2021 Annual Post-Construction Bat Mortality Monitoring Report

High Prairie Renewable Energy Center

Schuyler and Adair Counties, Missouri

Technical Assistance Letter (TAL) Level Monitoring (April 1 – May 14) and Incidental Take Permit (ITP) Level Monitoring (May 15 – October 31)

Project #193708256

Stantec

Prepared for:
Ameren Missouri
1901 Chouteau Avenue, PO Box 66149, MC 602
St. Louis, MO 63166-6149

Prepared by:
Stantec Consulting Services Inc.
2300 Swan Lake Boulevard, Suite 202
Independence, Iowa 50644

December 15, 2021

Table of Contents

LIST OF TABLES

LIST OF FIGURES

1.0 Introduction

1.1 PROJECT DESCRIPTION AND HISTORY

Ameren Missouri's (Ameren) High Prairie Renewable Energy Center (Project or High Prairie) consists of 175 turbines with an approximate 400-megawatt (MW) operating capacity in Schuyler and Adair Counties, Missouri.

Due to the potential risk of take of the federally-endangered Indiana bat (*Myotis sodalis*) and federally-threatened northern long-eared bat (*Myotis septentrionalis*) during operations, Ameren applied for and received an Incidental Take Permit (ITP) for these species, as well as for the little brown bat (*Myotis lucifugus*).

1.1.1 Spring (April 1 – May 14, 2021)

During the spring period (April 1 – May 14), the Project operated under a Technical Assistance Letter (TAL) from the U.S. Fish and Wildlife Service (USFWS). To avoid potential effects to the Indiana bat and northern long-eared bat, the TAL required feathering of all turbines below 6.9 meters-per-second (m/s) for 0.5 hour before sunset to 0.5 hour after sunrise when air temperatures were above 50°F from March 15 through October 31 based on the 10-minute rolling average at each individual turbine. Ameren voluntarily increased the avoidance measures when temperatures were above 50°F starting on March 15, 2021, and stopped all night time operations regardless of temperature on April 19, 2021. Post-construction monitoring continued under the TAL until the ITP was issued on May 14, 2021.

1.1.2 Summer (May 15 – August 14, 2021) and Fall (August 15 – October 31, 2021)

On May 14, 2021, USFWS issued an ITP for the Indiana bat, northern long-eared bat, and the little brown bat. The ITP covers operations of the wind project, following issuance of the permit, and the Project began operating at a 5.0 meters-per-second (m/s) cut-in speed, in accordance with the HCP and ITP permit conditions.

During the monitoring period, the turbines operated under a variety of cut-in speeds, summarized in Table 1-1 below.

Table 1-1. Summary of operational protocols (from 45 minutes before sunset to 45 minutes after sunrise) from April 1 through October 31, 2021, at the High Prairie Renewable Energy Center, Schuyler and Adair Counties, Missouri.

Date(s)	Number of Nights	Number of Turbines	Cut-in speed
April 1 – April 18	18	175	No operations above 50°F
April 19 – May 13	25	175	No operations

Date(s)	Number of Nights	Number of Turbines	Cut-in speed
May 14 – June 2	20	175	5.0 m/s
June 3 – June 8	6	175	6.0 m/s
June 9 – June 13	5	175	7.0 m/s
June 14	1	175	No operations
June 15 – June 20	6	84	7.0 m/s
		91	No operations
June 21 – October 31	133	175	No operations

1.2 PURPOSE AND OBJECTIVES OF THE MONITORING

Post-construction mortality monitoring activities in the spring (April 1 – May 14) adhered to the requirements outlined in the Project's TAL, specifically to document overall bat fatality rates and confirm avoidance of Indiana bat and northern long-eared bat fatalities. During the summer and fall (May 15 – October 31), post-construction mortality monitoring activities adhered to the requirements outlined in the Project's HCP, specifically to evaluate the effectiveness of the minimization measures and ensure that take of the covered species remains within the take limits set forth in the ITP.

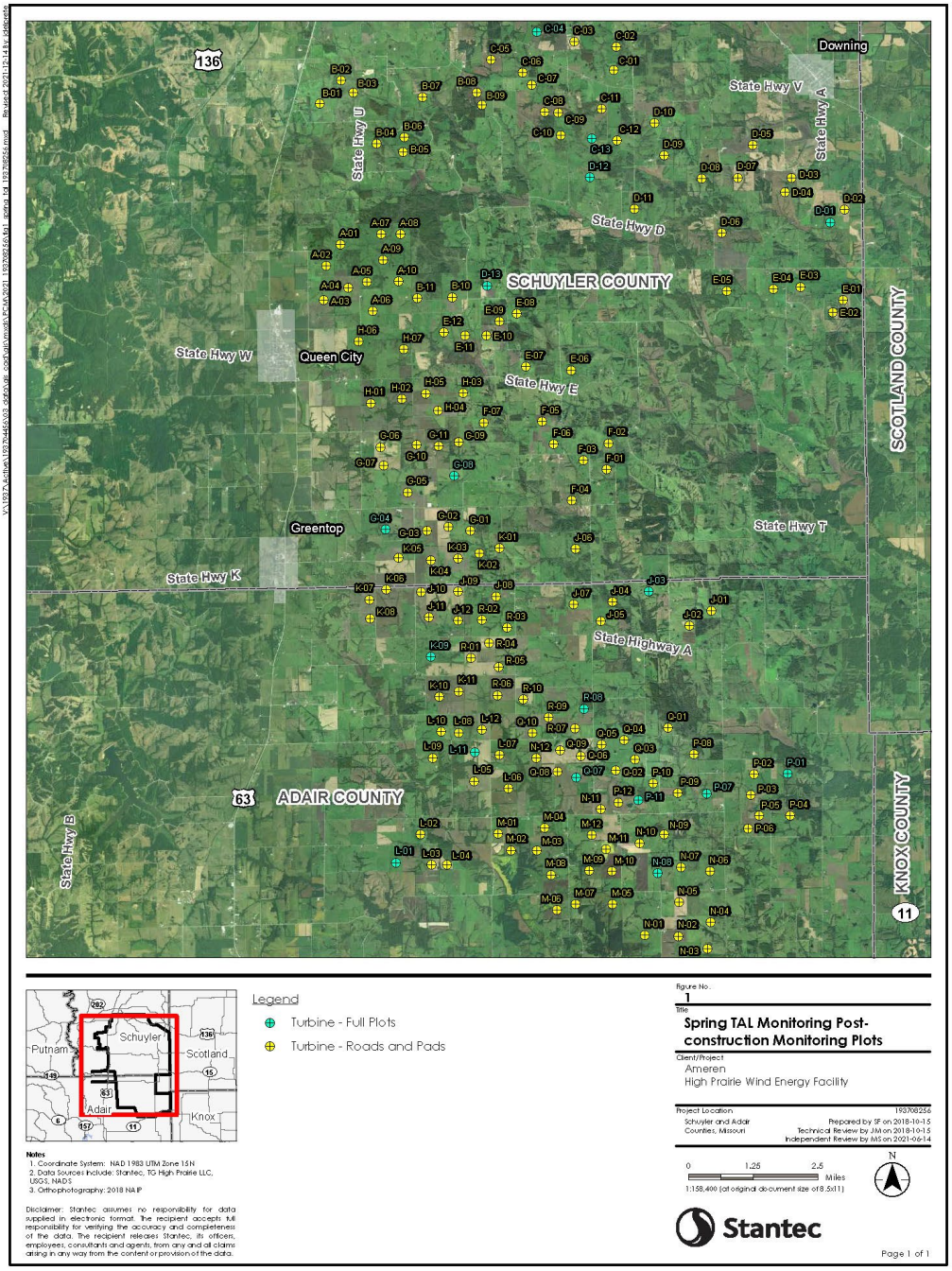


Figure 1. Spring TAL Monitoring Post-construction Monitoring Plots

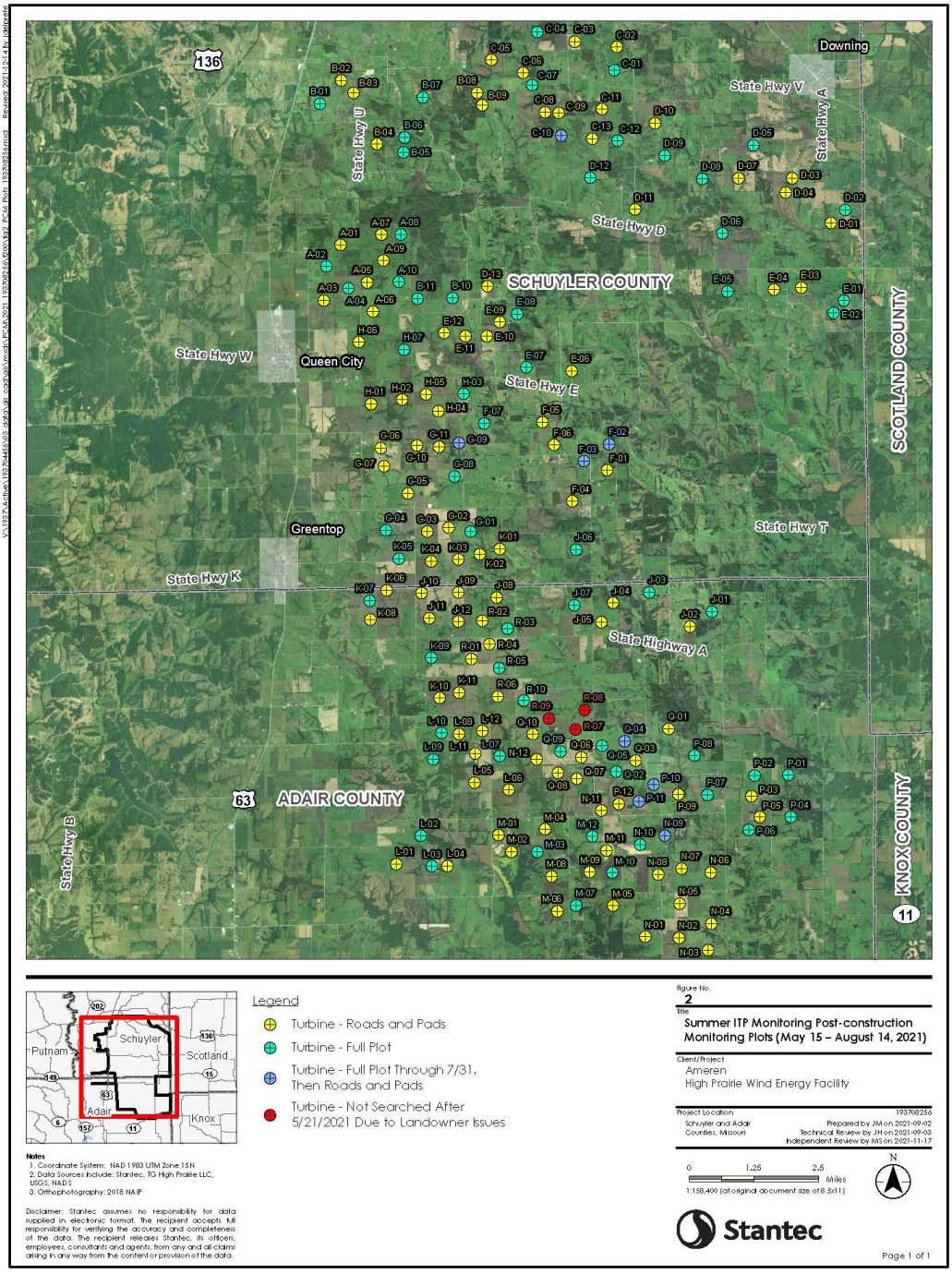


Figure 2. Summer ITP Monitoring Post-construction Monitoring Plots

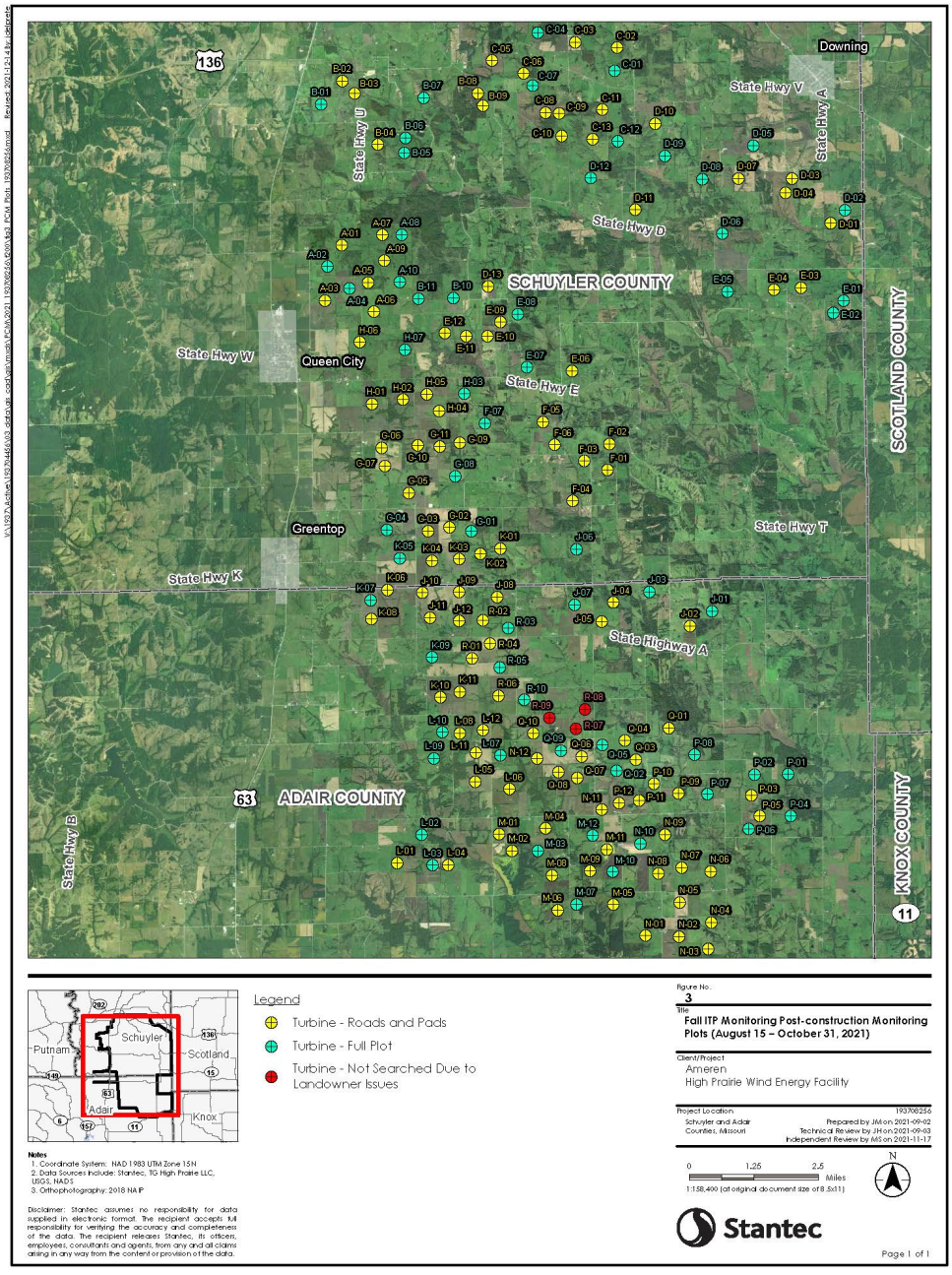


Figure 3. Fall ITP Monitoring Post-construction Monitoring Plots

2.0 Methods

Post-construction monitoring included the following components:

1. Standardized carcass searches to systematically search plots at all turbines for bat casualties attributable to the turbines
2. Searcher efficiency trials to estimate the percentage of bat casualties that were found by the searcher(s)
3. Carcass removal trials to estimate the persistence time of carcasses on-site before scavengers removed them

2.1 FIELD METHODS

2.1.1 Standardized Carcass Searches

Post-construction monitoring was conducted at 100% of the turbines between April 1 and October 31, 2021[1]. Standardized carcass searches consisted of searching the turbine pads and the roads out to 312 feet (ft; 95 meters [m]) and full plots out to 197 ft (60 m), though the proportion of roads and pads to full plots varied by season (Table 2-1). The search interval also varied by season, with a weekly search interval required under TAL-level monitoring in the spring and a twice weekly search interval required under the HCP-level monitoring during the summer and fall (Table 2-1). Three turbines were not searched after May 21, 2021, due to a lack of site access (Figure 2).

Table 2-1. Summary of post-construction monitoring protocols by season between April 1 and October 31, 2021, at the High Prairie Renewable Energy Center, Schuyler and Adair Counties, Missouri.

Season	Dates	Number of Full Plots	Number of Roads and Pads	Search Interval
Spring (TAL-level monitoring)	April 1 – May 14	17 (10%)	162 (90%)	Weekly (7 days)
Summer (HCP-level monitoring)	May 15 – August 14	70 (40%)	105 (60%)	Twice Weekly (~3.5 days)
Fall (HCP-level monitoring)	August 15 – October 31	60 (34%)	115 (66%)	Twice Weekly (~3.5 days)

[1] Note, searches were also conducted from March 15 – March 30 under the TAL, and from November 1-November 29, but are not included in this report as that is outside the dates included in the HCP and ITP. The spring search data was included in the 2021 Spring TAL report submitted to USFWS and MDC on June 15, 2021. The November data will be provided in a separate memo.

Standardized carcass searches were conducted by qualified searchers trained in mortality search methods, including proper handling and reporting of carcasses. Searchers were familiar with and able to accurately identify bat species likely to be found in the project area. Preliminary bat species identifications were made in the field by qualified staff. When carcass condition allowed, sex and age of the carcass were recorded. For bat carcasses, forearm length was recorded to facilitate species identification. In addition to the carcass, photographs and data collected for each carcass were used to verify the species identification. Photos of any unknown bats discovered were sent to a Stantec permitted bat biologist for positive identification, and carcasses were kept on-site. Any unknown bat or suspected *Myotis* was identified by a Stantec senior bat biologist who holds a USFWS permit for threatened and endangered bats, and/or sent to the Northern Arizona University's Bat Ecology and Genetics Lab[2] for genetic testing.

During searches, searchers walked at a rate of approximately 2 miles per hour (mph; 45 to 60 m per minute) while searching 10 ft (3 m) on either side. For each carcass found (for the purposes of this analysis, live or injured bats were considered a carcass), the following data were recorded digitally within Survey123 (ESRI, Redlands, CA):

- Date and time
- Initial species identification [this information was updated as needed based on photos, dentition, or results of genetic testing]
- Sex, age, and reproductive condition (when possible) [sex was updated based on genetic testing, if applicable]
- Global positioning system (GPS) location
- Distance and bearing to turbine
- Condition (intact, scavenged, decomposed)
- Any notes on presumed cause of death

A digital photograph of each carcass found was taken before the carcass was handled and removed. All bat carcasses were labeled, bagged, and stored in a freezer at the Project Operations and Maintenance Building[3]. Bat carcasses were collected and retained under the ITP and Missouri Department of Conservation Wildlife Collector's Permits #19170, #19158, #19171, #19376, #19374, #19372 and #19378.

Bat carcasses found in non-search areas were coded as incidental finds and documented in a similar fashion to those found in standardized surveys when possible. These included carcasses found during non-search times or outside the monitoring plot. Incidental bat carcasses were collected and stored in the freezer with the carcasses found during standardized surveys. As per industry standard, incidental finds were not included in the fatality estimates.

[2] https://in.nau.edu/bat-ecology-genetics/

[3] The Indiana bat found on 15 April was sent to the Wildlife Health Lab in Madison, Wisconsin per the USFWS for necropsy and genetic testing. One live bat was left in place, and three live bats were transported to a wildlife rehabilitator in Columbia, MO, where they remain. All other bat carcasses are in the O&M building freezer.

2.1.2 Searcher Efficiency Trials

Searcher efficiency trials were used to estimate the probability of bat carcass detection by the searchers. The searchers did not know when during the monitoring periods the trials were being conducted, at which turbines trial carcasses were placed, or the location or number of trial carcasses placed in any given search plot. Commercially available brown mouse carcasses were used as trial carcasses to represent bats.

All searcher efficiency trial carcasses were randomly placed by a field lead within the search plots. These were placed either the evening before monitoring, or in the morning prior to the planned carcass surveys for that day and checked after the searcher efficiency trial to ensure they had not been scavenged. The number of trial carcasses found by the searcher during the mortality surveys in each plot was recorded and compared to the total number of trial carcasses placed in the plot and not scavenged prior to the mortality search.

2.1.3 Carcass Removal Trials

A carcass removal trial was conducted to estimate the average length of time carcasses remained in the search plots (i.e., were available to find) before being removed by scavengers. Mouse carcasses used during the searcher efficiency trials were left in place, and their locations were discretely marked; alternatively, sometimes separate mouse carcasses were placed for carcass removal trials alone. Searchers monitored the trial carcasses over a period of up to 30 days. During the carcass removal trial, carcasses were checked every day for the first week, and then regularly checked until missing or 30 days had passed.

The condition of each carcass was recorded during each trial check. The conditions recorded were defined as follows:

- Intact – complete carcass with no body parts missing
- Scavenged – carcass with some evidence or signs of scavenging
- Fur spot – no carcass, but fur spot remaining
- Missing – no carcass or fur remaining

Any carcasses remaining at the end of the 30-day trial period were removed from the field.

2.2 DATA ANALYSIS - GENEST

Results include summaries of the raw data, including counts of species, the number of searches conducted, and the average search interval (calculated as the sum of the number of visits to a turbine divided by the number of days within a season).

The Generalized Estimator (GenEst; Dalthorp et al. 2018) was used for calculating bias correction factors (searcher efficiency, carcass persistence, and area adjustment) and the overall fatality rate and fatality estimates for all bats at the Project.

2.2.1 Searcher Efficiency (p)

Searcher efficiency (p) represents the average probability that a carcass was detected by the searcher. The searcher efficiency rate was calculated using the data collected during searcher efficiency trials (Section 2.1.6) by dividing the number of trial carcasses the observer found by the total number which remained available during the trial (i.e., non-scavenged). Analysis includes an evaluation of whether searcher efficiency differed by searcher, season (spring, summer, fall), or plot type (roads and pads, full plots). Searcher efficiency decay (k) was fixed at 0.67. This value represents the decrease in searcher efficiency (p) on subsequent searches (i.e., if a carcass is missed the first time it is available, it is less likely to be found on subsequent searches than a "fresh" carcass).

GenEst returns numerous models depending on the number of variables included in the analysis, as well as Akaike information criterion (AIC) values for each model. The AIC value is a statistical score for the quality of a model fit, where smaller AIC values are considered better models. However, models within 3-4 ΔAIC (the difference between each models AIC and the AIC of the "best" model) are generally considered indistinguishable by this measure (Dalthorp et al. 2018). Therefore, the best model was chosen based on a manual review of models with the lowest AIC values, and a top model was chosen from the models within 3-4 ΔAIC of the top model based on AIC alone. Confidence intervals were generated using 1,000 bootstrapped iterations.

2.2.2 Carcass Persistence

Carcass persistence times modeled in GenEst include using censored exponential, Weibull, lognormal, and loglogistic survival models of the data collected as part of the carcass removal trial (Section 2.1.3). GenEst returns numerous models depending on the number of variables included in the analysis, as well as AIC values for each model. The best model was chosen based on a comparison of models with the lowest AIC values, though similar to searcher efficiency, models were also graphically evaluated to ensure that they are logical, and the top model was chosen from the models within 3-4 ΔAIC of the top model based on AIC alone. Confidence intervals were generated using 1,000 bootstrapped iterations.

2.2.3 Density-weighted Proportion (DWP)

The DWP was calculated based on several parameters:

$$X_i = number\ of\ carcasses\ found\ within\ distance\ band\ i$$

$$a_i = fraction\ of\ ground\ searched\ within\ distance\ band\ i$$

$$\widehat{M}_i = relative\ mortality\ rate\ in\ each\ ring = \frac{X_i}{a_i}$$

$$\hat{p}(M_i) = fraction\ of\ total\ in\ each\ ring = \widehat{M}_i \,/\, \sum_i \widehat{M}_i$$

The number of carcasses found within each distance band (X_i) is simply a tally of the carcasses found at various distances. When each carcass is found, searchers measure the distance to the turbine using GIS and record that with the carcass information. For this analysis, only carcasses found during the summer (May 15 to August 15) were included, since the full plots changed between each season, which would lead to different values for the "fraction of area searched" by bin.

To determine the fraction of ground searched within each distance band (a_i), the turbine roads and pads were digitized, and the proportion of each distance band that included the road and pad was calculated for each of the 175 project turbines out to 100 meters from the turbine base. These values were then averaged across all turbines to determine the percentage of each distance band that was searched on roads and pads. For full plot turbines, 100% of the area within 60 meters was searched, and 0% of the area beyond 60 meters was searched. Given that 40% of turbines had full plots and 60% were searched only on roads and pads, the weighted average of these values was calculated for each distance band. It was assumed that all carcasses fall within 100 meters of the turbine base.

Using the turbine-specific GIS data from the digitized roads and pads (since the road and pad configuration can vary by turbine), a turbine-specific DWP was then calculated by multiplying the fraction of each distance band searched at a particular turbine by the fraction of the total for that distance band. This varied by season for some turbines as full plots changed due to search protocols and land access.

2.2.4 Adjusted Fatality Estimates (GenEst)

GenEst was used to calculate overall fatality rates for the Project (per turbine, per MW, and for all 175 turbines). All estimates include 90% confidence intervals. "Per turbine estimates" were calculated by dividing the GenEst estimate (and confidence intervals) by the number of turbines (175 turbines), and "per MW estimates" were calculated by dividing the GenEst estimate (and confidence intervals) by the total MW (400 MW).

Fatality estimates were split by several carcass variables, including season, species, and curtailment.

2.3 DATA ANALYSIS – EVIDENCE OF ABSENCE

Evidence of Absence (EofA; Dalthorp et al. 2017) was used for estimating the overall detection probability (g) and the estimated take of the Covered Species (M and λ).

2.3.1 Estimation of Detection Probability (g)

For analysis of the 2021 data, the "Multiple Class Module" was used to combine data from the two search classes (roads and pads and full plots) and across the three seasons (spring, summer, and fall). Site-specific monitoring data were used to calculate the g-value for each search class, including the following inputs:

- Search interval (I), calculated as the average time between searches for that plot type
- Number of searches, calculated as the average number of times each turbine within that plot type was visited
- Temporal coverage (v), which is set to 1 since monitoring occurred during the entire period of risk during each season
- Searcher efficiency, which was calculated using the "carcasses removed after one search" option and inputting the total number of carcasses available and the number of carcasses found for that plot type and season across all searchers
- Factor by which searcher efficiency changes with each search (k) was fixed at 0.67
- Persistence distribution, which was calculated using field trials to estimate the parameters, and the top model was selected based on results from GenEst modeling

This input was done for both road and pad searches and for full plots to calculate the detection probability (g) within those searched areas. Within the Multiple Class Module, the fraction of total carcasses arriving within each class needs to be assigned to the DWP column. This differs from the DWP calculated in Section 2.2.1, which is the proportion of bats expected to fall within the searched area at a particular turbine, whereas this DWP is the proportion of bats expected to fall within that class. The DWP was calculated for each of the plot types, as well as for an "unsearched" class to account for carcasses that fall outside of the searched area. The DWPs of these three classes (roads and pads, full plots and unsearched) must sum to one. The DWPs for roads and pads and full plots were calculated based on the DWPs calculated for the turbines within those plots (Section 2.2.1), using the average DWP for the plot type and multiplying it by the proportion of turbines within that plot type. The unsearched class was then calculated as one minus the sum of the DWPs for the searched areas.

Once these inputs were complete, the "Estimate overall detection probability (g)" option was chosen, and the overall detection probability for the summer monitoring period was calculated. This detection probability is the same for all three Covered Species.

2.3.2 Evaluation of Adaptive Management Triggers

For analysis of the 2021 data, the "Multiple Years Module" was used with the results of the detection probability (g) obtained as described in Section 2.3.1, along with the number of observed mortalities of each of the Covered Species. This analysis was run separately for each Covered Species to determine the total estimated mortality (M), the annual fatality rate (λ), the projected future take over the 6-year permit term if current take rate trends continue, and to evaluate whether the short-term triggers described in Table 7-3 of the HCP had been exceeded. All analysis was done at a=0.5.

2.3.3 Design Protocols – Future Monitoring

The HCP denotes a desired detection probability (g) of 0.2 over the 6-year permit term. To determine the probability of detection (g) needed during future monitoring, and (i.e., 2022 monitoring under the HCP) to achieve this detection probability (g), the following equation was used:

$$0.2 = \frac{2021\ detection\ probability + (5X)}{6}$$

$$\frac{1.2 - 2021\ detection\ probability}{5} = X$$

Where X is the average detection probability needed for each of the remaining five years of the permit in order to achieve a detection probability (g) of at least 0.2 over the 6-year permit term (per the Project's HCP).

3.0 Results

3.1 ALL BATS

3.1.1 Carcass Searches

A total of 8,288 searches were conducted between April 1 and October 31, under both TAL-monitoring in the spring (April 1 – May 14; 17 full plots and 162 roads and pads) and HCP-level monitoring in the summer (May 15 – August 14; 60-70 full plots and 105-115 roads and pads) and fall (August 15 – October 31; 60 full plots and 115 roads and pads) (Table 3-1).

Table 3-1. Summary of post-construction monitoring conducted between April 1 and October 31, 2021, at the High Prairie Renewable Energy Center, Schuyler and Adair Counties, Missouri.

Season	Dates	Number of Searches Conducted	Average Search Interval[1]	Number of bats found in standardized searches	Number of bats found incidentally
Spring (TAL-level monitoring)	April 1 – May 14	1,183	6.7 days	3	0
Summer (HCP-level monitoring)	May 15 – August 14	3,803	4.2 days	157	6
Fall (HCP-level monitoring)	August 15 – October 31	3,302	4.1 days	13	0
Total	April 1 – October 31	8,288	n/a	173	6

A total of 173 individual bat carcasses were found during standardized carcass searches, and 6 individual bat carcasses were found incidentally.

3.1.2 Species Composition

A summary of all bat carcasses found during the standardized carcass searches is shown in Table 3-2.

Table 3-2. Summary of all bat carcasses found during standardized carcass searches between April 1 and October 31, 2021, during post-construction monitoring at the High Prairie Renewable Energy Center, Schuyler and Adair Counties, Missouri.

Species (state/federal status)	Count (species composition)			
	Spring	Summer	Fall	Total
Evening Bat	0	54 (34.4%)	2 (15.4%)	56 (32.4%))
Hoary Bat (SOCC[1])	0	36 (22.9%)	0	36 (20.8%)
Eastern Red Bat	1 (33.3%)	19 (12.1%)	7 (53.8%)	27 (15.6%)
Silver-haired Bat (SOCC)	1 (33.3%)	19 (12.1%)	3 (23.1%)	23 (13.3%)
Big Brown Bat	0	20 (12.7%)	1 (7.7%)	21 (12.1%)
Indiana Bat (Covered Species, state & federally endangered, SOCC)	1 (33.3%)	6 (3.8%)	0	7 (4.0%)
Little Brown Bat (Covered Species, SOCC)	0	1 (0.6%)	0	1 (0.6%)
Tricolored Bat (SOCC)	0	1 (0.6%)	0	1 (0.6%)
Unknown (not Myotis)	0	1 (0.6%)	0	1 (0.6%)
Northern long-eared Bat (Covered Species, state endangered, federally threatened, SOCC)	0	0	0	0
Total	3 (100%)	157 (100%)	13 (100%)	173 (100%)

[1]Species of Conservation Concern (MDC)

A total of 173 bat carcasses were found, 172 of which were identified to the species level. The one unknown bat was determined to not be a *Myotis* species, and therefore was not genetically identified to the species level.

Of the 173 bat carcasses, the most common species found was the evening bat (*Nycticeius humeralis*), followed by the hoary bat (*Lasiurus cinereus*), eastern red bat (*Lasiurus borealis*), silver-haired bat (*Lasionycteris noctivagans*), big brown bat (*Eptesicus fuscus*), and Indiana bat; the least frequently found species (n=1 each) were the little brown bat and tricolored bat (*Perimyotis subflavus*). No northern long-eared bats (Covered Species, state-endangered and SOCC, federally threatened) were found.

Incidental finds included six bat carcasses during the summer monitoring period: three evening bats, one big brown bat, one hoary bat, and one Indiana bat.

3.1.3 Searcher Efficiency

Searcher efficiency trials were conducted during the post-construction monitoring during all three seasons (spring, summer, and fall). Data were analyzed in GenEst, with searcher, season, and plot type as the three predictor variables. The selected model included season and plot type as the predictors (Table 3-3). Selected model is shown in bold.

Table 3-3. Model comparison results from the top five models for searcher efficiency trials conducted between April 1 and October 31, 2021, at the High Prairie Renewable Energy Center, Schuyler and Adair Counties, Missouri. Selected model shown in bold.

Formula/Model	k	AIC_c	ΔAIC_c
p ~ Season + PlotType	**0.67**	**213.06**	**0**
p ~ PlotType	0.67	213.9	0.84
P ~ Season + PlotType + Season:PlotType	0.67	217.08	4.02
P ~ Searcher + PlotType	0.67	220.21	7.15
P ~Season + Searcher + PlotType	0.67	221.96	8.9

Based on the results of the top model, searcher efficiency ranged from a low of 48.7% on full plots in the summer to a high of 97.6% on roads and pads in the spring (Table 3-4). Searcher efficiency was tested using a total of 237 trial carcasses.

Table 3-4. Searcher efficiency during 2021 post-construction monitoring at the High Prairie Renewable Energy Center, Schuyler and Adair Counties, Missouri.

Season	Full Plots		Roads and Pads	
	Trial Carcasses	Searcher Efficiency (90% CI)	Trial Carcasses	Searcher Efficiency (90% CI)
Spring	6	0.79 (0.51 – 0.932)	31	0.976 (0.916 – 0.993)
Summer	64	0.487 (0.39 – 0.584)	58	0.911 (0.843 – 0.951)
Fall	39	0.618 (0.494 – 0.729)	39	0.946 (0.892 – 0.974)

3.1.4 Carcass Persistence

The top five models for carcass persistence in GenEst included exponential and Weibull distributions, with effects of season and/or plot type (Table 3-5). Based on visual analysis of these models, the Weibull distribution with season and plot type in the formula for location and a constant scale was selected as the model for carcass persistence.

Table 3-5. Model comparison results from the top five models for carcass persistence trials conducted between April 1 and October 31, 2021, at the High Prairie Renewable Energy Center, Schuyler and Adair Counties, Missouri. Selected model is shown in bold.

Distribution	Location Formula	Scale Formula	AIC_c	ΔAIC_c
Exponential	l ~ Season + PlotType	n/a	552.47	0
Exponential	l ~ Season	n/a	552.47	0
Weibull	**l ~ Season + PlotType**	**s ~ constant**	**553.04**	**0.57**
Weibull	l ~ Season	s ~ constant	553.34	0.87
Weibull	l ~ Season _ Plot Type	s ~ PlotType	554.89	2.42

Carcass persistence was tested using 125 carcasses across the three seasons. The shortest carcass persistence observed was in the summer, when carcass persistence averaged 2.2 days on roads and pads and 2.9 days on full plots, compared to spring which ranged from 5.5 to 7.2 days and fall which ranged from 3.1 to 4.1 days (Table 3-6).

Table 3-6. Carcass persistence during 2021 post-construction monitoring at the High Prairie Renewable Energy Center, Schuyler and Adair Counties, Missouri.

Season	Full Plots		Roads and Pads	
	Trial Carcasses	Carcass Persistence (90% CI)	Trial Carcasses	Carcass Persistence (90% CI)
Spring	12	7.2 (5.2 – 10.1)	14	5.5 (3.9 – 7.8)
Summer	21	2.9 (2.1 – 3.9)	20	2.2 (1.7 – 3.0)
Fall	30	4.1 (3.2 – 5.2)	28	3.1 (2.4 – 4.1)

3.1.5 Density-weighted Proportion (DWP)

The 157 bat carcasses found during standardized searches during the summer season were used to calculate the DWP (Table 3-7).

Table 3-7. Calculation of the Density-weighted Proportion (DWP) at the High Prairie Renewable Energy Center, Schuyler and Adair Counties, Missouri based on bat carcasses found between May 15 and August 15, 2021.

Distance Band (meters)	Number of Carcasses	Fraction of Area Searched	Relative Fatality Rate	Fraction of Total	Cumulative Percent of Carcasses
0-10	38	54.8%	69	14.5%	14.4%
10-20	26	42.8%	61	12.7%	27.2%
20-30	29	42.2%	69	14.3%	41.5%
30-40	25	41.8%	60	12.5%	54.0%
40-50	24	41.3%	58	12.1%	66.1%
50-60	14	41.1%	34	7.1%	73.2%
60-100	1	0.8%	128	26.8%	100.0%

Therefore, based on data from carcasses found in summer 2021, it is assumed that 73.2% of all bat carcasses fall within 60 meters of the turbine base and within the full plot searches, and 26.8% fall beyond the full plots.

Using the turbine-specific GIS data from the digitized roads and pads (since the road and pad configuration can vary by turbine), a turbine-specific DWP was then calculated by multiplying the fraction of each distance band searched at a particular turbine by the fraction of the total

for that distance band. Therefore, all full plot turbines have a DWP of 73.2%, and the DWP for road and pad turbines ranges from 5.3% to 9.8% (Appendix A).

3.1.6 Adjusted Fatality Estimates

Fatality rate estimates were calculated based upon the carcasses found during the standardized carcass searches and did not include any incidental finds. Observed bat mortality estimates were adjusted to account for searcher efficiency, carcass removal, the search schedule, and the turbine-specific DWPs.

3.1.6.1 Seasonal Fatality Estimates

The total estimated fatality by season is summarized in Table 3-8 and detailed in the following sections.

Table 3-8. Bat fatality rates by season from 2021 post-construction monitoring at the High Prairie Renewable Energy Center, Schuyler and Adair Counties, Missouri.

Season	Dates	Facility-wide Estimated Fatalities (90% CI)	Per-turbine Estimated Fatalities (90% CI)	Per-MW Estimated Fatalities
Spring	April 1 – May 14	23.6 (3.0 – 69.8)	0.1 (<0.1 – 0.4)	0.1 (<0.1 – 0.2)
Summer	May 15 – August 14	3,270.6 (2,166.9 – 4,859.4)	18.7 (12.4 – 27.8)	8.2 (5.4 – 12.1)
Fall	August 15 – October 31	274.6 (140.1 – 460.9)	1.6 (0.8 – 2.6)	0.7 (0.4 – 1.2)

3.1.6.1.1 Spring Fatality Estimates

Prior to April 19, the turbines did not operate when air temperature was above 50°F; from April 19 through May 14 turbines did not operate at all at night (Table 1-1). A total of three bat carcasses were found during this monitoring period (Table 3-1, Table 3-2). Applying the searcher efficiency rates (Table 3-4), carcass persistence rates (Table 3-6), turbine-specific DWPs (Appendix A), and the spring search schedule, results in an overall bat fatality estimate of 23.6 bats (90% CI: 3.0 to 69.8) across all 175 turbines between April 1 and May 14, 2021 – equivalent to 0.1 bat/turbine (90% CI: <0.1-0.4) or 0.1 bat/MW (90% CI: <0.1-0.2).

3.1.6.1.2 Summer Fatality Estimates

During the summer period, the turbines operated under a variety of cut-in speeds as summarized in Table 1-1. A total of 157 bat carcasses were found during this monitoring period (Table 3-1, Table 3-2). Applying the searcher efficiency rates (Table 3-4), carcass persistence rates (Table 3-6), turbine-specific DWPs (Appendix A), and the summer search schedule, results in an overall bat fatality estimate of 3,270.6 bats (90% CI: 2,166.9 – 4,859.4) across all 175 turbines between May 15

and August 14, 2021 – equivalent to 18.7 bats/turbine (90% CI: 12.4 – 27.8) or 8.2 bats/MW (90% CI: 5.4 – 12.1).

3.1.6.1.3 Fall Fatality Estimates

During the fall period, the turbines did not operate at all at night from August 15 through October 31 (Table 1-1). A total of 13 bat carcasses were found during this monitoring period (Table 3-1, Table 3-2). Applying the searcher efficiency rates (Table 3-4), carcass persistence rates (Table 3-6), turbine-specific DWPs (Appendix A), and the fall search schedule, results in an overall bat fatality estimate of 274.6 bats (90% CI: 140.1 – 460.9) across all 175 turbines between August 15 and October 31, 2021 – equivalent to 1.6 bats/turbine (90% CI: 0.8 – 2.6) or 0.7 bat/MW (90% CI: 0.4 – 1.2).

3.1.6.2 Fatality Rates by Species

The estimated fatality rates by species are shown in Table 3-9. The evening bat was the most commonly found species (Table 3-2), and was also the species with the highest fatality rate of 10.8 evening bats/turbine, followed by the eastern red bat (2.7 eastern red bats/turbine), hoary bat (2.4 hoary bats/turbine), big brown bat (1.7 big brown bats/turbine), silver-haired bat (1.6 silver-haired bats/turbine), and Indiana bat (0.2 Indiana bat/turbine). The remaining species (little brown bat, tricolored bat) were all estimated at or below 0.1 bat/turbine (Table 3-9).

Table 3-9. Bat fatality rates by species from April 1 – October 31, 2021, post-construction monitoring at the High Prairie Renewable Energy Center, Schuyler and Adair Counties, Missouri.

Species	Total Found	Total Estimated Fatality (90% CI)	Per-turbine Estimated Fatalities (90% CI)	Per-MW Estimated Fatalities (90% CI)
Evening Bat	56	1,893.6 (1,000.7 – 3,239.8)	10.8 (5.7 – 18.5)	4.7 (2.5 – 8.1)
Hoary Bat	36	428.5 (258.7 – 750.1)	2.4 (1.5 – 4.3)	1.1 (0.6 – 1.9)
Eastern Red Bat	27	468.1 (267.8 – 1,098.4)	2.7 (1.5 – 6.3)	1.2 (0.7 – 2.7)
Silver-haired Bat	23	284.9 (153.3 – 462.2)	1.6 (0.9 – 2.6)	0.7 (0.4 – 1.2)
Big Brown Bat	21	296.8 (157.6 – 535.9)	1.7 (0.9 – 3.1)	0.7 (0.4 – 1.3)
Indiana Bat	7	42.4 (13.5 – 94.1)	0.2 (0.1 – 0.5)	0.1 (<0.1 – 0.2)
Little Brown Bat	1	24.7 (1.0-73.5)	0.1 (<0.1 – 0.4)	0.1 (<0.1 – 0.2)
Tricolored Bat	1	3.5 (1.0-9.4)	<0.1 (<0.1 – 0.1)	<0.1 (<0.1 - <0.1)
Unknown (not *Myotis*)	1	3.2 (1.0-54.1)	<0.1 (<0.1 – 0.3)	<0.1 (<0.1 – 0.1)

3.1.6.3 Fatality Rates by Cut-in Speed

Based on when carcasses were found and the state of the carcass when found (fresh versus decomposed), as well as when turbines had last been searched, 149 bat carcasses were assigned to the cut-in speed at which it was thought to have been killed based on professional judgement. The remaining 24 carcasses could not reliably be assigned to a cut-in speed.

GenEst was then used with the relevant searcher efficiency rates (Table 3-4), carcass persistence rates (Table 3-6), turbine-specific DWPs (Appendix A), and the search schedule to split mortality by cut-in speed. The total estimated fatalities by cut-in speed were then scaled to represent the fatalities by turbine-night (defined as one turbine operating under that cut-in speed for one calendar night) to standardize rates since the turbines did not operate at all cut-in speeds for an equal number of nights (Table 1-1). Fatality estimates and rates by curtailment are summarized in Table 3-10.

Table 3-10. Summary of fatality rates by cut-in speed during 2021 post-construction monitoring at the High Prairie Renewable Energy Center in Schuyler and Adair Counties, Missouri, and related adaptive management. Analysis includes 149 carcasses which were able to be assigned to a cut-in speed.

Cut-in Speed	Number of Carcasses	Turbine-nights	Total Estimated Fatality	Fatality/turbine night	Percent Reduction from 5.0 m/s
5.0 m/s	92	3,500	2,654.1 (1,580.8 – 4,157.8)	0.76	n/a
6.0 m/s	17	1,050	152.8 (65.4 – 272.9)	0.15	80.3%
7.0 m/s	21	1,379	210.5 (103.4 – 345.7)	0.15	80.3%
No Operations (regardless of temperature)	16	28,371	286.7 (149.8 – 467.2)	0.01	98.7%
No Operations (>50°F)	3	3,150	23.6 (2.0 – 69.8)	<0.01	>98.7%

3.2 COVERED SPECIES

3.2.1 Bat-in-hand Triggers and Adaptive Management Responses Implemented

Among the Covered Species (Indiana bat, little brown bat, and northern long-eared bat), eight Indiana bats were found, and one little brown bat was found. No northern long-eared bats were found. The locations of these eight Indiana bat fatalities and one little brown bat fatality are shown in Figure 4 along with corresponding adaptive management buffers for female fatalities. One of the eight Indiana bats found was an incidental find and is thus not included in the EofA or GenEst analyses.

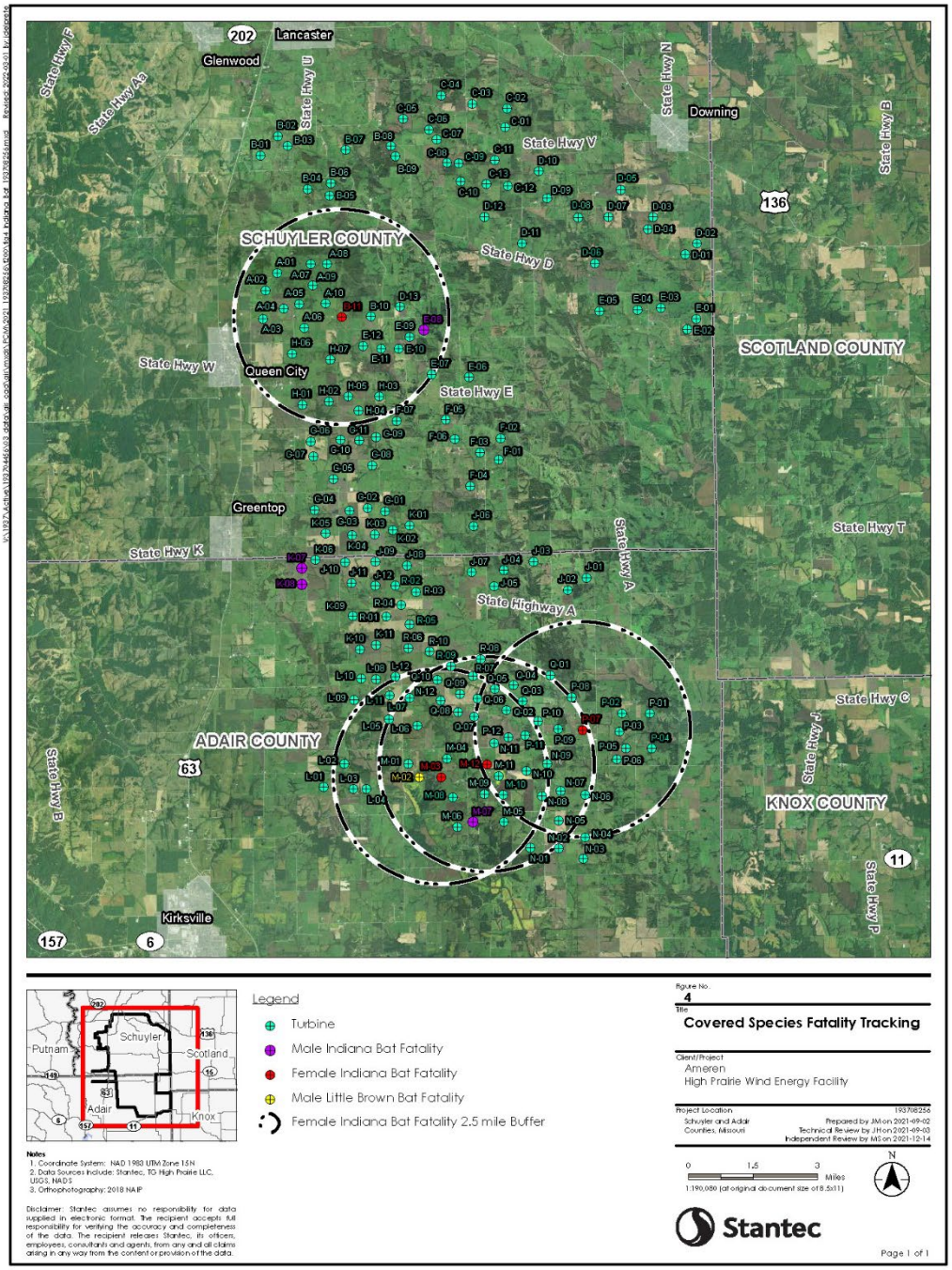


Figure 4. Covered Species Fatality Tracking

The changes in cut-in speeds outlined in Table 1-1 were in response to the Indiana bats found during post-construction monitoring and are summarized in Table 3-11.

Table 3-11. Summary of Covered Species found during 2021 post-construction monitoring at the High Prairie Renewable Energy Center in Schuyler and Adair Counties, Missouri, and related adaptive management.

"Bat in hand"	Required Adaptive Management	Date found	Species	Sex	Notes/Voluntary Measures Implemented
Indiana bat #1	None triggered	4/15/2021	Indiana Bat	Female	Prior to ITP issuance, Ameren voluntarily stopped all nighttime operations until permit issuance.
Indiana bat #2	None triggered	6/2/2021	Indiana Bat	Male	Initially identified as a female, but later confirmed male via genetic testing
Indiana bat #3	0.5 m/s cut-in speed increase required (5.5 m/s)	6/3/2021	Indiana Bat	Male	Ameren voluntarily increased cut-in speed by 1.0 m/s to 6.0 m/s
Indiana bat #4	0.5 m/s cut-in speed increase required (6.0 m/s) Second female found in southern part of project; no adaptive management triggered but 2.5-mile buffer added to map (Figure 4)	6/8/2021	Indiana Bat	Female	Ameren was already operating at the required 6.0 m/s, but voluntarily increased cut-in speeds by another 1.0 m/s the following night (6/9/2021) to 7.0 m/s site-wide
Indiana bat #5	0.5 m/s cut-in speed increase required (6.5 m/s)	6/14/2021	Indiana Bat	Male	Ameren was already voluntarily operating at 7.0 m/s; Ameren voluntarily shutdown operations site-wide for one night (6/14/2021), then resumed operations at 7.0 m/s in the northern part of the project and left the southern part of the project shutdown at night starting 6/15/2021

"Bat in hand"	Required Adaptive Management	Date found	Species	Sex	Notes/Voluntary Measures Implemented
Indiana bat #6	0.5 m/s cut-in speed increase required (7.0 m/s) First female found in the northern part of the project; 2.5-mile buffer around the fatality added to map (Figure 4)	6/21/2021	Indiana Bat	Female	Ameren was already voluntarily operating at 7.0. m/s in the northern part of the project; Ameren voluntarily shut-down night-time operations at all turbines starting 6/21/2021
Indiana bat #7	0.5 m/s cut-in speed increase required (7.5 m/s) Third female found in southern part of project; no adaptive management triggered but 2.5-mile buffer added to map (Figure 4)	6/2/2021	Indiana Bat	Female	Initially determined to be an unknown *Myotis*, species determined via genetic testing on 7/15/2021. Project already voluntarily not operating at night when species determination was confirmed.
Indiana bat #8	0.5 m/s cut-in speed increase required (8.0 m/s)	6/14/2021	Indiana Bat	Male	Initially determined to be an unknown *Myotis*, species determined via genetic testing on 7/15/2021. Project already voluntarily not operating at night when species determination was confirmed.
Little brown bat #1	None triggered	6/11/2021	Little Brown Bat	Male	Initially determined to be an unknown *Myotis* (suspected little brown based on the lack of a visible keel and the toe hairs), species confirmed via genetic testing on 7/15/2021

3.2.2 GenEst

As described in Section 3.1.5.2, GenEst estimated the Indiana bat fatality rate at 42.4 (90% CI: 13.5 – 94.1) and the little brown bat fatality rate at 24.7 (90% CI: 1.0-73.5). Since no northern long-eared bats were found, GenEst was unable to estimate a fatality rate for that species.

In addition, the GenEst analysis for the Indiana bat and little brown bat was also conducted with a 95% confidence interval to make the results comparable to EofA. The estimated fatality rates with 95% confidence intervals were 42.7 Indiana bats (95% CI: 10.3 – 98.8) and 24.6 little brown bats (95% CI: 1.0 – 82.9).

3.2.3 Evidence of Absence

Screenshots of the inputs for EofA are included in Appendix B and the results are summarized in the sections below. The "Multiple Classes" module was used in EofA. Because searcher efficiency and carcass persistence varied by season and plot type, the module was run four times: once for each season (with separate classes for each plot type plus an unsearched proportion), and once for the entire year (with separate classes for each season, and no unsearched portion since post-construction monitoring was conducted during the entire period of risk – April 1 through October 31).

3.2.3.1 Detection Probability (g)

The detection probability for the post-construction monitoring season (April 1 through October 31, 2021) was 0.115 (95% CI: 0.085 to 0.149), and for the ITP-monitoring period (May 15 – October 31) was 0.116 (95% CI: 0.086 – 0.150); however, this varied by season as summarized in Table 3-12.

Table 3-12. Summary of detection probability (g) by season and overall, during 2021 post-construction monitoring at the High Prairie Renewable Energy Center in Schuyler and Adair Counties, Missouri.

Season	Detection Probability (g) and 95% CI
Spring	0.080 (0.064 – 0.099)
Summer	0.113 (0.081 – 0.150)
Fall	0.163 (0.129 – 0.199)
Total/Overall	**0.115 (0.085 – 0.149)**
Total (ITP Monitoring)	**0.116 (0.086 – 0.150)**

3.2.3.2 Fatality Estimates (M* and λ)

Analysis in the EofA "Multiple Years Module" included calculation of the following for each of the Covered Species, per Section 7.5.2 of the HCP :

- Annual Take Estimate (M_{2021})
- Cumulative take estimate (same as M_{2021} since this is the first year of monitoring under the ITP)
- Annual take rate (λ)
- Projected Take Estimate (number estimated to have been killed to-date, plus the additional take likely to occur in the remaining years of the permit if the annual take rate stays the same)
- Number of Detected Fatalities (X)

Screenshots of inputs are provided in Appendix B, and results are summarized in Table 3-13.

Table 3-13. Summary of EofA outputs for the Covered Species from 2021 post-construction monitoring at the High Prairie Renewable Energy Center in Schuyler and Adair Counties, Missouri. For 2021, $M_{cumulative} = M_{2021}$ since it is the first year of monitoring/operations. Analysis done with a=0.5.

Species	Number of detected fatalities (X)	Annual/Cumulative Take Estimate (M_{2021}) (95% CI)	Annual Take Rate (λ) (95% CI)	Projected Take Estimate[1]	Short-term Trigger Exceedance
Indiana bat	8 (including 1 incidental)	63 (28 - 124)	67.1 (26.6 – 129.0)	401.4 (213 – 653)	Yes, λ > 12 with 50% credibility
Little brown bat	1	10 (1 – 34)	13.4 (0.943 – 42.7)	79.9 (16 – 192)	No, cannot infer λ > 16 with 50% credibility
Northern long-eared bat	0	1 (1 – 16)	4.47 (0.00434 – 22.7)	26.3 (1 - 90)	No, cannot infer λ > 3 with 50% credibility

[1]Projected take estimate assumes that detection probability (g) will vary in future years to achieve goal of 0.2 over the 6-year term, but assumes no operational changes that would reduce risk (i.e., this is the estimate for the Project operating under the same protocols as 2021 for all 6 years of the permit)

To-date, the avoidance trigger (see HCP Table 7-3) has not been reached for any of the three Covered Species (i.e., M_{2021} < permitted take at a=0.5). The short-term trigger was exceeded for the Indiana bat; however, adaptive management had already been implemented based on the "Bat in Hand" triggers (see Section 3.2.1), and no additional cut-in speed increases were required.

3.2.4 Comparison of GenEst and EofA Estimates for the Indiana Bat

GenEst estimated the Indiana bat fatality rate at 42.7 (95% CI: 10.3 – 98.8) compared to EofA, which estimated the Indiana bat fatality rate at 63 (95% CI: 28-124). GenEst thus estimated a lower fatality rate for Indiana bats than EofA. Theoretically, GenEst and EofA estimates would be expected to converge when enough carcasses are observed.

GenEst uses a sophisticated, carcass-specific detection probability for mortality estimation (looking at the exact day and turbine a carcass is found at, taking into account the searcher efficiency and carcass persistence for that plot type, the DWP at that turbine, and the search schedule for that turbine). Conversely, EofA requires the user to categorize each carcass within a search class and assign an overall detection probability (g) to that class of searches and the number of detected carcasses within that class. Therefore, EofA can be difficult to manage when the data structure is complex (multiple search classes, seasons, varying search protocols). Dalthorp et al. (2018) states that defining several detection probabilities to a set of carcasses (e.g., by plot type and/or season) can be an oversimplification and potentially misleading when used for estimating mortality. While attempts were made to split detection probability as best as possible in EofA (see Appendix B), it may be that GenEst is better able to predict fatality rates for the Indiana bat at High Prairie given the more sophisticated modeling employed and the number of carcasses detected at the site (i.e., 7 Indiana bats).

Stantec is continuing to investigate the discrepancy between these estimators to determine if improvements to the take estimation can be made and will follow-up with any additional analyses or discussion as appropriate.

3.3 DESIGN PROTOCOLS – FUTURE MONITORING

The project detection probability (g) was less than 0.2 during the first year of monitoring; therefore, adjustments will be made to the post-construction monitoring effort for the 2022 season to adjust to site-specific conditions. Section 8.1.3.2 of the HCP requires Ameren to contract with a 3rd party contractor to conduct the post-construction monitoring. In 2021, Ameren signed a contract with Stantec for Stantec to provide the 2021 and 2022 post-construction monitoring at the Project.

Specifically, High Prairie needs to achieve an average g-value of approximately 0.217[4] over the remaining five years of the permit term to achieve a detection probability (g) of 0.2 over the 6-year permit term. The bias correction factors from 2021 are being used to design and evaluate protocols for 2022, including the seasonal and plot-specific carcass persistence rates (Section 3.1.3) and searcher efficiency rates[5] (Section 3.1.2).

Ameren and Stantec are currently evaluating a range of protocols that would achieve a detection probability of ≥0.217, which may include, but not be limited to, increases to the search

[4] 0.2 = (0.115 + (X * 5)) / 6 X = 0.217
[5] It is assumed that a searcher efficiency of 0.61 can be achieved during the summer season based on fall results, which included changes to the mower being used and restricting full plots to those with land access.

frequency and/or increasing the number of full plots. A supplemental post-construction monitoring plan will be provided to USFWS and MDC in early 2022.

4.0 Summary of 2021 Post-construction Bat Mortality Monitoring and Next Steps

- Adaptive management was triggered due to Indiana bat fatalities in 2021 based on the bat-in-hand trigger. A minimum cut-in speed of 8.0 m/s from 45 minutes before sunset to 45 minutes after sunrise when temperatures are above 40°F will be required starting on April 1, 2022. Ameren will continue to coordinate with USFWS and MDC on technology implementation and determine appropriate cut-in speeds while continuing to minimize bat fatalities.

- A total of eight Indiana bats was found during post-construction mortality monitoring, seven of which were found during standardized searches. The short-term trigger was exceeded in 2021 but cut-in speed increases had already been made due to the bat in hand trigger.

- A total of four female Indiana bats were found; female Indiana bat fatalities will continue to be tracked and evaluated for adaptive management triggers.

- Adaptive management was not triggered for the little brown bat or northern long-eared bat.

- The detection probability (g) in 2021 was 0.116; a post-construction monitoring plan designed to achieve a goal detection probability ≥0.217 will be submitted to USFWS and MDC prior to the start of 2022 monitoring.

5.0 Literature Cited

Dalthorp, D., M. Huso, and D. Dail. 2017. Evidence of Absence (v2.0) Software User Guide: U.S. Geological Survey Data Series 1055, 109 p.. https://doi.org/10.3133/ds1055.

Dalthorp, D., L. Madsen, M.M. Huso, P.A. Rabie, R. Wolpert, J. Studyvin, J. Simonis, and J. Mintz. 2018. GenEst statistical models – A generalized estimator of mortality. No. 7-A2. U.S. Geological Survey, 2018.

Appendix A Turbine-specific Density-Weighted Proportions

Turbine ID	Spring DWP	Summer DWP	Fall DWP
A-01	0.080	0.080	0.080
A-02	0.057	0.732	0.732
A-03	0.057	0.057	0.057
A-04	0.061	0.732	0.732
A-05	0.058	0.058	0.058
A-06	0.078	0.078	0.078
A-07	0.062	0.062	0.062
A-08	0.056	0.732	0.732
A-09	0.057	0.057	0.057
A-10	0.074	0.732	0.732
B-01	0.062	0.732	0.732
B-02	0.057	0.057	0.057
B-03	0.057	0.057	0.057
B-04	0.057	0.057	0.057
B-05	0.081	0.732	0.732
B-06	0.073	0.732	0.732
B-07	0.057	0.732	0.732
B-08	0.071	0.071	0.071
B-09	0.057	0.057	0.057
B-10	0.057	0.732	0.732
B-11	0.057	0.732	0.732
C-01	0.078	0.732	0.732
C-02	0.060	0.060	0.060
C-03	0.057	0.057	0.057
C-04	0.732	0.732	0.732
C-05	0.057	0.057	0.057
C-06	0.057	0.057	0.057
C-07	0.057	0.732	0.732
C-08	0.090	0.090	0.090
C-09	0.074	0.053	0.053
C-10	0.057	0.732	0.057
C-11	0.057	0.057	0.057
C-12	0.062	0.732	0.732
C-13	0.732	0.057	0.057
D-01	0.732	0.057	0.057
D-02	0.057	0.732	0.732
D-03	0.057	0.057	0.057

Turbine ID	Spring DWP	Summer DWP	Fall DWP
D-04	0.057	0.057	0.057
D-05	0.057	0.732	0.732
D-06	0.060	0.732	0.732
D-07	0.057	0.057	0.057
D-08	0.057	0.732	0.732
D-09	0.057	0.732	0.732
D-10	0.057	0.057	0.057
D-11	0.057	0.057	0.057
D-12	0.732	0.732	0.732
D-13	0.732	0.059	0.059
E-01	0.059	0.732	0.732
E-02	0.060	0.732	0.732
E-03	0.057	0.057	0.057
E-04	0.057	0.057	0.057
E-05	0.062	0.732	0.732
E-06	0.057	0.057	0.057
E-07	0.057	0.732	0.732
E-08	0.062	0.732	0.732
E-09	0.079	0.079	0.079
E-10	0.065	0.065	0.065
E-11	0.057	0.057	0.057
E-12	0.057	0.057	0.057
F-01	0.057	0.057	0.057
F-02	0.059	0.732	0.059
F-03	0.057	0.732	0.057
F-04	0.057	0.057	0.057
F-05	0.057	0.057	0.057
F-06	0.059	0.059	0.059
F-07	0.057	0.732	0.732
G-01	0.060	0.732	0.732
G-02	0.057	0.057	0.057
G-03	0.078	0.078	0.078
G-04	0.732	0.732	0.732
G-05	0.057	0.057	0.057
G-06	0.061	0.061	0.061
G-07	0.057	0.057	0.057
G-08	0.732	0.732	0.732
G-09	0.057	0.732	0.057
G-10	0.057	0.057	0.057
G-11	0.057	0.057	0.057

Turbine ID	Spring DWP	Summer DWP	Fall DWP
H-01	0.059	0.059	0.059
H-02	0.059	0.059	0.059
H-03	0.060	0.732	0.732
H-04	0.076	0.076	0.076
H-05	0.059	0.059	0.059
H-06	0.074	0.074	0.074
H-07	0.057	0.732	0.732
J-01	0.061	0.732	0.732
J-02	0.057	0.057	0.057
J-03	0.732	0.732	0.732
J-04	0.062	0.062	0.062
J-05	0.057	0.057	0.057
J-06	0.058	0.732	0.732
J-07	0.062	0.732	0.732
J-08	0.062	0.062	0.062
J-09	0.057	0.057	0.057
J-10	0.057	0.057	0.057
J-11	0.057	0.057	0.057
J-12	0.057	0.057	0.057
K-01	0.057	0.057	0.057
K-02	0.057	0.057	0.057
K-03	0.080	0.080	0.080
K-04	0.086	0.086	0.086
K-05	0.057	0.732	0.732
K-06	0.058	0.058	0.058
K-07	0.057	0.732	0.732
K-08	0.058	0.058	0.058
K-09	0.732	0.732	0.732
K-10	0.057	0.057	0.057
K-11	0.057	0.057	0.057
L-01	0.732	0.057	0.057
L-02	0.059	0.732	0.732
L-03	0.057	0.732	0.732
L-04	0.057	0.057	0.057
L-05	0.059	0.059	0.059
L-06	0.061	0.061	0.061
L-07	0.060	0.732	0.732
L-08	0.057	0.057	0.057
L-09	0.057	0.732	0.732
L-10	0.058	0.732	0.732

Turbine ID	Spring DWP	Summer DWP	Fall DWP
L-11	0.732	0.057	0.057
L-12	0.057	0.057	0.057
M-01	0.092	0.092	0.092
M-02	0.057	0.057	0.057
M-03	0.068	0.732	0.732
M-04	0.062	0.062	0.062
M-05	0.057	0.057	0.057
M-06	0.098	0.098	0.098
M-07	0.057	0.732	0.732
M-08	0.057	0.057	0.057
M-09	0.057	0.057	0.057
M-10	0.080	0.732	0.732
M-11	0.076	0.076	0.076
M-12	0.057	0.732	0.732
N-01	0.057	0.057	0.057
N-02	0.066	0.066	0.066
N-03	0.059	0.059	0.059
N-04	0.058	0.058	0.058
N-05	0.058	0.058	0.058
N-06	0.057	0.057	0.057
N-07	0.057	0.057	0.057
N-08	0.732	0.059	0.059
N-09	0.057	0.732	0.057
N-10	0.060	0.732	0.732
N-11	0.057	0.057	0.057
N-12	0.057	0.057	0.057
P-01	0.732	0.732	0.732
P-02	0.056	0.732	0.732
P-03	0.056	0.056	0.056
P-04	0.057	0.732	0.732
P-05	0.074	0.074	0.074
P-06	0.072	0.732	0.732
P-07	0.732	0.732	0.732
P-08	0.057	0.732	0.732
P-09	0.057	0.057	0.057
P-10	0.057	0.732	0.057
P-11	0.732	0.732	0.057
P-12	0.057	0.057	0.057
Q-01	0.057	0.057	0.057
Q-02	0.057	0.732	0.732

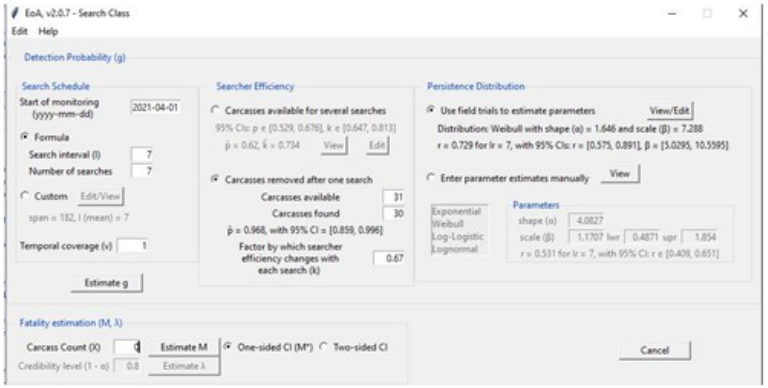
Turbine ID	Spring DWP	Summer DWP	Fall DWP
Q-03	0.058	0.058	0.058
Q-04	0.062	0.732	0.062
Q-05	0.074	0.732	0.732
Q-06	0.057	0.057	0.057
Q-07	0.732	0.057	0.057
Q-08	0.073	0.073	0.073
Q-09	0.076	0.732	0.732
Q-10	0.057	0.057	0.057
R-01	0.057	0.057	0.057
R-02	0.057	0.057	0.057
R-03	0.057	0.732	0.732
R-04	0.057	0.057	0.057
R-05	0.061	0.732	0.732
R-06	0.057	0.057	0.057
R-07	0.071	0.071	0.071
R-08	0.732	0.732	0.732
R-09	0.060	0.060	0.060
R-10	0.057	0.732	0.732

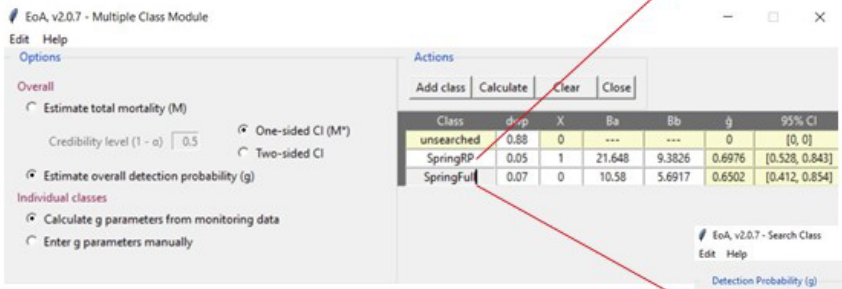
Appendix B Evidence of Absence Screenshots

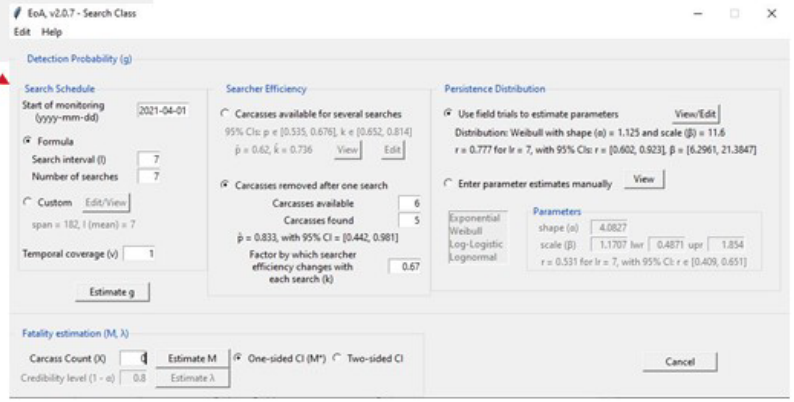
Summaries and screenshots of inputs for estimation of detection probability (g) and fatality estimates (M and λ) are provided on the following pages.

Spring 2021 Inputs

- Start date of 4/1/2021
- Search interval of ~7 days
- Average of 7 visits per turbine
- Temporal coverage of 100% of the season
- 30/31 SE trials found for roads and pads
- 5/6 SE trials found for full plots
- K fixed at 0.67
- Field trial CP data added by plot type, Weibull distribution chosen based on GenEst results







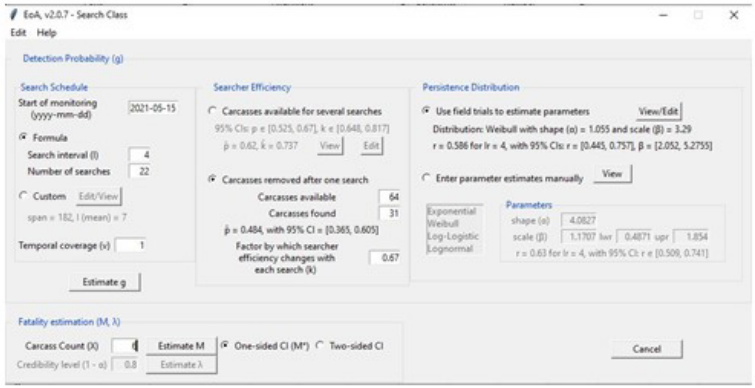
Additional info

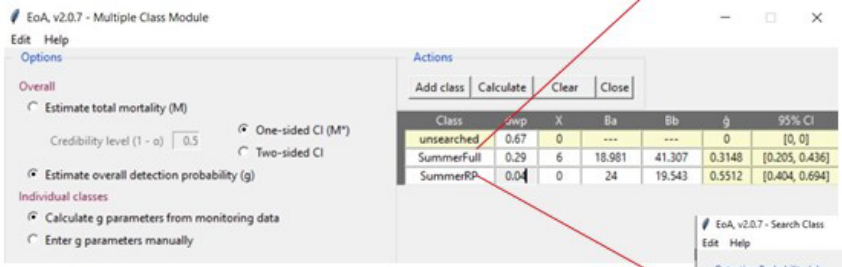
- 1 Indiana bat found on a road and pad turbine
- DWP assigned as follows:
  - RP=avg DWP for RP (0.055) * 0.9 = 0.05
  - Full = avg DWP for full (0.732) * 0.1 = 0.07
  - Unsearched = 1-(0.05+0.07) = 0.88

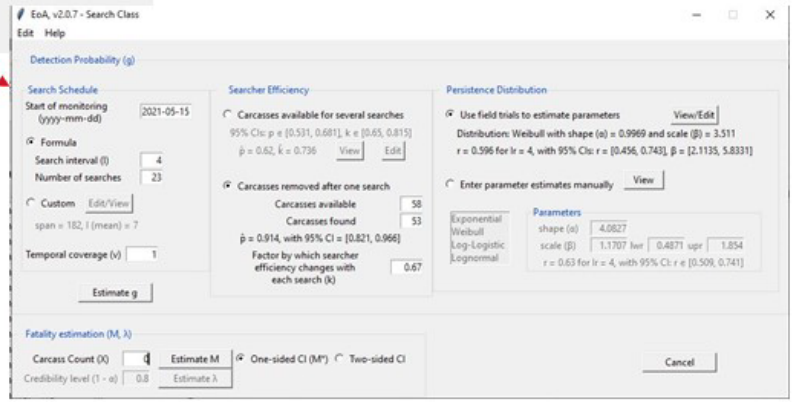
RESULTS: g = 0.08 (Ba=73.3, Bb=838.57) [NOTE: TAL-level monitoring, not HCP]

Summer 2021 Inputs

- Start date of 5/15/2021
- Search interval of ~4 days
- Average of 22-23 visits per turbine
- Temporal coverage of 100% of the season
- 53/58 SE trials found for roads and pads
- 31/64 SE trials found for full plots
- K fixed at 0.67
- Field trial CP data added by plot type, Weibull distribution chosen based on GenEst results







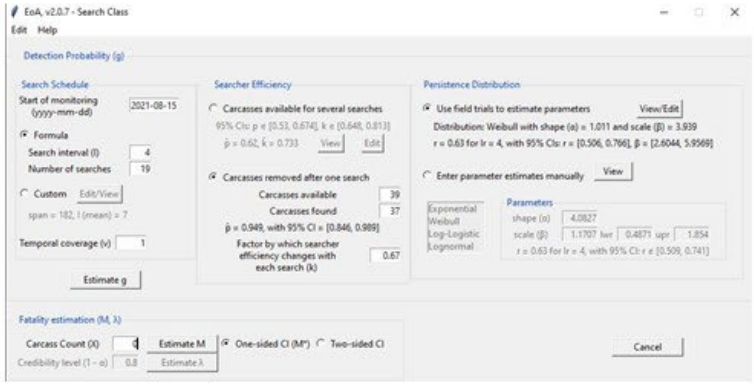
Additional info

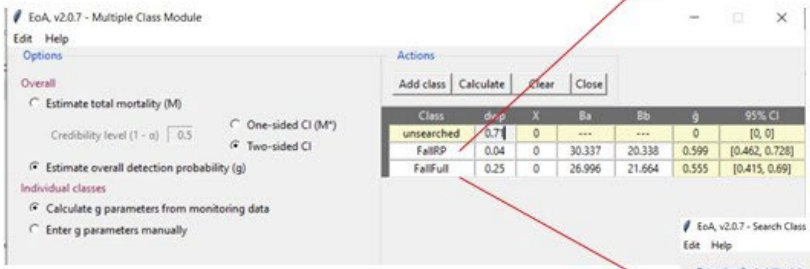
- 6 Indiana bats found on full plots
- DWP assigned as follows:
  - RP=avg DWP for RP (0.06) * 0.6 = 0.04
  - Full = avg DWP for full (0.732) * 0.4 = 0.29
  - Unsearched = 1-(0.29+0.04) = 0.67

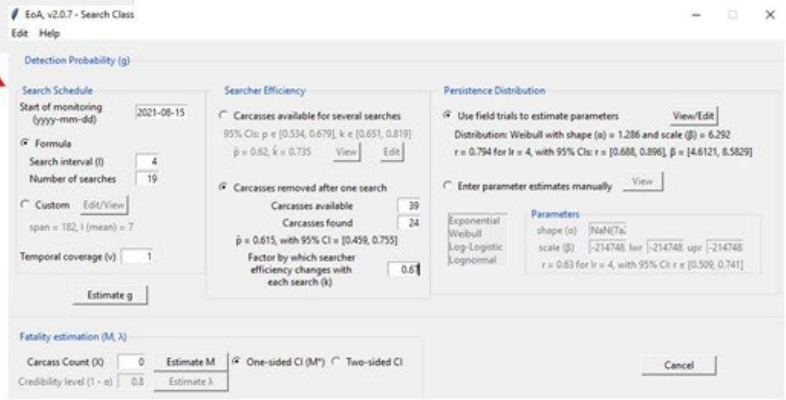
RESULTS: g = 0.113 (Ba=37.2508, Bb=291.3814)

Fall 2021 Inputs

- Start date of 8/15/2021
- Search interval of ~4 days
- Average of 19 visits per turbine
- Temporal coverage of 100% of the season
- 37/39 SE trials found for roads and pads
- 24/39 SE trials found for full plots
- K fixed at 0.67
- Field trial CP data added by plot type, Weibull distribution chosen based on GenEst results







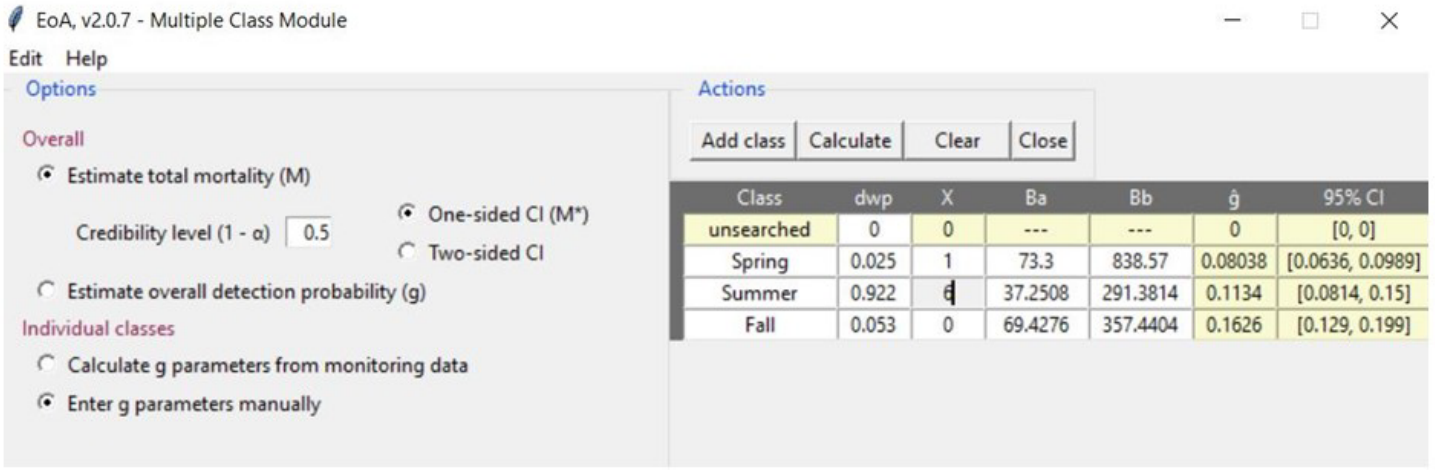
Additional info

- 0 Indiana bats found
- DWP assigned as follows:
  - RP=avg DWP for RP (0.06) * 0.66 = 0.04
  - Full = avg DWP for full (0.732) * 0.34 = 0.25
  - Unsearched = 1-(0.25+0.04) = 0.71

RESULTS: g = 0.163 (Ba=69.4276, Bb=357.4404)

Full Year 2021 Inputs

- Input the beta parameters that were derived by season from the previous inputs, ran model separately for Indiana bats (shown in screenshot below), little brown bats (1 summer fatality) and northern long-eared bats (no fatalities)
- Assigned DWP based on the percent of total bat fatalities that occurred in each season, adjusted for search effort
    - Spring: 3 fatalities/0.08 g-value = 37.5 [DWP: 0.025]
    - Summer: 157 fatalities/0.113 g-value = 1,389.4 [DWP: 0.922]
    - Fall: 13 fatalities/0.163 g-value = 79.8 [DWP: 0.053]



RESULTS:

g = 0.115 (Ba=44.9804, Bb=345.6797) [including spring]
g = 0.116 (Ba=43.3404, Bb=330.2421) [excluding spring TAL monitoring]

Adaptive Management Analysis - 2021 Inputs (Multiple Years Module)

- Input the beta parameters that were derived for the entire year (Ba=44.9804, Bb=345.6797), ran model separately for Indiana bats (shown in screenshot below), little brown bats (1 fatality) and northern long-eared bats (no fatalities)
- Used "Estimate M" and "track past mortality" with credibility set to 0.5 to estimate M* and λ
- Used "Estimate M" and "Projection of future mortality and estimates" to estimate projected fatality, assuming no reduction in fatality rate (ρ=1) and a detection probability (g) of 0.217 (0.20-0.24) for a 6-year project with a mortality threshold of 72 Indiana bats, 96 little brown bats, or 18 northern long-eared bats
- Used "Estimate average annual fatality rate (λ)" and "short term rate (λ>τ)" for a term of 1 year and α=0.5 to determine if the short-term trigger had been exceeded, with an "Annual rate threshold (τ)" of 12 Indiana bats, 16 little brown bats, or 3 northern long-eared bats