

Executive Summary

This report provides the Scientific Review Committee (SRC) with the following information:

- Summary results of the avian fatality monitoring study conducted at Altamont Pass Wind Resource Area (APWRA) between October 2005 and October 2007 (hereafter, current study);
- Parallel re-analysis of baseline avian fatality monitoring conducted at APWRA between March 1998 and May 2003 (hereafter, baseline study); Determination of the change in mortality in the four target raptor species and all non-raptor species between the baseline and the current study;
- Analysis of the relationship between the annual and monthly mortality in the four target raptor species and the local abundance (bird use) and behaviors of those species;
- Parallel analysis of avian mortality associated with a select overlapping set of turbines (hereafter, core NREL turbines) that were included in both the baseline and current study; and
- Comparison of avian mortality associated with a subset of modern, high capacity rated turbines (hereafter, the Diablo Winds turbines) and the APWRA-wide mortality estimates.

Table ES-1 summarizes the average annual number of avian fatalities documented for the baseline and current study, the average annual mortality as adjusted for search effort and detection probability, and the estimated average annual total number of fatalities throughout the APWRA. Comparisons between the baseline and current study revealed marked increases in the annual mortality rates and total fatalities of all species and species groups examined except the golden eagle, which decreased by 21%. When the results of all target raptors (golden eagle, red-tailed hawk, American kestrel, and burrowing owl) were combined, the mortality rate for the current study group increased 28% over baseline. The results of the current study show an obvious and repeated pattern of increased mortality across all target raptor species and species groups (except golden eagles) and non-raptor species groups in the current study compared to baseline. This pattern of increased mortality was also evident in the core NREL study that compared the mortality rates associated with turbines used in both the baseline study and the current study (Table ES-2), and in the Diablo Winds study (Table ES-3) that compared mortality rates associated with the larger Diablo winds turbines to the smaller turbines operating throughout the APWRA study area.

Part of the observed differences in fatality levels for the four target raptor species may be due to differences in the number of birds using the APWRA. Linear regression analysis of fatalities and bird use showed significant positive correlations for burrowing owl ($R^2 = 0.4525$) and red-tailed hawk ($R^2 = 0.5334$) but not for golden eagle ($R^2 = 0.0003$) or American kestrel ($R^2 = 0.0018$). However, the results of the burrowing owl analysis may be biased by bird use survey protocol. All bird use surveys for birds were conducted during the day, but burrowing owls are most active at night. This disjunctive timing is expected to yield an underestimation of burrowing owl use of the APWRA and an inflation of the use/mortality correlation value. This procedural bias likely did not affect the analyses for the other target raptor species, all of which are diurnal.

In conclusion, this study indicates that combined mortality rates of the four target raptor species have increased, not decreased during the current study period when compared to the baseline study. Only the mortality rate of the golden eagle appears to have decreased during this period. Additionally, the results of the Diablo Winds study suggest that mortality levels of all target raptors and non-raptor species (combined) could be reduced in areas where lower numbers of higher-capacity turbines are deployed.

Table ES-1. Average Annual Mortality and Estimated APWRA-Wide Fatalities of Baseline and Current Studies

Species/ Category	Baseline Study 1998–2003		Current Study 2005–2007		Percent Change of Mortality and Estimated APWRA-wide Fatalities
	Average Annual Mortality Rate (adjusted fatalities/MW/year)	Estimated APWRA-wide Average Annual Fatalities	Average Annual Mortality Rate (adjusted fatalities/MW/year)	Estimated APWRA-wide Average Annual Fatalities	
American Kestrel	0.6460	374.7	0.8431	489.0	13.24
Burrowing Owl	0.8267	479.5	2.0823	1,207.7	43.16
Golden Eagle	0.2111	122.4	0.1378	79.9	-20.99
Red-tailed Hawk	0.5369	311.4	0.7915	459.1	19.17
Total Target Species	2.2206	1,288.0	3.8547	2,235.7	26.90
Small Raptors	1.4727	854.2	2.9254	1,696.7	33.03
Medium Raptors	0.0273	15.8	0.0378	21.9	16.04
Large Raptors	0.9586	556.0	1.3705	794.9	17.68
Total Raptors	2.4586	1,426.0	4.3336	2,513.5	27.60
Small Non-Raptors	4.6107	2,674.2	11.1519	6,468.1	41.50
Medium Non-Raptors	1.0763	624.3	1.4091	817.3	13.39
Large Non-Raptors	0.2224	129.0	0.3074	178.3	16.05
Total Non-Raptors	5.9095	3,427.5	12.8685	7,463.7	37.06

Table ES-2. Average Annual Mortality and Estimated APWRA-Wide Fatalities of Core Shared NREL Turbines of Baseline and Current Studies

Species/ category	Baseline Study 1998–2003		Current Study 2005–2007		Percent Change of Mortality and Estimated APWRA-wide Fatalities
	Average Annual Mortality Rate (adjusted fatalities/MW/year)	Estimated APWRA-wide Average Annual Fatalities	Average Annual Mortality Rate (adjusted fatalities/MW/year)	Estimated APWRA-wide Average Annual Fatalities	
American Kestrel	0.5326	308.9	1.1437	663.4	36.46
Burrowing Owl	0.5987	347.3	1.9218	1,114.6	52.49
Golden Eagle	0.1337	77.6	0.1099	63.8	-9.76
Red-tailed Hawk	0.6899	400.1	0.9476	549.6	15.74
Total Target Species	1.9549	1,133.9	4.1230	2,391.4	35.67
Small Raptors	1.1313	656.2	3.0656	1,778.0	46.09
Medium Raptors	0.0000	0.0	0.0105	6.1	100.00
Large Raptors	1.0908	632.6	1.3576	787.4	10.90
Total Raptors	2.2221	1,288.8	4.4337	2,571.6	33.23
Small Non-Raptors	3.1733	1,840.5	10.3100	5,979.8	52.93
Medium Non-Raptors	1.2592	730.4	1.2471	723.3	-0.48
Large Non-Raptors	0.2700	156.6	0.4359	252.8	23.51
Total Non-Raptors	4.7025	2,727.5	11.9930	6,955.9	43.67

Table ES-3. Average Annual Mortality and Estimated APWRA-Wide Fatalities of Diablo and Non-Diablo Turbines in the Current Study

Species/ Category	Non-Diablo Current Study 2005–2007		Diablo Current Study 2005–2007		Percent Change of Mortality and Estimated APWRA-wide Fatalities
	Average Annual Mortality Rate (adjusted fatalities/MW/year)	Estimated APWRA-wide Average Annual Fatalities	Average Annual Mortality Rate (adjusted fatalities/MW/year)	Estimated APWRA-wide Average Annual Fatalities	
American Kestrel	0.9785	567.6	0.1552	90.0	-72.63
Burrowing Owl	2.1932	1,272.1	1.4454	838.3	-20.55
Golden Eagle	0.1726	100.1	0.0000	0.0	-100.00
Red-tailed Hawk	0.9125	529.2	0.1236	71.7	-76.14
Total Target Species	4.2568	2,468.9	1.7242	1,000.0	-42.34
Small Raptors	3.1718	1,839.6	1.6006	928.3	-32.92
Medium Raptors	0.0422	24.5	0.0122	7.1	-55.07
Large Raptors	1.6004	928.2	0.1493	86.6	-82.93
Total Raptors	4.8144	2,792.3	1.7621	1,022.0	-46.41
Small Non-Raptors	13.2087	7,661.1	2.9132	1,689.7	-63.86
Medium Non-Raptors	1.6285	944.5	0.2967	172.1	-69.18
Large Non-Raptors	0.3519	204.1	0.1241	72.0	-47.87
Total Non-Raptors	15.1892	8,809.7	3.3340	1,933.7	-64.00