2021 Post-Construction Monitoring Studies for the Meadow Lake Wind Resource Area Benton and White Counties, Indiana

Final Report

April 1 – May 15 and August – October 15, 2021

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WEST

EXECUTIVE SUMMARY

Meadow Lake Wind Farm I-VI, LLCs (collectively, Meadow Lake Wind Farm) are operating the Meadow Lake Wind Resource Area (MLWRA or Project) in Benton and White counties, Indiana. The MLWRA has 414 turbines and a nameplate generating capacity of approximately 801 megawatts. This report details the post-construction monitoring studies conducted in 2021, consistent with the MLWRA's Habitat Conservation Plan (HCP) and Incidental Take Permit (ITP; ESPER0005174) for Indiana bat and northern long-eared bat (Covered Species). Turbines were feathered below manufacturer cut-in speeds in the spring, and 5.0 meters (m) per second in the fall to minimize impacts to Covered Species.

Post-construction monitoring was completed in accordance with the study plan, which was approved by US Fish and Wildlife Service on March 10, 2021. The study plan targeted a probability of detection, or *g*, of 0.25 for the 111 wind turbines at Meadow Lake Wind Farms V and VI (i.e., a study-wide *g*). The effort required to target a *g* of 0.25 at 111 turbines was spread between all of the phases and 414 turbines at the Project. The overall goal of this post-construction fatality monitoring study was to estimate take for the Covered Species using the Evidence of Absence framework as outlined in the HCP, and to determine if adaptive management was necessary to maintain compliance with the Project's ITP.

Standardized carcass searches were completed for bat carcasses at three plot types: cleared plots, uncleared plots, and roads and pads. Technicians searched 111 turbines as roads and pads to a distance of 100 m (328 ft) from the turbine, every other week during spring (April 1 – May 15). In the fall (August 1 – October 15), a technician searched 55 turbines as roads and pads to a distance of 100 m from the turbine, weekly. Dog-handler teams searched 28 turbines as cleared plots with a 70-m (230-ft) radius and 29 turbines as uncleared plots with a 70 m-radius, weekly during the fall. Searcher efficiency and carcass persistence trials were also conducted during each season to correct for detection and scavenger bias.

No Covered Species were found at the MLWRA. Four-hundred-sixty-seven bats were found during the study. The most commonly found bat species were eastern red bat (44.5% of the fatalities), silver-haired bat (31.5%), hoary bat (18.8%), and big brown bat (4.5%). One evening bat, a state-endangered species, was recorded at the Project on August 20, 2021. Species composition recorded at the MLWRA was similar to previous studies at the Project and other wind facilities in the Midwest. Seventy-six bird carcasses were also recorded; no federally or state-listed birds were found.

The study-wide *g* (representing 111 turbines) was 0.35 (90% confidence interval [CI]: 0.33–0.36), and the site-wide *g* (representing 414 turbines) was 0.09 (90% CI: 0.089–0.097). Based on data collected to date, the Evidence of Absence model estimated the mean annual fatality rate at MLWRA was 5.38 Indiana bats and 5.38 northern long-eared bats; the probability that the estimated take rate exceeded the expected take rate did not exceed 0.95. The cumulative take estimates through 2021 for MLWRA were two Indiana bat fatalities and two northern long-eared

bat fatalities. The estimated levels of take for the Covered Species were below levels authorized within the ITP. No adaptive management actions are necessary at this time.

STUDY PARTICIPANTS

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REPORT REFERENCE

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

INTRODUCTION

Meadow Lake Wind Farm I-VI, LLCs (collectively, Meadow Lake Wind Farm), subsidiaries of EDP Renewables North America, LLC (EDPR), are operating the Meadow Lake Wind Resource Area (MLWRA) in Benton and White counties, Indiana. EDPR obtained an Incidental Take Permit (ITP; ESPER0005174, dated March 31, 2021) for the federally listed as endangered Indiana bat (*Myotis sodalis*) and the federally listed as threatened northern long-eared bat (*Myotis septentrionalis*; hereafter, Covered Species) from the US Fish and Wildlife Service (USFWS). Compliance monitoring is required by the ITP to determine if the level of take is in compliance with the authorized take and to evaluate the need for adaptive management measures.

The objectives of this study were to estimate take for the Covered Species using the Evidence of Absence (EoA) framework as outlined in the Habitat Conservation Plan (HCP; Meadow Lake Wind Farm 2021) and to determine if adaptive management was necessary to maintain compliance with the Project's ITP.

STUDY AREA

Approximately 97% of the nearly 14,382-hectare (35,549-acre) area within 0.4 kilometer (0.25 mile) of turbines is cultivated cropland (National Land Cover Database 2016). Corn (*Zea mays*) and soybean (*Glycine max*) are the most common crop types. The next most common land cover is developed areas (e.g., farmsteads) that collectively compose approximately 2.5% of the site. All other land cover types collectively make up less than one percent of the total land cover (Table 1).

Six wind farms make up the MLWRA (Figure 1). Turbine capacities within the MLWRA range from 1.5 megawatts (MW) to 3.6 MW, with hub heights ranging from 79 to 105 meters (m; 259 to 344 feet [ft]), and rotor diameters ranging from 80 m to 136 m (262 to 446 ft; Table 2). All turbines are within the migratory range of both Covered Species; to minimize impacts to the Covered Species during migration, MLWRA adjusted turbine operations during the spring and fall migration periods. During spring (April 1 – May 15), MLWRA committed to feathering blades on nights when temperatures were above 10 degrees (°) Celsius (C; 50 °Fahrenheit [F]) and wind speeds were below manufacturer cut-in speeds[1]. During fall (August 1 – October 15), MLWRA feathered blades on nights when temperatures were above 10 °C when wind speeds were below 5.0 m (16.4 ft) per second.

[1] In practice, MLWRA feathered on all nights, regardless of temperature.

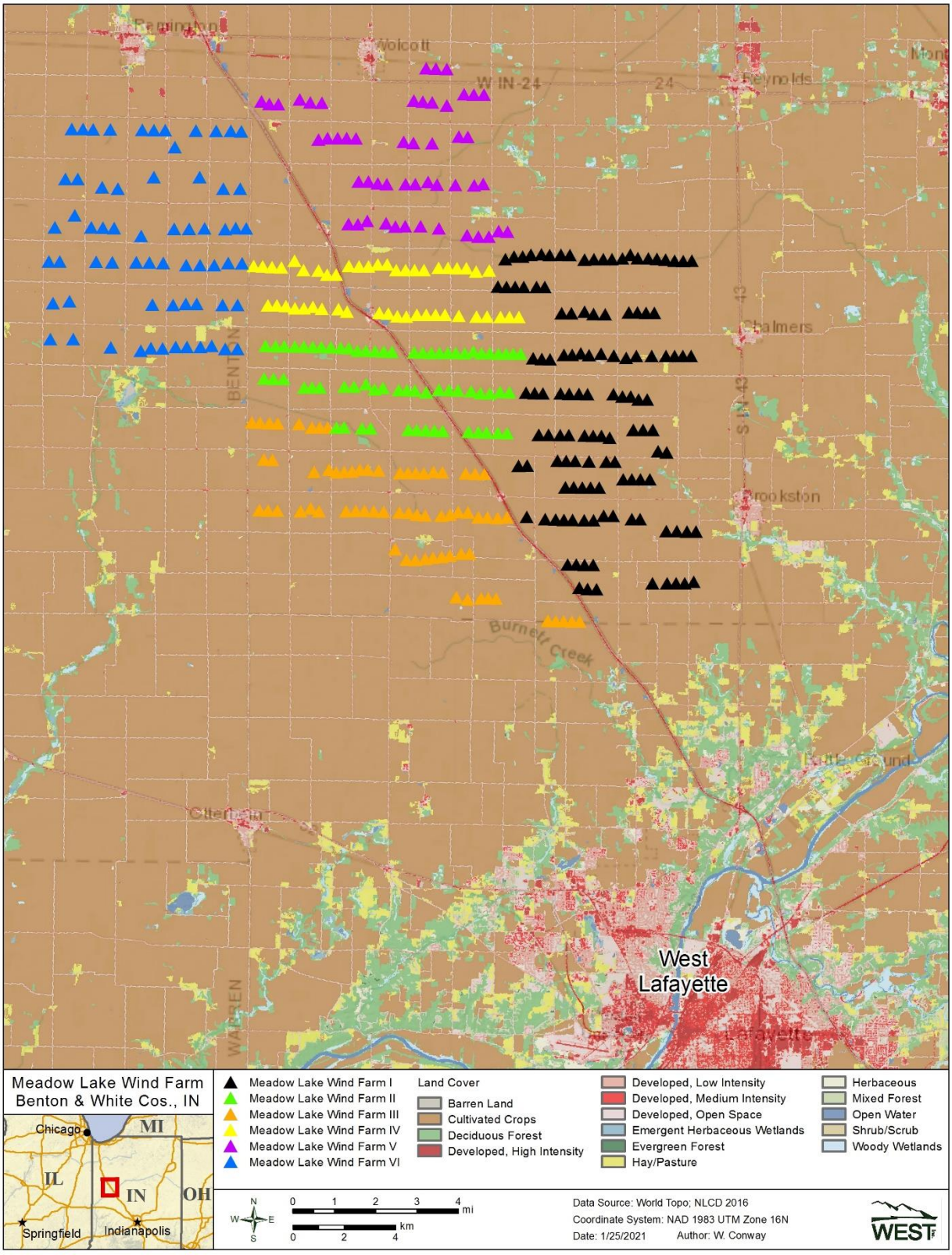

Figure 1. Turbine locations and surrounding land cover at the Meadow Lake Wind Resource Area in Benton and White counties, Indiana.

Table 1. Land cover types within 0.4 kilometer of turbines at the Meadow Lake Wind Resource Area in Benton and White counties, Indiana.

Habitat	Hectares	Acres	% Composition
Cultivated Crops	13,932	34,426	96.9
Developed*	365	902	2.5
Hay/Pasture	38	93	0.3
Deciduous Forest	19	47	0.1
Open Water	16	38	0.1
Herbaceous	5	13	<0.1
Barren Land	5	12	<0.1
Woody Wetlands	2	4	<0.1
Shrub/Scrub	1	3	<0.1
Emergent Herbaceous Wetlands	1	1	<0.1
Total**	**14,382**	**35,539**	**100**

Data from the National Land Cover Database 2016

* Developed areas include low-, medium-, and high-intensity developed areas, as well as developed open space.

** Sums can differ from values shown due to rounding.

Table 2. Phases, turbines, and operational dates of the Meadow Lake Wind Resource Area, Benton and White counties, Indiana.

Phase	Turbine Type	Number of Turbines	Commercial Operational Date	Hub Height (m)	Blade Diameter (m)
I	Vestas V82 1.65 MW	121	2009	80	82
II	Acciona AW-82 1.5MW	66	2010	80	82
III	GE 1.5 SLE 1.5 MW	69	2010	80	80
IV	Suzlon S88 2.1 MW	47	2010	79	88
V	Vestas V110 2.0 MW	50	2017	95	110
VI	Vestas V110 2.0 MW	12	2019	95	110
	Vestas V136 3.6 MW	49	2019	105	136

m = meter, MW = megawatt

METHODS

As specified in the HCP, Western EcoSystems Technology, Inc. (WEST) designed the monitoring effort to target a probability of detection, or *g*, of 0.25 for the 111 wind turbines at Meadow Lake Wind Farms V and VI (i.e., study-wide *g*). The effort required to target a *g* of 0.25 at 111 turbines was spread across all of the phases and 414 turbines at the Project. WEST developed a study plan that targeted a study-wide *g* of 0.25 using values from previous post-construction monitoring studies in the region (Good et al. 2016; Rodriguez et al. 2020a, 2020b, 2020c). WEST submitted a study plan to the USFWS on February 19, 2021 and received approval on March 10, 2021 (Marissa Reed, USFWS, pers. comm.).

Standardized Carcass Searches

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

Technicians and dog-handler teams conducted standardized carcass searches from April 1 – May 15 and August 1 – October 15, 2021. Search effort varied by season (Table 3), and

was designed to maximize effort when take of Covered Species was considered most likely to occur.

Table 3. Search effort by season and plot type at the Meadow Lake Wind Resource Area, Benton and White counties, Indiana.

Season	Plot Type	Search Interval	Number of Turbines	Search Team
Spring (April 1 – May 15)	100-m road and pad	14 days	111	Human
Fall (August 1 – October 15)	100-m road and pad	7 days	55	Human
	70-m cleared plot	7 days	28	Dog-Handler
	70-m uncleared plot	7 days	29	Dog-Handler

m = meter

Turbines were selected for inclusion in the study using a two-step process to achieve spatial balance in the sample across the MLWRA. Turbines were stratified by crop cover, followed by a Generalized Random Tessellation Stratified draw to select 100-m (328-ft) roads and pads (Stevens and Olsen 2004). Crop cover was included as a stratum to help determine where soybean fields were located for potential inclusion as uncleared plots in searches conducted by dog-handlers. The subset of turbines sampled within the MLWRA varied between seasons (Figure 2).

During the spring, a technician searched the gravel road and pad areas (roads and pads) under all 111 turbines to a distance of 100 m from the turbine, every other week (Table 3; Figure 2). Fifty-five turbines were searched once a week as 100-m roads and pads in the fall (Figure 3). If the road extended in multiple directions within 100-m of the turbine, the access road was searched in one direction, which was randomly selected. Dog-handler teams searched 28 turbines where crops were regularly mowed within a 70-m radius (70-m cleared plots; Figure 4) and 29 turbines as uncleared plots with a 70-m radius (70-m uncleared plots; Figure 5).

During fall, vegetation at 70-m cleared plots was mowed and maintained by MLWRA staff within 10 to 15 cm (four to six inches) in height to enhance detectability of carcasses. Uncleared plots were vegetated with soybeans (Figure 5). A cross pattern approximately 1.5-m (4.9-ft) wide was mowed into the uncleared soybean plots to assist with plot access.

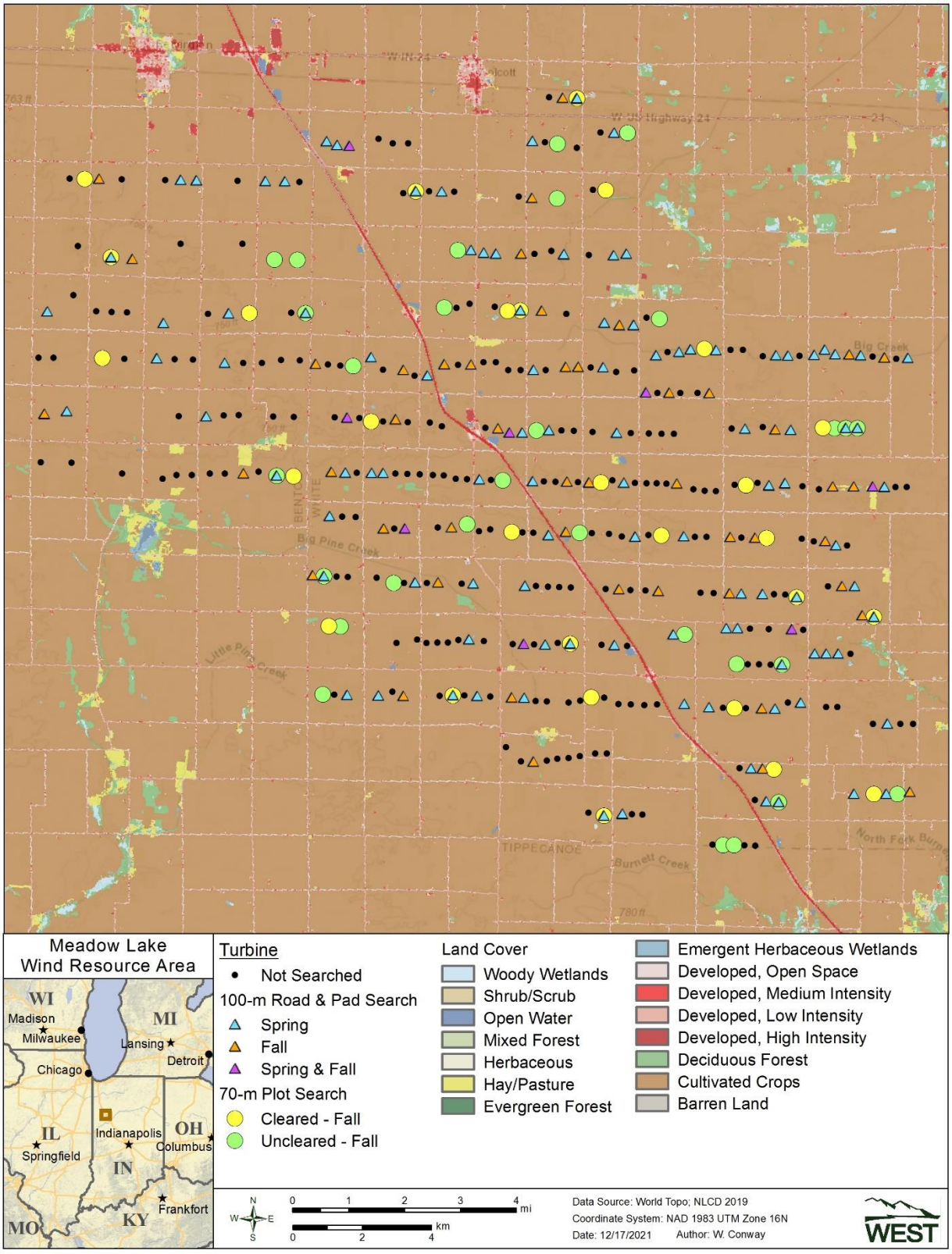

Figure 2. Turbine by plot type and surrounding land cover at the Meadow Lake Wind Resource Area in Benton and White counties, Indiana.

Figure 3. Representative photo of conditions of a 100-meter road and pad.

Figure 4. Representative photo of vegetation conditions in a 70-meter cleared plot.

Figure 5. Representative photo of vegetation conditions in a 70-meter uncleared plot.

Search Methods

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

Human Searchers

The technicians walked transects spaced five m (16 ft) apart at a rate of approximately 45–60 m (148–197 ft) per minute on gravel roads and pads within 100 m of the turbine. The technicians scanned the area for fatalities on both sides of the transects out to approximately 2.5 m (8.2 ft) to ensure full visual coverage of each search area.

Dog-Handler Teams

Dog-handler teams searched cleared and uncleared plots for bat carcasses. Detection dogs were considered candidates for carcass searches if they met requirements for temperament, basic obedience, and the ability to detect bird and/or bat carcasses. Temperament characteristics that

are sought after are high-energy dogs, with a high food or toy drive. Prior to conducting searches at the MLWRA, handlers trained their detection dogs on the scent of bat carcasses following methods derived from search and rescue programs and drug detection (Kay 2012, Helfers 2017). Dogs were initially trained on cotton scent swabs that had been rubbed on or stored in a container with bat carcasses and progressed to bat carcasses at increasing distances over a period of three to four weeks. Once the dog achieved a passing grade of 80% or higher in a scent recognition test, consisting of 10 blind trial lineups using bat carcasses, the dog and handler were evaluated in the field to measure performance. The detection dog coordinator conducted a 2-day field evaluation of each dog-handler team; after teams achieved a searcher efficiency of 75% or greater for 25 bats during evaluation trials, the teams were approved to conduct standardized carcass searches. Because the objective of the study was to document bat carcasses, dogs were not explicitly trained on native bird carcasses; however, all detection dogs alerted on birds in the field, and handlers rewarded bird finds in the field to encourage future alerts to bird carcasses. Detection dog breeds used at the MLWRA included German shepherd, Australian cattle dog, beagle mix, Border collie, black Labrador, and Belgian Malinois.

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

Data Collection

Technicians recorded the date, start and end times, technician name, turbine number, type of search and if any fatalities were found for each scheduled search. When a fatality was found, technicians placed a flag near it and continued the search. After searching the entire plot, the technician returned to record information for each fatality on a fatality data sheet, including the date and time, species, sex and age (when possible), technician name, turbine number, measured distance from turbine, azimuth from turbine, location of carcass as Universal Transverse Mercator coordinates, habitat surrounding carcass, condition of carcass (i.e., intact, scavenged, dismembered, feather spot [for birds only], injured), and estimated time of death (e.g., less than one day, two days). Technicians took digital photographs of each fatality, including any visible injuries, and surrounding habitat. The technician also plotted the location of each fatality on a map of the search area. Carcasses found in non-search areas (e.g., outside of a plot boundary) or outside of the scheduled study period were recorded as incidental discoveries and documented following the same protocol for those found during standard searches, but were not included in analysis.

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—an entire carcass found in multiple pieces distributed more than 1.0 m (3.3 ft) apart from one another due to scavenging or other reasons.
- Injured—a bat or bird found alive.

For bird carcasses, the following category was also used:

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

Bat carcasses were collected under the Projects ITP (ESPER0005174), WEST's Federal Native Endangered and Threatened Species Recovery Permit (TE234121-9), and WEST's Special Purpose Salvage Permit (2137). Technicians placed all bat carcasses in a re-sealable plastic bag labeled with the unique carcass identification number, turbine number, and date, for storage in a freezer on site. Leather and rubber gloves were used to handle all bat carcasses to eliminate possible transmission of rabies or other diseases. Bird carcasses were recorded, but left in place. Injured bats were left in place per the MLWRA Study Plan (Rodriguez et al. 2021), to avoid the potential to transmit SARS-CoV-2 to North American bat populations.

Tissue samples were collected from heavily scavenged or decomposed carcasses that could not be positively identified and had potential to be a Covered Species were submitted for identification to a USFWS-approved laboratory, either Northern Arizona University School of Forestry and Center for Microbial Genetics and Genomics, or Dr. Huffman's Wildlife Genetics Institute at East Stroudsburg University in Pennsylvania.

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 41.0 millimeters [1.6 inches] long) were identified to the closest genus or group possible and samples were not sent off for further identification.

Carcass Identification and Agency Notification

Identification of bird carcasses were verified by biologists with significant field experience in identification of birds and their feathers. The USFWS and the Indiana Department of Natural Resources (IDNR) were notified within 24 hours of positive identification of any species listed as endangered or threatened under the Endangered Species Act of 1973, or any state-listed threatened or endangered species. A permitted bat biologist (TE19208C-0) verified the

identifications of all bat carcasses in hand at the end of the surveys and delivered the carcasses to the USFWS Indiana Field Office in Bloomington, Indiana, on December 17, 2021.

Bias Trials

Searcher Efficiency Trials

The objective of the searcher efficiency trials was to estimate the probability that a carcass was found by searchers (i.e., technicians or dog-handler teams). 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*), big brown bats (*Eptesicus fuscus*), and silver haired bats (*Lasionycteris noctivagans*) that had previously been found on site, and big brown bats provided by Indiana State University. A minimum of 25 bat carcasses were placed and confirmed available per plot type and per season. Multiple trials were conducted in each season to measure the effect of potential changes in plot conditions on searcher efficiency over time.

Each trial carcass was discreetly marked with a black zip-tie and/or a piece of electrical tape around the upper forelimb for identification as a study carcass after it was found. Carcasses were dropped from waist-height or higher and allowed to land in a random posture. The number and location of trial carcasses found during the subsequent search were recorded, and the number of trial carcasses available for detection during each search was determined immediately after each trial by the person responsible for distributing the carcasses. Searchers had one chance to locate trial carcasses during the first search after carcass placement. The trial administrator walked in a meandering path and dropped trials for dog-handler teams the day prior to the next search to allow time for the scent to pool and disperse prior to scheduled searches. Following searches, any carcasses that were not detected were checked to confirm availability. Sixty-four trial carcasses were left in place and used for carcass persistence trials.

Carcass Persistence Trials

The objective of carcass persistence trials (CPT) was to estimate the length of time (in days) a carcass would persist, or be available for detection, in the field. Carcasses could be removed by scavenging or rendered undetectable by typical farming activities. A minimum of 15 trial carcasses were placed in each season and plot type to incorporate the effects of varying weather and scavenger densities on carcass persistence. No more than three trial carcasses were placed on a plot 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. Dog-handler teams were used on the 70-m cleared and uncleared plots to determine when carcasses were removed, while technicians determined the status of carcasses placed on 100-m roads and pads.

Search Area Mapping

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

Quality Assurance and Quality Control

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

Statistical Analysis

The EoA modeling framework (Dalthorp et al. 2017) was used to estimate take of the Covered Species. To estimate take, EoA used the arrival distribution of bats (described below), the number of Covered Species found, and the estimated overall probability of detecting a bat fatality based on data collected in the field. Data used in the EoA model included number of Covered Species fatalities, fatality spatial data from all bats found during surveys, and the results of searcher efficacy and CPT.

Searcher Efficiency Estimation

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

The change in searcher efficiency between successive searches was defined by a parameter called the detection reduction factor (*k*) that can range from zero to one. When *k* is zero, it implies

a carcass that was missed on the first search would never be found on subsequent searches. A *k* of one implies searcher efficiency remained constant no matter how many times a carcass was missed. Huso et al. (2017) estimated a value of $k = 0.67$ for bats, and this value was used to calculate bat fatality estimates using EoA, per the HCP.

Carcass Persistence Rate Estimation

CPT data were used to estimate the amount of time, in days, that carcasses remained available to be located by the searcher. Carcass persistence was also estimated separately for plots searched by technicians versus dog-handler teams to account for differences in modes of detection (i.e., technicians use sight while dogs use scent). The average probability that a carcass persisted through the search interval (i.e., the time between scheduled searches) was estimated using an interval-censored survival regression with four potential distributions: exponential, log-logistic, lognormal, and Weibull distributions (Kalbfleisch and Prentice 2002, Dalthorp et al. 2018). Season (spring or fall) and plot type (70-m cleared plot or 70-m uncleared plot) were used as potential covariates 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 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 used weight-based probability of detection and the proportion of area searched in each 1.0-m annulus around the turbine. Due to the variation in turbine sizes (hub heights range from 80–105 m and blade lengths range from 82–136 m in diameter), separate area adjustments were fit for each turbine size, except for the 41-m (135-ft) and 44-m (144-ft) rotor radius turbines, which were pooled due to their similarity in size and a limited sample size of the 44-m rotor radius turbines (22 turbines). An additional model was fitted with area adjustment pooled across all turbines. The best model between the two was selected using AICc. For all area adjustment models, distributions considered were normal, gamma, Gompertz, Rayleigh and Weibull (parameterized according to R Development Core Team [2016] and Yee [2015]). The best distributions were selected using AICc. The proportion of area searched was calculated in a Geographic Information System as the amount of area searched divided by the total area searched at each 1.0-m annulus around the turbine.

Carcasses Excluded from Area Adjustment Calculations

Fatalities were excluded from the area adjustment calculation when the carcass was discovered outside of the spatial and temporal scope of the survey design. For example, carcasses found outside a designated plot were not included in the analysis because the area adjustment accounts for the carcass by adjusting for unsearched areas. Carcasses found prior to the start of surveys (e.g., a carcass found on a plot in the summer that was not searched until the fall) were also

excluded because the carcass occurred outside of the study period. Note that carcasses found on a plot incidentally were included in the analysis if that plot had a scheduled search in the future. If a fatality of a Covered Species had been found outside of the spatial or temporal scope of the survey design, it would still be excluded from the area adjustment estimate, but would have been included in the EoA fatality estimate following Dalthorp et al. (2020).

Covered Species Take and Detection Probability Estimates

Evidence of Absence

EoA was used to estimate the median cumulative take to date (*M**), mean annual take rate (λ), and the probability that the estimated take rate (λ) exceeded the expected take rate (τ) 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 probability of detection (*g*) was estimated using the bias corrections for searcher efficiency, carcass persistence, and area searched, as well as the assumed seasonality of risk for the Covered Species, which per the HCP, was 11% in spring and 89% in fall. The study-wide *g* was calculated for the 111 study turbines and the site-wide, or effective, *g* for all 414 turbines was calculated and used for estimating take rates of the Covered Species. The EoA Single Class Module was used to estimate the distribution of detection probability in each search stratum. This resulted in alpha (α) and beta (β) parameters that defined the β distribution of detection probability in each stratum. The EoA Multiple Class Module was then used to combine detection probability distributions across strata (cleared plots searched by dog-handler teams, cleared plots searched by technicians, uncleared plots, and roads and pads), with weights for each class defined by the sampling fraction, area searched, and seasonal arrival proportions. The β distribution parameters were set to Ba = 0.01 and Bb = 1,000 for unsearched areas within each stratum. The results from the Multiple Years Module (Ba and Bb parameters for the detection probability to date) were used to estimate *M**, mean take rate λ, and its 95% CI, and the probability that $\lambda > \tau$. Appendix A shows how the compliance metrics were calculated using the EoA Graphical User Interface[2].

The EoA Multiple Years Module requires the input ρ, which weights the years appropriately; ρ was set to one for 2021 because 2021 was the only post-construction monitoring conducted to date under the ITP operations.

Adaptive Management Triggers

The estimates from the EoA analysis were used to test two adaptive management triggers: a short-term test of whether the estimated take rate exceeded the expected take rate, and a long-term test of whether permitted take had been met (Dalthorp and Huso 2015). Both the short- and long-term triggers were tested individually for each of the Covered Species.

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

Evidence of Absence Short-Term Trigger

The EoA short-term trigger is designed as an early warning signal that the project may be on the path to exceeding permitted take (T) by the end of the permit term. The short-term trigger is designed to determine if an adaptive management response is needed to prevent the cumulative take estimate from actuating a response to the long-term trigger test. The short-term trigger tests if the estimated annual take rate (λ) exceeded the expected take rate (τ = T ÷ years in permit) at a confidence level of α = 0.05, per the HCP. The MLWRA's short-term trigger is designed to evaluate a rolling window of six years of post-construction monitoring data. If, within any 6-year rolling window, the estimated take rate exceeds the expected take rate with 95% confidence, the short-term trigger would be met, indicating that the minimization plan in the HCP may need to be adjusted to ensure that the median cumulative take estimate (*M**) remains within the permitted limit over the ITP term. Only one year of data was used in this analysis because 2021 was the first year of monitoring under the ITP.

Evidence of Absence Long-Term Trigger

The EoA long-term trigger is designed to test if the cumulative take to date is equal to or greater than the permitted take (T) under the HCP (i.e., to test whether cumulative take has met permitted take). Per the HCP, cumulative take to date (*M**) was estimated at a confidence level of α = 0.5 (using the median, or 50th credible bound, of the posterior distribution of estimated mortality). If the cumulative take to date at α = 0.5 is less than the total permitted take (*M** < T), then the MLWRA is in compliance with the ITP. If the cumulative take to date at α = 0.5 is greater than or equal to the total permitted take (*M** ≥ T), then the take limit has been met and the MLWRA must enact avoidance measures.

RESULTS

Standardized Carcass Searches

Four-hundred-forty-three searches were completed in the spring, and 1,215 searches were completed in the fall (Table 4). Sixteen searches (less than 1%) were missed due to turbine maintenance, weather constraints, and/or safety hazards. Four-hundred-sixty-seven bat carcasses and 76 bird carcasses were found during surveys and incidentally (Appendix A).

Table 4. Number of searches per plot type at the Meadow Lake Wind Resource Area, Benton and White counties, Indiana, from April 1 – May 15 and August 1 – October 15, 2021.

Season	Plot Type	Search Interval	Number of Searches
Spring (April 1 – May 15)	100-m road and pad	14 Days	443
Fall (August 1 – October 15)	100-m road and pad	Weekly	599
	70-m cleared plot	Weekly	300
	70-m uncleared plot	Weekly	316
Overall			**1,658**

m = meter

Species Composition

No Covered Species were found. One evening bat (*Nycticeius humeralis*), a state-endangered species, was found on August 20, 2021, and the IDNR was notified within 24 hours of positive identification (on August 20, 2021). No other federally or state-listed bat species were found. Seventeen bats were found in the spring and 450 bats were found in the fall (Appendix A). The most commonly found bat species were eastern red bat (208 carcasses; 44.5%) and silver-haired bat (147 carcasses; 31.5%), followed by hoary bat (88 carcasses; 18.8%) and big brown bat (21 carcasses; 4.5%). One evening bat (0.2%), one Seminole bat (*Lasiurus seminolus*; 0.6%), and one *Lasiurus* spp. (0.2%) were also found. (Table 5, Appendix A). Over the course of the monitoring period, one heavily scavenged bat was sent off for genetic testing. Genetic testing determined that the previously unidentified bat was a silver-haired bat. The majority of bat carcasses were recorded on the 70-m cleared and uncleared plots searched by dog-handler teams (Table 6).

Carcasses for Area Adjustment Analysis

Fifteen of the 467 bats found were excluded from modeling the area adjustment for EoA; nine bat carcasses were excluded from analysis because the carcasses were found off plot. Another five bats were excluded because their estimated time of death was prior to the start of surveys (Table 5).

Table 5. Number and percent (%) of bat carcasses found at the Meadow Lake Wind Resource Area, Benton and White counties, Indiana, from April 1 – May 15 and August 1 – October 15, 2021.

	Included in Area Adjustment		Outside Search Area*		Outside Study Period*		Total	
Species	**Total**	**%**	**Total**	**%**	**Total**	**%**	**Total**	**%**
eastern red bat	201	44.5	3	30.0	4	80.0	208	44.5
silver-haired bat	142	31.4	5	50.0	0	0	147	31.5
hoary bat	86	19.0	1	10.0	1	20.0	88	18.8
big brown bat	20	4.4	1	10.0	0	0	21	4.5
evening bat	1	0.2	0	0	0	0	1	0.2
Seminole bat	1	0.2	0	0	0	0	1	0.2
unidentified *Lasiurus* bat	1	0.2	0	0	0	0	1	0.2
Total	**452**	**100**	**10**	**100**	**5**	**100**	**467**	**100**

* Carcasses not included in analysis

Table 6. Species composition by plot type for bat carcasses* found at the Meadow Lake Wind Resource Area, Benton and White counties, Indiana, from April 1 – May 15 and August 1 – October 15, 2021.

	Spring		Fall					
	100-m Road/Pad		100-m Road/Pad		70-m Cleared Plot		70-m Uncleared Plot	
Species	**# Carcasses**	%	**# Carcasses**	**%**	**# Carcasses**	**%**	**# Carcasses**	**%**
eastern red bat	0	0	27	50.9	95	41.5	79	47.9
silver-haired bat	4	80.0	16	30.2	72	31.4	50	30.3
hoary bat	1	20.0	5	9.4	52	22.7	28	17.0
big brown bat	0	0	4	7.5	10	4.4	6	3.6
evening bat	0	0	1	1.9	0	0	0	0
Seminole bat	0	0	0	0	0	0	1	0.6
unidentified *Lasiurus* bat	0	0	0	0	0	0	1	0.6
Total	**5**	**100**	**53**	**100**	**229**	**100**	**165**	**100**

* This table only includes bat carcasses included in the area adjustment calculation.

Sums can differ from values shown due to rounding.

m = meter

Bias Trials

Searcher Efficiency Trials

One-hundred-thirty bats were placed for searcher efficiency trials on 13 separate dates (April 2, April 14, May 12, August 9, August 26, September 2, September 15, September 16, September 27, September 29, October 3, October 4, and October 6), and 103 were available for search teams to find across all plot types. Overall searcher efficiency rates were 92.3% on 100-m roads and pads, and 70.6% across both 70-m cleared and 70-m uncleared plots (Table 7). The best-fit model for searcher efficiency on 70-m plots did not support the inclusion of plot type as a covariate, meaning there was not a statistically meaningful difference between searcher efficiency rates on 70-m uncleared and 70-m cleared plots (Appendix B). The best-fit model for searcher efficiency on roads and pads did not support the inclusion of season as a covariate (Appendix B).

Table 7. Searcher efficiency results by plot at the Meadow Lake Wind Resource Area, Benton and White counties, Indiana, from April 1 – May 15 and August 1 – October 15, 2021.

Season	Plot Type	Number Placed	Number Available	Number Found	% Found
Spring	Roads and pads	30	28	25	89.3
Fall	Uncleared	33	26	19	73.1
	Cleared	32	25	17	68.0
	Roads and pads	35	24	23	95.8
Overall 70-meter plots (cleared and uncleared)		**65**	**51**	**36**	**70.6**
Overall roads and pads		**65**	**52**	**48**	**92.3**
Overall		**130**	**103**	**84**	**81.6**

Carcass Persistence Trials

Sixty-two carcasses were placed to estimate carcass persistence. The best fit model for carcass persistence rates at 70-m cleared and 70-m uncleared plots had no covariates and an exponential distribution, which suggests carcass persistence rates did not vary between plot types (Appendix B). The best fit model for roads and pads had a lognormal distribution and included season as a scale covariate (Appendix B). The estimated median carcass persistence times were 17.4 days on 70-m plots and 10.0 days on 100-m roads and pads in both spring and fall (Table 8; Figures 6 and 7). Although median persistence times were the same for both spring and fall on 100-m roads and pads, variance between the two seasons was substantial enough to support inclusion of season as a covariate on the scale parameter of the fitted carass distribution. The average probability that a carcass persisted through a 14-day search interval on 100-m roads and pads in the spring was 0.59 (90% CI: 0.52–0.67). The average probability that a carcass persisted through a 7-day search interval in the fall was 0.82 (90% CI: 0.0.70–0.93) on 100-m roads and pads, and 0.87 (90% CI: 0.83–0.91) on 70-m plots (Figure 7).

Table 8. Carcass persistence top models with covariates, distributions, and model parameters for the Meadow Lake Wind Resource Area, Benton and White counties, Indiana, from April 1 – May 15 and August 1 – October 15, 2021.

Season	Plot Type	Distribution*	Estimated Median Removal Times (days)	Parameter 1**	Parameter 2**
Spring	100-m roads and pads	Lognormal	10.02	2.305	2.566
Fall	70-m plots	Exponential	17.43	0.0398	–
Fall	100-m roads and pads	Lognormal	10.02	2.305	1.137

* Parameterization follows the base R parameterization for this distribution.

** The exponential model only has one parameter, which is rate. Parameters 1 and 2 for the lognormal distribution are mean and standard deviation, respectively.

m = meter

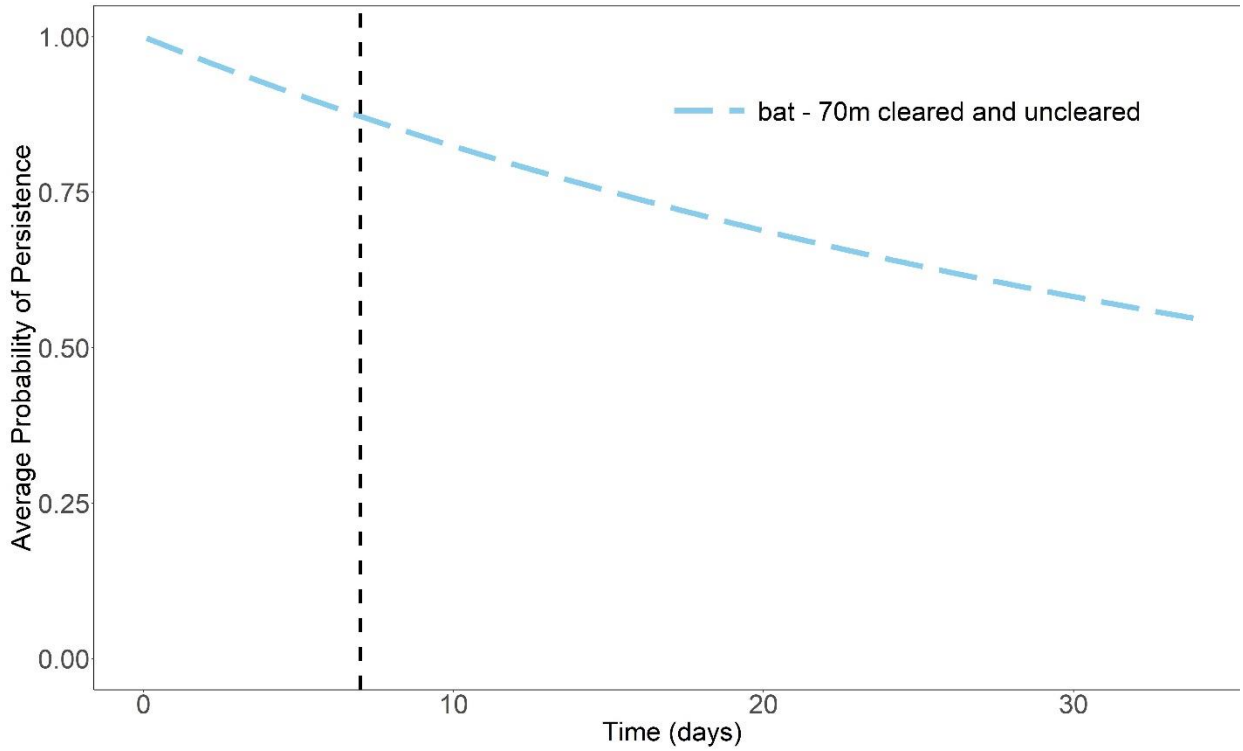

Figure 6. The average probability of carcass persistence on 70-meter cleared and uncleared plots, over time (in days) at the Meadow Lake Resource Area, Benton and White counties, Indiana, from August 1 – October 15, 2021.

Note: The vertical dotted line indicates the 7 day search interval for 70-m cleared and 70-m uncleared plots.

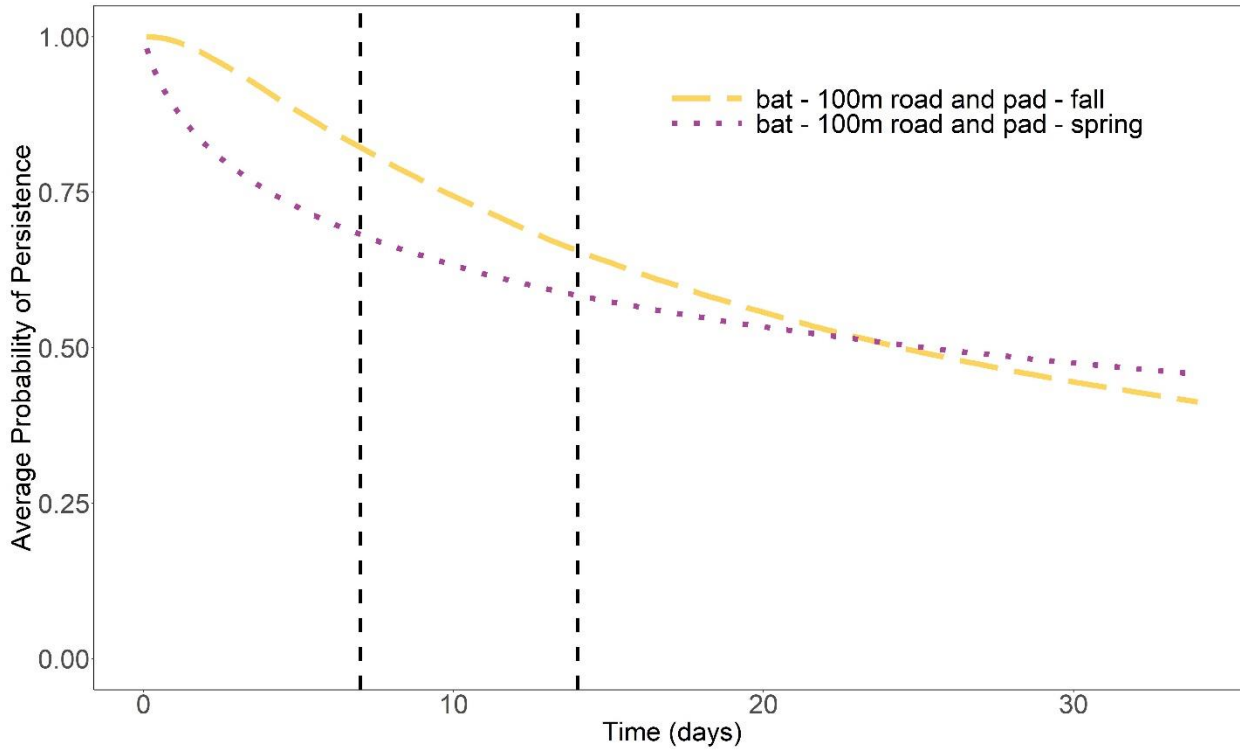

Figure 7. The average probability of carcass persistence on 100-meter roads and pads over time (in days) at the Meadow Lake Wind Resource Area, Benton and White counties, Indiana, from April 1 – May 15 and August 1 – October 15, 2021.

Note: The vertical dotted lines indicate the 7 and 14 search intervals for the 100-m roads and pads.

Statistical Analysis

Area Adjustment

The best-fit model for the distribution of bats with respect to distance from turbine base included blade length as a covariate, suggesting that the distribution of bats varied across turbine types (Appendix C). Therefore, there were multiple TWL adjustments for bats for all plot types. The TWL area adjustment for bats at 100-m roads and pads was estimated to range between 0.07–0.15 (Table 9). The TWL area adjustment for bats at 70-m plots was estimated to range between 0.92–1.00 (Appendix C, Table 9).

Table 9. Truncated weighted maximum likelihood search area adjustment estimates for the Meadow Lake Wind Resource Area, Benton and White counties, Indiana, from April 1 – May 15 and August 1 – October 15, 2021.

Blade Length*	Search Area Type	Season	Distribution	Parameter 1	Parameter 2	Area Adjustment
38 m	70-m cleared	Fall	Gompertz	0.0683	0.0049	0.98
	70-m uncleared	Fall	Gompertz	0.0683	0.0049	1.00
41 to 44 m	70-m cleared	Fall	Gompertz	0.0575	0.0032	0.92
	70-m uncleared	Fall	Gompertz	0.0575	0.0032	0.96
	100-m road and pad	Fall	Gompertz	0.0575	0.0032	0.07
	100-m road and pad	Spring	Gompertz	0.0575	0.0032	0.08
55 m	70-m cleared	Fall	Normal	35.2770	13.3972	0.97
	70-m uncleared	Fall	Normal	35.2770	13.3972	1.00
	100-m road and pad	Fall	Normal	35.2770	13.3972	0.08
	100-m road and pad	Spring	Normal	35.2770	13.3972	0.09
68 m	70-m cleared	Fall	Gompertz	0.0504	0.0079	0.97
	70-m uncleared	Fall	Gompertz	0.0504	0.0079	0.99
	100-m road and pad	Fall	Gompertz	0.0504	0.0079	0.14
	100-m road and pad	Spring	Gompertz	0.0504	0.0079	0.15

* 38-m blades, n = 51; 41- to 44-m blades, n = 196; 55-m blades, n = 100; 68-m blades, n = 98

m = meter

Covered Species Take Estimates

Evidence of Absence Framework

No Covered Species carcasses were found during the study. The study-wide *g* distribution achieved for the 2021 monitoring period was 0.35 (95% CI: 0.33–0.36). The site-wide *g* was 0.09 (95% CI: 0.089–0.097; Table 10). Inputs required to run the EoA Single Class Module and stratum-specific *g* distribution values and inputs required for the Multiple Class Module are provided in Appendix D.

Table 10. Probability of detection (*g*), Ba, Bb, and ρ for the Meadow Lake Wind Resource Area, Benton and White counties, Indiana from April 1 – May 15 and August 1 – October 15, 2021.

Metric	Ba*	Bb*	ρ**	*g*	95% CI
λ and Short-term Trigger (Last 6 Years)	1,605.22	15,648.77	1.0	0.093	0.089–0.097
*M** and Long-term Trigger (Cumulative)	1,605.22	15,648.77	1.0	0.093	0.089–0.097

* 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.

** ρ is the weight in the weighted average that is used to combine the probability of detection distributions across years.

CI = confidence interval

Mean annual take rate was estimated to be 5.38 (95% CI: 0.01–27.02) Indiana bats per year and 5.38 (95% CI: 0.01–27.02) northern long-eared bats per year from April 1 – May 15 and August 1 – October 15, 2021 (Table 11). The expected average annual take rate reported in the HCP is 25.1 Indiana bats per year and 5.8 northern long-eared bats per year.

Table 11. Probability the estimated take rates exceeded the expected take rates at the Meadow Lake Wind Resource Area, Benton and White counties, Indiana, from April 1 – May 15 and August 1 – October 15, 2021.

Species	Mean λ (95% CI)	Expected Take Rate (τ)	Pr(λ > τ) *	Short-Term Trigger Fires at α = 0.05?
Indiana bat	5.38 (0.01–27.02)	25.1	0.03	No
Northern long-eared bat	5.38 (0.01–27.02)	5.8	0.3	No

* Pr(λ > τ) reads, "the probability that λ (the annual take rate) is greater than τ (the expected annual take rate based on the total permitted take, used as a threshold for adaptive management)." If this probability is less than 0.95 (e.g., α = 0.05 for a 1-sided test), then no adaptive management is triggered because there is not sufficient evidence that the estimated annual take rate is greater than the expected annual take rate.

Adaptive Management—Evidence of Absence Short-Term Trigger

The short-term trigger assesses the probability that the estimated take rate exceeded the expected take rate, Pr(λ > τ). At a 95% confidence level (α = 0.05), Pr(λ > τ) must be greater than or equal to 0.95 for the short-term trigger to fire. For Indiana bat, Pr(λ > τ) = 0.03 and northern long-eared bat, Pr(λ > τ) = 0.3 (Table 11). Neither probability meets or exceeds 0.95, indicating the short-term trigger was not met and no adaptive management actions are necessary (Table 11; Figure 8).

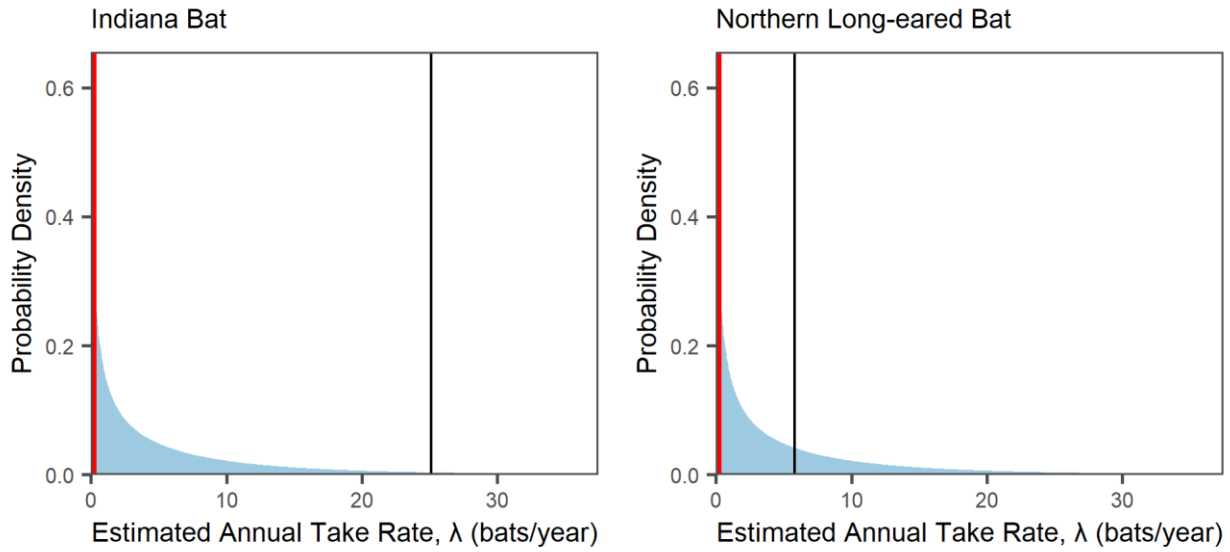

Figure 8. Estimated annual take rate (λ) of bats per year at the Meadow Lake Wind Resource Area, Benton and White counties, Indiana, from April 1 – May 15 and August 1 – October 15, 2021.

Note: The red region of the posterior distributions shows the region of the lower 5% quantile of the distributions (red region may not be visible when the posterior distribution is skewed heavily toward zero). The vertical line marks the expected take rate. The short-term trigger evaluates whether the vertical line falls within or to the left of the red region of the posterior distributions. For both species, the short-term trigger is not met because the vertical line (expected take rate) is not within or to the left of the red regions. In other words, the probability that estimated take rate is greater than the expected take rate does not exceed 95%.

Adaptive Management—Evidence of Absence Long-Term Trigger

Cumulative take to date, M^* at $\alpha = 0.5$ (50^{th} credible bound), was estimated as two Indiana bats and two northern long-eared bats (Table 12). These values fall below the total permitted take for each species (727 Indiana bats and 167 northern long-eared bats over the 29-year permit term). The long-term trigger was not met and the MLWRA is in compliance for both species because $M^* < T$ for both species. Therefore, an avoidance response is not necessary.

Table 12. Cumulative take estimate to date using Evidence of Absence for studies conducted at the Meadow Lake Wind Resource Area, Benton and White counties, Indiana, from April 1 – May 15 and August 1 – October 15, 2021.

Species	Cumulative Take (*M**)	Permitted Take (*T*)	Long-Term Trigger Fires at α = 0.5?
Indiana bat (50^{th} credible bound)	2	727	No
northern long-eared bat (50^{th} credible bound)	2	167	No

CONCLUSIONS

The post-construction monitoring effort completed in 2021 was consistent with the HCP's monitoring requirements and the MLWRA's 2021 study plan. Based on the count of zero Indiana bats and northern long-eared bats found and the site-wide *g* of 0.093 (90% CI: 0.089–0.097)[3], it was estimated that no more than two Indiana bat fatalities and two northern long-eared bat fatalities have occurred at the MLWRA. The estimated annual take rate did not exceed the expected annual take rate at a probability of 0.95 for either species. Together these metrics indicate that no adaptive management is necessary to remain consistent with take levels authorized by the ITP.

[3] The study-wide *g*, calculated across the 111 monitored turbines, was 0.35 (95% CI: 0.33–0.36).

REFERENCES

Burnham, K. P. and D. R. Anderson. 2002. Model Selection and Multimodel Inference: A Practical Information-Theoretic Approach. Second Edition. Springer, New York, New York.

Dalthorp, D. and M. Huso. 2015. A Framework for Decision Points to Trigger Adaptive Management Actions in Long-Term Incidental Take Permits. US Geological Survey Open-File Report 2015-1227. 88 pp. doi: 10.3133/ofr20151227. Available online: https://pubs.usgs.gov/of/2015/1227/ofr20151227.pdf

Dalthorp, D., M. M. P. Huso, and D. Dail. 2017. Evidence of Absence (V2.0) Software User Guide. US Geological Survey (USGS) Data Series 1055. USGS, Reston, Virginia. 109 pp. doi: 10.3133/ds1055. Available online: https://pubs.usgs.gov/ds/1055/ds1055.pdf

Dalthorp, D. H., L. Madsen, M. M. Huso, P. Rabie, R. Wolpert, J. Studyvin, J. Simonis, and J. M. Mintz. 2018. GenEst Statistical Models—a Generalized Estimator of Mortality. US Geological Survey Techniques and Methods, Volume 7, Chapter A2. 13 pp. doi: 10.3133/tm7A2. Available online: https://pubs.usgs.gov/tm/7a2/tm7a2.pdf

Dalthorp, D. H, P. Rabie, M. M. Huso, and A. Tredennick. 2020. Some Approaches to Accounting for Incidental Carcass Discoveries in Non-Monitored Years using the Evidence of Absence Model. US Geological Survey Open-File Report 2020-1027. 24 pp. Available online: https://pubs.er.usgs.gov/publication/ofr20201027

Endangered Species Act (ESA). 1973. 16 United States Code (USC) Sections (§§) 1531-1544, Public Law (PL) 93-205, December 28, 1973, as amended, PL 100-478 [16 USC 1531 et seq.]; 50 Code of Federal Regulations (CFR) 402.

Esri. 2021. World Imagery and Aerial Photos. (World Topo). ArcGIS Resource Center. Environmental Systems Research Institute (Esri), producers of ArcGIS software, Redlands, California. Available online: https://www.arcgis.com/home/webmap/viewer.html?useExisting=1&layers=10df2279f9684e4a9f6a7f08febac2a9

Good, R.E., G. Iskali, D. Riser-Espinoza and R. Schmitt. 2016. 2015 Post-Construction Monitoring Study, Timber Road II Wind Farm, Paulding, Ohio. Final Report: April 1–November 15, 2015. Prepared for EDP Renewables, Houston, Texas. Prepared by Western EcoSystems Technology, Inc. (WEST), Bloomington, Indiana.

Helfers, F. 2017. The Nose Work Handler - Foundation to Finesse. Dogwise Publishing, Wenatchee, Washington. 144 pp.

Huso, M., D. Dalthorp, and F. Korner-Nievergelt. 2017. Statistical Principles of Post-Construction Fatality Monitoring Design. Pp. *In*: M. Perrow, ed. Wildlife and Wind Farms, Conflicts and Solutions. Pelagic Publishing, Exeter, United Kingdom. Vol. 2, Onshore: Monitoring and Mitigation.

Kalbfleisch, J. D. and R. L. Prentice. 2002. The Statistical Analysis of Failure Time Data. John Wiley & Sons, Hoboken, New Jersey.

Kay, D. 2012. Super Sniffer Drill Book - a Workbook for Training Detector Dogs. Coveran Publishing House, 86 pp.

Khokan, M. R., W. Bari, and J. A. Khan. 2013. Weighted Maximum Likelihood Approach for Robust Estimation: Weibull Model. Dhaka University Journal of Science 61(2): 153-156.

Meadow Lake Wind Farm I-VI, LLCs (Meadow Lake Wind Farm). 2021. Indiana Bat and Northern Long-Eared Bat Final Habitat Conservation Plan for the Meadow Lake Wind Resource Area, White and Benton Counties, Indiana Meadow Lake Wind Farm, in consulation with Western EcoSystems Technology, Inc. (WEST). February 2021. Available online: https://ecos.fws.gov/docs/plan_documents/thcp/thcp_3347.pdf

National Land Cover Database (NLCD). 2016. *As cited includes*:

Yang, L., S. Jin, P. Danielson, C. Homer, L. Gass, S. M. Bender, A. Case, C. Costello, J. Dewitz, J. Fry, M. Funk, B. Granneman, G. C. Liknes, M. Rigge, and G. Xian. 2018. A New Generation of the United States National Land Cover Database: Requirements, Research Priorities, Design, and Implementation Strategies. ISPRS Journal of Photogrammetry and Remote Sensing 146: 108-123. doi: 10.1016/j.isprsjprs.2018.09.006.

and

Multi-Resolution Land Characteristics (MRLC). 2019. National Land Cover Database (NLCD) 2016. Multi-Resolution Land Characteristics (MRLC) Consortium. US Geological Survey (USGS) Earth Resources Observation and Science (EROS) Center, MRLC Project, Sioux Falls, South Dakota. May 10, 2019. Available online: https://www.mrlc.gov/data

North American Datum (NAD). 1983. NAD83 Geodetic Datum.

R Development Core Team. 2016. R: A Language and Environment for Statistical Computing. R Foundation for Statistical Computing, Vienna, Austria. Available online: http://www.R-project.org/

Rodriguez, M., A. Matteson, J. Lombardi, and D. Riser-Espinoza. 2020a. Post-Construction Monitoring Studies for the Meadow Lake V Wind Farm, White County, Indiana. Final Report: March - October, 2019. Prepared for EDP Renewables, Houston, Texas. Prepared by Western EcoSystems Technology, Inc. (WEST), Bloomington, Indiana. January 14, 2020.

Rodriguez, M., A. Matteson, J. Lombardi, and D. Riser-Espinoza. 2020b. Post-Construction Monitoring Studies for the Meadow Lake V Wind Farm, White County, Indiana. Final Report: March – October, 2019. Prepared for EDP Renewables, Houston, Texas. Prepared by Western EcoSystems Technology, Inc. (WEST), Bloomington, Indiana. January 14, 2020.

Rodriguez, M., A. Matteson, G. DiDonato, and D. Riser-Espinoza. 2020c. Post-Construction Monitoring Studies for the Meadow Lake VI Wind Farm, Benton County, Indiana. Final Report: March - October 2019. Prepared for EDP Renewables, Houston, Texas. Prepared by Western EcoSystems Technology (WEST) Inc., Bloomington, Indiana. January 16, 2020.

Rodriguez, M., P. Rabie, and K. DuBridge. 2021. 2021 Post-Construction Monitoring Study Plan for the Meadow Lake Wind Resource Area, Benton and White Counties, Indiana. Prepared for EDP Renewables North America, LLC, Houston, Texas. Prepared by Western EcoSystems Technology (WEST) Inc., Bloomington, Indiana. February 19, 2021.

Stevens, D. L., Jr. and A. R. Olsen. 2004. Spatially Balanced Sampling of Natural Resources. Journal of the American Statistical Association 99(465): 262-278. doi: 10.1198/016214504000000250.

Yee, T. W. 2015. Vector Generalized Linear and Additive Models: With an Implementation in R. Springer, New York.

Appendix A. Carcasses Found during the 2021 Post-Construction Monitoring Surveys at the Meadow Lake Wind Resource Area

Appendix A. Complete listing of carcasses found at the Meadow Lake Wind Resource Area, Benton and White Counties, Indiana, from April 1 – May 15 and August 1 - October 15, 2021.

Date Found	Species	Distance from Turbine (m)	Turbine	Search Type	Plot Type	Physical Condition
Bats						
04/14/2021	silver-haired bat	32	54	carcass search	100-m road and pad	scavenged
04/15/2021	hoary bat	68	429	carcass search	100-m road and pad	scavenged
04/29/2021	silver-haired bat	52	535	carcass search	100-m road and pad	intact
05/01/2021	silver-haired bat	7	252	carcass search	100-m road and pad	scavenged
05/14/2021	silver-haired bat	19	602	carcass search	100-m road and pad	scavenged
07/28/2021	big brown bat	31	31	incidental	70-m cleared	scavenged
07/28/2021	eastern red bat	46	31	incidental	70-m cleared	scavenged
07/29/2021	eastern red bat	30	31	incidental	70-m cleared	scavenged
07/29/2021	hoary bat	34	76	incidental	70-m cleared	scavenged
07/30/2021	eastern red bat	23	110	incidental	70-m cleared	scavenged
07/30/2021	hoary bat	17	110	incidental	70-m cleared	scavenged
07/30/2021	hoary bat	41	58	incidental	70-m cleared	scavenged
08/02/2021	hoary bat	24	31	incidental	70-m cleared	scavenged
08/02/2021	hoary bat	64	48	incidental	70-m cleared	scavenged
08/02/2021	hoary bat	52	68	carcass search	70-m cleared	intact
08/02/2021	unidentified *Lasiurus* bat	15	94	carcass search	70-m uncleared	dismembered
08/03/2021	eastern red bat	55	110	carcass search	70-m cleared	scavenged
08/03/2021	eastern red bat	39	119	carcass search	70-m uncleared	scavenged
08/03/2021	eastern red bat	25	119	carcass search	70-m uncleared	scavenged
08/03/2021	hoary bat	33	106	carcass search	70-m cleared	scavenged
08/03/2021	hoary bat	59	84	carcass search	70-m uncleared	dismembered
08/04/2021	big brown bat	5	55	carcass search	100-m road and pad	scavenged
08/04/2021	eastern red bat	7	367	carcass search	70-m uncleared	scavenged
08/06/2021	big brown bat	3	504	carcass search	70-m uncleared	scavenged
08/06/2021	big brown bat	74	621	carcass search**	70-m cleared	scavenged
08/06/2021	eastern red bat	29	508	carcass search	70-m uncleared	scavenged
08/06/2021	eastern red bat	42	508	carcass search	70-m uncleared	scavenged
08/06/2021	eastern red bat	26	508	carcass search	70-m uncleared	scavenged
08/06/2021	eastern red bat	34	621	carcass search	70-m cleared	scavenged
08/07/2021	big brown bat	64	538	incidental	70-m uncleared	scavenged
08/07/2021	eastern red bat	28	230	carcass search	70-m cleared	scavenged
08/07/2021	eastern red bat	27	444	carcass search	70-m cleared	scavenged
08/07/2021	eastern red bat	34	444	carcass search	70-m cleared	dismembered
08/07/2021	eastern red bat	15	538	incidental	70-m uncleared	scavenged
08/07/2021	eastern red bat	21	538	incidental	70-m uncleared	scavenged

Appendix A. Complete listing of carcasses found at the Meadow Lake Wind Resource Area, Benton and White Counties, Indiana, from April 1 – May 15 and August 1 - October 15, 2021.

Date Found	Species	Distance from Turbine (m)	Turbine	Search Type	Plot Type	Physical Condition
08/07/2021	eastern red bat	2	613	carcass search	70-m uncleared	scavenged
08/07/2021	hoary bat	20	610	carcass search	70-m cleared	scavenged
08/07/2021	hoary bat	34	610	carcass search	70-m cleared	scavenged
08/07/2021	hoary bat	10	613	carcass search	70-m uncleared	scavenged
08/07/2021	hoary bat	13	617	carcass search	70-m cleared	scavenged
08/07/2021	hoary bat	46	617	carcass search	70-m cleared	scavenged
08/09/2021	big brown bat	10	17	carcass search	70-m cleared	scavenged
08/09/2021	eastern red bat	67	28	carcass search	70-m uncleared	dismembered
08/09/2021	eastern red bat	40	28	carcass search	70-m uncleared	scavenged
08/09/2021	hoary bat	49	115	carcass search	70-m uncleared	scavenged
08/09/2021	hoary bat	11	17	carcass search	70-m cleared	dismembered
08/09/2021	hoary bat	31	17	carcass search	70-m cleared	scavenged
08/09/2021	hoary bat	28	28	carcass search	70-m uncleared	scavenged
08/09/2021	hoary bat	53	31	carcass search	70-m cleared	scavenged
08/10/2021	eastern red bat	9	215	carcass search	70-m uncleared	scavenged
08/10/2021	eastern red bat	62	236	carcass search	70-m uncleared	scavenged
08/10/2021	eastern red bat	14	303	carcass search	70-m uncleared	scavenged
08/10/2021	eastern red bat	43	363	carcass search	70-m cleared	scavenged
08/10/2021	hoary bat	30	363	carcass search	70-m cleared	feather spot
08/11/2021	eastern red bat	41	119	incidental	70-m uncleared	scavenged
08/11/2021	eastern red bat	43	307	carcass search	70-m uncleared	dismembered
08/11/2021	eastern red bat	28	307	carcass search	70-m uncleared	scavenged
08/11/2021	eastern red bat	56	326	carcass search	70-m uncleared	scavenged
08/11/2021	eastern red bat	45	326	carcass search	70-m uncleared	scavenged
08/11/2021	hoary bat	4	42	carcass search	100-m road and pad	scavenged
08/12/2021	big brown bat	17	508	carcass search	70-m uncleared	scavenged
08/12/2021	eastern red bat	53	508	carcass search	70-m uncleared	scavenged
08/13/2021	big brown bat	37	538	carcass search	70-m uncleared	scavenged
08/13/2021	eastern red bat	38	501	carcass search	70-m cleared	scavenged
08/13/2021	eastern red bat	16	519	carcass search	70-m uncleared	dismembered
08/13/2021	eastern red bat	68	525	carcass search	70-m cleared	scavenged
08/13/2021	eastern red bat	59	525	carcass search	70-m cleared	scavenged
08/13/2021	eastern red bat	13	610	carcass search	70-m cleared	scavenged
08/13/2021	eastern red bat	30	610	carcass search	70-m cleared	scavenged
08/13/2021	eastern red bat	29	610	carcass search	70-m cleared	scavenged
08/13/2021	eastern red bat	55	610	carcass search	70-m cleared	scavenged

Appendix A. Complete listing of carcasses found at the Meadow Lake Wind Resource Area, Benton and White Counties, Indiana, from April 1 – May 15 and August 1 - October 15, 2021.

Date Found	Species	Distance from Turbine (m)	Turbine	Search Type	Plot Type	Physical Condition
08/13/2021	eastern red bat	14	612	carcass search	70-m uncleared	scavenged
08/13/2021	eastern red bat	32	617	carcass search	70-m cleared	scavenged
08/13/2021	eastern red bat	48	617	carcass search	70-m cleared	scavenged
08/13/2021	eastern red bat	63	617	carcass search	70-m cleared	scavenged
08/13/2021	eastern red bat	58	621	carcass search	70-m cleared	scavenged
08/13/2021	eastern red bat	27	639	carcass search	70-m cleared	scavenged
08/13/2021	eastern red bat	50	651	carcass search	70-m uncleared	scavenged
08/13/2021	hoary bat	28	517	carcass search	70-m cleared	scavenged
08/13/2021	hoary bat	26	517	carcass search	70-m cleared	scavenged
08/13/2021	hoary bat	31	610	carcass search	70-m cleared	scavenged
08/13/2021	hoary bat	40	639	carcass search	70-m cleared	scavenged
08/13/2021	Seminole bat	56	651	carcass search	70-m uncleared	scavenged
08/14/2021	eastern red bat	14	119	incidental	70-m uncleared	scavenged
08/14/2021	eastern red bat	54	230	carcass search	70-m cleared	scavenged
08/14/2021	eastern red bat	20	230	carcass search	70-m cleared	scavenged
08/14/2021	eastern red bat	25	230	carcass search	70-m cleared	scavenged
08/14/2021	eastern red bat	34	327	carcass search	70-m cleared	scavenged
08/14/2021	eastern red bat	25	48	incidental	70-m cleared	intact
08/14/2021	eastern red bat	28	502	carcass search	100-m road and pad	scavenged
08/14/2021	eastern red bat	28	537	carcass search	70-m uncleared	feather spot
08/14/2021	eastern red bat	54	546	carcass search	70-m cleared	scavenged
08/14/2021	eastern red bat	10	58	incidental	70-m cleared	scavenged
08/14/2021	eastern red bat	19	58	incidental	70-m cleared	intact
08/14/2021	eastern red bat	13	616	carcass search	100-m road and pad	scavenged
08/14/2021	eastern red bat	43	76	incidental	70-m cleared	scavenged
08/14/2021	hoary bat	31	208	carcass search	70-m cleared	scavenged
08/14/2021	hoary bat	59	327	carcass search	70-m cleared	scavenged
08/14/2021	hoary bat	28	546	carcass search	70-m cleared	intact
08/14/2021	hoary bat	35	58	incidental	70-m cleared	scavenged
08/16/2021	big brown bat	44	31	carcass search	70-m cleared	scavenged
08/16/2021	big brown bat	19	58	carcass search	70-m cleared	scavenged
08/16/2021	big brown bat	44	76	carcass search	70-m cleared	dismembered
08/16/2021	eastern red bat	25	115	carcass search	70-m uncleared	dismembered
08/16/2021	eastern red bat	28	17	carcass search	70-m cleared	scavenged
08/16/2021	eastern red bat	5	28	carcass search	70-m uncleared	scavenged
08/16/2021	eastern red bat	30	28	carcass search	70-m uncleared	scavenged

Appendix A. Complete listing of carcasses found at the Meadow Lake Wind Resource Area, Benton and White Counties, Indiana, from April 1 – May 15 and August 1 - October 15, 2021.

Date Found	Species	Distance from Turbine (m)	Turbine	Search Type	Plot Type	Physical Condition
08/16/2021	eastern red bat	14	30	carcass search	70-m uncleared	scavenged
08/16/2021	eastern red bat	31	31	carcass search	70-m cleared	scavenged
08/16/2021	eastern red bat	11	31	carcass search	70-m cleared	scavenged
08/16/2021	eastern red bat	29	58	carcass search	70-m cleared	scavenged
08/16/2021	eastern red bat	59	84	carcass search	70-m uncleared	scavenged
08/16/2021	eastern red bat	40	94	carcass search	70-m uncleared	dismembered
08/16/2021	hoary bat	51	76	carcass search	70-m cleared	scavenged
08/16/2021	hoary bat	28	84	carcass search	70-m uncleared	scavenged
08/16/2021	hoary bat	55	84	carcass search	70-m uncleared	scavenged
08/16/2021	silver-haired bat	20	29	carcass search	70-m uncleared	scavenged
08/17/2021	big brown bat	27	368	carcass search	70-m uncleared	scavenged
08/17/2021	eastern red bat	32	110	carcass search	70-m cleared	scavenged
08/17/2021	eastern red bat	35	110	carcass search	70-m cleared	scavenged
08/17/2021	eastern red bat	62	110	carcass search	70-m cleared	dismembered
08/17/2021	eastern red bat	22	119	carcass search	70-m uncleared	dismembered
08/17/2021	eastern red bat	11	343	carcass search	70-m cleared	scavenged
08/17/2021	eastern red bat	5	363	incidental	70-m cleared	scavenged
08/17/2021	hoary bat	55	119	carcass search	70-m uncleared	scavenged
08/17/2021	hoary bat	42	119	carcass search	70-m uncleared	feather spot
08/17/2021	hoary bat	26	241	carcass search	70-m cleared	scavenged
08/17/2021	hoary bat	26	368	carcass search	70-m uncleared	scavenged
08/18/2021	eastern red bat	56	42	carcass search	100-m road and pad	scavenged
08/18/2021	eastern red bat	5	55	carcass search	100-m road and pad	scavenged
08/18/2021	eastern red bat	26	621	carcass search	70-m cleared	scavenged
08/18/2021	hoary bat	29	621	carcass search	70-m cleared	scavenged
08/18/2021	hoary bat	41	621	carcass search	70-m cleared	scavenged
08/19/2021	big brown bat	44	211	carcass search	100-m road and pad	scavenged
08/19/2021	eastern red bat	16	30	incidental	70-m uncleared	scavenged
08/19/2021	eastern red bat	25	61	carcass search	100-m road and pad	scavenged
08/19/2021	eastern red bat	11	651	carcass search	70-m uncleared	scavenged
08/19/2021	hoary bat	51	326	carcass search	70-m uncleared	scavenged
08/19/2021	unidentified bat	44	326	carcass search	70-m uncleared	scavenged
08/20/2021	big brown bat	70	525	carcass search	70-m cleared	scavenged
08/20/2021	big brown bat	70	525	carcass search	70-m cleared	intact
08/20/2021	eastern red bat	33	230	carcass search	70-m cleared	scavenged
08/20/2021	eastern red bat	6	418	carcass search	100-m road and pad	scavenged

Appendix A. Complete listing of carcasses found at the Meadow Lake Wind Resource Area, Benton and White Counties, Indiana, from April 1 – May 15 and August 1 - October 15, 2021.

Date Found	Species	Distance from Turbine (m)	Turbine	Search Type	Plot Type	Physical Condition
08/20/2021	eastern red bat	44	501	carcass search	70-m cleared	scavenged
08/20/2021	eastern red bat	32	517	carcass search	70-m cleared	intact
08/20/2021	eastern red bat	13	519	carcass search	70-m uncleared	scavenged
08/20/2021	eastern red bat	43	537	carcass search	70-m uncleared	scavenged
08/20/2021	eastern red bat	7	544	incidental	100-m road and pad	scavenged
08/20/2021	eastern red bat	66	648	incidental	100-m road and pad	scavenged
08/20/2021	eastern red bat	35	650	carcass search	70-m cleared	scavenged
08/20/2021	evening bat	30	653	carcass search	100-m road and pad	scavenged
08/20/2021	hoary bat	2	446	carcass search	100-m road and pad	dismembered
08/21/2021	eastern red bat	9	421	carcass search	70-m uncleared	intact
08/21/2021	eastern red bat	54	610	carcass search	70-m cleared	scavenged
08/21/2021	silver-haired bat	32	610	carcass search	70-m cleared	scavenged
08/23/2021	big brown bat	4	115	carcass search	70-m uncleared	scavenged
08/23/2021	eastern red bat	10	115	carcass search	70-m uncleared	scavenged
08/23/2021	eastern red bat	26	119	incidental	70-m uncleared	scavenged
08/23/2021	eastern red bat	25	236	carcass search	70-m uncleared	intact
08/23/2021	eastern red bat	52	31	carcass search	70-m cleared	intact
08/23/2021	eastern red bat	15	66	incidental	100-m road and pad	intact
08/23/2021	eastern red bat	6	84	carcass search	70-m uncleared	scavenged
08/23/2021	eastern red bat	41	90	carcass search	70-m uncleared	intact
08/23/2021	eastern red bat	31	94	carcass search	70-m uncleared	intact
08/23/2021	hoary bat	13	29	carcass search	70-m uncleared	scavenged
08/24/2021	eastern red bat	17	106	carcass search	70-m cleared	intact
08/24/2021	eastern red bat	43	241	carcass search	70-m cleared	scavenged
08/24/2021	eastern red bat	18	241	carcass search	70-m cleared	intact
08/24/2021	hoary bat	48	110	carcass search	70-m cleared	scavenged
08/24/2021	hoary bat	30	110	carcass search	70-m cleared	scavenged
08/24/2021	hoary bat	24	343	carcass search	70-m cleared	scavenged
08/24/2021	hoary bat	14	363	carcass search	70-m cleared	scavenged
08/24/2021	hoary bat	38	363	carcass search	70-m cleared	scavenged
08/25/2021	eastern red bat	24	117	carcass search	70-m cleared	dismembered
08/26/2021	eastern red bat	29	406	carcass search	100-m road and pad	scavenged
08/26/2021	eastern red bat	38	610	carcass search	70-m cleared	scavenged
08/26/2021	eastern red bat	32	610	carcass search	70-m cleared	scavenged
08/26/2021	eastern red bat	68	617	carcass search	70-m cleared	scavenged
08/26/2021	eastern red bat	55	621	carcass search	70-m cleared	scavenged

Appendix A. Complete listing of carcasses found at the Meadow Lake Wind Resource Area, Benton and White Counties, Indiana, from April 1 – May 15 and August 1 - October 15, 2021.

Date Found	Species	Distance from Turbine (m)	Turbine	Search Type	Plot Type	Physical Condition
08/26/2021	eastern red bat	49	621	carcass search	70-m cleared	scavenged
08/26/2021	hoary bat	7	639	carcass search	70-m cleared	scavenged
08/27/2021	eastern red bat	35	104	carcass search	100-m road and pad	scavenged
08/27/2021	eastern red bat	24	41	carcass search	100-m road and pad	scavenged
08/27/2021	eastern red bat	47	444	carcass search	70-m cleared	scavenged
08/27/2021	hoary bat	41	501	carcass search	70-m cleared	scavenged
08/28/2021	eastern red bat	7	520	carcass search	100-m road and pad	scavenged
08/28/2021	eastern red bat	25	544	carcass search	100-m road and pad	scavenged
08/30/2021	eastern red bat	32	119	incidental	70-m uncleared	scavenged
08/30/2021	eastern red bat	25	119	incidental	70-m uncleared	scavenged
08/30/2021	eastern red bat	25	17	carcass search	70-m cleared	scavenged
08/30/2021	eastern red bat	19	29	carcass search	70-m uncleared	scavenged
08/30/2021	eastern red bat	1	29	carcass search	70-m uncleared	scavenged
08/30/2021	eastern red bat	8	29	carcass search	70-m uncleared	scavenged
08/30/2021	eastern red bat	24	48	carcass search	70-m cleared	scavenged
08/30/2021	eastern red bat	38	48	carcass search	70-m cleared	scavenged
08/30/2021	eastern red bat	8	58	carcass search	70-m cleared	intact
08/30/2021	eastern red bat	12	84	carcass search	70-m uncleared	dismembered
08/30/2021	hoary bat	33	29	carcass search	70-m uncleared	scavenged
08/30/2021	hoary bat	14	30	carcass search	70-m uncleared	scavenged
08/31/2021	eastern red bat	25	106	carcass search	70-m cleared	intact
08/31/2021	eastern red bat	39	106	carcass search	70-m cleared	intact
08/31/2021	eastern red bat	24	110	carcass search	70-m cleared	scavenged
08/31/2021	eastern red bat	17	117	carcass search	70-m cleared	scavenged
08/31/2021	eastern red bat	20	208	carcass search	70-m cleared	scavenged
08/31/2021	hoary bat	6	106	carcass search	70-m cleared	intact
08/31/2021	hoary bat	5	119	carcass search	70-m uncleared	scavenged
08/31/2021	hoary bat	45	215	carcass search	70-m uncleared	scavenged
09/01/2021	big brown bat	4	3	carcass search	100-m road and pad	scavenged
09/01/2021	eastern red bat	37	256	carcass search	100-m road and pad	scavenged
09/01/2021	eastern red bat	46	406	carcass search	100-m road and pad	scavenged
09/01/2021	eastern red bat	31	42	carcass search	100-m road and pad	scavenged
09/01/2021	eastern red bat	66	6	carcass search	100-m road and pad	scavenged
09/01/2021	eastern red bat	3	73	carcass search	100-m road and pad	scavenged
09/01/2021	hoary bat	2	41	carcass search	100-m road and pad	scavenged
09/01/2021	hoary bat	35	94	carcass search	70-m uncleared	scavenged

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Date Found	Species	Distance from Turbine (m)	Turbine	Search Type	Plot Type	Physical Condition
09/01/2021	silver-haired bat	4	25	carcass search	100-m road and pad	scavenged
09/02/2021	eastern red bat	23	312	carcass search	70-m cleared	scavenged
09/02/2021	eastern red bat	35	326	carcass search	70-m uncleared	scavenged
09/02/2021	eastern red bat	5	327	carcass search	70-m cleared	scavenged
09/02/2021	eastern red bat	22	520	carcass search	100-m road and pad	scavenged
09/02/2021	eastern red bat	15	544	carcass search	100-m road and pad	scavenged
09/02/2021	eastern red bat	43	61	carcass search	100-m road and pad	scavenged
09/02/2021	eastern red bat	35	612	carcass search	70-m uncleared	intact
09/02/2021	eastern red bat	40	613	carcass search	70-m uncleared	intact
09/02/2021	eastern red bat	54	617	carcass search	70-m cleared	scavenged
09/02/2021	eastern red bat	26	653	carcass search	100-m road and pad	scavenged
09/02/2021	hoary bat	40	610	incidental	70-m cleared	dismembered
09/02/2021	hoary bat	23	617	carcass search	70-m cleared	intact
09/02/2021	hoary bat	18	639	carcass search	70-m cleared	scavenged
09/02/2021	silver-haired bat	41	229	carcass search	100-m road and pad	scavenged
09/02/2021	silver-haired bat	29	333	carcass search	70-m cleared	scavenged
09/02/2021	silver-haired bat	2	517	incidental	70-m cleared	scavenged
09/02/2021	silver-haired bat	46	520	carcass search	100-m road and pad	scavenged
09/02/2021	silver-haired bat	22	639	carcass search	70-m cleared	intact
09/02/2021	silver-haired bat	43	639	carcass search	70-m cleared	scavenged
09/03/2021	big brown bat	15	444	carcass search	70-m cleared	intact
09/03/2021	big brown bat	47	517	carcass search	70-m cleared	scavenged
09/03/2021	eastern red bat	37	421	carcass search	70-m uncleared	scavenged
09/03/2021	eastern red bat	36	444	carcass search	70-m cleared	intact
09/03/2021	eastern red bat	32	504	carcass search	70-m uncleared	scavenged
09/03/2021	eastern red bat	40	517	carcass search	70-m cleared	scavenged
09/03/2021	eastern red bat	11	517	carcass search	70-m cleared	scavenged
09/03/2021	eastern red bat	21	519	carcass search	70-m uncleared	scavenged
09/03/2021	eastern red bat	31	525	carcass search	70-m cleared	scavenged
09/03/2021	eastern red bat	34	537	carcass search	70-m uncleared	scavenged
09/03/2021	eastern red bat	51	545	carcass search	70-m cleared	dismembered
09/03/2021	hoary bat	13	230	carcass search	70-m cleared	scavenged
09/03/2021	hoary bat	22	517	carcass search	70-m cleared	scavenged
09/03/2021	hoary bat	35	517	carcass search	70-m cleared	scavenged
09/03/2021	hoary bat	15	517	carcass search	70-m cleared	scavenged
09/03/2021	hoary bat	9	546	carcass search	70-m cleared	intact

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Date Found	Species	Distance from Turbine (m)	Turbine	Search Type	Plot Type	Physical Condition
09/03/2021	silver-haired bat	44	537	carcass search	70-m uncleared	intact
09/03/2021	silver-haired bat	43	650	carcass search	70-m cleared	scavenged
09/04/2021	big brown bat	10	649	incidental	100-m road and pad	scavenged
09/04/2021	eastern red bat	32	421	incidental	70-m uncleared	scavenged
09/04/2021	eastern red bat	10	649	incidental	100-m road and pad	scavenged
09/04/2021	silver-haired bat	11	649	incidental	100-m road and pad	scavenged
09/05/2021	eastern red bat	44	502	incidental	100-m road and pad	intact
09/05/2021	hoary bat	41	537	incidental	70-m uncleared	intact
09/05/2021	silver-haired bat	21	525	incidental	70-m cleared	scavenged
09/05/2021	silver-haired bat	34	541	incidental	100-m road and pad	scavenged
09/06/2021	eastern red bat	11	29	carcass search	70-m uncleared	scavenged
09/06/2021	eastern red bat	24	30	carcass search	70-m uncleared	scavenged
09/06/2021	eastern red bat	42	94	carcass search	70-m uncleared	intact
09/06/2021	hoary bat	24	17	carcass search	70-m cleared	scavenged
09/06/2021	hoary bat	51	17	carcass search	70-m cleared	scavenged
09/06/2021	hoary bat	2	94	carcass search	70-m uncleared	scavenged
09/06/2021	silver-haired bat	21	29	carcass search	70-m uncleared	scavenged
09/06/2021	silver-haired bat	17	48	carcass search	70-m cleared	intact
09/06/2021	silver-haired bat	48	48	carcass search	70-m cleared	scavenged
09/06/2021	silver-haired bat	42	94	carcass search	70-m uncleared	intact
09/06/2021	silver-haired bat	27	94	carcass search	70-m uncleared	scavenged
09/07/2021	eastern red bat	43	110	carcass search	70-m cleared	dismembered
09/07/2021	hoary bat	9	117	carcass search	70-m cleared	scavenged
09/07/2021	hoary bat	2	367	carcass search	70-m uncleared	scavenged
09/07/2021	hoary bat	20	368	carcass search	70-m uncleared	intact
09/07/2021	silver-haired bat	29	110	carcass search	70-m cleared	scavenged
09/07/2021	silver-haired bat	13	241	carcass search	70-m cleared	scavenged
09/07/2021	silver-haired bat	29	244	carcass search	70-m uncleared	scavenged
09/08/2021	silver-haired bat	1	431	incidental	incidental	injured
09/09/2021	eastern red bat	31	25	carcass search	100-m road and pad	scavenged
09/09/2021	eastern red bat	37	312	carcass search	70-m cleared	scavenged
09/09/2021	eastern red bat	27	327	carcass search	70-m cleared	scavenged
09/09/2021	eastern red bat	40	327	carcass search	70-m cleared	scavenged
09/09/2021	eastern red bat	64	617	carcass search	70-m cleared	scavenged
09/09/2021	eastern red bat	35	639	carcass search	70-m cleared	scavenged
09/09/2021	eastern red bat	15	651	carcass search	70-m uncleared	scavenged

Appendix A. Complete listing of carcasses found at the Meadow Lake Wind Resource Area, Benton and White Counties, Indiana, from April 1 – May 15 and August 1 - October 15, 2021.

Date Found	Species	Distance from Turbine (m)	Turbine	Search Type	Plot Type	Physical Condition
09/09/2021	silver-haired bat	19	25	carcass search	100-m road and pad	injured
09/09/2021	silver-haired bat	34	307	carcass search	70-m uncleared	scavenged
09/09/2021	silver-haired bat	36	307	carcass search	70-m uncleared	scavenged
09/09/2021	silver-haired bat	64	610	carcass search	70-m cleared	intact
09/09/2021	silver-haired bat	64	610	carcass search	70-m cleared	scavenged
09/09/2021	silver-haired bat	33	610	carcass search	70-m cleared	scavenged
09/09/2021	silver-haired bat	40	610	carcass search	70-m cleared	scavenged
09/09/2021	silver-haired bat	17	610	carcass search	70-m cleared	dismembered
09/09/2021	silver-haired bat	23	613	carcass search	70-m uncleared	scavenged
09/09/2021	silver-haired bat	54	617	carcass search	70-m cleared	dismembered
09/09/2021	silver-haired bat	89	619	carcass search	70-m uncleared	scavenged
09/09/2021	silver-haired bat	20	619	carcass search	70-m uncleared	scavenged
09/09/2021	silver-haired bat	35	619	carcass search	70-m uncleared	scavenged
09/09/2021	silver-haired bat	47	639	carcass search	70-m cleared	scavenged
09/09/2021	silver-haired bat	25	639	carcass search	70-m cleared	scavenged
09/09/2021	silver-haired bat	50	639	carcass search	70-m cleared	scavenged
09/09/2021	silver-haired bat	13	649	incidental	100-m road and pad	intact
09/09/2021	silver-haired bat	30	651	carcass search	70-m uncleared	scavenged
09/10/2021	eastern red bat	25	508	carcass search	70-m uncleared	scavenged
09/10/2021	eastern red bat	56	621	carcass search	70-m cleared	scavenged
09/10/2021	eastern red bat	11	649	carcass search	100-m road and pad	scavenged
09/10/2021	hoary bat	44	621	carcass search	70-m cleared	scavenged
09/10/2021	silver-haired bat	32	501	carcass search	70-m cleared	scavenged
09/10/2021	silver-haired bat	37	508	carcass search	70-m uncleared	scavenged
09/10/2021	silver-haired bat	50	517	carcass search	70-m cleared	scavenged
09/10/2021	silver-haired bat	26	538	carcass search	70-m uncleared	scavenged
09/10/2021	silver-haired bat	47	621	carcass search	70-m cleared	dismembered
09/10/2021	silver-haired bat	15	621	carcass search	70-m cleared	intact
09/10/2021	silver-haired bat	34	621	carcass search	70-m cleared	intact
09/10/2021	silver-haired bat	47	650	carcass search	70-m cleared	scavenged
09/11/2021	eastern red bat	16	230	carcass search	70-m cleared	scavenged
09/11/2021	eastern red bat	25	550	carcass search	70-m uncleared	scavenged
09/11/2021	silver-haired bat	17	537	carcass search	70-m uncleared	scavenged
09/11/2021	silver-haired bat	23	545	carcass search	70-m cleared	scavenged
09/11/2021	silver-haired bat	26	545	incidental	70-m cleared	scavenged
09/12/2021	eastern red bat	12	446	incidental	100-m road and pad	scavenged

Appendix A. Complete listing of carcasses found at the Meadow Lake Wind Resource Area, Benton and White Counties, Indiana, from April 1 – May 15 and August 1 - October 15, 2021.

Date Found	Species	Distance from Turbine (m)	Turbine	Search Type	Plot Type	Physical Condition
09/13/2021	eastern red bat	27	17	carcass search	70-m cleared	scavenged
09/13/2021	eastern red bat	41	17	carcass search	70-m cleared	scavenged
09/13/2021	eastern red bat	36	48	carcass search	70-m cleared	scavenged
09/13/2021	eastern red bat	11	84	carcass search	70-m uncleared	intact
09/13/2021	hoary bat	16	30	carcass search	70-m uncleared	scavenged
09/13/2021	silver-haired bat	26	30	carcass search	70-m uncleared	scavenged
09/13/2021	silver-haired bat	55	48	carcass search	70-m cleared	scavenged
09/13/2021	silver-haired bat	18	94	carcass search	70-m uncleared	scavenged
09/14/2021	big brown bat	35	117	carcass search	70-m cleared	scavenged
09/14/2021	eastern red bat	37	208	carcass search	70-m cleared	scavenged
09/14/2021	hoary bat	76	115	carcass search	70-m uncleared	scavenged
09/14/2021	silver-haired bat	50	215	carcass search	70-m uncleared	scavenged
09/14/2021	silver-haired bat	35	215	carcass search	70-m uncleared	scavenged
09/14/2021	silver-haired bat	21	236	carcass search	70-m uncleared	scavenged
09/14/2021	silver-haired bat	28	244	carcass search	70-m uncleared	scavenged
09/15/2021	eastern red bat	38	367	carcass search	70-m uncleared	scavenged
09/15/2021	silver-haired bat	58	119	carcass search	70-m uncleared	scavenged
09/15/2021	silver-haired bat	13	343	carcass search	70-m cleared	scavenged
09/15/2021	silver-haired bat	43	343	carcass search	70-m cleared	scavenged
09/16/2021	eastern red bat	20	327	carcass search	70-m cleared	scavenged
09/16/2021	eastern red bat	36	651	carcass search	70-m uncleared	scavenged
09/16/2021	hoary bat	37	326	carcass search	70-m uncleared	scavenged
09/16/2021	hoary bat	36	617	carcass search	70-m cleared	scavenged
09/16/2021	silver-haired bat	35	307	carcass search	70-m uncleared	scavenged
09/16/2021	silver-haired bat	52	326	carcass search	70-m uncleared	scavenged
09/16/2021	silver-haired bat	54	617	carcass search	70-m cleared	scavenged
09/16/2021	silver-haired bat	48	617	carcass search	70-m cleared	scavenged
09/16/2021	silver-haired bat	65	621	carcass search	70-m cleared	scavenged
09/16/2021	silver-haired bat	85	621	incidental	70-m cleared	scavenged
09/17/2021	eastern red bat	46	501	carcass search	70-m cleared	unknown
09/17/2021	eastern red bat	46	504	carcass search	70-m uncleared	unknown
09/17/2021	eastern red bat	38	519	carcass search	70-m uncleared	unknown
09/17/2021	eastern red bat	29	545	carcass search	70-m cleared	scavenged
09/17/2021	hoary bat	31	501	carcass search	70-m cleared	unknown
09/17/2021	hoary bat	38	538	carcass search	70-m uncleared	unknown
09/17/2021	silver-haired bat	6	446	carcass search	100-m road and pad	intact

Appendix A. Complete listing of carcasses found at the Meadow Lake Wind Resource Area, Benton and White Counties, Indiana, from April 1 – May 15 and August 1 - October 15, 2021.

Date Found	Species	Distance from Turbine (m)	Turbine	Search Type	Plot Type	Physical Condition
09/17/2021	silver-haired bat	45	501	carcass search	70-m cleared	unknown
09/17/2021	silver-haired bat	25	504	carcass search	70-m uncleared	unknown
09/17/2021	silver-haired bat	33	517	carcass search	70-m cleared	unknown
09/17/2021	silver-haired bat	22	538	carcass search	70-m uncleared	unknown
09/17/2021	silver-haired bat	34	545	carcass search	70-m cleared	scavenged
09/18/2021	eastern red bat	50	68	carcass search	70-m cleared	scavenged
09/18/2021	hoary bat	47	68	carcass search	70-m cleared	dismembered
09/18/2021	silver-haired bat	53	421	carcass search	70-m uncleared	scavenged
09/19/2021	silver-haired bat	35	616	carcass search	100-m road and pad	dismembered
09/20/2021	eastern red bat	28	48	carcass search	70-m cleared	scavenged
09/20/2021	eastern red bat	40	610	carcass search	70-m cleared	scavenged
09/20/2021	eastern red bat	39	84	carcass search	70-m uncleared	scavenged
09/20/2021	eastern red bat	24	84	carcass search	70-m uncleared	scavenged
09/20/2021	hoary bat	55	48	carcass search	70-m cleared	scavenged
09/20/2021	silver-haired bat	30	610	carcass search	70-m cleared	scavenged
09/20/2021	silver-haired bat	44	610	carcass search	70-m cleared	scavenged
09/20/2021	silver-haired bat	32	610	carcass search	70-m cleared	scavenged
09/20/2021	silver-haired bat	25	610	carcass search	70-m cleared	scavenged
09/21/2021	eastern red bat	17	244	carcass search	70-m uncleared	scavenged
09/21/2021	eastern red bat	55	244	carcass search	70-m uncleared	scavenged
09/21/2021	hoary bat	41	106	carcass search	70-m cleared	scavenged
09/21/2021	hoary bat	54	236	carcass search	70-m uncleared	scavenged
09/21/2021	silver-haired bat	25	236	carcass search	70-m uncleared	scavenged
09/21/2021	silver-haired bat	37	343	carcass search	70-m cleared	scavenged
09/21/2021	silver-haired bat	25	363	carcass search	70-m cleared	scavenged
09/23/2021	eastern red bat	78	350	carcass search	70-m uncleared	scavenged
09/23/2021	eastern red bat	36	350	carcass search	70-m uncleared	scavenged
09/23/2021	eastern red bat	23	612	carcass search	70-m uncleared	scavenged
09/23/2021	hoary bat	33	406	carcass search	100-m road and pad	injured
09/23/2021	silver-haired bat	45	312	carcass search	70-m cleared	intact
09/23/2021	silver-haired bat	36	327	carcass search	70-m cleared	intact
09/23/2021	silver-haired bat	10	333	carcass search	70-m cleared	intact
09/23/2021	silver-haired bat	75	350	carcass search	70-m uncleared	intact
09/23/2021	silver-haired bat	33	406	carcass search	100-m road and pad	scavenged
09/23/2021	silver-haired bat	34	537	carcass search	70-m uncleared	scavenged
09/23/2021	silver-haired bat	59	610	carcass search	70-m cleared	scavenged

Appendix A. Complete listing of carcasses found at the Meadow Lake Wind Resource Area, Benton and White Counties, Indiana, from April 1 – May 15 and August 1 - October 15, 2021.

Date Found	Species	Distance from Turbine (m)	Turbine	Search Type	Plot Type	Physical Condition
09/23/2021	silver-haired bat	25	613	carcass search	70-m uncleared	scavenged
09/23/2021	silver-haired bat	60	619	carcass search	70-m uncleared	scavenged
09/23/2021	silver-haired bat	55	621	carcass search	70-m cleared	intact
09/23/2021	silver-haired bat	43	639	carcass search	70-m cleared	scavenged
09/24/2021	eastern red bat	51	501	carcass search	70-m cleared	scavenged
09/24/2021	hoary bat	6	421	carcass search	70-m uncleared	intact
09/24/2021	hoary bat	50	508	carcass search	70-m uncleared	scavenged
09/24/2021	hoary bat	40	545	carcass search	70-m cleared	scavenged
09/24/2021	silver-haired bat	36	230	carcass search	70-m cleared	scavenged
09/24/2021	silver-haired bat	42	230	carcass search	70-m cleared	scavenged
09/24/2021	silver-haired bat	12	444	carcass search	70-m cleared	scavenged
09/24/2021	silver-haired bat	38	504	carcass search	70-m uncleared	scavenged
09/24/2021	silver-haired bat	20	508	carcass search	70-m uncleared	scavenged
09/24/2021	silver-haired bat	11	519	carcass search	70-m uncleared	scavenged
09/24/2021	silver-haired bat	41	546	carcass search	70-m cleared	scavenged
09/24/2021	silver-haired bat	12	550	carcass search	70-m uncleared	scavenged
09/24/2021	silver-haired bat	50	650	carcass search	70-m cleared	scavenged
09/24/2021	silver-haired bat	40	650	carcass search	70-m cleared	intact
09/24/2021	silver-haired bat	50	650	carcass search	70-m cleared	scavenged
09/25/2021	silver-haired bat	42	544	carcass search	100-m road and pad	scavenged
09/25/2021	silver-haired bat	14	649	carcass search	100-m road and pad	scavenged
09/25/2021	silver-haired bat	23	649	carcass search	100-m road and pad	scavenged
09/27/2021	hoary bat	13	609	carcass search	100-m road and pad	scavenged
09/27/2021	silver-haired bat	41	110	carcass search	70-m cleared	scavenged
09/27/2021	silver-haired bat	17	30	carcass search	70-m uncleared	scavenged
09/27/2021	silver-haired bat	27	48	carcass search	70-m cleared	scavenged
09/27/2021	silver-haired bat	22	84	carcass search	70-m uncleared	scavenged
09/28/2021	silver-haired bat	29	236	carcass search	70-m uncleared	scavenged
09/28/2021	silver-haired bat	57	363	carcass search	70-m cleared	scavenged
09/28/2021	silver-haired bat	51	363	carcass search	70-m cleared	scavenged
09/28/2021	silver-haired bat	48	368	carcass search	70-m uncleared	scavenged
09/28/2021	silver-haired bat	37	368	carcass search	70-m uncleared	scavenged
09/29/2021	eastern red bat	34	406	carcass search	100-m road and pad	injured
09/29/2021	silver-haired bat	34	41	carcass search	100-m road and pad	scavenged
09/29/2021	silver-haired bat	73	639	carcass search	70-m cleared	scavenged
09/29/2021	silver-haired bat	40	639	carcass search	70-m cleared	scavenged

Appendix A. Complete listing of carcasses found at the Meadow Lake Wind Resource Area, Benton and White Counties, Indiana, from April 1 – May 15 and August 1 - October 15, 2021.

Date Found	Species	Distance from Turbine (m)	Turbine	Search Type	Plot Type	Physical Condition
09/30/2021	eastern red bat	59	106	carcass search	70-m cleared	scavenged
09/30/2021	eastern red bat	9	550	carcass search	70-m uncleared	scavenged
09/30/2021	eastern red bat	45	612	carcass search	70-m uncleared	scavenged
09/30/2021	silver-haired bat	50	307	carcass search	70-m uncleared	scavenged
09/30/2021	silver-haired bat	19	327	carcass search	70-m cleared	scavenged
09/30/2021	silver-haired bat	1	616	carcass search	100-m road and pad	injured
09/30/2021	silver-haired bat	51	650	carcass search	70-m cleared	scavenged
10/01/2021	eastern red bat	49	619	carcass search	70-m uncleared	scavenged
10/01/2021	silver-haired bat	49	501	carcass search	70-m cleared	scavenged
10/01/2021	silver-haired bat	49	501	carcass search	70-m cleared	scavenged
10/01/2021	silver-haired bat	45	501	carcass search	70-m cleared	scavenged
10/01/2021	silver-haired bat	33	508	carcass search	70-m uncleared	scavenged
10/01/2021	silver-haired bat	38	537	carcass search	70-m uncleared	scavenged
10/04/2021	eastern red bat	32	58	carcass search	70-m cleared	scavenged
10/04/2021	eastern red bat	36	94	carcass search	70-m uncleared	scavenged
10/04/2021	silver-haired bat	42	115	carcass search	70-m uncleared	scavenged
10/04/2021	silver-haired bat	56	28	carcass search	70-m uncleared	scavenged
10/05/2021	eastern red bat	43	363	carcass search	70-m cleared	scavenged
10/05/2021	silver-haired bat	57	363	carcass search	70-m cleared	scavenged
10/06/2021	silver-haired bat	56	610	carcass search	70-m cleared	scavenged
10/06/2021	silver-haired bat	48	610	carcass search	70-m cleared	scavenged
10/06/2021	silver-haired bat	49	621	incidental	70-m cleared	dismembered
10/07/2021	eastern red bat	32	651	carcass search	70-m uncleared	scavenged
10/07/2021	silver-haired bat	26	230	carcass search	70-m cleared	scavenged
10/07/2021	silver-haired bat	28	326	carcass search	70-m uncleared	dismembered
10/08/2021	silver-haired bat	30	502	carcass search	100-m road and pad	scavenged
10/11/2021	eastern red bat	52	115	carcass search	70-m uncleared	scavenged
10/11/2021	eastern red bat	61	119	carcass search	70-m uncleared	scavenged
10/11/2021	silver-haired bat	44	119	carcass search	70-m uncleared	scavenged
10/12/2021	silver-haired bat	28	17	carcass search	70-m cleared	scavenged
10/13/2021	eastern red bat	37	241	carcass search	70-m cleared	scavenged
10/15/2021	eastern red bat	36	650	carcass search	70-m cleared	scavenged
10/15/2021	hoary bat	49	508	carcass search	70-m uncleared	scavenged
10/15/2021	hoary bat	60	550	carcass search	70-m uncleared	scavenged
10/15/2021	silver-haired bat	39	421	carcass search	70-m uncleared	scavenged
10/15/2021	silver-haired bat	62	538	carcass search	70-m uncleared	scavenged

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Date Found	Species	Distance from Turbine (m)	Turbine	Search Type	Plot Type	Physical Condition
Birds						
04/02/2021	golden-crowned kinglet	103	514	carcass search	100-m road and pad	scavenged
04/04/2021	golden-crowned kinglet	87	535	incidental	100-m road and pad	intact
04/04/2021	killdeer	5	617	carcass search	100-m road and pad	dismembered
04/16/2021	killdeer	10	651	carcass search	100-m road and pad	dismembered
04/29/2021	brown-headed cowbird	3	408	carcass search	100-m road and pad	scavenged
05/13/2021	red-tailed hawk	43	639	incidental	70-m cleared	scavenged
05/14/2021	unidentified passerine	63	624	carcass search	100-m road and pad	feather spot
07/28/2021	unidentified passerine	33	31	incidental	70-m cleared	scavenged
07/29/2021	unidentified swallow	34	76	incidental	70-m cleared	scavenged
08/04/2021	house sparrow	4	55	carcass search	100-m road and pad	intact
08/05/2021	horned lark	1	209	carcass search	100-m road and pad	scavenged
08/05/2021	killdeer	49	357	carcass search	100-m road and pad	feather spot
08/06/2021	ruby-throated hummingbird	2	544	carcass search	100-m road and pad	intact
08/07/2021	dickcissel	1	613	carcass search	70-m uncleared	scavenged
08/07/2021	killdeer	31	444	carcass search	70-m cleared	feather spot
08/07/2021	unidentified small bird	25	444	carcass search	70-m cleared	scavenged
08/10/2021	unidentified passerine	41	110	carcass search	70-m cleared	scavenged
08/11/2021	brown-headed cowbird	1	211	carcass search	100-m road and pad	scavenged
08/11/2021	unidentified passerine	19	406	carcass search	100-m road and pad	feather spot
08/14/2021	unidentified passerine	24	616	carcass search	100-m road and pad	feather spot
08/14/2021	unidentified small bird	68	208	carcass search	70-m cleared	feather spot
08/14/2021	unidentified small bird	1	312	carcass search	70-m cleared	scavenged
08/16/2021	horned lark	40	48	carcass search	70-m cleared	feather spot
08/18/2021	barn swallow	39	617	carcass search	70-m cleared	scavenged
08/20/2021	horned lark	69	230	carcass search	70-m cleared	feather spot
08/20/2021	turkey vulture	11	533	incidental	100-m road and pad	scavenged
08/26/2021	mourning dove	28	326	carcass search	70-m uncleared	feather spot
08/30/2021	dickcissel	25	76	carcass search	70-m cleared	scavenged
08/31/2021	dickcissel	40	106	carcass search	70-m cleared	feather spot
09/02/2021	horned lark	30	621	carcass search	70-m cleared	dismembered
09/02/2021	horned lark	17	621	carcass search	70-m cleared	scavenged
09/02/2021	killdeer	43	312	carcass search	70-m cleared	scavenged
09/06/2021	unidentified small bird	44	84	carcass search	70-m uncleared	feather spot
09/09/2021	blackpoll warbler	37	610	carcass search	70-m cleared	scavenged

Appendix A. Complete listing of carcasses found at the Meadow Lake Wind Resource Area, Benton and White Counties, Indiana, from April 1 – May 15 and August 1 - October 15, 2021.

Date Found	Species	Distance from Turbine (m)	Turbine	Search Type	Plot Type	Physical Condition
09/09/2021	unidentified warbler	43	639	carcass search	70-m cleared	scavenged
09/10/2021	eastern whip-poor-will	55	621	carcass search	70-m cleared	scavenged
09/10/2021	unidentified passerine	33	517	carcass search	70-m cleared	scavenged
09/14/2021	yellow-billed cuckoo	49	215	carcass search	70-m uncleared	scavenged
09/16/2021	ovenbird	29	350	carcass search	70-m uncleared	scavenged
09/18/2021	unidentified warbler	26	550	carcass search	70-m uncleared	dismembered
09/21/2021	eastern meadowlark	33	110	carcass search	70-m cleared	scavenged
09/21/2021	eastern meadowlark	60	368	carcass search	70-m uncleared	scavenged
09/23/2021	chimney swift	22	639	carcass search	70-m cleared	scavenged
09/23/2021	red-tailed hawk	18	350	carcass search	70-m uncleared	scavenged
09/23/2021	red-tailed hawk	67	619	carcass search	70-m uncleared	scavenged
09/23/2021	unidentified passerine	31	350	carcass search	70-m uncleared	scavenged
09/23/2021	unidentified passerine	16	651	carcass search	70-m uncleared	dismembered
09/27/2021	mourning dove	2	110	carcass search	70-m cleared	scavenged
09/30/2021	killdeer	64	437	carcass search	100-m road and pad	scavenged
09/30/2021	ruby-crowned kinglet	45	612	carcass search	70-m uncleared	scavenged
09/30/2021	unidentified warbler	49	307	carcass search	70-m uncleared	scavenged
10/01/2021	eastern meadowlark	26	525	carcass search	70-m cleared	scavenged
10/06/2021	European starling	21	613	carcass search	70-m uncleared	scavenged
10/06/2021	killdeer	25	444	carcass search	70-m cleared	scavenged
10/07/2021	American redstart	36	619	carcass search	70-m uncleared	scavenged
10/07/2021	European starling	2	209	carcass search	100-m road and pad	dismembered
10/07/2021	killdeer	49	651	carcass search	70-m uncleared	intact
10/07/2021	mourning dove	1	41	carcass search	100-m road and pad	scavenged
10/08/2021	horned lark	39	508	carcass search	70-m uncleared	intact
10/11/2021	killdeer	23	58	carcass search	70-m cleared	feather spot
10/12/2021	mourning dove	53	343	carcass search	70-m cleared	feather spot
10/14/2021	golden-crowned kinglet	30	612	carcass search	70-m uncleared	scavenged
10/14/2021	killdeer	23	612	carcass search	70-m uncleared	scavenged
10/14/2021	unidentified small bird	56	619	carcass search	70-m uncleared	scavenged
10/14/2021	unidentified vireo	26	617	carcass search	70-m cleared	scavenged
10/14/2021	unidentified warbler	60	619	incidental	70-m uncleared	scavenged
10/14/2021	unidentified warbler	45	621	carcass search	70-m cleared	scavenged
10/15/2021	downy woodpecker	80	519	carcass search	70-m uncleared	scavenged
10/15/2021	eastern meadowlark	42	508	carcass search	70-m uncleared	scavenged
10/15/2021	golden-crowned kinglet	43	230	incidental	70-m cleared	scavenged

Appendix A. Complete listing of carcasses found at the Meadow Lake Wind Resource Area, Benton and White Counties, Indiana, from April 1 – May 15 and August 1 - October 15, 2021.

Date Found	Species	Distance from Turbine (m)	Turbine	Search Type	Plot Type	Physical Condition
10/15/2021	golden-crowned kinglet	47	421	carcass search	70-m uncleared	scavenged
10/15/2021	golden-crowned kinglet	40	650	carcass search	70-m cleared	scavenged
10/15/2021	killdeer	20	444	carcass search	70-m cleared	scavenged
10/15/2021	Nashville warbler	34	504	carcass search	70-m uncleared	scavenged
10/15/2021	northern flicker	9	538	carcass search	70-m uncleared	scavenged
10/15/2021	unidentified warbler	4	650	carcass search	70-m cleared	scavenged

Appendix B. Searcher Efficiency and Carcass Persistence Model Fitting Results

Appendix B1. Searcher efficiency models for 70-meter plots at the Meadow Lake Wind Resource Area, Benton and White counties, Indiana, from April 1 – May 15 and August 1 – October 15, 2021.

Covariates	*k* Value	AICc	Delta AICc
No Covariates	0.67	63.87	0*
Plot Search Type	0.67	65.88	2.01

* Selected model.

AICc = corrected Akaike Information Criterion.

Appendix B2. Searcher efficiency models for 100-meter roads and pads at the Meadow Lake Wind Resource Area, Benton and White counties, Indiana, from April 1 – May 15 and August 1 – October 15, 2021.

Covariates	*k* Value	AICc	Delta AICc
No Covariates	0.67	30.28	0*
Season	0.67	31.63	1.35

* Selected model.

AICc = corrected Akaike Information Criterion.

Appendix B3. Carcass persistence models with covariates and distributions for bats on 70-meter plots at the Meadow Lake Wind Resource Area, Benton and White counties, Indiana, from August 1 – October 15, 2021.

Location Covariates	Scale Covariates	Distribution	AICc	Delta AICc
No Covariates	-	Exponential	126.80	0*
No Covariates	No Covariates	Weibull	128.50	1.70
PlotSearchType	-	Exponential	129.09	2.29
No Covariates	No Covariates	Loglogistic	130.76	3.96
No Covariates	PlotSearchType	Weibull	130.91	4.11
PlotSearchType	No Covariates	Weibull	130.96	4.16
No Covariates	No Covariates	Lognormal	132.59	5.79
No Covariates	PlotSearchType	Loglogistic	132.96	6.16
PlotSearchType	No Covariates	Loglogistic	133.24	6.44
PlotSearchType	PlotSearchType	Weibull	133.58	6.78
No Covariates	PlotSearchType	Lognormal	134.66	7.86
PlotSearchType	No Covariates	Lognormal	134.97	8.17
PlotSearchType	PlotSearchType	Loglogistic	135.64	8.84
PlotSearchType	PlotSearchType	Lognormal	137.30	10.50

* Selected model

n = 30

AICc = corrected Akaike Information Criterion.

Appendix B4. Carcass persistence models with covariates and distributions for bats 100-meter roads and pads at the Meadow Lake Wind Resource Area, Benton and White counties, Indiana, from April 1 – May 15 and August 1 – October 15, 2021.

Location Covariates	Scale Covariates	Distribution	AICc	Delta AICc
No Covariates	Season	Lognormal	138.78	0*
No Covariates	Season	Loglogistic	139.19	0.41
No Covariates	Season	Weibull	139.56	0.78
Season	Season	Lognormal	140.01	1.23
Season	Season	Loglogistic	140.36	1.58
No Covariates	No Covariates	Loglogistic	140.86	2.08
No Covariates	No Covariates	Lognormal	141.12	2.34
Season	No Covariates	Loglogistic	141.43	2.65
Season	No Covariates	Lognormal	141.60	2.82
Season	Season	Weibull	141.81	3.03
No Covariates	No Covariates	Weibull	141.87	3.09
Season	No Covariates	Weibull	143.95	5.17
No Covariates	-	Exponential	144.58	5.80
Season	-	Exponential	146.50	7.72

* Selected model

n = 32

AICc = corrected Akaike Information Criterion.

Appendix C. Truncated Weighted Likelihood Area Adjustment Estimate Model Fitting Results

Appendix C1. Truncated weighted maximum likelihood search area adjustment models for the top 10 overall stratified models and the top pooled model at the Meadow Lake I-IV Wind Resource Area, Benton and White Counties, Indiana, from April 1, 2021 to October 15, 2021.

Blade Length				Pooled	AIC	Delta AIC
38m	41-44m	55m	68m			
Gompertz	Gompertz	Normal	Gompertz	NA	13438.2	0*
Gompertz	Gompertz	Normal	Normal	NA	13438.9	0.7
Gompertz	Gompertz	Normal	Rayleigh	NA	13439.9	1.7
Gompertz	Gompertz	Normal	Weibull	NA	13440.6	2.3
Normal	Gompertz	Normal	Gompertz	NA	13443.2	5.0
Gompertz	Gompertz	Weibull	Gompertz	NA	13443.9	5.6
Normal	Gompertz	Normal	Normal	NA	13443.9	5.6
Gompertz	Gompertz	Weibull	Normal	NA	13444.5	6.3
Normal	Gompertz	Normal	Rayleigh	NA	13444.9	6.6
Gompertz	Gompertz	Weibull	Rayleigh	NA	13445.5	7.3
-	-	-	-	Gompertz†	13599.0	160.8

Separate TWL models were fit across blade length stratum, (38m n = 51, 41-44m n = 196, 55m n = 100, 68m n = 98) and pooled across all stratum (n=445).

*Selected Model

† Model included for comparison. Not a top ten model

Appendix C2. Search area adjustment models for bats at 38-meter blade length turbines at the Meadow Lake Wind Resource Area, Benton and White counties, Indiana, from April 1 – May 15 and August 1 – October 15, 2021.

Distribution	AICc	Delta AICc
Gompertz	566.16	0*
Normal	571.13	4.97
Weibull	577.03	10.87
Rayleigh	578.31	12.15
Gamma	589.99	23.83

* Selected model

n = 51 bats

AICc = corrected Akaike Information Criterion.

Appendix C3. Search area adjustment models for bats at 41- and 44-meter blade length turbines at the Meadow Lake Wind Resource Area, Benton and White counties, Indiana, from April 1 – May 15 and August 1 – October 15, 2021.

Distribution	AICc	Delta AICc
Gompertz	9,185.96	0*
Normal	9,239.03	53.06
Weibull	9,290.72	104.75
Rayleigh	9,382.82	196.86
Gamma	9,444.15	258.19

* Selected model

n = 196 bats

AICc = corrected Akaike Information Criterion.

Appendix C4. Search area adjustment models for bats at 55-meter blade length turbines at the Meadow Lake Wind Resource Area, Benton and White counties, Indiana, from April 1 – May 15 and August 1 – October 15, 2021.

Distribution	AICc	Delta AICc
Normal	2,273.33	0*
Weibull	2,278.97	5.64
Gompertz	2,286.04	12.71
Gamma	2,318.96	45.63
Rayleigh	2,330.62	57.30

* Selected model

n = 100 bats

AICc = corrected Akaike Information Criterion.

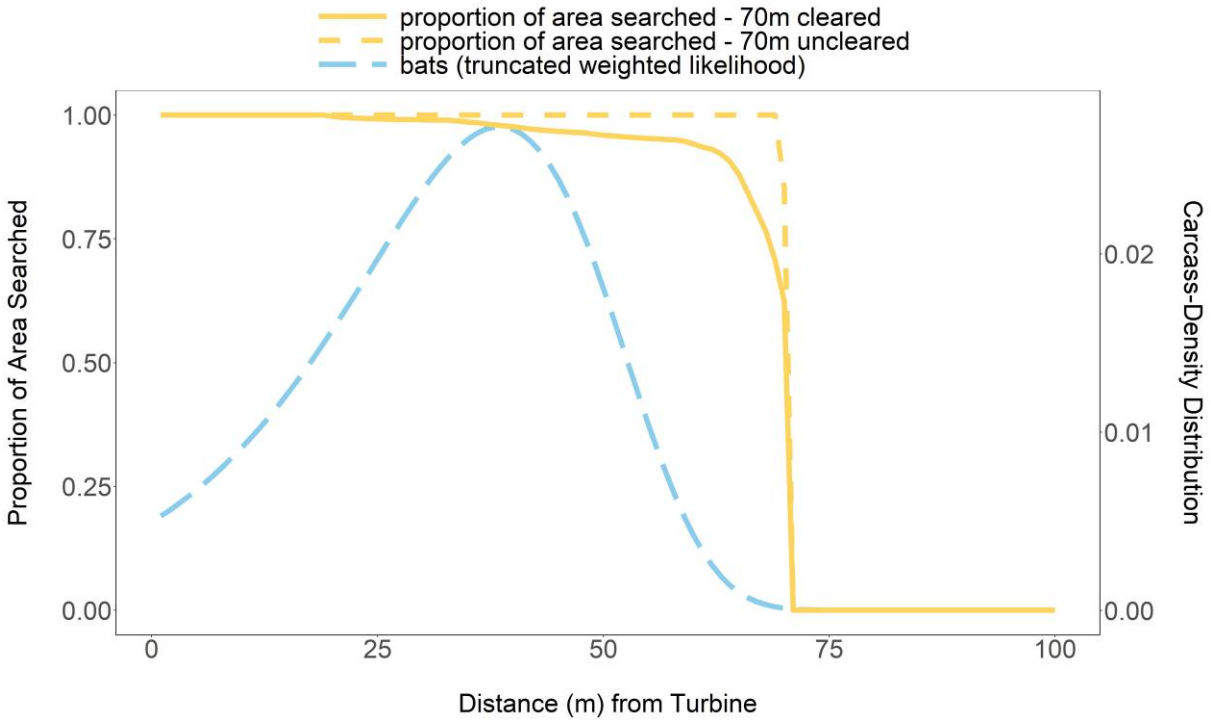
Appendix C5. Search area adjustment models for bats at 68-meter blade length turbines at the Meadow Lake Wind Resource Area, Benton and White counties, Indiana, from April 1 – May 15 and August 1 – October 15, 2021.

Distribution	AICc	Delta AICc
Gompertz	1,413.33	0*
Normal	1,413.99	0.66
Rayleigh	1,414.91	1.58
Weibull	1,415.67	2.34
Gamma	1,428.59	15.26

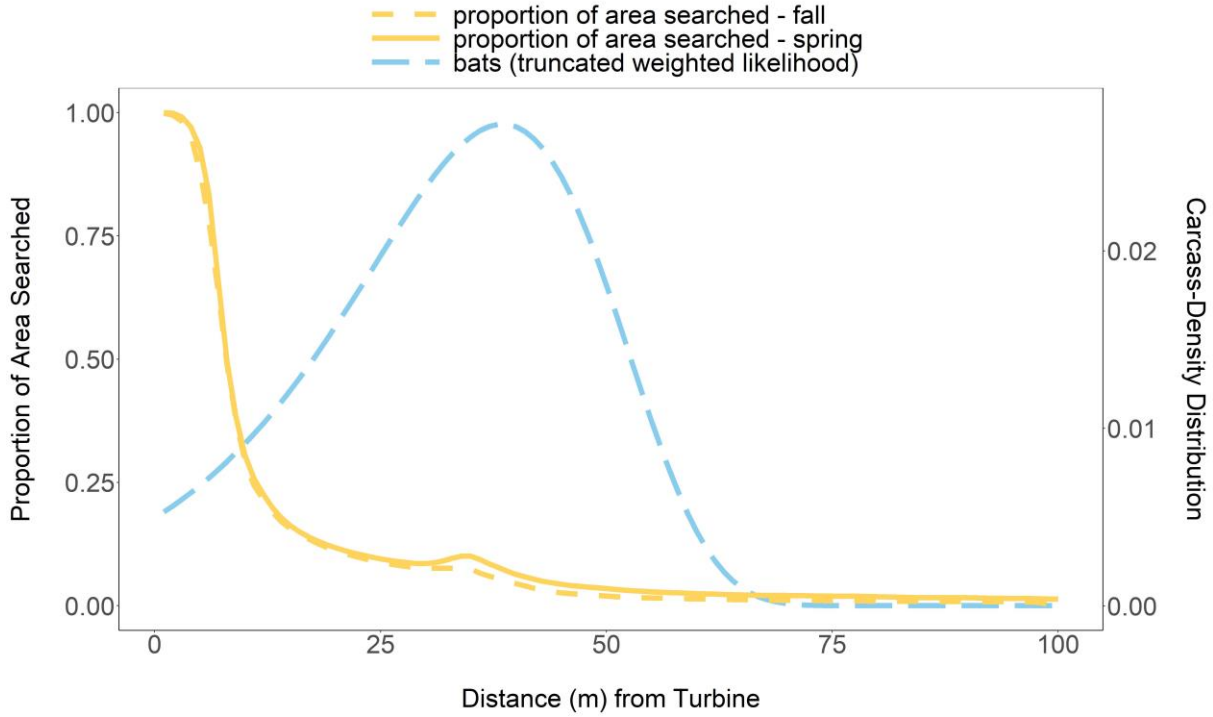
* Selected model

n = 98 bats

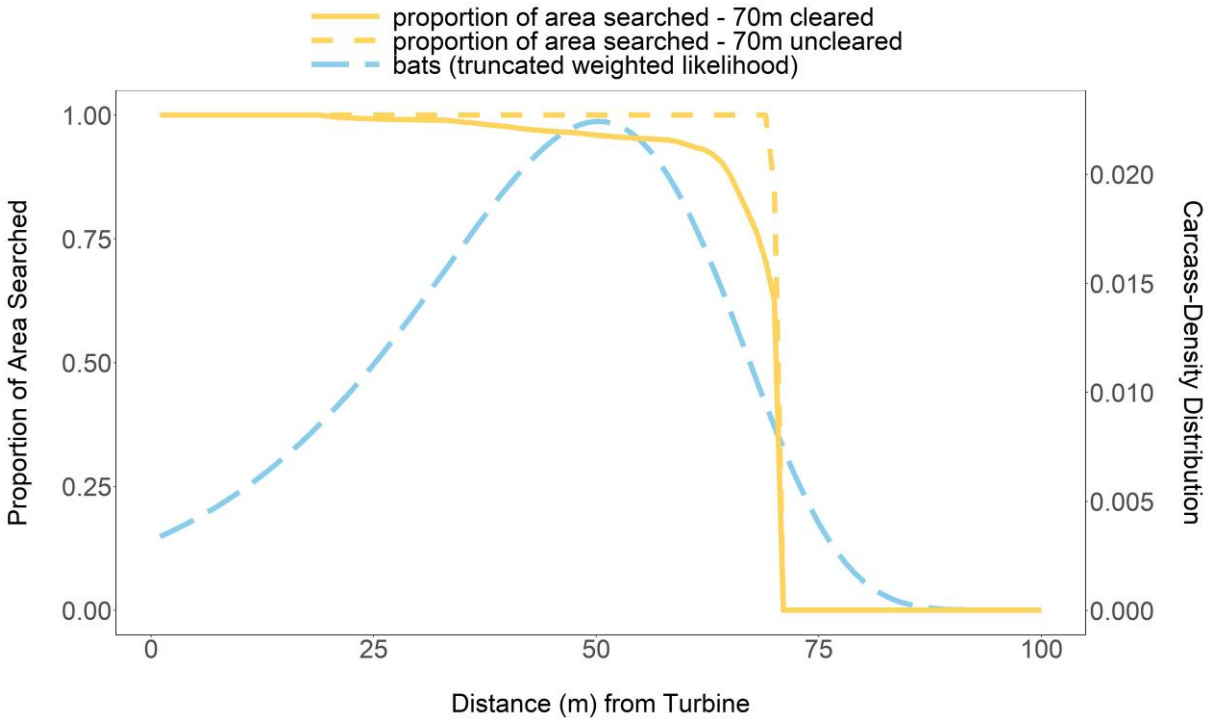
AICc = corrected Akaike Information Criterion.



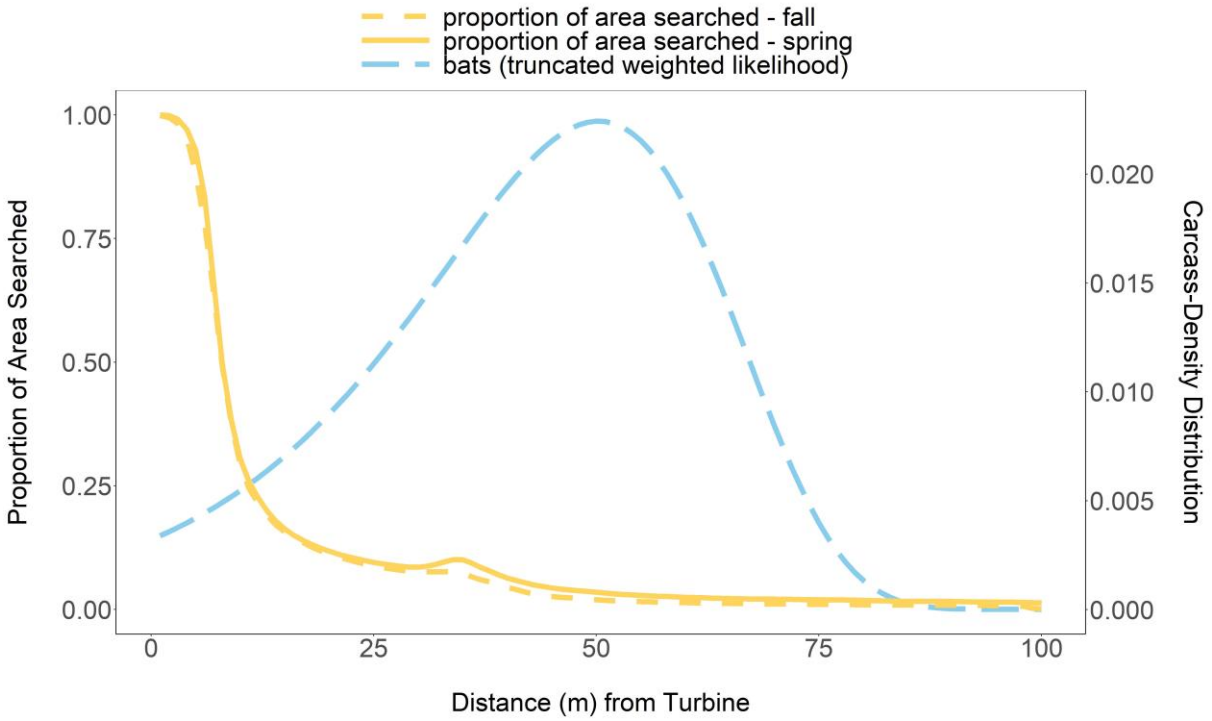
Appendix C6. Density of bat carcasses per area searched at all 70-meter plots surrounding turbines with 38-meter blades at the Meadow Lake Wind Resource Area, Benton and White counties, Indiana, from August 1 – October 15, 2021.



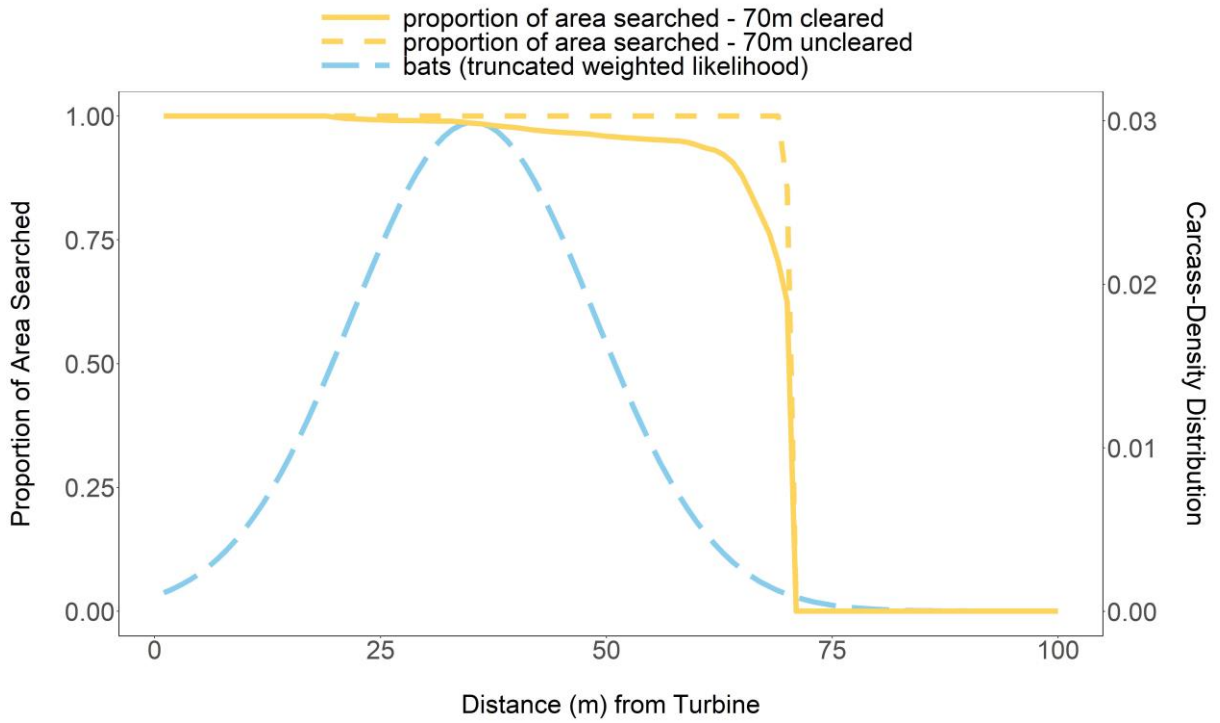
Appendix C7. Density of bat carcasses per area searched at all 100-meter roads and pads surrounding turbines with 38-meter blades at the Meadow Lake Wind Resource Area, Benton and White counties, Indiana, from April 1 – May 15 and August 1 – October 15, 2021.



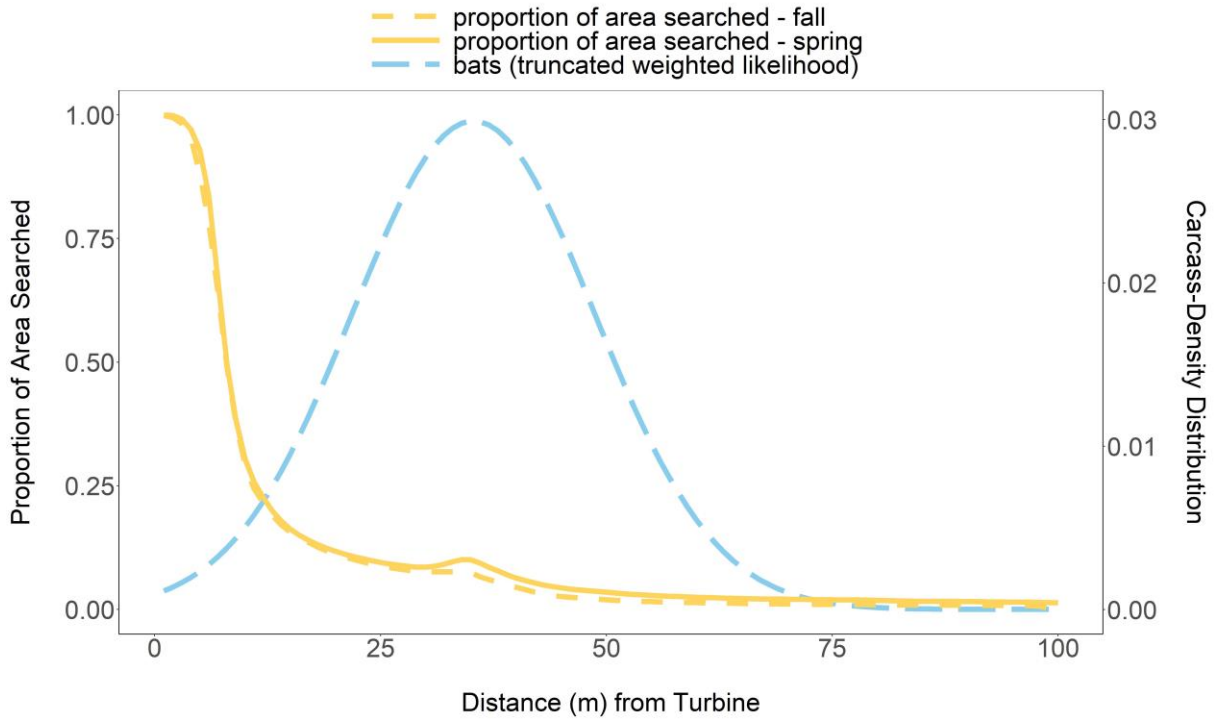
Appendix C8. Density of bat carcasses per area searched at all 70-meter plots surrounding turbines with 41- and 44-meter blades at the Meadow Lake Wind Resource Area, Benton and White counties, Indiana, from August 1 – October 15, 2021.



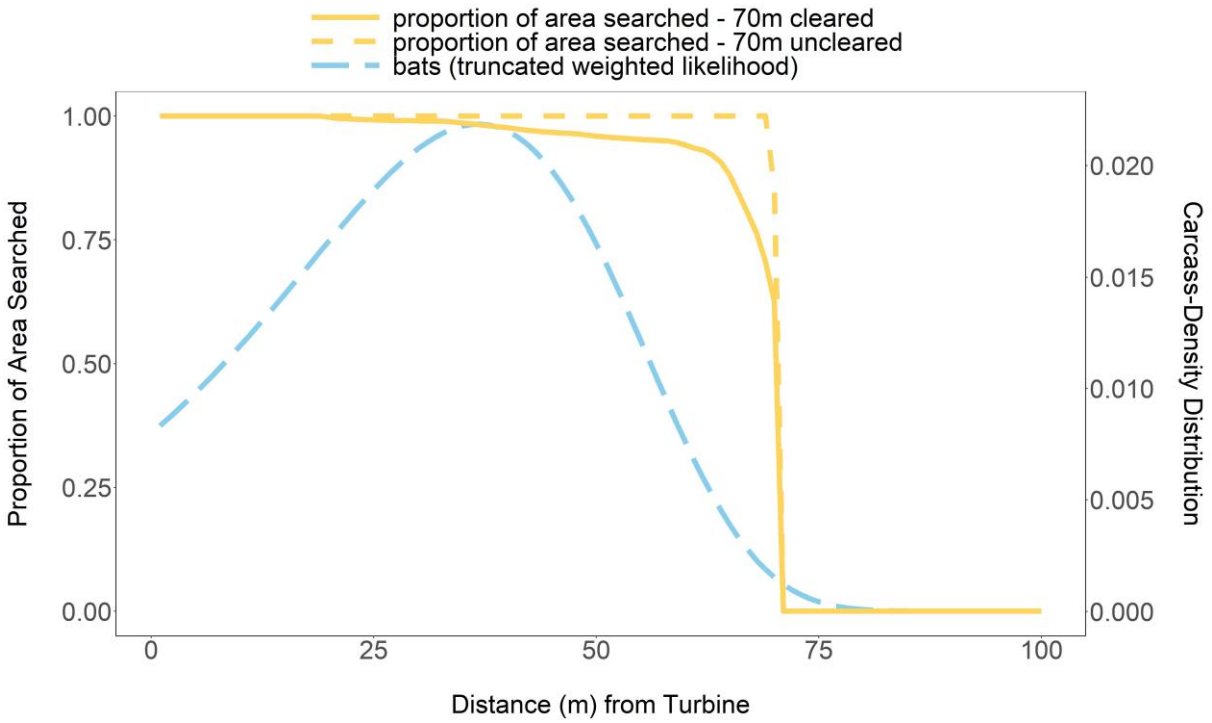
Appendix C9. Density of bat carcasses per area searched at all 100-meter road and pads surrounding turbines with 41- and 44-meter blades at the Meadow Lake Wind Resource Area, Benton and White counties, Indiana, from April 1 – May 15 and August 1 – October 15, 2021.



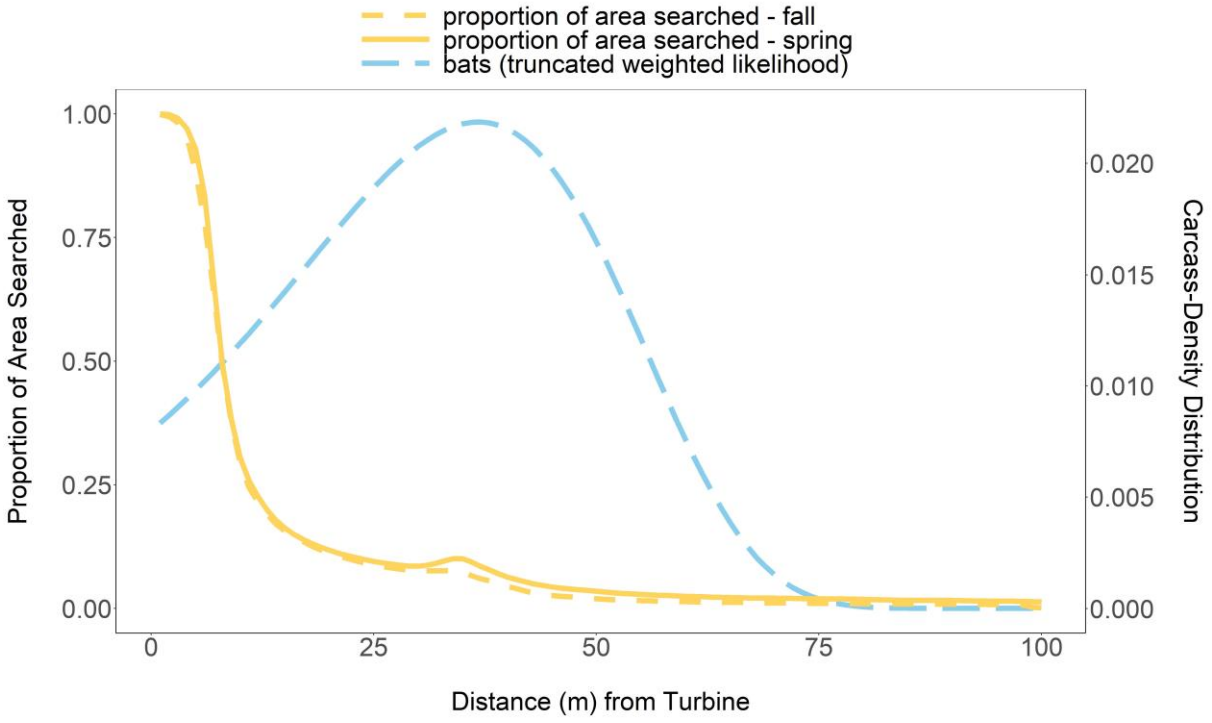
Appendix C10. Density of bat carcasses per area searched at all 70-meter (m) plots surrounding turbines with 41- and 44-m blades at the Meadow Lake Wind Resource Area, Benton and White counties, Indiana, from August 1 – October 15, 2021.



Appendix C11. Density of bat carcasses per area searched at all 100-meter (m) roads and pads surrounding turbines with 55-m blades at the Meadow Lake Wind Resource Area, Benton and White counties, Indiana, from April 1 – May 15 and August 1 – October 15, 2021.



Appendix C12. Density of bat carcasses per area searched at all 70-meter (m) plots surrounding turbines with 68-m blades at the Meadow Lake Wind Resource Area, Benton and White counties, Indiana, from August 1 – October 15, 2021.



Appendix C13. Density of bat carcasses per area searched at all 100-meter (m) roads and pads surrounding turbines with 68-m blades at the Meadow Lake Wind Resource Area, Benton and White counties, Indiana, from April 1 – May 15 and August 1 – October 15, 2021.

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 the Meadow Lake Wind Resource Area, Benton and White counties, Indiana, from April 1 – May 15 and August 1 – October 15, 2021.*

							Searcher Efficiency		Carcass Persistence**	
Season	Plot Type	Blade Length (m)	Search Interval (I)	Number of Searches	Spatial Coverage (a)	Temporal Coverage	Carcasses Available	Carcasses Found	Shape (α)	Scale (β)
Spring	100-m road and pad	38.5	14	5	0.1281	0.11	52	48	6.584	2.305
Spring	100-m road and pad	41–44	14	5	0.0709	0.11	52	48	6.584	2.305
Spring	100-m road and pad	55	14	5	0.1120	0.11	52	48	6.584	2.305
Spring	100-m road and pad	68	14	5	0.2205	0.11	52	48	6.584	2.305
Fall	100-m road and pad	38.5	7	12	0.1168	0.89	52	48	1.293	2.305
Fall	100-m road and pad	41–44	7	12	0.0608	0.89	52	48	1.293	2.305
Fall	100-m road and pad	55	7	12	0.1075	0.89	52	48	1.293	2.305
Fall	100-m road and pad	68	7	12	0.2283	0.89	52	48	1.293	2.305
Fall	70-m cleared plot	38.5	7	12	0.9773	0.89	51	36	N/A	25.154
Fall	70-m cleared plot	41–44	7	12	0.9254	0.89	51	36	N/A	25.154
Fall	70-m cleared plot	55	7	12	0.9290	0.89	51	36	N/A	25.154
Fall	70-m cleared plot	68	7	12	0.9931	0.89	51	36	N/A	25.154
Fall	70-m uncleared plot	38.5	7	12	0.9998	0.89	51	36	N/A	25.154
Fall	70-m uncleared plot	41–44	7	12	0.9565	0.89	51	36	N/A	25.154
Fall	70-m uncleared plot	55	7	12	0.9961	0.89	51	36	N/A	25.154
Fall	70-m uncleared plot	68	7	12	0.9940	0.89	51	36	N/A	25.154

*. *k* was assumed to equal 0.67 for all strata, per Huso et al. (2017). A loglogistic distribution was assumed for carcass persistence. The 95% upper and lower confidence intervals on β were set to 11.42, 11.44.

**. A lognormal distribution was used for carcass persistence on 100-m roads and pads. The 95% upper and lower confidence intervals on β were set to 1.75, 2.86. An exponential distribution was used for carcass persistence on 70-m cleared and uncleared plots. The 95% upper and lower confidence intervals on β were set to 16.395, 38.629.

m = meter

Appendix D2. Inputs needed to run Evidence of Absence: Multiple Class Module for the Meadow Lake Wind Resource Area, Benton and White counties, Indiana, from April 1 – May 15 and August 1 – October 15, 2021.

Season	Plot Type	Blade Length (m)	Ba	Bb	Within-Season Sampling Fraction
Spring	100-m road and pad	38.5	160.6652	2,094.1620	0.1261
Spring	100-m road and pad	41–44	183.9872	4,452.7780	0.5946
Spring	100-m road and pad	55	161.4021	2,414.2140	0.1622
Spring	100-m road and pad	68	152.7917	1,089.5530	0.1171
Fall	100-m road and pad	38.5	59.1647	24.7321	0.0450
Fall	100-m road and pad	41–44	73.6648	36.4227	0.1081
Fall	100-m road and pad	55	71.4517	35.4054	0.0450
Fall	100-m road and pad	68	62.7608	25.1635	0.0450
Fall	70-m cleared plot	38.5	64.5718	24.5315	0.0541
Fall	70-m cleared plot	41–44	68.9598	30.5583	0.1171
Fall	70-m cleared plot	55	61.4538	23.7160	0.0631
Fall	70-m cleared plot	68	63.1651	24.6099	0.0270
Fall	70-m uncleared plot	38.5	141.1201	1,410.8870	0.0450
Fall	70-m uncleared plot	41–44	157.4533	3,181.7290	0.3604
Fall	70-m uncleared plot	55	146.3023	1,613.4780	0.0631
Fall	70-m uncleared plot	68	123.2519	571.0474	0.0270

m = meter

Appendix D3. Inputs needed to run Evidence of Absence: Multiple Class Module for the Meadow Lake Wind Resource Area, Benton and White counties, Indiana, from April 1 – May 15 and August 1 – October 15, 2021.

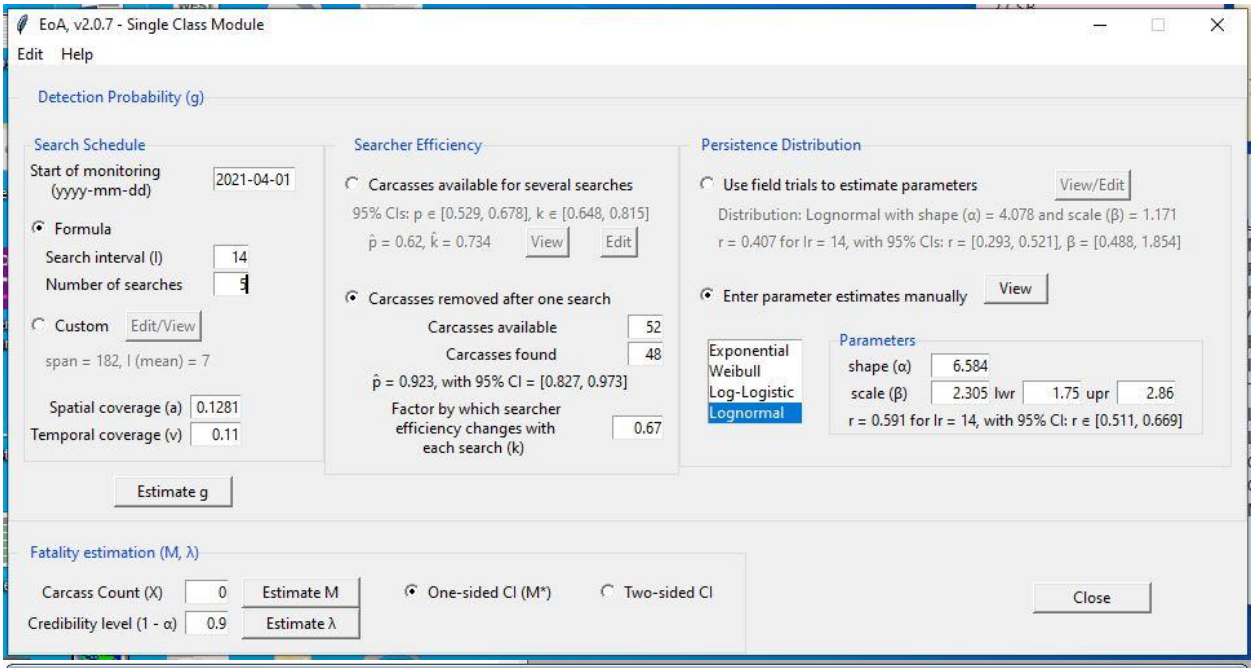
Season	Ba	Bb	Weights (DWP)
Spring (April 1–May 15)	596.561	9,842.622	0.11
Fall (August 1–October 15)	1,054.804	1,700.781	0.89

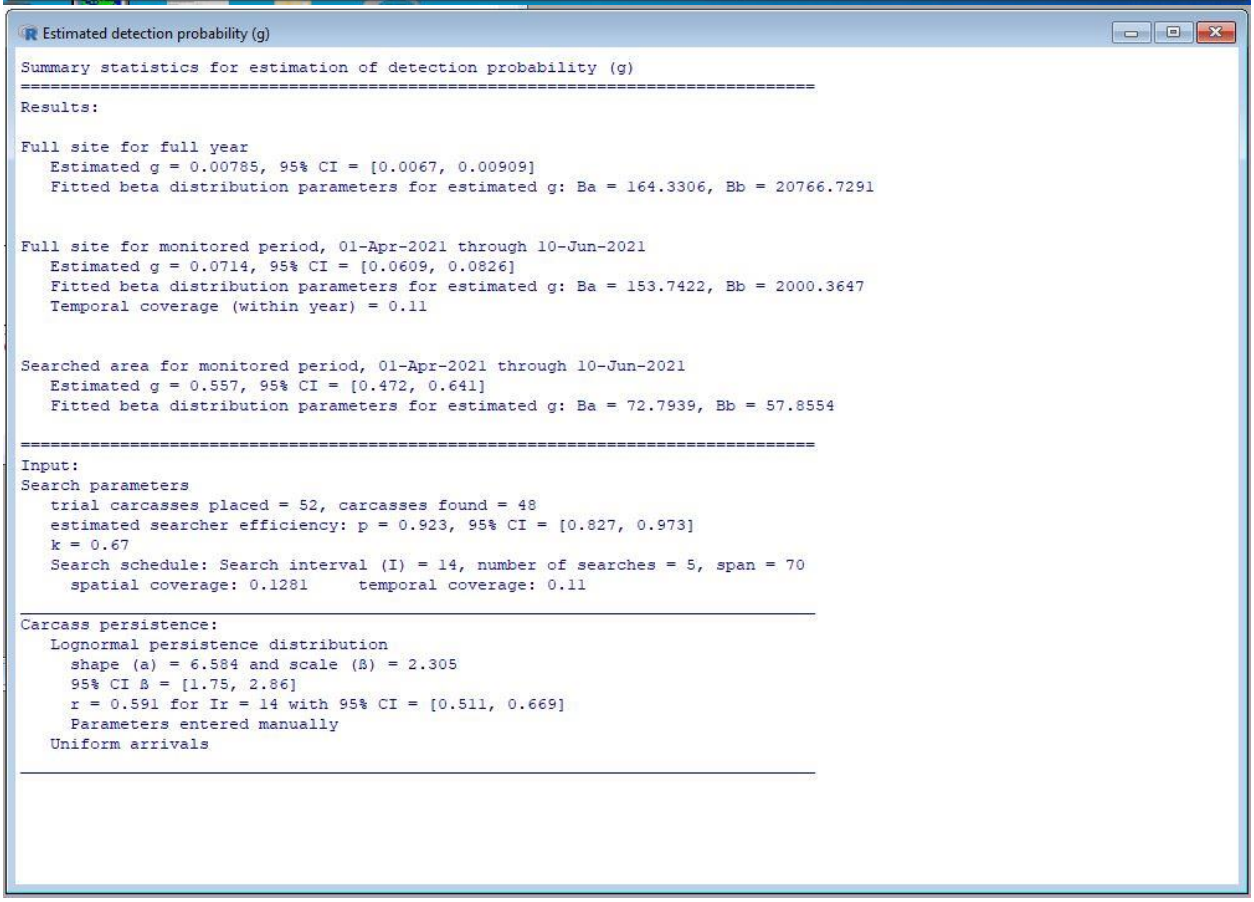
DWP = Density-weighted proportion

Appendix D4. Components of the site-wide *g* for the Meadow Lake Wind Resource Area, Benton and White counties, Indiana, from April 1 – May 15 and August 1 – October 15, 2021.

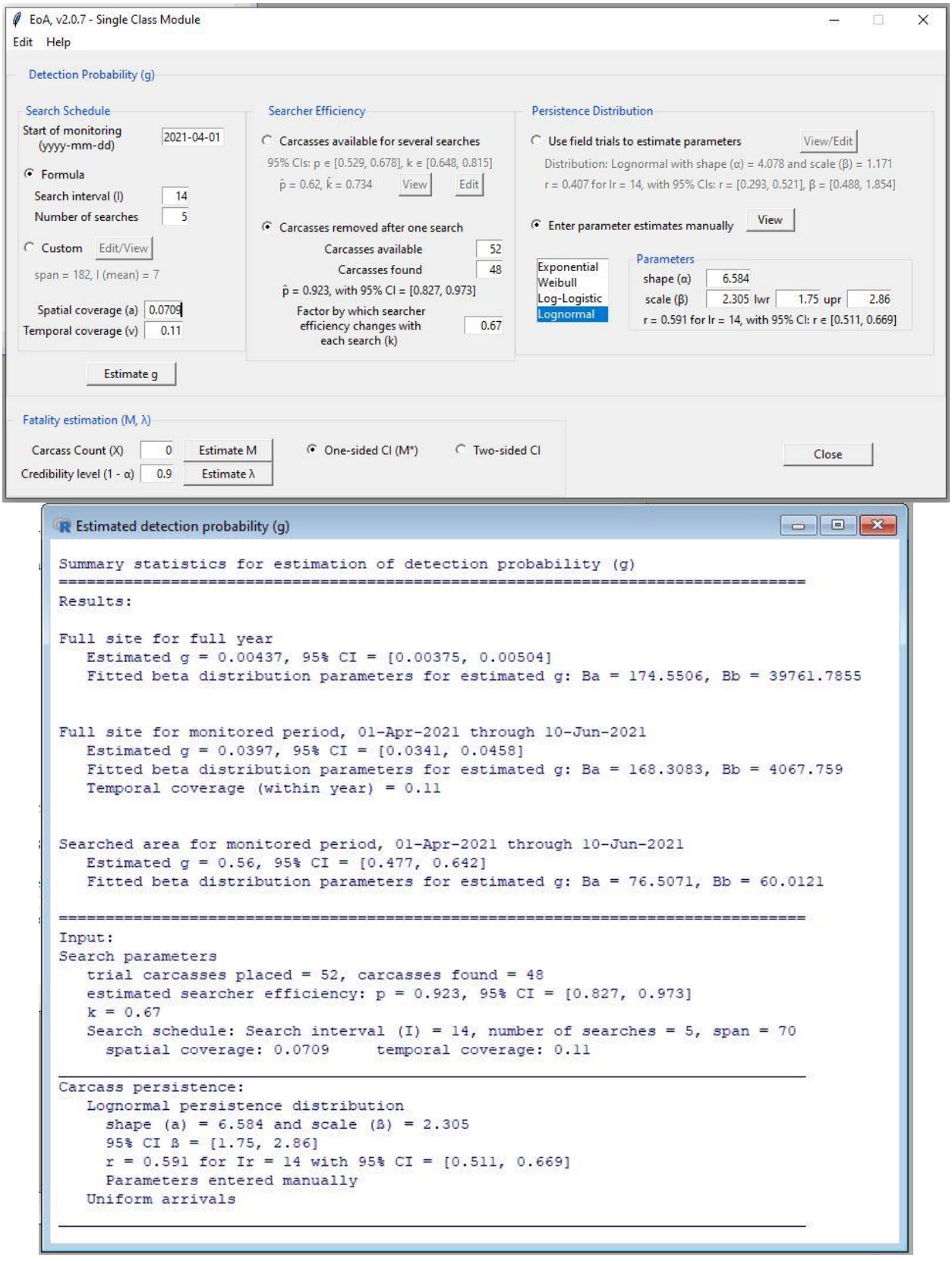
Turbines	Ba	Bb	Weights (DWP)	*g*	90% Confidence Intervals
111 (study turbines)	1,156.594	21,76.846	0.268116	0.346967	0.330899–0.363209
303 (unsearched turbines)	0.01	1,000.00	0.731884	0.00001	0.00000–0.00004
414 (site-wide)	**1,605.22**	**15,648.77**	**N/A**	**0.093035**	**0.088745–0.097413**

DWP = Density-weighted proportion

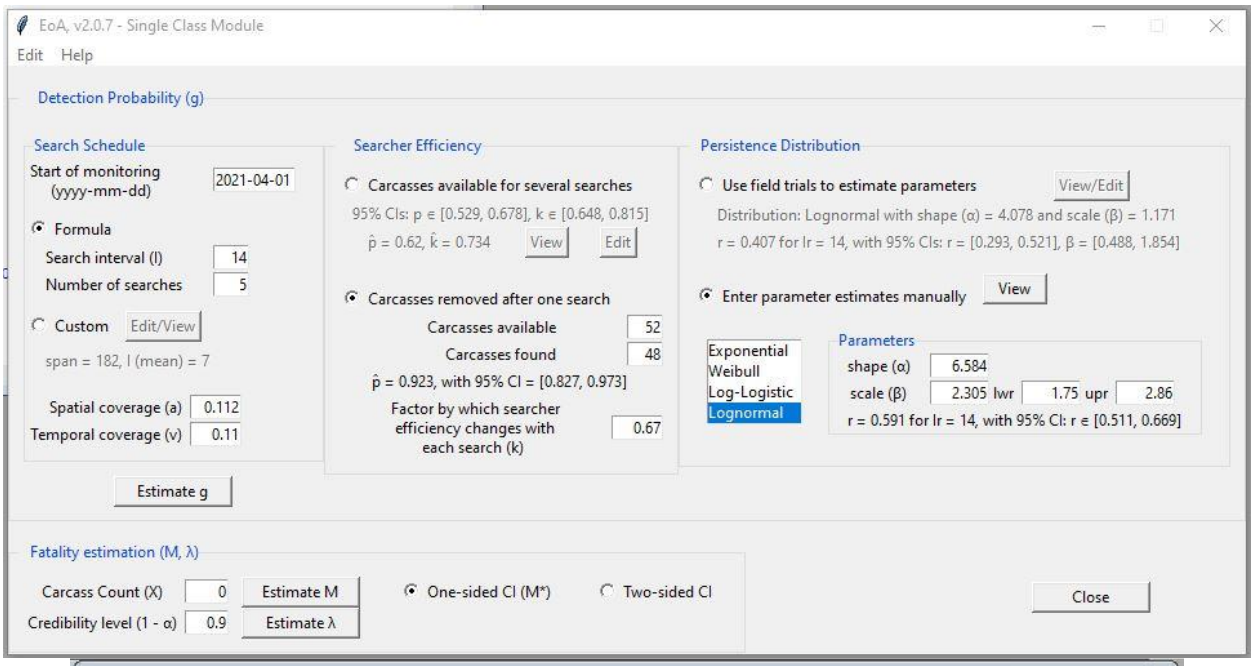


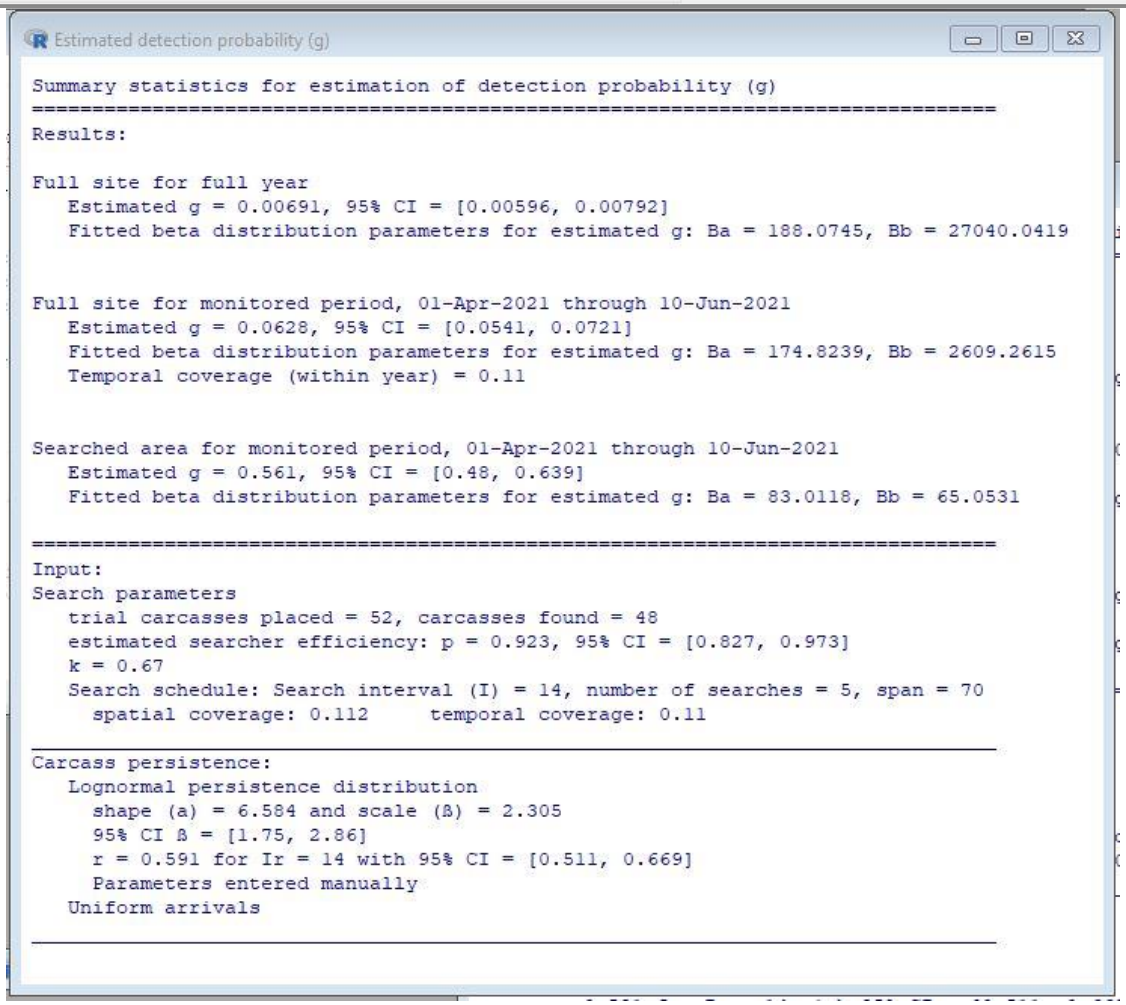


Appendix D5. Spring 2021, 100-meter road and pad searches at 14 turbines with a blade length of 38.5 meters, searched at a 14-day interval.

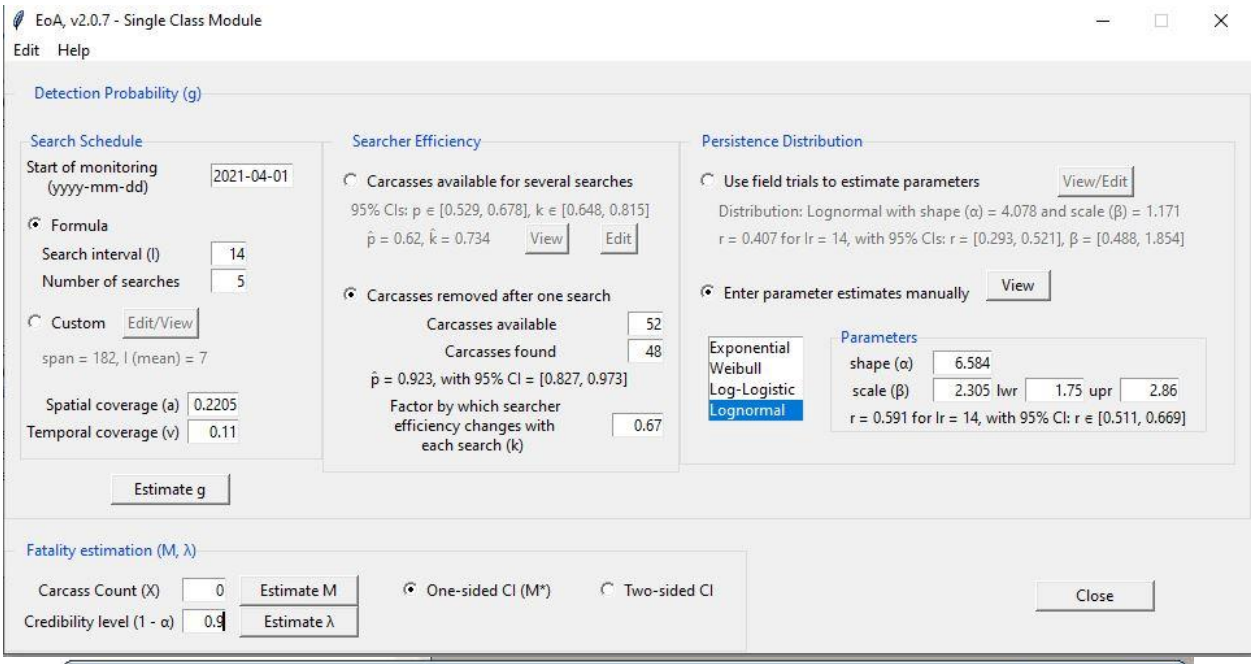


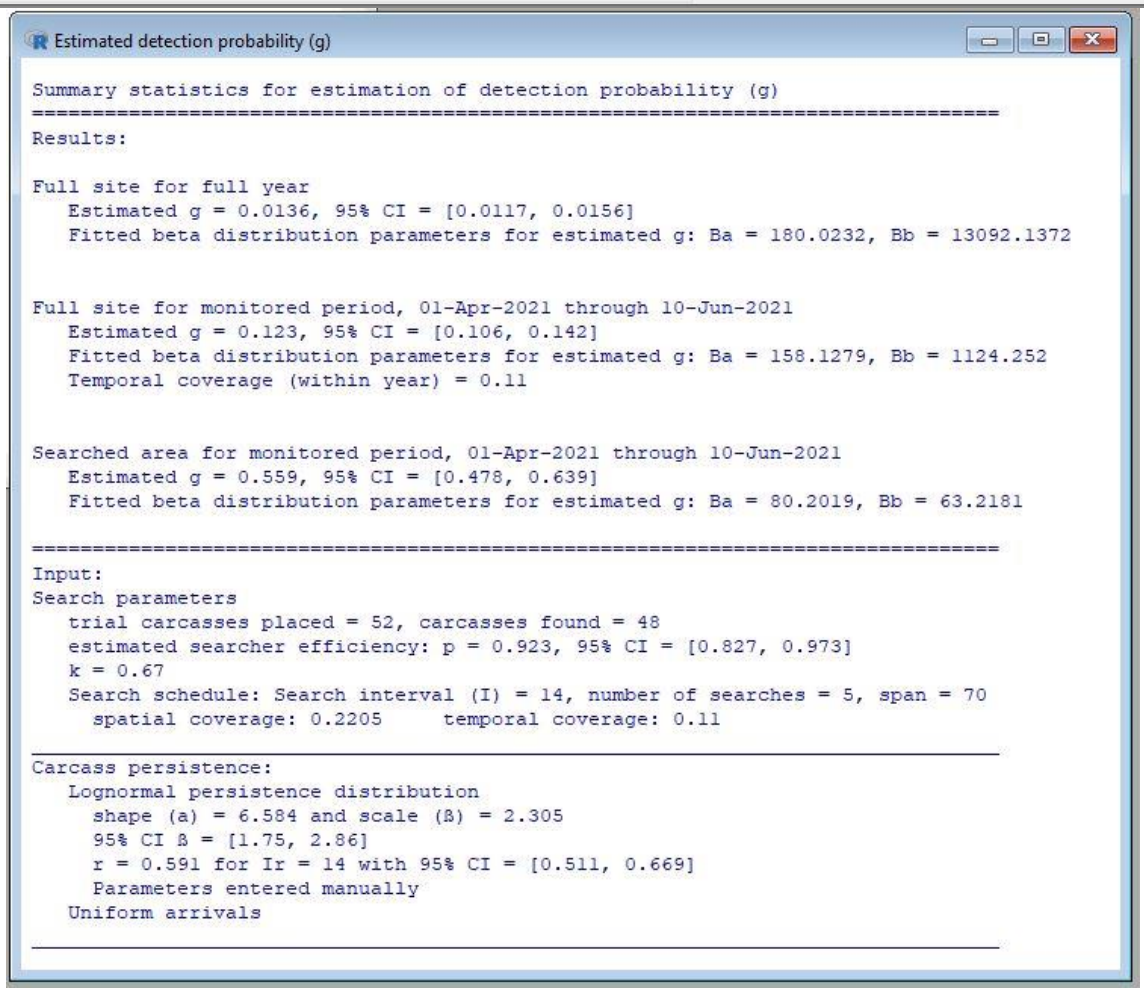
Appendix D6. Spring 2021, 100-meter road and pad searches at 66 turbines with a blade length of 41–44 meters, searched at a 14-day interval.



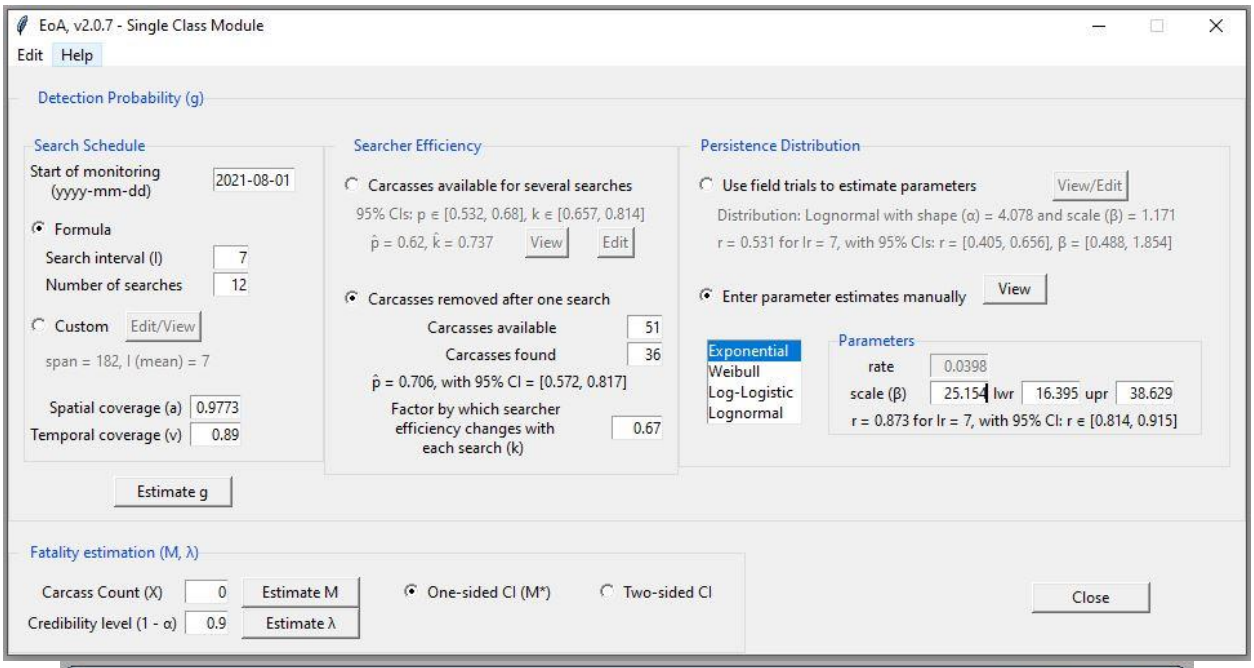


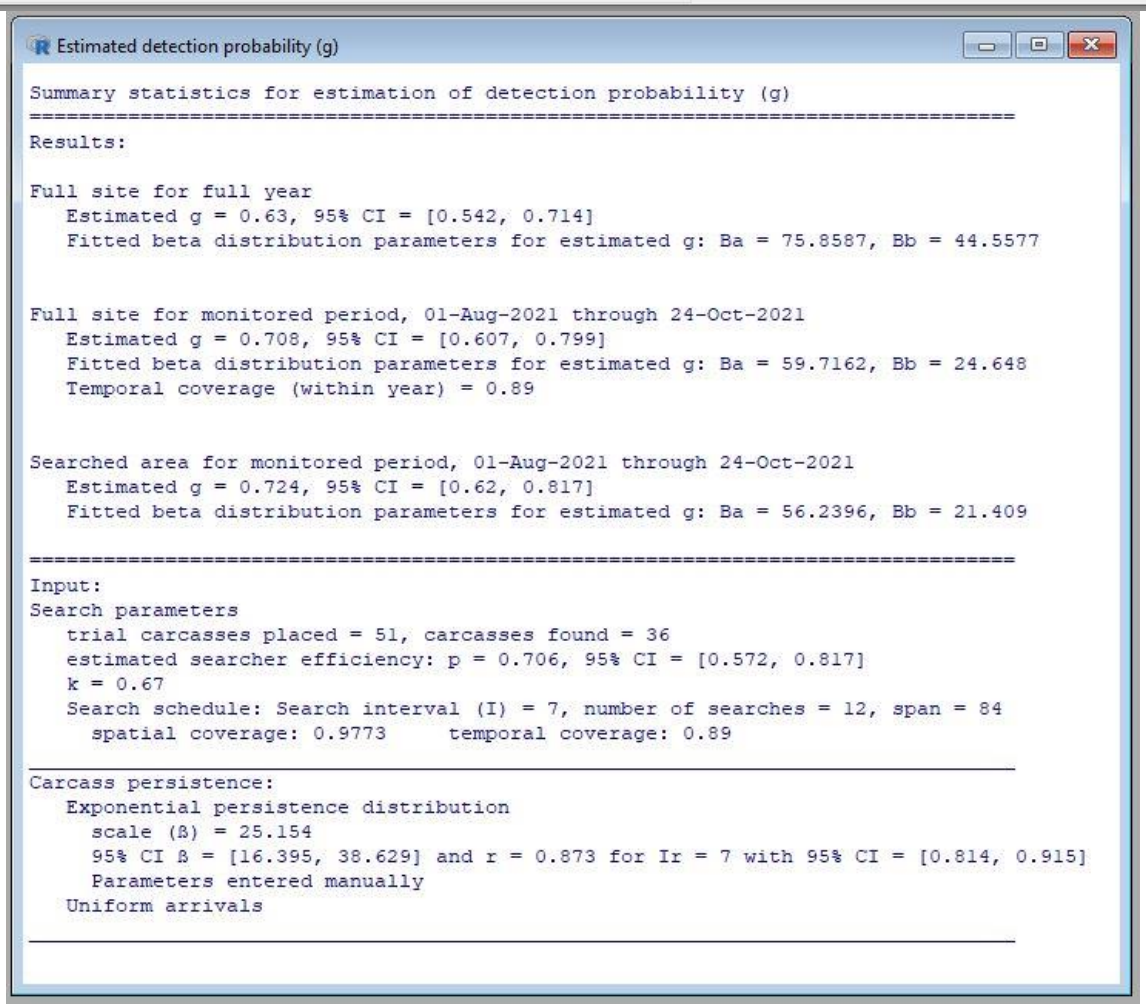
Appendix D7. Spring 2021, 100-meter road and pad searches at 18 turbines with a blade length of 55 meters, searched at a 14-day interval.



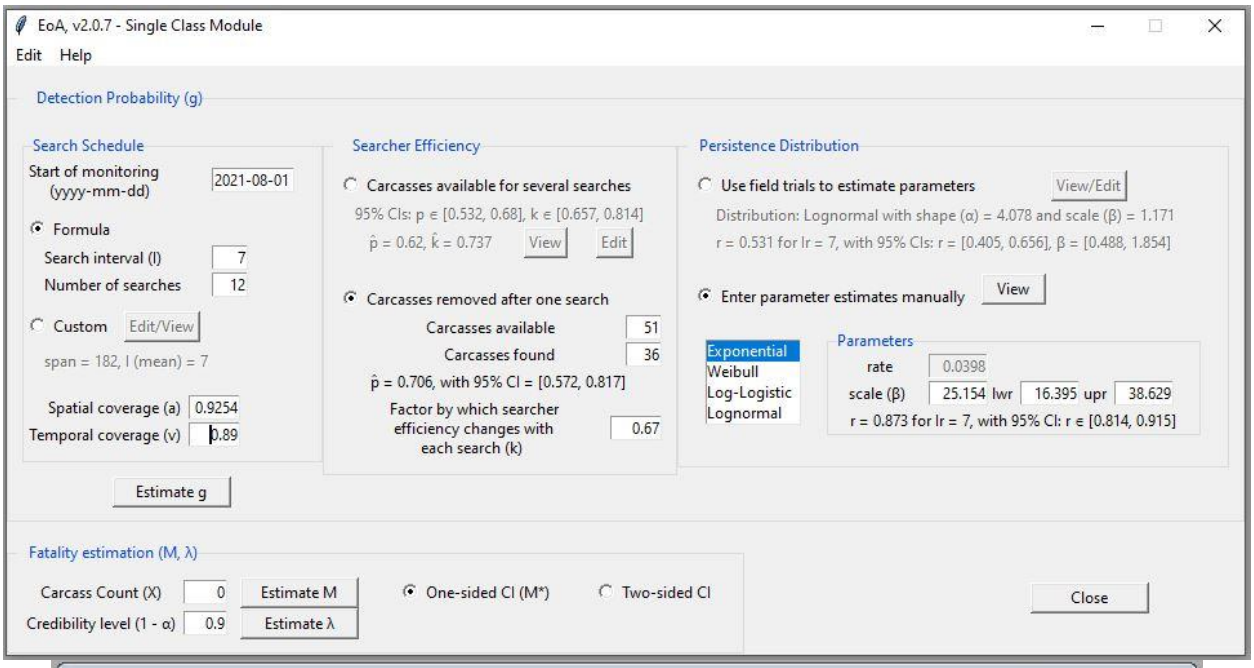


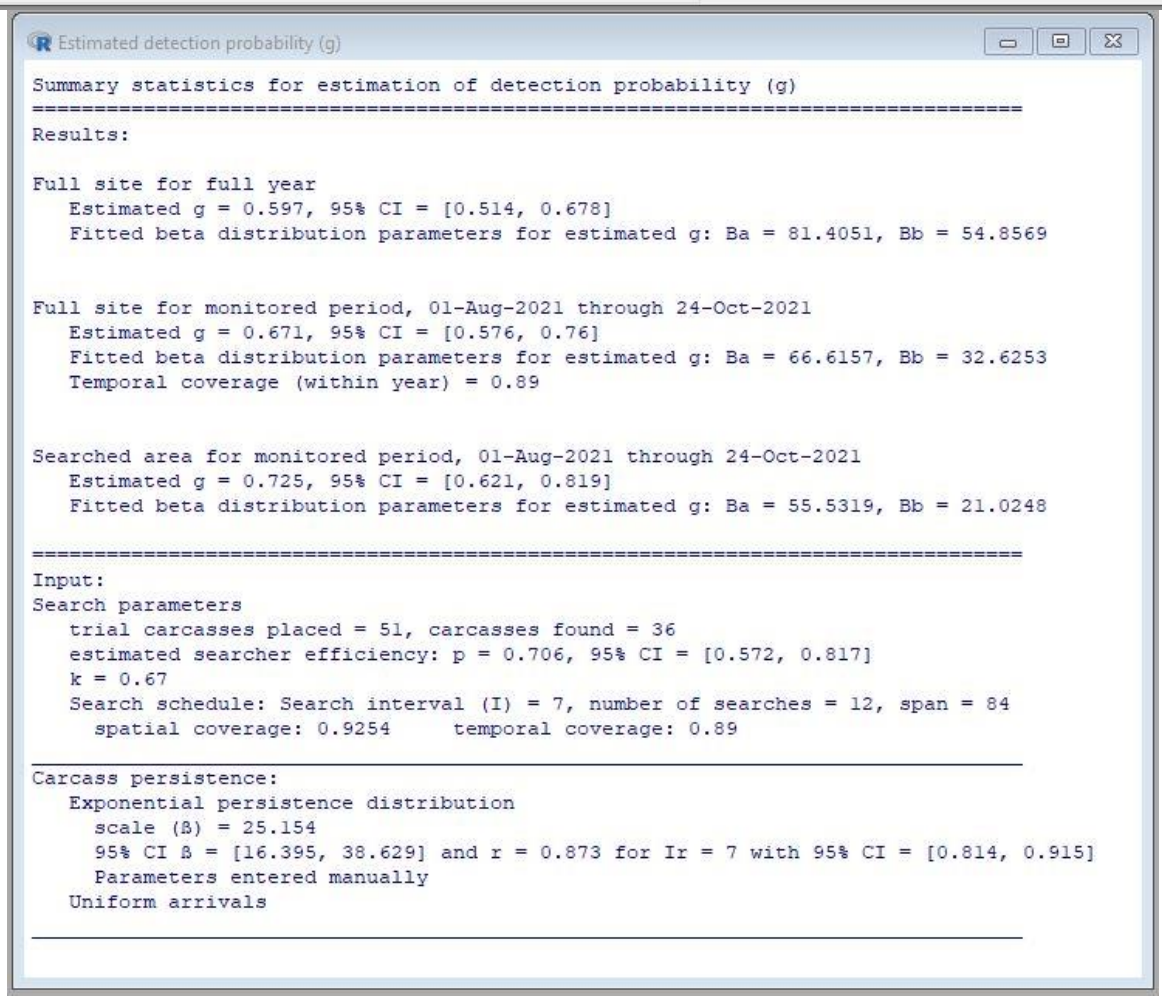
Appendix D8. Spring 2021, 100-meter road and pad searches at 13 turbines with a blade length of 68 meters, searched at a 14-day interval.



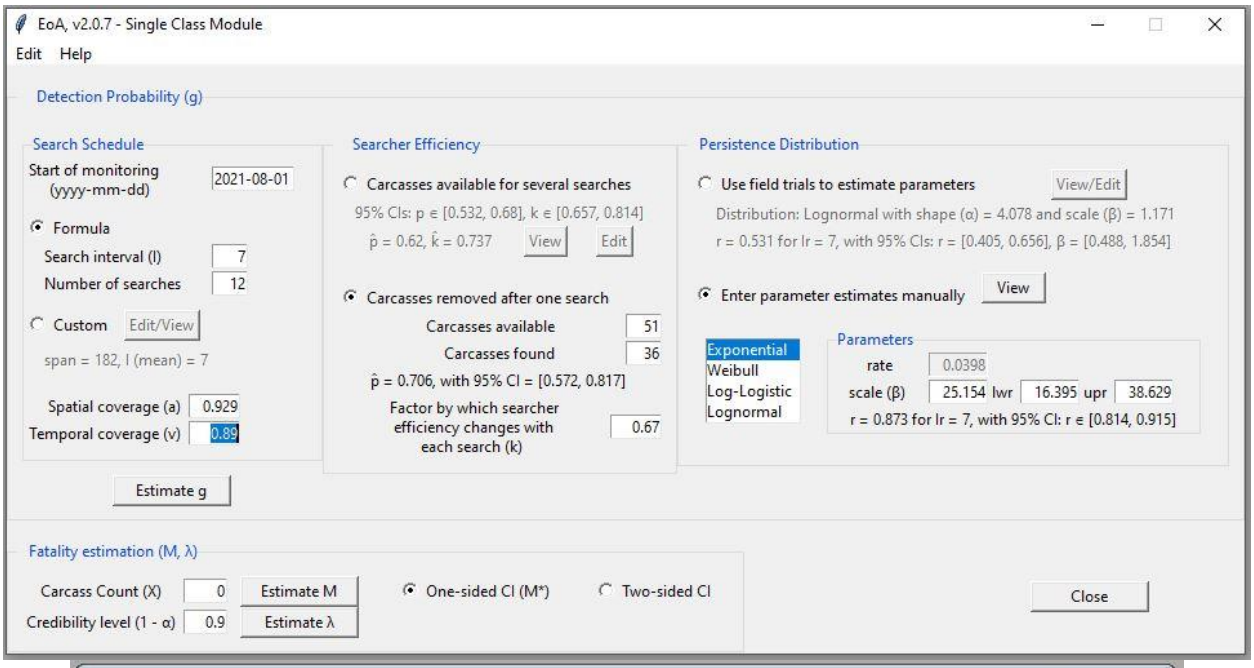


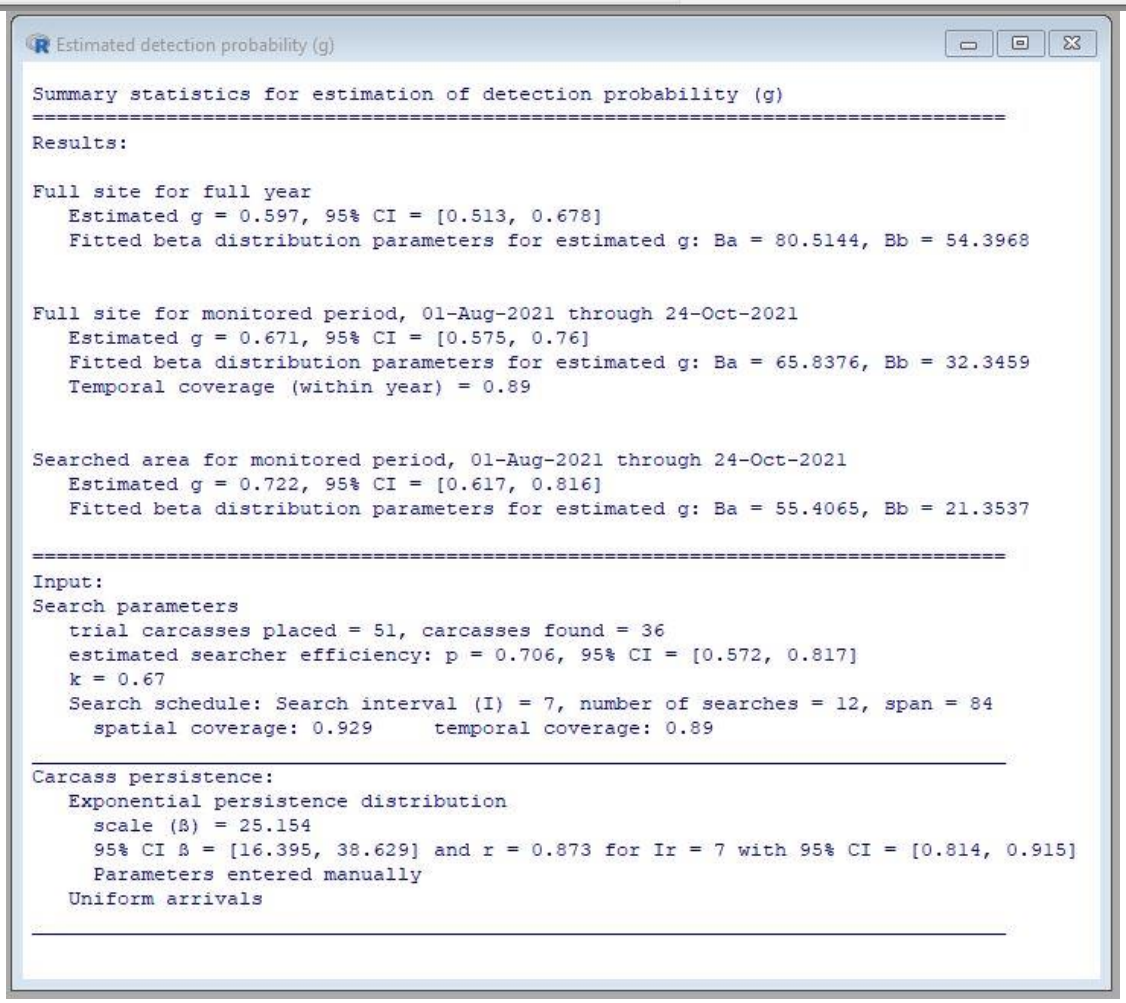
Appendix D9. Fall 2021, 70-meter cleared plot searches at five turbines with a blade length of 38.5 meters, searched at a 7-day interval.



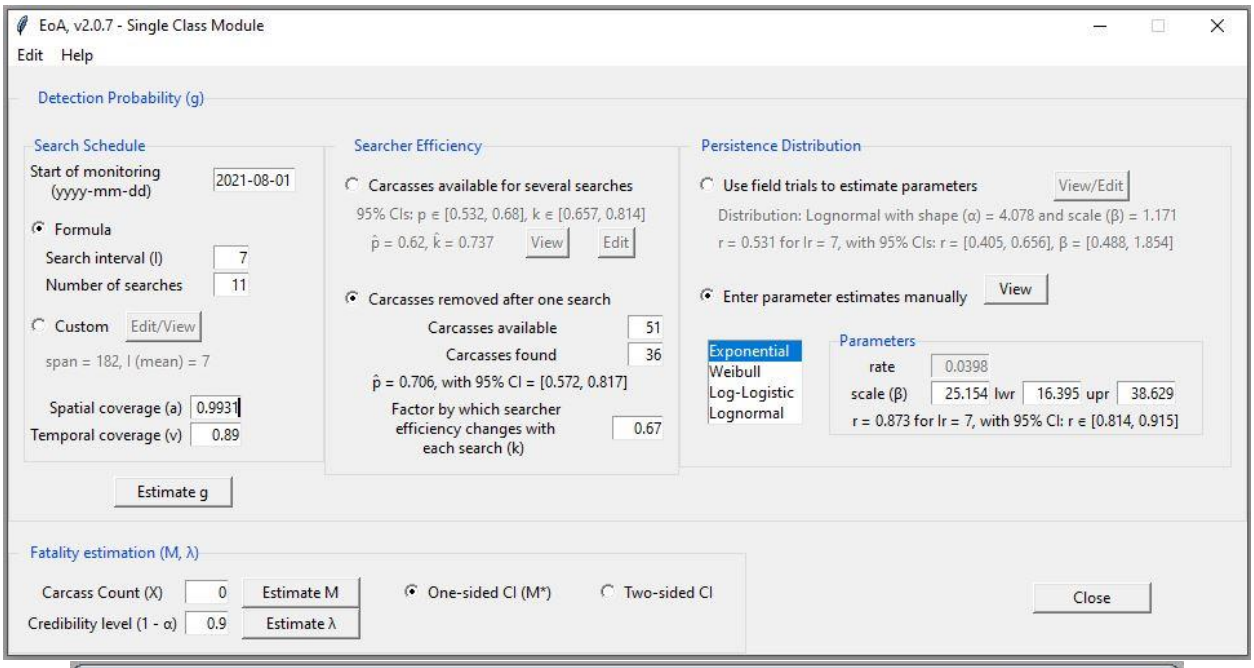


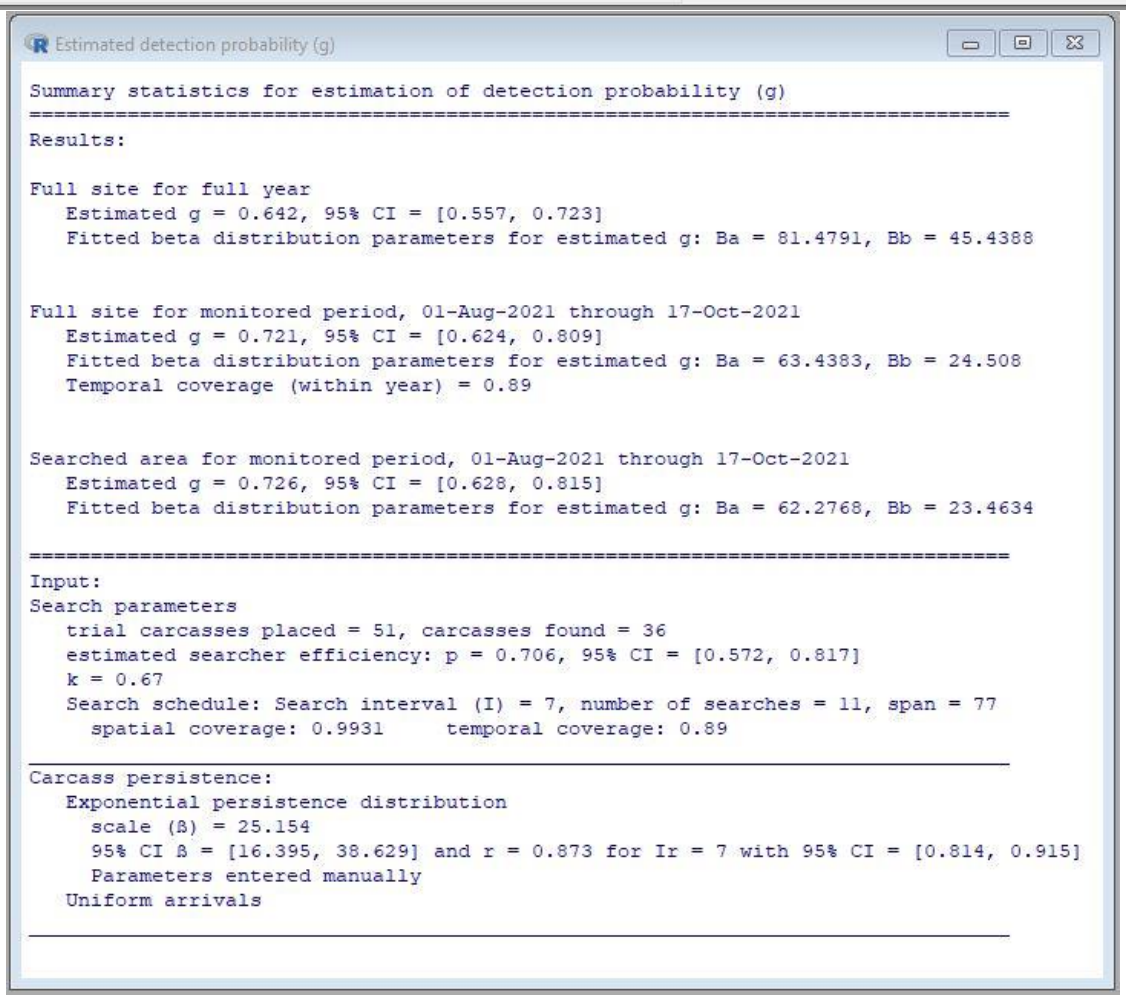
Appendix D10. Fall 2021, 70-meter cleared plot searches at 13 turbines with a blade length of 41–44 meters, searched at a 7-day interval.



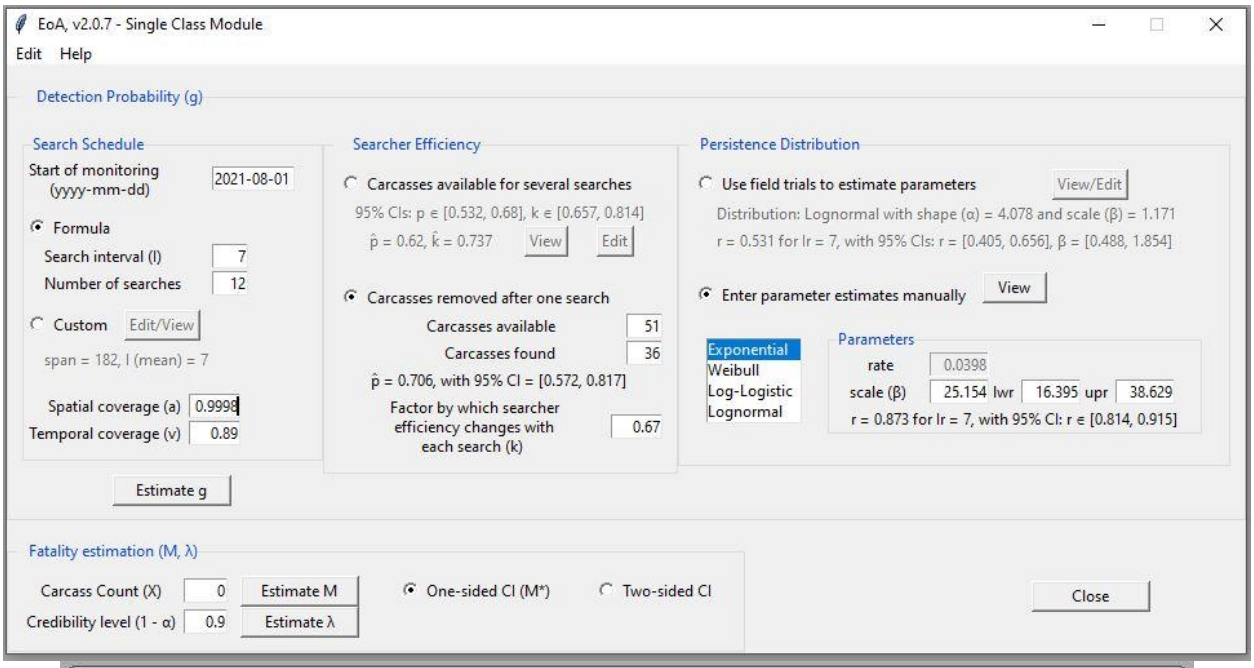


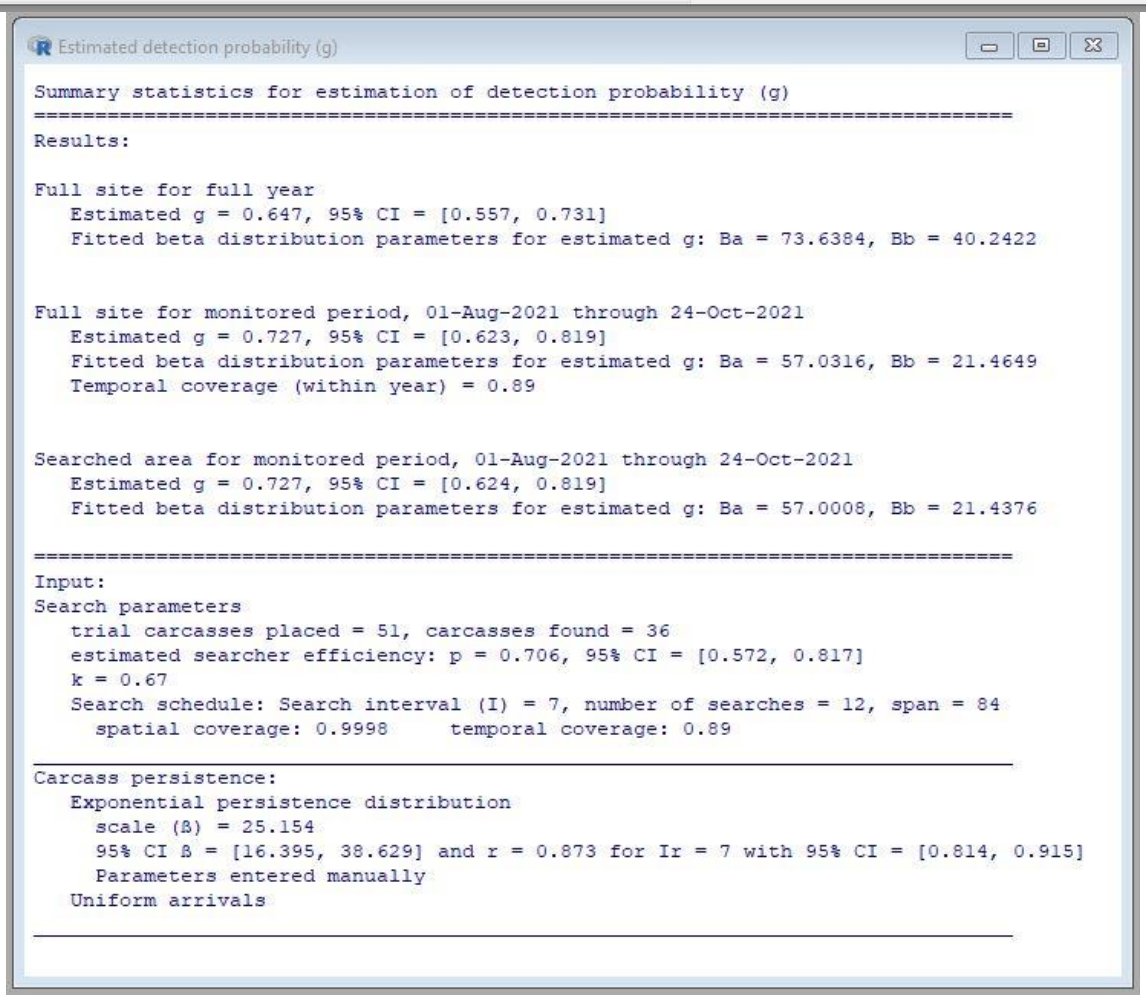
Appendix D11. Fall 2021, 70-meter cleared plot searches at five turbines with a blade length of 55 meters, searched at a 7-day interval.



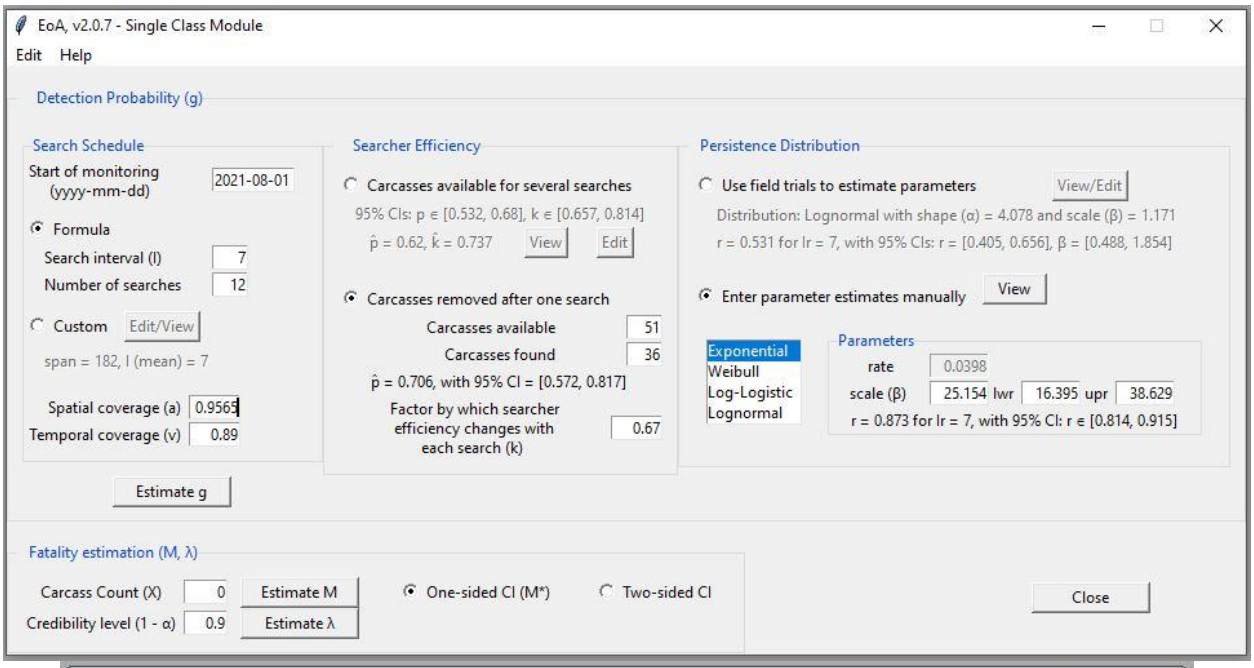


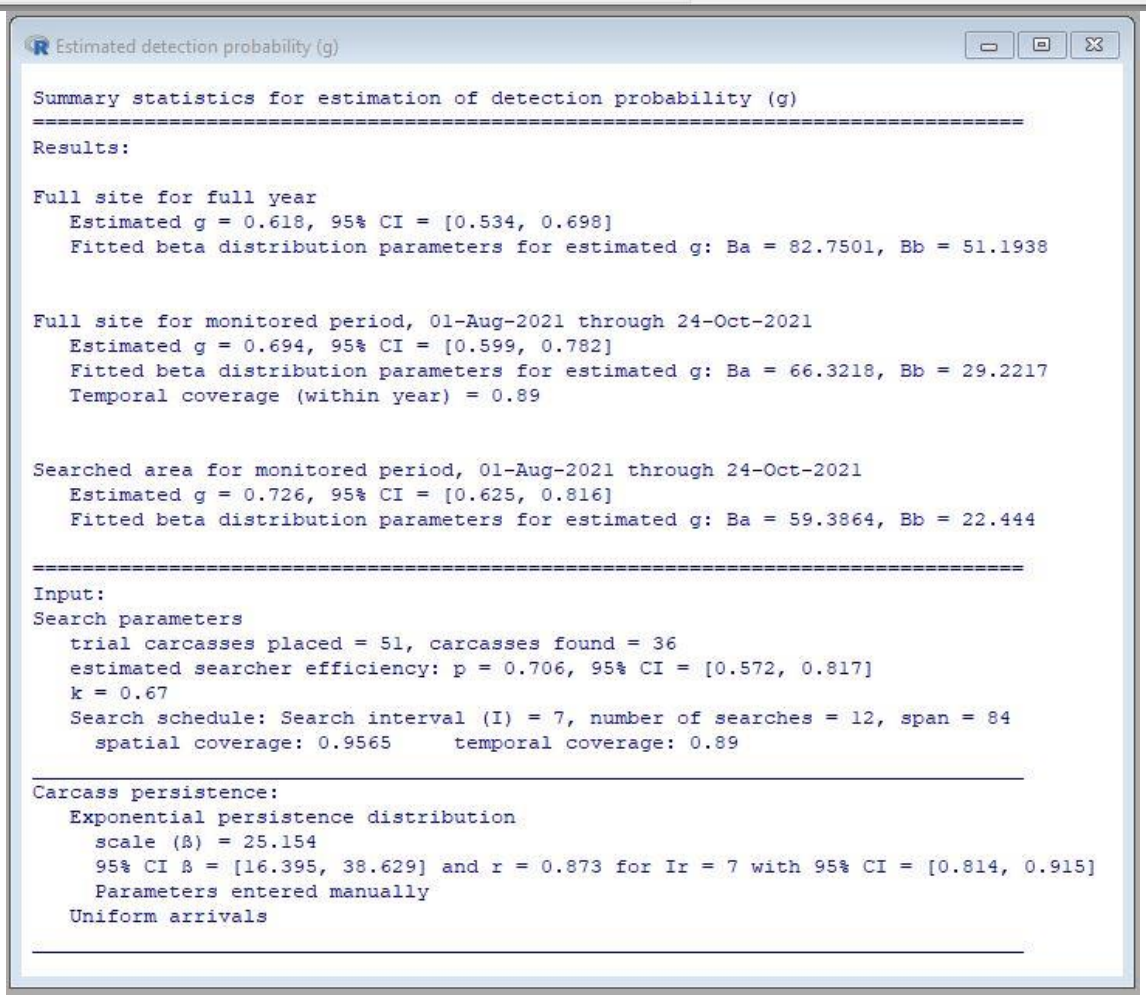
Appendix D12. Fall 2021, 70-meter cleared plot searches at five turbines with a blade length of 68 meters, searched at a 7-day interval.



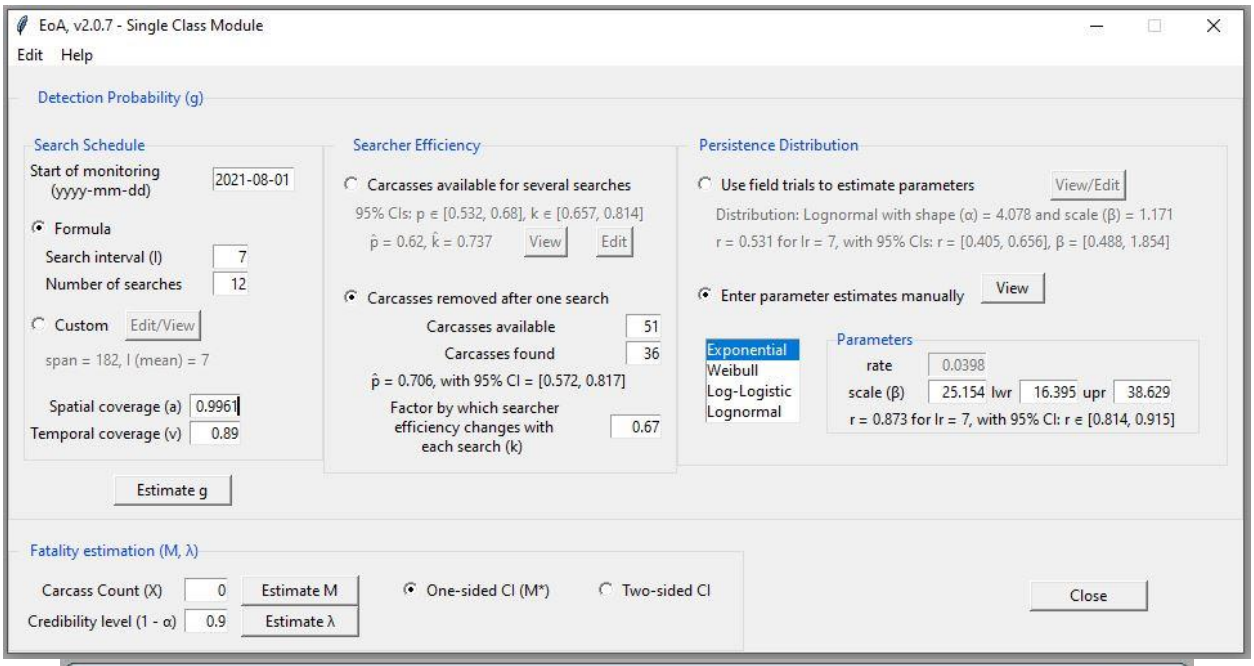


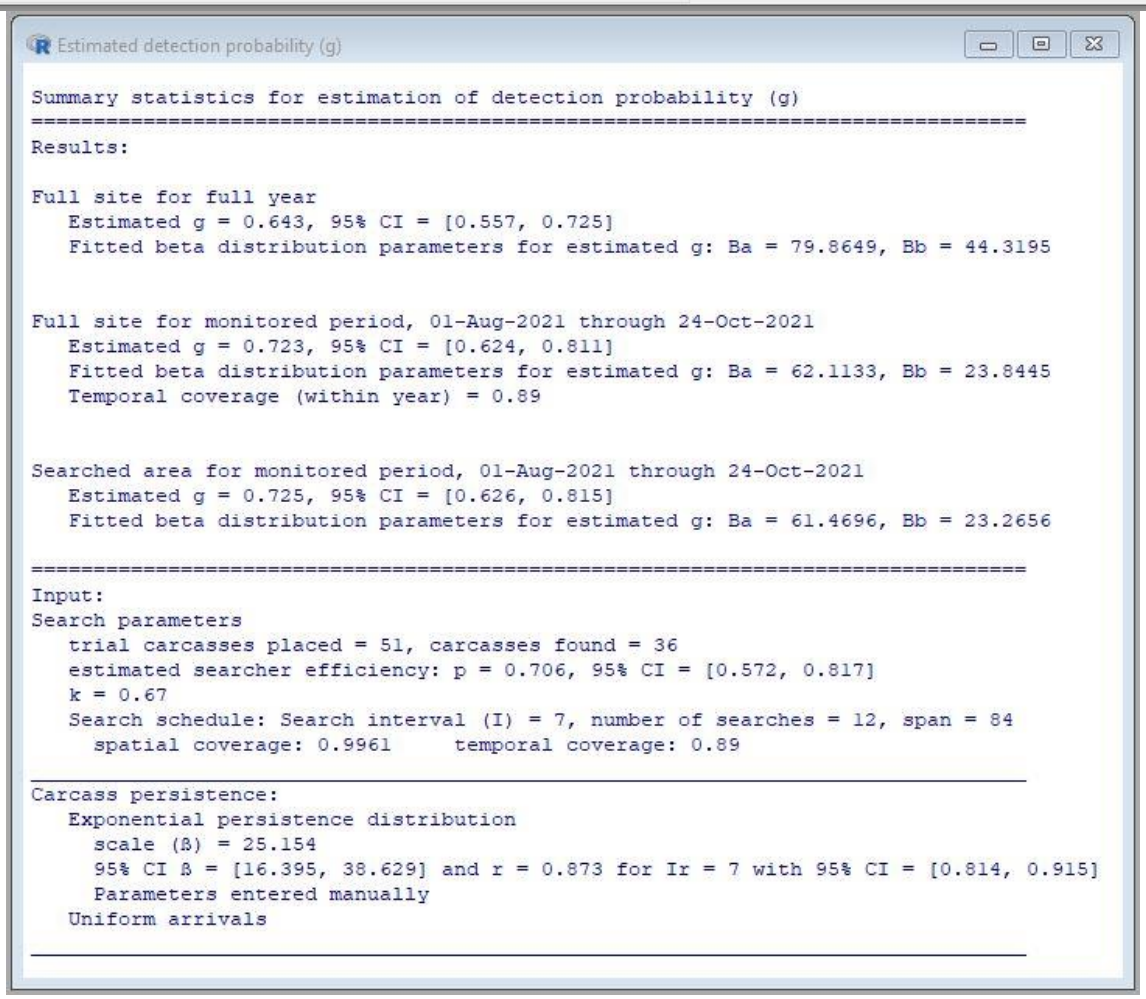
Appendix D13. Fall 2021, 70-meter uncleared plot searches at six turbines with a blade length of 38.5 meters, searched at a 7-day interval.



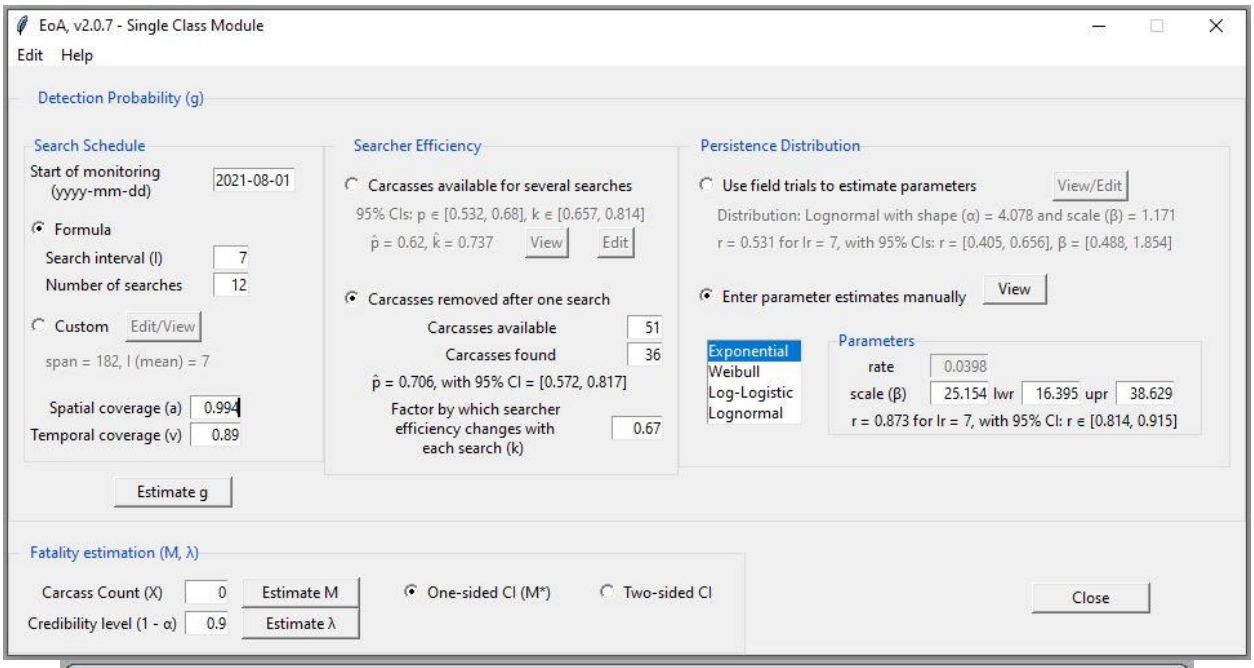


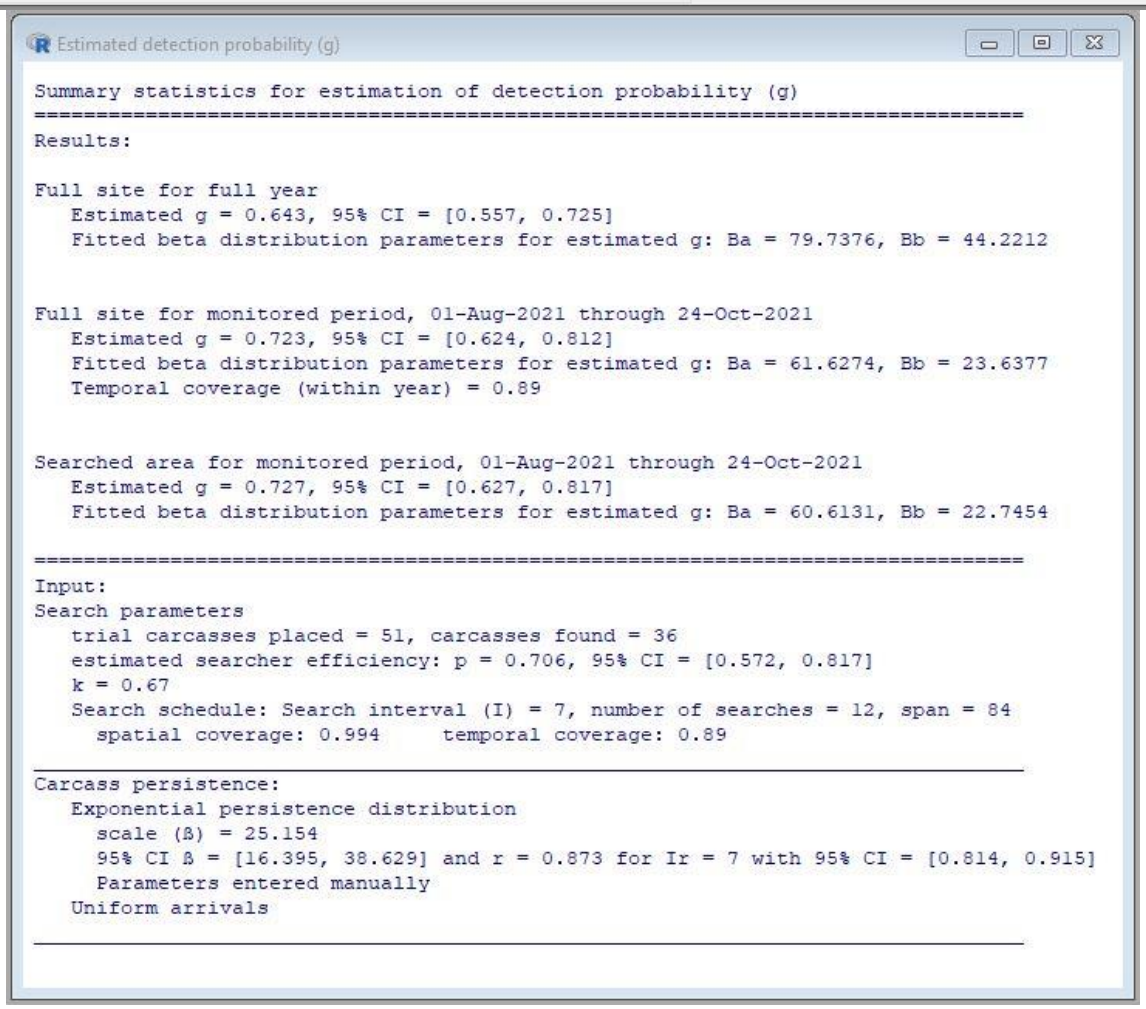
Appendix D14. Fall 2021, 70-meter uncleared plot searches at 13 turbines with a blade length of 41–44 meters, searched at a 7-day interval.



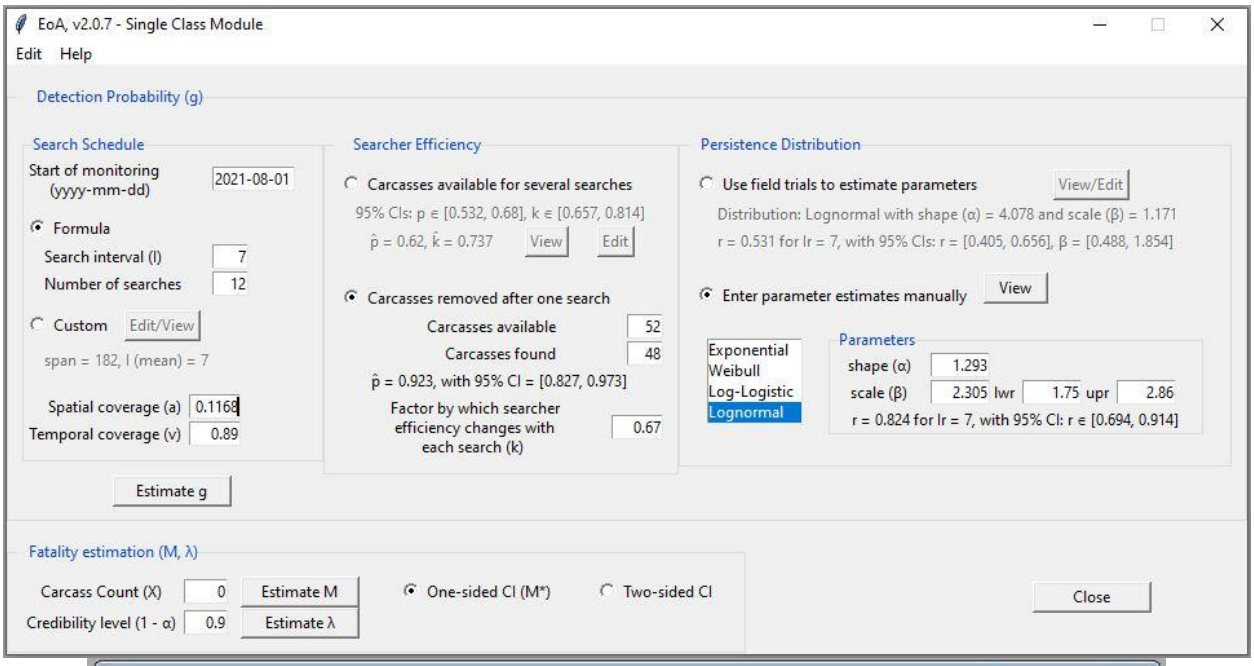


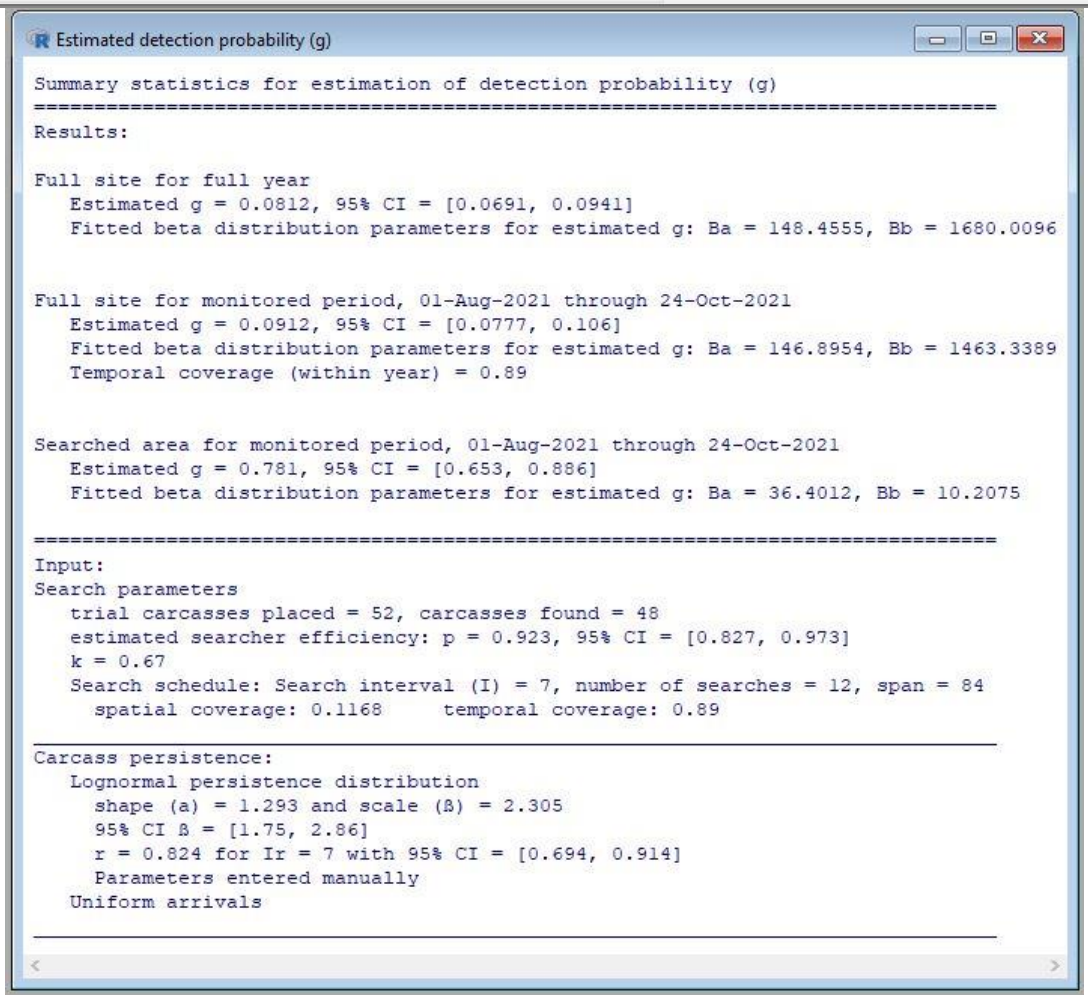
Appendix D15. Fall 2021, 70-meter uncleared plot searches at seven turbines with a blade length of 55 meters, searched at a 7-day interval.



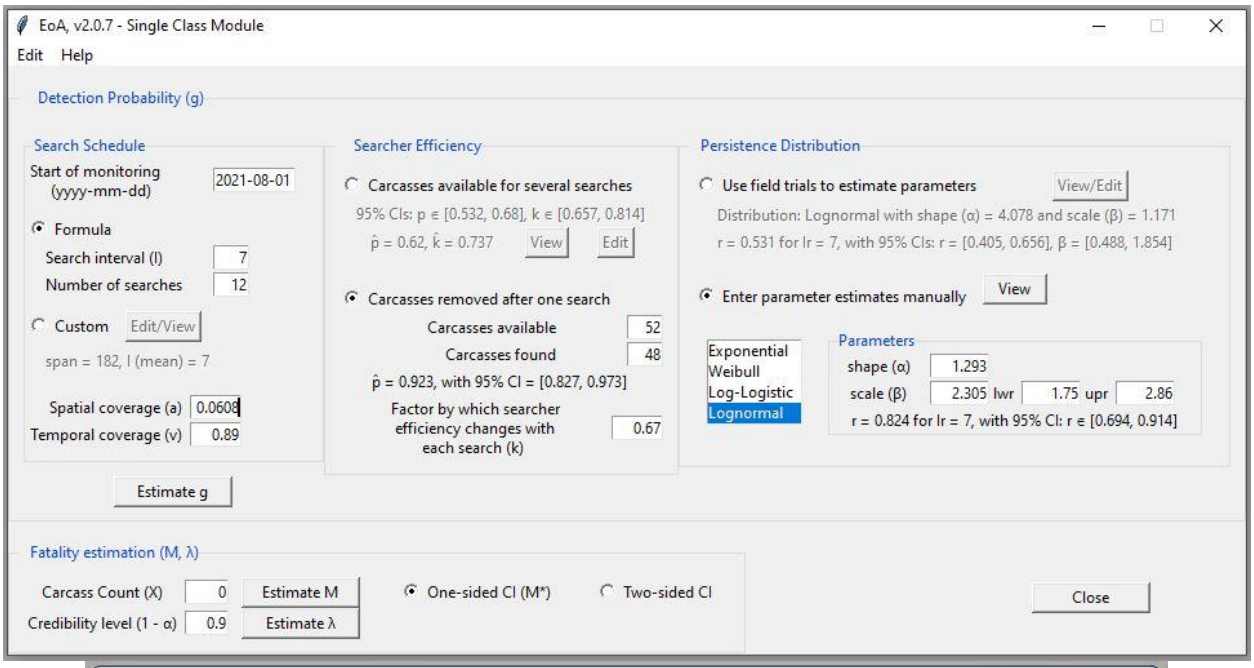


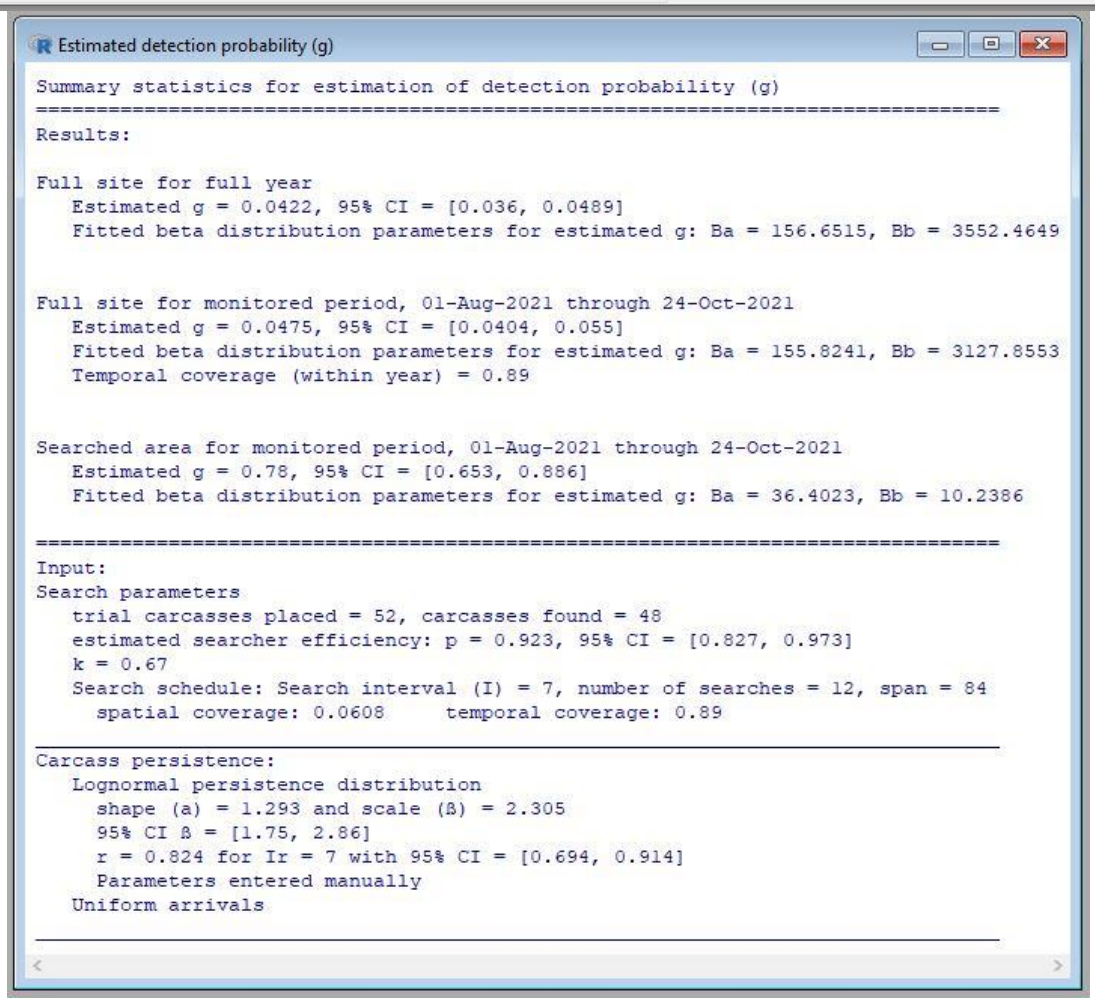
Appendix D16. Fall 2021, 70-meter uncleared plot searches at three turbines with a blade length of 68 meters, searched at a 7-day interval.



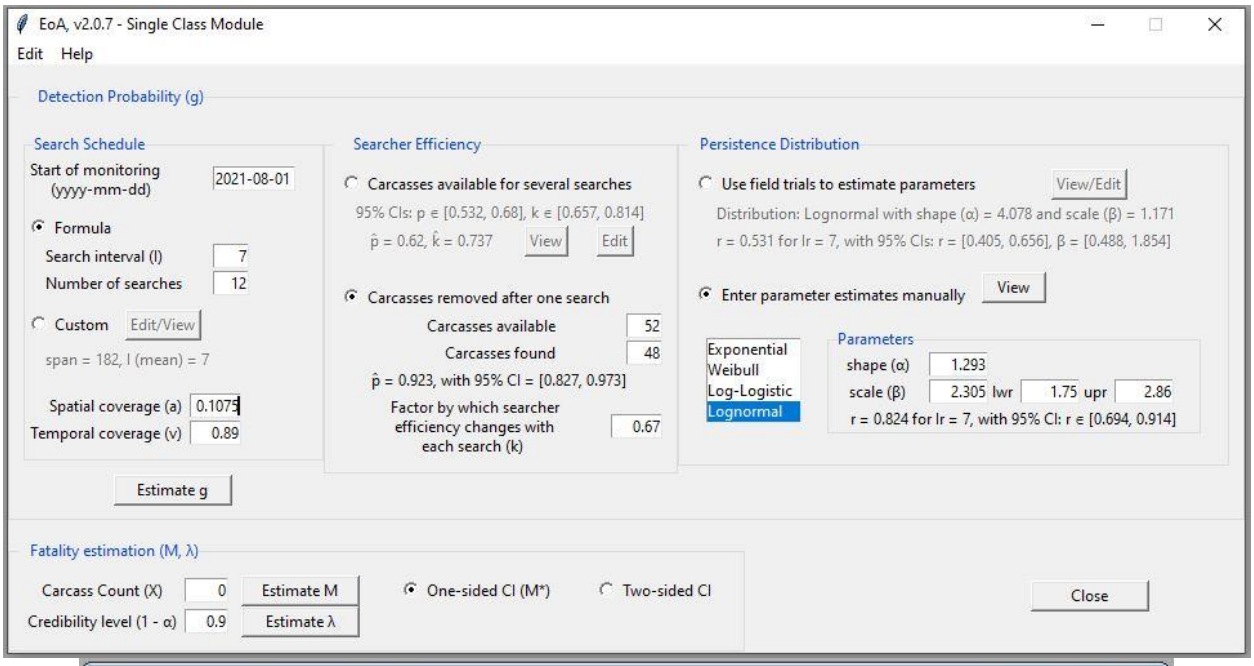


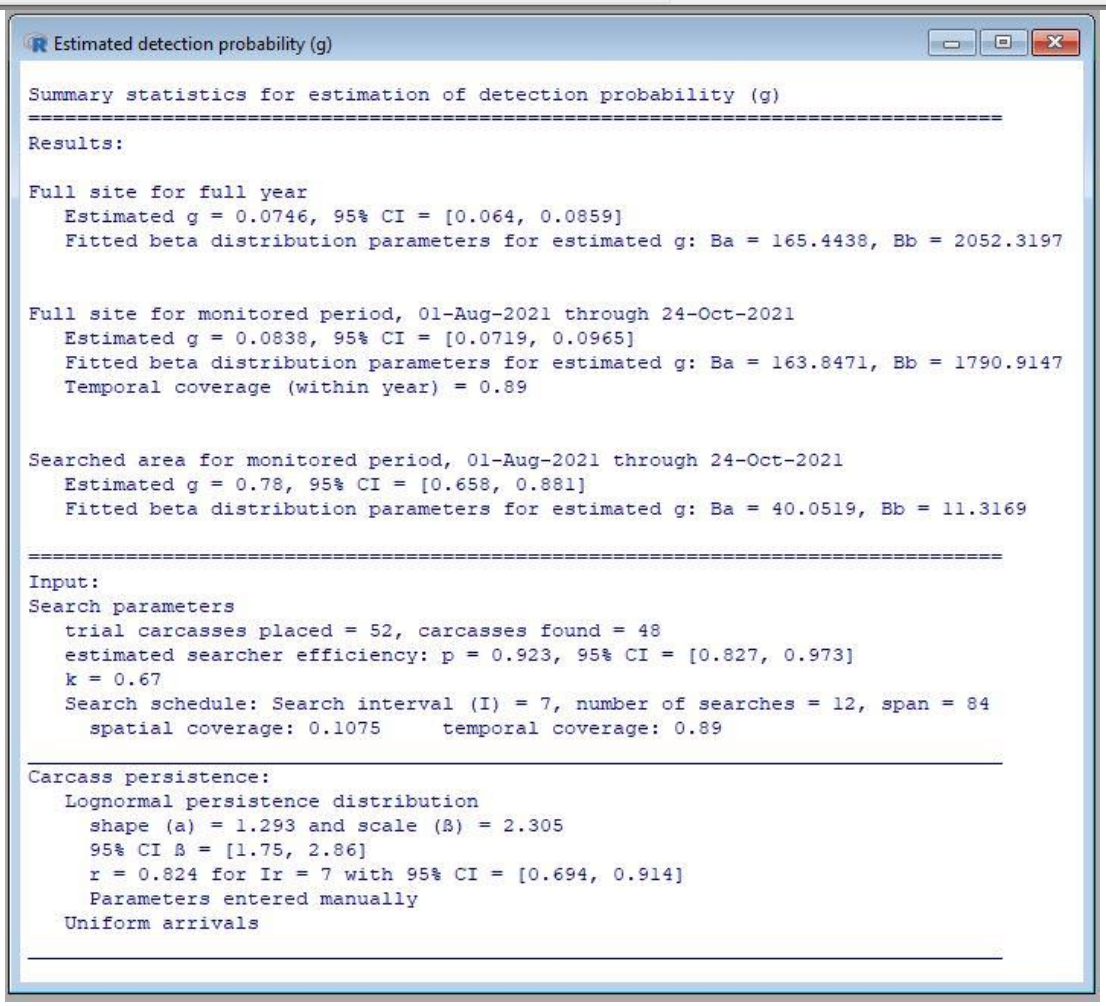
Appendix D17. Fall 2021, 100-meter road and pad searches at five turbines with a blade length of 38.5 meters, searched at a 7-day interval.



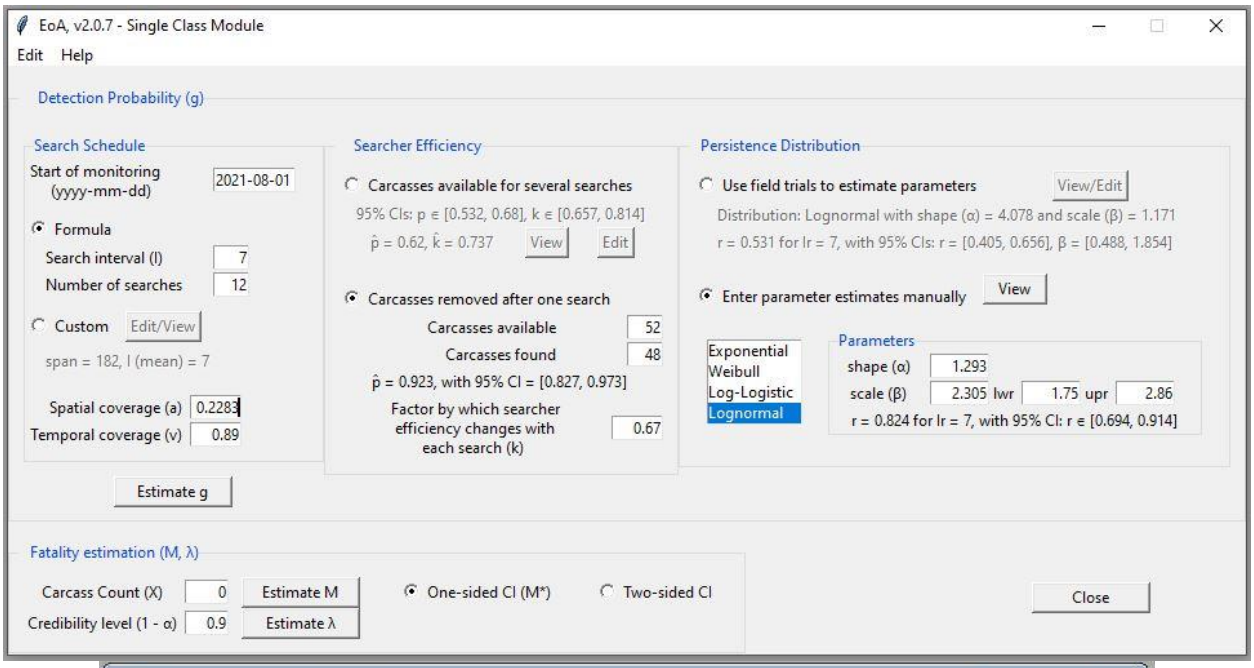


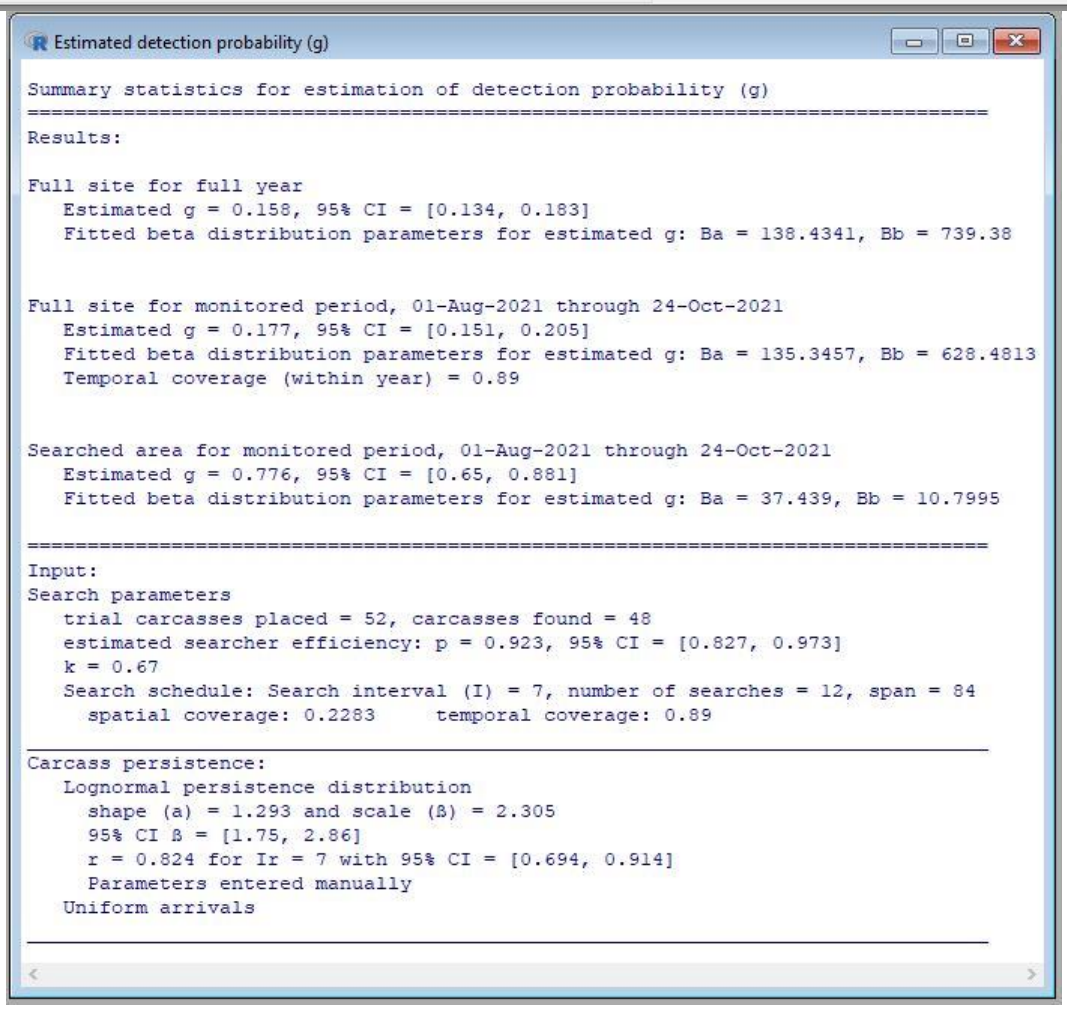
Appendix D18. Fall 2021, 100-meter road and pad searches at 40 turbines with a blade length of 41–44 meters, searched at a 7-day interval.



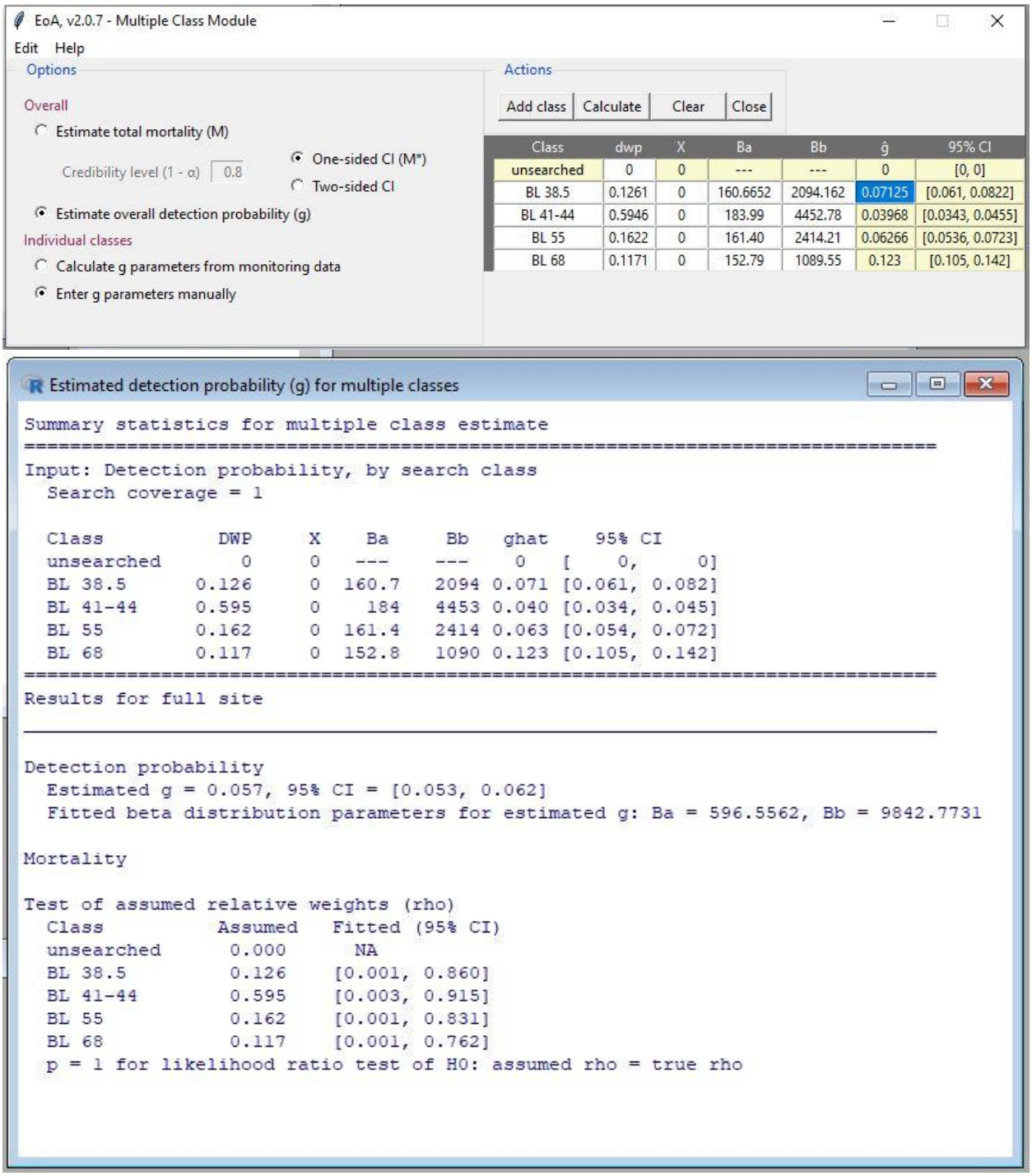


Appendix D19. Fall 2021, 100-meter road and pad searches at seven turbines with a blade length of 55 meters, searched at a 7-day interval.

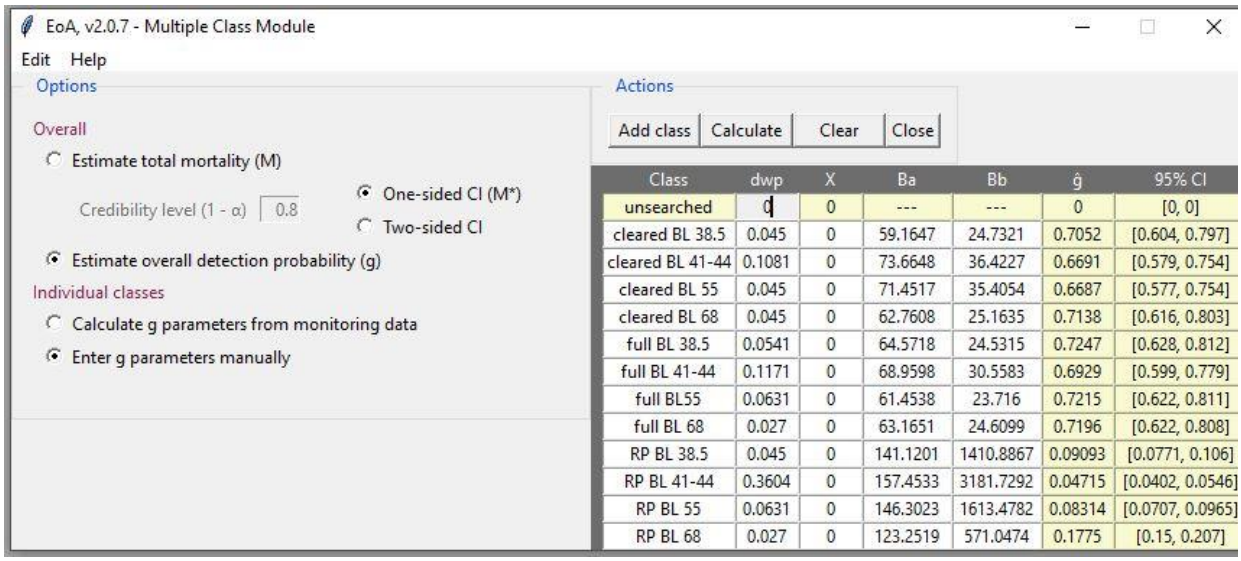




Appendix D20. Fall 2021, 100-meter road and pad searches at three turbines with a blade length of 68 meters, searched at a 7-day interval.

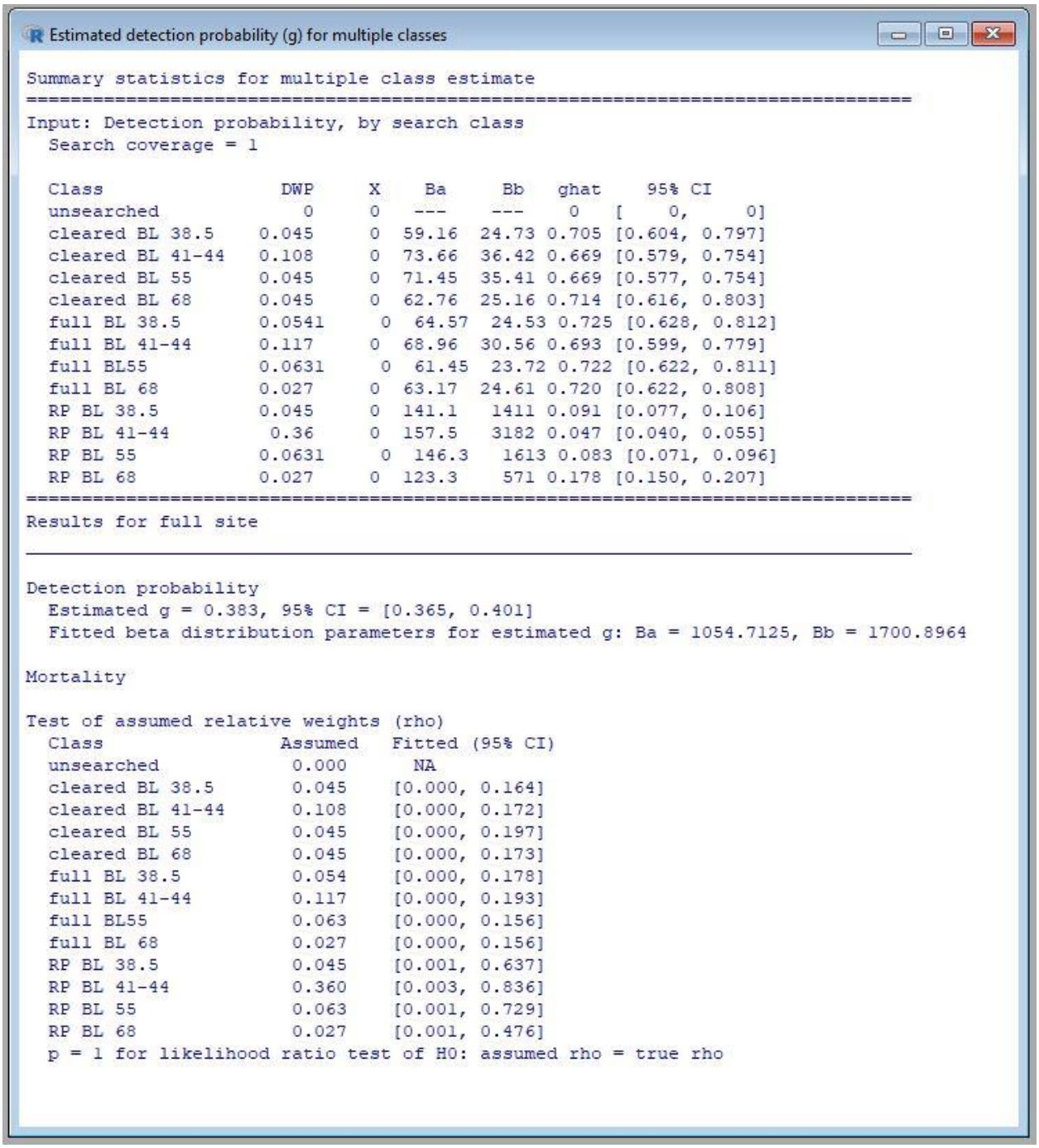


Appendix D21. Spring 2021, searches at 111 turbines, searched at a 14-day interval.

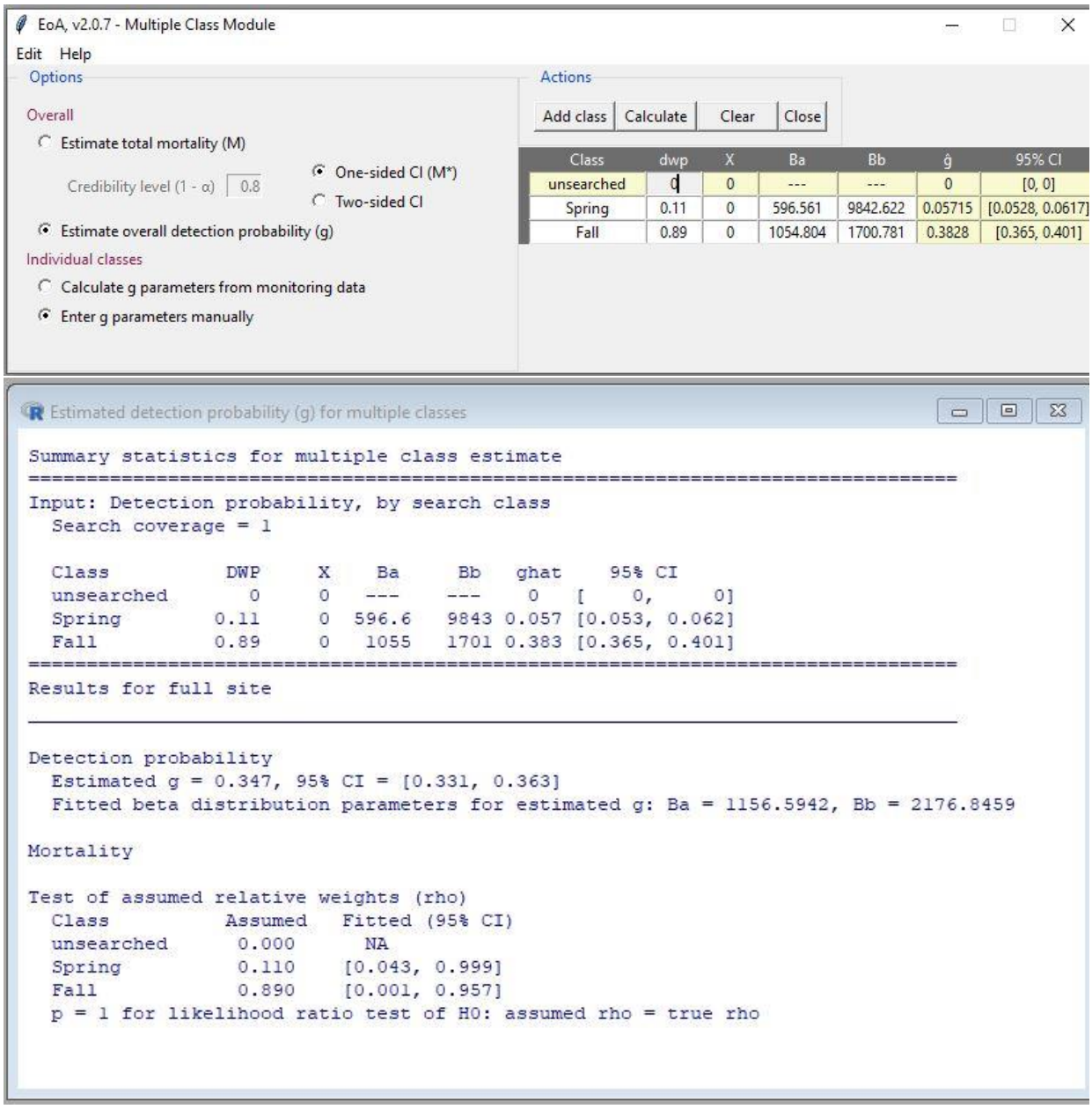


Class	dwp	X	Ba	Bb	ĝ	95% CI
unsearched	0	0	---	---	0	[0, 0]
cleared BL 38.5	0.045	0	59.1647	24.7321	0.7052	[0.604, 0.797]
cleared BL 41-44	0.1081	0	73.6648	36.4227	0.6691	[0.579, 0.754]
cleared BL 55	0.045	0	71.4517	35.4054	0.6687	[0.577, 0.754]
cleared BL 68	0.045	0	62.7608	25.1635	0.7138	[0.616, 0.803]
full BL 38.5	0.0541	0	64.5718	24.5315	0.7247	[0.628, 0.812]
full BL 41-44	0.1171	0	68.9598	30.5583	0.6929	[0.599, 0.779]
full BL55	0.0631	0	61.4538	23.716	0.7215	[0.622, 0.811]
full BL 68	0.027	0	63.1651	24.6099	0.7196	[0.622, 0.808]
RP BL 38.5	0.045	0	141.1201	1410.8867	0.09093	[0.0771, 0.106]
RP BL 41-44	0.3604	0	157.4533	3181.7292	0.04715	[0.0402, 0.0546]
RP BL 55	0.0631	0	146.3023	1613.4782	0.08314	[0.0707, 0.0965]
RP BL 68	0.027	0	123.2519	571.0474	0.1775	[0.15, 0.207]

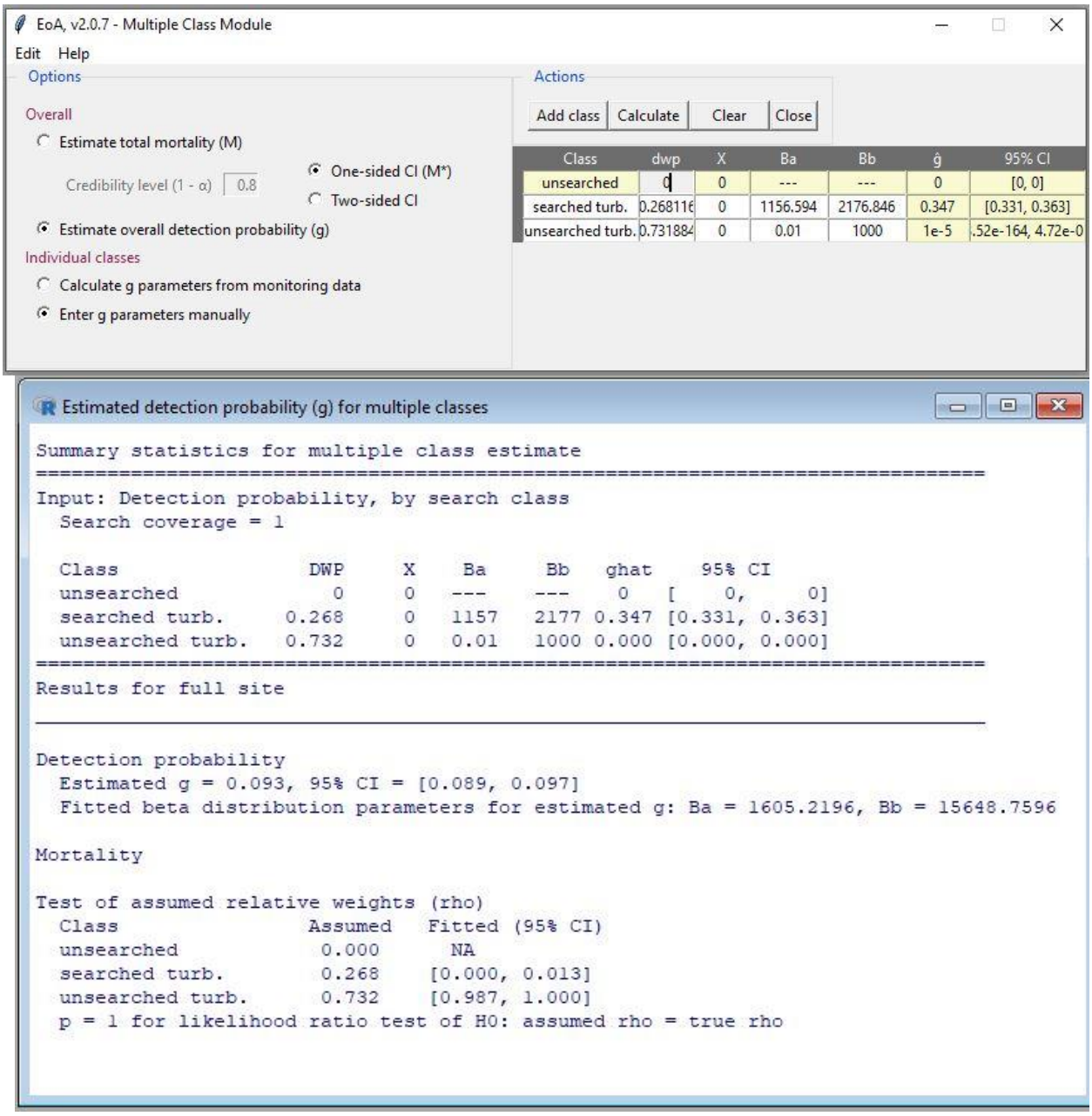
Appendix D22. Fall 2021, searches at 112 turbines, searched at a 7-day interval. Inputs.



Appendix D23. Fall 2021, searches at 112 turbines, searched at a 7-day interval. Output.



Appendix D24. Spring and Fall 2021, (n= 111 in spring, 112 in fall), searched at a 14-day interval in the spring and a 7-day interval in the fall.



Appendix D25. Searched and unsearched turbines 2021, searches at 112 of 414 turbines, searched at a 14-day interval in the spring and a 7-day interval in the fall.