

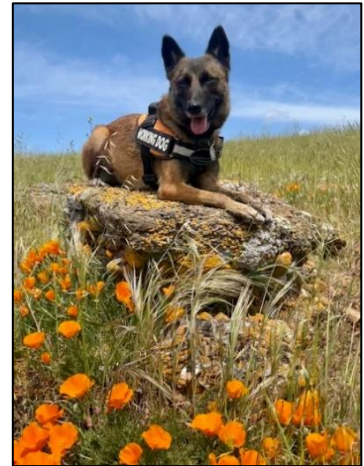
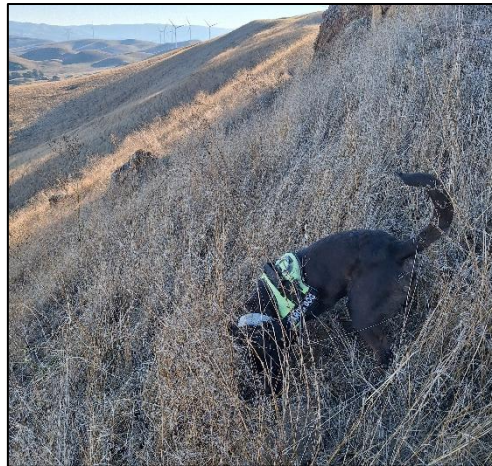


H. T. HARVEY & ASSOCIATES

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Vasco Winds Post-Construction Fatality Monitoring Project 2022–2024: Final Report



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Executive Summary

From November 21, 2022, through November 27, 2024, Great Basin Bird Observatory and H. T. Harvey & Associates conducted 2 years of post-construction fatality monitoring for birds and bats at the Vasco Winds facility in the Altamont Pass Wind Resource Area (APWRA). Vasco Winds is a repowered 78.2-MW facility comprising 34 2.3-MW Siemens turbines, located in Contra Costa County, California, north of I-580 and the City of Livermore in an area of mixed agricultural use (primarily cattle grazing).

Three years of comprehensive post-construction bat and bird fatality monitoring took place at the site from 2012–2015. An additional 2 years of monitoring were required to begin 10 years after the facility’s commercial operation date (i.e., in Years 10 and 11). This report summarizes the Year 10 and Year 11 supplemental monitoring, which commenced with partial clearance surveys in late November 2022 and involved standardized surveys from December through November each monitoring year.

We used stratified random sampling to select 17 of 34 turbines for 7-day-interval surveys using scent-detection dogs and 17 turbines for 28-day interval surveys by human searchers in Year 10. The turbines subjected to 7-day-dog and 28-day-human searches were switched in Year 11. All surveys covered 115-meter-radius circular plots around each turbine. Fatalities encountered during surveys were documented and collected.

We conducted field trials to estimate integrated carcass detectability (CD) (i.e., single estimates integrating the influences of searcher efficiency and carcass removal) for selected groups and species of bats and birds. Throughout the study, we periodically placed freshly dead bird and bat carcasses, which had been frozen and thawed prior to use, to serve as trial carcasses. In Year 10, the placements involved 46 bats of at least five species (placed *Myotis* spp. identified only as one of two possible species pairs) and 134 birds of 20 species. In Year 11, the placements involved 45 bats of at least three species and 126 birds of 36 species. All trial carcasses were collected if discovered by a survey team, but no separate persistence monitoring occurred. We used *GenEst* Version 1.4.9 to estimate CD and *GenEst* and *EoA3* Version 1.0.0.2 (hereafter *EoA*) to produce CD-adjusted annual fatality estimates for all bats combined; all birds combined; all small, medium, and large birds independently; all raptors combined; all nonraptors combined; four species of focal raptors (burrowing owl, American kestrel, golden eagle, red-tailed hawk), and Swainson’s hawk (see Appendix A for scientific names of all bat and bird species relevant to this study).

In Year 10, the search teams discovered 187 fatalities on the survey plots that qualified for inclusion in fatality estimates, including 5 species of bats and 21 confirmed species of birds. In Year 11, the search teams discovered 166 qualified fatalities, including at least 4 species of bats and 20 species of birds. Although based on different field and analytical protocols, the fatality rates from the current study (see table below) generally fell within the ranges of annual estimates derived from the original 3-year Vasco study for birds but not for bats. Higher bat fatality rates likely reflected a combination of improved detection with scent-detection dogs and interannual variation related to climatic factors.

Adjusted Annual Fatality Estimates for Focal Species and Species Groups During 2-Year Study

Species	Contributing Fatalities	Adjusted Total Fatalities		Fatalities Per Turbine		Fatalities Per MW	
		Median	95% CI	Median	95% CI	Median	95% CI
Year 10 ¹							
Small Birds ^{2,3}	48	156	117–213	4.58	3.45–6.27	1.99	1.50–2.72
Medium Birds ³	12	16	12–24	0.48	0.35–0.71	0.21	0.15–0.31
American Kestrel ³	4	6	4–13	0.19	0.12–0.37	0.08	0.05–0.16
Burrowing Owl ⁴	3	4	3–11	0.11	0.09–0.32	0.05	0.04–0.14
Large Birds ³	7	9	7–12	0.26	0.21–0.35	0.11	0.09–0.15
Golden Eagle ³	4	5	4–8	0.15	0.12–0.22	0.07	0.05–0.10
Red-tailed Hawk ⁴	1	1	1–2	0.03	0.03–0.06	0.01	0.01–0.03
Swainson’s Hawk	0	–	–	–	–	–	–
All Raptors ³	13	18	13–26	0.52	0.38–0.75	0.22	0.17–0.33
All Nonraptors ^{3,5}	54	164	–	4.80	–	2.09	–
All Birds ^{3,5}	67	181	–	5.32	–	2.31	–
All Bats ^{2,3}	118	532	400–743	15.64	11.76–21.86	6.80	5.11–9.51
Year 11							
Small Birds ^{2,3}	41	129	94–179	3.79	2.77–5.26	1.65	1.21–2.29
Medium Birds ³	5	8	5–16	0.25	0.15–0.47	0.11	0.06–0.20
American Kestrel ³	4	6	4–10	0.17	0.12–0.30	0.07	0.05–0.13
Burrowing Owl	0	–	–	–	–	–	–
Large Birds ³	22	29	23–38	0.85	0.67–1.13	0.37	0.29–0.49
Golden Eagle ⁴	2	2	2–3	0.06	0.06–0.09	0.03	0.03–0.04
Red-tailed Hawk ³	13	18	13–25	0.52	0.39–0.72	0.22	0.17–0.31
Swainson’s Hawk ⁴	1	1	1–2	0.03	0.03–0.06	0.01	0.01–0.03
All Raptors ³	24	32	26–42	0.95	0.75–1.24	0.41	0.33–0.54
All Nonraptors ^{3,5}	43	134	–	3.94	–	1.72	–
All Birds ^{3,5}	68	165	–	4.89	–	2.13	–
All Bats ^{2,3}	95	431	311–644	12.67	9.14–18.93	5.51	3.98–8.23

¹ Estimates for Year 10 were produced from an integrated 2-year analysis and vary from the single-year results presented in the initial Year 10 (single-year) report.

² Estimates derived from only 7-day surveys with detection dogs conducted at 17 of 34 turbines and extrapolated to represent the entire facility.

³ Fatality estimates calculated using *GenEst*.

⁴ Fatality estimates calculated using Evidence of Absence 3 version 1.0.0.2 (Dalthorp 2024).

⁵ Specifying confidence intervals for all birds combined and all nonraptors combined is impractical due to independent analyses for small birds and medium/large birds.

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Section 1.0 Introduction

The Vasco Winds facility, located in Contra Costa County, California within the Altamont Pass Wind Resource Area (APWRA), has been operational since 2012. The current 78.2 megawatt (MW) 34-turbine array occupies space that formerly supported numerous smaller, less-efficient, older-generation wind turbines that were operated for many years (Brown et al. 2016). Repowering of this facility represented the first phase by NextEra Energy Resources (NEER) to repower their overall wind-energy operations in the APWRA. This effort was initially governed by a multi-party settlement agreement in 2007 involving several wind companies operating throughout the APWRA, which was followed by a revised settlement agreement in 2010 (Alameda County Community Development Agency 2014: Appendices F2 and F3, respectively). A project-specific Environmental Impact Report (EIR) was then developed for the Vasco Winds project based on the 2010 Settlement Agreement (Contra Costa County Department of Conservation Development 2011). The goal of the overall APWRA repowering program is to achieve greater and more efficient energy production, while reducing turbine-related fatalities of especially four *focal raptor species* (golden eagles, red-tailed hawks, American kestrels, and burrowing owls; see Appendix A for scientific names of all bats and birds referred to in this report).

As described in the Vasco EIR, Mitigation Measure 4.4-1b iii first stipulated that an initial 3 years of comprehensive post-construction bat and bird fatality monitoring occur beginning shortly after the facility commenced commercial operation in 2012. This is a typical requirement for new wind projects in California, and the monitoring was completed in 2015 (Brown et al. 2016). The mitigation measure then also called for 2 years of further monitoring to commence on the 10th anniversary of the facility's commercial operation date. This report summarizes the results of those 2 years of subsequent monitoring effort, which commenced in late November 2022. The Contra Costa County Altamont Pass Technical Advisory Committee (TAC) approved the implemented monitoring plan.

Section 2.0 Study Area

The Vasco Winds facility is a 78.2 MW project comprising 34 2.3-MW Siemens turbines located in an area of mixed agricultural use (cattle grazing primarily). The facility is owned and operated by Vasco Winds, LLC, a wholly owned subsidiary of NextEra Energy Resources, LLC. It is located along Vasco Road, north of Interstate 580 and north of the City of Livermore (Figure 1), in the northern sector of the APWRA. Fifteen turbines in the western sector of the facility are located within Los Vaqueros Watershed, which is managed by the Contra Costa Water Management District.

The Vasco turbines have a hub height of 80 meters (m) and a rotor diameter of 101 m, which translates to a rotor-swept zone extending from 29.5–130.5 m above ground level. The landscape throughout the facility is rolling hills with occasional steep slopes and rocky outcrops, covered with mostly grazed annual grassland, plus scattered small groves of coastal live oak (*Quercus agrifolia*) and eucalyptus (*Eucalyptus sp.*) trees, limited riparian vegetation along small stream courses, and a few small seasonal livestock ponds. The turbines are situated on hilltops and ridgelines, with the vertical relief between hill/ridge tops and intervening valleys typically ranging from approximately 20–60 m, but occasionally up to as much as 150–160 m. The turbines are scattered among hilltops and along ridgelines in variable configurations, with spacing between adjacent turbines ranging from approximately 300–840 m.

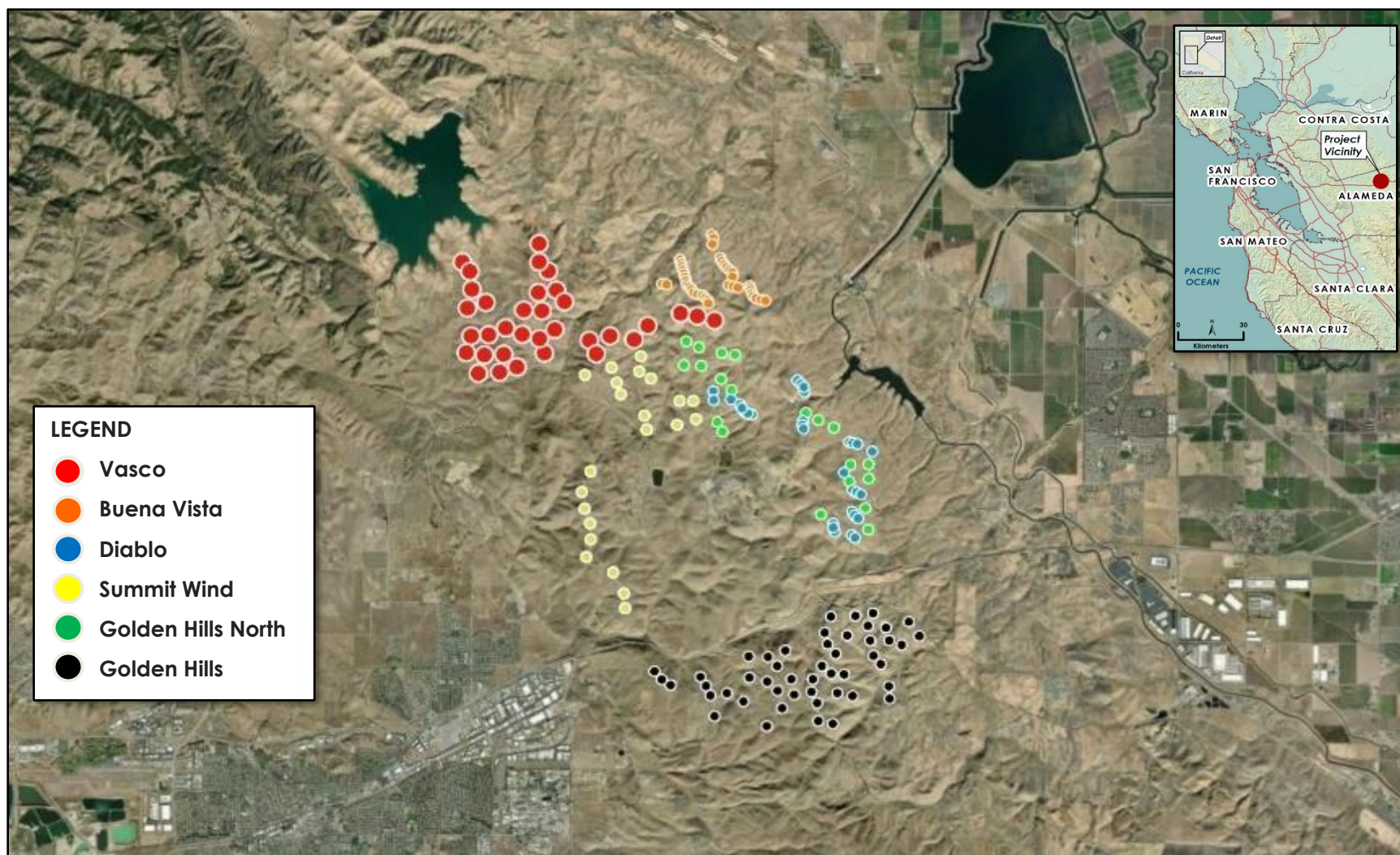


Figure 1. Study area map depicting turbine arrays at Vasco Winds (red circles) and neighboring facilities.

Section 3.0 Methods

Table 1 summarizes the primary features of the fatality monitoring conducted during this study.

Table 1. Key elements of approved study design for Vasco Winds Year 10 and 11 post-construction monitoring study.

Study Component	Description
Number of Turbines	34
Size of Project	78.2 MW composed of 2.3-MW Siemens turbines
Length of Study	2 years: December 2022 – November 2024
Search Area	115-m radius
Fatality Surveys	Randomly selected 50% of turbines with detection-dog searches at 7-day intervals, and 50% of turbines with human searches at 28-day intervals comprising 11 10-m wide circular transects. 7-day dog and 28-day human coverage switched between years.
Carcass Detectability Trials	Integrated carcass detectability trials for medium and large birds on all plots, and for bats and small birds only on 7-day plots.
Reports Due	Annually, 90 days after annual monitoring period ends

3.1 Fatality Surveys

3.1.1 Sampling Design and Survey Scheduling/Effort

We conducted year-round fatality surveys at all 34 turbines, using detection dogs to search 17 turbines at 7-day intervals and humans to search 17 turbines at 28-day intervals. The turbines subject to 7-day dog and 28-day human surveys were switched between monitoring years. Five dogs had worked on previous fatality-monitoring projects conducted by Great Basin Bird Observatory (GBBO) and H. T. Harvey & Associates in the APWRA, and the remaining dogs were trained using the same methods (GBBO and H. T. Harvey & Associates 2022, 2025a, 2025b; H. T. Harvey & Associates 2022, 2024a). We used generalized random tessellation stratified (GRTS) sampling (Stevens and Olsen 2004), with minor modifications to facilitate survey efficiency, to select a spatially balanced set of 17 turbines to be surveyed with detection dogs in Year 10, with the remainder searched by humans (Figure 2). We then reversed this selection for the Year 11 annual survey period.

Turbine-specific surveys were scheduled on the same day each week (7-day surveys) or on the same day every 4 weeks (28-days surveys) to maintain required search intervals. In both monitoring years, the 17 7-day turbines typically were searched over 4–5 days each week, whereas 4–5 of the 28-day turbines typically were searched over 2–3 days each week with 4 weeks required to complete a full survey round across all 17 28-day turbines. Variations sometimes occurred due to circumstances beyond our control; in such cases, we rescheduled the surveys to minimize deviation from the expected search interval. Surveys with detection dogs typically involved a single handler working with 2–3 dogs to cover 3–4 plots/day. Surveys by human searchers typically involved

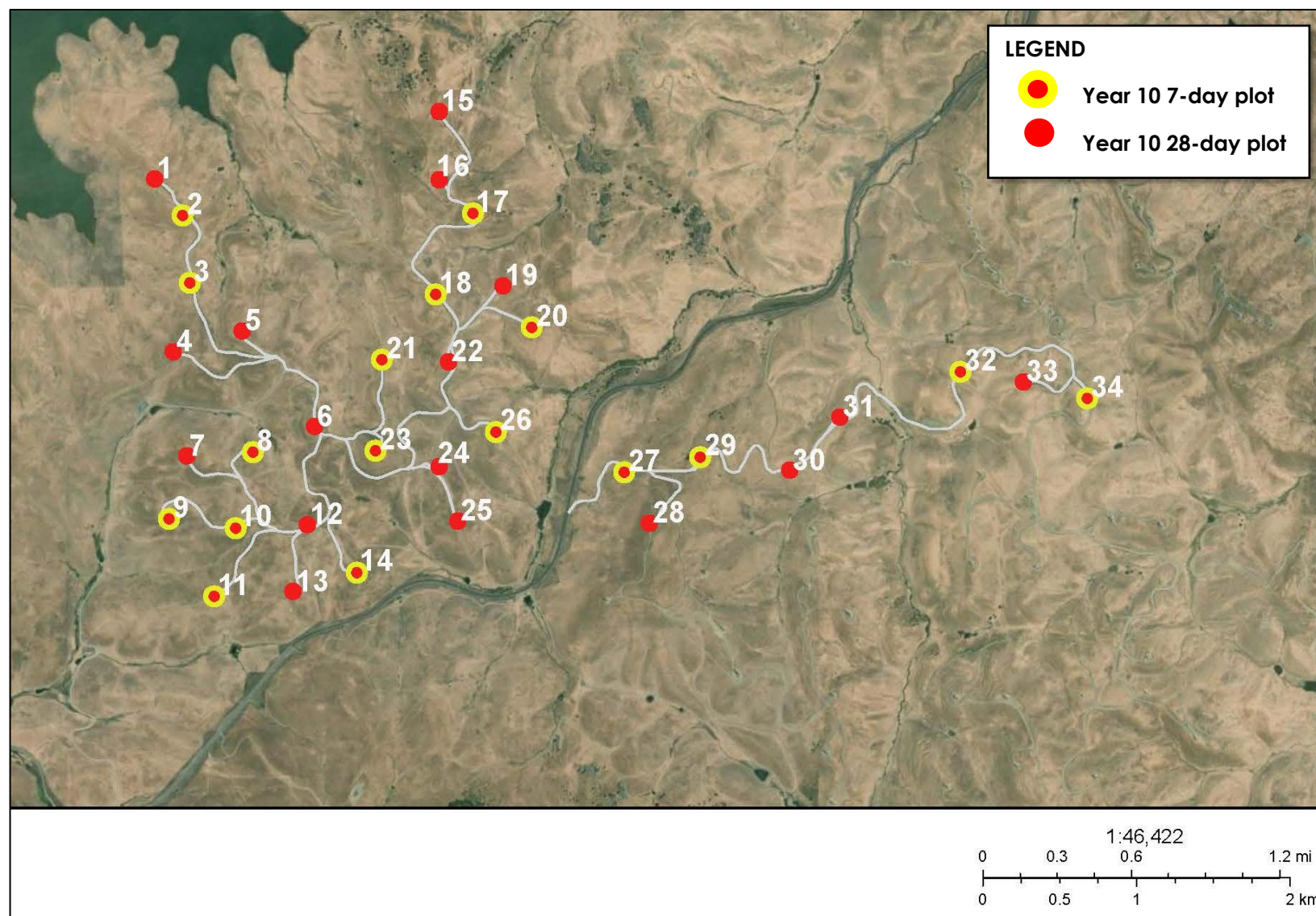


Figure 2. Layout of fatality survey plots during Vasco Winds study, with yellow/red turbines subject to 7-day-interval surveys with detection dogs in Year 10 and 28-day-interval surveys with human searchers in Year 11, and vice versa for red-only turbines.

one person covering 1–3 plots/day. The daily starting plot was randomized to minimize the potential for time-of-day biases in the fatality data.

Appendix B provides a summary of surveys and survey date ranges by year and turbine. In both Year 10 and Year 11, scheduled 7-day surveys (52 per turbine per year, 884 total) were missed at all sampled turbines (1–6 missed surveys per turbine in Year 10, 64 total; 1–7 missed surveys per turbine in Year 11, 43 total). Of 13 scheduled 28-day surveys per sampled turbine per year (221 total per year), single surveys were missed at five turbines in Year 10 and none were missed in Year 11. The primary causes of missed or shifted surveys included turbine maintenance, rancher activity, unhealthy air quality, weather-related and other safety issues, and biologist/canine illness.

3.1.2 Clearance Surveys

The TAC-approved study plan for this monitoring effort stipulated that clearance surveys be conducted on every plot before any standardized surveys commenced. This objective was not fully achieved due to 10 turbine-specific plots being inaccessible for clearance surveys during the available timeframe. The clearance surveys yielded only one fresh red-tailed hawk fatality, whereas several more obviously *aged out* (i.e., deposited more than one search interval before monitoring began—7 or 28 days depending on turbine) bird and bat fatalities were subsequently discovered during standardized surveys of several plots. Six aged-out fatalities were discovered during the first standardized surveys of individual plots, and the decomposed remains of an additional 10 fatalities were exposed by record-setting heavy rains during the first 4 months and were also considered aged out and excluded from fatality estimates. For estimation purposes, we excluded from fatality estimates any decomposed carcasses where our carcass aging indicated the fatality occurred more than one search interval before the first standardized survey of a given plot occurred (GBBO and H. T. Harvey & Associates 2022, 2025a, 2025b; H. T. Harvey & Associates 2022, 2024a, 2024b). The 16 aged-out carcasses excluded from fatality analyses involved 4 Mexican free-tailed bats, 1 unknown bat (genetic analysis could not resolve species), 1 red-tailed hawk, 1 unknown buteo, 1 unknown gull, 6 unknown large birds (no golden eagles based on measurements and morphology; Santa Cruz Predatory Bird Research Group 2005, Hurmence and Harness 2012), 1 unknown medium bird, and 1 unknown small bird (Appendix C).

3.1.3 Survey Protocols and Data Recording

All human surveyors (10 individuals), dog handlers (9), and detection dogs (13) involved in this study had prior experience conducting bird and bat fatality surveys or were well-trained before commencing work on this project. Detection-dog surveys were performed using and adjusting to wind patterns. The dogs worked off-leash and the handlers used body movements, hand signals, verbal cues, and whistles to control the dogs' movements to optimize coverage of the designated survey plots (H. T. Harvey & Associates 2024a). The human surveys covered plots following 11 circular transects beginning 5 m from the base of the turbine and spaced 10 m apart thereafter, with the outermost transect located 110 m from the turbine base providing coverage out to 115 m.

The detection-dog teams focused on detecting fatalities of all birds and bats, whereas the unaided human surveyors focused on medium or larger birds (size classes are defined below) (GBBO and H. T. Harvey &

Associates 2022, H. T. Harvey & Associates 2024a, 2024b). When a surveyor or detection-dog team located a fatality, they recorded specimen data and digital photographs using ArcGIS Field Maps (ESRI, Inc., Redlands, California) and customized data entry forms, running on GPS-enabled Samsung Galaxy Note tablets or the Field Maps phone app. The app was configured for offline use and included cached basemap imagery, turbine locations, survey plots, and roads as map layers. The data recorded for every fatality incident are described in Appendix D. Data recorded each time a plot was searched included wind and weather conditions, classification of groundcover on the plot as a whole, and notes about relevant search-area access issues and constraints (e.g., livestock, facility/turbine maintenance activities, inaccessible areas). Carcass collection and processing followed protocols used during similar monitoring efforts at the Golden Hills and Golden Hills North facilities (GBBO and H. T. Harvey & Associates 2022, 2025a, 2025b; H. T. Harvey & Associates 2022, 2024a, 2024b). After collection, fatalities were transferred to the Vasco Winds, LLC Operations & Maintenance freezer in Livermore to await disposal (nonnative species), sampling prior to use in carcass detectability trials, or transfer (native species) of samples or all remains to various state and federal agencies to support research purposes and genetic identification and sexing, where relevant.

Up to four tissue samples were taken from most collected bat fatalities. A sample was collected from all bats for the CDFW. A sample was collected for genetic sexing of all bats for which the sex could not be determined from visual inspection. For fresh carcasses suitable for use in subsequent carcass detectability trials, hair and tissue samples were collected for transfer to the U. S. Geological Survey (USGS) Renewables-Wildlife Solutions Initiative lab in Boise, Idaho. Otherwise, all other carcasses were labeled and delivered to the USGS after relevant tissues had been collected to support other tissue and genetics analyses. The only bat fatalities documented during this study that were not subject to tissue sampling or transfer to the USGS were three Mexican free-tailed bats discovered as fatalities during the first week of the study before federal permitting allowed for carcass collection, and one Mexican free-tailed bat found alive (Appendix C).

3.2 Carcass Detectability Trials

We conducted field trials to estimate carcass detectability (CD) using the Big *D* approach to estimate integrated CD (Brown et al. 2016; Smallwood et al. 2018; GBBO and H. T. Harvey & Associates 2022, 2025a, 2025b; H. T. Harvey & Associates 2022, 2024a, 2024b). The overall approach included the following elements:

- Trial carcasses were placed throughout the study period based on randomized, spatially balanced placement designs developed independently for bats, small birds, and medium/large birds, and irrespective of when surveys were scheduled.
- Trial carcasses were handled to minimize human odor and were discretely marked to facilitate identification upon discovery.
- Detections were recorded whenever they occurred, and carcasses were collected upon discovery (as with all actual fatalities).
- Carcasses were not monitored for persistence or to determine presence/absence before surveys.

- CD estimates integrated the influences of imperfect searcher efficiency, bleed-through (i.e., carcass not detected on first survey but detected on a subsequent survey; see Warren-Hicks et al. 2013), and removal of carcasses by scavengers and abiotic factors.
- For small birds (average species mass <100 grams [g]) and bats, the objective was to place at least 10 carcasses of each group on the 7-day plots per quarterly *Season* (*winter* December–February, *spring* March–May, *summer* June–August, and *fall* September–November) to enable effective estimation of detection rates for these groups on a quarterly basis (10 samples per covariate class is considered the minimum for generating reliable detectability estimates; Huso et al. 2012).
- To the degree carcass availability allowed, we made an effort to place a mix of small (mass <6 grams [g]), medium (6–11 g), and large (>11 g) bats during the CD trials, but without striving to necessarily ensure sufficient sample sizes for producing size-specific CD estimates.
- For medium (average species mass 100–499 g) and large birds (>500 g), the objective was to place an equitable mix of at least 10 carcasses total on the 7-day plots and 10 carcasses total on the 28-day plots per quarterly *Season* to enable effective independent estimation of quarterly detection rates for medium/large birds on both the 7-day and 28-day plots.
- Placements were not specifically allocated to ensure minimum acceptable sample sizes for estimating differences related to *Substrate Visibility* classes, defined as bare ground and gravel roads/pads = *high* visibility, grazed short/grass/forb = *moderate* visibility, and tall fallow grass/forb = *low* visibility. Nevertheless, where practical, we considered *Substrate Visibility* as a second covariate of potential interest in formulating the CD estimation models.

We sought representative variation in the time between placement and first survey of detectability trial carcasses by placing small numbers of new carcasses most weeks of the study, irrespective of survey schedules, and by allowing detections to occur at any time after a trial carcass was placed. Placement locations were based on GRTS spatially balanced allocation plans for each taxon-size class.

3.3 Estimating CD and Adjusted Fatality Rates

We used *GenEst* 1.4.9 (Dalthorp et al. 2018a, 2018b; Simonis et al. 2018; Rabie et al. 2021) to produce independent estimates of CD for all bats combined, all small birds, all medium birds, and all large birds. For bats and small birds, with sampling limited to 7-day surveys with detection dogs, we considered as potential covariates in the CD models monitoring *Year*, *Season* (quarterly but also three two-season alternatives considered independently: *Season2A* = fall/winter and spring/summer, *Season2B* = winter/spring and summer/fall, and *Season2C* = migration [spring and fall] and non-migration [winter and summer]), and *Substrate Visibility* (as defined in Section 3.2). For medium and large birds, we considered *Survey Type* (7-day dog or 28-day human) as a fourth potential covariate in those CD models. In developing the CD models, we considered only covariate combinations for which we had at least 10 cases represented for each possible covariate-class combination (Huso et al., 2012).

We used *GenEst* to derive CD-adjusted fatality estimates for focal species and species groups for which we documented four or more fatalities, and Evidence of Absence 3 version 1.0.0.2 (*EoA*) (Dalthorp 2024) to

generate fatality estimates for species with three or fewer fatalities. The cut-off of three fatalities was based on recommendations by M. Huso and D. Dalthorp (GenEst Workshop, November 27, 2018) and was stipulated in TAC guidance for this monitoring effort. Both *GenEst* and *EoA* were designed to support independent estimation of searcher efficiency (SE) and carcass persistence (CP), and model the effects of bleed-through and carcass aging on SE and CP. A *GenEst* developer previously provided a customized workaround to enable CD estimation based on the binomial Big *D* approach (H. T. Harvey & Associates 2024a), and we applied a similar manipulation in using *EoA* to effectively nullify the CP module (i.e., set parameters to render the estimate of *r*, the probability of persistence, as close to 1 as possible throughout the study period) and used only the SE module to adjust for integrated CD (based on further input/advice from *EoA* developer D. Dalthorp, personal communication 2024).

To achieve consistency with all prior analyses/reports prepared to produce fatality estimates at the Golden Hills and Golden Hills North facilities (GBBO and H. T. Harvey & Associates 2022, 2025a, 2025b; H. T. Harvey & Associates 2022, 2024a, 2024b), as well as with all other previous studies conducted in the APWRA prior to 2023, we used distance weighted proportion (*DWP*) factors of 0.95 for large birds, 0.98 for medium size birds, and 1.0 for small birds and bats (Hull and Muir 2010). Empirically quantifying the project-specific *DWP* (Dalthorp et al. 2023) was beyond the analytical scope of this study.

We report adjusted fatality estimates as median estimates $\pm$ 95% confidence intervals (CIs), including estimated total fatalities extrapolated by *GenEst* to represent the entire 34-turbine facility, plus fatalities per turbine and per MW of installed capacity. To specifically illustrate comparative fatality rates among sampled turbines for the purpose of identifying potential fatality hotspots, we generated estimated turbine-specific fatality totals for bats and small birds based on not having *GenEst* extrapolate the estimates to represent the entire facility.

Section 4.0 Results

4.1 Carcass Detectability

4.1.1 Bats

A designated biologist placed 46 bat trial carcasses on 17 7-day study plots in Year 10 and 45 bat trial carcasses on the other 17 study plots subjected to 7-day surveys in Year 11 (Figure 3). The Year 10 placements included 23 Mexican free-tailed bats, 3 hoary bats, 3 big brown bats, and 17 *Myotis* spp., and the Year 11 placements included 28 Mexican free-tailed bats and 17 *Myotis* spp. (Appendix E). In Year 10, 24% of the trial carcasses were placed on high visibility substrates, 43% on moderate visibility substrates, and 33% on low visibility substrates. In Year 11, 11% of the trial carcasses were placed on high visibility substrates, 40% on moderate visibility substrates, and 49% on low visibility substrates.

The detection-dog teams found 19 (41%) of 46 bat trial carcasses placed on the 7-day plots in Year 10 and 23 (51%) of 45 bat trial carcasses placed on 7-day plots in Year 11, all still on the original placement plots (Appendix E). In Year 10, 11 of 19 (58%) discovered trial carcasses were found within 1 week following placement (i.e., during the first survey after placement): six still intact, five scavenged. Three (16%) other trial carcasses were found within 2 weeks of placement (2 intact, 1 scavenged), three others (16%) were found within 1 month of placement (all intact), and two (11%) were found 40 and 55 days after placement (both intact). In Year 11, 9 of 23 (39%) discovered trial carcasses were found within 1 week of placement (7 intact, 2 scavenged), 7 (30%) within 2 weeks of placement (5 intact, 2 scavenged), 4 (17%) within 1 month of placement (2 intact, 2 scavenged), and three (13%) were found 32–255 days after placement (all scavenged).

GenEst modeling revealed the null model as the CD model with the lowest AICc score; however, the $\Delta AICc$ values were <2.00 for models with either *Year*, *Substrate Visibility*, *Season 2A*, or *Season 2B* as the sole predictor, indicating slightly poorer but competitive models (Appendix F). Accordingly, given guidance from the *GenEst* developers recommending that a season variable be included in all models developed using the nonstandard Big *D* approach to evaluating CD, whenever including such a variable resulted in a $\Delta AICc$ value that was ≤ 2 points compared to the model with the lowest AICc score, we selected the *Season 2A* model to produce CD-adjusted fatality estimates for bats. The *Season 2A* covariate reflected marginally lower CD during spring/summer (43%) than during fall/winter (49%) across both years (Table 2). Though the model including *Season* was not competitive due to high variance within seasons, estimated CD was overall lowest in summer (39%), higher in fall and spring (48%), and highest in winter (50%). With a slightly lower AICc score than the selected model, the model with only *Year* as a covariate indicated marginally lower CD in Year 10 (41%) than in Year 11 (51%), and the model with only *Substrate Visibility* as a covariate indicated the lowest CD on high-visibility substrates (31%), the highest CD on moderate-visibility substrates (55%), and moderate CD on low visibility substrates (43%). However, no models containing more than one covariate proved competitive based on AIC scores.

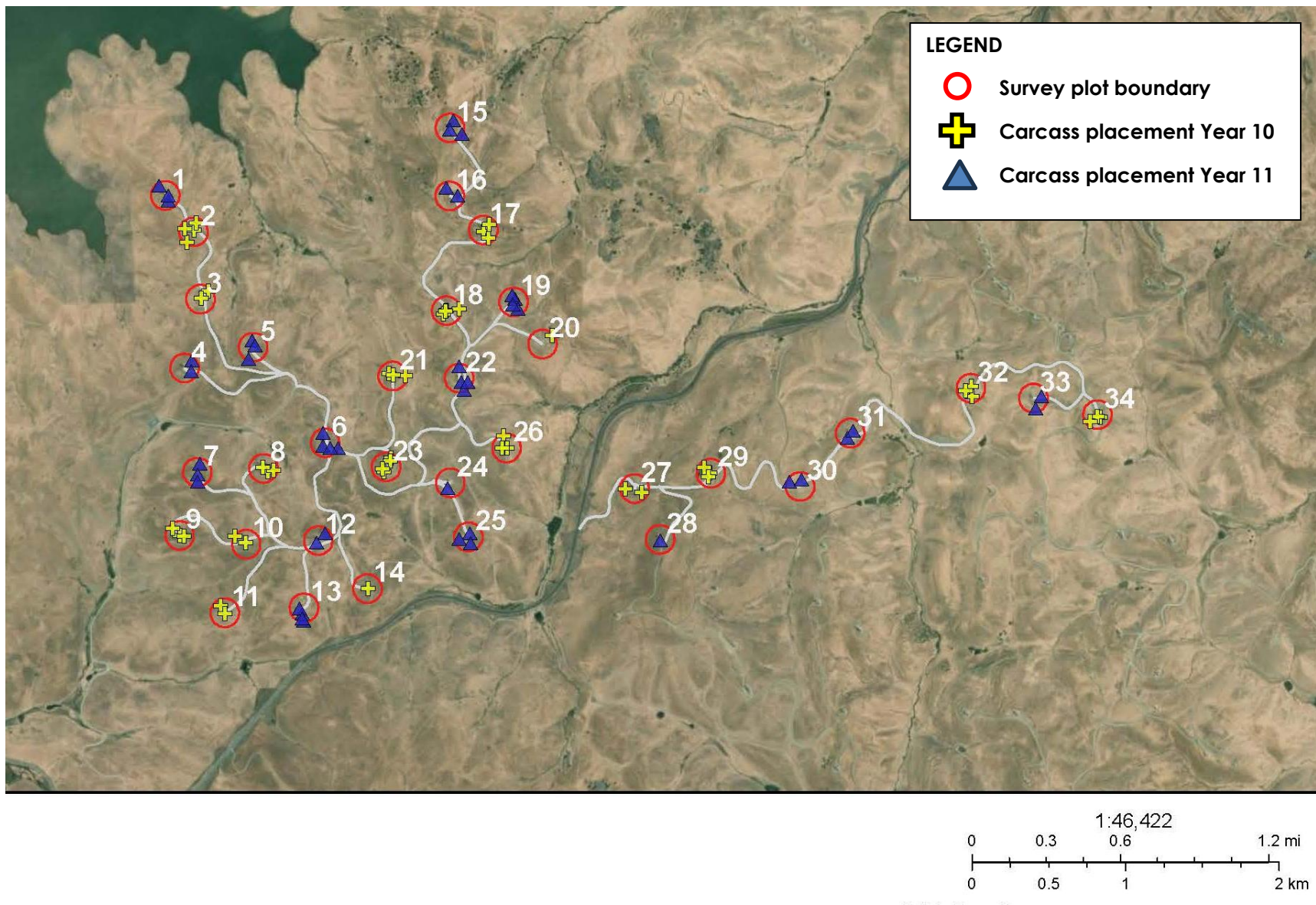


Figure 3. Annual placements of bat carcass detectability trial specimens on 7-day survey plots at Vasco Winds.

Table 2. GenEst Estimates of Carcass Detectability Used to Derive Adjusted Fatality Estimates for 2-Year Study

Taxon and Covariate Class	Carcasses Placed	Carcasses Found	% Found	Estimated CD	95% CI
Bats (7-day plots only)					
Fall/Winter ¹	47	23	49	0.489	0.351–0.629
Spring/Summer ¹	44	19	43	0.432	0.295–0.580
Small Birds (7-day plots only)					
Fall/Winter ¹	46	26	57	0.587	0.441–0.719
Spring/Summer ¹	42	27	64	0.643	0.489–0.772
Medium Birds					
7-day Plots – Migration ¹	23	18	78	0.760	0.574–0.881
28-day Plots – Migration	20	7	35	0.376	0.210–0.578
7-day Plots – Non-migration ¹	27	24	89	0.908	0.780–0.965
28-day Plots – Non-migration	16	11	69	0.655	0.435–0.823
Large Birds					
Winter/Spring	45	43	96	0.956	0.867–0.986
Summer/Fall	41	31	76	0.756	0.630–0.849

¹ Winter: December–February, Spring: March–May, Summer: June–August, Fall: September–November.

² Migration: fall and spring, Non-migration: summer and winter.

4.1.2 Small Birds

In Year 10, placements of 46 small birds on 7-day plots (Figure 4) included 18 individuals of 11 native species plus 28 individuals of two nonnative species (European starlings and house sparrows). Those placements included 15% on high visibility substrates, 61% on moderate visibility substrates, and 24% on low visibility substrates (Appendix E). The detection-dog teams found 27 (59%) of 46 small-bird trial carcasses. Of the carcasses found, 82% were detected within 1 week following placement (14 intact, 8 scavenged), 7% within 2 weeks (1 intact, 1 scavenged), and 11% between 25–55 days after placement (3 scavenged). One other small-bird trial carcass was found 105 days after placement in Year 11 on a survey plot, but not the one on which it was placed. Hence, we recorded this trial carcass as not found for estimation purposes.

In Year 11, placements of 42 small birds on 7-day plots (Figure 4) included 23 individuals of 16 native species and 19 individuals of two nonnative species (European starlings and house sparrows). Those placements included 17% on high visibility substrates, 36% on moderate visibility substrates, and 48% on low visibility substrates (Appendix E). The detection-dog teams found 27 (64%) of 42 small-bird trial carcasses. Of the carcasses found, 69% were detected within 1 week after placement (9 intact, 9 scavenged), 8% within 2 weeks (2 scavenged), and 23% within 1 month (3 intact, 3 scavenged).

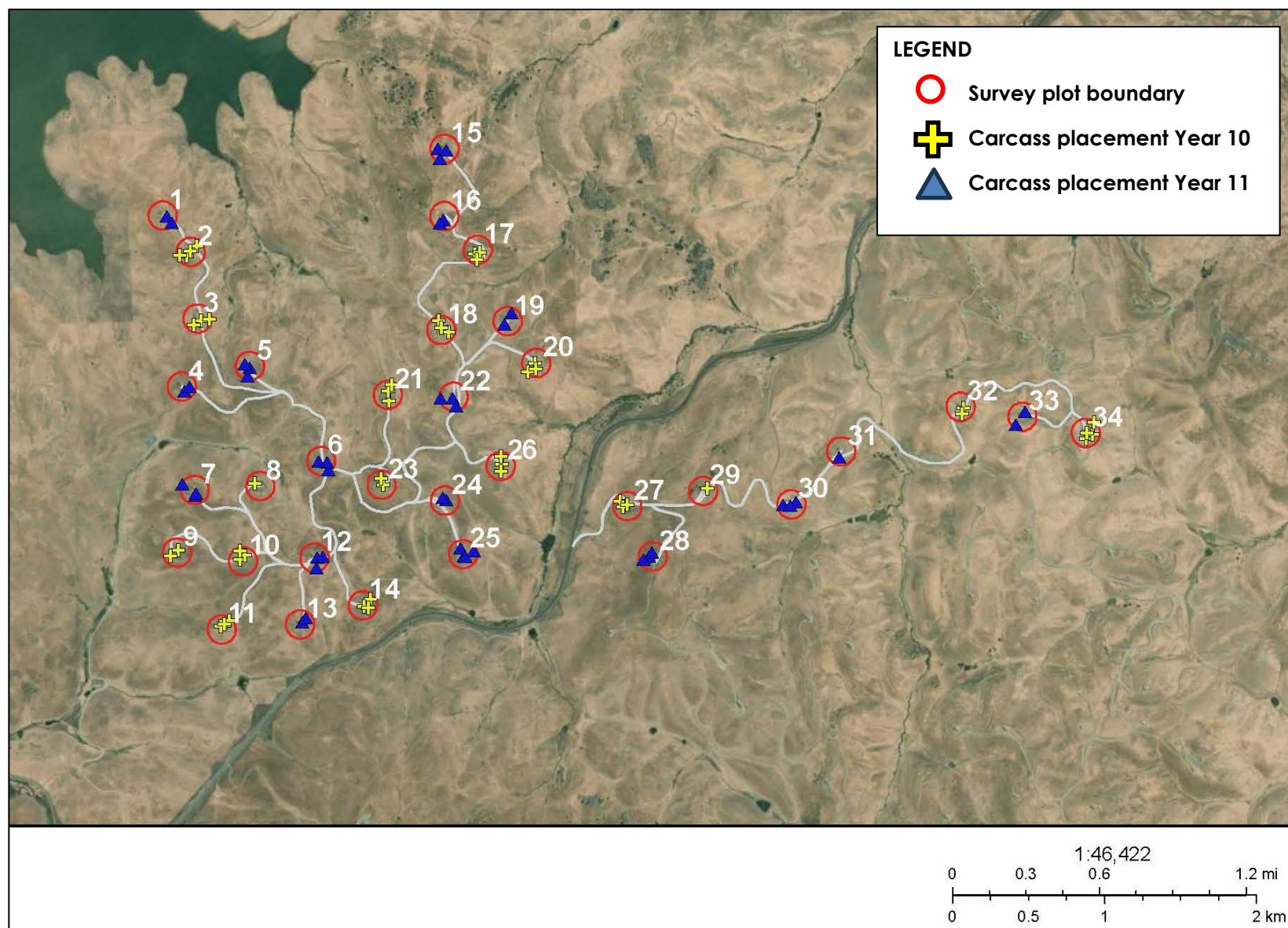


Figure 4. Annual placements of small-bird carcass detectability trial specimens at Vasco Winds

The *GenEst* null model again had the lowest AICc score, but ΔAICc was <2 points for models with either *Season 2A* or *Season 2C* as the sole predictor (Appendix F). With a slightly lower AICc score, we selected the model with *Season 2A* as the sole covariate to estimate CD for small birds, which reflected marginally lower CD during fall/winter (59%) than during spring/summer (64%) (Table 2). In comparison, a model with *Year* as the sole predictor was nearly competitive ($\Delta\text{AICc} = 2.09$), but reflected a nominal overall difference between monitoring years (61% in Year 10 vs. 62% in Year 11). With $\Delta\text{AICc} = 3.24$, a model with *Substrate Visibility* as the sole predictor was not competitive, but suggested a similar pattern as for bats: lowest (50%) on high visibility substrates, highest (65%) on moderate visibility substrates, and slightly lower (61%) on low visibility substrates.

4.1.3 Medium Birds

The trial placements included 48 medium birds in Year 10 and 38 medium birds in Year 11 (Figure 5). The Year 10 placements included 63% non-native rock pigeons and smaller numbers of three native species (including four American barn owls), distributed across both 7-day and 28-day plots. Of these, 15% were placed on high visibility substrates, 60% on moderate visibility substrates, and 25% on low visibility substrates. The Year 11 placements included 39% rock pigeons and smaller numbers of eight native species (including 1 American kestrel and 7 American barn owls). Of these, 13% were placed on high visibility substrates, 37% on moderate visibility substrates, and 50% on low visibility substrates.

In Year 10, the detection-dog teams found 20 (83%) of 24 trial carcasses on the original 7-day placement plots and the human surveyors found 10 (42%) of 24 medium birds on the original 28-day placement plots. Among the found 7-day trial carcasses, 85% were detected within 1 week after placement (13 intact, 4 scavenged) and 15% were detected more than 1 month after placement (3 scavenged). Among the found 28-day trial carcasses, 30% were detected within 1 week after placement (3 intact), 10% within 2 weeks (1 scavenged), 40% within 1 month (2 intact, 2 scavenged), and 20% more than 1 month after placement (2 scavenged). In addition, after the turbine-specific survey mode changed to a 7-day search interval in Year 11, a detection-dog team found one other medium-bird trial carcass placed in Year 10 on the original 28-day placement plot. We recorded this carcass as not found for Year 10 CD estimation purposes.

In Year 11, the detection-dog teams found 22 (85%) of 26 medium-bird trial carcasses and the human surveyors found 8 (67%) of 12 medium birds. Among the found 7-day trial carcasses, 64% were detected within 1 week after placement (9 intact, 5 scavenged), 14% within 2 weeks (2 intact, 1 scavenged), 18% within 1 month (4 scavenged), and 5% more than 1 month after placement (1 scavenged). Among the found 28-day trial carcasses, 38% were detected within 1 week after placement (1 intact, 2 scavenged), 25% within 2 weeks (1 intact, 1 scavenged), 25% within 1 month (2 scavenged), and 13% more than 1 month after placement (1 scavenged).

The *GenEst* CD model with the lowest AICc score, which we selected for fatality estimation, included the additive combination of *Survey Type* and *Season2C* and substantially improved upon the null model (Appendix F). Estimated CD was significantly higher on 7-day plots than on 28-day plots during both migration and non-migration seasons, and was notably higher during summer/winter non-migration seasons than during spring/fall migration seasons on both types of survey plots (Table 2). Six other models including other *Season*

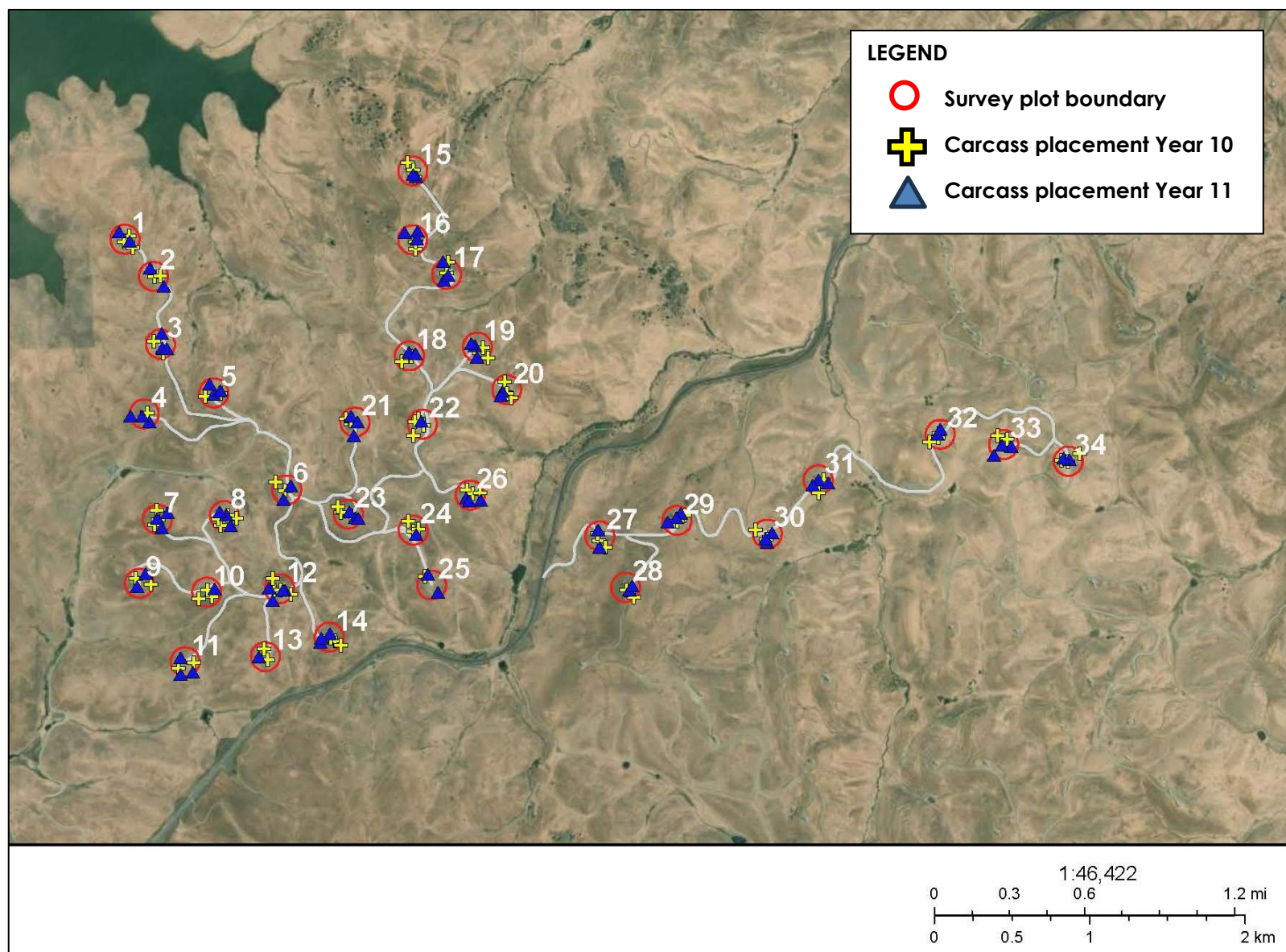


Figure 5. Annual placements of medium/large-bird carcass detectability trial specimens at Vasco Winds

variants and *Year* as covariates were also competitive with $\Delta AICc \leq 2.00$ (Appendix F). The *Year* effect reflected that CD was at least marginally lower in Year 10 across both *Survey Types* and various semi-annual *Season* variants.

4.1.4 Large Birds

Trial placements included 40 large birds in Year 10 and 46 large birds in Year 11 (Figure 5). The Year 10 placements included 83% red-tailed hawks plus a few individuals of two other native non-raptors distributed across both 7-day and 28-day plots. Of these, 10% were placed on high visibility substrates, 75% on moderate visibility substrates, and 15% on low visibility substrates. The Year 11 placements included 67% red-tailed hawks plus small numbers of two other native raptor species, five native non-raptor species, and wild turkey. Of these, 9% were placed on high visibility substrates, 48% on moderate visibility substrates, and 43% on low visibility substrates.

In Year 10, both the detection-dog teams and human surveyors found 18 (90%) of 20 large-bird trial carcasses on the original 7-day and 28-day placement plots, respectively. Among the found 7-day trial carcasses, 78% were detected within 1 week after placement (11 intact, 3 scavenged) and 22% were detected within 2 weeks after placement (2 intact, 2 scavenged). Among the found 28-day trial carcasses, 45% were detected within 1 week after placement (6 intact, 2 scavenged), 33% within 2 weeks (5 intact, 1 scavenged), and 22% within 1 month (3 intact, 1 scavenged).

In Year 11, the detection-dog teams found 14 (88%) of 16 trial carcasses and the human surveyors found 24 (80%) of 30 trial carcasses. Among the found 7-day trial carcasses, 86% were detected within 1 week after placement (9 intact, 3 scavenged), 7% within 2 weeks (1 intact), and 7% within 1 month (1 intact). Among the found 28-day trial carcasses, 45% were detected within 1 week after placement (6 intact, 2 scavenged), 33% within 2 weeks (3 intact, 5 scavenged), 17% within 1 month (2 intact, 2 scavenged), and 13% more than 1 month after placement (1 intact, 2 scavenged).

For large birds, the *GenEst* CD model with the lowest AICc score, which we selected for fatality estimation, included *Season2B* as the sole predictor and improved upon the null model with an AICc score more than 5 points lower (Appendix F). Estimated CD for large birds was higher during winter/spring (96%; comparable both seasons) than during summer/fall (76%; slightly higher in summer, lower in fall) (Table 2).

4.2 Composition of Fatalities

4.2.1 Bats

In Year 10, the detection-dog teams found 125 bat carcasses or carcass fragments on 7-day survey plots that were classified as representing individual bats, 118 of which formed the basis for adjusted fatality estimates (Table 3; Appendix C). Five carcasses were excluded because they were aged as having been deposited more than one search interval before monitoring began. Two carcasses were excluded as incidental finds outside of the survey plots. The 118 incidents used to derive adjusted fatality estimates included 75 Mexican free-tailed bats, 38 hoary bats, 2 special-status western red bats (a California species of special concern), 2 *Myotis* spp. (genetic ID could not resolve to species level; Appendix C), and 1 silver-haired bat.

Table 3. Documented Bat and Bird Fatalities by Survey Type, Size Class for Birds, and Qualification for Inclusion in Fatality Estimates

Monitoring Year	Survey Type	Taxon	Qualified ¹	Aged Out ²	Incidental Off-plot ³	28-day Bat/Small Bird ⁴	Total Fatalities
Year 10	7-day Dog	Bats	118	5	2	–	125
		Small Birds	48	1	3	–	52
		Medium Birds	10	0	1	–	11
		Large Birds	2	5	0	–	7
		All Birds	60	6	4	–	70
	28-day Human	Bats	0	0	0	0	0
		Small Birds	0	0	0	2	2
		Medium Birds	2	1	0	–	3
		Large Birds	5	4	1	–	10
		All Birds	7	5	1	2	15
	Combined	Total Bats	118	5	2	0	125
		Total Birds	67	11	5	2	85
Year 11	7-day Dog	Bats	95	–	17	–	112
		Small Birds	41	–	1	–	42
		Medium Birds	1	–	1	–	2
		Large Birds	14	–	2	–	16
		All Birds	56	–	4	–	60
	28-day Human	Bats	0	–	0	1	1
		Small Birds	0	–	0	3	3
		Medium Birds	4	–	1	–	5
		Large Birds	8	–	0	–	8
		All Birds	12	–	1	3	16
	Combined	Total Bats	95	–	17	1	113
		Total Birds	68	–	5	3	76

¹ Discovered on a delineated survey plot during a scheduled survey and included to generate fatality estimates.

² Found during the first surveys of plots and aged as having been deposited more than one search interval before monitoring began; excluded from fatality estimates.

³ Found outside of all delineated survey plots; excluded from fatality estimates.

⁴ Bats and small birds found by human searchers conducting 28-day-interval searches were excluded from fatality analyses, which for those taxa were generated only from data collected by detection-dog teams at 7-day search intervals.

In Year 11, the detection-dog teams found 112 bat carcasses or carcass fragments on 7-day survey plots that were classified as representing individual bats, 95 of which formed the basis for adjusted fatality estimates (Table 3; Appendix C). Seventeen carcasses were excluded as incidental finds outside of the survey plots. The human searchers also found 1 bat on a 28-day survey plot that we excluded from fatality estimates

(Appendix C). The 95 incidents used to derive adjusted fatality estimates included 69 Mexican free-tailed bats, 22 hoary bats, 1 western red bat, 1 Yuma myotis, 1 *Myotis* sp. (genetic analysis could not resolve species), and 1 unknown bat (genetic analysis could not resolve further).

4.2.2 Birds

In Year 10, the detection-dog teams found on the 7-day plots carcasses or carcass fragments representing 49 individual small birds, 10 medium birds, and 7 large birds that formed the basis for fatality estimates, and they incidentally found 3 other small birds (blue-gray gnatcatcher, horned lark, and Wilson's warbler) and 1 medium bird (mourning dove) outside of the 7-day plots that we excluded from fatality estimates (Table 3; Appendix C). The human surveyors found on the 28-day plots carcasses or carcass fragments representing 2 small birds, 3 medium birds, and 9 large birds, including the only golden eagle and red-tailed hawk fatalities documented during this monitoring year. We excluded all small birds found on or near 28-day plots from fatality estimates, and the human searchers also incidentally found one unidentified large bird outside of a 28-day plot that we excluded from fatality estimates. The Year 10 exclusions included the only blue-gray gnatcatcher confirmed during the 2-year study. Only one bird, a red-tailed hawk, was found during the clearance surveys (on a 28-day plot) conducted at 26 of the 34 turbine plots. We included this large bird in the fatality estimates because it was freshly killed within one search interval before the standardized surveys began.

In Year 11, the detection-dog teams found on the 7-day plots carcasses or carcass fragments representing 41 small birds, 1 medium bird, and 14 large birds that we included in fatality estimates, and they incidentally found 1 small unknown flycatcher (*Empidonax* sp.), 1 medium Eurasian collared-dove (only individual of this non-native species found during the study), and 2 large red-tailed hawks outside of the survey plots that we excluded from fatality estimates (Table 3; Appendix C). The human surveyors found on the 28-day plots carcasses or carcass fragments representing 3 small birds (excluded from fatality estimates), 4 medium birds, and 8 large birds, and they incidentally found one medium American kestrel outside of a survey plot that we excluded from fatality estimates.

Special-status species among the bird fatalities were six golden eagles (CA fully protected species [see California Department of Fish and Wildlife 2025] and protected under the federal Bald and Golden Eagle Protection Act; 4 in Year 10, 2 in Year 11), one Swainson's hawk (CA threatened species; in Year 11), three burrowing owls (candidate for listing under the California Endangered Species Act; all in Year 10), four Vaux's swifts (California Species of Special Concern [CSSC]; all in Year 10, plus 1 unknown swift in Year 10 and two in Year 11), one loggerhead shrike (CSSC; in Year 10), and one yellow warbler (CSSC; in Year 11). The medium and large birds included multiple fatalities of each of the four focal raptor species, plus one fatality of the state-threatened Swainson's hawk.

4.3 Fatality Estimates and Hotspots

4.3.1 Bats

The CD-adjusted median fatality estimates for all bats combined in Year 10, extrapolated to represent the entire facility, were 532 total individuals, 15.64 fatalities/turbine, and 6.80 fatalities/MW (Table 4). No qualified bat

Table 4. Adjusted Fatality Estimates for Focal Species and Groups by Monitoring Year at Vasco Winds

Species	Contributing Fatalities	Adjusted Total Fatalities		Fatalities Per Turbine		Fatalities Per MW	
		Median	95% CI	Median	95% CI	Median	95% CI
Year 10 ¹							
Small Birds ^{2,3}	48	156	117–213	4.58	3.45–6.27	1.99	1.50–2.72
Medium Birds ³	12	16	12–24	0.48	0.35–0.71	0.21	0.15–0.31
American Kestrel ³	4	6	4–13	0.19	0.12–0.37	0.08	0.05–0.16
Burrowing Owl ⁴	3	4	3–11	0.11	0.09–0.32	0.05	0.04–0.14
Large Birds ³	7	9	7–12	0.26	0.21–0.35	0.11	0.09–0.15
Golden Eagle ³	4	5	4–8	0.15	0.12–0.22	0.07	0.05–0.10
Red-tailed Hawk ⁴	1	1	1–2	0.03	0.03–0.06	0.01	0.01–0.03
Swainson's Hawk	0	–	–	–	–	–	–
All Raptors ³	13	18	13–26	0.52	0.38–0.75	0.22	0.17–0.33
All Nonraptors ^{3,5}	54	164	–	4.80	–	2.09	–
All Birds ^{3,5}	67	181	–	5.32	–	2.31	–
All Bats ^{2,3}	118	532	400–743	15.64	11.76–21.86	6.80	5.11–9.51
Year 11							
Small Birds ^{2,3}	41	129	94–179	3.79	2.77–5.26	1.65	1.21–2.29
Medium Birds ³	5	8	5–16	0.25	0.15–0.47	0.11	0.06–0.20
American Kestrel ³	4	6	4–10	0.17	0.12–0.30	0.07	0.05–0.13
Burrowing Owl	0	–	–	–	–	–	–
Large Birds ³	22	29	23–38	0.85	0.67–1.13	0.37	0.29–0.49
Golden Eagle ⁴	2	2	2–3	0.06	0.06–0.09	0.03	0.03–0.04
Red-tailed Hawk ³	13	18	13–25	0.52	0.39–0.72	0.22	0.17–0.31
Swainson's Hawk ⁴	1	1	1–2	0.03	0.03–0.06	0.01	0.01–0.03
All Raptors ³	24	32	26–42	0.95	0.75–1.24	0.41	0.33–0.54
All Nonraptors ^{3,5}	43	134	–	3.94	–	1.72	–
All Birds ^{3,5}	68	165	–	4.89	–	2.13	–
All Bats ^{2,3}	95	431	311–644	12.67	9.14–18.93	5.51	3.98–8.23

¹ Estimates for Year 10 were produced from an integrated 2-year analysis and vary from the single-year results presented in the Year 10 report.

² Estimates derived from only 7-day surveys with detection dogs conducted at 17 of 34 turbines and extrapolated to represent the entire facility.

³ Fatality estimates calculated using *GenEst*.

⁴ Fatality estimates calculated using Evidence of Absence 3 version 1.0.0.2 (Dalthorp 2024).

⁵ Specifying confidence intervals for all birds combined and all nonraptors combined is impractical due to independent analyses for small birds and medium/large birds.

fatalities were found during the winter quarter (December–February), only one Mexican free-tailed bat fatality and one hoary bat fatality were found during March, and only two hoary bats were found in April. As a result, the adjusted all-bat per-MW fatality estimates were low in March and April, rose slightly in May/June, dropped off again in July, increased markedly in August and peaked in September, and then dropped off again by November (Figure 6; we did not conduct post-hoc pairwise comparisons of these data, but nonoverlapping CIs indicate solidly significant differences).

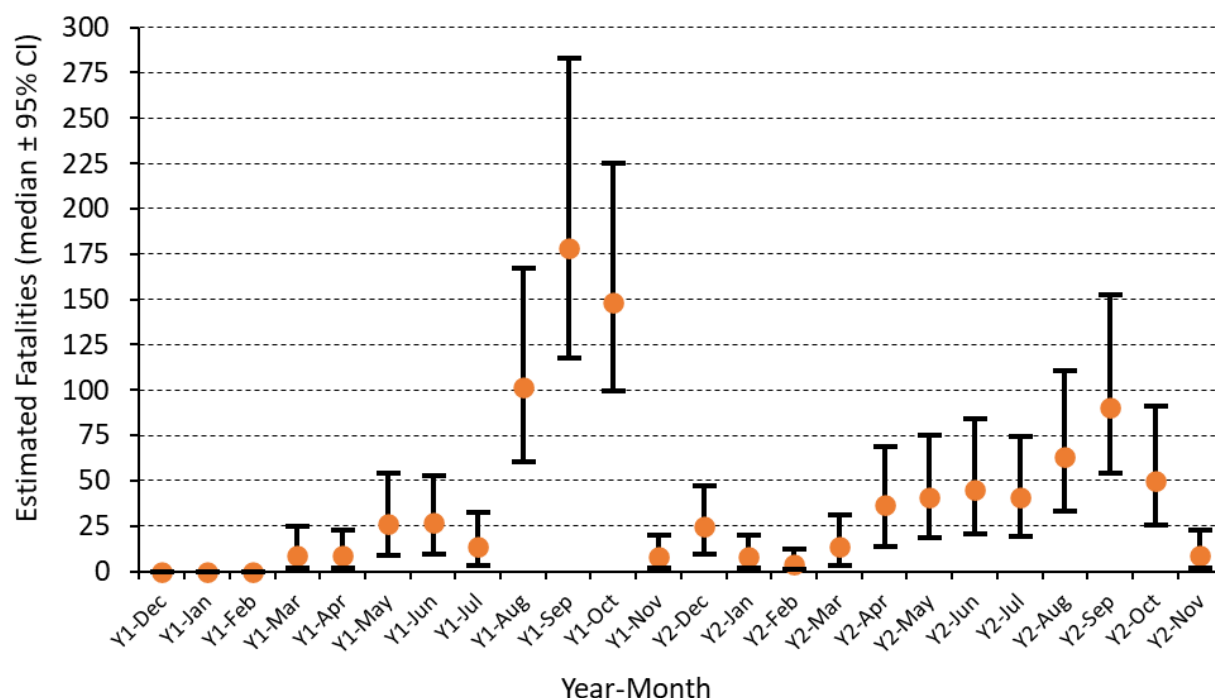


Figure 6. Estimated Fatality Totals for All Bats Combined by Monitoring Year and Month

Comparatively low all-bat fatality totals (i.e., <5 estimated fatalities per specific turbine) occurred at four turbines during Year 10 (WTGs 17, 18, 20, and 26) and at seven turbines in Year 11 (WTGs 1, 6, 7, 22, 30, 31, and 33) (Figure 7). Moderate totals (6.6–18.3 fatalities per specific turbine) occurred at eight turbines in Year 10 and at four turbines in Year 11. Significantly high (compared to lowest turbines and based on nonoverlapping CIs) totals (23.1–34.2 fatalities per specific turbine) occurred at five turbines in Year 10 (WTGs 2, 3, 11, 14, and 27) and at four turbines in Year 11 (WTGs 12, 13, 24, and 25) (Figure 7). With no repeat sampling of bat mortality at individual turbines during the 2-year study, hotspot evaluation was limited to comparing values among turbines from different years.

In this context, four potential fatality concentration areas were apparent (Figure 8). The first potential hotspot area encompassed WTGs 2–5 in the northwestern corner of the facility, where high estimated fatality totals occurred in Year 10 and moderate totals occurred in Year 11. The second potential hotspot area encompassed WTGs 11–14 in the southwestern sector, where high estimated totals occurred in both monitoring years. The third potential hotspot area encompassed WTGs 24–25 in the south-central sector, where high totals occurred

in Year 11. The fourth potential hotspot area encompassed WTGs 27–29 in the southeastern sector, where at least moderate totals occurred in both monitoring years.

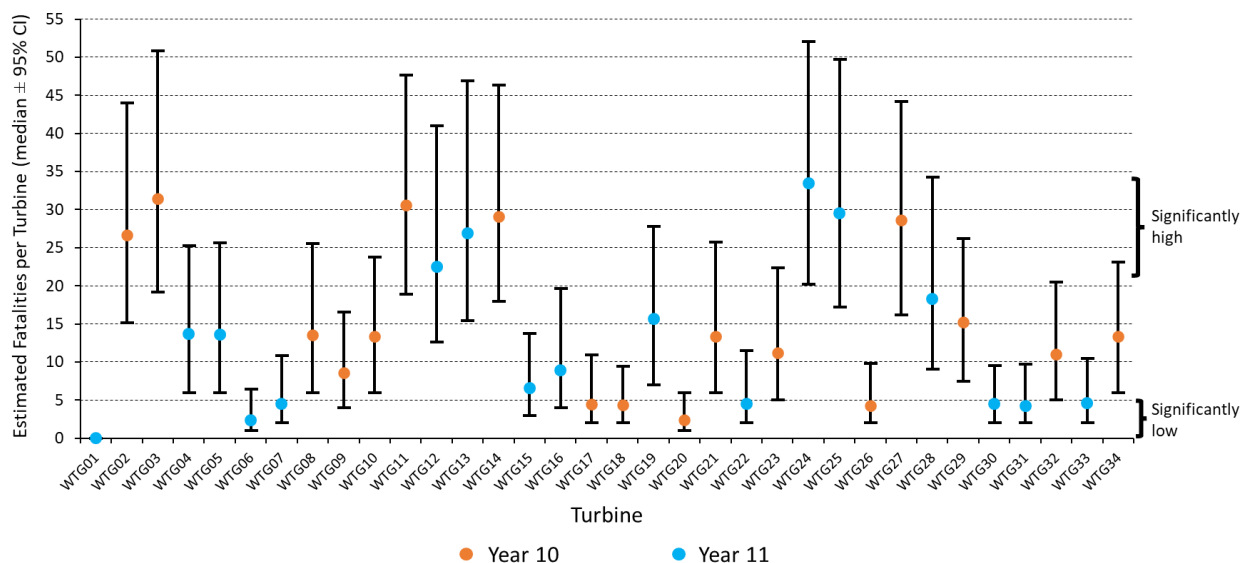


Figure 7. Adjusted All-Bat Year-Specific Fatality Estimates by Turbine (see Figure 2 for Turbine Locations)

4.3.2 Small Birds

In Year 10, the *GenEst* adjusted median fatality estimates for all small birds combined, extrapolated to represent the entire facility, were 156 individuals, 4.58 fatalities/turbine, and 1.99 fatalities/MW (Table 4). In Year 11, corresponding estimates were 129 individuals, 3.79 fatalities/turbine, and 1.65 fatalities/MW. Small bird fatalities generally increased from winter through fall in both years, except for dipping in summer during Year 10 (Figure 9).

Year- and turbine-specific small-bird fatality totals confirmed no fatalities at WTG25, comparatively low fatality totals (<2 estimated fatalities) at 10 other turbines, moderate totals at 20 turbines (2–9 estimated fatalities), and high totals at four turbines (WTGs 3, 24, and 29: >9 fatalities/turbine) (Figure 10). These comparative estimates illustrate a potential concentration zone running NW to SE through the facility (Figure 11), which is consistent with the predominant fall migratory path for songbirds through this region (opposite direction in spring; S. Terrill personal observation).

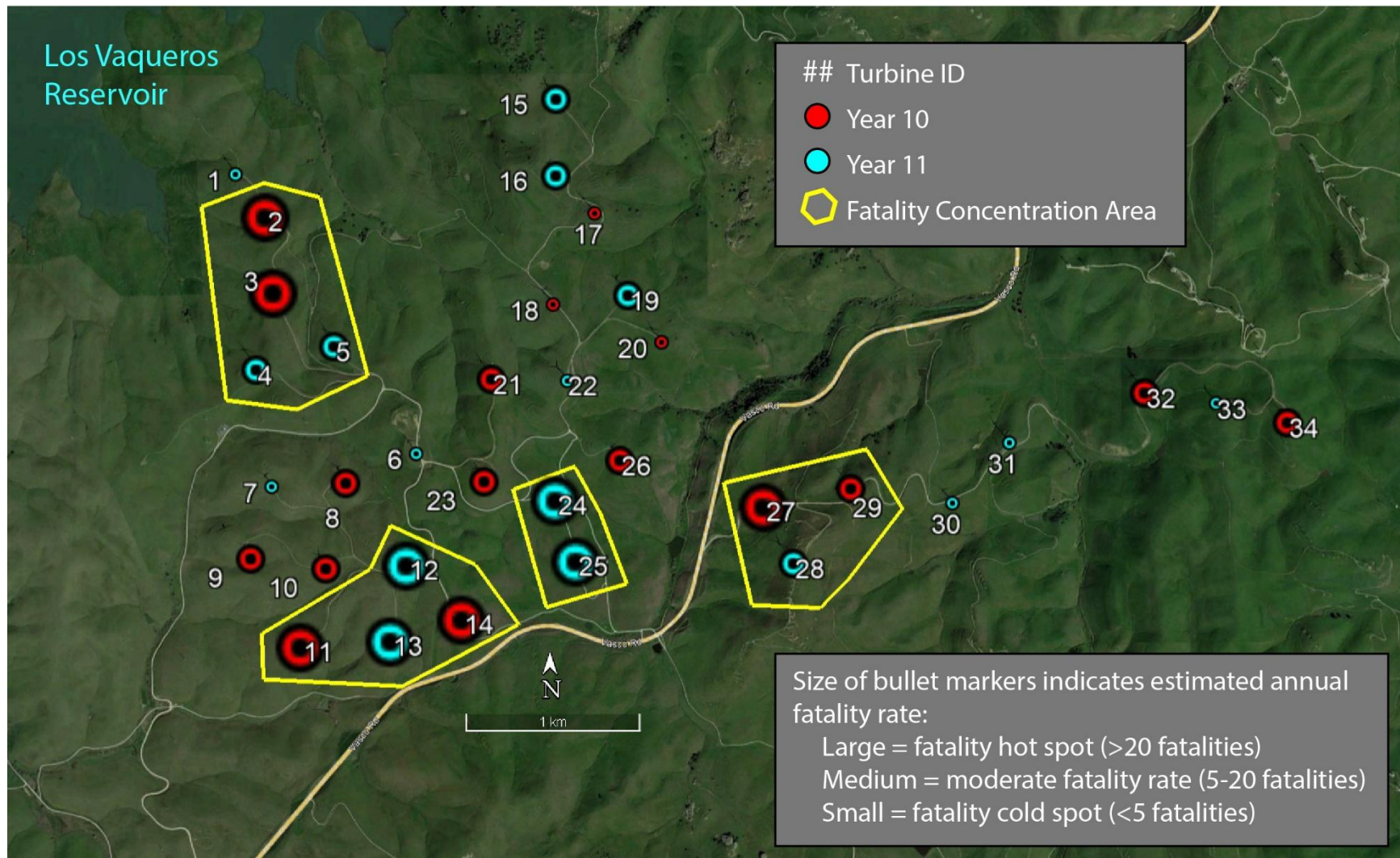


Figure 8. Potential Fatality Concentration Areas for Bats Based on Year-Specific 7-day Interval Fatality Estimates for Each Turbine

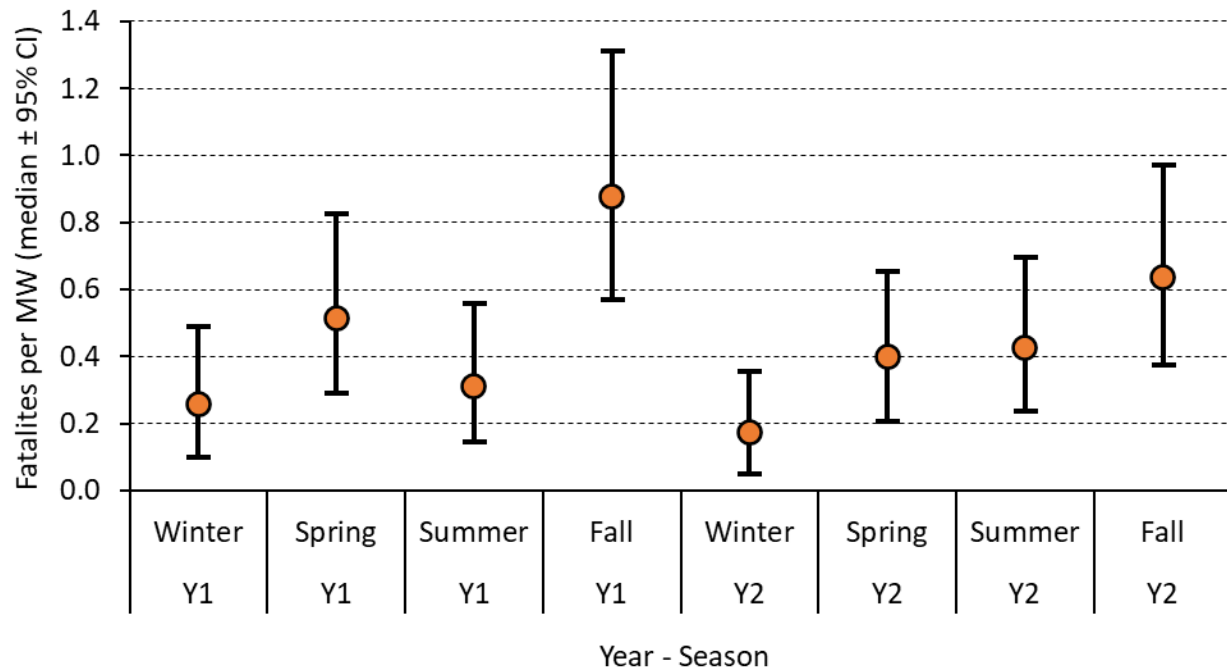


Figure 9. Adjusted Fatality Rates for All Small Birds Combined by Monitoring Year and Season

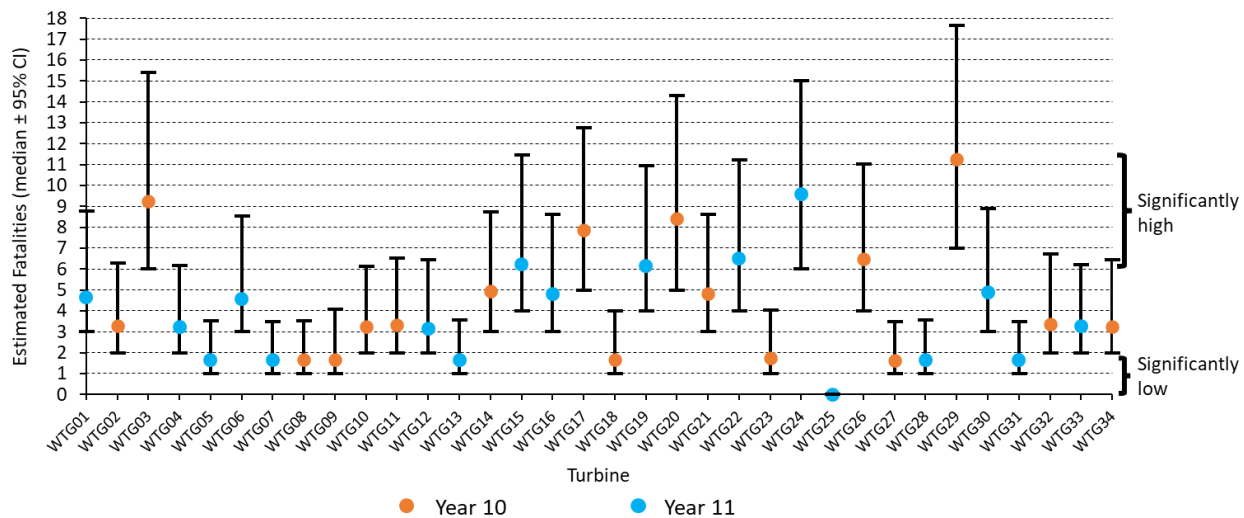


Figure 10. Adjusted Fatality Estimates for All Small Birds Combined by Turbine During Monitoring Years 10 and 11 (See Figure 2 for Turbine Locations)

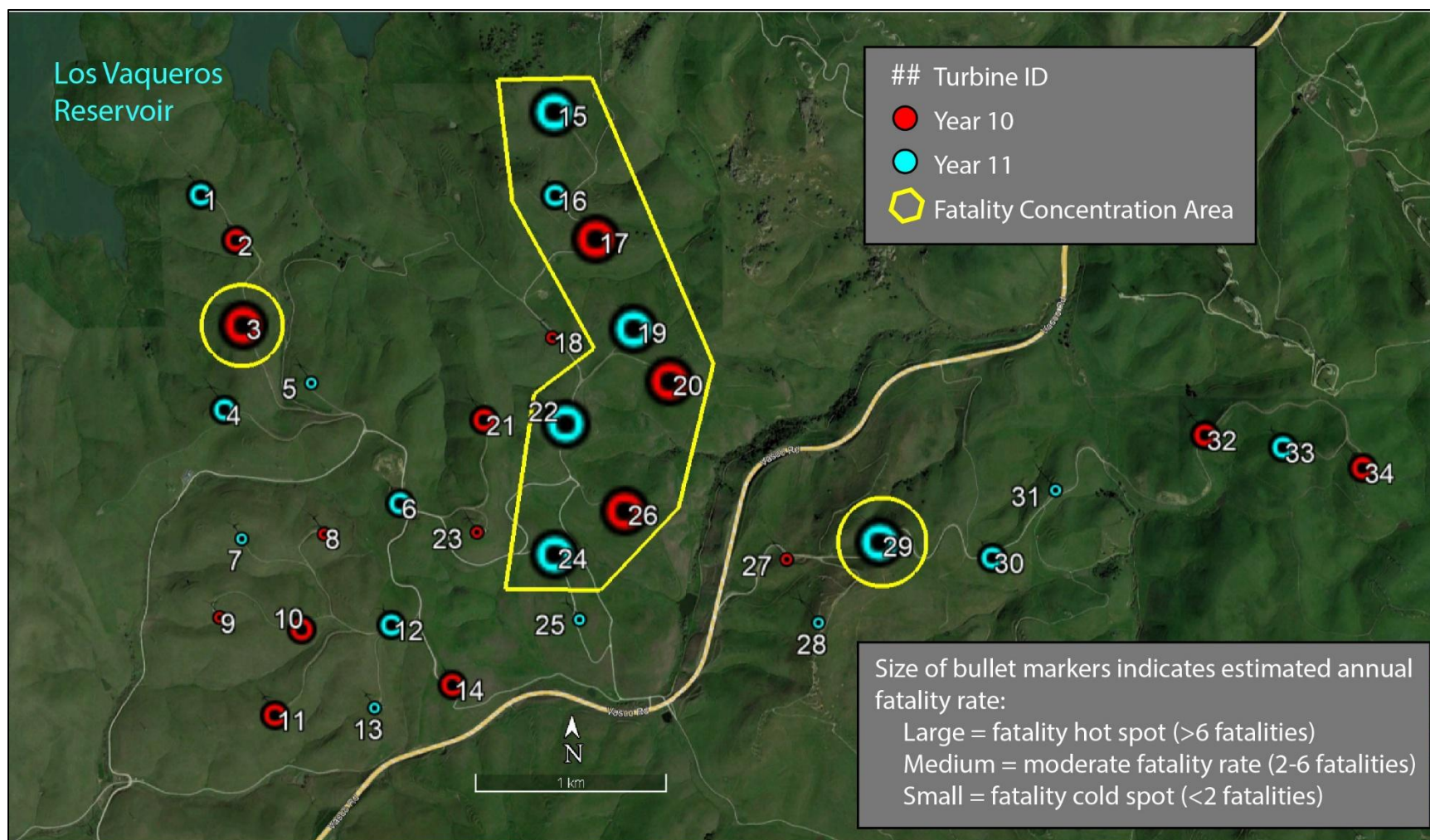


Figure 11. Fatality Concentration Areas for Small Birds Based on Year-Specific 7-day Interval Fatality Estimates for Each Turbine at Vasco Winds

4.3.3 Medium and Large Birds

Across both years of monitoring, four large bird species of interest had fewer than four fatalities detected in a given year, requiring *EoA* to produce adjusted fatality estimates. We used *EoA* to produce annual fatality estimates for golden eagles in Year 11 (2 fatalities), red-tailed hawks in Year 10 (1 fatality), Swainson's hawks in Year 11 (1 fatality), and burrowing owls in Year 10 (3 fatalities).

In Year 10, the *GenEst* adjusted median fatality estimates for all medium birds combined were 16 individuals for the entire facility, 0.48 fatalities/turbine, and 0.21 fatalities/MW (Table 4). In Year 11, the corresponding estimates were 8 individuals, 0.25 fatalities/turbine, and 0.11 fatalities/MW. In Year 10, the *GenEst* adjusted median fatality estimates for all large birds combined were 9 individuals for the facility, 0.26 fatalities/turbine, and 0.11 fatalities/MW (Table 4). In Year 11, the corresponding estimates were 29 individuals, 0.85 fatalities/turbine, and 0.37 fatalities/MW.

Unlike the small-bird group which included no raptors, both the medium- and large-bird groups included raptors and nonraptors. In Year 10, the *GenEst* adjusted median fatality estimates for all raptors combined were 18 individuals for the facility, 0.52 fatalities/turbine, and 0.22 fatalities/MW (Table 4). In Year 11, the corresponding estimates were 32 individuals, 0.95 fatalities/turbine, and 0.41 fatalities/MW. Medium/large nonraptor fatalities were generally less common and the seasonal distributions of medium/large raptor and nonraptor fatalities differed, including a notable jump in primarily red-tailed hawk fatalities during the fall of Year 11 (Figure 12).

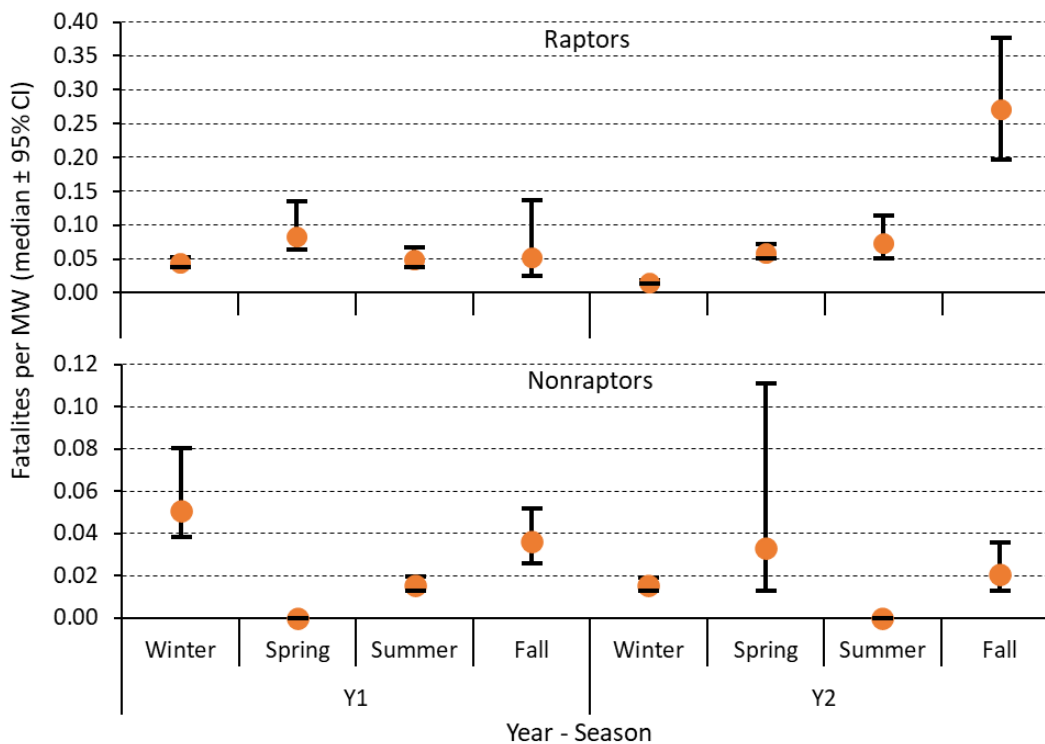


Figure 12. Adjusted Fatality Rates for Medium/Large Raptors and Nonraptors by Monitoring Year and Season

The Year 10 *GenEst* fatality estimates for golden eagles were 5 fatalities, 0.15 fatalities/turbine, and 0.07 fatalities/MW, and the Year 11 *EoA* estimates for golden eagles were more than 50% lower at 2 fatalities, 0.06 fatalities/turbine, and 0.03 fatalities/MW (Table 4). The golden eagle fatalities included 2 adults and 2 subadults in Year 10, and 1 subadult and 1 hatch-year juvenile in Year 11.

The Year 10 *EoA* fatality estimates for red-tailed hawks were 1 fatality, 0.03 fatalities/turbine, and 0.01 fatalities/MW, and the Year 11 *GenEst* estimates were higher at 18 fatalities (95% CI: 1–2), 0.52 fatalities/turbine, and 0.22 fatalities/MW. The qualified red-tailed hawk fatalities included 1 adult in Year 10 and 2 adults, 3 subadults with mixed adult/juvenile plumage, 6 hatch-year juveniles, and 2 scavenged unknown-age individuals in Year 11. The single hatch-year juvenile Swainson’s hawk fatality in Year 11 yielded *EoA* fatality estimates for that monitoring year of 1 fatality, 0.03 fatalities/turbine, and 0.01 fatalities/MW. The *GenEst* estimates for American kestrels were similar for both monitoring years: 6 fatalities, 0.19 fatalities/turbine, and 0.08 fatalities/MW Year 10, and 6 fatalities, 0.17 fatalities/turbine, and 0.07 fatalities/MW in Year 11. Lastly, with burrowing owl fatalities found only in Year 10, the annual *EoA* fatality estimates for that monitoring year were 4 fatalities, 0.11 fatalities/turbine, and 0.05 fatalities/MW.

For medium birds, at least one fatality was recorded at 16 of 34 turbines over the course of the 2-year study, one or two fatalities were recorded in both monitoring years at two turbines (WTGs 8 and 26), and two fatalities were recorded in a single year at two turbines (WTGs 8 and 32). These fatalities included single qualified burrowing owls at three turbines in Year 10 and single American kestrels at four turbines in Year 10 and at four turbines in Year 11 (Figure 13). The only turbine at which more than one fatality of these two focal species occurred was two American kestrels at WTG26, but one of these fatalities was found off-plot in Year 11 and was excluded from fatality estimates. The only possible zonal concentration for these two focal species was that single American kestrel fatalities occurred at WTGs 1–3 in the far northwest corner of the facility (Figure 13).

For large birds, 1–2 fatalities qualified for inclusion in fatality estimates were recorded per monitoring year at 23 of 34 turbines over the course of the 2-year study. Qualified fatalities were recorded in both monitoring years at three turbines (WTGs 28, 31, and 33) and twice in a single year at three turbines (WTGs 6, 9, and 33). Single golden eagle fatalities were recorded at six turbines, four in Year 10 and two in Year 11 (Figure 13). Among these turbines, WTG15 is located on the north-central edge of the facility <0.5 miles from a known golden eagle breeding territory within Los Vaqueros Watershed (occupied by a nonbreeding adult pair in 2024; H. T. Harvey & Associates 2025). Otherwise, all other golden eagle fatalities occurred along the south-central/southeastern margin of the facility (mostly along Dyer Road), including at WTG34, which is located less than 1 mile from a known golden eagle nesting area within the Golden Hills North facility (GBBO and H. T. Harvey & Associates 2022, 2025b). Qualified red-tailed hawk fatalities occurred at 12 of 34 turbines over the course of the 2-year study, all but one in Year 11 (Figure 13). Multiple red-tailed hawk fatalities occurred at WTG28 (two in Year 11) and WTG33 (1 in Year 10, 2 in Year 11), with the two fatalities at WTG33 in Year 11 found on the same day in late October (both hatch-year birds). Red-tailed hawk fatalities were well distributed across the facility, including along the south-central and southeastern margins where golden eagle fatalities also were found (Figure 13). The single Swainson’s hawk fatality occurred on the southwestern edge of the facility at WTG9. An American kestrel was the only other raptor fatality found at this turbine during the study, but it was near where several red-tailed hawk fatalities also occurred (WTGs 6–8 and 12; Figure 13).

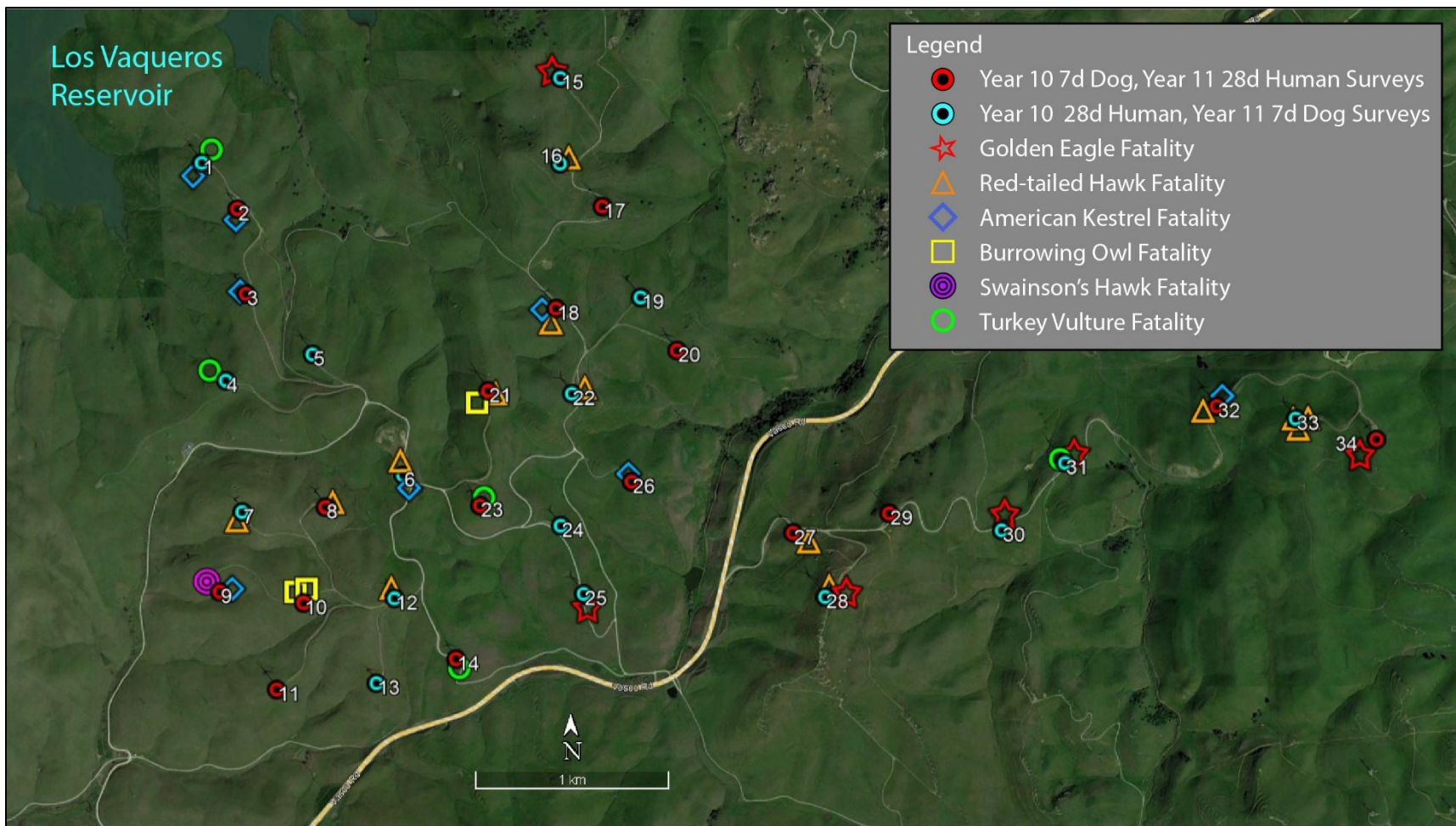


Figure 13. Distribution of Documented Raptor Fatalities During Two-Year Study at Vasco Winds

Section 5.0 Discussion

5.1 Carcass Detectability

5.1.1 Bats

During this study, CD for detection dogs searching for bats at 7-day intervals (35–54% depending on the year and quarterly season) was much higher than the 5% overall CD rate documented using humans searching at 7-day intervals during the original 3-year Vasco fatality monitoring study (Brown et al. 2016). This result is consistent with prior evidence that using detection dogs yields significantly greater detection rates for bats than searching with humans (Smallwood et al. 2020, H. T. Harvey & Associates 2024a). Compared to prior studies in the APWRA that used detection dogs searching at 7-day intervals, the CD rates for bats documented during the Year 10–11 Vasco study were generally lower compared to the ranges of annual values documented during the initial 3-year, year-round studies at the Golden Hills facility (53–75%; H. T. Harvey & Associates 2024a) and Golden Hills North facility (47–69%; GBBO and H. T. Harvey & Associates 2022). However, concurrent bat-focused, spring–fall monitoring at these sites in 2023 and 2024 yielded CD estimates that did not range quite as low but were generally similar to the current study: 42–57% at the Golden Hills depending on the season, and 49–55% at Golden Hills North depending on the season (GBBO and H. T. Harvey & Associates 2025a, 2025b).

Reasons for these modest site-specific and annual differences in dog-team CD rates for bats are uncertain, but may include the variable influences of (a) highly variable vegetation growth (including extensive areas with dense thistle) with attendant effects on searchability of plots, and (b) site-specific and annual differences in the scavenger communities, including the potential for more abundant/diverse scavenger populations near protected areas such as Los Vaqueros Reservoir and Vasco Caves Regional Preserve. We do not consider the individual dog teams to be a factor in the lower CD at Vasco compared to Golden Hills and Golden Hills North. Some of the handlers and dogs used during this Vasco project also worked during the original Golden Hills/Golden Hills North studies (GBBO and H. T. Harvey & Associates 2022, H. T. Harvey & Associates 2024a) and, although most of the dogs were relatively new to the work, all either worked or were trained for a minimum of 6 months prior to deployment on the Vasco project. Further, many of the same handlers and dogs worked at all three project sites concurrently during the course of the Year 10–11 Vasco study, and these dog teams found more bat fatalities on Golden Hills and Golden Hills North than in previous years (GBBO and H. T. Harvey & Associates 2025a, 2025b). Therefore, speculation that variability in the dog teams and handlers contributed to lower CD estimates is unwarranted.

5.1.2 Birds

For birds, the non-standard size-class definitions used in the initial 3-year Vasco monitoring report (Brown et al. 2016) do not closely correspond to the size-class definitions applied during this project. By their definition, half of our medium birds would be classified as small birds and half as large birds, and they also uniquely distinguished very large birds to represent a small number of placement samples of species such as vultures,

large geese, turkeys, and great blue herons. Therefore, direct comparisons of the size-class specific CD rates documented during the initial 3-year monitoring study and our study are not possible. Nevertheless, where smaller birds are concerned, comparing the overall CD rate for “small” birds from the previous study using humans searching at 7-day intervals (22%) against the rates documented in this study using detection dogs (59–64% depending on the season) again clearly points to the benefits of using detection dogs to search for bats and small birds. In contrast, the overall CD rates documented during the previous study for “large” and “very large” birds with humans searching at 28-day intervals (86%) was higher than the range of values documented during this study with similar effort for medium birds (38–65% depending on the season), but was within the range of values documented for large/very large birds (76–96% depending on the season; did not vary by survey interval). The ranges of CD rates for medium and large birds found by dog-teams and humans at Vasco using similar survey methods were comparable to those recorded at Golden Hills (H. T. Harvey & Associates 2024a, 2024b) and Golden Hills North (GBBO and H. T. Harvey & Associates 2022).

5.2 Composition of Fatalities

5.2.1 Bats

Compared to results from the prior 3-year Vasco study (Brown et al. 2016), a particularly noteworthy difference concerns the numbers of documented bat fatalities. Human searchers found 30 bat fatalities during the original 3-year study compared to an average of 110 bats per year in the current study with similar effort but using detection dogs. This difference further emphasizes the value of detection dogs for documenting robust fatality samples for small-bodied species such as bats and small birds (Smallwood et al. 2020; GBBO and H. T. Harvey & Associates 2022, 2025a, 2025b; H. T. Harvey & Associates 2024a). That said, although the numbers of analyzed bat fatalities differed markedly, the two studies documented mostly similar species composition. Mexican free-tailed bats and secondarily hoary bats predominated in both cases, with special-status western red bats also consistently represented in much smaller numbers (two fatalities each in 2 or 3 years). That said, two confirmed fatalities of silver-haired bats (one incidentally found off-plot) and a single confirmed fatality of a Yuma myotis were unique to this study (though the latter species was documented during acoustic monitoring conducted during the prior study). In addition, although the previous study uniquely confirmed one California myotis, we documented three other small *Myotis* as fatalities for which genetic analysis could not confirm the specific species, but which were one of three possible species: fringed myotis, little brown bat, or long-eared myotis.

5.2.2 Birds

For focal raptors, we confirmed fatalities of golden eagle, red-tailed hawk, and American kestrel in both years, and burrowing owl fatalities only during Year 10. The single fatality of a state-threatened Swainson’s hawk in Year 11 also was noteworthy. We confirmed fatalities of 12 bird species that were not recorded as fatalities during the previous 3-year study: snow goose, common raven, white-throated swift, red-breasted nuthatch, western tanager, Wilson’s warbler, hermit warbler, black-throated gray warbler, warbling vireo, white-crowned sparrow, lesser goldfinch, and the non-native Eurasian collared-dove. Conversely, 13 species of birds were recorded as fatalities during the previous 3-year study but not during this study, including two raptors of local

conservation interest (prairie falcon and American barn owl) and the now state-threatened tricolored blackbird. Further, all species represented in both studies have been recorded as fatalities during other studies in the APWRA. Cases of interannual variation in the representation of uncommon species likely reflect a combination of influences such as variable climate/landscape conditions and attendant effects on species distributions and movements, variation in survey techniques and opportunistic discoveries of rare fatality incidents, and variable species identification skills and circumstances (e.g., see Smallwood et al. 2018).

5.3 Fatality Estimates

5.3.1 Bats

The *GenEst*-estimated annual fatality rates from this study for all bats combined (5.51–6.80 fatalities/MW/year) were significantly higher than the annual estimates from the prior 3-year Vasco study calculated using a custom estimation approach (3.09–3.35 fatalities/MW/year; derived from Brown et al. 2016: Table 27). We suspect two primary reasons for the elevated bat fatality rates during the recent study. First, estimating based on data limited to 7-day interval surveys with detection dogs significantly improved the accuracy of the estimates (Smallwood et al. 2020). Second, the prior 3-year study from 2012–2015 corresponded to a severe, multi-year, statewide drought. In contrast, although severe drought applied when the recent study began in December 2022, no drought conditions pertained throughout most of the study period from March 2023 through September 2024 (U.S. Drought Monitor 2025). As a result, reservoirs in the area frequented by Mexican free-tailed bats were generally well filled during this study, and a generally mesic landscape compared to the period of severe drought likely contributed to population rebounds and greater overall bat foraging activity in, and movements through, the APWRA and surrounding region. Recent concurrent monitoring at Golden Hills and Golden Hills North during 2023 and 2024 also yielded relatively high bat fatality rates compared to previous years despite the implementation of elevated night-time cut-in-speed curtailment as an adaptive management measure (GBBO and H. T. Harvey & Associates 2025a, 2025b). For comparison, historical bat fatality rates were 0.26 fatalities/MW/year APWRA-wide at non-repowered facilities, 0.78 fatalities/MW/year at the Diablo Winds repowered project, and between 0.48–1.08 at the Buena Vista repowered project (Alameda County Community Development Agency 2014). However, historical rates provided in this report serve as anecdotal context only, because both field and analytical methods have evolved substantially since those rates were calculated, invalidating direct comparisons.

A thorough, facility-wide comparison of bat fatality distributions/hotspots from the initial 3-year study and this 2-year study is not entirely practical, because we conducted no replicate annual sampling of turbines in the recent study. In Year 10, we gathered data at only 3 of the 11 turbines classified in the three highest abundance categories depicted in Brown et al. (2016: Figure 33j). Among these three commonly sampled turbines (WTGs 14, 32, and 34) only the estimate for WTG14 from our study was relatively high and would be categorized similarly as a potential fatality hotspot. In addition, none of the other four turbines with relatively high estimates from this study in Year 10 (WTGs 2, 3, 11, and 27) ranked in the top three abundance categories from the prior study. In Year 11, we gathered data at the other eight turbines depicted as relative bat fatality hotspots during the prior study and documented elevated bat fatality rates at only two of those turbines (WTGs 13 and 25). In contrast, 5 of 11 turbines ranked as relative bat hotspots in the prior study exhibited among the lowest fatality

rates during Year 11 of the current study. In other words, except perhaps for five turbines arrayed along the southern margin of the facility, the prior and recent studies yielded relatively little commonality in terms of potential bat fatality hotspots. Reasons why turbines on the southern margin of the facility might yield more bat fatalities is unclear, although high fatality rates in the area of WTGs 32–34 could reflect foraging movements between Bethany Reservoir to the east and Los Vaqueros Reservoir to the northwest, especially for Mexican free-tailed bats that favor foraging around and over bodies of open water (Johnston 2013). There are nine turbines with annual fatality estimates that are significantly higher than the eleven turbines with the lowest fatality estimates (Figure 8). However, the fatality rates at the remaining 14 turbines are similar to both groups, suggesting that fatality rates at Project turbines demonstrate natural variation around a central tendency. Case in point, the highest estimated fatality rate at WTG 24 did not differ significantly from the rates at 56% of the Project turbines. Taken together, the results of the 2-year study provide no compelling evidence that certain turbines have significantly disproportionate bat fatalities relative to other turbines.

5.3.2 Birds

The golden eagle fatality estimates produced using *GenEst* for Year 10 (0.07 fatalities/MW/year) and *EoA* for Year 11 (0.03 fatalities/MW/year) were similar or slightly higher than the annual estimates from the prior 3-year Vasco study calculated using a custom estimation approach (0.02–0.06 fatalities/MW/year; derived from Brown et al. 2016: Table 27). It is also noteworthy that all six of the turbines where golden eagle fatalities were documented during this study lie within <2 miles of known golden eagle nesting areas (Wiens and Kolar 2021; GBBO and H. T. Harvey & Associates 2022, 2025a; H. T. Harvey & Associates 2025). The only common eagle fatality location between our study and the prior 3-year study was at WTG34 (one fatality during both studies; Brown et al. 2016: Figure 33e). A breeding territory arose in the vicinity of this turbine in 2019 on the adjacent Golden Hills North facility, several years after the prior 3-year Vasco study was conducted (GBBO and H. T. Harvey & Associates 2022). Historical golden eagle fatality rates were 0.09 fatalities/MW/year at non-repowered facilities APWRA-wide and 0.84 fatalities/MW/year at the Diablo Winds repower project (ICF International 2012a, 2012b).

The red-tailed hawk fatality estimate produced in Year 10 using *EoA* (0.01 fatalities/MW/year) was below the range of values from the prior 3-year study (0.05–0.34 fatalities/MW/year; Brown et al. 2016: Table 27), whereas the Year 11 estimate produced using *GenEst* (0.22 fatalities/MW/year) fell within that range. Although our study and the prior study documented red-tailed hawk fatalities at similar numbers of turbines (13 and 17 turbines, respectively), fatalities occurred in both studies at only four turbines (WTGs 21, 27, 32, and 33), including one of the two turbines (WTG33) that ranked as top hotspots during the prior 3-year study (Brown et al. 2016: Figure 33f). Historical red-tailed hawk fatality rates were 0.32 fatalities/MW/year at non-repowered facilities APWRA-wide, 0.20 fatalities/MW/year at the Diablo Winds repower project, and 0.10 fatalities/MW/year at the Buena Vista repower project (ICF International 2012a, 2012b).

The *GenEst*-estimated Year 10 and Year 11 fatality rates for American kestrels (0.08 and 0.07 fatalities/MW, respectively) were at or below all annual estimates from the prior 3-year study (0.08–0.44 fatalities/MW). One of the four documented fatalities was found at the primary fatality hotspot for this species identified in the prior study (WTG32) and a second fatality was found at one of several moderate hotspots from the prior study

(WTG26). The other two fatalities were found at turbines where no kestrel fatalities were found previously (WTGs 6 and 9), but those two turbines lie on either side of another moderate hotspot from the prior study (WTG8). In contrast, no kestrel fatalities were found at or near WTG20 during this study, which was classified as the second highest hotspot for the species during the prior study. Historical American kestrel fatality rates were 0.76 fatalities/MW/year for non-repowered facilities APWRA-wide, 0.09 fatalities/MW/year at the Diablo Winds repower project, and 0.15 fatalities/MW/year at the Buena Vista repower project (ICF International 2012a, 2012b).

For burrowing owls, the *EoA*-estimated Year 10 fatality rate from this study (0.05 fatalities/MW/year) fell within the range of annual rates documented during the prior Vasco study (0–0.17 fatalities/MW/year), whereas no fatalities in Year 11 matched the findings from Years 2 and 3 of the prior study. The three documented fatalities from this study were found at WTGs 8, 10, and 21, none of which match or are close to the three turbines where burrowing owl fatalities were found during the prior study (WTGs 24, 30, and 31). Historical burrowing owl fatality rates were 0.99 fatalities/MW/year at non-repowered facilities APWRA-wide and 0.84 fatalities/MW/year at the Diablo Winds repower project (ICF International 2012a, 2012b).

At the group level, the *GenEst*-estimated annual fatality rates for all raptors combined (0.22–0.41 fatalities/MW/year) remained on the low side compared to the annual rates from the prior 3-year Vasco study (0.23–1.01 fatalities/MW). The baseline fatality rate used in the project-specific FEIR was 2.2 raptors/MW/year (Contra Costa County Department of Conservation Development 2011). The Diablo Winds and Buena Vista repower projects had estimated fatality rates of 1.21 raptors/MW/year and 0.31 raptors/MW/year, respectively (ICF International 2012b).

The fatality numbers for most other species were too low both across the prior 3-year Vasco study and this 2-year study to yield meaningful comparisons. One exception is higher numbers of both Vaux's and white-throated swifts among the fatalities from this study (4 Vaux's swifts, 10 white-throated swifts, and 3 unidentified swifts) compared to only one Vaux's swift found during the prior study. H. T. Harvey & Associates (2024a) previously noted evidence of an apparent increase in the fatality rates of both swift species at Golden Hills compared to prior pre- and early post-repowering assessments. Higher CD for small birds using dog-teams at 7-day search intervals likely contributed to the apparent increase, but human searches at 28-day intervals also yielded many of the swift fatalities found during the original Golden Hills study.

In summary, the estimated annual fatality rates for focal raptors during this study were similar or lower than the corresponding annual estimates from the initial 3-year Vasco study conducted a decade ago, and there was little overlap among turbines identified as potential fatality hotspots during the two periods, except for one case involving red-tailed hawks. Red-tailed hawk fatalities occurred during both studies at four turbines (WTGs 21, 27, 32, and 33). WTG33 ranked as the top hot spot for red-tailed hawk fatalities during the prior 3-year study and was the only turbine with three red-tailed hawk fatalities during our study. This southeastern sector of the facility appears to be a consistent fatality hotspot for red-tailed hawks, with neighboring turbine WTG32 to the west also having had single red-tailed hawk fatalities during both studies and two others having occurred at neighboring turbine WTG34 to the east during the early study. In contrast, only one turbine had a golden eagle fatality during both studies (WTG34) and the distributions of fatalities during the two studies were otherwise dissimilar. Similarly, single American kestrel fatalities occurred during both studies at three turbines (WTGs 18,

26, 32) but kestrel fatalities were generally scattered throughout the facility in small numbers. Lastly, there was no overlap or particular spatial correspondence between the turbines where burrowing owl fatalities were found during our study (2 turbines) and the prior study (3 turbines). Taken together, the results of the 2-year study provide no compelling evidence that certain turbines have significantly disproportionate focal raptor fatalities relative to other turbines with the potential exception WTG33 for red-tailed hawks.

Section 6.0 References

- Alameda County Community Development Agency. 2014. Altamont Pass Wind Resource Area Repowering Final Program Environmental Impact Report. State Clearinghouse #2010082063. Hayward, California. <https://www.acgov.org/cda/planning/landuseprojects/documents/apwra/Complete_Final_Program_EIR.pdf>.
- Brown, K., K. S. Smallwood, B. Karas, and J. M. Szewczak. 2016. Final Report 2012–2015, Avian and Bat Monitoring Project, Vasco Winds, LLC. Prepared by Ventas Environmental Solutions, Portland, Oregon. Prepared for NextEra Energy Resources, Livermore, California.
- California Department of Fish and Wildlife. 2025. Special Animals List. Sacramento, California. <<https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=109406&inline>>.
- Contra Costa County Department of Conservation Development. 2011. Vasco Winds Repowering Project Final Environmental Impact Report. SCH No. 2010032094, County File No. LP08-2049. Martinez, California. <<https://www.acgov.org/cda/planning/landuseprojects/documents/AWI-FEIR-7-2-13.pdf>>.
- Dalthorp, D. 2024. R Package ‘*ea3*’: Wildlife Mortality Estimator for Low Fatality Rates and Imperfect Detection. <https://cran.rstudio.com/web/packages/ea3/ea3.pdf>.
- Dalthorp, D., L. Madsen, M. Huso, R. Wolpert, P. Rabie, J. Studyvin, J. Simonis, and J. Mintz. 2018a. *GenEst* Statistical Models—A Generalized Estimator of Mortality. Techniques and Methods 7-A2. U.S. Geological Survey, Reston, Virginia. <<https://doi.org/10.3133/tm7A2>>.
- Dalthorp, D. H., J. Simonis, L. Madsen, M. M. Huso, P. Rabie, J. M. Mintz, R. Wolpert, J. Studyvin, and F. Korner-Nievergelt. 2018b. Generalized Mortality Estimator (*GenEst*) - R code & GUI. U.S. Geological Survey, Reston, Virginia. <<https://doi.org/10.5066/P9O9BATL>>.
- Dalthorp, D., M. Huso, M. Dalthorp, and J. Mintz. 2023. Accounting for the fraction of carcasses outside the searched area and the estimation of bird and bat fatalities at wind energy facilities. arXiv:2201.10064v2. <<https://doi.org/10.48550/arXiv.2201.10064>>.
- Great Basin Bird Observatory (GBBO) and H. T. Harvey & Associates. 2022. Golden Hills North Wind Energy Center Postconstruction Fatality Monitoring Final 3-Year Report. May 16, 2022. Reno, Nevada and Los Gatos, California. Prepared for Golden Hills North Wind, LLC, Livermore, California.
- Great Basin Bird Observatory (GBBO) and H. T. Harvey & Associates. 2025a. Golden Hills Wind Energy Center Bat Adaptive Monitoring Report: Years 1 and 2. Reno, Nevada and Los Gatos, California. Draft Report, January 27, 2025. Prepared for Golden Hills Wind, LLC, Livermore, California.
- Great Basin Bird Observatory (GBBO) and H. T. Harvey & Associates. 2025b. Golden Hills North Wind Energy Center Bat Adaptive Monitoring Report: Years 1 and 2. Reno, Nevada and Los Gatos, California.

- Draft Report, Draft Report, January 27, 2025. Prepared for Golden Hills North Wind, LLC, Livermore, California.
- H. T. Harvey & Associates. 2022. Golden Hills Wind Energy Center Fall 2021 Bat Adaptive Management Report. Los Gatos, California. March 9, 2022. Prepared for Golden Hills Wind, LLC, Livermore, California.
- H. T. Harvey & Associates. 2024a. Golden Hills Wind Energy Center Postconstruction Fatality Monitoring: Final 3-Year Report. Los Gatos, California. March 12, 2024. Prepared for Golden Hills Wind, LLC, Livermore, California. <<https://www.acgov.org/cda/planning/landuseprojects/documents/apwra/Golden-Hills-Post-Construction-Monitoring-Final-3-Year-Report.pdf>>.
- H. T. Harvey & Associates. 2024b. Golden Hills Wind Energy Center Golden Eagle Adaptive Management Monitoring Project: Final 3-Year Report. Los Gatos, California. March 12, 2024. Prepared for Golden Hills Wind, LLC, Livermore, California. <<https://www.acgov.org/cda/planning/landuseprojects/documents/apwra/Golden-Hills-Adaptive-Management-Monitoring-Final-3-year-Report.pdf>>.
- H. T. Harvey & Associates. 2025. Los Vaqueros Reservoir Project Annual Golden Eagle Monitoring Report 2024. Los Gatos, California. Prepared for Contra Costa Water Management District, Concord, California.
- Hull, C. L., and S. Muir. 2010. Search areas for monitoring bird and bat carcasses at wind farms using a Monte Carlo model. *Australasian Journal of Environmental Management* 17:77–87. <<https://doi.org/10.1080/14486563.2010.9725253>>.
- Hurmen, J., and R. Harness. 2012. Identification of raptor bones. Pages 103–108 *in* Wildlife Forensic Field Manual, Fourth Edition (D. N. Walker and W. J. Adrian, Editors). Association of Midwest Fish and Game Law Enforcement Officers. <https://www.researchgate.net/publication/295550335_Identification_of_Raptor_Bones#fullTextFileContent>.
- Huso, M., N. Som, and L. Ladd. 2012. Fatality estimator user's guide. U. S. Geological Survey Data Series 729. <<http://pubs.usgs.gov/ds/729>>.
- ICF International. 2012a. Altamont Pass Wind Resource Area Bird Fatality Study, Bird Years 2005–2010. October. ICF #00904.08. Sacramento, California. Prepared for Alameda County Community Development Agency, Hayward, California.
- ICF International. 2012b. Altamont Pass Wind Resource Area Alameda County Avian Fatality Monitoring Team Data. ICF #00904.08. Sacramento, California. Prepared for Alameda County Community Development Agency, Hayward, California.
- Johnston, D. S. 2013. Effects of urbanization on bats in California: winners and losers. Western Bat Working Group. Presentation on April 3, 2013, Santa Fe, New Mexico.
- U.S. Drought Monitor. 2025. Map Archive: California. National Drought Mitigation Center, University of Nebraska-Lincoln, Lincoln, Nebraska. <<https://droughtmonitor.unl.edu/Maps/MapArchive.aspx>>.

- Rabie, P. A., D. Riser-Espinosa, J. Studyvin, D. Dalthorp, and M. Huso. 2021. Performance of the GenEst mortality estimator compared to the Huso and Schoenfeld estimators. AWWI Technical Report. American Wind Wildlife Institute, Washington, D.C. <<https://pubs.usgs.gov/publication/70217783>>.
- Santa Cruz Predatory Bird Research Group. 2005. Guide to Raptor Remains - A Photographic Guide to Identifying the Remains of Selected Species of California Raptors. Santa Cruz, California. Prepared by EDM International, Inc., Fort Collins, Colorado. Prepared for the California Energy Commission, Sacramento, California. CEC-500-2005-001.
- Simonis, J., D. Dalthorp, M. Huso, J. Mintz, L. Madsen, P. Rabie, and J. Studyvin. 2018. *GenEst* User Guide—Software for a Generalized Estimator of Mortality. Techniques and Methods 7-C19. U.S. Geological Survey, Reston, Virginia. <<https://doi.org/10.3133/tm7C19>>.
- Smallwood, K. S., D. A. Bell, and S. Standish. 2020. Dogs detect larger wind energy effects on bats and birds. *Journal of Wildlife Management* 84:852–864. <<https://doi.org/10.1002/jwmg.21863>>.
- Smallwood, K. S., D. A. Bell, E. L. Walther, E. Leyvas, S. Standish, J. Mount, and B. Karas. 2018. Estimating wind turbine fatalities using integrated detection trials. *Journal of Wildlife Management* 82:1169–1184. <<https://doi.org/10.1002/jwmg.21468>>.
- Warren-Hicks, W., J. Newman, R. Wolpert, B. Karas, and L. Tran. 2013. Improving methods for estimating fatality of birds and bats at wind energy facilities. CEC-500-2012-086. California Wind Energy Association, Berkeley, California, and California Energy Commission, Public Interest Energy Research Program, Sacramento, California.
- Wiens, J. D., and P. S. Kolar. 2021. Golden eagle population surveys in the vicinity of the Altamont Pass Wind Resource Area, California, 2014–21. U.S. Geological Survey Open-File Report 2021–1107. <<https://doi.org/10.3133/ofr20211107>>.

Appendix A. Species Names

Group	Common name	Scientific Name
Bats	Big brown bat	<i>Eptesicus fuscus</i>
	California myotis	<i>Myotis californicus</i>
	Fringed myotis	<i>Myotis thysanodes</i>
	Hoary bat	<i>Lasiurus cinereus</i>
	Little brown bat	<i>Myotis lucifugus</i>
	Long-eared myotis	<i>Myotis evotis</i>
	Mexican free-tailed bat	<i>Tadarida brasiliensis</i>
	Silver-haired bat	<i>Lasionycteris noctivagans</i>
	Western red bat	<i>Lasiurus frantzii</i>
	Western small-footed myotis	<i>Myotis ciliolabrum</i>
	Yuma myotis	<i>Myotis yumanensis</i>
Birds	Acorn Woodpecker	<i>Melanerpes formicivorus</i>
	American Barn Owl	<i>Tyto furcata</i>
	American Crow	<i>Corvus brachyrhynchos</i>
	American Kestrel	<i>Falco sparverius</i>
	Band-tailed Pigeon	<i>Patagioenas fasciata</i>
	Barn Swallow	<i>Hirundo rustica</i>
	Black-bellied Plover	<i>Pluvialis squatarola</i>
	Black-headed Grosbeak	<i>Pheucticus melanocephalus</i>
	Black-throated Gray Warbler	<i>Setophaga nigrescens</i>
	Blue-gray Gnatcatcher	<i>Poliophtila caerulea</i>
	Brown Creeper	<i>Certhia americana</i>
	Burrowing Owl	<i>Athene cunicularia</i>
	Cackling Goose	<i>Branta hutchinsii</i>
	California Gull	<i>Larus californicus</i>
	California Quail	<i>Callipepla californica</i>
	Cedar Waxwing	<i>Bombycilla cedrorum</i>
	Chestnut-backed Chickadee	<i>Poecile rufescens</i>
	Clark's Grebe	<i>Aechmophorus clarkii</i>
	Common Raven	<i>Corvus corax</i>
	Dark-eyed Junco	<i>Junco hyemalis</i>
	Double-crested Cormorant	<i>Nannopterum auritum</i>
	Eurasian Collared-Dove	<i>Streptopelia decaocto</i>
	European Starling	<i>Sturnus vulgaris</i>
	Fox Sparrow	<i>Passerella iliaca</i>
	Golden Eagle	<i>Aquila chrysaetos</i>
	Golden-crowned Sparrow	<i>Zonotrichia atricapilla</i>
	Great Egret	<i>Ardea alba</i>
	Great Horned Owl	<i>Bubo virginianus</i>

Group	Common name	Scientific Name
	Great-tailed Grackle	<i>Quiscalus mexicanus</i>
	Hermit Thrush	<i>Catharus guttatus</i>
	Hermit Warbler	<i>Setophaga occidentalis</i>
	Horned Lark	<i>Eremophila alpestris</i>
	House Finch	<i>Haemorrhous mexicanus</i>
	House Sparrow	<i>Passer domesticus</i>
	Killdeer	<i>Charadrius vociferus</i>
	Least Sandpiper	<i>Calidris minutilla</i>
	Lesser Goldfinch	<i>Spinus psaltria</i>
	Loggerhead Shrike	<i>Lanius ludovicianus</i>
	Mourning Dove	<i>Zenaida macroura</i>
	Nuttall's Woodpecker	<i>Dryobates nuttallii</i>
	Purple Finch	<i>Haemorrhous purpureus</i>
	Red-breasted Nuthatch	<i>Sitta canadensis</i>
	Red-tailed Hawk	<i>Buteo jamaicensis</i>
	Red-winged Blackbird	<i>Agelaius phoeniceus</i>
	Rock Pigeon	<i>Columba livia</i>
	Ruby-crowned Kinglet	<i>Corthylio calendula</i>
	Semipalmated Plover	<i>Charadrius semipalmatus</i>
	Short-billed Dowitcher	<i>Limnodromus griseus</i>
	Snow Goose	<i>Anser caerulescens</i>
	Song Sparrow	<i>Melospiza melodia</i>
	Spotted Towhee	<i>Pipilo maculatus</i>
	Swainson's Hawk	<i>Buteo swainsoni</i>
	Townsend's Warbler	<i>Setophaga townsendi</i>
	Turkey Vulture	<i>Cathartes aura</i>
	Vaux's Swift	<i>Chaetura vauxi</i>
	Warbling Vireo	<i>Vireo gilvus</i>
	Western Grebe	<i>Aechmophorus occidentalis</i>
	Western Meadowlark	<i>Sturnella neglecta</i>
	Western Sandpiper	<i>Calidris mauri</i>
	Western Tanager	<i>Piranga ludoviciana</i>
	White-breasted Nuthatch	<i>Sitta carolinensis</i>
	White-crowned Sparrow	<i>Zonotrichia leucophrys</i>
	White-throated Swift	<i>Aeronautes saxatalis</i>
	Wild Turkey	<i>Meleagris gallopavo</i>
	Wilson's Warbler	<i>Cardellina pusilla</i>

Appendix B. Summary of Fatality Surveys Conducted During Study

Turbine	Year 10			Year 11		
	Number of Surveys	Date of First Survey	Date of Last Survey	Number of Surveys	Date of First Survey	Date of Last Survey
WTG-01	13	02-Dec-22	07-Nov-23	50	04-Dec-23	25-Nov-24
WTG-02	50	29-Nov-22	29-Nov-23	13	27-Dec-23	21-Nov-24
WTG-03	50	28-Nov-22	29-Nov-23	13	26-Dec-23	21-Nov-24
WTG-04	14	29-Nov-22	23-Nov-23	49	04-Dec-23	25-Nov-24
WTG-05	13	02-Dec-22	08-Nov-23	51	06-Dec-23	26-Nov-24
WTG-06	13	02-Dec-22	08-Nov-23	50	05-Dec-23	26-Nov-24
WTG-07	13	09-Dec-22	09-Nov-23	51	05-Dec-23	26-Nov-24
WTG-08	47	06-Dec-22	30-Nov-23	13	05-Dec-23	26-Nov-24
WTG-09	46	06-Dec-22	30-Nov-23	14	05-Dec-23	26-Nov-24
WTG-10	49	06-Dec-22	29-Nov-23	13	19-Dec-23	18-Nov-24
WTG-11	48	06-Dec-22	29-Nov-23	13	21-Dec-23	15-Nov-24
WTG-12	13	09-Dec-22	09-Nov-23	50	06-Dec-23	26-Nov-24
WTG-13	13	09-Dec-22	10-Nov-23	51	06-Dec-23	26-Nov-24
WTG-14	49	05-Dec-22	01-Dec-23	13	19-Dec-23	15-Nov-24
WTG-15	14	29-Nov-22	24-Nov-23	51	07-Dec-23	27-Nov-24
WTG-16	14	02-Dec-22	16-Nov-23	50	07-Dec-23	27-Nov-24
WTG-17	50	02-Dec-22	30-Nov-23	13	15-Dec-23	05-Nov-24
WTG-18	47	02-Dec-22	30-Nov-23	13	15-Dec-23	05-Nov-24
WTG-19	14	02-Dec-22	23-Nov-23	48	08-Dec-23	27-Nov-24
WTG-20	50	02-Dec-22	01-Dec-23	13	07-Dec-23	06-Nov-24
WTG-21	51	08-Dec-22	29-Nov-23	13	27-Dec-23	25-Nov-24
WTG-22	14	29-Nov-22	16-Nov-23	48	08-Dec-23	27-Nov-24
WTG-23	52	29-Nov-22	27-Nov-23	13	27-Dec-23	25-Nov-24
WTG-24	14	02-Dec-22	25-Nov-23	50	04-Dec-23	25-Nov-24
WTG-25	13	02-Dec-22	08-Nov-23	50	04-Dec-23	25-Nov-24
WTG-26	49	29-Nov-22	01-Dec-23	13	07-Dec-23	06-Nov-24
WTG-27	48	30-Nov-22	28-Nov-23	13	14-Dec-23	15-Nov-24
WTG-28	13	30-Nov-22	17-Nov-23	48	05-Dec-23	25-Nov-24
WTG-29	48	30-Nov-22	28-Nov-23	13	14-Dec-23	15-Nov-24
WTG-30	14	30-Nov-22	17-Nov-23	45	08-Dec-23	26-Nov-24
WTG-31	13	07-Dec-22	10-Nov-23	49	05-Dec-23	25-Nov-24
WTG-32	48	30-Nov-22	28-Nov-23	13	21-Dec-23	19-Nov-24
WTG-33	14	30-Nov-22	10-Nov-23	50	05-Dec-23	26-Nov-24
WTG-34	49	30-Nov-22	28-Nov-23	13	22-Dec-23	19-Nov-24

Appendix C. Records of All Bird and Bat Fatalities Documented During Study

Year	Carcass Type	Date	Turbine ID	Distance From Turbine (meters)	Direction From Turbine (°)	Substrate	Species	Size Class	Carcass Condition	Included In Fatality Estimates?
10	Bat	05-Dec-22	14	67	260	Grazed/Short Grass	Mexican free-tailed bat ³	Medium	Scavenged-decomposed	No-Aged out
10	Bat	06-Dec-22	8	50	350	Grazed/Short Grass	Mexican free-tailed bat	Medium	Intact-decomposed	No-Aged out
10	Bat	07-Dec-22	29	23	180	Grazed/Short Grass	Mexican free-tailed bat ³	Medium	Scavenged-decomposed	No-Aged out
10	Bat	07-Dec-22	32	15	190	Road	Mexican free-tailed bat ³	Medium	Scavenged-decomposed	No-Aged out
10	Bat	08-Feb-23	11	81	120	Grazed/Short Grass	Unknown bat ¹	Medium	Scavenged-decomposed	No-Aged out
10	Bat	08-Mar-23	8	36	90	Grazed/Short Grass	Hoary bat	Large	Intact-decomposed	Yes
10	Bat	20-Mar-23	23	92	327	Grazed/Short Grass	Mexican free-tailed bat	Medium	Intact-fresh	Yes
10	Bat	11-Apr-23	27	45	79	Grazed/Short Grass	Hoary bat	Large	Scavenged-partial decomposed	Yes
10	Bat	17-Apr-23	2	95	51	Grazed/Short Grass	Hoary bat	Large	Intact-partial decomposed	Yes
10	Bat	01-May-23	23	65	40	Grazed/Short Grass	Mexican free-tailed bat ³	Medium	Injured	Yes
10	Bat	04-May-23	11	11	138	Grazed/Short Grass	Mexican free-tailed bat	Medium	Intact-fresh	Yes
10	Bat	04-May-23	10	86	68	Grazed/Short Grass	Hoary bat	Large	Intact-fresh	Yes
10	Bat	08-May-23	14	92	64	Tall Fallow Grass/Forb	Mexican free-tailed bat	Medium	Intact-fresh	Yes
10	Bat	15-May-23	23	65	344	Tall Fallow Grass/Forb	Mexican free-tailed bat	Medium	Intact-partial decomposed	Yes
10	Bat	31-May-23	11	82	40	Road	Hoary bat	Large	Intact-fresh	Yes
10	Bat	08-Jun-23	26	88	42	Tall Fallow Grass/Forb	Hoary bat	Large	Intact-partial decomposed	Yes
10	Bat	12-Jun-23	2	114	28	Grazed/Short Grass	Mexican free-tailed bat	Medium	Intact-partial decomposed	Yes
10	Bat	13-Jun-23	14	111	24	Tall Fallow Grass/Forb	Hoary bat	Large	Intact-partial decomposed	Yes
10	Bat	26-Jun-23	2	105	18	Grazed/Short Grass	Mexican free-tailed bat	Medium	Intact-partial decomposed	Yes
10	Bat	27-Jun-23	27	84	46	Tall Fallow Grass/Forb	Hoary bat	Large	Intact-partial decomposed	Yes
10	Bat	28-Jun-23	10	94	18	Grazed/Short Grass	Mexican free-tailed bat	Medium	Intact-partial decomposed	Yes
10	Bat	05-Jul-23	27	36	6	Road	Hoary bat	Large	Scavenged-partial decomposed	Yes
10	Bat	27-Jul-23	11	40	10	Tall Fallow Grass/Forb	Hoary bat	Large	Intact-fresh	Yes
10	Bat	31-Jul-23	23	115	64	Tall Fallow Grass/Forb	Mexican free-tailed bat	Medium	Intact-partial decomposed	Yes
10	Bat	01-Aug-23	27	83	60	Tall Fallow Grass/Forb	Mexican free-tailed bat	Medium	Intact-partial decomposed	Yes
10	Bat	04-Aug-23	14	110	25	Tall Fallow Grass/Forb	Mexican free-tailed bat	Medium	Intact-partial decomposed	Yes
10	Bat	10-Aug-23	8	8	224	Turbine pad	Hoary bat	Large	Dismembered-partial decomposed	Yes
10	Bat	11-Aug-23	14	108	40	Tall Fallow Grass/Forb	Mexican free-tailed bat	Medium	Dismembered-partial decomposed	Yes
10	Bat	15-Aug-23	29	6	57	Grazed/Short Grass	Mexican free-tailed bat	Medium	Scavenged-partial decomposed	Yes
10	Bat	15-Aug-23	29	110	86	Tall Fallow Grass/Forb	Mexican free-tailed bat	Medium	Scavenged-partial decomposed	Yes
10	Bat	15-Aug-23	27	107	20	Tall Fallow Grass/Forb	Hoary bat	Large	Intact-partial decomposed	Yes
10	Bat	15-Aug-23	27	68	6	Grazed/Short Grass	Hoary bat	Large	Intact-partial decomposed	Yes

Year	Carcass Type	Date	Turbine ID	Distance From Turbine (meters)	Direction From Turbine (°)	Substrate	Species	Size Class	Carcass Condition	Included In Fatality Estimates?
10	Bat	17-Aug-23	18	102	29	Grazed/Short Grass	Mexican free-tailed bat	Medium	Scavenged-partial decomposed	Yes
10	Bat	24-Aug-23	3	38	353	Tall Fallow Grass/Forb	Mexican free-tailed bat	Medium	Intact-partial decomposed	Yes
10	Bat	24-Aug-23	3	66	38	Grazed/Short Grass	<i>Myotis</i> sp.	Small	Scavenged-partial decomposed	Yes
10	Bat	25-Aug-23	32	14	47	Tall Fallow Grass/Forb	Mexican free-tailed bat	Medium	Intact-partial decomposed	Yes
10	Bat	25-Aug-23	27	26	198	Bare Dirt/Disturbed Soil	Silver-haired bat	Medium	Scavenged-partial decomposed	Yes
10	Bat	26-Aug-23	11	1	335	Turbine pad	Mexican free-tailed bat	Medium	Intact-fresh	Yes
10	Bat	26-Aug-23	8	70	58	Grazed/Short Grass	Hoary bat	Large	Intact-partial decomposed	Yes
10	Bat	26-Aug-23	8	90	7	Grazed/Short Grass	Mexican free-tailed bat	Medium	Intact-partial decomposed	Yes
10	Bat	26-Aug-23	8	67	16	Grazed/Short Grass	Hoary bat	Large	Intact-fresh	Yes
10	Bat	28-Aug-23	2	25	60	Bare Dirt/Disturb Soil	Mexican free-tailed bat	Medium	Intact-partial decomposed	Yes
10	Bat	28-Aug-23	21	26	30	Tall Fallow Grass/Forb	Hoary bat	Large	Intact-partial decomposed	Yes
10	Bat	28-Aug-23	21	53	21	Tall Fallow Grass/Forb	Mexican free-tailed bat	Medium	Dismembered-partial decomposed	Yes
10	Bat	28-Aug-23	21	60	36	Tall Fallow Grass/Forb	Mexican free-tailed bat	Medium	Intact-partial decomposed	Yes
10	Bat	28-Aug-23	21	25	231	Bare Dirt/Disturb Soil	Hoary bat	Large	Scavenged-partial decomposed	Yes
10	Bat	01-Sep-23	17	57	58	Tall Fallow Grass/Forb	Western red bat	Medium	Scavenged-partial decomposed	Yes
10	Bat	01-Sep-23	17	75	6	Tall Fallow Grass/Forb	Mexican free-tailed bat	Medium	Dismembered-partial decomposed	Yes
10	Bat	05-Sep-23	29	98	50	Tall Fallow Grass/Forb	Mexican free-tailed bat	Medium	Intact-partial decomposed	Yes
10	Bat	05-Sep-23	27	67	10	Tall Fallow Grass/Forb	Mexican free-tailed bat	Medium	Scavenged-partial decomposed	Yes
10	Bat	05-Sep-23	32	92	60	Tall Fallow Grass/Forb	Mexican free-tailed bat	Medium	Intact-partial decomposed	Yes
10	Bat	05-Sep-23	32	86	55	Tall Fallow Grass/Forb	Mexican free-tailed bat	Medium	Intact-partial decomposed	Yes
10	Bat	05-Sep-23	34	75	12	Tall Fallow Grass/Forb	Hoary bat	Large	Scavenged-partial decomposed	Yes
10	Bat	06-Sep-23	9	41	120	Tall Fallow Grass/Forb	Mexican free-tailed bat	Medium	Intact-partial decomposed	Yes
10	Bat	06-Sep-23	10	53	295	Tall Fallow Grass/Forb	Mexican free-tailed bat	Medium	Scavenged-partial decomposed	Yes
10	Bat	06-Sep-23	11	29	355	Tall Fallow Grass/Forb	Hoary bat ³	Large	Injured	Yes
10	Bat	12-Sep-23	21	48	46	Grazed/Short Grass	Mexican free-tailed bat	Medium	Intact-partial decomposed	Yes
10	Bat	12-Sep-23	3	60	69	Grazed/Short Grass	Hoary bat	Large	Intact-partial decomposed	Yes
10	Bat	12-Sep-23	3	3	90	Turbine pad	Mexican free-tailed bat	Medium	Scavenged-partial decomposed	Yes
10	Bat	12-Sep-23	3	87	351	Tall Fallow Grass/Forb	Hoary bat	Large	Intact-partial decomposed	Yes
10	Bat	12-Sep-23	3	65	14	Grazed/Short Grass	Mexican free-tailed bat ³	Medium	Injured	Yes
10	Bat	12-Sep-23	2	108	12	Grazed/Short Grass	Hoary bat	Large	Scavenged-partial decomposed	Yes
10	Bat	12-Sep-23	2	115	5	Grazed/Short Grass	Hoary bat	Large	Intact-partial decomposed	Yes
10	Bat	13-Sep-23	34	109	69	Tall Fallow Grass/Forb	Mexican free-tailed bat	Medium	Intact-partial decomposed	Yes
10	Bat	13-Sep-23	34	103	51	Tall Fallow Grass/Forb	Hoary bat	Large	Intact-partial decomposed	Yes
10	Bat	13-Sep-23	29	109	24	Grazed/Short Grass	Mexican free-tailed bat	Medium	Intact-partial decomposed	Yes
10	Bat	14-Sep-23	9	2	330	Turbine pad	Mexican free-tailed bat	Medium	Scavenged-fresh	Yes
10	Bat	14-Sep-23	11	10	19	Tall Fallow Grass/Forb	Mexican free-tailed bat	Medium	Scavenged-partial decomposed	Yes

Year	Carcass Type	Date	Turbine ID	Distance From Turbine (meters)	Direction From Turbine (°)	Substrate	Species	Size Class	Carcass Condition	Included In Fatality Estimates?
10	Bat	14-Sep-23	11	52	348	Tall Fallow Grass/Forb	Hoary bat	Large	Intact-partial decomposed	Yes
10	Bat	15-Sep-23	20	110	65	Tall Fallow Grass/Forb	Hoary bat	Large	Scavenged-decomposed	Yes
10	Bat	18-Sep-23	3	115	26	Grazed/Short Grass	Western red bat	Medium	Scavenged-partial decomposed	Yes
10	Bat	18-Sep-23	3	97	34	Grazed/Short Grass	Hoary bat	Large	Intact-partial decomposed	Yes
10	Bat	18-Sep-23	2	21	12	Grazed/Short Grass	Mexican free-tailed bat	Medium	Dismembered-partial decomposed	Yes
10	Bat	25-Sep-23	2	31	54	Rocky Drainage	Mexican free-tailed bat	Medium	Intact-partial decomposed	Yes
10	Bat	25-Sep-23	2	93	53	Grazed/Short Grass	Mexican free-tailed bat	Medium	Intact-partial decomposed	Yes
10	Bat	25-Sep-23	3	84	34	Grazed/Short Grass	Mexican free-tailed bat	Medium	Intact-partial decomposed	Yes
10	Bat	25-Sep-23	3	32	22	Tall Fallow Grass/Forb	Mexican free-tailed bat	Medium	Intact-partial decomposed	Yes
10	Bat	25-Sep-23	3	55	23	Tall Fallow Grass/Forb	Mexican free-tailed bat	Medium	Intact-partial decomposed	Yes
10	Bat	25-Sep-23	23	61	60	Grazed/Short Grass	Mexican free-tailed bat	Medium	Intact-partial decomposed	Yes
10	Bat	27-Sep-23	10	69	18	Grazed/Short Grass	Mexican free-tailed bat	Medium	Intact-partial decomposed	Yes
10	Bat	27-Sep-23	10	87	35	Grazed/Short Grass	Hoary bat	Large	Intact-partial decomposed	Yes
10	Bat	28-Sep-23	14	104	15	Tall Fallow Grass/Forb	Mexican free-tailed bat	Medium	Intact-partial decomposed	Yes
10	Bat	28-Sep-23	14	114	15	Tall Fallow Grass/Forb	Hoary bat	Large	Scavenged-partial decomposed	Yes
10	Bat	28-Sep-23	14	95	10	Tall Fallow Grass/Forb	Mexican free-tailed bat	Medium	Intact-partial decomposed	Yes
10	Bat	28-Sep-23	14	91	5	Tall Fallow Grass/Forb	Hoary bat	Large	Intact-partial decomposed	Yes
10	Bat	02-Oct-23	3	74	4	Tall Fallow Grass/Forb	Mexican free-tailed bat	Medium	Intact-fresh	Yes
10	Bat	02-Oct-23	2	77	57	Grazed/Short Grass	Mexican free-tailed bat	Medium	Intact-partial decomposed	Yes
10	Bat	03-Oct-23	29	50	85	Grazed/Short Grass	Mexican free-tailed bat	Medium	Scavenged-partial decomposed	Yes
10	Bat	03-Oct-23	29	78	99	Grazed/Short Grass	Mexican free-tailed bat	Medium	Scavenged-fresh	Yes
10	Bat	03-Oct-23	27	37	8	Tall Fallow Grass/Forb	Mexican free-tailed bat	Medium	Scavenged-partial decomposed	Yes
10	Bat	03-Oct-23	34	26	12	Bare Dirt/Disturb Soil	Mexican free-tailed bat	Medium	Scavenged-partial decomposed	Yes
10	Bat	03-Oct-23	34	77	50	Tall Fallow Grass/Forb	Hoary bat	Large	Intact-partial decomposed	Yes
10	Bat	04-Oct-23	9	44	52	Bare Dirt/Disturb Soil	Mexican free-tailed bat	Medium	Intact-fresh	Yes
10	Bat	04-Oct-23	10	92	19	Grazed/Short Grass	Mexican free-tailed bat	Medium	Intact-partial decomposed	Yes
10	Bat	04-Oct-23	11	24	15	Tall Fallow Grass/Forb	Mexican free-tailed bat	Medium	Intact-fresh	Yes
10	Bat	04-Oct-23	11	51	328	Tall Fallow Grass/Forb	Mexican free-tailed bat	Medium	Intact-partial decomposed	Yes
10	Bat	04-Oct-23	11	14	293	Bare Dirt/Disturb Soil	Mexican free-tailed bat	Medium	Intact-fresh	Yes
10	Bat	04-Oct-23	11	55	74	Tall Fallow Grass/Forb	Myotis sp.	Small	Scavenged-partial decomposed	Yes
10	Bat	04-Oct-23	11	41	65	Tall Fallow Grass/Forb	Hoary bat	Large	Intact-partial decomposed	Yes
10	Bat	04-Oct-23	14	36	116	Grazed/Short Grass	Mexican free-tailed bat	Medium	Intact-fresh	Yes
10	Bat	04-Oct-23	14	40	117	Grazed/Short Grass	Mexican free-tailed bat	Medium	Intact-fresh	Yes
10	Bat	04-Oct-23	14	48	112	Tall Fallow Grass/Forb	Mexican free-tailed bat	Medium	Intact-fresh	Yes
10	Bat	04-Oct-23	14	36	74	Tall Fallow Grass/Forb	Mexican free-tailed bat	Medium	Intact-partial decomposed	Yes
10	Bat	04-Oct-23	14	40	56	Grazed/Short Grass	Mexican free-tailed bat	Medium	Scavenged-partial decomposed	Yes

Year	Carcass Type	Date	Turbine ID	Distance From Turbine (meters)	Direction From Turbine (°)	Substrate	Species	Size Class	Carcass Condition	Included In Fatality Estimates?
10	Bat	07-Oct-23	26	112	30	Tall Fallow Grass/Forb	Mexican free-tailed bat	Medium	Intact-partial decomposed	Yes
10	Bat	09-Oct-23	21	51	102	Grazed/Short Grass	Hoary bat	Large	Intact-partial decomposed	Yes
10	Bat	10-Oct-23	29	46	359	Grazed/Short Grass	Hoary bat	Large	Intact-partial decomposed	Yes
10	Bat	10-Oct-23	27	68	33	Grazed/Short Grass	Hoary bat	Large	Intact-fresh	Yes
10	Bat	10-Oct-23	27	103	261	Grazed/Short Grass	Mexican free-tailed bat	Medium	Intact-partial decomposed	Yes
10	Bat	16-Oct-23	2	44	135	Grazed/Short Grass	Mexican free-tailed bat	Medium	Scavenged-partial decomposed	Yes
10	Bat	16-Oct-23	3	27	50	Grazed/Short Grass	Mexican free-tailed bat	Medium	Intact-partial decomposed	Yes
10	Bat	16-Oct-23	3	87	343	Grazed/Short Grass	Hoary bat	Large	Intact-partial decomposed	Yes
10	Bat	17-Oct-23	27	80	40	Grazed/Short Grass	Hoary bat	Large	Scavenged-partial decomposed	Yes
10	Bat	17-Oct-23	27	115	25	Grazed/Short Grass	Mexican free-tailed bat	Medium	Intact-partial decomposed	Yes
10	Bat	18-Oct-23	9	41	291	Grazed/Short Grass	Mexican free-tailed bat	Medium	Intact-partial decomposed	Yes
10	Bat	18-Oct-23	10	125	53	Grazed/Short Grass	Mexican free-tailed bat	Medium	Intact-partial decomposed	No-Off plot
10	Bat	18-Oct-23	8	54	328	Grazed/Short Grass	Mexican free-tailed bat	Medium	Intact-partial decomposed	Yes
10	Bat	24-Oct-23	32	70	15	Tall Fallow Grass/Forb	Mexican free-tailed bat	Medium	Intact-partial decomposed	Yes
10	Bat	25-Oct-23	11	48	300	Tall Fallow Grass/Forb	Mexican free-tailed bat	Medium	Intact-partial decomposed	Yes
10	Bat	26-Oct-23	18	70	307	Grazed/Short Grass	Mexican free-tailed bat	Medium	Intact-partial decomposed	Yes
10	Bat	31-Oct-23	32	112	75	Tall Fallow Grass/Forb	Hoary bat	Large	Intact-partial decomposed	Yes
10	Bat	31-Oct-23	34	35	50	Bare Dirt/Disturb Soil	Mexican free-tailed bat	Medium	Scavenged-partial decomposed	Yes
10	Bat	08-Nov-23	27	120	15	Tall Fallow Grass/Forb	Mexican free-tailed bat	Medium	Intact-partial decomposed	No-Off plot
10	Bat	12-Nov-23	2	64	64	Tall Fallow Grass/Forb	Mexican free-tailed bat	Medium	Scavenged-partial decomposed	Yes
10	Bat	29-Nov-23	11	16	81	Grazed/Short Grass	Mexican free-tailed bat	Medium	Scavenged-fresh	Yes
11	Bat	05-Dec-23	31	50	131	Grazed/Short Grass	Mexican free-tailed bat	Medium	Scavenged-partial decomposed	Yes
11	Bat	07-Dec-23	15	28	288	Tall Fallow Grass/Forb	Mexican free-tailed bat	Medium	Intact-decomposed	Yes
11	Bat	08-Dec-23	30	32	217	Tall Fallow Grass/Forb	Mexican free-tailed bat	Medium	Scavenged-partial decomposed	Yes
11	Bat	11-Dec-23	24	85	95	Tall Fallow Grass/Forb	Mexican free-tailed bat	Medium	Scavenged-decomposed	Yes
11	Bat	11-Dec-23	24	91	180	Bare Dirt/Disturb Soil	Unknown bat ¹	Small	Scavenged-decomposed	Yes
11	Bat	18-Dec-23	4	70	333	Grazed/Short Grass	Mexican free-tailed bat	Medium	Scavenged-partial decomposed	Yes
11	Bat	22-Jan-24	24	109	23	Grazed/Short Grass	Hoary bat	Large	Scavenged-partial decomposed	Yes
11	Bat	28-Jan-24	25	62	183	Grazed/Short Grass	Mexican free-tailed bat	Medium	Intact-fresh	Yes
11	Bat	28-Feb-24	19	29	55	Grazed/Short Grass	Mexican free-tailed bat	Medium	Intact-fresh	Yes
11	Bat	20-Mar-24	24	111	20	Grazed/Short Grass	Mexican free-tailed bat	Medium	Intact-fresh	Yes
11	Bat	21-Mar-24	28	95	35	Grazed/Short Grass	Mexican free-tailed bat	Medium	Dismembered-partial decomposed	Yes
11	Bat	26-Mar-24	28	75	76	Grazed/Short Grass	Hoary bat	Large	Dismembered-fresh	Yes
11	Bat	01-Apr-24	25	83	66	Grazed/Short Grass	Mexican free-tailed bat	Medium	Scavenged-partial decomposed	Yes
11	Bat	03-Apr-24	12	74	345	Grazed/Short Grass	Hoary bat	Large	Intact-fresh	Yes
11	Bat	12-Apr-24	19	10	45	Bare Dirt/Disturb Soil	Mexican free-tailed bat	Medium	Intact-fresh	Yes

Year	Carcass Type	Date	Turbine ID	Distance From Turbine (meters)	Direction From Turbine (°)	Substrate	Species	Size Class	Carcass Condition	Included In Fatality Estimates?
11	Bat	15-Apr-24	4	55	354	Tall Fallow Grass/Forb	Mexican free-tailed bat	Medium	Intact-partial decomposed	Yes
11	Bat	17-Apr-24	12	39	60	Tall Fallow Grass/Forb	Hoary bat	Large	Intact-partial decomposed	Yes
11	Bat	18-Apr-24	13	17	70	Tall Fallow Grass/Forb	Mexican free-tailed bat	Medium	Intact-partial decomposed	Yes
11	Bat	18-Apr-24	13	39	340	Tall Fallow Grass/Forb	Mexican free-tailed bat ³	Medium	Injured	Yes
11	Bat	18-Apr-24	19	10	50	Bare Dirt/Disturb Soil	Mexican free-tailed bat	Medium	Intact-fresh	Yes
11	Bat	06-May-24	4	75	330	Tall Fallow Grass/Forb	Mexican free-tailed bat	Medium	Intact-partial decomposed	Yes
11	Bat	07-May-24	30	36	85	Tall Fallow Grass/Forb	Mexican free-tailed bat	Medium	Scavenged-partial decomposed	Yes
11	Bat	07-May-24	5	86	23	Tall Fallow Grass/Forb	Mexican free-tailed bat	Medium	Intact-partial decomposed	Yes
11	Bat	19-May-24	25	60	35	Tall Fallow Grass/Forb	Mexican free-tailed bat	Medium	Intact-partial decomposed	Yes
11	Bat	19-May-24	4	122	65	Tall Fallow Grass/Forb	Mexican free-tailed bat	Medium	Scavenged-partial decomposed	No-Off plot
11	Bat	24-May-24	15	92	25	Tall Fallow Grass/Forb	Mexican free-tailed bat	Medium	Intact-partial decomposed	Yes
11	Bat	24-May-24	15	92	25	Tall Fallow Grass/Forb	Mexican free-tailed bat	Medium	Scavenged-partial decomposed	Yes
11	Bat	27-May-24	12	82	45	Tall Fallow Grass/Forb	Hoary bat	Large	Intact-partial decomposed	Yes
11	Bat	27-May-24	13	78	65	Tall Fallow Grass/Forb	Mexican free-tailed bat	Medium	Intact-partial decomposed	Yes
11	Bat	28-May-24	22	123	85	Tall Fallow Grass/Forb	Mexican free-tailed bat	Medium	Scavenged-partial decomposed	No-Off plot
11	Bat	28-May-24	19	100	70	Tall Fallow Grass/Forb	Mexican free-tailed bat	Medium	Scavenged-partial decomposed	Yes
11	Bat	06-Jun-24	28	89	60	Tall Fallow Grass/Forb	Mexican free-tailed bat	Medium	Scavenged-partial decomposed	Yes
11	Bat	10-Jun-24	25	82	50	Tall Fallow Grass/Forb	Mexican free-tailed bat	Medium	Intact-partial decomposed	Yes
11	Bat	10-Jun-24	25	87	2	Tall Fallow Grass/Forb	<i>Myotis</i> sp. ²	Unknown	Scavenged-partial decomposed	Yes
11	Bat	13-Jun-24	12	41	5	Grazed/Short Grass	Mexican free-tailed bat	Medium	Intact-partial decomposed	Yes
11	Bat	13-Jun-24	13	100	46	Bare Dirt/Disturb Soil	Hoary bat	Large	Scavenged-partial decomposed	Yes
11	Bat	13-Jun-24	13	58	300	Tall Fallow Grass/Forb	Hoary bat	Large	Scavenged-partial decomposed	Yes
11	Bat	13-Jun-24	16	96	48	Grazed/Short Grass	Mexican free-tailed bat	Medium	Scavenged-decomposed	Yes
11	Bat	13-Jun-24	16	85	48	Tall Fallow Grass/Forb	Hoary bat	Large	Intact-partial decomposed	Yes
11	Bat	17-Jun-24	24	78	62	Grazed/Short Grass	Mexican free-tailed bat	Medium	Intact-fresh	Yes
11	Bat	26-Jun-24	12	70	40	Tall Fallow Grass/Forb	Mexican free-tailed bat	Medium	Intact-partial decomposed	Yes
11	Bat	04-Jul-24	22	122	51	Tall Fallow Grass/Forb	Hoary bat	Large	Scavenged-decomposed	No-Off plot
11	Bat	11-Jul-24	12	80	336	Tall Fallow Grass/Forb	Hoary bat	Large	Scavenged-decomposed	Yes
11	Bat	11-Jul-24	12	127	42	Tall Fallow Grass/Forb	Mexican free-tailed bat	Medium	Intact-partial decomposed	No-Off plot
11	Bat	15-Jul-24	24	93	59	Tall Fallow Grass/Forb	Hoary bat	Large	Dismembered-partial decomposed	Yes
11	Bat	15-Jul-24	25	82	42	Tall Fallow Grass/Forb	Mexican free-tailed bat	Medium	Dismembered-partial decomposed	Yes
11	Bat	15-Jul-24	25	111	24	Tall Fallow Grass/Forb	Mexican free-tailed bat	Medium	Intact-fresh	Yes
11	Bat	22-Jul-24	28	119	20	Bare Dirt/Disturb Soil	Mexican free-tailed bat	Medium	Intact-fresh	No-Off plot
11	Bat	22-Jul-24	25	52	34	Tall Fallow Grass/Forb	Yuma myotis	Small	Scavenged-decomposed	Yes
11	Bat	22-Jul-24	25	118	65	Tall Fallow Grass/Forb	Mexican free-tailed bat	Medium	Intact-partial decomposed	No-Off plot
11	Bat	22-Jul-24	24	12	48	Turbine pad	Mexican free-tailed bat	Medium	Scavenged-partial decomposed	Yes

Year	Carcass Type	Date	Turbine ID	Distance From Turbine (meters)	Direction From Turbine (°)	Substrate	Species	Size Class	Carcass Condition	Included In Fatality Estimates?
11	Bat	24-Jul-24	6	96	28	Grazed/Short Grass	Hoary bat	Large	Intact-fresh	Yes
11	Bat	25-Jul-24	22	108	28	Tall Fallow Grass/Forb	Mexican free-tailed bat	Medium	Scavenged-partial decomposed	Yes
11	Bat	29-Jul-24	4	92	53	Road	Mexican free-tailed bat	Medium	Scavenged-partial decomposed	Yes
11	Bat	01-Aug-24	5	79	337	Tall Fallow Grass/Forb	Mexican free-tailed bat	Medium	Dismembered-fresh	Yes
11	Bat	07-Aug-24	25	56	67	Grazed/Short Grass	Mexican free-tailed bat	Medium	Intact-partial decomposed	Yes
11	Bat	07-Aug-24	25	56	52	Grazed/Short Grass	Mexican free-tailed bat	Medium	Intact-partial decomposed	Yes
11	Bat	08-Aug-24	22	120	80	Tall Fallow Grass/Forb	Mexican free-tailed bat	Medium	Scavenged-decomposed	No-Off plot
11	Bat	08-Aug-24	22	130	30	Tall Fallow Grass/Forb	Mexican free-tailed bat	Medium	Scavenged-partial decomposed	No-Off plot
11	Bat	09-Aug-24	8	87	10	Tall Fallow Grass/Forb	Mexican free-tailed bat	Medium	Dismembered-partial decomposed	No-28-day bat/small bird
11	Bat	12-Aug-24	24	112	44	Tall Fallow Grass/Forb	Mexican free-tailed bat	Medium	Intact-partial decomposed	Yes
11	Bat	19-Aug-24	25	40	42	Grazed/Short Grass	Hoary bat	Large	Intact-partial decomposed	Yes
11	Bat	19-Aug-24	28	94	61	Tall Fallow Grass/Forb	Mexican free-tailed bat	Medium	Scavenged-decomposed	Yes
11	Bat	22-Aug-24	5	83	318	Tall Fallow Grass/Forb	Hoary bat	Large	Intact-partial decomposed	Yes
11	Bat	29-Aug-24	13	6	45	Road	Mexican free-tailed bat	Medium	Intact-partial decomposed	Yes
11	Bat	29-Aug-24	13	70	65	Tall Fallow Grass/Forb	Mexican free-tailed bat	Medium	Intact-partial decomposed	Yes
11	Bat	29-Aug-24	12	54	2	Tall Fallow Grass/Forb	Mexican free-tailed bat	Medium	Intact-partial decomposed	Yes
11	Bat	29-Aug-24	7	109	15	Tall Fallow Grass/Forb	Hoary bat	Large	Scavenged-partial decomposed	Yes
11	Bat	29-Aug-24	5	35	340	Tall Fallow Grass/Forb	Mexican free-tailed bat	Medium	Scavenged-partial decomposed	Yes
11	Bat	30-Aug-24	19	59	12	Grazed/Short Grass	Western red bat	Medium	Intact-fresh	Yes
11	Bat	30-Aug-24	19	41	88	Bare Dirt/Disturb Soil	Mexican free-tailed bat	Medium	Scavenged-decomposed	Yes
11	Bat	02-Sep-24	24	37	15	Tall Fallow Grass/Forb	Mexican free-tailed bat	Medium	Intact-partial decomposed	Yes
11	Bat	02-Sep-24	24	36	60	Tall Fallow Grass/Forb	Mexican free-tailed bat	Medium	Intact-partial decomposed	Yes
11	Bat	02-Sep-24	12	39	320	Tall Fallow Grass/Forb	Hoary bat	Large	Scavenged-partial decomposed	Yes
11	Bat	02-Sep-24	12	119	20	Tall Fallow Grass/Forb	Mexican free-tailed bat	Medium	Scavenged-decomposed	No-Off plot
11	Bat	02-Sep-24	13	32	282	Tall Fallow Grass/Forb	Mexican free-tailed bat	Medium	Scavenged-partial decomposed	Yes
11	Bat	02-Sep-24	4	86	28	Tall Fallow Grass/Forb	Hoary bat	Large	Scavenged-partial decomposed	Yes
11	Bat	05-Sep-24	22	69	359	Tall Fallow Grass/Forb	Mexican free-tailed bat	Medium	Intact-partial decomposed	Yes
11	Bat	09-Sep-24	24	59	7	Tall Fallow Grass/Forb	Mexican free-tailed bat	Medium	Scavenged-partial decomposed	Yes
11	Bat	09-Sep-24	25	32	10	Tall Fallow Grass/Forb	Mexican free-tailed bat	Medium	Scavenged-partial decomposed	Yes
11	Bat	09-Sep-24	4	71	28	Tall Fallow Grass/Forb	Mexican free-tailed bat	Medium	Intact-partial decomposed	Yes
11	Bat	11-Sep-24	5	86	20	Tall Fallow Grass/Forb	Mexican free-tailed bat	Medium	Intact-partial decomposed	Yes
11	Bat	11-Sep-24	30	117	70	Tall Fallow Grass/Forb	Silver-haired bat	Medium	Intact-partial decomposed	No-Off plot
11	Bat	11-Sep-24	30	119	65	Grazed/Short Grass	Mexican free-tailed bat	Medium	Intact-fresh	No-Off plot
11	Bat	14-Sep-24	16	38	68	Tall Fallow Grass/Forb	Mexican free-tailed bat	Medium	Scavenged-partial decomposed	Yes
11	Bat	18-Sep-24	12	22	335	Grazed/Short Grass	Mexican free-tailed bat	Medium	Intact-partial decomposed	Yes

Year	Carcass Type	Date	Turbine ID	Distance From Turbine (meters)	Direction From Turbine (°)	Substrate	Species	Size Class	Carcass Condition	Included In Fatality Estimates?
11	Bat	24-Sep-24	28	66	24	Tall Fallow Grass/Forb	Mexican free-tailed bat	Medium	Intact-partial decomposed	Yes
11	Bat	27-Sep-24	13	35	340	Tall Fallow Grass/Forb	Mexican free-tailed bat	Medium	Intact-partial decomposed	Yes
11	Bat	27-Sep-24	13	105	8	Tall Fallow Grass/Forb	Mexican free-tailed bat	Medium	Scavenged-partial decomposed	Yes
11	Bat	28-Sep-24	16	65	320	Tall Fallow Grass/Forb	Hoary bat	Large	Scavenged-partial decomposed	Yes
11	Bat	28-Sep-24	19	89	86	Tall Fallow Grass/Forb	Hoary bat	Large	Scavenged-partial decomposed	Yes
11	Bat	30-Sep-24	24	28	52	Tall Fallow Grass/Forb	Mexican free-tailed bat	Medium	Scavenged-partial decomposed	Yes
11	Bat	30-Sep-24	24	27	52	Tall Fallow Grass/Forb	Mexican free-tailed bat	Medium	Scavenged-partial decomposed	Yes
11	Bat	30-Sep-24	25	64	340	Tall Fallow Grass/Forb	Mexican free-tailed bat	Medium	Intact-partial decomposed	Yes
11	Bat	30-Sep-24	28	135	40	Tall Fallow Grass/Forb	Mexican free-tailed bat	Medium	Scavenged-decomposed	No-Off plot
11	Bat	07-Oct-24	24	75	348	Tall Fallow Grass/Forb	Mexican free-tailed bat	Medium	Intact-partial decomposed	Yes
11	Bat	07-Oct-24	25	120	52	Tall Fallow Grass/Forb	Mexican free-tailed bat	Medium	Scavenged-partial decomposed	No-Off plot
11	Bat	08-Oct-24	31	54	340	Tall Fallow Grass/Forb	Mexican free-tailed bat	Medium	Dismembered-partial decomposed	Yes
11	Bat	10-Oct-24	12	50	11	Tall Fallow Grass/Forb	Hoary bat	Large	Scavenged-decomposed	Yes
11	Bat	10-Oct-24	12	120	55	Tall Fallow Grass/Forb	Mexican free-tailed bat	Medium	Intact-partial decomposed	No-Off plot
11	Bat	10-Oct-24	13	62	295	Tall Fallow Grass/Forb	Mexican free-tailed bat	Medium	Scavenged-partial decomposed	Yes
11	Bat	10-Oct-24	5	46	70	Tall Fallow Grass/Forb	Hoary bat	Large	Scavenged-partial decomposed	Yes
11	Bat	10-Oct-24	6	117	18	Grazed/Short Grass	Mexican free-tailed bat	Medium	Scavenged-partial decomposed	No-Off plot
11	Bat	21-Oct-24	28	108	37	Tall Fallow Grass/Forb	Hoary bat	Large	Scavenged-decomposed	Yes
11	Bat	21-Oct-24	28	51	71	Tall Fallow Grass/Forb	Mexican free-tailed bat	Medium	Scavenged-decomposed	Yes
11	Bat	30-Oct-24	33	12	6	Grazed/Short Grass	Mexican free-tailed bat	Unknown	Scavenged-decomposed	Yes
11	Bat	30-Oct-24	33	53	320	Tall Fallow Grass/Forb	Mexican free-tailed bat	Medium	Scavenged-partial decomposed	Yes
11	Bat	30-Oct-24	28	12	81	Grazed/Short Grass	Mexican free-tailed bat	Unknown	Scavenged-partial decomposed	Yes
11	Bat	31-Oct-24	7	62	330	Tall Fallow Grass/Forb	Mexican free-tailed bat	Medium	Scavenged-partial decomposed	Yes
11	Bat	04-Nov-24	24	90	48	Tall Fallow Grass/Forb	Mexican free-tailed bat	Medium	Scavenged-partial decomposed	Yes
11	Bat	06-Nov-24	33	119	58	Tall Fallow Grass/Forb	Mexican free-tailed bat	Medium	Intact-partial decomposed	No-Off plot
11	Bat	07-Nov-24	12	135	56	Grazed/Short Grass	Mexican free-tailed bat	Medium	Scavenged-partial decomposed	No-Off plot
11	Bat	21-Nov-24	13	32	72	Tall Fallow Grass/Forb	Hoary bat	Large	Intact-partial decomposed	Yes
10	Bird	30-Nov-22	33	15	275	Grazed/Short Grass	Red-tailed Hawk	Large	Scavenged-fresh	Yes
10	Bird	06-Dec-22	11	95	13	Grazed/Short Grass	Unknown large bird	Large	Scavenged-decomposed	No-Aged out
10	Bird	06-Dec-22	11	80	252	Grazed/Short Grass	Unknown medium bird	Medium	Scavenged-feather spot	Yes
10	Bird	08-Dec-22	20	89	113	Grazed/Short Grass	Horned Lark	Small	Scavenged-feather spot	Yes
10	Bird	09-Dec-22	7	50	113	Grazed/Short Grass	Red-tailed Hawk	Large	Scavenged-feather spot	No-Aged out
10	Bird	15-Dec-22	28	26	93	Grazed/Short Grass	Unknown large bird	Large	Scavenged-decomposed	No-Aged out
10	Bird	26-Dec-22	23	29	30	Grazed/Short Grass	Turkey Vulture	Large	Intact-fresh	Yes
10	Bird	03-Jan-23	2	60	307	Grazed/Short Grass	Unknown large bird	Large	Scavenged-decomposed	No-Aged out

Year	Carcass Type	Date	Turbine ID	Distance From Turbine (meters)	Direction From Turbine (°)	Substrate	Species	Size Class	Carcass Condition	Included In Fatality Estimates?
10	Bird	10-Jan-23	32	70	259	Grazed/Short Grass	Horned Lark	Small	Scavenged-partial decomposed	Yes
10	Bird	16-Jan-23	30	90	100	Grazed/Short Grass	Unknown buteo	Large	Scavenged-decomposed	No-Aged out
10	Bird	01-Feb-23	8	55	243	Grazed/Short Grass	Unknown large bird	Large	Scavenged-decomposed	No-Aged out
10	Bird	02-Feb-23	31	10	40	Bare Dirt/Disturb Soil	Golden Eagle	Large	Dismembered-fresh	Yes
10	Bird	07-Feb-23	32	74	192	Grazed/Short Grass	Loggerhead Shrike	Small	Scavenged-feather spot	Yes
10	Bird	08-Feb-23	11	80	125	Grazed/Short Grass	Unknown gull	Large	Scavenged-decomposed	No-Aged out
10	Bird	08-Feb-23	9	61	182	Grazed/Short Grass	Ruby-crowned Kinglet	Small	Intact-partial decomposed	Yes
10	Bird	08-Feb-23	26	66	260	Grazed/Short Grass	Western Meadowlark	Small	Scavenged-feather spot	Yes
10	Bird	13-Feb-23	21	90	184	Grazed/Short Grass	Horned Lark	Small	Scavenged-feather spot	Yes
10	Bird	16-Feb-23	17	134	248	Grazed/Short Grass	Mourning Dove	Medium	Scavenged-feather spot	No-Off plot
10	Bird	20-Feb-23	21	70	101	Grazed/Short Grass	Unknown large bird	Large	Scavenged-decomposed	No-Aged out
10	Bird	22-Feb-23	25	117	10	Grazed/Short Grass	Unknown large bird	Large	Scavenged-decomposed	No-Off plot
10	Bird	22-Feb-23	25	89	40	Grazed/Short Grass	Mourning Dove	Medium	Scavenged-feather spot	Yes
10	Bird	22-Feb-23	25	43	90	Grazed/Short Grass	Unknown large bird	Large	Scavenged-decomposed	No-Aged out
10	Bird	23-Feb-23	8	100	25	Grazed/Short Grass	Mourning Dove	Medium	Scavenged-feather spot	Yes
10	Bird	01-Mar-23	10	75	317	Grazed/Short Grass	Burrowing Owl	Medium	Scavenged-feather spot	Yes
10	Bird	01-Mar-23	9	57	84	Grazed/Short Grass	American Kestrel	Medium	Scavenged-partial decomposed	Yes
10	Bird	02-Mar-23	14	110	90	Grazed/Short Grass	Western Meadowlark	Small	Scavenged-feather spot	Yes
10	Bird	06-Mar-23	2	57	277	Grazed/Short Grass	Unknown small bird	Small	Scavenged-decomposed	No-Aged out
10	Bird	08-Mar-23	8	62	355	Grazed/Short Grass	Burrowing Owl	Medium	Scavenged-feather spot	Yes
10	Bird	09-Mar-23	28	93	88	Grazed/Short Grass	Golden Eagle	Large	Dismembered-fresh	Yes
10	Bird	13-Mar-23	21	97	230	Grazed/Short Grass	Burrowing Owl	Medium	Scavenged-feather spot	Yes
10	Bird	23-Mar-23	1	69	111	Grazed/Short Grass	Unknown medium bird	Medium	Scavenged-decomposed	No-Aged out
10	Bird	26-Apr-23	17	10	117	Grazed/Short Grass	Horned Lark	Small	Scavenged-partial decomposed	Yes
10	Bird	27-Apr-23	10	107	73	Grazed/Short Grass	Western Meadowlark	Small	Scavenged-partial decomposed	Yes
10	Bird	03-May-23	29	46	157	Tall Fallow Grass/Forb	Wilson's Warbler	Small	Dismembered-partial decomposed	Yes
10	Bird	03-May-23	29	81	72	Tall Fallow Grass/Forb	White-crowned Sparrow	Small	Intact-partial decomposed	Yes
10	Bird	05-May-23	26	18	57	Grazed/Short Grass	Black-throated Gray Warbler	Small	Scavenged-partial decomposed	Yes
10	Bird	09-May-23	34	34	300	Bare Dirt/Disturb Soil	Horned Lark	Small	Intact-partial decomposed	No-Non-flighted juvenile
10	Bird	15-May-23	3	42	24	Road	Vaux's Swift	Small	Scavenged-partial decomposed	Yes
10	Bird	15-May-23	3	23	350	Grazed/Short Grass	Vaux's Swift	Small	Intact-partial decomposed	Yes
10	Bird	19-May-23	26	71	56	Tall Fallow Grass/Forb	Vaux's Swift	Small	Intact-partial decomposed	Yes
10	Bird	22-May-23	2	97	67	Grazed/Short Grass	Wilson's Warbler	Small	Scavenged-partial decomposed	Yes
10	Bird	23-May-23	29	47	350	Grazed/Short Grass	Wilson's Warbler	Small	Scavenged-partial decomposed	Yes
10	Bird	25-May-23	18	119	55	Grazed/Short Grass	Wilson's Warbler	Small	Scavenged-partial decomposed	No-Off plot

Year	Carcass Type	Date	Turbine ID	Distance From Turbine (meters)	Direction From Turbine (°)	Substrate	Species	Size Class	Carcass Condition	Included In Fatality Estimates?
10	Bird	29-May-23	3	50	20	Bare Dirt/Disturb Soil	Horned Lark	Small	Intact-partial decomposed	Yes
10	Bird	30-May-23	29	70	140	Tall Fallow Grass/Forb	Hermit Warbler	Small	Scavenged-partial decomposed	Yes
10	Bird	01-Jun-23	17	63	62	Tall Fallow Grass/Forb	Unknown small bird	Small	Scavenged-feather spot	Yes
10	Bird	08-Jun-23	26	35	310	Grazed/Short Grass	American Kestrel	Medium	Scavenged-feather spot	Yes
10	Bird	20-Jun-23	32	65	22	Tall Fallow Grass/Forb	American Kestrel	Medium	Intact-partial decomposed	Yes
10	Bird	27-Jun-23	34	2	309	Turbine pad	Mourning Dove	Medium	Intact-fresh	Yes
10	Bird	01-Jul-23	30	108	110	Tall Fallow Grass/Forb	Golden Eagle	Large	Scavenged-partial decomposed	Yes
10	Bird	12-Jul-23	8	106	26	Grazed/Short Grass	Western Meadowlark	Small	Intact-partial decomposed	Yes
10	Bird	24-Jul-23	21	110	26	Tall Fallow Grass/Forb	Western Tanager	Small	Intact-fresh	Yes
10	Bird	31-Jul-23	3	116	12	Tall Fallow Grass/Forb	Blue-gray Gnatcatcher	Small	Scavenged-partial decomposed	No-Off plot
10	Bird	04-Aug-23	20	125	24	Tall Fallow Grass/Forb	Horned Lark	Small	Scavenged-feather spot	No-Off plot
10	Bird	14-Aug-23	3	98	37	Grazed/Short Grass	Black-throated Gray Warbler	Small	Intact-partial decomposed	Yes
10	Bird	17-Aug-23	17	39	77	Road	Horned Lark	Small	Intact-partial decomposed	Yes
10	Bird	17-Aug-23	17	12	110	Grazed/Short Grass	Horned Lark	Small	Intact-partial decomposed	Yes
10	Bird	24-Aug-23	3	70	17	Grazed/Short Grass	Warbling Vireo	Small	Intact-partial decomposed	Yes
10	Bird	26-Aug-23	11	34	318	Grazed/Short Grass	Vaux's Swift	Small	Scavenged-feather spot	Yes
10	Bird	01-Sep-23	20	55	18	Tall Fallow Grass/Forb	White-throated Swift	Small	Intact-partial decomposed	Yes
10	Bird	05-Sep-23	27	95	80	Bare Dirt/Disturb Soil	Unknown small bird	Small	Scavenged-fresh	Yes
10	Bird	05-Sep-23	34	52	15	Grazed/Short Grass	Unknown warbler	Small	Scavenged-partial decomposed	Yes
10	Bird	07-Sep-23	14	54	115	Grazed/Short Grass	Unknown swift	Small	Scavenged-feather spot	Yes
10	Bird	11-Sep-23	7	85	230	Bare Dirt/Disturb Soil	Unknown small bird	Small	Scavenged-feather spot	No-28-day bat/small bird
10	Bird	11-Sep-23	13	11	75	Bare Dirt/Disturb Soil	Unknown small bird	Small	Scavenged-partial decomposed	No-28-day bat/small bird
10	Bird	12-Sep-23	3	93	347	Grazed/Short Grass	Unknown small bird	Small	Scavenged-fresh	Yes
10	Bird	13-Sep-23	32	109	330	Tall Fallow Grass/Forb	Mourning Dove	Medium	Dismembered-partial decomposed	Yes
10	Bird	13-Sep-23	29	21	46	Grazed/Short Grass	Western Meadowlark	Small	Scavenged-feather spot	Yes
10	Bird	25-Sep-23	2	53	26	Tall Fallow Grass/Forb	Red-breasted Nuthatch	Small	Scavenged-partial decomposed	Yes
10	Bird	25-Sep-23	21	78	66	Grazed/Short Grass	Unknown small bird	Small	Scavenged-feather spot	Yes
10	Bird	27-Sep-23	10	68	35	Tall Fallow Grass/Forb	Red-breasted Nuthatch	Small	Intact-partial decomposed	Yes
10	Bird	04-Oct-23	11	50	344	Tall Fallow Grass/Forb	Unknown small bird	Small	Scavenged-partial decomposed	Yes
10	Bird	06-Oct-23	17	114	270	Tall Fallow Grass/Forb	Red-winged Blackbird	Small	Scavenged-feather spot	Yes
10	Bird	06-Oct-23	18	92	305	Grazed/Short Grass	Western Tanager	Small	Scavenged-feather spot	Yes
10	Bird	07-Oct-23	20	113	60	Tall Fallow Grass/Forb	Common Raven	Large	Scavenged-feather spot	Yes
10	Bird	16-Oct-23	23	111	60	Grazed/Short Grass	Unknown small bird	Small	Scavenged-partial decomposed	Yes
10	Bird	19-Oct-23	14	1	190	Turbine pad	Western Meadowlark	Small	Injured	Yes

Year	Carcass Type	Date	Turbine ID	Distance From Turbine (meters)	Direction From Turbine (°)	Substrate	Species	Size Class	Carcass Condition	Included In Fatality Estimates?
10	Bird	24-Oct-23	29	60	113	Tall Fallow Grass/Forb	White-throated Swift	Small	Scavenged-feather spot	Yes
10	Bird	26-Oct-23	15	42	290	Tall Fallow Grass/Forb	Golden Eagle	Large	Scavenged-decomposed	Yes
10	Bird	26-Oct-23	20	69	43	Grazed/Short Grass	White-throated Swift	Small	Intact-partial decomposed	Yes
10	Bird	31-Oct-23	29	22	45	Tall Fallow Grass/Forb	Western Meadowlark	Small	Scavenged-feather spot	Yes
10	Bird	02-Nov-23	20	30	70	Tall Fallow Grass/Forb	Horned Lark	Small	Intact-fresh	Yes
10	Bird	08-Nov-23	6	95	156	Bare Dirt/Disturb Soil	American Kestrel	Medium	Scavenged-feather spot	Yes
10	Bird	09-Nov-23	20	74	100	Tall Fallow Grass/Forb	Horned Lark	Small	Scavenged-feather spot	Yes
10	Bird	15-Nov-23	34	46	225	Tall Fallow Grass/Forb	White-throated Swift	Small	Scavenged-feather spot	Yes
10	Bird	25-Nov-23	26	21	255	Grazed/Short Grass	White-throated Swift	Small	Scavenged-feather spot	Yes
11	Bird	08-Dec-23	22	65	255	Tall Fallow Grass/Forb	European Starling	Small	Scavenged-partial decomposed	Yes
11	Bird	08-Dec-23	30	47	136	Tall Fallow Grass/Forb	White-throated Swift	Small	Scavenged-partial decomposed	Yes
11	Bird	13-Dec-23	6	62	168	Road	Snow Goose	Large	Dismembered-fresh	Yes
11	Bird	05-Jan-24	16	20	45	Grazed/Short Grass	Western Meadowlark	Small	Dismembered-fresh	Yes
11	Bird	15-Jan-24	24	69	340	Grazed/Short Grass	Lesser Goldfinch	Small	Scavenged-partial decomposed	Yes
11	Bird	17-Jan-24	14	85	180	Tall Fallow Grass/Forb	Turkey Vulture	Large	Dismembered-partial decomposed	Yes
11	Bird	05-Mar-24	4	30	237	Grazed/Short Grass	European Starling	Small	Scavenged-partial decomposed	Yes
11	Bird	12-Mar-24	31	89	125	Grazed/Short Grass	Unknown swift	Small	Scavenged-feather spot	Yes
11	Bird	15-Mar-24	34	114	230	Grazed/Short Grass	Golden Eagle	Large	Dismembered-partial decomposed	Yes
11	Bird	21-Mar-24	30	60	50	Grazed/Short Grass	Dark-eyed Junco	Small	Scavenged-feather spot	Yes
11	Bird	22-Mar-24	6	95	330	Grazed/Short Grass	Red-tailed Hawk	Large	Dismembered-fresh	Yes
11	Bird	02-Apr-24	31	35	277	Grazed/Short Grass	Turkey Vulture	Large	Dismembered-partial decomposed	Yes
11	Bird	04-Apr-24	15	44	33	Grazed/Short Grass	Unknown flycatcher	Small	Dismembered-fresh	Yes
11	Bird	02-May-24	6	69	8	Tall Fallow Grass/Forb	Unknown flycatcher	Small	Intact-partial decomposed	Yes
11	Bird	06-May-24	4	85	36	Tall Fallow Grass/Forb	Unknown small bird	Small	Scavenged-feather spot	Yes
11	Bird	08-May-24	16	46	54	Tall Fallow Grass/Forb	Red-tailed Hawk	Large	Dismembered-partial decomposed	Yes
11	Bird	14-May-24	30	92	5	Tall Fallow Grass/Forb	Unknown small bird	Small	Scavenged-feather spot	Yes
11	Bird	19-May-24	24	22	135	Tall Fallow Grass/Forb	White-throated Swift	Small	Intact-partial decomposed	Yes
11	Bird	22-May-24	8	98	30	Grazed/Short Grass	Rock Pigeon	Medium	Scavenged-partial decomposed	Yes
11	Bird	28-May-24	22	118	80	Tall Fallow Grass/Forb	Unknown flycatcher	Small	Scavenged-partial decomposed	No-Off plot
11	Bird	28-May-24	22	100	50	Tall Fallow Grass/Forb	Unknown small bird	Small	Scavenged-partial decomposed	Yes
11	Bird	28-May-24	6	20	180	Tall Fallow Grass/Forb	Horned Lark	Small	Intact-partial decomposed	Yes
11	Bird	05-Jun-24	12	45	325	Tall Fallow Grass/Forb	Horned Lark	Small	Scavenged-partial decomposed	Yes
11	Bird	05-Jun-24	5	85	55	Tall Fallow Grass/Forb	Unknown small bird	Small	Scavenged-feather spot	Yes
11	Bird	08-Jun-24	22	113	30	Tall Fallow Grass/Forb	Wilson's Warbler	Small	Scavenged-partial decomposed	Yes
11	Bird	01-Jul-24	1	77	31	Tall Fallow Grass/Forb	Turkey Vulture	Large	Intact-fresh	Yes
11	Bird	09-Jul-24	21	37	117	Tall Fallow Grass/Forb	Red-tailed Hawk	Large	Dismembered-partial decomposed	Yes

Year	Carcass Type	Date	Turbine ID	Distance From Turbine (meters)	Direction From Turbine (°)	Substrate	Species	Size Class	Carcass Condition	Included In Fatality Estimates?
11	Bird	15-Jul-24	24	111	240	Grazed/Short Grass	Western Meadowlark	Small	Scavenged-partial decomposed	Yes
11	Bird	22-Jul-24	24	50	260	Grazed/Short Grass	Western Meadowlark	Small	Intact-partial decomposed	Yes
11	Bird	29-Jul-24	24	42	15	Tall Fallow Grass/Forb	White-throated Swift	Small	Dismembered-partial decomposed	Yes
11	Bird	29-Jul-24	25	83	111	Tall Fallow Grass/Forb	Golden Eagle	Large	Intact-partial decomposed	Yes
11	Bird	08-Aug-24	15	100	22	Tall Fallow Grass/Forb	Unknown small bird	Small	Scavenged-partial decomposed	Yes
11	Bird	08-Aug-24	19	89	76	Tall Fallow Grass/Forb	Unknown small bird	Small	Scavenged-feather spot	Yes
11	Bird	08-Aug-24	19	68	49	Tall Fallow Grass/Forb	Western Meadowlark	Small	Scavenged-feather spot	Yes
11	Bird	09-Aug-24	9	15	355	Tall Fallow Grass/Forb	Swainson's Hawk	Large	Intact-partial decomposed	Yes
11	Bird	26-Aug-24	1	102	38	Tall Fallow Grass/Forb	Unknown flycatcher	Small	Intact-partial decomposed	Yes
11	Bird	29-Aug-24	6	71	112	Grazed/Short Grass	Unknown swift	Small	Scavenged-decomposed	Yes
11	Bird	02-Sep-24	24	47	19	Tall Fallow Grass/Forb	White-throated Swift	Small	Scavenged-partial decomposed	Yes
11	Bird	02-Sep-24	12	63	320	Tall Fallow Grass/Forb	Red-tailed Hawk	Large	Dismembered-partial decomposed	Yes
11	Bird	02-Sep-24	1	24	3	Tall Fallow Grass/Forb	Unknown small bird	Small	Scavenged-feather spot	Yes
11	Bird	02-Sep-24	4	96	300	Tall Fallow Grass/Forb	Turkey Vulture	Large	Intact-partial decomposed	Yes
11	Bird	05-Sep-24	22	100	53	Tall Fallow Grass/Forb	Black-throated Gray Warbler	Small	Scavenged-partial decomposed	Yes
11	Bird	09-Sep-24	1	83	350	Tall Fallow Grass/Forb	Yellow Warbler	Small	Scavenged-partial decomposed	Yes
11	Bird	17-Sep-24	27	113	120	Tall Fallow Grass/Forb	Red-tailed Hawk	Large	Dismembered-partial decomposed	Yes
11	Bird	17-Sep-24	28	53	1	Grazed/Short Grass	Red-tailed Hawk	Large	Intact-fresh	Yes
11	Bird	18-Sep-24	13	19	223	Grazed/Short Grass	White-throated Swift	Small	Scavenged-feather spot	Yes
11	Bird	23-Sep-24	25	128	331	Tall Fallow Grass/Forb	Red-tailed Hawk	Large	Dismembered-partial decomposed	No-Off plot
11	Bird	25-Sep-24	3	105	20	Grazed/Short Grass	Golden-crowned Sparrow	Small	Intact-fresh	No-28-day bat/small bird
11	Bird	25-Sep-24	3	33	260	Grazed/Short Grass	American Kestrel	Medium	Intact-fresh	Yes
11	Bird	27-Sep-24	7	14	40	Tall Fallow Grass/Forb	Red-tailed Hawk	Large	Dismembered-partial decomposed	Yes
11	Bird	28-Sep-24	22	74	63	Grazed/Short Grass	Red-tailed Hawk	Large	Intact-partial decomposed	Yes
11	Bird	01-Oct-24	8	57	200	Grazed/Short Grass	Western Meadowlark	Small	Scavenged-feather spot	No-28-day bat/small bird
11	Bird	01-Oct-24	9	67	300	Grazed/Short Grass	Unknown gull	Large	Scavenged-feather spot	Yes
11	Bird	03-Oct-24	15	12	215	Tall Fallow Grass/Forb	Western Meadowlark	Small	Scavenged-feather spot	Yes
11	Bird	03-Oct-24	15	102	83	Tall Fallow Grass/Forb	Western Meadowlark	Small	Scavenged-feather spot	Yes
11	Bird	07-Oct-24	20	41	240	Grazed/Short Grass	Western Meadowlark	Small	Scavenged-fresh	No-28-day bat/small bird
11	Bird	09-Oct-24	18	40	180	Tall Fallow Grass/Forb	American Kestrel	Medium	Scavenged-feather spot	Yes
11	Bird	12-Oct-24	16	101	359	Tall Fallow Grass/Forb	Unknown small bird	Small	Scavenged-feather spot	Yes
11	Bird	14-Oct-24	33	29	237	Tall Fallow Grass/Forb	European Starling	Small	Scavenged-partial decomposed	Yes
11	Bird	14-Oct-24	28	61	58	Tall Fallow Grass/Forb	Ruby-crowned Kinglet	Small	Scavenged-feather spot	Yes

Year	Carcass Type	Date	Turbine ID	Distance From Turbine (meters)	Direction From Turbine (°)	Substrate	Species	Size Class	Carcass Condition	Included In Fatality Estimates?
11	Bird	15-Oct-24	12	75	70	Tall Fallow Grass/Forb	Dark-eyed Junco	Small	Scavenged-feather spot	Yes
11	Bird	17-Oct-24	19	30	50	Grazed/Short Grass	Western Meadowlark	Small	Scavenged-feather spot	Yes
11	Bird	21-Oct-24	1	110	217	Tall Fallow Grass/Forb	American Kestrel	Medium	Scavenged-partial decomposed	Yes
11	Bird	21-Oct-24	2	15	160	Grazed/Short Grass	American Kestrel	Medium	Scavenged-feather spot	Yes
11	Bird	22-Oct-24	4	127	107	Grazed/Short Grass	Eurasian Collared-Dove	Medium	Scavenged-feather spot	No-Off plot
11	Bird	24-Oct-24	32	105	260	Tall Fallow Grass/Forb	Red-tailed Hawk	Large	Injured	Yes
11	Bird	29-Oct-24	8	40	40	Tall Fallow Grass/Forb	Red-tailed Hawk	Large	Scavenged-feather spot	Yes
11	Bird	30-Oct-24	33	71	86	Road	Red-tailed Hawk	Large	Intact-fresh	Yes
11	Bird	30-Oct-24	33	71	162	Tall Fallow Grass/Forb	Red-tailed Hawk	Large	Intact-fresh	Yes
11	Bird	02-Nov-24	19	110	110	Tall Fallow Grass/Forb	Unknown small bird	Small	Scavenged-feather spot	Yes
11	Bird	05-Nov-24	18	109	190	Tall Fallow Grass/Forb	Red-tailed Hawk	Large	Scavenged-feather spot	Yes
11	Bird	05-Nov-24	28	178	314	Tall Fallow Grass/Forb	Red-tailed Hawk	Large	Scavenged-feather spot	No-Off plot
11	Bird	06-Nov-24	26	123	280	Grazed/Short Grass	American Kestrel	Medium	Scavenged-feather spot	No-Off plot
11	Bird	08-Nov-24	16	31	41	Tall Fallow Grass/Forb	Horned Lark	Small	Scavenged-feather spot	Yes
11	Bird	13-Nov-24	7	92	55	Tall Fallow Grass/Forb	Western Meadowlark	Small	Scavenged-feather spot	Yes
11	Bird	26-Nov-24	33	92	310	Tall Fallow Grass/Forb	Western Meadowlark	Small	Scavenged-feather spot	Yes

¹ Genetic analysis was unable to confirm ID.

² Genetic analysis was unable to resolve species; either *M. lucifugus*, *evotis*, or *thysanodes*.

³ No tissue samples collected.

Appendix D. Data Recorded for Documented Fatalities

1. A unique incident number composed of the year, month, date, and a sequential fatality number for that day; e.g., the third specimen found on October 11, 2023, would be #20231011-03.
2. Date and time found.
3. Identification number of closest operational (fully functioning/intact) turbine (presumed to be the focal turbine if during a standard fatality search).
4. GPS coordinates of the carcass, using the Universal Transverse Mercator (UTM), North American Datum 1983 (NAD83) coordinate system, accurate to $\pm 3\text{--}4$ m.
5. Distance (m) and direction (degrees) of the carcass from the nearest operational turbine.
6. If closer to the carcass than the nearest turbine, distance (m) and direction (degrees) from other nearby structure that could pose a fatality or injury risk for bats or birds.
7. Description of other nearest non-turbine structure, if relevant.
8. Categorical description of substrate on which carcass was found, determined at the scale of approximately a few square meters centered on the carcass: turbine pad, road, bare dirt/disturbed soil, grazed/short grass, or tall fallow grass/forb.
9. Species or closest taxonomic group possible of the carcass. For example, a California myotis could be classified as such, or as an unknown myotis, or (as a last resort) an unknown bat.
10. Evidence for species identification; e.g., measurements, distinctive pelage, hair sample, etc. If a recognized sensitive species, detailed notes, measurements, and extensive photos were recorded to substantiate ID.
11. Age and sex, if known.
12. Basis of age/sex determination.
13. Carcass condition:
 - *Dismembered – fresh*: Partial carcass showing obvious signs of trauma; carcass flexible, no signs of decomposition
 - *Dismembered – partially decomposed*: Partial carcass showing obvious signs of trauma; stiff-flesh present; insects have begun to reduce carcass
 - *Intact – fresh*: carcass flexible, no signs of decomposition
 - *Intact – partially decomposed*: stiff-flesh present; insects have begun to reduce carcass
 - *Intact – decomposed*: intact/mummified/rotten carcass or fur and bones only
 - *Scavenged – fresh*: fresh tissue and blood present; evidence of scavenging by vertebrates
 - *Scavenged – partially decomposed*: stiff-flesh present; insects have begun to reduce carcass in addition to vertebrate scavenging
 - *Scavenged – decomposed*: decomposed body parts/bones with or without flesh/fur; evidence of vertebrate scavenging
 - *Scavenged – feather spot*: no flesh or body parts present; minimum of two flight feathers or 10 body feathers.
 - *Injured*

- *Other, see notes*
14. Carcass condition notes: confirm intact or complete but severed carcass, or list parts found versus missing, with specific reference to left and right parts, and describe evidence of blunt-force trauma (i.e., broken bones, lacerations, severed body parts, major contusions, etc.), internal bleeding, other injuries, emaciation, disease, etc.
 15. Likely cause of death:
 - *Blade Strike/Turbine Collision*
 - A. Intact carcass with injuries consistent with a turbine blade strike or tower collision.
 - B. Intact or scavenged carcass of rarely depredated large raptors and vultures with no discernable signs of trauma, found within the search radius.
 - C. Intact carcass of bats (no evidence of vertebrate scavenging/predation) with no apparent injuries, found within the search radius.
 - *Other Collision*
Intact carcass with injuries consistent with having collided with fence, building, other equipment/structure, or vehicle (i.e., blunt-force trauma, broken wings or neck, etc.), but no evidence of blade strike, electrocution, or line strike, and found outside of turbine search radius and beneath (within 10 m) power lines or guy wires (vertebrate scavenging/predation may obscure or mimic line-strike injuries).
 - *Unknown*
Lack of obvious trauma, carcass condition (state of scavenging or degradation), and/or location precludes confident assessment.
 16. Categorical estimated time since death: fresh, <1 week, <1 month, or >1 month.
 17. Types of insects observed on/in carcass, if any, with brief description of kind and size.
 18. Scavenger/predator: type of predator or scavenger (bird, large mammal, small mammal, or invertebrate), if possible, to determine, and the effects of scavenging/predation.
 19. Categorical condition of flesh: fresh, gooey, dried, or none.
 20. Categorical condition of eyes: round and fluid-filled, sunken, dried, or none.
 21. Additional notes about special circumstances, carcass condition, details for identification of rare species, obvious injuries, and potential cause of death if other than those listed above.
 22. Unique image numbers for digital photographs of carcass confirming status (e.g., intact, scavenged, scattered parts, etc.) and portraying evidence of trauma where relevant, key facets required for positive species identification (e.g., distinct plumage or pelage features, illustration of size, bone structures, etc.), and the habitat in the immediate vicinity of the carcass. At least four initial photos are taken before the carcass is disturbed to clearly document the initial carcass disposition and the focal-area and landscape setting, with additional photos taken as needed to document other salient features of the specimen.

Appendix E. Carcass Detectability Trial Placements and Discoveries During Study

Year	Carcass Type	Date Placed	Turbine ID	Latitude	Longitude	Substrate	Carcass Size	Species	Discovery Date	Condition At Discovery	Discovery Interval (days)
10	Bat	09-Dec-22	26	37.790747	-121.701727	Grazed/Short Grass	Medium	Mexican free-tailed bat	22-Dec-22	Scavenged-partial decomposed	13
10	Bat	17-Dec-22	23	37.789447	-121.710071	Grazed/Short Grass	Medium	Mexican free-tailed bat	26-Dec-22	Intact-fresh	9
10	Bat	23-Dec-22	17	37.802663	-121.703252	Grazed/Short Grass	Small	Myotis californicus/ciliolabrum	29-Dec-22	Intact-fresh	6
10	Bat	29-Dec-22	10	37.784884	-121.721608	Grazed/Short Grass	Large	Hoary bat	na	na	na
10	Bat	29-Dec-22	14	37.781814	-121.711744	Grazed/Short Grass	Medium	Mexican free-tailed bat	03-Jan-23	Intact-partial decomposed	5
10	Bat	20-Jan-23	11	37.780831	-121.722666	Grazed/Short Grass	Medium	Mexican free-tailed bat	25-Jan-23	Scavenged-partial decomposed	5
10	Bat	03-Feb-23	32	37.793618	-121.667180	Turbine Pad	Small	Myotis californicus/ciliolabrum	na	na	na
10	Bat	03-Feb-23	34	37.791818	-121.657633	Grazed/Short Grass	Small	Myotis californicus/ciliolabrum	na	na	na
10	Bat	21-Feb-23	23	37.788646	-121.710620	Grazed/Short Grass	Medium	Mexican free-tailed bat	na	na	na
10	Bat	21-Feb-23	21	37.794248	-121.708983	Tall Fallow Grass/Forb	Small	Myotis californicus/ciliolabrum	na	na	na
10	Bat	21-Feb-23	29	37.788552	-121.686483	Bare Dirt/Disturb Soil	Small	Myotis yumanensis/lucifugus	na	na	na
10	Bat	03-Mar-23	18	37.798066	-121.705991	Road	Large	Hoary bat	09-Mar-23	Scavenged-fresh	6
10	Bat	30-Mar-23	26	37.790017	-121.701479	Road	Medium	Mexican free-tailed bat	30-Mar-23	Intact-partial decomposed	0
10	Bat	04-Apr-23	2	37.802823	-121.725338	Tall Fallow Grass/Forb	Large	Hoary bat	na	na	na
10	Bat	07-Apr-23	23	37.789264	-121.710109	Grazed/Short Grass	Large	Big brown bat	na	na	na
10	Bat	14-Apr-23	34	37.791857	-121.657860	Tall Fallow Grass/Forb	Medium	Mexican free-tailed bat	09-May-23	Intact-partial decomposed	25
10	Bat	14-Apr-23	27	37.787635	-121.692763	Grazed/Short Grass	Medium	Mexican free-tailed bat	na	na	na
10	Bat	14-Apr-23	18	37.797854	-121.706203	Grazed/Short Grass	Small	Myotis californicus/ciliolabrum	08-Jun-23	Intact-partial decomposed	55
10	Bat	28-Apr-23	34	37.791564	-121.658360	Grazed/Short Grass	Medium	Mexican free-tailed bat	23-May-23	Intact-partial decomposed	25
10	Bat	28-Apr-23	9	37.784906	-121.725699	Turbine Pad	Small	Myotis californicus/ciliolabrum	na	na	na
10	Bat	12-May-23	2	37.802745	-121.724616	Bare Dirt/Disturb Soil	Small	Myotis californicus/ciliolabrum	15-May-23	Intact-partial decomposed	3
10	Bat	22-May-23	32	37.793032	-121.667098	Tall Fallow Grass/Forb	Large	Mexican free-tailed bat	na	na	na
10	Bat	09-Jun-23	17	37.802280	-121.702888	Grazed/Short Grass	Large	Mexican free-tailed bat	na	na	na
10	Bat	09-Jun-23	9	37.784879	-121.725397	Grazed/Short Grass	Small	Myotis californicus/ciliolabrum	na	na	na
10	Bat	21-Jun-23	29	37.788367	-121.686590	Grazed/Short Grass	Large	Mexican free-tailed bat	na	na	na
10	Bat	21-Jun-23	3	37.799193	-121.723563	Tall Fallow Grass/Forb	Small	Myotis yumanensis/lucifugus	na	na	na
10	Bat	27-Jun-23	20	37.796597	-121.698168	Tall Fallow Grass/Forb	Medium	Mexican free-tailed bat	29-Jun-23	Intact-partial decomposed	2
10	Bat	29-Jun-23	32	37.793383	-121.667605	Grazed/Short Grass	Medium	Mexican free-tailed bat	08-Aug-23	Intact-partial decomposed	40
10	Bat	11-Jul-23	3	37.798788	-121.724099	Turbine Pad	Small	Myotis yumanensis/lucifugus	na	na	na
10	Bat	11-Jul-23	11	37.780347	-121.722362	Bare Dirt/Disturb Soil	Small	Myotis yumanensis/lucifugus	na	na	na
10	Bat	20-Jul-23	18	37.798150	-121.705038	Grazed/Short Grass	Medium	Mexican free-tailed bat	21-Jul-23	Intact-partial decomposed	1
10	Bat	20-Jul-23	2	37.803150	-121.724455	Tall Fallow Grass/Forb	Medium	Mexican free-tailed bat	na	na	na
10	Bat	28-Jul-23	8	37.788647	-121.719176	Tall Fallow Grass/Forb	Medium	Mexican free-tailed bat	na	na	na
10	Bat	28-Jul-23	21	37.794375	-121.710225	Tall Fallow Grass/Forb	Small	Myotis californicus/ciliolabrum	na	na	na
10	Bat	04-Aug-23	10	37.784498	-121.720840	Turbine Pad	Small	Myotis californicus/ciliolabrum	na	na	na
10	Bat	11-Sep-23	9	37.785323	-121.726232	Grazed/Short Grass	Medium	Big brown bat	14-Sep-23	Scavenged-partial decomposed	3
10	Bat	13-Sep-23	23	37.788812	-121.710697	Tall Fallow Grass/Forb	Small	Myotis yumanensis/lucifugus	25-Sep-23	Intact-partial decomposed	12
10	Bat	10-Oct-23	21	37.794315	-121.709905	Turbine Pad	Medium	Mexican free-tailed bat	na	na	na
10	Bat	10-Oct-23	8	37.788750	-121.718743	Tall Fallow Grass/Forb	Medium	Mexican free-tailed bat	na	na	na

Year	Carcass Type	Date Placed	Turbine ID	Latitude	Longitude	Substrate	Carcass Size	Species	Discovery Date	Condition At Discovery	Discovery Interval (days)
10	Bat	10-Oct-23	17	37.803107	-121.702828	Tall Fallow Grass/Forb	Small	Myotis californicus/ciliolabrum	26-Oct-23	Intact-partial decomposed	16
10	Bat	30-Oct-23	27	37.787443	-121.691548	Tall Fallow Grass/Forb	Medium	Mexican free-tailed bat	na	na	na
10	Bat	13-Nov-23	8	37.788919	-121.719551	Grazed/Short Grass	Large	Big brown bat	na	na	na
10	Bat	13-Nov-23	26	37.790040	-121.701837	Grazed/Short Grass	Medium	Mexican free-tailed bat	18-Nov-23	Scavenged-partial decomposed	5
10	Bat	23-Nov-23	29	37.788890	-121.686898	Tall Fallow Grass/Forb	Medium	Mexican free-tailed bat	28-Nov-23	Scavenged-partial decomposed	5
10	Bat	23-Nov-23	2	37.802053	-121.725180	Tall Fallow Grass/Forb	Small	Myotis yumanensis/lucifugus	na	na	na
10	Bat	25-Nov-23	18	37.798004	-121.706038	Bare Dirt/Disturb Soil	Medium	Mexican free-tailed bat	na	na	na
11	Bat	19-Dec-23	22	37.793465	-121.704648	Grazed/Short Grass	Medium	Mexican free-tailed bat	na	na	na
11	Bat	27-Dec-23	19	37.798760	-121.700919	Grazed/Short Grass	Medium	Mexican free-tailed bat	29-Dec-23	Intact-fresh	2
11	Bat	03-Jan-24	12	37.784555	-121.715598	Road	Small	Myotis californicus/ciliolabrum	10-Jan-24	Intact-partial decomposed	7
11	Bat	03-Jan-24	22	37.793942	-121.704887	Tall Fallow Grass/Forb	Small	Myotis californicus/ciliolabrum	13-Jan-24	Intact-partial decomposed	10
11	Bat	11-Jan-24	6	37.790208	-121.715108	Grazed/Short Grass	Small	Myotis yumanensis/lucifugus	18-Jan-24	Scavenged-partial decomposed	7
11	Bat	11-Jan-24	33	37.792375	-121.662375	Tall Fallow Grass/Forb	Small	Myotis yumanensis/lucifugus	na	na	na
11	Bat	17-Jan-24	4	37.795158	-121.724780	Tall Fallow Grass/Forb	Medium	Mexican free-tailed bat	28-Jan-24	Scavenged-partial decomposed	11
11	Bat	17-Jan-24	15	37.809179	-121.705468	Grazed/Short Grass	Medium	Mexican free-tailed bat	28-Sep-24	Scavenged-decomposed	255
11	Bat	17-Jan-24	28	37.784662	-121.690138	Road	Medium	Mexican free-tailed bat	na	na	na
11	Bat	24-Jan-24	7	37.789159	-121.724192	Tall Fallow Grass/Forb	Medium	Mexican free-tailed bat	13-Feb-24	Intact-fresh	20
11	Bat	12-Feb-24	13	37.779993	-121.716533	Grazed/Short Grass	Medium	Mexican free-tailed bat	na	na	na
11	Bat	12-Feb-24	25	37.785073	-121.704248	Grazed/Short Grass	Medium	Mexican free-tailed bat	na	na	na
11	Bat	14-Feb-24	30	37.788118	-121.680638	Tall Fallow Grass/Forb	Medium	Mexican free-tailed bat	na	na	na
11	Bat	07-Mar-24	1	37.805372	-121.727227	Grazed/Short Grass	Small	Myotis californicus/ciliolabrum	na	na	na
11	Bat	18-Mar-24	19	37.798208	-121.700693	Grazed/Short Grass	Medium	Mexican free-tailed bat	29-Mar-24	Intact-partial decomposed	11
11	Bat	01-Apr-24	5	37.796370	-121.720318	Tall Fallow Grass/Forb	Medium	Mexican free-tailed bat	10-Apr-24	Intact-partial decomposed	9
11	Bat	18-Apr-24	12	37.785087	-121.714913	Tall Fallow Grass/Forb	Small	Myotis californicus/ciliolabrum	na	na	na
11	Bat	29-Apr-24	7	37.788517	-121.724365	Road	Small	Myotis yumanensis/lucifugus	01-May-24	Intact-partial decomposed	2
11	Bat	06-May-24	31	37.790674	-121.676328	Grazed/Short Grass	Small	Myotis californicus/ciliolabrum	na	na	na
11	Bat	13-May-24	24	37.787734	-121.705857	Tall Fallow Grass/Forb	Small	Myotis yumanensis/lucifugus	26-Aug-24	Scavenged-decomposed	105
11	Bat	17-May-24	15	37.808640	-121.705724	Road	Medium	Mexican free-tailed bat	na	na	na
11	Bat	17-May-24	22	37.793941	-121.704397	Tall Fallow Grass/Forb	Small	Myotis yumanensis/lucifugus	na	na	na
11	Bat	25-May-24	5	37.796055	-121.720103	Tall Fallow Grass/Forb	Medium	Mexican free-tailed bat	na	na	na
11	Bat	09-Jun-24	1	37.804495	-121.726553	Grazed/Short Grass	Small	Myotis yumanensis/lucifugus	10-Jun-24	Intact-partial decomposed	1
11	Bat	03-Jul-24	13	37.780418	-121.716647	Tall Fallow Grass/Forb	Medium	Mexican free-tailed bat	na	na	na
11	Bat	06-Jul-24	6	37.790933	-121.715083	Grazed/Short Grass	Medium	Mexican free-tailed bat	18-Jul-24	Intact-partial decomposed	12
11	Bat	06-Jul-24	31	37.791075	-121.675905	Grazed/Short Grass	Medium	Mexican free-tailed bat	na	na	na
11	Bat	30-Jul-24	5	37.795253	-121.720603	Grazed/Short Grass	Medium	Mexican free-tailed bat	29-Aug-24	Scavenged-decomposed	30
11	Bat	04-Aug-24	33	37.793087	-121.662002	Tall Fallow Grass/Forb	Medium	Mexican free-tailed bat	na	na	na
11	Bat	13-Aug-24	16	37.805263	-121.705995	Tall Fallow Grass/Forb	Medium	Mexican free-tailed bat	30-Aug-24	Intact-partial decomposed	17
11	Bat	13-Aug-24	4	37.794557	-121.724853	Grazed/Short Grass	Medium	Mexican free-tailed bat	na	na	na
11	Bat	13-Aug-24	6	37.790053	-121.713990	Grazed/Short Grass	Small	Myotis yumanensis/lucifugus	17-Aug-24	Intact-partial decomposed	4
11	Bat	18-Aug-24	22	37.794848	-121.705035	Tall Fallow Grass/Forb	Medium	Mexican free-tailed bat	19-Sep-24	Scavenged-partial decomposed	32
11	Bat	14-Sep-24	13	37.780717	-121.716848	Tall Fallow Grass/Forb	Small	Mexican free-tailed bat	27-Sep-24	Scavenged-partial decomposed	13
11	Bat	09-Oct-24	6	37.790060	-121.714558	Grazed/Short Grass	Medium	Mexican free-tailed bat	10-Oct-24	Scavenged-partial decomposed	1
11	Bat	09-Oct-24	19	37.798973	-121.701108	Tall Fallow Grass/Forb	Small	Myotis californicus/ciliolabrum	17-Oct-24	Intact-partial decomposed	8
11	Bat	15-Oct-24	16	37.804810	-121.705144	Tall Fallow Grass/Forb	Medium	Mexican free-tailed bat	na	na	na

Year	Carcass Type	Date Placed	Turbine ID	Latitude	Longitude	Substrate	Carcass Size	Species	Discovery Date	Condition At Discovery	Discovery Interval (days)
11	Bat	15-Oct-24	1	37.804788	-121.726529	Grazed/Short Grass	Small	Myotis californicus/ciliolabrum	16-Oct-24	Intact-partial decomposed	1
11	Bat	20-Oct-24	25	37.784776	-121.705059	Tall Fallow Grass/Forb	Small	Myotis californicus/ciliolabrum	04-Nov-24	Scavenged-partial decomposed	15
11	Bat	27-Oct-24	30	37.788230	-121.679727	Tall Fallow Grass/Forb	Medium	Mexican free-tailed bat	30-Oct-24	Intact-partial decomposed	3
11	Bat	29-Oct-24	15	37.808392	-121.704842	Grazed/Short Grass	Medium	Mexican free-tailed bat	na	na	na
11	Bat	05-Nov-24	25	37.784523	-121.704163	Tall Fallow Grass/Forb	Medium	Myotis californicus/ciliolabrum	na	na	na
11	Bat	10-Nov-24	13	37.780113	-121.716640	Tall Fallow Grass/Forb	Medium	Mexican free-tailed bat	na	na	na
11	Bat	19-Nov-24	7	37.788117	-121.724383	Tall Fallow Grass/Forb	Medium	Mexican free-tailed bat	na	na	na
11	Bat	19-Nov-24	19	37.798448	-121.701058	Road	Small	Myotis californicus/ciliolabrum	na	na	na
10	Bird	09-Dec-22	2	37.802444	-121.725536	Grazed/Short Grass	Small	European Starling	12-Dec-22	Scavenged-feather spot	3
10	Bird	09-Dec-22	27	37.787363	-121.692138	Grazed/Short Grass	Large	Red-tailed Hawk	13-Dec-22	Intact-fresh	4
10	Bird	09-Dec-22	12	37.784298	-121.714618	Grazed/Short Grass	Large	Red-tailed Hawk	03-Jan-23	Scavenged-partial decomposed	25
10	Bird	17-Dec-22	22	37.793465	-121.705668	Grazed/Short Grass	Medium	American Crow	na	na	na
10	Bird	17-Dec-22	34	37.791908	-121.657375	Grazed/Short Grass	Small	House Finch	na	na	na
10	Bird	17-Dec-22	8	37.788666	-121.718591	Grazed/Short Grass	Large	Red-tailed Hawk	21-Dec-22	Intact-partial decomposed	4
10	Bird	29-Dec-22	11	37.780602	-121.722462	Grazed/Short Grass	Small	Song Sparrow	na	na	na
10	Bird	06-Jan-23	1	37.804604	-121.726847	Tall Fallow Grass/Forb	Medium	American Crow	22-Jan-23	Intact-partial decomposed	16
10	Bird	06-Jan-23	34	37.791617	-121.657835	Grazed/Short Grass	Small	Hermit Thrush	na	na	na
10	Bird	06-Jan-23	9	37.784876	-121.724853	Grazed/Short Grass	Large	Red-tailed Hawk	11-Jan-23	Intact-fresh	5
10	Bird	06-Jan-23	15	37.808327	-121.705563	Grazed/Short Grass	Large	Red-tailed Hawk	19-Jan-23	Intact-partial decomposed	13
10	Bird	12-Jan-23	16	37.804216	-121.705558	Grazed/Short Grass	Medium	American Crow	13-Jan-23	Intact-fresh	1
10	Bird	12-Jan-23	2	37.802641	-121.724166	Bare Dirt/Disturb Soil	Medium	Rock Pigeon	17-Jan-23	Scavenged-partial decomposed	5
10	Bird	12-Jan-23	21	37.793864	-121.709867	Grazed/Short Grass	Small	Western Sandpiper	17-Jan-23	Scavenged-partial decomposed	5
10	Bird	12-Jan-23	18	37.797929	-121.705427	Grazed/Short Grass	Small	White-crowned Sparrow	na	na	na
10	Bird	17-Jan-23	20	37.795627	-121.698518	Grazed/Short Grass	Medium	American Barn Owl	20-Jan-23	Intact-partial decomposed	3
10	Bird	17-Jan-23	10	37.784171	-121.720402	Grazed/Short Grass	Large	Red-tailed Hawk	19-Jan-23	Intact-partial decomposed	2
10	Bird	17-Jan-23	28	37.784110	-121.689593	Grazed/Short Grass	Medium	Rock Pigeon	na	na	na
10	Bird	20-Jan-23	9	37.785069	-121.725638	Grazed/Short Grass	Small	House Sparrow	na	na	na
10	Bird	20-Jan-23	24	37.787922	-121.705716	Bare Dirt/Disturb Soil	Large	Red-tailed Hawk	25-Jan-23	Intact-partial decomposed	5
10	Bird	20-Jan-23	26	37.790138	-121.701485	Bare Dirt/Disturb Soil	Small	Western Sandpiper	20-Jan-23	Intact-partial decomposed	0
10	Bird	30-Jan-23	21	37.794425	-121.710616	Grazed/Short Grass	Medium	American Crow	30-Jan-23	Intact-fresh	0
10	Bird	30-Jan-23	12	37.784526	-121.715834	Grazed/Short Grass	Large	Red-tailed Hawk	02-Feb-23	Intact-partial decomposed	3
10	Bird	30-Jan-23	4	37.794752	-121.725123	Grazed/Short Grass	Large	Red-tailed Hawk	16-Feb-23	Intact-partial decomposed	17
10	Bird	03-Feb-23	5	37.795728	-121.720868	Grazed/Short Grass	Medium	American Crow	23-Feb-23	Intact-partial decomposed	20
10	Bird	03-Feb-23	14	37.781622	-121.711427	Grazed/Short Grass	Medium	Black-bellied Plover	na	na	na
10	Bird	03-Feb-23	2	37.802683	-121.724699	Turbine Pad	Small	European Starling	20-Feb-23	Scavenged-feather spot	17
10	Bird	10-Feb-23	14	37.782164	-121.711270	Grazed/Short Grass	Small	Fox Sparrow	16-Feb-23	Intact-fresh	6
10	Bird	10-Feb-23	20	37.796067	-121.698987	Road	Small	House Sparrow	na	na	na
10	Bird	10-Feb-23	34	37.792033	-121.658366	Grazed/Short Grass	Medium	Rock Pigeon	14-Feb-23	Scavenged-feather spot	4
10	Bird	10-Feb-23	10	37.784529	-121.720999	Grazed/Short Grass	Small	Western Sandpiper	15-Feb-23	Intact-partial decomposed	5
10	Bird	21-Feb-23	6	37.790758	-121.715751	Grazed/Short Grass	Medium	American Barn Owl	na	na	na
10	Bird	21-Feb-23	32	37.793052	-121.667975	Tall Fallow Grass/Forb	Medium	American Crow	na	na	na
10	Bird	21-Feb-23	26	37.790299	-121.701780	Grazed/Short Grass	Medium	Rock Pigeon	22-Feb-23	Intact-fresh	1
10	Bird	03-Mar-23	26	37.789713	-121.701506	Grazed/Short Grass	Small	House Sparrow	09-Mar-23	Intact-partial decomposed	6

Year	Carcass Type	Date Placed	Turbine ID	Latitude	Longitude	Substrate	Carcass Size	Species	Discovery Date	Condition At Discovery	Discovery Interval (days)
10	Bird	03-Mar-23	16	37.804608	-121.705540	Grazed/Short Grass	Large	Red-tailed Hawk	08-Mar-23	Scavenged-partial decomposed	5
10	Bird	03-Mar-23	21	37.794271	-121.710251	Grazed/Short Grass	Medium	Rock Pigeon	06-Mar-23	Intact-partial decomposed	3
10	Bird	03-Mar-23	15	37.809168	-121.706096	Grazed/Short Grass	Medium	Rock Pigeon	na	na	na
10	Bird	18-Mar-23	33	37.793229	-121.662291	Tall Fallow Grass/Forb	Medium	American Crow	na	na	na
10	Bird	18-Mar-23	29	37.788845	-121.685906	Grazed/Short Grass	Large	Red-tailed Hawk	21-Mar-23	Scavenged-partial decomposed	3
10	Bird	18-Mar-23	12	37.785223	-121.715952	Grazed/Short Grass	Large	Red-tailed Hawk	30-Mar-23	Intact-partial decomposed	12
10	Bird	18-Mar-23	7	37.789137	-121.724426	Grazed/Short Grass	Medium	Rock Pigeon	30-Mar-23	Scavenged-feather spot	12
10	Bird	18-Mar-23	21	37.794423	-121.709958	Grazed/Short Grass	Small	Western Sandpiper	20-Mar-23	Intact-partial decomposed	2
10	Bird	30-Mar-23	22	37.794420	-121.705332	Grazed/Short Grass	Large	Red-tailed Hawk	04-Apr-23	Intact-partial decomposed	5
10	Bird	30-Mar-23	6	37.790286	-121.715081	Grazed/Short Grass	Large	Red-tailed Hawk	19-Apr-23	Intact-partial decomposed	20
10	Bird	04-Apr-23	26	37.790610	-121.701497	Grazed/Short Grass	Small	House Sparrow	07-Apr-23	Intact-fresh	3
10	Bird	07-Apr-23	27	37.787785	-121.692259	Grazed/Short Grass	Large	California Gull	11-Apr-23	Scavenged-partial decomposed	4
10	Bird	07-Apr-23	12	37.784548	-121.715359	Turbine Pad	Large	California Gull	27-Apr-23	Intact-partial decomposed	20
10	Bird	07-Apr-23	14	37.781745	-121.711757	Grazed/Short Grass	Small	European Starling	13-Apr-23	Intact-fresh	6
10	Bird	07-Apr-23	23	37.788809	-121.710258	Grazed/Short Grass	Medium	Rock Pigeon	10-Apr-23	Scavenged-feather spot	3
10	Bird	07-Apr-23	11	37.779993	-121.722840	Grazed/Short Grass	Medium	Rock Pigeon	12-Apr-23	Scavenged-feather spot	5
10	Bird	14-Apr-23	20	37.795583	-121.699527	Grazed/Short Grass	Small	House Sparrow	20-Apr-23	Scavenged-feather spot	6
10	Bird	28-Apr-23	9	37.785194	-121.725984	Rocky Drainage	Large	California Gull	10-May-23	Scavenged-feather spot	12
10	Bird	28-Apr-23	32	37.793439	-121.666997	Rocky Drainage	Small	European Starling	03-May-23	Scavenged-feather spot	5
10	Bird	28-Apr-23	24	37.788070	-121.705340	Grazed/Short Grass	Medium	Rock Pigeon	na	na	na
10	Bird	28-Apr-23	34	37.792588	-121.657230	Tall Fallow Grass/Forb	Small	White-breasted Nuthatch	03-May-23	Intact-partial decomposed	5
10	Bird	05-May-23	33	37.793459	-121.663019	Tall Fallow Grass/Forb	Medium	American Barn Owl	12-Dec-23	Scavenged-decomposed	221
10	Bird	05-May-23	27	37.786987	-121.691667	Grazed/Short Grass	Large	Red-tailed Hawk	09-May-23	Scavenged-feather spot	4
10	Bird	05-May-23	20	37.796526	-121.699014	Grazed/Short Grass	Medium	Rock Pigeon	05-May-23	Intact-fresh	0
10	Bird	05-May-23	18	37.797728	-121.706526	Grazed/Short Grass	Medium	Rock Pigeon	05-May-23	Intact-fresh	0
10	Bird	05-May-23	17	37.802816	-121.703260	Turbine Pad	Medium	Rock Pigeon	05-May-23	Intact-fresh	0
10	Bird	05-May-23	13	37.780525	-121.716356	Grazed/Short Grass	Medium	Rock Pigeon	na	na	na
10	Bird	12-May-23	23	37.788937	-121.710305	Grazed/Short Grass	Small	House Sparrow	na	na	na
10	Bird	12-May-23	20	37.795722	-121.698931	Grazed/Short Grass	Small	Least Sandpiper	na	na	na
10	Bird	18-May-23	10	37.784755	-121.720662	Grazed/Short Grass	Small	House Sparrow	24-May-23	Intact-partial decomposed	6
10	Bird	18-May-23	3	37.798595	-121.723935	Grazed/Short Grass	Small	House Sparrow	na	na	na
10	Bird	18-May-23	14	37.781343	-121.710997	Tall Fallow Grass/Forb	Large	Red-tailed Hawk	23-May-23	Intact-partial decomposed	5
10	Bird	18-May-23	3	37.798881	-121.724663	Grazed/Short Grass	Large	Red-tailed Hawk	29-May-23	Intact-partial decomposed	11
10	Bird	22-May-23	7	37.788296	-121.724582	Grazed/Short Grass	Large	Red-tailed Hawk	25-May-23	Intact-partial decomposed	3
10	Bird	09-Jun-23	18	37.798588	-121.706179	Grazed/Short Grass	Small	Chestnut-backed Chickadee	na	na	na
10	Bird	09-Jun-23	30	37.787586	-121.679677	Grazed/Short Grass	Medium	Rock Pigeon	na	na	na
10	Bird	21-Jun-23	11	37.780937	-121.721797	Tall Fallow Grass/Forb	Small	European Starling	na	na	na
10	Bird	27-Jun-23	14	37.781762	-121.711747	Grazed/Short Grass	Large	California Gull	27-Jun-23	Intact-partial decomposed	0
10	Bird	27-Jun-23	10	37.784528	-121.720727	Grazed/Short Grass	Medium	Rock Pigeon	28-Jun-23	Intact-partial decomposed	1
10	Bird	11-Jul-23	8	37.788848	-121.719263	Tall Fallow Grass/Forb	Large	Red-tailed Hawk	20-Jul-23	Intact-partial decomposed	9
10	Bird	21-Jul-23	1	37.804958	-121.726457	Tall Fallow Grass/Forb	Large	California Gull	na	na	na
10	Bird	21-Jul-23	31	37.790912	-121.675705	Grazed/Short Grass	Medium	Rock Pigeon	21-Aug-23	Scavenged-feather spot	31
10	Bird	21-Jul-23	32	37.793333	-121.667348	Road	Medium	Rock Pigeon	25-Aug-23	Scavenged-feather spot	35
10	Bird	28-Jul-23	29	37.788530	-121.686398	Turbine Pad	Medium	American Barn Owl	01-Aug-23	Intact-partial decomposed	4

Year	Carcass Type	Date Placed	Turbine ID	Latitude	Longitude	Substrate	Carcass Size	Species	Discovery Date	Condition At Discovery	Discovery Interval (days)
10	Bird	28-Jul-23	14	37.781657	-121.711432	Road	Small	European Starling	na	na	na
10	Bird	02-Aug-23	17	37.802528	-121.703460	Grazed/Short Grass	Small	European Starling	04-Aug-23	Intact-partial decomposed	2
10	Bird	02-Aug-23	2	37.802987	-121.724260	Tall Fallow Grass/Forb	Small	European Starling	30-Oct-23	Scavenged-feather spot	89
10	Bird	04-Aug-23	17	37.802597	-121.703117	Grazed/Short Grass	Small	House Sparrow	11-Aug-23	Intact-partial decomposed	7
10	Bird	04-Aug-23	19	37.798519	-121.701239	Road	Large	Red-tailed Hawk	04-Aug-23	Intact-fresh	0
10	Bird	04-Aug-23	7	37.788592	-121.724332	Turbine Pad	Large	Red-tailed Hawk	14-Aug-23	Intact-partial decomposed	10
10	Bird	04-Aug-23	11	37.780728	-121.722152	Grazed/Short Grass	Small	Western Sandpiper	10-Aug-23	Scavenged-partial decomposed	6
10	Bird	10-Aug-23	32	37.793581	-121.667284	Grazed/Short Grass	Medium	American Crow	26-Sep-23	Scavenged-feather spot	47
10	Bird	10-Aug-23	28	37.784533	-121.690117	Grazed/Short Grass	Large	California Gull	21-Aug-23	Scavenged-feather spot	11
10	Bird	11-Aug-23	23	37.789275	-121.710474	Tall Fallow Grass/Forb	Small	House Sparrow	na	na	na
10	Bird	11-Aug-23	34	37.792412	-121.656998	Tall Fallow Grass/Forb	Large	Red-tailed Hawk	15-Aug-23	Intact-partial decomposed	4
10	Bird	11-Aug-23	23	37.789010	-121.711000	Tall Fallow Grass/Forb	Medium	Rock Pigeon	12-Sep-23	Scavenged-feather spot	32
10	Bird	11-Aug-23	8	37.788987	-121.719893	Road	Small	Western Sandpiper	na	na	na
10	Bird	16-Aug-23	30	37.787472	-121.679890	Grazed/Short Grass	Large	Great Egret	21-Aug-23	Scavenged-feather spot	5
10	Bird	18-Aug-23	19	37.798528	-121.700597	Grazed/Short Grass	Medium	American Crow	27-Oct-23	Scavenged-feather spot	70
10	Bird	18-Aug-23	10	37.785040	-121.720998	Tall Fallow Grass/Forb	Small	European Starling	26-Aug-23	Scavenged-decomposed	8
10	Bird	18-Aug-23	27	37.787967	-121.692613	Tall Fallow Grass/Forb	Small	European Starling	26-Sep-23	Scavenged-feather spot	39
10	Bird	18-Aug-23	21	37.794804	-121.709665	Tall Fallow Grass/Forb	Small	House Sparrow	28-Aug-23	Intact-partial decomposed	10
10	Bird	18-Aug-23	3	37.798199	-121.723978	Grazed/Short Grass	Large	Red-tailed Hawk	24-Aug-23	Intact-partial decomposed	6
10	Bird	18-Aug-23	22	37.794228	-121.705583	Tall Fallow Grass/Forb	Medium	Rock Pigeon	na	na	na
10	Bird	24-Aug-23	26	37.790118	-121.701362	Grazed/Short Grass	Large	Red-tailed Hawk	27-Aug-23	Intact-partial decomposed	3
10	Bird	24-Aug-23	34	37.791940	-121.657887	Turbine Pad	Medium	Rock Pigeon	25-Aug-23	Intact-fresh	1
10	Bird	24-Aug-23	15	37.808758	-121.705675	Turbine Pad	Medium	Rock Pigeon	28-Sep-23	Scavenged-feather spot	35
10	Bird	19-Sep-23	32	37.793108	-121.667115	Tall Fallow Grass/Forb	Small	Cedar Waxwing	26-Sep-23	Scavenged-feather spot	7
10	Bird	19-Sep-23	30	37.787992	-121.680708	Tall Fallow Grass/Forb	Medium	Rock Pigeon	21-Sep-23	Intact-fresh	2
10	Bird	05-Oct-23	29	37.788697	-121.686087	Tall Fallow Grass/Forb	Small	European Starling	10-Oct-23	Intact-partial decomposed	5
10	Bird	05-Oct-23	31	37.790153	-121.676103	Grazed/Short Grass	Large	Red-tailed Hawk	12-Oct-23	Intact-fresh	7
10	Bird	05-Oct-23	27	37.787600	-121.692435	Grazed/Short Grass	Small	Western Sandpiper	na	na	na
10	Bird	10-Oct-23	17	37.803466	-121.703152	Tall Fallow Grass/Forb	Medium	American Crow	12-Oct-23	Intact-partial decomposed	2
10	Bird	10-Oct-23	3	37.798663	-121.723268	Tall Fallow Grass/Forb	Small	Western Sandpiper	16-Oct-23	Scavenged-partial decomposed	6
10	Bird	17-Oct-23	8	37.788266	-121.719767	Grazed/Short Grass	Medium	American Crow	18-Oct-23	Intact-partial decomposed	1
10	Bird	17-Oct-23	13	37.781128	-121.716605	Grazed/Short Grass	Medium	American Crow	10-Nov-23	Scavenged-feather spot	24
10	Bird	17-Oct-23	2	37.802408	-121.724960	Grazed/Short Grass	Small	House Sparrow	23-Oct-23	Scavenged-feather spot	6
10	Bird	17-Oct-23	10	37.784027	-121.721343	Grazed/Short Grass	Large	Red-tailed Hawk	25-Oct-23	Scavenged-feather spot	8
10	Bird	19-Oct-23	9	37.784735	-121.726203	Grazed/Short Grass	Small	European Starling	na	na	na
10	Bird	26-Oct-23	22	37.794051	-121.704935	Grazed/Short Grass	Large	Red-tailed Hawk	na	na	na
10	Bird	26-Oct-23	18	37.797993	-121.705875	Bare Dirt/Disturb Soil	Medium	Rock Pigeon	26-Oct-23	Intact-partial decomposed	0
10	Bird	26-Oct-23	5	37.795887	-121.719787	Grazed/Short Grass	Medium	Rock Pigeon	na	na	na
10	Bird	30-Oct-23	34	37.791950	-121.657756	Grazed/Short Grass	Small	European Starling	12-Feb-24	Scavenged-feather spot	105
10	Bird	07-Nov-23	25	37.785317	-121.704823	Tall Fallow Grass/Forb	Medium	American Crow	08-Nov-23	Intact-partial decomposed	1
10	Bird	07-Nov-23	27	37.787733	-121.692098	Road	Small	House Sparrow	08-Nov-23	Intact-partial decomposed	1
10	Bird	07-Nov-23	8	37.788623	-121.719922	Tall Fallow Grass/Forb	Large	Red-tailed Hawk	08-Nov-23	Intact-partial decomposed	1
10	Bird	07-Nov-23	26	37.790151	-121.700816	Grazed/Short Grass	Medium	Rock Pigeon	na	na	na
10	Bird	07-Nov-23	19	37.797921	-121.700239	Tall Fallow Grass/Forb	Medium	Rock Pigeon	na	na	na

Year	Carcass Type	Date Placed	Turbine ID	Latitude	Longitude	Substrate	Carcass Size	Species	Discovery Date	Condition At Discovery	Discovery Interval (days)
10	Bird	13-Nov-23	3	37.798350	-121.724437	Grazed/Short Grass	Small	Acorn Woodpecker	na	na	na
10	Bird	13-Nov-23	2	37.802593	-121.724591	Grazed/Short Grass	Large	Red-tailed Hawk	20-Nov-23	Intact-partial decomposed	7
10	Bird	13-Nov-23	24	37.788492	-121.706043	Grazed/Short Grass	Large	Red-tailed Hawk	25-Nov-23	Intact-partial decomposed	12
10	Bird	13-Nov-23	20	37.795883	-121.698872	Grazed/Short Grass	Large	Red-tailed Hawk	na	na	na
10	Bird	13-Nov-23	11	37.780328	-121.721725	Grazed/Short Grass	Medium	Rock Pigeon	na	na	na
10	Bird	22-Nov-23	4	37.794975	-121.724863	Tall Fallow Grass/Forb	Medium	Rock Pigeon	na	na	na
10	Bird	22-Nov-23	19	37.797845	-121.701252	Tall Fallow Grass/Forb	Medium	Rock Pigeon	na	na	na
10	Bird	23-Nov-23	1	37.804287	-121.726196	Tall Fallow Grass/Forb	Large	Red-tailed Hawk	02-Dec-23	Intact-partial decomposed	9
10	Bird	24-Nov-23	18	37.798185	-121.705983	Bare Dirt/Disturb Soil	Small	European Starling	na	na	na
10	Bird	24-Nov-23	23	37.789358	-121.711182	Grazed/Short Grass	Large	Red-tailed Hawk	na	na	na
10	Bird	25-Nov-23	17	37.802184	-121.703345	Tall Fallow Grass/Forb	Small	House Sparrow	30-Nov-23	Intact-partial decomposed	5
11	Bird	19-Dec-23	12	37.784672	-121.715239	Grazed/Short Grass	Small	European Starling	20-Dec-23	Intact-partial decomposed	1
11	Bird	19-Dec-23	25	37.785498	-121.704614	Grazed/Short Grass	Medium	Rock Pigeon	26-Dec-23	Scavenged-feather spot	7
11	Bird	21-Dec-23	11	37.779727	-121.722714	Grazed/Short Grass	Large	Turkey Vulture	17-Jan-24	Intact-partial decomposed	27
11	Bird	22-Dec-23	3	37.799403	-121.724070	Grazed/Short Grass	Large	Red-tailed Hawk	26-Dec-23	Intact-fresh	4
11	Bird	27-Dec-23	7	37.788313	-121.724353	Grazed/Short Grass	Small	European Starling	17-Jan-24	Scavenged-feather spot	21
11	Bird	27-Dec-23	30	37.787868	-121.679493	Tall Fallow Grass/Forb	Large	Red-tailed Hawk	16-Jan-24	Intact-partial decomposed	20
11	Bird	03-Jan-24	11	37.780670	-121.722685	Tall Fallow Grass/Forb	Medium	American Crow	17-Jan-24	Intact-partial decomposed	14
11	Bird	03-Jan-24	6	37.789857	-121.714377	Tall Fallow Grass/Forb	Small	European Starling	na	na	na
11	Bird	03-Jan-24	31	37.790946	-121.676073	Bare Dirt/Disturb Soil	Medium	Rock Pigeon	12-Jan-24	Intact-partial decomposed	9
11	Bird	03-Jan-24	30	37.787792	-121.680452	Bare Dirt/Disturb Soil	Small	Western Sandpiper	na	na	na
11	Bird	11-Jan-24	17	37.802463	-121.703472	Grazed/Short Grass	Large	Red-tailed Hawk	12-Jan-24	Scavenged-partial decomposed	1
11	Bird	11-Jan-24	4	37.794275	-121.724962	Tall Fallow Grass/Forb	Large	Red-tailed Hawk	15-Jan-24	Intact-partial decomposed	4
11	Bird	11-Jan-24	22	37.794070	-121.705122	Grazed/Short Grass	Small	Spotted Towhee	08-Feb-24	Scavenged-partial decomposed	28
11	Bird	17-Jan-24	25	37.785230	-121.704551	Road	Small	European Starling	22-Jan-24	Scavenged-partial decomposed	5
11	Bird	17-Jan-24	34	37.792097	-121.657748	Grazed/Short Grass	Large	Red-tailed Hawk	24-Jan-24	Intact-partial decomposed	7
11	Bird	17-Jan-24	1	37.804767	-121.726472	Tall Fallow Grass/Forb	Small	Red-winged Blackbird	22-Jan-24	Scavenged-partial decomposed	5
11	Bird	17-Jan-24	30	37.787355	-121.679845	Grazed/Short Grass	Medium	Short-billed Dowitcher	na	na	na
11	Bird	24-Jan-24	23	37.788763	-121.709952	Grazed/Short Grass	Large	California Gull	24-Jan-24	Intact-partial decomposed	1
11	Bird	24-Jan-24	16	37.804567	-121.705823	Grazed/Short Grass	Small	European Starling	na	na	na
11	Bird	24-Jan-24	19	37.798678	-121.701212	Tall Fallow Grass/Forb	Medium	Rock Pigeon	26-Jan-24	Scavenged-feather spot	2
11	Bird	05-Feb-24	5	37.795863	-121.720278	Road	Large	California Gull	07-Feb-24	Scavenged-partial decomposed	2
11	Bird	05-Feb-24	24	37.788080	-121.705607	Grazed/Short Grass	Small	European Starling	05-Feb-24	Intact-fresh	1
11	Bird	05-Feb-24	2	37.802125	-121.723893	Tall Fallow Grass/Forb	Large	Red-tailed Hawk	na	na	na
11	Bird	12-Feb-24	16	37.804352	-121.706055	Grazed/Short Grass	Small	Killdeer	14-Feb-24	Scavenged-feather spot	2
11	Bird	12-Feb-24	26	37.789897	-121.701838	Grazed/Short Grass	Large	Turkey Vulture	26-Feb-24	Intact-partial decomposed	14
11	Bird	14-Feb-24	8	37.788930	-121.719355	Grazed/Short Grass	Large	Red-tailed Hawk	28-Feb-24	Scavenged-partial decomposed	14
11	Bird	14-Feb-24	33	37.792360	-121.663272	Tall Fallow Grass/Forb	Medium	Rock Pigeon	20-Feb-24	Scavenged-feather spot	6
11	Bird	14-Feb-24	14	37.781574	-121.712488	Grazed/Short Grass	Medium	Rock Pigeon	21-Feb-24	Scavenged-partial decomposed	7
11	Bird	19-Feb-24	1	37.805230	-121.727170	Grazed/Short Grass	Large	California Gull	19-Feb-24	Intact-fresh	1
11	Bird	19-Feb-24	7	37.788474	-121.724296	Road	Small	House Sparrow	21-Feb-24	Scavenged-feather spot	2
11	Bird	19-Feb-24	28	37.784575	-121.689893	Bare Dirt/Disturb Soil	Large	Red-tailed Hawk	26-Feb-24	Intact-partial decomposed	7
11	Bird	07-Mar-24	6	37.790278	-121.714505	Grazed/Short Grass	Small	Black-headed Grosbeak	14-Mar-24	Scavenged-feather spot	7
11	Bird	07-Mar-24	14	37.782050	-121.711760	Grazed/Short Grass	Large	Cackling Goose	na	na	na

Year	Carcass Type	Date Placed	Turbine ID	Latitude	Longitude	Substrate	Carcass Size	Species	Discovery Date	Condition At Discovery	Discovery Interval (days)
11	Bird	07-Mar-24	12	37.783973	-121.715957	Grazed/Short Grass	Medium	Rock Pigeon	07-Mar-24	Intact-partial decomposed	1
11	Bird	18-Mar-24	3	37.798541	-121.724005	Road	Medium	American Barn Owl	19-Mar-24	Intact-partial decomposed	1
11	Bird	18-Mar-24	31	37.790654	-121.676488	Grazed/Short Grass	Medium	California Quail	21-Mar-24	Intact-partial decomposed	3
11	Bird	18-Mar-24	28	37.784720	-121.690458	Grazed/Short Grass	Small	Yellow-rumped Warbler	na	na	na
11	Bird	01-Apr-24	12	37.784573	-121.715047	Grazed/Short Grass	Medium	California Quail	na	na	na
11	Bird	01-Apr-24	19	37.798400	-121.701262	Road	Small	Purple Finch	18-Apr-24	Scavenged-feather spot	17
11	Bird	18-Apr-24	33	37.792848	-121.662025	Tall Fallow Grass/Forb	Medium	American Barn Owl	06-Jun-24	Scavenged-feather spot	49
11	Bird	18-Apr-24	29	37.788998	-121.686160	Tall Fallow Grass/Forb	Large	Red-tailed Hawk	23-Aug-24	Scavenged-decomposed	127
11	Bird	29-Apr-24	26	37.789777	-121.700790	Tall Fallow Grass/Forb	Medium	American Crow	na	na	na
11	Bird	29-Apr-24	25	37.784437	-121.703880	Tall Fallow Grass/Forb	Medium	Band-tailed Pigeon	19-May-24	Scavenged-partial decomposed	20
11	Bird	29-Apr-24	15	37.808772	-121.706230	Tall Fallow Grass/Forb	Small	Dark-eyed Junco	na	na	na
11	Bird	29-Apr-24	4	37.794490	-121.725137	Bare Dirt/Disturb Soil	Small	European Starling	na	na	na
11	Bird	06-May-24	28	37.784985	-121.690255	Tall Fallow Grass/Forb	Small	Dark-eyed Junco	21-May-24	Intact-partial decomposed	15
11	Bird	06-May-24	7	37.788982	-121.725315	Tall Fallow Grass/Forb	Small	House Sparrow	na	na	na
11	Bird	06-May-24	5	37.796462	-121.720586	Tall Fallow Grass/Forb	Large	Red-tailed Hawk	07-May-24	Intact-partial decomposed	1
11	Bird	06-May-24	34	37.792206	-121.658202	Tall Fallow Grass/Forb	Large	Red-tailed Hawk	09-Jun-24	Intact-partial decomposed	34
11	Bird	13-May-24	8	37.788298	-121.719060	Tall Fallow Grass/Forb	Large	Red-tailed Hawk	22-May-24	Scavenged-partial decomposed	9
11	Bird	13-May-24	27	37.787043	-121.692106	Tall Fallow Grass/Forb	Large	Red-tailed Hawk	28-May-24	Intact-partial decomposed	15
11	Bird	13-May-24	21	37.794638	-121.710242	Tall Fallow Grass/Forb	Large	Red-tailed Hawk	14-Jun-24	Scavenged-partial decomposed	32
11	Bird	17-May-24	9	37.785544	-121.725219	Tall Fallow Grass/Forb	Medium	American Barn Owl	22-May-24	Scavenged-partial decomposed	5
11	Bird	17-May-24	18	37.798305	-121.706003	Grazed/Short Grass	Medium	American Barn Owl	na	na	na
11	Bird	17-May-24	25	37.785065	-121.703558	Tall Fallow Grass/Forb	Small	European Starling	05-Jun-24	Intact-partial decomposed	19
11	Bird	17-May-24	16	37.805190	-121.706330	Tall Fallow Grass/Forb	Large	Great Horned Owl	24-May-24	Intact-partial decomposed	7
11	Bird	25-May-24	30	37.787940	-121.679484	Tall Fallow Grass/Forb	Small	Brown Creeper	na	na	na
11	Bird	25-May-24	13	37.780875	-121.716328	Tall Fallow Grass/Forb	Small	House Sparrow	27-May-24	Intact-partial decomposed	2
11	Bird	25-May-24	12	37.784713	-121.716218	Tall Fallow Grass/Forb	Large	Red-tailed Hawk	27-May-24	Intact-fresh	2
11	Bird	25-May-24	15	37.808422	-121.705495	Tall Fallow Grass/Forb	Large	Red-tailed Hawk	28-May-24	Intact-partial decomposed	3
11	Bird	25-May-24	19	37.798003	-121.701020	Tall Fallow Grass/Forb	Large	Red-tailed Hawk	08-Jun-24	Intact-partial decomposed	14
11	Bird	09-Jun-24	28	37.784842	-121.689686	Tall Fallow Grass/Forb	Medium	American Crow	12-Jun-24	Intact-partial decomposed	3
11	Bird	09-Jun-24	22	37.793594	-121.704867	Tall Fallow Grass/Forb	Small	House Sparrow	na	na	na
11	Bird	09-Jun-24	23	37.788730	-121.709738	Tall Fallow Grass/Forb	Large	Red-tailed Hawk	14-Jun-24	Scavenged-partial decomposed	5
11	Bird	03-Jul-24	11	37.779862	-121.721790	Tall Fallow Grass/Forb	Medium	American Crow	15-Oct-24	Scavenged-feather spot	104
11	Bird	03-Jul-24	7	37.789055	-121.723643	Tall Fallow Grass/Forb	Medium	Rock Pigeon	11-Jul-24	Scavenged-decomposed	8
11	Bird	30-Jul-24	21	37.794282	-121.709752	Grazed/Short Grass	Large	California Gull	12-Aug-24	Scavenged-decomposed	13
11	Bird	30-Jul-24	18	37.798220	-121.705517	Tall Fallow Grass/Forb	Large	Double-crested Cormorant	na	na	na
11	Bird	30-Jul-24	13	37.781115	-121.716062	Grazed/Short Grass	Small	European Starling	01-Aug-24	Intact-partial decomposed	2
11	Bird	30-Jul-24	12	37.784587	-121.715250	Grazed/Short Grass	Large	Red-tailed Hawk	01-Aug-24	Scavenged-partial decomposed	2
11	Bird	30-Jul-24	22	37.794320	-121.705127	Bare Dirt/Disturb Soil	Large	Western Grebe	03-Aug-24	Scavenged-feather spot	4
11	Bird	04-Aug-24	7	37.788718	-121.724368	Other - See Notes	Medium	American Crow	08-Aug-24	Intact-partial decomposed	4
11	Bird	04-Aug-24	28	37.784577	-121.690885	Tall Fallow Grass/Forb	Small	Horned Lark	13-Aug-24	Scavenged-decomposed	9
11	Bird	04-Aug-24	20	37.796040	-121.699160	Grazed/Short Grass	Large	Red-tailed Hawk	na	na	na
11	Bird	04-Aug-24	24	37.788223	-121.705860	Tall Fallow Grass/Forb	Small	White-throated Swift	07-Aug-24	Scavenged-partial decomposed	3
11	Bird	13-Aug-24	19	37.798817	-121.701430	Tall Fallow Grass/Forb	Medium	American Crow	15-Aug-24	Intact-partial decomposed	2
11	Bird	13-Aug-24	15	37.808163	-121.706052	Tall Fallow Grass/Forb	Small	Barn Swallow	05-Sep-24	Intact-partial decomposed	23

Year	Carcass Type	Date Placed	Turbine ID	Latitude	Longitude	Substrate	Carcass Size	Species	Discovery Date	Condition At Discovery	Discovery Interval (days)
11	Bird	13-Aug-24	17	37.803522	-121.703528	Grazed/Short Grass	Large	Red-tailed Hawk	na	na	na
11	Bird	13-Aug-24	29	37.788743	-121.686457	Grazed/Short Grass	Large	Turkey Vulture	23-Aug-24	Intact-partial decomposed	10
11	Bird	13-Aug-24	5	37.795853	-121.720246	Road	Small	White-throated Swift	17-Aug-24	Intact-partial decomposed	4
11	Bird	13-Aug-24	30	37.787729	-121.679897	Road	Small	Yellow-rumped Warbler	na	na	na
11	Bird	18-Aug-24	14	37.781795	-121.712443	Grazed/Short Grass	Medium	American Crow	18-Sep-24	Scavenged-decomposed	31
11	Bird	18-Aug-24	32	37.793579	-121.667405	Grazed/Short Grass	Medium	Common Raven	04-Sep-24	Scavenged-partial decomposed	17
11	Bird	18-Aug-24	25	37.784772	-121.704260	Grazed/Short Grass	Medium	Great-tailed Grackle	19-Aug-24	Intact-partial decomposed	1
11	Bird	18-Aug-24	12	37.784063	-121.715305	Tall Fallow Grass/Forb	Small	Nuttall's Woodpecker	22-Aug-24	Intact-partial decomposed	4
11	Bird	18-Aug-24	33	37.792962	-121.662692	Bare Dirt/Disturb Soil	Medium	Rock Pigeon	19-Aug-24	Intact-fresh	1
11	Bird	18-Aug-24	24	37.787813	-121.705491	Grazed/Short Grass	Medium	Rock Pigeon	26-Aug-24	Intact-partial decomposed	8
11	Bird	18-Aug-24	31	37.790785	-121.675405	Tall Fallow Grass/Forb	Medium	Rock Pigeon	03-Sep-24	Scavenged-partial decomposed	16
11	Bird	18-Aug-24	1	37.804707	-121.726417	Bare Dirt/Disturb Soil	Medium	Rock Pigeon	09-Sep-24	Scavenged-partial decomposed	22
11	Bird	18-Aug-24	4	37.794717	-121.724791	Grazed/Short Grass	Small	Semipalmated Plover	26-Aug-24	Scavenged-partial decomposed	8
11	Bird	18-Aug-24	10	37.784680	-121.720220	Grazed/Short Grass	Large	Wild Turkey	28-Aug-24	Scavenged-partial decomposed	10
11	Bird	14-Sep-24	33	37.792533	-121.663072	Tall Fallow Grass/Forb	Small	Horned Lark	na	na	na
11	Bird	14-Sep-24	30	37.787545	-121.679930	Tall Fallow Grass/Forb	Medium	Rock Pigeon	08-Oct-24	Scavenged-feather spot	24
11	Bird	14-Sep-24	6	37.790345	-121.715117	Grazed/Short Grass	Small	Western Sandpiper	18-Sep-24	Scavenged-partial decomposed	4
11	Bird	08-Oct-24	29	37.788514	-121.687108	Tall Fallow Grass/Forb	Medium	American Barn Owl	18-Oct-24	Scavenged-partial decomposed	10
11	Bird	08-Oct-24	32	37.793849	-121.667186	Grazed/Short Grass	Large	California Gull	30-Oct-24	Scavenged-feather spot	22
11	Bird	09-Oct-24	16	37.805298	-121.705372	Tall Fallow Grass/Forb	Medium	Rock Pigeon	12-Oct-24	Scavenged-feather spot	3
11	Bird	09-Oct-24	15	37.808689	-121.705609	Tall Fallow Grass/Forb	Small	Townsend's Warbler	na	na	na
11	Bird	15-Oct-24	20	37.795797	-121.699267	Grazed/Short Grass	Medium	American Crow	na	na	na
11	Bird	15-Oct-24	25	37.784746	-121.704176	Grazed/Short Grass	Small	European Starling	21-Oct-24	Intact-fresh	6
11	Bird	15-Oct-24	4	37.794602	-121.725495	Grazed/Short Grass	Large	Red-tailed Hawk	16-Oct-24	Intact-fresh	1
11	Bird	15-Oct-24	9	37.784806	-121.725869	Tall Fallow Grass/Forb	Large	Red-tailed Hawk	29-Oct-24	Intact-partial decomposed	14
11	Bird	20-Oct-24	17	37.802755	-121.703137	Road	Medium	American Barn Owl	na	na	na
11	Bird	20-Oct-24	33	37.793282	-121.662365	Tall Fallow Grass/Forb	Small	European Starling	21-Oct-24	Scavenged-partial decomposed	1
11	Bird	20-Oct-24	3	37.798503	-121.723717	Grazed/Short Grass	Large	Red-tailed Hawk	21-Oct-24	Intact-fresh	1
11	Bird	20-Oct-24	5	37.796070	-121.719771	Tall Fallow Grass/Forb	Medium	Rock Pigeon	na	na	na
11	Bird	27-Oct-24	8	37.789108	-121.719825	Tall Fallow Grass/Forb	Large	Clark's Grebe	29-Oct-24	Scavenged-partial decomposed	2
11	Bird	27-Oct-24	1	37.804407	-121.726083	Grazed/Short Grass	Small	European Starling	29-Oct-24	Intact-fresh	2
11	Bird	27-Oct-24	23	37.789102	-121.710350	Tall Fallow Grass/Forb	Large	Red-tailed Hawk	30-Oct-24	Intact-partial decomposed	3
11	Bird	27-Oct-24	7	37.788155	-121.724068	Tall Fallow Grass/Forb	Large	Red-tailed Hawk	31-Oct-24	Intact-partial decomposed	4
11	Bird	27-Oct-24	21	37.793490	-121.710037	Grazed/Short Grass	Large	Red-tailed Hawk	05-Nov-24	Scavenged-feather spot	9
11	Bird	29-Oct-24	16	37.804842	-121.705420	Tall Fallow Grass/Forb	Medium	American Kestrel	01-Nov-24	Scavenged-partial decomposed	3
11	Bird	29-Oct-24	26	37.789706	-121.701626	Grazed/Short Grass	Large	Red-tailed Hawk	na	na	na
11	Bird	29-Oct-24	19	37.799070	-121.700750	Tall Fallow Grass/Forb	Small	White-throated Swift	na	na	na
11	Bird	05-Nov-24	4	37.794612	-121.726368	Tall Fallow Grass/Forb	Medium	American Barn Owl	11-Nov-24	Intact-partial decomposed	6
11	Bird	05-Nov-24	2	37.803152	-121.724907	Grazed/Short Grass	Large	California Gull	21-Nov-24	Scavenged-feather spot	16
11	Bird	05-Nov-24	5	37.795374	-121.720441	Tall Fallow Grass/Forb	Small	European Starling	na	na	na
11	Bird	05-Nov-24	12	37.784740	-121.714792	Tall Fallow Grass/Forb	Small	Golden-crowned Sparrow	07-Nov-24	Scavenged-partial decomposed	2
11	Bird	10-Nov-24	22	37.794065	-121.706026	Grazed/Short Grass	Small	European Starling	na	na	na
11	Bird	10-Nov-24	27	37.788034	-121.692185	Tall Fallow Grass/Forb	Large	Red-tailed Hawk	15-Nov-24	Intact-fresh	5
11	Bird	10-Nov-24	6	37.790593	-121.714660	Grazed/Short Grass	Large	Red-tailed Hawk	na	na	na

Year	Carcass Type	Date Placed	Turbine ID	Latitude	Longitude	Substrate	Carcass Size	Species	Discovery Date	Condition At Discovery	Discovery Interval (days)
11	Bird	19-Nov-24	6	37.789790	-121.715152	Grazed/Short Grass	Medium	American Crow	na	na	na
11	Bird	19-Nov-24	5	37.796062	-121.720633	Tall Fallow Grass/Forb	Small	European Starling	na	na	na
11	Bird	19-Nov-24	15	37.808573	-121.705700	Road	Large	Red-tailed Hawk	na	na	na
11	Bird	19-Nov-24	13	37.780728	-121.716987	Tall Fallow Grass/Forb	Medium	Rock Pigeon	21-Nov-24	Intact-partial decomposed	2
11	Bird	19-Nov-24	31	37.790577	-121.676249	Grazed/Short Grass	Small	White-throated Swift	20-Nov-24	Intact-partial decomposed	1

Appendix F. Candidate Models Evaluated to Compose GenEst Models for Estimating Carcass Detectability During Study

In the tables below, note the following:

- Formula *p* describes variation in the median probability of detection (CD) among covariate classes.
- Formula *k* describes how the probability of detection declines with successive survey attempts. For this analysis, *k* was set to zero (0) as part of a customized approach to using GenEst to estimate CD based on binomial field trials (i.e., carcass is discovered or not with no monitoring for persistence and no limit on time to discovery).
- AICc = Akaike Information Criterion corrected for small samples sizes
- Independent variables are defined as follows: *Survey Type*: 7-day interval with detection dogs or 28-day interval with humans; *Season*: winter, spring, summer, or fall as defined in Section 3.2; *Season 2A* = fall/winter or spring/summer; *Season 2B*: winter/spring or summer/fall; *Season 2C* = migration (spring and fall) or non-migration (winter and summer); *Substrate Visibility*: high = bare dirt or gravel road/pad, moderate = grazed short grass/forb or rocky drainage, or low = tall fallow grass/forb.
- In each table, the selected model is highlighted in green and the null model in gray.

Bats: 7-day survey plots only

Formula <i>p</i>	Formula <i>k</i>	AICc	ΔAICc
p ~ Constant	k fixed at 0	127.66	0.00
p ~ Year	k fixed at 0	128.87	1.21
p ~ Visibility	k fixed at 0	129.02	1.36
p ~ Season2A	k fixed at 0	129.45	1.79
p ~ Season2B	k fixed at 0	129.48	1.82
p ~ Season2C	k fixed at 0	129.67	2.01
p ~ Year + Visibility	k fixed at 0	130.47	2.81
p ~ Year + Season2B	k fixed at 0	130.77	3.11
p ~ Season2C + Visibility	k fixed at 0	130.78	3.12
p ~ Year + Season2A	k fixed at 0	130.78	3.12
p ~ Season2B + Visibility	k fixed at 0	130.93	3.27
p ~ Year + Season2C	k fixed at 0	130.93	3.27
p ~ Season2A + Visibility	k fixed at 0	130.99	3.33
p ~ Year * Season2C	k fixed at 0	131.33	3.67
p ~ Year * Season2B	k fixed at 0	131.67	4.01
p ~ Year + Season2C + Visibility	k fixed at 0	132.27	4.61
p ~ Year + Season2B + Visibility	k fixed at 0	132.49	4.83
p ~ Year + Season2A + Visibility	k fixed at 0	132.53	4.87

Formula p	Formula k	AICc	ΔAICc
p ~ Year * Season2C + Visibility	k fixed at 0	132.73	5.07
p ~ Year * Season2A	k fixed at 0	132.88	5.22
p ~ Season	k fixed at 0	133.43	5.77
p ~ Year * Season2B + Visibility	k fixed at 0	133.82	6.16
p ~ Year * Season2A + Visibility	k fixed at 0	134.81	7.15
p ~ Season + Visibility	k fixed at 0	134.83	7.17
p ~ Year + Season	k fixed at 0	134.89	7.23
p ~ Year + Season + Visibility	k fixed at 0	136.52	8.86
p ~ Year * Season	k fixed at 0	138.78	11.12
p ~ Year * Season + Visibility	k fixed at 0	141.17	13.51

Small Birds: 7-day survey plots only

Formula p	Formula k	AICc	ΔAICc
p ~ constant	k fixed at 0	119.45	0.00
p ~ Season2A	k fixed at 0	121.26	1.81
p ~ Season2C	k fixed at 0	121.36	1.91
p ~ Year	k fixed at 0	121.54	2.09
p ~ Season2B	k fixed at 0	121.55	2.10
p ~ Year * Season2C	k fixed at 0	122.10	2.65
p ~ Visibility	k fixed at 0	122.69	3.24
p ~ Year + Season2A	k fixed at 0	123.39	3.94
p ~ Year + Season2C	k fixed at 0	123.49	4.04
p ~ Year + Season2B	k fixed at 0	123.68	4.23
p ~ Season2C + Visibility	k fixed at 0	124.52	5.07
p ~ Season2A + Visibility	k fixed at 0	124.58	5.13
p ~ Year + Visibility	k fixed at 0	124.84	5.39
p ~ Season2B + Visibility	k fixed at 0	124.89	5.44
p ~ Year * Season2C + Visibility	k fixed at 0	125.37	5.92
p ~ Season	k fixed at 0	125.41	5.96
p ~ Year * Season2A	k fixed at 0	125.49	6.04
p ~ Year * Season2B	k fixed at 0	125.88	6.43
p ~ Year + Season2C + Visibility	k fixed at 0	126.71	7.26
p ~ Year + Season2A + Visibility	k fixed at 0	126.76	7.31
p ~ Year + Season2B + Visibility	k fixed at 0	127.09	7.64
p ~ Year + Season	k fixed at 0	127.64	8.19
p ~ Season + Visibility	k fixed at 0	128.77	9.32
p ~ Year * Season2A + Visibility	k fixed at 0	129.05	9.60
p ~ Year * Season2B + Visibility	k fixed at 0	129.36	9.91
p ~ Year * Season	k fixed at 0	130.99	11.54
p ~ Year + Season + Visibility	k fixed at 0	131.04	11.59
p ~ Year * Season + Visibility	k fixed at 0	134.87	15.42

Medium Birds

Formula p	Formula k	AICc	ΔAICc
p ~ Season2C + Survey Type	k fixed at 0	95.31	0.00
p ~ Season2A * Survey Type	k fixed at 0	95.85	0.54
p ~ Year + Season2C + Survey Type	k fixed at 0	96.03	0.72
p ~ Season + Survey Type	k fixed at 0	96.20	0.89
p ~ Year * Season2C + Survey Type	k fixed at 0	96.44	1.13
p ~ Year * Season2A + Survey Type	k fixed at 0	96.90	1.59
p ~ Season2C * Survey Type	k fixed at 0	97.19	1.88
p ~ Year + Season + Survey Type	k fixed at 0	97.34	2.03
p ~ Year + Season2C + Survey Type + Year : Survey Type	k fixed at 0	97.34	2.03
p ~ Season2A + Survey Type	k fixed at 0	97.60	2.29
p ~ Year + Season2C + Survey Type + Season2C : Survey Type	k fixed at 0	97.92	2.61
p ~ Year + Season2C + Survey Type + Year : Season2C + Year : Survey Type	k fixed at 0	97.95	2.64
p ~ Survey Type	k fixed at 0	98.02	2.71
p ~ Year + Season2C + Survey Type + Year : Season2C + Season2C : Survey Type	k fixed at 0	98.21	2.90
p ~ Year + Season2A + Survey Type + Year : Survey Type + Survey Type : Season2A	k fixed at 0	98.36	3.05
p ~ Year + Season2A + Survey Type	k fixed at 0	98.77	3.46
p ~ Year + Season + Survey Type + Year : Survey Type	k fixed at 0	98.79	3.48
p ~ Year + Survey Type	k fixed at 0	98.89	3.58
p ~ Year + Season2A + Survey Type + Year : Season2A + Survey Type : Season2A	k fixed at 0	99.12	3.81
p ~ Year + Season2C + Survey Type + Year : Survey Type + Season2C : Survey Type	k fixed at 0	99.16	3.85
p ~ Year + Season2C + Survey Type + Year : Season2C + Year : Survey Type + Season2C : Survey Type	k fixed at 0	99.24	3.93
p ~ Season * Survey Type	k fixed at 0	99.62	4.31
p ~ Year + Season + Survey Type + Survey Type : Season	k fixed at 0	99.63	4.32
p ~ Season2B + Survey Type	k fixed at 0	99.72	4.41
p ~ Year * Survey Type	k fixed at 0	100.32	5.01
p ~ Year + Season2A + Survey Type + Year : Survey Type	k fixed at 0	100.33	5.02
p ~ Year + Season2A + Survey Type + Year : Survey Type + Year : Season2A + Survey Type : Season2A	k fixed at 0	100.73	5.42
p ~ Year + Season2B + Survey Type	k fixed at 0	100.74	5.43
p ~ Year + Season + Survey Type + Year : Survey Type + Survey Type : Season	k fixed at 0	101.02	5.71
p ~ Season2B * Survey Type	k fixed at 0	101.86	6.55
p ~ Year * Season2C * Survey Type	k fixed at 0	101.99	6.68
p ~ Year + Season2B + Survey Type + Year : Survey Type	k fixed at 0	102.13	6.82
p ~ Year * Season + Survey Type	k fixed at 0	102.22	6.91
p ~ Year * Season2A * Survey Type	k fixed at 0	102.34	7.03
p ~ Year + Season2A + Survey Type + Year : Survey Type + Year : Season2A	k fixed at 0	102.52	7.21
p ~ Year + Season2B + Survey Type + Survey Type : Season2B	k fixed at 0	102.88	7.57
p ~ Year * Season2B + Survey Type	k fixed at 0	102.99	7.68
p ~ Year + Season2C	k fixed at 0	103.10	7.79
p ~ Year * Season2C	k fixed at 0	103.42	8.11
p ~ Season2C + Visibility	k fixed at 0	103.64	8.33
p ~ Year + Season2C + Visibility	k fixed at 0	103.77	8.46

Formula p	Formula k	AICc	ΔAICc
p ~ Season2C	k fixed at 0	103.93	8.62
p ~ Year + Season + Survey Type + Year : Survey Type + Year : Season	k fixed at 0	104.06	8.75
p ~ Year + Season2C + Visibility + Year : Season2C	k fixed at 0	104.11	8.80
p ~ Year + Season2B + Survey Type + Year : Survey Type + Survey Type : Season2B	k fixed at 0	104.37	9.06
p ~ Year + Season2B + Survey Type + Year : Survey Type + Year : Season2B	k fixed at 0	104.44	9.13
p ~ Year + Season	k fixed at 0	104.51	9.20
p ~ Season	k fixed at 0	104.75	9.44
p ~ Year + Season2B + Survey Type + Year : Season2B + Survey Type : Season2B	k fixed at 0	105.19	9.88
p ~ Season + Visibility	k fixed at 0	105.44	10.13
p ~ Year + Season + Survey Type + Year : Season + Survey Type : Season	k fixed at 0	105.45	10.14
p ~ Year + Season + Visibility	k fixed at 0	106.16	10.85
p ~ Year + Visibility	k fixed at 0	106.46	11.15
p ~ Visibility	k fixed at 0	106.52	11.21
p ~ Year + Season2B + Survey Type + Year : Survey Type + Year : Season2B + Survey Type : Season2B	k fixed at 0	106.74	11.43
p ~ Year	k fixed at 0	106.77	11.46
p ~ Season2A + Visibility	k fixed at 0	106.78	11.47
p ~ Year + Season2A	k fixed at 0	106.78	11.47
p ~ Season2A	k fixed at 0	107.13	11.82
p ~ Year + Season2A + Visibility	k fixed at 0	107.19	11.88
p ~ Year + Season + Survey Type + Year : Survey Type + Year : Season + Survey Type : Season	k fixed at 0	107.32	12.01
p ~ constant	k fixed at 0	107.45	12.14
p ~ Year + Season2B	k fixed at 0	108.55	13.24
p ~ Season2B + Visibility	k fixed at 0	108.63	13.32
p ~ Year + Season2B + Visibility	k fixed at 0	108.66	13.35
p ~ Year * Season2B * Survey Type	k fixed at 0	108.72	13.41
p ~ Year * Season2A	k fixed at 0	108.88	13.57
p ~ Season2B	k fixed at 0	108.98	13.67
p ~ Year + Season2A + Visibility + Year : Season2A	k fixed at 0	109.32	14.01
p ~ Year * Season	k fixed at 0	110.24	14.93
p ~ Year * Season2B	k fixed at 0	110.72	15.41
p ~ Year + Season2B + Visibility + Year : Season2B	k fixed at 0	110.87	15.56
p ~ Year + Season + Visibility + Year : Season	k fixed at 0	111.03	15.72
p ~ Year * Season * Survey Type	k fixed at 0	118.11	22.80

Large Birds

Formula p	Formula k	AICc	ΔAICc
p ~ Season2B	k fixed at 0	66.06	0.00
p ~ Year + Season2B	k fixed at 0	67.15	1.09
p ~ Survey Type + Season2B	k fixed at 0	67.93	1.87
p ~ Year * Season2B	k fixed at 0	68.61	2.55
p ~ Survey Type * Season2B	k fixed at 0	68.99	2.93
p ~ Year + Survey Type * Season2B	k fixed at 0	69.14	3.08
p ~ Year + Survey Type + Season2B	k fixed at 0	69.25	3.19

Formula p	Formula k	AICc	ΔAICc
p ~ Year + Survey Type + Season2B + Year : Season2B	k fixed at 0	69.70	3.64
p ~ Year + Survey Type + Season2B + Year : Season2B + Survey Type : Season2B	k fixed at 0	69.85	3.79
p ~ Season2B + Visibility	k fixed at 0	70.19	4.13
p ~ Season	k fixed at 0	70.20	4.14
p ~ Year + Season2B + Visibility	k fixed at 0	71.22	5.16
p ~ Year + Survey Type + Season2B + Year : Survey Type + Survey Type : Season2B	k fixed at 0	71.45	5.39
p ~ Year + Season	k fixed at 0	71.47	5.41
p ~ Year * Survey Type + Season2B	k fixed at 0	71.48	5.42
p ~ Year + Season2B + Visibility + Year : Season2B	k fixed at 0	71.51	5.45
p ~ constant	k fixed at 0	71.56	5.50
p ~ Survey Type * Season2A	k fixed at 0	71.74	5.68
p ~ Year + Survey Type + Season2B + Year : Survey Type + Year : Season2B	k fixed at 0	71.98	5.92
p ~ Year + Survey Type + Season2B + Year : Survey Type + Year : Season2B + Survey Type : Season2B	k fixed at 0	72.09	6.03
p ~ Year + Survey Type * Season	k fixed at 0	72.12	6.06
p ~ Survey Type + Season	k fixed at 0	72.15	6.09
p ~ Year + Survey Type * Season2A	k fixed at 0	72.21	6.15
p ~ Year	k fixed at 0	72.66	6.60
p ~ Survey Type * Season2C	k fixed at 0	72.89	6.83
p ~ Survey Type	k fixed at 0	73.23	7.17
p ~ Year + Survey Type * Season2C	k fixed at 0	73.29	7.23
p ~ Season2A	k fixed at 0	73.36	7.30
p ~ Season2C	k fixed at 0	73.45	7.39
p ~ Year + Survey Type + Season2A + Year : Season2A + Survey Type : Season2A	k fixed at 0	73.48	7.42
p ~ Year + Survey Type + Season	k fixed at 0	73.67	7.61
p ~ Survey Type * Season	k fixed at 0	73.70	7.64
p ~ Year + Survey Type + Season2A + Year : Survey Type + Survey Type : Season2A	k fixed at 0	74.12	8.06
p ~ Season + Visibility	k fixed at 0	74.55	8.49
p ~ Year + Survey Type	k fixed at 0	74.55	8.49
p ~ Year + Season2C	k fixed at 0	74.60	8.54
p ~ Year + Survey Type + Season + Year : Survey Type + Survey Type : Season	k fixed at 0	74.60	8.54
p ~ Year + Season2A	k fixed at 0	74.62	8.56
p ~ Survey Type + Season2A	k fixed at 0	75.10	9.04
p ~ Survey Type + Season2C	k fixed at 0	75.14	9.08
p ~ Year * Season2A	k fixed at 0	75.19	9.13
p ~ Year + Survey Type + Season2C + Year : Season2C + Survey Type : Season2C	k fixed at 0	75.21	9.15
p ~ Year + Survey Type + Season2C + Year : Survey Type + Survey Type : Season2C	k fixed at 0	75.45	9.39
p ~ Visibility	k fixed at 0	75.57	9.51
p ~ Year + Season + Visibility	k fixed at 0	75.75	9.69
p ~ Year + Survey Type + Season2A + Year : Survey Type + Year : Season2A + Survey Type : Season2A	k fixed at 0	75.85	9.79
p ~ Year * Survey Type + Season	k fixed at 0	76.01	9.95
p ~ Year * Season2C	k fixed at 0	76.04	9.98
p ~ Year + Visibility	k fixed at 0	76.35	10.29
p ~ Year + Survey Type + Season2C	k fixed at 0	76.51	10.45
p ~ Year + Survey Type + Season2A	k fixed at 0	76.57	10.51
p ~ Year * Survey Type	k fixed at 0	76.58	10.52
p ~ Year * Season	k fixed at 0	77.13	11.07

Formula p	Formula k	AICc	ΔAICc
p ~ Year + Survey Type + Season2A + Year : Season2A	k fixed at 0	77.18	11.12
p ~ Year + Survey Type + Season + Year : Season	k fixed at 0	77.40	11.34
p ~ Season2C + Visibility	k fixed at 0	77.48	11.42
p ~ Season2A + Visibility	k fixed at 0	77.55	11.49
p ~ Year + Survey Type + Season2C + Year : Survey Type + Year : Season2C + Survey Type : Season2C	k fixed at 0	77.58	11.52
p ~ Year * Survey Type * Season2B	k fixed at 0	77.60	11.54
p ~ Year + Survey Type + Season + Year : Season + Survey Type : Season	k fixed at 0	77.77	11.71
p ~ Year + Survey Type + Season2C + Year : Season2C	k fixed at 0	78.01	11.95
p ~ Year + Season2C + Visibility	k fixed at 0	78.15	12.09
p ~ Year + Season2A + Visibility	k fixed at 0	78.54	12.48
p ~ Year * Survey Type + Season2C	k fixed at 0	78.60	12.54
p ~ Year * Survey Type + Season2A	k fixed at 0	78.65	12.59
p ~ Year + Season2A + Visibility + Year : Season2A	k fixed at 0	79.01	12.95
p ~ Year + Survey Type + Season2A + Year : Survey Type + Year : Season2A	k fixed at 0	79.33	13.27
p ~ Year + Season + Visibility + Year : Season	k fixed at 0	79.61	13.55
p ~ Year + Survey Type + Season + Year : Survey Type + Year : Season	k fixed at 0	79.96	13.90
p ~ Year + Season2C + Visibility + Year : Season2C	k fixed at 0	80.01	13.95
p ~ Year + Survey Type + Season + Year : Survey Type + Year : Season + Survey Type : Season	k fixed at 0	80.11	14.05
p ~ Year + Survey Type + Season2C + Year : Survey Type + Year : Season2C	k fixed at 0	80.19	14.13
p ~ Year * Survey Type * Season2A	k fixed at 0	80.34	14.28
p ~ Year * Survey Type * Season2C	k fixed at 0	82.08	16.02
p ~ Year * Survey Type * Season	k fixed at 0	97.46	31.40