MONTEZUMA WIND LLC (MONTEZUMA I)

2012 AVIAN AND BAT FATALITY MONITORING REPORT

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Introduction

The Montezuma Wind LLC Wind Energy Center Facility (Montezuma I) is a 36.8-megawatt (MW) wind energy project in the Montezuma Hills Wind Resource Area (MHWRA) in California's Central Valley (Figure 1). The project comprises sixteen 2.3 MW Siemens wind turbines (Figures 2 and 3a) on 1,466 acres characterized by mixed agricultural uses and scattered wetland areas (Figure 3b). Nonnative annual grasslands used for sheep grazing and winter wheat are the predominant land uses, with some fields used to grow safflower and other crops. Small wetlands and small, widely scattered groves of Eucalyptus trees (*Eucalyptus* sp.) and native willows (*Salix* sp.) also occur within the project area. The project area is bordered on three sides by existing wind energy facilities and is thus considered an infill project.

Because bird and bat mortality has emerged as a key issue in the operation of wind projects, it has become important to incorporate scientifically robust post-construction monitoring programs. Accurate and defensible analyses of these projects' effects on bird and bat populations can inform future design decisions that could result in reductions in avian and bat fatalities related to turbine interactions.

The accurate estimation of turbine-related avian and bat fatalities poses significant challenges, primarily because of the intensive effort required to conduct thorough searches of the area around turbines and the fact that fatalities are—on a per turbine basis—relatively rare events even though total numbers of birds and bats killed at a site within a year may be large. However, new developments continue to provide insights into improvements in the avian and bat fatality monitoring process. The sampling protocols and analyses conducted as part of the post-construction monitoring program for Montezuma I have taken advantage of these advances and represents a conservative (least prone to error) approach to the accurate estimation of avian and bat fatalities. The approach was designed to meet or exceed the requirements and standards outlined in the following documents.

- *Solano County Land Use Permit No. U-06-06*, specifically Condition of Approval No. 35 / Mitigation Measure BIO-9a.
- National Wind Coordinating Committee / RESOLVE's *Studying Wind Energy / Bird Interactions: A Guidance Document*.
- The California Energy Commission's *California Guidelines for Reducing Impacts to Birds and Bats from Wind Energy Development*.
- NextEra Energy Resource's *Montezuma Wind Plant Project Raptor Mitigation Plan*.

The purpose of this report is to provide estimates of avian and bat fatalities occurring in the Montezuma I project area, to evaluate their relationship to information gathered on the relative abundance of birds and potential raptor prey species occurring within the project area, and to compare these values with estimates derived from similar studies in the adjacent areas of the MHWRA.

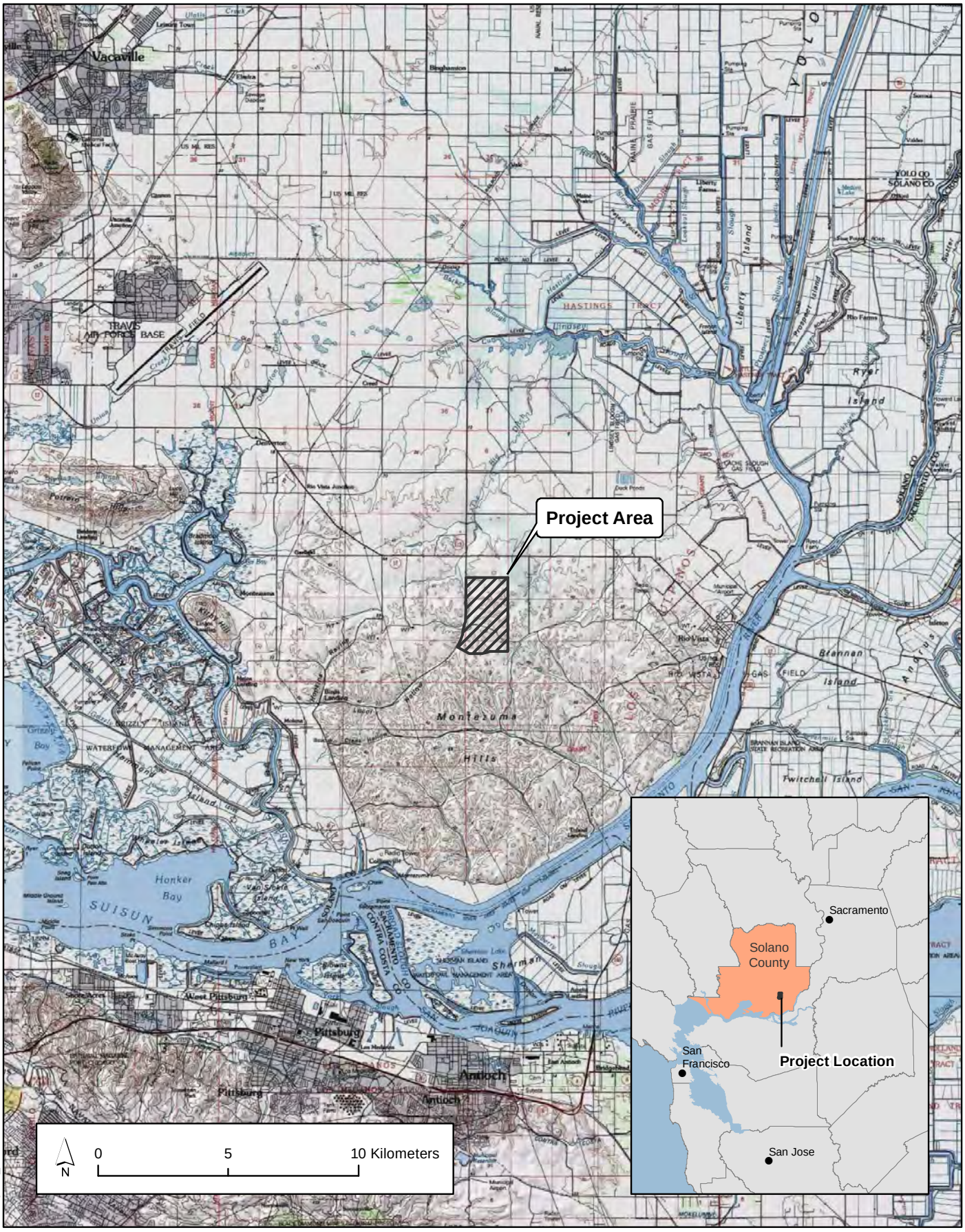

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Figure 1
Location of the Montezuma I Wind Energy Facility

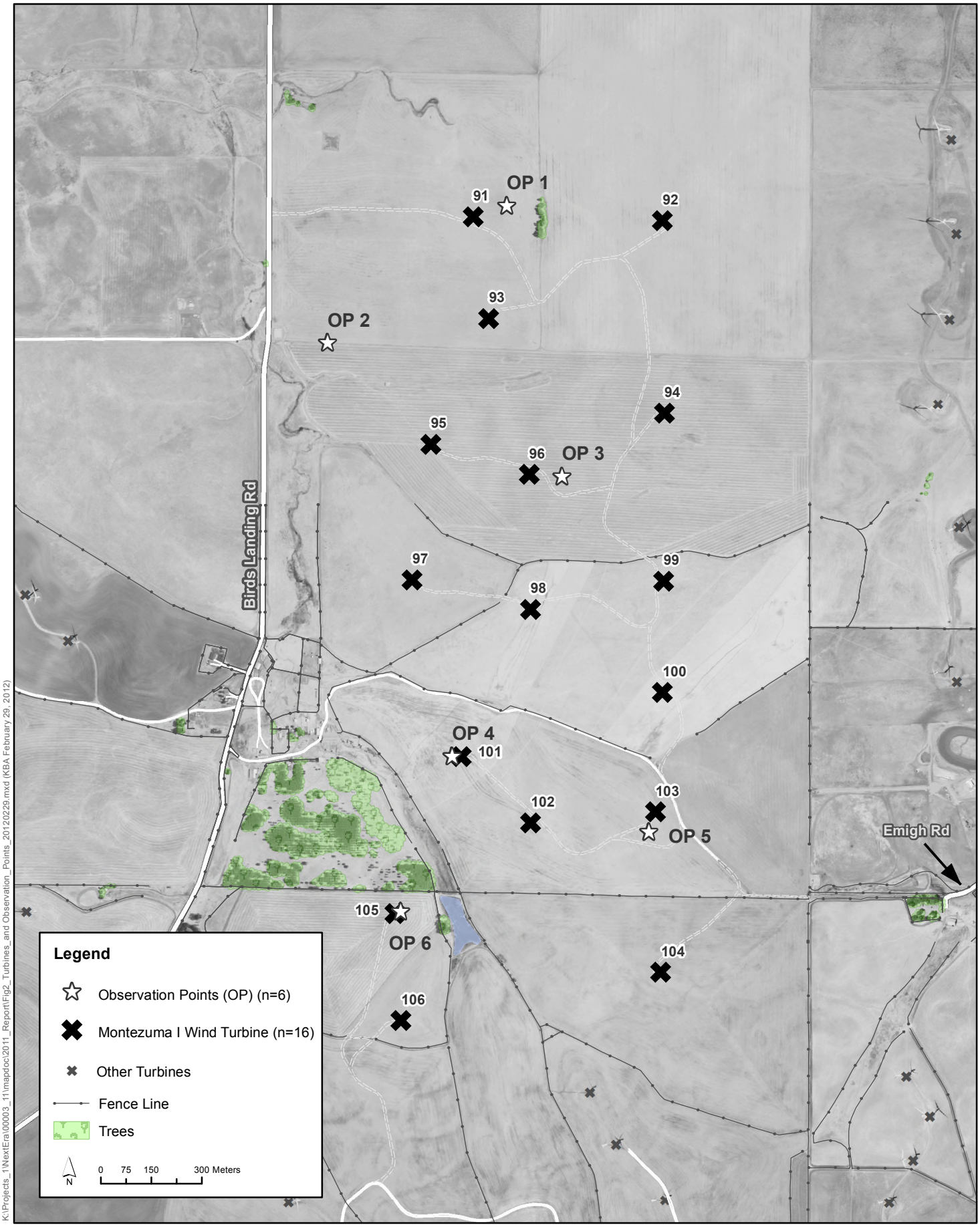

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Figure 2
Turbines and Avian Use Observation Points (OPs) at the Montezuma I Wind Energy Facility

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Figure 3a
Siemens 2.3 MW Turbines in the Montezuma I Project Area

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Figure 3b
Typical Habitats Surrounding the Siemens 2.3 MW Turbines in the Montezuma I Project Area

Chapter 2
Methods

Field Methods

Carcass Searches

We conducted carcass searches from January 2011 through December 2012. Searches were conducted at all 16 turbines every week (i.e., a 7-day search interval) from January 1, 2011, through July 31, 2011. To reduce costs and bring the level of effort in line with similarly sized projects in California, we reduced the level of effort beginning August 1, 2011 and conducted searches at six of the turbines (turbines 92, 99, 100, 102, 104, and 10) using a 14-day search interval for the rest of the year, maintaining the 7-day search interval at all the remaining turbines. In 20112, we again searched 6 of the turbines (91, 93, 98, 99, 100, and 101) using a 14-day search interval and continued the 7-day search interval at the remaining 10 turbines. Carcass searches were typically conducted for 3 days (Tuesday through Thursday) each week. Search crews recorded predominant land cover type (nonnative annual grassland, wheat, safflower, etc.), vegetation height, and the proportion of the search area that could be searched during each visit. During parts of the year, one of the landowners used electric fences to rotate sheep through the pasture, thereby preventing the search crew from accessing portions of the standard turbine search area. Although the size and duration of these exclusions were relatively minor, they were documented so that they could be taken into account when estimating avian and bat fatality rates.

The search area extended approximately 105 meters from each turbine in all directions. Searchers walked transects spaced approximately 6 meters apart, with adjustments made for variations in terrain and vegetation height. When evidence of a fatality was found, the location was documented using a GPS unit, the carcass was photographed, a tissue sample and/or feather sample was collected, and specific data on the condition of the carcasses were recorded. To be considered a fatality, each find must have included body parts or feathers. In the case of feathers, at least five tail feathers, two primaries from the same wing within 5 meters of each other, or a total of 10 feathers must have been found. Time of death for each carcass was estimated as fresh (less than 24 hours old), within search interval (greater than 24 hours but less than 7 or 14 days of age), greater than the search interval (less than 30 but greater than 7 or 14 days of age), and aged (greater than 30 days). Whenever partial remains were found, the data were cross-referenced with finds from previous searches and adjacent turbines to avoid double counting. All carcasses found within the search area were assumed to be turbine-related unless evidence was available to indicate an alternative cause of death.

Estimating Detection Probability

The number of fatalities detected during carcass surveys is not equal to the actual number of fatalities because some unknown proportion of birds and bats killed by turbines is never observed. To develop a statistically supportable estimate of turbine-related fatalities, the probability of detecting a fatality must be determined. Surveyors can miss carcasses during carcass searches. The proportion of carcasses available to be detected that is actually detected is a metric commonly

referred to as *searcher efficiency*. Carcasses can also be removed from the search area during the interval between deposition of the carcass and the subsequent carcass survey, and thus are not available to be detected by searchers. The probability of a carcass being removed by scavengers or other factors during this interval is commonly referred to as *carcass persistence*. Accordingly, it has become customary to split detection probability into these two components—searcher efficiency and carcass persistence—and attempt to estimate these two probabilities separately using searcher efficiency trials and carcass persistence trials.

Both searcher efficiency trials and carcass persistence trials were conducted at Montezuma I, as summarized below. Carcasses used in these trials were obtained from fatality searches in the project area, from another project site in the nearby Altamont Pass Wind Resource Area, or from nearby wildlife rehabilitation centers. Only species potentially present within the project were used in the searcher efficiency and carcass persistence trials.

Bat carcasses were not used in searcher efficiency or carcass persistence trials because we were unwilling to use bat carcasses obtained from offsite locations because of the potential risk of disease transmission. Although both searcher efficiency and carcass persistence rates are undoubtedly different for bats than for small birds, in the absence of bat carcasses we used estimates of searcher efficiency and carcass persistence from small birds to estimate total bat fatalities in the project area. The resulting estimates of total bat fatalities are likely biased low due to a generally lower searcher efficiency for bat carcasses relative to small birds (PNWWRM IX. 2013).

Searcher Efficiency Trials

To estimate the proportion of fatalities present but not detected by searchers, we conducted searcher efficiency trials. Because searcher efficiency may be influenced by type and height of vegetation or other factors affecting visibility, weather, cloud cover, and other environmental factors that vary by season, we conducted trials seasonally.

In 2011 we conducted two separate trials: one in summer (defined as April through September) and one in winter (defined as October through March). A total of 20 bird carcasses—10 small birds and 10 large birds—were placed during each trial in the morning prior to searches being conducted. Situations in which carcasses were laced were divided into two visibility categories, high and low. Two size classes, small and large, were chosen for analytical purposes. Birds weighing more than 153 grams (4.9 ounces), were considered large. Sixteen of these carcasses were placed in situations with a visibility classification of low and 24 were placed in situations with a visibility classification of high.

In 2012, we conducted one searcher efficiency trial in each of the following four seasons: spring (defined as mid-February through mid-May), summer (mid-May through mid-August), fall (mid-August to mid-November), and winter (mid-November through mid-February; winter trials continued into 2013). A total of 10 carcasses of each size class were placed during the summer trials, 10 large and 12 carcasses during the winter trials, 11 large and 11 small carcasses during the spring trials, and 11 large and 13 small carcasses during the fall trials. Twenty five of these carcasses were placed in situations with a visibility classification of low and 61 were placed in situations with a visibility classification of high.

Carcasses were placed at randomly chosen distances and bearings from all turbines (but within the maximum search radius). Carcass search crews were blind to when trials were being conducted.

Search crews were notified at the end of the day on which trials were conducted so that carcasses not detected could be collected.

Carcass Persistence Trials

To estimate the proportion of carcasses that are removed from the search area by scavengers or other forces between carcass searches, we conducted carcass persistence trials, with each trial broken into two 14-day periods, with 10–11 carcasses placed in each period to avoid an overabundance of carcasses at any one time.

In 2011, we conducted two trials, one during summer (April through September) and one during winter (October through March). In each trial 20 marked carcasses—including 10 small and 10 large birds—were placed at random directions and distances from turbines and checked each day for the first 5 days and then every other day until the fourteenth day, when all carcass remains were removed from the field. Carcasses were classified according to their condition and photographed at each check. All turbines were included in each trial.

In 2012, we conducted four trials, one in each of the four seasons defined above under searcher efficiency trials in 2012. In the spring trial, carcasses were checked every day for the first 5 days and then every other day until the fourteenth day, when all carcass remains were removed from the field. In the summer, fall, and winter trials, carcasses were checked every day for the first 4 days and then every other day until the fourteenth day when all carcass remains were removed from the field. Carcasses were classified according to their condition and photographed at each check.

Avian Use and Abundance Surveys

Surveys of avian use (i.e., relative abundance) can be helpful in interpreting changes in fatality rates over time. The methods outlined below were chosen to maintain consistency with other wind generation facilities in the MHWRA.

Six observation points (OPs) were selected (Figure 2) to provide complete coverage of all available habitat types within the project area. Each point was surveyed once per week for 30 minutes from March 2011 through December 31, 2012. Observations were conducted in the morning, early afternoon, and late afternoon. The order in which the OPs were surveyed was rotated systematically to ensure that each OP was surveyed at various times of day.

Each survey was conducted for 30 minutes and covered the entire 360-degree viewshed. Every 60 seconds, the observer scanned the viewshed and recorded the number of each species seen and/or heard and a distance category from the point at which the observation was made. Surveys were not conducted on days with outlying weather conditions. We then calculated the number of bird-minutes each species was observed per observation session.

Potential Prey Abundance

To address prey availability, all observations of potential mammalian prey species (i.e., California ground squirrels, lagomorphs, rodents, etc.) made during carcass searches of the project area were documented. Observations of prey species observed during other times were recorded incidentally. Species, number observed, activity of the surveyor at the time of detection (i.e., during carcass searches or incidentally), and locations were recorded.

Analytical Methods

We estimated total annual fatalities in the project area and the average number of fatalities per turbine for individual species, raptors, non-raptors, all birds, and all bats using the Huso estimator (Huso 2010). We used the R software program developed by Huso (Huso et al. 2011) to develop appropriate models of the searcher efficiency and carcass persistence components of detection probability and to calculate point estimates and confidence intervals of total fatalities. We used the Huso estimator because it has been shown to be less biased than other estimators under the conditions and sampling protocol used in this study, because it provides a relatively simple means of modeling detection probability, and because it provides a mechanism to adjust for fatalities not found because of temporary exclusions to the standard search area. The estimator and associated software program use a bootstrap re-sampling technique to provide approximate confidence intervals around the estimates. We calculated 95% confidence intervals based on 1,000 bootstrap samples. Results from 2011 indicated that the difference in estimates using the Huso estimator and the Curry and Kerlinger estimator were minor (39 versus 38 raptors and 191 versus 197 total birds, respectively [ICF International 2012]). Accordingly, we did not include estimates using other estimators in this report.

We evaluated the effects of season (winter and summer for 2011; winter, spring, summer, and fall for 2012), carcass size (small and large), and visibility (high and low) on searcher efficiency and carcass persistence rates and chose the models with the smallest Akaike Information Criterion (AIC) values to generate final estimates of total fatalities. We chose two size classes because we lacked sufficient statistical power to evaluate more than two classes and because our experience in the Altamont Pass Wind Resource Area indicates that adding a medium size class does not contribute significantly to the prediction of detection rates. Mourning doves were classified as small birds, and anything larger than a mourning dove was classified as a large bird. For 2012, we defined an additional variable for an alternative season (AltSeason) that collapsed the four seasonal categories used in 2012 into the two categories used in 2011 (winter and summer).

For carcass persistence, we evaluated carcass size, season, AltSeason, and visibility using four different distributions commonly used to model survival or persistence times (i.e., the Weibull, exponential, lognormal, and loglogistic distributions [White and Garrott 1990]).

To account for the temporary exclusions from portions of the search area due to local agricultural practices (noted above), we calculated the total size of the theoretical search area around each turbine and multiplied this by the total number of searches conducted for that turbine to obtain a measure of total theoretical effort. We then calculated the total actual effort by taking the size of the exclusion areas and multiplying by the number of searches during which the exclusion was operative. Dividing the actual by the theoretical total search area gave a proportion of the total area searched; this value was used in the Huso estimator to represent the proportion of the area searched.

Chapter 3
Results

A total of 71 bird and 20 bat fatalities (assumed to be turbine-related) were documented during regular searches in 2011 in the Montezuma I project area (Table 3-1). Five of these birds were found during the first round of searches (i.e., clearing searches) and were therefore excluded from the analyses because they could not be assigned to an interval. An additional 17 bird and 4 bat fatalities were found incidentally to carcass searches and were thus also excluded from the analyses. In total, 66 birds and 20 bats were used in the analysis of fatality rates and estimates of total fatalities in 2011.

A total of 99 bird and 8 bat fatalities (assumed to be turbine-related) were documented during regular searches in 2012 (Table 3-1). One additional injured bird found during regular searches sustained permanent damage and was nonreleasable; because this bird was lost to the wild population and the location of the incident was known (searchers observed the bird dropping from the turbine), it was included in the analyzed fatalities. An additional nine bird fatalities were found incidentally to carcass searches and were thus excluded from the analyses. In total, 100 birds and 8 bats were used in the analysis of fatality rates and estimates of total fatalities for 2012.

Table 3-1. Species and Type of Fatalities Detected in the Montezuma I Project Area, 2011 and 2012

	2011			2012	
Species	Clearing Searches	Included In Analysis	Incidental Finds	Included in Analysis	Incidental Finds
Birds					
Cooper's hawk	0	1	0	0	0
Northern harrier	0	4	0	0	0
Red-tailed hawk	1	10	5	2	0
Swainson's hawk	0	1	0	0	0
Turkey vulture	0	3	2	2	1
American kestrel	0	3	0	4	0
Great horned owl	0	0	0	2	0
Barn owl	0	0	1	2	0
Unidentified raptor	0	1	0	0	0
Total raptors	**1**	**23**	**8**	**12**	**1**
Green-winged teal	0	0	0	1	0
Mallard	0	1	0	1	0
Ruddy duck	0	0	1	0	0
Horned lark	0	0	0	2	0
White-throated swift	0	1	0	0	0
Killdeer	0	0	0	2	0
Mourning dove	0	4	0	21	2
Rock pigeon[a]	0	1	2	2	1
Unidentified dove	0	1	0	1	0
Common raven	0	0	0	0	1
Savannah sparrow	0	1	0	0	0

Species	2011			2012	
	Clearing Searches	Included In Analysis	Incidental Finds	Included in Analysis	Incidental Finds
Unidentified sparrow	0	0	0	1	0
White-crowned sparrow	0	1	0	0	0
American goldfinch	0	0	0	1	0
House finch	0	0	0	2	0
Tree swallow	0	3	0	0	0
Unidentified swallow	1	0	0	0	0
Brewer's blackbird	0	0	0	1	0
Red-winged blackbird	0	7	1	7	1
Unidentified blackbird	0	0	0	7	0
Western meadowlark	1	4	0	14	1
Loggerhead shrike	0	0	0	1	0
Northern mockingbird	0	1	0	0	0
Wilson's warbler	0	0	0	1	0
Yellow warbler	0	1	1	1	0
Yellow-rumped warbler	0	0	0	1	0
Northern flicker	1	1	0	0	0
American coot	0	3	0	3	0
Black rail	0	0	0	1	0
Sora	0	0	0	1	0
Ruby-crowned kinglet	0	1	0	1	1
European starling[a]	1	2	0	2	0
Western tanager	0	1	0	2	0
Unidentified small bird	0	6	4	7	1
Unidentified medium bird	0	2	0	3	0
Unidentified large bird	0	1	0	1	0
Total non-raptors	**4**	**43**	**9**	**88**	**8**
Total birds	**5**	**66**	**17**	**100**	**9**
Bats					
Hoary bat	0	11	2	4	0
Mexican free-tailed bat	0	8	2	4	0
Unidentified bat	0	1	0	0	0
Total bats	**0**	**20**	**4**	**8**	**0**

[a] Nonnative species.

Detection Probability Modeling

We fit several models to the searcher efficiency data for both years and evaluated them for fit to the data (Table 3-2). In 2011, carcass size was the variable most significantly related to searcher efficiency, followed by season. Visibility explained relatively little variation in searcher efficiency or carcass persistence. This may have been due to the fact that we did not classify visibility *a priori* and therefore did not place carcasses in such a way as to optimally evaluate visibility. However, the model with carcass size alone was selected as the final model because it was the most parsimonious model and had the lowest AIC value. The large difference in AIC values between the models with carcass size and models without carcass size strongly indicates that size is an important determinant of searcher efficiency.

Carcass size was also the variable that explained most of the variation in searcher efficiency in 2012. Based on AIC values, the model with just two seasons (summer and winter, i.e., the variable AltSeason) was a better fit to the data than the model with four seasons. The best model for 2012 included the interaction between size and AltSeason (Table 3-2).

The estimates of searcher efficiency probabilities from the selected models are given in Table 3-3. Searcher efficiency estimates were generally lower in 2012 than in 2011, particularly for small birds, but also for large birds in summer.

We also fit several models to the carcass persistence data. The lognormal and loglogistic distributions fit the data better than did the exponential or Weibull distributions in all cases (Table 3-4). In 2011, carcass size and season equally explained variation in carcass persistence rates. The model with both size and season had an AIC value more than 10 points lower than models with only size or only season, indicating that both variables were important in explaining variation in carcass persistence rates in 2011 (Table 3-4).

In 2012, size was again the variable that explained the most variation in carcass persistence rates. Like searcher efficiency, the model with only two seasonal categories (summer and winter, i.e., AltSeason) fit the data better than did the model with four seasons (i.e., the variable season) (Table 3-4).

The estimates of carcass persistence probabilities from the selected models are given in Table 3-5. Carcass persistence rates for small birds differed substantially between years, while rates for large birds stayed relatively constant.

Table 3-2. Searcher Efficiency Models Evaluated and Their Associated AIC Values Based on Trials Conducted in the Montezuma I Project Area, 2011 and 2012

Model	AIC Value
2011	
Size	50.68
Season	59.05
Visibility	59.30
Size + Season	51.36
Size + Season + Size * Season	50.82
2012	
Size	110.40
Season	128.21
AltSeason	125.00
Visibility	123.70
Size + Visibility	109.78
Size + Visibility + Size*Visibility	111.30
Size + AltSeason	110.00
Size + AltSeason + Size*AltSeason	108.90
Size + Season	113.88
Size + Season + Size*Season	116.18

Note: Red text indicates selected model.

Table 3-3. Searcher Efficiency Estimates (95% Confidence Interval) for the Selected Model Based on Carcasses Placed at the Montezuma I Project Area, 2011 and 2012

Size	Season (2011) or AltSeason (2012)	Carcasses Placed	Carcasses Found	Searcher Efficiency Estimate
2011 (Size, AIC Value 50.68)				
Small	N/A	22	9	0.41 (0.23–0.64)
Large	N/A	20	17	0.85 (0.7–1.0)
Total	**–**	**42**	**26**	**–**
2012 (Size + AltSeason + Size*AltSeason, AIC Value 108.90)				
Small	Summer	15	5	0.33 (0.13–0.60)
Small	Winter	31	10	0.32 (0.16–0.48)
Large	Summer	18	10	0.56 (0.28–0.78)
Large	Winter	24	21	0.87 (0.75–1.00)
Total	**–**	**88**	**46**	**–**

Table 3-4. Carcass Persistence Rate Models Evaluated and Their Associated AIC Values Based on Trials Conducted in the Montezuma I Project Area, 2011 and 2012

Model	AIC Value
2011	
Size (Exponential)	88.02
Size (Weibull)	80.69
Size (Loglogistic)	79.94
Size (Lognormal)	79.46
Season (Exponential)	88.02
Season (Weibull)	80.69
Season (Loglogistic)	79.94
Season (Lognormal)	79.46
Visibility (Loglogistic)	90.32
Visibility (Lognormal)	89.76
Size + Season (Lognormal)	67.63
Size + Season (Loglogistic)	67.38
Size + Season + Size*Season (Lognormal)	69.63
Size + Season + Size*Season (Loglogistic)	69.34
2012	
Size (Lognormal)	162.49
Season (Lognormal)	171.00
AltSeason (Lognormal)	167.4
Visibility (Lognormal)	169.00
Size + AltSeason (Lognormal)	162.41
Size + AltSeason + Size * AltSeason (Lognormal)	164.30

Note: Red text indicates selected model.

Table 3-5. Carcass Persistence Rate Estimates for the Selected Model Based on Carcasses Placed in the Montezuma I Project Area, 2011 and 2012

Size	Season (2011) or AltSeason (2012)	Carcasses Placed	Carcass Persistence Estimate (r)
2011 (Size + Season [Loglogistic], AIC Value 67.38)			
Small	Summer	10	0.97 (0.84–1.00)
Small	Winter	10	0.42 (0.23–0.71)
Large	Summer	10	1.00 (0.99–1.00)
Large	Winter	10	0.97 (0.84–1.00)
2012 (Size + AltSeason [Lognormal], AIC Value 162.41)			
Small	Summer	22	0.81 (0.67–0.93)
Small	Winter	21	0.90 (0.79–0.98)
Large	Summer	20	0.95 (0.86–1.00)
Large	Winter	21	0.98 (0.92–1.00)

Estimates of Total Fatalities

Estimates of the total number of birds and bats killed in the Montezuma I project area in presumably turbine-related incidents during 2011 and 2012 are presented in Table 3-6. Western meadowlarks and red-winged blackbirds were the most commonly killed birds in the project area in 2011. These species continued to be among the most commonly killed species in 2012, although mourning dove fatalities increased substantially in 2012, becoming the most commonly killed species at the site. Overall, bird fatalities increased by 72%, from 191 in 2011 to 328 in 2012. This increase reflects an increase in the number of non-raptors killed in 2012, particularly among mourning doves.

Total raptor fatalities decreased 26% from 2011 to 2012. American kestrels continued to be the most commonly killed raptor, with the estimated number of kestrels killed annually remaining static between years at 15. However, red-tailed hawk fatalities decreased by 69% between 2011 and 2012, and northern harrier fatalities decreased 100% from five to zero between years. Total bat fatalities decreased by 56% between 2011 and 2012.

No fatalities of federally listed as threatened or endangered species were documented during 2011 or 2012. However, one Swainson's hawk fatality was documented in 2011 and one black rail fatality was documented in 2012; both species are listed as threatened under the California Endangered Species Act. Hoary bats and Mexican free-tailed bats were the only bat species documented as fatalities during the study.

The annual per turbine and per megawatt fatality rates for the project area are presented in Appendix A to facilitate comparisons with other studies.

Post-construction monitoring data are available from four other wind generation facilities in the MHWRA: a 1-year fatality study at the Solano Wind site (Burleson Consulting 2010), a 1-year study at the Shiloh II site (Kerlinger et al. 2010), a 3-year study at the Shiloh I site (Kerlinger et al. 2009), and a 2-year study at the High Winds site (Kerlinger et al. 2006). Although there are differences between studies in carcass search effort (primarily due to the greater spacing of transects around turbines in the other studies) and analytical methods, general comparisons can be informative. Overall avian fatality rates were higher at Montezuma I than three of the four facilities for which data are available, but lower than the average rates for the study with the longest duration (Table 3-7). Fatality rates were higher for the most common raptor species at the Montezuma I site compared with the four other studies. However, no golden eagles, white-tailed kites, ferruginous hawks, or rough-legged hawks were killed at the Montezuma I site, and thus fatality rates for those species were lower than those of the other studies. Estimated bat fatality rates were lower at Montezuma I than those reported at three of the four other studies for which data are available.

Table 3-6. Unadjusted Avian and Bat Fatalities and Estimated Total Annual Fatalities (95% Confidence Interval) in the Montezuma I Project Area, 2011 and 2012

	Unadjusted Fatalities		Estimated Total (Adjusted)	
Species	2011	2012	2011	2012
Birds				
Cooper's hawk	1	0	2 (2–5)	0
Northern harrier	4	0	5 (2–10)	0
Red-tailed hawk	10	2	13 (4–24)	4 (2–9)
Swainson's hawk	1	0	2 (2–5)	0
Turkey vulture	3	2	4 (2–8)	4 (2–10)
American kestrel	3	4	15 (3–50)	15 (4–37)
Great horned owl	0	2	0	4 (3–16)
Barn owl	0	2	0	4 (2–13)
Unidentified large raptor	1	0	2 (2–5)	0
Total raptors[a]	**23**	**12**	**39 (20–76)**	**29 (13–57)**
Green-winged teal	0	1	0	2 (2–4)
Mallard	1	1	2 (2–5)	3 (2–11)
Horned lark	0	2	0	8 (6–36)
White-throated swift	1	0	7 (4–36)	0
Killdeer	0	2	0	8 (3–23)
Mourning dove	4	21	11 (4–32)	79 (34–239)
Rock pigeon[b]	1	2	2 (2–4)	4 (2–9)
Unidentified dove	1	1	2 (2–4)	2 (2–5)
Savannah sparrow	1	0	7 (4–34)	0
Unidentified sparrow	0	1	0	4 (3–20)
White-crowned sparrow	1	0	8 (5–40)	0
American goldfinch	0	1	0	4 (3–15)
House finch	0	2	0	8 (3–25)
Tree swallow	3	0	19 (5–62)	0
Brewer's blackbird	0	1	0	4 (3–17)
Red-winged blackbird	7	7	22 (3–67)	26 (8–65)
Unidentified blackbird	0	7	0	28 (8–100)
Western meadowlark	4	14	25 (6–88)	51 (22–145)
Loggerhead shrike	0	1	0	5 (3–24)
Northern mockingbird	1	0	3 (2–10)	0
Wilson's warbler	0	1	0	4 (3–21)
Yellow warbler	1	1	3 (2–12)	4 (3–20)
Yellow-rumped warbler	0	1	0	4 (3–16)
Northern flicker	1	0	2 (2–5)	0
American coot	3	3	4 (2–8)	4 (2–8)
Black rail	0	1	0	4 (3–21)
Sora	0	1	0	4 (3–21)
Ruby-crowned kinglet	1	1	3 (2–13)	4 (3–21)
European starling[b]	2	2	12 (4–46)	8 (3–22)
Western tanager	1	2	3 (2–11)	8 (3–30)
Unidentified small bird	6	7	23 (4–66)	26 (8–81)
Unidentified medium bird	2	3	3 (2–6)	5 (2–13)
Unidentified large bird	1	1	2 (2–5)	2 (2–4)
Total non-raptors[a]	**43**	**88**	**152 (84–337)**	**300 (186–694)**
Total birds[a]	**66**	**100**	**191 (117–425)**	**328 (216–779)**
Bats				
Hoary bat	11	4	29 (12–64)	17 (5–59)
Mexican free-tailed bat	8	4	39 (15–109)	15 (5–44)
Unidentified bat	1	0	3 (2–12)	0
Total bats[a]	**20**	**8**	**70 (39–162)**	**31 (19–81)**

[a] Estimated number of birds and bats killed is rounded to the nearest whole number. Accordingly, estimates of totals for each group may be different from the sum of individuals composing that group.

[b] Nonnative species.

Table 3-7. Comparison of Adjusted Fatality Rates (per MW per year) in the Montezuma I Project Area with Other Sites in the Montezuma Hills Wind Resource Area

Species/Group	High Winds (2-year average)	Shiloh I (3-year average)	Shiloh II (2-year average)	Solano Wind (1 year)	Montezuma I (2-year average)
Overall avian	**1.36**	**6.96**	**1.95**	**0.34**	**7.1 (4.5–16.4)**
Selected raptors					
Northern harrier	0	0.01	–	–	0.07 (0.03–0.14)
Golden eagle	0.01	0.005	–	–	–
White-tailed kite	0.023	–	–	–	–
Red-tailed hawk	0.14	0.07	0.09	0.15	0.23 (0.08 –0.57)
Ferruginous hawk	0.01	0.01	–	–	–
Rough-legged hawk	0.01	–	–	–	–
Swainson's hawk					0.03 (0.03–0.07)
American kestrel	0.21	0.28	0.03	0.06	0.41 (0.10–1.69)
Peregrine falcon	–	0.005	–	–	–
Overall bat	**2.02**	**3.92**	**2.72**	**1.65**	**1.90 (1.06–4.40)**

Sources: High Winds, Kerlinger et al. 2006; Shiloh I, Kerlinger et al. 2009; Shiloh II, Kerlinger et al. 2010; Solano Wind, Burleson Consulting 2010.

Spatial and Temporal Variation in the Distribution of Fatalities

The distributions of (unadjusted) fatalities across the project area for total birds, raptors, non-raptors, and bats are provided in Table 3-8 and depicted in Figure 4. Total avian fatalities were distributed relatively evenly across turbines. Turbine 97, which had the highest incidence of avian fatalities in 2011, had a lower number of avian fatalities recorded in 2012 than 7 of the 16 turbines in the project area. Of the four turbines with the highest number of avian fatalities in 2011, turbine 105 was the only turbine that remained in the top four turbines for unadjusted avian fatalities in 2012, indicating a high degree of annual variation in the number of avian fatalities at each turbine. The majority of fatalities at turbine 105 were mourning doves, although two great horned owl fatalities were documented at this turbine in 2012. Raptor fatalities were also relatively evenly distributed across turbines. Turbine 97 and turbine 101 were the turbines with the highest number of unadjusted raptor fatalities. Unadjusted bat fatalities were also distributed relatively uniformly across the 16 turbines in the project area.

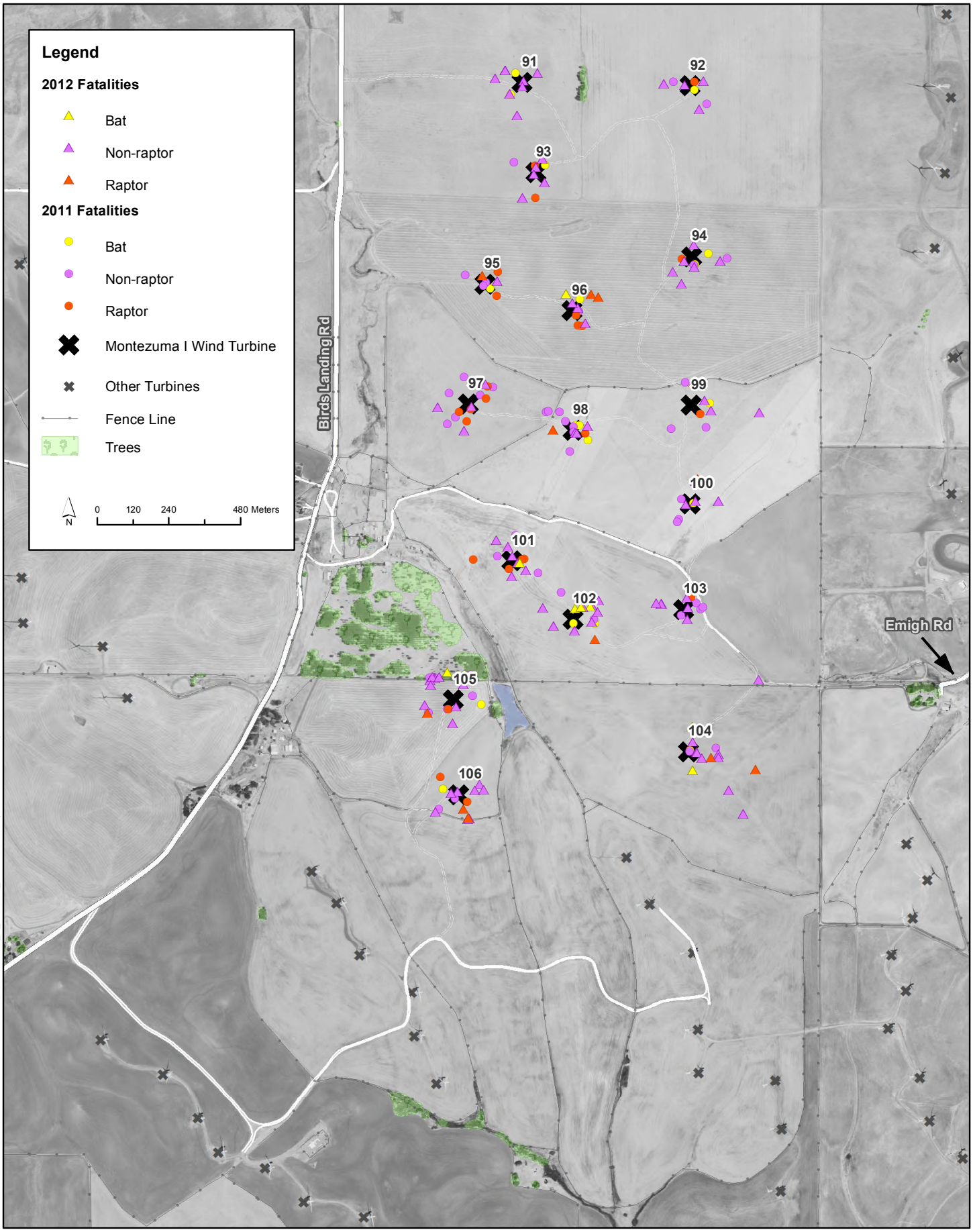

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Figure 4
Distribution of Fatality Detections
Across the Montezuma I Wind Energy Facility, 2011-2012

Table 3-8. Total Number of Unadjusted Avian and Bat Fatalities Detected per Turbine in the Montezuma I Project Area, 2011 and 2012

	Unadjusted Raptor Fatalities		Unadjusted Non-Raptor Fatalities		Unadjusted Total Avian Fatalities		Unadjusted Bat Fatalities	
Turbine	2011	2012	2011	2012	2011	2012	2011	2012
91	0	0	0	8	0	8	2	0
92	1	0	2	4	3	4	1	0
93	2	0	1	4	3	4	1	1
94	1	1	1	4	2	5	2	1
95	2	1	2	1	4	2	1	0
96	3	0	1	5	4	5	2	1
97	5	2	6	3	11	5	0	1
98	1	1	7	2	8	3	3	0
99	1	2	2	1	3	3	1	0
100	0	0	3	4	3	4	1	1
101	4	1	3	5	7	6	1	1
102	0	1	2	10	2	11	2	1
103	1	0	4	6	5	6	0	0
104	0	0	2	9	2	9	1	0
105	1	2	6	12	7	14	1	0
106	1	1	1	10	2	11	1	1
Total fatalities	**23**	**12**	**43**	**88**	**66**	**100**	**20**	**8**

Note: Unadjusted fatalities should be interpreted with caution. Search effort was not equal among turbines due to the use of a two different search intervals at different turbines.

The distribution of adjusted fatalities across the project area, which take into account variations in search effort due to search interval, temporary agricultural exclusions, and other factors, are presented in Table 3-9 for comparison, along with the estimates and confidence intervals for 2011 and 2012 combined. Of the four turbines with the highest number of avian fatalities in 2011, none remained in the top four turbines for adjusted avian fatalities in 2012. The distribution of total adjusted fatalities for the 2 years combined form a continuum ranging from 17 at turbine 94 to 50 at turbine 105. Based on the overlap between the 95% confidence intervals around the estimate of total fatalities for the 2 years combined at each turbine, there is no evidence for any turbine being a larger fatality risk than any other. Therefore, no additional statistical analyses were conducted. However, the turbines with the highest estimates of total fatalities for the 2 years combined tend to be closer to the orchard and farmhouse at the southwestern edge of the project area (Figure 4).

Table 3-9. Total Number of Adjusted Avian Fatalities Detected per Turbine in the Montezuma I Project Area, 2011 and 2012

	Total Adjusted Avian Fatalities		
Turbine	2011	2012	2011 and 2012 combined
91	0	29 (22–129)	28 (22–109)
92	11 (7–50)	12 (10–52)	20 (16–83)
93	4 (4–14)	15 (10–59)	23 (18–110)
94	4 (3–15)	14 (11–61)	17 (14–63)
95	16 (10–73)	5 (4–20)	18 (15–76)
96	7 (6–22)	18 (13–83)	24 (20–98)
97	27 (21–119)	17 (13–68)	40 (34–155)
98	25 (17–109)	5 (4 –17)	29 (23–105)
99	14 (8–72)	11 (8–42)	22 (17–89)
100	9 (6–35)	18 (11–94)	20 (17–77)
101	21 (15–88)	22 (16–96)	39 (32–145)
102	11 (7–57)	34 (24–150)	37 (30–145)
103	19 (13–92)	20 (13–91)	32 (26–122)
104	6 (4–23)	34 (24–158)	35 (27–146)
105	15 (12–58)	41 (31–167)	50 (43–190)
106	10 (6–44)	40 (30–175)	43 (34–171)
Total fatalities	**191**	**328 (209–707)**	**472 (360–760)**

The number of adjusted fatalities for raptors, non-raptors, all birds, and all bats detected per month are presented in Table 3-10. For all birds, fatalities were relatively well distributed throughout the year in 2011. However, in 2012 fatalities spiked in May and then increased again during the period August through October, corresponding roughly to the period of natal dispersal and/or fall migration. For raptors, there was no consistent pattern in the number of fatalities each month. Fatalities were relatively evenly distributed throughout the year in 2011, while in 2012 there were no fatalities detected through the winter and spring (Table 3-10).

There was a large seasonal component to bat fatalities, with all documented fatalities occurring from August through October in both years, except for one fatality documented in June of 2011 (Table 3-10).

Table 3-10. Total Number of Adjusted Avian and Bat Fatalities Detected per Month in the Montezuma I Project Area, 2011 and 2012

	Adjusted Raptors		Adjusted Non-Raptors		Adjusted Total Birds		Adjusted Bats	
Month	2011	2012	2011	2012	2011	2012	2011	2012
January	6 (4–31)	0	28 (7–88)	26 (8–59)	34 (11–100)	26 (8–60)	0	0
February	2 (2–5)	0	14 (2–43)	18 (7–39)	15 (3–47)	18 (6–41)	0	0
March	3 (2–7)	0	2 (2–5)	10 (3–39)	4 (2–9)	9 (2–24)	0	0
April	2 (2–5)	0	15 (5–35)	22 (5–80)	16 (6–35)	21 (4–59)	0	0
May	2 (2–5)	10 (3–24)	15 (2–43)	34 (8–120)	16 (2–54)	43 (14–124)	0	0
June	3 (2–7)	0	6 (2–17)	14 (4–47)	8 (2–21)	14 (4–47)	3 (2–12)	0
July	7 (2–14)	2 (2–8)	6 (2–15)	15 (3–58)	12 (5–27)	16 (3–48)	0	0
August	3 (2–7)	4 (2–12)	8 (3–23)	41 (9–143)	11 (4–24)	44 (8–139)	13 (3–35)	4 (3–20)
September	7 (2–13)	0	8 (3–23)	59 (19–194)	14 (6–27)	59 (20–188)	26 (11–58)	17 (5–55)
October	3 (2–7)	9 (2–22)	29 (7–90)	36 (16–85)	31 (10–99)	45 (25–96)	29 (8–90)	11 (3–37)
November	2 (2–5)	5 (2–15)	27 (6–88)	17 (6–39)	28 (8–91)	22 (10–45)	0	0
December	6 (4–29)	0	2 (2–5)	16 (5–41)	8 (2–31)	16 (4–38)	0	0
Total[1]	39 (22–75)	29 (18–50)	152 (86–348)	302 (187–788)	191 (122–405)	328 (215–685)	70 (38–151)	31 (19–84)

[1] Totals are not sums of the individual estimates but are independent estimates themselves and are therefore different from the sum of monthly totals due to differences in samples sizes and characteristics of the search interval

Spatial and Temporal Variation in Potential Prey Abundance

The total numbers of potential mammalian prey species detected (both dead and alive) at each turbine are presented in Table 3-11. Numbers of potential mammalian prey species were dominated by mice, voles, and unidentified small mammals in 2011. The numbers of small mammals detected declined substantially from 2011 to 2012, the reasons for which are unknown. Total numbers of black-tailed jackrabbits and medium-sized mammals also declined between years, although not nearly as much. California ground squirrels increased slightly, and skunks were detected for the first time in 2012.

There was no clear pattern in the spatial distribution of potential prey species detected in 2011. With the exception of small mammals in 2011 and black-tailed jackrabbits in both years, sample sizes were too small to draw definitive conclusions. For black-tailed jackrabbits, turbines with the highest numbers observed were dominated by grassland habitats, although 9 of the 16 turbines in the project area were dominated by grasslands. Trends were similar when numbers observed were adjusted for search effort.

Table 3-11. Total Number of Live Potential Mammalian Prey Species Detected during Carcass Searches at Each Turbine in the Montezuma I Project Area, 2011 and 2012

	Mouse, Vole, or Unidentified Small Mammal		Black-Tailed Jackrabbit		Unidentified Medium Mammal		Skunk		California Ground Squirrel	
Turbine	2011	2012	2011	2012	2011	2012	2011	2012	2011	2012
91	7	0	8	4	5	0	0	0	0	0
92	131	1	23	4	0	0	0	0	0	0
93	11	0	0	5	0	0	0	0	0	2
94	123	0	0	2	1	0	0	1	0	0
95	100	0	3	2	0	0	0	0	0	0
96	80	0	1	4	0	0	0	0	0	0
97	64	0	7	2	0	0	0	0	1	1
98	63	0	4	0	0	0	0	0	0	1
99	83	0	1	1	0	0	0	0	0	0
100	40	0	0	1	0	0	0	0	0	0
101	53	0	11	1	0	0	0	0	3	0
102	36	0	0	12	0	0	0	0	1	0
103	43	0	1	0	1	0	0	0	0	0
104	5	0	1	0	0	0	0	0	0	0
105	45	0	21	11	0	0	0	0	0	0
106	29	3	13	8	0	0	0	0	0	0
Total	**913**	**4**	**94**	**57**	**7**	**0**	**0**	**1**	**5**	**4**

The number of live potential mammalian prey species detected by month during regular carcass searches was also dominated by mice, voles, and unidentified small mammals in 2011 and by black-tailed jackrabbits in 2012 (Table 3-12). Black-tailed jackrabbits were regularly observed in both years. California ground squirrels were rarely observed. The numbers of live potential mammalian prey species in every category except for California ground squirrels and skunks decreased substantially between 2011 and 2012. This may be due in part to an approximately 13 percent greater search effort in 2011 relative to 2012.

Table 3-12. Total Number of Live Potential Mammalian Prey Species Detected During Carcass Searches by Month in the Montezuma I Project Area, 2011 and 2012

	Mouse, Vole, or Unidentified Small Mammal		Black-Tailed Jackrabbit		Unidentified Medium Mammal		Skunk		California Ground Squirrel	
Month	2011	2012	2011	2012	2011	2012	2011	2012	2011	2012
January	119	4	13	9	0	0	0	0	0	0
February	69	0	8	7	1	0	0	0	0	0
March	171	0	6	4	0	0	0	0	0	0
April	67	0	3	2	0	0	0	1	0	1
May	75	0	2	1	0	0	0	0	0	0
June	75	0	6	3	1	0	0	0	0	0
July	143	0	13	9	0	0	0	0	0	0
August	143	0	6	4	0	0	0	0	2	0
September	20	0	5	3	0	0	0	0	1	0
October	0	0	10	7	0	0	0	0	0	1
November	0	0	13	7	0	0	0	0	1	1
December	2	0	10	1	0	0	0	0	0	1
Total	**884**	**4**	**95**	**57**	**2**	**0**	**0**	**1**	**4**	**4**

Avian Use and Abundance

A total of 61 avian species were documented within the project area in 2011 and 2012. Blackbirds, primarily red-winged blackbirds, were the most abundant avian species group in the project area (Tables 3-13 and 3-14), followed by swallows, rock pigeons, and meadowlarks. Turkey vultures were by far the most common raptor. The vast majority of species observed were common species found throughout the agricultural areas of the Central Valley of California. However, a few sensitive or special status species were occasionally observed. These include ferruginous hawk (DFW Watch List Species), peregrine falcon (DFW Fully Protected Species), burrowing owl (DFW Species of Special Concern), loggerhead shrike (DFW Species of Special Concern), Swainson's hawk (State listed as Threatened), and golden eagle (DFW Fully Protected Species).

Ferruginous hawk and burrowing owl were both observed for the first time in 2012, but only briefly during a single survey in December of 2012. Likewise, a single peregrine falcon was observed in 2011 in December. In 2012, a peregrine falcon was also observed in both November and December.

Loggerhead shrikes are common in the vicinity of the project area and are regularly observed in every month of the year. The average number of minutes per session that loggerhead shrikes were observed increased between 2011 and 2012, corresponding with an increase in fatalities from 0 in 2011 to 1 in 2012. Swainson's hawk were observed only in September and October in 2011 but were observed in April, May, July, August, September, and October of 2012, although only in very low numbers in both years. They do not nest within the confines of the project area. Golden eagles were observed during a single survey in March and June of 2011 and in January, March, and November of 2012.

Changes in the annual estimates of total fatalities were correlated with changes in relative abundance for some species but not for others. Estimates of total northern harrier fatalities declined from 5 in 2011 to 0 in 2012, corresponding with a decline in average bird use from 4.85 to 1.63. Conversely, the decline in estimates of red-tailed hawk fatalities from 13 in 2011 to 4 in 2012 occurred despite an increase in average use between years from 6.61 in 2011 to 8.03 in 2012.

Estimates of mourning dove fatalities increased from 11 in 2011 to 79 in 2012, accounting for most of the increase in estimates of total avian fatalities between years; this increase corresponds with a doubling of average mourning dove use from 2.04 in 2011 to 4.06 in 2012. Bird use was the highest overall at OP numbers 3 and 4 in both years.

Table 3-13. Total Number of Bird-Minutes Documented by Species during Avian Surveys Conducted at Six Observation Points at the Montezuma I Project Area, 2011

Common Name	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	Average
American kestrel	3.08	0.89	1.43	1.25	2.22	0.50	0.69	3.13	2.30	4.46	19.96	2.00
Golden eagle	0.08	0.00	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.13	0.01
Red-tailed hawk	8.38	3.21	0.22	0.96	0.89	9.06	17.46	11.71	8.89	5.35	66.12	6.61
Turkey vulture	7.42	3.58	4.74	9.42	24.67	89.06	54.00	70.75	16.78	14.69	295.10	29.51
White-tailed kite	0.75	0.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.86	0.09
Northern harrier	13.96	9.68	6.04	7.83	2.78	5.75	1.96	0.25	0.15	0.12	48.52	4.85
Swainson's hawk	0.00	0.00	0.00	0.00	0.00	0.00	2.00	0.17	0.00	0.00	2.17	0.22
Peregrine falcon	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.08	0.01
American white pelican	0.00	0.00	5.30	1.71	0.00	0.00	0.00	0.00	0.00	0.00	7.01	0.70
Greater white-fronted goose	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.50	0.50	0.05
Canada goose	17.79	9.37	18.39	0.00	1.00	0.56	0.04	7.00	4.52	0.15	58.82	5.88
Mallard	2.58	4.21	3.83	1.29	0.00	0.00	0.00	0.00	0.00	0.00	11.91	1.19
Great egret	0.00	0.11	0.04	0.00	0.00	0.00	0.00	0.08	0.07	0.00	0.31	0.03
American coot	0.00	1.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.05	0.11
Killdeer	0.79	0.00	0.74	0.63	0.00	0.06	1.19	2.83	3.07	11.46	20.78	2.08
Rock pigeon	8.54	2.84	2.96	5.21	7.00	5.44	12.92	29.83	45.70	77.54	197.98	19.80
Mourning dove	0.54	9.95	5.26	2.71	1.44	0.06	0.35	0.08	0.04	0.00	20.43	2.04
Vaux's swift	0.00	0.00	1.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.30	0.13
Northern flicker	0.13	0.00	0.00	0.00	0.00	0.00	0.00	0.42	0.04	0.27	0.85	0.08
Black phoebe	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.15	0.19	0.02
Say's phoebe	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.50	0.58	0.06
Western kingbird	0.00	0.00	0.74	0.33	0.00	0.00	0.00	0.00	0.00	0.00	1.07	0.11
Loggerhead shrike	1.42	2.74	3.83	1.04	0.00	0.50	0.96	1.04	0.81	1.81	14.15	1.41
Western scrub-jay	0.00	0.00	0.43	0.04	0.00	0.00	0.69	0.58	0.19	0.69	2.63	0.26
Yellow-billed magpie	0.00	0.05	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.14	0.01
American crow	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.00	0.07	0.01
Common raven	8.58	9.95	1.78	5.63	3.33	27.81	18.31	34.00	15.15	22.38	146.92	14.69
Horned lark	0.00	0.32	0.17	0.00	0.06	0.00	0.00	4.58	6.48	0.00	11.61	1.16
Cliff swallow	0.29	0.00	1.65	2.42	0.00	0.00	0.00	0.00	0.00	0.00	4.36	0.44
Tree swallow	0.00	0.00	0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.17	0.02
Barn swallow	0.58	2.16	2.57	2.63	1.61	0.13	0.19	0.04	0.00	0.00	9.90	0.99

Table 3-13. Continued

Common Name	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	Average
Unidentified swallow	21.96	5.26	15.30	5.38	4.67	49.25	11.19	0.08	0.52	0.00	113.61	11.36
Ruby-crowned kinglet	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.01
American robin	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.26	0.08	0.34	0.03
Northern mockingbird	0.13	0.32	0.00	0.29	0.00	0.00	0.00	0.00	0.07	0.31	1.11	0.11
European starling	102.96	31.95	8.52	2.17	0.00	0.00	0.81	4.13	2.63	28.92	182.08	18.21
American pipit	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.15	16.23	16.38	1.64
Yellow-rumped warbler	1.25	0.21	0.00	0.00	0.00	0.00	0.00	0.00	0.07	1.31	2.84	0.28
Savannah sparrow	0.00	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.11	0.04	0.20	0.02
White-crowned sparrow	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.17	4.41	1.35	6.92	0.69
Dark-eyed junco	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.42	0.42	0.04
Black-headed grosbeak	0.00	0.00	0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.22	0.02
Red-winged blackbird	294.88	238.16	192.96	142.29	0.44	0.00	0.46	796.96	3.30	20.96	1,690.40	169.04
Western meadowlark	20.92	8.84	10.26	3.46	0.00	0.00	2.42	7.42	10.70	10.23	74.25	7.43
Yellow-headed blackbird	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.04	0.00
Brewer's blackbird	0.29	1.63	0.00	1.50	0.00	0.00	0.85	42.67	380.30	836.69	1,263.92	126.39
Brown-headed cowbird	0.00	0.47	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.47	0.05
House finch	0.33	0.00	0.57	0.92	0.00	0.00	0.00	0.00	0.00	0.00	1.82	0.18
Total	**517.79**	**347.11**	**289.52**	**199.13**	**50.11**	**188.19**	**126.50**	**1018.92**	**506.81**	**1056.73**	**4,300.80**	**430.08**

Table 3-14. Total Number of Bird-Minutes Documented for by Species during Avian Surveys Conducted at Six Observation Points at the Montezuma I Project Area, 2012

Common Name	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	Average
American kestrel	5.15	6.00	5.65	2.10	0.22	0.17	1.63	1.19	0.83	1.00	3.50	2.58	30.02	2.50
Burrowing owl	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.04	0.00
Golden eagle	0.63	0.00	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.30	0.00	2.02	0.17
Red-tailed hawk	15.11	11.56	5.52	4.90	1.56	0.17	0.75	6.10	6.17	7.92	14.10	22.46	96.31	8.03
Turkey vulture	25.04	21.20	24.48	11.00	9.11	9.29	33.31	49.24	118.00	46.88	5.27	5.92	358.74	29.89
White-tailed kite	0.00	0.00	0.48	0.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.62	0.05
Northern harrier	0.19	0.28	2.39	4.10	3.00	2.04	1.06	1.76	3.67	0.23	0.20	0.63	19.54	1.63
Swainson's hawk	0.00	0.00	0.00	4.38	0.17	0.00	0.19	0.52	0.25	0.15	0.00	0.00	5.66	0.47
Ferruginous hawk	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.25	0.25	0.02
Rough-legged hawk	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.46	0.46	0.04
Unidentified buteo	0.00	0.00	7.17	2.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	9.17	0.76
Peregrine falcon	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.08	0.15	0.01
Prairie falcon	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.33	0.00	0.41	0.03
Unidentified falcon	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.00
Greater white-fronted goose	0.00	0.00	21.74	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	21.74	1.81
Canada goose	0.59	2.64	16.78	2.81	3.83	0.08	1.69	0.43	13.33	5.92	0.20	7.75	56.06	4.67
Unidentified goose	76.67	1,461.20	43.65	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1,581.52	131.79
Mallard	0.00	0.08	0.61	3.48	4.22	0.75	0.00	0.00	0.00	0.00	0.00	0.00	9.14	0.76
Common goldeneye	0.00	0.48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.48	0.04
Unidentified duck	0.00	0.08	0.00	0.19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.27	0.02
American white pelican	0.00	0.00	0.52	3.67	0.56	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.74	0.40
Great egret	0.00	0.00	0.00	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.01
Great-horned owl	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.15	0.00	1.25	2.40	0.20
White pelican	0.00	0.00	0.00	0.00	0.00	0.67	0.00	0.00	0.00	0.00	0.00	0.00	0.67	0.06
American coot	0.00	0.00	0.00	0.86	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.86	0.07
Killdeer	3.15	0.52	0.43	0.05	0.50	0.33	0.13	0.00	0.17	4.00	1.23	10.29	20.80	1.73
Rock pigeon	58.33	11.56	20.57	2.29	2.39	3.58	7.75	4.62	8.17	17.92	14.53	45.96	197.67	16.47
Mourning dove	0.15	2.40	1.30	2.38	3.67	1.58	16.31	18.71	0.25	0.23	1.37	0.38	48.73	4.06
Anna's hummingbird	0.00	0.00	0.00	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.00
Northern flicker	0.00	0.00	0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.31	8.00	12.63	21.11	1.76
Black phoebe	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.08	0.01

Table 3-14. Continued

Common Name	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	Average
Say's phoebe	0.93	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.03	3.92	5.88	0.49
Western kingbird	0.00	0.00	0.00	0.00	0.56	0.58	0.00	0.00	0.00	0.00	0.00	0.00	1.14	0.09
Loggerhead shrike	0.89	1.68	1.09	0.57	3.94	1.29	0.19	7.67	0.33	1.42	9.93	15.13	44.13	3.68
Western scrub-jay	0.11	0.00	0.00	0.19	0.39	0.17	0.13	2.86	5.17	0.27	0.17	0.46	9.90	0.83
Yellow-billed magpie	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.16	0.01
American crow	0.00	0.00	0.00	0.00	0.00	0.00	0.88	1.29	0.67	16.69	0.43	0.00	19.95	1.66
Common raven	25.70	28.76	28.57	18.14	1.89	1.67	2.31	2.10	2.83	10.12	4.47	20.92	147.47	12.29
Horned lark	5.26	0.00	0.00	1.24	0.00	0.00	0.06	0.48	0.00	1.04	13.47	10.17	31.71	2.64
Tree swallow	0.00	0.00	2.17	2.33	0.00	0.00	0.00	1.29	0.08	0.00	0.00	0.00	5.88	0.49
Violet-green swallow	0.00	0.00	0.00	0.00	0.00	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.01
Northern rough-winged swallow	0.00	0.00	0.00	0.00	0.00	0.38	0.00	0.00	0.00	0.00	0.00	0.00	0.38	0.03
Cliff swallow	0.00	0.00	0.00	0.00	0.22	1.96	0.00	3.05	0.17	0.00	0.00	0.00	5.39	0.45
Barn swallow	0.00	0.00	0.30	1.00	1.17	1.67	1.44	0.67	1.08	0.38	0.00	0.00	7.71	0.64
Unidentified swallow	0.00	0.12	1.65	38.05	0.17	1.42	3.63	34.24	20.50	0.73	0.47	0.00	100.96	8.41
House wren	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	1.00	0.08
Ruby-crowned kinglet	0.00	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.25	6.29	0.52
Western bluebird	0.00	0.00	0.00	0.00	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.06	0.00
American robin	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.83	3.83	0.32
Northern mockingbird	0.00	0.00	0.13	0.00	0.00	0.17	0.00	0.10	0.00	0.00	0.00	3.75	4.14	0.35
European starling	8.15	8.84	76.09	2.48	11.28	1.88	0.44	0.24	0.00	388.12	1,513.90	921.21	2,932.60	244.38
American pipit	40.04	0.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.40	3.38	43.93	3.66
Yellow-rumped warbler	0.07	0.00	0.00	0.19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.63	4.89	0.41
Savannah sparrow	0.11	0.36	0.04	0.00	0.00	0.00	0.00	0.00	0.00	2.42	26.30	48.75	77.99	6.50
White-crowned sparrow	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.83	14.96	17.79	1.48
Golden-crowned sparrow	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.04	0.00
Western tanager	0.00	0.00	0.00	0.00	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.00
Red-winged blackbird	27.81	18.64	212.83	270.57	62.00	54.50	0.06	0.00	0.00	145.35	39.83	35.67	867.26	72.27
Tricolored blackbird	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1,160.97	57.79	1,218.76	101.56
Western meadowlark	33.85	7.24	14.09	6.05	6.50	6.25	5.94	34.48	13.17	79.85	146.17	54.79	408.36	34.03
Yellow-headed blackbird	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.04	0.08	0.01
Brewer's blackbird	149.74	22.88	5.04	1.43	0.00	0.75	0.19	0.81	0.25	42.23	288.57	81.42	593.30	49.44

Table 3-14. Continued

Common Name	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	Average
Unidentified blackbird	1,436.56	630.92	487.74	97.10	0.28	7.42	0.06	0.00	0.17	1,732.23	4,897.10	1,076.50	10,366.06	863.84
Brown-headed cowbird	0.00	0.00	0.00	0.00	0.56	0.21	0.00	0.00	0.00	0.00	0.20	0.00	0.96	0.08
House finch	4.63	0.00	0.00	0.14	0.44	0.96	4.19	3.05	0.00	5.77	15.60	3.38	38.15	3.18
Lesser goldfinch	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.77	0.13	0.89	0.07
American goldfinch	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.08	0.00	31.90	5.67	37.70	3.14
Total	**1,918.96**	**2,237.56**	**981.35**	**483.95**	**118.67**	**100.04**	**82.31**	**174.90**	**195.33**	**2,512.42**	**8,205.63**	**2,483.58**	**19,494.72**	**1,624.56**

Chapter 4
Discussion

Estimated total avian fatality rates at Montezuma I over the last 2 years were generally higher than those reported at other wind energy facilities in the MHWRA. Estimated avian fatality rates were higher than those reported for the nearby High Winds and Shiloh II wind energy facilities, but nearly identical to the 3-year average for the nearby Shiloh I facility. Fatality rates for bats were lower than three of the four studies from the MHWRA for which data are available.

Overall avian fatalities increased in the Montezuma I project area between 2011 and 2012. However, this was due primarily to an increase in the number of mourning dove fatalities, a common game species that is one of the most abundant birds in North America (Otis et al. 2008). Conversely, both raptor and bat fatalities decreased substantially between years. Northern harrier fatalities decreased from 5 in 2011 to 0 in 2012, while red-tailed hawk fatalities decreased from 13 in 2011 to 4 in 2012. The decrease in raptor fatalities corresponded with a decrease in potential mammalian prey species documented during regular carcass searches. Changes in fatality rates between years were correlated with changes in avian use for many—but not all—species. The decrease in northern harrier fatalities was accompanied by a decrease in use, while the increase in mourning dove fatalities was correlated with an increase in use. However, the decrease in red-tailed hawk fatalities was not correlated with the increase in use from 2011 to 2012.

There was no clear pattern in the spatial distribution of avian fatalities in the Montezuma I project area. The turbine with the highest number of adjusted fatalities in 2011 had a lower number of fatalities in 2012 than 9 of the 16 turbines in the project area. None of the four turbines with the highest total fatality estimates in 2011 remained in the top five in 2012. Clearly, there is a great deal of annual variation in fatality rates at individual turbines.

There were also no clear seasonal patterns in the distribution of unadjusted fatalities, with the exception of a spike in fatalities in the fall of 2012. Additional monitoring will be needed to determine if the spike in fatalities in the fall of 2012 is a regular phenomenon or a random occurrence.

Modeling results from the searcher efficiency and carcass persistence trials conducted during this study indicate that arbitrarily dividing the year into four seasons may not be warranted. Using the number of carcasses recommended in the CEC Guidelines (California Energy Commission and California Department of Fish and Game 2007) for each seasonal trial did not result in a better model of either searcher efficiency or carcass persistence than models that divided the year into just two seasons. The best models supported the hypothesis that there are only two seasons that substantially affect searcher efficiency and carcass persistence, at least in agricultural habitats in the climate of central California.

Chapter 5
References Cited

Burleson Consulting, Inc. 2010. Avian and Bat Mortality Monitoring Summary Report, Solano Wind Project, Solano County, California. Draft. June. Folsom, CA. Prepared for Sacramento Municipal Utility District, Sacramento, CA.

California Energy Commission and California Department of Fish and Game. 2007. California Guidelines for Reducing Impacts to Birds and Bats from Wind Energy Development. Commission Final Report. California Energy Commission, Renewables Committee, and Energy Facilities Siting Division, and California Department of Fish and Game, Resources Management and Policy Division. CEC-700-2007-008-CMF.

Huso, M. M. P. 2010. *An estimator of wildlife fatality from observed carcasses.* Environmetrics (2010). Blackwell-Wiley. DOI: 10.1002/env.

Huso, M. M. P., N. Som, and L. Ladd. 2011. Fatality Estimator: U.S. Geological Survey Data Series [Not yet approved by USGS]

ICF International. 2010. *Montezuma Wind Plant Project Raptor Mitigation Plan*. May. (ICF 00171.10.) Sacramento, CA. Prepared for NextEra Energy Resources, LLC, Juno Beach, FL.

ICF International. 2012. *2011 Avian and Bat Fatality Monitoring Report*. April. (ICF 00003.11.) Sacramento, CA. Prepared for NextEra Energy Resources.

Kerlinger, P., R. Curry, C. Wilkerson, L. Culp, A. Hasch, and A. Jain. 2006. *Avian Monitoring Study and Risk Assessment for the Shiloh II Wind Power Project, Solano County, California—Final Report*. Curry & Kerlinger, LLC, McLean, VA. Prepared for enXco, Inc., Tracy, CA.

Kerlinger, P., R. Curry, L. Culp, A. Hasch, and A. Jain. 2009. *Post-Construction Avian Monitoring Study for the Shiloh I Wind Power Project, Solano County, California*. Final Report. Curry & Kerlinger LLC, McLean, VA. Prepared for Iberdrola Renewables.

———. 2010. *Post-Construction Avian Monitoring Study for the Shiloh II Wind Power Project, Solano County, California*. Year One Report. Curry & Kerlinger LLC, McLean, VA. Prepared for enXco, Inc., Tracy, CA.

Otis, David L., John H. Schulz, David Miller, R. E. Mirarchi and T. S. Baskett. 2008. *Mourning Dove (*Zenaida macroura*), The Birds of North America Online.* A. Poole, Ed. Ithaca: Cornell Lab of Ornithology. Available: <http://bna.birds.cornell.edu/bna/species/117>. Accessed: March 4, 2013.

PNWWRM IX. 2013. Proceedings of the Wind-Wildlife Research Meeting IX. Broomfield, CO. November 28-30, 2012. Prepared for the Wildlife Workgroup of the National Wind Coordinating Collaborative by the American Wind Wildlife Institute, Washington, DC, Susan Savitt Schwartz, ed. 175 pp.

White, G. C., and R. A. Garrott. 1990. Analysis of Wildlife Radio-Tracking Data. New York: Academic Press.

Appendix A

Fatalities per MW (95% Confidence Interval) and Adjusted Fatalities per Turbine (95% Confidence Interval) at the Montezuma I Project Site, 2011 and 2012

Appendix A. Fatalities per MW (95% Confidence Interval), and Fatalities per Turbine (95% Confidence Interval) in the Montezuma I Project Area, 2011 and 2012

	2011			2012		
Species	Unadjusted Fatalities	Adjusted Fatalities per MW per Year	Adjusted Fatalities per Turbine per Year	Unadjusted Fatalities	Adjusted Fatalities per MW per Year	Adjusted Fatalities per Turbine per Year
Birds						
Cooper's hawk	1	0.05 (0.05–0.14)	0.08 (0.06–0.30)	0	0	0
Northern harrier	4	0.14 (0.05–0.27)	0.31 (0.07–0.60)	0	0	0
Red-tailed hawk	10	0.35 (0.11–0.65)	0.76 (0.22–1.46)	2	0.11 (0.05–0.24)	0.19 (0.07–0.56)
Swainson's hawk	1	0.05 (0.05–0.14)	0.08 (0.07–0.29)	0	0	0
American kestrel	3	0.41 (0.08–1.36)	0.90 (0.17–3.06)	4	0.41 (0.11–1.01)	0.91 (0.23–2.29)
Great-horned owl	0	0	0	2	0.11 (0.08–0.43)	0.24 (0.18–0.97)
Barn owl	0	0	0	2	0.11 (0.05–0.35)	0.24 (0.09–0.77)
Unidentified raptor	1	0.05 (0.05–0.14)	0.08 (0.07–0.30)	0	0	0
Turkey vulture	3	0.11 (0.05–0.22)	0.22 (0.07–0.47)	2	0.11 (0.05–0.27)	0.21 (0.07–0.60)
Total raptors[a]	**23**	**1.06 (0.54–2.07)**	**2.42 (1.20–4.73)**	**12**	**0.79 (0.35–1.55)**	**1.79 (0.78–3.51)**
Green-winged teal	0	0	0	1	0.05 (0.05–0.11)	0.07 (0.07–0.24)
Mallard	1	0.05 (0.05–0.14)	0.07 (0.07–0.25)	1	0.08 (0.05–0.30)	0.13 (0.10–0.63)
Horned lark	0	0	0	2	0.22 (0.16–0.98)	0.45 (0.34–2.19)
White-throated swift	1	0.19 (0.11–0.98)	0.38 (0.23–2.19)	0	0	0
Killdeer	0	0	0	2	0.22 (0.08–0.63)	0.46 (0.16–1.40)
Mourning dove	4	0.30 (0.11–0.87)	0.65 (0.23–1.95)	21	2.15 (0.92–6.49)	4.90 (2.08–14.90)
Rock pigeon[b]	1	0.05 (0.05–0.11)	0.08 (0.7–0.24)	2	0.11 (0.05–0.24)	0.19 (0.07–0.55)
Unidentified dove	1	0.05 (0.05–0.11)	0.07 (0.07–0.22)	1	0.05 (0.05–0.14)	0.07 (0.07–0.26)
Savannah sparrow	1	0.19 (0.11–0.92)	0.38 (0.22–2.08)	0	0	0
White-crowned sparrow	1	0.22 (0.14–1.09)	0.05 (0.26–2.50)	0	0	0
Unidentified sparrow	0	0	0	1	0.11 (0.08–0.54)	0.23 (0.14–1.25)
American goldfinch	0	0	0	1	0.11 (0.08–0.41)	0.21 (0.14–0.90)
House finch	0	0	0	2	0.22 (0.08–0.68)	0.45 (0.17–1.53)
Tree swallow	3	0.52 (0.14–1.68)	1.14 (0.27–3.84)	0	0	0
Brewer's blackbird	0	0	0	1	0.11 (0.08–0.46)	0.23 (0.16–1.04)

Species	2011			2012		
	Unadjusted Fatalities	Adjusted Fatalities per MW per Year	Adjusted Fatalities per Turbine per Year	Unadjusted Fatalities	Adjusted Fatalities per MW per Year	Adjusted Fatalities per Turbine per Year
Red-winged blackbird	7	0.60 (0.08–1.82)	1.34 (0.17–4.18)	7	0.71 (0.22–1.77)	1.59 (0.45–4.01)
Unidentified blackbird	0	0	0	7	0.76 (0.22–2.72)	1.75 (0.47–6.20)
Western meadowlark	4	0.68 (0.16–2.39)	1.56 (0.33–5.49)	14	1.39 (0.60–3.94)	3.18 (1.36–9.02)
Loggerhead shrike	0	0	0	1	0.14 (0.08–0.65)	0.26 (0.15–1.44)
Northern mockingbird	1	0.08 (0.05–0.27)	0.16 (0.11–0.59)	0	0	0
Wilson's warbler	0	0	0	1	0.11 (0.08–0.57)	0.23 (0.14–1.27)
Yellow warbler	1	0.08 (0.05–0.33)	0.16 (0.11–0.71)	1	0.11 (0.08–0.54)	0.23 (0.14–1.25)
Yellow-rumped warbler	0	0	0	1	0.11 (0.08–0.43)	0.21 (0.14–0.94)
Northern flicker	1	0.05 (0.05–0.14)	0.08 (0.07–0.28)	0	0	0
American coot	3	0.11 (0.05–0.22)	0.23 (0.07–0.49)	3	0.11 (0.05–0.22)	0.23 (0.07–0.49)
Black rail	0	0	0	1	0.11 (0.08–0.57)	0.24 (0.14–1.26)
Sora	0	0	0	1	0.11 (0.08–0.57)	0.24 (0.14–1.26)
Ruby-crowned kinglet	1	0.08 (0.05–0.35)	0.17 (0.11–0.76)	1	0.11 (0.08–0.57)	0.23 (0.14–1.27)
European starling[b]	2	0.33 (0.11–1.25)	0.72 (0.24–2.87)	2	0.22 (0.08–0.60)	0.45 (0.16–1.37)
Western tanager	1	0.08 (0.05–0.30)	0.16 (0.10–0.63)	2	0.22 (0.08–0.82)	0.50 (0.16–1.84)
Unidentified small bird	6	0.63 (0.11–1.79)	1.40 (0.22–4.12)	7	0.71 (0.22–2.20)	1.61 (0.47–5.05)
Unidentified medium bird	2	0.08 (0.05–0.16)	0.15 (0.07–0.36)	3	0.14 (0.05–0.35)	0.26 (0.07–0.77)
Unidentified large bird	1	0.05 (0.05–0.14)	0.08 (0.07–0.30)	1	0.05 (0.05–0.11)	0.07 (0.07–0.24)
Total non-raptors[a]	**43**	**4.13 (2.28–9.16)**	**9.50 (5.23–21.01)**	**88**	**8.15 (5.05–18.06)**	**18.69 (11.62–43.37)**
Total birds[a]	**66**	**5.19 (3.18–11.55)**	**11.91 (7.28–26.56)**	**100**	**8.91 (5.87–21.17)**	**20.48 (13.48–48.68)**
Bats						
Hoary bat	11	0.79 (0.33–1.74)	1.78 (0.69–4.00)	4	0.46 (0.14–1.60)	1.00 (0.31–3.66)
Mexican free-tailed bat	8	1.06 (0.41–2.96)	2.39 (0.92–6.80)	4	0.41 (0.14–1.20)	0.91 (0.26–2.72)
Unidentified bat	1	0.08 (0.05–0.33)	0.16 (0.11–0.73)	0	0	0
Total bats[a]	**20**	**1.90 (1.06–4.40)**	**4.33 (2.38–10.08)**	**8**	**0.84 (0.52–2.20)**	**1.91 (1.14–5.01)**

[a] Estimated number of birds and bats killed is rounded to the nearest whole number. Accordingly, estimates of totals for each group may be different from the sum of individuals composing that group.

[b] Nonnative species.

Appendix B

Species, Turbine Number, Date, Date of Previous Search, Size Class, Age Class, Sex, and Visibility of Fatalities Found During Regular Searches in the Montezuma I Project Area, 2011 and 2012

Appendix B

Species, Turbine Number, Date, Date of Previous Search, Size Class, Age Class, Sex, and Visibility of Fatalities Found During Regular Searches in the Montezuma I Project Area, 2011 and 2012

Species	Turbine Number	Date	Date of Previous Search	Size Class	Visibility	Age class	Sex
American kestrel	101	1/12/2011	1/5/2011	S	Low	Unk	Mal
European starling	95	1/13/2011	1/6/2011	S	High	Adu	Unk
Small bird	99	1/13/2011	1/6/2011	S	High	Unk	Unk
Small bird	99	1/13/2011	1/6/2011	S	High	Unk	Unk
American coot	93	1/20/2011	1/13/2011	L	High	Unk	Unk
Northern flicker	105	1/25/2011	1/18/2011	L	High	Adu	Fem
White-throated swift	97	1/26/2011	1/19/2011	S	Low	Unk	Unk
American coot	105	2/1/2011	1/25/2011	L	Low	Unk	Unk
European starling	105	2/15/2011	2/8/2011	S	High	Unk	Unk
Unidentified large bird	97	2/23/2011	2/16/2011	L	High	Unk	Unk
Unidentified raptor	97	2/23/2011	2/16/2011	L	High	Unk	Unk
Savannah sparrow	103	3/2/2011	2/23/2011	S	High	Adu	Unk
American coot	100	3/9/2011	3/2/2011	L	High	Unk	Unk
Northern harrier	103	3/9/2011	3/2/2011	L	Low	Unk	Unk
Northern harrier	93	3/31/2011	3/24/2011	L	High	Imm	Fem
Medium bird	100	4/6/2011	3/30/2011	L	Low	Unk	Unk
Ruby-crowned kinglet	103	4/6/2011	3/30/2011	S	High	Adu	Mal
Small bird	98	4/13/2011	4/6/2011	S	High	Unk	Unk
Medium bird	105	4/19/2011	4/12/2011	L	Low	Unk	Unk
Unidentified dove	105	4/19/2011	4/12/2011	L	Low	Unk	Unk
Small bird	97	4/20/2011	4/13/2011	S	High	Unk	Unk
Small bird	97	4/27/2011	4/20/2011	S	High	Unk	Unk
Red-tailed hawk	96	4/28/2011	4/21/2011	L	Low	Unk	Unk
Mallard	92	5/10/2011	5/3/2011	L	Low	Unk	Fem
Western tanager	103	5/11/2011	5/4/2011	S	Low	Adu	Mal
Red-tailed hawk	96	5/12/2011	5/5/2011	L	Low	Imm	Unk
Mourning dove	98	5/18/2011	5/11/2011	S	Low	Unk	Unk
Red-winged blackbird	98	5/25/2011	5/18/2011	S	Low	Imm	Unk
Red-winged blackbird	98	6/1/2011	5/25/2011	S	Low	Imm	Unk
Red-winged blackbird	98	6/1/2011	5/25/2011	S	Low	Imm	Unk
Mexican free-tailed bat	106	6/7/2011	5/31/2011	S	Low	Unk	Fem
Red-tailed hawk	97	6/8/2011	6/1/2011	L	High	Imm	Unk
Red-tailed hawk	96	6/16/2011	6/9/2011	L	Low	Imm	Unk
Red-winged blackbird	101	6/22/2011	6/15/2011	S	Low	Adu	Unk
Red-winged blackbird	96	6/30/2011	6/23/2011	S	High	Adu	Mal

Species	Turbine Number	Date	Date of Previous Search	Size Class	Visibility	Age class	Sex
Turkey vulture	101	7/6/2011	6/29/2011	L	Low	Imm	Unk
American kestrel	98	7/7/2011	6/30/2011	S	High	Adu	Mal
Northern harrier	94	7/7/2011	6/30/2011	L	High	Imm	Unk
Mourning dove	104	7/12/2011	7/5/2011	S	Low	Unk	Unk
Red-winged blackbird	95	7/14/2011	7/7/2011	S	High	Adu	Mal
Red-tailed hawk	92	7/20/2011	7/13/2011	L	Low	Unk	Unk
Western meadowlark	102	8/16/2011	8/2/2011	S	Low	Imm	Unk
Mourning dove	104	8/17/2011	8/3/2011	S	High	Adu	Unk
Hoary bat	105	8/23/2011	8/16/2011	S	Low	Unk	Unk
Hoary bat	99	8/23/2011	8/9/2011	S	High	Unk	Unk
Cooper's hawk	101	8/24/2011	8/17/2011	L	High	Imm	Mal
Northern mockingbird	105	8/30/2011	8/23/2011	S	Low	Imm	Unk
Hoary bat	94	9/1/2011	8/25/2011	S	High	Unk	Unk
Hoary bat	96	9/1/2011	8/25/2011	S	High	Unk	Unk
Hoary bat	96	9/1/2011	8/25/2011	S	High	Unk	Unk
Red-tailed hawk	99	9/6/2011	8/23/2011	L	High	Imm	Unk
Turkey vulture	105	9/6/2011	8/30/2011	L	High	Adu	Unk
Small bird	101	9/7/2011	8/31/2011	S	High	Unk	Unk
Swainson's hawk	97	9/7/2011	8/31/2011	L	High	Imm	Unk
Hoary bat	94	9/8/2011	9/1/2011	S	High	Unk	Unk
Turkey vulture	95	9/8/2011	9/1/2011	L	High	Adu	Unk
Hoary bat	102	9/13/2011	8/30/2011	S	High	Unk	Mal
Hoary bat	102	9/13/2011	8/30/2011	S	High	Unk	Unk
Hoary bat	91	9/13/2011	8/30/2011	S	High	Unk	Unk
Hoary bat	98	9/14/2011	9/7/2011	S	High	Unk	Unk
Mourning dove	98	9/14/2011	9/7/2011	S	Low	Unk	Unk
Red-tailed hawk	97	9/14/2011	9/7/2011	L	High	Unk	Unk
Red-tailed hawk	93	9/15/2011	9/8/2011	L	High	Imm	Unk
Yellow warbler	94	9/15/2011	9/8/2011	S	High	Adu	Mal
Mexican free-tailed bat	104	9/20/2011	9/6/2011	S	High	Unk	Mal
Hoary bat	98	9/21/2011	9/14/2011	S	High	Unk	Unk
Unidentified bat	101	9/21/2011	9/14/2011	S	High	Unk	Unk
Mexican free-tailed bat	95	9/22/2011	9/15/2011	S	High	Unk	Unk
Mexican free-tailed bat	93	9/29/2011	9/22/2011	S	High	Unk	Mal
Mexican free-tailed bat	91	10/11/2011	9/27/2011	S	High	Unk	Unk
Red-winged blackbird	98	10/12/2011	10/5/2011	S	High	Imm	Mal
Mexican free-tailed bat	98	10/12/2011	10/5/2011	S	High	Unk	Mal
Mexican free-tailed bat	92	10/18/2011	10/4/2011	S	High	Unk	Unk
Western meadowlark	92	10/18/2011	10/4/2011	S	Low	Unk	Unk
Mexican free-tailed bat	100	10/19/2011	10/12/2011	S	High	Unk	Unk
Tree swallow	103	10/19/2011	10/12/2011	S	High	Adu	Fem
White-crowned sparrow	106	10/25/2011	10/11/2011	S	High	Unk	Unk
Red-tailed hawk	101	11/2/2011	10/26/2011	L	High	Unk	Unk
Red-tailed hawk	97	11/2/2011	10/26/2011	L	High	Imm	Unk
Northern harrier	106	11/8/2011	10/25/2011	L	Low	Unk	Unk

Species	Turbine Number	Date	Date of Previous Search	Size Class	Visibility	Age class	Sex
Tree swallow	100	11/22/2011	11/15/2011	S	High	Adu	Unk
Tree swallow	97	11/22/2011	11/15/2011	S	High	Adu	Unk
Western meadowlark	101	11/30/2011	11/23/2011	S	High	Unk	Unk
Western meadowlark	102	12/6/2011	11/22/2011	S	High	Adu	Unk
Rock pigeon	97	12/13/2011	12/6/2011	L	High	Unk	Unk
American kestrel	95	12/15/2011	12/8/2011	S	High	Adu	Mal
Red-winged blackbird	101	01/03/2012	12/28/2011	S	High	Imm	Mal
Green-winged teal	92	01/04/2012	12/27/2011	L	High	Unk	Mal
Mourning dove	91	01/10/2012	12/20/2011	S	High	Unk	Unk
Red-winged blackbird	101	01/10/2012	01/03/2012	S	High	Imm	Mal
Mourning dove	106	01/12/2012	01/05/2012	S	Low	Unk	Unk
Western meadowlark	95	01/18/2012	01/11/2012	S	High	Unk	Unk
Western meadowlark	106	01/19/2012	01/12/2012	S	Low	Unk	Unk
Horned lark	104	01/26/2012	01/19/2012	S	High	Unk	Unk
Yellow-rumped warbler	92	02/01/2012	01/25/2012	S	High	Adu	Unk
European starling	91	02/07/2012	01/24/2012	S	High	Adu	Unk
American coot	103	02/21/2012	02/07/2012	L	High	Unk	Unk
Killdeer	99	02/21/2012	02/07/2012	S	High	Unk	Unk
American coot	98	02/28/2012	02/14/2012	L	High	Unk	Unk
Mourning dove	93	02/28/2012	02/14/2012	S	High	Adu	Unk
Medium bird	105	03/01/2012	02/23/2012	L	Low	Unk	Unk
Western meadowlark	96	03/07/2012	02/29/2012	S	High	Adu	Unk
Brewer's blackbird	93	03/13/2012	02/28/2012	S	High	Adu	Unk
Rock pigeon	91	04/03/2012	03/20/2012	L	Low	Adu	Unk
Red-winged blackbird	91	04/03/2012	03/20/2012	S	Low	Adu	Mal
Western meadowlark	101	04/10/2012	04/03/2012	S	Low	Adu	Unk
Mourning dove	91	04/17/2012	04/03/2012	S	Low	Adu	Unk
Mourning dove	96	04/18/2012	04/11/2012	S	High	Adu	Unk
Mourning dove	104	04/26/2012	04/19/2012	S	High	Adu	Unk
Great horned owl	105	05/03/2012	04/26/2012	L	Low	Unk	Unk
Mourning dove	105	05/03/2012	04/26/2012	S	Low	Unk	Unk
Red-tailed hawk	102	05/16/2012	05/09/2012	L	Low	Adu	Unk
Mourning dove	106	05/17/2012	05/10/2012	S	Low	Unk	Unk
Red-winged blackbird	106	05/17/2012	05/10/2012	S	Low	Adu	Fem
Small bird	97	05/17/2012	05/10/2012	S	High	Unk	Unk
American kestrel	101	05/22/2012	05/15/2012	S	Low	Adu	Mal
Western meadowlark	102	05/23/2012	05/16/2012	S	Low	Adu	Unk
Mourning dove	97	05/24/2012	05/17/2012	S	High	Unk	Unk
Small bird	105	05/24/2012	05/17/2012	S	Low	Unk	Unk
Small bird	106	05/24/2012	05/17/2012	S	Low	Unk	Unk
Turkey vulture	99	05/29/2012	05/15/2012	L	Low	Adu	Unk
Yellow warbler	101	05/29/2012	05/22/2012	S	Low	Unk	Unk
Western tanager	100	06/19/2012	06/05/2012	S	Low	Adu	Fem
Mourning dove	102	06/20/2012	06/13/2012	S	Low	Unk	Unk
Mourning dove	104	06/21/2012	06/14/2012	S	High	Unk	Unk

Species	Turbine Number	Date	Date of Previous Search	Size Class	Visibility	Age class	Sex
Rock pigeon	102	06/27/2012	06/20/2012	L	Low	Unk	Unk
Barn owl	97	07/05/2012	06/28/2012	L	High	Adu	Unk
mallard	98	07/17/2012	07/03/2012	L	High	Adu	Mal
Mourning dove	91	07/24/2012	07/10/2012	S	Low	Adu	Unk
Mourning dove	91	07/24/2012	07/10/2012	S	Low	Imm	Unk
Mourning dove	105	07/26/2012	07/19/2012	S	Low	Imm	Unk
Mourning dove	105	08/02/2012	07/26/2012	S	Low	Unk	Unk
Great horned owl	105	08/09/2012	08/02/2012	L	Low	Unk	Unk
Horned lark	104	08/09/2012	08/02/2012	S	High	Unk	Unk
Mourning dove	105	08/09/2012	08/02/2012	S	Low	Adu	Unk
Medium bird	105	08/16/2012	08/09/2012	L	Low	Unk	Unk
Mourning dove	105	08/16/2012	08/09/2012	S	Low	Unk	Unk
Small bird	104	08/16/2012	08/09/2012	S	High	Unk	Unk
Loggerhead shrike	103	08/21/2012	08/07/2012	S	High	Unk	Unk
Western meadowlark	103	08/21/2012	08/07/2012	S	High	Unk	Unk
Hoary bat	94	08/22/2012	08/15/2012	S	High	Adu	Unk
Black rail	104	08/23/2012	08/16/2012	S	High	Adu	Mal
Barn owl	94	08/29/2012	08/22/2012	L	High	Adu	Fem
Mourning dove	106	08/30/2012	08/23/2012	S	Low	Unk	Unk
Sora	104	08/30/2012	08/23/2012	S	High	Adu	Unk
Mexican free-tailed bat	97	09/06/2012	08/30/2012	S	High	Unk	Unk
Hoary bat	93	09/11/2012	08/28/2012	S	High	Unk	Unk
Hoary bat	100	09/11/2012	08/28/2012	S	High	Adu	Mal
Small bird	92	09/12/2012	09/05/2012	S	Low	Unk	Unk
Mexican free-tailed bat	102	09/12/2012	09/05/2012	S	High	Adu	Unk
Western meadowlark	96	09/12/2012	09/05/2012	S	High	Adu	Unk
Western meadowlark	103	09/18/2012	09/04/2012	S	High	Unk	Unk
Unidentified blackbird	94	09/19/2012	09/12/2012	S	High	Unk	Unk
Unidentified blackbird	100	09/25/2012	09/11/2012	S	Low	Unk	Unk
Unidentified blackbird	100	09/25/2012	09/11/2012	S	Low	Unk	Unk
Unidentified blackbird	100	09/25/2012	09/11/2012	S	Low	Unk	Unk
Ruby-crowned kinglet	102	09/26/2012	09/19/2012	S	High	Adu	Unk
Small bird	102	09/26/2012	09/19/2012	S	High	Unk	Unk
Western meadowlark	96	09/26/2012	09/19/2012	S	High	Unk	Unk
Western meadowlark	102	09/26/2012	09/19/2012	S	High	Adu	Unk
Wilson's warbler	102	09/26/2012	09/19/2012	S	High	Adu	Mal
Mourning dove	106	09/27/2012	09/20/2012	S	Low	Unk	Unk
Unidentified blackbird	106	09/27/2012	09/20/2012	S	Low	Unk	Unk
Mourning dove	101	10/02/2012	09/25/2012	S	High	Unk	Unk
Red-winged blackbird	103	10/02/2012	09/18/2012	S	High	Adu	Mal
Mexican free-tailed bat	96	10/03/2012	09/26/2012	S	Low	Unk	Unk
Western meadowlark	94	10/03/2012	09/26/2012	S	High	Unk	Unk
Hoary bat	106	10/04/2012	09/27/2012	S	Low	Adu	Mal
Western tanager	104	10/04/2012	09/27/2012	S	High	Adu	Unk
American coot	102	10/10/2012	10/03/2012	L	High	Unk	Unk

Species	Turbine Number	Date	Date of Previous Search	Size Class	Visibility	Age class	Sex
Western meadowlark	102	10/10/2012	10/03/2012	S	High	Unk	Unk
House finch	104	10/11/2012	10/04/2012	S	High	Adu	Fem
Killdeer	97	10/11/2012	10/04/2012	S	High	Adu	Unk
Mourning dove	92	10/17/2012	10/10/2012	S	Low	Unk	Unk
Mexican free-tailed bat	101	10/23/2012	10/16/2012	S	High	Unk	Unk
American kestrel	106	10/25/2012	10/18/2012	S	Low	Adu	Mal
Western meadowlark	105	10/25/2012	10/18/2012	S	Low	Unk	Unk
American kestrel	99	10/30/2012	10/16/2012	S	High	Adu	Fem
Red-tailed hawk	95	10/31/2012	10/24/2012	L	High	Adu	Unk
Western meadowlark	102	10/31/2012	10/24/2012	S	High	Unk	Unk
Red-winged blackbird	93	11/06/2012	10/23/2012	S	Low	Adu	Fem
Small bird	105	11/08/2012	11/01/2012	S	Low	Unk	Unk
Unidentified dove	103	11/13/2012	10/30/2012	L	High	Unk	Unk
Medium bird	94	11/14/2012	11/07/2012	L	High	Unk	Unk
Turkey vulture	98	11/19/2012	11/06/2012	L	High	Adu	Unk
Unidentified blackbird	96	11/20/2012	11/14/2012	S	High	Unk	Unk
American kestrel	97	11/29/2012	11/21/2012	S	High	Unk	Mal
Red-winged blackbird	106	11/29/2012	11/21/2012	S	Low	Adu	Mal
House finch	91	12/11/2012	11/27/2012	S	High	Adu	Mal
Unidentified large bird	105	12/13/2012	12/06/2012	L	Low	Unk	Unk
Unidentified blackbird	93	12/18/2012	12/04/2012	S	Low	Unk	Unk
American goldfinch	105	12/20/2012	12/13/2012	S	High	Unk	Unk
European starling	106	12/28/2012	12/20/2012	S	High	Unk	Unk

Appendix C

Species, Turbine Number, Date Placed, Size Class, Visibility Category, and Outcome of Carcasses Used in Searcher Efficiency Trials at the Montezuma I Project Site, 2011 and 2012

Appendix C

Species, Turbine Number, Date Placed, Size Class, Visibility Category, and Outcome of Carcasses Used in Searcher Efficiency Trials at the Montezuma I Project Site, 2011 and 2012

Species	Turbine Number	Date Placed	Size Class	Visibility	Found
American coot	102	8/2/2011	Large	High	Yes
American crow	95	3/7/2012	Large	High	Yes
American crow	105	4/18/2012	Large	High	No
American crow	91	5/1/2012	Large	Low	No
American crow	93	8/14/2012	Large	High	Yes
American crow	97	11/14/2012	Large	High	Yes
American crow	101	1/21/2013	Large	High	No
American goldfinch	99	8/9/2011	Small	High	Yes
American kestrel	92	11/7/2012	Small	Low	No
American kestrel	105	11/7/2012	Small	Low	No
American kestrel	96	2/12/2013	Small	High	Yes
American robin	95	11/17/2011	Small	High	No
American robin	94	3/7/2012	Small	High	No
American robin	97	4/5/2012	Small	High	No
Barn owl	101	12/7/2011	Large	Low	Yes
Barn swallow	99	7/27/2011	Small	Low	Yes
Barn swallow	91	8/2/2011	Small	High	No
Barn swallow	103	12/7/2011	Small	High	No
Barn swallow	98	8/14/2012	Small	High	Yes
Black-crowned night-heron	101	11/16/2011	Large	High	Yes
Black-crowned night-heron	105	12/6/2011	Large	High	No
Black-crowned night-heron	102	3/7/2012	Large	High	Yes
Black-crowned night-heron	101	3/13/2012	Large	High	Yes
Black-crowned night-heron	104	4/18/2012	Large	High	Yes
Black-crowned night-heron	106	4/18/2012	Large	High	No
Barn owl	98	3/13/2012	Large	Low	Yes
Barn owl	93	6/18/2012	Large	Low	Yes
Barn owl	101	7/9/2012	Large	Low	No
Barn owl	99	9/17/2012	Large	High	Yes
Barn owl	95	10/17/2012	Large	High	Yes
Barn owl	102	11/14/2012	Large	High	Yes
Barn owl	100	12/3/2012	Large	Low	Yes
Bullock's oriole	102	3/13/2012	Small	High	No
Burrowing owl	99	7/9/2012	Small	Low	No
Burrowing owl	106	11/7/2012	Small	Low	No

Species	Turbine Number	Date Placed	Size Class	Visibility	Found
Burrowing owl	92	2/13/2013	Small	High	Yes
Canada goose	96	7/27/2011	Large	Low	No
Cooper's hawk	100	6/18/2012	Large	Low	No
Cooper's hawk	95	11/14/2012	Large	High	No
Cooper's hawk	102	2/13/2013	Large	High	Yes
Cooper's hawk	102	12/6/2011	Large	High	Yes
Common raven	93	3/13/2012	Large	High	Yes
European starling	94	11/7/2012	Small	High	Yes
European starling	105	2/12/2013	Small	High	No
Gadwall	98	6/18/2012	Large	High	Yes
Great-horned owl	98	12/7/2011	Large	High	Yes
Great-horned owl	103	9/17/2012	Large	High	Yes
Great-horned owl	98	10/22/2012	Large	High	Yes
Great-horned owl	91	1/21/2013	Large	High	Yes
Great-horned owl	94	1/21/2013	Large	High	Yes
Great-horned owl	99	2/13/2013	Large	Low	Yes
House finch	106	12/6/2011	Small	Low	No
House finch	93	12/22/2011	Small	High	No
House finch	93	3/13/2012	Small	High	Yes
House finch	104	4/5/2012	Small	High	No
House finch	91	5/1/2012	Small	Low	No
House finch	101	8/14/2012	Small	High	No
House finch	93	2/14/2013	Small	High	No
House finch	106	2/14/2013	Small	High	No
House sparrow	104	12/13/2011	Small	High	Yes
House sparrow	93	8/14/2012	Small	High	Yes
Lesser goldfinch	96	3/7/2012	Small	High	No
Lesser goldfinch	92	10/17/2012	Small	Low	No
Loggerhead shrike	93	7/27/2011	Small	High	Yes
Loggerhead shrike	99	7/9/2012	Small	Low	No
Mallard	100	7/26/2011	Large	Low	Yes
Mallard	91	7/9/2012	Large	Low	Yes
Mallard	101	8/14/2012	Large	High	No
Mallard	91	9/17/2012	Large	High	Yes
Mourning dove	97	8/3/2011	Small	Low	Yes
Mourning dove	98	8/3/2011	Small	Low	Yes
Mourning dove	103	11/16/2011	Small	High	No
Mourning dove	91	12/6/2011	Small	High	No
Mourning dove	99	12/13/2011	Small	High	No
Mourning dove	98	8/14/2012	Small	High	Yes
Mourning dove	101	9/17/2012	Small	High	Yes
Mourning dove	93	10/22/2012	Small	High	No
Mourning dove	92	11/7/2012	Small	Low	Yes
Mourning dove	92	11/7/2012	Small	Low	No
Mourning dove	93	12/3/2012	Small	High	No

Species	Turbine Number	Date Placed	Size Class	Visibility	Found
Mourning dove	100	2/14/2013	Small	Low	No
Mourning dove	104	2/14/2013	Small	High	Yes
Northern flicker	103	8/3/2011	Large	Low	No
Northern harrier	97	7/26/2011	Large	Low	Yes
Northern harrier	106	8/2/2011	Large	Low	Yes
Northern harrier	92	8/9/2011	Large	Low	Yes
Northern mockingbird	97	11/16/2011	Small	High	No
Northern mockingbird	98	11/16/2011	Small	High	Yes
Northern mockingbird	92	3/7/2012	Small	High	No
Northern mockingbird	104	4/5/2012	Small	High	No
Ring-necked pheasant	101	12/3/2012	Large	High	Yes
Rock pigeon	101	6/18/2012	Large	Low	Yes
Rock pigeon	100	8/14/2012	Large	Low	No
Rock pigeon	96	11/14/2012	Large	High	No
Red-shouldered hawk	100	10/22/2012	Large	High	Yes
Red-tailed hawk	101	7/26/2011	Large	Low	Yes
Red-tailed hawk	100	8/3/2011	Large	Low	Yes
Red-tailed hawk	100	11/16/2011	Large	High	Yes
Red-tailed hawk	96	11/17/2011	Large	High	Yes
Red-tailed hawk	100	12/7/2011	Large	High	Yes
Red-tailed hawk	94	3/13/2012	Large	Low	Yes
Red-tailed hawk	98	12/3/2012	Large	Low	Yes
Red-tailed hawk	95	1/21/2013	Large	High	Yes
Red-winged blackbird	103	7/26/2011	Small	Low	No
Red-winged blackbird	94	7/27/2011	Small	High	No
Red-winged blackbird	101	8/3/2011	Small	Low	Yes
Red-winged blackbird	95	8/4/2011	Small	High	Yes
Red-winged blackbird	100	3/13/2012	Small	Low	No
Red-winged blackbird	93	8/14/2012	Small	High	No
Red-winged blackbird	100	8/14/2012	Small	Low	Yes
Red-winged blackbird	103	2/13/2013	Small	High	No
Song sparrow	100	8/14/2012	Small	Low	No
Song sparrow	104	2/14/2013	Small	High	No
Swainson's hawk	103	7/9/2012	Large	High	No
Swainson's hawk	94	1/21/2013	Large	High	Yes
Tree swallow	92	3/13/2012	Small	High	Yes
Tree swallow	101	8/14/2012	Small	High	No
Turkey vulture	105	8/2/2011	Large	High	Yes
Turkey vulture	93	11/17/2011	Large	High	Yes
Turkey vulture	94	11/17/2011	Large	High	Yes
Turkey vulture	97	4/18/2012	Large	High	Yes
White-crowned sparrow	96	2/12/2013	Small	High	No
Western scrub-jay	94	10/17/2012	Small	High	Yes
Western scrub-jay	94	11/7/2012	Small	High	Yes
Western scrub-jay	106	2/14/2013	Small	High	Yes

Species	Turbine Number	Date Placed	Size Class	Visibility	Found
Western tanager	104	8/9/2011	Small	Low	No
White-tailed kite	101	10/22/2012	Large	High	Yes
Yellow warbler	98	7/26/2011	Small	High	No

Appendix D

Species, Date Placed, Size Class, Visibility Category, Turbine Number, and Outcome, and Day of Trial Carcass was Last Detected, and Day of Trial Carcass was Last Checked for Carcasses Used in Carcass Persistence Trials at the Montezuma I Project Site, 2011 and 2012

Appendix D

Species, Date Placed, Size Class, Visibility Category, Turbine Number, and Outcome, and Day of Trial Carcass was Last Detected, and Day of Trial Carcass was Last Checked for Carcasses Used in Carcass Persistence Trials at the Montezuma I Project Site, 2011 and 2012

Species	Turbine Number	Date Placed	Size Class	Visibility	Day of Trial Carcass was last Detected	Day of Trial Carcass was last Checked
American coot	102	8/2/2011	Large	High	14	14
American coot	103	3/13/2012	Large	High	14	14
American crow	96	8/16/2011	Large	High	14	14
American crow	91	5/1/2012	Large	Low	14	14
American crow	95	5/1/2012	Large	Low	14	14
American crow	101	5/1/2012	Large	Low	5	7
American crow	92	12/3/2012	Large	High	14	14
American crow	101	1/21/2013	Large	High	14	14
American robin	99	8/16/2011	Small	High	14	14
American robin	95	11/16/2011	Small	High	4	5
American robin	97	12/6/2011	Small	High	1	1
Barn owl	101	12/6/2011	Large	Low	14	14
Barn swallow	91	8/2/2011	Small	High	14	14
Barn swallow	103	12/6/2011	Small	High	2	3
Barn swallow	96	9/17/2012	Small	High	1	2
Black-crowned night-heron	101	11/16/2011	Large	Low	2	3
Black-crowned night-heron	105	12/6/2011	Large	Low	14	14
Black-crowned night-heron	101	3/13/2012	Large	High	14	14
Bewick's wren	97	1/21/2013	Small	High	3	4
Barn owl	98	3/13/2012	Large	Low	14	14
Barn owl	93	6/18/2012	Large	Low	14	14
Barn owl	101	7/9/2012	Large	Low	2	3
Barn owl	99	9/17/2012	Large	High	14	14
Barn owl	100	12/3/2012	Large	Low	14	14
Brewer's blackbird	106	5/1/2012	Small	Low	1	1
Brewer's blackbird	94	9/17/2012	Small	High	4	6
Bullock's oriole	102	3/13/2012	Small	High	14	14
Burrowing owl	99	7/9/2012	Small	Low	14	14
California gull	106	8/16/2011	Large	High	14	14

Species	Turbine Number	Date Placed	Size Class	Visibility	Day of Trial Carcass was last Detected	Day of Trial Carcass was last Checked
Cedar waxwing	96	6/18/2012	Small	High	14	14
Cedar waxwing	105	10/22/2012	Small	Low	14	14
Cliff swallow	95	6/18/2012	Small	High	14	14
Cliff swallow	97	7/9/2012	Small	High	14	14
Cooper's hawk	102	12/6/2011	Large	High	14	14
Cooper's hawk	100	6/18/2012	Large	Low	12	14
Cooper's hawk	102	9/17/2012	Large	High	14	14
Cooper's hawk	94	10/22/2012	Large	High	14	14
Cooper's hawk	103	12/3/2012	Large	High	14	14
Common raven	93	3/13/2012	Large	High	14	14
European starling	94	12/6/2011	Small	High	1	1
European starling	94	6/18/2012	Small	High	14	14
European starling	106	9/17/2012	Small	Low	8	10
Gadwall	98	6/18/2012	Large	High	2	3
Great-horned owl	98	12/6/2011	Large	High	14	14
Great-horned owl	103	9/17/2012	Large	High	14	14
Great-horned owl	98	10/22/2012	Large	High	14	14
Great-horned owl	91	1/21/2013	Large	High	14	14
Great-horned owl	94	1/21/2013	Large	High	14	14
House finch	106	12/6/2011	Small	Low	1	2
House finch	93	3/13/2012	Small	High	14	14
House finch	91	5/1/2012	Small	Low	14	14
House finch	94	5/1/2012	Small	Low	14	14
House finch	92	7/9/2012	Small	Low	14	14
House finch	103	10/22/2012	Small	High	8	10
House finch	99	12/3/2012	Small	Low	14	14
House finch	104	1/21/2013	Small	High	14	14
House finch	105	1/21/2013	Small	High	4	6
House sparrow	92	8/16/2011	Small	High	14	14
House sparrow	105	8/16/2011	Small	Low	14	14
House sparrow	99	6/18/2012	Small	Low	14	14
Loggerhead shrike	99	7/9/2012	Small	Low	3	6
Mallard	91	8/16/2011	Large	High	14	14
Mallard	103	6/18/2012	Large	Low	14	14
Mallard	91	7/9/2012	Large	Low	14	14
Mallard	105	7/9/2012	Large	Low	14	14
Mallard	91	9/17/2012	Large	High	14	14
Mourning dove	97	8/2/2011	Small	Low	14	14
Mourning dove	98	8/2/2011	Small	Low	14	14
Mourning dove	104	8/16/2011	Small	Low	14	14
Mourning dove	92	11/16/2011	Small	Low	1	1
Mourning dove	103	11/16/2011	Small	High	14	14
Mourning dove	91	12/6/2011	Small	High	1	2
Mourning dove	97	3/13/2012	Small	High	14	14

Species	Turbine Number	Date Placed	Size Class	Visibility	Day of Trial Carcass was last Detected	Day of Trial Carcass was last Checked
Mourning dove	101	5/1/2012	Small	Low	14	14
Mourning dove	92	6/18/2012	Small	Low	14	14
Mourning dove	101	9/17/2012	Small	High	2	3
Mourning dove	93	10/22/2012	Small	High	4	6
Mourning dove	93	12/3/2012	Small	High	14	14
Mourning dove	102	12/3/2012	Small	High	14	14
Mourning dove	96	1/21/2013	Small	High	14	14
Mourning dove	106	1/21/2013	Small	High	14	14
Northern flicker	103	8/2/2011	Large	Low	14	14
Northern harrier	106	8/2/2011	Large	High	14	14
Northern mockingbird	100	8/16/2011	Small	High	2	3
Northern mockingbird	97	11/16/2011	Small	High	14	14
Northern mockingbird	98	11/16/2011	Small	High	1	2
Prairie falcon	92	5/1/2012	Large	Low	14	14
Ruby-crowned kinglet	91	12/3/2012	Small	High	1	2
Ring-necked pheasant	101	12/3/2012	Large	High	14	14
Rock pigeon	101	6/18/2012	Large	Low	14	14
Rock pigeon	102	7/9/2012	Large	Low	14	14
Red-shouldered hawk	93	8/16/2011	Large	High	14	14
Red-shouldered hawk	100	10/22/2012	Large	High	14	14
Red-tailed hawk	100	8/2/2011	Large	Low	14	14
Red-tailed hawk	96	11/16/2011	Large	High	14	14
Red-tailed hawk	100	11/16/2011	Large	High	14	14
Red-tailed hawk	100	12/6/2011	Large	High	14	14
Red-tailed hawk	94	3/13/2012	Large	Low	14	14
Red-tailed hawk	92	9/17/2012	Large	Low	14	14
Red-tailed hawk	95	10/22/2012	Large	High	14	14
Red-tailed hawk	98	12/3/2012	Large	Low	14	14
Red-tailed hawk	95	1/21/2013	Large	High	14	14
Red-winged blackbird	95	8/2/2011	Small	High	14	14
Red-winged blackbird	101	8/2/2011	Small	Low	14	14
Red-winged blackbird	97	3/13/2012	Small	High	14	14
Red-winged blackbird	100	3/13/2012	Small	Low	14	14
Red-winged blackbird	105	5/1/2012	Small	Low	1	1
Savannah sparrow	95	7/9/2012	Small	High	14	14

Species	Turbine Number	Date Placed	Size Class	Visibility	Day of Trial Carcass was last Detected	Day of Trial Carcass was last Checked
Swainson's hawk	103	7/9/2012	Large	High	14	14
Swainson's hawk	94	1/21/2013	Large	High	14	14
Tree swallow	92	3/13/2012	Small	High	7	9
Tree swallow	102	5/1/2012	Small	Low	14	14
Turkey vulture	105	8/2/2011	Large	Low	14	14
Turkey vulture	93	11/16/2011	Large	High	14	14
Turkey vulture	94	11/16/2011	Large	High	14	14
Turkey vulture	99	5/1/2012	Large	Low	14	14
White-crowned sparrow	97	10/22/2012	Small	High	14	14
White-crowned sparrow	94	12/3/2012	Small	High	14	14
Western kingbird	100	9/17/2012	Small	High	2	3
Western screech owl	94	8/16/2011	Small	High	14	14
Western screech owl	104	10/22/2012	Small	High	14	14
Western screech owl	102	1/21/2013	Small	High	2	3
White-tailed kite	101	10/22/2012	Large	High	14	14
Yellow-rumped warbler	104	7/9/2012	Small	High	14	14