plot	scavenged	yes[1]
09/14/2023	cedar waxwing	33	37	carcass search	full plot	scavenged	yes[1]
09/14/2023	unidentified thrasher	37	78	carcass search	full plot	scavenged	yes[1]
09/18/2023	American redstart	49	10	carcass search	full plot	scavenged	yes[1]
09/18/2023	northern flicker	28	6	carcass search	full plot	scavenged	yes[1]
09/18/2023	turkey vulture	9	25	carcass search	road and pad	scavenged	no
09/18/2023	house sparrow	42	14	carcass search	full plot	scavenged	yes[1]
09/22/2023	mourning dove	53	43	carcass search	full plot	scavenged	yes[1]
09/28/2023	unidentified passerine	50	6	carcass search	full plot	scavenged	yes[1]
10/02/2023	unidentified flycatcher	13	9	carcass search[2]	road and pad	scavenged	no
10/05/2023	cedar waxwing	41	6	carcass search	full plot	scavenged	yes[1]
10/05/2023	chimney swift	32	10	carcass search	full plot	scavenged	yes[1]
10/06/2023	chimney swift	31	43	carcass search	full plot	scavenged	yes[1]
10/09/2023	golden-crowned kinglet	51	24	carcass search	full plot	scavenged	yes[1]
10/10/2023	turkey vulture	78	44	carcass search[2]	full plot	scavenged	yes[1]
10/12/2023	Northern parula	77	55	carcass search[2]	full plot	scavenged	yes[1]
10/12/2023	American goldfinch	12	74	carcass search	road and pad	scavenged	no

[1]. Dog-aided search.

[2]. Carcass found outside search area

[3]. Carcass died prior to study start

Appendix B. Searcher Efficiency and Carcass Persistence Model Fitting Results.

Appendix B1. Searcher efficiency results by plot type at the Crescent Wind Project, Hillsdale County, Michigan from April 1 – October 15, 2023.

Season	Searcher Type	# Placed	# Available	# Found	% Found
Spring	Road and Pad	20	16	15	93.8
Summer	Road and Pad	20	16	13	81.2
	Square Plot	33	27	21	77.8
Fall	Road and Pad	21	16	15	93.8
	Square Plot	22	18	14	77.8
Overall	Road and Pad	61	48	43	89.6
Overall	Square Plot	55	45	35	77.8

Appendix B2. Searcher efficiency models for dog-aided searches (square plots) at the Crescent Wind Project, Hillsdale County, Michigan from April 1– October 15, 2023 (n=45).

Covariates	k Value	AICc	Delta AICc
No Covariates	0.67	49.77	0[1]
Season	0.67	51.96	2.19

[1] Selected model.

AICc = Corrected Akaike Information Criterion.

Delta AICc = Change in AICc.

Appendix B3. Searcher efficiency models for technician searches (road and pad plots) at the Crescent Wind Project, Hillsdale County, Michigan from April 1– October 15, 2023 (n = 48).

Covariates	k Value	AICc	Delta AICc
No Covariates	0.67	34.16	0[1]
Season	0.67	36.95	2.79

[1] Selected model.

AICc = Corrected Akaike Information Criterion.

Delta AICc = Change in AICc.

Appendix B4. Carcass persistence models with covariates and distributions for bats at dog-aided search plots (square plots) at the Crescent Wind Project, Hillsdale County, Michigan, from April 1, 2023 to October 15, 2023 (n = 25).

Location Covariates	Scale Covariates	Distribution	AICc	Delta AICc
No Covariates	No Covariates	Weibull	105.13	0[1]
No Covariates	No Covariates	loglogistic	106.48	1.35
No Covariates	Season	Weibull	106.7	1.57
No Covariates	No Covariates	lognormal	107.08	1.95
Season	No Covariates	Weibull	107.52	2.39
No Covariates	Season	loglogistic	108.24	3.11
No Covariates	Season	lognormal	108.97	3.84
No Covariates	-	exponential	108.98	3.85
Season	No Covariates	loglogistic	109.08	3.95
Season	Season	Weibull	109.25	4.12
Season	No Covariates	lognormal	109.66	4.53
Season	-	exponential	111.09	5.96
Season	Season	loglogistic	111.09	5.96
Season	Season	lognormal	111.77	6.64

[1] Selected model.

AICc = Corrected Akaike Information Criterion.

Delta AICc = Change in AICc.

Appendix B5. Carcass persistence models with covariates and distributions for bats at technician searched plots (road and pad plots) at the Crescent Wind Project, Hillsdale County, Michigan, from April 1, 2023 to October 15, 2023 (n = 40).

Location Covariates	Scale Covariates	Distribution	AICc	Delta AICc
No Covariates	No Covariates	loglogistic	164.93	0[1]
No Covariates	No Covariates	lognormal	164.93	0
No Covariates	No Covariates	Weibull	165.35	0.42
Season	No Covariates	Weibull	166.32	1.39
Season	No Covariates	lognormal	166.48	1.55
Season	No Covariates	loglogistic	167.28	2.35
No Covariates	Season	lognormal	169.45	4.52
No Covariates	Season	loglogistic	169.65	4.72
No Covariates	Season	Weibull	169.79	4.86
Season	Season	Weibull	171.7	6.77
Season	Season	lognormal	171.87	6.94
Season	Season	loglogistic	172.67	7.74
Season	-	exponential	178.17	13.24
No Covariates	-	exponential	181.54	16.61

[1] Selected model.

AICc = Corrected Akaike Information Criterion.

Delta AICc = Change in AICc.

Appendix C. Truncated Weighted Likelihood (TWL) Area Adjustment Model Fitting Results.

Appendix C1. Search area adjustment models for bats found at the Crescent Wind Project, Hillsdale County, Michigan, from April 1 – October 15, 2023.

2.8 MW	2.3 MW	Pooled	AICc	DeltaAICc
gamma	gamma	–	20,409.38	0[1]
gamma	Weibull	–	20,410.29	0.91
gamma	normal	–	20,412.14	2.77
gamma	Gompertz	–	20,412.19	2.81
Weibull	gamma	–	20,427.17	17.79
Weibull	Weibull	–	20,428.08	18.70
Weibull	normal	–	20,429.93	20.56
Weibull	Gompertz	–	20,429.98	20.60
–	–	gamma	20,464.98	55.60
–	–	Weibull	20,482.08	72.70

[1] Selected model.

AICc = Corrected Akaike Information Criterion.

Delta AICc = Change in AICc.

Appendix C2. Truncated weighted maximum likelihood search area adjustment estimates for the Crescent Wind Project, Hillsdale County, Michigan, from April 1 – October 15, 2023 (Bat n = 39, 2.3-MW turbines; Bat n = 499, 2.8-MW turbines).

Size Class	Search Area Type	Distribution	Parameter 1	Parameter 2	Area Adjustment
Bat	square plot 2.3 MW	gamma	1.3662	0.0768	0.98
	road and pad 2.3 MW	gamma	1.3662	0.0768	0.42
	square plot 2.8 MW	gamma	1.5894	0.0323	0.80
	road and pad 2.8 MW	gamma	1.5894	0.0323	0.12

* All plots were searched as road and pad plots in the spring.

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

Appendix D1. Inputs needed to run Evidence of Absence: Single Class Module for 2.3 MW and 2.8 MW turbines at the Crescent Wind Project, Hillsdale County, Michigan, from April 1 – October 15, 2023[1]

Season	Turbine Size (MW)	Plot Type	Aided Search	Search Interval (I)	# of Searches	Spatial Coverage(a)	Searcher Efficiency		Carcass Persistence[2]	
							Carcasses Available	Carcasses Found	Shape (α)	Scale (β)
spring	2.3	road/pad	none	7	7	0.42	48	43	0.88	2.78
spring	2.8	road/pad	none	7	7	0.12	48	43	0.88	2.78
summer	2.3	full plot	dog	3.5	21	0.98	45	35	0.58	21.24
summer	2.8	full plot	dog	3.5	21	0.8	45	35	0.58	21.24
summer	2.3	road/pad	none	3.5	21	0.42	48	43	0.88	2.78
summer	2.8	road/pad	none	3.5	21	0.12	48	43	0.88	2.78
fall	2.3	full plot	dog	3.5	22	0.98	45	35	0.58	21.24
fall	2.8	full plot	dog	3.5	22	0.8	45	35	0.58	21.24
fall	2.3	road/pad	none	3.5	22	0.42	48	43	0.88	2.78
fall	2.8	road/pad	none	3.5	22	0.12	48	43	0.88	2.78

[1] *k* was assumed to equal 0.67 for all strata, per Huso et al. (2017).

[2] A log-logistic distribution was used for carcass persistence on technician-searched 100-m road and pad plots. The 95% upper and lower confidence intervals on β for technician searches were set to 1.48, 5.22. A Weibull distribution was used for carcass persistence on dog-aided square plot searches. The 95% upper and lower confidence intervals on β for dog-aided searches were set to 9.56, 47.18.

m = meter; MW = megawatt.

Appendix D2. Inputs needed to run Evidence of Absence model to combine across plot types within each season: Multiple Class Module for the Crescent Wind Project, Hillsdale County, Michigan, from April 1 – October 15, 2023.

Season	Plot Type	Turbine Size (MW)	Ba	Bb	Within-Season Sampling Fraction	Relative Turbine Operations	Weights (DWP)
spring	road and pad	2.3	606.20	2324.8	0.1	1	0.1
spring	road and pad	2.8	732.76	11960.95	0.9	1	0.9
summer	full plot	2.3	57.21	23.48	0.03	1	0.03
summer	full plot	2.8	82.50	60.74	0.3	1	0.3
summer	road and pad	2.3	861.85	2322.93	0.07	1	0.07
summer	road and pad	2.8	1092.64	13373.58	0.6	1	0.6
fall	full plot	2.3	57.21	23.44	0.03	1	0.03
fall	full plot	2.8	82.54	60.7	0.3	1	0.3
fall	road and pad	2.3	865.53	2332.3	0.07	1	0.07
fall	road and pad	2.8	1097.36	13428.82	0.6	1	0.6

m = meter.

DWP = Density-weighted proportion

Appendix D3. Inputs needed to run Evidence of Absence model to combine across seasons: Multiple Class Module for the Crescent Wind Project, Hillsdale County, Michigan, from April 1 – October 15, 2023.

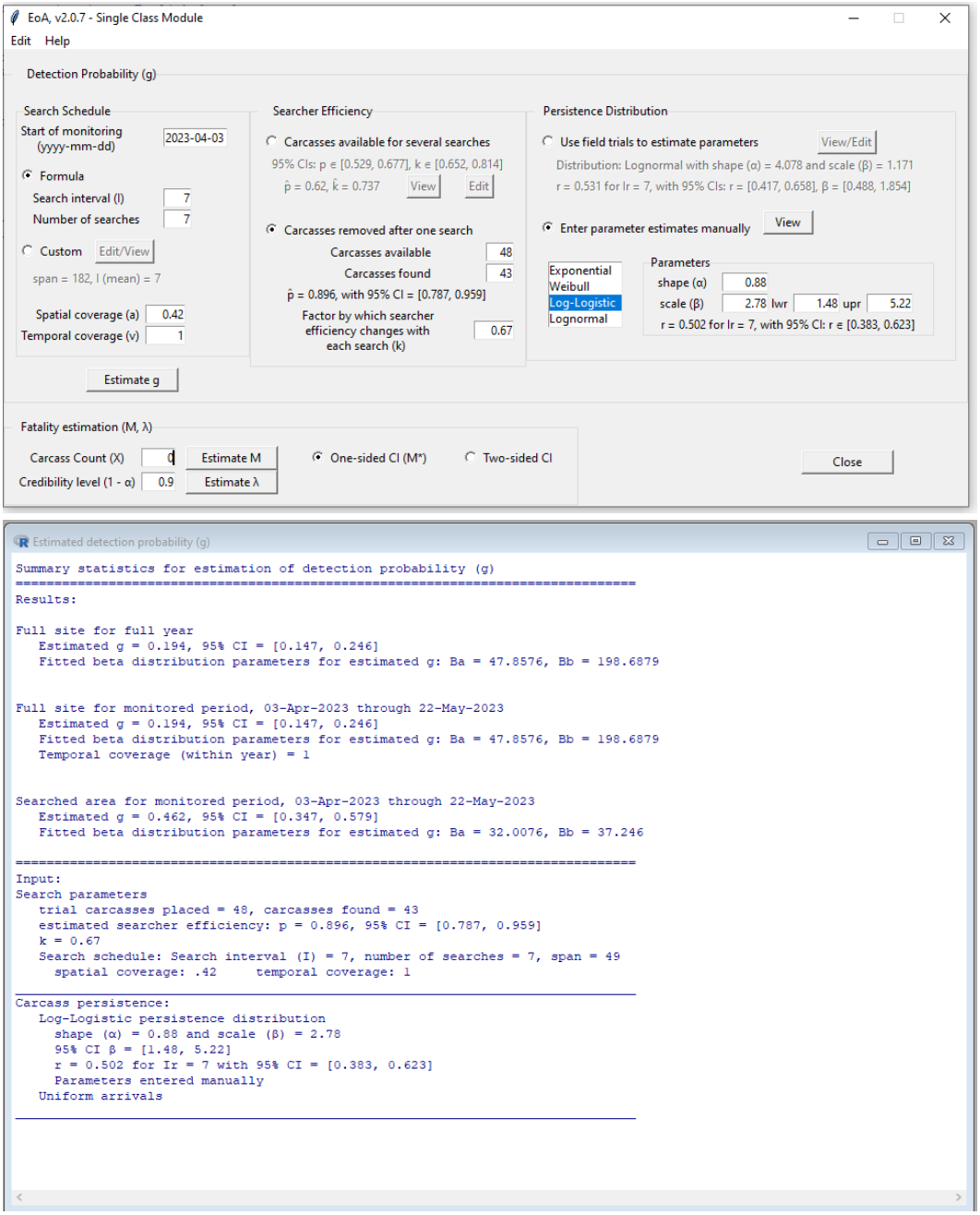
Season	Ba	Bb	Arrival Proportion	Relative Turbine Operations	Weights (DWP)
Spring (April 1 – May 14)	1213.96	15498.99	0.07	1	0.07
Summer (May 15 – July 31)	317.49	904.69	0.36	1	0.36
Fall (August 1 - October 15)	317.79	904.99	0.57	1	0.57

DWP = Density-weighted proportion.

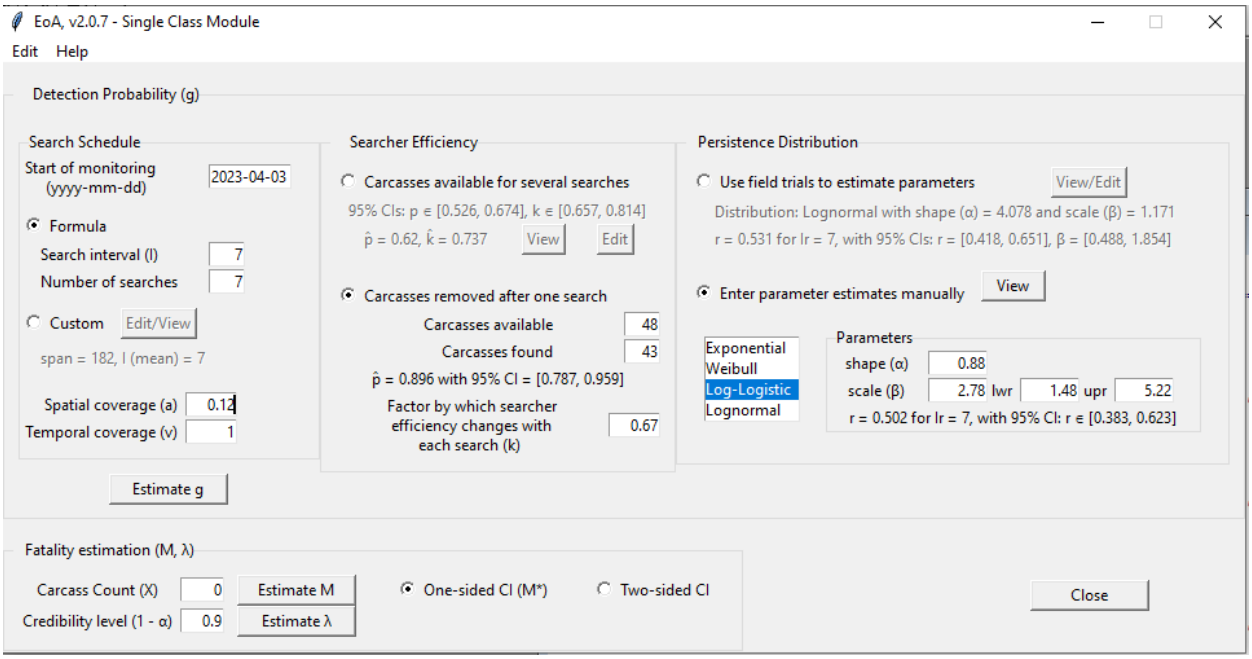
Appendix D4. Inputs needed to run Evidence of Absence model to combine across years: Multiple Years Module for the Crescent Wind Project, Hillsdale County, Michigan, from April 1 – October 15, 2023.

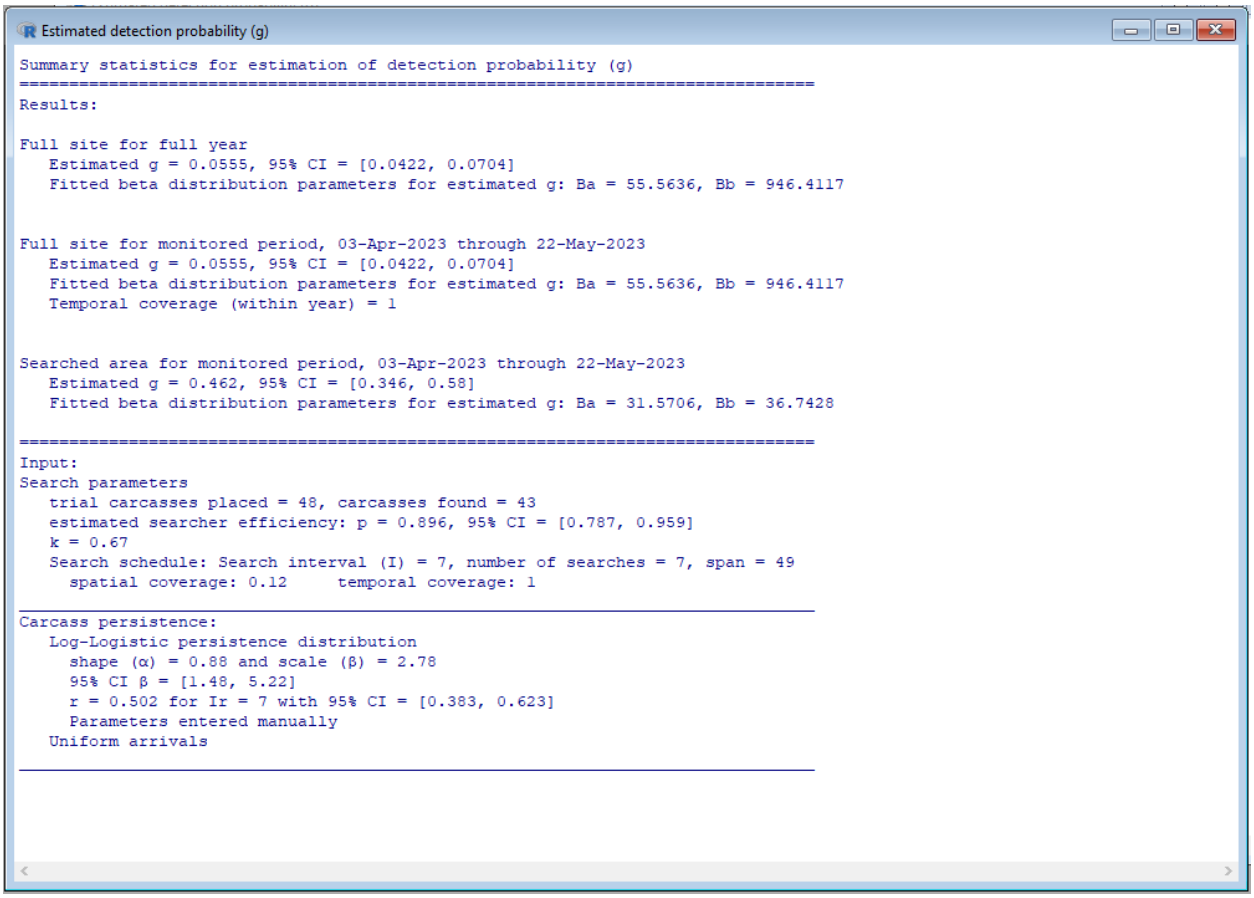
Year	Ba	Bb	Weights (ρ)
2021	272.38	386.10	1.14
2023	641.50	1958.39	1.00

Appendix E. Screenshots of Inputs for Single Class, Multiple Class, and Multi Year Modules in Evidence of Absence.

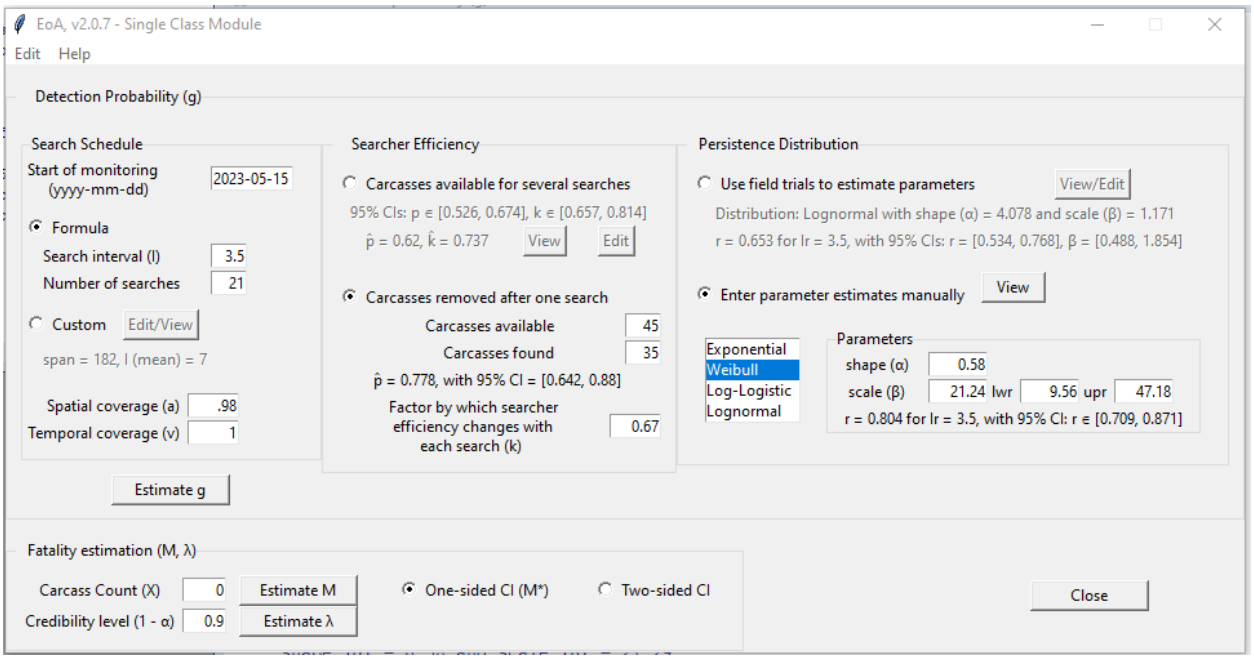


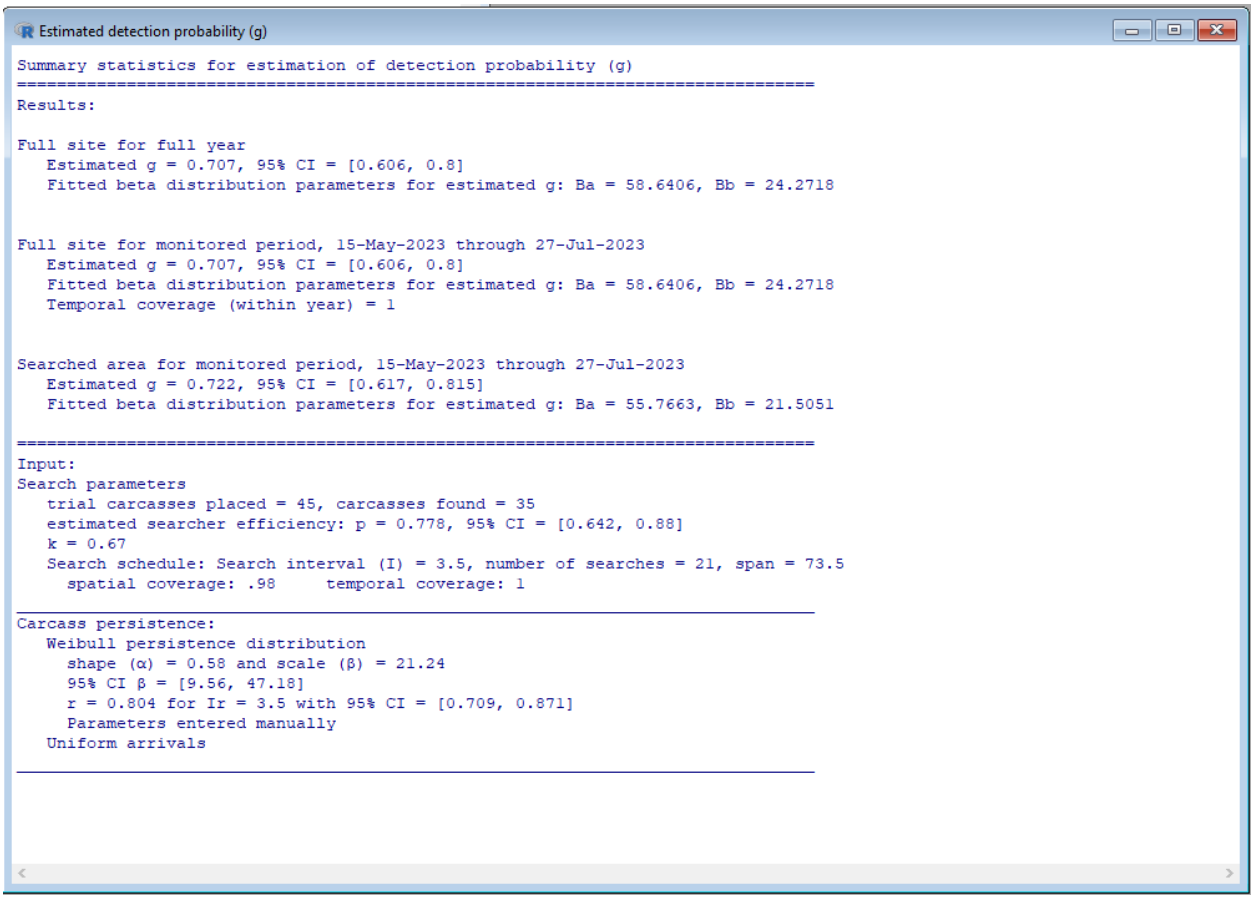
Appendix E1. Screen shot of Evidence of Absence (v2.0.7) graphical user interface, Single Class Module inputs for spring 2023, 100-meter road and pad searches at 6, 2.3 megawatt turbines with a blade length of 58 meters, searched at a 7-day interval.



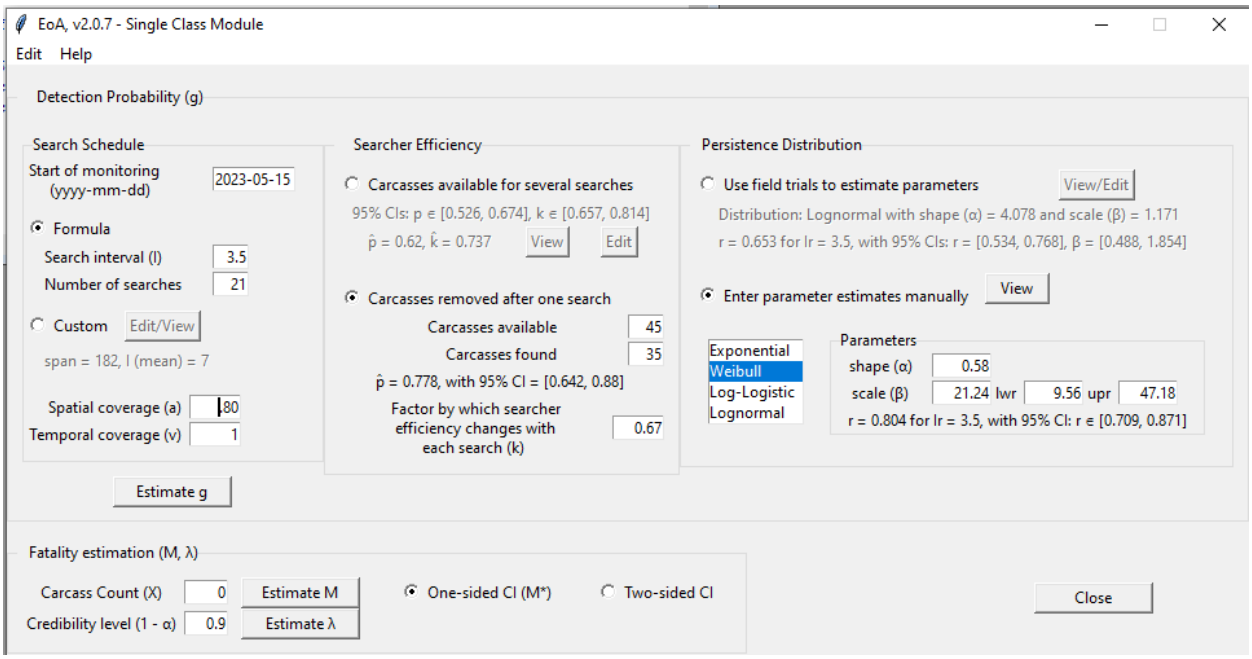


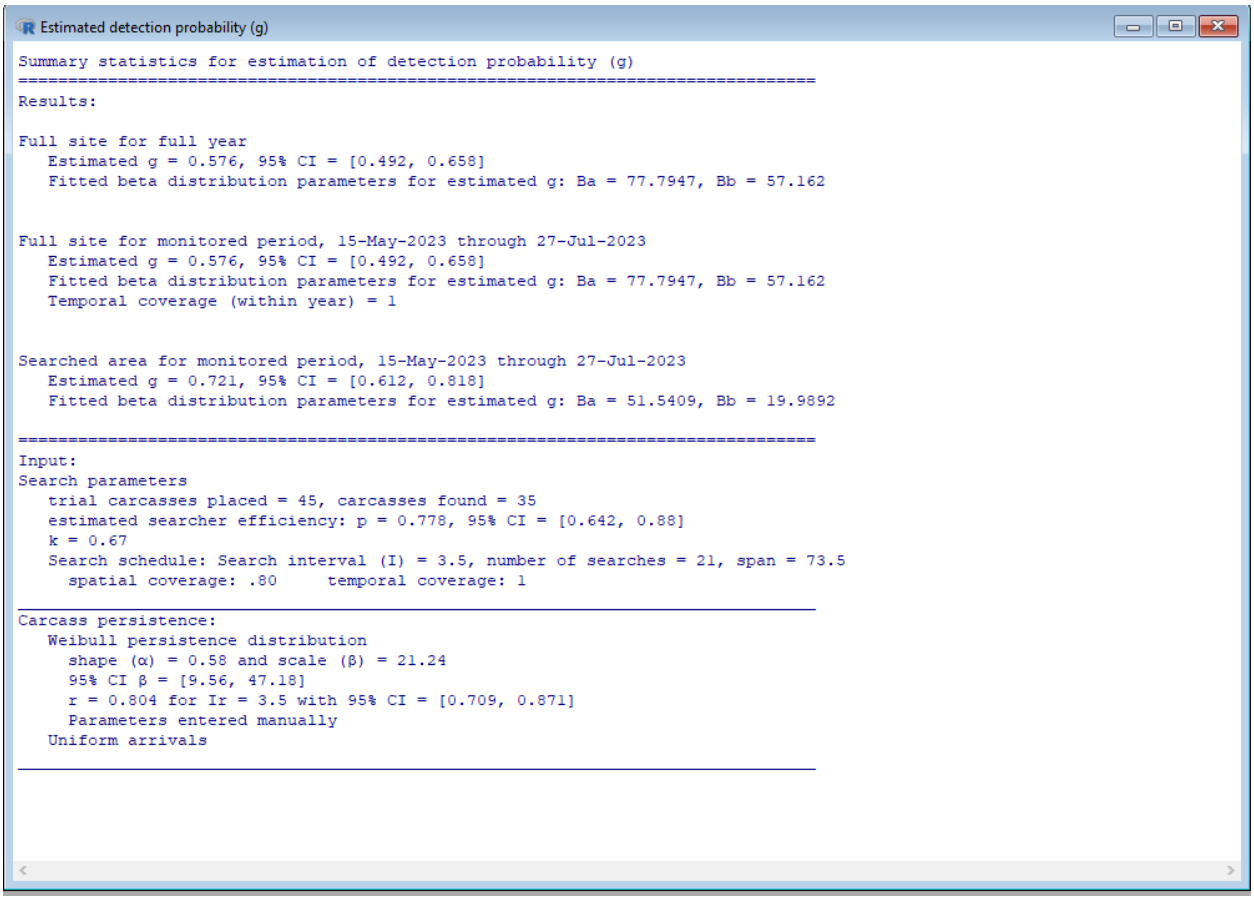
Appendix E2. Screen shot of Evidence of Absence (v2.0.7) graphical user interface, Single Class Module inputs for Spring 2023, 100-meter road and pad searches at 54, 2.8 megawatt turbines with a blade length of 63.5 meters, searched at a 7-day interval.



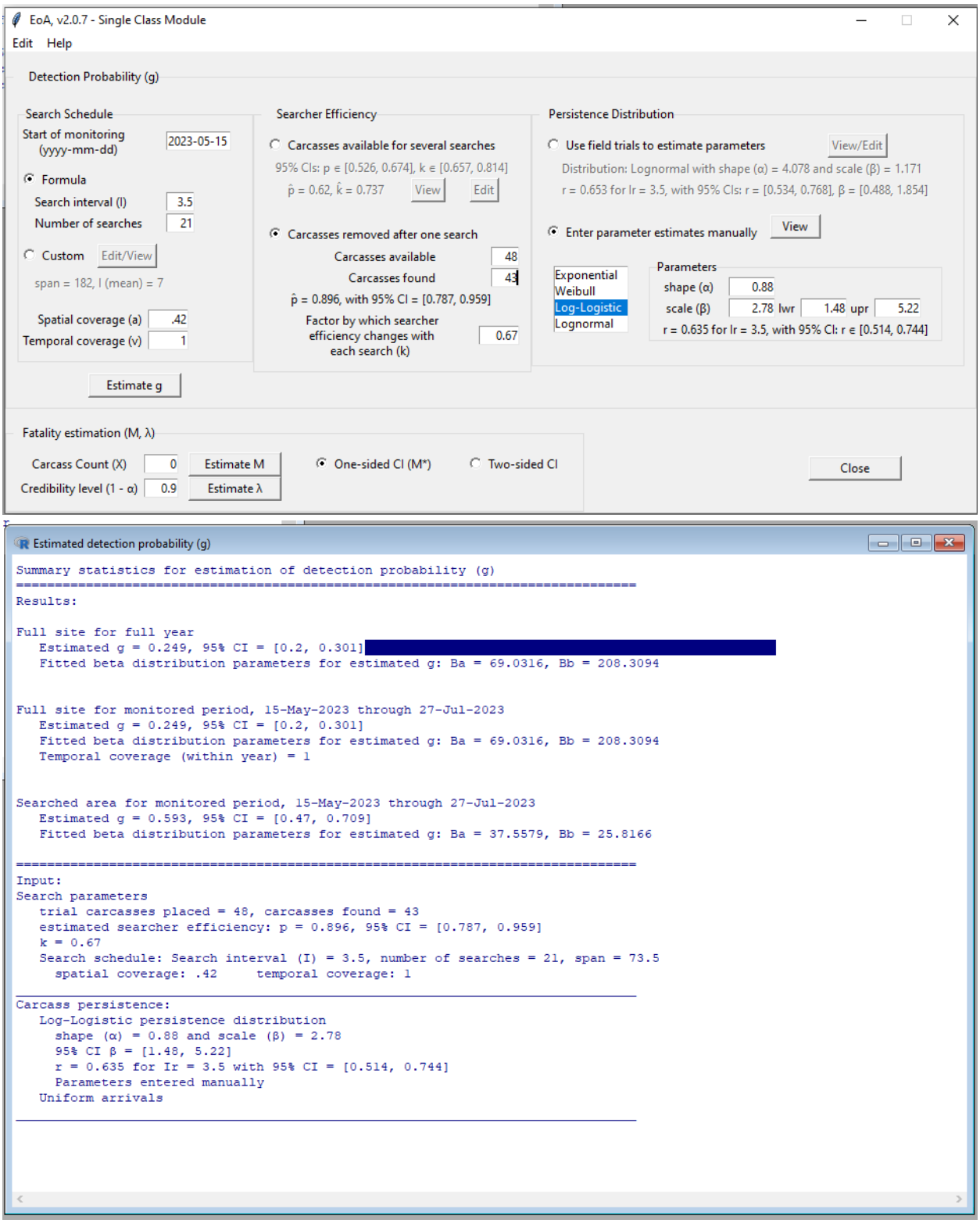


Appendix E3. Screen shot of Evidence of Absence (v2.0.7) graphical user interface, Single Class Module inputs for Summer 2023, 140-meter square plot, dog-aided searches at two, 2.3 megawatt turbines with a blade length of 58 meters, searched at a 3.5-day interval

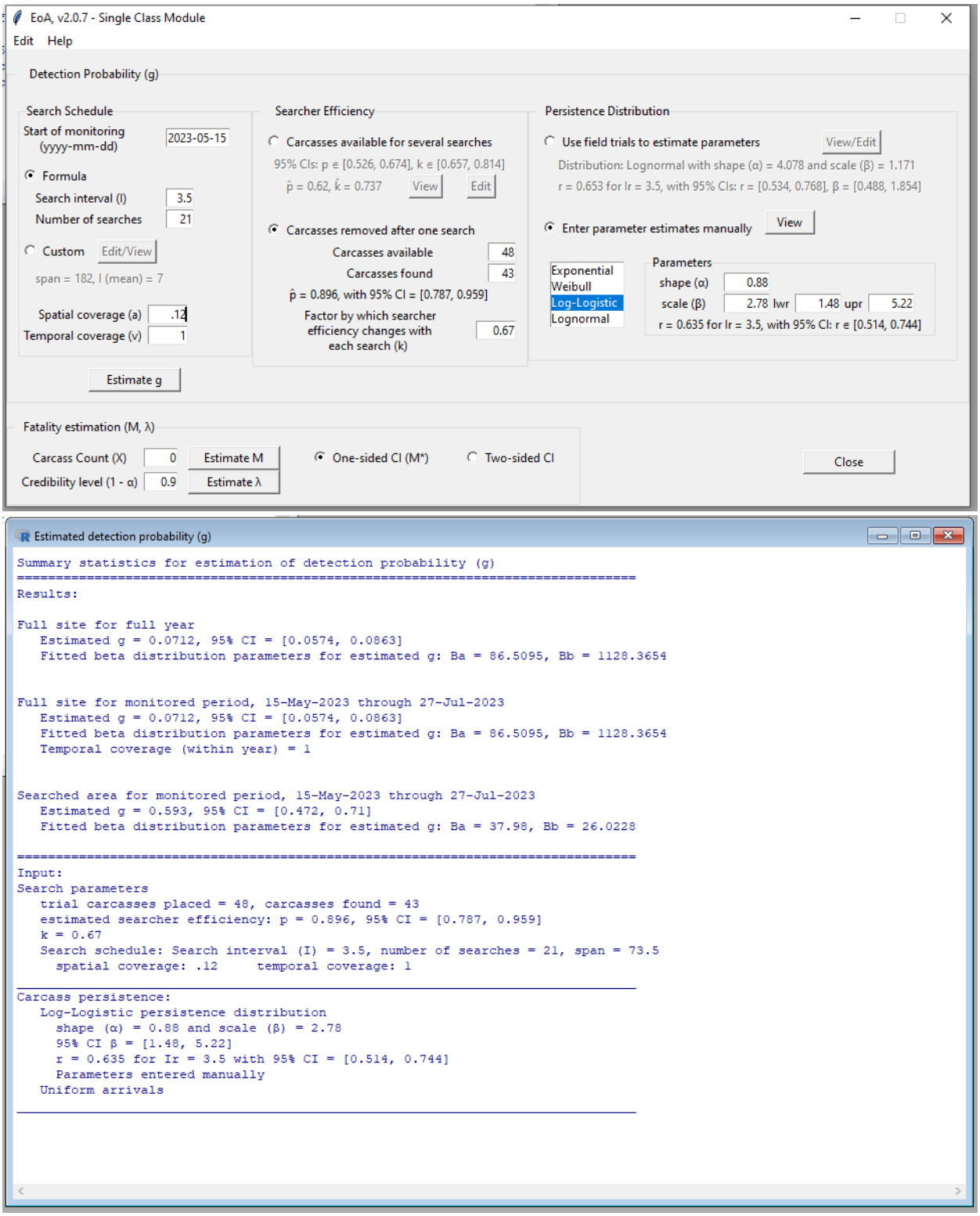




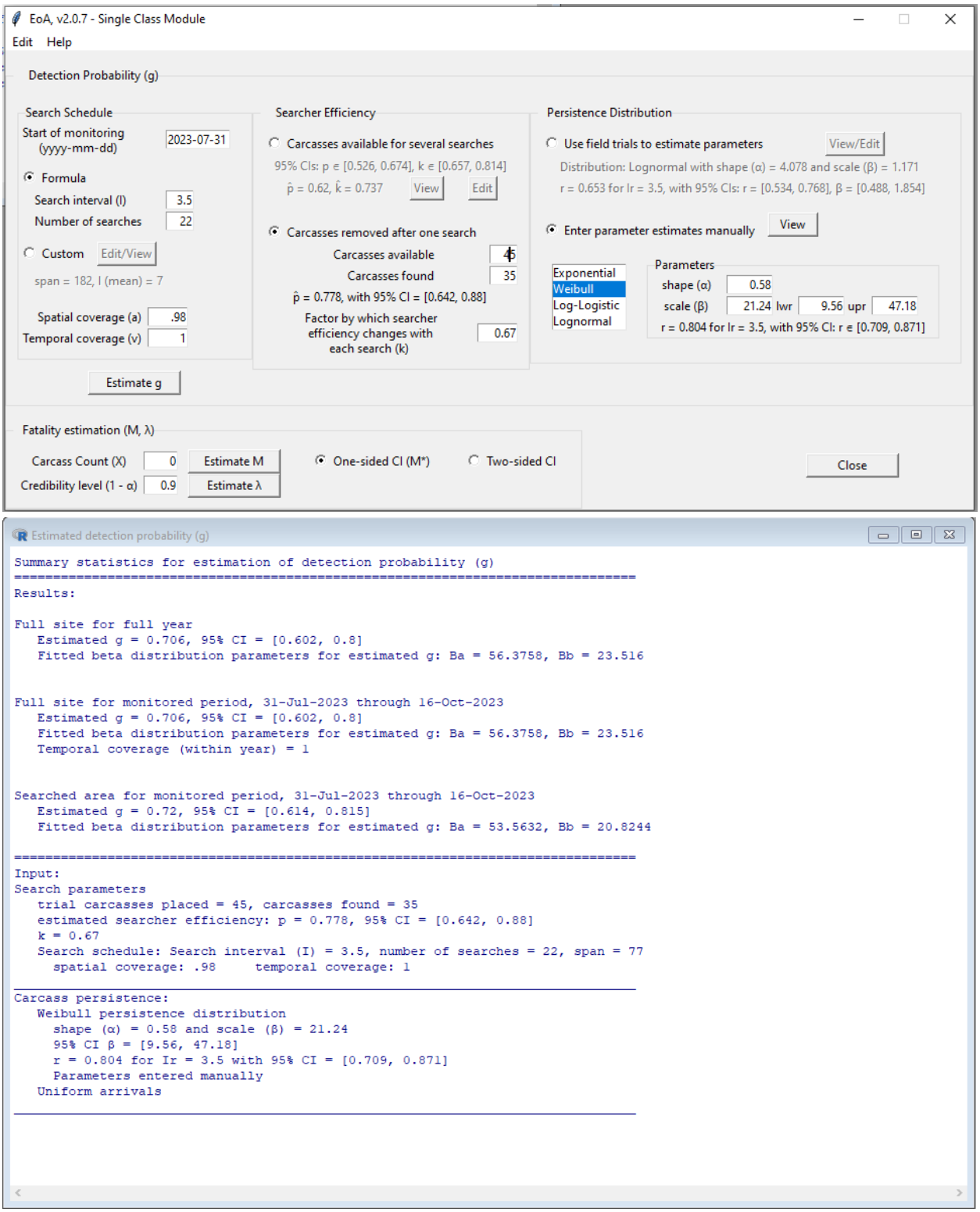
Appendix E4. Screen shot of Evidence of Absence (v2.0.7) graphical user interface, Single Class Module inputs for Summer 2023, 140-meter square plot, dog-aided searches at 18, 2.8 megawatt turbines with a blade length of 63.5 meters, searched at a 3.5-day interval.



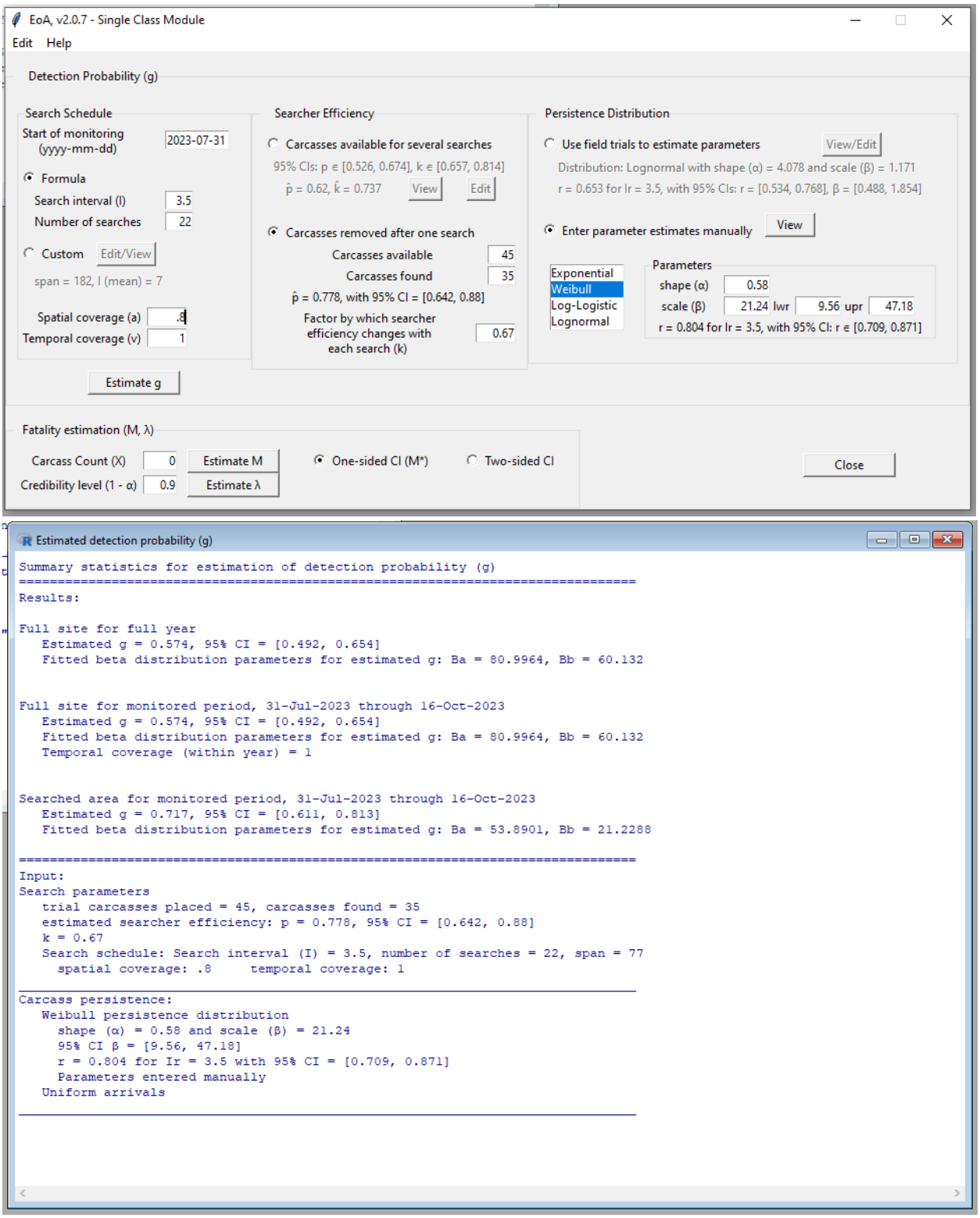
Appendix E5. Screen shot of Evidence of Absence (v2.0.7) graphical user interface, Single Class Module inputs for Summer 2023, 100-meter road and pad searches at four, 2.3 megawatt turbines with a blade length of 58 meters, searched at a 3.5-day interval.



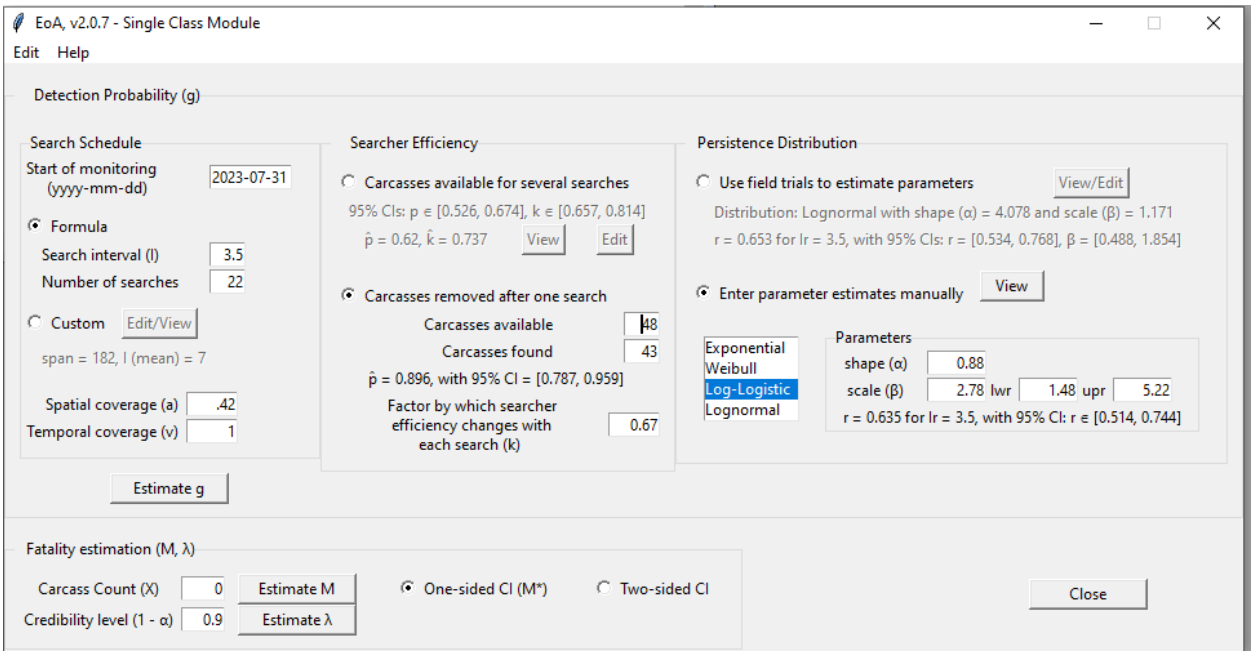
Appendix E6. Screen shot of Evidence of Absence (v2.0.7) graphical user interface, Single Class Module inputs for Summer 2023, 100-meter road and pad searches at 36, 2.8 megawatt turbines with a blade length of 63.5 meters, searched at a 3.5-day interval.

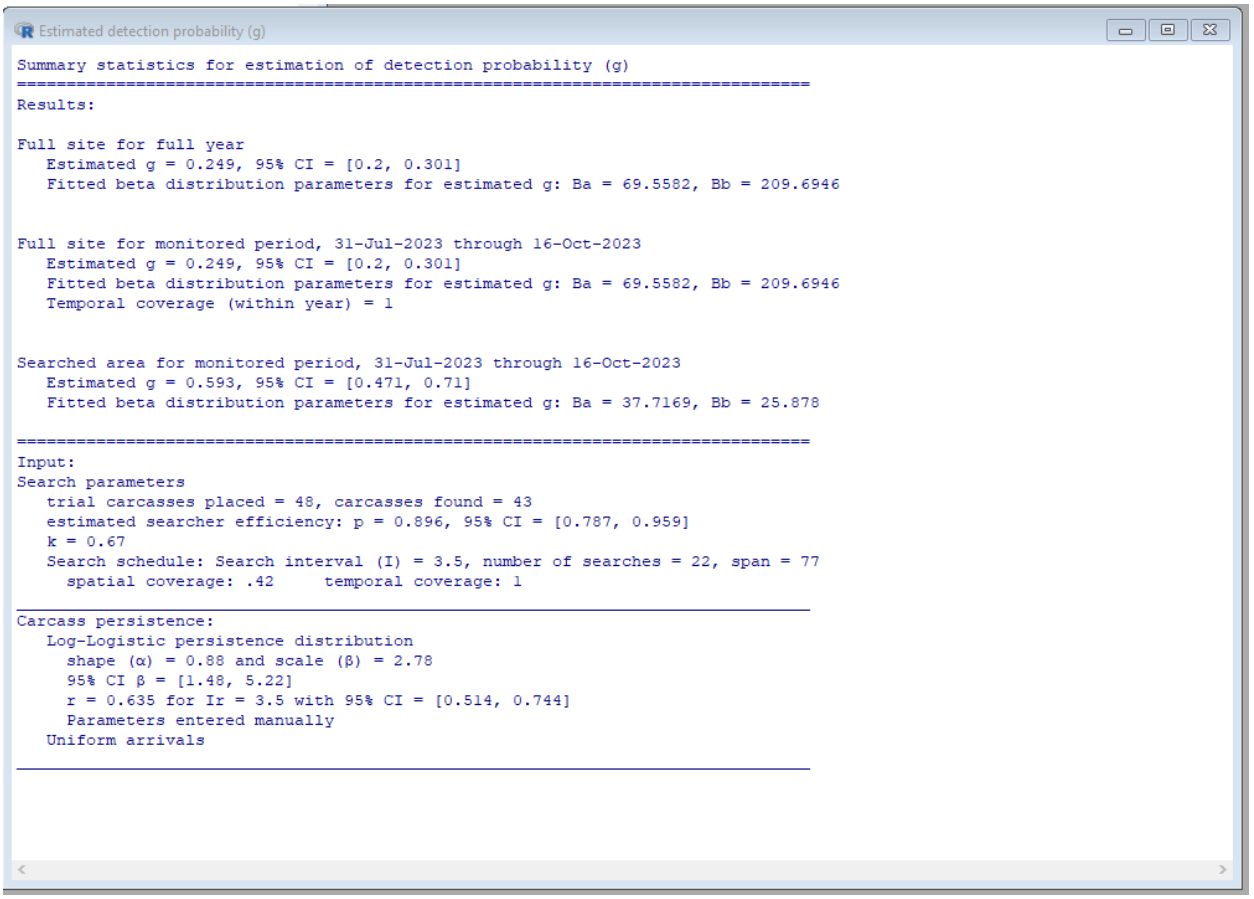


Appendix E7. Screen shot of Evidence of Absence (v2.0.7) graphical user interface, Single Class Module inputs for Fall 2023, 140-meter square plot, dog-aided searches at two, 2.3 megawatt turbines with a blade length of 58 meters, searched at a 3.5-day interval.

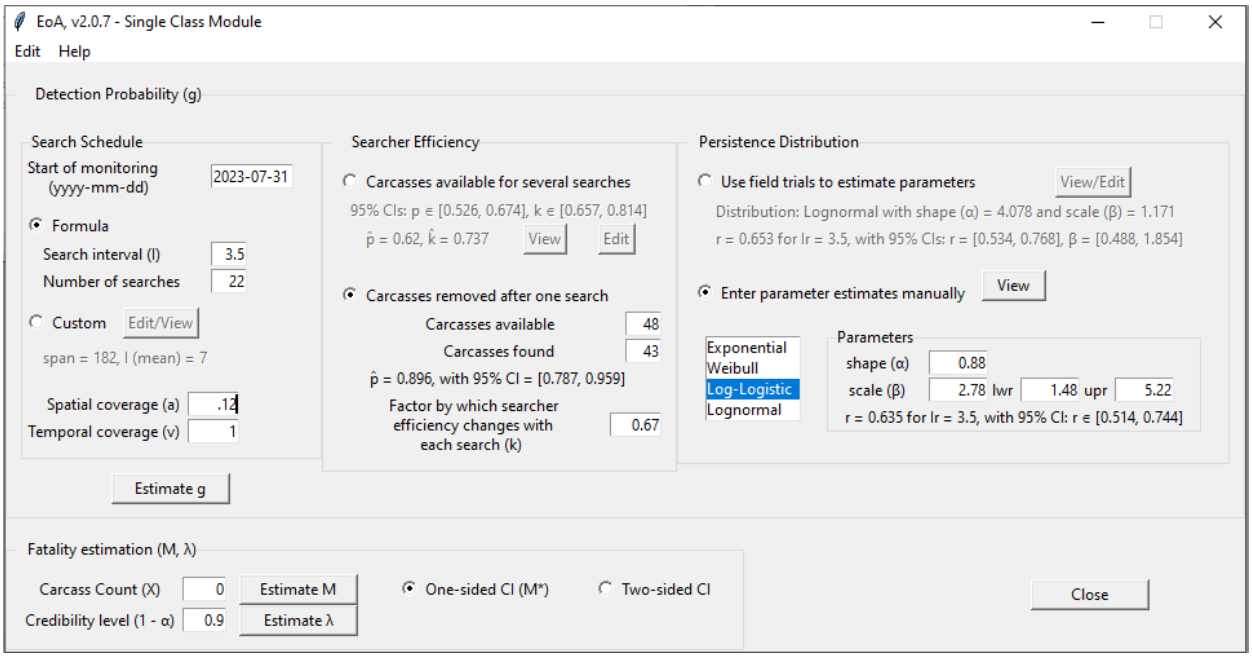


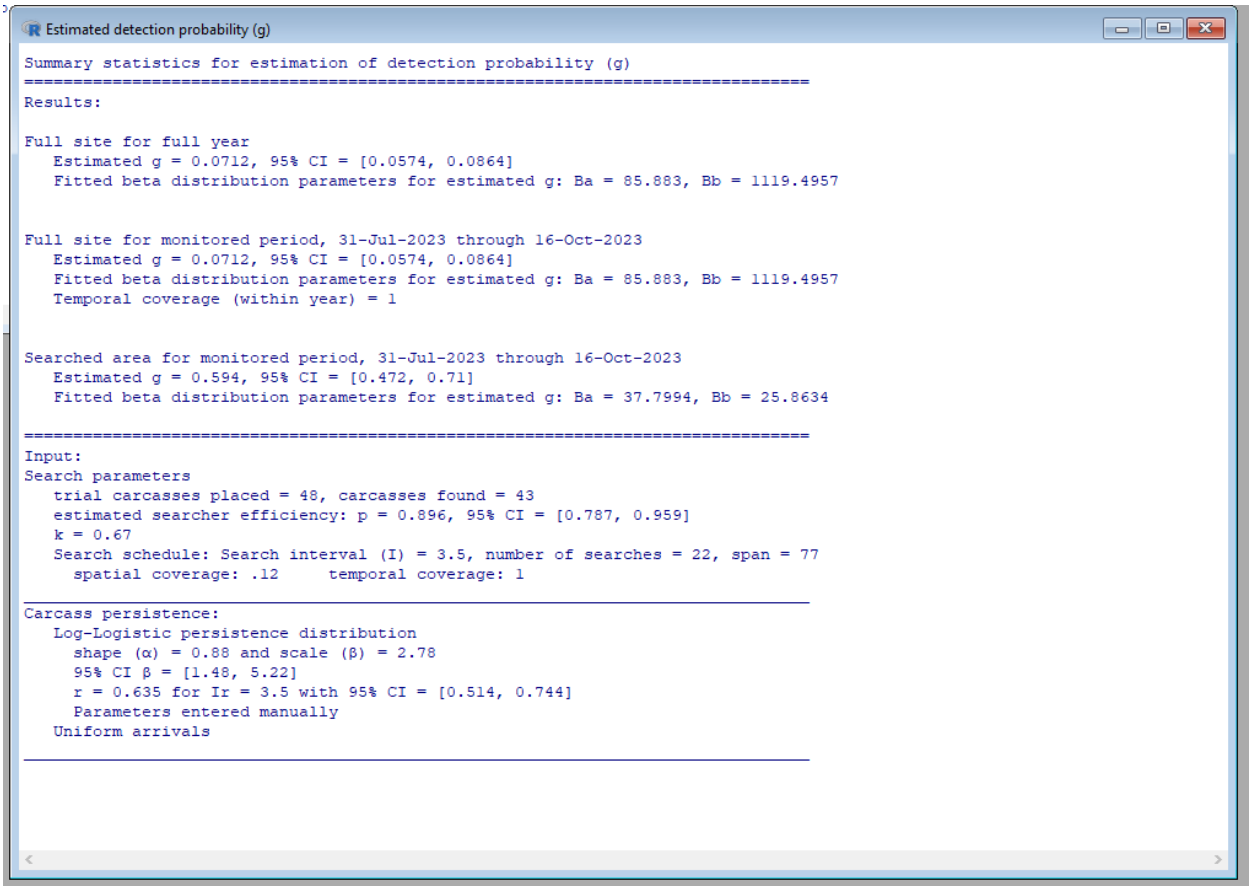
Appendix E8. Screen shot of Evidence of Absence (v2.0.7) graphical user interface, Single Class Module inputs for Fall 2023, 40-meter square plot, dog-aided searches at 18, 2.8 megawatt turbines with a blade length of 63.5 meters, searched at a 3.5-day interval.



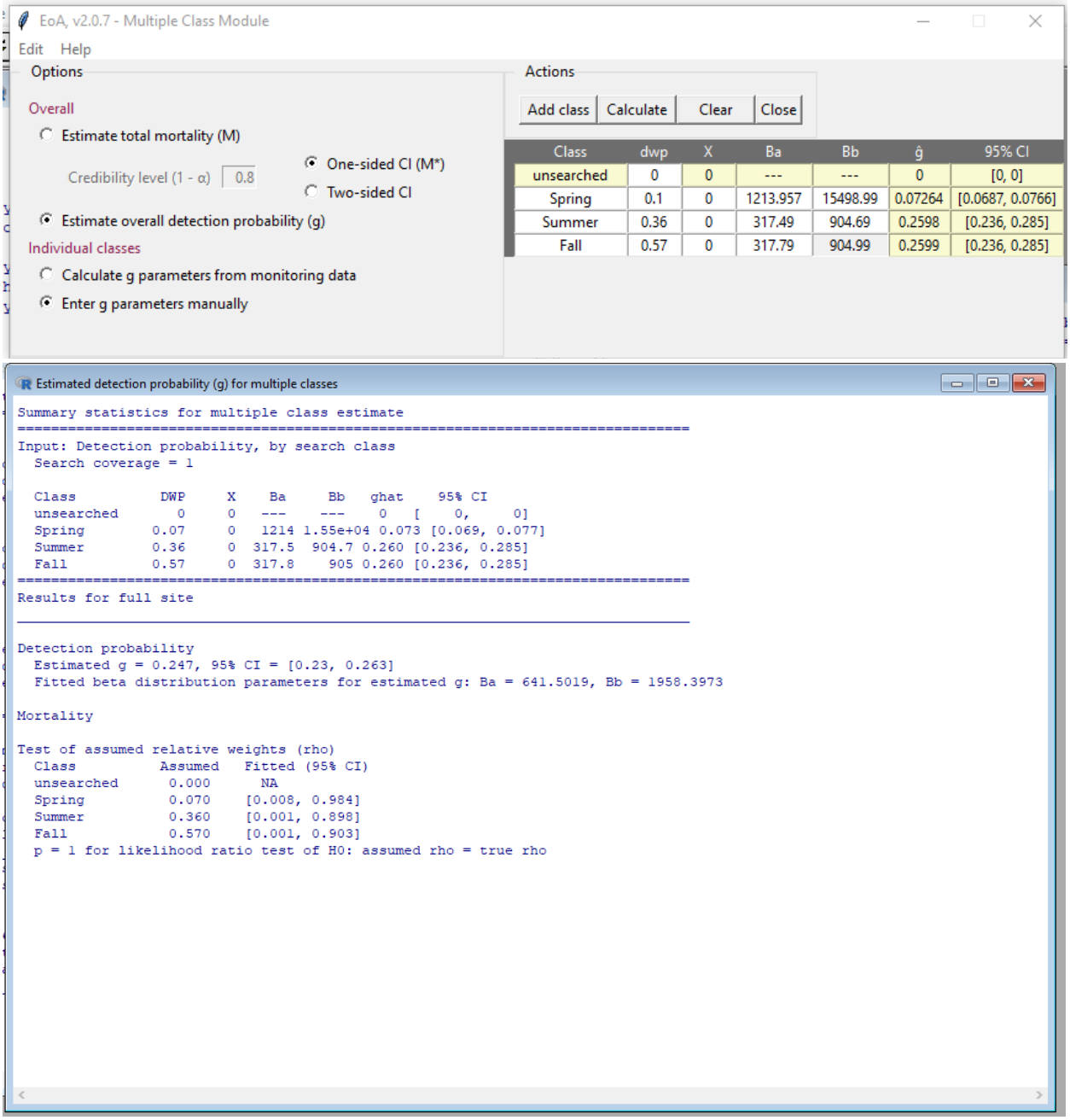


Appendix E9. Screen shot of Evidence of Absence (v2.0.7) graphical user interface, Single Class Module inputs for Fall 2023, 100-meter road and pad searches at four, 2.3 megawatt turbines with a blade length of 58 meters, searched at a 3.5-day interval.

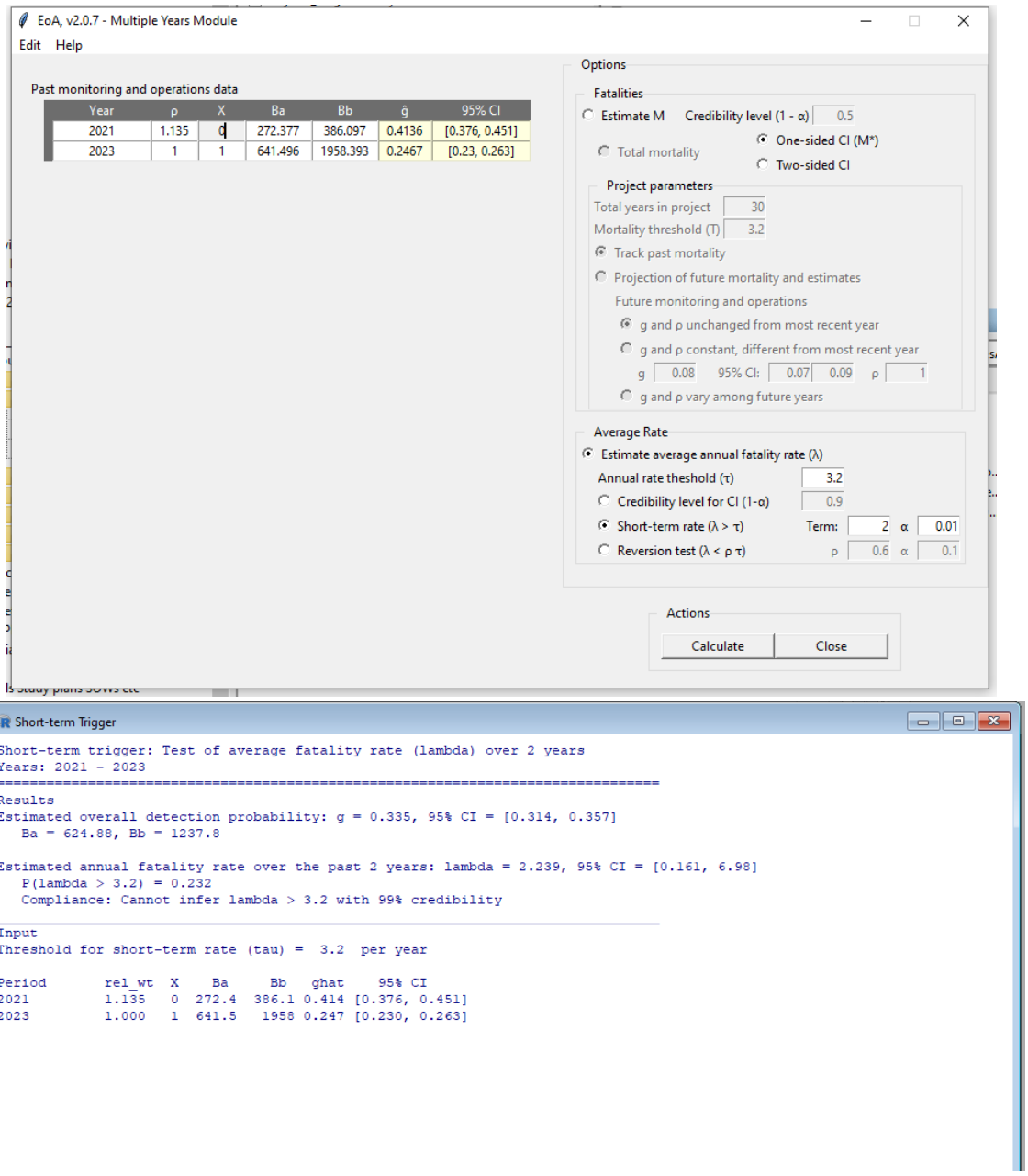




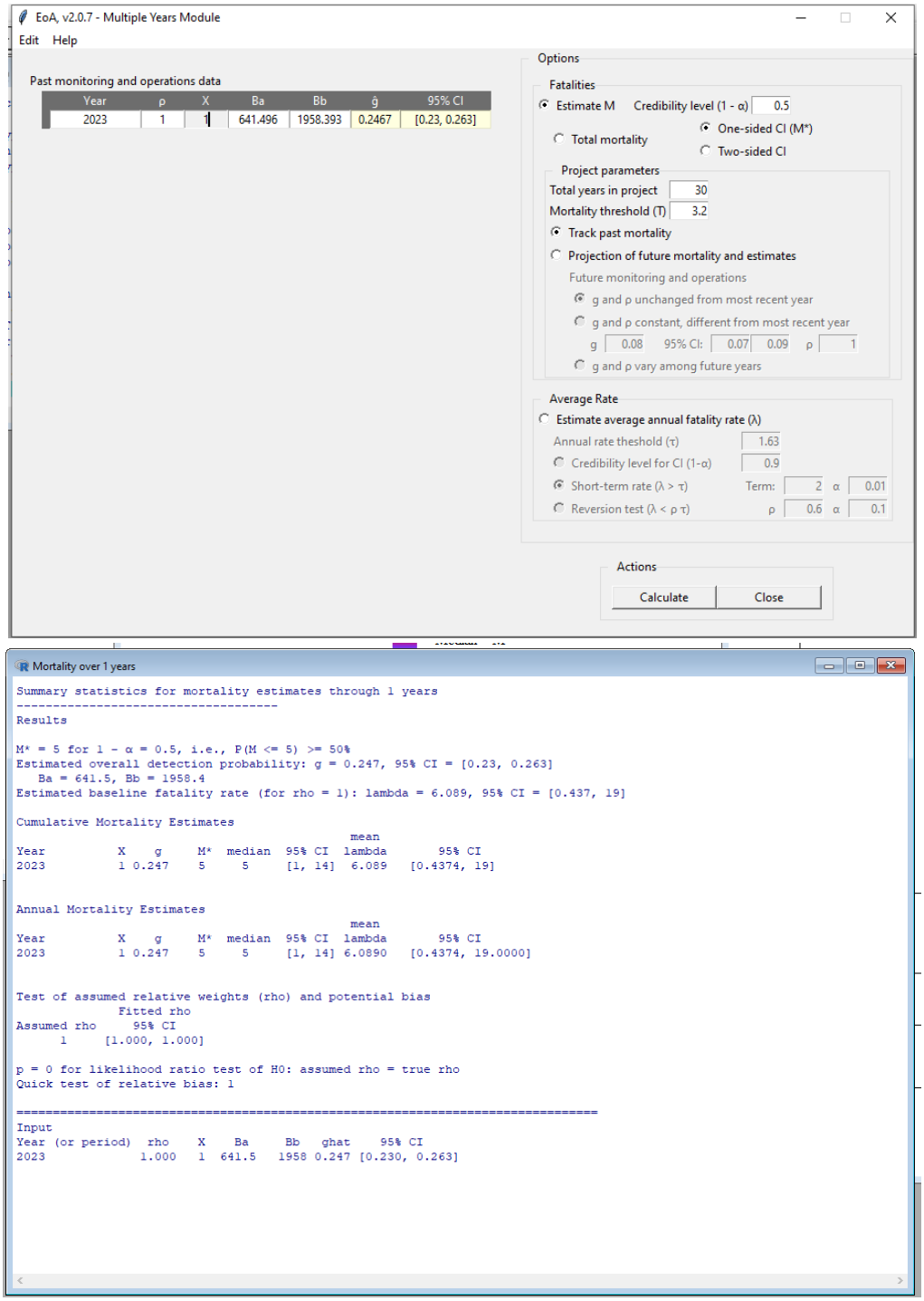
Appendix E10. Screen shot of Evidence of Absence (v2.0.7) graphical user interface, Single Class Module inputs for Fall 2023, 100-meter road and pad searches at 36, 2.8 megawatt turbines with a blade length of 63.5 meters, searched at a 3.5-day interval.



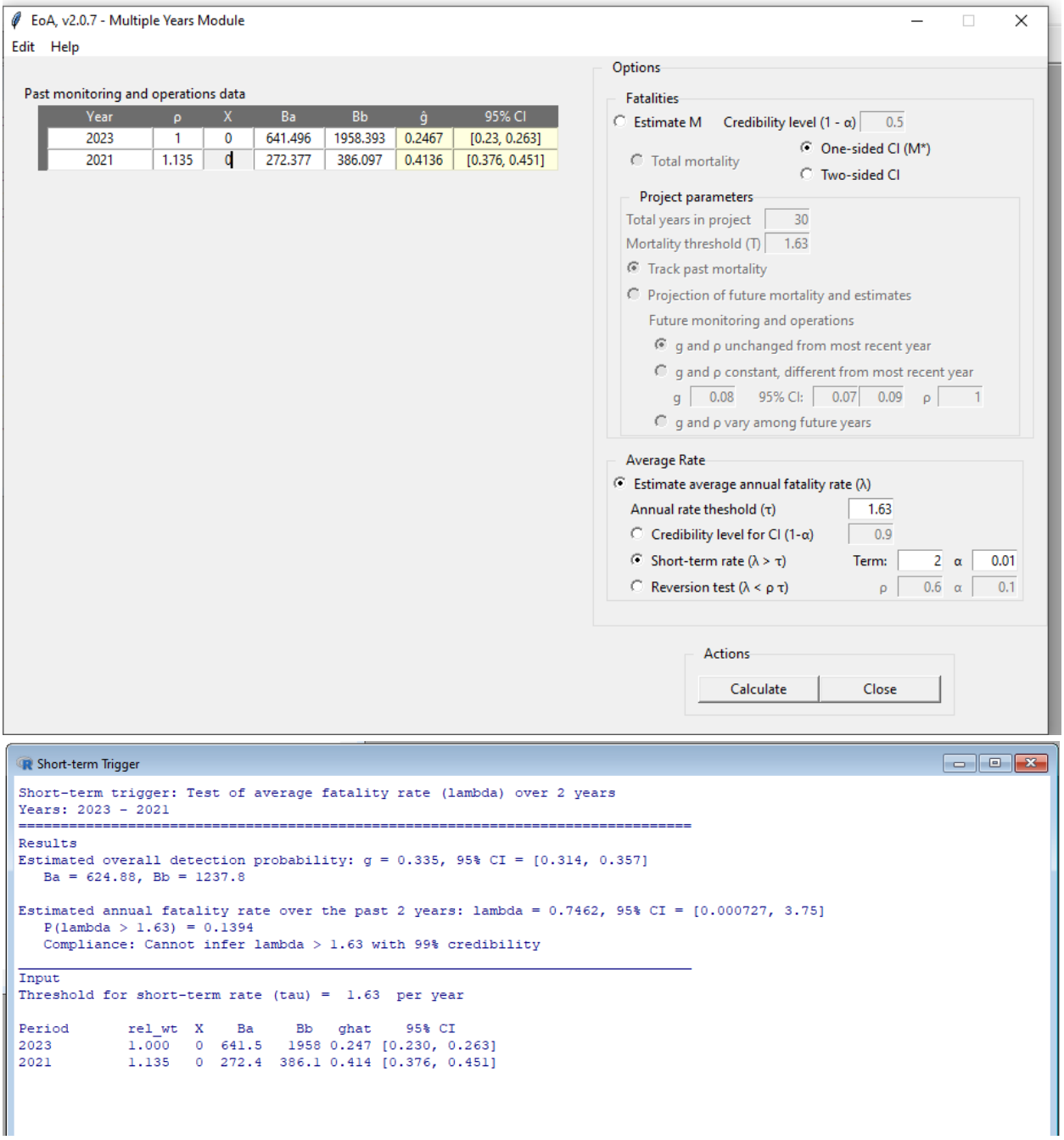
Appendix E11. Screen shot of Evidence of Absence (v2.0.7) graphical user interface, Multiple Class Module inputs and output for Spring, Summer and Fall 2023, (n=60 in all seasons), searched at a 7-day interval in the spring and a 3.5-day interval in summer and fall.



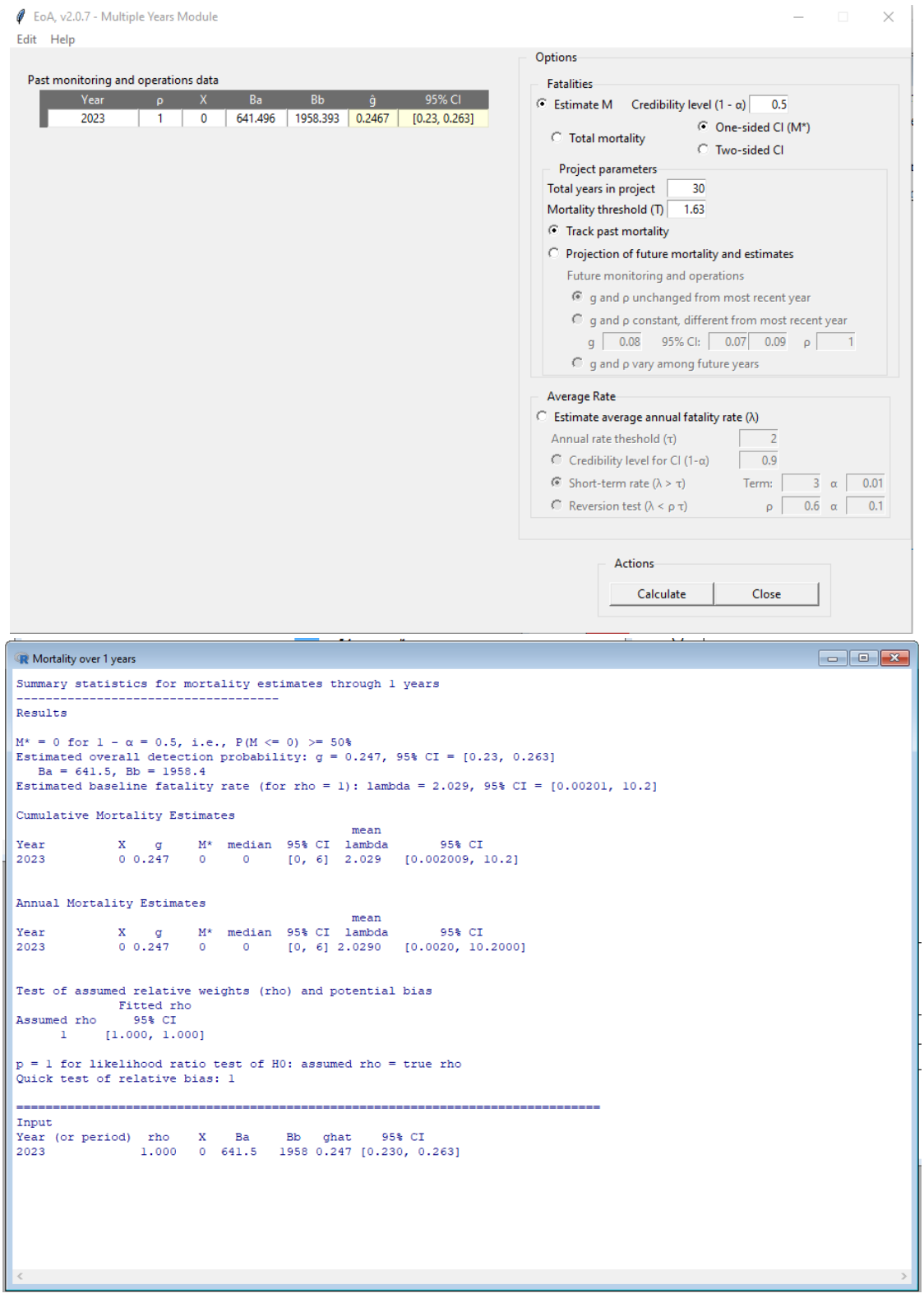
Appendix E12. Screen shot of Evidence of Absence (v2.0.7) graphical user interface, Multiple Year Module for Indiana bat rolling average detection probability and short-term adaptive management trigger test. Inputs are based on values reported in the main text. Note that although the weight (ρ) column of the Multiple Years Module sums to 2.135, the EoA GUI produces a "year-adjusted λ", by calculating the average λ over the number of input rows (years) in the multi-year module of the GUI. Because the ρ values associated with each year in the GUI are scaled so that a rho of 1.0 is equivalent to a typical operations year for the wind farm (but 2021 was not a typical operation year), we would like to calculate the "ρ-adjusted λ". The GUI does not accommodate that calculation. The "ρ-adjusted λ", 2.1, is equivalent to the "year-adjusted λ" (2.239 as seen in the output above) divided by the sum of ρ (2.135) and multiplied by the number of years (2).



Appendix E13. Screen shot of Evidence of Absence (v2.0.7) graphical user interface, Multiple Year Module for Indiana bat ITP term-to-date detection probability and cumulative take estimate (M*). Inputs are based on values reported in the main text.



Appendix E14. Screen shot of Evidence of Absence (v2.0.7) graphical user interface, Multiple Year Module for northern long-eared bat rolling average detection probability and short-term adaptive management trigger test. Inputs are based on values reported in the main text. Note that although the weight (ρ) column of the Multiple Years Module sums to 2.135, the EoA GUI produces a "year-adjusted λ", by calculating the average λ over the number of input rows (years) in the multi-year module of the GUI. Because the ρ values associated with each year in the GUI are scaled so that a rho of 1.0 is equivalent to a typical operations year for the wind farm (but 2021 was not a typical operation year), we would like to calculate the "ρ-adjusted λ". The GUI does not accommodate that calculation. The "ρ-adjusted λ", 0.70, is equivalent to the "year-adjusted λ" (0.75 as seen in the output above) divided by the sum of ρ (2.135) and multiplied by the number of years (2).



Appendix E15. Screen shot of Evidence of Absence (v2.0.7) graphical user interface, Multiple Year Module for northern long-eared bat ITP term-to-date detection probability and cumulative take estimate (M*). Inputs are based on values reported in the main text.