Post-construction Monitoring Study for the Cardinal Point Wind Project

Year 1 Incidental Take Permit Report – 2023

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EXECUTIVE SUMMARY

Capital Power Corporation (Capital Power) operates the Cardinal Point Wind Project (Project) in McDonough and Warren counties, Illinois. The Project began operating in March 2020, and consists of 60 wind turbines with a total generating capacity of 166 megawatts (MW). Post-construction fatality monitoring (PCM) occurred at the Project during the first two years of operation. During the second year (2021), Indiana bats (listed as endangered under the Endangered Species Act of 1973) were found as fatalities, and Capital Power coordinated with the US Fish and Wildlife Service (USFWS) on appropriate operational responses. Capital Power also began developing a Habitat Conservation Plan (HCP) in support of applying for an incidental take permit (ITP) for four bat species. In August 2023, Capital Power subsequently obtained a 6-year ITP to cover incidental take of the Indiana bat, northern long-eared bat, tricolored bat, and little brown bat (collectively, Covered Species). A key component of the HCP implemented under the ITP is testing an optimized smart curtailment (OSC) system for bats.

This report details the PCM study conducted by Western EcoSystems Technology, Inc. (WEST) in 2023, consistent with the Project's HCP and ITP (ESPER3926307) for the Covered Species. The purpose of monitoring the Project in 2023 was to estimate Covered Species take, test adaptive management triggers, and evaluate the efficacy of the OSC. To this end, 20 turbines each were assigned to one of three groups using a spatially balanced sample design: 7.5-meter per second (m/s) blanket curtailment, 5.0 m/s blanket curtailment, and an OSC treatment designed to avoid at least 50% of collision risk as approximated by bat activity levels gathered at the Project in 2022. The 7.5 m/s blanket curtailment group was intended to increase the probability that take limits would not be exceeded for the Covered Species during the initial research phase of this ITP. The research component of this study aimed to compare relative energy production and rates of all-bat fatalities for the OSC and 5.0 m/s blanket curtailment groups. Turbine operations in the OSC treatment group were informed by the relationship between acoustic bat activity, power generation, and weather and temporal variables including wind speed, temperature, time of night, and date.

PCM was completed in accordance with the study plan approved by the USFWS on June 2, 2023. The study plan was designed to achieve a 15% probability of detecting a single bat carcass (*g* of 0.15) for the 40 wind turbines operating at risk at the Project (i.e., turbines in the 5.0 m/s blanket curtailment and OSC treatment groups). Standardized carcass searches for bat carcasses were completed at three plot types: 12 turbines were searched as 70-m cleared plots, eight turbines were searched as 70-m uncleared (soy) plots, and 40 turbines were searched as 100-m road and pad plots. Searches were conducted by two types of searchers: detection dog teams (consisting of a dog trained to detect carcasses and a handler) searched all 70-m cleared and uncleared plots, whereas technicians searched all 100-m road and pad plots. The search interval varied with turbine treatment group. Searches at 7.5 m/s blanket curtailment turbines were conducted once weekly, whereas searches at 5.0 m/s blanket curtailment and OSC turbines occurred twice weekly. Searcher efficiency and carcass persistence trials were also conducted to correct for detection and scavenger bias.

Acoustic monitoring was also completed according to the approved study plan. The goal of acoustic monitoring was to inform any necessary revisions to the OSC approach in 2024. Detectors were deployed March 10 – November 2, 2023, and all detectors and microphones were operating for 91% of the survey period. The acoustic data collected in 2023 showed that all-bat activity was elevated between July 15 and August 24, with the highest activity levels July 25 – August 12. Qualitative review of the acoustic data from 2023 confirmed Indiana, tricolored, and little brown bat calls. No northern long-eared bat calls were identified. The activity patterns of the three confirmed Covered Species generally followed the same patterns as the all-bat calls.

All turbines were searched at least once per week from July 15 – October 15, for a total of 1,291 carcass searches. Eight Indiana bats and five tricolored bats were found (all at turbines operating at OSC or 5.0 m/s blanket curtailment). No northern long-eared bats or little brown bats were found. In total, 892 bat carcasses were found during the study. The most frequently found bat species were the eastern red bat (64.1%), silver-haired bat (11.0%), hoary bat (10.1%), and big brown bat (4.5%). Searchers also found 26 evening bats (2.9%), 23 unidentified *Lasiurus* bats (2.6%), 16 eastern red or Seminole bats (1.8%), eight unidentified non-*Myotis* bats (0.9%), five Seminole bats (0.6%), and one unidentified bat (0.1%). Additionally, a total of 90 bird carcasses were recorded; no federally or state-listed birds were found.

Using GenEst, a generalized estimator of fatality, the estimated all-bat fatality rate was 34.31 bats/MW (90% confidence interval [CI]: 25.96–48.40), or 85.77 bats/turbine (90% CI: 64.91–121.01), for the OSC group. The estimated all-bat fatality rate was 21.69 bats/MW (90% CI: 16.95–29.58), or 54.23 bats/turbine (90% CI: 42.38–73.95), for the 5.0 m/s blanket curtailment group. The estimated all-bat fatality rate was 13.28 bats/MW (90% CI: 3.70–38.43), or 33.21 bats/turbine (90% CI: 9.24–96.32) for the 7.5 m/s blanket curtailment group. Because the search effort for the 7.5 m/s blanket curtailment group was much less than for the other two groups, the all-bat fatality estimates are not as precise for this group and direct comparisons to the all-bat fatality estimates in the OSC and 5.0 m/s blanket curtailment groups should not be made.

The turbines in the OSC and 5.0 m/s blanket curtailment groups operated as anticipated, curtailing 94.7% and 96.9% of the time, respectively, when expected based on wind speed and cut-in speed. Also as expected, the OSC turbines were operating more than the 5.0 m/s blanket curtailment turbines. OSC turbines were operating 76.6% of the time and were curtailed 19.8% of the time. In contrast, the 5.0 m/s blanket curtailment turbines were operating 65.9% of the time and were curtailed 25.9% of the time. The OSC algorithm exceeded the minimum expectation for 50% coverage of acoustic activity in 2023, achieving 59% call coverage when turbines were curtailed. In comparison, the 5.0 m/s blanket curtailment group achieved 62% call coverage when turbines were curtailed.

Using Evidence of Absence, the overall detection probability (g) was 0.318 (90% CI: 0.284–0.354) for the 40 turbines operating under OSC or 5.0 m/s blanket curtailment. The estimated median annual fatality rates were 25.76 Indiana bats, 16.31 tricolored bats, and 0.72 little brown bats. The

cumulative take estimates for the study period were 25 Indiana bats, 16 tricolored bats, and zero little brown bats. Per the HCP, no take estimate was calculated for the northern long-eared bat.

While the median annual fatality rates were estimated based on these Year 1 data, the adaptive management triggers for projected take will not be tested until Year 3. The cumulative take estimates have not exceeded the authorized take for Indiana, tricolored, or little brown bats. The count of northern long-eared bats has not exceeded the authorized take. No carcasses of Covered Species were documented with an estimated time of death between October 1 – 15, corroborating an expectation of low risk during this period. Furthermore, the cumulative take for Indiana bats is below the threshold that would trigger a mitigation true-up. Therefore, based on the Year 1 results, no adaptive management actions have been triggered, as defined in the HCP.

The totality of the data collected in Year 1 (i.e., turbine operations, acoustic activity, fatalities, etc.), will be used, in coordination with the USFWS, to inform the minimization measures that will be implemented in Year 2. Although the acoustic call coverage was similar between the OSC and 5.0 m/s blanket curtailment groups (53% and 54%, respectively), the all-bat fatality estimates were more different than expected. Additional analysis of the acoustic data collected to date will be considered in development of the Year 2 (2024) OSC algorithm, and additional acoustic monitoring will be conducted in 2024 to further inform OSC development and seasonal risk assessments for Year 3 for all bats as well as the Covered Species.

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REPORT REFERENCE

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INTRODUCTION

Capital Power Corporation (Capital Power) operates the Cardinal Point Wind Project (Project) in McDonough and Warren counties, Illinois. The Project began operating in March 2020, and consists of 60 wind turbines with a total generating capacity of 166 megawatts (MW). The Project consists of two types of turbines: 48 General Electric (GE) 2.8-MW turbines and 12 GE 2.5-MW turbines. Each turbine has a hub height of 89 meters (m) and a rotor diameter of 127 m. In August 2023, Capital Power obtained an incidental take permit (ITP; ESPER3926307) from the US Fish and Wildlife Service (USFWS) to cover incidental take of the Indiana bat (*Myotis sodalis*), northern long-eared bat (*M. septentrionalis*), tricolored bat (*Perimyotis subflavus*), and little brown bat (*M. lucifugus*; collectively, Covered Species) at the Project. A key component of the Habitat Conservation Plan (HCP) that will be implemented under the ITP is testing an optimized smart curtailment (OSC) system to minimize risk to all bat species (including the Covered Species). This report details the post-construction fatality monitoring (PCM) study conducted by Western EcoSystems Technology, Inc. (WEST) in 2023, consistent with the Project's HCP and ITP for the Covered Species.

2023 Study Objectives

As committed to in the HCP for the Project, Capital Power tested the effectiveness of OSC by comparing all-bat fatality rates from turbines operating under an OSC algorithm to turbines operating under blanket 5.0-meter per second (m/s) curtailment in 2023. The overall research goal outlined in the HCP and associated 6-year ITP term is to test a novel approach to minimizing impacts to the Covered Species (as described further below), while also minimizing impacts to other bat species, with the objective of informing a long-term operational strategy at the Project. In addition to producing a field validation study that compares OSC and 5.0 m/s blanket curtailment, the other objectives of the 2023 monitoring surveys were to demonstrate compliance with Covered Species take limits by tracking take of northern long-eared bats and by producing take estimates for Indiana, tricolored, and little brown bats, and to gather information (using both fatality and acoustic data) to test the adaptive management triggers as laid out in the HCP.

Overview of Optimized Smart Curtailment

Wind energy development may impact migratory and local bat populations, especially for tree-roosting species (Cryan et al. 2009, Hayes 2013, Frick et al. 2017). However, the most severe threat to North American bats that overwinter in caves is white-nose syndrome (WNS), a fungal disease (Blehert et al. 2009, Cheng et al. 2021). WNS is the biggest challenge to the recovery of Indiana bats, northern long-eared bats, little brown bats, and tricolored bats, which have all experienced significant declines due to this disease (Cheng et al. 2021). While these species are infrequently killed at wind energy facilities (WEST 2021, 2023; Pruitt and Reed 2022), wind energy development and WNS may interact to reduce the abundance of their already depressed populations (Erickson et al. 2016).

Bat mortality resulting from turbine collision is inversely related to wind speed (e.g., Arnett et al. 2008, Horn et al. 2008). Therefore, feathering[1] turbine blades and raising cut-in speeds (i.e., curtailing) at night during periods of low wind reduces bat mortality (reviewed in Adams et al. 2021, Whitby et al. 2021). Although "blanket curtailment" (curtailing every turbine, every night for an entire season) has proven effective at reducing bat fatalities, it can cause substantial losses in energy production. These losses can jeopardize the financial viability of a wind energy project. To better balance conservation needs with turbine shutdown time, "smart curtailment" makes operational decisions based on project-specific factors associated with collision risk. Specifically, in this report, smart curtailment is defined as a model-based approach using bat activity metrics in a statistical model with weather and temporal variables to predict periods of high or low risk and to curtail accordingly.

Acoustic activity while turbines are in motion (i.e., acoustic exposure) is related to bat fatalities (Peterson et al. 2021). The relationship between fatalities and acoustic activity forms the basis for using activity indices to train models to generate curtailment schedules that minimize bat fatalities. While limited field studies have been conducted to validate this approach, model-based smart curtailment holds promise for reducing potential power loss and bat fatality rates (Behr et al. 2017; Barré et al. 2023).

OSC, developed by WEST, advances model-based smart curtailment by explicitly accounting for power loss in the algorithm decision process. WEST's OSC calculates the tradeoff between power loss and conservation benefit in each algorithm; therefore, the final algorithm can be tuned to achieve a target risk reduction while minimizing power loss. The model is adaptable to use any variable that can be programmed in a turbine supervisory control and data acquisition (SCADA) system, which includes time, date, and weather conditions such as wind speed and temperature. Turbines are then curtailed to specific cut-in speeds according to logical rules designed to achieve a target risk reduction and acceptable power loss.

The USFWS commonly accepts blanket curtailment at 5.0 m/s as a minimization measure in HCPs for the Covered Species. The cost of curtailment at wind speeds above 5.0 m/s increases substantially and thus increased cut-in speeds are unlikely to be adopted broadly by wind operators across the ranges of the Covered Species. Therefore, as the need for curtailment increases to minimize risk to bats, smart curtailment provides a viable alternative that could meet USFWS objectives while maintaining the economic viability of wind energy facilities within the range of Covered Species.

[1.] "Feathering" means that below the cut-in speed wind speed, turbine blades will be pitched into the wind such that they rotate slowly (less than one revolution per minute). Feathering is also known as "pausing".

STUDY AREA

The Project area encompasses 18,678 hectares (ha) of private land in McDonough and Warren counties, Illinois, approximately 13 kilometers northwest of Macomb, Illinois (Figure 1). The main land cover is row crops, with pasturelands, rural residences, and farmsteads scattered throughout (Table 1). There are 13 named streams within the Permit Area along with a 5-ha state conservation area, the Sciota Railroad Prairie. Many of the streams originate in the Project Area and flow out to the east or west. Natural areas that provide potential habitat for bats, such as forest and open water, account for less than 1% of the Project Area.

Table 1.   Land cover composition within the Cardinal Point Wind Project area.

Land Cover Type	Coverage (Hectares)	% Composition
Cultivated Cropland	17,340	92.8
Developed[1]	788	4.2
Hay/Pasture	420	2.3
Forest	124	0.7
Barren Land	4	<0.1
Open Water	1	<0.1
Herbaceous	<1	<0.1
Total[2]	**18,678**	**100**

[1.] May include developed open space, developed low intensity, developed medium intensity, and developed high intensity.

[2.] Sums of values can differ from totals shown due to rounding.

Source: National Land Cover Database 2021.

METHODS

WEST used Project-specific acoustic and SCADA data from 2022 to develop an OSC algorithm for implementation at the Project in fall 2023. The acoustic data were collected at 16 turbines and SCADA data were collected at all 60 turbines (Figures 1 and 2). WEST also used Project-specific data to develop a PCM study plan that targeted a probability of detection (g) of 0.15 to meet the monitoring commitments in the HCP. Capital Power submitted the study plan to the USFWS on May 17, 2023, and received approval from the USFWS on June 2, 2023 (A. Schorg, USFWS, pers. comm.).
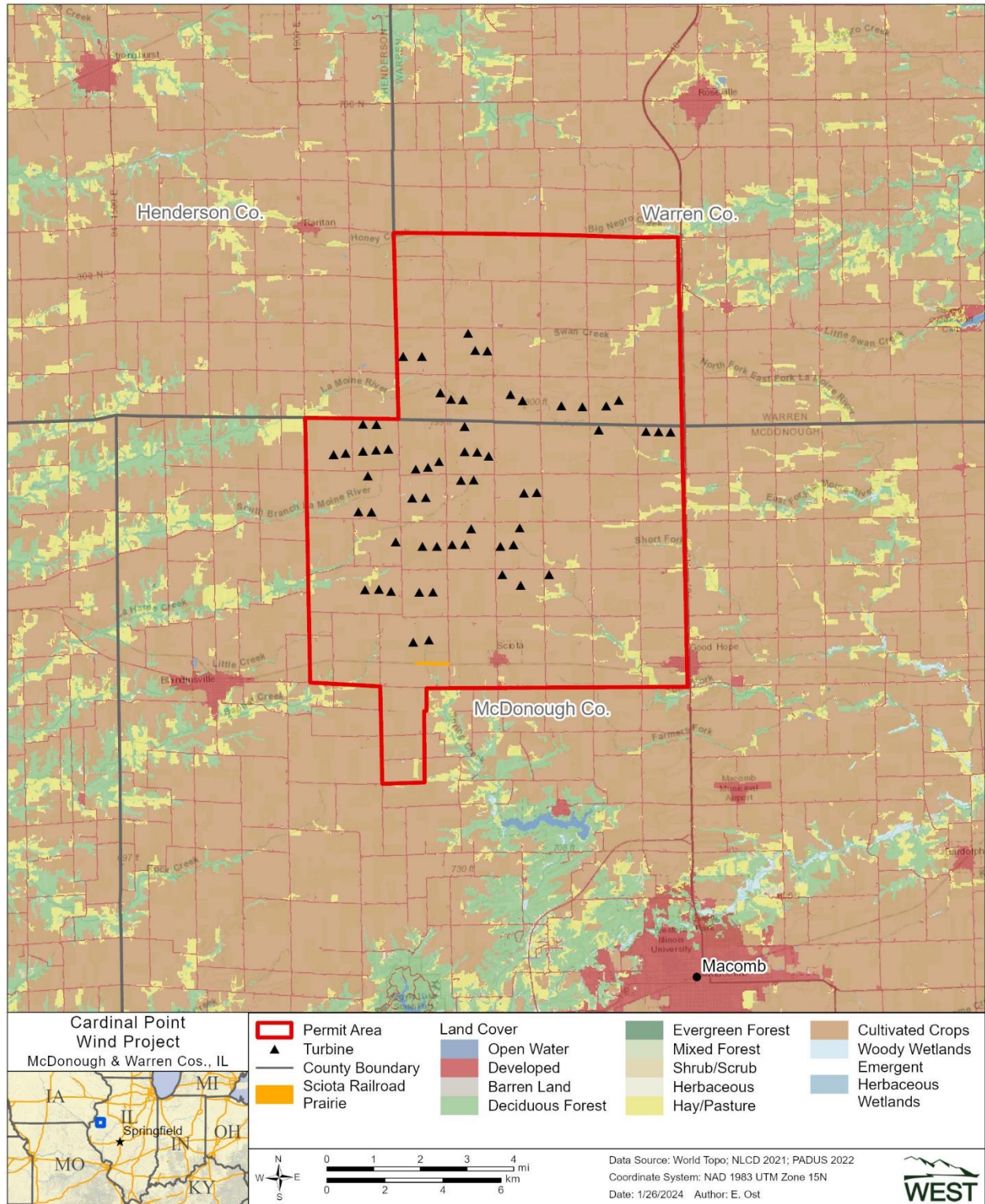
Figure 1.   Land cover and turbine locations (n = 60 turbines) at the Cardinal Point Wind Project.
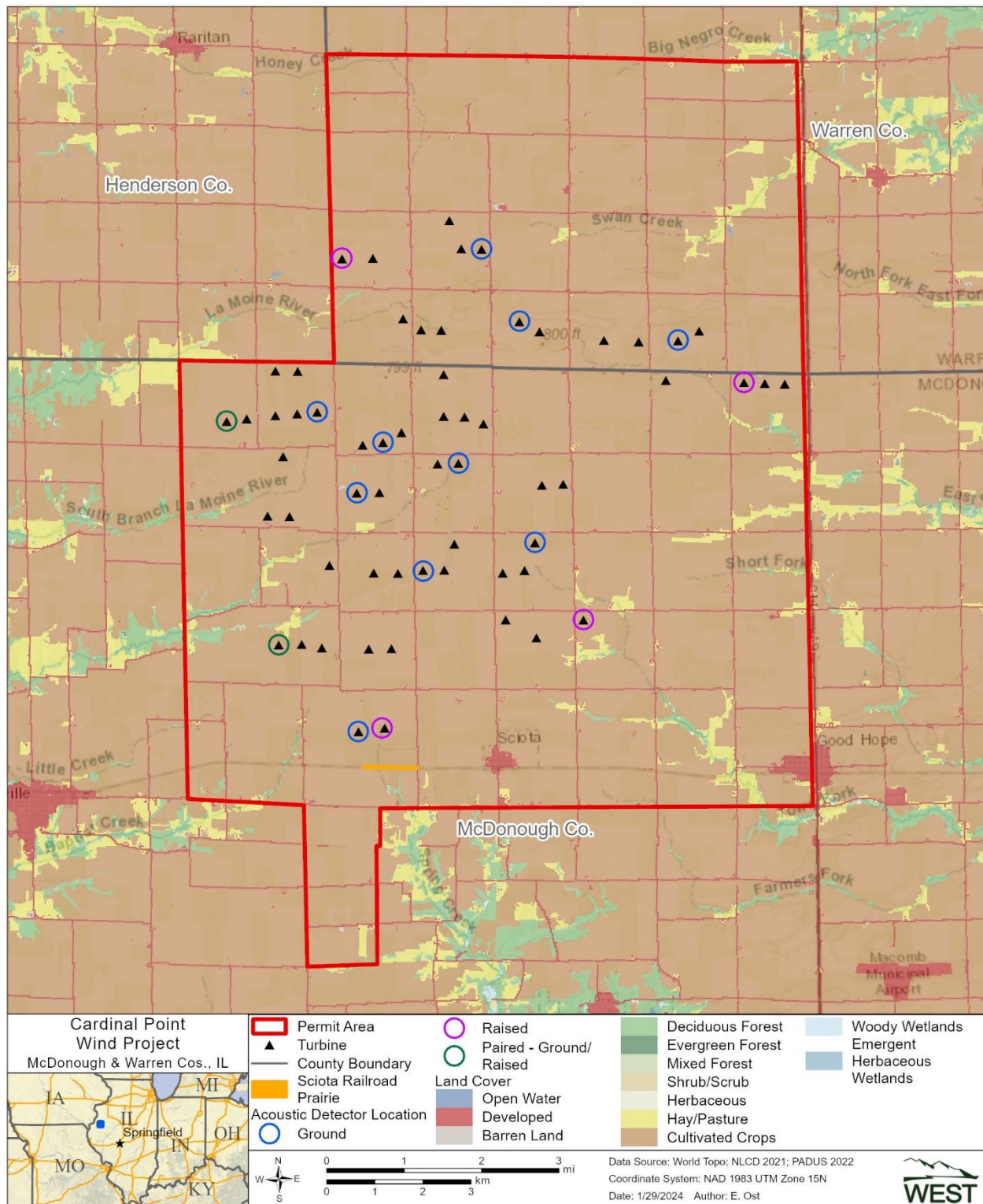
Figure 2.   Locations of six raised (nacelle-mounted) and 12 ground-level acoustic detectors deployed at 16 turbines at the Cardinal Point Wind Project in 2022 and 2023.

Optimized Smart Curtailment Development

Using acoustic bat activity from 2022, WEST's OSC model was run to produce facility-specific algorithms (i.e., sets of logical curtailment rules) to consider for implementation at the Project in 2023. Data from all acoustic detectors (six raised to nacelle height and 12 ground-based) deployed from July 15 – September 30 in 2022 were used. "Bat passes" (individual echolocation sequences of bats passing by and recorded on the detector) were summed across 10-min intervals for all species (Figure 3). The acoustic data collected in 2022 and used in the OSC development for implementation in 2023 showed that bat activity was concentrated between July 15 and September 1, generally beginning 10–20 min after sunset and tapering off one to two hours before sunrise (Figure 3).
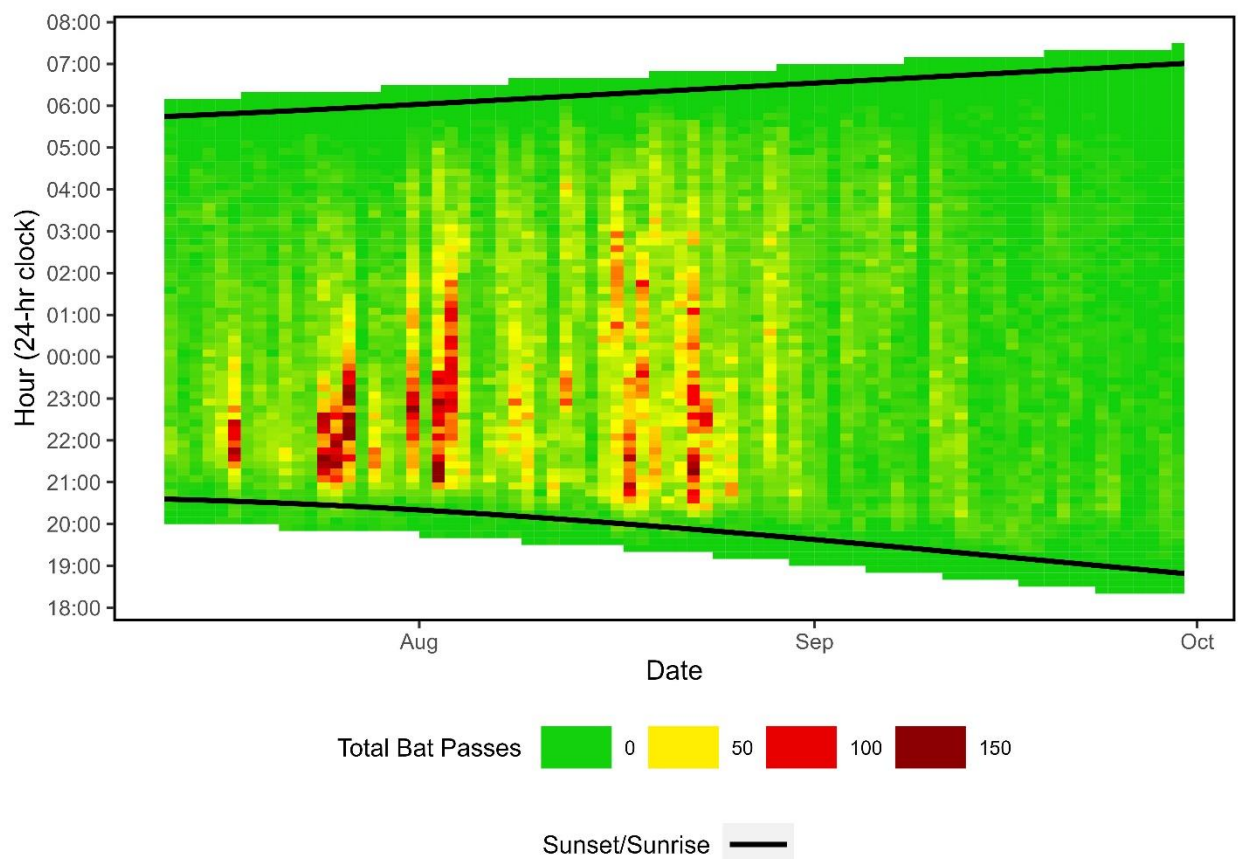
Figure 3. **The distribution of bat activity (i.e. bat passes; sums of 10-min interval aggregations of bat echolocation sequences) for all detectors recording at the Cardinal Point Wind Project, July 15 – September 30, 2022.**

Each turbine has a SCADA operations and communications system that provides automated, independent, and remote operation. SCADA data provide detailed information for each turbine's operation and performance, allowing real-time control and continuous monitoring to ensure optimal operation and identification of potential problems. Wind speed, temperature, revolutions per minute (RPM), and operational codes were averaged across 10 min for each turbine. For every 10-min interval within the study period, SCADA variables were aligned with the bat activity

data. These variables included date, time of night (hours since sunset and hours until sunrise), temperature (degrees Celsius [°C]), and wind speed (m/s; measured at the nacelle).

The OSC model was run using all the above SCADA inputs considered as predictor variables. The model run produced 200,000 OSC algorithms. An OSC algorithm dictates curtailment based on rules associated with combinations of SCADA variables. More specifically, an algorithm is a curtailment schedule with rule-based changes in cut-in speed informed by specific combinations of the date, time of night, wind speed, and temperature.

For each algorithm, power production and bat activity coverage were calculated by applying each algorithm rule set to the SCADA and acoustic data collected in 2022. To estimate power production, an empirical power curve using wind speed (m/s), production values (MW), and a smoothing spline was produced from 2022 data where potential power production based on wind speed for each 10-min window of data was estimated. No curtailment above the manufacturer's cut-in speed (i.e., 3.0 m/s) was assumed as a reference condition for total possible power production across the entire study period. For each algorithm, the reduction in lost power (that is, the percentage gained back toward total possible power production) relative to blanket curtailment at 5.0 m/s was calculated. To estimate the conservation benefit, bat activity "coverage" was calculated as the percentage of total bat activity (i.e., bat passes) that would have occurred during periods when turbines were curtailed (i.e., the blades would not have been rotating) if the algorithm had been implemented in 2022.

Consultation with GE in late spring and early summer 2023 revealed restrictions on algorithm complexity that could be implemented. Specifically, GE requested that no more than one cut-in speed be programmed within a single night. The initial run of the OSC suggested time of night as a predictor with multiple cut-in speeds switching throughout the night. Temperature was not identified as a good predictor for this dataset, likely because warm temperatures occur throughout the fall at the Project. To accommodate GE's request for a simpler algorithm, Capital Power ultimately chose a set of curtailment rules that included date, time of night, and wind speed as predictors.

With 200,000 potential algorithms, the final algorithm was chosen according to the following selection criteria: 1) the algorithm could be implemented with the current version of the SCADA software; 2) curtailment covered ≥50% of bat activity data collected in 2022; 3) the algorithm maximized power production among the algorithms that attained ≥ 50% bat activity coverage based on expected curtailment; and 4) the algorithm was as simple, or parsimonious, as possible without compromising any of the previous three criteria. From July 15 – August 31, turbines were operated as follows: from sunset to 20 min after sunset there was no curtailment; from 20 min after sunset to one hour and 45 min before sunrise turbines were feathered below 5.5 m/s; and from one hour and 45 min before sunrise to sunrise there was no curtailment (Figure 4). From September 1 – September 30, turbines were operated as follows: from sunset to 25 min after sunset there was no curtailment; from 25 min after sunset to one hour and 45 min before sunrise turbines were feathered below 3.0 m/s; and from one hour and 45 min before sunrise to sunrise there was no curtailment (Figure 4). Additionally, although not part of the OSC, turbines were also

feathered below 3.0 m/s October 1 – November 15 when temperatures were above 10 °C, per the HCP (Table 2). All curtailment ceased November 16.
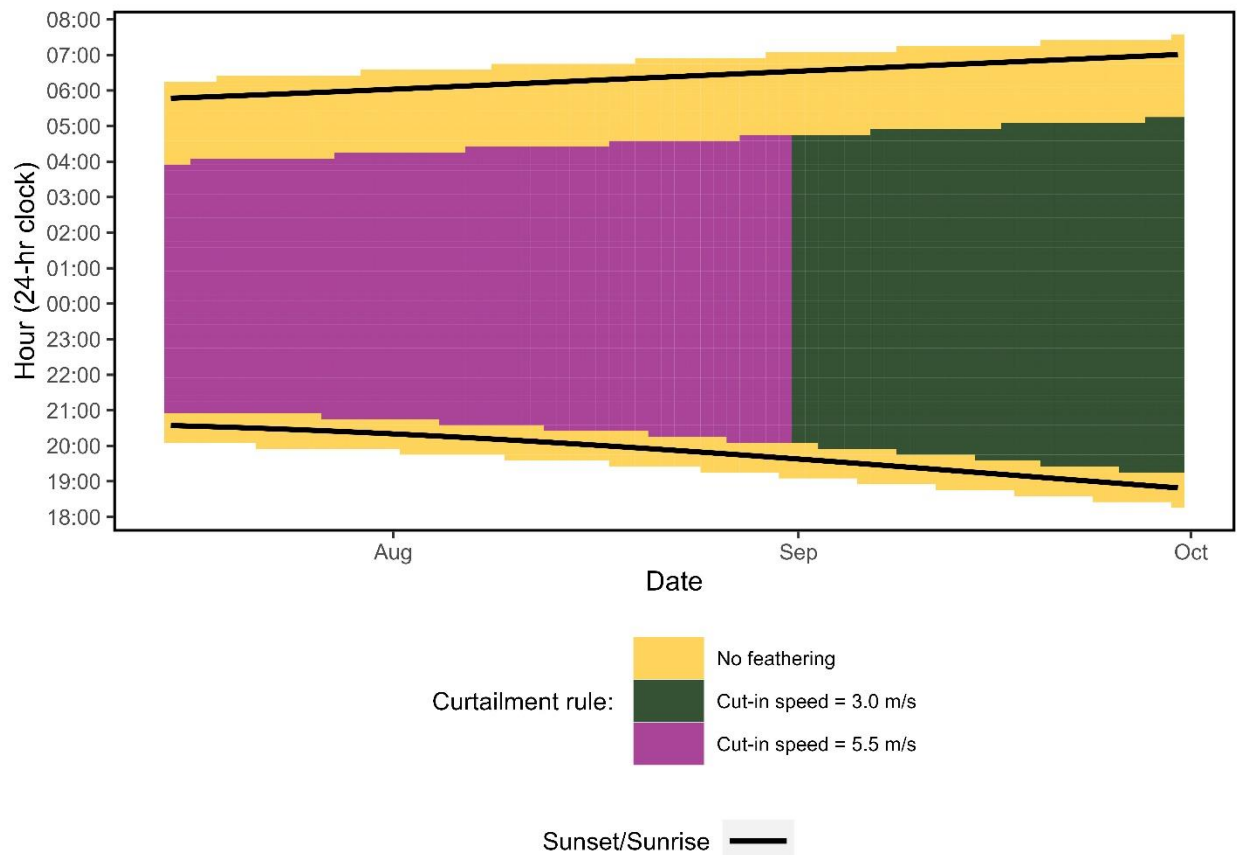
Figure 4.   Optimized smart curtailment (OSC) algorithm implemented at 20 turbines at the Cardinal Point Wind Project, July 15 – September 30, 2023.

Had the algorithm been operating in 2022 from July 15 – September 30, 51.1% of bat activity (as recorded) would have occurred when turbines were in a curtailed state based on wind speeds and cut-in speeds. This is comparable to the 47.5% coverage estimated during the same period with a 5.0 m/s (blanket) cut-in speed.

Curtailment Treatments

Turbines were assigned to three groups (with 20 turbines in each) as described below: 7.5 m/s blanket curtailment, 5.0 m/s blanket curtailment, or OSC (variable cut-in speeds with a maximum of 5.5 m/s; Table 2, Figure 5). Groups were assigned using a spatially balanced sample design to ensure that selected turbines provided a representative sample of the facility. Generalized random tessellation stratified sampling was used to select turbine treatments and plot types (Stevens and Olsen 2004; Olsen et al. 2012), as implemented in the *survey R* package (Dumelle et al. 2023). For the 40 turbines within either the OSC or 5.0 m/s blanket curtailment groups, plot type (cleared, uncleared, and road and pad plot) was randomly assigned (Figure 5). Curtailment assignments for the OSC and 5.0 m/s blanket curtailment groups were subsequently verified

using operational and weather data (see *Evaluation of Optimized Smart Curtailment Performance in 2023* below).

In 2023, the facility operated at a 3.0 m/s cut-in speed from April 1 – July 14 and from October 1 – November 15 from sunset to sunrise when temperatures were above 10°C. Turbine operations were split into three groups from July 15 – September 30 (Table 2). The 7.5 m/s blanket curtailment group was feathered below cut-in speed from sunset to sunrise when temperatures were above 10°C. The 5.0 m/s blanket curtailment group was feathered below cut-in speed from sunset to sunrise when temperatures were above 10°C. The OSC group operated at variable cut-in speeds from July 15 – September 30 with no temperature threshold. Although the curtailment experiment (OSC vs. 5.0 m/s blanket curtailment) ended October 1, fatality monitoring continued through October 15.

Table 2. **Operational curtailment implemented during the fall season at the Cardinal Point Wind Project in 2023.**

Season	Turbines	Time of Day	Cut-In Speed*	Feathering Below Cut-In?**	Temperature Threshold*
July 15 – September 30	20	sunset to sunrise	7.5 m/s	Yes	10°C
	20	sunset to sunrise	5.0 m/s	Yes	10°C
	20	variable†	OSC – variable†	Yes‡	None
October 1 – November 15	60	sunset to sunrise	3.0 m/s	Yes	10°C

* All cut-in speeds listed in Table 2, and as described for this Project throughout this report, were adjusted +0.4 m/s to account for hysteresis of the turbine operations. "Hysteresis of turbine operations" refers to the buffer-in threshold values of wind speeds necessary to change the operation state between curtailed and not curtailed. For example, a turbine with a 5.0 m/s cut-in speed, may require a sustained wind speed of more than 5.2 m/s for the rotor to begin spinning from a curtailed state, and may require a sustained wind speed of less than 4.8 m/s to begin curtailing from an operational state. In this example, increasing the cut-in speed threshold with a 0.4 m/s offset ensures turbines are curtailed below 5.0 m/s.

** Feathering means that turbine blades will be pitched into the wind such that they spin at approximately one revolution per minute.

† July 15 – August 31: cut-in speed was 5.5 m/s from 25 minutes (min) after sunset until one hour and 45 min before sunrise; evening of September 1 – September 30: cut-in speed was 3.0 m/s from 25 min after sunset until to one hour and 45 min before sunrise.

‡ During the period of OSC implementation (July 15 – September 30), feathering below cut-in speed was eliminated for short periods of the night, from sunset to 25 min after sunset and from one hour and 45 min before sunrise to sunrise.

°C = degrees Celsius; m/s = meters per second; OSC = optimized smart curtailment.
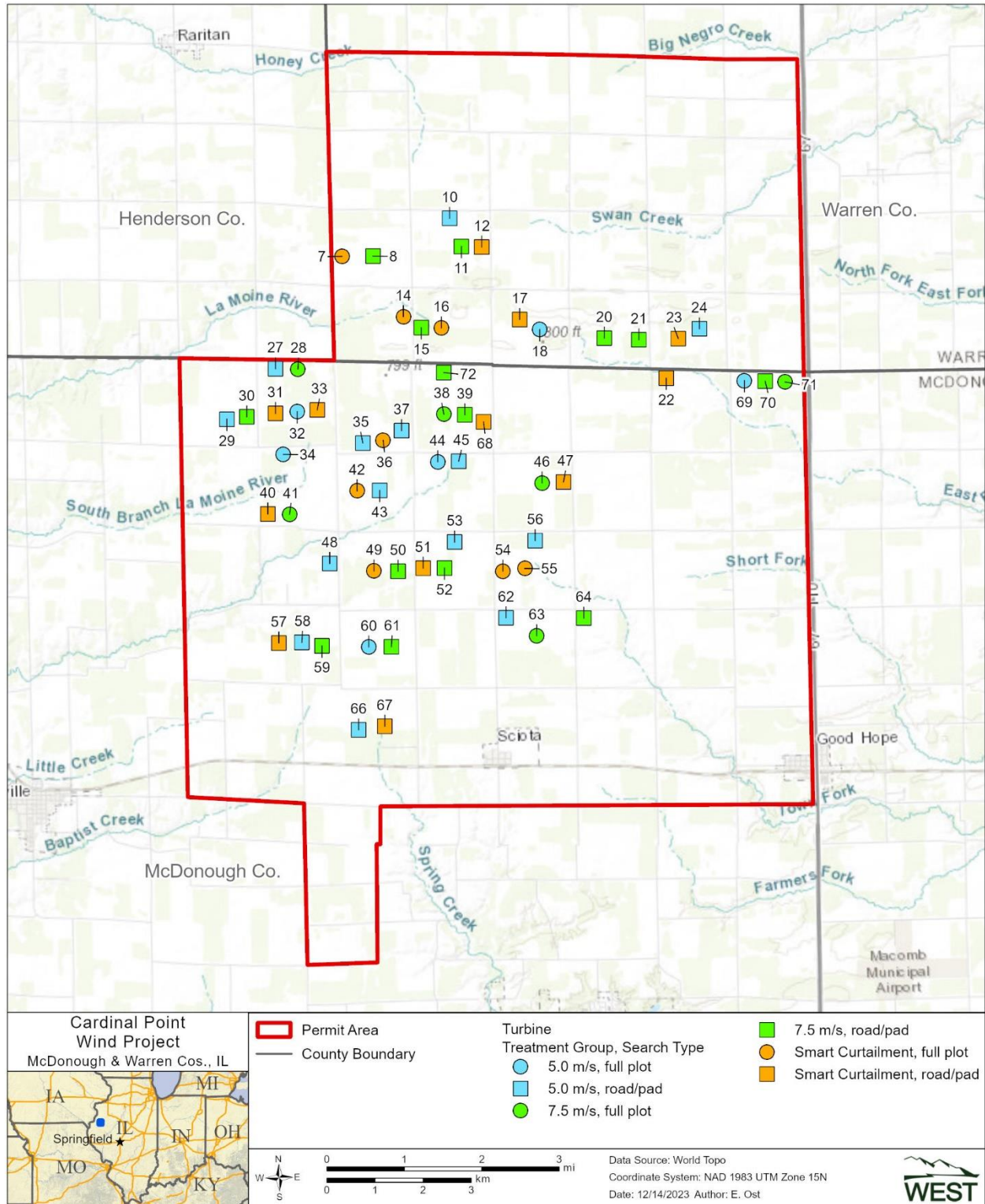
Figure 5. Turbine treatment and plot types surveyed from July 15 – October 15, 2023, at the Cardinal Point Wind Project.

Acoustic Monitoring

Acoustic monitoring occurred March 10 – November 2, 2023, to understand seasonal risk to the Covered Species and to gather additional data for adjusting minimization measures, as needed, in future years. Surveys were conducted at the same locations used in 2022, which were spatially balanced throughout the Project Area at six nacelle-mounted detectors and 12 ground detectors at 16 total locations (Figure 2). Full-spectrum Song Meter SM3BAT ultrasonic detectors (SM3; Wildlife Acoustics, Inc., Maynard, Massachusetts) and full-spectrum Song Meter SM4BAT ultrasonic detectors (SM4; Wildlife Acoustics, Inc.) were used during the study. The SM3 detector records on two channels, allowing for simultaneous recording on two microphones. The microphones of ground detectors were elevated three m above ground, whereas the microphones of raised detectors were elevated 95 m above ground. SM4 detectors utilize broadband high-frequency omnidirectional microphones to detect the echolocation calls of foraging and commuting bats. These echolocation calls were recorded and stored on memory cards for analysis.

Each microphone represents a single station and samples a discrete airspace. SM3 and SM4 microphones have a variable detection distance (approximate maximum detection distance of 30 m), influenced by atmospheric attenuation (affected by humidity, temperature, and air pressure), surrounding vegetation, and wind, as well as bat call frequency, amplitude, and direction.

Detectors were programmed to record from approximately 30 min before sunset until 30 min after sunrise each night throughout the survey period. Detectors were checked every other week throughout the survey period to ensure they were functioning properly. Summary files associated with each recording session were reviewed in detail to ensure each detector (and station) was operational and the microphone(s) was/were triggering throughout the recording period. The SM3s and SM4s were set using a trigger window of five seconds and a maximum file length of 15 seconds.

The full-spectrum acoustic recordings were input into Kaleidoscope Pro 5.4.7 (Kaleidoscope; Wildlife Acoustics, Inc. 2022) for automated identification using the Bats of North America classifier 5.4.0 at the "0" sensitivity setting (Wildlife Acoustics, Inc. 2022). These settings and version are approved by the USFWS for acoustic analysis of sensitive species (USFWS 2019). Despite the capabilities of Kaleidoscope, many bat passes cannot be identified with absolute certainty, either because only call fragments were recorded due to the distance between the bat and microphone, or because many bat species produce similar calls with overlapping call characteristics that often cannot be distinguished. Therefore, automated call identification is imperfect, and each identification has an associated error rate (USFWS 2013, USFWS and US Geological Survey 2019).

Full-spectrum data were transformed into zero-crossing data using Kaleidoscope, allowing data to be viewed in Analook© software as digital spectrograms that show changes in echolocation call frequency over time (Analook 2004). Frequency versus time displays were used to separate bat

calls from other types of ultrasonic noise (e.g., wind, rain, insects) and to determine call frequency category. A bat pass was defined as a sequence of at least two echolocation calls (pulses) produced by an individual bat with no pause between calls of more than one second, unless determined to be a single individual by a qualified bat biologist (Fenton 1980, Gannon et al. 2003).

All calls identified as a Covered Species by automated identification software were examined and verified by a qualified biologist with extensive acoustic identification experience. If call sequences were not characteristic of the identified Covered Species, contained distinct calls produced by another species, or were of insufficient quality, they were reclassified. Additionally, calls identified as high frequency bat calls, but not identified to species by automated identification software were also examined and verified by a qualified biologist.

Evaluation of Optimized Smart Curtailment Performance in 2023

Acoustic Activity

To assess differences in bat activity between 2022 and 2023, bat activity was examined across date and time within night. Using the 2023 acoustic data and turbine SCADA, observed coverage (i.e., the percentage of bat activity occurring while turbine blades were not moving) was calculated for the two treatment groups (OSC and 5.0 m/s blanker curtailment). Acoustic data from the three ground-based detectors deployed at OSC turbines were used to estimate actual call coverage at those three OSC turbines, and acoustic data from the four ground-based detectors deployed at 5.0 m/s blanket curtailment turbines were used to estimate actual call coverage at those four 5.0 m/s turbines. Coverage was estimated by assessing the percentage of bat activity, in 10-min intervals, that was associated with each of the three turbine operation codes at this subset of OSC and 5.0 m/s turbines: 1) operating, 2) curtailed for bats, and 3) down/maintenance. When operating codes were associated with RPM of less than one, these were changed to curtailed for bats as the turbine operational states would be the same.

In addition, using the 2023 acoustic data and turbine SCADA, bat activity coverage across all 16 detectors was estimated for hypothetical scenarios in which all monitored turbines operated under either OSC or 5.0 m/s blanket curtailment. Coverage was estimated by pairing all-bat activity data and turbine SCADA data to calculate the percentage of bat passes occurring during expected turbine curtailment or operation, as determined from wind speed and the planned cut-in speed in each 10-min interval.

Turbine Operations and Maintenance

To ensure that the fatality estimates of the two treatment groups (OSC and 5.0 m/s blanket curtailment) were not biased due to excessive maintenance or down time in one group or the other, an analysis of turbine operations was performed on the SCADA data. Proportions of time in the operating, curtailed, and down/maintenance state were calculated overall and by month for the period of July 15 – October 15, 2023. These states were determined by the manufacturer operations codes within the SCADA data and modified as described in the paragraph above.

Periods when turbines were down or undergoing maintenance were then removed from the above dataset. A confusion matrix showing the percentage of time that expected and actual operational states were and were not in agreement was produced for each turbine and across both treatment groups to ensure that turbines were behaving correctly. The expected behavior of each turbine was determined to be operating or curtailed based on the cut-in speed and the wind speed in each 10-min interval. The actual behavior of each turbine was determined by the manufacturer-provided states (i.e., operating or curtailed for bats), again with the modification that operating turbines with RPM less than one were reclassified as curtailed for bats.

Standardized Carcass Searches

WEST used data from previous PCM studies at the Project (Chodachek et al. 2022, 2023) to develop a study plan that targeted a probability of detection *g* of 0.15 across the 40 turbines operating under OCS or 5.0 m/s blanket curtailment (i.e., turbines with non-zero Evidence of Absence [EoA] weights). Standardized carcass searches were conducted during the fall (July 15 – October 15) at all 60 turbines. The curtailment experiment was conducted from July 15 – September 30, but monitoring continued through October 15 to ensure that the survey period completely encompassed the fall active season for bats.

Number of Turbines Sampled, Search Frequency, and Plot Size

Detection dog teams searched 12 cleared and eight uncleared plots within a 70-m radius of 20 turbines twice weekly (Table 3; Figure 5). These turbines were allocated evenly between the 5.0 m/s and OSC treatment groups. Project staff maintained the vegetation height inside the 70-m radius search area of cleared plots to 25 centimeters or less. Uncleared plots were planted in soybeans (*Glycine max*) and had up to four transects mowed, each approximately 1.5 m wide, to assist detection dog teams with plot access while limiting overall crop damages. The remaining 20 5.0 m/s blanket and OSC turbines were searched twice weekly by technicians as 100-m roads and pad plots (Table 3; Figure 5). The 20 7.5 m/s blanket curtailment turbines were searched weekly by technicians as 100-m roads and pad plots (Table 3, Figure 5). Treatment assignments were constant throughout the study.

Table 3. Search effort by treatment group, searcher type, and plot type at the Cardinal Point Wind Project, from July 15 – October 15, 2023.

Curtailment Treatment Group[1]	Searcher	Plot Type	Number of Plots	Search Interval
5.0 m/s blanket	Technician	100-m roads and pads	10	3.5 days
	Detection dog team	70-m cleared plots	6	3.5 days
	Detection dog team	70-m uncleared plots	4	3.5 days
OSC	Technician	100-m roads and pads	10	3.5 days
	Detection dog team	70-m cleared plots	6	3.5 days
	Detection dog team	70-m uncleared plots	4	3.5 days
7.5 m/s blanket	Technician	100-m roads and pads	20	7.0 days

[1.] From October 1 – 15, all turbines were curtailed below 3.0 meters per second (m/s), with a temperature threshold of 10 degrees Celsius. The plot types and search intervals that were in place from July 15 – September 30 were maintained throughout this additional monitoring period.

Search Methods

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

Road and Pad Searches – Technician

Technicians walked transects spaced five m apart at a rate of approximately 45–60 m per min on all gravel road and pad areas within 100-m of the turbine. The technicians scanned the area for carcasses on both sides of the transect out to approximately 2.5 m to ensure full visual coverage of each search area (Figure 6).

Figure 6.   Representative photographs of a 100-meter road and pad plot searched by a technician at the Cardinal Point Wind Project, from July 15 – October 15, 2023. Inset shows a gravel pad at a turbine base.

Plot Searches – Detection Dog Teams

Detection dog teams searched 70-m full plots (including both cleared and uncleared plots) for bat carcasses (Figures 7 and 8). Prior to each search, handlers determined the survey start point and the number of transects needed to cover the plot after considering wind speed and direction, as well as crop row direction and density (when applicable). Handlers oriented the detection dog to start searches perpendicular to the wind to maximize scent detection. Both wind speed and crop density can affect dispersal of the target odor (i.e., bat carcasses) across the search area. To maximize detection rates during an olfactory search, transect width varied with crop density,

ranging from five to 10 m apart in densely vegetated areas, to 10–15 m apart in shorter vegetation. Any unsearchable areas were delimited and accounted for in the searched area adjustment.

Figure 7.   Representative photograph of a 70-meter cleared plot searched by a detection dog team at the Cardinal Point Wind Project, from July 15 – October 15, 2023.
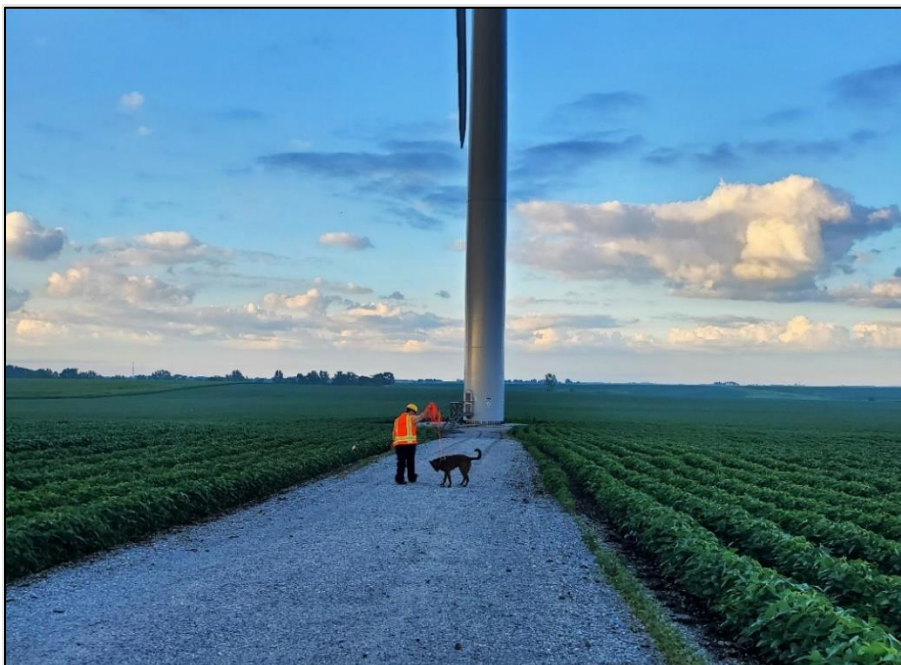
Figure 8.   Representative photograph of a 70-meter uncleared plot searched by a detection dog team at the Cardinal Point Wind Project, from July 15 – October 15, 2023.

Detection Dog Team Evaluation

Detection dogs were considered candidates for conducting carcass searches at the Project if they met basic temperament and obedience criteria and demonstrated the trainability to detect bat carcasses. Temperament characteristics sought after were high-energy and a high toy or food drive. Prior to conducting searches at the Project, handlers trained their detection dogs on the scent of bat carcasses following methods derived from search and rescue programs, and drug detection programs (Kay 2012, Helfers 2017). Dogs were initially trained on dehydrated bat carcasses as the target odor. Once the dog had 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 under conditions representative of the actual survey area. The detection dog coordinator conducted a 2-day field evaluation for any detection dog team new to WEST, and again on an annual basis for returning teams; after teams achieved a searcher efficiency (SEEF) of 75% or greater for a minimum 15 trial bats placed during double-blind evaluation trials, the teams were approved to conduct carcass searches. Because the objective of the study focused on detecting bat carcasses, dogs were not explicitly trained with native bird carcasses; however, all detection dogs alerted to bird carcasses in the field, and handlers rewarded bird finds in the field to encourage future alerts to bird carcasses. Breeds of detection dogs used at the Project included English shepherd, Australian shepherd mix, and Labrador retriever/Doberman mix.

Data Collection

For each scheduled search, technicians recorded the date, start and end times, technician name, turbine number, type of search, and if any carcasses were found. When a carcass was found, technicians placed a flag near it and continued the search. After searching the entire plot, the technician returned to record information for each carcass on a carcass information sheet, including the date and time, species, sex and age (when possible), technician name, turbine number, measured distance from turbine, azimuth from turbine, location of carcass using a geographic coordinate system (latitude and longitude), habitat surrounding carcass, condition of carcass (e.g., intact, scavenged, dismembered, injured), and estimated time of death (e.g., less than one day, two to three days).

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

- Intact—a carcass that is complete, is 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 apart from one another due to scavenging or other reasons.
- Injured—a bat or bird found alive.

For bird carcasses, the following category was also used:

- Feather spot—10 or more feathers (excluding down), or two or more primary feathers at one location indicating predation or scavenging of a bird carcass.

Technicians took digital photographs of each carcass, including any visible injuries, and surrounding habitat. No bird carcasses were collected, but a marker was placed next to each bird carcass to avoid duplicate counting. Bat carcasses were collected under the Project's ITP (#ESPER3926307), WEST's Federal Native Endangered and Threatened Species Recovery Permit (ES234121), and WEST's State Scientific Collection Permit (17362). At the time of the study, a state Incidental Take Authorization (ITA) was pending and the Illinois Department of Natural Resources (Illinois DNR) had approved the associated Conservation Plan (covering the state-listed Indiana bat and northern long-eared bat); the ITA was issued by the Illinois DNR on January 19, 2024 (ITA 263).Technicians placed each bat carcass in a re-sealable plastic bag labeled with a unique carcass identification number, turbine number, and date, for storage in a freezer on site. Leather gloves covered by nitrile or latex gloves were used to handle all bat carcasses to eliminate possible transmission of rabies or other zoonotic diseases, and to reduce possible human scent bias on any carcasses used later in bias trials. Any live, injured bats were recorded and considered fatalities for analysis purposes when observed in search areas and were handled in accordance with permit conditions (left in place).

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

Carcass Identification and Agency Notification

Identification of bird carcasses was verified by biologists with significant field experience in identification of birds and their feathers. Federally permitted bat biologists verified the identifications of all bat carcasses via photographs throughout the survey period (ES26854C-2, TE21829B-2, ES03495B-3, TE33467D-0, TE62046D). The USFWS was notified within 24 hours of positive identification of any Covered Species based on morphological characteristics evident in photographs. The Illinois DNR was identified within 24 hours of positive identification of any Indiana bat carcasses based on morphological characteristics evident in photographs. In the event a bat carcass could not be identified to species by a permitted bat biologist and had the potential to be a Covered species (i.e., no fur was present on the wing, forearm measured less than 40 millimeters [mm]), a tissue sample was taken and sent to the Dr. Jane Huffman Wildlife Genetics Institute at East Stroudsburg University for genetic identification. For those samples that were genetically identified as a Covered Species, molecular sex determination was also requested. The results of the genetic testing were provided to the USFWS on December 11, 2023, and to the Illinois DNR on January 22, 2024. Bat carcasses that were heavily scavenged but did not have potential to be a Covered Species (i.e., fur was present on the wing, forearm measured more than 42 mm) were identified to the closest genus or species group possible and were not sent off for genetic testing.

Bias Trials

Searcher Efficiency Trials

The objective of SEEF trials was to estimate the probability that a carcass was found by searchers. SEEF trials were conducted in the same areas where carcass searches occurred. Searchers did not know when SEEF trials were being conducted or the location of the trial carcasses. Trial carcasses consisted of eastern red bats (*Lasiurus borealis*), hoary bats (*L. cinereus*), and a big brown bat (*Eptesicus fuscus*) that had previously been found on site. A minimum of 19 bat carcasses were placed and confirmed available per plot type by the trial administrator. Multiple trials were conducted to account for potential changes in plot conditions on SEEF throughout the season.

Each trial carcass was discreetly marked with a black zip-tie around the upper forelimb for identification as a study carcass. The trial administrator walked in a meandering path and dropped trial carcasses from waist-height or higher and allowing them to land in a random posture at the pre-determined drop locations. Carcasses were dropped the afternoon prior to the next search to allow time for the scent to pool and disperse prior to scheduled searches by detection dog teams. The number and locations of trial carcasses found during the subsequent search were recorded, and the number of trial carcasses available for detection during each search was determined immediately after each trial by the trial administrator. Searchers had one chance to locate trial carcasses during the first search after carcass placement. Following searches, the trial administrator coordinated with the detection dog handlers to check any trial carcasses that were not detected to confirm their availability.

Carcass Persistence Trials

The objective of carcass persistence (CP) trials (CPTs) 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 plot type to account for the effects of varying weather and climatic conditions on CP across plot types. No more than three trial carcasses were placed on a plot per CPT to avoid potential over-seeding and attracting scavengers.

Technicians monitored the CPT carcasses as closely as possible over a 30-day period according to the following schedule: carcasses were checked daily for the first four days, then on days 7, 10, 14, 20, and 30. Trial carcasses were monitored until the carcasses were completely removed or the trial period ended.

Search Area Mapping

Technicians recorded the boundaries of all plots using an Eos submeter Global Positioning System 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.

Quality Assurance and Quality Control

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

Fatality Estimation

Fatality estimates were calculated for all bats by plot/searcher type[2] for the OSC, 5.0 m/s blanket curtailment group, and 7.5 m/s blanket curtailment group, using GenEst (a generalized estimator of fatality; Dalthorp et al. 2018, Simonis et al. 2018). Each carcass included in the analysis was adjusted for SEEF, CPT, a detection reduction factor (k; see below), and a search area adjustment. Estimates and 90% confidence intervals (CIs) were calculated using a parametric bootstrap (Dalthorp et al. 2018) for each category listed above.

The EoA (Dalthorp et al. 2017) modeling framework was used to estimate take of the Covered Species. To estimate take, EoA used data collected in the field to estimate the overall probability of detecting a bat fatality, the take rate of the Covered Species, and the number of Covered Species carcasses that occurred. GenEst methods were used to fit statistical models for SEEF, CP, and the searched area adjustment (Dalthorp et al. 2018, 2019; Simonis et al. 2018) as inputs for the EoA-derived take estimates. Adaptive management triggers were evaluated using EoA, except for the northern long-eared bat (where a "bats in hand" method is used, per HCP Section 6.5).

Searcher Efficiency Estimation

EoA uses raw SEEF data (number of found and available trial carcasses) to inform the overall probability of detection. However, to determine if SEEF data should be pooled, or separated by strata such as season or plot type, SEEF was modeled using logistic regression, while accounting for the detection reduction factor, k (Dalthorp et al. 2018). SEEF was modeled separately for detection dog teams and technicians to account for different modes of detection (scent for dogs, sight for humans), with plot type (cleared vs. uncleared) included as a potential covariate for the detection dog team models. Model selection was completed using the corrected Akaike Information Criterion (AICc; Burnham and Anderson 2002). The best model was selected as the most parsimonious model (with the fewest parameters) within two AICc units of the model with the lowest AICc value. SEEF values were input into the EoA software according to the model selection results (Dalthorp et al. 2018, Simonis et al. 2018).

[2.] Note that plot type (cleared and uncleared plots or road and pad plots) and searcher type (technician or detection dog team) were always associated with one another in this study, such that plot type and searcher type are interchangeable.

The change in SEEF between successive searches was defined by a parameter called the detection reduction factor (*k*) that can range from zero to one. When *k* is zero, it implies a carcass that was missed on the first search would never be found on subsequent searches. A *k* of one implies SEEF remained constant no matter how many times a carcass was missed. 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 and GenEst.

Carcass Persistence Rate Estimation

Data collected during CPT were used to estimate the amount of time, in days, carcasses remained available to be located by the searcher. The average probability a carcass persisted through the search interval (i.e., the time between scheduled searches) was estimated using an interval censored- survival regression with four potential distributions: exponential, loglogistic, lognormal, and Weibull distributions (Kalbfleisch and Prentice 2002, Dalthorp et al. 2018). CPT was modeled separately for detection dog teams and technicians to account for different modes of detection (scent for dogs, sight for humans). Plot type (cleared vs. uncleared) was included as a potential covariate in the detection dog team models, which was fit to all parameters of the candidate distributions. 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% CI of β) were used as inputs in the EoA Single Class Module (Dalthorp et al. 2018, Simonis et al. 2018).

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 was used to estimate the carcass-density distribution using site-specific fatality locations (Khokan et al. 2013). TWL uses a weight-based probability of detection and the proportion of area searched in each 1.0-m annulus around the turbine. Bats struck by turbine blades at higher speeds tend to land farther from the turbines compared to those struck at lower speeds (e.g., Rabie et al. 2022). Therefore, due to the varying cut-in speeds between treatment groups, carcass-density distribution models were fit for each group separately and compared to additional models fit with data pooled across all curtailment groups. Distributions considered were normal, gamma, Gompertz, and Weibull (parameterized according to R Development Core Team [2016] and Yee [2015]). The best model was selected as the most parsimonious model within two AICc units of the model with the lowest AICc value. 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 Analysis

Fatalities were excluded from the area adjustment calculation when the carcass was discovered outside of the spatial and temporal scope of the survey design. Carcasses found outside a designated plot were not included because the area adjustment accounts for the carcass by adjusting for unsearched areas. Carcasses found prior to the start of surveys (e.g., during

detection dog team evaluations) were also excluded because the fatality event occurred outside of the study period. Carcasses found on a plot incidentally were included in the analysis if that plot had a scheduled search in the future.

Covered Species Take

Covered Species-specific take estimates were calculated in EoA (Dalthorp et al. 2017). These estimates require three components: carcass counts of the Covered Species, probability of detection (*g*), and a density-weighted proportion (DWP). The annual take rate (λ) was estimated for Indiana, tricolored, and little brown bats; no estimates were generated for the northern long-eared bat, as detection of a single carcass triggers adaptive management. Cumulative take estimates (M*) were also estimated to determine whether the authorized take amounts had been exceeded for Indiana, tricolored, or little brown bats (HCP Sections 6.4.2 and 6.5).

The probability of detection (*g)* was calculated based on SEEF, CP, proportion of carcasses in the search area (i.e., the searched area adjustment), the fraction to which SEEF was reduced with each successive search (detection reduction factor, or "*k*" in the EoA model/software), and the arrival proportions (i.e., phenology of bat mortality). Differences in turbine operations (e.g., turbines down for maintenance) and the level of risk between curtailment treatments were also accounted for, as described below.

The data from the study was separated into search strata, where each stratum was defined by a group of turbines and length of time in which all bias corrections were the same. For this study, strata were defined by each combination of plot type, treatment group, and season (e.g., road and pad plots at turbines in the OSC group during the fall). The EoA Single Class module was used to estimate the detection probability in each search stratum, which resulted in α and β parameters that defined the beta distribution of detection probability in each stratum.

EoA requires estimates of the weights ("DWP" in the software), which represent the relative amount of fatality risk within each search stratum (HCP Section 6.4.2.1). There are three factors that were considered in determining weights: the within-season sampling fraction, the relative turbine operations, and the relative curtailment risk (Table 4). The within-season sampling fraction was defined as the proportion of turbines in each stratum relative to the total number of turbines at the Project. The relative turbine operations were defined as the proportion of turbine-searches in which turbines were operational, where one search at each of the 40 risk turbines (the 20 operating under 5.0 m/s blanket curtailment and the 20 operating under OSC) counted as 40 turbine-searches. Given that turbines at every project undergo routine maintenance due to repair or other unplanned downtime, relative turbine operations were considered normal (i.e., one) unless the proportion of non-operational turbine-visits was more than 0.1 during the study period. Finally, the relative curtailment risk was defined as the relative fatality risk to bats associated with each curtailment treatment. For this Year 1 study, the 7.5-m/s cut-in speed represented curtailment under which Covered Species take was not reasonably certain to occur. Consequently, the relative fatality risk for the 20 turbines that operated at 7.5 m/s was assumed to be zero. The relative curtailment risk weights associated with the 5.0 m/s blanket curtailment turbines and the OSC turbines were determined based on the fraction of bat calls recorded while

turbine blades were spinning. For this study, because an ITP had not been obtained until the fall, and because monitoring was only conducted in the fall, detection probabilities and take estimates were calculated for the fall season only. Therefore, it was assumed that 100% of the risk occurred in the fall in this study (i.e., the arrival proportion was assumed to be one).

The EoA Multiple Class Module was used to combine detection probability distributions across plot types, with weights (as described above) calculated as the product of the within-season sampling fraction, relative turbine operations, and relative curtailment risk, re-scaled to sum to one within fall (Table 4). The results from the Multiple Class Module were used to estimate λ (the annual take rate) and M* (the cumulative take to date). Appendix E describes how the take estimates and detection probability were calculated using the EoA graphical user interface and includes representative screenshots of the inputs for the Single Class and Multiple Class modules.

Table 4. **Weights used for combining detection probability distributions across strata in the EoA Multiple Class Module.**

Plot Type	Curtailment Group	Within-Season Sampling Fraction	Relative Turbine Operations	Relative Curtailment Risk	Weights (DWP)
Full plot	5.0 m/s	0.17	1	0.42	0.24
	OSC	0.17	1	0.43	0.26
Road and pad	5.0 m/s	0.17	1	0.42	0.24
	OSC	0.17	1	0.43	0.26
	7.5 m/s	0.33	1	0	0

DWP = density-weighted proportion; m/s = meters per second; OSC = optimized smart curtailment.

Adaptive Management Triggers

Following the commitments in the HCP, the EoA model was used to estimate the annual take rate (λ) and cumulative take (M*) for use in testing adaptive management triggers to ensure compliance with the ITP.[3] While the median annual fatality rates were estimated as part of Year 1 reporting requirements per Section 6.6 of the HCP, the adaptive management triggers surrounding projected take will not be tested until Year 3 (per Section 6.5 of the HCP).

The cumulative take estimates from the EoA analysis were used to test one adaptive management trigger in Year 1: a long-term test of whether permitted take had been met for Indiana, tricolored, or little brown bats (Dalthorp and Huso 2015). In addition to the adaptive management trigger evaluated using EoA, several other triggers were evaluated: whether any Covered Species were found in the summer, whether any Covered Species were documented from October 1 – 15, and whether any northern long-eared bat carcasses were discovered (HCP Section 6.5).

An adaptive management trigger for mitigation was also evaluated. This trigger tested whether the cumulative take (M*) for Indiana bats was equal to or greater than 80% of the take used to calculate the upfront mitigation amount. The upfront mitigation amount covered the impact of the

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[3]. EoA will be used to estimate the cumulative take for Indiana, little brown, and tricolored bats. A "bats-in-hand" approach will be used for northern long-eared bats (Section **Error! Reference source not found.** of the HCP).

taking of 50% of the authorized take for Indiana bats (240), so the mitigation trigger tests whether M* is equal to or greater than 96 (80% of 120 Indiana bats).

Curtailment Effectiveness

As noted above, one goal of the study was to evaluate the effectiveness of the implemented OSC at reducing all-bat fatality at the Project in the first year of the ITP. To do this, all-bat fatality rates for OSC and the 5.0 m/s treatment groups were estimated using GenEst.

RESULTS

Acoustic Monitoring

Bat activity was monitored from March 10 – November 2, 2023. Overall, all detectors and microphones were operating for 91% of the sampling period (n = 3,881 nights). The detector deployed at Turbine 69 was mistakenly deployed at the ground rather than the nacelle at the start of the 2023 survey period; the first 28 nights of data collection were therefore ground-based after which the microphone was correctly positioned at the nacelle.

The acoustic data collected in 2023 showed that bat activity for all species combined was elevated between July 15 and August 24, with the highest activity levels from July 25 – August 12 (Figure 9, bottom panel). This peak in activity generally began 10–20 min after sunset and tapered off two hours before sunrise. This pattern has similarities to what was observed in 2022 (Figure 9, top panel), but was shifted slightly earlier in the year with heightened activity in early August that tapered off during mid-August. In contrast, in 2022, heightened activity persisted through late August.

Overall, qualitative review of the acoustic data from 2023 confirmed Indiana bat, tricolored bat, and little brown bat calls. No northern long-eared bat calls were identified in the dataset. The activity patterns of the three confirmed Covered Species generally followed the same seasonal and nightly patterns as shown above for all bat calls. Further information regarding the 2023 acoustic monitoring data, as relevant to any modifications to the OSC algorithm, will be provided as part of the study plan that will be developed for Year 2.
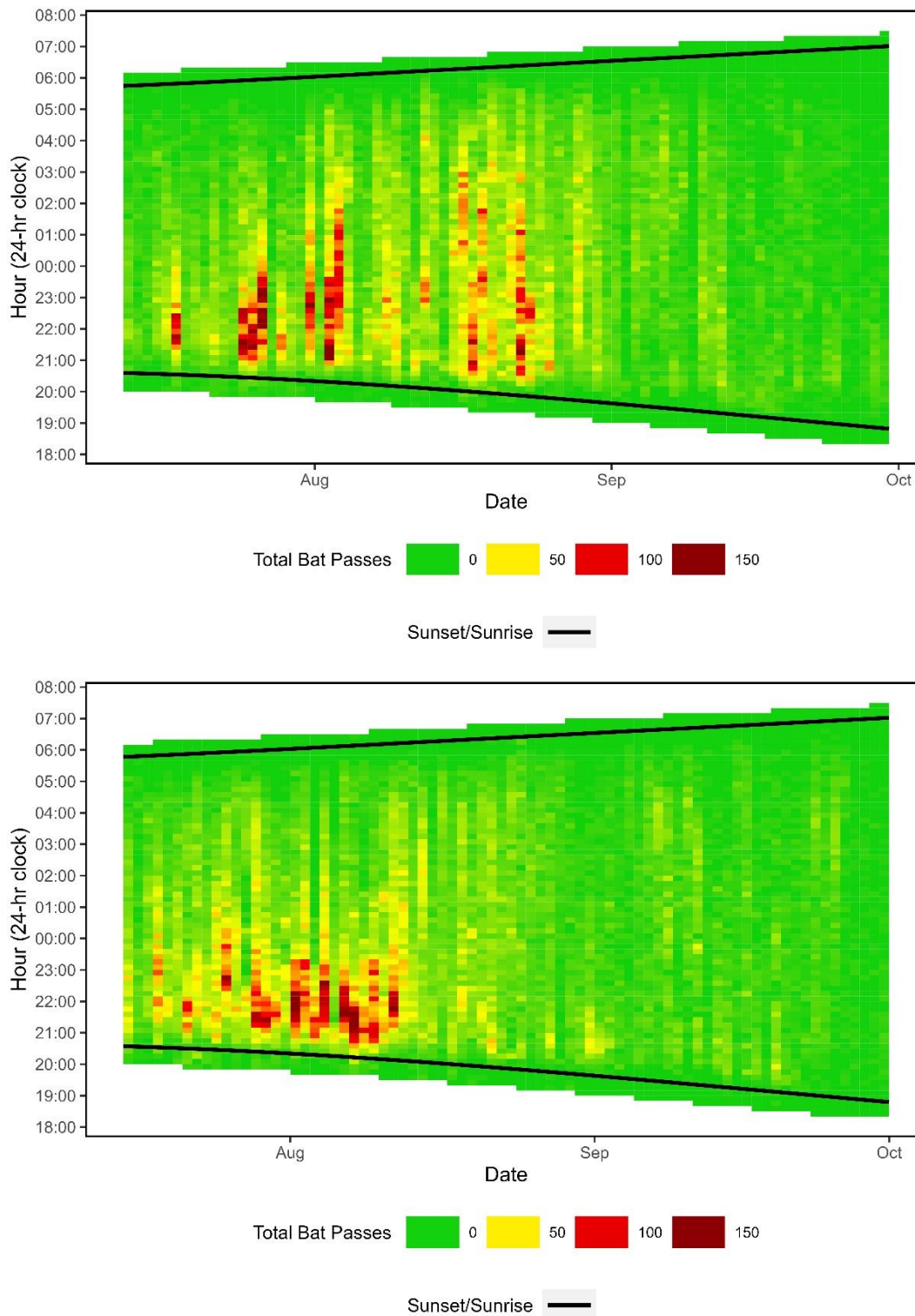
Figure 9. The distribution of bat activity (i.e., bat passes—sums of 10-min interval aggregations of bat echolocation sequences) for all detectors recording at the Cardinal Point Wind Project, from July 15 – September 30, 2022 (top panel) and July 15 – September 30, 2023 (bottom panel).

Evaluation of Optimized Smart Curtailment Performance in 2023

Acoustic Activity

Acoustic activity coverage was similar in the two curtailment treatments: 54% and 53% of the bat passes in the 5.0 m/s blanket curtailment group and the OSC group, respectively, occurred during curtailment. Eight percent and 6% of acoustic activity occurred when turbines were not operating for other down/maintenance reasons in the 5.0 m/s blanket curtailment group and the OSC group, respectively. Simulation scenarios in which all turbines were operating according to cut-in speeds and responding perfectly to wind speeds indicated that the bat activity coverage would have been 61% and 63% for the 5.0 m/s blanket curtailment group and the OSC group, respectively.

Turbine Operations and Maintenance

Using the manufacturer-provided codes from the full extent of the fatality monitoring period, from July 15 – October 15, the turbines at the Project were operating 65.9% and 76.6% of the time and were curtailed 25.9% and 19.8% of the time for the 5.0 m/s blanket curtailment and OSC treatment groups, respectively. The 5.0 m/s blanket curtailment group was down for maintenance or otherwise not operational 8.2% of the time, more than twice the down/maintenance percentage of the OSC group (3.7%; Figure 10).

Operating time across treatment groups was similar in July, August, and October (Figure 11). In September, the OSC group was operating 20% more than the 5.0 m/s blanket curtailment group; this difference is explained by the lower percentages of time in curtailment and turbine down/maintenance in the OSC group (Figure 11). Down/maintenance time in August and September was more than two times higher in the 5.0 m/s blanket curtailment group compared to the OSC group (Figure 11).

Disregarding down/maintenance time, turbines operated for the most part according to expectations. For example, when turbines were expected to be operating (i.e., based on wind speed and cut-in speed), turbines were operating 93.1% and 93.9% of the time for the 5.0 m/s blanket curtailment and OSC groups, respectively. When turbines were expected to be curtailed, turbines were curtailed 96.9% and 94.7% of the time for 5.0 m/s blanket curtailment and OSC groups, respectively (Table 5).

Because the operational states are determined from 10-min averages, a certain level of mismatch would naturally occur between how turbines were expected to be operating and how they were operating. Nonetheless, it was apparent that certain turbines were operating erroneously more often than others. For example, turbine 16 (OSC group) was only curtailed 71.9% of the time that it was expected to be curtailed and was instead operating 28.1% of the time it was expected to be curtailed. Other erroneously operating turbines were turbines 45 (OSC group), 72 (5.0 m/s blanket curtailment group), and 51 (5.0 m/s blanket curtailment group) which were operating 16.1%, 14.2%, and 10.6% of the time that curtailment was expected, respectively. All other turbine-specific error rates ranged from 5–10% of the time, indicating that the turbines were

infrequently curtailed when they should have been operating. These low-level error rates may be explained by the time lag in increasing RPM in response to increasing wind speed.
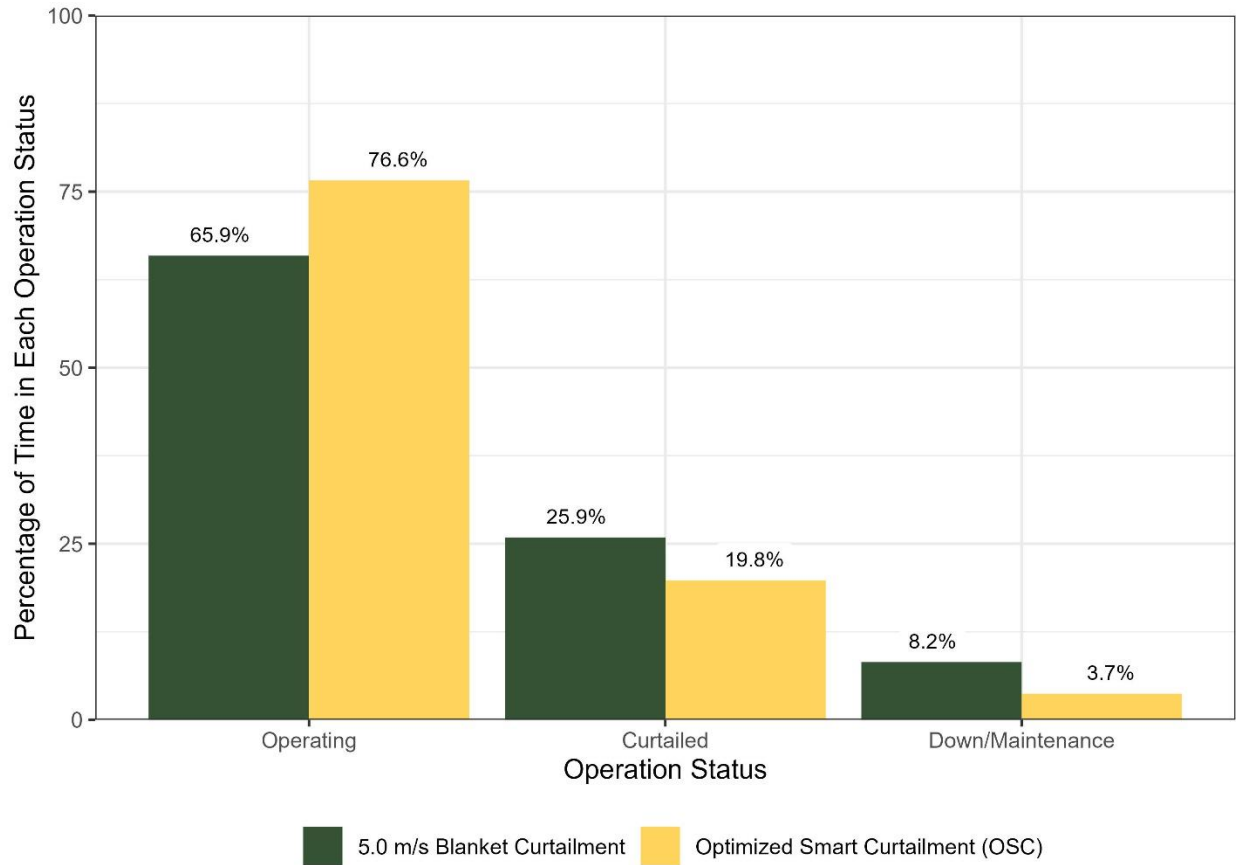
Figure 10. The percentage of time in each operation state (operating, curtailed, or down/maintenance) for the 5.0 m/s and OSC treatment groups of turbines during nighttime at the Cardinal Point Wind Project, July 15 – October 15, 2023.
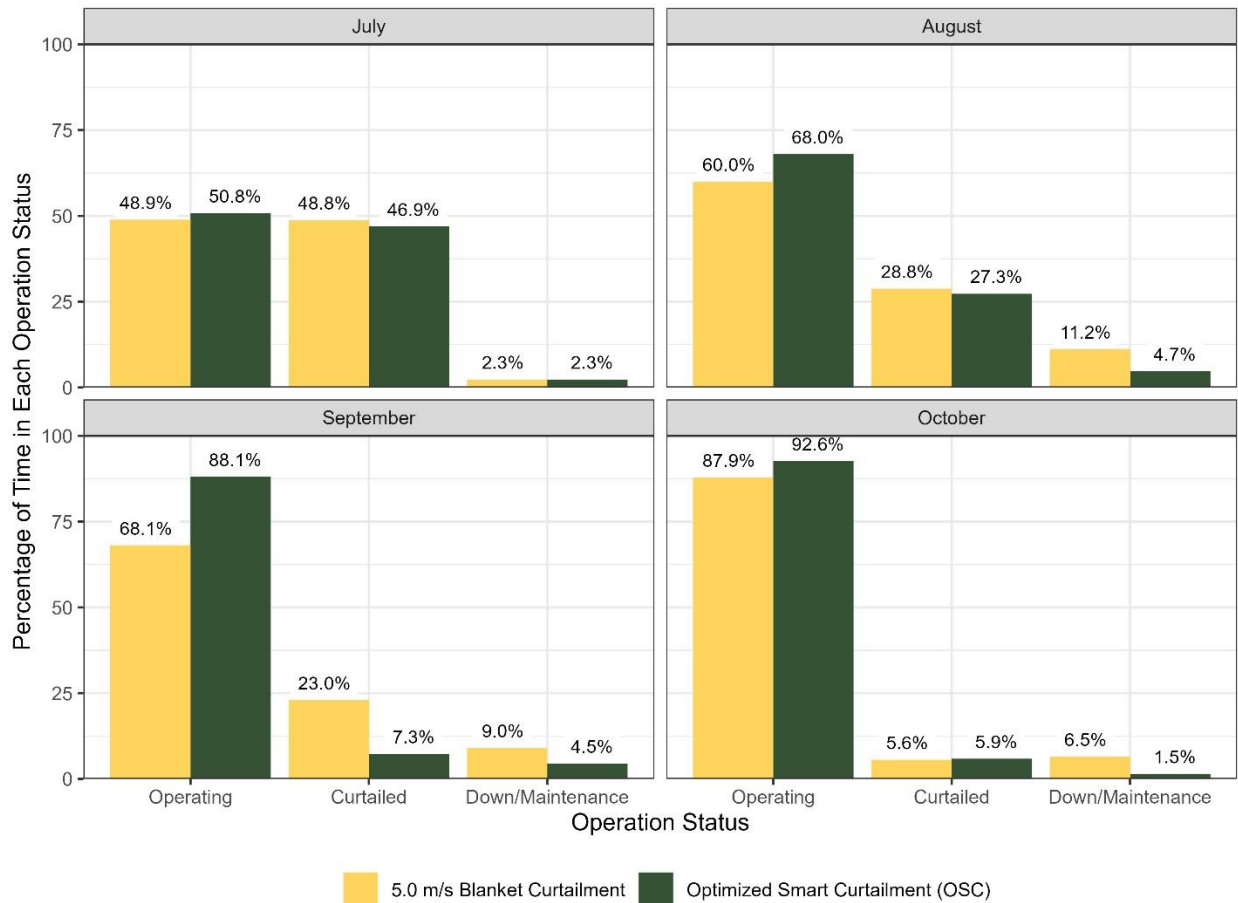
Figure 11. The percentage of time in each operation state (operating, curtailed, or down/maintenance) by month for the 5.0 m/s and OSC treatment groups (n = 20 turbines each) during nighttime at the Cardinal Point Wind Project, July 15 – October 15, 2023.

Table 5. Expected and unexpected operations (after removing down/maintenance states) confusion matrix displaying the percentage of time of correct and incorrect turbine operational state relative to expectations in the 5.0 m/s blanket curtailment and OSC groups during nighttime at the Cardinal Point Wind Project, July 15 – October 15, 2023.

		Actual State	
Curtailment Group	**Expected State**	**Operating**	**Curtailed**
5.0 m/s	Operating	93.1%	6.9%
	Curtailed	3.1%	96.9%
OSC	Operating	93.8%	6.2%
	Curtailed	5.3%	94.7%

m/s = meters per second; OSC = optimized smart curtailment.

Standardized Carcass Searches

In total, 1,291 carcass searches were conducted (Table 6). Eight searches (less than 0.6%) were missed due to turbine maintenance, weather constraints, or safety hazards. Bat carcasses were found at OSC and 5.0 m/s blanket curtailment turbines during each week of the monitoring period, with a peak in the end of August and early September (Figure 12). A small number of bat carcasses were found at the 7.5 m/s blanket curtailment turbines in eight of the 13 weeks of the monitoring period (Figure 12).

Table 6. **Search interval, number of searches, and number of bat carcasses found by curtailment group, searcher type, and plot type at the Cardinal Point Wind Project, from July 15 – October 15, 2023.**

Curtailment Treatment Group	Searcher	Plot Type	Search Interval	Number of Searches	Number of Bat Carcasses
5.0 m/s	Technician	100-m road and pad plot	3.5 days	258	33
	Detection dog team	70-m cleared plot	3.5 days	155	265
	Detection dog team	70-m uncleared plot	3.5 days	104	115
OSC	Technician	100-m road and pad plot	3.5 days	259	42
	Detection dog team	70-m cleared plot	3.5 days	144	284
	Detection dog team	70-m uncleared plot	3.5 days	115	135
7.5 m/s	Technician	100-m road and pad plot	7.0 days	256	18
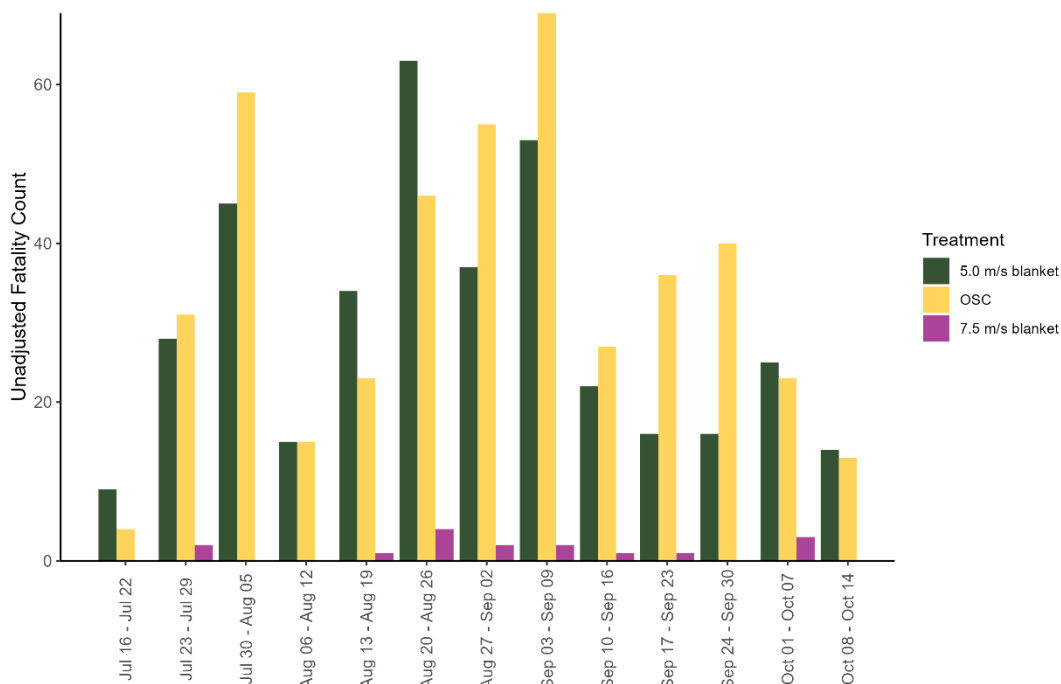
Figure 12. **Unadjusted fatality counts by week for the turbines operating in the 5.0 m/s blanket curtailment, OSC, and 7.5 m/s blanket curtailment treatment groups (n = 20 turbines each) at the Cardinal Point Wind Project, July 15 – October 15, 2023. The OSC cut-in speed decreased from 5.5 m/s to 3.0 m/s on September 1.**

Species Composition

Eight hundred and ninety-two bat carcasses were found during surveys and incidentally from July 15 – October 15, 2023 (Appendix A). Four Covered Species carcasses were identified based on morphological characteristics: one Indiana bat and three tricolored bats (Table 7). An additional seven Indiana bat and two tricolored bat carcasses were identified via genetic testing (see below, and Tables 7 and 8), for a total of eight Indiana bats and five tricolored bats discovered at the Project. None of the Indiana bat or tricolored bat carcasses were found at turbines operating at 7.5 m/s. Four of the Indiana bat carcasses were found at 5.0 m/s blanket curtailment turbines, and four were found at OSC turbines. Of the tricolored bat carcasses, one was found at a 5.0 m/s blanket curtailment turbine, and the other four were found at OSC turbines. No northern long-eared bat or little brown bat carcasses were discovered during monitoring.

WEST submitted tissue samples to the Dr. Jane Huffman Wildlife Genetics Institute at East Stroudsburg University for genetic testing from all known Covered Species (n = 4) and from bat carcasses and/or partial remains (n = 36) that could not be ruled out as being Covered Species. Results of the genetic testing confirmed the identities of the four known Covered Species (Table 6). Of the 36 unknown bats, species identifications were as follows: seven Indiana bats, two tricolored bats, eight eastern red bats, two hoary bats, six silver-haired bats (*Lasionycteris noctivagans*), four big brown bats, and six evening bats (*Nycticeius humeralis*; Appendix B). One sample failed analysis due to DNA degradation and remained classified as an unidentified bat (Appendix B). Genetic sex determination was also obtained for all Covered Species (Table 7).

The most common bat species found were the eastern red bat (64.1%), silver-haired bat (11.0%), hoary bat (10.1%), and big brown bat (4.5%). Searchers also found 26 evening bats, 23 unidentified *Lasiurus* bats, 16 eastern red or Seminole bats, eight unidentified non-*Myotis* bats, five Seminole bats (*Lasiurus seminolus*), and one unidentified bat (Table 8).

Table 7. **Summary of Covered Species found during post-construction fatality monitoring at the Cardinal Point Wind Project, from July 15 – October 15, 2023.**

Species	Date Found	Estimated Time since Death (in days)	Turbine Treatment Group	Species Identification in the Field	Genetic Species Identification	Genetic Sex Determination
Tricolored bat (*Perimyotis subflavus*)	8/21/2023	7–14	OSC	tricolored bat	*Perimyotis subflavus*[1]	Male
	8/26/2023	2–3	OSC	tricolored bat	*Perimyotis subflavus*[1]	Female
	8/29/2023	unknown	OSC	unidentified; dismembered, no head	*Perimyotis subflavus*[1]	Male
	9/1/2023	2–3	5.0 m/s	tricolored bat	*Perimyotis subflavus*[2]	Female
	9/11/2023	4–7	OSC	unidentified; dismembered, no head	*Perimyotis subflavus*[2]	Female
Indiana bat (*Myotis sodalis*)	8/22/2023	0–1	5.0 m/s	Indiana bat	*Myotis sodalis*[1]	Female
	8/26/2023	2–3	5.0 m/s	unidentified; dismembered	*Myotis sodalis*[1]	Male
	9/1/2023	4–7	OSC	unidentified Myotis	*Myotis sodalis*[2]	Female
	9/4/2023	2–3	5.0 m/s	unidentified Myotis	*Myotis sodalis*[2]	Female
	9/12/2023	2–3	5.0 m/s	unidentified; dismembered, no head	*Myotis sodalis*[2]	Male
	9/12/2023	4–7	OSC	unidentified; dismembered, no head	*Myotis sodalis*[2]	Female
	9/15/2023	15–30	OSC	unidentified; dismembered, jaw present	*Myotis sodalis*[2]	Female
	9/29/2023	2–3	OSC	unidentified; dismembered, no head	*Myotis sodalis*[3]	Female

[1.] Results provided in WY-UNK-NF-088 REPORT 1.

[2.] Results provided in WY-UNK-NF-096 REPORT 4.

[3.] Results provided in WY-UNK-NF-031 REPORT 5.

m/s = meters per second; OSC = optimized smart curtailment.

Table 8. Summary of bat carcasses found at the Cardinal Point Wind Project, from July 15 – October 15, 2023.

Species	Included in Fatality Estimate		Outside Search Area[1]		Outside Study Period[1]		Total	
	Total	%	Total	%	Total	%	Total	%
Eastern red bat	532	63.8	20	83.3	20	58.8	572	64.1
Silver-haired bat	96	11.5	1	4.2	1	2.9	98	11.0
Hoary bat	81	9.7	1	4.2	8	23.5	90	10.1
Big brown bat	37	4.4	0	0	3	8.8	40	4.5
Evening bat	25	3.0	1	4.2	0	0	26	2.9
Unidentified Lasiurus bat	20	2.4	1	4.2	2	5.9	23	2.6
Eastern red bat or Seminole bat	16	1.9	0	0	0	0	16	1.8
Unidentified non-myotis	8	1.0	0	0	0	0	8	0.9
Indiana bat	8	1.0	0	0	0	0	8	0.9
Seminole bat	5	0.6	0	0	0	0	5	0.6
Tricolored bat	5	0.6	0	0	0	0	5	0.6
Unidentified bat	1	0.1	0	0	0	0	1	0.1
Overall[2]	**834**	**100**	**24**	**100**	**34**	**100**	**892**	**100**

[1.] Carcasses not included in analysis.

[2.] Sums of percentages may not add to 100% due to rounding.

Fatality Estimates

Searcher Efficiency Estimates

Seventy-five bat carcasses were placed for SEEF trials on four separate dates; 46 were available for detection dog teams to find on 70-m full plots, and 19 were available for technicians to find on 100-m road and pad plots. The best-fit model for SEEF for detection dog teams did not support the inclusion of plot type as a covariate, meaning that SEEF did not differ between cleared and uncleared full plots (Table 9, Appendix C1). Overall SEEF was estimated to be 78.26% for detection dog teams on full plots and 97.37%[4] for technicians on 100-m road and pad plots (Table 9).

Table 9. Searcher efficiency results by plot type at the Cardinal Point Wind Project, from July 15 – October 15, 2023.

Plot Type	Number Placed	Number Available	Number Found	% Found	Searcher Type
70-m full plots	53	46	36	78.26	detection dog teams
100-m road and pad plots	22	19	19	100[4]	technicians

m = meter.

Carcass Persistence Estimates

Fifty-three bat carcasses were placed to estimate CP, with 35 placed on 70-m full plots and 18 placed on 100-m road and pad plots. The best-fit model for CP for detection dog teams on full

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[4.] Estimates of SEEF using GenEst are always less than one, even if 100% of the trials were found (Table 9, Appendix C2).

plots was a lognormal distribution with no covariates, which suggests CP did not differ between cleared and uncleared full plots (Appendix C3). For technicians on road and pad plots, the best-fit model for CP was a loglogistic distribution with no covariates (Appendix C4). The estimated median CP times were 5.37 days on full plots and 2.88 days on road and pad plots (Table 10). The average probability that a carcass persisted through a 3.5-day search interval was 0.72 (90% CI: 0.61–0.81) on full plots searched by detection dog teams and 0.66 (90% CI: 0.51–0.79) on road and pad plots searched by technicians (Figure 13).
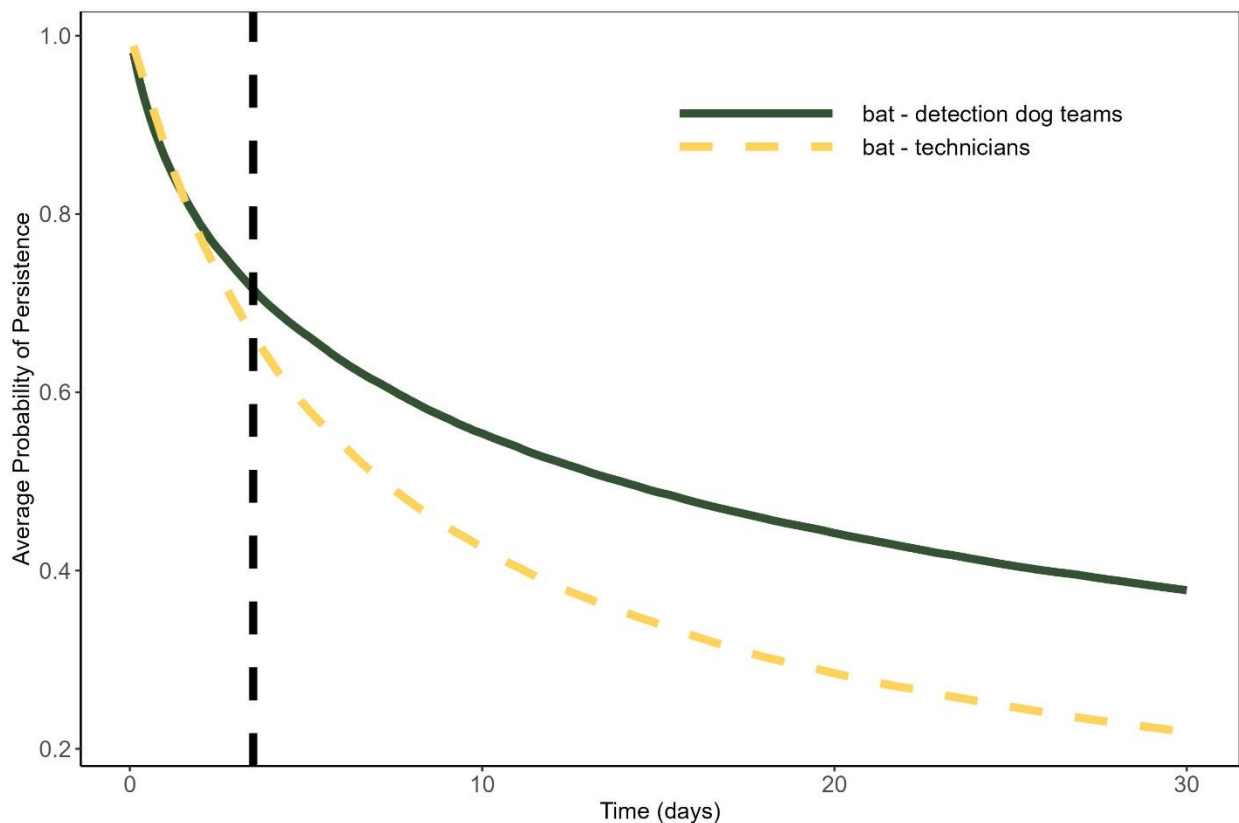
Figure 13. Average probability of carcass persistence as a function of time (days) for bat carcasses on full plots searched by detection dog teams and on road and pad plots searched by technicians at the Cardinal Point Wind Project, from July 15 – October 15, 2023. The average search interval was 3.5 days and is represented by the dashed vertical line.

Table 10. Carcass persistence top models with covariates, distributions, and model parameters for the Cardinal Point Wind Project, from July 15 – October 15, 2023.

Size Class	Plot Type	Distribution	Predicted Median Removal Times (days)	Parameter 1	Parameter 2	Aided Search Type
Bats	70-m full plots	lognormal[1]	5.37	meanlog = 1.681	sdlog = 2.251	yes[3]
	100-m road and pads	loglogistic[2]	2.88	shape = 0.906	scale = 1.056	none

[1.] Parameterization follows the base R parameterization for this distribution.

[2.] Parameterization follows the FAdist parameterization for this distribution.

[3.] Dog-aided search.

m = meter.

Area Adjustment

Fifty-eight of the 892 bats found during the survey period were excluded from modeling the area adjustment for GenEst and EoA. Twenty-four carcasses were excluded because they were found off plot, and another 34 carcasses were excluded because the estimated time of death was prior to the start of surveys (Appendices A and D).

The best-fit models for the distribution of bats with respect to distance from turbine base suggested that curtailment regime had a significant effect on the carcass-density distribution. The top model for turbines in the 5.0 m/s blanket curtailment group was a Gompertz distribution and the top model for turbines in the OSC group was a normal distribution (Appendix D). The TWL area adjustment for bats was estimated to be 0.97 for full plots in the 5.0 m/s blanket curtailment group, 0.89 for full plots in the OSC group, 0.084 for road and pad plots in the 5.0 m/s blanket curtailment group, 0.068 for road and pad plots in the OSC group, and 0.043 for road and pad plots in the 7.5 m/s blanket curtailment group (Appendix D).

Covered Species Take Estimates

As described above, eight Indiana bat and five tricolored bat carcasses were found during the study; no little brown bat or northern long-eared bat carcasses were detected. Using EoA, the overall probability of detection (g) was 0.318 (90%: 0.284–0.354; Table 11; Appendix E1) for the turbines in the 5.0 m/s blanket curtailment and OSC groups. Inputs required to run the EoA Single Class and Multiple Class modules are described in Appendix E.

The estimated median annual fatality rates (λ) were 25.76 Indiana bats (95% CI: 11.8–48.35), 16.31 tricolored bats (95% CI: 5.97–35.01), and 0.72 little brown bats (95% CI: 0–7.96; Table 11). The cumulative take estimates (M*) for the study period were 25 Indiana bats, 16 tricolored bats, and zero little brown bats (Table 12). No northern long-eared bat carcasses were found.

Table 11. **Annual probability of detection (g), Ba, and Bb, for the Cardinal Point Wind Project, from July 15 – October 15, 2023.**

Year	Ba[1]	Bb[1]	g	90% CI
2023	151.19	323.08	0.32	0.284-0.354

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

CI = confidence interval.

Table 12. **Cumulative take estimates to date using Evidence of Absence for studies conducted within the incidental take permit (ITP) term to date at Cardinal Point Wind Project, for ITP Year 1 (2023).**

Species	Cumulative Take (M*)	Authorized Take (T**)	Long-term Trigger Fires at $\alpha = 0.5$?
Indiana bat (50th credible bound)	25	240	No
Tricolored bat (50th credible bound)	16	18	No
Little brown bat (50th credible bound)	0	18	No

Adaptive Management Assessment

The adaptive management triggers laid out in Table 6.5 of the HCP were assessed. While take rates were estimated based on this Year 1 data, the adaptive management triggers surrounding projected take will not be tested until Year 3. Additionally, no Covered Species were documented from October 1 – 15 in Year 1. Per the seasonal risk adaptive management trigger, this will be further assessed after Year 2, to determine if no Covered Species are found in this timeframe in Year 2 and if acoustic data indicates no curtailment is needed to maintain the overall collision risk goals, at which point no monitoring would occur in October starting in Year 3.

As noted above, the cumulative take estimates (M*) have not exceeded the authorized take for Indiana, tricolored, or little brown bats. No northern long-eared bat carcasses were found, and no carcasses of Covered Species were documented with an estimated time of death occurring during the summer. Regarding the mitigation adaptive management trigger, the cumulative take (median) for Indiana bats is 25; this is below the threshold of 96 bats that would trigger a mitigation true-up. Therefore, no adaptive management triggers were met in Year 1, and no responsive actions are necessary.

Estimating Curtailment Effectiveness

The all-bat fatality estimates for the 5.0 m/s blanket curtailment and OSC groups were 21.69 and 34.31 bats per MW (54.23 and 85.77 bats per turbine) per study period, respectively (Table 13).

Table 13. All-bat fatality rates per megawatt (MW) and per turbine for the 5.0 m/s blanket curtailment and OSC groups at the Cardinal Point Wind Project, from July 15 – October 15, 2023.

	Bat Fatalities per MW		Bat Fatalities per Turbine	
Curtailment Treatment	**Estimate**	**90% CI**	**Estimate**	**90% CI**
5.0 m/s	21.69	16.95–29.58	54.23	42.38–73.95
OSC	34.31	25.96–48.40	85.77	64.91–121.01
7.5 m/s	13.28	3.70–38.53	33.21	9.24–96.32

CI = confidence interval; m/s = meters per second; OSC = optimized smart curtailment.

CONCLUSIONS AND DISCUSSION

Take of Covered Species and Adaptive Management Assessment

Based on EoA, the detection probability for this study was 0.318, meaning that roughly one third of all bats taken at the Project are thought to have been detected by searchers. Detection rates were more than double what was expected (achieved probability of 0.318 compared to the target probability of 0.15). Given this detection rate, take estimates for the Covered Species should be highly accurate.

Eight Indiana bat and five tricolored bat carcasses were found during the study, all between August 21 and September 29 at turbines operating either under OSC or 5.0 m/s blanket

curtailment. No northern long-eared bat or little brown bat carcasses were found in 2023. The estimated cumulative take (M*) for the study period was 25 Indiana bats, zero little brown bats, and 16 tricolored bats. During the 6-year permit term, the Project is permitted to take up to 240 Indiana, six northern long-eared, 18 tricolored bats, and 18 little brown bats. Therefore, authorized take was not exceeded for any of the Covered Species in the first year of the ITP (Table 12). No other adaptive management triggers were met based on fatalities in Year 1 (Table 14).

The authorized take amount of 18 tricolored bats was selected because it was known that tricolored bats could occur at the Project and therefore be at some risk of incidental take during the 6-year permit term, and yet none had been detected in three years of fatality monitoring prior to ITP implementation (HCP Sections 3.5.2 and 5.1). Because the cumulative take estimate of 16 for this species is approaching the authorized take limit of 18, Capital Power is in the processing of amending their ITP to increase the take authorization for tricolored bats.

Table 14.   Adaptive management plan for the Cardinal Point Wind Project.

Trigger	Action/Monitoring	Result/Response
Mitigation		
For Indiana bats, the cumulative take (M* in EoA) is equal to or greater than 80% of the take used to calculate the upfront mitigation amount	1) Conduct a mitigation true-up based on the median projected take for the remainder of the permit term (using the projection tool in EoA), and/or 2) the smart curtailment algorithm will be modified to reduce take to stay within the amount already mitigated for. Monitor to $g = 0.15$ any year in which a new curtailment regime is implemented	The cumulative take was 25 Indiana bats, which is less than 80% of the take used to calculate the upfront mitigation amount (i.e., 25 < 120 Indiana bats × 80%). No mitigation true-up is needed now.
A mitigation true-up has been triggered, and 10 or more Indiana bat carcasses have been discovered at the Project to date	Use the observed sex ratio to determine any remaining mitigation offsets.	A mitigation true-up has not been triggered.
Take Estimates		
Starting in Year 3 and using EoA, the median projected life of permit take exceeds what is expected for Indiana bats, based on the *implementation* take	Revise smart curtailment algorithm such that it is designed to keep future fatalities at or below the *implementation* take rate. Monitor to $g = 0.15$ any year in which a new curtailment regime is implemented	The median projected life of permit take will be calculated in Year 3 of the ITP.
Starting in Year 3 and using EoA, the median projected life of permit take exceeds what is expected for little brown and tricolored bats, based on the *authorized* take	Revise smart curtailment algorithm such that it is designed to keep future fatalities at or below the *authorized* take rate. Monitor to $g = 0.15$ any year in which a new curtailment regime is implemented	The median projected life of permit take will be calculated in Year 3 of the ITP.

Table 14.   Adaptive management plan for the Cardinal Point Wind Project.

Trigger	Action/Monitoring	Result/Response
In any year, if one or more northern long-eared bat carcasses are discovered at the Project	Coordinate with the USFWS about the need for additional minimization measures or another appropriate response. Coordinate with the USFWS about the need for additional monitoring	No northern long-eared bat carcasses were detected. There is no need to coordinate with the USFWS regarding northern long-eared bats.
In any year and using EoA, the cumulative take estimate has exceeded the *authorized* take amount for Indiana, little brown, or tricolored bats	Implement curtailment measures such that take is unlikely based on the best available acoustic activity data from the Project. Road-and-pad monitoring because no take is expected to occur under the turbine operational adjustment	The cumulative take estimates did not exceed the authorized take amounts for Indiana bats (M* = 25, authorized = 240), little brown bats (M* = 0, authorized = 18), or tricolored bats (M* = 16, authorized = 18).
Seasonal Risk		
No Covered Species fatalities are detected in the summer of Year 1 or Year 2	In coordination with the USFWS, Capital Power may choose to: 1) continue acoustic monitoring in the summer in Year 3; or 2) analyze acoustic data to refine assumptions about seasonal arrival proportions in EoA, which would then be used to inform take estimates. Drop summer fatality and acoustic monitoring for the remainder of the permit term	Summer fatality monitoring was not conducted this year because an ITP had not yet been obtained, but it will be conducted next year.
1) A Covered Species carcass is found during the summer, or 2) Acoustic data indicate that summer curtailment is needed to maintain the minimization standard of avoiding 50% of collision risk	Assess which turbines have summer risk using all available acoustic and fatality data, update assumptions about summer risk for EoA-based detection probabilities for take estimates and adaptive management assessments moving forward (Section 6.4.2.1), and revise the smart curtailment algorithm to include summer at some or all turbines. Decisions will be made based on the biological goals and objectives. Continue summer fatality monitoring at any curtailed turbines; Capital Power may discontinue acoustic monitoring	Summer fatality monitoring was not conducted this year because an ITP had not yet been obtained, but it will be conducted next year.

Table 14.   Adaptive management plan for the Cardinal Point Wind Project.

Trigger	Action/Monitoring	Result/Response
No Covered Species fatalities are detected in the last two weeks of fall (October 1 – 15) in Year 1 or Year 2 and acoustic data indicate that no curtailment is needed in this time period to maintain the minimization standard of avoiding 50% of collision risk	Discontinue monitoring in October starting in Year 3 so that the revised fall end date for monitoring is October 1	No Covered Species fatalities were detected October 1 – 15. Fatality monitoring will be conducted again October 1 – 15 next year.
Minimization Approach		
Capital Power no longer wishes to implement OSC, either because use of this approach no longer meets the "maximum extent practicable" requirement, or because an alternative technology better meets the biological goals and objectives of the HCP	Implement blanket curtailment or some other minimization approach, as agreed upon by the USFWS, and manage to the *implementation* take amount for Indiana bats (and to the *authorized* take for the other three species) Monitor to *g* = 0.15 any year in which a new minimization regime is implemented.	The Project plans to implement OSC again in 2024.

EoA = Evidence of Absence; *g* = detection probability; HCP = Habitat Conservation Plan; ITP = incidental take permit; NA = not applicable; OSC = optimized smart curtailment; USFWS = US Fish and Wildlife Service.

Curtailment Effectiveness

Blanket curtailment is designed to operate all night and all season, typically based on a set of regionally defined season dates. In contrast, OSC is designed to operate only during those portions of the night or season when bats are expected to be active (using recorded calls at a project site as a proxy for activity). In the study, a typical fall minimization approach of 5.0 m/s blanket curtailment was pitted against an OSC that was developed using one year of Project-specific acoustic and power production data. The OSC was designed to balance fatality minimization and power production while avoiding at least 50% of bat activity.

As expected, OSC turbines in this study operated more than 5.0 m/s blanket curtailment turbines (Figure 9). Overall, OSC turbines operated 76.6% of the time and were curtailed 19.8% of the time between July 15 – October 15, 2023. In contrast, the 5.0 m/s blanket curtailment turbines were operating 65.9% of the time and were curtailed 25.9% of the time. The greatest difference in operational time between the two curtailment treatments occurred in the month of September, when OSC operated 20% more than blanket turbines (Figure 10). This result is consistent with the way turbines were programmed; the difference in cut-in speed was designed to be greatest between the two curtailment treatments in this month (5.0 m/s blanket versus 3.0 m/s OSC), which was informed by the marked decrease in bat activity observed from late August to early September 2022 (Figures 3 and 9). However, at least some of the increased operational time for OSC was due to an unexpected difference in how often turbines were down for maintenance or otherwise not operating: 3.7% of the time for OSC turbines and 8.2% of the time for 5.0 m/s blanket curtailment turbines (Figure 9).

Ignoring down/maintenance time, turbines in both curtailment treatment groups operated mostly according to expectations. For example, turbines operated as expected (based on wind speed and cut-in speed) 93.1% and 93.9% of the time for the 5.0 m/s blanket curtailment and OSC groups, respectively. Conversely when turbines were expected to be curtailed, this occurred 96.9% and 94.7% of the time for 5.0 m/s blanket curtailment and OSC groups, respectively (Table 5). These results confirm that both blanket curtailment and OSC can be reliably implemented to reduce bat fatalities at the Project.

The OSC algorithm was expected to minimize collision risk for the Covered Species (as approximated by acoustic activity for all bat species) by at least 50% compared to what would have been anticipated under non-curtailed operations. Based on the 2022 acoustic data, the expected call coverage in 2023 under OSC was 51.1% and the actual call coverage (based on 2023 acoustic activity and operation data) was 59%. In comparison, the expected call coverage in 2023 under 5.0 blanket curtailment was 47.5% and the actual call coverage was 62%. Based on these results, the OSC algorithm exceeded the minimum expectation for 50% coverage of acoustic activity in 2023. Given that the actual call coverage for 5.0 m/s blanket curtailment call coverage was similar to the actual call coverage in the OSC group, we would also expect the all-bat fatality estimates to be similar between the two treatments. However, the point estimates were higher in the OSC group than the 5.0 m/s blanket curtailment group: 34.3 bats/MW and 85.8 bats/turbine compared to 21.7 bats/MW and 54.2 bats/turbine, respectively (Table 13). While the 90% CIs for these estimates overlap, the degree of overlap is small (Table 13). In a traditional statistical hypothesis setting, the presence of overlap would suggest no difference between the estimates (i.e., the two curtailment treatments were equally effective). However, one of the goals of Year 1 ITP monitoring was to test the efficacy of the treatments and use this information to refine OSC in Year 2. In this context, it appears that OSC could be refined in Year 2 to further minimize risk to bats.

An examination of the unadjusted bat fatality counts by week may help explain the difference in the all-bat fatality estimates between the two curtailment groups (Figure 12). Although these counts are unadjusted for search biases and area searched, the number of observed bat fatalities in these two groups were more similar in July and August, and then again in October, than they were in September (Figure 12). On September 1, the cut-in speed for OSC was lowered to 3.0 m/s, and the observed weekly carcass count for the OSC group then exceeded the observed weekly carcass count for the 5.0 m/s blanket curtailment group for the remainder of the month. The decision to reduce the cut-in speed starting September 1 in the OSC algorithm was based on the sharp decrease in all-bat activity that was observed in 2022 (Figure 3). A sharp decrease in all-bat activity was also observed in 2023, but it occurred even earlier in August than it had in 2022 (Figure 9). Surprisingly, this change in acoustic activity that was detected in both years was not reflected in the fatality data collected in 2023.

The fatality data in 2023 suggests that the lower amount of acoustic activity observed in September does not reflect a proportional decrease in the risk of bat-wind turbine collisions. This could be because migrating bats are not always echolocating (Corcoran et al. 2021), and so acoustic activity during this time may underestimate bat activity and therefore collision risk. A

second possible explanation for this discrepancy is that bat behavior around wind turbines changes throughout the year. One study, conducted in Colorado, showed distinct seasonal peaks in bat behavior in July and September that included more chases and close approaches to turbine surfaces than in other months (Goldenberg et al. 2021). This increase in risky behavior could increase per-capita collision risk without an increase in the number of acoustic calls detected.

Another possible explanation for this apparent mismatch between activity and fatalities in September is that species composition changes during the fall. If per-capita risk varies by species, due to factors such as behavior or body size, and species composition changes throughout the monitoring period, collision risk could be changing throughout the season without those changes being reflected in the metric of risk used in this study: all-bat acoustic activity. It is possible, for example, that some species are heavily represented in the acoustic dataset in July and August during peak activity, but that their behavior does not place them at high collision risk. Similarly, for example, if there is a shift in species composition heading into the fall migratory season, when migratory tree bats are most abundant and risky behavior increases, then all-bat acoustic activity may underestimate collision risk during this period if the species that are most active in late summer are not as likely to collide with turbines as tree bats. Additional analysis of the acoustic data, including an evaluation of changes in species composition over time, will be considered in development of the 2024 (Year 2) OSC algorithm.

All data collected in Year 1 (i.e., turbine operations, acoustic activity, and fatalities), will be used, in coordination with the USFWS, to inform the minimization measures that will be implemented in Year 2. Additional acoustic monitoring will be conducted in 2024 to further inform OSC development and seasonal risk assessments for Year 3 for all bats as well as the Covered Species.

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Appendix A. Bat and Bird Carcasses Found during the 2023 Post-construction Fatality Monitoring Surveys

Appendix A. Complete list of carcasses found at the Cardinal Point Wind Project, from July 12 – October 15, 2023.

Found Date	Species	Distance from Turbine (meters)	Search Type	Search Area Type	Physical Condition	Aided Search[1]
Bats						
07/12/2023	eastern red bat	7	incidental[3]	5.0 m/s cleared plot	scavenged	no
07/12/2023	eastern red bat	9	incidental[3]	5.0 m/s cleared plot	intact	no
07/13/2023	eastern red bat	17	incidental[3]	5.0 m/s uncleared plot	scavenged	yes
07/13/2023	eastern red bat	35	incidental[3]	5.0 m/s road and pad plot	scavenged	no
07/13/2023	eastern red bat	59	incidental[3]	OSC uncleared plot	scavenged	yes
07/13/2023	eastern red bat	57	incidental[3]	OSC uncleared plot	scavenged	yes
07/13/2023	hoary bat	20	incidental[3]	OSC uncleared plot	intact	yes
07/17/2023	big brown bat	1	carcass search[3]	7.5 m/s road and pad plot	scavenged	no
07/17/2023	eastern red bat	6	carcass search[3]	OSC uncleared plot	scavenged	yes
07/17/2023	eastern red bat	15	carcass search[3]	OSC uncleared plot	scavenged	yes
07/17/2023	eastern red bat	42	carcass search[3]	5.0 m/s cleared plot	scavenged	yes
07/17/2023	eastern red bat	52	carcass search[3]	OSC cleared plot	scavenged	yes
07/17/2023	eastern red bat	17	carcass search[3]	5.0 m/s uncleared plot	scavenged	yes
07/18/2023	big brown bat	35	carcass search[3]	5.0 m/s cleared plot	scavenged	yes
07/18/2023	big brown bat	30	carcass search[3]	5.0 m/s cleared plot	scavenged	yes
07/18/2023	eastern red bat	29	carcass search[3]	5.0 m/s cleared plot	scavenged	yes
07/18/2023	eastern red bat	44	carcass search[3]	5.0 m/s cleared plot	scavenged	yes
07/18/2023	eastern red bat	27	carcass search[3]	OSC cleared plot	scavenged	yes
07/18/2023	eastern red bat	30	carcass search[3]	5.0 m/s uncleared plot	scavenged	yes
07/18/2023	eastern red bat	10	carcass search[3]	5.0 m/s road and pad plot	intact	no
07/18/2023	eastern red bat	40	carcass search[3]	OSC uncleared plot	scavenged	yes
07/18/2023	hoary bat	30	carcass search[3]	OSC uncleared plot	scavenged	yes
07/18/2023	hoary bat	34	carcass search[3]	5.0 m/s uncleared plot	intact	yes
07/18/2023	hoary bat	31	carcass search[3]	OSC cleared plot	scavenged	yes
07/18/2023	hoary bat	32	carcass search[3]	5.0 m/s uncleared plot	scavenged	yes
07/18/2023	hoary bat	25	carcass search[3]	5.0 m/s uncleared plot	scavenged	yes
07/18/2023	hoary bat	27	carcass search[3]	OSC uncleared plot	scavenged	yes
07/18/2023	silver-haired bat	34	carcass search[3]	5.0 m/s uncleared plot	intact	yes
07/18/2023	unidentified lasiurus bat	23	carcass search[3]	5.0 m/s cleared plot	dismembered	yes
07/18/2023	unidentified lasiurus bat	14	carcass search[3]	5.0 m/s uncleared plot	dismembered	yes
07/19/2023	eastern red bat	32	carcass search[3]	OSC uncleared plot	scavenged	yes
07/20/2023	eastern red bat	30	carcass search	5.0 m/s cleared plot	scavenged	yes
07/20/2023	eastern red bat	73	carcass search[2]	5.0 m/s cleared plot	scavenged	yes
07/20/2023	eastern red bat	49	carcass search	OSC cleared plot	scavenged	yes
07/20/2023	eastern red bat	34	carcass search	OSC uncleared plot	scavenged	yes

Appendix A. Complete list of carcasses found at the Cardinal Point Wind Project, from July 12 – October 15, 2023.

Found Date	Species	Distance from Turbine (meters)	Search Type	Search Area Type	Physical Condition	Aided Search[1]
07/20/2023	eastern red bat	56	carcass search	5.0 m/s cleared plot	scavenged	yes
07/20/2023	unidentified non-myotis	37	carcass search	5.0 m/s cleared plot	scavenged	yes
07/21/2023	eastern red bat	10	carcass search[3]	5.0 m/s cleared plot	scavenged	yes
07/21/2023	eastern red bat	18	carcass search	OSC cleared plot	scavenged	yes
07/21/2023	eastern red bat	11	carcass search[3]	7.5 m/s road and pad plot	scavenged	no
07/21/2023	eastern red bat	10	carcass search	5.0 m/s uncleared plot	scavenged	yes
07/21/2023	eastern red bat	21	carcass search	5.0 m/s uncleared plot	scavenged	yes
07/21/2023	hoary bat	24	carcass search[3]	5.0 m/s cleared plot	scavenged	yes
07/21/2023	unidentified non-myotis	62	carcass search	5.0 m/s cleared plot	dismembered	yes
07/21/2023	unidentified non-myotis	38	carcass search	OSC cleared plot	scavenged	yes
07/22/2023	big brown bat	28	carcass search	5.0 m/s cleared plot	intact	yes
07/22/2023	silver-haired bat	30	carcass search	5.0 m/s cleared plot	scavenged	yes
07/22/2023	unidentified lasiurus bat	28	carcass search	5.0 m/s cleared plot	dismembered	yes
07/24/2023	eastern red bat	6	carcass search	7.5 m/s road and pad plot	dismembered	no
07/24/2023	eastern red bat	28	carcass search	OSC uncleared plot	scavenged	yes
07/25/2023	eastern red bat	24	incidental	5.0 m/s cleared plot	intact	no
07/25/2023	eastern red bat	40	carcass search	5.0 m/s cleared plot	scavenged	yes
07/25/2023	eastern red bat	29	carcass search	5.0 m/s cleared plot	scavenged	yes
07/25/2023	eastern red bat	31	carcass search	5.0 m/s cleared plot	scavenged	yes
07/25/2023	eastern red bat	76	carcass search[2]	OSC cleared plot	scavenged	yes
07/25/2023	eastern red bat	75	carcass search[2]	OSC cleared plot	scavenged	yes
07/25/2023	eastern red bat	12	carcass search	OSC cleared plot	scavenged	yes
07/25/2023	eastern red bat	5	carcass search	5.0 m/s road and pad plot	scavenged	no
07/25/2023	eastern red bat	29	carcass search	5.0 m/s uncleared plot	intact	yes
07/25/2023	eastern red bat	11	carcass search	OSC cleared plot	scavenged	yes
07/25/2023	eastern red bat	18	carcass search	OSC cleared plot	scavenged	yes
07/25/2023	hoary bat	44	carcass search	OSC cleared plot	scavenged	yes
07/26/2023	eastern red bat	26	carcass search	5.0 m/s cleared plot	scavenged	yes
07/26/2023	eastern red bat	23	carcass search	5.0 m/s cleared plot	intact	yes
07/26/2023	eastern red bat	58	carcass search	7.5 m/s road and pad plot	scavenged	no
07/27/2023	Seminole bat	15	carcass search	OSC cleared plot	scavenged	yes
07/27/2023	big brown bat	16	carcass search	5.0 m/s uncleared plot	intact	yes
07/27/2023	eastern red bat	56	carcass search	5.0 m/s cleared plot	scavenged	yes
07/27/2023	eastern red bat	58	carcass search	OSC cleared plot	scavenged	yes
07/27/2023	eastern red bat	14	carcass search	OSC cleared plot	scavenged	yes
07/27/2023	eastern red bat	36	carcass search	OSC cleared plot	scavenged	yes
07/27/2023	eastern red bat	63	carcass search	OSC cleared plot	dismembered	yes

Appendix A. Complete list of carcasses found at the Cardinal Point Wind Project, from July 12 – October 15, 2023.

Found Date	Species	Distance from Turbine (meters)	Search Type	Search Area Type	Physical Condition	Aided Search[1]
07/27/2023	eastern red bat	60	carcass search	OSC uncleared plot	scavenged	yes
07/27/2023	eastern red bat	67	carcass search	OSC uncleared plot	scavenged	yes
07/27/2023	eastern red bat	54	carcass search	OSC uncleared plot	scavenged	yes
07/27/2023	eastern red bat	56	carcass search	OSC uncleared plot	scavenged	yes
07/27/2023	eastern red bat	57	carcass search	5.0 m/s cleared plot	scavenged	yes
07/27/2023	eastern red bat	59	carcass search	5.0 m/s cleared plot	scavenged	yes
07/27/2023	eastern red bat	53	carcass search	OSC cleared plot	scavenged	yes
07/27/2023	eastern red bat	14	carcass search	5.0 m/s uncleared plot	intact	yes
07/27/2023	eastern red bat	11	carcass search	5.0 m/s uncleared plot	scavenged	yes
07/27/2023	eastern red bat	16	carcass search	5.0 m/s uncleared plot	scavenged	yes
07/27/2023	eastern red bat	45	carcass search	5.0 m/s cleared plot	scavenged	yes
07/27/2023	eastern red bat or Seminole bat	51	carcass search	OSC cleared plot	scavenged	yes
07/27/2023	hoary bat	35	carcass search	OSC cleared plot	scavenged	yes
07/27/2023	hoary bat	43	carcass search	OSC uncleared plot	dismembered	yes
07/27/2023	hoary bat	25	carcass search	OSC cleared plot	scavenged	yes
07/27/2023	unidentified lasiurus bat	26	carcass search	5.0 m/s cleared plot	dismembered	yes
07/28/2023	eastern red bat	39	carcass search	5.0 m/s cleared plot	scavenged	yes
07/28/2023	eastern red bat	40	carcass search	5.0 m/s cleared plot	dismembered	yes
07/28/2023	eastern red bat	51	carcass search	5.0 m/s cleared plot	scavenged	yes
07/28/2023	eastern red bat	37	carcass search	5.0 m/s cleared plot	scavenged	yes
07/28/2023	eastern red bat	5	carcass search	OSC road and pad plot	scavenged	no
07/28/2023	eastern red bat	15	carcass search	OSC uncleared plot	scavenged	yes
07/28/2023	eastern red bat	60	carcass search	5.0 m/s uncleared plot	intact	yes
07/28/2023	eastern red bat	24	carcass search	5.0 m/s uncleared plot	scavenged	yes
07/28/2023	eastern red bat	14	carcass search	OSC cleared plot	scavenged	yes
07/28/2023	eastern red bat	44	carcass search	OSC cleared plot	scavenged	yes
07/28/2023	eastern red bat	35	carcass search	OSC cleared plot	intact	yes
07/28/2023	eastern red bat	44	carcass search	OSC cleared plot	scavenged	yes
07/28/2023	eastern red bat	76	carcass search[2]	5.0 m/s cleared plot	scavenged	yes
07/28/2023	eastern red bat	68	carcass search	5.0 m/s cleared plot	scavenged	yes
07/28/2023	eastern red bat	23	carcass search	5.0 m/s cleared plot	scavenged	yes
07/28/2023	eastern red bat	9	carcass search	OSC road and pad plot	scavenged	no
07/28/2023	eastern red bat	5	carcass search	OSC uncleared plot	intact	yes
07/28/2023	eastern red bat	41	carcass search	OSC uncleared plot	scavenged	yes
07/28/2023	eastern red bat	20	carcass search	OSC uncleared plot	scavenged	yes
07/29/2023	eastern red bat	19	carcass search	OSC uncleared plot	scavenged	yes
07/29/2023	eastern red bat	54	carcass search	OSC uncleared plot	scavenged	yes

Appendix A. Complete list of carcasses found at the Cardinal Point Wind Project, from July 12 – October 15, 2023.

Found Date	Species	Distance from Turbine (meters)	Search Type	Search Area Type	Physical Condition	Aided Search[1]
07/29/2023	eastern red bat	62	carcass search	5.0 m/s uncleared plot	scavenged	yes
07/29/2023	eastern red bat	29	carcass search	5.0 m/s uncleared plot	scavenged	yes
07/29/2023	eastern red bat or Seminole bat	6	incidental	5.0 m/s road and pad plot	scavenged	no
07/31/2023	Seminole bat	45	carcass search	OSC road and pad plot	scavenged	no
07/31/2023	big brown bat	32	carcass search	OSC cleared plot	scavenged	yes
07/31/2023	big brown bat	27	carcass search	5.0 m/s cleared plot	scavenged	yes
07/31/2023	big brown bat	24	carcass search	5.0 m/s uncleared plot	scavenged	yes
07/31/2023	eastern red bat	43	carcass search	OSC road and pad plot	scavenged	no
07/31/2023	eastern red bat	40	carcass search	5.0 m/s cleared plot	scavenged	yes
07/31/2023	eastern red bat	42	carcass search	5.0 m/s cleared plot	scavenged	yes
07/31/2023	eastern red bat	6	carcass search	5.0 m/s road and pad plot	intact	no
07/31/2023	eastern red bat	28	carcass search	OSC cleared plot	scavenged	yes
07/31/2023	eastern red bat	54	carcass search	OSC cleared plot	scavenged	yes
07/31/2023	eastern red bat	38	carcass search	OSC road and pad plot	scavenged	no
07/31/2023	eastern red bat	5	carcass search	OSC road and pad plot	scavenged	no
07/31/2023	eastern red bat	43	carcass search	OSC cleared plot	scavenged	yes
07/31/2023	eastern red bat	15	carcass search	OSC cleared plot	scavenged	yes
07/31/2023	eastern red bat	24	carcass search	OSC cleared plot	dismembered	yes
07/31/2023	eastern red bat	44	carcass search	OSC cleared plot	scavenged	yes
07/31/2023	eastern red bat	21	carcass search	OSC uncleared plot	scavenged	yes
07/31/2023	eastern red bat	30	carcass search	OSC cleared plot	scavenged	yes
07/31/2023	eastern red bat	15	carcass search	OSC cleared plot	scavenged	yes
07/31/2023	eastern red bat	40	carcass search	OSC cleared plot	scavenged	yes
07/31/2023	eastern red bat	30	carcass search	5.0 m/s uncleared plot	intact	yes
07/31/2023	eastern red bat	48	carcass search	5.0 m/s uncleared plot	scavenged	yes
07/31/2023	eastern red bat	59	carcass search	5.0 m/s uncleared plot	scavenged	yes
07/31/2023	eastern red bat	15	carcass search	5.0 m/s uncleared plot	scavenged	yes
07/31/2023	eastern red bat	56	carcass search	5.0 m/s uncleared plot	scavenged	yes
07/31/2023	eastern red bat	50	carcass search	5.0 m/s cleared plot	scavenged	yes
07/31/2023	eastern red bat	60	carcass search	5.0 m/s cleared plot	scavenged	yes
07/31/2023	eastern red bat	45	carcass search	5.0 m/s cleared plot	scavenged	yes
07/31/2023	eastern red bat	22	carcass search	5.0 m/s cleared plot	scavenged	yes
07/31/2023	eastern red bat or Seminole bat	33	carcass search	OSC cleared plot	scavenged	yes
07/31/2023	hoary bat	24	carcass search	5.0 m/s cleared plot	scavenged	yes
07/31/2023	hoary bat	39	carcass search	OSC cleared plot	scavenged	yes
08/01/2023	big brown bat	19	carcass search	OSC cleared plot	scavenged	yes
08/01/2023	big brown bat	35	carcass search	OSC cleared plot	scavenged	yes

Appendix A. Complete list of carcasses found at the Cardinal Point Wind Project, from July 12 – October 15, 2023.

Found Date	Species	Distance from Turbine (meters)	Search Type	Search Area Type	Physical Condition	Aided Search[1]
08/01/2023	big brown bat	53	carcass search	OSC cleared plot	scavenged	yes
08/01/2023	eastern red bat	52	carcass search	5.0 m/s cleared plot	scavenged	yes
08/01/2023	eastern red bat	52	carcass search	5.0 m/s cleared plot	scavenged	yes
08/01/2023	eastern red bat	8	carcass search	OSC road and pad plot	scavenged	no
08/01/2023	eastern red bat	59	carcass search	5.0 m/s cleared plot	scavenged	yes
08/01/2023	eastern red bat	16	carcass search	5.0 m/s cleared plot	scavenged	yes
08/01/2023	eastern red bat	32	carcass search	5.0 m/s cleared plot	scavenged	yes
08/01/2023	eastern red bat	54	carcass search	5.0 m/s cleared plot	scavenged	yes
08/01/2023	eastern red bat	56	carcass search	5.0 m/s cleared plot	scavenged	yes
08/01/2023	eastern red bat	52	carcass search	OSC cleared plot	scavenged	yes
08/01/2023	eastern red bat	69	carcass search	OSC cleared plot	scavenged	yes
08/01/2023	eastern red bat	9	carcass search [2]	5.0 m/s road and pad plot	scavenged	no
08/01/2023	eastern red bat	39	carcass search	OSC road and pad plot	intact	no
08/01/2023	eastern red bat	1	carcass search	OSC road and pad plot	scavenged	no
08/01/2023	eastern red bat	28	carcass search	OSC uncleared plot	scavenged	yes
08/01/2023	eastern red bat	44	carcass search	OSC cleared plot	scavenged	yes
08/01/2023	eastern red bat	9	carcass search	OSC cleared plot	scavenged	yes
08/01/2023	eastern red bat	40	carcass search	OSC cleared plot	scavenged	yes
08/01/2023	eastern red bat	20	carcass search	5.0 m/s cleared plot	scavenged	yes
08/01/2023	eastern red bat	31	carcass search	5.0 m/s cleared plot	scavenged	yes
08/01/2023	eastern red bat	65	carcass search	5.0 m/s cleared plot	scavenged	yes
08/01/2023	eastern red bat	27	carcass search	5.0 m/s uncleared plot	scavenged	yes
08/01/2023	eastern red bat	42	carcass search	5.0 m/s road and pad plot	scavenged	no
08/01/2023	eastern red bat	66	carcass search	OSC uncleared plot	scavenged	yes
08/01/2023	eastern red bat	55	carcass search	OSC uncleared plot	scavenged	yes
08/01/2023	eastern red bat	47	carcass search	OSC uncleared plot	scavenged	yes
08/01/2023	eastern red bat	46	carcass search	OSC uncleared plot	scavenged	yes
08/01/2023	eastern red bat	20	carcass search	OSC uncleared plot	scavenged	yes
08/01/2023	eastern red bat	21	carcass search	OSC uncleared plot	scavenged	yes
08/01/2023	hoary bat	57	carcass search	5.0 m/s cleared plot	scavenged	yes
08/01/2023	hoary bat	59	carcass search	5.0 m/s uncleared plot	intact	yes
08/01/2023	unidentified lasiurus bat	17	carcass search	OSC cleared plot	dismembered	yes
08/02/2023	eastern red bat	5	carcass search	OSC uncleared plot	scavenged	yes
08/02/2023	eastern red bat	22	carcass search	OSC uncleared plot	scavenged	yes
08/03/2023	eastern red bat	55	carcass search	5.0 m/s cleared plot	scavenged	yes
08/03/2023	eastern red bat	8	carcass search	5.0 m/s road and pad plot	scavenged	no
08/03/2023	eastern red bat	56	carcass search	OSC cleared plot	scavenged	yes

Appendix A. Complete list of carcasses found at the Cardinal Point Wind Project, from July 12 – October 15, 2023.

Found Date	Species	Distance from Turbine (meters)	Search Type	Search Area Type	Physical Condition	Aided Search[1]
08/03/2023	eastern red bat	14	carcass search	OSC road and pad plot	scavenged	no
08/03/2023	eastern red bat	41	carcass search	OSC cleared plot	scavenged	yes
08/03/2023	eastern red bat	32	carcass search	OSC cleared plot	scavenged	yes
08/03/2023	eastern red bat	58	carcass search	OSC cleared plot	scavenged	yes
08/03/2023	eastern red bat	26	carcass search	5.0 m/s uncleared plot	scavenged	yes
08/03/2023	eastern red bat	62	carcass search	5.0 m/s uncleared plot	scavenged	yes
08/03/2023	eastern red bat	48	carcass search	5.0 m/s uncleared plot	scavenged	yes
08/03/2023	eastern red bat	12	carcass search	5.0 m/s cleared plot	scavenged	yes
08/03/2023	eastern red bat	7	carcass search	5.0 m/s cleared plot	dismembered	yes
08/03/2023	hoary bat	30	carcass search	OSC cleared plot	scavenged	yes
08/03/2023	hoary bat	30	carcass search	OSC uncleared plot	intact	yes
08/03/2023	hoary bat	51	carcass search	OSC cleared plot	scavenged	yes
08/03/2023	unidentified lasiurus bat	55	carcass search	OSC cleared plot	scavenged	yes
08/04/2023	eastern red bat	55	carcass search	5.0 m/s cleared plot	scavenged	yes
08/04/2023	eastern red bat	61	carcass search	5.0 m/s cleared plot	intact	yes
08/04/2023	eastern red bat	59	carcass search	5.0 m/s cleared plot	scavenged	yes
08/04/2023	eastern red bat	47	carcass search	5.0 m/s cleared plot	scavenged	yes
08/04/2023	eastern red bat	64	carcass search	5.0 m/s cleared plot	scavenged	yes
08/04/2023	eastern red bat	49	carcass search	5.0 m/s cleared plot	scavenged	yes
08/04/2023	eastern red bat	29	carcass search	OSC cleared plot	scavenged	yes
08/04/2023	eastern red bat	42	carcass search	OSC road and pad plot	scavenged	no
08/04/2023	eastern red bat	23	carcass search	5.0 m/s uncleared plot	scavenged	yes
08/04/2023	eastern red bat	51	carcass search	OSC cleared plot	dismembered	yes
08/04/2023	eastern red bat	44	carcass search	OSC cleared plot	scavenged	yes
08/04/2023	eastern red bat	27	carcass search	5.0 m/s uncleared plot	scavenged	yes
08/04/2023	eastern red bat	49	carcass search	OSC uncleared plot	scavenged	yes
08/04/2023	eastern red bat	60	carcass search	OSC uncleared plot	scavenged	yes
08/04/2023	eastern red bat	41	carcass search	OSC uncleared plot	scavenged	yes
08/04/2023	evening bat	17	carcass search	OSC uncleared plot	dismembered	yes
08/04/2023	hoary bat	30	carcass search	OSC cleared plot	scavenged	yes
08/04/2023	hoary bat	43	carcass search	5.0 m/s road and pad plot	scavenged	no
08/04/2023	hoary bat	35	carcass search	OSC cleared plot	scavenged	yes
08/04/2023	hoary bat	39	carcass search	OSC uncleared plot	scavenged	yes
08/04/2023	silver-haired bat	27	carcass search	OSC uncleared plot	scavenged	yes
08/07/2023	eastern red bat	35	carcass search	5.0 m/s cleared plot	scavenged	yes
08/07/2023	eastern red bat	46	carcass search	5.0 m/s cleared plot	scavenged	yes
08/07/2023	eastern red bat	27	carcass search	OSC cleared plot	scavenged	yes

Appendix A. Complete list of carcasses found at the Cardinal Point Wind Project, from July 12 – October 15, 2023.

Found Date	Species	Distance from Turbine (meters)	Search Type	Search Area Type	Physical Condition	Aided Search[1]
08/07/2023	eastern red bat	72	carcass search[2]	5.0 m/s uncleared plot	scavenged	yes
08/07/2023	eastern red bat	45	carcass search	5.0 m/s cleared plot	scavenged	yes
08/08/2023	eastern red bat	67	carcass search	5.0 m/s cleared plot	scavenged	yes
08/08/2023	eastern red bat	36	carcass search	5.0 m/s cleared plot	scavenged	yes
08/08/2023	eastern red bat	1	carcass search	OSC road and pad plot	intact	no
08/08/2023	eastern red bat	69	carcass search	OSC cleared plot	scavenged	yes
08/08/2023	eastern red bat	61	carcass search	OSC cleared plot	scavenged	yes
08/08/2023	eastern red bat	61	carcass search	5.0 m/s cleared plot	scavenged	yes
08/08/2023	eastern red bat	93	carcass search[2]	5.0 m/s cleared plot	scavenged	yes
08/08/2023	eastern red bat	53	carcass search	5.0 m/s cleared plot	scavenged	yes
08/08/2023	eastern red bat	32	carcass search	5.0 m/s cleared plot	scavenged	yes
08/08/2023	eastern red bat	56	carcass search	OSC uncleared plot	scavenged	yes
08/08/2023	eastern red bat	55	carcass search	OSC uncleared plot	scavenged	yes
08/08/2023	evening bat	16	carcass search	OSC cleared plot	intact	yes
08/08/2023	hoary bat	37	carcass search	5.0 m/s cleared plot	scavenged	yes
08/08/2023	hoary bat	41	carcass search	5.0 m/s uncleared plot	scavenged	yes
08/10/2023	eastern red bat	46	carcass search	OSC cleared plot	scavenged	yes
08/10/2023	eastern red bat	17	carcass search	OSC cleared plot	scavenged	yes
08/10/2023	eastern red bat	20	carcass search	OSC uncleared plot	scavenged	yes
08/10/2023	eastern red bat	31	carcass search	OSC cleared plot	scavenged	yes
08/10/2023	eastern red bat	56	carcass search	OSC cleared plot	scavenged	yes
08/10/2023	eastern red bat	24	carcass search	5.0 m/s uncleared plot	scavenged	yes
08/10/2023	silver-haired bat	44	carcass search	5.0 m/s cleared plot	scavenged	yes
08/11/2023	hoary bat	25	carcass search	OSC uncleared plot	scavenged	yes
08/11/2023	silver-haired bat	41	carcass search	5.0 m/s cleared plot	scavenged	yes
08/11/2023	silver-haired bat	14	carcass search	OSC uncleared plot	scavenged	yes
08/11/2023	unidentified non-myotis	29	carcass search	OSC cleared plot	scavenged	yes
08/12/2023	eastern red bat	5	carcass search	5.0 m/s cleared plot	scavenged	yes
08/12/2023	hoary bat	49	carcass search	5.0 m/s cleared plot	intact	yes
08/14/2023	big brown bat	46	carcass search	5.0 m/s cleared plot	dismembered	yes
08/14/2023	big brown bat	28	carcass search	5.0 m/s road and pad plot	intact	no
08/14/2023	eastern red bat	37	carcass search	OSC cleared plot	scavenged	yes
08/14/2023	eastern red bat	13	carcass search	OSC cleared plot	dismembered	yes
08/14/2023	eastern red bat	31	carcass search	OSC cleared plot	scavenged	yes
08/14/2023	eastern red bat	54	carcass search	OSC cleared plot	scavenged	yes
08/14/2023	eastern red bat	59	carcass search	OSC cleared plot	scavenged	yes
08/14/2023	eastern red bat	17	carcass search	5.0 m/s uncleared plot	scavenged	yes

Appendix A. Complete list of carcasses found at the Cardinal Point Wind Project, from July 12 – October 15, 2023.

Found Date	Species	Distance from Turbine (meters)	Search Type	Search Area Type	Physical Condition	Aided Search[1]
08/14/2023	eastern red bat	37	carcass search	5.0 m/s cleared plot	scavenged	yes
08/14/2023	hoary bat	13	carcass search	OSC cleared plot	intact	yes
08/14/2023	silver-haired bat	30	carcass search	OSC cleared plot	scavenged	yes
08/15/2023	big brown bat	13	carcass search	5.0 m/s cleared plot	scavenged	yes
08/15/2023	big brown bat	44	carcass search	5.0 m/s cleared plot	scavenged	yes
08/15/2023	big brown bat	32	carcass search	OSC cleared plot	scavenged	yes
08/15/2023	big brown bat	29	carcass search	OSC cleared plot	intact	yes
08/15/2023	big brown bat	37	carcass search	OSC uncleared plot	scavenged	yes
08/15/2023	big brown bat	27	carcass search	OSC uncleared plot	scavenged	yes
08/15/2023	eastern red bat	48	carcass search	5.0 m/s cleared plot	scavenged	yes
08/15/2023	eastern red bat	40	carcass search	5.0 m/s cleared plot	scavenged	yes
08/15/2023	eastern red bat	39	carcass search	5.0 m/s cleared plot	scavenged	yes
08/15/2023	eastern red bat	6	carcass search	5.0 m/s cleared plot	intact	yes
08/15/2023	eastern red bat	52	carcass search	OSC cleared plot	scavenged	yes
08/15/2023	eastern red bat	24	carcass search	5.0 m/s uncleared plot	scavenged	yes
08/15/2023	eastern red bat	30	carcass search	5.0 m/s cleared plot	intact	yes
08/15/2023	eastern red bat	41	carcass search	5.0 m/s cleared plot	scavenged	yes
08/15/2023	eastern red bat	7	carcass search	5.0 m/s cleared plot	intact	yes
08/15/2023	hoary bat	18	carcass search	5.0 m/s cleared plot	intact	yes
08/15/2023	hoary bat	26	carcass search	5.0 m/s uncleared plot	scavenged	yes
08/15/2023	hoary bat	37	carcass search	5.0 m/s uncleared plot	scavenged	yes
08/15/2023	hoary bat	67	carcass search	5.0 m/s uncleared plot	scavenged	yes
08/17/2023	big brown bat	40	carcass search	5.0 m/s cleared plot	dismembered	yes
08/17/2023	eastern red bat	73	carcass search	5.0 m/s cleared plot	scavenged	yes
08/17/2023	eastern red bat	46	carcass search	5.0 m/s cleared plot	scavenged	yes
08/17/2023	eastern red bat	42	carcass search	5.0 m/s cleared plot	dismembered	yes
08/17/2023	eastern red bat	42	carcass search	5.0 m/s cleared plot	scavenged	yes
08/17/2023	eastern red bat	37	incidental	5.0 m/s cleared plot	intact	no
08/17/2023	eastern red bat	56	carcass search	OSC cleared plot	scavenged	yes
08/17/2023	eastern red bat	6	carcass search	5.0 m/s road and pad plot	dismembered	no
08/17/2023	eastern red bat	80	carcass search [2]	5.0 m/s uncleared plot	scavenged	yes
08/17/2023	eastern red bat	61	carcass search	5.0 m/s cleared plot	scavenged	yes
08/17/2023	eastern red bat	11	carcass search	5.0 m/s cleared plot	scavenged	yes
08/17/2023	evening bat	32	carcass search	5.0 m/s cleared plot	scavenged	yes
08/17/2023	hoary bat	31	carcass search	OSC uncleared plot	scavenged	yes
08/18/2023	eastern red bat	22	carcass search	5.0 m/s cleared plot	scavenged	yes
08/18/2023	eastern red bat	12	carcass search	5.0 m/s cleared plot	scavenged	yes

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Found Date	Species	Distance from Turbine (meters)	Search Type	Search Area Type	Physical Condition	Aided Search[1]
08/18/2023	eastern red bat	32	carcass search	OSC cleared plot	scavenged	yes
08/18/2023	eastern red bat	23	carcass search	OSC uncleared plot	scavenged	yes
08/18/2023	eastern red bat	68	carcass search	OSC cleared plot	scavenged	yes
08/18/2023	eastern red bat	25	carcass search	OSC cleared plot	scavenged	yes
08/18/2023	eastern red bat	61	carcass search	OSC cleared plot	scavenged	yes
08/18/2023	eastern red bat	36	carcass search	5.0 m/s cleared plot	intact	yes
08/18/2023	eastern red bat	51	carcass search	OSC road and pad plot	scavenged	no
08/18/2023	eastern red bat	63	carcass search	7.5 m/s road and pad plot	dismembered	no
08/18/2023	eastern red bat	69	carcass search	5.0 m/s uncleared plot	intact	yes
08/18/2023	eastern red bat	42	carcass search	OSC uncleared plot	scavenged	yes
08/18/2023	eastern red bat	26	carcass search	OSC uncleared plot	scavenged	yes
08/18/2023	evening bat	37	carcass search	5.0 m/s uncleared plot	scavenged	yes
08/18/2023	hoary bat	66	carcass search	5.0 m/s cleared plot	dismembered	yes
08/18/2023	silver-haired bat	32	carcass search	OSC uncleared plot	intact	yes
08/21/2023	big brown bat	57	carcass search	5.0 m/s cleared plot	intact	yes
08/21/2023	eastern red bat	42	carcass search	5.0 m/s cleared plot	scavenged	yes
08/21/2023	eastern red bat	66	carcass search	OSC cleared plot	intact	yes
08/21/2023	eastern red bat	12	carcass search	7.5 m/s road and pad plot	scavenged	no
08/21/2023	eastern red bat	25	carcass search	OSC road and pad plot	scavenged	no
08/21/2023	eastern red bat	44	carcass search	OSC cleared plot	dismembered	yes
08/21/2023	eastern red bat	30	carcass search	OSC uncleared plot	scavenged	yes
08/21/2023	eastern red bat	53	carcass search	OSC uncleared plot	scavenged	yes
08/21/2023	eastern red bat	41	carcass search	OSC uncleared plot	scavenged	yes
08/21/2023	eastern red bat	21	carcass search	OSC uncleared plot	scavenged	yes
08/21/2023	eastern red bat	34	carcass search	5.0 m/s cleared plot	scavenged	yes
08/21/2023	eastern red bat	54	carcass search	5.0 m/s cleared plot	scavenged	yes
08/21/2023	eastern red bat	33	carcass search	5.0 m/s road and pad plot	scavenged	no
08/21/2023	eastern red bat	18	carcass search	5.0 m/s uncleared plot	scavenged	yes
08/21/2023	eastern red bat	67	carcass search	5.0 m/s cleared plot	scavenged	yes
08/21/2023	eastern red bat	63	carcass search	5.0 m/s cleared plot	scavenged	yes
08/21/2023	eastern red bat	18	carcass search	5.0 m/s cleared plot	scavenged	yes
08/21/2023	evening bat	22	carcass search	OSC cleared plot	dismembered	yes
08/21/2023	hoary bat	29	carcass search	OSC cleared plot	scavenged	yes
08/21/2023	hoary bat	50	carcass search	OSC cleared plot	scavenged	yes
08/21/2023	hoary bat	24	carcass search	5.0 m/s cleared plot	intact	yes
08/21/2023	silver-haired bat	62	carcass search	OSC cleared plot	scavenged	yes
08/21/2023	tricolored bat	53	carcass search	OSC cleared plot	scavenged	yes

Appendix A. Complete list of carcasses found at the Cardinal Point Wind Project, from July 12 – October 15, 2023.

Found Date	Species	Distance from Turbine (meters)	Search Type	Search Area Type	Physical Condition	Aided Search[1]
08/22/2023	Indiana bat	44	carcass search	5.0 m/s cleared plot	intact	yes
08/22/2023	big brown bat	44	carcass search	5.0 m/s cleared plot	intact	yes
08/22/2023	big brown bat	8	carcass search	5.0 m/s cleared plot	scavenged	yes
08/22/2023	eastern red bat	63	carcass search	5.0 m/s cleared plot	scavenged	yes
08/22/2023	eastern red bat	69	carcass search	5.0 m/s cleared plot	scavenged	yes
08/22/2023	eastern red bat	54	carcass search	5.0 m/s cleared plot	scavenged	yes
08/22/2023	eastern red bat	59	carcass search	5.0 m/s cleared plot	scavenged	yes
08/22/2023	eastern red bat	49	carcass search	5.0 m/s cleared plot	scavenged	yes
08/22/2023	eastern red bat	28	carcass search	5.0 m/s cleared plot	scavenged	yes
08/22/2023	eastern red bat	17	carcass search	5.0 m/s cleared plot	scavenged	yes
08/22/2023	eastern red bat	58	carcass search	5.0 m/s cleared plot	scavenged	yes
08/22/2023	eastern red bat	16	carcass search	5.0 m/s uncleared plot	scavenged	yes
08/22/2023	eastern red bat	5	carcass search	OSC cleared plot	intact	yes
08/22/2023	eastern red bat	67	carcass search	OSC cleared plot	scavenged	yes
08/22/2023	eastern red bat	18	carcass search	OSC cleared plot	dismembered	yes
08/22/2023	eastern red bat	27	carcass search	OSC cleared plot	scavenged	yes
08/22/2023	eastern red bat	58	carcass search	5.0 m/s cleared plot	scavenged	yes
08/22/2023	eastern red bat	62	carcass search	5.0 m/s cleared plot	scavenged	yes
08/22/2023	eastern red bat	32	carcass search	OSC road and pad plot	intact	no
08/22/2023	eastern red bat	32	carcass search	5.0 m/s road and pad plot	intact	no
08/22/2023	eastern red bat	9	carcass search	5.0 m/s road and pad plot	scavenged	no
08/22/2023	eastern red bat	65	carcass search	5.0 m/s uncleared plot	scavenged	yes
08/22/2023	hoary bat	52	carcass search	5.0 m/s cleared plot	scavenged	yes
08/22/2023	hoary bat	61	carcass search	OSC uncleared plot	scavenged	yes
08/23/2023	eastern red bat	10	carcass search	OSC uncleared plot	scavenged	yes
08/23/2023	eastern red bat	8	carcass search	OSC uncleared plot	intact	yes
08/23/2023	eastern red bat	29	carcass search	OSC uncleared plot	dismembered	yes
08/23/2023	eastern red bat	41	carcass search	OSC uncleared plot	scavenged	yes
08/23/2023	eastern red bat	26	carcass search	OSC uncleared plot	scavenged	yes
08/23/2023	eastern red bat	54	carcass search	5.0 m/s road and pad plot	scavenged	no
08/23/2023	eastern red bat	14	carcass search	5.0 m/s road and pad plot	scavenged	no
08/23/2023	evening bat	65	carcass search	OSC uncleared plot	scavenged	yes
08/23/2023	hoary bat	57	carcass search	OSC road and pad plot	intact	no
08/25/2023	big brown bat	13	carcass search	OSC cleared plot	dismembered	yes
08/25/2023	big brown bat	26	carcass search	OSC cleared plot	intact	yes
08/25/2023	eastern red bat	7	carcass search	OSC road and pad plot	intact	no
08/25/2023	eastern red bat	43	carcass search	OSC cleared plot	dismembered	yes

Appendix A. Complete list of carcasses found at the Cardinal Point Wind Project, from July 12 – October 15, 2023.

Found Date	Species	Distance from Turbine (meters)	Search Type	Search Area Type	Physical Condition	Aided Search[1]
08/25/2023	eastern red bat	12	carcass search	OSC uncleared plot	scavenged	yes
08/25/2023	eastern red bat	5	carcass search	OSC uncleared plot	intact	yes
08/25/2023	eastern red bat	62	carcass search	5.0 m/s cleared plot	dismembered	yes
08/25/2023	eastern red bat	49	carcass search	5.0 m/s uncleared plot	scavenged	yes
08/25/2023	eastern red bat	73	carcass search[2]	5.0 m/s uncleared plot	scavenged	yes
08/25/2023	eastern red bat	71	carcass search	7.5 m/s road and pad plot	intact	no
08/25/2023	eastern red bat	51	carcass search	5.0 m/s uncleared plot	intact	yes
08/25/2023	eastern red bat	2	carcass search	5.0 m/s uncleared plot	intact	yes
08/25/2023	eastern red bat	45	carcass search	5.0 m/s uncleared plot	intact	yes
08/25/2023	eastern red bat	39	carcass search	5.0 m/s uncleared plot	intact	yes
08/25/2023	eastern red bat	4	carcass search	5.0 m/s road and pad plot	dismembered	no
08/25/2023	eastern red bat	17	carcass search	5.0 m/s cleared plot	scavenged	yes
08/25/2023	eastern red bat	72	carcass search[2]	5.0 m/s cleared plot	intact	yes
08/25/2023	eastern red bat	50	carcass search	5.0 m/s cleared plot	scavenged	yes
08/25/2023	eastern red bat	61	carcass search	5.0 m/s cleared plot	scavenged	yes
08/25/2023	hoary bat	32	carcass search	OSC uncleared plot	dismembered	yes
08/25/2023	hoary bat	58	carcass search	5.0 m/s uncleared plot	scavenged	yes
08/25/2023	hoary bat	20	carcass search	5.0 m/s uncleared plot	injured	yes
08/25/2023	silver-haired bat	34	carcass search	5.0 m/s cleared plot	scavenged	yes
08/26/2023	Indiana bat	39	carcass search	5.0 m/s cleared plot	dismembered	yes
08/26/2023	eastern red bat	56	carcass search	5.0 m/s cleared plot	scavenged	yes
08/26/2023	eastern red bat	47	carcass search	5.0 m/s cleared plot	scavenged	yes
08/26/2023	eastern red bat	23	carcass search	5.0 m/s cleared plot	scavenged	yes
08/26/2023	eastern red bat	21	carcass search	5.0 m/s cleared plot	scavenged	yes
08/26/2023	eastern red bat	58	carcass search	5.0 m/s cleared plot	scavenged	yes
08/26/2023	eastern red bat	58	carcass search	5.0 m/s cleared plot	scavenged	yes
08/26/2023	eastern red bat	7	carcass search	OSC road and pad plot	scavenged	no
08/26/2023	eastern red bat	6	carcass search	OSC cleared plot	intact	yes
08/26/2023	eastern red bat	11	carcass search	OSC uncleared plot	intact	yes
08/26/2023	eastern red bat	46	carcass search	OSC uncleared plot	intact	yes
08/26/2023	eastern red bat	55	carcass search	5.0 m/s uncleared plot	dismembered	yes
08/26/2023	eastern red bat	31	carcass search	OSC cleared plot	scavenged	yes
08/26/2023	eastern red bat	62	carcass search	OSC cleared plot	scavenged	yes
08/26/2023	eastern red bat	50	carcass search	OSC cleared plot	scavenged	yes
08/26/2023	eastern red bat	53	carcass search	OSC cleared plot	scavenged	yes
08/26/2023	eastern red bat	29	carcass search	OSC cleared plot	scavenged	yes
08/26/2023	eastern red bat	53	carcass search	5.0 m/s cleared plot	dismembered	yes

Appendix A. Complete list of carcasses found at the Cardinal Point Wind Project, from July 12 – October 15, 2023.

Found Date	Species	Distance from Turbine (meters)	Search Type	Search Area Type	Physical Condition	Aided Search[1]
08/26/2023	eastern red bat	14	carcass search	5.0 m/s cleared plot	intact	yes
08/26/2023	eastern red bat	62	carcass search	5.0 m/s cleared plot	dismembered	yes
08/26/2023	eastern red bat	69	carcass search	5.0 m/s cleared plot	scavenged	yes
08/26/2023	eastern red bat	20	carcass search	5.0 m/s cleared plot	intact	yes
08/26/2023	eastern red bat	50	carcass search	5.0 m/s cleared plot	scavenged	yes
08/26/2023	eastern red bat	52	carcass search	7.5 m/s road and pad plot	scavenged	no
08/26/2023	eastern red bat	5	carcass search	7.5 m/s road and pad plot	scavenged	no
08/26/2023	eastern red bat	38	carcass search	5.0 m/s uncleared plot	scavenged	yes
08/26/2023	eastern red bat	35	carcass search	5.0 m/s uncleared plot	scavenged	yes
08/26/2023	eastern red bat	24	carcass search	OSC uncleared plot	scavenged	yes
08/26/2023	eastern red bat	11	carcass search	OSC uncleared plot	scavenged	yes
08/26/2023	eastern red bat	5	carcass search	5.0 m/s road and pad plot	scavenged	no
08/26/2023	hoary bat	45	carcass search	5.0 m/s cleared plot	scavenged	yes
08/26/2023	hoary bat	6	carcass search	OSC cleared plot	dismembered	yes
08/26/2023	hoary bat	19	carcass search	OSC cleared plot	scavenged	yes
08/26/2023	silver-haired bat	41	carcass search	5.0 m/s uncleared plot	scavenged	yes
08/26/2023	tricolored bat	27	carcass search	OSC uncleared plot	scavenged	yes
08/26/2023	unidentified non-myotis	20	carcass search	5.0 m/s cleared plot	dismembered	yes
08/28/2023	big brown bat	26	carcass search	5.0 m/s cleared plot	scavenged	yes
08/28/2023	big brown bat	13	carcass search	OSC cleared plot	dismembered	yes
08/28/2023	big brown bat	41	carcass search	5.0 m/s cleared plot	dismembered	yes
08/28/2023	eastern red bat	34	carcass search	5.0 m/s cleared plot	dismembered	yes
08/28/2023	eastern red bat	19	carcass search	OSC cleared plot	intact	yes
08/28/2023	eastern red bat	41	carcass search	OSC cleared plot	dismembered	yes
08/28/2023	eastern red bat	26	carcass search	OSC uncleared plot	scavenged	yes
08/28/2023	eastern red bat	33	carcass search	OSC uncleared plot	scavenged	yes
08/28/2023	eastern red bat	54	carcass search	OSC uncleared plot	scavenged	yes
08/28/2023	eastern red bat	38	carcass search	OSC uncleared plot	scavenged	yes
08/28/2023	eastern red bat	61	carcass search	OSC cleared plot	intact	yes
08/28/2023	eastern red bat	51	carcass search	OSC cleared plot	intact	yes
08/28/2023	eastern red bat	31	carcass search	5.0 m/s uncleared plot	scavenged	yes
08/28/2023	eastern red bat	35	carcass search	5.0 m/s cleared plot	scavenged	yes
08/28/2023	eastern red bat	54	carcass search	5.0 m/s cleared plot	scavenged	yes
08/28/2023	eastern red bat or Seminole bat	43	carcass search	5.0 m/s cleared plot	dismembered	yes
08/28/2023	silver-haired bat	10	carcass search	OSC cleared plot	scavenged	yes
08/28/2023	silver-haired bat	50	carcass search	OSC cleared plot	scavenged	yes
08/28/2023	silver-haired bat	11	carcass search	5.0 m/s road and pad plot	scavenged	no

Appendix A. Complete list of carcasses found at the Cardinal Point Wind Project, from July 12 – October 15, 2023.

Found Date	Species	Distance from Turbine (meters)	Search Type	Search Area Type	Physical Condition	Aided Search[1]
08/28/2023	eastern red bat	33	carcass search	OSC cleared plot	dismembered	yes
08/28/2023	unidentified lasiurus bat	64	carcass search	5.0 m/s cleared plot	dismembered	yes
08/28/2023	unidentified lasiurus bat	46	carcass search	OSC cleared plot	dismembered	yes
08/28/2023	unidentified lasiurus bat	22	carcass search	5.0 m/s cleared plot	dismembered	yes
08/28/2023	unidentified lasiurus bat	26	carcass search	5.0 m/s uncleared plot	dismembered	yes
08/29/2023	big brown bat	46	carcass search	5.0 m/s cleared plot	intact	yes
08/29/2023	eastern red bat	69	carcass search	5.0 m/s cleared plot	scavenged	yes
08/29/2023	eastern red bat	59	carcass search	5.0 m/s cleared plot	dismembered	yes
08/29/2023	eastern red bat	18	carcass search	5.0 m/s cleared plot	intact	yes
08/29/2023	eastern red bat	41	carcass search	OSC road and pad plot	intact	no
08/29/2023	eastern red bat	55	carcass search	5.0 m/s cleared plot	scavenged	yes
08/29/2023	eastern red bat	62	carcass search	5.0 m/s cleared plot	scavenged	yes
08/29/2023	eastern red bat	28	carcass search	5.0 m/s cleared plot	scavenged	yes
08/29/2023	eastern red bat	46	carcass search	OSC cleared plot	scavenged	yes
08/29/2023	eastern red bat	39	carcass search	OSC cleared plot	scavenged	yes
08/29/2023	eastern red bat	16	carcass search	OSC cleared plot	dismembered	yes
08/29/2023	eastern red bat	66	carcass search	OSC cleared plot	scavenged	yes
08/29/2023	eastern red bat	23	carcass search	OSC cleared plot	scavenged	yes
08/29/2023	eastern red bat	42	carcass search	OSC cleared plot	scavenged	yes
08/29/2023	eastern red bat	34	carcass search	OSC cleared plot	scavenged	yes
08/29/2023	eastern red bat	21	carcass search	OSC cleared plot	scavenged	yes
08/29/2023	eastern red bat	6	carcass search	5.0 m/s road and pad plot	scavenged	no
08/29/2023	eastern red bat	55	carcass search	5.0 m/s uncleared plot	scavenged	yes
08/29/2023	eastern red bat	15	carcass search	OSC cleared plot	scavenged	yes
08/29/2023	eastern red bat	15	carcass search	OSC cleared plot	intact	yes
08/29/2023	eastern red bat	40	carcass search	OSC cleared plot	dismembered	yes
08/29/2023	eastern red bat	25	carcass search	OSC cleared plot	scavenged	yes
08/29/2023	eastern red bat	59	carcass search	OSC road and pad plot	scavenged	no
08/29/2023	eastern red bat	35	carcass search	OSC cleared plot	scavenged	yes
08/29/2023	eastern red bat	31	carcass search	OSC cleared plot	scavenged	yes
08/29/2023	eastern red bat	34	carcass search	OSC cleared plot	scavenged	yes
08/29/2023	eastern red bat	47	carcass search	OSC cleared plot	scavenged	yes
08/29/2023	eastern red bat	19	carcass search	5.0 m/s uncleared plot	scavenged	yes
08/29/2023	eastern red bat	29	carcass search	5.0 m/s road and pad plot	scavenged	no
08/29/2023	eastern red bat	11	carcass search	5.0 m/s road and pad plot	intact	no
08/29/2023	eastern red bat or Seminole bat	49	carcass search	OSC cleared plot	dismembered	yes
08/29/2023	hoary bat	59	carcass search	5.0 m/s cleared plot	scavenged	yes

Appendix A. Complete list of carcasses found at the Cardinal Point Wind Project, from July 12 – October 15, 2023.

Found Date	Species	Distance from Turbine (meters)	Search Type	Search Area Type	Physical Condition	Aided Search[1]
08/29/2023	hoary bat	7	incidental	OSC cleared plot	intact	no
08/29/2023	silver-haired bat	25	carcass search	5.0 m/s cleared plot	intact	yes
08/29/2023	silver-haired bat	5	carcass search	OSC road and pad plot	intact	no
08/29/2023	tricolored bat	16	carcass search	OSC cleared plot	dismembered	yes
08/31/2023	eastern red bat	73	carcass search[2]	5.0 m/s cleared plot	scavenged	yes
08/31/2023	eastern red bat	27	carcass search	OSC cleared plot	scavenged	yes
08/31/2023	eastern red bat	60	carcass search	OSC cleared plot	scavenged	yes
08/31/2023	eastern red bat	18	carcass search	OSC cleared plot	dismembered	yes
08/31/2023	eastern red bat	59	carcass search	OSC uncleared plot	intact	yes
08/31/2023	eastern red bat	18	carcass search	7.5 m/s road and pad plot	scavenged	no
08/31/2023	eastern red bat	41	carcass search	OSC uncleared plot	scavenged	yes
08/31/2023	eastern red bat	28	carcass search	5.0 m/s cleared plot	dismembered	yes
08/31/2023	eastern red bat	23	carcass search	5.0 m/s cleared plot	scavenged	yes
08/31/2023	eastern red bat	49	carcass search	OSC cleared plot	intact	yes
08/31/2023	eastern red bat	60	carcass search	5.0 m/s cleared plot	scavenged	yes
08/31/2023	eastern red bat	62	carcass search	5.0 m/s cleared plot	scavenged	yes
08/31/2023	hoary bat	60	carcass search	OSC cleared plot	scavenged	yes
08/31/2023	hoary bat	18	carcass search	OSC cleared plot	scavenged	yes
08/31/2023	silver-haired bat	46	carcass search	7.5 m/s road and pad plot	intact	no
09/01/2023	Indiana bat	47	carcass search	OSC cleared plot	scavenged	yes
09/01/2023	eastern red bat	16	carcass search	5.0 m/s cleared plot	intact	yes
09/01/2023	eastern red bat	2	carcass search	OSC road and pad plot	intact	no
09/01/2023	eastern red bat	25	carcass search	OSC cleared plot	scavenged	yes
09/01/2023	eastern red bat	57	carcass search	OSC road and pad plot	scavenged	no
09/01/2023	eastern red bat	27	carcass search	OSC uncleared plot	scavenged	yes
09/01/2023	eastern red bat	54	carcass search	OSC cleared plot	intact	yes
09/01/2023	eastern red bat	46	carcass search	OSC cleared plot	scavenged	yes
09/01/2023	eastern red bat	40	carcass search	OSC cleared plot	dismembered	yes
09/01/2023	eastern red bat	40	carcass search	5.0 m/s cleared plot	injured	yes
09/01/2023	eastern red bat	49	carcass search	5.0 m/s cleared plot	scavenged	yes
09/01/2023	eastern red bat	52	carcass search	5.0 m/s cleared plot	scavenged	yes
09/01/2023	eastern red bat	60	carcass search	OSC cleared plot	scavenged	yes
09/01/2023	eastern red bat	49	carcass search	OSC cleared plot	intact	yes
09/01/2023	hoary bat	58	carcass search	5.0 m/s cleared plot	scavenged	yes
09/01/2023	hoary bat	59	carcass search	OSC cleared plot	scavenged	yes
09/01/2023	silver-haired bat	9	carcass search	5.0 m/s cleared plot	dismembered	yes
09/01/2023	silver-haired bat	42	carcass search	OSC cleared plot	intact	yes

Appendix A. Complete list of carcasses found at the Cardinal Point Wind Project, from July 12 – October 15, 2023.

Found Date	Species	Distance from Turbine (meters)	Search Type	Search Area Type	Physical Condition	Aided Search[1]
09/01/2023	silver-haired bat	60	carcass search	5.0 m/s road and pad plot	intact	no
09/01/2023	tricolored bat	26	carcass search	5.0 m/s cleared plot	scavenged	yes
09/04/2023	Indiana bat	31	carcass search	5.0 m/s uncleared plot	scavenged	yes
09/04/2023	big brown bat	17	carcass search	5.0 m/s cleared plot	intact	yes
09/04/2023	eastern red bat	60	carcass search	5.0 m/s cleared plot	dismembered	yes
09/04/2023	eastern red bat	52	carcass search	OSC cleared plot	scavenged	yes
09/04/2023	eastern red bat	19	carcass search	OSC cleared plot	scavenged	yes
09/04/2023	eastern red bat	6	carcass search	OSC cleared plot	scavenged	yes
09/04/2023	eastern red bat	7	carcass search	OSC cleared plot	scavenged	yes
09/04/2023	eastern red bat	3	carcass search	OSC road and pad plot	intact	no
09/04/2023	eastern red bat	50	carcass search	OSC cleared plot	scavenged	yes
09/04/2023	eastern red bat	52	carcass search	OSC cleared plot	scavenged	yes
09/04/2023	eastern red bat	26	carcass search	OSC uncleared plot	dismembered	yes
09/04/2023	eastern red bat	58	carcass search	OSC uncleared plot	scavenged	yes
09/04/2023	eastern red bat	48	carcass search	5.0 m/s cleared plot	intact	yes
09/04/2023	eastern red bat	47	carcass search	5.0 m/s cleared plot	scavenged	yes
09/04/2023	eastern red bat	13	carcass search	5.0 m/s cleared plot	scavenged	yes
09/04/2023	eastern red bat	59	carcass search	OSC cleared plot	scavenged	yes
09/04/2023	eastern red bat	41	carcass search	5.0 m/s uncleared plot	scavenged	yes
09/04/2023	eastern red bat	28	carcass search	5.0 m/s uncleared plot	scavenged	yes
09/04/2023	eastern red bat	32	carcass search	5.0 m/s uncleared plot	scavenged	yes
09/04/2023	eastern red bat	13	carcass search	5.0 m/s cleared plot	intact	yes
09/04/2023	hoary bat	30	carcass search	5.0 m/s uncleared plot	scavenged	yes
09/04/2023	silver-haired bat	8	carcass search	OSC road and pad plot	scavenged	no
09/04/2023	silver-haired bat	24	carcass search	OSC cleared plot	scavenged	yes
09/04/2023	silver-haired bat	51	carcass search	OSC cleared plot	scavenged	yes
09/04/2023	silver-haired bat	62	carcass search	OSC cleared plot	intact	yes
09/04/2023	silver-haired bat	21	carcass search	OSC cleared plot	intact	yes
09/04/2023	silver-haired bat	5	carcass search	OSC cleared plot	scavenged	yes
09/04/2023	silver-haired bat	46	carcass search	OSC cleared plot	scavenged	yes
09/04/2023	silver-haired bat	46	carcass search	OSC uncleared plot	dismembered	yes
09/04/2023	silver-haired bat	26	carcass search	5.0 m/s cleared plot	dismembered	yes
09/04/2023	unidentified lasiurus bat	5	carcass search	5.0 m/s cleared plot	dismembered	yes
09/05/2023	big brown bat	32	carcass search	OSC uncleared plot	scavenged	yes
09/05/2023	eastern red bat	25	carcass search	5.0 m/s cleared plot	scavenged	yes
09/05/2023	eastern red bat	52	carcass search	5.0 m/s cleared plot	scavenged	yes
09/05/2023	eastern red bat	51	carcass search	5.0 m/s cleared plot	scavenged	yes

Appendix A. Complete list of carcasses found at the Cardinal Point Wind Project, from July 12 – October 15, 2023.

Found Date	Species	Distance from Turbine (meters)	Search Type	Search Area Type	Physical Condition	Aided Search[1]
09/05/2023	eastern red bat	40	carcass search	5.0 m/s cleared plot	scavenged	yes
09/05/2023	eastern red bat	35	carcass search	5.0 m/s cleared plot	scavenged	yes
09/05/2023	eastern red bat	20	carcass search	5.0 m/s cleared plot	scavenged	yes
09/05/2023	eastern red bat	31	carcass search	5.0 m/s cleared plot	scavenged	yes
09/05/2023	eastern red bat	51	carcass search	OSC cleared plot	scavenged	yes
09/05/2023	eastern red bat	53	carcass search	OSC cleared plot	scavenged	yes
09/05/2023	eastern red bat	54	carcass search	OSC road and pad plot	scavenged	no
09/05/2023	eastern red bat	37	carcass search	OSC road and pad plot	scavenged	no
09/05/2023	eastern red bat	41	carcass search	OSC uncleared plot	scavenged	yes
09/05/2023	eastern red bat	53	carcass search	5.0 m/s cleared plot	scavenged	yes
09/05/2023	eastern red bat	21	carcass search	5.0 m/s cleared plot	dismembered	yes
09/05/2023	eastern red bat	29	carcass search	OSC cleared plot	scavenged	yes
09/05/2023	eastern red bat	58	carcass search	OSC cleared plot	scavenged	yes
09/05/2023	eastern red bat	40	carcass search	OSC cleared plot	scavenged	yes
09/05/2023	eastern red bat	54	carcass search[2]	5.0 m/s road and pad plot	scavenged	no
09/05/2023	eastern red bat	58	carcass search	OSC uncleared plot	scavenged	yes
09/05/2023	eastern red bat	51	carcass search	OSC uncleared plot	dismembered	yes
09/05/2023	eastern red bat	28	carcass search	OSC uncleared plot	scavenged	yes
09/05/2023	eastern red bat	15	carcass search	OSC uncleared plot	dismembered	yes
09/05/2023	eastern red bat or Seminole bat	24	carcass search	5.0 m/s uncleared plot	dismembered	yes
09/05/2023	evening bat	45	carcass search	OSC cleared plot	dismembered	yes
09/05/2023	hoary bat	62	carcass search	OSC uncleared plot	scavenged	yes
09/05/2023	hoary bat	40	carcass search	OSC uncleared plot	dismembered	yes
09/05/2023	silver-haired bat	60	carcass search	5.0 m/s cleared plot	dismembered	yes
09/05/2023	silver-haired bat	30	incidental	5.0 m/s cleared plot	scavenged	yes
09/05/2023	silver-haired bat	65	carcass search	5.0 m/s cleared plot	scavenged	yes
09/05/2023	silver-haired bat	52	carcass search	5.0 m/s cleared plot	scavenged	yes
09/05/2023	silver-haired bat	66	carcass search	5.0 m/s cleared plot	scavenged	yes
09/05/2023	silver-haired bat	40	carcass search	5.0 m/s cleared plot	scavenged	yes
09/05/2023	silver-haired bat	52	carcass search	5.0 m/s cleared plot	scavenged	yes
09/05/2023	silver-haired bat	34	carcass search	OSC cleared plot	intact	yes
09/05/2023	silver-haired bat	55	carcass search	OSC cleared plot	scavenged	yes
09/05/2023	silver-haired bat	53	carcass search	OSC cleared plot	scavenged	yes
09/05/2023	silver-haired bat	62	carcass search	5.0 m/s uncleared plot	dismembered	yes
09/05/2023	silver-haired bat	66	carcass search	5.0 m/s uncleared plot	scavenged	yes
09/05/2023	silver-haired bat	46	carcass search	OSC uncleared plot	scavenged	yes
09/05/2023	silver-haired bat	18	carcass search	OSC uncleared plot	scavenged	yes

Appendix A. Complete list of carcasses found at the Cardinal Point Wind Project, from July 12 – October 15, 2023.

Found Date	Species	Distance from Turbine (meters)	Search Type	Search Area Type	Physical Condition	Aided Search[1]
09/05/2023	silver-haired bat	10	carcass search	OSC uncleared plot	scavenged	yes
09/07/2023	big brown bat	58	carcass search	5.0 m/s cleared plot	scavenged	yes
09/07/2023	eastern red bat	11	carcass search	5.0 m/s cleared plot	dismembered	yes
09/07/2023	eastern red bat	49	carcass search	OSC cleared plot	scavenged	yes
09/07/2023	eastern red bat	4	carcass search	OSC road and pad plot	intact	no
09/07/2023	eastern red bat	3	carcass search	7.5 m/s road and pad plot	scavenged	no
09/07/2023	eastern red bat	24	carcass search	OSC cleared plot	scavenged	yes
09/07/2023	eastern red bat	34	carcass search	OSC cleared plot	scavenged	yes
09/07/2023	eastern red bat	45	carcass search	OSC cleared plot	intact	yes
09/07/2023	eastern red bat	40	carcass search	OSC uncleared plot	scavenged	yes
09/07/2023	eastern red bat	5	carcass search	7.5 m/s road and pad plot	scavenged	no
09/07/2023	eastern red bat	60	carcass search	5.0 m/s cleared plot	scavenged	yes
09/07/2023	eastern red bat	58	carcass search	OSC cleared plot	scavenged	yes
09/07/2023	eastern red bat	28	carcass search	OSC cleared plot	scavenged	yes
09/07/2023	eastern red bat	4	carcass search	OSC cleared plot	intact	yes
09/07/2023	eastern red bat	28	carcass search	OSC road and pad plot	intact	no
09/07/2023	eastern red bat	44	carcass search	5.0 m/s uncleared plot	scavenged	yes
09/07/2023	eastern red bat	37	carcass search	5.0 m/s uncleared plot	intact	yes
09/07/2023	eastern red bat	54	carcass search	5.0 m/s uncleared plot	scavenged	yes
09/07/2023	eastern red bat or Seminole bat	0	carcass search	OSC road and pad plot	intact	no
09/07/2023	hoary bat	68	carcass search	5.0 m/s cleared plot	dismembered	yes
09/07/2023	hoary bat	52	carcass search	OSC cleared plot	scavenged	yes
09/07/2023	hoary bat	7	carcass search	OSC uncleared plot	intact	yes
09/07/2023	hoary bat	43	carcass search	OSC uncleared plot	scavenged	yes
09/07/2023	hoary bat	52	carcass search	OSC cleared plot	intact	yes
09/07/2023	silver-haired bat	69	carcass search	OSC cleared plot	dismembered	yes
09/07/2023	silver-haired bat	39	carcass search	OSC cleared plot	scavenged	yes
09/07/2023	silver-haired bat	45	carcass search	5.0 m/s uncleared plot	scavenged	yes
09/07/2023	unidentified lasiurus bat	46	carcass search	5.0 m/s cleared plot	dismembered	yes
09/08/2023	eastern red bat	16	carcass search	5.0 m/s cleared plot	intact	yes
09/08/2023	eastern red bat	47	carcass search	5.0 m/s cleared plot	scavenged	yes
09/08/2023	eastern red bat	66	carcass search	OSC cleared plot	scavenged	yes
09/08/2023	eastern red bat	32	carcass search	OSC uncleared plot	scavenged	yes
09/08/2023	eastern red bat	24	carcass search	5.0 m/s uncleared plot	scavenged	yes
09/08/2023	eastern red bat	37	carcass search	5.0 m/s uncleared plot	scavenged	yes
09/08/2023	eastern red bat	43	carcass search	5.0 m/s cleared plot	scavenged	yes
09/08/2023	eastern red bat	19	carcass search	5.0 m/s cleared plot	scavenged	yes

Appendix A. Complete list of carcasses found at the Cardinal Point Wind Project, from July 12 – October 15, 2023.

Found Date	Species	Distance from Turbine (meters)	Search Type	Search Area Type	Physical Condition	Aided Search[1]
09/08/2023	eastern red bat	60	carcass search	5.0 m/s cleared plot	scavenged	yes
09/08/2023	eastern red bat	40	carcass search	OSC cleared plot	scavenged	yes
09/08/2023	eastern red bat	78	carcass search [2]	OSC cleared plot	scavenged	yes
09/08/2023	eastern red bat or Seminole bat	42	carcass search	OSC cleared plot	scavenged	yes
09/08/2023	eastern red bat	60	carcass search	OSC cleared plot	scavenged	yes
09/08/2023	eastern red bat	56	carcass search	OSC cleared plot	intact	yes
09/08/2023	eastern red bat	55	carcass search	OSC uncleared plot	scavenged	yes
09/08/2023	eastern red bat or Seminole bat	39	carcass search	5.0 m/s cleared plot	dismembered	yes
09/08/2023	eastern red bat	42	carcass search	OSC cleared plot	scavenged	yes
09/08/2023	eastern red bat	41	carcass search	OSC uncleared plot	dismembered	yes
09/08/2023	hoary bat	25	carcass search	5.0 m/s cleared plot	intact	yes
09/08/2023	hoary bat	55	carcass search	OSC cleared plot	scavenged	yes
09/08/2023	hoary bat	55	carcass search	OSC cleared plot	scavenged	yes
09/08/2023	unidentified lasiurus bat	66	carcass search	5.0 m/s cleared plot	dismembered	yes
09/08/2023	unidentified lasiurus bat	30	carcass search	5.0 m/s cleared plot	dismembered	yes
09/08/2023	unidentified lasiurus bat	23	carcass search	OSC cleared plot	dismembered	yes
09/08/2023	unidentified lasiurus bat	25	carcass search	5.0 m/s uncleared plot	dismembered	yes
09/11/2023	eastern red bat	5	carcass search	7.5 m/s road and pad plot	intact	no
09/11/2023	eastern red bat	23	carcass search	OSC uncleared plot	scavenged	yes
09/11/2023	eastern red bat	10	carcass search	OSC uncleared plot	dismembered	yes
09/11/2023	eastern red bat	23	carcass search	5.0 m/s cleared plot	dismembered	yes
09/11/2023	eastern red bat	2	carcass search	OSC cleared plot	intact	yes
09/11/2023	eastern red bat	60	carcass search	OSC cleared plot	scavenged	yes
09/11/2023	eastern red bat	40	carcass search	5.0 m/s cleared plot	scavenged	yes
09/11/2023	eastern red bat or Seminole bat	67	carcass search	OSC uncleared plot	scavenged	yes
09/11/2023	hoary bat	12	carcass search	OSC uncleared plot	scavenged	yes
09/11/2023	silver-haired bat	47	carcass search	OSC cleared plot	dismembered	yes
09/11/2023	silver-haired bat	48	carcass search	OSC uncleared plot	scavenged	yes
09/11/2023	silver-haired bat	51	carcass search	OSC cleared plot	scavenged	yes
09/11/2023	silver-haired bat	39	carcass search	OSC cleared plot	dismembered	yes
09/11/2023	tricolored bat	56	carcass search	OSC cleared plot	dismembered	yes
09/11/2023	unidentified lasiurus bat	39	carcass search	OSC cleared plot	dismembered	yes
09/11/2023	unidentified lasiurus bat	46	carcass search	5.0 m/s cleared plot	dismembered	yes
09/12/2023	Indiana bat	31	carcass search	5.0 m/s cleared plot	dismembered	yes
09/12/2023	Indiana bat	55	carcass search	OSC cleared plot	scavenged	yes
09/12/2023	eastern red bat	61	carcass search	OSC road and pad plot	scavenged	no
09/12/2023	eastern red bat	51	carcass search	OSC uncleared plot	dismembered	yes

Appendix A. Complete list of carcasses found at the Cardinal Point Wind Project, from July 12 – October 15, 2023.

Found Date	Species	Distance from Turbine (meters)	Search Type	Search Area Type	Physical Condition	Aided Search[1]
09/12/2023	eastern red bat	8	carcass search	OSC uncleared plot	scavenged	yes
09/12/2023	eastern red bat or Seminole bat	26	carcass search	OSC cleared plot	scavenged	yes
09/12/2023	silver-haired bat	29	carcass search	OSC cleared plot	scavenged	yes
09/12/2023	unidentified lasiurus bat	44	carcass search	5.0 m/s cleared plot	scavenged	yes
09/14/2023	eastern red bat	26	carcass search	5.0 m/s cleared plot	intact	yes
09/14/2023	eastern red bat	56	carcass search	OSC cleared plot	scavenged	yes
09/14/2023	eastern red bat	37	carcass search	5.0 m/s uncleared plot	dismembered	yes
09/14/2023	eastern red bat	27	carcass search	5.0 m/s uncleared plot	scavenged	yes
09/14/2023	eastern red bat	29	carcass search	5.0 m/s cleared plot	scavenged	yes
09/14/2023	hoary bat	53	carcass search	5.0 m/s cleared plot	intact	yes
09/14/2023	silver-haired bat	29	carcass search	OSC cleared plot	scavenged	yes
09/14/2023	silver-haired bat	21	carcass search	OSC uncleared plot	dismembered	yes
09/14/2023	silver-haired bat	23	carcass search	5.0 m/s cleared plot	intact	yes
09/14/2023	silver-haired bat	49	carcass search	5.0 m/s uncleared plot	scavenged	yes
09/14/2023	silver-haired bat	35	carcass search	5.0 m/s uncleared plot	scavenged	yes
09/14/2023	unidentified lasiurus bat	37	carcass search	5.0 m/s cleared plot	dismembered	yes
09/15/2023	Indiana bat	53	carcass search	OSC cleared plot	dismembered	yes
09/15/2023	eastern red bat	58	carcass search	OSC cleared plot	intact	yes
09/15/2023	eastern red bat	67	carcass search	5.0 m/s uncleared plot	dismembered	yes
09/15/2023	eastern red bat	40	carcass search	5.0 m/s uncleared plot	dismembered	yes
09/15/2023	eastern red bat	61	carcass search	5.0 m/s uncleared plot	scavenged	yes
09/15/2023	eastern red bat	67	carcass search	5.0 m/s cleared plot	scavenged	yes
09/15/2023	eastern red bat	24	carcass search	5.0 m/s cleared plot	scavenged	yes
09/15/2023	eastern red bat	86	carcass search[2]	5.0 m/s cleared plot	scavenged	yes
09/15/2023	eastern red bat	35	carcass search	OSC cleared plot	scavenged	yes
09/15/2023	eastern red bat	46	carcass search	OSC uncleared plot	scavenged	yes
09/15/2023	eastern red bat or Seminole bat	47	carcass search	OSC uncleared plot	dismembered	yes
09/15/2023	evening bat	74	carcass search[2]	5.0 m/s uncleared plot	scavenged	yes
09/15/2023	hoary bat	30	carcass search	5.0 m/s uncleared plot	intact	yes
09/15/2023	silver-haired bat	63	carcass search	OSC cleared plot	dismembered	yes
09/16/2023	silver-haired bat	32	carcass search	5.0 m/s cleared plot	intact	yes
09/16/2023	silver-haired bat	47	carcass search	5.0 m/s cleared plot	intact	yes
09/18/2023	eastern red bat	65	carcass search	OSC road and pad plot	intact	no
09/18/2023	eastern red bat	41	carcass search	5.0 m/s cleared plot	intact	yes
09/18/2023	eastern red bat	56	carcass search	OSC cleared plot	dismembered	yes
09/18/2023	eastern red bat	40	carcass search	OSC cleared plot	intact	yes
09/18/2023	eastern red bat	48	carcass search	OSC cleared plot	scavenged	yes

Appendix A. Complete list of carcasses found at the Cardinal Point Wind Project, from July 12 – October 15, 2023.

Found Date	Species	Distance from Turbine (meters)	Search Type	Search Area Type	Physical Condition	Aided Search[1]
09/18/2023	eastern red bat	44	carcass search	OSC cleared plot	scavenged	yes
09/18/2023	hoary bat	41	carcass search	5.0 m/s uncleared plot	scavenged	yes
09/18/2023	silver-haired bat	27	carcass search	OSC cleared plot	scavenged	yes
09/18/2023	silver-haired bat	31	carcass search	OSC cleared plot	scavenged	yes
09/18/2023	silver-haired bat	31	carcass search	OSC cleared plot	intact	yes
09/19/2023	eastern red bat	94	carcass search	OSC road and pad plot	intact	no
09/19/2023	eastern red bat	54	carcass search	OSC cleared plot	scavenged	yes
09/19/2023	eastern red bat	47	carcass search	OSC cleared plot	scavenged	yes
09/19/2023	eastern red bat	46	carcass search	OSC cleared plot	scavenged	yes
09/19/2023	eastern red bat	30	carcass search	OSC cleared plot	dismembered	yes
09/19/2023	eastern red bat	35	carcass search	5.0 m/s cleared plot	scavenged	yes
09/19/2023	eastern red bat	14	carcass search	5.0 m/s cleared plot	scavenged	yes
09/19/2023	eastern red bat	15	carcass search	5.0 m/s cleared plot	intact	yes
09/19/2023	eastern red bat	32	carcass search	5.0 m/s uncleared plot	dismembered	yes
09/19/2023	eastern red bat	57	carcass search	5.0 m/s uncleared plot	scavenged	yes
09/19/2023	hoary bat	12	carcass search	OSC cleared plot	intact	yes
09/19/2023	silver-haired bat	51	carcass search	5.0 m/s cleared plot	scavenged	yes
09/19/2023	silver-haired bat	27	carcass search	OSC cleared plot	scavenged	yes
09/19/2023	silver-haired bat	21	carcass search	OSC cleared plot	scavenged	yes
09/19/2023	silver-haired bat	0	carcass search	OSC cleared plot	scavenged	yes
09/19/2023	unidentified lasiurus bat	25	carcass search	OSC uncleared plot	dismembered	yes
09/21/2023	eastern red bat	49	carcass search	OSC cleared plot	dismembered	yes
09/21/2023	eastern red bat	8	carcass search	7.5 m/s road and pad plot	intact	no
09/21/2023	eastern red bat	61	carcass search	OSC cleared plot	scavenged	yes
09/21/2023	eastern red bat	64	carcass search	OSC uncleared plot	scavenged	yes
09/21/2023	eastern red bat	15	carcass search	OSC uncleared plot	scavenged	yes
09/21/2023	eastern red bat	32	carcass search	OSC cleared plot	scavenged	yes
09/21/2023	eastern red bat	30	carcass search	OSC cleared plot	scavenged	yes
09/21/2023	eastern red bat	6	carcass search	OSC road and pad plot	intact	no
09/21/2023	eastern red bat	16	carcass search	5.0 m/s cleared plot	scavenged	yes
09/21/2023	hoary bat	39	carcass search	OSC cleared plot	scavenged	yes
09/21/2023	hoary bat	45	carcass search	5.0 m/s uncleared plot	scavenged	yes
09/21/2023	silver-haired bat	24	carcass search	OSC cleared plot	scavenged	yes
09/21/2023	unidentified non-myotis	56	carcass search	OSC cleared plot	dismembered	yes
09/22/2023	big brown bat	31	carcass search	OSC cleared plot	intact	yes
09/22/2023	eastern red bat	61	carcass search	5.0 m/s cleared plot	intact	yes
09/22/2023	eastern red bat	47	carcass search[2]	OSC road and pad plot	injured	no

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Found Date	Species	Distance from Turbine (meters)	Search Type	Search Area Type	Physical Condition	Aided Search[1]
09/22/2023	eastern red bat	44	carcass search	5.0 m/s uncleared plot	scavenged	yes
09/22/2023	eastern red bat	14	carcass search	OSC cleared plot	scavenged	yes
09/22/2023	eastern red bat	21	carcass search	OSC cleared plot	scavenged	yes
09/22/2023	eastern red bat	49	carcass search	OSC cleared plot	scavenged	yes
09/22/2023	eastern red bat	21	carcass search	5.0 m/s cleared plot	scavenged	yes
09/22/2023	eastern red bat	53	carcass search	OSC cleared plot	scavenged	yes
09/22/2023	eastern red bat or Seminole bat	29	carcass search	OSC cleared plot	dismembered	yes
09/22/2023	hoary bat	40	carcass search	OSC cleared plot	intact	yes
09/22/2023	silver-haired bat	33	carcass search	5.0 m/s cleared plot	scavenged	yes
09/22/2023	silver-haired bat	39	carcass search	OSC cleared plot	scavenged	yes
09/22/2023	silver-haired bat	38	carcass search	5.0 m/s uncleared plot	scavenged	yes
09/22/2023	unidentified lasiurus bat	75	carcass search[2]	OSC uncleared plot	dismembered	yes
09/22/2023	unidentified lasiurus bat	55	carcass search	5.0 m/s cleared plot	dismembered	yes
09/25/2023	Seminole bat	34	carcass search	OSC cleared plot	scavenged	yes
09/25/2023	big brown bat	20	carcass search	OSC road and pad plot	scavenged	no
09/25/2023	eastern red bat	51	carcass search	OSC cleared plot	scavenged	yes
09/25/2023	eastern red bat	46	carcass search	OSC uncleared plot	scavenged	yes
09/25/2023	eastern red bat	4	carcass search	OSC road and pad plot	intact	no
09/25/2023	eastern red bat	57	carcass search	OSC cleared plot	dismembered	yes
09/25/2023	hoary bat	26	carcass search	OSC uncleared plot	scavenged	yes
09/25/2023	hoary bat	56	carcass search	OSC uncleared plot	intact	yes
09/25/2023	hoary bat	41	carcass search	OSC uncleared plot	scavenged	yes
09/25/2023	silver-haired bat	19	carcass search	OSC uncleared plot	scavenged	yes
09/25/2023	silver-haired bat	1	carcass search	OSC uncleared plot	intact	yes
09/25/2023	silver-haired bat	34	carcass search	OSC cleared plot	scavenged	yes
09/25/2023	silver-haired bat	57	carcass search	5.0 m/s uncleared plot	scavenged	yes
09/25/2023	unidentified bat	27	carcass search	5.0 m/s uncleared plot	dismembered	yes
09/26/2023	big brown bat	30	carcass search	5.0 m/s uncleared plot	dismembered	yes
09/26/2023	eastern red bat	49	carcass search	5.0 m/s cleared plot	scavenged	yes
09/26/2023	eastern red bat	55	carcass search	5.0 m/s cleared plot	dismembered	yes
09/26/2023	eastern red bat	43	carcass search	5.0 m/s cleared plot	scavenged	yes
09/26/2023	eastern red bat	30	carcass search	5.0 m/s cleared plot	scavenged	yes
09/26/2023	eastern red bat	69	carcass search	OSC cleared plot	scavenged	yes
09/26/2023	hoary bat	17	carcass search	OSC cleared plot	scavenged	yes
09/26/2023	hoary bat	43	carcass search	OSC cleared plot	intact	yes
09/26/2023	silver-haired bat	21	carcass search	5.0 m/s cleared plot	scavenged	yes
09/26/2023	silver-haired bat	24	carcass search	OSC cleared plot	scavenged	yes

Appendix A. Complete list of carcasses found at the Cardinal Point Wind Project, from July 12 – October 15, 2023.

Found Date	Species	Distance from Turbine (meters)	Search Type	Search Area Type	Physical Condition	Aided Search[1]
09/26/2023	silver-haired bat	40	carcass search	OSC cleared plot	dismembered	yes
09/26/2023	silver-haired bat	68	carcass search	OSC cleared plot	intact	yes
09/26/2023	silver-haired bat	21	carcass search	5.0 m/s uncleared plot	scavenged	yes
09/27/2023	big brown bat	61	carcass search	OSC cleared plot	scavenged	yes
09/27/2023	eastern red bat	50	carcass search	OSC cleared plot	intact	yes
09/27/2023	eastern red bat	62	carcass search	OSC cleared plot	scavenged	yes
09/27/2023	hoary bat	18	carcass search	5.0 m/s cleared plot	scavenged	yes
09/27/2023	hoary bat	1	carcass search	5.0 m/s road and pad plot	dismembered	no
09/27/2023	silver-haired bat	60	carcass search	5.0 m/s cleared plot	scavenged	yes
09/27/2023	silver-haired bat	39	carcass search	5.0 m/s cleared plot	scavenged	yes
09/28/2023	Seminole bat	18	carcass search	OSC cleared plot	intact	yes
09/28/2023	eastern red bat	28	carcass search	OSC cleared plot	scavenged	yes
09/28/2023	eastern red bat	13	carcass search	OSC cleared plot	scavenged	yes
09/28/2023	eastern red bat	36	carcass search	OSC cleared plot	intact	yes
09/28/2023	eastern red bat	37	carcass search	OSC cleared plot	intact	yes
09/28/2023	eastern red bat	46	carcass search	OSC cleared plot	scavenged	yes
09/28/2023	eastern red bat	55	carcass search	OSC uncleared plot	intact	yes
09/28/2023	eastern red bat	40	carcass search	OSC cleared plot	scavenged	yes
09/28/2023	eastern red bat	44	carcass search	OSC cleared plot	scavenged	yes
09/28/2023	evening bat	61	carcass search	OSC cleared plot	scavenged	yes
09/28/2023	evening bat	43	carcass search	OSC cleared plot	scavenged	yes
09/29/2023	big brown bat	64	carcass search	OSC uncleared plot	scavenged	yes
09/29/2023	eastern red bat	49	carcass search	OSC uncleared plot	scavenged	yes
09/29/2023	eastern red bat	40	carcass search	OSC uncleared plot	intact	yes
09/29/2023	eastern red bat	73	carcass search [2]	OSC uncleared plot	scavenged	yes
09/29/2023	eastern red bat	18	carcass search	OSC uncleared plot	scavenged	yes
09/29/2023	eastern red bat	64	carcass search	OSC cleared plot	dismembered	yes
09/29/2023	eastern red bat	30	carcass search	5.0 m/s uncleared plot	scavenged	yes
09/29/2023	eastern red bat	80	carcass search [2]	5.0 m/s uncleared plot	scavenged	yes
09/29/2023	eastern red bat or Seminole bat	64	carcass search	OSC uncleared plot	scavenged	yes
09/29/2023	hoary bat	61	carcass search	5.0 m/s cleared plot	scavenged	yes
09/29/2023	silver-haired bat	34	carcass search	OSC uncleared plot	scavenged	yes
09/29/2023	Indiana bat	19	carcass search	OSC cleared plot	dismembered	yes
09/30/2023	eastern red bat	66	carcass search	5.0 m/s cleared plot	scavenged	yes
10/02/2023	eastern red bat	56	carcass search	5.0 m/s cleared plot	scavenged	yes
10/02/2023	eastern red bat	43	carcass search	OSC cleared plot	scavenged	yes
10/02/2023	eastern red bat	19	carcass search	OSC cleared plot	scavenged	yes

Appendix A. Complete list of carcasses found at the Cardinal Point Wind Project, from July 12 – October 15, 2023.

Found Date	Species	Distance from Turbine (meters)	Search Type	Search Area Type	Physical Condition	Aided Search[1]
10/02/2023	eastern red bat	61	carcass search	5.0 m/s cleared plot	scavenged	yes
10/02/2023	silver-haired bat	58	carcass search	5.0 m/s cleared plot	intact	yes
10/02/2023	silver-haired bat	81	carcass search [2]	OSC cleared plot	scavenged	yes
10/03/2023	Seminole bat	50	carcass search	OSC cleared plot	scavenged	yes
10/03/2023	big brown bat	26	carcass search	5.0 m/s cleared plot	intact	yes
10/03/2023	big brown bat	23	carcass search	OSC uncleared plot	scavenged	yes
10/03/2023	eastern red bat	49	carcass search	OSC uncleared plot	scavenged	yes
10/03/2023	eastern red bat	61	carcass search	5.0 m/s uncleared plot	scavenged	yes
10/03/2023	hoary bat	44	carcass search	5.0 m/s cleared plot	scavenged	yes
10/03/2023	hoary bat	48	carcass search	OSC uncleared plot	scavenged	yes
10/03/2023	hoary bat	52	carcass search	5.0 m/s uncleared plot	scavenged	yes
10/03/2023	hoary bat	56	carcass search	5.0 m/s uncleared plot	scavenged	yes
10/03/2023	silver-haired bat	1	carcass search	5.0 m/s uncleared plot	scavenged	yes
10/03/2023	silver-haired bat	42	carcass search	OSC uncleared plot	scavenged	yes
10/05/2023	big brown bat	67	carcass search	5.0 m/s uncleared plot	intact	yes
10/05/2023	eastern red bat	72	carcass search	OSC road and pad plot	intact	no
10/05/2023	eastern red bat	30	carcass search	OSC cleared plot	intact	yes
10/05/2023	eastern red bat	14	carcass search	OSC cleared plot	scavenged	yes
10/05/2023	eastern red bat	50	carcass search	OSC cleared plot	scavenged	yes
10/05/2023	eastern red bat	67	carcass search	OSC uncleared plot	scavenged	yes
10/05/2023	eastern red bat	21	carcass search	OSC cleared plot	scavenged	yes
10/05/2023	eastern red bat	36	carcass search	5.0 m/s uncleared plot	intact	yes
10/05/2023	eastern red bat or Seminole bat	41	carcass search	5.0 m/s uncleared plot	dismembered	yes
10/05/2023	evening bat	5	carcass search	OSC road and pad plot	intact	no
10/05/2023	evening bat	55	carcass search	5.0 m/s cleared plot	intact	yes
10/05/2023	evening bat	25	carcass search	OSC cleared plot	intact	yes
10/05/2023	evening bat	24	carcass search	OSC cleared plot	intact	yes
10/05/2023	evening bat	47	carcass search	5.0 m/s road and pad plot	intact	no
10/05/2023	evening bat	33	carcass search	5.0 m/s uncleared plot	intact	yes
10/05/2023	evening bat	21	carcass search	5.0 m/s uncleared plot	intact	yes
10/05/2023	silver-haired bat	7	carcass search	OSC road and pad plot	scavenged	no
10/05/2023	silver-haired bat	7	carcass search	OSC cleared plot	intact	yes
10/06/2023	eastern red bat	23	carcass search	5.0 m/s cleared plot	scavenged	yes
10/06/2023	eastern red bat	37	carcass search	OSC uncleared plot	scavenged	yes
10/06/2023	eastern red bat	17	carcass search	5.0 m/s cleared plot	scavenged	yes
10/06/2023	eastern red bat or Seminole bat	14	carcass search	OSC cleared plot	dismembered	yes
10/06/2023	evening bat	8	carcass search	7.5 m/s road and pad plot	dismembered	no

Appendix A. Complete list of carcasses found at the Cardinal Point Wind Project, from July 12 – October 15, 2023.

Found Date	Species	Distance from Turbine (meters)	Search Type	Search Area Type	Physical Condition	Aided Search[1]
10/06/2023	evening bat	20	carcass search	5.0 m/s road and pad plot	intact	no
10/06/2023	hoary bat	47	carcass search	5.0 m/s uncleared plot	scavenged	yes
10/06/2023	hoary bat	15	carcass search	5.0 m/s uncleared plot	scavenged	yes
10/06/2023	hoary bat	61	carcass search	OSC uncleared plot	intact	yes
10/06/2023	silver-haired bat	6	carcass search	7.5 m/s road and pad plot	intact	no
10/06/2023	silver-haired bat	29	carcass search	5.0 m/s road and pad plot	intact	no
10/06/2023	silver-haired bat	23	carcass search	OSC cleared plot	intact	yes
10/06/2023	silver-haired bat	14	carcass search	5.0 m/s cleared plot	intact	yes
10/06/2023	silver-haired bat	37	carcass search	5.0 m/s cleared plot	scavenged	yes
10/06/2023	evening bat	71	carcass search	OSC cleared plot	dismembered	yes
10/06/2023	unidentified non-myotis	39	carcass search	7.5 m/s road and pad plot	injured	no
10/06/2023	unidentified non-myotis	0	carcass search	5.0 m/s road and pad plot	injured	no
10/09/2023	eastern red bat	64	carcass search	OSC cleared plot	scavenged	yes
10/09/2023	eastern red bat	33	carcass search	OSC uncleared plot	scavenged	yes
10/09/2023	evening bat	59	carcass search	OSC cleared plot	scavenged	yes
10/09/2023	hoary bat	35	carcass search	OSC cleared plot	scavenged	yes
10/09/2023	silver-haired bat	8	carcass search	OSC uncleared plot	intact	yes
10/09/2023	evening bat	68	carcass search	OSC cleared plot	dismembered	yes
10/10/2023	eastern red bat	14	carcass search[2]	5.0 m/s road and pad plot	intact	no
10/10/2023	evening bat	34	carcass search	5.0 m/s cleared plot	scavenged	yes
10/10/2023	evening bat	7	carcass search	OSC road and pad plot	scavenged	no
10/11/2023	eastern red bat	37	carcass search	OSC cleared plot	intact	yes
10/11/2023	eastern red bat	67	carcass search	OSC cleared plot	intact	yes
10/11/2023	evening bat	1	carcass search	5.0 m/s road and pad plot	dismembered	no
10/11/2023	evening bat	44	carcass search	5.0 m/s uncleared plot	intact	yes
10/12/2023	eastern red bat	51	carcass search	OSC cleared plot	intact	yes
10/12/2023	eastern red bat	24	carcass search	5.0 m/s cleared plot	scavenged	yes
10/12/2023	eastern red bat	49	carcass search	5.0 m/s cleared plot	intact	yes
10/12/2023	eastern red bat	77	carcass search[2]	5.0 m/s uncleared plot	scavenged	yes
10/12/2023	eastern red bat	12	carcass search[2]	5.0 m/s road and pad plot	scavenged	no
10/12/2023	eastern red bat	55	carcass search	5.0 m/s uncleared plot	intact	yes
10/12/2023	eastern red bat	66	carcass search	5.0 m/s cleared plot	intact	yes
10/12/2023	hoary bat	67	carcass search	5.0 m/s road and pad plot	intact	no
10/12/2023	hoary bat	74	carcass search[2]	5.0 m/s uncleared plot	scavenged	yes
10/12/2023	silver-haired bat	0	carcass search	5.0 m/s cleared plot	injured	yes
10/12/2023	silver-haired bat	61	carcass search	5.0 m/s uncleared plot	intact	yes
10/14/2023	eastern red bat	36	carcass search	5.0 m/s cleared plot	dismembered	yes

Appendix A. Complete list of carcasses found at the Cardinal Point Wind Project, from July 12 – October 15, 2023.

Found Date	Species	Distance from Turbine (meters)	Search Type	Search Area Type	Physical Condition	Aided Search[1]
10/14/2023	eastern red bat	34	carcass search	OSC cleared plot	intact	yes
10/14/2023	eastern red bat	61	carcass search	OSC road and pad plot	intact	no
10/14/2023	eastern red bat	47	carcass search	5.0 m/s cleared plot	intact	yes
10/14/2023	eastern red bat	35	carcass search	5.0 m/s uncleared plot	scavenged	yes
10/14/2023	hoary bat	41	carcass search	OSC uncleared plot	scavenged	yes
10/14/2023	silver-haired bat	44	carcass search	5.0 m/s cleared plot	scavenged	yes
Birds						
07/13/2023	horned lark	5	incidental	5.0 m/s road and pad plot	scavenged	no
07/13/2023	red-tailed hawk	29	incidental [2]	5.0 m/s road and pad plot	scavenged	no
07/17/2023	killdeer	7	carcass search	5.0 m/s uncleared plot	scavenged	yes
07/21/2023	killdeer	46	carcass search	5.0 m/s cleared plot	dismembered	yes
07/22/2023	red-tailed hawk	50	carcass search	OSC cleared plot	scavenged	yes
07/25/2023	killdeer	38	carcass search	5.0 m/s cleared plot	scavenged	yes
08/01/2023	purple martin	43	carcass search	5.0 m/s cleared plot	scavenged	yes
08/04/2023	unidentified swallow	59	carcass search	5.0 m/s uncleared plot	scavenged	yes
08/07/2023	unidentified swallow	28	carcass search	5.0 m/s cleared plot	scavenged	yes
08/08/2023	cliff swallow	67	carcass search	OSC uncleared plot	scavenged	yes
08/08/2023	unidentified blackbird	5	carcass search	5.0 m/s uncleared plot	feather spot	yes
08/10/2023	killdeer	57	carcass search	OSC cleared plot	feather spot	yes
08/10/2023	tree swallow	42	carcass search	OSC cleared plot	scavenged	yes
08/10/2023	unidentified sparrow	67	carcass search	5.0 m/s cleared plot	scavenged	yes
08/14/2023	killdeer	35	carcass search	OSC uncleared plot	scavenged	yes
08/14/2023	killdeer	46	carcass search	5.0 m/s uncleared plot	dismembered	yes
08/14/2023	tree swallow	35	carcass search	5.0 m/s uncleared plot	scavenged	yes
08/15/2023	killdeer	52	carcass search	5.0 m/s cleared plot	feather spot	yes
08/15/2023	unidentified swallow	40	carcass search	OSC uncleared plot	dismembered	yes
08/17/2023	killdeer	58	carcass search	OSC cleared plot	feather spot	yes
08/17/2023	unidentified sparrow	30	carcass search	OSC uncleared plot	scavenged	yes
08/18/2023	unidentified empidonax	62	carcass search	OSC cleared plot	scavenged	yes
08/25/2023	killdeer	62	carcass search	OSC cleared plot	feather spot	yes
08/26/2023	American redstart	66	carcass search	OSC cleared plot	scavenged	yes
08/26/2023	horned lark	57	carcass search	OSC cleared plot	feather spot	yes
08/26/2023	yellow-billed cuckoo	65	carcass search	OSC uncleared plot	scavenged	yes
08/28/2023	American redstart	68	carcass search	OSC cleared plot	scavenged	yes
08/28/2023	horned lark	6	carcass search	OSC cleared plot	scavenged	yes
08/28/2023	horned lark	8	carcass search	OSC cleared plot	intact	yes
08/29/2023	horned lark	26	carcass search	5.0 m/s cleared plot	scavenged	yes

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Found Date	Species	Distance from Turbine (meters)	Search Type	Search Area Type	Physical Condition	Aided Search[1]
08/29/2023	red-eyed vireo	55	carcass search	OSC cleared plot	scavenged	yes
08/31/2023	magnolia warbler	73	carcass search [2]	5.0 m/s cleared plot	intact	yes
08/31/2023	red-eyed vireo	46	carcass search	OSC cleared plot	scavenged	yes
08/31/2023	unidentified empidonax	73	carcass search [2]	5.0 m/s cleared plot	scavenged	yes
09/01/2023	horned lark	9	carcass search	5.0 m/s cleared plot	scavenged	yes
09/01/2023	horned lark	41	carcass search	OSC cleared plot	intact	yes
09/04/2023	cliff swallow	36	carcass search	OSC uncleared plot	scavenged	yes
09/04/2023	dickcissel	6	carcass search	OSC cleared plot	scavenged	yes
09/04/2023	horned lark	28	carcass search	OSC cleared plot	dismembered	yes
09/04/2023	horned lark	16	carcass search	OSC cleared plot	dismembered	yes
09/04/2023	ruby-throated hummingbird	7	carcass search	OSC cleared plot	scavenged	yes
09/05/2023	barn swallow	50	carcass search	OSC cleared plot	scavenged	yes
09/05/2023	unidentified passerine	38	carcass search	5.0 m/s cleared plot	scavenged	yes
09/05/2023	warbling vireo	8	carcass search	OSC cleared plot	scavenged	yes
09/07/2023	horned lark	49	carcass search	OSC cleared plot	feather spot	yes
09/12/2023	horned lark	51	carcass search	5.0 m/s cleared plot	feather spot	yes
09/12/2023	magnolia warbler	53	carcass search	5.0 m/s cleared plot	scavenged	yes
09/12/2023	ruby-throated hummingbird	68	carcass search	OSC cleared plot	scavenged	yes
09/14/2023	horned lark	62	carcass search	OSC cleared plot	feather spot	yes
09/14/2023	horned lark	34	carcass search	OSC cleared plot	feather spot	yes
09/14/2023	killdeer	57	carcass search	5.0 m/s cleared plot	feather spot	yes
09/14/2023	magnolia warbler	53	carcass search	OSC cleared plot	scavenged	yes
09/15/2023	American redstart	59	carcass search	OSC cleared plot	scavenged	yes
09/15/2023	horned lark	10	carcass search	OSC cleared plot	scavenged	yes
09/15/2023	magnolia warbler	70	carcass search	5.0 m/s cleared plot	scavenged	yes
09/15/2023	pine warbler	30	carcass search	OSC cleared plot	scavenged	yes
09/15/2023	unidentified passerine	49	carcass search	5.0 m/s cleared plot	dismembered	yes
09/15/2023	unidentified warbler	44	carcass search	5.0 m/s uncleared plot	feather spot	yes
09/15/2023	unidentified warbler	36	carcass search	5.0 m/s cleared plot	dismembered	yes
09/16/2023	bay-breasted warbler	28	carcass search	5.0 m/s cleared plot	scavenged	yes
09/18/2023	American redstart	52	carcass search	OSC cleared plot	scavenged	yes
09/18/2023	American redstart	50	carcass search	5.0 m/s cleared plot	dismembered	yes
09/19/2023	Wilson's warbler	12	carcass search	OSC cleared plot	feather spot	yes
09/19/2023	magnolia warbler	38	carcass search	OSC uncleared plot	intact	yes
09/19/2023	red-eyed vireo	33	carcass search	5.0 m/s cleared plot	scavenged	yes
09/19/2023	unidentified empidonax	69	carcass search	OSC road and pad plot	scavenged	no
09/21/2023	horned lark	26	carcass search	5.0 m/s cleared plot	intact	yes

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Found Date	Species	Distance from Turbine (meters)	Search Type	Search Area Type	Physical Condition	Aided Search[1]
09/22/2023	American redstart	61	carcass search	OSC uncleared plot	dismembered	yes
09/25/2023	Nashville warbler	7	carcass search	OSC cleared plot	scavenged	yes
09/25/2023	unidentified passerine	35	carcass search	OSC uncleared plot	dismembered	yes
09/26/2023	red-eyed vireo	31	carcass search	OSC cleared plot	scavenged	yes
09/28/2023	ruby-throated hummingbird	28	carcass search	OSC cleared plot	dismembered	yes
09/28/2023	unidentified warbler	24	carcass search	OSC uncleared plot	feather spot	yes
09/28/2023	unidentified warbler	50	carcass search	5.0 m/s cleared plot	feather spot	yes
09/29/2023	Eurasian tree sparrow	5	carcass search	5.0 m/s road and pad plot	scavenged	no
09/29/2023	horned lark	44	carcass search	OSC cleared plot	scavenged	yes
09/29/2023	horned lark	44	carcass search	5.0 m/s uncleared plot	scavenged	yes
09/29/2023	red-eyed vireo	57	carcass search	OSC uncleared plot	scavenged	yes
10/02/2023	black-throated green warbler	56	carcass search	OSC cleared plot	scavenged	yes
10/02/2023	red-eyed vireo	32	carcass search	5.0 m/s cleared plot	intact	yes
10/03/2023	magnolia warbler	38	carcass search	5.0 m/s uncleared plot	dismembered	yes
10/03/2023	unidentified warbler	26	carcass search	5.0 m/s cleared plot	dismembered	yes
10/06/2023	house sparrow	22	carcass search	OSC cleared plot	scavenged	yes
10/09/2023	Eurasian tree sparrow	3	carcass search	5.0 m/s cleared plot	scavenged	yes
10/09/2023	unidentified warbler	62	carcass search	OSC cleared plot	dismembered	yes
10/09/2023	unidentified wren	42	carcass search	5.0 m/s cleared plot	dismembered	yes
10/10/2023	Tennessee warbler	25	carcass search	5.0 m/s cleared plot	dismembered	yes
10/12/2023	unidentified wren	77	carcass search [2]	5.0 m/s uncleared plot	scavenged	yes
10/14/2023	magnolia warbler	54	carcass search	5.0 m/s uncleared plot	dismembered	yes
10/14/2023	unidentified warbler	8	carcass search	7.5 m/s road and pad plot	scavenged	no

[1]. Dog-aided search.

[2]. Carcass was found outside the search area.

[3]. Carcass removed from analysis due to clearing search.

OSC = optimized smart curtailment; m/s = meters per second.

Appendix B. Genetic Testing Results for Bat Carcasses Found during the 2023 Post-construction Fatality Monitoring Surveys

DNA EVALUATION REPORT

November 9, 2023

Submitted by:
Amanda Hale
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415 W. 17th St. Suite 200
Cheyenne WY, 82001

Laboratory ID # WY-UNK-NF-088- REPORT 1
Services Requested: Species Identification and Gender Identification
Date Received at DNA Lab: August 31, 2023

Description of Sample Submitted: Samples were submitted to the Dr. Jane Huffman Wildlife Genetics Institute on August 31, 2023. Samples included: (Items 1-11) all items submitted for analysis were labeled WY-UNK-NF-088 with unique numbers, each sample item highlighted in detail within Table 1.

Summary of Methods: Samples submitted to the Dr. Jane Huffman Wildlife Genetics Institute were evaluated. Following laboratory standards of practice, a DNA extraction was performed using a Qiagen DNeasy Blood and Tissue kit. To confirm species, a portion of the mitochondrial cytochrome oxidase subunit 1 (CO1) gene and cytochrome b (cytb) gene were targeted. Successful sequence fragments were analyzed using the National Centers for Biotechnology Information (BLAST) database and Barcode of Life Database (BOLD). To determine gender, the zinc finger Y-chromosomal protein (ZFY) gene was used to target the Y chromosome. Successful amplification of Y chromosome was visualized using gel electrophoresis.

Summary of Results and Conclusion: To confirm species, DNA was successfully extracted from sample items 1-11. Final DNA analysis, species identification, and gender identification is highlighted in detail within Table 1.

Table 1: Results of species and gender identification for sample items 1-11 submitted for testing.

Lab ID	Casualty ID	Species ID	Gender
WY-UNK-NF-088-1	082328-UNBA-71-1	*Nycticeius humeralis* (Evening bat)	N/A
WY-UNK-NF-088-2	081723-UNBA-42-1	*Eptesicus fuscus* (Big brown bat)	N/A
WY-UNK-NF-088-3	081423-UNBA-42-1	*Eptesicus fuscus* (Big brown bat)	N/A
WY-UNK-NF-088-4	082923-UNBA-32-1	*Perimyotis subflavus* (Tricolored bat)	Male
WY-UNK-NF-088-5	082523-UNBA-16-1	*Eptesicus fuscus* (Big brown bat)	N/A
WY-UNK-NF-088-6	082523-UNBA-36-1	*Lasiurus cinereus* (Hoary Bat)	N/A
WY-UNK-NF-088-7	082623-UNBA-55-1	*Myotis sodalis* (Indiana bat)	Male
WY-UNK-NF-088-8	082923-UNBA-18-1	*Lasiurus borealis* (Eastern red bat)	N/A
WY-UNK-NF-088-9	082223-INBA-28-1	*Myotis sodalis* (Indiana bat)	Female
WY-UNK-NF-088-10	082123-TRBA-16-1	*Perimyotis subflavus* (Tricolored bat)	Male
WY-UNK-NF-088-11	082623-TRBA-71-1	*Perimyotis subflavus* (Tricolored bat)	Female

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DNA EVALUATION REPORT

November 9, 2023

Submitted by:
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Laboratory ID # WY-UNK-NF-096 – REPORT 4
Services Requested: Species Identification and Gender Identification
Date Received at DNA Lab: September 28, 2023

Description of Sample Submitted: Samples were submitted to the Dr. Jane Huffman Wildlife Genetics Institute on September 28, 2023. Samples included: (Items 1-23) all items submitted for analysis were labeled WY-UNK-NF-096 with unique numbers, each sample item highlighted in detail within Table 1.

Summary of Methods: Samples submitted to the Dr. Jane Huffman Wildlife Genetics Institute were evaluated. Following laboratory standards of practice, a DNA extraction was performed using a Qiagen DNeasy Blood and Tissue kit. To confirm species, a portion of the mitochondrial cytochrome oxidase subunit 1 (CO1) gene and cytochrome b (cytb) gene were targeted. Successful sequence fragments were analyzed using the National Centers for Biotechnology Information (BLAST) database and Barcode of Life Database (BOLD). To determine gender, the zinc finger Y-chromosomal protein (ZFY) gene was used to target the Y chromosome. Successful amplification of Y chromosome was visualized using gel electrophoresis.

Summary of Results and Conclusion: To confirm species, DNA was successfully extracted from sample items 1-4 and 6-23. DNA extraction for sample item 5 failed to isolate mammal DNA as a result of decomposition. Final DNA analysis, species identification, and gender identification is highlighted in detail within Table 1.

Table 1: Results of species and gender identification for sample items 1-23 submitted for testing.

Lab ID	Casualty ID	Species ID	Gender
WY-UNK-NF-096-1	091223-UNBA-63-1	*Myotis sodalis* (Indiana bat)	Female
WY-UNK-NF-096-2	092623-UNBA-46-1	*Eptesicus fuscus* (Big brown bat)	N/A
WY-UNK-NF-096-3	091923-UNBA-69-1	*Lasiurus borealis* (Eastern red bat)	N/A
WY-UNK-NF-096-4	090523-UNBA-69-1	*Lasionycteris noctivagans* (Silver-haired bat)	N/A
WY-UNK-NF-096-5	092523-UNBA-54-1	Failed Sample Analysis	N/A
WY-UNK-NF-096-6	090123-UNMY-49-1	*Myotis sodalis* (Indiana bat)	Female
WY-UNK-NF-096-7	091423-UNBA-54-1	*Lasiurus borealis* (Eastern red bat)	N/A
WY-UNK-NF-096-8	090523-UNBA-55-1	*Lasiurus borealis* (Eastern red bat)	N/A
WY-UNK-NF-096-9	091123-UNBA-38-1	*Lasionycteris noctivagans* (Silver-haired bat)	N/A
WY-UNK-NF-096-10	091523-UNBA-46-2	*Lasiurus borealis* (Eastern red bat)	N/A
WY-UNK-NF-096-11	091523-UNBA-46-1	*Lasiurus borealis* (Eastern red bat)	N/A
WY-UNK-NF-096-12	091223-UNBA-55-1	*Myotis sodalis* (Indiana bat)	Male
WY-UNK-NF-096-13	091123-UNBA-44-1	*Lasionycteris noctivagans* (Silver-haired bat)	N/A
WY-UNK-NF-096-14	090423-UNMY-54-1	*Myotis sodalis* (Indiana bat)	Female
WY-UNK-NF-096-15	091123-UNBA-34-1	*Perimyotis subflavus* (Tricolored bat)	Female
WY-UNK-NF-096-16	091123-UNBA-42-1	*Lasiurus borealis* (Eastern red bat)	N/A
WY-UNK-NF-096-17	091523-UNBA-63-1	*Myotis sodalis* (Indiana bat)	Female
WY-UNK-NF-096-18	090523-UNBA-63-1	*Nycticeius humeralis* (Evening bat)	N/A

DNA EVALUATION REPORT

November 16, 2023

Submitted by:
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Cheyenne WY, 82001

Laboratory ID # WY-UNK-NF-103-Report 5
Services Requested: Species Identification and Gender Identification
Date Received at DNA Lab: October 18, 2023

Description of Sample Submitted: Samples were submitted to the Dr. Jane Huffman Wildlife Genetics Institute on October 18, 2023. Samples included: (Items 1-5) all items submitted for analysis were labeled WY-UNK-NF-103 with unique numbers, each sample item highlighted in detail within Table 1.

Summary of Methods: Samples submitted to the Dr. Jane Huffman Wildlife Genetics Institute were evaluated. Following laboratory standards of practice, a DNA extraction was performed using a Qiagen DNeasy Blood and Tissue kit. To confirm species, a portion of the mitochondrial cytochrome oxidase subunit 1 (CO1) gene and cytochrome b (cytb) gene were targeted. Successful sequence fragments were analyzed using the National Centers for Biotechnology Information (BLAST) database and Barcode of Life Database (BOLD). To determine gender, the zinc finger Y-chromosomal protein (ZFY) gene was used to target the Y chromosome. Successful amplification of Y chromosome was visualized using gel electrophoresis.

Summary of Results and Conclusion: To confirm species, DNA was successfully extracted from sample items 1-5. Final DNA analysis, species identification, and gender identification is highlighted in detail within Table 1.

Table 1: Results of species and gender identification for sample items 1-5 submitted for testing.

Lab ID	Casualty ID	Species ID	Gender
WY-UNK-NF-103-1	092823-UNBA-16-1	*Nycticeius humeralis* (Evening bat)	N/A
WY-UNK-NF-103-2	092923-UNBA-32-1	*Myotis sodalis* (Indiana bat)	Female
WY-UNK-NF-103-3	100623-UNBA-32-1	*Nycticeius humeralis* (Evening bat)	N/A
WY-UNK-NF-103-4	100623-UNBA-49-1	*Nycticeius humeralis* (Evening bat)	N/A
WY-UNK-NF-103-5	100923-UNBA-16-1	*Nycticeius humeralis* (Evening bat)	N/A

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Appendix C. Searcher Efficiency and Carcass Persistence Model Fitting Results

Appendix C1. Searcher efficiency models for dog-aided searches (full plots) at the Cardinal Point Wind Project, from July 15 – October 15, 2023 (n = 46 bat carcasses).

Covariates	k Value	AICc	Delta AICc
Plot Type	0.67	49.89	0
No Covariates	0.67	50.26	0.37*

* Selected model.

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

Appendix C2. Searcher efficiency models for technician searches (road and pad plots) at the Cardinal Point Wind Project, McDonough and Warren counties, Illinois, from July 15 – October 15, 2023 (n = 19 bat carcasses).

Covariates	k Value	AICc	Delta AICc
No Covariates	0.67	3.25	0*

* Selected model.

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

Appendix C3. Carcass persistence models with covariates and distributions for bats at dog-aided search plots (full plots) at the Cardinal Point Wind Project, from July 15 – October 15, 2023 (n = 35 bat carcasses).

Location Covariates	Scale Covariates	Distribution	AICc	Delta AICc
No Covariates	No Covariates	lognormal	151.34	0*
No Covariates	No Covariates	loglogistic	151.58	0.24
No Covariates	Plot Type	lognormal	152.49	1.15
No Covariates	Plot Type	loglogistic	152.76	1.42
Plot Type	No Covariates	lognormal	153.28	1.94
Plot Type	No Covariates	loglogistic	153.44	2.10
Plot Type	Plot Type	lognormal	154.48	3.14
Plot Type	Plot Type	loglogistic	154.67	3.33
No Covariates	No Covariates	Weibull	154.76	3.42
Plot Type	No Covariates	Weibull	156.12	4.78
No Covariates	Plot Type	Weibull	156.59	5.25
Plot Type	Plot Type	Weibull	158.11	6.77
No Covariates	–	exponential	173.19	21.85
Plot Type	–	exponential	173.54	22.20

* Selected model.

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

Appendix C4. Carcass persistence models with covariates and distributions for bats at the Cardinal Point Wind Project, from July 15 – October 15, 2023 (n = 18 bat carcasses).

Location Covariates	Scale Covariates	Distribution	AICc	Delta AICc
No Covariates	No Covariates	loglogistic	81.42	0*
No Covariates	No Covariates	lognormal	81.97	0.55
No Covariates	No Covariates	Weibull	84.50	3.08
No Covariates	–	exponential	88.25	6.83

* Selected model.

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

Appendix D. Truncated Weighted Likelihood Area Adjustment Model Fitting Results

Appendix D1. Stratified search area adjustment models for bats from the Cardinal Point Wind Project, from July 15 – October 15, 2023.

Distribution				AICc	DeltaAICc
5.0 m/s	OSC	7.5 m/s	Pooled		
Gompertz	normal	Gompertz	–	31,627.91	0*
normal	normal	Gompertz	–	31,662.38	34.47
Gompertz	Weibull	Gompertz	–	31,690.03	62.12
Weibull	normal	Gompertz	–	31,707.36	79.45
normal	Weibull	Gompertz	–	31,724.50	96.59
Gompertz	Gompertz	Gompertz	–	31,743.93	116.03
Weibull	Weibull	Gompertz	–	31,769.48	141.57
normal	Gompertz	Gompertz	–	31,778.41	150.50
Weibull	Gompertz	Gompertz	–	31,823.39	195.48
Gompertz	gamma	Gompertz	–	31,827.12	199.21

* Selected model.

AICc = corrected Akaike Information Criterion; Delta AICc = change in AICc.
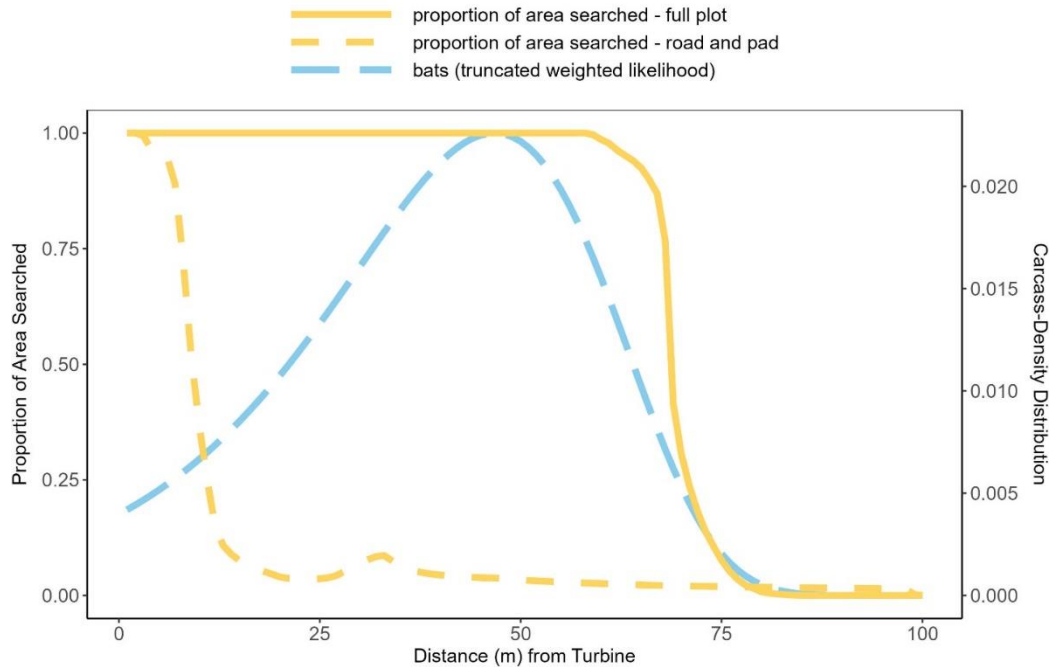
Appendix D2. Estimated carcass-density distribution, and proportion of area searched by distance from turbine for bats found at turbines in the 5.0 m/s treatment group, at the Cardinal Point Wind Project, McDonough and Warren counties, Illinois, from July 15 – October 15, 2023.
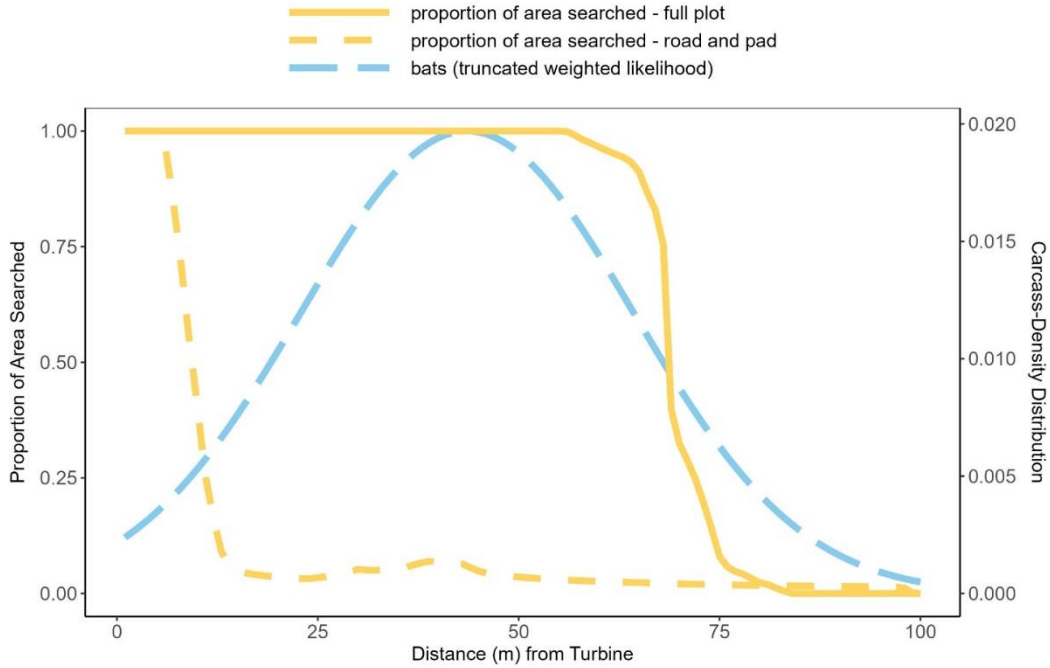
Appendix D3. Estimated bat carcass-density distribution, and proportion of area searched by distance from turbine for bats found at turbines in the OSC treatment group at the Cardinal Point Wind Project, from July 15 – October 15, 2023.
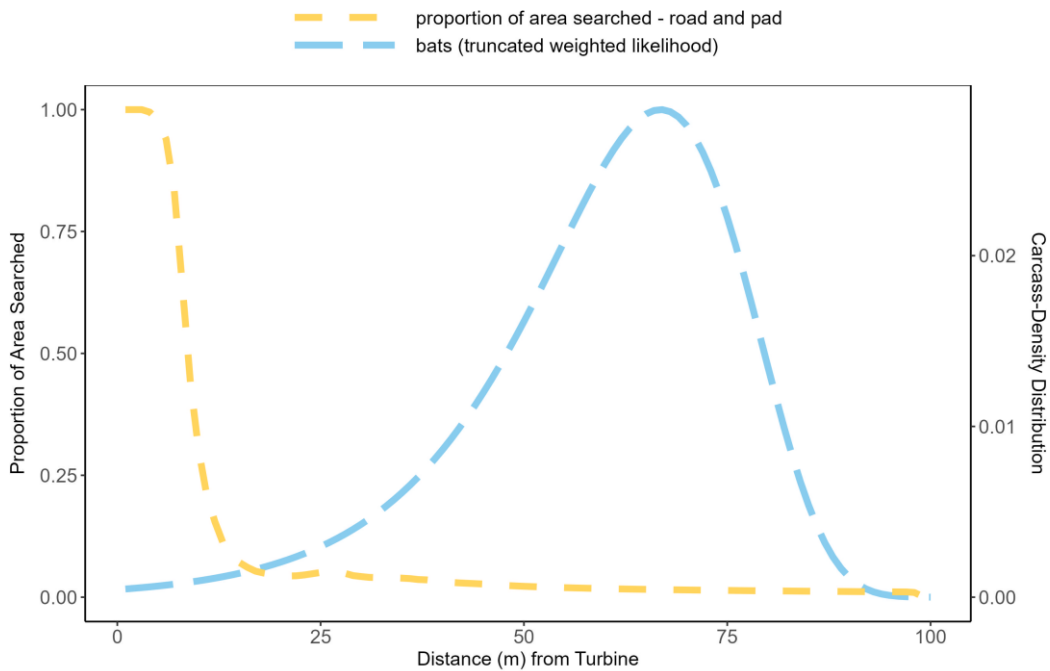
Appendix D4. Estimated carcass-density distribution, and proportion of area searched by distance from turbine for bats found at turbines in the 7.5 m/s control treatment group, at the Cardinal Point Wind Project, from July 15 – October 15, 2023.

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

Appendix E1. Inputs needed to run Evidence of Absence within the fall season: Single Class Module for the Cardinal Point Wind Project, from July 15 – October 15, 2023.[1]

Plot Type	Treatment Group	Aided Search	Search Interval (I)	# of Searches	Spatial Coverage (a)	Searcher Efficiency		Carcass Persistence[2,3]	
						Carcasses Available	Carcasses Found	Shape (α)	Scale (β)
full plot	5.0 m/s	dog	3.5	27	0.966	46	36	5.07	1.68
	OSC	dog	3.5	27	0.893	46	36	5.07	1.68
road and pad	5.0 m/s	none	3.5	27	0.084	19	18	1.10	2.88
	OSC	none	3.5	27	0.068	19	18	1.10	2.88
	7.5 m/s	none	7.0	14	0.043	19	18	1.10	2.88

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

[2.] A lognormal distribution was used for carcass persistence on dog-aided full plot searches. The 95% confidence interval on β for dog-aided searches was set to 0.90–2.47.

[3.] A log-logistic distribution was used for carcass persistence on technician-searched road and pad plot searches. The 95% confidence interval on β for technician searches was set to 1.40–5.92.

m/s = meters per second; OSC = optimized smart curtailment.

Appendix E2. Inputs needed to run Evidence of Absence (EoA) model to combine across plot types within the fall season: Multiple Class Module for the Cardinal Point Wind Project, from July 15 - October 15, 2023.[1]

Season	Plot Type	Treatment Group	Ba	Bb	DWP[1]
fall	full plot	5.0 m/s	36.16	22.82	0.24
		OSC	40.54	30.92	0.26
	road and pad	5.0 m/s	475.17	8,385.33	0.24
		OSC	480.40	10,631.28	0.26
		7.5 m/s	375.98	18,946.18	0

[1.] DWP = density-weighted proportion weight used in EoA Multiple Class Module.

m/s = meters per second; OSC = optimized smart curtailment.

Appendix E3. Screen shot of Evidence of Absence (v2.0.7) graphical user interface, Single Class Module inputs for fall 2023, 70-meter full plot searches at 10 turbines in the 5.0 meter/second blanket curtailment group, searched at a 3.5-day interval.

EoA, v2.0.7 - Single Class Module

Edit   Help

Detection Probability (g)

Search Schedule

Start of monitoring (yyyy-mm-dd): 2023-07-15

● Formula
- Search interval (I): 3.5
- Number of searches: 27

○ Custom   Edit/View
span = 182, I (mean) = 7

Spatial coverage (a): 0.08
Temporal coverage (v): 1

[Estimate g]

Searcher Efficiency

○ Carcasses available for several searches
95% CIs: p ∈ [0.528, 0.671], k ∈ [0.648, 0.813]
$\hat{p}$ = 0.62, $\hat{k}$ = 0.735   [View] [Edit]

● Carcasses removed after one search
- Carcasses available: 19
- Carcasses found: 18

$\hat{p}$ = 0.947, with 95% CI = [0.779, 0.994]

Factor by which searcher efficiency changes with each search (k): 0.67

Persistence Distribution

○ Use field trials to estimate parameters   [View/Edit]
Distribution: Lognormal with shape (α) = 4.078 and scale (β) = 1.171
r = 0.653 for Ir = 3.5, with 95% CIs: r = [0.529, 0.768], β = [0.488, 1.854]

● Enter parameter estimates manually   [View]

| Exponential | Weibull | Log-Logistic | **Lognormal** |

Parameters
- shape (α): 1.1
- scale (β): 2.88   lwr: 1.4   upr: 5.92

r = 0.981 for Ir = 3.5, with 95% CI: r ∈ [0.791, 1]

Fatality estimation (M, λ)

- Carcass Count (X): 0   [Estimate M]
- Credibility level (1 - α): 0.9   [Estimate λ]

● One-sided CI (M*)   ○ Two-sided CI

[Close]

Estimated detection probability (g)

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

Full site for full year
    Estimated g = 0.0719, 95% CI = [0.0503, 0.097]
    Fitted beta distribution parameters for estimated g: Ba = 33.6538, Bb = 434.1112


Full site for monitored period, 15-Jul-2023 through 17-Oct-2023
    Estimated g = 0.0719, 95% CI = [0.0503, 0.097]
    Fitted beta distribution parameters for estimated g: Ba = 33.6538, Bb = 434.1112
    Temporal coverage (within year) = 1


Searched area for monitored period, 15-Jul-2023 through 17-Oct-2023
    Estimated g = 0.894, 95% CI = [0.609, 0.999]
    Fitted beta distribution parameters for estimated g: Ba = 6.5315, Bb = 0.7705


===============================================================================
Input:
Search parameters
    trial carcasses placed = 19, carcasses found = 18
    estimated searcher efficiency: p = 0.947, 95% CI = [0.779, 0.994]
    k = 0.67
    Search schedule: Search interval (I) = 3.5, number of searches = 27, span = 94.5
      spatial coverage: 0.08      temporal coverage: 1
    _____
Carcass persistence:
    Lognormal persistence distribution
      shape (α) = 1.1 and scale (β) = 2.88
      95% CI β = [1.4, 5.92]
      r = 0.981 for Ir = 3.5 with 95% CI = [0.791, 1]
      Parameters entered manually
    Uniform arrivals
    _____
```

Appendix E4. Screen shot of Evidence of Absence (v2.0.7) graphical user interface, Single Class Module inputs for fall 2023, 100-meter road and pad plot searches at 10 turbines in the 5.0 meter/second blanket curtailment group, searched at a 3.5-day interval.

EoA, v2.0.7 - Single Class Module

Edit   Help

Detection Probability (g)

Search Schedule

Start of monitoring (yyyy-mm-dd): 2023-07-15

⦿ Formula
Search interval (I): 3.5
Number of searches: 27

◯ Custom   Edit/View
span = 182, I (mean) = 7

Spatial coverage (a): 0.89
Temporal coverage (v): 1

Estimate g

Searcher Efficiency

◯ Carcasses available for several searches
95% CIs: p ∈ [0.528, 0.671], k ∈ [0.648, 0.813]
p̂ = 0.62, k̂ = 0.735   View   Edit

⦿ Carcasses removed after one search
Carcasses available: 46
Carcasses found: 36
p̂ = 0.783, with 95% CI = [0.649, 0.882]
Factor by which searcher efficiency changes with each search (k): 0.67

Persistence Distribution

◯ Use field trials to estimate parameters   View/Edit
Distribution: Lognormal with shape (α) = 4.078 and scale (β) = 1.171
r = 0.653 for Ir = 3.5, with 95% CIs: r = [0.529, 0.768], β = [0.488, 1.854]

⦿ Enter parameter estimates manually   View

Exponential
Weibull
Log-Logistic
Lognormal

Parameters
shape (α): 5.07
scale (β): 1.68   lwr 0.9   upr 2.47
r = 0.717 for Ir = 3.5, with 95% CI: r ∈ [0.598, 0.817]

Fatality estimation (M, λ)

Carcass Count (X): 0   Estimate M   ⦿ One-sided CI (M*)   ◯ Two-sided CI
Credibility level (1 - α): 0.9   Estimate λ

Close

Estimated detection probability (g)

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

Full site for full year
    Estimated g = 0.564, 95% CI = [0.457, 0.668]
    Fitted beta distribution parameters for estimated g: Ba = 46.8376, Bb = 36.1766


Full site for monitored period, 15-Jul-2023 through 17-Oct-2023
    Estimated g = 0.564, 95% CI = [0.457, 0.668]
    Fitted beta distribution parameters for estimated g: Ba = 46.8376, Bb = 36.1766
    Temporal coverage (within year) = 1


Searched area for monitored period, 15-Jul-2023 through 17-Oct-2023
    Estimated g = 0.634, 95% CI = [0.511, 0.749]
    Fitted beta distribution parameters for estimated g: Ba = 39.18, Bb = 22.6218

================================================================================
Input:
Search parameters
    trial carcasses placed = 46, carcasses found = 36
    estimated searcher efficiency: p = 0.783, 95% CI = [0.649, 0.882]
    k = 0.67
    Search schedule: Search interval (I) = 3.5, number of searches = 27, span = 94.5
      spatial coverage: 0.89    temporal coverage: 1
_____
Carcass persistence:
    Lognormal persistence distribution
      shape (α) = 5.07 and scale (β) = 1.68
      95% CI β = [0.9, 2.47]
      r = 0.717 for Ir = 3.5 with 95% CI = [0.598, 0.817]
      Parameters entered manually
    Uniform arrivals
_____
```

Appendix E5. Screen shot of Evidence of Absence (v2.0.7) graphical user interface, Single Class Module inputs for fall 2023, 70-meter full plot searches at 10 turbines in the optimized smart curtailment group, searched at a 3.5-day interval.

EoA, v2.0.7 - Single Class Module

Edit   Help

Detection Probability (g)

Search Schedule

Start of monitoring (yyyy-mm-dd): `2023-07-15`

◉ Formula
- Search interval (I): `3.5`
- Number of searches: `27`

○ Custom   Edit/View

span = 182, I (mean) = 7

Spatial coverage (a): `0.07`
Temporal coverage (v): `1`

[Estimate g]

Searcher Efficiency

○ Carcasses available for several searches

95% CIs: p ∈ [0.528, 0.671], k ∈ [0.648, 0.813]
$\hat{p}$ = 0.62, $\hat{k}$ = 0.735   [View] [Edit]

◉ Carcasses removed after one search
- Carcasses available: `19`
- Carcasses found: `18`

$\hat{p}$ = 0.947, with 95% CI = [0.779, 0.994]

Factor by which searcher efficiency changes with each search (k): `0.67`

Persistence Distribution

○ Use field trials to estimate parameters   [View/Edit]

Distribution: Lognormal with shape (α) = 4.078 and scale (β) = 1.171
r = 0.653 for Ir = 3.5, with 95% CIs: r = [0.529, 0.768], β = [0.488, 1.854]

◉ Enter parameter estimates manually   [View]

Exponential	**Parameters**
Weibull	shape (α): `1.1`
Log-Logistic	scale (β): `2.88` lwr `1.4` upr `5.92`
Lognormal	r = 0.981 for Ir = 3.5, with 95% CI: r ∈ [0.791, 1]

Fatality estimation (M, λ)

Carcass Count (X): `0`   [Estimate M]
Credibility level (1 - α): `0.9`   [Estimate λ]

◉ One-sided CI (M*)   ○ Two-sided CI

[Close]

Estimated detection probability (g)

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

Full site for full year
    Estimated g = 0.0632, 95% CI = [0.0449, 0.0843]
    Fitted beta distribution parameters for estimated g: Ba = 36.7547, Bb = 544.9246


Full site for monitored period, 15-Jul-2023 through 17-Oct-2023
    Estimated g = 0.0632, 95% CI = [0.0449, 0.0843]
    Fitted beta distribution parameters for estimated g: Ba = 36.7547, Bb = 544.9246
    Temporal coverage (within year) = 1


Searched area for monitored period, 15-Jul-2023 through 17-Oct-2023
    Estimated g = 0.898, 95% CI = [0.619, 0.999]
    Fitted beta distribution parameters for estimated g: Ba = 6.715, Bb = 0.7605


==============================================================================
Input:
Search parameters
    trial carcasses placed = 19, carcasses found = 18
    estimated searcher efficiency: p = 0.947, 95% CI = [0.779, 0.994]
    k = 0.67
    Search schedule: Search interval (I) = 3.5, number of searches = 27, span = 94.5
      spatial coverage: 0.07    temporal coverage: 1

Carcass persistence:
    Lognormal persistence distribution
      shape (α) = 1.1 and scale (β) = 2.88
      95% CI β = [1.4, 5.92]
      r = 0.981 for Ir = 3.5 with 95% CI = [0.791, 1]
    Parameters entered manually
    Uniform arrivals
```

Appendix E6. Screen shot of Evidence of Absence (v2.0.7) graphical user interface, Single Class Module inputs for fall 2023, 100-meter road and pad plot searches at 10 turbines in the optimized smart curtailment group, searched at a 3.5-day interval.

EoA, v2.0.7 - Single Class Module

Edit   Help

Detection Probability (g)

Search Schedule

Start of monitoring (yyyy-mm-dd): 2023-07-15

◉ Formula
Search interval (I): 7
Number of searches: 14

○ Custom   Edit/View
span = 182, I (mean) = 7

Spatial coverage (a): 0.04
Temporal coverage (v): 1

[Estimate g]

Searcher Efficiency

○ Carcasses available for several searches
95% CIs: p ∈ [0.528, 0.671], k ∈ [0.648, 0.813]
p̂ = 0.62, k̂ = 0.735   [View]   [Edit]

◉ Carcasses removed after one search
Carcasses available: 19
Carcasses found: 18
p̂ = 0.947, with 95% CI = [0.779, 0.994]
Factor by which searcher efficiency changes with each search (k): 0.67

Persistence Distribution

○ Use field trials to estimate parameters   [View/Edit]
Distribution: Lognormal with shape (α) = 4.078 and scale (β) = 1.171
r = 0.531 for Ir = 7, with 95% CIs: r = [0.423, 0.65], β = [0.488, 1.854]

◉ Enter parameter estimates manually   [View]

Exponential
Weibull
Log-Logistic
Lognormal

Parameters
shape (α): 1.1
scale (β): 2.88   lwr: 1.4   upr: 5.92
r = 0.929 for Ir = 7, with 95% CI: r ∈ [0.601, 1]

Fatality estimation (M, λ)

Carcass Count (X): 0   [Estimate M]
Credibility level (1 - α): 0.9   [Estimate λ]

◉ One-sided CI (M*)   ○ Two-sided CI

[Close]

Estimated detection probability (g)

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

Full site for full year
    Estimated g = 0.033, 95% CI = [0.0187, 0.0512]
    Fitted beta distribution parameters for estimated g: Ba = 15.0821, Bb = 441.4673


Full site for monitored period, 15-Jul-2023 through 21-Oct-2023
    Estimated g = 0.033, 95% CI = [0.0187, 0.0512]
    Fitted beta distribution parameters for estimated g: Ba = 15.0821, Bb = 441.4673
    Temporal coverage (within year) = 1


Searched area for monitored period, 15-Jul-2023 through 21-Oct-2023
    Estimated g = 0.82, 95% CI = [0.41, 0.997]
    Fitted beta distribution parameters for estimated g: Ba = 3.8028, Bb = 0.8336


================================================================================
Input:
Search parameters
    trial carcasses placed = 19, carcasses found = 18
    estimated searcher efficiency: p = 0.947, 95% CI = [0.779, 0.994]
    k = 0.67
    Search schedule: Search interval (I) = 7, number of searches = 14, span = 98
      spatial coverage: 0.04    temporal coverage: 1
                                                                    _____

Carcass persistence:
    Lognormal persistence distribution
      shape (α) = 1.1 and scale (β) = 2.88
      95% CI β = [1.4, 5.92]
      r = 0.929 for Ir = 7 with 95% CI = [0.601, 1]
      Parameters entered manually
    Uniform arrivals
                                                                    _____
```

Appendix E7. Screen shot of Evidence of Absence (v2.0.7) graphical user interface, Single Class Module inputs for fall 2023, 100-meter road and pad plot searches at 20 turbines in the 7.5 meter/second blanket curtailment group, searched at a 7-day interval.

EoA, v2.0.7 - Multiple Class Module

Edit   Help

Options

Overall

○ Estimate total mortality (M)

Credibility level (1 - α) [0.5]

● One-sided CI (M*)
○ Two-sided CI

● Estimate overall detection probability (g)

Individual classes

○ Calculate g parameters from monitoring data

● Enter g parameters manually

Actions

Add class Calculate Clear Close

Class	dwp	X	Ba	Bb	ĝ	95% CI
unsearched	0	0	---	---	0	[0, 0]
full plot 5 m/s	0.24	0	36.16	22.82	0.6131	[0.487, 0.732]
full plot OSC	0.26	0	40.54	30.92	0.5673	[0.452, 0.679]
road/pad 5 m/s	0.24	0	475.17	8385.33	0.05363	[0.049, 0.0584]
road/pad OSC	0.26	0	480.4	10631.28	0.04323	[0.0395, 0.0471]
road/pad 7.5 m/s	0	0	375.98	18946.18	0.01946	[0.0176, 0.0215]

R Estimated detection probability (g) for multiple classes

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

  Class                DWP     X    Ba      Bb     ghat     95% CI
  unsearched             0     0   ---     ---        0  [    0,       0]
  full plot 5 m/s     0.24     0  36.16   22.82   0.613  [0.487, 0.732]
  full plot OSC       0.26     0  40.54   30.92   0.567  [0.452, 0.679]
  road/pad 5 m/s      0.24     0  475.2    8385   0.054  [0.049, 0.058]
  road/pad OSC        0.26     0  480.4 1.063e+04  0.043  [0.040, 0.047]
  road/pad 7.5 m/s       0     0    376 1.895e+04  0.019  [0.018, 0.021]
================================================================================
Results for full site

_____

Detection probability
  Estimated g = 0.319, 95% CI = [0.278, 0.361]
  Fitted beta distribution parameters for estimated g: Ba = 151.0138, Bb = 322.7496

Mortality

Test of assumed relative weights (rho)
  Class                Assumed   Fitted (95% CI)
  unsearched             0.000        NA
  full plot 5 m/s        0.240    [0.000, 0.221]
  full plot OSC          0.260    [0.000, 0.271]
  road/pad 5 m/s         0.240    [0.001, 0.842]
  road/pad OSC           0.260    [0.001, 0.877]
  road/pad 7.5 m/s       0.000    [0.004, 0.962]
  p = 1 for likelihood ratio test of H0: assumed rho = true rho
```

Appendix E8. Screen shot of Evidence of Absence (v2.0.7) graphical user interface, Multiple Class Module inputs for fall 2023 to estimate overall detection probability (g), searches at 60 turbines, searched at 3.5- and 7-day intervals.

EoA, v2.0.7 - Multiple Class Module

Edit   Help

Options

Overall

● Estimate total mortality (M)

Credibility level (1 - α) 0.5

○ One-sided CI (M*)
○ Two-sided CI

○ Estimate overall detection probability (g)

Individual classes

○ Calculate g parameters from monitoring data

● Enter g parameters manually

Actions

Add class   Calculate   Clear   Close

Class	dwp	X	Ba	Bb	ġ	95% CI
unsearched	0	0	---	---	0	[0, 0]
full plot 5 m/s	0.24	4	36.16	22.82	0.6131	[0.487, 0.732]
full plot OSC	0.26	4	40.54	30.92	0.5673	[0.452, 0.679]
road/pad 5 m/s	0.24	0	475.17	8385.33	0.05363	[0.049, 0.0584]
road/pad OSC	0.26	0	480.4	10631.28	0.04323	[0.0395, 0.0471]
road/pad 7.5 m/s	0	0	375.98	18946.18	0.01946	[0.0176, 0.0215]

R Estimated mortality (M) & detection probability (g) for multiple classes

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

  Class            DWP     X    Ba      Bb     ghat     95% CI
  unsearched        0      0    ---     ---      0    [    0,      0]
  full plot 5 m/s  0.24    4   36.16   22.82  0.613  [0.487, 0.732]
  full plot OSC    0.26    4   40.54   30.92  0.567  [0.452, 0.679]
  road/pad 5 m/s   0.24    0  475.2    8385   0.054  [0.049, 0.058]
  road/pad OSC     0.26    0  480.4 1.063e+04 0.043  [0.040, 0.047]
  road/pad 7.5 m/s    0    0  376   1.895e+04 0.019  [0.018, 0.021]
================================================================================
Results for full site
_____


Detection probability
  Estimated g = 0.319, 95% CI = [0.278, 0.361]
  Fitted beta distribution parameters for estimated g: Ba = 151.0138, Bb = 322.7496

Mortality
  M* = 25 for credibility 1 - alpha = 0.5, i.e., P(M <= 25) >= 50%
  Estimated annual fatality rate: lambda = 26.8, 95% CI = [ 11.8, 48.28]

Test of assumed relative weights (rho)
  Class            Assumed   Fitted (95% CI)
  unsearched        0.000      NA
  full plot 5 m/s   0.240    [0.025, 0.466]
  full plot OSC     0.260    [0.030, 0.474]
  road/pad 5 m/s    0.240    [0.001, 0.609]
  road/pad OSC      0.260    [0.001, 0.676]
  road/pad 7.5 m/s  0.000    [0.003, 0.843]
  p = 0.86888 for likelihood ratio test of H0: assumed rho = true rho

Mortality rates (lambda) by class
  Class            Median       IQR            95% CI
  unsearched        ---          ---            ---
  full plot 5 m/s   6.86    [ 4.82,  9.45]  [ 2.19, 16.14]
  full plot OSC     7.42    [ 5.21, 10.21]  [ 2.37, 17.43]
  road/pad 5 m/s    4.25    [ 0.95, 12.36]  [ 0.01, 47.02]
```

Appendix E9. Screen shot of Evidence of Absence (v2.0.7) graphical user interface, Multiple Class Module inputs for fall 2023 to estimate M* for the Indiana bat, searches at 60 turbines, searched at 3.5- and 7-day intervals.

EoA, v2.0.7 - Multiple Class Module

Edit Help

Options

Overall

○ Estimate total mortality (M)

Credibility level (1 - α) 0.5

○ One-sided CI (M*)
○ Two-sided CI

○ Estimate overall detection probability (g)

Individual classes

○ Calculate g parameters from monitoring data

○ Enter g parameters manually

Actions

| Add class | Calculate | Clear | Close |

Class	dwp	X	Ba	Bb	ĝ	95% CI
unsearched	0	0	---	---	0	[0, 0]
full plot 5 m/s	0.24	1	36.16	22.82	0.6131	[0.487, 0.732]
full plot OSC	0.26	4	40.54	30.92	0.5673	[0.452, 0.679]
road/pad 5 m/s	0.24	0	475.17	8385.33	0.05363	[0.049, 0.0584]
road/pad OSC	0.26	0	480.4	10631.28	0.04323	[0.0395, 0.0471]
road/pad 7.5 m/s	0	0	375.98	18946.18	0.01946	[0.0176, 0.0215]

R Estimated mortality (M) & detection probability (g) for multiple classes

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

  Class                DWP     X    Ba      Bb    ghat     95% CI
  unsearched             0     0   ---     ---      0  [    0,      0]
  full plot 5 m/s     0.24     1 36.16   22.82  0.613 [0.487, 0.732]
  full plot OSC       0.26     4 40.54   30.92  0.567 [0.452, 0.679]
  road/pad 5 m/s      0.24     0 475.2    8385  0.054 [0.049, 0.058]
  road/pad OSC        0.26     0 480.4 1.063e+04 0.043 [0.040, 0.047]
  road/pad 7.5 m/s       0     0   376 1.895e+04 0.019 [0.018, 0.021]
==============================================================================
Results for full site
_____

Detection probability
  Estimated g = 0.319, 95% CI = [0.278, 0.361]
  Fitted beta distribution parameters for estimated g: Ba = 151.0138, Bb = 322.7496

Mortality
  M* = 16 for credibility 1 - alpha = 0.5, i.e., P(M <= 16) >= 50%
  Estimated annual fatality rate: lambda = 17.4, 95% CI = [ 5.96, 34.96]

Test of assumed relative weights (rho)
  Class              Assumed   Fitted (95% CI)
  unsearched           0.000        NA
  full plot 5 m/s      0.240    [0.003, 0.257]
  full plot OSC        0.260    [0.032, 0.620]
  road/pad 5 m/s       0.240    [0.001, 0.659]
  road/pad OSC         0.260    [0.001, 0.728]
  road/pad 7.5 m/s     0.000    [0.005, 0.878]
  p = 0.61647 for likelihood ratio test of H0: assumed rho = true rho

Mortality rates (lambda) by class
  Class              Median       IQR            95% CI
  unsearched           ---        ---             ---
  full plot 5 m/s     1.95   [ 0.99,  3.40]  [ 0.18,  7.85]
  full plot OSC       7.42   [ 5.21, 10.21]  [ 2.37, 17.43]
  road/pad 5 m/s      4.25   [ 0.95, 12.36]  [ 0.01, 47.02]
```
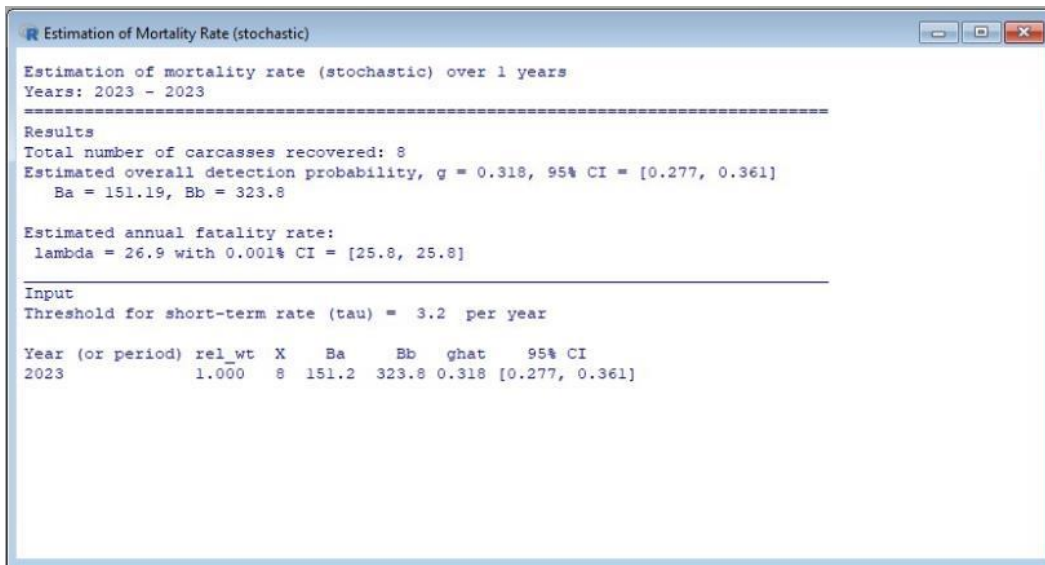
Appendix E10. Screen shot of Evidence of Absence (v2.0.7) graphical user interface, Multiple Class Module inputs for fall 2023 to estimate M* for the tricolored bat, searches at 60 turbines, searched at 3.5- and 7-day intervals.

Appendix E11. Screen shot of Evidence of Absence (v2.0.7) graphical user interface, Multiple Class Module inputs for fall 2023 to estimate M* for the little brown bat, searches at 60 turbines, searched at 3.5- and 7-day intervals.
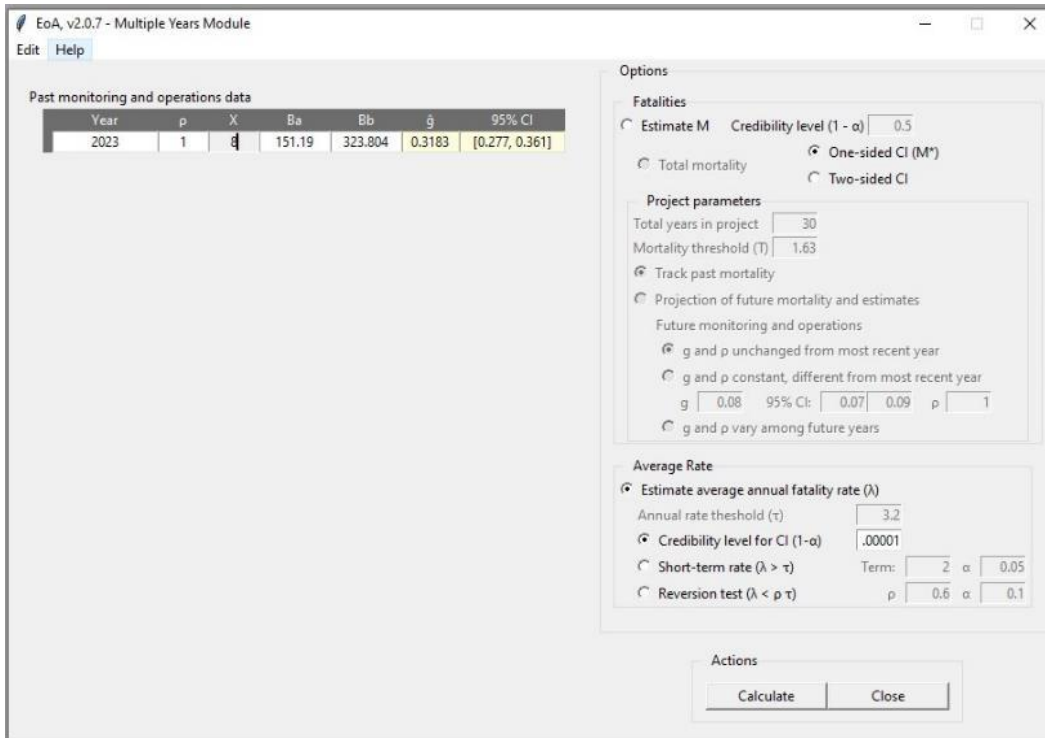
Appendix E12. Screen shot of Evidence of Absence (v2.0.7) graphical user interface (GUI), Multiple Years Module inputs for estimation of Indiana bat rolling average detection probability and annual take estimate. Inputs are based on values reported in the main text.

Note: To obtain the median λ from the EoA GUI, a confidence interval (CI) credibility level of 0.00001 was used. The median annual take rate can be obtained from the upper and lower bounds on the 50% CI for the mean annual take rate.
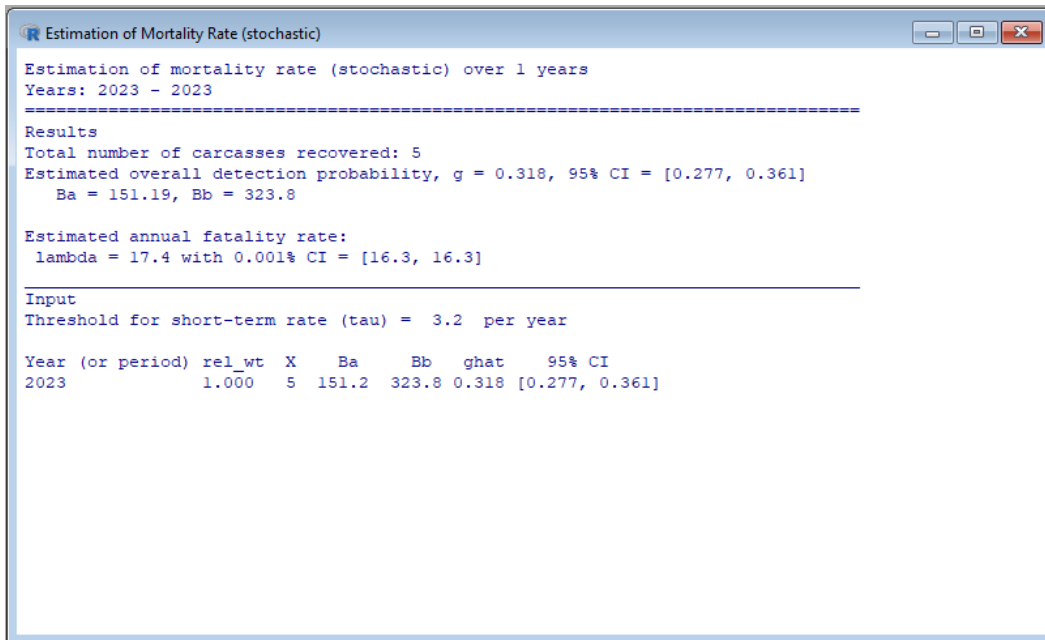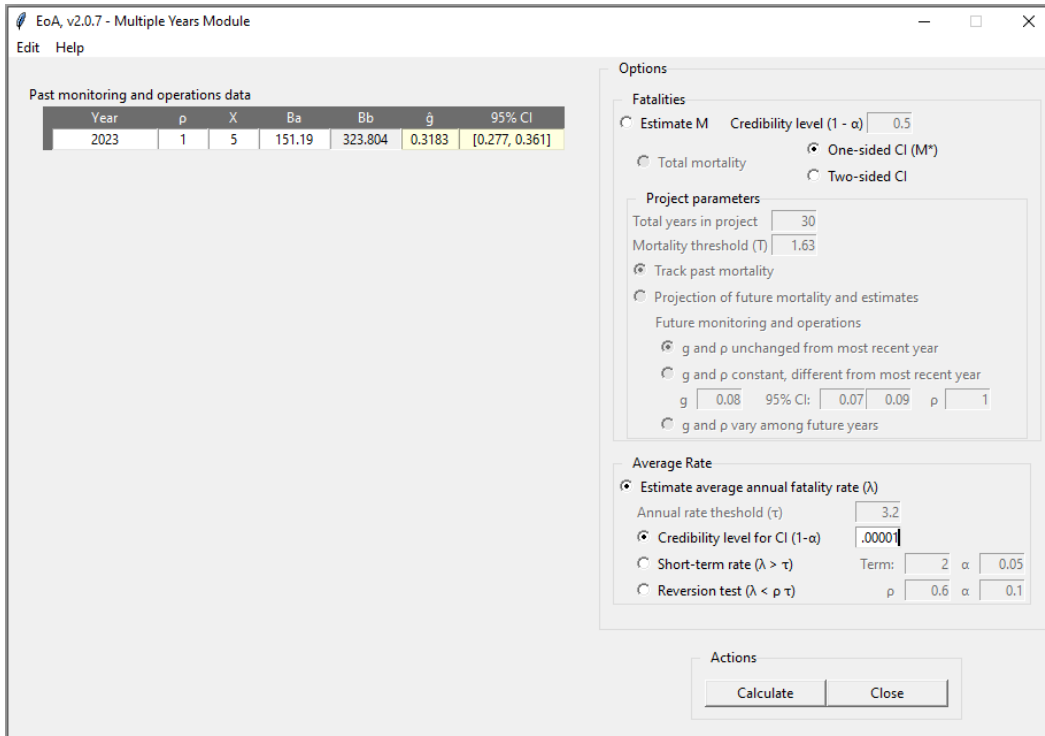
Appendix E13. Screen shot of Evidence of Absence (v2.0.7) graphical user interface (GUI), Multiple Years Module inputs for estimation of tricolored bat rolling average detection probability and annual take rate. Inputs are based on values reported in the main text.

Note: To obtain the median λ from the EoA GUI, a confidence interval (CI) credibility level of 0.00001 was used. The median annual take rate can be obtained from the upper and lower bounds on the 50% CI for the mean annual take rate.

EoA, v2.0.7 - Multiple Years Module

Edit   Help

Past monitoring and operations data

Year	ρ	X	Ba	Bb	ĝ	95% CI
2023	1	0	151.19	323.804	0.3183	[0.277, 0.361]

Options

Fatalities
- ○ Estimate M   Credibility level (1 - α) 0.5
  - ○ Total mortality
    - ● One-sided CI (M*)
    - ○ Two-sided CI

Project parameters
- Total years in project 30
- Mortality threshold (T) 1.63
- ● Track past mortality
- ○ Projection of future mortality and estimates
  - Future monitoring and operations
    - ● g and ρ unchanged from most recent year
    - ○ g and ρ constant, different from most recent year
      - g 0.08   95% CI: 0.07   0.09   ρ 1
    - ○ g and ρ vary among future years

Average Rate
- ● Estimate average annual fatality rate (λ)
  - Annual rate theshold (τ) 3.2
  - ● Credibility level for CI (1-α) .00001
  - ○ Short-term rate (λ > τ)   Term: 2   α 0.05
  - ○ Reversion test (λ < ρ τ)   ρ 0.6   α 0.1

Actions
[Calculate]   [Close]

R Estimation of Mortality Rate (stochastic)

```
Estimation of mortality rate (stochastic) over 1 years
Years: 2023 - 2023
================================================================================
Results
Total number of carcasses recovered: 0
Estimated overall detection probability, g = 0.318, 95% CI = [0.277, 0.361]
   Ba = 151.19, Bb = 323.8

Estimated annual fatality rate:
 lambda = 1.58 with 0.001% CI = [0.717, 0.717]

Input
Threshold for short-term rate (tau) =  3.2  per year

Year (or period) rel_wt  X    Ba      Bb    ghat     95% CI
2023             1.000   0  151.2  323.8  0.318 [0.277, 0.361]
```
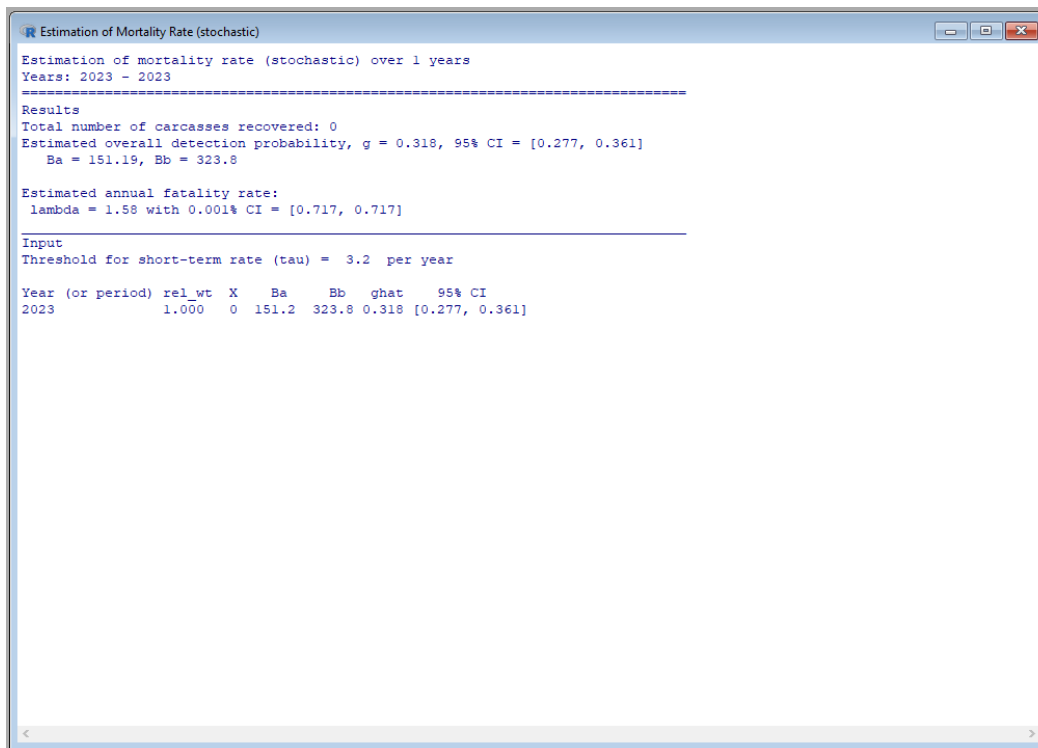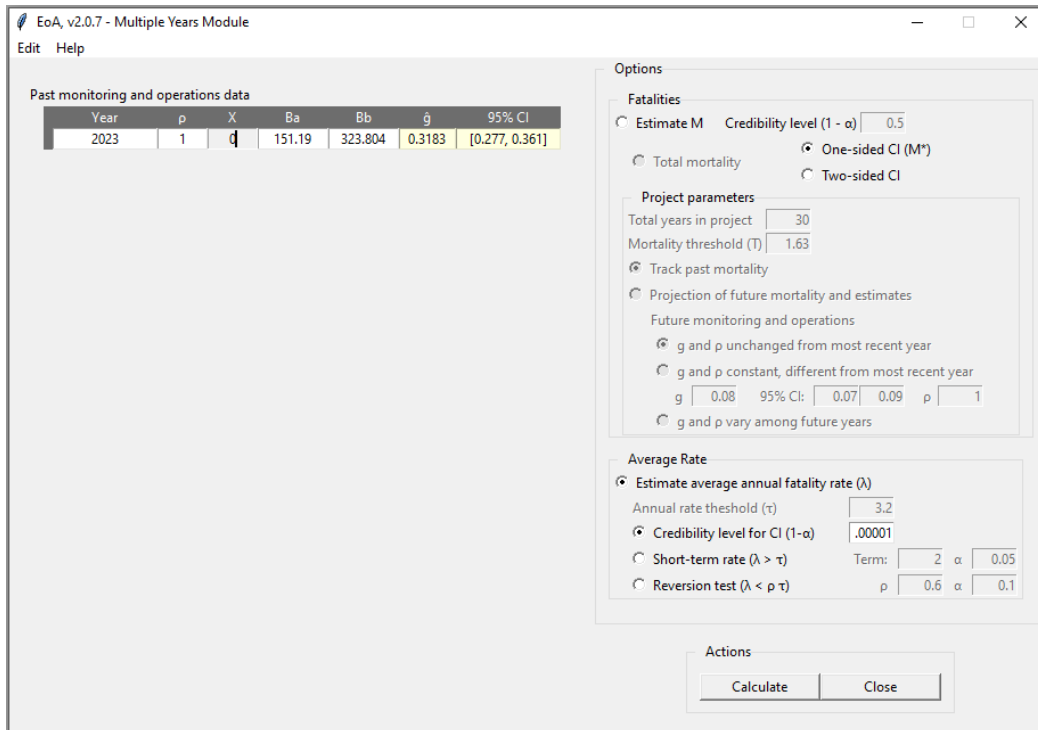
Appendix E14. Screen shot of Evidence of Absence (v2.0.7) graphical user interface (GUI), Multiple Years Module inputs for estimation of little brown bat rolling average detection probability and annual take rate. Inputs are based on values reported in the main text.

Note: To obtain the median λ from the EoA GUI, a confidence interval (CI) credibility level of 0.00001 was used. The median annual take rate can be obtained from the upper and lower bounds on the 50% CI for the mean annual take rate.