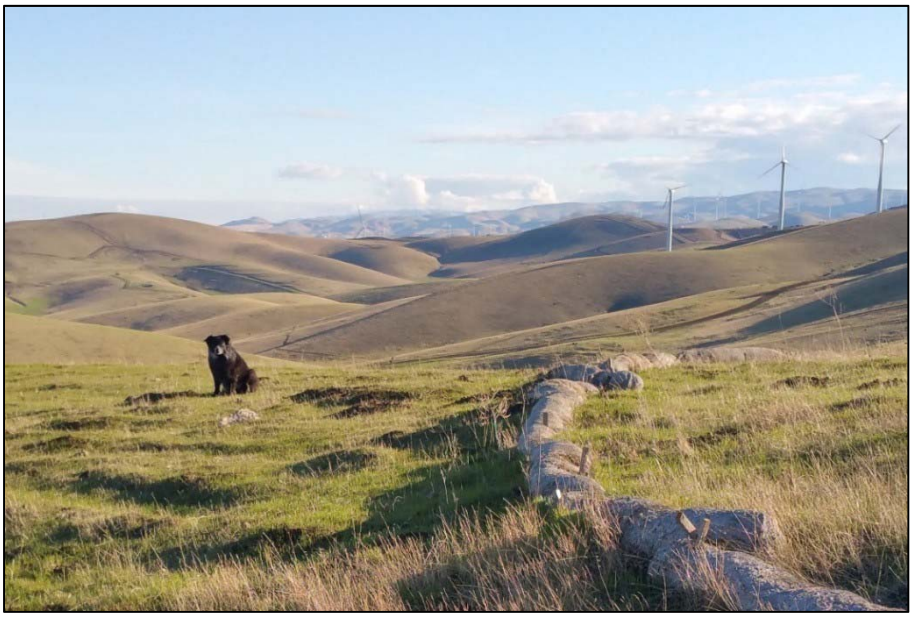
Golden Hills North Wind Energy Center
Postconstruction Fatality Monitoring Report: Years 1 and 2



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Executive Summary

The Golden Hills North (GHN) Wind Energy Center is a 46-megawatt (MW) wind-energy facility comprising 20 2.3-MW turbines located in the Altamont Pass Wind Resource Area (APWRA) of Alameda County, California. This report summarizes the results of the first two of three years of postconstruction bird and bat fatality monitoring required to meet the conditions of approval outlined in the Conditional Use Permit (PLN2015-00157) issued for GHN (hereafter, "Project") by the East County Board of Zoning Adjustments in 2015. It also presents the results of weekly raptor activity surveys conducted from established points to provide context concerning raptor presence and activity patterns. The results presented here are preliminary and will not be finalized until the completion of the third and final year of scheduled mortality and raptor monitoring.

Field and Analytical Methods

Fatality surveys for all bird and bat species were conducted with scent-detection dogs, using training standards and protocols previously developed by H. T. Harvey & Associates starting in 2013. Circular survey plots of 115-meter (m) radius were centered on each turbine. During a given year, half the turbines were surveyed at 7-day intervals and the other half at 28-day intervals. This selection will be changed each year using spatially-balanced annual designs that ensure every turbine receives at least one year of 7-day surveys and one year of 28-day surveys. Carcass detectability (CD) trials also were conducted throughout each year across all turbines. Raptor activity was monitored every week using 30-minute counts at four strategically placed observation points.

Documented fatalities coupled with estimated CD parameters were used to generate adjusted fatality estimates for the whole GHN facility using both 7-day and 28-day survey data. We used the TAC-approved Big D approach to produce fatality estimates adjusted for CD. Estimating CD involved field trials resulting in probability of detection estimates that integrated the influences of searcher efficiency, carcass persistence, and bleed-through without independently estimating each value. Adjusted fatality estimates were produced using a customized implementation of the USGS *GenEst* fatality estimator. Independent multi-year CD models were generated to inform these estimates for bats, small birds, medium birds, and large birds. Covariates considered for inclusion in the CD estimation models were *Year* (monitoring Year 1 or 2), *Survey Type* (7-day or 28-day), and *Season* (several four- and two-season variants evaluated independently). To illustrate the temporal and spatial distributions of fatalities during the monitoring period, we used *GenEst* to produce turbine-specific, adjusted annual fatality estimates and *GenEst* parameters to produce monthly adjusted estimates for selected groups and species.

Results and Discussion

Fatality surveys took place between October 8, 2018 and October 3, 2020. Some departures from idealized survey intervals and turbine coverage occurred due to nesting golden eagles and turbine failures, which rendered some plots inaccessible for periods of time. Additionally, fatality survey activity was curtailed during some periods when wildfire produced unhealthy air quality. Appropriate adjustments were made to CD trial carcass

placements and fatality estimation to reflect these departures from idealized design. New trial carcasses were placed on all available 7-day and 28-day plots during 39 weeks of Year 1 and 43 weeks of Year 2. Carcass detectability over both years on 7-day plots was greater than 60% for bats and small birds, approximately 80% for medium birds, and 100% for large birds. Carcass detectability over both years on 28-day plots was lower; approximately 30% for bats, approximately 50% for small birds, just over 70% for medium birds, and nearly 100% for large birds. None of the selected *GenEst* CD models included Year as a contributing predictor, with interannual differences nominal for all groups. The selected models for bats and small birds included the effects of *Survey Type* and *Season2A* (two-season variant: fall/winter, spring/summer). The model for medium birds included only *Season2A*. The null model was selected for large birds, reflecting an overall, perennially sustained CD rate of >98%.

Fatalities recorded over both years included five bat species, nine raptor species (including vultures), and 54 nonraptor bird species. The native bat and birds included one bat species, three raptor species, and four nonraptor species that are afforded special status in California: western red bat, golden eagle, burrowing owl, long-eared owl, Vaux's swift, yellow warbler, yellow-breasted chat, and tricolored blackbird. In total, 453 individual bats and 348 individual bird fatalities that contributed to fatality estimation were recorded on survey plots over the two years. For bats, estimated Year 1 fatalities were nonsignificantly higher than estimated Year 2 fatalities, and bat mortality averaged highest in summer and was negligible in winter. For birds, fatality rates did not differ across years, and were highest in spring for nonraptors and highest in fall for raptors. Fatality rates for bats and all bird groups tended to be higher at turbines in the middle of the facility than at other turbines; however, bat and nonraptor fatalities were recorded at all turbines in both years. Raptor fatalities were recorded at only 7 of 20 turbines during both monitoring years, and no raptor fatalities were recorded at three turbines. Red-tailed hawk was the only raptor species with more than 10 documented fatalities each year. Subadults often predominate among the golden eagle fatalities recorded in the APWRA, but two years of records from GHN showed approximately equal numbers of full adults and subadults (three of each, plus one that could only be aged as non-juvenile).

In comparison to other repowered wind facilities in the area, the 2-year average bat fatality rate per MW was at least 2–3 times higher at GHN (Table ES-1), a pattern primarily driven by Mexican free-tailed bat fatalities. This could be plausibly attributed to the combination of detection-dog teams being used for all surveys and the presence of reservoirs near GHN. The nonraptor fatality rates also were higher at both GHN and Golden Hills (GH) than at other repowered projects. In contrast, with all native and nonnative species included, the GH and GHN nonraptor estimates (5.55 and 5.13 fatalities per MW per year, respectively) were significantly lower than the estimated APWRA-wide pre-repowering rate (8.38). However, this marked difference primarily reflects a substantial post-repower reduction in fatalities of nonnative rock pigeons and European starlings. Limited to native species, the GH/GHN nonraptor estimates were marginally higher than the established PEIR mortality threshold (Table ES-1). Note, however, that such comparisons do not present an accurate picture, because the threshold value is biased low, because it was based on searches conducted only by humans at mostly long 45-day search intervals and at only a small proportion of the old-generation turbines.

The combined raptor fatality rate at GHN was comparable to other repowered facilities, and substantially lower than during the pre-repowering era. The 2-year average fatality rates for golden eagles and red-tailed hawks

were similar to the values established as thresholds in the APWRA repowering Programmatic Environmental Impact Report, whereas it appears fatality rates have declined substantially post-repowering for American kestrels, burrowing owls, and other raptor species of local conservation concern such as prairie falcon and barn owl.

There were 415 raptor activity surveys conducted from four points over both years, producing 12,450 cumulative minutes of observation time. Raptor observations were made during about 22% of all survey minutes, and represented 12 species, with red-tailed hawk (44%), golden eagle (29%), and turkey vulture (10%) accounting for most records. Sightings made within 50 m of turbine blades accounted for 8% of all raptor observations, with turkey vulture and golden eagle most often recorded in proximity to turbines.

The results of two years of GHN monitoring, coupled with findings from GH, emphasize the value of scent-detection dogs for bat and small bird fatality surveys. They also indicate that, when detection dogs are used as searchers, search interval is an important factor in fatality estimation for bats, but not for birds. Even with tailored CD adjustments, fatality estimates based on 28-day surveys significantly underestimate bat fatalities.

Table ES-1. Comparison of Adjusted Fatalities Per MW (95% Confidence Interval) Estimates for Bats, All Nonraptors, All Raptors, and Selected Bird Species From This Study and Other Relevant Monitoring Studies Conducted in the Altamont Pass Wind Resource Area (APWRA). [1]

Study	All Bats	All Native Nonraptors	Loggerhead Shrike	Tricolored Blackbird	All Raptors	Golden Eagle[2]	Red-tailed Hawk	Swainson's Hawk	American Kestrel	Prairie Falcon	Burrowing Owl	Barn Owl
This Project: 2-year average	10.21 (9.04–11.38)	4.98 (4.22–5.74)	0	0.02 (0.00–0.05)	0.71 (0.46–0.96)	***0.09*** ***(0.06–0.11)***	0.30 (0.14–0.46)	0	0.13 (0.11–0.15)	0.01 (0.00–0.04)	0.05 (0.01–0.10)	0.02 (0.00–0.05)
Golden Hills: 3-year average	5.55 (5.15–5.95)	5.25 (4.26–6.23)	0.05 (0.00–0.16)	0.03 (0.00–0.06)	1.12 (0.81–1.43)	***0.14*** ***(0.07–0.22)***	0.52 (0.25–0.79)	0	0.10 (0.07–0.14)	0.01 (0.00–0.01)	0.19 (0.02–0.35)	0.02 (0.00–0.05)
Vasco Winds: 3-year average	3.21 (3.06–3.36)	1.94 (1.10–2.77)	0.02 (0.00–0.07)	0.02 (0.00–0.06)	0.64 (0.20–1.09)	0.04 (0.02–0.07)	0.21 (0.04–0.38)	0	0.28 (0.07–0.49)	0.01 (0.00–0.03)	0.06 (0.00–0.17)	0.02 (0.00–0.05)
Buena Vista: 3-year average	0.67	1.01	0	0	0.36	0.07	0.17	0	0.09	nd[3]	0	nd
Diablo Winds: 5-year average	0.78	2.51	nd	nd	1.21	0.02 (0.02–0.02)	0.28 (0.24–0.32)	nd	0.07 (0.05–0.09)	nd	0.58 (0.39–0.77)	nd
APWRA-wide Pre-repower: 2005–13 average	0.12–0.26	nd	0.15 (0.06–0.24)	0.01 (0.01–0.02)	2.01 (1.46–2.55)	0.09 (0.07–0.10)	0.40 (0.33–0.47)	0.001 (0.001–0.001)	0.56 (0.37–0.74)	0.02 (0.01–0.02)	0.67 (0.44–0.90)	0.18 (0.14–0.21)
Average estimates reflected in Programmatic EIR [4]												
Repowered Vasco Winds Year 1	nd	2.09	–[3]	–	0.64	0.03	0.25	–	0.30	–	0.05	0.03
Repowered Buena Vista 3-year	0.48–1.08	1.01	–	–	0.31	0.04	0.10	–	0.15	0.00	0	0.00
Repowered Diablo Winds 5-year	0.78	2.51	0.00	–	1.21	0.01	0.20	–	0.09	–	0.84	0.02
Nonrepowered APWRA-wide, 7-year	0.26	4.50	0.19	–	2.43	0.08	0.44	0.00	0.59	0.02	0.78	0.24

[1] This table corresponds to Table 18 in the full report, which provides additional information about data sources and attribution in table footnotes that are not reproduced here.

[2] ***The values for this species presented here from this Project and the Golden Hills project represent adjusted estimates derived using GenEst; however, we consider the unadjusted fatality counts with off-plot incidental finds included (i.e., carcasses opportunistically found outside of standard survey plots) to be the most accurate mortality indices for Golden Eagles in the Golden Hills study areas.*** For this Project, the documented and adjusted annual fatality rates were effectively the same, because estimated carcass detectability for large birds exceeded 98% across the study. For the 3-year Golden Hills project, the unadjusted average annual fatality rate was 0.12 fatalities per MW (95% CI = 0.07–0.19).

[3] Indicates no suitable estimate was available for comparison.

[4] Entries with "–" generally indicate that no relevant fatalities were found. Discrepancies between these values and comparative values above reflect either (a) post-reporting calculation adjustments made in consultation with NextEra and the Altamont TAC reflected in the PEIR values, or (b) updates reported in subsequent project reports reflecting the collection and analysis of additional years of monitoring data not reflected in the PEIR.

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Section 1.0 Introduction

The Golden Hills North (GHN) Wind Energy Center is a 46-megawatt (MW) repowered wind-energy facility comprising 20 2.3-MW General Electric turbines located in the Altamont Pass Wind Resource Area (APWRA) of Alameda County, California (Figure 1). The facility, located just north of Interstate 580 and east of the City of Livermore, is owned and operated by Golden Hills North Wind, LLC, a wholly-owned subsidiary of NextEra Energy Resources, LLC, and began commercial operation in December 2017. The facility is situated in a mixed agricultural landscape where cattle grazing is the primary agricultural land use. It is co-located with another independently owned facility (Diablo Winds; see Western EcoSystems Technology 2006), and Interstate 580 separates the GHN facility from NextEra's Golden Hills (GH) Wind Energy Center to the south.

The GHN facility occupies space that formerly supported numerous smaller, less-efficient, older-generation wind turbines that were operated for many years. Repowering this facility represents the third and final phase of NextEra's efforts to repower their overall APWRA wind-energy operations (Golden Hills North Wind, LLC 2015). NextEra's efforts are in turn a component of an overall APWRA repowering program designed to achieve greater and more efficient energy production, while reducing turbine-related fatalities of especially four *focal raptor species*: golden eagle, red-tailed hawk, American kestrel, and burrowing owl (Alameda County Community Development Agency 2014) (see Appendix A for scientific names of all bat and bird species relevant to this study). The Programmatic Environmental Impact Report (PEIR) for the APWRA repowering effort (Alameda County Community Development Agency 2014: page 3.4-55) focused on the four focal raptor species, plus two other now state-listed species (Swainson's hawk and tricolored blackbird) and three other species of local conservation concern (loggerhead shrike, prairie falcon, and barn owl). Hereafter, we distinguish the full suite of nine species emphasized in the PEIR as *PEIR-emphasis species*. Based on estimates derived from pre-repowering monitoring studies, the PEIR identified average annual fatality rates for these species, for all raptors combined, and for all native nonraptors combined. These rates were then established as average annual fatality thresholds for evaluating the effectiveness of new repowered projects, with exceedance of a threshold based on 3 years of required postconstruction monitoring expected to trigger adaptive management.

This report summarizes the results of the first 2 of 3 years of post-construction monitoring for raptor activity and bird and bat fatalities at GHN (hereafter "Project"), as required to meet the conditions of approval outlined in the Conditional Use Permit (PLN2015-00157) issued for the facility (East County Board of Zoning Adjustments 2015). The Alameda County Technical Advisory Committee (TAC) approved the implemented monitoring plan. The period of performance covered in this report is October 8, 2018 through October 3, 2020. Year 1 of this Project occurred concurrently with Year 3 of the GH post-construction bat and bird fatality monitoring project (H. T. Harvey & Associates 2021a).

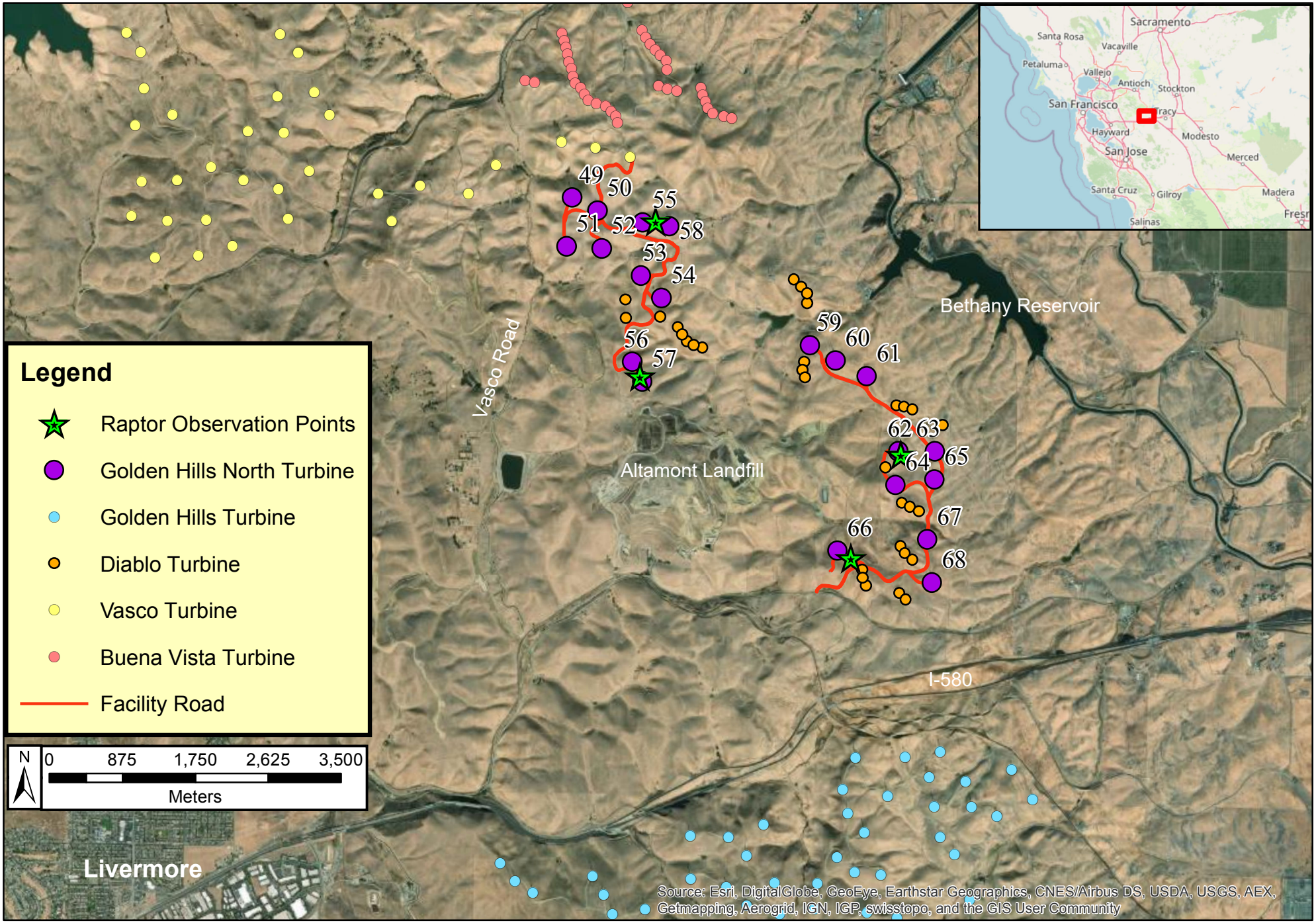

Figure 1. Study Area Map Depicting Wind Turbine Arrays and Raptor Observation Points.

Section 2.0 Methods

2.1 Study Site

The 20 GHN turbines have a hub height of 80 meters (m) and rotor diameter of 110 m, which translates to a rotor swept zone extending from 25–135 m above ground level. The habitat throughout the facility is rolling hills with occasional steep slopes and rocky outcrops. The landscape comprises grazed annual grassland, small groves of eucalyptus and oak, and several primarily seasonal livestock ponds. The wind facility is adjacent to the Altamont Landfill and Resource Recovery facility to the southwest (closest turbine approximately 300 m away) and Bethany Reservoir to the east (closest turbine approximately 900 m away) (Figure 1). The turbines are situated on hilltops and ridgelines, with the vertical relief between hill/ridge tops and intervening valleys ranging from approximately 30–60 m, and occasionally as much as 140 m. The turbines are generally arranged in strings of 2–3 turbines, with spacing between adjacent turbines within strings ranging from approximately 250–700 m, and a maximum nearest-neighbor distance between turbines of approximately 1,100 m.

2.2 Bird and Bat Fatality Surveys

2.2.1 Sampling Design and Survey Scheduling

Fatality searches were generally conducted throughout the year at all turbines (but see Section 3.1), and all searches were conducted using teams of scent-detection dogs and their handlers. Survey plots covered a radius of 115 m around each turbine base. During each monitoring year, surveys were conducted at 7-day intervals at 10 (50%) turbines and at 28-day intervals at 10 (50%) turbines. We used generalized random-tessellation stratified (GRTS) sampling (Stevens and Olsen 2004) to preselect distinct but overlapping spatially balanced arrays of 10 turbines to survey at 7-day intervals each year of the planned 3-year study, with the selections constrained to ensure that all turbines would be subjected to 7-day and 28-day surveys during at least 1 year of the study (Figure 2).

Each week typically included 10 7-day surveys and two 28-day surveys, with two additional 28-day surveys conducted every fourth week to complete a full 28-day round of those surveys. To minimize the potential for spatiotemporal sampling biases, we preselected the daily survey arrays to variably disperse sampling across the facility within each weekly period, while also ensuring reasonable logistical efficiency on a given day (i.e., minimizing back-and-forth travel across the facility). In addition, each day's surveys began at a plot randomly chosen from among that day's relevant plots, and then proceeded in the most efficient manner to cover that day's remaining plots.

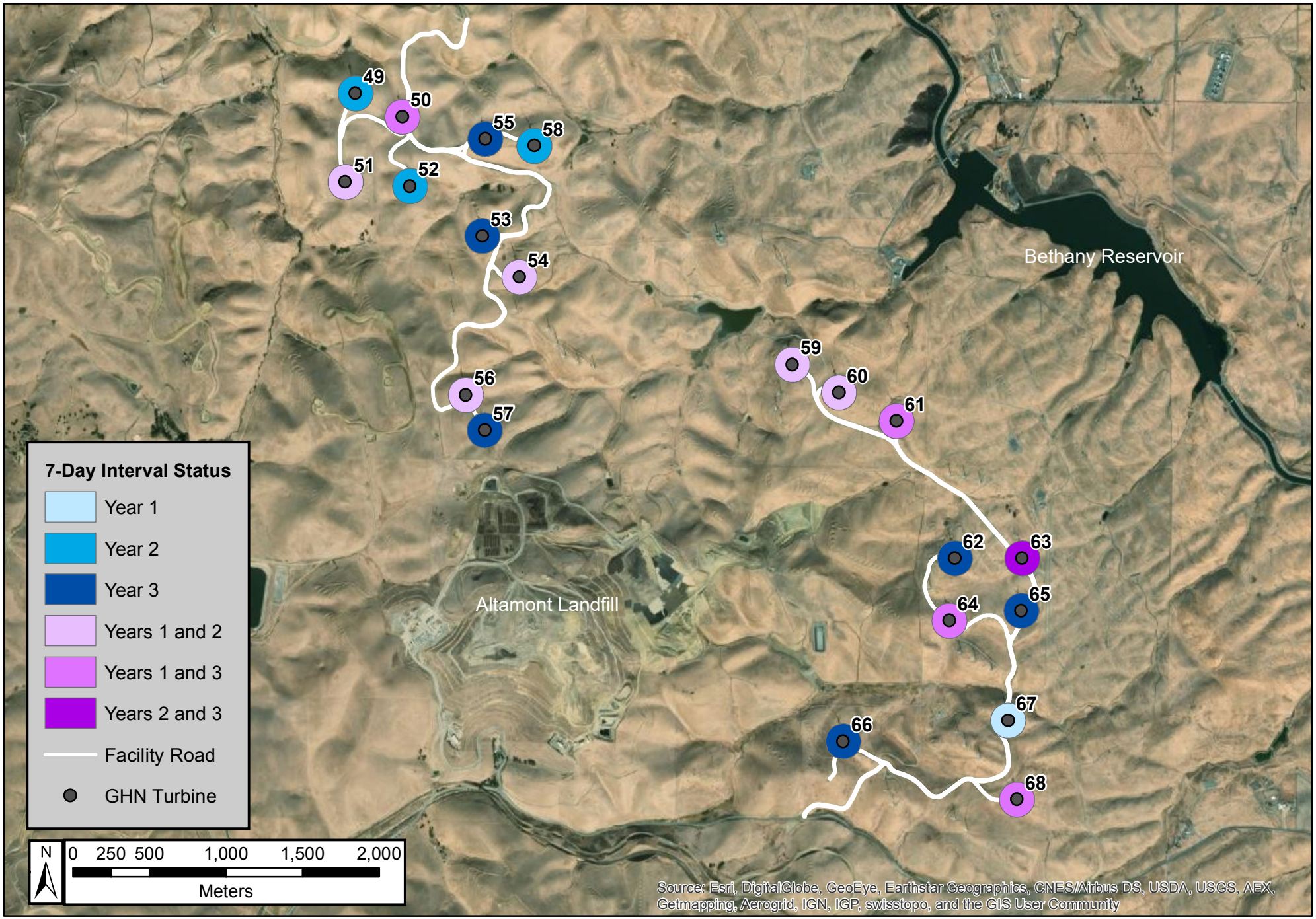

Figure 2. Preselected Spatially Balanced Annual Arrays of Sampling Plots Subject to 7-Day-Interval Fatality Surveys Across Planned 3-Year Study.

2.2.2 Survey Protocols and Data Recording

The daily timing of the fatality surveys varied seasonally. Access constraints designed to protect sensitive amphibians constrained survey times to no earlier than 30 minutes after sunrise and no later than 30 minutes before sundown from November 1 through June 15. Otherwise, during summer the surveys generally began as early as possible in the morning and tended to begin and end 1–2 hours earlier than at other times of year. It was also sometimes necessary in the summer to recommence a given day's surveys during evening hours to avoid the midday heat.

Surveys proceeded according to predetermined schedules unless challenging weather precluded a safe and effective effort (e.g., heavy rain, lightning, or excessive heat) or other health and safety matters intervened (e.g., livestock-related constraints, excessive wildfire smoke during summer, and occasional turbine and roadway/weed-control maintenance activities). When 7-day surveys could not be completed as scheduled, we rescheduled the surveys in a manner that did not alter the search interval for any of the 7-day plots by more than 1–2 days, or skipped the missed surveys if that was not feasible. When 28-day surveys could not be completed as scheduled, we generally rescheduled them to occur as quickly as possible during the same week without altering the planned schedule for other surveys that week.

All primary handlers and detection dogs involved in this study had prior experience conducting bird and bat fatality surveys. Four handlers and six detection dogs accomplished the Year 1 surveys, and two handlers and five dogs accomplished the Year 2 surveys. Typically, an individual handler alternated use of two dogs to complete four full-plot surveys in a given day.

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 dog's movements to optimize coverage of the designated survey plots. This was usually accomplished by having the dog search downwind of the survey area at a distance appropriate for the wind speed and direction. The detection distances and number of survey passes required for a given survey were determined based on wind speed (i.e., more survey passes at closer spacing in light wind and fewer survey passes spaced farther apart in strong wind). The handler also discretionarily directed the detection dog to increase the search intensity in areas of high habitat complexity (e.g., uneven ground and thick vegetation). In addition, although no systematic effort was made to search outside the designated survey plots, the detection dogs frequently detected off-plot fatalities within 20–30 m of plot boundaries, especially on the downwind side where they were often worked to ensure good coverage of those plot margins.

We followed guidelines for classifying avian fatalities typically applied in the APWRA (Altamont Monitoring Team 2007, CEC and CDFG 2007). To qualify as a fatality, bird feather spots must have included either ≥10 feathers total or at least five tail feathers or two primaries located within ≤5 m of each other, whereas any bird or bat carcass that included bones, skin, or flesh qualified as a fatality. Upon finding a fatality, the handler temporarily marked each location with flagging and then either returned after searching the entire plot to record data on all finds using an electronic data form, or enlisted the help of another support biologist to collect the carcasses and record relevant data.

The handlers recorded specimen data and digital photographs using Classic Collector 18.0.03 (ESRI, Inc., Redlands, California) and customized data entry forms, running on GPS-enabled Samsung Galaxy Note tablets. The app was configured for offline use and included cached basemap imagery, turbine locations, survey plots, and roads as map layers. Data recorded for every fatality incident included:

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, 2018, would be #20181011-03.
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 ±3–4 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 red-tailed hawk could be classified as such, or as an unknown buteo where less evidence is available, or (as a last resort) as an unknown large raptor. Similarly, a California myotis could be classified as such, or as an unknown myotis, or (as a last resort) an unknown small bat. If a bird fatality could not be assigned to a clear taxonomic group, then it was classified by size as follows:
    - *Small* = <100 grams (g); smaller than a mourning dove
    - *Medium* = 100–500 g; mourning dove/American kestrel up to American crow/northern harrier size
    - *Large* = >500 g; common raven/red-tailed hawk size or larger
10. Evidence for species identification; e.g., plumage, individual feathers, measurements, hair sample for bats, 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; e.g., for birds—plumage, molt limits, fault bars, etc.
13. Carcass condition:
    - *Intact – fresh*: eyes fluid-filled, 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 feathers/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/feathers/fur; evidence

of vertebrate scavenging

- *Scavenged – feather spot*: record notes about whether feathers are fresh, bleached, or decomposed
- *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 the kinds of feathers found (especially primaries, secondaries, and rectrices), and describe evidence of blunt-force trauma (i.e., broken bones, lacerations, severed body parts, major contusions, etc.), internal bleeding, electrocution (i.e., singed feathers, other burn marks, clenched talons, etc.), 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 other birds and bats (no evidence of vertebrate scavenging/predation) with no apparent injuries, found within the search radius.
    - *Electrocution*
        A. Carcass with obvious signs of electrocution; i.e., singed feathers, burn marks on feet or wrists, clenched talons, etc.
        B. Intact carcass with no apparent injuries found within 3 m of a power pole and >10 m from turbine string axis.
- *Line Strike*
        A. Intact carcass with injuries consistent with a line strike (i.e., blunt-force trauma, broken wings or neck, decapitation, etc.), but no evidence of electrocution, and found outside of turbine search radius and within 10 m of power lines or guy wires.
        B. Intact carcass with no apparent injuries found outside of turbine search radius, within 10 m of power lines or guy wires, and >3 m from the nearest power pole.
- *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 (not used for large raptors that are rarely depredated but sometimes scavenged; other codes are used then; e.g., *Blade Strike/Turbine Collision B*).

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. Categorical condition of enamel, for birds: waxy covering on culmen and claws present, or not.
22. Categorical color, for birds: leg scales and/or cere have begun to fade or not.
23. Additional notes about special circumstances, carcass condition, details for identification of rare species, band numbers, obvious injuries, and potential cause of death if other than those listed above.
24. 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.

Other data recorded each time an area was searched included wind and weather conditions, classification of the groundcover on the plot as a whole, and notes about relevant search-area access issues and constraints (e.g., related to livestock and facility/turbine maintenance activities).

After completing a given survey and recording data for each incident, the biologists placed all discovered carcasses or body parts in zip-locked plastic bags, and clearly labeled each bag with information about the collection circumstances, the species ID, and the relevant incident number. All carcasses were then transferred to the NextEra office facility in Livermore for further processing, specimen labeling conforming to the requirements of relevant state and federal permits, and storage in the designated freezer located there. Variants of this standard procedure were implemented when either selected special-status species or injured/debilitated bats or birds were found. Relevant agency permits required special authorizations and communications to handle and manage carcasses (or injured animals) of species listed as state or federally endangered, threatened, or candidates for listing, and/or as a California fully protected (CA-FP) species. All such specimens typically were collected within 48 hours after confirming appropriate authorizations. If an injured/debilitated bat or bird was discovered, arrangements were made to secure the animal and a NextEra representative transported the animal to a nearby wildlife rehabilitation facility.

All bird or bat fatalities discovered on the Project site apart from (spatially or temporally) standard fatality surveys were recorded as incidental finds. Hereafter, we refer to all fatalities found outside of standard survey plots as *off-plot incidentals*, and all fatalities found on standard surveys plots but not during a standard survey as *on-plot incidentals*. If an on-plot incidental carcass was found by a nonsurveyor, fatality data were recorded for that carcass and, unless the find was a special-status species requiring special handling (e.g., CA-FP golden eagles), the carcass was left in place to allow for potential detection during a subsequent standard survey.

2.3 Carcass Detectability Trials

2.3.1 Sampling Design

Throughout the study, we conducted trials to estimate carcass detectability and support developing adjusted fatality estimates (see Section 2.4.2). We used the TAC-approved Big *D* approach to estimate carcass detectability (CD) (Brown et al. 2016, ICF International 2016, Smallwood and Neher 2016, Smallwood 2017), which included the following elements:

- Trial carcasses were placed most weeks throughout the study based on randomized, spatially balanced placement designs and irrespective of when surveys were scheduled.
- 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 generated for bats and birds of different size classes integrated the influences of imperfect searcher efficiency, bleed-through, and removal of carcasses by scavengers and abiotic factors.

We sought representative variation in the ages of detectability trial carcasses by placing small numbers of trial carcasses on both 7-day and 28-day plots during most weeks irrespective of survey schedules, and by allowing detections to occur at any time after a trial carcass was placed. Placements occurred based on independent year-specific GRTS spatial allocation plans for 7-day and 28-day plots. Our placement strategy helped to ensure effective spatial and temporal representation across the facility, as well as effective randomization of placements relative to substrate variability. Regularly dispersing new trial carcasses across the landscape throughout the survey period also helped mimic natural fatality deposition patterns to the degree practicable. Achieving this objective helped ensure the validity of the Big *D* "binomial" approach to conducting detectability trials (i.e., trial carcasses are either found or not, without regard to elapsed time between placement and discovery nor the reasons for failed detection) and using available estimator software to produce adjusted fatality estimates (discussed further in Section 2.4.2).

We sought to place a sufficient number of trial carcasses to enable effective estimation of bird and bat detection rates on both 7-day and 28-day plots on a quarterly seasonal basis, with seasons defined as: fall = September–November; winter = December–February; spring = March–May; summer = June–August. Our ideal sampling target for this study was to place during each quarter at least 10 bat, 10 small bird (≤100 grams [g]; smaller than a mourning dove), 10 medium bird (101–500 g; mourning dove up to crow/barn owl size), and 10 large (>500 g; buteos/ravens and larger) trial carcasses spread out across the 7-day plots, and a similar array of carcasses spread out across the 28-day plots. Ten samples per covariate class combination is considered the minimum for generating reliable detectability estimates (Huso et al. 2012). Unfortunately, challenges obtaining sufficient numbers of suitable carcasses (constrained by relevant federal and state permits authorizing such acquisitions for the purpose of this Project) precluded consistently achieving this objective, especially in Year 1 for bats and small birds, and generally for medium and large birds (see Section 3.2.1).

We did not purposefully seek to achieve sufficient samples to support modeling the influence of substrate/visibility classes on carcass detectability. That would have required stratifying placements to increase representation of proportionately uncommon high-visibility substrates (i.e., gravel and bare dirt), which was constrained by limited carcass availability. Instead, we assumed that the spatially balanced, randomized placement of carcasses across the facility throughout each annual period would effectively represent the relevant influences of substrate/visibility on the ability of the detection-dog teams to move through the survey plots and detect relevant carcasses. Similarly, we did not seek to model handler-dog teams explicitly as covariates in the estimation models. Instead, throughout the study we scheduled teams to maximize the probability that all relevant surveyor combinations were presented with opportunities to detect diverse specimens of different types and sizes.

2.3.2 Composition of Trial Carcasses and Placement Protocols

A designated biologist not involved in the fatality surveys placed freshly dead (i.e., estimated to be no more than 1–2 days dead when found, and then frozen and thawed before placement) and specially marked bat and bird trial carcasses on survey plots without the survey teams having knowledge of such placements. The designated biologist mapped the location of each placed carcass, recorded the placement date and time, classified the placement substrate, and took digital photographs of the placed trial carcass using a standardized tablet-based data entry form.

State permitting required that we use only largely intact bat and bird carcasses that were frozen and thawed before placement. Scavenging rates of fresh/frozen and thawed carcasses may be lower than for fresh/never frozen specimens (Kerns et al. 2005, Strickland et al. 2011), and dismembered or opened carcasses may attract scavengers more readily than intact carcasses (Smallwood 2007). Nevertheless, state permitting dictated that all trial specimens be frozen and thawed before deployment to help manage possible disease transmission, and managing the freezing, thawing, and placement of torn or dismembered carcasses was impractical. Moreover, the integrated trials required placing only freshly dead (frozen and thawed) specimens to constitute trials that matched, to the degree practicable, the carcass persistence patterns of freshly deposited fatalities.

Before placing a trial carcass on the landscape, the biologist marked each trial carcass with a small piece of green electrical tape wrapped around a leg or bat wing. The tape marking included a unique trial ID number for reference, if the specimen tag was large enough for such a marker to be placed and remain reasonably inconspicuous. The biologist also clipped off the tips of primaries, secondaries, and rectrices on all bird trial carcasses to facilitate identification when only a feather spot remained following a scavenging event. Heavy scavenging of a trial carcass before a detection-dog team had a chance to search for it could have removed the specimen tag or evidence of clipped feathers and hindered identification as a trial carcass. We minimized such identification errors by carefully crosschecking locations and other details when heavily scavenged, unmarked fatalities of species used as trial specimens were discovered on relevant plots. Nevertheless, it is possible that the scavenged, unmarked remains of some trial carcasses, especially bats, were recorded as fatalities after scavengers dispersed remains to other locations on the same plot.

All trial specimens were handled only with nitrile gloves and with handling time minimized. When placing carcasses, the designated biologist took a circuitous route to and from the randomly selected placement location,

and randomly tossed the carcass up to 10 m away from that position (recording the direction and distance to the deposited carcass from the predetermined placement coordinates). These protocols minimized the chance that the detection dogs or mammalian scavengers could follow human scent trails to the trial specimens (Reyes et al. 2016). We also attempted to ensure that carcass markings used to distinguish trial specimens from new fatalities were as inconspicuous as possible to minimize the chance of artificially attracting visual scavengers (e.g., common ravens and raptors).

For the trials we used species known, or with the potential to occur, in the study area, including primarily native species, but also a few readily available nonnative species that routinely occur in the study area (i.e., European starling, rock pigeon, and house sparrow) (CEC and CDFG 2007, Smallwood 2007). We avoided using other surrogate animals because of evidence that scavenging rates for avian surrogates such as gamebirds and chickens, and for bat surrogates such as mice, can be much higher than for the species they are meant to mimic (Smallwood 2007, Hale 2010). All specimens used for detectability trials during this Project were (a) found as freshly dead (as defined above in this section and in Section 2.2.2) fatalities during the study; (b) recovered freshly dead elsewhere in central California as authorized by staff salvage permits (broad coverage for birds and bats); or (c) were gathered from regional animal rescue/rehabilitation centers, avian control operations at regional airports, and other approved and permitted sources (e.g., local falconers and raptor trapping operations). All of the latter specimens showed no outward signs of disease and were never treated with medicines; died naturally, were euthanized using only CO_2, or were shot with non-lead ammunition; and were frozen shortly after they died or were euthanized. State permits constrained the sources of all trial carcasses gathered from outside the facility to 18 counties in central California, with additional geographical constraints applied to sources of bats (i.e., excluded from the Sierra Nevada and upper foothills).

2.3.3 Estimating Probability of Detection

We used *GenEst* 1.4.4 to estimate CD and produce adjusted fatality estimates for bats and birds (Dalthorp et al. 2018a, b; Simonis et al. 2018). *GenEst* was designed to support independent estimation of searcher efficiency (SE) and carcass persistence (CP), and incorporate explicit modeling of bleed-through (e.g., see Warren-Hicks et al. 2013). To accommodate the Big-*D* approach to quantifying CD, the *GenEs*t developers provided a work-around to support using the SE module to generate CD estimates based on binomial trial outcomes (see Appendix B). The modified approach included modeling the influences of potential covariates such as season, but excluded explicit modeling of bleed-through and underlying processes reflecting the influence of time and carcass aging on detectability by searchers and removal by scavengers or abiotic factors (Dalthorp et al. 2018a). Rather than have the estimator model known influences on SE and CP in an attempt to produce less-biased estimates, applying the customized Big *D* approach assumed that the pattern of trial placements effectively mimicked the pattern of fatality depositions across the study landscape. Such mimicking was necessary to ensure that the resulting CD estimates effectively accounted for the influence of variation in elapsed times between placement and discovery on the degradation state of carcasses, and attendant interactive effects on the probability detection by searchers and removal by scavengers or abiotic factors.

To develop the *GenEst* CD models, we evaluated the influence of the following covariates:

Year: Monitoring *Year 1* or *Year 2*

***Size Class* (birds only)**: *small*, *medium*, and *large* (as defined in Section 2.2.2)

Survey Type: *7-day* and *28-day* search intervals

Season (four possible variants considered independently): *Season*: fall = September–November; winter = December–February; spring = March–May; summer = June–August; *Season2A*: fall/winter and spring/summer; *Season2B*: winter/spring and summer/fall; and *Season2C*: fall/spring migration seasons and winter/summer nonmigration seasons

For bats and each size class of birds, we compared Akaike Information Criterion scores corrected for small sample sizes (AICc) of all possible, estimable candidate models to evaluate the merits of different additive and factorial combinations of the above covariates for predicting CD. We considered an AICc score reduction (ΔAICc) of more than two points indicative of an improved model, reflecting a better balance of goodness-of-fit and parsimony (Burnham and Anderson 2002). We considered as potential final models only those models that were based on a minimum of 10 detectability trial cases per covariate-class combination (Huso et al. 2012). This restriction effectively precluded modeling substrate/visibility classifications as a potential predictor, because of limited (but proportionately representative) sample sizes for minimal-cover/high-visibility substrates. In selecting final models, we chose those that included a season variable if ΔAICc for any such model was ≤2.00 compared to the model with the lowest AICc value. The latter approach reflected the following factors:

- Both the fatality and detectability data were expected to vary seasonally.
- Spatially randomized and temporally representative placements of trial carcasses throughout each monitoring year explicitly supported developing seasonal adjustment factors, if warranted.
- Including an informative season variable in the estimation models was recommended to bolster use of the customized *GenEst* routine for handling binomial detectability trials (D. Dalthorp, USGS, personal communication).

To discern differences in CD estimates (or adjusted fatality estimates; see next section) among groups of interest (e.g., monitoring years, seasons, or survey types), we compared 95% CIs for group medians to discern approximate statistically significant differences. With relevant group sample sizes purposefully constrained to ≥10, we equated no overlap between 95% CIs for two groups as indicative of a highly significant difference ($P \leq 0.01$), and up to approximately 50% overlap between the lower CI range of one group and the upper CI range of another group as indicative of a significant difference ($P \leq 0.05$) (Cumming et al. 2007; also see Payton et al. 2003 and Wester 2018 for related discussions about misinterpreting overlapping/nonoverlapping CIs).

2.4 Fatality Estimates

2.4.1 Filtering Records Prior to Analysis

Before calculating fatality estimates, we excluded Year 1 carcasses for which our aging suggested the carcass had been deposited more than one search interval before the first fatality survey was conducted on a given plot. We eliminated these *aged-out carcasses* from the estimates, because they likely reflected fatalities accumulated

during the preceding 10 months of facility operation. In producing adjusted fatality estimates, we also excluded (a) off-plot incidentals; (b) on-plot incidentals left in place but never found during a standard survey (carcass detectability adjustments account for such misses); and (c) carcasses of non-volant juvenile birds.

2.4.2 Adjusted Fatality Estimates

We used *GenEst* to derive CD-adjusted, annual fatality estimates for all species of bats and birds detected as qualified fatalities (see previous section), and for selected species groups. We emphasize group estimates for bats, native nonraptors, and raptors, and species-specific estimates for the four focal raptor species, other PEIR-emphasis species, and other species documented as fatalities five or more times in at least one of the two survey years (considered the minimum sample size for generating meaningful fatality estimates; Huso et al. 2012).

To discern differences in adjusted fatality estimates among groups of interest, we used the same approach as for CD estimates, evaluating overlap in 95% CIs for group medians to coarsely distinguish statistically significant differences. To provide context for discussing the relative precision of adjusted fatality estimates, we used a nonstandard but simple and informative coefficient of variation (CV) derived as the ratio of the width of the 95% CI divided by the median estimate. Based on this metric, we arbitrarily equated relatively *good* precision with a CV $\leq$ 0.50, *fair* precision with 0.50 < CV $\leq$ 1.0, and *poor* precision with a CV > 1.0. We emphasize here that fatality estimates are notoriously associated with poor precision in a conventional sense (i.e., excessively wide CIs), so one must not mistake our definition of "good precision" with categorizations of high precision based on conventional coefficients of variation calculated as the standard deviation divided by the mean (parameters not produced by *GenEst*).

Absent customized programming, the standard *GenEst* graphical user interface was capable of splitting fatality estimates only two ways, which precluded generating adjusted fatality estimates (medians and 95% CIs) to compare seasonal patterns among groups of birds within years, and differences between 7-day and 28-day surveys for groups of birds within years.

Fatality rates may be underestimated if the estimates do not account for blade-strike fatalities that fall outside of survey plots and are not detected (Smallwood 2007, 2013; Hull and Muir 2010; Huso and Dalthorp 2014). *GenEst* is programmed to incorporate distance weighted proportion (*DWP*) adjustment factors to account for the proportion of fatalities expected to be deposited within searched areas (Simonis et al. 2018). We did not attempt to estimate *DWP* values for this Project, because such estimation is fraught with challenges and potential biases absent rigorous sampling to describe and quantify fatality distributions well beyond the bounds of standard sampling plots (Smallwood 2007, 2013; Smallwood et al. 2010, 2020). Instead, to ensure effective comparisons of fatality rates between the initial 3-year GH monitoring project and this 3-year Project, we used the same factors represented in the GH final 3-year report (H. T. Harvey & Associates 2021a): 1.0 (no adjustment) for bats and small birds, 0.98 for medium-sized birds, and 0.95 for large birds.

Factors that may contribute to overestimating wind-turbine-related mortality based on surveys such as this include unrelated background mortality resulting from factors such as predation, disease, starvation, and fence-wire strikes (Smallwood 2007, ICF International 2016). Due to the high cost involved in conducting rigorous studies with enough statistical power to be useful, few researchers have attempted to quantify and adjust for

background mortality in the context of energy development (Erickson et al. 2014), and we did not attempt to do so in this Project.

2.4.3 Partitioning Analyses to Account for Survey Constraints

As discussed further in Section 3.1, turbine operations and survey activities were temporarily curtailed at selected turbines during both monitoring years, because of: (a) the unexpected establishment in Year 1 of a new golden eagle nest in the northern sector of the facility, which was occupied and fledged young in both monitoring years; and (b) the catastrophic failure of two turbines late in Year 2. To protect the nesting eagles, daytime operation was curtailed at four nearby turbines (WTGs 52, 53, 55, and 58) and no surveys were conducted at those turbines for approximately 4 months each year. To generate adjusted fatality estimates for bats, we excluded all fatality data from the four turbines and extrapolated results from the other 16 turbines to generate estimates of facility-level fatality totals. We chose this approach because bat fatalities were likely to continue occurring at the four turbines (nighttime operation not curtailed), but the lack of surveys for 4 months each year precluded generating reliable mortality indices using incomplete data from those turbines. In contrast, we did not exclude data from the four relevant turbines in deriving estimates for birds, because turbine-related bird fatalities were expected to be negligible while the turbines were being curtailed during daytime hours. As a result, allowing the dataset to reflect minimal fatalities at the four relevant turbines during the 4-month curtailment periods each year was expected to mimic reality for birds, whereas that was not expected to be the case for strictly nocturnal bats given no cessation of nighttime turbine operation.

The catastrophic failure of WTG60 and WTG61 in late August 2020 resulted in the complete cessation of all turbine operations for 1 week and all surveys for 3 weeks, and constrained survey coverage at all turbines for the remaining 2 weeks of the Year 2 monitoring period. After the 3-week survey hiatus, surveys were allowed to resume at all operational turbines, but coverage was limited to donut-shaped areas with 61-m-radius donut-hole exclusion zones established around all turbines. The *GenEst* fatality estimation routine easily accommodated the 3-week gap in survey coverage at all turbines; however, a customized approach was required to account for the 61-m donut-hole coverage restriction. To account for this effect, we partitioned the dataset in a manner that supported assigning different *DWP* adjustment factors to all turbines during the 2 weeks that the constraint applied (M. Huso, USGS, personal communication). In brief, the approach involved (a) assigning two identifiers to all turbines, (b) populating the survey schedule files used in *GenEst* to associate the primary turbine identifiers with search schedules until the donut-hole exclusion applied and alternative identifiers thereafter, (c) populating the *DWP* files used in *GenEst* to associated different values with the primary and alternative turbine identifiers, and (d) coding all fatalities documented during the exclusion period with the alternative turbine identifiers.

2.5 Raptor Activity Surveys

Surveys were conducted on the Project site throughout the study to provide insight about the relative abundance and activity patterns of primarily golden eagles, but also other raptor species as time and focus allowed. Four fixed raptor observation points were established on the Project site and were surveyed weekly by a single experienced observer using a 30-minute point-count protocol. The four observation points were located

near wind turbine generator (WTG) 58 (Point 1), WTG57 (Point 2), WTG 62 (Point 3), and WTG 66 (Point 4) (Figure 1). We chose observation sites on ridgetops that provided relatively unobstructed views of the Project area; however, no locations provided unobstructed 360° views of the broad landscape due to the complex rolling hills topography. We spaced the four count sites to minimize visual overlap between the points and decrease the likelihood of double-counting individual raptors on a given day. The survey and data collection protocols and metrics used followed guidelines in U.S. Fish and Wildlife Service (2013).

To minimize potential temporal biases, we varied the order in which the four observation points were surveyed each week to ensure that, across the monitoring period, each point was sampled at different times throughout the day and on various days of the week. During each point-count survey, the surveyor focused on a cylindrical detection area extending out approximately 800 m in all directions and vertically up to approximately 185 m above ground level (i.e., 50 m above the maximum rotor swept height of 135 m). Every 60 seconds, the observer scanned the 360° viewshed and recorded the number, location, and behavior of raptors they saw or heard. Data recording for golden eagles and other raptor species occurred according to the following priority order:

1. Use by golden eagles.
2. Behavior of golden eagles.
3. Use by other raptors, including turkey vultures.
4. Behavior of other raptors.

Data recording involved the following metrics, definitions, and procedures:

1. **Minute:** minute when bird was detected. A stopwatch was started at the beginning of the session. If a bird was detected 5 minutes and 38 seconds into the survey, the minute was recorded as 6. If an individual bird was present within the survey area for the duration of the survey period, the minute was recorded as 31. More than one entry for each minute was allowed; e.g., if a turkey vulture was soaring in one location and another turkey vulture was contouring in another area, each was recorded on a separate line within the same minute.
2. **Species:** four-letter American Ornithologists' Union (AOU) code for the species observed.
3. **Age Class:** age of bird, if discernable. Although it is possible to identify five age classes of golden eagles (i.e., juvenile, Basic I, Basic II, Basic III, and Adult; see Bloom and Clark 2001), this level of discernment is often difficult to achieve in a field setting focused on free-flying eagles. Therefore, we used the following age classifications to reflect the level of accuracy actually achieved:
    a) Adult – clear evidence of no white present in wings or tail, and no retained juvenile secondaries
    b) Nonadult – white present in wings or tail, but further age discrimination not achieved
    c) Unknown
4. **Number:** number of individuals of the same species observed in the minute-long observation period being recorded and engaged in similar behavior in the same basic location.
5. **Turbine Location:** location of bird relative to turbine, classified as within 50 m of the rotor swept area (1) or outside of that area (0).

6. **Turbine Number**: WTG number for any bird recorded as within 50 m of a turbine

7. **General Location:** The particular region of the survey area in which a bird was located during the minute it was engaging in the recorded behavior, designated by an alphanumeric code and defined by the four directional quadrants and four distance categories. Each survey area was divided into cardinal-direction quadrants (i.e., "A" = NW to NE, "B" = NE to SE, "C" = SE to SW, "D" = SW to NW) and the survey radius was divided into four distance categories (i.e., 0–100 m, 101–300 m, 301–600 m, and 600–800 m). This classification resulted in 16 possible location categories, each designated by a unique code (i.e., A1...A4. B1…B4, etc.), which was recorded for each bird observation within each survey minute.

8. **Behavior**: classified for each individual raptor or relevant species-specific group of raptors using the codes defined in Table 1

Table 1. Codes and Definitions Used to Classify Raptor Behavior During Activity Surveys

Code	Behavior	Definition
1	Perched / Hopping / Running	A stationary bird or a bird moving while on the ground without flying
2	Flying	Directional flight powered by wing flaps
3	Soaring / Circling	Few wing beats and gradual turning, often powered by thermals / tight circles with some wing beats
4	Hovering / Kiting	Stationary position - maintained using wind currents or by frequent wing beats
5	Diving	Wings recessed or folded for rapid downward flight, usually to attack prey or competitor
6	Contouring	Flights close to the terrain, and changing directions and height with the terrain
7	Chasing / Being Chased	Strong flight away from a larger following bird, or smaller bird(s) following and diving at the subject, or subject following another bird with powered flight (wings beating)
8	Courtship	Undulating display flights or copulation

Section 3.0 Results

3.1 Survey Effort and Search Intervals

The search intervals achieved at individual turbines varied from the ideal 7-day or 28-day interval for several reasons (Appendix C provides annual summaries of surveys and survey date ranges by turbine for each monitoring year). Relatively minor variation occurred as a result of: (a) interannual rotations of the 7-day search-interval plots; (b) periodic schedule adjustments to accommodate changing survey and personnel needs; and (c) other occasional logistical, safety, and personnel constraints. Using *GenEst* to estimate fatalities effectively accommodated such unanticipated and unavoidable minor variation in search intervals. More significant variation in the search intervals achieved at different turbines occurred during the two monitoring years because of: (a) the unexpected establishment in Year 1 of a new Golden Eagle nest site in the northern sector of the facility (an area where a pair had resided for a few years but was not known to have nested previously; P. Kolar, USGS, personal communication); and (b) a turbine damage issue in Year 2.

The Golden Eagles occupied their new nest site and produced young in both monitoring years. To minimize disturbance of the nesting birds and the potential for turbine-related mortality, fatality surveys were seasonally curtailed at four turbines (WTGs 52, 53, 55, and 58; see Figure 1) where the survey plots encroached to within <800 m of the nest site, and Golden Hills Wind proactively curtailed all daytime operation of those four turbines during the same periods. The survey and turbine curtailments began when territory occupancy and initial nesting behavior was first confirmed each year, and continued until observations indicated that fledglings were beginning to forage on their own and the nest site was no longer a primary focal point. The curtailment periods extended from March 20–July 17 in 2019 and from February 18–June 24 in 2020. In Year 1, all four relevant turbines were designated as 28-day survey plots, whereas in Year 2, two were 7-day plots (WTGs 52 and 58) and two were 28-day plots (WTGs 53 and 55).

In late August 2020, WTGs 60 and 61 failed, causing the whole facility to be shut down for 1 week. The two failed turbines did not resume normal operations before the end of Year 2, whereas all other turbines resumed normal operations after the initial 1-week emergency shut down. No surveys were allowed from September 2–21 and only modified fatality surveys were allowed for the remaining 2 weeks of the Year 2 monitoring period. The modified fatality surveys were constrained to exclude all areas within 61-m of any turbine.

3.2 Carcass Detectability

3.2.1 Composition and Placement of Trial Carcasses

The designated biologist placed new bird and/or bat carcasses on the 7-day and 28-day plots during 39 of 52 weeks in Year 1, and during 43 of 52 weeks in Year 2, so that new carcasses were available 49 of 52 weeks. The study-wide placements consisted of 150 bats of at least 7 species (*Myotis* spp. sometimes were not easily identifiable), 152 small birds of 28 species, 73 medium birds of 10 species, and 80 large birds of 18 species (Table 2; Appendix D). A majority (60%) of the placed bats were Mexican free-tailed bats; the remainder comprised 8% hoary bats, 31% *Myotis* spp., and 1% big brown bats. A majority (64%) of the small-bird

placements involved two nonnative species (house sparrows and European starlings), and a majority (57%) of the medium-bird placements involved one nonnative species (rock pigeon). No other individual species composed 5% or more of the small-bird placements, whereas two native species each composed more than 5% of the medium-bird placements: American kestrel (8%) and barn owl (16%). The large-bird placements included no nonnative species, and five species composed 5% or more of the total: red-tailed hawk (28%), Canada goose (13%), mallard (9%), turkey vulture (8%), western gull (6%), and California gull (5%). Across the two monitoring years, 49% of the bats, 18% of the small birds, 7% of the medium birds, and 15% of the large birds originated as fatalities at the GH facilities during the study. Figures 3 and 4 illustrate the overall bat and bird placement arrays in Year 2; the placement patterns in Year 1 were similar.

Table 2. Placements of Carcass Detectability Trial Specimens by Year, Species Group, and Survey Type

Year	Species Group	Number of Species	Number of Individuals[1]		
			7-day Plots	28-day Plots	Combined
Year 1	Bats	5–7[2]	30	35	65
	Small birds	14	33	30	63
	Medium birds	4	11	24	35
	Large birds	13	22	10	32
Year 2	Bats	6–8[2]	47	38	85
	Small birds	24	43	41	84
	Medium birds	11	19	19	38
	Large birds	17	22	24	46
Combined	Bats	7–9[2]	77	73	150
	Small birds	28	76	71	147
	Medium birds	10	30	43	73
	Large birds	18	44	34	78

[1] Figures include carcasses placed just before or during seasonal 4-month survey and daytime turbine curtailment periods at four clustered turbines (implemented in both survey years to protect nesting golden eagles), which were subsequently excluded for analytical purposes (see Section 3.2.2).

[2] Included sets of *Myotis* spp. that could only be confidently identified as one of two possible species.

Given initial uncertainty concerning the extent of the required survey curtailment for nesting eagles, placement of bat and bird trial carcasses continued on the four relevant plots as scheduled through mid-May in Year 1. In contrast, no trial placements occurred on the four plots during the survey-curtailment period in Year 2; however, three placements occurred just before the curtailment period and no surveys of the relevant plots occurred before that shutdown.

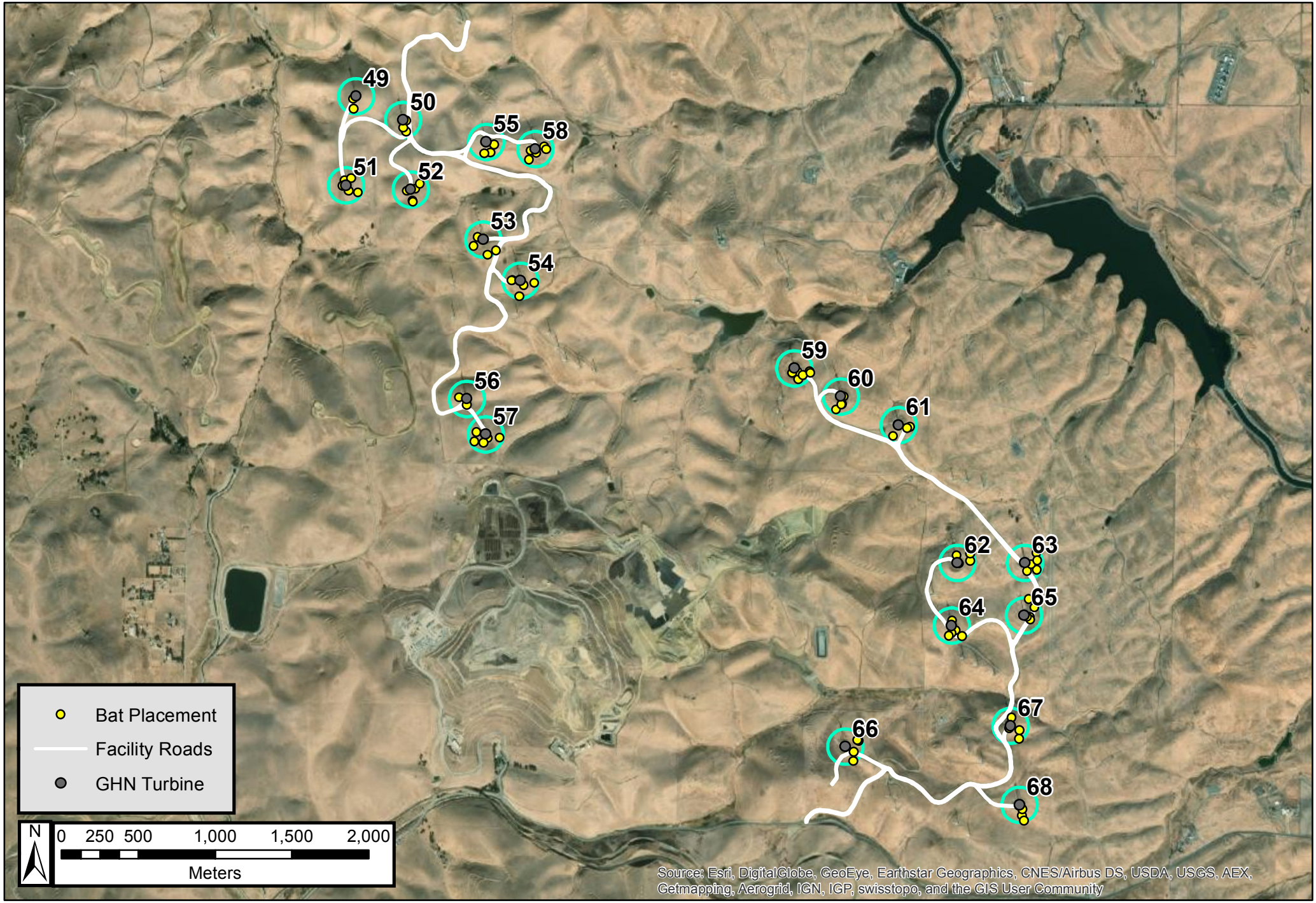

Figure 3. Placement of Detectability Trial Bat Specimens: Year 2

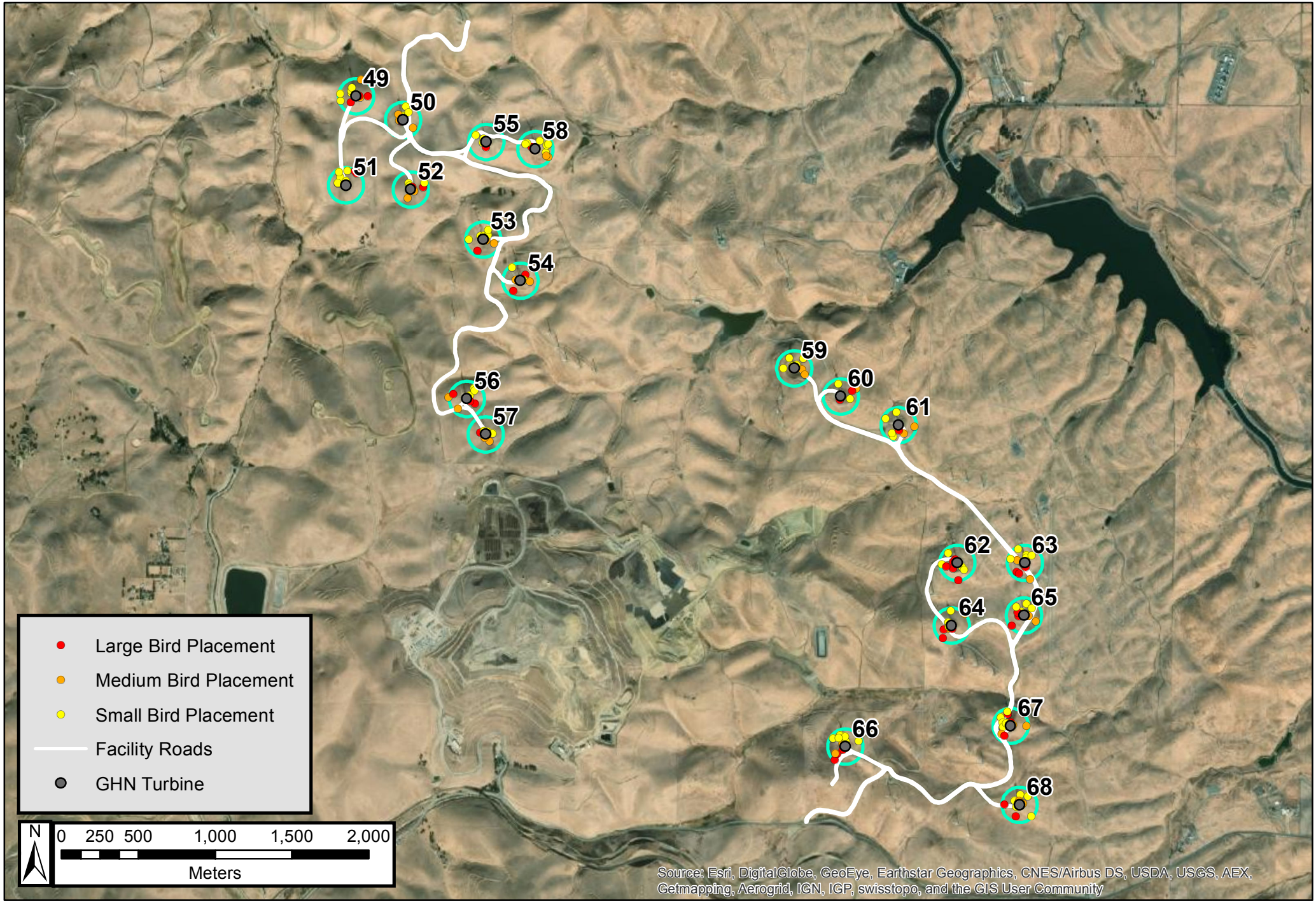

Figure 4. Placement of Detectability Trial Bird Specimens: Year 2

3.2.2 Probability of Detection

Four turbines were operated only at night during the annual curtailment periods for nesting eagles; hence, only nocturnal species and migrants were subject to turbine-related fatality risk at those turbines during those periods. As a result, turbine-related bird mortality was expected to be minimal at the four turbines during the curtailment periods. Therefore, mimicking the deposition of actual bird fatalities during the curtailment periods by continuing to place trial carcasses on the four plots was not necessary to generate unbiased adjusted fatality estimates for the facility. For this reason, we excluded from further consideration all bird trial carcasses that were placed on the four relevant survey plots during the Year 1 curtailment period (n = 3 small birds, 1 medium bird, and 2 large birds) or just before a curtailment period with no chance for detection until after relevant surveys resumed 4 months later (n = 1 small bird in Year 1). For reference, five of the seven excluded bird trial carcasses were subsequently found after the surveys resumed 2.5–4 months after placement.

Unlike for birds, bat mortality was expected to remain unabated at the four turbines where only nighttime operation was allowed for 4 months each year to protect nesting eagles. Placement of bat trial carcasses ideally should have continued unabated on those plots throughout both curtailment periods to support effective fatality estimation involving those turbines. Including trial data for bats placed during the curtailment periods, when additional mortality was expected, would have reflected the overall seasonal reduction in bat detection rates caused by not surveying four turbines for 4 months. In turn, incorporating greater adjustments to account for overall lower detectability during spring/summer resulting from the survey curtailments would theoretically have resulted in less-biased facility-wide fatality rates for bats. We partially met the continued placement objective for bats during the Year 1 curtailment period, but we purposefully did not pursue that objective during the Year 2 curtailment period. We adopted the latter approach to further reduce the likelihood of disturbing the nesting eagles by placing carcasses nearby during their breeding season.

Because of these interannual inconsistencies, in the end we elected to estimate bat detection rates after excluding all detectability data derived from carcasses placed on the four relevant plots just before or during a curtailment period. However, to bolster the overall detectability sample sizes, we included trial data representing bats placed on the four plots during other periods when subsequent discovery across multiple, typically scheduled surveys was possible. In the end, this filtering resulted in the exclusion of three bat carcasses placed on 28-day plots in Year 1, one bat carcass placed on a 7-day plot in Year 2, and one bat carcass placed on a 28-day plot in Year 2.

With the datasets filtered as described above, in Year 1 the detection-dog teams ultimately found 67% of the bats, 61% of the small birds, 82% of the medium birds, and 100% of the large birds placed on 7-day plots, and 26% of the bats, 53% of the small birds, 71% of the medium birds, and 100% of the large birds placed on 28-day plots (Table 3). The results for Year 2 were markedly similar, with no consistent differences between years evident across the primary taxon–size-class groups. Notably, although effectively inconsequential for producing fatality estimates adjusted for detectability, the Year 2 sample data included the only one of 78 placed large-bird carcass (a mallard on a 28-day plot) that the detection-dogs teams never found (Table 3).

Table 3. Carcass Detectability Trial Results by Year and Survey Type

Year	Taxon–Size-Class[1]	Survey Type	Number of Carcasses Placed[2]	Number of Carcasses Found	% Found
Year 1	Bats	7-day	30	20	67
		28-day	35	9	26
	Small Birds	7-day	33	20	61
		28-day	30	16	53
	Medium Birds	7-day	11	9	82
		28-day	24	17	71
	Large Birds	7-day	22	22	100
		28-day	10	10	100
Year 2	Bats	7-day	47	29	62
		28-day	38	13	34
	Small Birds	7-day	44	27	61
		28-day	41	19	46
	Medium Birds	7-day	18	14	78
		28-day	19	14	74
	Large Birds	7-day	22	22	100
		28-day	24	23	96

[3] Average species mass used as basis for classifying bird sizes: small ≤100 g; medium 101–500 g, large >500 g.
[4] Figures exclude carcasses placed just before or during seasonal 4-month survey and daytime turbine curtailment periods at four clustered turbines (implemented in both survey years to protect nesting golden eagles).

The top *GenEst* model for predicting CD for bats included *Survey Type* as the sole predictor; however, the ΔAICc for the second-best model containing the additive combination of *Survey Type* and *Season2A* was 1.27 (Appendix E). Hence, we selected the latter model as the basis for estimating CD for bats (Table 4). That model indicated that the probability of detection-dog teams finding bats did not vary appreciably between the two monitoring years (nonsignificantly lower in Year 1), but was consistently significantly higher on 7-day plots than on 28-day plots, and was consistently at least marginally higher during spring/summer than during fall/winter. Models containing the additive combination of *Survey Type* + *Season2B* and the factorial combination of *Survey Type* * *Season2A* were the only other models with ΔAICc ≤2.00 compared to the top model; however, a diverse array of other candidate models scored AICc values lower than the null (constant-only) model (ΔAICc = 15.16) (Appendix E).

For small birds, the selected CD model was the top model and, as was true for bats, included *Survey Type* + *Season2A* as additive predictors (Appendix E). Unlike for bats, however, the array of candidate small-bird models with ΔAICc ≤2.00 included the null model (ΔAICc = 0.67), suggesting that the top model had relatively low explanatory power. The selected model indicated patterns similar to those shown for bats; i.e., that CD for small birds did not vary appreciably between the two monitoring years (nominally higher in Year 1), was at least

marginally higher on 7-day plots than on 28-day plots, and was marginally higher during spring/summer than during fall/winter (Table 4).

Table 4. Carcass Detectability (CD) Adjustment Factors Used in *GenEst* to Generate Adjusted Fatality Estimates for Monitoring Years 1 and 2

Taxon/ Size Class[1]	Survey Type and/or Season	Number of Carcasses Placed	% Found	Modeled CD[2]	
				Median	95% CI
Bats	7-day – Fall/Winter	34	65	0.5955	0.4482 – 0.7273
	7-day – Spring/Summer	43	63	0.6687	0.5346 – 0.7801
	28-day – Fall/Winter	33	21	0.2653	0.1599 – 0.4065
	28-day – Spring/Summer	40	38	0.3311	0.2173 – 0.4689
Small Birds	7-day – Fall/Winter	38	50	0.5441	0.4057 – 0.6760
	7-day – Spring/Summer	39	72	0.6750	0.5383 – 0.7872
	28-day – Fall/Winter	34	47	0.4213	0.2889 – 0.5660
	28-day – Spring/Summer	37	51	0.5588	0.4186 – 0.6903
Medium Birds	Fall/Winter	38	66	0.6579	0.4959 – 0.7899
	Spring/Summer	34	85	0.8529	0.6918 – 0.9374
Large Birds	All Combined	78	99	0.9872	0.9146 – 0.9982

[1] Average species mass of birds: small, 4–100 g (Anna's hummingbird up to western meadowlark); medium, 119–450 g (mourning dove up to horned grebe); and large 520 – 5,800 g (ring-billed gull up to wild turkey).

[2] *GenEst* estimation models: bats – p ~ Survey Type + *Season2A*, k ~ fixed at 0; small birds – p ~ *Survey Type* + *Season2A*, k ~ fixed at 0; medium birds – p ~ *Season2A*; and large birds – p ~ Constant, k ~ fixed at 0. See Appendix E for modeling results comparing potential candidate models and illustrating the basis for model selections.

For medium birds, the selected CD model was the top model and incorporated *Season2A* as the sole predictor (Appendix E). That model was the only model with a lower AICc score than the null model (AICc = 1.64); however, the additive *SurveyType* + *Season2A* model also scored ΔAICc ≤2.00. The selected model indicated that CD for medium birds did not vary appreciably between the two monitoring years (nominally lower in Year 1) or between survey types (nominally higher on 7-day plots), but showed the same seasonal pattern as for bats and small birds; i.e., at least marginally higher CD in spring/summer than during fall/winter (Table 4).

For large birds, the selected and top CD model was the null model. Single-predictor models with any of the three two-season variables, *Survey Type*, or *Year* all scored ΔAICc values ≤2.05 compared to the null model. However, we selected the null model to proceed because, given an overall documented CD rate of 98.7%, adjusting for interannual and/or seasonal variation in detectability of large birds was not warranted.

3.3 Composition and Condition of Fatality Incidents

Including all non-duplicate incident records, the detection-dog teams found, and our forensic expert was able to confirm, five species of bats as fatalities during the 2 years of monitoring (Table 5). Each year the bat fatalities included consistent proportions of Mexican free-tailed bats (77–82% of annual fatality total) and hoary bats

(14–16%). The only other bat species for which we confirmed one or more fatalities in both monitoring years was western red bat, which is a California species of special concern (CA-SSC).

The bird fatalities included nine confirmed, native species of raptors and vultures, with four of those species encountered in only one of the two monitoring years (Table 5). The nonraptor bird fatalities involved three nonnative species (rock pigeon, Eurasian collared-dove, and European starling) and 51 native species. More raptor and nonraptor species were confirmed as fatalities in Year 1 (8 and 43 species, respectively) than in Year 2 (6 and 35 species, respectively). Of the nine PEIR-emphasis species, only loggerhead shrikes and Swainson's hawks were not represented among the fatalities. The native bird species encountered as fatalities included three raptor species and four nonraptor species that are afforded special-status protection in California: golden eagle (California fully protected [CA-FP] and federally protected under the Bald and Golden Eagle Protection Act [BGEPA]), burrowing owl (CA-SSC), long-eared owl (CA-SSC), Vaux's swift (CA-SSC), yellow warbler (CA-SSC), yellow-breasted chat (CA-SSC), and tricolored blackbird (California threatened [CA-T]) (Table 5).

Table 5. All Documented Bat and Volant Bird Fatalities by Species and Year

Group	Species	Year 1	Year 2	Total	Special Status
Bats	Big brown bat	1	0	1	–
	Hoary bat	48	33	81	–
	Mexican free-tailed bat	232	191	423	–
	Silver-haired bat	1	0	1	–
	Western red bat	7	1	8	CA-SSC
	Unknown bat	14	7	21	–
All Bats		303	232	535	–
Raptors	American kestrel	8	5	13	–
	Barn owl	4	0	4	–
	Burrowing owl	3	2	5	CA-SSC
	Ferruginous hawk	2	4	6	–
	Golden eagle	6	4	10	CA-FP, BGEPA
	Long-eared owl	0	1	1	CA-SSC
	Prairie falcon	1	0	1	–
	Red-tailed hawk	24	18	42	–
	Turkey vulture	1	0	1	–
	Unknown buteo	3	2	5	–
Nonraptors	American coot	0	1	1	–
	Black-headed grosbeak	2	3	5	–
	Black-throated gray warbler	2	1	3	–
	Brewer's blackbird	1	0	1	–
	Bullock's oriole	1	0	1	–
	California gull	10	2	12	–
	Caspian tern	0	1	1	–
	Chipping sparrow	1	0	1	–
	Cliff swallow	1	1	2	–

Group	Species	Year 1	Year 2	Total	Special Status
	Common raven	2	2	4	–
	Common yellowthroat	0	2	2	–
	Dark-eyed junco	2	1	3	–
	Eurasian collared-dove	1	0	1	–
	European starling	4	3	7	–
	Fox sparrow	0	1	1	–
	Glaucous-winged gull	2	1	3	–
	Golden-crowned sparrow	0	1	1	–
	Grasshopper sparrow	0	1	1	–
	Green-winged teal	0	3	3	–
	Hermit thrush	1	1	2	–
	Hermit warbler	1	0	1	–
	Herring gull	1	2	3	–
	Horned lark	17	12	29	–
	House finch	2	3	5	–
	House wren	1	3	4	–
	Killdeer	1	0	1	–
	Lincoln's sparrow	0	2	2	–
	MacGillivray's warbler	3	3	6	–
	Mallard	2	0	2	–
	Marsh wren	2	1	3	–
	Mourning dove	3	0	3	–
	Nashville warbler	2	1	3	–
	Northern mockingbird	0	1	1	–
	Orange-crowned warbler	3	1	4	–
	Pied-billed grebe	1	0	1	–
	Red-breasted nuthatch	1	0	1	–
	Red-winged blackbird	1	0	1	–
	Ring-billed gull	1	0	1	–
	Rock pigeon	2	0	2	–
	Ruby-crowned kinglet	3	0	3	–
	Spotted towhee	1	0	1	–
	Swainson's thrush	0	1	1	–
	Townsend's warbler	1	1	2	–
	Tree swallow	4	0	4	–
	Tricolored blackbird	1	0	1	CA-T
	Vaux's swift	0	1	1	CA-SSC
	Warbling vireo	4	1	5	–
	Western meadowlark	12	10	22	–
	Western tanager	2	0	2	–
	White-crowned sparrow	1	1	2	–

Group	Species	Year 1	Year 2	Total	Special Status
	White-throated swift	7	11	18	–
	Wilson's warbler	9	6	15	–
	Yellow warbler	3	3	6	CA-SSC
	Yellow-breasted chat	1	0	1	CA-SSC
	Unknown blackbird	5	0	5	?
	Unknown flycatcher	8	4	12	–
	Unknown gull	22	18	40	–
	Unknown hummingbird	0	1	1	–
	Unknown kinglet	1	0	1	–
	Unknown sparrow	3	0	3	?
	Unknown swallow	0	4	4	–
	Unknown thrush	0	1	1	–
	Unknown vireo	2	1	3	–
	Unknown warbler	13	5	18	?
	Unknown waterbird	1	1	2	–
	Unknown wren	0	1	1	–
	Unknown small bird	23	20	43	–
	Unknown medium bird	1	1	2	–
	Unknown med-large bird	2	0	2	–
	Unknown large bird	2	0	2	–
All Birds		258	182	440	

[1] Values include 33 bats, 24 raptors, and 22 nonraptors excluded from further consideration, because carcass ageing indicated the fatalities occurred more than one search interval before the Project began.

[2] CA-FP = California fully protected; CA-SSC = California species of special concern; CA-T = California threatened species; BGEPA = Bald and Golden Eagle Protection Act.

Generating statistically meaningful (i.e., sufficiently accurate and precise) annual fatality estimates typically requires a sample size of at least five individuals, and comparing estimates among species groups or other covariate classifications typically requires a minimum of 10 samples per group (Huso et al. 2012). During Year 1, we confirmed five or more fatalities of only three bat species and eight bird species, and during Year 2 the relevant tallies were only two bat species and six bird species (Table 5). The only bird species for which we confirmed 10 or more fatalities in both monitoring years were red-tailed hawk, horned lark, and western meadowlark, and white-throated swift was the only other species for which we confirmed 10 or more fatalities in a single year. However, we documented a high total number of gull fatalities (58; four species confirmed) and 69% of these fatalities were not identified to species. Hence, the gull fatalities almost certainly included more than 10 California gulls (the most common identified gull fatality) in both monitoring years. Similarly, our forensic specialist was able to confirm 10 species of warblers among the fatalities, involving 43 individuals, but she was able to classify another 18 individuals only as unknown warblers and 43 unknown small birds also likely included some warblers. Hence, again it is likely that the fatality counts for at least the commonly identified Wilson's warbler also exceeded 10 individuals in one or both years.

3.3.1 Condition of Fatality Incidents at Time of Discovery

Three bats and two birds were found alive and later died or were euthanized at a rehabilitation facility, and amounted to <3% of the group fatalities for bats, small birds, and medium birds (Table 6). A majority (61%) of the documented bat fatalities were found as mostly intact/complete carcasses in various states of decomposition, with another 10% found as largely complete carcasses where all major body parts (i.e., head, torso, limbs, and at least most primary flight feathers) were still present, but a predator or scavenger had variably removed some fur, skin, body feathers, or internal organs and tissues. Conversely, 29% of the bat carcasses were found as incomplete carcasses where either a predator, scavenger, advanced decomposition and dispersal, or abiotic factors had removed one or more major body parts that potentially could be found somewhere else and qualify as a separate fatality if not properly matched to the documented remains.

Table 6. Representation Across 2-Year Study of Bat and Bird Fatalities in Various Conditions at the Time of Discovery, Excluding Carcasses Deposited Before Study Began

		Bats		Small Birds[1]		Medium Birds[1]		Large Birds[1]	
Carcass Condition		***n***	**%**	***n***	**%**	***n***	**%**	***n***	**%**
Complete	Injured – died/euthanized	3	1	1	<1	1	3	0	0
	Intact – fresh	85	17	16	6	1	3	12	11
	Intact – early decomposition	215	43	39	15	3	10	26	24
	Intact – decomposed	4	1	1	<1	0	0	0	0
	Dismembered – fresh	1	<1	1	<1	0	0	3	3
Subtotal		308	61	58	23	5	17	41	38
Mostly Complete[2]	Depredated/scavenged – fresh	6	1	4	2	2	7	3	3
	Depredated/scavenged – early decomposition	45	9	3	1	1	3	3	3
Subtotal		51	10	7	3	3	10	6	6
Incomplete	Dismembered – fresh	2	<1	1	<1	2	7	4	4
	Dismembered – early decomposition	1	<1	3	1	0	0	1	1
	Dismembered – decomposed	1	<1	0	0	0	0	1	1
	Depredated/scavenged – fresh	13	3	9	4	1	3	4	4
	Depredated/scavenged – feather spot	0	0	69	27	8	27	17	16
	Depredated/scavenged – early decomposition	122	24	109	43	9	30	31	29
	Depredated/scavenged – decomposed	5	1	0	0	2	7	2	2
Subtotal		144	29	191	75	22	73	60	56
Total		503	–	256	–	30	–	107	–

[1] Average mass of birds: small, 4–100 g (Anna's hummingbird up to western meadowlark); medium, 119–450 g (mourning dove/American kestrel up to pied-billed grebe/barn owl); and large 520 – 4,200 g (ring-billed gull up to golden eagle).

[2] Cases where all major parts were still present but scavenging had notably removed/dispersed flesh, fur, feathers, and/or small parts (e.g., a mandible or foot).

In contrast to the case for bats, much higher proportions of the small (75%) and medium-sized (73%) bird fatalities and a moderately high 56% of the large bird fatalities were found as only feather spots or otherwise incomplete carcasses (Table 6). It was also noteworthy that relatively high proportions of the medium (7%) and large (9%) bird fatalities could be confidently classified as having suffered blade-strike injuries that severed either the torso, head, or a primary appendage(s). That said, based on discernable forensic evidence, we classified 23% of the bat fatalities, 14% of the small-bird fatalities, 21% of the medium-bird fatalities, and 38% of the large-bird fatalities as having clearly resulted from a blade-strike/turbine collision.

3.4 Fatality Estimates

3.4.1 Classification of Records Suited to Fatality Estimation

Across the 2-year study, we collected data on 969 fatality or injury incidents, which translated to 892 individual fatalities of bats and volant birds that were deposited during the survey period and were potentially suited to developing fatality estimates. Of these, 801 fatalities were deposited on survey plots and qualified as the basis for calculating adjusted fatality estimates (Table 7). We identified 77 individual finds (25 bat records and 52 bird records) as duplicates representing previously discovered fatalities, and combined relevant records to compose the fatality tallies. We excluded five fatalities of nonvolant juvenile birds found in Year 1, all likely horned larks and western meadowlarks (common grassland breeders in the Project area). We excluded 33 bats and 46 birds found during the first month of surveys in Year 1, for which carcass ageing suggested deposition occurred more than one search interval before the first relevant survey. These *aged-out* carcasses involved 24 raptors, including 3 golden eagles, 12 red-tailed hawks, 3 American kestrels, and 2 burrowing owls, with relevant carcasses of the latter two species found only on 7-day plots. We also excluded 1 bat and 3 birds recorded as on-plot incidentals that were left in place but were never found during a standard survey. Lastly, we excluded all off-plot incidentals (49 bats and 42 birds; Table 7) when calculating adjusted fatality estimates. After the above filtering, 237 bats and 182 birds remained as the basis for estimating adjusted Year 1 fatalities, and 216 bats and 166 birds remained as the basis for estimating adjusted Year 2 fatalities (Tables 7 and 8, Appendixes F and G).

The five injured bats and birds found during the study involved two Mexican free-tailed bats in Year 1 (one found off-plot and one found on-plot) and a third Mexican free-tailed bat, a long-eared owl, and a white-throated swift in Year 2 (all found on-plot). The off-plot incidental find of a Mexican free-tailed bat, alive with no outward signs of injury, occurred 138 m from the nearest turbine. This bat might have experienced an encounter with a turbine blade; however, the detection dogs commonly find bats outside of the 115-m-radius survey plots. Therefore, we excluded this off-plot incidental injured bat, along with all off-plot incidental bat fatalities, from the tallies used to derive the adjusted fatality estimates. The other four injured animals were found on survey plots during standard surveys, and were treated as fatalities used to derive the adjusted estimates.

Table 7. Documented Bat and Volant Bird Fatalities, Excluding Aged-Out Carcasses, by Survey Year, Size Class for Birds, and Incident Type

Survey Year	Taxon	Size Class[1]	Off Plot Incidental[2]	On Plot Record Type			On Plot Total	Grand Total
				7-Day	28-Day	Incidental		
Year 1	Bat	–	33	184	53	0	237	270
	Bird	Small	17	93	32	0	125	142
		Medium	2	10	4	0	14	16
		Large	9	29	14	0	43	52
		All Birds	28	132	50	0	182	210
Year 2	Bat	–	16	170	46	0	216	232
	Bird	Small	4	85	24	1	110	114
		Medium	1	9	3	0	12	13
		Large	9	28	12	4	44	53
		All Birds	14	122	39	4	166	180
Combined Total Bats			49	354	99	0	453	502
Combined Total Birds			42	254	89	5	348	390

[1] Average species mass of birds: small, 4–100 g (Anna's hummingbird up to western meadowlark); medium, 119–450 g (mourning dove/American kestrel up to pied-billed grebe/barn owl); and large 520 – 4,200 g (ring-billed gull up to golden eagle).
[2] Cases excluded to derive adjusted fatality estimates.

3.4.2 Bats

The Year 1 estimate of total bat fatalities was nonsignificantly higher than the Year 2 estimate, and the precision of both estimates was good (as defined in Section 2.4.2) (Table 9; annual estimates for all detected species are provided in Appendixes H and I). This interannual pattern was evident for all confirmed bat species, though the relative precision of species-specific estimates ranged from good for the most-common Mexican free-tailed bat, to fair for hoary bats, to poor for the uncommonly encountered western red bat and silver-haired bat. Excluding data from the four eagle-curtailment turbines eliminated the single fatality of a big brown bat found in July during Year 1. That elimination precluded calculating adjusted fatality estimates for big brown bat, but the interannual pattern was the same as for silver-haired bat; i.e., one fatality in Year 1 and none in Year 2.

Comparing the Year 1 fatality totals for bats derived from 7-day and 28-day surveys was confounded by having incorporated data for ten 7-day turbines but only six 28-day turbines. No such estimation bias applied to the Year 2 data, because that year's sampling encompassed the same number of 7-day and 28-day plots (8 each). Nevertheless, comparing per-turbine fatality rates derived without having *GenEst* extrapolate the fatality totals to facility level (20 turbine) estimates provided an unbiased basis for comparing the magnitude of fatality estimates for bats derived from the two survey types in both years. Those estimates indicated significantly higher bat fatality rates on 7-day plots than on 28-day plots in both years, despite 28-day values estimated with only fair precision (Table 10).

Table 8. Bat and Bird Fatalities Assigned to Survey Plots and Used to Calculate Adjusted Fatality Estimates by Year, Size Class for Birds, Survey Type, and Season

Survey Year	Taxon	Size Class[1]	Survey Type	Season[2]				Total
				Fall	Winter	Spring	Summer	
Year 1	Bats	Small	7-day	68	3	40	73	184
			28-day	18	0	14	21	53
	Total Bats			86	3	54	94	237
	Birds	Small	7-day	18	13	31	31	93
			28-day	10	3	11	8	32
		Medium	7-day	1	6	1	2	10
			28-day	1	1	1	1	4
		Large	7-day	6	10	4	9	29
			28-day	7	4	3	0	14
	Total Birds			43	37	51	51	182
Year 2	Bats	Small	7-day	34	1	59	76	170
			28-day	19	0	14	13	46
	Total Bats			53	1	73	89	216
	Birds	Small	7-day	16	8	33	29	86
			28-day	7	4	7	6	24
		Medium	7-day	1	4	0	4	9
			28-day	2	1	0	0	3
		Large	7-day	3	14	5	6	28
			28-day	8	4	3	1	16
	Total Birds			37	35	48	46	166
Combined Total Bats				139	4	127	183	453
Combined Total Birds				80	72	99	97	348

[1] Average species mass of birds: small, 4–100 g (Anna's hummingbird up to western meadowlark); medium, 119–450 g (mourning dove/American kestrel up to pied-billed grebe/barn owl); and large 520 – 4,200 g (ring-billed gull up to golden eagle).

[2] Fall = September – November (each year combines data from two successive seasons); winter = December – February; spring = March – May; summer = June – August.

The selected *GenEst* CD model for bats incorporated *Season2A* as a predictor rather than *Season*, perhaps largely because basing the analysis on roughly twice the sample size per season bolstered the statistical power of the two-season model. Regardless, evaluating quarterly seasonal differences in estimated bat fatality rates was most informative and helped illustrate interannual variation in the seasonal pattern (Table 11). In both years, the bat fatality rate was estimated to be highest in summer, nonsignificantly lower in fall, and negligible in winter; however, the spring fatality rate ranked third lowest in Year 1 but similar to the high summer rate in Year 2. In addition, quarterly seasonal estimates were generated with only fair precision in most cases and poor precision for fall in Year 2 and winter in both years.

Table 9. Adjusted Fatality Estimates for Bats by Year and Species

Year	Species	Contributing Fatalities[1]	Total Fatalities[2]		Fatalities per Turbine		Fatalities per MW	
			Median	95% CI[3]	Median	95% CI	Median	95% CI
Year 1	Mexican free-tailed bat	166	376	312 – 464	18.79	15.61 – 23.22	8.17	6.79 –10.10
	Hoary bat	38	92	66 – 129	4.60	3.30 – 6.46	2.00	1.44 –2.81
	Western red bat	6	12	6 – 20	0.60	0.30 – 0.98	0.26	0.13 –0.42
	Silver-haired bat	1	2	1 – 5	0.11	0.05 – 0.26	0.05	0.02 –0.11
	Unidentified bat	5	15	5 – 32	0.74	0.25 – 1.59	0.32	0.11 –0.69
	All bats	216	497	419 – 613	24.86	20.94 – 30.65	10.81	9.10 –13.33
Year 2	Mexican free-tailed bat	152	355	293 – 454	17.77	14.67 – 22.68	7.73	6.38 –9.86
	Hoary bat	25	67	43 – 103	3.36	2.17 – 5.17	1.46	0.94 –2.25
	Western red bat	1	5	1 – 16	0.23	0.05 – 0.82	0.10	0.02 –0.36
	Silver-haired bat	0	0	0 – 0	0.00	0.00 – 0.00	0.00	0.00 –0.00
	Unidentified bat	4	12	4 – 29	0.60	0.20 – 1.44	0.26	0.09 –0.63
	All bats	182	442	364 – 560	22.12	18.18 – 28.02	9.62	7.90 –12.18
2-Year Average	Mexican free-tailed bat	318	366	346 – 386	18.28	17.28 – 19.28	7.95	7.52 –8.38
	Hoary bat	63	80	56 – 104	3.98	2.77 – 5.19	1.73	1.20 –2.26
	Western red bat	7	8	1 – 15	0.41	0.05 – 0.77	0.18	0.02 –0.34
	Silver-haired bat	1	1	0 – 3	0.05	0.00 – 0.15	0.02	0.00 –0.07
	Unidentified bat	9	13	10 – 16	0.67	0.54 – 0.80	0.29	0.23 –0.35
	All bats	398	470	416 – 524	23.49	20.80 – 26.18	10.21	9.04 –11.38

[1] Excludes (a) fatalities aged as having been deposited more than one search interval before the start of the monitoring Project; (b) off-plot incidental finds (i.e., carcasses opportunistically found outside of standard survey plots); and (c) on-plot incidental finds that were found and left in place by a nonsurveyor, and never found again during a standard survey.

[2] Values were extrapolated in *GenEst* from data gathered at 16 turbines to represent the entire facility consisting of 20 turbines.

[3] CI = confidence interval.

Table 10. Adjusted Fatality Estimates for Bats by Year and Survey Type Based on Data from 16 Fully Operational Turbines

Year	Survey Type	Contributing Fatalities[1]	Total Fatalities[2]		Fatalities per Turbine	
			Median	95% CI[3]	Median	95% CI
Year 1	7-day	181	284	243 – 354	28.42	24.26 – 35.44
	28-day	35	112	71 – 175	18.71	11.85 – 29.19
Year 2	7-day	147	231	194 – 290	28.84	24.23 – 36.30
	28-day	35	119	74 – 185	14.90	9.25 – 23.13

[1] Excludes (a) fatalities aged as having been deposited more than one search interval before the start of the monitoring Project; (b) off-plot incidental finds (i.e., carcasses opportunistically found outside of standard survey plots); and (c) on-plot incidental finds that were found and left in place by a nonsurveyor, and never found again during a standard survey.
[2] Values were generated using *GenEst* and data from 16 of 20 turbines that remained fully operational during all or most of each monitoring year, without extrapolation to include estimated fatalities at the four excluded turbines.
[3] CI = confidence interval.

Table 11. Adjusted Fatality Estimates for Bats by Year and Season

Year	Season[1]	Contributing Fatalities[2]	Total Fatalities[3]		Fatalities per Turbine	
			Median	95% CI[4]	Median	95% CI
Year 1	Fall	72	172	128 – 239	8.61	6.41 – 11.97
	Winter	3	6	3 – 12	0.31	0.15 – 0.62
	Spring	54	127	94 – 178	6.35	4.71 – 8.91
	Summer	87	190	147 – 261	9.50	7.34 – 13.07
Year 2	Fall	31	108	69 – 175	5.42	3.43 – 8.76
	Winter	1	2	1 – 5	0.10	0.05 – 0.26
	Spring	73	164	123 – 215	8.18	6.16 – 10.77
	Summer	77	167	129 – 221	8.34	6.45 – 11.06

[1] Fall = September – November (each year combines data from two successive seasons); winter = December – February; spring = March – May; summer = June – August.
[2] Excludes (a) fatalities aged as having been deposited more than one search interval before the start of the Project; (b) off-plot incidental finds (i.e., carcasses opportunistically found outside of standard survey plots); and (c) on-plot incidental finds that were found and left in place by a nonsurveyor, and never found again during a standard survey.
[3] Values were extrapolated in *GenEst* from data gathered at 16 turbines to represent the entire facility consisting of 20 turbines.
[4] CI = confidence interval.

3.4.3 Birds

There were no statistically significant differences between the Year 1 and Year 2 adjusted annual fatality estimates for all birds combined or any primary species group except raptors (lower in Year 1) (Table 12; annual estimates for all detected species are provided in Appendixes H and I). With data for the 2 years combined, the fatality estimates for nonraptors derived from the 7-day surveys were significantly higher than the estimates derived from the 28-day surveys, whereas the 7-day and 28-day estimates for raptors were not significantly different (Table 13).

Table 12. Adjusted Fatality Estimates for Selected Groups of Birds by Year

Year	Taxon[1]	Contributing Fatalities[2]	Total Fatalities		Fatalities Per Turbine		Fatalities Per MW	
			Median	95% CI[3]	Median	95% CI	Median	95% CI
Year 1	All birds	182	284	247 – 337	14.21	12.37 – 16.86	6.18	3.96 – 7.33
	Small birds	125	217	183 – 268	10.87	9.13 – 13.39	4.73	2.72 – 5.82
	Medium birds	14	20	14 – 28	0.99	0.71 – 1.39	0.43	0.30 – 0.61
	Large birds	43	46	43 – 51	2.31	2.15 – 2.53	1.01	0.93 – 1.10
	Nonraptors-All	159	257	221 – 310	12.87	11.06 – 15.50	5.60	3.46 – 6.74
	Nonraptors-Native	154	249	213 – 301	12.44	10.67 – 15.03	5.41	3.35 – 6.53
	Raptors	23	27	23 – 32	1.33	1.15 – 1.60	0.58	0.50 – 0.69
Year 2	All birds	166	258	227 – 300	12.91	11.33 – 15.01	5.61	3.61 – 6.53
	Small birds	110	191	160 – 234	9.56	7.99 – 11.69	4.16	2.39 – 5.08
	Medium birds	12	18	12 – 27	0.92	0.61 – 1.33	0.40	0.26 – 0.58
	Large birds	44	48	44 – 53	2.38	2.20 – 2.65	1.04	0.96 – 1.15
	Nonraptors-All	134	220	189 – 262	10.99	9.43 – 13.10	4.78	2.91 – 5.70
	Nonraptors-Native	131	214	184 – 255	10.72	9.22 – 12.75	4.66	2.85 – 5.54
	Raptors	32	38	32 – 45	1.92	1.61 – 2.27	0.84	0.70 – 0.99

[1] Average species mass of birds: small, 4–100 g (Anna's hummingbird up to western meadowlark); medium, 119–450 g (mourning dove/American kestrel up to pied-billed grebe/barn owl); and large 520 – 4,200 g (ring-billed gull up to golden eagle).

[2] Excludes (a) fatalities aged as having been deposited more than one search interval before the start of the monitoring Project; (b) off-plot incidental finds (i.e., carcasses opportunistically found outside of standard survey plots); and (c) on-plot incidental finds that were found and left in place by a nonsurveyor, and never found again during a standard survey.

[3] CI = confidence interval.

Table 13. Adjusted Fatality Estimates for Nonraptors and Raptors by Survey Type Based on Combined Two-Year Data

Species Group	Survey Type	Contributing Fatalities[1]	Total Fatalities		Fatalities per Turbine	
			Median	95% CI[2]	Median	95% CI
Nonraptors	7-day	226	344	293 – 412	34.35	29.33 – 41.18
	28-day	67	132	101 – 182	13.16	10.09 – 18.22
Raptors	7-day	29	35	29 – 42	3.48	2.93 – 4.17
	28-day	26	30	26 – 36	3.02	2.60 – 3.58

[1] Excludes (a) fatalities aged as having been deposited more than one search interval before the start of the monitoring Project; (b) off-plot incidental finds (i.e., carcasses opportunistically found outside of standard survey plots); and (c) on-plot incidental finds that were found and left in place by a nonsurveyor, and never found again during a standard survey.

[2] CI = confidence interval.

Based on combined 2-year data, the nonraptor fatality rate was estimated to be highest in spring and significantly lower in winter compared to spring and summer (Table 14). A different seasonal pattern was shown for raptors: significantly higher in fall than in any other season and significantly higher in winter and summer than in spring. The precision of these combined seasonal estimates was generally good, but rated only fair for nonraptors in fall.

Table 14. Adjusted Fatality Estimates for Nonraptors and Raptors by Season Based on Combined Two-Year Data

Species Group	Season[1]	Contributing Fatalities[2]	Total Fatalities		Fatalities per Turbine	
			Median	95% CI[3]	Median	95% CI
Nonraptors	Fall	57	114	87 – 161	5.68	4.35 – 8.07
	Winter	59	93	75 – 118	4.67	3.76 – 5.91
	Spring	91	137	115 – 174	6.87	5.76 – 8.71
	Summer	86	128	105 – 160	6.40	5.27 – 8.02
Raptors	Fall	23	28	23 – 35	1.41	1.15 – 1.76
	Winter	13	15	13 – 20	0.77	0.65 – 0.98
	Spring	8	9	8 – 11	0.45	0.40 – 0.53
	Summer	11	13	11 – 15	0.63	0.55 – 0.75

[1] Fall = September – November (each year combines data from two successive seasons); winter = December – February; spring = March – May; summer = June – August.
[2] Excludes (a) fatalities aged as deposited more than one search interval before the start of the monitoring Project; (b) off-plot incidental finds (i.e., carcasses opportunistically found outside of standard survey plots); and (c) on-plot incidental finds that were found and left in place by a nonsurveyor, and never found again during a standard survey.
[3] CI = confidence interval.

Mimicking the results for all raptors combined, the Year 2 adjusted fatality estimates were higher than the Year 1 estimates for all four focal raptor species, significantly so except for American Kestrels, whereas the opposite pattern nominally applied to the other relevant PEIR-emphasis raptor species—prairie falcon and barn owl (Table 15). The seventh detected PEIR-emphasis species—tricolored blackbird—was confirmed as a fatality only once in Year 1, the same as for prairie falcon and barn owl. In addition to the single fatalities confirmed for each of three blackbird species in Year 1 (Appendix F), five other blackbird carcasses found that year could not be identified to species. Some of those fatalities might have been other tricolored blackbirds; however, that could only be determined by genetic analysis, which was outside the scope of our effort. Those carcasses also could just as easily have been other blackbird species. The five other bird species with five or more fatalities documented in one or both years also showed variable and mostly nonsignificant interannual differences; however, the estimated fatality rate for California gulls was significantly higher in Year 1 (8 confirmed fatalities) than in Year 2 (1 confirmed fatality). Moreover, with the data for all gulls combined (n = 40 documented fatalities), the same significant pattern applied: 26 (95% CI: 24–28) estimated fatalities in Year 1, 17 (16–19) in Year 2. These annual species-specific estimates were rendered with relatively good precision for golden eagle, red-tailed hawk, prairie falcon, and California gull; fair precision for horned lark; fair to poor precision for American kestrel, burrowing owl, and Wilson's warbler; and poor precision for western meadowlark, white-throated swift, tricolored blackbird, and barn owl.

Table 15. Adjusted Fatality Estimates for Selected Bird Species by Year

Year	Species[1]	Contributing Fatalities[2]	Total Fatalities		Fatalities Per Turbine		Fatalities Per MW	
			Median	95% CI[3]	Median	95% CI	Median	95% CI
Year 1	Golden eagle	3	3	3 – 4	0.17	0.15 – 0.19	0.07	0.07 – 0.08
	Red-tailed hawk	9	10	9 – 11	0.50	0.45 – 0.56	0.22	0.20 – 0.24
	American kestrel	4	6	4 – 9	0.28	0.20 – 0.46	0.12	0.09 – 0.20
	Prairie falcon	1	1	1 – 1	0.06	0.05 – 0.06	0.02	0.02 – 0.03
	Burrowing owl	1	1	1 – 2	0.07	0.05 – 0.09	0.03	0.02 – 0.04
	Barn owl	1	2	1 – 3	0.08	0.05 – 0.17	0.04	0.02 – 0.07
	Tricolored blackbird	1	2	1 – 4	0.09	0.05 – 0.21	0.04	0.02 – 0.09
	California gull	8	9	8 – 10	0.45	0.40 – 0.49	0.19	0.17 – 0.21
	Horned lark	16	26	18 – 35	1.28	0.88 – 1.76	0.56	0.38 – 0.76
	Western meadowlark	10	19	11 – 31	0.96	0.55 – 1.54	0.42	0.24 – 0.67
	White-throated swift	7	12	7 – 19	0.59	0.35 – 0.96	0.26	0.15 – 0.42
	Wilson's warbler	6	9	6 – 15	0.47	0.30 – 0.75	0.20	0.13 – 0.33
Year 2	Golden eagle	4	4	4 – 5	0.22	0.20 – 0.25	0.10	0.09 – 0.11
	Red-tailed hawk	16	18	16 – 20	0.88	0.80 – 1.02	0.38	0.35 – 0.44
	American kestrel	4	6	4 – 11	0.32	0.20 – 0.57	0.14	0.09 – 0.25
	Prairie falcon	0	0	0 – 0	0.00	0.00 – 0.00	0.00	0.00 – 0.00
	Burrowing owl	2	4	2 – 7	0.18	0.10 – 0.33	0.08	0.04 – 0.14
	Barn owl	0	0	0 – 0	0.00	0.00 – 0.00	0.00	0.00 – 0.00
	Tricolored blackbird	0	0	0 – 0	0.00	0.00 – 0.00	0.00	0.00 – 0.00
	California gull	1	1	1 – 1	0.06	0.05 – 0.06	0.02	0.02 – 0.03
	Horned lark	12	20	13 – 29	1.00	0.65 – 1.45	0.43	0.28 – 0.63
	Western meadowlark	8	15	8 – 23	0.73	0.40 – 1.17	0.32	0.17 – 0.51
	White-throated swift	11	21	12 – 34	1.05	0.62 – 1.69	0.46	0.27 – 0.73
	Wilson's warbler	6	9	6 – 15	0.47	0.30 – 0.74	0.21	0.13 – 0.32

[1] Selected species represent PEIR-emphasis species detected as fatalities during the study, and other native species for which five or more qualified fatalities were documented during one or both survey years. See Appendixes H and I for comprehensive annual fatality estimates by species.

[2] Excludes (a) fatalities aged as having been deposited more than one search interval before the start of the monitoring Project; (b) off-plot incidental finds (i.e., carcasses opportunistically found outside of standard survey plots); and (c) on-plot incidental finds that were found and left in place by a nonsurveyor, and never found again during a standard survey.

[3] CI = confidence interval.

3.5 Temporal Distribution of Fatalities

Based on adjusted estimates, bat fatalities were scarce from December through March during both survey years, whereas variable annual patterns occurred between April and September (Figure 5). In 2019, bat fatalities were relatively low in April and then exhibited high peaks in May (spring migration) and September (fall migration), whereas in 2020 the monthly fatality rate was highest in April and then dropped down to a moderate level in August and September. This seasonal pattern reflected the dominant influence of the abundant Mexican free-tailed bat; however, hoary bats also exhibited a peak in fatality activity in fall 2019 and a declining pattern from May through September in 2020 (Figure 6). In contrast, confirmed fatalities of the special-status western red bat occurred only in spring and especially fall 2019.

Nonraptor fatalities were recorded in all months of the 2-year study and, in both 2019 and 2020, the adjusted fatality totals were lowest in March, highest in May, and generally sustained at similar, comparatively moderate levels during other months (Figure 5). Among nonraptor species commonly encountered as fatalities, horned larks and Wilson's warblers were most commonly found from spring through summer in both years; western meadowlarks were most often found in October and January each year; white-throated swifts were most often found in November each year; and California gulls were found each month from April through September in 2019, but only one was confirmed after that in February 2020 (Figure 7). In many cases, examining seasonal patterns for selected nonraptor species groups yielded improved insight. Regarding gulls, data for all species combined (including unidentified individuals) showed that gull fatalities continued to occur during most months between December 2019 and August 2020. Similarly, combining data for all detected warblers demonstrated that warbler fatalities occurred monthly from April through September/October in both 2019 and 2020, with high peaks both years in May. Data for three other relatively common species groups (blackbirds, grosbeaks and sparrows, and flycatchers) provided other insight and helped highlight the generally higher diversity of nonraptor fatalities in 2019 compared to 2020 (Figure 7). For example, both white-throated swift and blackbird fatalities commonly occurred from January through July in 2019, and a major winter spike in swift fatalities occurred in November 2019, but such fatalities were either absent or scarce in 2020.

No qualified raptor fatalities were recorded during March in either 2019 or 2020, nor during three other spring and summer months across the 2-year study (Figure 5). The full month of surveys conducted in October 2019 yielded the highest adjusted monthly fatality total for raptors, and adding the partial estimates for October 2018 (~3 weeks sample) and October 2020 (~1 week sample) yielded a similar combined total (Figure 5). Otherwise, the combined raptor fatality totals did not follow consistent annual patterns across other months. Moreover, in general neither consistent interspecific temporal patterns nor consistent intraspecific interannual patterns were readily apparent at the species level for raptors (Figure 8). Exceptions were both golden eagles and red-tailed hawks showing the highest estimated fatality totals in October 2019, American kestrel fatalities generally occurring only from October through December, and burrowing owl fatalities occurring only between July and September each year.

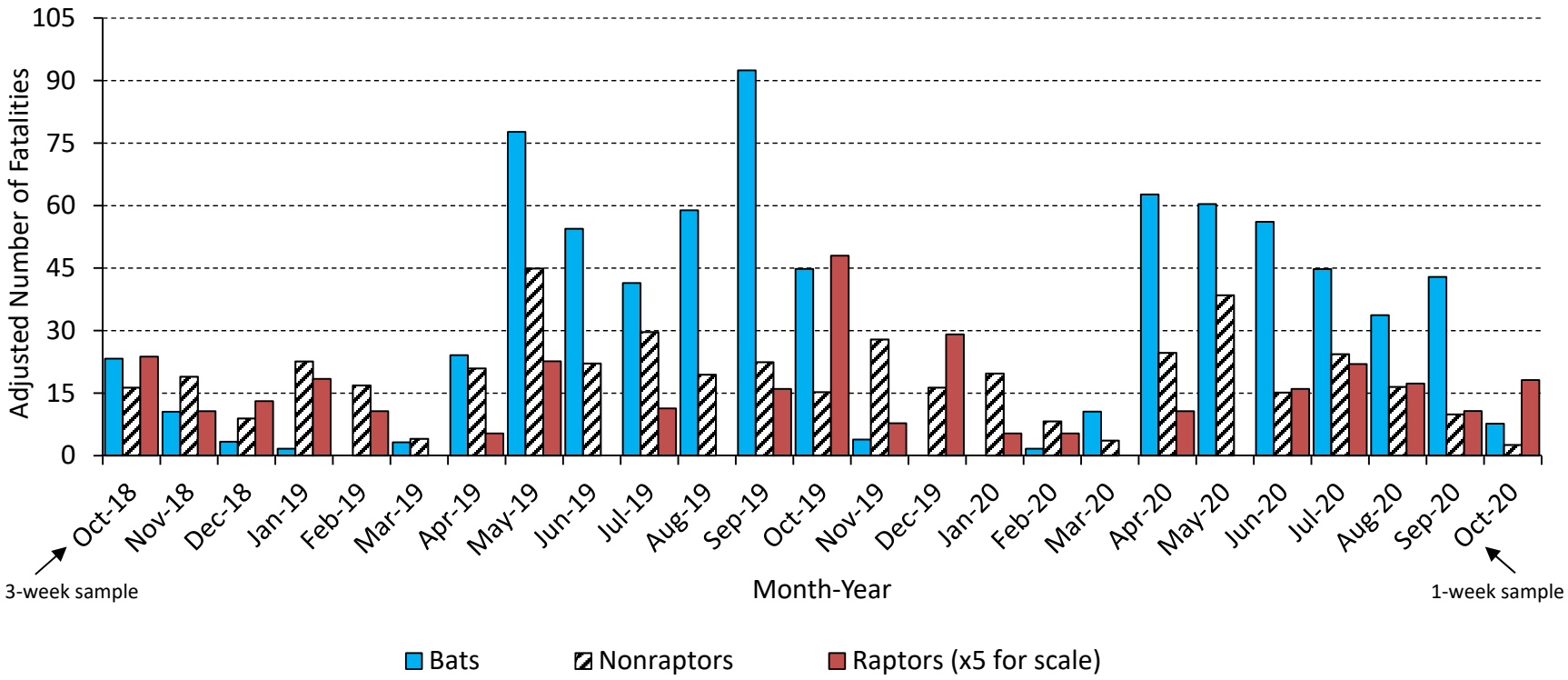

Figure 5. Monthly Variation Across 2-Year Study in Adjusted Fatality Totals for Bats, Nonraptors, and Raptors

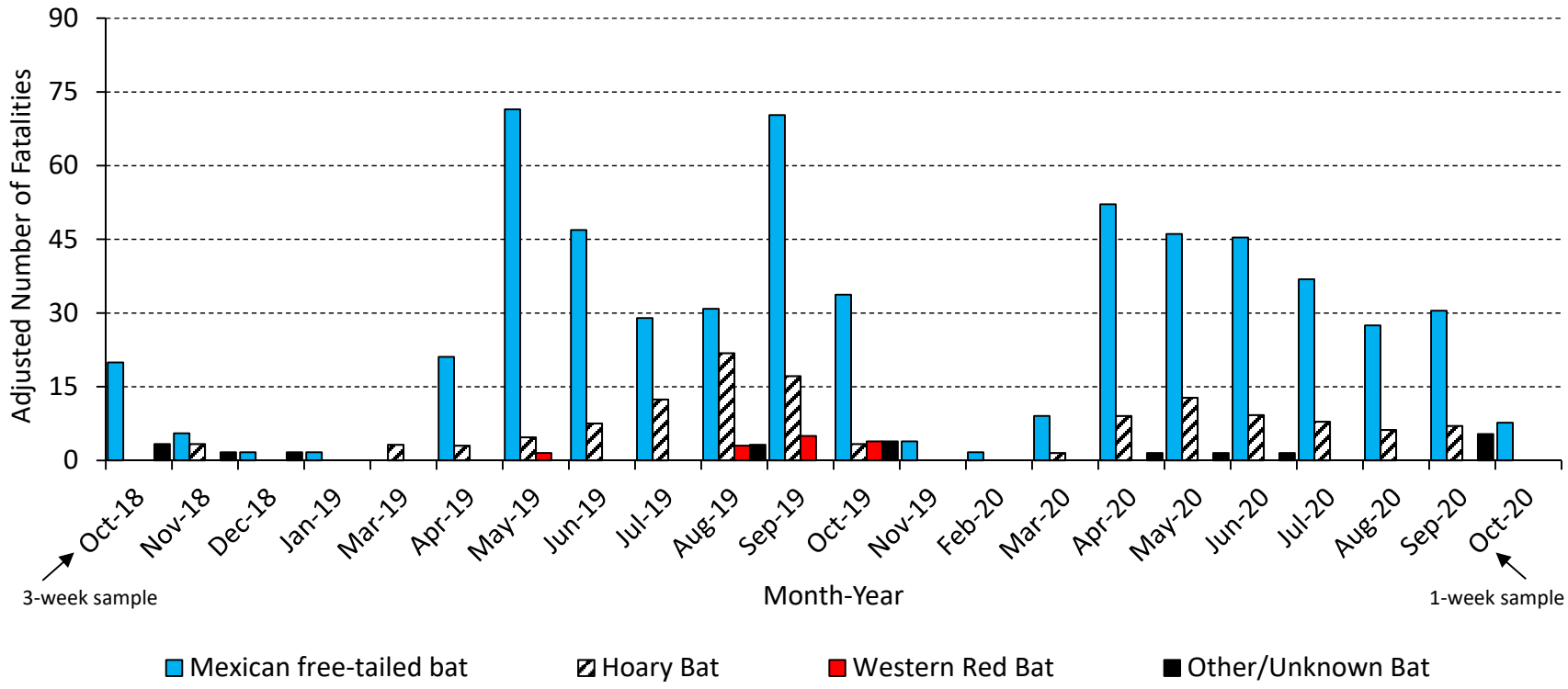

Figure 6. Monthly Variation Across 2-Year Study in Species-Specific Adjusted Fatality Totals for Bats

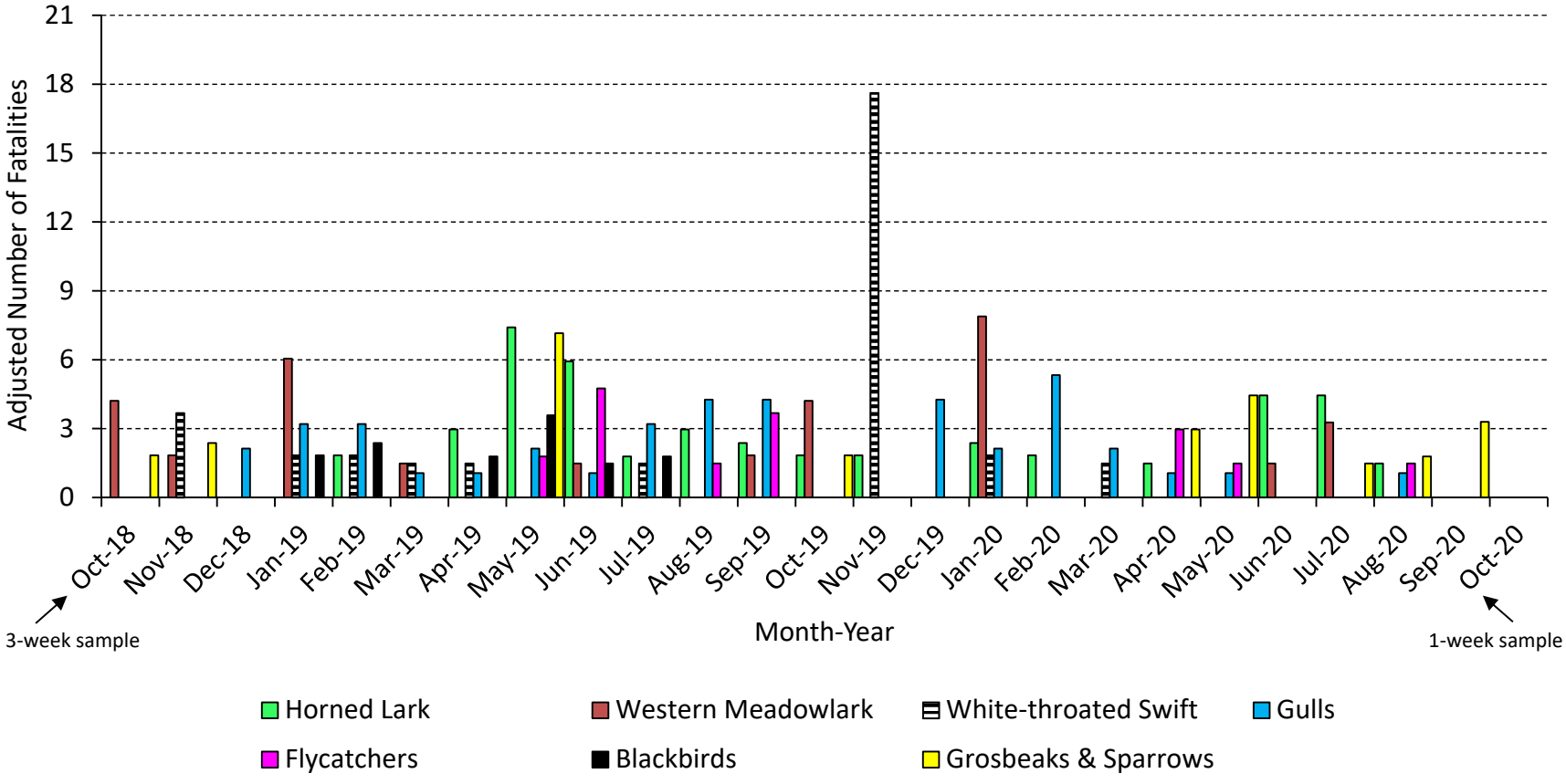

Figure 7. Monthly Variation Across 2-Year Study in Adjusted Fatality Totals for Selected Nonraptor Species and Groups

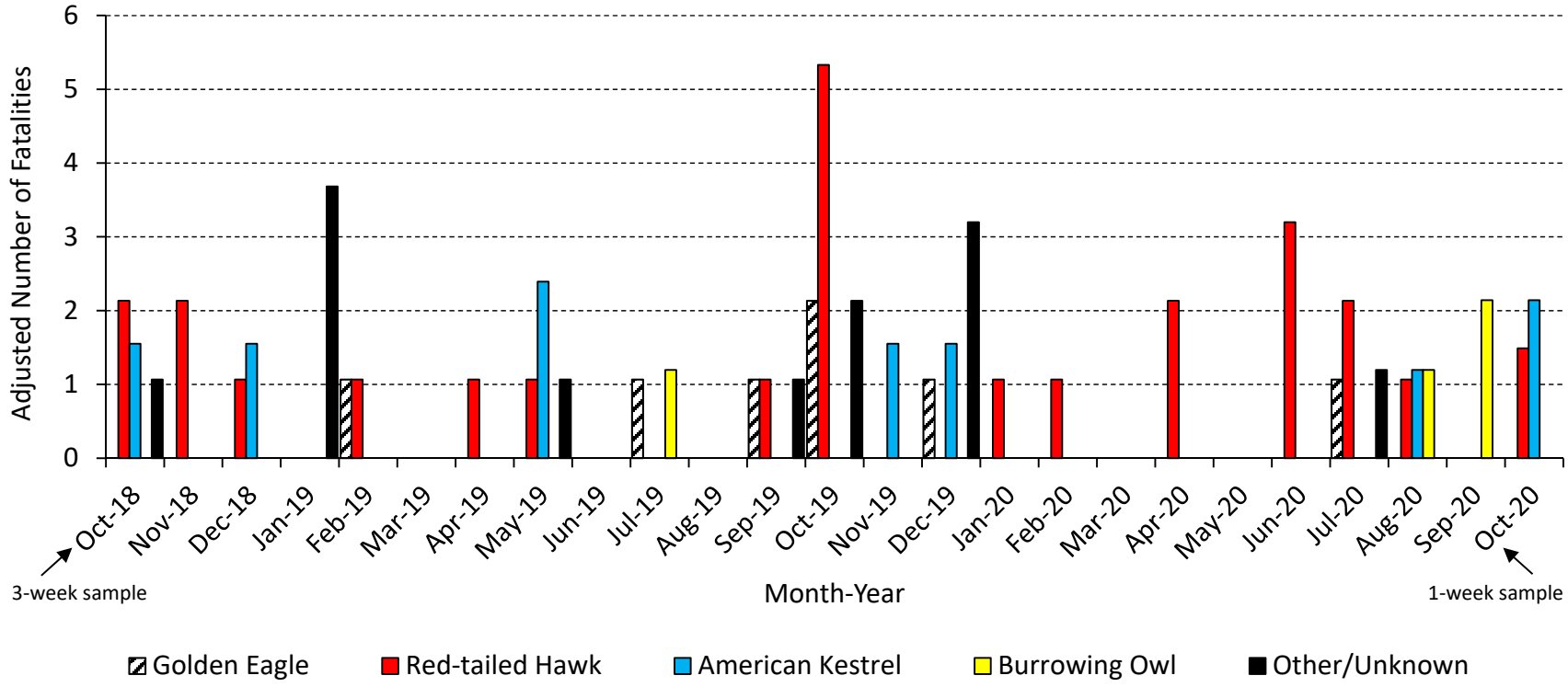

Figure 8. Monthly Variation Across 2-Year Study in Species-Specific Adjusted Fatality Totals for Selected Raptors

3.6 Spatial Distribution of Fatalities

The detection-dog teams found at least one bat and one nonraptor fatality on every plot they surveyed during both survey years. Based on adjusted estimates, both bat and nonraptor fatalities were generally more common in the middle sector of the facility, with WTGs 54, 56, 59, and 60 (see Figure 2 for turbine locations) exhibiting relatively high fatality rates for both groups (Figure 9). Bat fatality rates were also moderately high during both years at WTGs 49 and 51 in the northwest sector, and were generally least common in the southeast sector. In contrast, estimated nonraptor fatality rates were generally similarly lower in the northwest and southeast sectors compared to the middle sector. It is also important to recognize that, for both species groups, turbines exhibiting the highest adjusted 2-year fatality totals were generally those surveyed at 7-day intervals during both years, which suggests that comparing fatality rates for these groups across turbines subject to different 7-day versus 28-day sampling regimes may lead to biased inference. WTG57, surveyed at 28-day intervals in both years, was an exception for bats in yielding the second highest total number of adjusted fatalities (Figure 9).

The detection-dog teams discovered raptor fatalities during both monitoring years at only 7 of the 20 turbines and found none at WTGs 49, 52, and 55 (Figure 9). Similar to bats and nonraptors, the highest turbine-specific fatality rates for all raptors combined generally occurred in the middle of the facility at WTGs 56–57 and 59–61. Unlike for the other two groups, however, raptor fatalities were also comparatively common in the southeast sector, especially at WTG65. In addition, although the highest 2-year adjusted raptor fatality total occurred at WTG59, surveyed at 7-day intervals in both years, most of the turbines exhibiting moderately high 2-year raptor fatality totals were surveyed at 28-day intervals in one or both years.

At the raptor species level, WTG59 in the middle sector stood out as a 2-year hotspot for golden eagle fatalities (Figure 9), with 3 of 7 qualified fatalities (two in Year 1 and one in Year 2) and one additional aged-out carcass found on this survey plot. Of the remainder, single fatalities occurred at WTG53 in the northwest sector and at WTGs 62 (plus another aged-out carcass), 65, and 68 in the southeast sector. In contrast, the detection-dog teams detected qualified red-tailed hawk fatalities at six turbines in Year 1 (three with multiple fatalities), at nine turbines in Year 2 (six with multiple fatalities), and in both years at three turbines spread out across the facility (WTGs 56, 58, and 65). The highest number of red-tailed hawk fatalities detected at a single turbine across the 2 years of monitoring (4) occurred at WTG 58 in the northwest sector; however, the greatest cluster of red-tailed hawk fatalities occurred in the southeast sector at WTGs 62–67, with four qualified fatalities at these turbines in Year 1 and eight in Year 2. Red-tailed hawk fatalities were also moderately concentrated in the middle sector at WTGs 56–57 and 59–61. We also excluded eight other aged-out red-tailed hawk fatalities found in the southeast cluster of turbines (WTGs 64–67), two in the northwest (WTGs 52 and 53), and two in the central sector (WTG59).

Too few fatalities of other raptor species were encountered during the first 2 years of this study to support meaningful assessments of potential fatality hotspots. That said, WTG61 in the east-central sector stood out as the only turbine where the detection-dog teams found more than one American kestrel fatality (3) in a single year. In addition, WTG51 in the northwest sector was the only turbine where we recorded qualified kestrel fatalities in both years (one each year); however, we documented other aged-out kestrel fatalities in Year 1 at

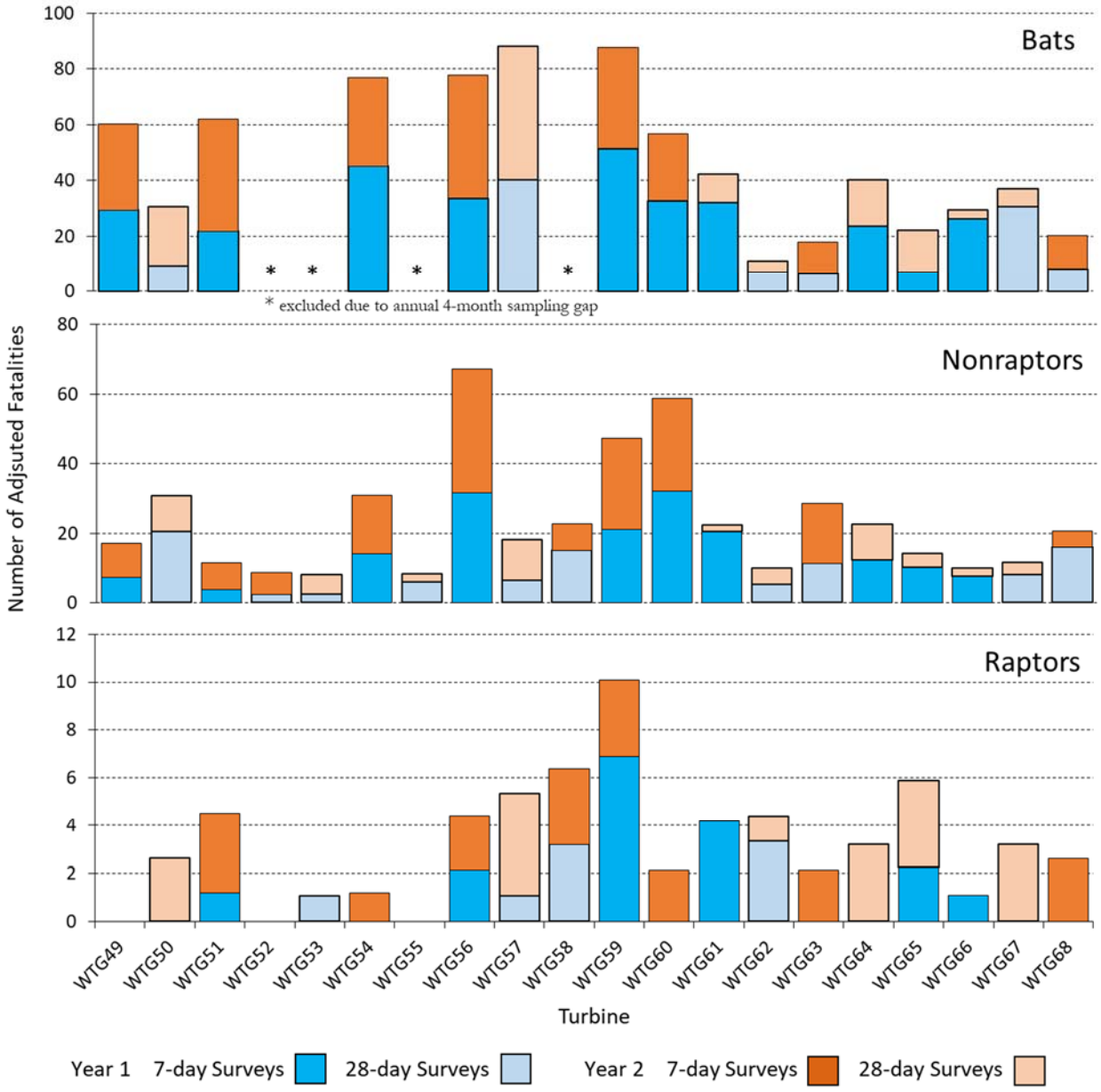

Figure 9. Adjusted Bat, Nonraptor, and Raptor Fatalities by Year, Survey Type, and Turbine

WTG50 (1) and WTG68 (2), where single qualified fatalities also occurred in Year 1. Lastly, the high combined-raptor fatality rate at WTG59 partly reflected that being the only turbine where we documented fatalities of more than one raptor species besides the four focal species, involving single Year 1 fatalities of ferruginous hawk, prairie falcon, and barn owl.

3.7 Raptor Activity Surveys

Raptor activity surveys were conducted at all four observation points every week between October 11, 2018 and October 3, 2019, with two exceptions. No surveys were conducted at Point 2 during the week of September 23, 2019 in Year 1, because the presence of industrial equipment precluded safely conducting the survey. Safety concerns related to turbine damage also required temporarily relocating all count sites further away from all turbines (minimum of 305 m spacing) during 2 weeks in Year 2 (September 7–14, 2020).

A total of 415 raptor activity surveys were conducted across the 2 years of monitoring (207 in Year 1, 208 in Year 2), encompassing 12,450 minutes (207.5 hours) of observation (6,210 minutes in Year 1, 6,240 minutes in Year 2). Data from the alternative count sites temporarily used in September 2020 represented 2% of the total observation time and 1.5% of all raptor observations. We combined those data with data collected at the relevant primary points for analysis.

Raptor detections occurred during 1,395 (22%) of the combined survey minutes in Year 1 and during 1,545 (25%) of the combined survey minutes in Year 2 (Table 16). Note that the detection tallies do not represent the number of individuals observed, because individual raptors were often recorded multiple times during a given survey. No raptors were observed during 24% of the surveys conducted over the 2-year study period. The highest proportion of surveys with no raptor detections occurred at Point 2 (34%) and the lowest proportion occurred at Point 4 (12%).

Table 16. Raptor Activity Observation Totals by Species, Count Site, and Year

Species	Minutes of Observation by Survey Point: Year 1 / Year 2				Total Minutes Observed Year 1/Year 2	Percent of Combined Total
	1	2	3	4		
American Kestrel	35/8	0/5	0/2	62/23	97/38	5%
Bald Eagle	0/2	0/0	31/	0/0	31/2	1%
Cooper's Hawk	2/0	0/0	0/0	0/0	2/0	<1%
Ferruginous Hawk	31/0	4/0	3/18	1/46	39/64	4%
Golden Eagle	97/86	28/17	208/275	62/67	395/445	29%
Northern Harrier	11/2	1/9	32/20	46/31	90/62	5%
Peregrine Falcon	0/0	0/1	0/0	0/0	0/1	<1%
Prairie Falcon	35/0	0/1	1/1	0/1	36/3	1%
Rough-legged Hawk	0/0	0/0	0/1	0/25	0/26	1%
Red-tailed Hawk	31/79	89/108	61/101	369/467	550/755	44%
Turkey Vulture	8/11	50/68	24/44	69/26	151/149	10%
White-tailed Kite	0/0	0/0	0/0	4/0	4/0	<1%
All Species	250/188	172/201	360/455	613/655	1395/1545	–
Percent of Combined Total	15	13	28	43	–	–

Twelve raptor species were observed during the surveys (Table 16). The most commonly observed species were red-tailed hawk (44% of all observation minutes), golden eagle (29%), turkey vulture (10%), and northern harrier (5%). Each of these species was recorded at all four observation points in both years. In contrast, bald eagles and peregrine falcons were detected during only two surveys, and white-tailed kites, rough-legged hawks, and Cooper's hawks were detected during only single surveys.

The most commonly observed behavior was perching (52%), followed by soaring/circling (34%) and flying (7%) (Table 17). Raptors were observed chasing, or being chased by, other birds on 32 occasions, with most of the chasing done by common ravens. We added a subcategory of flying, "Courtship". This included 17 instances of undulating flight and one observation of copulation. Golden eagles regularly perched on the off-site, non-Project transmission towers southwest of observation Point 3. Red-tailed hawks frequently perched on the weather station southwest of Point 4, which was also occasionally used by American kestrels and once by a golden eagle.

Table 17. Raptor Behaviors Observed During Activity Surveys by Species and Year

	Number of Minutes Engaged in Behavior Type[1]							
Species	Perched	Flying	Soaring	Hovering/ Kiting	Contouring	Diving	Chasing/ Being Chased	Courtship
American Kestrel	84/14	6/6	5/6	0/7	0/0	0/0	2/5	0/2
Bald Eagle	30/0	1/0	0/0	0/0	0/0	0/0	0/2	0/0
Cooper's Hawk	0/0	0/0	2/0	0/0	0/0	0/0	0/0	0/0
Ferruginous Hawk	30/29	1/1	5/2	3/30	0/1	0/0	0/1	0/0
Golden Eagle	223/278	21/30	128/131	0/0	18/0	4/1	2/5	0/0
Northern Harrier	30/2	20/7	22/34	0/0	18/9	0/0	0/1	0/0
Peregrine Falcon	0/0	0/1	0/0	0/0	0/0	0/0	0/0	0/9
Prairie Falcon	30/0	5/0	1/2	0/0	0/0	0/1	0/0	0/0
Rough-legged Hawk	0/3	0/0	0/23	0/0	0/0	0/0	0/0	0/0
Red-tailed Hawk	391/430	50/48	82/198	19/54	1/4	2/1	4/10	0/0
Turkey Vulture	0/0	14/11	133/135	0/3	4/0	0/0	0/0	0/10
White-tailed Kite	0/0	0/0	4/0	0/0	0/0	0/0	0/0	0/0
Total	818/756	118/104	382/531	22/94	41/14	6/3	8/24	0/19
Percent of Total Observations	54%	8%	31%	4%	2%	<1%	1%	1%

[1] See Table 1 for descriptions of categories.

Nine of the 12 recorded species of raptors were observed within 50 m of turbine blades on a total of 82 occasions (8% of all observations). Of the four species with >100 minutes of observation, turkey vultures were observed close to the blades most often (10%), followed by golden eagle (8%), red-tailed hawk (7%), and northern harrier (4%).

Golden eagles, red-tailed hawks, turkey vultures, and northern harriers were observed throughout the year, but golden eagle detections were most common in October, red-tailed hawk detections were more common in winter and migration seasons than in summer, and turkey vultures were most frequently observed in spring and summer (Figures 10 and 11). Similar to red-tailed hawks, American kestrels were most commonly observed in fall and winter, and were uncommon during spring and summer (Figure 10). In contrast, ferruginous and rough-legged hawks were observed only in fall and winter (Figure 11).

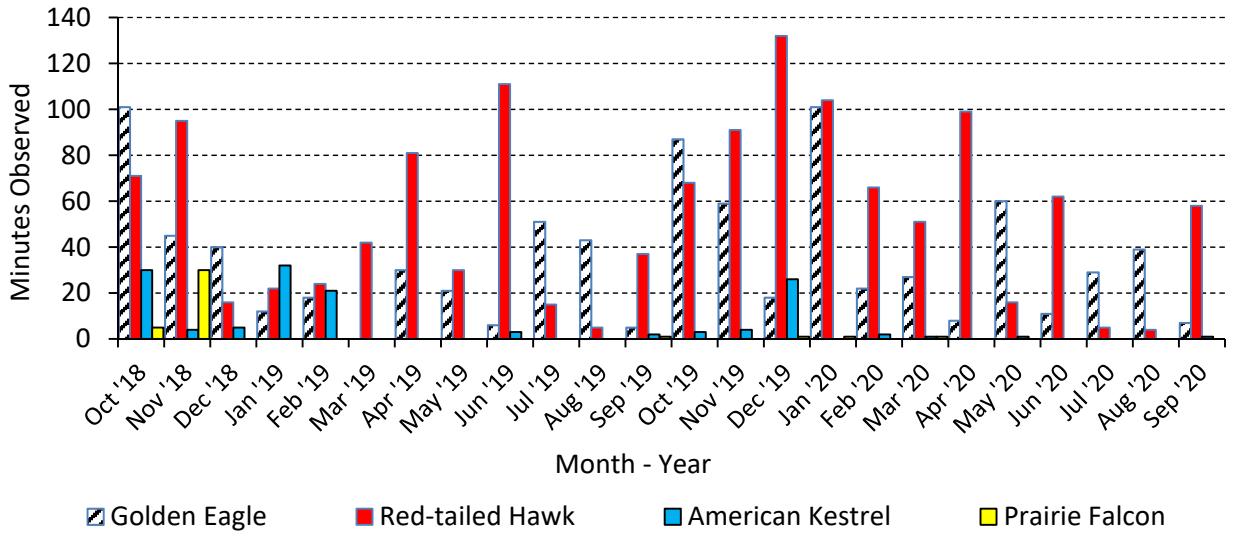

Figure 10. Observation Totals by Month for PEIR-Emphasis Raptor Species Detected During Activity Surveys

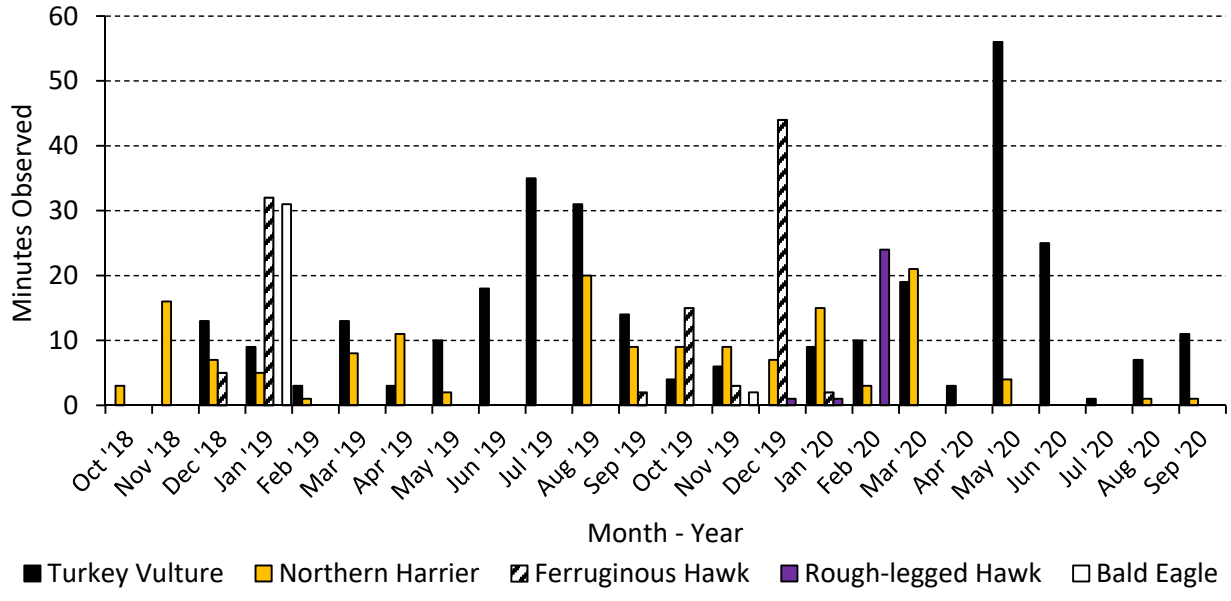

Figure 11. Observation Totals by Month for Non-PEIR-Emphasis Raptor Species Observed for More Than Five Minutes During Activity Surveys Over the Course of 2 Years

Section 4.0 Discussion

4.1 Carcass Detectability

The wind conditions in the Project area usually provided ideal search conditions for detection-dog teams. Unpublished studies performed by H. T. Harvey & Associates indicate that trained detection dogs can consistently identify a target scent up to 24 m from the transect line walked by the handler in light wind conditions (2–3 kilometers per hour [kph]), and will alert to target scent well over 30 m from the transect line in moderate to high wind conditions (16–24 kph) (also see Paula et al. 2011). Winds in excess of 40 kph may, however, hinder a dog's ability to detect target scents.

The results of this Project and the initial 3-year GH post-construction monitoring project (H. T. Harvey & Associates 2021a) emphasize the high value of using scent-detection dogs to survey for bats and small birds (also see Arnett 2006, Paula et al. 2011, Reyes et al. 2016). During Year 1 of the GHN study and concurrent Year 3 of the GH study, estimated CD for bats and small birds on 7-day plots surveyed by detection-dog teams was 53–67% and 55–57%, respectively, whereas searcher efficiency alone (i.e., not reduced by carcass removal) for humans searchers is often ≤15% for bats and <35% for small birds (H. T. Harvey & Associates 2015, Brown et al. 2016). In addition, bat CD for humans searching at 28-day intervals was 68% lower during Year 3 of the GH project than it was for detection-dog teams searching concurrently at 28-day intervals during Year 1 of the GHN Project.

The results of the first 2 years of this 3-year Project also indicated that bat CD for detection-dog teams was significantly lower on 28-day plots (annual estimates 26–34%) than on 7-day plots (62–67%). This pattern likely reflected the influence of a greater probability of carcass removal (whether by scavengers, through carcass decomposition, or by abiotic factors) over the longer search interval (Smallwood 2017). A lesser difference was indicated for small birds, however, with small-bird CD only slightly higher on 7-day plots (55%) than on 28-day plots (47%). This combined pattern also applied during Year 1 of the GH project, when detection-dog teams conducted all of the surveys. During that survey period, estimated bat CD was significantly higher on 7-day plots (75%) than on 28-day plots (49%), whereas small-bird CD was similar on 7-day (52%) and 28-day plots (50%) (H. T. Harvey & Associates 2021a).

We suspect the above difference reflects that bats are generally more odiferous than small birds when freshly dead, because feathers trap core body odors more than fur does. As a result, like detection dogs, odor-driven mammalian scavengers probably detect freshly dead bats more easily than freshly dead small birds, resulting in more rapid scavenging of bats than small birds. In turn, more rapid scavenging contributes to a greater proportional decline in integrated CD on 28-day plots, because proportionately fewer bats remain to be detected given the longer search interval. That rapid, complete removal of bat carcasses by scavengers is the most likely explanation for the difference in bat CD on 7-day versus 28-day plots is further supported by evidence that detection-dogs routinely locate even tiny bits of bat remains (e.g., skin/fur patches <1 square centimeter in size and small wing fragments) on the survey plots. Therefore, carcass decomposition likely plays only a limited role in reducing the likelihood of bat discovery for scent-detection dogs under a 28-day search regime, whereas that

factor is known to have a great influence on SE/CD for humans searching for bats and especially small birds (Smallwood 2017).

Results from the 2-year GHN and 3-year GH studies indicated both similarities and differences in comparing CD estimates for larger birds versus bats and small birds, relative to the influences of 7-day versus 28-day surveys and detection-dog teams versus human searchers. During Year 1 of the GH project, when detection-dog teams did both the 7-day and 28-day surveys, approximations indicated that CD of medium birds was marginally lower on 28-day plots (67%, 95% CI: 0.44–0.75) than on 7-day plots (87%, 0.73–1.00), but for large birds was non-significantly higher on 28-day plots (0.96, 0.91–1.00) than on 7-day plots (0.89, 0.79–1.00) H. T. Harvey & Associates 2021a). In addition, for medium and large birds, estimated CD on 28-plots was similar for detection-dog teams at GHN in Year 1 (71% and 100%, respectively) and for human searchers at GH during concurrent Year 3 of that project (68% and 96%) (H. T. Harvey & Associates 2021a).

The above combination of results suggests the following conclusions:

- Detection-dog teams detect carcasses of bats and small birds at a substantially higher rate than human searchers.
- Visually oriented human searchers are able to detect larger bird carcasses at a similar level as detection dogs searching primarily based on smell.
- Extending search intervals from 7 days to 28 days significantly reduces integrated CD for detection dogs searching for bats, and to a lesser degree small birds, but not for larger birds.

4.2 Composition of Fatality Incidents

4.2.1 Bats

No bat species were detected as fatalities during this 2-year Project that had not been previously detected as a fatality species during the 3-year GH project, and the three most frequently encountered species were common to both studies (H. T. Harvey & Associates 2021a). Among the latter species, hoary and Mexican free-tailed bats are open aerial foragers that make fall migratory movements. Hoary bats are solitary and migrate long distances, possibly more than 2,000 kilometers (Cryan et al. 2004), whereas the Mexican free-tailed bats found in the APWRA typically make seasonal movements within California, such as between the Central Valley where they raise young in large colonies and the central coast where large numbers overwinter (Johnston 1998). Mexican free-tailed bats are abundant and have not been categorized as at risk, whereas the available evidence suggests hoary bat populations are declining (Frick et al. 2017).

The western red bat's range in California is limited, with maternity areas generally restricted to lowland, old-growth riparian woodlands (Pierson and Rainey 1998). This species raises young in the Central Valley and based on range maps of males and females, both sexes typically overwinter along the coast, suggesting this species makes seasonal movements within California (Johnston and Whitford 2009). Like the hoary bat, this species is a solitary foliage-roosting bat, but unlike hoary bats and Mexican free-tailed bats, western red bats forage primarily in open areas along streams and riverine habitats. This suggests that their populations in the region

are much smaller than those of the two predominant species represented as fatalities in the APWRA. Mostly because more than 90% of the old-growth riparian forests of the Central Valley have been lost or significantly degraded, this species is listed as a CA-SSC and California populations are considered at risk (Williams 1986, Pierson et al. 2000).

Small numbers of silver-haired and big brown bat fatalities were also recorded during the 3-year GH study (H. T. Harvey & Associates 2021a), but none were recorded previously during the long-term APWRA-wide study (ICF International 2016) or any of the other previous post-repowering studies (Western EcoSystems Technology 2006, Insignia Environmental 2012, Brown et al. 2016). Big brown bats are common residents throughout northern California; often roost in human-made structures as well as a variety of natural substrates; typically forage over open habitats among scattered trees and structures; and are not considered at risk (Harris 1990). Silver-haired bats are primarily forest dwellers that are sporadically abundant in California; roost in tree cavities and crevices; typically forage low over streams, ponds, and brushy areas; can be found in many habitats during migration; and are not considered at risk (Harris et al. 2005).

4.2.2 Birds

During the first 2 years of this Project, 1 raptor species (long-eared owl) and 21 nonraptor species were uniquely confirmed as fatalities compared to the 3-year GH study (H. T. Harvey & Associates 2021a). Most notably, no gulls were detected as fatalities during the 3-year GH project, whereas the first 2 years of this Project revealed 79 individual gull fatalities involving at least four species. In addition, seven other species uniquely recorded as fatalities at the GHN site were species that rely on marsh and aquatic habitats (i.e., coots, ducks, grebes, terns, common yellowthroat, and marsh wren). These results reflect the GHN location between Bethany Reservoir to the east and the Altamont Landfill and a smaller reservoir to the west (see Figure 1). A large gull population uses the area as a primary flight corridor to move among the reservoirs and landfill (ICF International 2016), and the proximity of water bodies used by other waterbirds is not matched within or near the GH facility.

Most of the other bird species uniquely detected during this Project in small numbers were small-bird species that are not expected to occur routinely in the APWRA except as transient migrants/dispersers. It was noteworthy, however, that 10 species were not confirmed as fatalities during the previous long-term APWRA-wide study (ICF International 2016) nor any of the other post-repowering studies (Western EcoSystems Technology 2006, Insignia Environmental 2012, Brown et al. 2016, H. T. Harvey & Associates 2021a). These species were Caspian tern, green-winged teal, long-eared owl, red-breasted nuthatch, marsh wren, chipping sparrow, MacGillivray's warbler, Nashville warbler, yellow-breasted chat, and Bullock's oriole. Although interannual variation in regional landscape and climatic conditions, and attendant influences on the population dynamics of relevant species, probably contributed to these differences, the exceptional finding abilities of the detection dogs and identification skills of the GHN monitoring team were contributing factors.

The 9-year APWRA-wide monitoring study revealed only two white-throated swift fatalities and no fatalities of the special-status Vaux's swift (CA-SSC) (ICF International 2016). In contrast, we confirmed 18 white-throated swift fatalities and one Vaux's swift fatality during the first 2 years of this study, and the 3-year GH study documented 50 white-throated swift fatalities and nine Vaux's swift fatalities. As has been shown for bats (Barclay et al. 2007, Cryan and Barclay 2009), larger turbines that extend farther up into the airspace may

represent a greater problem for high-flying, aerial-foraging swifts than the smaller, older generation turbines that were once prevalent in the APWRA. However, other relevant post-repowering survey efforts revealed no fatalities of either swift species (Western EcoSystems Technology 2006, Insignia Environmental 2012, Brown et al. 2016), suggesting that other spatiotemporal or annual climatic factors may have influenced these outcomes. In addition, by increasing the probability of finding and confirming uncommon species, the higher search efficiency of detection dogs and exceptional forensic skills of project staff also could have contributed to the elevated species-specific fatality numbers for swifts, as well as for other diverse species of especially smaller birds. In addition, although 28-day interval surveys also perform poorly for bats and small birds, the even longer 45-day search intervals employed during earlier pre-repowering APWRA studies further reduced the probability of those studies detecting diverse species of smaller birds (Smallwood 2017).

4.2.2.1 Focal Raptors

Golden eagle fatalities in the APWRA typically involve a high proportion of subadults and fewer juvenile and adult birds (Hunt et al. 1995, 1999; Hunt 2002). This proved to be true on a 3-year aggregate basis for the GH project, with 20 of 26 (77%) eagle fatalities that could be confidently aged classified as subadults, and with no more than two adult fatalities recorded in a single monitoring year and none recorded during Year 3, which ran concurrent with Year 1 of this Project (H. T. Harvey & Associates 2021a). The 2-year data from GHN did not match this pattern, however. Unlike at GH, the Year 1 GHN fatalities included three adults, two subadults, and another old, incomplete carcass that could only be aged as a non-juvenile, and the Year 2 fatalities included one adult and one subadult. Whether these results reflect a greater impact on local breeders or nonbreeding floater adults, or are simply an artifact of a small sample size, is unknown. A third year of GHN data and 2 years of concurrent data from the ongoing GH monitoring effort may help clarify this pattern.

During both years of this Project, multiple fatalities of all four focal raptor species were recorded, but the fatality counts exceeded 10 individuals per year only for red-tailed hawks. The temporal distribution of red-tailed hawk fatalities varied during the 2 years of study, but the adjusted fatality estimates were at least moderately high in fall 2018 and high in fall 2019. The fall migratory/dispersive passage of red-tailed hawks through northern California and influx of winter residents in central California, including through and into the APWRA, typically is substantial (Hoffman et al. 1990, Goodrich and Smith 2008, Hull et al. 2009; and see Figure 10). The preliminary estimated detection rate for red-tailed hawks at the long-term fall migration monitoring site in the Marin Headlands of California, located approximately 78 km west-northwest of the APWRA, was an above-average 22.6 sightings per hour in 2018 and a slightly above-average 18.6 sightings per hour in 2019, and had increased each year from 2016 through 2018 before dropping back down slightly in 2019 (Golden Gate Raptor Observatory 2017, 2018, 2019, 2020). In contrast, the adjusted fatality rates for red-tailed hawks at the GH site declined significantly between 2016 and 2018 (H. T. Harvey & Associates 2021a) and the October/November 2018 fatality rates were similar at the GH and GHN sites (GH: 0.11 fatalities per turbine in both months; GHN: 0.07–0.08 fatalities per turbine per month). Similarly, although there were some commonalities, variation in the monthly fatality rate also did not closely match monthly variation in activity data for red-tailed hawks at GHN. For example, although both fatality and activity rates tended to be at least moderately high in October/November of 2018 and 2019, and during spring 2020, the activity surveys uniquely showed relatively high activity during spring/early summer 2019 and winter 2019/2020. Also noteworthy was the fact that the

fall 2018 fatalities at GHN involved a near equal mix of adult and nonadult red-tailed hawks, whereas the fall 2018 fatalities at GH involved primarily adults. Collectively, these comparative results suggest a complex interplay of regional population and movement dynamics, local habitat characteristics and prey availability, and risk of collision with wind turbines. Further insight will be generated after the third year of monitoring is completed at the GHN site and the concurrent annual results from a multi-year adaptive management/minimization monitoring extension project at the GH site are compiled.

During the 3-year GH study (H. T. Harvey & Associates 2021a) and during the first 2 years of this study, most American kestrel fatalities were detected in fall and winter. Curiously, the only kestrel fatalities recorded at the two sites in spring (2 at each site) all occurred during April/May 2019. Whether or not these spring fatalities represented local breeders is unknown. In this case, 2 years of raptor activity surveys at GHN yielded few spring sightings of kestrels, suggesting that the likelihood of local breeders being killed during the breeding season is probably low; however, local breeders could easily disperse into the facility areas to forage during winter. Notably, although myriad old-generation turbines once provide many more opportunities for kestrels to both perch and nest across the APWRA, currently there are few suitable nest substrates available to kestrels within the two facility areas.

Although the small annual tallies of burrowing owl fatalities (2–3) thus far recorded at GHN are similar to the Year 1 total recorded at the GH site (2), the unadjusted per turbine fatality rates at GH in Year 2 and concurrent Year 3 were 2–3 times higher, suggesting that the GH site at least intermittently attracts greater numbers of burrowing owls and/or their predators.

4.2.2.2 Other PEIR-Emphasis Species

Regarding the nine PEIR-emphasis species, the 2-year results from this Project included no fatalities of Swainson's hawk and loggerhead shrike, one prairie falcon, one tricolored blackbird, five burrowing owls, five barn owls, and greater numbers of the other three focal raptor species. In comparison, across more than 4 years of monitoring at the GH facility (encompassing more than twice as many turbines) the unadjusted fatality totals have included no Swainson's hawks, 1 loggerhead shrike, 2 prairie falcons, 4 tricolored blackbirds, 45 burrowing owls, 6 barn owls, and greater numbers of the other three focal raptor species (H. T. Harvey & Associates 2021a, 2021b, unpublished data). These results suggest that the Golden Hills facilities currently and collectively represent a low risk of mortality for five of the nine PEIR-emphasis species (Swainson's hawks, loggerhead shrikes, prairie falcons, barn owls, and tricolored blackbirds), but potentially a variable site-specific risk for burrowing owls (see Section 4.3.2.3 for further discussion of comparisons for focal raptor species).

4.3 Fatality Estimates

4.3.1 DWP Adjustment Factors

Based on work in the Golden Hills with detection dogs, we now know it is inaccurate to assume all bats and small birds killed by blade strikes initially fall to the ground within the survey plots used during recent repowering projects (e.g., Smallwood et al. 2020, H. T. Harvey & Associates unpublished data). Moreover, based on fatality finds by detection dogs during the first 2 years of this Project, only 90–92% of bats and small

birds were found on survey plots, whereas 96% of medium-sized birds and 78% of large nonraptors, but 98% of large raptors, were found on survey plots. This evidence suggests that, given modern, tall turbines with large rotor-swept areas, the probability of being hit by a blade strike and flung outside of a survey plot before falling to the ground is greater for bats and small birds that are more easily transported by the prevailing winds after being hit than larger birds. This potential pattern contradicts indications in Smallwood (2013) of no distribution differences for birds of different size classes and notably higher estimated on-plot proportions for bats than for birds. Regardless, incorporating a *DWP* factor of 1.0 for bats and small birds in the GH/GHN studies underestimates to an unknown degree the true fatality rates for small birds and bats; however, developing more accurate an unbiased *DWP* correction factors is beyond the scope of these Projects.

4.3.2 7-Day Versus 28-Day Interval Surveys

Comparing the combined 7-day and 28-day adjusted fatality estimates provided additional evidence that, despite tailored CD adjustments, relying on a 28-day search interval consistently underestimates fatality rates for bats (Brown et al. 2016, Smallwood and Neher 2016, Smallwood 2017, H. T. Harvey & Associates 2021a). However, the 2-year results from this Project suggested the difference was comparatively immaterial for developing accurate fatality estimates for birds when all searches were conducted using detection dogs.

4.3.3 Comparisons with Other APWRA Studies

4.3.3.1 Bats

The estimated annual fatality rates per MW for all bats combined were similar during the first 2 years of this Project and averaged approximately 2–3 times higher than the 3-year averages from the GH and Vasco Winds post-repowering monitoring projects (Table 18). The differences reflect a uniquely and substantially elevated fatality rate for Mexican free-tailed bats at GHN thus far compared to the previous repowering studies. The comparison includes estimates from concurrent GH Year 3 (1.55 fatalities per MW) and GHN Year 1 (1.39 fatalities per MW), both of which studies benefited from use of scent-detection dogs. The estimated annual fatality rate for the uncommon, special-status western red bat also was notably higher during GHN Year 1 (0.37 fatalities per MW per year) than during GH Year 3 (0.07), whereas the estimated annual fatality rate for hoary bats was similar and slightly higher at GH during the concurrent year of study (3.14 versus 2.77). The 3-year GH data also illustrated divergent interannual patterns for Mexican free-tailed bats, hoary bats, and western red bats, whereas fatalities of all three species declined slightly in Year 2 of the GHN Project.

We suspect the elevated fatality rate for Mexican free-tailed bats at GHN reflects the presence of several reservoirs near the site (e.g., Bethany Reservoir; see Figures 1 and 2), unlike at the GH site (see H. T. Harvey & Associates 2021a). Mexican free-tailed bats frequently forage over large bodies of lacustrine fresh water, such as reservoirs, especially during summer and fall months (Johnston 2013), whereas hoary bats typically forage along riparian corridors (Kalcounis et al. 1999) and western red bats typically forage along open areas of riparian habitats and the edges of adjacent meadows (Pierson et al. 1999). Further, both temporal and spatial variation in the activity patterns and fatality rates of different bat and bird species have undoubtedly increased markedly in the past several years in response to factors such as the severe drought that plagued most of California from 2012–2016, highly variable climate since then, and the two worst wildfire seasons on record for California in

Table 18. Comparison of Adjusted Annual Fatalities Per MW (95% Confidence Interval) Estimates for Selected Taxa From This Study and Other Relevant Monitoring Studies Conducted in the Altamont Pass Wind Resource Area (APWRA)

Study	All Bats	All Native Nonraptors	Loggerhead Shrike	Tricolored Blackbird	All Raptors	Golden Eagle[1]	Red-tailed Hawk	Swainson's Hawk	American Kestrel	Prairie Falcon	Burrowing Owl	Barn Owl
This Project: 2-year average	10.21 (9.04–11.38)	4.98 (4.22–5.74)	0	0.02 (0.00–0.05	0.71 (0.46–0.96)	***0.09 (0.06–0.11)***	0.30 (0.14–0.46	0	0.13 (0.11–0.15)	0.01 (0.00–0.04)	0.05 (0.01–0.10	0.02 (0.00–0.05)
Golden Hills: 3-year average[2]	5.55 (5.15–5.95)	5.25 (4.26–6.23)	0.05 (0.00–0.16)	0.03 (0.00–0.06)	1.12 (0.81–1.43)	***0.14 (0.07–0.22)***	0.52 (0.25–0.79)	0	0.10 (0.07–0.14)	0.01 (0.00–0.01)	0.19 (0.02–0.35)	0.02 (0.00–0.05)
Vasco Winds: 3-year average[3]	3.21 (3.06–3.36)	1.94 (1.10–2.77)	0.02 (0.00–0.07)	0.02 (0.00–0.06)	0.64 (0.20–1.09)	0.04 (0.02–0.07)	0.21 (0.04–0.38)	0	0.28 (0.07–0.49)	0.01 (0.00–0.03)	0.06 (0.00–0.17)	0.02 (0.00–0.05)
Buena Vista: 3-year average[4]	0.67	1.01	0	0	0.36	0.07	0.17	0	0.09	nd[5]	0	nd
Diablo Winds: 5-year average[6]	0.78	2.51	nd	nd	1.21	0.02 (0.02–0.02)	0.28 (0.24–0.32)	nd	0.07 (0.05–0.09)	nd	0.58 (0.39–0.77)	nd
APWRA-wide Pre-repower: 2005–13 average[7]	0.12–0.26	nd	0.15 (0.06–0.24)	0.01 (0.01–0.02)	2.01 (1.46–2.55)	0.09 (0.07–0.10)	0.40 (0.33–0.47)	0.001 (0.001–0.001)	0.56 (0.37–0.74)	0.02 (0.01–0.02)	0.67 (0.44–0.90)	0.18 (0.14–0.21)
Average estimates reflected in Programmatic EIR [8]												
Repowered Vasco Winds Year 1 [9]	nd	2.09	–	–	0.64	0.03	0.25	–	0.30	–	0.05	0.03
Repowered Buena Vista 3-year	0.48–1.08	1.01	–	–	0.31	0.04	0.10	–	0.15	0.00	0	0.00
Repowered Diablo Winds 5-year	0.78	2.51	0.00	–	1.21	0.01	0.20	–	0.09	–	0.84	0.02
Nonrepowered APWRA-wide, 7-year	0.26	4.50	0.19	–	2.43	0.08	0.44	0.00	0.59	0.02	0.78	0.24

[1] Source: H. T. Harvey & Associates (2021a).

[2] ***The values for this species presented here from this Project and the Golden Hills project represent adjusted estimates derived using GenEst; however, we consider the unadjusted fatality counts with off-plot incidental finds included (i.e., carcasses opportunistically found outside of standard survey plots) to be the most accurate mortality indices for Golden Eagles in the Golden Hills study areas (see H. T. Harvey & Associates 2021 for further discussion).*** For this Project, the documented and adjusted annual fatality rates were effectively the same, because estimated carcass detectability for large birds exceeded 98% throughout the study. For the 3-year Golden Hills project, the unadjusted average annual fatality rate was 0.12 fatalities per MW (95% CI = 0.07–0.19).

[3] Source: Brown et al. (2016). Values were derived from those presented in Table 27, which were based on overall detection (*D*) probabilities (comparative values based on independent estimation of searcher efficiency (SE) and carcass persistence (CP) were notably higher).

[4] Source: Insignia Environmental (2012). Values represent those derived using "Estimator Two" with SE and carcass removal rates derived from the study (no CIs or year-specific fatality totals provided). Value for native nonraptors was taken from Alameda County Community Development Agency (2014: Table 3.4-10). One fatality each was documented for prairie falcon and barn owl, but no adjusted fatality estimates were available for comparison.

[5] Entries with "nd" indicate no suitable estimate was available for comparison.

[6] The value for bats was based on data from 2005–2007 only as represented in Smallwood and Karas (2009). Value for all raptors was taken from Alameda County Community Development Agency (2014: Table 3.4-10). Values with CIs are taken from ICF International (2016: Table 3-18).

[7] The value for bats was derived from Smallwood and Karas (2009) as summarized in Alameda County Community Development Agency (2014: page 3.4-48); range represents values pertaining to older and newer generations of pre-repower turbines. Values with CIs are taken from ICF International (2016: Tables 3–6 and 3-18).

[8] Source: Alameda County Community Development Agency (2014: Table 3.4-10). "–" generally indicates that no relevant fatalities were found. Discrepancies between these values and comparative values above reflect either (a) post-reporting calculation adjustments made in consultation with NextEra and the Altamont TAC reflected in the PEIR values, or (b) updates reported in subsequent project reports reflecting the collection and analysis of additional years of monitoring data not reflected in the PEIR.

[9] Value not provided for bats because Year 1-only estimate did not represent a valid metric. Value for golden eagles represents an updated average value for Years 1 and 2.

the past 3 years. Therefore, relying on short-term datasets to draw inferences about predominant spatiotemporal patterns would be unwise at this juncture. Due to a lack of credible information about previous bat fatality rates in the APWRA, it is not possible to be confident about what the bat fatality rates may have been during the pre-repowering period. From 2005–2013, only 23 bat fatalities were found in the APWRA during regular searches at monitored turbines (ICF International 2016), but that dearth of documented fatalities might have reflected primarily the use of long search intervals (e.g., 45 days) and only human searchers. Bat fatalities were discovered at higher rates beginning in 2007 after shorter search intervals were used (Smallwood 2017); however, that sampling also occurred primarily at larger, new-generation turbines (Smallwood and Karas 2009, Brown et al. 2016). The number of confirmed bat fatalities then increased by an order of magnitude when scent-detection dogs were used during Year 1 of the GH post-repower monitoring project (H. T. Harvey & Associates 2021a; also see Arnett 2006, Paula et al. 2011). Nevertheless, as smaller, older-generation turbines have been replaced by much larger, new-generation turbines, concern has risen about the possibility that taller turbines will increase the probability of bat fatalities (Barclay et al. 2007). As a result, interest in accurately documenting bat fatality rates in the APWRA has grown; however, without a solid baseline to compare against, it is not possible to quantify the effects of repowering with larger turbines on bat fatality rates in the APWRA. Moreover, the comparative results for Mexican free-tailed bats from this Project and the partially concurrent GH study clearly emphasize that turbine-related fatality risk can vary substantially across the APWRA.

4.3.3.2 Nonraptors

Both Golden Hills projects have yielded higher average annual fatality rates for all nonraptors combined than the three previous post-repowering projects; however, the per-MW fatality rates in the Golden Hills study areas (averages of 5.13 and 5.55 fatalities per MW per year), as well as from the other post-repower studies, have remained substantially below the pre-repowering estimate from the APWRA-wide study (8.38). However, the latter difference primarily reflects a substantial post-repower reduction in fatalities of nonnative rock pigeons and European starlings. Limited to native species, the GHN/GH nonraptor estimates were marginally higher than the established PEIR mortality threshold (Table 18). The differences in results among projects partly reflect the inevitable confounding influences of interannual variation among datasets collected during different periods with highly variable climatic patterns. However, the PEIR threshold value for native nonraptors is also biased low when compared to estimates from the Golden Hills projects, because the shorter search intervals and high searcher efficiency of detection dogs in the new studies resulted in more robust and accurate mortality indices for bats and smaller birds. These collective results suggest that repowering may be having an overall neutral effect on the fatality rates of native nonraptors as a group in the Golden Hills study areas.

For the two PEIR-emphasis nonraptor species, we have not documented any loggerhead shrike fatalities at the GHN site and to date all post-repowering projects have demonstrated reduced fatality rates for this CSSC compared to pre-repowering years in the APWRA. In contrast, the average annual fatality rates from the three most recent post-repowering projects (two Golden Hills and Vasco Winds) suggest that the tricolored blackbird fatality rate might have increased compared to the pre-repowering estimates from the APWRA-wide study. Note, however, that except for three fatalities confirmed during Year 3 of the GH study (H. T. Harvey & Associates 2021), the documented fatality patterns at the GH/GHN and Vasco (Brown et al. 2016) sites have been similar to the pattern documented across the APWRA-wide study; i.e., variable patterns of single or no

fatalities most years since 2005. In addition, in years when tricolored blackbird fatalities have been confirmed, the ranges of annual estimates derived from the APWRA-wide study and from the GH/GHN/Vasco studies have been identical: 0.02–0.06 fatalities per MW per year. Lastly, the overall scarcity of confirmed fatalities and the inherent difficulty in distinguishing the species of incomplete blackbird carcasses without genetic analyses (heretofore not done for any of these APWRA studies, and all such studies have routinely included unidentified blackbirds in the fatality tallies) confound and potentially bias such comparisons and, therefore, preclude rendering a definitive assessment of pre- and post-repower fatality rates for tricolored blackbirds.

4.3.3.3 Raptors

The GHN 2-year average fatality rate for all raptors combined (0.69 fatalities per MW per year) fell well within the range of estimates from the other post-repowering projects, and well below the PEIR pre-repowering threshold rate of 2.01 (Table 18). At the species level, the estimated 2-year average per-MW fatality rate for golden eagles was marginally lower than the GH average, marginally higher than the averages from the other post-repowering studies, and matched the PEIR threshold value (Table 18). A similar pattern applied to red-tailed hawks, except the GHN 2-year average was nonsignificantly lower than the PEIR threshold value. For American Kestrels, both Golden Hills projects have yielded average annual fatality rates that were less than half the rate documented during the Vasco Winds study, similar to the rates during the other post-repowering studies, and significantly lower than the PEIR threshold value. Comparisons of the GHN 2-year average for burrowing owls against the average fatality rates from other post-repowering projects were similarly variable and the GHN rate was again significantly lower than the PEIR threshold value for the species. Lastly, fatality estimates for the remaining two PEIR-emphasis species—prairie falcon and barn owl—have been equivalent from the two Golden Hills and Vasco Winds projects, and again much lower than the PEIR threshold value.

4.3.4 Spatial Patterns and Potential Fatality Hot Spots

The 4-month annual gaps in effective coverage at four turbines, plus other lesser intermittent survey and turbine curtailments limit the value of seeking to identify potential fatality hotspots at this project site based on adjusted fatality estimates. In addition, a likely bias caused by underestimating fatalities on 28-day plots further confounds any turbine-specific hotspot analyses for bats. Nevertheless, a pattern previously noted for gull fatalities in the APWRA (ICF International 2016) was again abundantly apparent in the GHN data, with most of the gull fatalities documented at turbines that lie within the corridor that runs from Bethany Reservoir in the east-northeast to the municipal refuse dump and two other smaller reservoirs to the west-southwest. Potential hot spots were also most common in this corridor for all bats, all nonraptors, and all raptors as groups, probably reflecting the combined influences of the proximity of attractive waterbodies and associated mesic habitats, scavenging opportunities at the landfill, and raptor predators being attracted to aggregating bats and other birds. WTG59 in the central sector, the closest GHN turbine to Bethany Reservoir, was especially notable as a probable fatality hotspot in being the only turbine where multiple golden eagle fatalities occurred, where the highest species diversity of documented raptor fatalities occurred, where the highest 2-year bat fatality rate occurred, and where the third highest 2-year combined fatality rate for all nonraptors occurred. For raptors as a group, but especially for red-tailed hawks, potential hotspots were also apparent in the southeast sector, especially at WTG65, but possible reasons for this potential concentration of fatalities are currently unclear.

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Appendix A. Common and Scientific Names of Bats and Birds Mentioned in This Report

Group	Common name	Scientific Name
Bats	Big brown bat	*Eptesicus fuscus*
	California myotis	*Myotis californicus*
	Hoary bat	*Lasiurus cinereus*
	Little brown bat	*Myotis lucifugus*
	Long-legged myotis	*Myotis volans*
	Mexican free-tailed bat	*Tadarida brasiliensis*
	Silver-haired bat	*Lasionycteris noctivagans*
	Western red bat	*Lasiurus blossevillii*
Birds	American coot	*Fulica americana*
	American crow	*Corvus brachyrhynchos*
	American kestrel	*Falco sparverius*
	American robin	*Turdus migratorius*
	Anna's hummingbird	*Calypte anna*
	Bald eagle	*Haliaeetus leucocephalus*
	Barn owl	*Tyto alba*
	Barn swallow	*Hirundo rustica*
	Black-bellied plover	*Pluvialis squatarola*
	Black-headed grosbeak	*Pheucticus melanocephalus*
	Black-throated gray warbler	*Setophaga nigrescens*
	Brewer's blackbird	*Euphagus cyanocephalus*
	Bufflehead	*Bucephala albeola*
	Bullock's oriole	*Icterus bullockii*
	Burrowing owl	*Athene cunicularia*
	California gull	*Larus californicus*
	Canada goose	*Branta canadensis*
	Caspian tern	*Hydroprogne caspia*
	Cedar waxwing	*Bombycilla cedrorum*
	Chestnut-backed chickadee	*Poecile rufescens*
	Chipping sparrow	*Spizella passerina*
	Cliff swallow	*Petrochelidon pyrrhonota*
	Common raven	*Corvus corax*
	Common yellowthroat	*Geothlypis trichas*
	Cooper's hawk	*Accipiter cooperii*
	Dark-eyed junco	*Junco hyemalis*
	Eurasian collared-dove	*Streptopelia decaocto*
	European starling	*Sturnus vulgaris*
	Ferruginous hawk	*Buteo regalis*

Group	Common name	Scientific Name
	Fox sparrow	*Passerella iliaca*
	Glaucous-winged gull	*Larus glaucescens*
	Golden eagle	*Aquila chrysaetos*
	Golden-crowned sparrow	*Zonotrichia atricapilla*
	Grasshopper sparrow	*Ammodramus savannarum*
	Great blue heron	*Ardea herodias*
	Great egret	*Ardea alba*
	Great horned owl	*Bubo virginianus*
	Green-winged teal	*Anas crecca*
	Hermit thrush	*Catharus guttatus*
	Hermit warbler	*Setophaga occidentalis*
	Herring gull	*Larus argentatus*
	Horned grebe	*Podiceps auritus*
	Horned lark	*Eremophila alpestris*
	House finch	*Haemorhous mexicanus*
	House sparrow	*Passer domesticus*
	House wren	*Troglodytes aedon*
	Killdeer	*Charadrius vociferus*
	Lincoln's sparrow	*Melospiza lincolnii*
	Long-eared owl	*Asio otus*
	MacGillivray's warbler	*Geothlypis tolmiei*
	Mallard	*Anas platyrhynchos*
	Marsh wren	*Cistothorus palustris*
	Mew gull	*Larus canus*
	Mourning dove	*Zenaida macroura*
	Nashville warbler	*Oreothlypis ruficapilla*
	Northern harrier	*Circus cyaneus*
	Northern mockingbird	*Mimus polyglottos*
	Northern shoveler	*Anas clypeata*
	Orange-crowned warbler	*Oreothlypis celata*
	Peregrine falcon	*Falco peregrinus*
	Pied-billed grebe	*Podilymbus podiceps*
	Pine siskin	*Spinus pinus*
	Prairie falcon	*Falco mexicanus*
	Red-breasted nuthatch	*Sitta canadensis*
	Red-tailed hawk	*Buteo jamaicensis*
	Red-winged blackbird	*Agelaius phoeniceus*
	Ring-billed gull	*Larus delawarensis*
	Rock pigeon	*Columba livia*
	Rough-legged hawk	*Buteo lagopus*
	Ruby-crowned kinglet	*Regulus calendula*

Group	Common name	Scientific Name
	Ruddy duck	*Oxyura jamaicensis*
	Say's phoebe	*Sayornis saya*
	Spotted towhee	*Pipilo maculatus*
	Swainson's thrush	*Catharus ustulatus*
	Townsend's warbler	*Setophaga townsendi*
	Tree swallow	*Tachycineta bicolor*
	Tricolored blackbird	*Agelaius tricolor*
	Turkey vulture	*Cathartes aura*
	Vaux's swift	*Chaetura vauxi*
	Warbling vireo	*Vireo gilvus*
	Western gull	*Larus occidentalis*
	Western meadowlark	*Sturnella neglecta*
	Western sandpiper	*Calidris mauri*
	Western tanager	*Piranga ludoviciana*
	White-crowned sparrow	*Zonotrichia leucophrys*
	White-tailed kite	*Elanus leucurus*
	White-throated swift	*Aeronautes saxatalis*
	Wild turkey	*Meleagris gallopavo*
	Wilson's warbler	*Cardellina pusilla*
	Yellow warbler	*Setophaga petechia*
	Yellow-breasted chat	*Icteria virens*
	Yellow-rumped warbler	*Setophaga coronata*

Appendix B. Description of Customized Approach Used in *GenEst* to Accommodate Binomial Carcass Detectability Trials

Dan Dalthorp (U.S. Geological Survey, Corvallis, OR) provided the information below to Jeff Smith (H. T. Harvey & Associates) in the form of a PowerPoint slide deck on August 7, 2019. The provided information is copied verbatim below.

****

Binomial Trials

The Idea:

- g is the probability of detecting a carcass that arrives in searched areas during the span of the monitoring season
- Estimate g by placing trial carcasses in the field and using the fraction of them that searchers find as g
- The Advantage:
- Simplifies the field trials because carcasses do not need follow-up visits to determine carcass removal times (CP trials) or to verify that missed carcasses were still available to searchers (SE trials)

Disadvantages:

- Very sensitive to carcass placement times...MUST accurately reflect carcass arrival times (much more so than with regular CP trials)
- Sensitive to search covariates (visibility, season, size, etc.)

  [same way as standard SE trials are...but don't forget!]

Binomial Trials in GenEst

- GenEst can be used to analyze PCM data from binomial trials

The Idea:

- Carcasses are either found or not...doesn't matter whether missed carcasses were removed by scavengers or simply overlooked by searchers
- Enter the binomial trial data in an SE, recording simply whether each trial carcass was eventually found by searchers (1) or not (0)
- Model SE using covariates (just like with standard GenEst data) and $k = 0$.
- DO USE season as a covariate for SE because g will depend on season even if standard SE does not.
- Set up a dummy CP file that will give you $r = 1$

An Example

- wind_cleared data using bats only (and modified SE and CP files):

SE:

- File: include covariates but only one "search" column to indicate whether carcasses were eventually found (1) or not (0)
- Modeling: use covariates (as per usual) but with fixed $k = 0$

CP:

- File: Dummy file with 4 points:
- LastPresent = total span of monitoring period (2x) and span + 1 (2x)
- FirstAbsent = span + 1 (2x) and Inf (2x)
- Modeling: lognormal without covariates

CPID	Last Present	First Absent
cp1	200	201
cp2	200	201
cp3	201	Inf
cp4	201	Inf

DWP, SS, CO:

- Files: just as with standard analyses

Appendix C. Fatality Surveys Conducted in Years 1 and 2

Year	Turbine	Number by Search Interval		Date of First Survey	Date of Last Survey
		7-day	28-day		
Year 1	WTG-49		13	17-Oct-18	18-Sep-19
	WTG-50	46		11-Oct-18	3-Oct-19
	WTG-51	46		11-Oct-18	3-Oct-19
	WTG-52 [1]		8	10-Oct-18	11-Sep-19
	WTG-53 [1]		8	31-Oct-18	2-Oct-19
	WTG-54	46		11-Oct-18	3-Oct-19
	WTG-55 [1]		9	25-Oct-18	25-Sep-19
	WTG-56	46		10-Oct-18	3-Oct-19
	WTG-57		12	22-Oct-18	20-Sep-19
	WTG-58 [1]		9	25-Oct-18	20-Sep-19
	WTG-59	47		10-Oct-18	2-Oct-19
	WTG-60	47		8-Oct-18	1-Oct-19
	WTG-61	47		8-Oct-18	1-Oct-19
	WTG-62		13	16-Oct-18	18-Sep-19
	WTG-63		13	9-Oct-18	11-Sep-19
	WTG-64	46		8-Oct-18	1-Oct-19
	WTG-65		13	30-Oct-18	2-Oct-19
	WTG-66		13	23-Oct-18	25-Sep-19
	WTG-67	46		9-Oct-18	1-Oct-19
	WTG-68	47		9-Oct-18	2-Oct-19
Year 2	WTG-49	49		08-Oct-19	29-Sep-20
	WTG-50		13	16-Oct-19	30-Sep-20
	WTG-51	49		08-Oct-19	29-Sep-20
	WTG-52 [1]	30		08-Oct-19	29-Sep-20
	WTG-53 [1]		8	09-Oct-19	22-Sep-20
	WTG-54	49		09-Oct-19	01-Oct-20
	WTG-55 [1]		8	16-Oct-19	01-Oct-20
	WTG-56	49		09-Oct-19	30-Sep-20
	WTG-57		13	09-Oct-19	24-Sep-20
	WTG-58 [1]	30		08-Oct-19	29-Sep-20
	WTG-59	48		10-Oct-19	03-Oct-20
	WTG-60	46		10-Oct-19	20-Aug-20
	WTG-61		12	18-Oct-19	21-Aug-20
	WTG-62		13	23-Oct-19	01-Oct-20
	WTG-63	48		10-Oct-19	03-Oct-20
	WTG-64		13	18-Oct-19	01-Oct-20
	WTG-65		13	23-Oct-19	03-Oct-20
	WTG-66		12	30-Oct-19	22-Sep-20
	WTG-67		12	30-Oct-19	22-Sep-20
	WTG-68	48		10-Oct-19	03-Oct-20

[1] Daytime turbine function and fatality surveys curtailed from mid-March to mid-July 2019 and from mid-February to late-June 2020 to protect nesting golden eagles.

Appendix D. Carcass Detectability Trial Specimen Placements in Years 1 and 2

Project Year	Date Placed	Survey Type	Turbine ID	UTM East	UTM North	Placement Substrate	Species	Size Class	Detected?	Date Found	Carcass Age at Discovery (days)
Y1	05-Nov-18	28-day	57	618405	4180918	Grazed/short grass	Mexican free-tailed bat	Bat	No	–	–
Y1	07-Nov-18	7-day	51	617464	4182469	Grazed/short grass	Mexican free-tailed bat	Bat	Yes	08-Nov-18	1
Y1	07-Nov-18	7-day	56	618227	4181104	Grazed/short grass	European starling	Small	Yes	Nov-08-18	1
Y1	07-Nov-18	7-day	64	621472	4179784	Tall fallow grass/forb	Rock pigeon	Medium	Yes	27-Nov-18	20
Y1	14-Nov-18	7-day	56	618259	4181109	Grazed/short grass	Hoary bat	Bat	Yes	06-Dec-18	22
Y1	14-Nov-18	28-day	57	618423	4180938	Grazed/short grass	Hoary bat	Bat	No	–	–
Y1	14-Nov-18	7-day	59	620294	4181417	Grazed/short grass	Barn owl	Medium	No	–	–
Y1	14-Nov-18	28-day	65	621904	4179781	Grazed/short grass	Rock pigeon	Medium	No	–	–
Y1	14-Nov-18	28-day	66	620804	4178876	Tall fallow grass/forb	Cedar waxwing	Small	No		-
Y1	14-Nov-18	7-day	67	621815	4179087	Tall fallow grass/forb	European starling	Small	No	–	–
Y1	27-Nov-18	28-day	53	618343	4182134	Grazed/short grass	European starling	Small	Yes	28-Nov-18	1
Y1	27-Nov-18	7-day	54	618605	4181921	Turbine pad	Cedar waxwing	Small	Yes	06-Dec-18	9
Y1	28-Nov-18	7-day	50	617762	4182892	Grazed/short grass	Mexican free-tailed bat	Bat	Yes	06-Dec-18	8
Y1	29-Nov-18	7-day	61	621020	4181009	Grazed/short grass	Canada goose	Large	Yes	04-Dec-18	5
Y1	29-Nov-18	28-day	63	621914	4180235	Grazed/short grass	Rock pigeon	Medium	Yes	05-Dec-18	6
Y1	10-Dec-18	7-day	68	621950	4178604	Grazed/short grass	Mexican free-tailed bat	Bat	Yes	12-Dec-18	2
Y1	11-Dec-18	28-day	49	617500	4183098	Grazed/short grass	House finch	Small	Yes	12-Dec-18	1
Y1	11-Dec-18	28-day	55	618366	4182795	Grazed/short grass	Mexican free-tailed bat	Bat	No	–	–
Y1	11-Dec-18	7-day	60	620690	4181198	Grazed/short grass	House finch	Small	No	–	–
Y1	11-Dec-18	28-day	62	621461	4180169	Grazed/short grass	American kestrel	Medium	Yes	12-Dec-18	1
Y1	13-Dec-18	28-day	52	617883	4182458	Grazed/short grass	Great horned owl	Large	Yes	01-Jan-19	19
Y1	20-Dec-18	28-day	53	618310	4182189	Grazed/short grass	European starling	Small	No	–	–
Y1	20-Dec-18	7-day	59	620400	4181352	Grazed/short grass	Mexican free-tailed bat	Bat	Yes	02-Jan-19	13
Y1	20-Dec-18	7-day	60	620710	4181247	Grazed/short grass	Red-tailed hawk	Large	Yes	01-Jan-19	12
Y1	20-Dec-18	28-day	63	621939	4180076	Grazed/short grass	Mexican free-tailed bat	Bat	No	–	–
Y1	20-Dec-18	28-day	65	622133	4179784	Grazed/short grass	Red-tailed hawk	Large	Yes	31-Dec-18	11
Y1	21-Dec-18	7-day	61	621052	4181011	Grazed/short grass	European starling	Small	Yes	08-Jan-19	18
Y1	31-Dec-18	7-day	56	618290	4181099	Grazed/short grass	House sparrow	Small	No	–	–
Y1	31-Dec-18	28-day	62	621585	4180113	Grazed/short grass	House sparrow	Small	No	–	–
Y1	31-Dec-18	28-day	65	621935	4179794	Grazed/short grass	Mexican free-tailed bat	Bat	Yes	31-Dec-18	0
Y1	31-Dec-18	7-day	68	621879	4178552	Tall fallow grass/forb	Mexican free-tailed bat	Bat	Yes	02-Jan-19	2
Y1	02-Jan-19	28-day	57	618380	4180890	Grazed/short grass	Barn owl	Medium	Yes	11-Jan-19	9
Y1	02-Jan-19	7-day	64	621479	4179657	Grazed/short grass	Turkey vulture	Large	Yes	08-Jan-19	6
Y1	09-Jan-19	7-day	51	617506	4182511	Grazed/short grass	Mexican free-tailed bat	Bat	Yes	17-Jan-19	8

Project Year	Date Placed	Survey Type	Turbine ID	UTM East	UTM North	Placement Substrate	Species	Size Class	Detected?	Date Found	Carcass Age at Discovery (days)
Y1	09-Jan-19	7-day	51	617505	4182546	Grazed/short grass	Canada goose	Large	Yes	10-Jan-19	1
Y1	09-Jan-19	28-day	52	617877	4182498	Grazed/short grass	Mexican free-tailed bat	Bat	No	–	–
Y1	09-Jan-19	28-day	53	618427	4182173	Grazed/short grass	Great blue heron	Large	Yes	23-Jan-19	14
Y1	09-Jan-19	28-day	53	618351	4182163	Turbine pad	American kestrel	Medium	No	–	–
Y1	09-Jan-19	28-day	62	621543	4180159	Grazed/short grass	European starling	Small	No	–	–
Y1	09-Jan-19	7-day	67	621885	4179053	Grazed/short grass	European starling	Small	No	–	–
Y1	15-Jan-19	28-day	55	618434	4182741	Grazed/short grass	*Myotis* spp.	Bat	No	–	–
Y1	15-Jan-19	7-day	56	618240	4181044	Grazed/short grass	*Myotis* spp.	Bat	Yes	17-Jan-19	2
Y1	15-Jan-19	28-day	57	618347	4180952	Grazed/short grass	European starling	Small	No	–	–
Y1	16-Jan-19	7-day	64	621423	4179714	Grazed/short grass	Rock pigeon	Medium	Yes	22-Jan-19	6
Y1	16-Jan-19	28-day	65	621877	4179828	Grazed/short grass	Rock pigeon	Medium	No	–	–
Y1	16-Jan-19	7-day	67	621875	4179170	Grazed/short grass	European starling	Small	No	–	–
Y1	21-Jan-19	7-day	64	621451	4179639	Grazed/short grass	*Myotis* spp.	Bat	No	–	–
Y1	21-Jan-19	28-day	65	621953	4179710	Grazed/short grass	Red-tailed hawk	Large	Yes	23-Jan-19	2
Y1	23-Jan-19	7-day	50	617491	4183165	Grazed/short grass	Cedar waxwing	Small	Yes	24-Jan-19	1
Y1	23-Jan-19	28-day	52	617836	4182400	Grazed/short grass	European starling	Small	Yes	30-Jan-19	7
Y1	23-Jan-19	7-day	56	618362	4181113	Grazed/short grass	Red-tailed hawk	Large	Yes	23-Jan-19	0
Y1	23-Jan-19	28-day	57	618397	4180928	Grazed/short grass	*Myotis* spp.	Bat	No	–	–
Y1	24-Jan-19	7-day	56	618273	4181183	Grazed/short grass	Wild turkey	Large	Yes	13-Feb-19	20
Y1	24-Jan-19	7-day	68	621996	4178539	Tall fallow grass/forb	Canada goose	Large	Yes	26-Feb-19	33
Y1	06-Feb-19	7-day	50	617786	4182951	Grazed/short grass	European starling	Small	Yes	07-Mar-19	29
Y1	06-Feb-19	7-day	68	621931	4178551	Grazed/short grass	European starling	Small	No	–	–
Y1	07-Feb-19	7-day	50	617820	4182908	Grazed/short grass	Mexican free-tailed bat	Bat	No	–	–
Y1	07-Feb-19	7-day	61	621056	4181076	Grazed/short grass	Red-tailed hawk	Large	Yes	26-Feb-19	19
Y1	12-Feb-19	7-day	64	621538	4179800	Grazed/short grass	European starling	Small	No	–	–
Y1	12-Feb-19	28-day	65	621980	4179802	Bare/disturbed soil	Mexican free-tailed bat	Bat	No	–	–
Y1	19-Feb-19	28-day	49	617480	4183098	Grazed/short grass	Mexican free-tailed bat	Bat	No	–	–
Y1	19-Feb-19	7-day	54	618630	4181949	Grazed/short grass	Tree swallow	Small	No	–	–
Y1	19-Feb-19	28-day	58	618662	4182658	Grazed/short grass	*Myotis* spp.	Bat	No	–	–
Y1	19-Feb-19	28-day	62	621544	4180080	Grazed/short grass	Rock pigeon	Medium	Yes	06-Mar-19	15
Y1	19-Feb-19	28-day	65	621963	4179797	Grazed/short grass	Cedar waxwing	Small	Yes	20-Feb-19	1
Y1	19-Feb-19	7-day	68	621914	4178576	Grazed/short grass	*Myotis* spp.	Bat	Yes	20-Feb-19	1
Y1	05-Mar-19	28-day	49	617481	4183093	Grazed/short grass	*Myotis* spp.	Bat	No	–	–
Y1	05-Mar-19	7-day	50	617823	4182966	Grazed/short grass	Mexican free-tailed bat	Bat	No	–	–
Y1	07-Mar-19	28-day	63	621932	4180155	Grazed/short grass	Canada goose	Large	Yes	24-Apr-19	48
Y1	07-Mar-19	7-day	67	621864	4179081	Turbine pad	Glaucous-winged gull	Large	Yes	05-Mar-19	-2
Y1	12-Mar-19	7-day	51	617503	4182443	Grazed/short grass	Hoary bat	Bat	Yes	11-Apr-19	30
Y1	12-Mar-19	7-day	54	618626	4181962	Grazed/short grass	European starling	Small	No	–	–

Project Year	Date Placed	Survey Type	Turbine ID	UTM East	UTM North	Placement Substrate	Species	Size Class	Detected?	Date Found	Carcass Age at Discovery (days)
Y1	12-Mar-19	7-day	56	618266	4181120	Turbine pad	Mexican free-tailed bat	Bat	No	–	–
Y1	03-Apr-19	7-day	59	620447	4181440	Tall fallow grass/forb	Western sandpiper	Small	Yes	10-Apr-19	7
Y1	03-Apr-19	7-day	64	621431	4179757	Tall fallow grass/forb	Horned grebe	Medium	Yes	09-Apr-19	6
Y1	11-Apr-19	7-day	50	617708	4182951	Tall fallow grass/forb	Mourning dove	Medium	Yes	09-May-19	28
Y1	11-Apr-19	7-day	50	617789	4182989	Tall fallow grass/forb	Rock pigeon	Medium	Yes	18-Apr-19	7
Y1	11-Apr-19	7-day	64	621446	4179758	Grazed/short grass	White-throated swift	Small	Yes	16-Apr-19	5
Y1	11-Apr-19	28-day	66	620867	4178915	Tall fallow grass/forb	Hoary bat	Bat	Yes	31-Jul-19	111
Y1	11-Apr-19	7-day	68	621977	4178521	Tall fallow grass/forb	Western meadowlark	Small	Yes	22-May-19	41
Y1	18-Apr-19	7-day	61	621107	4181123	Tall fallow grass/forb	Mexican free-tailed bat	Bat	No	–	–
Y1	18-Apr-19	7-day	61	621144	4181026	Tall fallow grass/forb	Mexican free-tailed bat	Bat	Yes	23-Apr-19	5
Y1	18-Apr-19	7-day	63	621932	4180198	Tall fallow grass/forb	Ring-billed gull	Large	Yes	22-May-19	34
Y1	23-Apr-19	7-day	59	620403	4181377	Grazed/short grass	Hoary bat	Bat	Yes	08-May-19	15
Y1	23-Apr-19	7-day	59	620374	4181351	Grazed/short grass	Great egret	Large	Yes	01-May-19	8
Y1	23-Apr-19	28-day	66	620830	4179001	Tall fallow grass/forb	European starling	Small	Yes	08-May-19	15
Y1	23-Apr-19	7-day	67	621898	4179110	Tall fallow grass/forb	Western sandpiper	Small	Yes	23-Apr-19	0
Y1	24-Apr-19	28-day	49	617534	4183128	Tall fallow grass/forb	Mexican free-tailed bat	Bat	Yes	03-May-19	9
Y1	02-May-19	7-day	54	618603	4181911	Tall fallow grass/forb	Red-tailed hawk	Large	Yes	02-May-19	0
Y1	02-May-19	7-day	60	620690	4181184	Grazed/short grass	Mexican free-tailed bat	Bat	Yes	07-May-19	5
Y1	02-May-19	28-day	65	621997	4179888	Grazed/short grass	*Myotis* spp.	Bat	No	–	–
Y1	07-May-19	7-day	50	617866	4182937	Tall fallow grass/forb	European starling	Small	Yes	14-May-19	7
Y1	07-May-19	7-day	61	621070	4181022	Grazed/short grass	Great blue heron	Large	Yes	16-May-19	9
Y1	07-May-19	28-day	63	621987	4180108	Tall fallow grass/forb	Mexican free-tailed bat	Bat	No	–	–
Y1	17-May-19	7-day	54	618637	4181804	Tall fallow grass/forb	House finch	Small	Yes	23-May-19	6
Y1	17-May-19	7-day	56	618269	4181093	Grazed/short grass	*Myotis* spp.	Bat	Yes	23-May-19	6
Y1	17-May-19	7-day	60	620631	4181290	Tall fallow grass/forb	Cedar waxwing	Small	Yes	21-May-19	4
Y1	17-May-19	28-day	63	621895	4180138	Grazed/short grass	*Myotis* spp.	Bat	No	–	–
Y1	21-May-19	7-day	60	620645	4181272	Tall fallow grass/forb	European starling	Small	Yes	21-May-19	0
Y1	21-May-19	28-day	66	620727.3	4178911	Tall fallow grass/forb	Mexican free-tailed bat	Bat	No	–	–
Y1	21-May-19	28-day	66	620729	4178904	Tall fallow grass/forb	Mexican free-tailed bat	Bat	Yes	05-Jun-19	15
Y1	28-May-19	28-day	49	617487	4183060	Grazed/short grass	Rock pigeon	Medium	Yes	26-Jun-19	29
Y1	28-May-19	28-day	62	621469	4180165	Grazed/short grass	Herring gull	Large	Yes	30-May-19	2
Y1	28-May-19	28-day	63	621875	4180172	Tall fallow grass/forb	*Myotis* spp.	Bat	No	–	–
Y1	28-May-19	28-day	66	620833	4179005	Tall fallow grass/forb	Canada goose	Large	Yes	05-Jun-19	8
Y1	28-May-19	28-day	67	621878	4179077	Grazed/short grass	Mexican free-tailed bat	Bat	Yes	11-Jun-19	14
Y1	28-May-19	7-day	68	621957	4178523	Tall fallow grass/forb	Hoary bat	Bat	Yes	12-Jun-19	15
Y1	28-May-19	7-day	68	621874	4178660	Tall fallow grass/forb	Western sandpiper	Small	Yes	30-May-19	2
Y1	04-Jun-19	28-day	49	617472	4183102	Grazed/short grass	*Myotis* spp.	Bat	Yes	24-Jul-19	50
Y1	04-Jun-19	7-day	51	617435	4182478	Grazed/short grass	Chestnut-backed chickadee	Small	No	–	–

Project Year	Date Placed	Survey Type	Turbine ID	UTM East	UTM North	Placement Substrate	Species	Size Class	Detected?	Date Found	Carcass Age at Discovery (days)
Y1	05-Jun-19	7-day	51	617461	4182525	Tall fallow grass/forb	California gull	Large	Yes	06-Jun-19	1
Y1	05-Jun-19	28-day	57	618340	4180811	Tall fallow grass/forb	European starling	Small	No	–	–
Y1	05-Jun-19	28-day	67	621855	4179194	Grazed/short grass	Hoary bat	Bat	No	–	–
Y1	09-Jun-19	28-day	49	617450	4183113	Tall fallow grass/forb	Rock pigeon	Medium	Yes	26-Jun-19	17
Y1	09-Jun-19	7-day	56	618265.9	4181131	Grazed/short grass	Red-tailed hawk	Large	Yes	13-Jun-19	4
Y1	09-Jun-19	28-day	62	621568	4180179	Grazed/short grass	*Myotis* spp.	Bat	No	–	–
Y1	09-Jun-19	28-day	63	622008	4180222	Tall fallow grass/forb	European starling	Small	No	–	–
Y1	09-Jun-19	28-day	65	621927	4179800	Grazed/short grass	Mexican free-tailed bat	Bat	No	–	–
Y1	17-Jun-19	7-day	50	617881	4182955	Tall fallow grass/forb	*Myotis* spp.	Bat	Yes	11-Jul-19	24
Y1	17-Jun-19	7-day	54	618606	4181881	Tall fallow grass/forb	Mexican free-tailed bat	Bat	No	–	–
Y1	17-Jun-19	28-day	62	621464	4180083	Grazed/short grass	European starling	Small	Yes	26-Jun-19	9
Y1	17-Jun-19	28-day	65	621889	4179858	Tall fallow grass/forb	Rock pigeon	Medium	Yes	10-Jul-19	23
Y1	18-Jun-19	7-day	64	621451	4179809	Tall fallow grass/forb	Mexican free-tailed bat	Bat	Yes	25-Jun-19	7
Y1	24-Jun-19	28-day	49	617464	4183077	Grazed/short grass	European starling	Small	No	–	–
Y1	24-Jun-19	28-day	66	620797	4178894	Grazed/short grass	European starling	Small	Yes	03-Jul-19	9
Y1	24-Jun-19	28-day	66	620802	4179010	Tall fallow grass/forb	European starling	Small	Yes	03-Jul-19	9
Y1	27-Jun-19	7-day	50	617812	4182888	Grazed/short grass	House sparrow	Small	Yes	27-Jun-19	0
Y1	27-Jun-19	7-day	67	621919	4179124	Tall fallow grass/forb	Rock pigeon	Medium	No	–	–
Y1	02-Jul-19	7-day	51	617353	4182561	Grazed/short grass	House sparrow	Small	No	–	–
Y1	02-Jul-19	7-day	54	618588	4181925	Grazed/short grass	European starling	Small	Yes	18-Jul-19	16
Y1	02-Jul-19	7-day	60	620689	4181163	Grazed/short grass	Rock pigeon	Medium	Yes	16-Jul-19	14
Y1	02-Jul-19	7-day	61	621020	4180952	Tall fallow grass/forb	Mexican free-tailed bat	Bat	No	–	–
Y1	03-Jul-19	7-day	61	621020	4180952	Tall fallow grass/forb	Canada goose	Large	Yes	03-Jul-19	0
Y1	11-Jul-19	7-day	51	617436	4182496	Grazed/short grass	European starling	Small	Yes	18-Jul-19	7
Y1	11-Jul-19	7-day	59	620378	4181478	Tall fallow grass/forb	European starling	Small	Yes	17-Jul-19	6
Y1	11-Jul-19	28-day	62	621416	4180134	Tall fallow grass/forb	*Myotis* spp.	Bat	Yes	24-Jul-19	13
Y1	11-Jul-19	28-day	66	620712	4178885	Tall fallow grass/forb	Canada goose	Large	Yes	31-Jul-19	20
Y1	11-Jul-19	7-day	67	621785	4179054	Tall fallow grass/forb	Mexican free-tailed bat	Bat	No	–	–
Y1	15-Jul-19	28-day	58	618735	4182676	Tall fallow grass/forb	European starling	Small	No	–	–
Y1	15-Jul-19	28-day	62	621468	4180120	Tall fallow grass/forb	Mexican free-tailed bat	Bat	Yes	24-Jul-19	9
Y1	15-Jul-19	28-day	62	621595	4180123	Tall fallow grass/forb	European starling	Small	No	–	–
Y1	16-Jul-19	7-day	54	618589	4181899	Turbine pad	Rock pigeon	Medium	Yes	18-Jul-19	2
Y1	16-Jul-19	28-day	57	618285	4180870	Tall fallow grass/forb	European starling	Small	Yes	20-Sep-19	66
Y1	22-Jul-19	7-day	56	618347	4181047	Tall fallow grass/forb	Canada goose	Large	Yes	25-Jul-19	3
Y1	23-Jul-19	7-day	51	617432	4182507	Tall fallow grass/forb	Herring gull	Large	Yes	25-Jul-19	2
Y1	23-Jul-19	28-day	53	618355	4182152	Tall fallow grass/forb	Rock pigeon	Medium	Yes	07-Aug-19	15
Y1	23-Jul-19	28-day	58	618671	4182689	Tall fallow grass/forb	Mexican free-tailed bat	Bat	No	–	–
Y1	23-Jul-19	28-day	62	621467	4180179	Grazed/short grass	Rock pigeon	Medium	Yes	14-Aug-19	22

Project Year	Date Placed	Survey Type	Turbine ID	UTM East	UTM North	Placement Substrate	Species	Size Class	Detected?	Date Found	Carcass Age at Discovery (days)
Y1	29-Jul-19	28-day	55	618257	4182875	Grazed/short grass	Rock pigeon	Medium	Yes	31-Jul-19	2
Y1	29-Jul-19	28-day	58	618609	4182853	Tall fallow grass/forb	Mexican free-tailed bat	Bat	No	–	–
Y1	29-Jul-19	28-day	63	621908	4180154	Grazed/short grass	Rock pigeon	Medium	Yes	18-Sep-19	51
Y1	06-Aug-19	28-day	52	617867	4182476	Turbine pad	European starling	Small	Yes	14-Aug-19	8
Y1	06-Aug-19	28-day	55	618354	4182797	Turbine pad	Mexican free-tailed bat	Bat	No	–	–
Y1	06-Aug-19	28-day	55	618273	4182876	Grazed/short grass	Barn owl	Medium	Yes	07-Aug-19	1
Y1	06-Aug-19	7-day	59	620347	4181409	Tall fallow grass/forb	Rock pigeon	Medium	Yes	14-Aug-19	8
Y1	06-Aug-19	28-day	65	621912	4179896	Grazed/short grass	Hermit warbler	Small	Yes	07-Aug-19	1
Y1	13-Aug-19	28-day	52	617905	4182415	Tall fallow grass/forb	Rock pigeon	Medium	No	–	–
Y1	13-Aug-19	28-day	53	618333	4182151	Tall fallow grass/forb	Rock pigeon	Medium	Yes	04-Sep-19	22
Y1	13-Aug-19	7-day	61	621021	4181080	Tall fallow grass/forb	Horned lark	Small	No	–	–
Y1	13-Aug-19	28-day	63	621977	4180182	Tall fallow grass/forb	European starling	Small	No	–	–
Y1	13-Aug-19	7-day	67	621763	4179107	Tall fallow grass/forb	Rock pigeon	Medium	Yes	20-Aug-19	7
Y1	19-Aug-19	7-day	50	617822	4182963	Tall fallow grass/forb	Long-legged myotis	Bat	Yes	22-Aug-19	3
Y1	19-Aug-19	28-day	52	617905	4182415	Tall fallow grass/forb	Great egret	Large	Yes	15-Oct-19	57
Y1	19-Aug-19	28-day	55	618342	4182733	Tall fallow grass/forb	European starling	Small	No	–	–
Y1	19-Aug-19	28-day	57	618406	4180884	Grazed/short grass	Warbling vireo	Small	Yes	23-Aug-19	4
Y1	19-Aug-19	28-day	63	621848	4180073	Grazed/short grass	Rock pigeon	Medium	No	–	–
Y1	26-Aug-19	28-day	52	617861	4182497	Road	European starling	Small	Yes	08-Oct-19	43
Y1	26-Aug-19	7-day	59	620377	4181483	Tall fallow grass/forb	Mexican free-tailed bat	Bat	No	–	–
Y1	26-Aug-19	7-day	61	621065	4181113	Tall fallow grass/forb	Red-tailed hawk	Large	Yes	27-Aug-19	1
Y1	26-Aug-19	28-day	62	621484	4180128	Grazed/short grass	European starling	Small	No	–	–
Y1	26-Aug-19	28-day	63	621918	4180142	Grazed/short grass	Northern mockingbird	Small	Yes	11-Sep-19	16
Y1	02-Sep-19	28-day	49	617401	4183035	Tall fallow grass/forb	Mexican free-tailed bat	Bat	No	–	–
Y1	02-Sep-19	28-day	52	617910	4182576	Tall fallow grass/forb	Hoary bat	Bat	No	–	–
Y1	02-Sep-19	28-day	57	618431	4180910	Grazed/short grass	Barn owl	Medium	Yes	20-Sep-19	18
Y1	02-Sep-19	7-day	60	620652	4181303	Tall fallow grass/forb	Hoary bat	Bat	No	–	–
Y1	02-Sep-19	28-day	62	621473	4180166	Grazed/short grass	Red-tailed hawk	Large	Yes	18-Sep-19	16
Y1	09-Sep-19	28-day	49	617394	4183012	Tall fallow grass/forb	Rock pigeon	Medium	No	–	–
Y1	09-Sep-19	28-day	55	618366	4182818	Grazed/short grass	Rock pigeon	Medium	No	16-Oct-19	-
Y1	09-Sep-19	7-day	59	620419	4181405	Grazed/short grass	European starling	Small	Yes	11-Sep-19	2
Y1	09-Sep-19	28-day	62	621464	4180117	Grazed/short grass	Mexican free-tailed bat	Bat	No	–	–
Y1	09-Sep-19	28-day	66	620780	4178907	Grazed/short grass	Rock pigeon	Medium	Yes	25-Sep-19	16
Y1	13-Sep-19	28-day	53	618255	4182141	Tall fallow grass/forb	Mexican free-tailed bat	Bat	No	–	–
Y1	13-Sep-19	28-day	53	618383	4182208	Tall fallow grass/forb	European starling	Small	Yes	06-Nov-19	54
Y1	13-Sep-19	7-day	54	618515	4181952	Grazed/short grass	Rock pigeon	Medium	Yes	19-Sep-19	6
Y1	13-Sep-19	28-day	55	618338	4182848	Grazed/short grass	Rock pigeon	Medium	Yes	25-Sep-19	12
Y1	13-Sep-19	28-day	58	618634	4182745	Tall fallow grass/forb	Rock pigeon	Medium	Yes	20-Sep-19	7

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Y1	23-Sep-19	7-day	59	620379	4181268	Tall fallow grass/forb	Wild turkey	Large	Yes	25-Sep-19	2
Y1	23-Sep-19	7-day	61	621094	4181071	Grazed/short grass	Canada goose	Large	Yes	24-Sep-19	1
Y1	23-Sep-19	28-day	66	620778	4178904	Tall fallow grass/forb	Mexican free-tailed bat	Bat	Yes	25-Sep-19	2
Y1	23-Sep-19	28-day	66	620742	4178979	Grazed/short grass	European starling	Small	No	–	–
Y1	23-Sep-19	7-day	68	621958	4178602	Grazed/short grass	Mexican free-tailed bat	Bat	Yes	25-Sep-19	2
Y1	30-Sep-19	7-day	54	618605	4182000	Tall fallow grass/forb	European starling	Small	Yes	03-Oct-19	3
Y1	30-Sep-19	7-day	61	621103	4181036	Grazed/short grass	Hoary bat	Bat	Yes	01-Oct-19	1
Y1	30-Sep-19	28-day	65	621920	4179875	Grazed/short grass	European starling	Small	Yes	02-Oct-19	2
Y1	30-Sep-19	7-day	67	621917	4179042	Tall fallow grass/forb	European starling	Small	No	–	–
Y2	10-Oct-19	28-day	64	621448	4179730	Road	Red-tailed hawk	Large	Yes	18-Oct-19	8
Y2	14-Oct-19	28-day	50	617794	4182950	Grazed/short grass	Black-headed grosbeak	Small	No	–	–
Y2	14-Oct-19	28-day	55	618401	4182781	Grazed/short grass	Mexican free-tailed bat	Bat	Yes	16-Oct-19	2
Y2	14-Oct-19	28-day	61	621157	4181017	Grazed/short grass	Little brown bat	Bat	No	–	–
Y2	21-Oct-19	28-day	50	617817	4183015	Grazed/short grass	Barn swallow	Small	No	–	–
Y2	21-Oct-19	7-day	52	617946	4182491	Tall fallow grass/forb	California gull	Large	Yes	22-Oct-19	1
Y2	21-Oct-19	28-day	57	618391	4180886	Turbine pad	Rock pigeon	Medium	Yes	06-Nov-19	16
Y2	21-Oct-19	7-day	58	618639	4182748	Tall fallow grass/forb	Mexican free-tailed bat	Bat	Yes	22-Oct-19	1
Y2	29-Oct-19	7-day	52	617897	4182478	Grazed/short grass	Hoary bat	Bat	Yes	29-Oct-19	0
Y2	29-Oct-19	7-day	60	620672	4181114	Grazed/short grass	Mexican free-tailed bat	Bat	Yes	07-Nov-19	9
Y2	29-Oct-19	7-day	64	621466	4179763	Bare/disturbed soil	Little brown bat	Bat	No	–	–
Y2	30-Oct-19	7-day	51	617391	4182503	Tall fallow grass/forb	Hermit thrush	Small	Yes	29-Oct-19	-1
Y2	05-Nov-19	7-day	51	617405	4182542	Grazed/short grass	European starling	Small	Yes	05-Nov-19	0
Y2	05-Nov-19	7-day	59	620380	4181394	Grazed/short grass	European starling	Small	No	–	–
Y2	05-Nov-19	7-day	63	621935	4180184	Grazed/short grass	European starling	Small	No	–	–
Y2	05-Nov-19	28-day	65	621963	4179807	Grazed/short grass	Rock pigeon	Medium	Yes	20-Nov-19	15
Y2	11-Nov-19	7-day	51	617434	4182521	Grazed/short grass	Mexican free-tailed bat	Bat	Yes	13-Nov-19	2
Y2	11-Nov-19	28-day	62	621519	4180115	Grazed/short grass	Hermit thrush	Small	Yes	20-Nov-19	9
Y2	11-Nov-19	28-day	66	620753	4178999	Tall fallow grass/forb	European starling	Small	No	–	–
Y2	12-Nov-19	7-day	51	617389	4182504	Tall fallow grass/forb	European starling	Small	No	–	–
Y2	12-Nov-19	7-day	54	618564	4181905	Grazed/short grass	Black-bellied plover	Medium	Yes	13-Nov-19	1
Y2	12-Nov-19	7-day	58	618644	4182773	Tall fallow grass/forb	Ferruginous hawk	Large	Yes	12-Nov-19	0
Y2	19-Nov-19	7-day	59	620421	4181308	Grazed/short grass	Mexican free-tailed bat	Bat	Yes	21-Nov-19	2
Y2	19-Nov-19	7-day	59	620409	4181404	Grazed/short grass	Dark-eyed junco	Small	Yes	21-Nov-19	2
Y2	19-Nov-19	28-day	61	621117	4180974	Grazed/short grass	Rock pigeon	Medium	No	–	–
Y2	19-Nov-19	28-day	62	621482	4180186	Grazed/short grass	Little brown bat	Bat	No	–	–
Y2	19-Nov-19	28-day	66	620770	4178940	Bare/disturbed soil	Rock pigeon	Medium	Yes	25-Nov-19	6
Y2	21-Nov-19	7-day	52	617847	4182420	Tall fallow grass/forb	American kestrel	Medium	No	–	–
Y2	21-Nov-19	7-day	56	618210	4181059	Grazed/short grass	Barn owl	Medium	Yes	25-Nov-19	4

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Y2	21-Nov-19	28-day	57	618360	4180905	Grazed/short grass	Ferruginous hawk	Large	Yes	04-Dec-19	13
Y2	21-Nov-19	7-day	57	618409	4180869	Grazed/short grass	Mexican free-tailed bat	Bat	No	–	–
Y2	24-Nov-19	28-day	65	621970	4179800	Grazed/short grass	Mexican free-tailed bat	Bat	No	–	–
Y2	24-Nov-19	28-day	66	620793	4178959	Tall fallow grass/forb	White-throated swift	Small	Yes	25-Nov-19	1
Y2	24-Nov-19	28-day	67	621854	4179071	Road	Mexican free-tailed bat	Bat	No	–	–
Y2	24-Nov-19	28-day	67	621967	4179090	Tall fallow grass/forb	Rock pigeon	Medium	No	–	–
Y2	04-Dec-19	28-day	53	618326	4182184	Bare/disturbed soil	White-throated swift	Small	No	–	–
Y2	04-Dec-19	7-day	58	618727	4182778	Grazed/short grass	Mexican free-tailed bat	Bat	No	–	–
Y2	04-Dec-19	7-day	63	621875	4180091	Tall fallow grass/forb	Western gull	Large	Yes	05-Dec-19	1
Y2	04-Dec-19	28-day	64	621438	4179711	Grazed/short grass	Rock pigeon	Medium	Yes	12-Dec-19	8
Y2	04-Dec-19	28-day	65	621945	4179886	Grazed/short grass	European starling	Small	No	–	–
Y2	04-Dec-19	28-day	67	621798	4179141	Tall fallow grass/forb	European starling	Small	No	–	–
Y2	10-Dec-19	28-day	50	617795	4182913	Grazed/short grass	Great egret	Large	Yes	08-Jan-20	29
Y2	10-Dec-19	7-day	54	618617	4181871	Grazed/short grass	Little brown bat	Bat	Yes	18-Dec-19	8
Y2	10-Dec-19	7-day	56	618287	4181146	Grazed/short grass	European starling	Small	Yes	18-Dec-19	8
Y2	10-Dec-19	7-day	60	620799	4181256	Grazed/short grass	American coot	Medium	Yes	17-Jan-20	38
Y2	10-Dec-19	28-day	61	621048	4180952	Grazed/short grass	Mexican free-tailed bat	Bat	Yes	12-Dec-19	2
Y2	16-Dec-19	7-day	52	617954	4182521	Grazed/short grass	European starling	Small	Yes	07-Jan-20	22
Y2	16-Dec-19	7-day	54	618626	4181942	Grazed/short grass	Mallard	Large	Yes	18-Dec-19	2
Y2	16-Dec-19	7-day	58	618755	4182711	Grazed/short grass	Black-bellied plover	Medium	Yes	22-Dec-19	6
Y2	16-Dec-19	28-day	62	621459	4180147	Bare/disturbed soil	Great blue heron	Large	Yes	18-Dec-19	2
Y2	19-Dec-19	7-day	51	617421	4182487	Grazed/short grass	Mexican free-tailed bat	Bat	Yes	29-Dec-19	10
Y2	19-Dec-19	7-day	51	617508	4182572	Grazed/short grass	Herring gull	Large	Yes	22-Dec-19	3
Y2	19-Dec-19	7-day	51	617441	4182521	Grazed/short grass	European starling	Small	Yes	22-Dec-19	3
Y2	19-Dec-19	28-day	64	621491	4179701	Grazed/short grass	Mexican free-tailed bat	Bat	No	–	–
Y2	19-Dec-19	7-day	68	621953	4178505	Grazed/short grass	*Myotis* spp.	Bat	Yes	30-Dec-19	11
Y2	19-Dec-19	7-day	68	621939	4178643	Grazed/short grass	European starling	Small	Yes	09-Jan-20	21
Y2	28-Dec-19	28-day	50	617826	4182850	Grazed/short grass	Mexican free-tailed bat	Bat	No	–	–
Y2	28-Dec-19	7-day	52	617850	4182518	Grazed/short grass	European starling	Small	No	–	–
Y2	28-Dec-19	7-day	63	621945	4180099	Grazed/short grass	Little brown bat	Bat	No	–	–
Y2	28-Dec-19	28-day	64	621411	4179705	Grazed/short grass	Canada goose	Large	Yes	10-Jan-20	13
Y2	28-Dec-19	28-day	64	621438	4179751	Grazed/short grass	European starling	Small	Yes	10-Jan-20	13
Y2	06-Jan-20	7-day	49	617570	4183076	Tall fallow grass/forb	Ferruginous hawk	Large	Yes	07-Jan-20	1
Y2	06-Jan-20	28-day	53	618367	4182158	Grazed/short grass	Rock pigeon	Medium	No	–	–
Y2	06-Jan-20	28-day	67	621878	4179094	Grazed/short grass	American kestrel	Medium	No	–	–
Y2	07-Jan-20	7-day	60	620761	4181189	Grazed/short grass	European starling	Small	Yes	09-Jan-20	2
Y2	07-Jan-20	28-day	64	621464	4179681	Grazed/short grass	Mexican free-tailed bat	Bat	No	–	–
Y2	14-Jan-20	28-day	57	618423	4180850	Grazed/short grass	Ruddy duck	Medium	Yes	29-Jan-20	15

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Y2	15-Jan-20	7-day	68	621903	4178601	Grazed/short grass	European starling	Small	Yes	16-Jan-20	1
Y2	17-Jan-20	7-day	50	617823	4182922	Grazed/short grass	*Myotis* spp.	Bat	No	–	–
Y2	17-Jan-20	7-day	50	617807	4182875	Grazed/short grass	Mexican free-tailed bat	Bat	Yes	05-Feb-20	19
Y2	17-Jan-20	7-day	58	618615	4182798	Grazed/short grass	House finch	Small	No	–	–
Y2	20-Jan-20	7-day	58	618630	4182691	Grazed/short grass	Mexican free-tailed bat	Bat	No	–	–
Y2	20-Jan-20	7-day	63	621877	4180169	Grazed/short grass	American crow	Medium	Yes	23-Jan-20	3
Y2	21-Jan-20	28-day	53	618311	4182178	Grazed/short grass	*Myotis* spp.	Bat	Yes	29-Jan-20	8
Y2	21-Jan-20	28-day	55	618378	4182728	Grazed/short grass	Mexican free-tailed bat	Bat	No	–	–
Y2	21-Jan-20	28-day	64	621439	4179752	Grazed/short grass	European starling	Small	Yes	07-Feb-20	17
Y2	27-Jan-20	7-day	49	617519	4183066	Grazed/short grass	Green-winged teal	Medium	Yes	28-Jan-20	1
Y2	27-Jan-20	28-day	53	618252	4182161	Grazed/short grass	European starling	Small	Yes	15-Jul-20	170
Y2	27-Jan-20	7-day	63	621934	4180126	Grazed/short grass	Herring gull	Large	Yes	30-Jan-20	3
Y2	27-Jan-20	7-day	63	621835	4180176	Grazed/short grass	European starling	Small	No	–	–
Y2	27-Jan-20	7-day	68	621836	4178576	Grazed/short grass	Turkey vulture	Large	Yes	30-Jan-20	3
Y2	03-Feb-20	7-day	51	617451	4182588	Grazed/short grass	Pine siskin	Small	No	–	–
Y2	03-Feb-20	28-day	61	621049	4180954	Grazed/short grass	Say's phoebe	Small	No	–	–
Y2	03-Feb-20	28-day	62	621498	4180030	Grazed/short grass	Red-tailed hawk	Large	Yes	12-Feb-20	9
Y2	03-Feb-20	28-day	64	621547	4179809	Grazed/short grass	Barn owl	Medium	Yes	07-Feb-20	4
Y2	03-Feb-20	28-day	66	620788	4178991	Grazed/short grass	European starling	Small	Yes	19-Feb-20	16
Y2	09-Feb-20	7-day	49	617476	4183054	Road	Mexican free-tailed bat	Bat	Yes	11-Feb-20	2
Y2	09-Feb-20	7-day	49	617514	4183077	Grazed/short grass	Red-tailed hawk	Large	Yes	11-Feb-20	2
Y2	11-Feb-20	28-day	57	618409	4180916	Grazed/short grass	European starling	Small	No	–	–
Y2	11-Feb-20	7-day	59	620359	4181445	Grazed/short grass	Western meadowlark	Small	Yes	20-Feb-20	9
Y2	17-Feb-20	28-day	65	621980	4179859	Grazed/short grass	European starling	Small	No	–	–
Y2	17-Feb-20	28-day	66	620723	4178839	Grazed/short grass	Northern shoveler	Large	Yes	19-Feb-20	2
Y2	17-Feb-20	28-day	67	621809	4179113	Grazed/short grass	White-throated swift	Small	Yes	19-Feb-20	2
Y2	17-Feb-20	7-day	68	621914	4178501	Grazed/short grass	Western gull	Large	Yes	05-Mar-20	17
Y2	23-Feb-20	28-day	57	618336	4180909	Tall fallow grass/forb	Mexican free-tailed bat	Bat	Yes	26-Feb-20	3
Y2	23-Feb-20	28-day	57	618441	4180901	Tall fallow grass/forb	American robin	Small	No	–	–
Y2	23-Feb-20	28-day	57	618383	4180916	Road	European starling	Small	Yes	26-Feb-20	3
Y2	23-Feb-20	28-day	64	621408	4179649	Grazed/short grass	Red-tailed hawk	Large	Yes	06-Mar-20	12
Y2	25-Feb-20	28-day	61	621137	4181009	Grazed/short grass	*Myotis* spp.	Bat	Yes	06-Mar-20	10
Y2	25-Feb-20	7-day	63	622004	4180217	Grazed/short grass	Mexican free-tailed bat	Bat	No	–	–
Y2	03-Mar-20	7-day	51	617464	4182453	Grazed/short grass	Mexican free-tailed bat	Bat	Yes	10-Mar-20	7
Y2	03-Mar-20	7-day	59	620444	4181375	Grazed/short grass	Barn owl	Medium	Yes	05-Mar-20	2
Y2	03-Mar-20	28-day	62	621498	4180136	Turbine pad	Mexican free-tailed bat	Bat	Yes	11-Mar-20	8
Y2	03-Mar-20	28-day	62	621462	4180105	Grazed/short grass	California gull	Large	Yes	11-Mar-20	8
Y2	03-Mar-20	28-day	65	621855	4179741	Grazed/short grass	Turkey vulture	Large	Yes	11-Mar-20	8

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Y2	09-Mar-20	7-day	54	618149	4181130	Grazed/short grass	Rock pigeon	Medium	No	–	–
Y2	09-Mar-20	7-day	59	620416	4181357	Grazed/short grass	Mexican free-tailed bat	Bat	Yes	12-Mar-20	3
Y2	09-Mar-20	7-day	60	620713	4181155	Grazed/short grass	*Myotis* spp.	Bat	Yes	12-Mar-20	3
Y2	09-Mar-20	28-day	65	621975	4179782	Grazed/short grass	Mexican free-tailed bat	Bat	Yes	11-Mar-20	2
Y2	09-Mar-20	7-day	66	620876	4178968	Tall fallow grass/forb	European starling	Small	Yes	20-Mar-20	11
Y2	17-Mar-20	7-day	60	620721	4181201	Grazed/short grass	*Myotis* spp.	Bat	Yes	19-Mar-20	2
Y2	17-Mar-20	7-day	63	622007	4180108	Tall fallow grass/forb	Mexican free-tailed bat	Bat	No	–	–
Y2	25-Mar-20	7-day	51	617394	4182578	Grazed/short grass	European starling	Small	Yes	31-Mar-20	6
Y2	25-Mar-20	28-day	64	621468	4179712	Grazed/short grass	Mallard	Large	Yes	03-Apr-20	9
Y2	26-Mar-20	28-day	61	621041	4180975	Grazed/short grass	European starling	Small	No	–	–
Y2	26-Mar-20	28-day	64	621446	4179664	Tall fallow grass/forb	*Myotis* spp.	Bat	No	–	–
Y2	26-Mar-20	28-day	66	620847	4178893	Road	Mexican free-tailed bat	Bat	No	–	–
Y2	30-Mar-20	7-day	54	618550	4181833	Grazed/short grass	Herring gull	Large	Yes	01-Apr-20	2
Y2	30-Mar-20	7-day	59	620449	4181448	Tall fallow grass/forb	European starling	Small	Yes	08-Apr-20	9
Y2	30-Mar-20	28-day	61	620996	4181069	Tall fallow grass/forb	European starling	Small	Yes	01-May-20	32
Y2	30-Mar-20	28-day	62	621387	4180130	Tall fallow grass/forb	European starling	Small	Yes	07-Apr-20	8
Y2	30-Mar-20	28-day	65	621897	4179806	Tall fallow grass/forb	Red-tailed hawk	Large	Yes	07-Apr-20	8
Y2	09-Apr-20	28-day	50	617772	4182965	Grazed/short grass	Rock pigeon	Medium	Yes	24-Jun-20	76
Y2	09-Apr-20	7-day	51	617477	4182538	Tall fallow grass/forb	*Myotis* spp.	Bat	Yes	20-Apr-20	11
Y2	09-Apr-20	7-day	56	618321	4181096	Tall fallow grass/forb	Northern shoveler	Large	Yes	15-Apr-20	6
Y2	09-Apr-20	28-day	65	621952	4179799	Road	Mexican free-tailed bat	Bat	No	–	–
Y2	09-Apr-20	28-day	66	620847	4178832	Tall fallow grass/forb	Mexican free-tailed bat	Bat	Yes	15-Apr-20	6
Y2	09-Apr-20	28-day	67	621813	4179082	Tall fallow grass/forb	European starling	Small	Yes	15-Apr-20	6
Y2	15-Apr-20	7-day	49	617481	4182991	Tall fallow grass/forb	*Myotis* spp.	Bat	No	–	–
Y2	15-Apr-20	7-day	49	617464	4183093	Grazed/short grass	European starling	Small	Yes	20-Apr-20	5
Y2	15-Apr-20	28-day	61	621184	4181024	Tall fallow grass/forb	Barn owl	Medium	Yes	01-May-20	16
Y2	15-Apr-20	7-day	68	621986	4178635	Tall fallow grass/forb	European starling	Small	Yes	06-May-20	21
Y2	15-Apr-20	7-day	68	621915	4178566	Road	White-throated swift	Small	Yes	16-Apr-20	1
Y2	19-Apr-20	7-day	60	620696	4181182	Grazed/short grass	Turkey vulture	Large	Yes	22-Apr-20	3
Y2	19-Apr-20	28-day	62	621572	4180157	Tall fallow grass/forb	Little brown bat	Bat	No	–	–
Y2	19-Apr-20	7-day	63	621971	4180144	Tall fallow grass/forb	Hoary bat	Bat	Yes	22-Apr-20	3
Y2	19-Apr-20	7-day	63	621893	4180086	Grazed/short grass	Red-tailed hawk	Large	Yes	22-Apr-20	3
Y2	19-Apr-20	28-day	66	620879	4178964	Tall fallow grass/forb	Big brown bat	Bat	No	–	–
Y2	24-Apr-20	7-day	56	618311	4181193	Tall fallow grass/forb	European starling	Small	Yes	17-Jun-20	54
Y2	24-Apr-20	28-day	57	618325	4180845	Tall fallow grass/forb	Mexican free-tailed bat	Bat	No	–	–
Y2	24-Apr-20	7-day	59	620495	4181360	Tall fallow grass/forb	*Myotis* spp.	Bat	No	–	–
Y2	24-Apr-20	7-day	60	620774	4181243	Tall fallow grass/forb	Red-tailed hawk	Large	Yes	30-Apr-20	6
Y2	24-Apr-20	28-day	65	621914	4179837	Tall fallow grass/forb	European starling	Small	Yes	05-May-20	11

Project Year	Date Placed	Survey Type	Turbine ID	UTM East	UTM North	Placement Substrate	Species	Size Class	Detected?	Date Found	Carcass Age at Discovery (days)
Y2	03-May-20	28-day	50	617870	4182878	Grazed/short grass	Barn owl	Medium	Yes	27-May-20	24
Y2	03-May-20	7-day	60	620683	4181285	Tall fallow grass/forb	European starling	Small	No	–	–
Y2	03-May-20	28-day	65	621889	4179830	Tall fallow grass/forb	Western gull	Large	Yes	04-May-20	1
Y2	11-May-20	7-day	56	618289	4181111	Tall fallow grass/forb	Great horned owl	Large	Yes	19-May-20	8
Y2	11-May-20	7-day	60	620706	4181152	Grazed/short grass	Mexican free-tailed bat	Bat	Yes	28-May-20	17
Y2	11-May-20	28-day	66	620710	4178979	Tall fallow grass/forb	European starling	Small	No	–	–
Y2	11-May-20	28-day	67	621807	4179038	Tall fallow grass/forb	Green-winged teal	Medium	Yes	14-May-20	3
Y2	11-May-20	28-day	67	621833	4179106	Tall fallow grass/forb	White-throated swift	Small	Yes	14-May-20	3
Y2	17-May-20	28-day	50	617838	4182980	Road	Hermit thrush	Small	No	–	–
Y2	17-May-20	7-day	56	618216	4181130	Tall fallow grass/forb	Mexican free-tailed bat	Bat	Yes	02-Jun-20	16
Y2	17-May-20	28-day	57	618389	4180875	Tall fallow grass/forb	American kestrel	Medium	Yes	19-May-20	2
Y2	17-May-20	7-day	63	621965	4180048	Tall fallow grass/forb	Rock pigeon	Medium	Yes	20-May-20	3
Y2	17-May-20	7-day	68	621933	4178572	Turbine pad	*Myotis* spp.	Bat	No	–	–
Y2	24-May-20	7-day	49	617521	4183183	Tall fallow grass/forb	Mew gull	Medium	No	–	–
Y2	24-May-20	28-day	61	621076	4181029	Turbine pad	California myotis	Bat	No	–	–
Y2	24-May-20	28-day	62	621417	4180117	Tall fallow grass/forb	Mallard	Large	Yes	01-Jun-20	8
Y2	24-May-20	28-day	64	621442	4179724	Road	European starling	Small	No	14-Oct-20	-
Y2	24-May-20	28-day	64	621454	4179828	Tall fallow grass/forb	Yellow-rumped warbler	Small	No	–	–
Y2	24-May-20	7-day	68	621955	4178548	Grazed/short grass	Mexican free-tailed bat	Bat	No	–	–
Y2	31-May-20	7-day	51	617500	4182589	Tall fallow grass/forb	Red-tailed hawk	Large	Yes	23-Jun-20	23
Y2	31-May-20	7-day	54	618618	4181906	Grazed/short grass	Western sandpiper	Small	Yes	02-Jun-20	2
Y2	31-May-20	28-day	57	618488	4180874	Grazed/short grass	Mexican free-tailed bat	Bat	Yes	16-Jun-20	16
Y2	31-May-20	28-day	57	618407	4180896	Grazed/short grass	Red-tailed hawk	Large	Yes	16-Jun-20	16
Y2	31-May-20	7-day	59	620380	4181347	Grazed/short grass	*Myotis* spp.	Bat	Yes	16-Jul-20	46
Y2	31-May-20	7-day	63	621882	4180245	Grazed/short grass	European starling	Small	No		-
Y2	08-Jun-20	7-day	54	618687	4181887	Tall fallow grass/forb	*Myotis* spp.	Bat	No	–	–
Y2	08-Jun-20	7-day	63	621971	4180202	Grazed/short grass	Brewer's blackbird	Small	Yes	12-Jun-20	4
Y2	08-Jun-20	28-day	66	620775	4178906	Grazed/short grass	Western gull	Large	Yes	11-Jun-20	3
Y2	08-Jun-20	28-day	67	621922	4179063	Tall fallow grass/forb	Mexican free-tailed bat	Bat	Yes	11-Jun-20	3
Y2	14-Jun-20	7-day	49	617493	4183088	Tall fallow grass/forb	Yellow-rumped warbler	Small	No	–	–
Y2	14-Jun-20	28-day	57	618384	4180840	Tall fallow grass/forb	Mexican free-tailed bat	Bat	Yes	16-Jun-20	2
Y2	14-Jun-20	7-day	68	621959	4178588	Grazed/short grass	American crow	Medium	Yes	18-Jun-20	4
Y2	19-Jun-20	7-day	49	617461	4183035	Road	Turkey vulture	Large	Yes	23-Jun-20	4
Y2	19-Jun-20	28-day	61	621066	4181112	Tall fallow grass/forb	Western sandpiper	Small	Yes	28-Jun-20	9
Y2	19-Jun-20	28-day	62	621571	4180201	Tall fallow grass/forb	Mexican free-tailed bat	Bat	No	–	–
Y2	19-Jun-20	28-day	62	621534	4180100	Tall fallow grass/forb	Western meadowlark	Small	No	–	–
Y2	19-Jun-20	28-day	66	620792	4178921	Turbine pad	*Myotis* spp.	Bat	No	–	–
Y2	30-Jun-20	7-day	54	618544	4181902	Grazed/short grass	Mexican free-tailed bat	Bat	Yes	01-Jul-20	1

Project Year	Date Placed	Survey Type	Turbine ID	UTM East	UTM North	Placement Substrate	Species	Size Class	Detected?	Date Found	Carcass Age at Discovery (days)
Y2	30-Jun-20	7-day	54	618539	4181988	Tall fallow grass/forb	Black-throated gray warbler	Small	Yes	01-Jul-20	1
Y2	30-Jun-20	28-day	61	621085	4180994	Grazed/short grass	Red-tailed hawk	Large	Yes	24-Jul-20	24
Y2	30-Jun-20	28-day	65	622000	4179862	Bare/disturbed soil	Mexican free-tailed bat	Bat	No	–	–
Y2	02-Jul-20	7-day	52	617880	4182403	Tall fallow grass/forb	Mexican free-tailed bat	Bat	No	–	–
Y2	06-Jul-20	28-day	53	618287	4182118	Tall fallow grass/forb	Mexican free-tailed bat	Bat	Yes	15-Jul-20	9
Y2	06-Jul-20	28-day	55	618327	4182795	Grazed/short grass	Brewer's blackbird	Small	No		-
Y2	06-Jul-20	28-day	55	618330	4182822	Tall fallow grass/forb	European starling	Small	Yes	22-Jul-20	16
Y2	06-Jul-20	7-day	56	618317	4181182	Tall fallow grass/forb	Anna's hummingbird	Small	Yes	08-Jul-20	2
Y2	06-Jul-20	28-day	66	620868	4178970	Tall fallow grass/forb	Mexican free-tailed bat	Bat	Yes	08-Jul-20	2
Y2	11-Jul-20	7-day	52	617843	4182464	Grazed/short grass	Mexican free-tailed bat	Bat	Yes	14-Jul-20	3
Y2	11-Jul-20	7-day	52	617884	4182395	Tall fallow grass/forb	Mexican free-tailed bat	Bat	Yes	14-Jul-20	3
Y2	11-Jul-20	7-day	54	618657	4181901	Tall fallow grass/forb	Barn owl	Medium	Yes	15-Jul-20	4
Y2	11-Jul-20	7-day	58	618697	4182817	Tall fallow grass/forb	American kestrel	Medium	Yes	14-Jul-20	3
Y2	11-Jul-20	28-day	66	620737	4178878	Tall fallow grass/forb	Mallard	Large	Yes	05-Aug-20	25
Y2	17-Jul-20	7-day	52	617890	4182468	Grazed/short grass	Green-winged teal	Medium	Yes	21-Jul-20	4
Y2	17-Jul-20	28-day	55	618338	4182722	Grazed/short grass	Mexican free-tailed bat	Bat	No	–	–
Y2	17-Jul-20	7-day	56	618269	4181083	Grazed/short grass	Mexican free-tailed bat	Bat	Yes	22-Jul-20	5
Y2	17-Jul-20	7-day	58	618740	4182744	Tall fallow grass/forb	House finch	Small	No	–	–
Y2	17-Jul-20	28-day	67	621842	4179167	Tall fallow grass/forb	Common raven	Large	Yes	05-Aug-20	19
Y2	25-Jul-20	7-day	49	617460	4183109	Tall fallow grass/forb	European starling	Small	No	–	–
Y2	25-Jul-20	7-day	52	617857	4182503	Grazed/short grass	Warbling vireo	Small	Yes	28-Jul-20	3
Y2	25-Jul-20	7-day	58	618679	4182733	Grazed/short grass	*Myotis* spp.	Bat	No	–	–
Y2	25-Jul-20	7-day	59	620450	4181335	Road	Big brown bat	Bat	Yes	06-Aug-20	12
Y2	25-Jul-20	28-day	62	621474	4180164	Tall fallow grass/forb	California gull	Large	Yes	29-Jul-20	4
Y2	03-Aug-20	7-day	49	617466	4183132	Tall fallow grass/forb	House sparrow	Small	No	–	–
Y2	03-Aug-20	7-day	52	617925	4182516	Tall fallow grass/forb	*Myotis* spp.	Bat	Yes	29-Sep-20	57
Y2	03-Aug-20	7-day	54	618538	4181899	Grazed/short grass	Mexican free-tailed bat	Bat	Yes	05-Aug-20	2
Y2	03-Aug-20	28-day	55	618347	4182766	Tall fallow grass/forb	Red-tailed hawk	Large	Yes	19-Aug-20	16
Y2	03-Aug-20	7-day	59	620501	4181349	Tall fallow grass/forb	*Myotis* spp.	Bat	No	–	–
Y2	06-Aug-20	7-day	51	617525	4182446	Tall fallow grass/forb	Mexican free-tailed bat	Bat	Yes	11-Aug-20	5
Y2	06-Aug-20	7-day	52	617876	4182495	Grazed/short grass	Turkey vulture	Large	Yes	11-Aug-20	5
Y2	06-Aug-20	28-day	53	618433	4182093	Tall fallow grass/forb	*Myotis* spp.	Bat	No	–	–
Y2	06-Aug-20	28-day	53	618418	4182143	Grazed/short grass	Mourning dove	Medium	Yes	12-Aug-20	6
Y2	06-Aug-20	7-day	58	618662	4182758	Grazed/short grass	Bufflehead	Medium	Yes	11-Aug-20	5
Y2	15-Aug-20	28-day	53	618376	4182194	Grazed/short grass	European starling	Small	No	–	–
Y2	15-Aug-20	28-day	53	618348	4182191	Grazed/short grass	Western sandpiper	Small	No	–	–
Y2	15-Aug-20	7-day	59	620383	4181377	Grazed/short grass	American crow	Medium	Yes	19-Aug-20	4
Y2	15-Aug-20	7-day	59	620321	4181379	Grazed/short grass	Black-throated gray warbler	Small	Yes	20-Aug-20	5

Project Year	Date Placed	Survey Type	Turbine ID	UTM East	UTM North	Placement Substrate	Species	Size Class	Detected?	Date Found	Carcass Age at Discovery (days)
Y2	19-Aug-20	7-day	49	617394	4183044	Tall fallow grass/forb	Brewer's blackbird	Small	Yes	27-Aug-20	8
Y2	19-Aug-20	28-day	50	617778	4182922	Grazed/short grass	Barn owl	Medium	Yes	30-Sep-20	42
Y2	19-Aug-20	28-day	62	621427	4180205	Tall fallow grass/forb	European starling	Small	Yes	28-Aug-20	9
Y2	19-Aug-20	7-day	63	621919	4180146	Road	Red-tailed hawk	Large	Yes	20-Aug-20	1
Y2	19-Aug-20	28-day	65	621878	4179867	Tall fallow grass/forb	House wren	Small	No	–	–
Y2	26-Aug-20	7-day	68	621932	4178606	Grazed/short grass	Rock pigeon	Medium	Yes	29-Aug-20	3
Y2	29-Aug-20	7-day	63	621936	4180202	Grazed/short grass	Red-winged blackbird	Small	No	–	–
Y2	29-Aug-20	28-day	67	621870	4179143	Tall fallow grass/forb	*Myotis* spp.	Bat	No	–	–
Y2	29-Aug-20	28-day	67	621865	4179109	Grazed/short grass	Mallard	Large	Yes	22-Sep-20	24
Y2	31-Aug-20	28-day	50	617814	4182952	Grazed/short grass	European starling	Small	Yes	13-Oct-20	43
Y2	31-Aug-20	7-day	58	618740	4182760	Tall fallow grass/forb	Mexican free-tailed bat	Bat	Yes	01-Sep-20	1
Y2	21-Sep-20	28-day	53	618376	4182062	Road	Mexican free-tailed bat	Bat	No	–	–
Y2	21-Sep-20	28-day	53	618310	4182091	Tall fallow grass/forb	Western gull	Large	Yes	22-Sep-20	1
Y2	21-Sep-20	28-day	53	618376	4182230	Tall fallow grass/forb	European starling	Small	Yes	22-Sep-20	1
Y2	21-Sep-20	7-day	54	618591	4181799	Road	Mexican free-tailed bat	Bat	Yes	24-Sep-20	3
Y2	21-Sep-20	28-day	55	618280	4182846	Tall fallow grass/forb	European starling	Small	No	–	–
Y2	21-Sep-20	7-day	58	618741	4182722	Tall fallow grass/forb	Rock pigeon	Medium	Yes	21-Sep-20	0
Y2	21-Sep-20	7-day	58	618605	4182796	Tall fallow grass/forb	European starling	Small	Yes	21-Sep-20	0
Y2	21-Sep-20	7-day	58	618741	4182792	Tall fallow grass/forb	Ruby-crowned kinglet	Small	Yes	21-Sep-20	0
Y2	21-Sep-20	28-day	66	620729	4178881	Tall fallow grass/forb	Mourning dove	Medium	No	–	–
Y2	21-Sep-20	28-day	66	620747	4178983	Tall fallow grass/forb	Western sandpiper	Small	Yes	22-Sep-20	1
Y2	21-Sep-20	28-day	67	621920	4179005	Tall fallow grass/forb	California myotis	Bat	No	–	–
Y2	21-Sep-20	28-day	67	621824	4179027	Grazed/short grass	Mallard	Large	No	–	–
Y2	21-Sep-20	28-day	67	621840	4179185	Bare/disturbed soil	Red-winged blackbird	Small	No	–	–
Y2	21-Sep-20	7-day	68	621967	4178475	Tall fallow grass/forb	*Myotis* spp.	Bat	No	–	–
Y2	27-Sep-20	7-day	49	617389	4183089	Tall fallow grass/forb	European starling	Small	No	07-Oct-20	-
Y2	27-Sep-20	7-day	56	618180	4181155	Grazed/short grass	Glaucous-winged gull	Large	Yes	30-Sep-20	3
Y2	27-Sep-20	7-day	58	618753	4182800	Tall fallow grass/forb	Wilson's warbler	Small	No	–	–
Y2	27-Sep-20	7-day	59	620462	4181343	Bare/disturbed soil	Barn owl	Medium	No	–	–
Y2	27-Sep-20	7-day	63	622008	4180169	Tall fallow grass/forb	Hoary bat	Bat	No	–	–
Y2	27-Sep-20	28-day	64	621532	4179663	Tall fallow grass/forb	Mexican free-tailed bat	Bat	No	21-Oct-20	-
Y2	27-Sep-20	28-day	65	621959	4179917	Tall fallow grass/forb	California myotis	Bat	No	–	–
Y2	27-Sep-20	28-day	65	622010	4179778	Grazed/short grass	Rock pigeon	Medium	Yes	03-Oct-20	6
Y2	27-Sep-20	7-day	68	622014	4178508	Tall fallow grass/forb	European starling	Small	No	–	–

Appendix E. *GenEst* Carcass Detectability (CD) Candidate Models and Selections to Estimate Adjusted Fatalities

The tables below represent the top 20 *GenEst* candidate models (based on AICc scores) describing CD for bats and birds across the 2-year study. Predictor variables analyzed were *Year* (monitoring Year 1 or Year 2); *Survey Type* (7-day or 28-day search interval); *Size Class* for birds (included in all models) classified as *Small* (≤100 g), *Medium* (101–500 g), or *Large* (>500 g); and four alternative forms of a season variable considered independently: *Season*: fall = September – November; winter = December – February; spring = March – May; summer = June – August; *Season2A*: fall/winter and spring/summer; *Season2B*: winter/spring and summer/fall; and *Season2C*: fall/spring migration seasons and winter/summer nonmigration seasons. The models selected to produce adjusted fatality estimates are highlighted in ***bold italics***, and the null model is gray-shaded for reference when shown. Selected models had the lowest AICc score among relevant candidates that were based on a minimum of 10 detectability trial cases per covariate combination. The *GenEst* searcher efficiency module used to predict CD specifies a "*p* formula" describing variation in the median probability of detection (CD) among covariate classes, and a "*k* formula" describing 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) (Appendix B).

Bats

Formula *p*	Formula *k*	AICc	ΔAICc
p ~ SurveyType	k fixed at 0	194.38	0.00
p ~ SurveyType + Season2A	***k fixed at 0***	***195.65***	***1.27***
p ~ SurveyType + Season2B	k fixed at 0	196.21	1.83
p ~ SurveyType * Season2A	k fixed at 0	196.22	1.84
p ~ Year + SurveyType	k fixed at 0	196.41	2.03
p ~ SurveyType + Season2C	k fixed at 0	196.46	2.08
p ~ Year + SurveyType + Season2A	k fixed at 0	197.72	3.34
p ~ Year * SurveyType	k fixed at 0	197.75	3.37
p ~ SurveyType * Season2C	k fixed at 0	197.92	3.54
p ~ SurveyType * Season2B	k fixed at 0	197.95	3.57
p ~ Year + SurveyType + Season2B	k fixed at 0	198.26	3.88
p ~ Year + SurveyType * Season2A	k fixed at 0	198.31	3.93
p ~ Year + SurveyType + Season2C	k fixed at 0	198.52	4.14
p ~ Year * SurveyType + Season2A	k fixed at 0	199.06	4.68
p ~ Year * Season2C + SurveyType	k fixed at 0	199.34	4.96
p ~ Year * Season2A + SurveyType	k fixed at 0	199.63	5.25
p ~ Year * SurveyType + Season2B	k fixed at 0	199.63	5.25
p ~ SurveyType + Season	k fixed at 0	199.64	5.26
p ~ Year + SurveyType + Season2A + Year: SurveyType + SurveyType:Season2A	k fixed at 0	199.72	5.34
p ~ Year * SurveyType + Season2C	k fixed at 0	199.89	5.51

Small Birds

Formula *p*	Formula *k*	AICc	ΔAICc
p ~ SurveyType + Season2A	***k fixed at 0***	***204.80***	***0.00***
p ~ Season2A	k fixed at 0	204.89	0.09
p ~ Season2C	k fixed at 0	205.08	0.28
p ~ Season	k fixed at 0	205.43	0.63
p ~ SurveyType	k fixed at 0	205.46	0.66
p ~ constant	k fixed at 0	205.47	0.67
p ~ SurveyType + Season2C	k fixed at 0	205.59	0.79
p ~ SurveyType * Season2A	k fixed at 0	205.64	0.84
p ~ Year * Season2C	k fixed at 0	205.71	0.91
p ~ SurveyType + Season	k fixed at 0	206.12	1.32
p ~ Year + Season2C	k fixed at 0	206.84	2.04
p ~ Year * Season2C + SurveyType	k fixed at 0	206.84	2.04
p ~ Year + SurveyType + Season2A	k fixed at 0	206.86	2.06
p ~ Year + Season2A	k fixed at 0	206.92	2.12
p ~ SurveyType * Season2C	k fixed at 0	206.96	2.16
p ~ Season2B	k fixed at 0	207.03	2.23
p ~ SurveyType + Season2B	k fixed at 0	207.22	2.42
p ~ Year + Season	k fixed at 0	207.31	2.51
p ~ Year	k fixed at 0	207.39	2.59
p ~ Year + SurveyType	k fixed at 0	207.41	2.61

Medium Birds

Formula *p*	Formula *k*	AICc	ΔAICc
p ~ Season2A	***k fixed at 0***	***81.39***	***0.00***
p ~ constant	k fixed at 0	83.03	1.64
p ~ SurveyType + Season2A	k fixed at 0	83.36	1.97
p ~ Year + Season2A	k fixed at 0	83.48	2.09
p ~ Season2C	k fixed at 0	83.64	2.25
p ~ SurveyType * Season2A	k fixed at 0	84.29	2.90
p ~ SurveyType	k fixed at 0	84.66	3.27
p ~ Season2B	k fixed at 0	84.97	3.58
p ~ SurveyType * Season2C	k fixed at 0	85.10	3.71
p ~ Season	k fixed at 0	85.12	3.73
p ~ Year	k fixed at 0	85.13	3.74
p ~ SurveyType + Season2C	k fixed at 0	85.33	3.94
p ~ Year + SurveyType + Season2A	k fixed at 0	85.55	4.16
p ~ Year * Season2A	k fixed at 0	85.68	4.29
p ~ Year + Season2C	k fixed at 0	85.70	4.31
p ~ Year + SurveyType * Season2A	k fixed at 0	86.57	5.18
p ~ SurveyType + Season2B	k fixed at 0	86.66	5.27
p ~ Year + SurveyType	k fixed at 0	86.84	5.45
p ~ Year + Season2B	k fixed at 0	87.15	5.76
p ~ Year * Season2C	k fixed at 0	87.19	5.80

Large Birds

Formula *p*	Formula *k*	AICc	ΔAICc
p ~ constant	***k fixed at 0***	***12.75***	***0.00***
p ~ Season2B	k fixed at 0	13.93	1.18
p ~ Season2C	k fixed at 0	14.19	1.44
p ~ SurveyType	k fixed at 0	14.19	1.44
p ~ Season2A	k fixed at 0	14.31	1.56
p ~ Year	k fixed at 0	14.80	2.05
p ~ Year + SurveyType + Season2A	k fixed at 0	15.05	2.30
p ~ Year + SurveyType + Season2B	k fixed at 0	15.25	2.50
p ~ Year + SurveyType + Season2C	k fixed at 0	15.25	2.50
p ~ Year + SurveyType * Season2A	k fixed at 0	17.34	4.59
p ~ Year * SurveyType + Season2A	k fixed at 0	17.34	4.59
p ~ Year + SurveyType * Season2B	k fixed at 0	17.54	4.79
p ~ Year * Sesason2B + SurveyType	k fixed at 0	17.54	4.79
p ~ Year * SurveyType + Season2B	k fixed at 0	17.54	4.79
p ~ Year + SurveyType * Season2C	k fixed at 0	17.54	4.79
p ~ Year * Season2C + SurveyType	k fixed at 0	17.54	4.79
p ~ Year * SurveyType + Season2C	k fixed at 0	17.54	4.79
p ~ Season	k fixed at 0	18.28	5.53
p ~ SurveyType * Season2B	k fixed at 0	18.79	6.04
p ~ SurveyType * Season2A	k fixed at 0	18.93	6.18

Appendix F. Bat Fatality and Injury Incidents Documented in Monitoring Years 1 and 2

Project Year	Species	Date	Turbine[1]	Survey Type	Distance From Turbine (m)	Bearing From Turbine (°)	Carcass Condition	Included to Estimate Adjusted Fatalities?[2]
Y1	Big brown bat	31-Jul-19	WTG-55	28-day	78	70	Intact-partial decomposed	Excluded: GE nesting closure
Y1	Hoary bat	09-Oct-18	WTG-63	28-day	25	55	Scavenged-partial decomposed	Excluded: predates survey
Y1	Hoary bat	09-Oct-18	WTG-68	7-day	80	43	Scavenged-partial decomposed	Excluded: predates survey
Y1	Hoary bat	16-Oct-18	WTG-62	28-day	45	93	Scavenged-partial decomposed	Excluded: predates survey
Y1	Hoary bat	18-Oct-18	WTG-54	7-day	25	29	Scavenged-partial decomposed	Excluded: predates survey
Y1	Hoary bat	18-Oct-18	WTG-54	7-day	45	23	Scavenged-partial decomposed	Excluded: predates survey
Y1	Hoary bat	01-Nov-18	WTG-54	7-day	39	40	Scavenged-partial decomposed	Included
Y1	Hoary bat	01-Nov-18	WTG-54	7-day	44	111	Scavenged-partial decomposed	Included
Y1	Hoary bat	13-Mar-19	WTG-66	28-day	37	141	Intact-fresh	Included
Y1	Hoary bat	25-Apr-19	WTG-51	7-day	20	299	Scavenged-partial decomposed	Included
Y1	Hoary bat	25-Apr-19	WTG-54	7-day	20	33	Intact-partial decomposed	Included
Y1	Hoary bat	15-May-19	WTG-65	28-day	49	97	Scavenged-partial decomposed	Included
Y1	Hoary bat	23-May-19	WTG-50	7-day	89	348	Intact-fresh	Included
Y1	Hoary bat	30-May-19	WTG-68	Incidental	121	17	Scavenged-partial decomposed	Excluded: off plot
Y1	Hoary bat	04-Jun-19	WTG-60	7-day	115	45	Scavenged-partial decomposed	Included
Y1	Hoary bat	06-Jun-19	WTG-51	7-day	21	75	Intact-partial decomposed	Included
Y1	Hoary bat	06-Jun-19	WTG-54	7-day	54	44	Scavenged-partial decomposed	Included
Y1	Hoary bat	06-Jun-19	WTG-56	7-day	89	61	Intact-partial decomposed	Included
Y1	Hoary bat	27-Jun-19	WTG-56	7-day	96	75	Scavenged-partial decomposed	Included
Y1	Hoary bat	03-Jul-19	WTG-66	28-day	59	92	Intact-partial decomposed	Included
Y1	Hoary bat	23-Jul-19	WTG-67	7-day	69	30	Intact-partial decomposed	Included
Y1	Hoary bat	24-Jul-19	WTG-49	28-day	78	21	Intact-partial decomposed	Included
Y1	Hoary bat	24-Jul-19	WTG-59	7-day	76	354	Scavenged-partial decomposed	Included
Y1	Hoary bat	25-Jul-19	WTG-51	7-day	64	75	Intact-partial decomposed	Included
Y1	Hoary bat	31-Jul-19	WTG-55	28-day	34	330	Intact-partial decomposed	Excluded: GE nesting closure
Y1	Hoary bat	14-Aug-19	WTG-59	7-day	59	71	Intact-partial decomposed	Included
Y1	Hoary bat	15-Aug-19	WTG-51	7-day	91	2	Intact-fresh	Included
Y1	Hoary bat	20-Aug-19	WTG-60	7-day	99	163	Intact-fresh	Included

Project Year	Species	Date	Turbine[1]	Survey Type	Distance From Turbine (m)	Bearing From Turbine (°)	Carcass Condition	Included to Estimate Adjusted Fatalities?[2]
Y1	Hoary bat	20-Aug-19	WTG-64	7-day	74	60	Scavenged-partial decomposed	Included
Y1	Hoary bat	21-Aug-19	WTG-49	28-day	41	30	Intact-fresh	Included
Y1	Hoary bat	21-Aug-19	WTG-49	28-day	102	33	Intact-partial decomposed	Included
Y1	Hoary bat	23-Aug-19	WTG-58	28-day	73	24	Intact-partial decomposed	Excluded: GE nesting closure
Y1	Hoary bat	27-Aug-19	WTG-64	7-day	108	27	Intact-partial decomposed	Included
Y1	Hoary bat	27-Aug-19	WTG-64	Incidental	120	45	Scavenged-partial decomposed	Excluded: off plot
Y1	Hoary bat	28-Aug-19	WTG-66	28-day	83	60	Intact-partial decomposed	Included
Y1	Hoary bat	28-Aug-19	WTG-66	28-day	107	112	Intact-partial decomposed	Included
Y1	Hoary bat	29-Aug-19	WTG-56	7-day	71	65	Intact-fresh	Included
Y1	Hoary bat	03-Sep-19	WTG-61	7-day	91	31	Scavenged-partial decomposed	Included
Y1	Hoary bat	10-Sep-19	WTG-60	7-day	26	24	Scavenged-partial decomposed	Included
Y1	Hoary bat	10-Sep-19	WTG-64	7-day	50	92	Intact-partial decomposed	Included
Y1	Hoary bat	10-Sep-19	WTG-67	7-day	51	3	Intact-partial decomposed	Included
Y1	Hoary bat	11-Sep-19	WTG-68	7-day	26	125	Scavenged-decomposed	Included
Y1	Hoary bat	12-Sep-19	WTG-50	7-day	50	33	Scavenged-partial decomposed	Included
Y1	Hoary bat	17-Sep-19	WTG-67	7-day	115	52	Scavenged-partial decomposed	Included
Y1	Hoary bat	19-Sep-19	WTG-51	Incidental	130	66	Intact-partial decomposed	Excluded: off plot
Y1	Hoary bat	25-Sep-19	WTG-66	28-day	21	10	Scavenged-partial decomposed	Included
Y1	Hoary bat	25-Sep-19	WTG-68	7-day	111	77	Scavenged-partial decomposed	Included
Y1	Hoary bat	01-Oct-19	WTG-67	7-day	73	186	Scavenged-partial decomposed	Included
Y1	Mexican free-tailed bat	08-Oct-18	WTG-60	7-day	48	78	Scavenged-decomposed	Excluded: predates survey
Y1	Mexican free-tailed bat	08-Oct-18	WTG-61	7-day	10	25	Intact-partial decomposed	Included
Y1	Mexican free-tailed bat	08-Oct-18	WTG-61	7-day	14	13	Intact-partial decomposed	Included
Y1	Mexican free-tailed bat	08-Oct-18	WTG-61	7-day	38	301	Intact-partial decomposed	Excluded: predates survey
Y1	Mexican free-tailed bat	08-Oct-18	WTG-64	7-day	98	7	Intact-partial decomposed	Excluded: predates survey
Y1	Mexican free-tailed bat	08-Oct-18	WTG-64	7-day	110	54	Intact-partial decomposed	Included
Y1	Mexican free-tailed bat	09-Oct-18	WTG-67	7-day	50	40	Intact-fresh	Included
Y1	Mexican free-tailed bat	09-Oct-18	WTG-67	7-day	50	120	Intact-partial decomposed	Excluded: predates survey
Y1	Mexican free-tailed bat	09-Oct-18	WTG-67	7-day	56	105	Intact-partial decomposed	Excluded: predates survey
Y1	Mexican free-tailed bat	10-Oct-18	WTG-52	28-day	34	338	Dismembered-fresh	Excluded: GE nesting closure
Y1	Mexican free-tailed bat	10-Oct-18	WTG-52	28-day	53	32	Scavenged-fresh	Excluded: GE nesting closure
Y1	Mexican free-tailed bat	10-Oct-18	WTG-52	28-day	58	64	Intact-partial decomposed	Excluded: GE nesting closure

Project Year	Species	Date	Turbine[1]	Survey Type	Distance From Turbine (m)	Bearing From Turbine (°)	Carcass Condition	Included to Estimate Adjusted Fatalities?[2]
Y1	Mexican free-tailed bat	10-Oct-18	WTG-52	28-day	94	65	Intact-partial decomposed	Excluded: GE nesting closure
Y1	Mexican free-tailed bat	10-Oct-18	WTG-59	7-day	27	87	Scavenged-partial decomposed	Excluded: predates survey
Y1	Mexican free-tailed bat	10-Oct-18	WTG-59	7-day	83	70	Scavenged-partial decomposed	Included
Y1	Mexican free-tailed bat	10-Oct-18	WTG-59	7-day	109	6	Scavenged-partial decomposed	Included
Y1	Mexican free-tailed bat	10-Oct-18	WTG-59	7-day	109	22	Scavenged-partial decomposed	Excluded: predates survey
Y1	Mexican free-tailed bat	11-Oct-18	WTG-54	7-day	107	61	Scavenged-fresh	Included
Y1	Mexican free-tailed bat	15-Oct-18	WTG-60	7-day	46	87	Intact-fresh	Included
Y1	Mexican free-tailed bat	15-Oct-18	WTG-60	7-day	66	75	Intact-decomposed	Excluded: predates survey
Y1	Mexican free-tailed bat	15-Oct-18	WTG-61	7-day	38	75	Intact-fresh	Included
Y1	Mexican free-tailed bat	16-Oct-18	WTG-64	7-day	81	21	Scavenged-decomposed	Excluded: predates survey
Y1	Mexican free-tailed bat	16-Oct-18	WTG-67	7-day	39	62	Intact-partial decomposed	Excluded: predates survey
Y1	Mexican free-tailed bat	17-Oct-18	WTG-59	7-day	90	50	Intact-partial decomposed	Excluded: predates survey
Y1	Mexican free-tailed bat	17-Oct-18	WTG-59	7-day	90	66	Intact-partial decomposed	Excluded: predates survey
Y1	Mexican free-tailed bat	17-Oct-18	WTG-59	7-day	110	46	Intact-partial decomposed	Included
Y1	Mexican free-tailed bat	18-Oct-18	WTG-50	Incidental	126	34	Scavenged-partial decomposed	Excluded: off plot
Y1	Mexican free-tailed bat	18-Oct-18	WTG-54	7-day	6	357	Intact-fresh	Included
Y1	Mexican free-tailed bat	24-Oct-18	WTG-59	7-day	36	77	Scavenged-fresh	Included
Y1	Mexican free-tailed bat	24-Oct-18	WTG-59	Incidental	128	32	Intact-fresh	Excluded: off plot
Y1	Mexican free-tailed bat	24-Oct-18	WTG-59	Incidental	138	64	Alive-injured	Excluded: off plot
Y1	Mexican free-tailed bat	25-Oct-18	WTG-58	28-day	16	81	Scavenged-fresh	Excluded: GE nesting closure
Y1	Mexican free-tailed bat	25-Oct-18	WTG-58	28-day	70	10	Scavenged-partial decomposed	Excluded: GE nesting closure
Y1	Mexican free-tailed bat	30-Oct-18	WTG-67	7-day	58	113	Scavenged-decomposed	Excluded: predates survey
Y1	Mexican free-tailed bat	31-Oct-18	WTG-53	28-day	25	140	Intact-partial decomposed	Excluded: GE nesting closure
Y1	Mexican free-tailed bat	31-Oct-18	WTG-53	28-day	65	5	Intact-decomposed	Excluded: predates survey
Y1	Mexican free-tailed bat	01-Nov-18	WTG-54	7-day	66	105	Scavenged-decomposed	Excluded: predates survey
Y1	Mexican free-tailed bat	06-Nov-18	WTG-60	7-day	16	350	Scavenged-partial decomposed	Excluded: predates survey
Y1	Mexican free-tailed bat	06-Nov-18	WTG-61	7-day	33	287	Intact-partial decomposed	Included
Y1	Mexican free-tailed bat	07-Nov-18	WTG-59	7-day	47	36	Scavenged-partial decomposed	Excluded: predates survey
Y1	Mexican free-tailed bat	07-Nov-18	WTG-59	7-day	75	68	Intact-partial decomposed	Excluded: predates survey
Y1	Mexican free-tailed bat	20-Nov-18	WTG-62	28-day	89	352	Scavenged-partial decomposed	Included
Y1	Mexican free-tailed bat	12-Dec-18	WTG-68	7-day	3	2	Intact-fresh	Included
Y1	Mexican free-tailed bat	10-Jan-19	WTG-56	7-day	26	67	Intact-fresh	Included

Project Year	Species	Date	Turbine[1]	Survey Type	Distance From Turbine (m)	Bearing From Turbine (°)	Carcass Condition	Included to Estimate Adjusted Fatalities?[2]
Y1	Mexican free-tailed bat	11-Apr-19	WTG-50	7-day	79	205	Intact-partial decomposed	Included
Y1	Mexican free-tailed bat	16-Apr-19	WTG-61	7-day	60	27	Intact-fresh	Included
Y1	Mexican free-tailed bat	16-Apr-19	WTG-61	7-day	75	6	Intact-partial decomposed	Included
Y1	Mexican free-tailed bat	17-Apr-19	WTG-59	7-day	25	8	Scavenged-partial decomposed	Included
Y1	Mexican free-tailed bat	17-Apr-19	WTG-59	7-day	72	26	Intact-partial decomposed	Included
Y1	Mexican free-tailed bat	23-Apr-19	WTG-60	7-day	71	55	Intact-partial decomposed	Included
Y1	Mexican free-tailed bat	23-Apr-19	WTG-61	7-day	75	42	Scavenged-partial decomposed	Included
Y1	Mexican free-tailed bat	24-Apr-19	WTG-59	7-day	80	26	Intact-fresh	Included
Y1	Mexican free-tailed bat	30-Apr-19	WTG-60	7-day	75	11	Intact-partial decomposed	Included
Y1	Mexican free-tailed bat	30-Apr-19	WTG-60	7-day	100	52	Intact-partial decomposed	Included
Y1	Mexican free-tailed bat	30-Apr-19	WTG-60	7-day	100	60	Intact-partial decomposed	Included
Y1	Mexican free-tailed bat	30-Apr-19	WTG-64	7-day	50	25	Scavenged-partial decomposed	Included
Y1	Mexican free-tailed bat	30-Apr-19	WTG-64	7-day	100	28	Intact-partial decomposed	Included
Y1	Mexican free-tailed bat	30-Apr-19	WTG-64	7-day	110	2	Scavenged-partial decomposed	Included
Y1	Mexican free-tailed bat	01-May-19	WTG-59	7-day	67	70	Scavenged-partial decomposed	Included
Y1	Mexican free-tailed bat	01-May-19	WTG-59	7-day	100	37	Intact-fresh	Included
Y1	Mexican free-tailed bat	01-May-19	WTG-59	Incidental	120	21	Intact-partial decomposed	Excluded: off plot
Y1	Mexican free-tailed bat	01-May-19	WTG-59	Incidental	120	24	Scavenged-partial decomposed	Excluded: off plot
Y1	Mexican free-tailed bat	01-May-19	WTG-59	Incidental	130	54	Scavenged-partial decomposed	Excluded: off plot
Y1	Mexican free-tailed bat	02-May-19	WTG-54	7-day	50	52	Scavenged-partial decomposed	Included
Y1	Mexican free-tailed bat	03-May-19	WTG-49	28-day	14	30	Scavenged-partial decomposed	Included
Y1	Mexican free-tailed bat	03-May-19	WTG-57	28-day	53	116	Intact-partial decomposed	Included
Y1	Mexican free-tailed bat	03-May-19	WTG-57	28-day	65	8	Intact-partial decomposed	Included
Y1	Mexican free-tailed bat	03-May-19	WTG-57	28-day	74	37	Intact-partial decomposed	Included
Y1	Mexican free-tailed bat	03-May-19	WTG-57	28-day	74	84	Scavenged-partial decomposed	Included
Y1	Mexican free-tailed bat	07-May-19	WTG-60	7-day	60	14	Scavenged-partial decomposed	Included
Y1	Mexican free-tailed bat	07-May-19	WTG-60	7-day	60	85	Intact-partial decomposed	Included
Y1	Mexican free-tailed bat	07-May-19	WTG-61	7-day	83	65	Intact-partial decomposed	Included
Y1	Mexican free-tailed bat	07-May-19	WTG-64	7-day	58	347	Intact-partial decomposed	Included
Y1	Mexican free-tailed bat	08-May-19	WTG-59	7-day	75	67	Intact-partial decomposed	Included
Y1	Mexican free-tailed bat	08-May-19	WTG-59	7-day	78	62	Intact-partial decomposed	Included
Y1	Mexican free-tailed bat	08-May-19	WTG-59	7-day	86	62	Intact-partial decomposed	Included

Project Year	Species	Date	Turbine[1]	Survey Type	Distance From Turbine (m)	Bearing From Turbine (°)	Carcass Condition	Included to Estimate Adjusted Fatalities?[2]
Y1	Mexican free-tailed bat	08-May-19	WTG-66	28-day	55	142	Scavenged-partial decomposed	Included
Y1	Mexican free-tailed bat	09-May-19	WTG-50	7-day	43	358	Intact-fresh	Included
Y1	Mexican free-tailed bat	09-May-19	WTG-54	7-day	94	357	Intact-partial decomposed	Included
Y1	Mexican free-tailed bat	09-May-19	WTG-54	7-day	104	3	Intact-partial decomposed	Included
Y1	Mexican free-tailed bat	09-May-19	WTG-56	7-day	110	60	Intact-partial decomposed	Included
Y1	Mexican free-tailed bat	09-May-19	WTG-56	Incidental	119	40	Scavenged-partial decomposed	Excluded: off plot
Y1	Mexican free-tailed bat	14-May-19	WTG-60	7-day	87	26	Intact-partial decomposed	Included
Y1	Mexican free-tailed bat	14-May-19	WTG-61	7-day	114	55	Scavenged-partial decomposed	Included
Y1	Mexican free-tailed bat	16-May-19	WTG-54	7-day	114	38	Scavenged-partial decomposed	Included
Y1	Mexican free-tailed bat	21-May-19	WTG-67	7-day	114	183	Scavenged-partial decomposed	Included
Y1	Mexican free-tailed bat	22-May-19	WTG-63	28-day	70	60	Scavenged-partial decomposed	Included
Y1	Mexican free-tailed bat	23-May-19	WTG-51	7-day	37	294	Scavenged-partial decomposed	Included
Y1	Mexican free-tailed bat	30-May-19	WTG-57	28-day	85	38	Scavenged-decomposed	Included
Y1	Mexican free-tailed bat	30-May-19	WTG-57	28-day	85	50	Intact-partial decomposed	Included
Y1	Mexican free-tailed bat	30-May-19	WTG-59	7-day	94	70	Scavenged-decomposed	Included
Y1	Mexican free-tailed bat	31-May-19	WTG-49	28-day	41	90	Intact-partial decomposed	Included
Y1	Mexican free-tailed bat	31-May-19	WTG-49	28-day	50	54	Intact-partial decomposed	Included
Y1	Mexican free-tailed bat	31-May-19	WTG-49	28-day	67	68	Intact-partial decomposed	Included
Y1	Mexican free-tailed bat	31-May-19	WTG-54	7-day	76	21	Intact-partial decomposed	Included
Y1	Mexican free-tailed bat	31-May-19	WTG-56	7-day	78	240	Intact-partial decomposed	Included
Y1	Mexican free-tailed bat	04-Jun-19	WTG-60	7-day	35	22	Scavenged-partial decomposed	Included
Y1	Mexican free-tailed bat	04-Jun-19	WTG-60	7-day	55	56	Scavenged-partial decomposed	Included
Y1	Mexican free-tailed bat	04-Jun-19	WTG-60	7-day	111	25	Scavenged-partial decomposed	Included
Y1	Mexican free-tailed bat	04-Jun-19	WTG-60	Incidental	132	38	Scavenged-partial decomposed	Excluded: off plot
Y1	Mexican free-tailed bat	04-Jun-19	WTG-61	7-day	102	46	Scavenged-fresh	Included
Y1	Mexican free-tailed bat	04-Jun-19	WTG-61	7-day	114	33	Scavenged-fresh	Included
Y1	Mexican free-tailed bat	04-Jun-19	WTG-67	7-day	40	99	Scavenged-partial decomposed	Included
Y1	Mexican free-tailed bat	04-Jun-19	WTG-67	7-day	99	51	Scavenged-partial decomposed	Included
Y1	Mexican free-tailed bat	05-Jun-19	WTG-59	7-day	74	64	Scavenged-partial decomposed	Included
Y1	Mexican free-tailed bat	05-Jun-19	WTG-59	7-day	100	80	Scavenged-fresh	Included
Y1	Mexican free-tailed bat	05-Jun-19	WTG-59	7-day	104	38	Intact-partial decomposed	Included
Y1	Mexican free-tailed bat	05-Jun-19	WTG-59	7-day	114	50	Scavenged-partial decomposed	Included

Project Year	Species	Date	Turbine[1]	Survey Type	Distance From Turbine (m)	Bearing From Turbine (°)	Carcass Condition	Included to Estimate Adjusted Fatalities?[2]
Y1	Mexican free-tailed bat	05-Jun-19	WTG-59	Incidental	132	62	Scavenged-partial decomposed	Excluded: off plot
Y1	Mexican free-tailed bat	06-Jun-19	WTG-54	7-day	54	76	Intact-partial decomposed	Included
Y1	Mexican free-tailed bat	06-Jun-19	WTG-54	7-day	99	22	Intact-decomposed	Included
Y1	Mexican free-tailed bat	06-Jun-19	WTG-54	7-day	114	3	Intact-partial decomposed	Included
Y1	Mexican free-tailed bat	06-Jun-19	WTG-54	Incidental	118	29	Scavenged-partial decomposed	Excluded: off plot
Y1	Mexican free-tailed bat	06-Jun-19	WTG-56	7-day	56	41	Intact-partial decomposed	Included
Y1	Mexican free-tailed bat	06-Jun-19	WTG-56	7-day	57	59	Scavenged-partial decomposed	Included
Y1	Mexican free-tailed bat	06-Jun-19	WTG-56	7-day	106	44	Intact-partial decomposed	Included
Y1	Mexican free-tailed bat	12-Jun-19	WTG-59	7-day	53	347	Scavenged-partial decomposed	Included
Y1	Mexican free-tailed bat	12-Jun-19	WTG-59	7-day	99	56	Scavenged-partial decomposed	Included
Y1	Mexican free-tailed bat	12-Jun-19	WTG-59	7-day	111	69	Scavenged-partial decomposed	Included
Y1	Mexican free-tailed bat	18-Jun-19	WTG-60	7-day	103	–	Intact-fresh	Included
Y1	Mexican free-tailed bat	20-Jun-19	WTG-54	7-day	98	13	Scavenged-partial decomposed	Included
Y1	Mexican free-tailed bat	20-Jun-19	WTG-54	7-day	99	33	Intact-fresh	Included
Y1	Mexican free-tailed bat	20-Jun-19	WTG-54	7-day	106	40	Scavenged-partial decomposed	Included
Y1	Mexican free-tailed bat	20-Jun-19	WTG-56	7-day	52	30	Scavenged-partial decomposed	Included
Y1	Mexican free-tailed bat	20-Jun-19	WTG-56	Incidental	122	50	Intact-partial decomposed	Excluded: off plot
Y1	Mexican free-tailed bat	25-Jun-19	WTG-67	7-day	38	90	Intact-partial decomposed	Included
Y1	Mexican free-tailed bat	26-Jun-19	WTG-49	28-day	90	50	Intact-fresh	Included
Y1	Mexican free-tailed bat	26-Jun-19	WTG-49	Incidental	122	50	Scavenged-partial decomposed	Excluded: off plot
Y1	Mexican free-tailed bat	27-Jun-19	WTG-51	7-day	71	35	Intact-partial decomposed	Included
Y1	Mexican free-tailed bat	27-Jun-19	WTG-54	7-day	107	30	Scavenged-partial decomposed	Included
Y1	Mexican free-tailed bat	27-Jun-19	WTG-54	7-day	108	30	Scavenged-partial decomposed	Included
Y1	Mexican free-tailed bat	04-Jul-19	WTG-54	7-day	98	15	Scavenged-decomposed	Included
Y1	Mexican free-tailed bat	04-Jul-19	WTG-54	Incidental	126	40	Intact-partial decomposed	Excluded: off plot
Y1	Mexican free-tailed bat	04-Jul-19	WTG-56	7-day	55	350	Intact-partial decomposed	Included
Y1	Mexican free-tailed bat	10-Jul-19	WTG-59	7-day	100	37	Intact-partial decomposed	Included
Y1	Mexican free-tailed bat	10-Jul-19	WTG-59	7-day	114	84	Scavenged-partial decomposed	Included
Y1	Mexican free-tailed bat	11-Jul-19	WTG-50	7-day	30	220	Scavenged-partial decomposed	Included
Y1	Mexican free-tailed bat	11-Jul-19	WTG-51	7-day	92	40	Intact-partial decomposed	Included
Y1	Mexican free-tailed bat	11-Jul-19	WTG-54	7-day	74	55	Scavenged-partial decomposed	Included
Y1	Mexican free-tailed bat	11-Jul-19	WTG-56	7-day	107	60	Intact-partial decomposed	Included

Project Year	Species	Date	Turbine[1]	Survey Type	Distance From Turbine (m)	Bearing From Turbine (°)	Carcass Condition	Included to Estimate Adjusted Fatalities?[2]
Y1	Mexican free-tailed bat	11-Jul-19	WTG-56	Incidental	126	46	Intact-partial decomposed	Excluded: off plot
Y1	Mexican free-tailed bat	16-Jul-19	WTG-64	7-day	41	2	Intact-partial decomposed	Included
Y1	Mexican free-tailed bat	17-Jul-19	WTG-59	Incidental	131	50	Intact-partial decomposed	Excluded: off plot
Y1	Mexican free-tailed bat	18-Jul-19	WTG-54	7-day	99	48	Intact-partial decomposed	Included
Y1	Mexican free-tailed bat	18-Jul-19	WTG-54	Incidental	134	30	Intact-partial decomposed	Excluded: off plot
Y1	Mexican free-tailed bat	18-Jul-19	WTG-56	7-day	60	180	Scavenged-partial decomposed	Included
Y1	Mexican free-tailed bat	24-Jul-19	WTG-62	28-day	97	6	Intact-partial decomposed	Included
Y1	Mexican free-tailed bat	25-Jul-19	WTG-56	7-day	50	330	Intact-partial decomposed	Included
Y1	Mexican free-tailed bat	25-Jul-19	WTG-56	7-day	97	39	Intact-partial decomposed	Included
Y1	Mexican free-tailed bat	25-Jul-19	WTG-56	7-day	100	40	Intact-partial decomposed	Included
Y1	Mexican free-tailed bat	25-Jul-19	WTG-56	7-day	108	15	Dismembered-partial decomposed	Included
Y1	Mexican free-tailed bat	25-Jul-19	WTG-56	Incidental	126	4	Intact-partial decomposed	Excluded: off plot
Y1	Mexican free-tailed bat	26-Jul-19	WTG-57	28-day	64	39	Intact-partial decomposed	Included
Y1	Mexican free-tailed bat	01-Aug-19	WTG-51	Incidental	135	35	Scavenged-partial decomposed	Excluded: off plot
Y1	Mexican free-tailed bat	06-Aug-19	WTG-64	Incidental	125	30	Intact-fresh	Excluded: off plot
Y1	Mexican free-tailed bat	06-Aug-19	WTG-67	7-day	42	90	Intact-partial decomposed	Included
Y1	Mexican free-tailed bat	07-Aug-19	WTG-53	28-day	20	195	Dismembered-decomposed	Excluded: GE nesting closure
Y1	Mexican free-tailed bat	07-Aug-19	WTG-59	Incidental	137	54	Scavenged-partial decomposed	Excluded: off plot
Y1	Mexican free-tailed bat	07-Aug-19	WTG-59	Incidental	148	55	Intact-decomposed	Excluded: off plot
Y1	Mexican free-tailed bat	08-Aug-19	WTG-50	Incidental	125	58	Intact-partial decomposed	Excluded: off plot
Y1	Mexican free-tailed bat	08-Aug-19	WTG-54	7-day	96	32	Intact-fresh	Included
Y1	Mexican free-tailed bat	08-Aug-19	WTG-54	7-day	115	71	Intact-partial decomposed	Included
Y1	Mexican free-tailed bat	08-Aug-19	WTG-54	Incidental	130	21	Intact-fresh	Excluded: off plot
Y1	Mexican free-tailed bat	08-Aug-19	WTG-56	7-day	62	50	Intact-partial decomposed	Included
Y1	Mexican free-tailed bat	14-Aug-19	WTG-52	28-day	68	37	Intact-partial decomposed	Excluded: GE nesting closure
Y1	Mexican free-tailed bat	14-Aug-19	WTG-63	Incidental	119	38	Intact-partial decomposed	Excluded: off plot
Y1	Mexican free-tailed bat	15-Aug-19	WTG-51	7-day	104	40	Intact-fresh	Included
Y1	Mexican free-tailed bat	22-Aug-19	WTG-51	7-day	67	49	Intact-partial decomposed	Included
Y1	Mexican free-tailed bat	22-Aug-19	WTG-51	7-day	103	45	Scavenged-partial decomposed	Included
Y1	Mexican free-tailed bat	23-Aug-19	WTG-57	28-day	57	83	Intact-partial decomposed	Included
Y1	Mexican free-tailed bat	23-Aug-19	WTG-57	28-day	60	70	Intact-partial decomposed	Included
Y1	Mexican free-tailed bat	23-Aug-19	WTG-58	28-day	76	24	Scavenged-partial decomposed	Excluded: GE nesting closure

Project Year	Species	Date	Turbine[1]	Survey Type	Distance From Turbine (m)	Bearing From Turbine (°)	Carcass Condition	Included to Estimate Adjusted Fatalities?[2]
Y1	Mexican free-tailed bat	23-Aug-19	WTG-58	28-day	100	65	Scavenged-partial decomposed	Excluded: GE nesting closure
Y1	Mexican free-tailed bat	27-Aug-19	WTG-60	7-day	55	100	Intact-partial decomposed	Included
Y1	Mexican free-tailed bat	27-Aug-19	WTG-61	7-day	94	60	Intact-partial decomposed	Included
Y1	Mexican free-tailed bat	27-Aug-19	WTG-61	Incidental	134	70	Intact-partial decomposed	Excluded: off plot
Y1	Mexican free-tailed bat	28-Aug-19	WTG-59	7-day	113	81	Intact-partial decomposed	Included
Y1	Mexican free-tailed bat	28-Aug-19	WTG-59	Incidental	129	50	Intact-partial decomposed	Excluded: off plot
Y1	Mexican free-tailed bat	28-Aug-19	WTG-66	28-day	59	54	Intact-partial decomposed	Included
Y1	Mexican free-tailed bat	28-Aug-19	WTG-66	28-day	105	55	Intact-partial decomposed	Included
Y1	Mexican free-tailed bat	29-Aug-19	WTG-56	7-day	113	22	Dismembered-fresh	Included
Y1	Mexican free-tailed bat	29-Aug-19	WTG-56	7-day	114	31	Intact-partial decomposed	Included
Y1	Mexican free-tailed bat	03-Sep-19	WTG-60	7-day	102	25	Intact-partial decomposed	Included
Y1	Mexican free-tailed bat	03-Sep-19	WTG-60	7-day	115	59	Intact-partial decomposed	Included
Y1	Mexican free-tailed bat	03-Sep-19	WTG-64	7-day	73	42	Scavenged-partial decomposed	Included
Y1	Mexican free-tailed bat	03-Sep-19	WTG-67	7-day	104	57	Intact-partial decomposed	Included
Y1	Mexican free-tailed bat	04-Sep-19	WTG-53	28-day	78	24	Intact-partial decomposed	Excluded: GE nesting closure
Y1	Mexican free-tailed bat	04-Sep-19	WTG-59	7-day	84	67	Scavenged-partial decomposed	Included
Y1	Mexican free-tailed bat	05-Sep-19	WTG-51	7-day	74	62	Intact-partial decomposed	Included
Y1	Mexican free-tailed bat	05-Sep-19	WTG-51	Incidental	123	71	Scavenged-partial decomposed	Excluded: off plot
Y1	Mexican free-tailed bat	05-Sep-19	WTG-54	7-day	47	15	Intact-partial decomposed	Included
Y1	Mexican free-tailed bat	05-Sep-19	WTG-54	7-day	87	24	Intact-fresh	Included
Y1	Mexican free-tailed bat	05-Sep-19	WTG-54	Incidental	119	52	Intact-partial decomposed	Excluded: off plot
Y1	Mexican free-tailed bat	10-Sep-19	WTG-60	7-day	50	16	Intact-fresh	Included
Y1	Mexican free-tailed bat	10-Sep-19	WTG-61	7-day	111	52	Intact-partial decomposed	Included
Y1	Mexican free-tailed bat	12-Sep-19	WTG-54	7-day	23	57	Scavenged-fresh	Included
Y1	Mexican free-tailed bat	12-Sep-19	WTG-56	7-day	93	6	Scavenged-partial decomposed	Included
Y1	Mexican free-tailed bat	17-Sep-19	WTG-60	7-day	40	104	Intact-fresh	Included
Y1	Mexican free-tailed bat	17-Sep-19	WTG-60	7-day	60	4	Intact-partial decomposed	Included
Y1	Mexican free-tailed bat	17-Sep-19	WTG-61	7-day	19	170	Scavenged-partial decomposed	Included
Y1	Mexican free-tailed bat	17-Sep-19	WTG-61	7-day	30	109	Intact-partial decomposed	Included
Y1	Mexican free-tailed bat	17-Sep-19	WTG-61	7-day	64	31	Scavenged-partial decomposed	Included
Y1	Mexican free-tailed bat	17-Sep-19	WTG-61	Incidental	131	45	Scavenged-partial decomposed	Excluded: off plot
Y1	Mexican free-tailed bat	17-Sep-19	WTG-61	Incidental	139	54	Intact-partial decomposed	Excluded: off plot

Project Year	Species	Date	Turbine[1]	Survey Type	Distance From Turbine (m)	Bearing From Turbine (°)	Carcass Condition	Included to Estimate Adjusted Fatalities?[2]
Y1	Mexican free-tailed bat	17-Sep-19	WTG-64	7-day	1	10	Scavenged-partial decomposed	Included
Y1	Mexican free-tailed bat	17-Sep-19	WTG-67	7-day	16	47	Scavenged-partial decomposed	Included
Y1	Mexican free-tailed bat	17-Sep-19	WTG-67	7-day	35	113	Scavenged-partial decomposed	Included
Y1	Mexican free-tailed bat	17-Sep-19	WTG-67	7-day	35	355	Scavenged-partial decomposed	Included
Y1	Mexican free-tailed bat	18-Sep-19	WTG-49	28-day	9	309	Intact-partial decomposed	Included
Y1	Mexican free-tailed bat	18-Sep-19	WTG-59	7-day	103	78	Intact-partial decomposed	Included
Y1	Mexican free-tailed bat	18-Sep-19	WTG-68	7-day	69	77	Scavenged-partial decomposed	Included
Y1	Mexican free-tailed bat	19-Sep-19	WTG-51	7-day	43	28	Intact-fresh	Included
Y1	Mexican free-tailed bat	19-Sep-19	WTG-51	7-day	53	330	Intact-partial decomposed	Included
Y1	Mexican free-tailed bat	19-Sep-19	WTG-54	7-day	47	46	Scavenged-partial decomposed	Included
Y1	Mexican free-tailed bat	20-Sep-19	WTG-57	28-day	8	280	Intact-fresh	Included
Y1	Mexican free-tailed bat	20-Sep-19	WTG-57	28-day	47	117	Intact-fresh	Included
Y1	Mexican free-tailed bat	20-Sep-19	WTG-57	28-day	77	13	Scavenged-partial decomposed	Included
Y1	Mexican free-tailed bat	20-Sep-19	WTG-58	28-day	111	80	Intact-partial decomposed	Excluded: GE nesting closure
Y1	Mexican free-tailed bat	24-Sep-19	WTG-61	7-day	92	82	Intact-fresh	Included
Y1	Mexican free-tailed bat	24-Sep-19	WTG-67	7-day	19	85	Intact-fresh	Included
Y1	Mexican free-tailed bat	25-Sep-19	WTG-59	7-day	1	270	Alive-injured	Included
Y1	Mexican free-tailed bat	25-Sep-19	WTG-59	7-day	24	89	Scavenged-partial decomposed	Included
Y1	Mexican free-tailed bat	26-Sep-19	WTG-50	7-day	27	14	Scavenged-fresh	Included
Y1	Mexican free-tailed bat	26-Sep-19	WTG-54	7-day	44	50	Intact-fresh	Included
Y1	Mexican free-tailed bat	26-Sep-19	WTG-56	7-day	108	70	Intact-partial decomposed	Included
Y1	Mexican free-tailed bat	01-Oct-19	WTG-61	7-day	24	104	Intact-partial decomposed	Included
Y1	Mexican free-tailed bat	01-Oct-19	WTG-61	7-day	66	15	Intact-partial decomposed	Included
Y1	Mexican free-tailed bat	01-Oct-19	WTG-67	7-day	16	215	Intact-partial decomposed	Included
Y1	Mexican free-tailed bat	02-Oct-19	WTG-53	28-day	34	151	Scavenged-partial decomposed	Excluded: GE nesting closure
Y1	Mexican free-tailed bat	02-Oct-19	WTG-53	28-day	39	213	Intact-partial decomposed	Excluded: GE nesting closure
Y1	Mexican free-tailed bat	02-Oct-19	WTG-59	7-day	105	55	Intact-fresh	Included
Y1	Mexican free-tailed bat	03-Oct-19	WTG-51	7-day	47	24	Intact-partial decomposed	Included
Y1	Silver-haired bat	16-Oct-18	WTG-64	7-day	43	76	Intact-fresh	Included
Y1	Western red bat	08-Oct-18	WTG-61	7-day	37	152	Intact-partial decomposed	Excluded: predates survey
Y1	Western red bat	08-May-19	WTG-68	7-day	40	74	Intact-partial decomposed	Included
Y1	Western red bat	13-Aug-19	WTG-64	7-day	60	41	Scavenged-partial decomposed	Included

Project Year	Species	Date	Turbine[1]	Survey Type	Distance From Turbine (m)	Bearing From Turbine (°)	Carcass Condition	Included to Estimate Adjusted Fatalities?[2]
Y1	Western red bat	27-Aug-19	WTG-64	7-day	112	40	Intact-partial decomposed	Included
Y1	Western red bat	03-Sep-19	WTG-67	7-day	72	344	Scavenged-fresh	Included
Y1	Western red bat	18-Sep-19	WTG-59	7-day	112	150	Intact-partial decomposed	Included
Y1	Western red bat	24-Sep-19	WTG-67	7-day	82	42	Intact-partial decomposed	Included
Y1	Unknown bat	10-Oct-18	WTG-56	7-day	80	48	Scavenged-partial decomposed	Excluded: predates survey
Y1	Unknown bat	11-Oct-18	WTG-54	7-day	52	340	Scavenged-partial decomposed	Excluded: predates survey
Y1	Unknown bat	15-Oct-18	WTG-61	7-day	58	320	Scavenged-decomposed	Excluded: predates survey
Y1	Unknown bat	16-Oct-18	WTG-62	28-day	25	70	Scavenged-partial decomposed	Excluded: predates survey
Y1	Unknown bat	16-Oct-18	WTG-62	28-day	33	322	Scavenged-partial decomposed	Excluded: predates survey
Y1	Unknown bat	17-Oct-18	WTG-56	7-day	18	110	Scavenged-partial decomposed	Excluded: predates survey
Y1	Unknown bat	17-Oct-18	WTG-59	7-day	31	50	Scavenged-partial decomposed	Excluded: predates survey
Y1	Unknown bat	17-Oct-18	WTG-59	7-day	111	52	Scavenged-partial decomposed	Included
Y1	Unknown bat	25-Oct-18	WTG-54	7-day	16	83	Scavenged-decomposed	Excluded: predates survey
Y1	Unknown bat	27-Nov-18	WTG-60	7-day	93	32	Scavenged-decomposed	Excluded: predates survey
Y1	Unknown bat	27-Nov-18	WTG-64	7-day	31	100	Scavenged-partial decomposed	Included
Y1	Unknown bat	18-Dec-18	WTG-67	7-day	5	54	Intact-fresh	Included
Y1	Unknown bat	14-Aug-19	WTG-63	28-day	54	17	Scavenged-partial decomposed	Included
Y1	Unknown bat	02-Oct-19	WTG-65	28-day	36	175	Scavenged-partial decomposed	Included
Y2	Hoary bat	22-Oct-19	WTG-58	7-day	48	331	Scavenged-partial decomposed	Excluded: GE nesting closure
Y2	Hoary bat	23-Oct-19	WTG-56	7-day	32	194	Dismembered-fresh	Included
Y2	Hoary bat	13-Nov-19	WTG-55	28-day	77	70	Scavenged-partial decomposed	Excluded: GE nesting closure
Y2	Hoary bat	24-Mar-20	WTG-54	7-day	16	308	Scavenged-fresh	Included
Y2	Hoary bat	16-Apr-20	WTG-59	7-day	53	357	Intact-partial decomposed	Included
Y2	Hoary bat	20-Apr-20	WTG-49	7-day	37	17	Intact-partial decomposed	Included
Y2	Hoary bat	23-Apr-20	WTG-68	7-day	83	82	Scavenged-partial decomposed	Included
Y2	Hoary bat	28-Apr-20	WTG-49	7-day	15	320	Scavenged-partial decomposed	Included
Y2	Hoary bat	28-Apr-20	WTG-51	7-day	25	93	Intact-partial decomposed	Included
Y2	Hoary bat	28-Apr-20	WTG-51	7-day	104	52	Intact-partial decomposed	Included
Y2	Hoary bat	05-May-20	WTG-65	28-day	64	106	Intact-partial decomposed	Included
Y2	Hoary bat	27-May-20	WTG-50	28-day	15	50	Scavenged-partial decomposed	Included
Y2	Hoary bat	29-May-20	WTG-64	28-day	57	80	Intact-partial decomposed	Included
Y2	Hoary bat	29-May-20	WTG-64	28-day	103	31	Intact-partial decomposed	Included

Project Year	Species	Date	Turbine[1]	Survey Type	Distance From Turbine (m)	Bearing From Turbine (°)	Carcass Condition	Included to Estimate Adjusted Fatalities?[2]
Y2	Hoary bat	02-Jun-20	WTG-54	7-day	50	41	Scavenged-partial decomposed	Included
Y2	Hoary bat	02-Jun-20	WTG-63	7-day	106	44	Intact-fresh	Included
Y2	Hoary bat	12-Jun-20	WTG-59	7-day	33	141	Scavenged-partial decomposed	Included
Y2	Hoary bat	16-Jun-20	WTG-51	7-day	89	54	Intact-partial decomposed	Included
Y2	Hoary bat	24-Jun-20	WTG-50	28-day	65	4	Intact-partial decomposed	Included
Y2	Hoary bat	01-Jul-20	WTG-65	28-day	82	34	Intact-fresh	Included
Y2	Hoary bat	08-Jul-20	WTG-56	7-day	81	49	Intact-fresh	Included
Y2	Hoary bat	08-Jul-20	WTG-67	28-day	98	30	Scavenged-partial decomposed	Included
Y2	Hoary bat	04-Aug-20	WTG-52	7-day	35	46	Intact-partial decomposed	Excluded: GE nesting closure
Y2	Hoary bat	11-Aug-20	WTG-51	7-day	94	45	Intact-partial decomposed	Included
Y2	Hoary bat	11-Aug-20	WTG-52	7-day	101	48	Intact-partial decomposed	Excluded: GE nesting closure
Y2	Hoary bat	11-Aug-20	WTG-58	7-day	82	70	Scavenged-partial decomposed	Excluded: GE nesting closure
Y2	Hoary bat	12-Aug-20	WTG-53	28-day	56	71	Intact-partial decomposed	Excluded: GE nesting closure
Y2	Hoary bat	12-Aug-20	WTG-57	28-day	66	41	Scavenged-partial decomposed	Included
Y2	Hoary bat	27-Aug-20	WTG-49	7-day	115	28	Intact-fresh	Included
Y2	Hoary bat	01-Sep-20	WTG-49	7-day	50	67	Scavenged-partial decomposed	Included
Y2	Hoary bat	01-Sep-20	WTG-52	7-day	50	49	Intact-partial decomposed	Excluded: GE nesting closure
Y2	Hoary bat	22-Sep-20	WTG-53	28-day	106	65	Scavenged-partial decomposed	Excluded: GE nesting closure
Y2	Hoary bat	24-Sep-20	WTG-57	28-day	55	11	Intact-fresh	Included
Y2	Mexican free-tailed bat	08-Oct-19	WTG-49	7-day	18	356	Intact-fresh	Included
Y2	Mexican free-tailed bat	08-Oct-19	WTG-49	7-day	109	38	Intact-partial decomposed	Included
Y2	Mexican free-tailed bat	08-Oct-19	WTG-52	7-day	35	21	Scavenged-partial decomposed	Excluded: GE nesting closure
Y2	Mexican free-tailed bat	08-Oct-19	WTG-58	7-day	13	72	Scavenged-partial decomposed	Excluded: GE nesting closure
Y2	Mexican free-tailed bat	08-Oct-19	WTG-58	7-day	47	1	Scavenged-partial decomposed	Excluded: GE nesting closure
Y2	Mexican free-tailed bat	08-Oct-19	WTG-65	Incidental	2	200	Intact-partial decomposed	Excluded: on plot incidental
Y2	Mexican free-tailed bat	09-Oct-19	WTG-53	28-day	49	358	Scavenged-partial decomposed	Excluded: GE nesting closure
Y2	Mexican free-tailed bat	09-Oct-19	WTG-57	28-day	64	11	Intact-fresh	Included
Y2	Mexican free-tailed bat	09-Oct-19	WTG-57	28-day	71	62	Scavenged-fresh	Included
Y2	Mexican free-tailed bat	09-Oct-19	WTG-57	28-day	79	51	Intact-fresh	Included
Y2	Mexican free-tailed bat	10-Oct-19	WTG-59	7-day	115	12	Intact-fresh	Included
Y2	Mexican free-tailed bat	15-Oct-19	WTG-49	7-day	26	301	Scavenged-partial decomposed	Included
Y2	Mexican free-tailed bat	15-Oct-19	WTG-58	7-day	94	17	Intact-fresh	Excluded: GE nesting closure

Project Year	Species	Date	Turbine[1]	Survey Type	Distance From Turbine (m)	Bearing From Turbine (°)	Carcass Condition	Included to Estimate Adjusted Fatalities?[2]
Y2	Mexican free-tailed bat	16-Oct-19	WTG-55	28-day	52	27	Intact-partial decomposed	Excluded: GE nesting closure
Y2	Mexican free-tailed bat	18-Oct-19	WTG-61	28-day	38	341	Intact-fresh	Included
Y2	Mexican free-tailed bat	24-Oct-19	WTG-63	7-day	115	50	Intact-partial decomposed	Included
Y2	Mexican free-tailed bat	31-Oct-19	WTG-63	7-day	102	190	Scavenged-fresh	Included
Y2	Mexican free-tailed bat	05-Nov-19	WTG-58	7-day	43	96	Scavenged-partial decomposed	Excluded: GE nesting closure
Y2	Mexican free-tailed bat	06-Nov-19	WTG-53	28-day	73	120	Scavenged-partial decomposed	Excluded: GE nesting closure
Y2	Mexican free-tailed bat	15-Nov-19	WTG-64	28-day	103	182	Scavenged-partial decomposed	Included
Y2	Mexican free-tailed bat	12-Feb-20	WTG-56	7-day	28	16	Intact-fresh	Included
Y2	Mexican free-tailed bat	04-Mar-20	WTG-56	7-day	20	214	Intact-fresh	Included
Y2	Mexican free-tailed bat	12-Mar-20	WTG-68	7-day	110	67	Intact-fresh	Included
Y2	Mexican free-tailed bat	24-Mar-20	WTG-54	7-day	90	11	Intact-fresh	Included
Y2	Mexican free-tailed bat	24-Mar-20	WTG-56	7-day	90	21	Intact-fresh	Included
Y2	Mexican free-tailed bat	24-Mar-20	WTG-56	7-day	113	22	Scavenged-partial decomposed	Included
Y2	Mexican free-tailed bat	24-Mar-20	WTG-59	7-day	1	297	Intact-fresh	Included
Y2	Mexican free-tailed bat	01-Apr-20	WTG-54	7-day	108	89	Intact-partial decomposed	Included
Y2	Mexican free-tailed bat	02-Apr-20	WTG-60	7-day	67	91	Intact-fresh	Included
Y2	Mexican free-tailed bat	03-Apr-20	WTG-64	28-day	59	80	Intact-fresh	Included
Y2	Mexican free-tailed bat	16-Apr-20	WTG-59	7-day	63	13	Intact-fresh	Included
Y2	Mexican free-tailed bat	16-Apr-20	WTG-59	7-day	70	80	Intact-fresh	Included
Y2	Mexican free-tailed bat	16-Apr-20	WTG-59	7-day	75	99	Scavenged-fresh	Included
Y2	Mexican free-tailed bat	16-Apr-20	WTG-59	7-day	97	88	Scavenged-fresh	Included
Y2	Mexican free-tailed bat	16-Apr-20	WTG-60	7-day	16	49	Intact-fresh	Included
Y2	Mexican free-tailed bat	16-Apr-20	WTG-60	7-day	112	71	Intact-fresh	Included
Y2	Mexican free-tailed bat	16-Apr-20	WTG-63	7-day	106	44	Intact-partial decomposed	Included
Y2	Mexican free-tailed bat	16-Apr-20	WTG-68	7-day	41	335	Scavenged-partial decomposed	Included
Y2	Mexican free-tailed bat	16-Apr-20	WTG-68	7-day	84	92	Scavenged-partial decomposed	Included
Y2	Mexican free-tailed bat	21-Apr-20	WTG-54	7-day	64	15	Intact-partial decomposed	Included
Y2	Mexican free-tailed bat	21-Apr-20	WTG-56	7-day	105	77	Scavenged-partial decomposed	Included
Y2	Mexican free-tailed bat	21-Apr-20	WTG-57	28-day	49	127	Intact-partial decomposed	Included
Y2	Mexican free-tailed bat	21-Apr-20	WTG-57	28-day	90	30	Intact-partial decomposed	Included
Y2	Mexican free-tailed bat	21-Apr-20	WTG-57	28-day	93	90	Intact-partial decomposed	Included
Y2	Mexican free-tailed bat	22-Apr-20	WTG-60	7-day	47	32	Intact-partial decomposed	Included

Project Year	Species	Date	Turbine[1]	Survey Type	Distance From Turbine (m)	Bearing From Turbine (°)	Carcass Condition	Included to Estimate Adjusted Fatalities?[2]
Y2	Mexican free-tailed bat	22-Apr-20	WTG-60	7-day	92	44	Scavenged-partial decomposed	Included
Y2	Mexican free-tailed bat	22-Apr-20	WTG-60	7-day	96	24	Scavenged-partial decomposed	Included
Y2	Mexican free-tailed bat	23-Apr-20	WTG-68	7-day	96	17	Scavenged-partial decomposed	Included
Y2	Mexican free-tailed bat	29-Apr-20	WTG-50	28-day	78	50	Intact-partial decomposed	Included
Y2	Mexican free-tailed bat	29-Apr-20	WTG-54	7-day	65	20	Intact-fresh	Included
Y2	Mexican free-tailed bat	29-Apr-20	WTG-54	7-day	81	38	Intact-partial decomposed	Included
Y2	Mexican free-tailed bat	29-Apr-20	WTG-54	7-day	84	83	Intact-fresh	Included
Y2	Mexican free-tailed bat	29-Apr-20	WTG-56	7-day	47	80	Intact-partial decomposed	Included
Y2	Mexican free-tailed bat	29-Apr-20	WTG-56	7-day	96	20	Intact-fresh	Included
Y2	Mexican free-tailed bat	30-Apr-20	WTG-59	7-day	80	70	Intact-partial decomposed	Included
Y2	Mexican free-tailed bat	30-Apr-20	WTG-60	7-day	35	92	Intact-partial decomposed	Included
Y2	Mexican free-tailed bat	01-May-20	WTG-61	28-day	56	84	Intact-partial decomposed	Included
Y2	Mexican free-tailed bat	05-May-20	WTG-56	7-day	69	80	Intact-fresh	Included
Y2	Mexican free-tailed bat	05-May-20	WTG-56	7-day	102	59	Intact-partial decomposed	Included
Y2	Mexican free-tailed bat	05-May-20	WTG-62	Incidental	121	40	Intact-partial decomposed	Excluded: off plot
Y2	Mexican free-tailed bat	06-May-20	WTG-59	7-day	66	95	Intact-partial decomposed	Included
Y2	Mexican free-tailed bat	06-May-20	WTG-60	Incidental	134	32	Intact-partial decomposed	Excluded: off plot
Y2	Mexican free-tailed bat	13-May-20	WTG-49	7-day	87	25	Intact-partial decomposed	Included
Y2	Mexican free-tailed bat	13-May-20	WTG-51	7-day	82	65	Intact-partial decomposed	Included
Y2	Mexican free-tailed bat	14-May-20	WTG-54	7-day	113	46	Scavenged-partial decomposed	Included
Y2	Mexican free-tailed bat	14-May-20	WTG-56	7-day	41	39	Intact-partial decomposed	Included
Y2	Mexican free-tailed bat	14-May-20	WTG-56	7-day	113	13	Intact-partial decomposed	Included
Y2	Mexican free-tailed bat	18-May-20	WTG-51	7-day	101	13	Intact-partial decomposed	Included
Y2	Mexican free-tailed bat	19-May-20	WTG-54	7-day	76	46	Scavenged-partial decomposed	Included
Y2	Mexican free-tailed bat	19-May-20	WTG-54	7-day	77	4	Intact-partial decomposed	Included
Y2	Mexican free-tailed bat	19-May-20	WTG-54	7-day	103	11	Intact-partial decomposed	Included
Y2	Mexican free-tailed bat	19-May-20	WTG-57	28-day	62	344	Intact-partial decomposed	Included
Y2	Mexican free-tailed bat	20-May-20	WTG-60	7-day	92	77	Intact-fresh	Included
Y2	Mexican free-tailed bat	20-May-20	WTG-60	7-day	114	72	Scavenged-partial decomposed	Included
Y2	Mexican free-tailed bat	26-May-20	WTG-49	7-day	72	40	Intact-fresh	Included
Y2	Mexican free-tailed bat	27-May-20	WTG-50	28-day	46	8	Scavenged-partial decomposed	Included
Y2	Mexican free-tailed bat	27-May-20	WTG-50	28-day	95	42	Scavenged-partial decomposed	Included

Project Year	Species	Date	Turbine[1]	Survey Type	Distance From Turbine (m)	Bearing From Turbine (°)	Carcass Condition	Included to Estimate Adjusted Fatalities?[2]
Y2	Mexican free-tailed bat	27-May-20	WTG-54	7-day	110	40	Scavenged-partial decomposed	Included
Y2	Mexican free-tailed bat	28-May-20	WTG-56	Incidental	118	43	Intact-partial decomposed	Excluded: off plot
Y2	Mexican free-tailed bat	28-May-20	WTG-59	7-day	50	70	Intact-partial decomposed	Included
Y2	Mexican free-tailed bat	28-May-20	WTG-59	7-day	87	19	Intact-partial decomposed	Included
Y2	Mexican free-tailed bat	28-May-20	WTG-59	7-day	110	52	Scavenged-partial decomposed	Included
Y2	Mexican free-tailed bat	28-May-20	WTG-60	7-day	74	70	Scavenged-partial decomposed	Included
Y2	Mexican free-tailed bat	29-May-20	WTG-61	28-day	70	55	Scavenged-partial decomposed	Included
Y2	Mexican free-tailed bat	02-Jun-20	WTG-56	7-day	83	39	Intact-partial decomposed	Included
Y2	Mexican free-tailed bat	02-Jun-20	WTG-56	7-day	98	79	Intact-partial decomposed	Included
Y2	Mexican free-tailed bat	03-Jun-20	WTG-60	7-day	56	62	Intact-fresh	Included
Y2	Mexican free-tailed bat	10-Jun-20	WTG-49	7-day	108	28	Intact-partial decomposed	Included
Y2	Mexican free-tailed bat	10-Jun-20	WTG-51	7-day	81	53	Intact-partial decomposed	Included
Y2	Mexican free-tailed bat	10-Jun-20	WTG-51	7-day	85	61	Intact-partial decomposed	Included
Y2	Mexican free-tailed bat	10-Jun-20	WTG-51	7-day	87	64	Intact-partial decomposed	Included
Y2	Mexican free-tailed bat	10-Jun-20	WTG-51	7-day	95	49	Scavenged-partial decomposed	Included
Y2	Mexican free-tailed bat	11-Jun-20	WTG-54	7-day	92	40	Intact-partial decomposed	Included
Y2	Mexican free-tailed bat	11-Jun-20	WTG-66	28-day	95	74	Scavenged-partial decomposed	Included
Y2	Mexican free-tailed bat	12-Jun-20	WTG-59	7-day	75	353	Scavenged-partial decomposed	Included
Y2	Mexican free-tailed bat	12-Jun-20	WTG-59	Incidental	122	34	Scavenged-partial decomposed	Excluded: off plot
Y2	Mexican free-tailed bat	12-Jun-20	WTG-60	7-day	64	43	Scavenged-partial decomposed	Included
Y2	Mexican free-tailed bat	12-Jun-20	WTG-60	7-day	110	28	Intact-partial decomposed	Included
Y2	Mexican free-tailed bat	16-Jun-20	WTG-51	7-day	82	62	Scavenged-partial decomposed	Included
Y2	Mexican free-tailed bat	16-Jun-20	WTG-51	7-day	99	44	Intact-partial decomposed	Included
Y2	Mexican free-tailed bat	17-Jun-20	WTG-54	7-day	72	50	Intact-partial decomposed	Included
Y2	Mexican free-tailed bat	17-Jun-20	WTG-54	Incidental	117	27	Intact-partial decomposed	Excluded: off plot
Y2	Mexican free-tailed bat	17-Jun-20	WTG-54	Incidental	118	31	Intact-fresh	Excluded: off plot
Y2	Mexican free-tailed bat	17-Jun-20	WTG-56	7-day	80	75	Intact-partial decomposed	Included
Y2	Mexican free-tailed bat	17-Jun-20	WTG-56	7-day	90	53	Intact-partial decomposed	Included
Y2	Mexican free-tailed bat	17-Jun-20	WTG-56	7-day	104	71	Intact-partial decomposed	Included
Y2	Mexican free-tailed bat	17-Jun-20	WTG-56	7-day	114	17	Intact-partial decomposed	Included
Y2	Mexican free-tailed bat	18-Jun-20	WTG-59	7-day	16	17	Intact-fresh	Included
Y2	Mexican free-tailed bat	18-Jun-20	WTG-59	7-day	57	31	Scavenged-partial decomposed	Included

Project Year	Species	Date	Turbine[1]	Survey Type	Distance From Turbine (m)	Bearing From Turbine (°)	Carcass Condition	Included to Estimate Adjusted Fatalities?[2]
Y2	Mexican free-tailed bat	18-Jun-20	WTG-59	7-day	75	351	Scavenged-partial decomposed	Included
Y2	Mexican free-tailed bat	18-Jun-20	WTG-59	7-day	99	86	Scavenged-partial decomposed	Included
Y2	Mexican free-tailed bat	18-Jun-20	WTG-60	7-day	35	149	Intact-fresh	Included
Y2	Mexican free-tailed bat	18-Jun-20	WTG-63	7-day	101	32	Scavenged-partial decomposed	Included
Y2	Mexican free-tailed bat	24-Jun-20	WTG-56	7-day	97	13	Intact-partial decomposed	Included
Y2	Mexican free-tailed bat	24-Jun-20	WTG-56	7-day	98	15	Scavenged-partial decomposed	Included
Y2	Mexican free-tailed bat	29-Jun-20	WTG-52	7-day	53	95	Intact-partial decomposed	Excluded: GE nesting closure
Y2	Mexican free-tailed bat	30-Jun-20	WTG-51	7-day	112	58	Intact-partial decomposed	Included
Y2	Mexican free-tailed bat	02-Jul-20	WTG-59	7-day	90	51	Intact-partial decomposed	Included
Y2	Mexican free-tailed bat	02-Jul-20	WTG-59	Incidental	117	67	Intact-partial decomposed	Excluded: off plot
Y2	Mexican free-tailed bat	07-Jul-20	WTG-49	7-day	64	56	Intact-fresh	Included
Y2	Mexican free-tailed bat	07-Jul-20	WTG-51	7-day	49	27	Intact-fresh	Included
Y2	Mexican free-tailed bat	07-Jul-20	WTG-51	7-day	92	17	Intact-partial decomposed	Included
Y2	Mexican free-tailed bat	07-Jul-20	WTG-58	7-day	20	1	Scavenged-partial decomposed	Excluded: GE nesting closure
Y2	Mexican free-tailed bat	08-Jul-20	WTG-56	7-day	39	34	Scavenged-partial decomposed	Included
Y2	Mexican free-tailed bat	08-Jul-20	WTG-67	28-day	115	102	Scavenged-partial decomposed	Included
Y2	Mexican free-tailed bat	09-Jul-20	WTG-59	7-day	115	52	Scavenged-partial decomposed	Included
Y2	Mexican free-tailed bat	09-Jul-20	WTG-68	7-day	106	87	Intact-partial decomposed	Included
Y2	Mexican free-tailed bat	14-Jul-20	WTG-49	7-day	96	55	Intact-fresh	Included
Y2	Mexican free-tailed bat	14-Jul-20	WTG-49	7-day	104	26	Intact-partial decomposed	Included
Y2	Mexican free-tailed bat	14-Jul-20	WTG-58	7-day	74	298	Scavenged-partial decomposed	Excluded: GE nesting closure
Y2	Mexican free-tailed bat	14-Jul-20	WTG-58	7-day	81	70	Scavenged-decomposed	Excluded: GE nesting closure
Y2	Mexican free-tailed bat	14-Jul-20	WTG-58	Incidental	123	65	Intact-decomposed	Excluded: off plot
Y2	Mexican free-tailed bat	15-Jul-20	WTG-53	28-day	103	69	Scavenged-partial decomposed	Excluded: GE nesting closure
Y2	Mexican free-tailed bat	15-Jul-20	WTG-56	7-day	39	20	Scavenged-fresh	Included
Y2	Mexican free-tailed bat	15-Jul-20	WTG-56	7-day	46	3	Scavenged-partial decomposed	Included
Y2	Mexican free-tailed bat	15-Jul-20	WTG-56	7-day	60	8	Intact-partial decomposed	Included
Y2	Mexican free-tailed bat	15-Jul-20	WTG-57	28-day	50	23	Intact-partial decomposed	Included
Y2	Mexican free-tailed bat	15-Jul-20	WTG-57	28-day	67	359	Intact-partial decomposed	Included
Y2	Mexican free-tailed bat	16-Jul-20	WTG-60	Incidental	118	60	Intact-fresh	Excluded: off plot
Y2	Mexican free-tailed bat	21-Jul-20	WTG-49	7-day	104	47	Scavenged-partial decomposed	Included
Y2	Mexican free-tailed bat	21-Jul-20	WTG-51	7-day	113	41	Intact-partial decomposed	Included

Project Year	Species	Date	Turbine[1]	Survey Type	Distance From Turbine (m)	Bearing From Turbine (°)	Carcass Condition	Included to Estimate Adjusted Fatalities?[2]
Y2	Mexican free-tailed bat	21-Jul-20	WTG-58	7-day	77	52	Intact-partial decomposed	Excluded: GE nesting closure
Y2	Mexican free-tailed bat	22-Jul-20	WTG-54	Incidental	125	27	Scavenged-partial decomposed	Excluded: off plot
Y2	Mexican free-tailed bat	23-Jul-20	WTG-68	7-day	106	45	Intact-partial decomposed	Included
Y2	Mexican free-tailed bat	24-Jul-20	WTG-64	28-day	63	95	Scavenged-partial decomposed	Included
Y2	Mexican free-tailed bat	28-Jul-20	WTG-49	Incidental	121	52	Intact-partial decomposed	Excluded: off plot
Y2	Mexican free-tailed bat	30-Jul-20	WTG-60	7-day	104	61	Intact-partial decomposed	Included
Y2	Mexican free-tailed bat	04-Aug-20	WTG-52	7-day	61	86	Intact-partial decomposed	Excluded: GE nesting closure
Y2	Mexican free-tailed bat	11-Aug-20	WTG-51	7-day	108	70	Scavenged-partial decomposed	Included
Y2	Mexican free-tailed bat	12-Aug-20	WTG-54	7-day	115	44	Intact-fresh	Included
Y2	Mexican free-tailed bat	12-Aug-20	WTG-56	7-day	107	48	Intact-fresh	Included
Y2	Mexican free-tailed bat	12-Aug-20	WTG-57	28-day	95	50	Scavenged-partial decomposed	Included
Y2	Mexican free-tailed bat	13-Aug-20	WTG-59	7-day	72	50	Intact-partial decomposed	Included
Y2	Mexican free-tailed bat	13-Aug-20	WTG-60	7-day	11	286	Intact-fresh	Included
Y2	Mexican free-tailed bat	13-Aug-20	WTG-63	7-day	94	47	Scavenged-partial decomposed	Included
Y2	Mexican free-tailed bat	13-Aug-20	WTG-68	7-day	100	64	Intact-partial decomposed	Included
Y2	Mexican free-tailed bat	18-Aug-20	WTG-51	7-day	99	52	Intact-partial decomposed	Included
Y2	Mexican free-tailed bat	18-Aug-20	WTG-52	7-day	75	359	Intact-fresh	Excluded: GE nesting closure
Y2	Mexican free-tailed bat	19-Aug-20	WTG-54	7-day	80	19	Scavenged-partial decomposed	Included
Y2	Mexican free-tailed bat	19-Aug-20	WTG-56	7-day	51	26	Intact-fresh	Included
Y2	Mexican free-tailed bat	19-Aug-20	WTG-56	7-day	108	62	Intact-partial decomposed	Included
Y2	Mexican free-tailed bat	20-Aug-20	WTG-59	7-day	83	67	Scavenged-partial decomposed	Included
Y2	Mexican free-tailed bat	27-Aug-20	WTG-49	Incidental	130	44	Intact-partial decomposed	Excluded: off plot
Y2	Mexican free-tailed bat	27-Aug-20	WTG-51	7-day	100	55	Scavenged-fresh	Included
Y2	Mexican free-tailed bat	28-Aug-20	WTG-54	7-day	63	346	Intact-fresh	Included
Y2	Mexican free-tailed bat	28-Aug-20	WTG-56	Incidental	123	39	Intact-partial decomposed	Excluded: off plot
Y2	Mexican free-tailed bat	28-Aug-20	WTG-65	28-day	46	91	Intact-partial decomposed	Included
Y2	Mexican free-tailed bat	01-Sep-20	WTG-49	7-day	50	49	Intact-fresh	Included
Y2	Mexican free-tailed bat	01-Sep-20	WTG-49	7-day	50	57	Intact-fresh	Included
Y2	Mexican free-tailed bat	01-Sep-20	WTG-49	7-day	50	67	Scavenged-partial decomposed	Included
Y2	Mexican free-tailed bat	01-Sep-20	WTG-49	7-day	110	62	Intact-partial decomposed	Included
Y2	Mexican free-tailed bat	01-Sep-20	WTG-52	7-day	50	34	Intact-partial decomposed	Excluded: GE nesting closure
Y2	Mexican free-tailed bat	01-Sep-20	WTG-52	7-day	50	38	Scavenged-partial decomposed	Excluded: GE nesting closure

Project Year	Species	Date	Turbine[1]	Survey Type	Distance From Turbine (m)	Bearing From Turbine (°)	Carcass Condition	Included to Estimate Adjusted Fatalities?[2]
Y2	Mexican free-tailed bat	22-Sep-20	WTG-53	28-day	114	88	Intact-fresh	Excluded: GE nesting closure
Y2	Mexican free-tailed bat	22-Sep-20	WTG-58	7-day	90	295	Scavenged-partial decomposed	Excluded: GE nesting closure
Y2	Mexican free-tailed bat	23-Sep-20	WTG-49	7-day	95	350	Intact-partial decomposed	Included
Y2	Mexican free-tailed bat	23-Sep-20	WTG-51	7-day	62	300	Intact-partial decomposed	Included
Y2	Mexican free-tailed bat	23-Sep-20	WTG-51	7-day	89	28	Intact-partial decomposed	Included
Y2	Mexican free-tailed bat	23-Sep-20	WTG-51	7-day	104	34	Intact-partial decomposed	Included
Y2	Mexican free-tailed bat	23-Sep-20	WTG-51	7-day	107	56	Scavenged-partial decomposed	Included
Y2	Mexican free-tailed bat	23-Sep-20	WTG-51	7-day	114	43	Intact-decomposed	Included
Y2	Mexican free-tailed bat	23-Sep-20	WTG-51	Incidental	125	48	Intact-partial decomposed	Excluded: off plot
Y2	Mexican free-tailed bat	23-Sep-20	WTG-52	7-day	115	27	Scavenged-partial decomposed	Excluded: GE nesting closure
Y2	Mexican free-tailed bat	23-Sep-20	WTG-52	7-day	115	51	Intact-fresh	Excluded: GE nesting closure
Y2	Mexican free-tailed bat	24-Sep-20	WTG-54	7-day	100	57	Alive-injured	Included
Y2	Mexican free-tailed bat	24-Sep-20	WTG-54	7-day	114	10	Scavenged-fresh	Included
Y2	Mexican free-tailed bat	24-Sep-20	WTG-56	Incidental	123	49	Intact-partial decomposed	Excluded: off plot
Y2	Mexican free-tailed bat	24-Sep-20	WTG-57	28-day	98	54	Intact-fresh	Included
Y2	Mexican free-tailed bat	24-Sep-20	WTG-57	Incidental	127	50	Scavenged-fresh	Excluded: off plot
Y2	Mexican free-tailed bat	01-Oct-20	WTG-55	28-day	56	100	Intact-partial decomposed	Excluded: GE nesting closure
Y2	Mexican free-tailed bat	03-Oct-20	WTG-63	7-day	70	67	Intact-fresh	Included
Y2	Mexican free-tailed bat	03-Oct-20	WTG-65	28-day	69	8	Scavenged-partial decomposed	Included
Y2	Western red bat	23-Oct-19	WTG-62	28-day	74	104	Intact-partial decomposed	Included
Y2	Unknown bat	16-Oct-19	WTG-55	28-day	55	103	Scavenged-partial decomposed	Excluded: GE nesting closure
Y2	Unknown bat	22-Apr-20	WTG-59	7-day	76	349	Scavenged-partial decomposed	Included
Y2	Unknown bat	06-May-20	WTG-59	7-day	111	5	Scavenged-partial decomposed	Included
Y2	Unknown bat	02-Jun-20	WTG-56	7-day	10	335	Scavenged-partial decomposed	Included
Y2	Unknown bat	29-Sep-20	WTG-52	7-day	85	95	Scavenged-partial decomposed	Excluded: GE nesting closure
Y2	Unknown bat	30-Sep-20	WTG-50	28-day	88	140	Scavenged-partial decomposed	Included
Y2	Unknown bat	01-Oct-20	WTG-55	28-day	54	65	Scavenged-partial decomposed	Excluded: GE nesting closure

[1] Turbine IDs of the form WTG-D## represent Diablo Winds turbines.

[2] Included = included in adjusted fatality estimates. Excluded: off plot = carcass excluded from adjusted fatality estimates because it was found outside of all survey plots. Excluded: on plot incidental = carcass excluded from adjusted fatality estimates because it was discovered incidental to standard surveys by a relevant surveyor or was left in place and never found by surveyors. Excluded: GE nesting closure = carcass excluded from adjusted fatality estimates to support extrapolated estimation without fatalities collected at four turbines where avoiding disturbance of nesting golden eagles curtailed fatality surveys and day-time turbine operation for 4 months each monitoring year.

Appendix G. Bird Fatality and Injury Incidents Documented in Monitoring Years 1 and 2

Project Year	Species	Date	Turbine[1]	Survey Type	Distance From Turbine (m)	Bearing From Turbine (°)	Carcass Condition	Included to Estimate Adjusted Fatalities?[2]
Y1	American kestrel	09-Oct-18	WTG-68	7-day	41	330	Scavenged-partial decomposed	Excluded: predates survey
Y1	American kestrel	11-Oct-18	WTG-50	7-day	50	71	Scavenged-featherspot	Excluded: predates survey
Y1	American kestrel	15-Oct-18	WTG-61	7-day	75	109	Scavenged-featherspot	Included
Y1	American kestrel	16-Oct-18	WTG-68	7-day	77	65	Scavenged-featherspot	Excluded: predates survey
Y1	American kestrel	04-Dec-18	WTG-61	7-day	58	39	Scavenged-featherspot	Included
Y1	American kestrel	09-Jan-19	WTG-53	Incidental	8	90	Dismembered-fresh	Excluded: on-plot incidental
Y1	American kestrel	30-May-19	WTG-62	28-day	23	164	Scavenged-partial decomposed	Included
Y1	American kestrel	31-May-19	WTG-51	7-day	40	160	Intact-partial decomposed	Included
Y1	Barn owl	09-Oct-18	WTG-63	28-day	17	262	Intact-decomposed	Excluded: predates survey
Y1	Barn owl	09-Oct-18	WTG-63	28-day	51	242	Scavenged-decomposed	Excluded: predates survey
Y1	Barn owl	30-Jan-19	WTG-59	7-day	113	92	Scavenged-featherspot	Included
Y1	Barn owl	15-Aug-19	WTG-D23	Incidental	442	258	Scavenged-partial decomposed	Excluded: off plot
Y1	Black-headed grosbeak	22-May-19	WTG-63	28-day	87	62	Scavenged-partial decomposed	Included
Y1	Black-headed grosbeak	22-May-19	WTG-63	28-day	100	84	Intact-partial decomposed	Included
Y1	Black-throated gray warbler	21-Aug-19	WTG-59	7-day	115	35	Scavenged-fresh	Included
Y1	Black-throated gray warbler	27-Aug-19	WTG-60	7-day	40	55	Intact-partial decomposed	Included
Y1	Brewer's blackbird	27-Feb-19	WTG-52	28-day	64	166	Scavenged-partial decomposed	Included
Y1	Bullock's oriole	22-May-19	WTG-59	7-day	86	17	Scavenged-partial decomposed	Included
Y1	Burrowing owl	15-Oct-18	WTG-61	7-day	74	109	Scavenged-partial decomposed	Excluded: predates survey
Y1	Burrowing owl	17-Oct-18	WTG-59	7-day	50	195	Scavenged-partial decomposed	Excluded: predates survey
Y1	Burrowing owl	10-Jul-19	WTG-65	28-day	88	150	Scavenged-partial decomposed	Included
Y1	California gull	15-Oct-18	WTG-60	7-day	86	29	Scavenged-partial decomposed	Excluded: predates survey
Y1	California gull	30-Apr-19	WTG-60	7-day	10	345	Scavenged-partial decomposed	Included
Y1	California gull	21-May-19	WTG-61	7-day	1	118	Intact-fresh	Included
Y1	California gull	05-Jun-19	WTG-59	7-day	62	90	Scavenged-partial decomposed	Included
Y1	California gull	10-Jul-19	WTG-62	Incidental	3	190	Intact-partial decomposed	Excluded: on-plot incidental
Y1	California gull	16-Jul-19	WTG-61	7-day	67	140	Intact-partial decomposed	Included
Y1	California gull	06-Aug-19	WTG-60	7-day	80	11	Dismembered-fresh	Included
Y1	California gull	20-Aug-19	WTG-60	7-day	36	28	Intact-partial decomposed	Included
Y1	California gull	03-Sep-19	WTG-60	7-day	113	57	Scavenged-partial decomposed	Included
Y1	California gull	18-Sep-19	WTG-62	28-day	113	213	Scavenged-decomposed	Included
Y1	Chipping sparrow	03-May-19	WTG-49	28-day	65	15	Scavenged-partial decomposed	Included
Y1	Cliff swallow	30-May-19	WTG-68	7-day	50	77	Scavenged-partial decomposed	Included
Y1	Common raven	07-Nov-18	WTG-63	28-day	107	105	Scavenged-partial decomposed	Included

Project Year	Species	Date	Turbine[1]	Survey Type	Distance From Turbine (m)	Bearing From Turbine (°)	Carcass Condition	Included to Estimate Adjusted Fatalities?[2]
Y1	Common raven	02-Jan-19	WTG-68	7-day	108	117	Scavenged-partial decomposed	Included
Y1	Dark-eyed junco	18-Oct-18	WTG-50	7-day	24	41	Scavenged-featherspot	Included
Y1	Dark-eyed junco	03-May-19	WTG-49	28-day	88	359	Scavenged-partial decomposed	Included
Y1	Eurasian collared-dove	21-Nov-18	WTG-58	28-day	108	173	Scavenged-featherspot	Included
Y1	European starling	16-Oct-18	WTG-67	7-day	97	180	Scavenged-partial decomposed	Excluded: predates survey
Y1	European starling	20-Dec-18	WTG-50	7-day	80	116	Scavenged-fresh	Included
Y1	European starling	07-Feb-19	WTG-56	7-day	113	185	Scavenged-fresh	Included
Y1	European starling	28-Feb-19	WTG-51	7-day	114	233	Scavenged-partial decomposed	Included
Y1	Ferruginous hawk	09-Oct-18	WTG-63	28-day	60	101	Intact-partial decomposed	Excluded: predates survey
Y1	Ferruginous hawk	24-Oct-18	WTG-59	7-day	34	116	Intact-partial decomposed	Included
Y1	Glaucous-winged gull	31-Oct-18	WTG-59	7-day	101	82	Scavenged-decomposed	Excluded: predates survey
Y1	Glaucous-winged gull	12-Dec-18	WTG-59	7-day	26	130	Intact-fresh	Included
Y1	Golden eagle	16-Oct-18	WTG-62	28-day	44	73	Dismembered-decomposed	Excluded: predates survey
Y1	Golden eagle	25-Oct-18	WTG-58	28-day	73	351	Intact-decomposed	Excluded: predates survey
Y1	Golden eagle	28-Nov-18	WTG-59	7-day	105	162	Dismembered-decomposed	Excluded: predates survey
Y1	Golden eagle	20-Feb-19	WTG-53	28-day	73	223	Intact-fresh	Included
Y1	Golden eagle	10-Jul-19	WTG-59	7-day	108	92	Dismembered-fresh	Included
Y1	Golden eagle	25-Sep-19	WTG-59	7-day	60	51	Intact-fresh	Included
Y1	Hermit thrush	03-Oct-19	WTG-54	7-day	61	62	Intact-fresh	Included
Y1	Hermit warbler	23-Jul-19	WTG-60	7-day	114	11	Intact-fresh	Included
Y1	Herring gull	30-Jan-19	WTG-59	7-day	36	261	Intact-fresh	Included
Y1	Horned lark	17-Oct-18	WTG-59	7-day	35	59	Scavenged-partial decomposed	Excluded: predates survey
Y1	Horned lark	26-Feb-19	WTG-60	7-day	38	204	Scavenged-partial decomposed	Included
Y1	Horned lark	24-Apr-19	WTG-59	7-day	74	347	Scavenged-featherspot	Included
Y1	Horned lark	30-Apr-19	WTG-61	7-day	3	193	Scavenged-partial decomposed	Included
Y1	Horned lark	23-May-19	WTG-50	7-day	49	60	Intact-partial decomposed	Included
Y1	Horned lark	23-May-19	WTG-56	7-day	65	232	Intact-partial decomposed	Included
Y1	Horned lark	29-May-19	WTG-61	7-day	25	210	Scavenged-featherspot	Included
Y1	Horned lark	29-May-19	WTG-61	7-day	30	180	Scavenged-partial decomposed	Included
Y1	Horned lark	31-May-19	WTG-56	7-day	36	270	Intact-partial decomposed	Included
Y1	Horned lark	06-Jun-19	WTG-54	7-day	114	22	Intact-partial decomposed	Included
Y1	Horned lark	12-Jun-19	WTG-68	7-day	9	148	Scavenged-partial decomposed	Included
Y1	Horned lark	20-Jun-19	WTG-56	7-day	20	63	Scavenged-fresh	Included
Y1	Horned lark	27-Jun-19	WTG-56	7-day	20	54	Scavenged-partial decomposed	Included
Y1	Horned lark	26-Jul-19	WTG-57	28-day	39	199	Intact-partial decomposed	Included
Y1	Horned lark	01-Aug-19	WTG-56	7-day	64	180	Scavenged-partial decomposed	Included
Y1	Horned lark	15-Aug-19	WTG-56	7-day	16	238	Scavenged-partial decomposed	Included
Y1	Horned lark	11-Sep-19	WTG-63	28-day	30	231	Scavenged-partial decomposed	Included

Project Year	Species	Date	Turbine[1]	Survey Type	Distance From Turbine (m)	Bearing From Turbine (°)	Carcass Condition	Included to Estimate Adjusted Fatalities?[2]
Y1	House finch	01-Jan-19	WTG-67	7-day	79	179	Scavenged-featherspot	Included
Y1	House finch	17-Apr-19	WTG-65	28-day	100	78	Scavenged-partial decomposed	Included
Y1	House wren	26-Jul-19	WTG-54	7-day	114	40	Intact-partial decomposed	Included
Y1	Killdeer	21-Nov-18	WTG-55	Incidental	160	100	Scavenged-featherspot	Excluded: off plot
Y1	MacGillivray's warbler	21-May-19	WTG-60	7-day	86	42	Scavenged-partial decomposed	Included
Y1	MacGillivray's warbler	11-Jul-19	WTG-56	Incidental	120	50	Intact-partial decomposed	Excluded: off plot
Y1	MacGillivray's warbler	18-Jul-19	WTG-56	7-day	103	35	Scavenged-partial decomposed	Included
Y1	Mallard	23-Oct-18	WTG-66	28-day	65	60	Scavenged-featherspot	Excluded: predates survey
Y1	Mallard	27-Aug-19	WTG-60	Incidental	117	64	Scavenged-partial decomposed	Excluded: off plot
Y1	Marsh wren	14-May-19	WTG-64	7-day	84	66	Scavenged-partial decomposed	Included
Y1	Marsh wren	18-Jul-19	WTG-50	7-day	60	18	Intact-partial decomposed	Included
Y1	Mourning dove	10-Oct-18	WTG-56	7-day	49	122	Scavenged-featherspot	Excluded: predates survey
Y1	Mourning dove	16-Jan-19	WTG-66	28-day	1	344	Scavenged-featherspot	Included
Y1	Mourning dove	19-Feb-19	WTG-60	7-day	23	15	Scavenged-fresh	Included
Y1	Nashville warbler	16-Apr-19	WTG-61	7-day	20	40	Scavenged-partial decomposed	Included
Y1	Nashville warbler	07-May-19	WTG-64	7-day	53	51	Scavenged-partial decomposed	Included
Y1	Orange-crowned warbler	18-Apr-19	WTG-56	7-day	75	10	Scavenged-partial decomposed	Included
Y1	Orange-crowned warbler	06-Jun-19	WTG-56	7-day	82	5	Intact-partial decomposed	Included
Y1	Orange-crowned warbler	11-Jul-19	WTG-56	7-day	83	80	Intact-partial decomposed	Included
Y1	Pied-billed grebe	11-Dec-18	WTG-67	7-day	49	171	Scavenged-partial decomposed	Included
Y1	Prairie falcon	08-May-19	WTG-59	7-day	82	130	Scavenged-partial decomposed	Included
Y1	Red-breasted nuthatch	01-Oct-19	WTG-60	7-day	99	84	Scavenged-fresh	Included
Y1	Red-tailed hawk	08-Oct-18	WTG-64	7-day	30	186	Scavenged-partial decomposed	Excluded: predates survey
Y1	Red-tailed hawk	08-Oct-18	WTG-64	7-day	48	78	Intact-decomposed	Excluded: predates survey
Y1	Red-tailed hawk	09-Oct-18	WTG-67	7-day	32	152	Scavenged-partial decomposed	Excluded: predates survey
Y1	Red-tailed hawk	09-Oct-18	WTG-67	7-day	53	330	Dismembered-partial decomposed	Excluded: predates survey
Y1	Red-tailed hawk	09-Oct-18	WTG-67	7-day	76	64	Scavenged-partial decomposed	Excluded: predates survey
Y1	Red-tailed hawk	10-Oct-18	WTG-52	28-day	40	307	Scavenged-decomposed	Excluded: predates survey
Y1	Red-tailed hawk	10-Oct-18	WTG-59	7-day	37	113	Scavenged-decomposed	Excluded: predates survey
Y1	Red-tailed hawk	17-Oct-18	WTG-59	7-day	50	195	Scavenged-partial decomposed	Excluded: predates survey
Y1	Red-tailed hawk	23-Oct-18	WTG-66	28-day	41	87	Scavenged-decomposed	Excluded: predates survey
Y1	Red-tailed hawk	23-Oct-18	WTG-66	28-day	49	56	Scavenged-partial decomposed	Included
Y1	Red-tailed hawk	30-Oct-18	WTG-65	28-day	35	254	Intact-partial decomposed	Included
Y1	Red-tailed hawk	30-Oct-18	WTG-65	28-day	53	214	Scavenged-decomposed	Excluded: predates survey
Y1	Red-tailed hawk	31-Oct-18	WTG-53	28-day	14	43	Intact-partial decomposed	Excluded: predates survey
Y1	Red-tailed hawk	20-Nov-18	WTG-62	28-day	113	3	Scavenged-decomposed	Included
Y1	Red-tailed hawk	21-Nov-18	WTG-58	28-day	75	193	Scavenged-fresh	Included
Y1	Red-tailed hawk	28-Nov-18	WTG-65	28-day	108	83	Scavenged-decomposed	Excluded: predates survey

Project Year	Species	Date	Turbine[1]	Survey Type	Distance From Turbine (m)	Bearing From Turbine (°)	Carcass Condition	Included to Estimate Adjusted Fatalities?[2]
Y1	Red-tailed hawk	29-Nov-18	WTG-56	Incidental	223	214	Scavenged-fresh	Excluded: off plot
Y1	Red-tailed hawk	18-Dec-18	WTG-58	28-day	96	49	Scavenged-partial decomposed	Included
Y1	Red-tailed hawk	01-Jan-19	WTG-55	Incidental	176	226	Scavenged-partial decomposed	Excluded: off plot
Y1	Red-tailed hawk	28-Feb-19	WTG-56	7-day	58	47	Intact-partial decomposed	Included
Y1	Red-tailed hawk	03-Apr-19	WTG-62	28-day	25	10	Intact-partial decomposed	Included
Y1	Red-tailed hawk	08-May-19	WTG-59	7-day	56	123	Intact-partial decomposed	Included
Y1	Red-tailed hawk	03-Sep-19	WTG-61	Incidental	134	352	Dismembered-decomposed	Excluded: off plot
Y1	Red-tailed hawk	19-Sep-19	WTG-56	7-day	11	169	Intact-partial decomposed	Included
Y1	Red-winged blackbird	17-Apr-19	WTG-65	28-day	100	133	Scavenged-partial decomposed	Included
Y1	Ring-billed gull	27-Nov-18	WTG-60	Incidental	118	55	Scavenged-partial decomposed	Excluded: off plot
Y1	Rock pigeon	08-Oct-18	WTG-D16	Incidental	75	16	Scavenged-featherspot	Excluded: off plot
Y1	Rock pigeon	04-Dec-18	WTG-67	7-day	78	241	Scavenged-partial decomposed	Included
Y1	Ruby-crowned kinglet	06-Nov-18	WTG-60	7-day	63	99	Scavenged-partial decomposed	Included
Y1	Ruby-crowned kinglet	02-Jan-19	WTG-68	7-day	68	170	Scavenged-featherspot	Included
Y1	Ruby-crowned kinglet	07-May-19	WTG-64	7-day	54	40	Scavenged-partial decomposed	Included
Y1	Spotted towhee	21-Nov-18	WTG-58	28-day	104	42	Scavenged-partial decomposed	Included
Y1	Townsend's warbler	09-May-19	WTG-56	7-day	97	55	Scavenged-partial decomposed	Included
Y1	Tree swallow	24-Oct-18	WTG-59	7-day	50	16	Intact-fresh	Included
Y1	Tree swallow	07-Nov-18	WTG-59	7-day	47	112	Scavenged-partial decomposed	Excluded: predates survey
Y1	Tree swallow	31-Jul-19	WTG-55	28-day	20	280	Intact-partial decomposed	Included
Y1	Tree swallow	23-Aug-19	WTG-58	28-day	53	280	Intact-partial decomposed	Included
Y1	Tricolored blackbird	30-May-19	WTG-62	28-day	36	118	Dismembered-partial decomposed	Included
Y1	Turkey vulture	10-Oct-18	WTG-59	7-day	66	338	Scavenged-decomposed	Excluded: predates survey
Y1	Unknown blackbird	31-Jan-19	WTG-50	7-day	115	213	Scavenged-featherspot	Included
Y1	Unknown blackbird	22-May-19	WTG-63	28-day	86	312	Scavenged-partial decomposed	Included
Y1	Unknown blackbird	06-Jun-19	WTG-50	7-day	94	140	Scavenged-featherspot	Included
Y1	Unknown blackbird	10-Jul-19	WTG-65	28-day	101	109	Scavenged-featherspot	Included
Y1	Unknown blackbird	05-Sep-19	WTG-50	Incidental	127	21	Scavenged-partial decomposed	Excluded: off plot
Y1	Unknown buteo	01-Jan-19	WTG-61	7-day	52	248	Scavenged-featherspot	Included
Y1	Unknown buteo	11-Jan-19	WTG-58	28-day	50	82	Scavenged-featherspot	Included
Y1	Unknown buteo	20-Sep-19	WTG-57	28-day	66	60	Scavenged-featherspot	Included
Y1	Unknown flycatcher	09-Oct-18	WTG-67	7-day	75	46	Scavenged-partial decomposed	Excluded: predates survey
Y1	Unknown flycatcher	31-May-19	WTG-49	28-day	79	4	Scavenged-partial decomposed	Included
Y1	Unknown flycatcher	04-Jun-19	WTG-67	7-day	98	47	Scavenged-partial decomposed	Included
Y1	Unknown flycatcher	05-Jun-19	WTG-66	28-day	83	36	Scavenged-partial decomposed	Included
Y1	Unknown flycatcher	06-Jun-19	WTG-50	7-day	100	30	Intact-partial decomposed	Included
Y1	Unknown flycatcher	22-Aug-19	WTG-54	7-day	60	72	Intact-partial decomposed	Included
Y1	Unknown flycatcher	10-Sep-19	WTG-60	7-day	38	358	Intact-partial decomposed	Included

Project Year	Species	Date	Turbine[1]	Survey Type	Distance From Turbine (m)	Bearing From Turbine (°)	Carcass Condition	Included to Estimate Adjusted Fatalities?[2]
Y1	Unknown flycatcher	17-Sep-19	WTG-61	7-day	110	66	Intact-partial decomposed	Included
Y1	Unknown gull	08-Oct-18	WTG-61	7-day	99	157	Scavenged-featherspot	Excluded: predates survey
Y1	Unknown gull	09-Oct-18	WTG-67	7-day	50	120	Scavenged-featherspot	Excluded: predates survey
Y1	Unknown gull	17-Oct-18	WTG-59	7-day	90	22	Scavenged-partial decomposed	Excluded: predates survey
Y1	Unknown gull	23-Oct-18	WTG-67	7-day	96	352	Scavenged-featherspot	Excluded: predates survey
Y1	Unknown gull	12-Dec-18	WTG-59	7-day	92	23	Scavenged-partial decomposed	Included
Y1	Unknown gull	02-Jan-19	WTG-54	7-day	39	16	Scavenged-featherspot	Included
Y1	Unknown gull	11-Jan-19	WTG-58	28-day	24	84	Scavenged-partial decomposed	Included
Y1	Unknown gull	12-Feb-19	WTG-64	7-day	84	280	Scavenged-featherspot	Included
Y1	Unknown gull	13-Feb-19	WTG-59	7-day	115	28	Scavenged-fresh	Included
Y1	Unknown gull	21-Feb-19	WTG-56	7-day	60	129	Scavenged-featherspot	Included
Y1	Unknown gull	08-Mar-19	WTG-58	28-day	55	358	Scavenged-fresh	Included
Y1	Unknown gull	30-May-19	WTG-57	28-day	39	92	Scavenged-partial decomposed	Included
Y1	Unknown gull	04-Jun-19	WTG-60	Incidental	130	44	Scavenged-partial decomposed	Excluded: off plot
Y1	Unknown gull	02-Jul-19	WTG-60	7-day	62	96	Dismembered-fresh	Included
Y1	Unknown gull	18-Jul-19	WTG-56	7-day	60	180	Scavenged-featherspot	Included
Y1	Unknown gull	23-Jul-19	WTG-60	Incidental	122	15	Scavenged-partial decomposed	Excluded: off plot
Y1	Unknown gull	24-Jul-19	WTG-59	Incidental	164	41	Intact-partial decomposed	Excluded: off plot
Y1	Unknown gull	21-Aug-19	WTG-59	7-day	90	198	Scavenged-partial decomposed	Included
Y1	Unknown gull	28-Aug-19	WTG-59	7-day	78	40	Scavenged-partial decomposed	Included
Y1	Unknown gull	03-Sep-19	WTG-60	7-day	59	27	Scavenged-partial decomposed	Included
Y1	Unknown gull	10-Sep-19	WTG-60	7-day	78	34	Scavenged-partial decomposed	Included
Y1	Unknown gull	11-Sep-19	WTG-59	Incidental	146	115	Scavenged-featherspot	Excluded: off plot
Y1	Unknown kinglet	22-Oct-18	WTG-64	7-day	35	47	Scavenged-featherspot	Included
Y1	Unknown large bird	17-Oct-18	WTG-59	7-day	48	75	Scavenged-decomposed	Excluded: predates survey
Y1	Unknown large bird	31-Oct-18	WTG-59	7-day	85	16	Scavenged-decomposed	Excluded: predates survey
Y1	Unknown medium bird	06-Aug-19	WTG-60	7-day	89	50	Scavenged-partial decomposed	Included
Y1	Unknown med-large bird	15-Jan-19	WTG-64	7-day	32	162	Scavenged-decomposed	Included
Y1	Unknown med-large bird	30-Jul-19	WTG-60	7-day	76	45	Scavenged-partial decomposed	Included
Y1	Unknown small bird	08-Oct-18	WTG-61	7-day	48	358	Scavenged-featherspot	Excluded: predates survey
Y1	Unknown small bird	09-Oct-18	WTG-67	7-day	100	70	Scavenged-featherspot	Excluded: predates survey
Y1	Unknown small bird	10-Oct-18	WTG-56	7-day	51	37	Scavenged-partial decomposed	Excluded: predates survey
Y1	Unknown small bird	16-Oct-18	WTG-64	Incidental	126	90	Scavenged-featherspot	Excluded: off plot
Y1	Unknown small bird	23-Oct-18	WTG-66	28-day	93	29	Scavenged-partial decomposed	Included
Y1	Unknown small bird	21-Nov-18	WTG-58	28-day	86	37	Scavenged-featherspot	Included
Y1	Unknown small bird	28-Nov-18	WTG-65	28-day	72	122	Scavenged-partial decomposed	Included
Y1	Unknown small bird	20-Dec-18	WTG-56	7-day	1	4	Scavenged-fresh	Included
Y1	Unknown small bird	16-Jan-19	WTG-59	7-day	54	19	Scavenged-featherspot	Included

Project Year	Species	Date	Turbine[1]	Survey Type	Distance From Turbine (m)	Bearing From Turbine (°)	Carcass Condition	Included to Estimate Adjusted Fatalities?[2]
Y1	Unknown small bird	20-Feb-19	WTG-65	28-day	107	26	Scavenged-featherspot	Included
Y1	Unknown small bird	30-Apr-19	WTG-61	7-day	97	35	Scavenged-partial decomposed	Included
Y1	Unknown small bird	30-Apr-19	WTG-61	7-day	101	46	Scavenged-partial decomposed	Included
Y1	Unknown small bird	03-May-19	WTG-49	28-day	90	4	Scavenged-partial decomposed	Included
Y1	Unknown small bird	15-May-19	WTG-65	Incidental	129	187	Scavenged-featherspot	Excluded: off plot
Y1	Unknown small bird	30-May-19	WTG-68	7-day	113	47	Scavenged-featherspot	Included
Y1	Unknown small bird	11-Jun-19	WTG-60	7-day	34	31	Scavenged-partial decomposed	Included
Y1	Unknown small bird	27-Jun-19	WTG-50	7-day	106	352	Scavenged-partial decomposed	Included
Y1	Unknown small bird	02-Jul-19	WTG-60	7-day	91	343	Scavenged-featherspot	Included
Y1	Unknown small bird	03-Jul-19	WTG-66	28-day	41	160	Scavenged-featherspot	Included
Y1	Unknown small bird	11-Jul-19	WTG-50	7-day	106	336	Scavenged-partial decomposed	Included
Y1	Unknown small bird	29-Aug-19	WTG-50	7-day	84	305	Scavenged-featherspot	Included
Y1	Unknown small bird	11-Sep-19	WTG-63	28-day	93	35	Scavenged-partial decomposed	Included
Y1	Unknown small bird	20-Sep-19	WTG-58	Incidental	129	289	Scavenged-featherspot	Excluded: off plot
Y1	Unknown sparrow	24-Oct-18	WTG-56	7-day	62	18	Scavenged-featherspot	Included
Y1	Unknown sparrow	07-Nov-18	WTG-59	7-day	92	59	Scavenged-partial decomposed	Included
Y1	Unknown sparrow	18-Sep-19	WTG-62	28-day	45	184	Scavenged-featherspot	Included
Y1	Unknown vireo	11-Jul-19	WTG-56	7-day	109	31	Scavenged-partial decomposed	Included
Y1	Unknown vireo	29-Aug-19	WTG-54	Incidental	141	54	Scavenged-partial decomposed	Excluded: off plot
Y1	Unknown warbler	10-Oct-18	WTG-56	7-day	37	64	Scavenged-partial decomposed	Excluded: predates survey
Y1	Unknown warbler	25-Oct-18	WTG-58	28-day	72	57	Scavenged-featherspot	Included
Y1	Unknown warbler	14-May-19	WTG-61	7-day	107	58	Scavenged-featherspot	Included
Y1	Unknown warbler	14-May-19	WTG-61	Incidental	120	40	Scavenged-partial decomposed	Excluded: off plot
Y1	Unknown warbler	06-Jun-19	WTG-56	7-day	91	30	Scavenged-partial decomposed	Included
Y1	Unknown warbler	20-Jun-19	WTG-54	Incidental	124	30	Scavenged-partial decomposed	Excluded: off plot
Y1	Unknown warbler	16-Jul-19	WTG-60	7-day	83	48	Scavenged-partial decomposed	Included
Y1	Unknown warbler	25-Jul-19	WTG-56	7-day	115	6	Scavenged-partial decomposed	Included
Y1	Unknown warbler	31-Jul-19	WTG-55	28-day	115	60	Scavenged-partial decomposed	Included
Y1	Unknown warbler	23-Aug-19	WTG-57	28-day	98	35	Scavenged-featherspot	Included
Y1	Unknown warbler	05-Sep-19	WTG-56	Incidental	128	61	Scavenged-partial decomposed	Excluded: off plot
Y1	Unknown warbler	24-Sep-19	WTG-67	Incidental	127	86	Scavenged-partial decomposed	Excluded: off plot
Y1	Unknown warbler	25-Sep-19	WTG-59	7-day	98	84	Scavenged-partial decomposed	Included
Y1	Unknown waterbird	09-Oct-18	WTG-68	7-day	83	353	Scavenged-featherspot	Excluded: predates survey
Y1	Warbling vireo	30-Apr-19	WTG-61	7-day	65	35	Scavenged-partial decomposed	Included
Y1	Warbling vireo	07-May-19	WTG-61	7-day	12	12	Scavenged-partial decomposed	Included
Y1	Warbling vireo	09-May-19	WTG-54	7-day	59	91	Scavenged-partial decomposed	Included
Y1	Warbling vireo	08-Aug-19	WTG-54	Incidental	150	33	Intact-fresh	Excluded: off plot
Y1	Western meadowlark	10-Oct-18	WTG-56	7-day	100	97	Scavenged-partial decomposed	Excluded: predates survey

Project Year	Species	Date	Turbine[1]	Survey Type	Distance From Turbine (m)	Bearing From Turbine (°)	Carcass Condition	Included to Estimate Adjusted Fatalities?[2]
Y1	Western meadowlark	25-Oct-18	WTG-58	28-day	23	338	Scavenged-featherspot	Included
Y1	Western meadowlark	31-Oct-18	WTG-59	7-day	73	62	Scavenged-partial decomposed	Included
Y1	Western meadowlark	07-Nov-18	WTG-68	7-day	80	332	Scavenged-featherspot	Included
Y1	Western meadowlark	02-Jan-19	WTG-56	7-day	62	102	Scavenged-partial decomposed	Included
Y1	Western meadowlark	10-Jan-19	WTG-50	7-day	86	279	Scavenged-featherspot	Included
Y1	Western meadowlark	16-Jan-19	WTG-55	28-day	57	106	Scavenged-featherspot	Included
Y1	Western meadowlark	07-Mar-19	WTG-50	7-day	42	318	Scavenged-fresh	Included
Y1	Western meadowlark	30-May-19	WTG-68	Incidental	138	47	Intact-decomposed	Excluded: off plot
Y1	Western meadowlark	13-Jun-19	WTG-54	7-day	90	95	Scavenged-partial decomposed	Included
Y1	Western meadowlark	12-Sep-19	WTG-51	7-day	113	185	Scavenged-featherspot	Included
Y1	Western meadowlark	02-Oct-19	WTG-53	28-day	72	235	Scavenged-featherspot	Included
Y1	Western tanager	29-Aug-19	WTG-50	7-day	48	5	Scavenged-partial decomposed	Included
Y1	Western tanager	25-Sep-19	WTG-68	7-day	48	46	Scavenged-partial decomposed	Included
Y1	White-crowned sparrow	08-Oct-18	WTG-61	7-day	5	223	Intact-partial decomposed	Excluded: predates survey
Y1	White-throated swift	28-Nov-18	WTG-68	7-day	43	73	Scavenged-featherspot	Included
Y1	White-throated swift	29-Nov-18	WTG-54	7-day	58	25	Scavenged-featherspot	Included
Y1	White-throated swift	22-Jan-19	WTG-64	7-day	36	42	Dismembered-fresh	Included
Y1	White-throated swift	12-Feb-19	WTG-61	7-day	70	322	Scavenged-fresh	Included
Y1	White-throated swift	07-Mar-19	WTG-56	7-day	34	353	Intact-fresh	Included
Y1	White-throated swift	30-Apr-19	WTG-67	7-day	35	80	Intact-partial decomposed	Included
Y1	White-throated swift	03-Jul-19	WTG-68	7-day	45	344	Scavenged-partial decomposed	Included
Y1	Wilson's warbler	10-Oct-18	WTG-59	7-day	102	25	Intact-partial decomposed	Excluded: predates survey
Y1	Wilson's warbler	30-Apr-19	WTG-60	7-day	50	10	Scavenged-partial decomposed	Included
Y1	Wilson's warbler	30-Apr-19	WTG-61	7-day	85	54	Scavenged-partial decomposed	Included
Y1	Wilson's warbler	30-Apr-19	WTG-64	7-day	67	51	Scavenged-partial decomposed	Included
Y1	Wilson's warbler	03-May-19	WTG-57	28-day	82	52	Scavenged-partial decomposed	Included
Y1	Wilson's warbler	07-May-19	WTG-60	7-day	37	81	Scavenged-partial decomposed	Included
Y1	Wilson's warbler	04-Jun-19	WTG-60	7-day	34	30	Scavenged-partial decomposed	Included
Y1	Wilson's warbler	04-Jul-19	WTG-54	Incidental	127	37	Scavenged-partial decomposed	Excluded: off plot
Y1	Wilson's warbler	05-Sep-19	WTG-54	Incidental	119	29	Scavenged-fresh	Excluded: off plot
Y1	Yellow warbler	25-Jun-19	WTG-60	Incidental	122	50	Scavenged-featherspot	Excluded: off plot
Y1	Yellow warbler	28-Aug-19	WTG-68	Incidental	119	50	Scavenged-partial decomposed	Excluded: off plot
Y1	Yellow warbler	05-Sep-19	WTG-54	7-day	57	56	Scavenged-partial decomposed	Included
Y1	Yellow-breasted chat	30-May-19	WTG-68	7-day	109	43	Scavenged-featherspot	Included
Y2	American coot	12-Feb-20	WTG-62	28-day	42	42	Scavenged-partial decomposed	Included
Y2	American kestrel	13-Nov-19	WTG-50	28-day	29	26	Scavenged-featherspot	Included
Y2	American kestrel	24-Dec-19	WTG-68	7-day	35	176	Dismembered-fresh	Included
Y2	American kestrel	11-Aug-20	WTG-51	7-day	12	138	Intact-partial decomposed	Included

Project Year	Species	Date	Turbine[1]	Survey Type	Distance From Turbine (m)	Bearing From Turbine (°)	Carcass Condition	Included to Estimate Adjusted Fatalities?[2]
Y2	American kestrel	30-Sep-20	WTG-50	Incidental	121	159	Scavenged-featherspot	Excluded: off plot
Y2	American kestrel	03-Oct-20	WTG-59	7-day	83	80	Scavenged-partial decomposed	Included
Y2	Black-headed grosbeak	14-May-20	WTG-56	7-day	87	159	Scavenged-partial decomposed	Included
Y2	Black-headed grosbeak	15-May-20	WTG-60	7-day	78	85	Scavenged-featherspot	Included
Y2	Black-headed grosbeak	21-Aug-20	WTG-64	28-day	50	78	Intact-partial decomposed	Included
Y2	Black-throated gray warbler	22-Apr-20	WTG-60	7-day	112	55	Intact-fresh	Included
Y2	Burrowing owl	28-Aug-20	WTG-54	7-day	76	274	Intact-partial decomposed	Included
Y2	Burrowing owl	22-Sep-20	WTG-67	28-day	89	285	Scavenged-fresh	Included
Y2	California gull	13-Feb-20	WTG-59	7-day	61	96	Intact-partial decomposed	Included
Y2	California gull	20-May-20	WTG-60	Incidental	136	57	Intact-partial decomposed	Excluded: off plot
Y2	Caspian tern	02-Jul-20	WTG-59	Incidental	128	69	Scavenged-partial decomposed	Excluded: off plot
Y2	Cliff swallow	06-May-20	WTG-63	7-day	5	43	Dismembered-partial decomposed	Included
Y2	Common raven	04-Dec-19	WTG-54	7-day	35	180	Scavenged-featherspot	Included
Y2	Common raven	30-Apr-20	WTG-63	7-day	115	59	Intact-partial decomposed	Included
Y2	Common yellowthroat	08-Apr-20	WTG-60	7-day	88	41	Intact-partial decomposed	Included
Y2	Common yellowthroat	05-May-20	WTG-56	7-day	112	71	Intact-partial decomposed	Included
Y2	Dark-eyed junco	16-Oct-19	WTG-56	7-day	82	107	Intact-fresh	Included
Y2	European starling	06-Nov-19	WTG-56	7-day	64	265	Scavenged-partial decomposed	Included
Y2	European starling	19-Dec-19	WTG-60	7-day	65	130	Scavenged-featherspot	Included
Y2	European starling	22-Dec-19	WTG-49	7-day	48	115	Scavenged-featherspot	Included
Y2	Ferruginous hawk	10-Oct-19	WTG-60	7-day	58	72	Scavenged-partial decomposed	Included
Y2	Ferruginous hawk	31-Oct-19	WTG-60	7-day	29	309	Intact-fresh	Included
Y2	Ferruginous hawk	04-Dec-19	WTG-57	28-day	35	300	Intact-partial decomposed	Included
Y2	Fox sparrow	24-Sep-20	WTG-57	28-day	63	47	Intact-fresh	Included
Y2	Glaucous-winged gull	19-Dec-19	WTG-59	7-day	58	195	Scavenged-fresh	Included
Y2	Golden eagle	15-Oct-19	WTG-62	Incidental	25	280	Intact-partial decomposed	Included
Y2	Golden eagle	24-Oct-19	WTG-68	7-day	24	38	Intact-partial decomposed	Included
Y2	Golden eagle	24-Nov-19	WTG-65	Incidental	53	90	Intact-fresh	Included
Y2	Golden eagle	23-Jul-20	WTG-59	7-day	93	32	Dismembered-partial decomposed	Included
Y2	Golden-crowned sparrow	19-May-20	WTG-54	7-day	40	49	Scavenged-partial decomposed	Included
Y2	Grasshopper sparrow	07-Jul-20	WTG-58	7-day	87	69	Scavenged-partial decomposed	Included
Y2	Green-winged teal	31-Dec-19	WTG-63	7-day	51	105	Scavenged-fresh	Included
Y2	Green-winged teal	31-Dec-19	WTG-63	7-day	52	103	Intact-fresh	Included
Y2	Green-winged teal	09-Jan-20	WTG-63	7-day	44	89	Scavenged-partial decomposed	Included
Y2	Hermit thrush	21-Apr-20	WTG-54	7-day	112	49	Intact-fresh	Included
Y2	Herring gull	05-Dec-19	WTG-60	7-day	110	334	Intact-fresh	Included
Y2	Herring gull	19-Mar-20	WTG-60	7-day	113	359	Dismembered-fresh	Included
Y2	Horned lark	10-Oct-19	WTG-60	7-day	44	212	Intact-partial decomposed	Included

Project Year	Species	Date	Turbine[1]	Survey Type	Distance From Turbine (m)	Bearing From Turbine (°)	Carcass Condition	Included to Estimate Adjusted Fatalities?[2]
Y2	Horned lark	06-Nov-19	WTG-56	7-day	65	183	Scavenged-featherspot	Included
Y2	Horned lark	08-Jan-20	WTG-50	28-day	15	82	Scavenged-featherspot	Included
Y2	Horned lark	20-Feb-20	WTG-59	7-day	102	202	Scavenged-featherspot	Included
Y2	Horned lark	29-Apr-20	WTG-56	7-day	26	73	Scavenged-partial decomposed	Included
Y2	Horned lark	03-Jun-20	WTG-59	7-day	50	236	Scavenged-partial decomposed	Included
Y2	Horned lark	17-Jun-20	WTG-56	7-day	41	282	Scavenged-partial decomposed	Included
Y2	Horned lark	18-Jun-20	WTG-59	7-day	37	127	Scavenged-partial decomposed	Included
Y2	Horned lark	07-Jul-20	WTG-51	7-day	29	294	Scavenged-featherspot	Included
Y2	Horned lark	07-Jul-20	WTG-52	7-day	43	337	Scavenged-partial decomposed	Included
Y2	Horned lark	28-Jul-20	WTG-52	7-day	70	352	Intact-partial decomposed	Included
Y2	Horned lark	28-Aug-20	WTG-56	7-day	39	62	Scavenged-partial decomposed	Included
Y2	House finch	15-Nov-19	WTG-64	28-day	37	177	Scavenged-partial decomposed	Included
Y2	House finch	31-Dec-19	WTG-63	7-day	20	248	Intact-fresh	Included
Y2	House finch	05-May-20	WTG-62	28-day	50	75	Scavenged-partial decomposed	Included
Y2	House wren	29-Jun-20	WTG-58	7-day	106	71	Scavenged-partial decomposed	Included
Y2	House wren	08-Jul-20	WTG-54	7-day	41	30	Intact-fresh	Included
Y2	House wren	22-Jul-20	WTG-50	28-day	41	54	Intact-partial decomposed	Included
Y2	Lincoln's sparrow	22-Apr-20	WTG-60	7-day	65	24	Dismembered-fresh	Included
Y2	Lincoln's sparrow	30-Apr-20	WTG-63	7-day	105	78	Intact-partial decomposed	Included
Y2	Long-eared owl	22-Jul-20	WTG-56	7-day	1	270	Alive-injured	Included
Y2	MacGillivray's warbler	22-Apr-20	WTG-59	7-day	99	63	Scavenged-partial decomposed	Included
Y2	MacGillivray's warbler	19-May-20	WTG-56	7-day	92	61	Intact-partial decomposed	Included
Y2	MacGillivray's warbler	19-May-20	WTG-56	7-day	112	54	Intact-partial decomposed	Included
Y2	Marsh wren	11-Jun-20	WTG-67	28-day	39	10	Scavenged-partial decomposed	Included
Y2	Nashville warbler	19-May-20	WTG-54	7-day	92	36	Intact-partial decomposed	Included
Y2	Northern mockingbird	13-Nov-19	WTG-50	28-day	29	26	Scavenged-featherspot	Included
Y2	Orange-crowned warbler	05-May-20	WTG-56	7-day	105	66	Intact-partial decomposed	Included
Y2	Red-tailed hawk	11-Oct-19	WTG-64	Incidental	12	268	Intact-fresh	Included
Y2	Red-tailed hawk	18-Oct-19	WTG-64	28-day	12	268	Intact-partial decomposed	Included
Y2	Red-tailed hawk	18-Oct-19	WTG-64	28-day	45	77	Intact-partial decomposed	Included
Y2	Red-tailed hawk	23-Oct-19	WTG-65	28-day	64	256	Intact-partial decomposed	Included
Y2	Red-tailed hawk	28-Oct-19	WTG-67	Incidental	10	250	Intact-partial decomposed	Excluded: on-plot incidental
Y2	Red-tailed hawk	30-Oct-19	WTG-67	28-day	27	189	Intact-partial decomposed	Included
Y2	Red-tailed hawk	25-Nov-19	WTG-D13	Incidental	150	262	Scavenged-partial decomposed	Excluded: off plot
Y2	Red-tailed hawk	23-Jan-20	WTG-63	7-day	60	206	Intact-fresh	Included
Y2	Red-tailed hawk	19-Feb-20	WTG-56	7-day	73	340	Dismembered-fresh	Included
Y2	Red-tailed hawk	06-Apr-20	WTG-51	7-day	49	40	Dismembered-fresh	Included
Y2	Red-tailed hawk	29-Apr-20	WTG-50	28-day	25	21	Intact-partial decomposed	Included

Project Year	Species	Date	Turbine[1]	Survey Type	Distance From Turbine (m)	Bearing From Turbine (°)	Carcass Condition	Included to Estimate Adjusted Fatalities?[2]
Y2	Red-tailed hawk	31-May-20	WTG-57	Incidental	6	90	Intact-fresh	Included
Y2	Red-tailed hawk	10-Jun-20	WTG-51	7-day	53	323	Intact-partial decomposed	Included
Y2	Red-tailed hawk	16-Jun-20	WTG-57	28-day	41	66	Intact-partial decomposed	Included
Y2	Red-tailed hawk	16-Jul-20	WTG-63	7-day	97	112	Scavenged-partial decomposed	Included
Y2	Red-tailed hawk	21-Jul-20	WTG-58	7-day	34	108	Intact-partial decomposed	Included
Y2	Red-tailed hawk	27-Aug-20	WTG-58	7-day	102	11	Scavenged-featherspot	Included
Y2	Red-tailed hawk	03-Oct-20	WTG-65	28-day	91	17	Scavenged-partial decomposed	Included
Y2	Swainson's thrush	19-May-20	WTG-56	7-day	70	45	Intact-fresh	Included
Y2	Townsend's warbler	22-Sep-20	WTG-53	28-day	98	62	Scavenged-featherspot	Included
Y2	Vaux's swift	06-May-20	WTG-60	7-day	50	4	Intact-partial decomposed	Included
Y2	Warbling vireo	29-Apr-20	WTG-56	Incidental	69	26	Intact-fresh	Included
Y2	Western meadowlark	10-Oct-19	WTG-68	7-day	61	2	Scavenged-featherspot	Included
Y2	Western meadowlark	07-Jan-20	WTG-49	7-day	0	35	Intact-partial decomposed	Included
Y2	Western meadowlark	08-Jan-20	WTG-55	28-day	39	167	Scavenged-featherspot	Included
Y2	Western meadowlark	08-Jan-20	WTG-56	7-day	20	179	Scavenged-featherspot	Included
Y2	Western meadowlark	28-Jan-20	WTG-52	7-day	58	274	Scavenged-fresh	Included
Y2	Western meadowlark	12-Mar-20	WTG-63	Incidental	117	347	Scavenged-featherspot	Excluded: off plot
Y2	Western meadowlark	23-Jun-20	WTG-49	7-day	30	287	Scavenged-featherspot	Included
Y2	Western meadowlark	14-Jul-20	WTG-51	7-day	34	95	Scavenged-partial decomposed	Included
Y2	Western meadowlark	24-Jul-20	WTG-64	28-day	19	19	Intact-partial decomposed	Included
Y2	Western meadowlark	30-Sep-20	WTG-50	Incidental	120	156	Scavenged-partial decomposed	Excluded: off plot
Y2	White-crowned sparrow	19-May-20	WTG-56	Incidental	126	47	Scavenged-partial decomposed	Excluded: off plot
Y2	White-throated swift	06-Nov-19	WTG-54	7-day	37	58	Scavenged-featherspot	Included
Y2	White-throated swift	06-Nov-19	WTG-54	7-day	48	297	Intact-fresh	Included
Y2	White-throated swift	06-Nov-19	WTG-56	7-day	1	185	Alive-injured	Included
Y2	White-throated swift	06-Nov-19	WTG-56	7-day	8	326	Scavenged-featherspot	Included
Y2	White-throated swift	12-Nov-19	WTG-51	7-day	19	307	Intact-partial decomposed	Included
Y2	White-throated swift	13-Nov-19	WTG-56	7-day	33	167	Scavenged-featherspot	Included
Y2	White-throated swift	20-Nov-19	WTG-65	28-day	90	274	Scavenged-featherspot	Included
Y2	White-throated swift	25-Nov-19	WTG-56	7-day	33	273	Scavenged-featherspot	Included
Y2	White-throated swift	25-Nov-19	WTG-66	28-day	13	358	Scavenged-partial decomposed	Included
Y2	White-throated swift	21-Jan-20	WTG-58	7-day	27	285	Intact-fresh	Included
Y2	White-throated swift	24-Mar-20	WTG-60	7-day	44	259	Intact-fresh	Included
Y2	Wilson's warbler	23-Apr-20	WTG-68	7-day	78	27	Scavenged-partial decomposed	Included
Y2	Wilson's warbler	13-May-20	WTG-49	7-day	78	85	Intact-partial decomposed	Included
Y2	Wilson's warbler	19-May-20	WTG-57	28-day	70	38	Scavenged-partial decomposed	Included
Y2	Wilson's warbler	17-Jun-20	WTG-54	7-day	99	27	Scavenged-featherspot	Included
Y2	Wilson's warbler	24-Jul-20	WTG-64	28-day	57	40	Scavenged-fresh	Included

Project Year	Species	Date	Turbine[1]	Survey Type	Distance From Turbine (m)	Bearing From Turbine (°)	Carcass Condition	Included to Estimate Adjusted Fatalities?[2]
Y2	Wilson's warbler	27-Aug-20	WTG-51	7-day	87	44	Scavenged-fresh	Included
Y2	Yellow warbler	23-Oct-19	WTG-54	7-day	102	14	Scavenged-featherspot	Included
Y2	Yellow warbler	17-Jun-20	WTG-54	7-day	26	80	Scavenged-featherspot	Included
Y2	Yellow warbler	17-Jun-20	WTG-56	7-day	111	12	Intact-partial decomposed	Included
Y2	Unknown buteo	04-Dec-19	WTG-57	28-day	114	270	Scavenged-partial decomposed	Included
Y2	Unknown buteo	22-Dec-19	WTG-58	7-day	32	287	Scavenged-partial decomposed	Included
Y2	Unknown flycatcher	22-Apr-20	WTG-63	7-day	62	36	Intact-partial decomposed	Included
Y2	Unknown flycatcher	30-Apr-20	WTG-59	7-day	80	68	Scavenged-fresh	Included
Y2	Unknown flycatcher	20-May-20	WTG-59	7-day	104	71	Scavenged-partial decomposed	Included
Y2	Unknown flycatcher	29-Aug-20	WTG-68	7-day	90	78	Intact-partial decomposed	Included
Y2	Unknown gull	10-Oct-19	WTG-59	Incidental	120	123	Scavenged-partial decomposed	Excluded: off plot
Y2	Unknown gull	05-Dec-19	WTG-59	7-day	60	85	Scavenged-partial decomposed	Included
Y2	Unknown gull	11-Dec-19	WTG-60	7-day	15	94	Scavenged-fresh	Included
Y2	Unknown gull	15-Jan-20	WTG-65	Incidental	122	185	Scavenged-featherspot	Excluded: off plot
Y2	Unknown gull	17-Jan-20	WTG-59	7-day	76	30	Scavenged-featherspot	Included
Y2	Unknown gull	17-Jan-20	WTG-60	7-day	68	85	Scavenged-partial decomposed	Included
Y2	Unknown gull	23-Jan-20	WTG-59	Incidental	144	55	Scavenged-featherspot	Excluded: off plot
Y2	Unknown gull	27-Jan-20	WTG-59	Incidental	256	316	Scavenged-fresh	Excluded: off plot
Y2	Unknown gull	06-Feb-20	WTG-60	7-day	65	7	Scavenged-featherspot	Included
Y2	Unknown gull	13-Feb-20	WTG-59	7-day	55	105	Dismembered-fresh	Included
Y2	Unknown gull	20-Feb-20	WTG-59	7-day	55	46	Scavenged-featherspot	Included
Y2	Unknown gull	26-Feb-20	WTG-57	28-day	36	83	Intact-fresh	Included
Y2	Unknown gull	12-Mar-20	WTG-59	7-day	72	36	Scavenged-partial decomposed	Included
Y2	Unknown gull	19-Mar-20	WTG-59	Incidental	128	81	Scavenged-featherspot	Excluded: off plot
Y2	Unknown gull	03-Apr-20	WTG-64	28-day	47	159	Scavenged-partial decomposed	Included
Y2	Unknown gull	28-May-20	WTG-59	7-day	54	34	Intact-partial decomposed	Included
Y2	Unknown gull	06-Aug-20	WTG-59	Incidental	133	79	Scavenged-partial decomposed	Excluded: off plot
Y2	Unknown gull	13-Aug-20	WTG-59	7-day	73	21	Scavenged-featherspot	Included
Y2	Unknown hummingbird	01-Apr-20	WTG-50	28-day	93	99	Scavenged-partial decomposed	Included
Y2	Unknown swallow	16-Jul-20	WTG-59	7-day	65	17	Intact-partial decomposed	Included
Y2	Unknown swallow	16-Jul-20	WTG-59	7-day	74	350	Scavenged-partial decomposed	Included
Y2	Unknown swallow	21-Jul-20	WTG-58	7-day	60	307	Scavenged-partial decomposed	Included
Y2	Unknown swallow	23-Jul-20	WTG-60	7-day	60	65	Scavenged-partial decomposed	Included
Y2	Unknown thrush	30-Dec-19	WTG-53	28-day	87	67	Scavenged-featherspot	Included
Y2	Unknown vireo	27-May-20	WTG-50	28-day	8	25	Scavenged-partial decomposed	Included
Y2	Unknown warbler	22-Apr-20	WTG-60	7-day	83	17	Scavenged-partial decomposed	Included
Y2	Unknown warbler	30-Apr-20	WTG-63	7-day	100	75	Scavenged-partial decomposed	Included
Y2	Unknown warbler	01-May-20	WTG-61	28-day	69	88	Scavenged-partial decomposed	Included

Project Year	Species	Date	Turbine[1]	Survey Type	Distance From Turbine (m)	Bearing From Turbine (°)	Carcass Condition	Included to Estimate Adjusted Fatalities?[2]
Y2	Unknown warbler	06-May-20	WTG-60	7-day	67	35	Dismembered-partial decomposed	Included
Y2	Unknown warbler	21-Jul-20	WTG-51	7-day	91	60	Scavenged-partial decomposed	Included
Y2	Unknown waterbird	30-Jul-20	WTG-59	7-day	109	64	Scavenged-partial decomposed	Included
Y2	Unknown wren	04-Aug-20	WTG-58	7-day	81	41	Scavenged-partial decomposed	Included
Y2	Unknown medium bird	15-Jan-20	WTG-65	28-day	1	180	Scavenged-decomposed	Included
Y2	Unknown small bird	10-Oct-19	WTG-59	7-day	23	270	Scavenged-partial decomposed	Included
Y2	Unknown small bird	19-Nov-19	WTG-49	7-day	94	71	Scavenged-featherspot	Included
Y2	Unknown small bird	29-Jan-20	WTG-57	28-day	81	341	Scavenged-featherspot	Included
Y2	Unknown small bird	20-Apr-20	WTG-49	7-day	81	89	Scavenged-partial decomposed	Included
Y2	Unknown small bird	05-May-20	WTG-56	7-day	101	58	Scavenged-partial decomposed	Included
Y2	Unknown small bird	06-May-20	WTG-60	7-day	106	62	Scavenged-featherspot	Included
Y2	Unknown small bird	06-May-20	WTG-60	Incidental	129	37	Scavenged-featherspot	Excluded: off plot
Y2	Unknown small bird	14-May-20	WTG-56	7-day	97	50	Scavenged-featherspot	Included
Y2	Unknown small bird	14-May-20	WTG-67	28-day	105	75	Scavenged-featherspot	Included
Y2	Unknown small bird	20-May-20	WTG-60	7-day	34	356	Scavenged-partial decomposed	Included
Y2	Unknown small bird	29-May-20	WTG-64	28-day	98	68	Scavenged-featherspot	Included
Y2	Unknown small bird	17-Jun-20	WTG-56	7-day	115	38	Scavenged-partial decomposed	Included
Y2	Unknown small bird	30-Jul-20	WTG-60	7-day	102	59	Scavenged-partial decomposed	Included
Y2	Unknown small bird	04-Aug-20	WTG-52	7-day	98	45	Scavenged-partial decomposed	Included
Y2	Unknown small bird	05-Aug-20	WTG-54	7-day	15	101	Scavenged-featherspot	Included
Y2	Unknown small bird	06-Aug-20	WTG-63	7-day	75	67	Scavenged-featherspot	Included
Y2	Unknown small bird	20-Aug-20	WTG-59	7-day	78	46	Scavenged-partial decomposed	Included
Y2	Unknown small bird	28-Aug-20	WTG-62	28-day	80	80	Scavenged-partial decomposed	Included
Y2	Unknown small bird	24-Sep-20	WTG-57	28-day	91	2	Scavenged-featherspot	Included
Y2	Unknown small bird	03-Oct-20	WTG-63	7-day	97	55	Scavenged-featherspot	Included

[1] Turbine IDs of the form WTG-D## represent Diablo Winds turbines.

[2] Included = included in adjusted fatality estimates. Excluded: off plot = carcass excluded from adjusted fatality estimates because found outside all survey plots. Excluded: on plot incidental = carcass excluded from adjusted fatality estimates because it was discovered incidental to standard surveys by a relevant surveyor or was left in place and never found by surveyors.

Appendix H. Adjusted Annual Fatality Estimates for All Bat and Bird Species Calculated Using *GenEst*: Year 1

Note: Although estimated here for all species regardless of sample size, species-specific estimates based on fewer than five documented fatalities are considered unreliable (Huso et al. 2012).

Species	Size Class	Contributing Fatalities	Fatalities Per Turbine		Fatalities Per MW		Total Fatalities	
			Estimate	95% CI	Estimate	95% CI	Estimate	95% CI
Bats[1]								
Mexican free-tailed bat	–	166	18.79	15.61 – 23.22	8.17	6.79 – 10.10	376	312 – 464
Hoary bat	–	38	4.60	3.30 – 6.46	2.00	1.44 – 2.81	92	66 – 129
Western red bat	–	6	0.60	0.30 – 0.98	0.26	0.13 – 0.42	12	6 – 20
Silver-haired bat	–	1	0.11	0.05 – 0.26	0.05	0.02 – 0.11	2	1 – 5
Unknown bat	–	5	0.74	0.25 – 1.59	0.32	0.11 – 0.69	15	5 – 32
Birds								
American coot	M	0	0.00	0.00 – 0.00	0.00	0.00 – 0.00	0	0 – 0
American kestrel	M	4	0.28	0.20 – 0.46	0.12	0.09 – 0.20	6	4 – 9
Barn owl	M	1	0.08	0.05 – 0.17	0.04	0.02 – 0.07	2	1 – 3
Black-headed grosbeak	S	2	0.19	0.10 – 0.37	0.08	0.04 – 0.16	4	2 – 7
Black-throated gray warbler	S	2	0.15	0.10 – 0.29	0.07	0.04 – 0.12	3	2 – 6
Brewer's blackbird	S	1	0.12	0.05 – 0.37	0.05	0.02 – 0.16	2	1 – 7
Bullock's oriole	S	1	0.08	0.05 – 0.16	0.04	0.02 – 0.07	2	1 – 3
Burrowing owl	M	1	0.07	0.05 – 0.09	0.03	0.02 – 0.04	1	1 – 2
California gull	L	8	0.45	0.40 – 0.49	0.19	0.17 – 0.21	9	8 – 10
Chipping sparrow	S	1	0.09	0.05 – 0.22	0.04	0.02 – 0.09	2	1 – 4
Cliff swallow	S	1	0.08	0.05 – 0.16	0.04	0.02 – 0.07	2	1 – 3
Common raven	L	2	0.11	0.10 – 0.13	0.05	0.04 – 0.06	2	2 – 3
Common yellowthroat	S	0	0.00	0.00 – 0.00	0.00	0.00 – 0.00	0	0 – 0
Dark-eyed junco	S	2	0.18	0.10 – 0.37	0.08	0.04 – 0.16	4	2 – 7
Eurasian collared-dove	M	1	0.08	0.05 – 0.18	0.04	0.02 – 0.08	2	1 – 4
European starling	S	3	0.28	0.15 – 0.55	0.12	0.07 – 0.24	6	3 – 11
Ferruginous hawk	L	1	0.06	0.05 – 0.06	0.02	0.02 – 0.03	1	1 – 1
Fox sparrow	S	0	0.00	0.00 – 0.00	0.00	0.00 – 0.00	0	0 – 0

Species	Size Class	Contributing Fatalities	Fatalities Per Turbine		Fatalities Per MW		Total Fatalities	
			Estimate	95% CI	Estimate	95% CI	Estimate	95% CI
Glaucous-winged gull	L	1	0.06	0.05 – 0.06	0.02	0.02 – 0.03	1	1 – 1
Golden eagle	L	3	0.17	0.15 – 0.19	0.07	0.07 – 0.08	3	3 – 4
Golden-crowned sparrow	S	0	0.00	0.00 – 0.00	0.00	0.00 – 0.00	0	0 – 0
Grasshopper sparrow	S	0	0.00	0.00 – 0.00	0.00	0.00 – 0.00	0	0 – 0
Green-winged teal	M	0	0.00	0.00 – 0.00	0.00	0.00 – 0.00	0	0 – 0
Hermit thrush	S	1	0.09	0.05 – 0.23	0.04	0.02 – 0.10	2	1 – 5
Hermit warbler	S	1	0.08	0.05 – 0.16	0.04	0.02 – 0.07	2	1 – 3
Herring gull	L	1	0.06	0.05 – 0.07	0.02	0.02 – 0.03	1	1 – 1
Horned lark	S	16	1.28	0.88 – 1.76	0.56	0.38 – 0.76	26	18 – 35
House finch	S	2	0.18	0.10 – 0.37	0.08	0.04 – 0.16	4	2 – 7
House wren	S	1	0.08	0.05 – 0.16	0.04	0.02 – 0.07	2	1 – 3
Lincoln's sparrow	S	0	0.00	0.00 – 0.00	0.00	0.00 – 0.00	0	0 – 0
Loggerhead shrike	S	0	0.00	0.00 – 0.00	0.00	0.00 – 0.00	0	0 – 0
Long-eared owl	M	0	0.00	0.00 – 0.00	0.00	0.00 – 0.00	0	0 – 0
MacGillivray's warbler	S	2	0.15	0.10 – 0.29	0.07	0.04 – 0.12	3	2 – 6
Marsh wren	S	2	0.16	0.10 – 0.28	0.07	0.04 – 0.12	3	2 – 6
Mourning dove	M	2	0.16	0.10 – 0.30	0.07	0.04 – 0.13	3	2 – 6
Nashville warbler	S	2	0.16	0.10 – 0.29	0.07	0.04 – 0.13	3	2 – 6
Northern mockingbird	S	0	0.00	0.00 – 0.00	0.00	0.00 – 0.00	0	0 – 0
Orange-crowned warbler	S	3	0.22	0.15 – 0.38	0.10	0.07 – 0.17	4	3 – 8
Pied-billed grebe	M	1	0.08	0.05 – 0.18	0.04	0.02 – 0.08	2	1 – 4
Prairie falcon	L	1	0.06	0.05 – 0.06	0.02	0.02 – 0.03	1	1 – 1
Red-breasted nuthatch	S	1	0.09	0.05 – 0.22	0.04	0.02 – 0.10	2	1 – 4
Red-tailed hawk	L	9	0.50	0.45 – 0.56	0.22	0.20 – 0.24	10	9 – 11
Red-winged blackbird	S	1	0.09	0.05 – 0.22	0.04	0.02 – 0.10	2	1 – 4
Rock pigeon	M	1	0.08	0.05 – 0.17	0.04	0.02 – 0.07	2	1 – 3
Ruby-crowned kinglet	S	3	0.26	0.15 – 0.48	0.11	0.07 – 0.21	5	3 – 10
Spotted towhee	S	1	0.12	0.05 – 0.33	0.05	0.02 – 0.14	2	1 – 7
Swainson's thrush	S	0	0.00	0.00 – 0.00	0.00	0.00 – 0.00	0	0 – 0
Townsend's warbler	S	1	0.08	0.05 – 0.16	0.04	0.02 – 0.07	2	1 – 3
Tree swallow	S	3	0.27	0.15 – 0.52	0.12	0.07 – 0.22	5	3 – 10
Tricolored blackbird	S	1	0.09	0.05 – 0.21	0.04	0.02 – 0.09	2	1 – 4
Unidentified blackbird	S	4	0.35	0.20 – 0.61	0.15	0.09 – 0.27	7	4 – 12

Species	Size Class	Contributing Fatalities	Fatalities Per Turbine		Fatalities Per MW		Total Fatalities	
			Estimate	95% CI	Estimate	95% CI	Estimate	95% CI
Unidentified buteo	S	3	0.17	0.15 – 0.19	0.07	0.07 – 0.08	3	3 – 4
Unidentified flycatcher	S	7	0.60	0.35 – 0.93	0.26	0.15 – 0.40	12	7 – 19
Unidentified gull	S	14	0.76	0.70 – 0.85	0.33	0.30 – 0.37	15	14 – 17
Unidentified hummingbird	S	0	0.00	0.00 – 0.00	0.00	0.00 – 0.00	0	0 – 0
Unidentified medium bird	S	3	0.21	0.15 – 0.31	0.09	0.07 – 0.14	4	3 – 6
Unidentified small bird	S	22	2.06	1.42 – 2.88	0.89	0.62 – 1.25	41	28 – 58
Unidentified warbler	S	8	0.70	0.40 – 1.10	0.30	0.17 – 0.48	14	8 – 22
Vaux's swift	S	0	0.00	0.00 – 0.00	0.00	0.00 – 0.00	0	0 – 0
Warbling vireo	L	3	0.22	0.15 – 0.39	0.10	0.07 – 0.17	4	3 – 8
Western meadowlark	S	10	0.96	0.55 – 1.54	0.42	0.24 – 0.67	19	11 – 31
Western tanager	L	2	0.17	0.10 – 0.35	0.07	0.04 – 0.15	3	2 – 7
White-throated swift	S	7	0.59	0.35 – 0.96	0.26	0.15 – 0.42	12	7 – 19
Wilson's warbler	S	6	0.47	0.30 – 0.75	0.20	0.13 – 0.33	9	6 – 15
Yellow warbler	S	1	0.09	0.05 – 0.23	0.04	0.02 – 0.10	2	1 – 5
Yellow-breasted chat	M	1	0.08	0.05 – 0.17	0.04	0.02 – 0.07	2	1 – 3

Appendix I. Adjusted Annual Fatality Estimates for All Bat and Bird Species Calculated Using *GenEst*: Year 2

Note: Although estimated here for all species regardless of sample size, species-specific estimates based on fewer than five documented fatalities are considered unreliable (Huso et al. 2012).

Species	Size Class	Contributing Fatalities	Fatalities Per Turbine		Fatalities Per MW		Total Fatalities	
			Median	95% CI	Median	95% CI	Median	95% CI
Bats								
Mexican free-tailed bat	–	152	17.77	14.67 – 22.68	7.73	6.38 – 9.86	355	293 – 454
Hoary bat	–	25	3.36	2.17 – 5.17	1.46	0.94 – 2.25	67	43 – 103
Western red bat	–	1	0.23	0.05 – 0.82	0.10	0.02 – 0.36	5	1 – 16
Unknown bat	–	4	0.60	0.20 – 1.44	0.26	0.09 – 0.63	12	4 – 29
Birds								
American coot	M	0	0.06	0.05 – 0.06	0.02	0.02 – 0.03	1	1 – 1
American kestrel	M	4	0.32	0.20 – 0.57	0.14	0.09 – 0.25	6	4 – 11
Barn owl	M	1	0.00	0.00 – 0.00	0.00	0.00 – 0.00	0	0 – 0
Black-headed grosbeak	S	2	0.25	0.15 – 0.43	0.11	0.07 – 0.19	5	3 – 9
Black-throated gray warbler	S	2	0.08	0.05 – 0.16	0.04	0.02 – 0.07	2	1 – 3
Brewer's blackbird	S	1	0.00	0.00 – 0.00	0.00	0.00 – 0.00	0	0 – 0
Bullock's oriole	S	1	0.00	0.00 – 0.00	0.00	0.00 – 0.00	0	0 – 0
Burrowing owl	M	1	0.18	0.10 – 0.33	0.08	0.04 – 0.14	4	2 – 7
California gull	L	8	0.06	0.05 – 0.06	0.02	0.02 – 0.03	1	1 – 1
Chipping sparrow	S	1	0.00	0.00 – 0.00	0.00	0.00 – 0.00	0	0 – 0
Cliff swallow	S	1	0.08	0.05 – 0.16	0.04	0.02 – 0.07	2	1 – 3
Common raven	L	2	0.11	0.10 – 0.13	0.05	0.04 – 0.05	2	2 – 3
Common yellowthroat	S	0	0.16	0.10 – 0.28	0.07	0.04 – 0.12	3	2 – 6
Dark-eyed junco	S	2	0.09	0.05 – 0.23	0.04	0.02 – 0.10	2	1 – 5
Eurasian collared-dove	M	1	0.00	0.00 – 0.00	0.00	0.00 – 0.00	0	0 – 0
European starling	S	3	0.28	0.15 – 0.54	0.12	0.07 – 0.24	6	3 – 11
Ferruginous hawk	L	1	0.17	0.15 – 0.19	0.07	0.07 – 0.08	3	3 – 4
Fox sparrow	S	0	0.16	0.05 – 0.51	0.07	0.02 – 0.22	3	1 – 10
Glaucous-winged gull	L	1	0.06	0.05 – 0.06	0.02	0.02 – 0.03	1	1 – 1

Species	Size Class	Contributing Fatalities	Fatalities Per Turbine		Fatalities Per MW		Total Fatalities	
			Median	95% CI	Median	95% CI	Median	95% CI
Golden eagle	L	3	0.22	0.20 – 0.25	0.10	0.09 – 0.11	4	4 – 5
Golden-crowned sparrow	S	0	0.08	0.05 – 0.16	0.04	0.02 – 0.07	2	1 – 3
Grasshopper sparrow	S	0	0.08	0.05 – 0.16	0.04	0.02 – 0.07	2	1 – 3
Green-winged teal	M	0	0.23	0.15 – 0.43	0.10	0.07 – 0.19	5	3 – 9
Hermit thrush	S	1	0.09	0.05 – 0.16	0.04	0.02 – 0.07	2	1 – 3
Hermit warbler	S	1	0.00	0.00 – 0.00	0.00	0.00 – 0.00	0	0 – 0
Herring gull	L	1	0.11	0.10 – 0.13	0.05	0.04 – 0.05	2	2 – 3
Horned lark	S	16	1.00	0.65 – 1.45	0.43	0.28 – 0.63	20	13 – 29
House finch	S	2	0.29	0.15 – 0.57	0.13	0.07 – 0.25	6	3 – 11
House wren	S	1	0.25	0.15 – 0.42	0.11	0.07 – 0.18	5	3 – 8
Lincoln's sparrow	S	0	0.16	0.10 – 0.28	0.07	0.04 – 0.12	3	2 – 6
Loggerhead shrike	S	0	0.00	0.00 – 0.00	0.00	0.00 – 0.00	0	0 – 0
Long-eared owl	M	0	0.07	0.05 – 0.09	0.03	0.02 – 0.04	1	1 – 2
MacGillivray's warbler	S	2	0.23	0.15 – 0.40	0.10	0.07 – 0.17	5	3 – 8
Marsh wren	S	2	0.09	0.05 – 0.21	0.04	0.02 – 0.09	2	1 – 4
Mourning dove	M	2	0.00	0.00 – 0.00	0.00	0.00 – 0.00	0	0 – 0
Nashville warbler	S	2	0.08	0.05 – 0.16	0.04	0.02 – 0.07	2	1 – 3
Northern mockingbird	S	0	0.12	0.05 – 0.34	0.05	0.02 – 0.15	2	1 – 7
Orange-crowned warbler	S	3	0.08	0.05 – 0.16	0.04	0.02 – 0.07	2	1 – 3
Pied-billed grebe	M	1	0.00	0.00 – 0.00	0.00	0.00 – 0.00	0	0 – 0
Prairie falcon	L	1	0.00	0.00 – 0.00	0.00	0.00 – 0.00	0	0 – 0
Red-breasted nuthatch	S	1	0.00	0.00 – 0.00	0.00	0.00 – 0.00	0	0 – 0
Red-tailed hawk	L	9	0.88	0.80 – 1.02	0.38	0.35 – 0.44	18	16 – 20
Red-winged blackbird	S	1	0.00	0.00 – 0.00	0.00	0.00 – 0.00	0	0 – 0
Rock pigeon	M	1	0.00	0.00 – 0.00	0.00	0.00 – 0.00	0	0 – 0
Ruby-crowned kinglet	S	3	0.00	0.00 – 0.00	0.00	0.00 – 0.00	0	0 – 0
Spotted towhee	S	1	0.00	0.00 – 0.00	0.00	0.00 – 0.00	0	0 – 0
Swainson's thrush	S	0	0.08	0.05 – 0.16	0.04	0.02 – 0.07	2	1 – 3
Townsend's warbler	S	1	0.16	0.05 – 0.52	0.07	0.02 – 0.22	3	1 – 10
Tree swallow	S	3	0.00	0.00 – 0.00	0.00	0.00 – 0.00	0	0 – 0
Tricolored blackbird	S	1	0.00	0.00 – 0.00	0.00	0.00 – 0.00	0	0 – 0
Unidentified blackbird	S	0	0.00	0.00 – 0.00	0.00	0.00 – 0.00	0	0 – 0
Unidentified buteo	S	3	0.11	0.10 – 0.13	0.05	0.04 – 0.06	2	2 – 3

Species	Size Class	Contributing Fatalities	Fatalities Per Turbine		Fatalities Per MW		Total Fatalities	
			Median	95% CI	Median	95% CI	Median	95% CI
Unidentified flycatcher	S	10	0.30	0.20 – 0.50	0.13	0.09 – 0.22	6	4 – 10
Unidentified gull	S	2	0.65	0.60 – 0.73	0.28	0.26 – 0.32	13	12 – 15
Unidentified hummingbird	S	7	0.09	0.05 – 0.22	0.04	0.02 – 0.09	2	1 – 4
Unidentified medium bird	S	6	0.15	0.10 – 0.24	0.06	0.04 – 0.11	3	2 – 5
Unidentified small bird	S	1	2.29	1.60 – 3.11	0.99	0.70 – 1.35	46	32 – 62
Unidentified warbler	S	1	0.39	0.25 – 0.66	0.17	0.11 – 0.29	8	5 – 13
Vaux's swift	S	4	0.08	0.05 – 0.16	0.04	0.02 – 0.07	2	1 – 3
Warbling vireo	L	3	0.08	0.05 – 0.16	0.04	0.02 – 0.07	2	1 – 3
Western meadowlark	S	7	0.73	0.40 – 1.17	0.32	0.17 – 0.51	15	8 – 23
Western tanager	L	14	0.00	0.00 – 0.00	0.00	0.00 – 0.00	0	0 – 0
White-throated swift	S	0	1.05	0.62 – 1.69	0.46	0.27 – 0.73	21	12 – 34
Wilson's warbler	S	8	0.47	0.30 – 0.74	0.21	0.13 – 0.32	9	6 – 15
Yellow warbler	S	22	0.25	0.15 – 0.43	0.11	0.07 – 0.19	5	3 – 9
Yellow-breasted chat	M	3	0.00	0.00 – 0.00	0.00	0.00 – 0.00	0	0 – 0