Technical Memorandum

Date: November 6, 2008

To: Alameda County Community Development Agency

From: Altamont Pass Avian Monitoring Team

cc: Altamont Pass Wind Resource Area Scientific Review Committee

Subject: Altamont Pass Carcass Removal/Scavenging Trial

Introduction

The Altamont Pass Wind Resource Area (APWRA) is located in central California approximately 56 miles (90 kilometers) east of San Francisco. Permits have been granted for 5,400 wind turbines distributed over 50,000 acres (150 square kilometers) of rolling grassland hills and valleys in the APWRA. The APWRA supports a broad diversity of resident and migratory bird species that regularly move through the wind turbine area (Orloff and Flannery 1996). Multiple studies of avian fatality at the APWRA have documented golden eagles, red-tailed hawks, American kestrels, burrowing owls, barn owls, and a diverse mix of non-raptor species that are killed each year in turbine-related incidents (Howell and DiDonato 1991, Orloff and Flannery 1996, Howell 1997, Smallwood and Thelander 2008, Altamont Pass Avian Monitoring Team. 2008).

Two widely recognized sources of error are typically accounted for in estimating wind turbine-related mortality of birds – 1) carcasses not detected by searchers during fatality surveys, and 2) carcasses removed by scavengers between surveys (Smallwood 2007). In order to predict the total bird fatalities that occur, the number of fatalities observed is adjusted by a detection probability factor that incorporates both the searcher efficiency and scavenger removal metrics. Smallwood (2007) summarized searcher detection rates for reported trials and developed models to predict scavenger removal of carcasses. Those metrics can be used to adjust avian mortality estimates when site-specific trials are not conducted, and allow for improved comparability of estimates between wind farms.

The purpose of the Altamont Pass carcass removal/scavenging trials is to provide information that can be used to develop site specific scavenger removal rates for avian fatalities caused by wind

turbines at the APWRA. Most removal/scavenging trials conducted at wind farms have used frozen bird carcasses (including domestic species such as chickens or game hens) as surrogates for wind turbine-caused mortality, which can contribute to scavenging preference biases. In addition, most of these trials also placed multiple carcasses in a small area at one time, which can result in potential scavenger swamping biases. In the Altamont Pass trial, we minimize these potential biases by leaving fresh carcasses in place that were found during on-going fatality searches, and then monitoring those carcasses over time. A secondary purpose of the Altamont Pass carcass removal/scavenging trial was to gather information that will add to our carcass age metric knowledge. That secondary objective is not addressed in this technical memorandum.

Methods

Carcass removal/scavenging trials at the APWRA were conducted from December 2005 through August 2008 to account for the influence of seasons, weather conditions, vegetative conditions and other effects on carcass removal and scavenging. The trials continued beyond August 2008, but was August was chosen as the cut-off date for this technical memo. Fresh intact carcasses of medium to large birds (generally target raptors) detected during the on-going avian fatality study were left in place and monitored over time. The avian fatality study involved monthly surveys within a 50-foot radius of 2,500 wind turbines at the APWRA - see Altamont Pass Avian Monitoring Team (2008) for details on this study. Golden eagle carcasses were not included in the scavenging trial because of obligations to process those birds in accordance with federal and California permit stipulations. Trial carcasses were marked with green tape applied to the bird's legs and/or wings; primary feathers of some carcasses were also cut in an identifiable manner. Data recorded for each carcass included the relative location of the carcass (compass bearing and distance from nearest intact turbine), species, degree of exposure, carcass condition, date, and time.

For the carcass removal/scavenging study, trial carcasses were periodically checked over about a 9-week period (up to 68 days). Some carcasses were tracked longer to gain further insight into carcass disposition over extended periods. Those data, however, are not evaluated in this memorandum. Carcasses were generally checked each day for the first 3 days after discovery, twice a week for the next two weeks, then once per week for the remainder of the trial period. At each visit, the condition of the trial carcass was noted – i.e., whether the carcass was intact (I), scavenged (S), a feather spot (FS, >10 feathers), or absent (0, <10 feathers). In addition, the type and degree of scavenging was noted, photos were taken, and pertinent notes were recorded on the physical condition and age metrics of the carcass. Upon the conclusion of each individual trial, the remaining carcass and feathers (if any) were removed from the site.

Results and Discussion

A total of 32 fresh avian carcasses were monitored as part of the Altamont Pass carcass removal/scavenging trial (Table 1). All trial carcasses were intact or almost intact (i.e., included the torso with most body parts present) and showed no evidence of scavenging at first discovery. Most (23) of the trial carcasses were red-tailed hawks. Other species represented included great horned owl (3), turkey vulture (3), common raven, (2) and barn owl (1). All of these species are categorized as large-sized birds.

Evidence of vertebrate scavenging and/or carcass removal was recorded for 56.3% (18 of 32) of the trial carcasses tracked for up to 9 weeks (Table 1). Vertebrate removal/scavenging was documented for all species of trial carcasses monitored, and included 11 red-tailed hawks, 2 great horned owls, 2 turkey vultures, 2 common ravens, and 1 barn owl. When removal/scavenging was documented, it occurred between 2 and 58 days after initial carcass discovery; 33.3% (6 of 18) occurred during the first week, and 83.3% (15 of 18) within the first six weeks (Table 1).

The effect of vertebrate scavenging on carcass detectability of large birds was low. Most carcasses (30 of 32 or 93.7%) were detectible even when scavenged because the residual evidence from vertebrate scavenging (i.e., the remains of body parts or feathers) remained identifiable (Table 1). Only 2 of the 32 trial carcasses monitored (6.3%) were entirely removed from the turbine study sites without residual evidence (Table 1). Given that the two carcasses were large birds (a red-tail hawk and a great-horned owl) that disappeared within 8 days of discovery, it was assumed that vertebrate scavengers had removed the carcasses from the turbine study area (vs. displaced by the wind). It was not uncommon for vertebrate scavengers to scatter trial carcasses and carcass parts while feeding on them. It was also not uncommon for strong winds to move trial carcasses and carcass parts around. Surveyors searched for carcasses and carcass parts that had been scattered, and tracked these parts for the remainder of the individual trials. Whenever a trial carcass or body parts moved from its prior location, a determination was made as to whether vertebrate scavenging was the likely cause of the movement.

As noted above and in Table 1, few large bird carcasses were removed by scavengers at APWRA without leaving residual evidence that could be detected by surveyors. In the two cases where complete removal occurred, it happened within 8 days of first detection. Based upon the removal/scavenging rates observed in this study, the predicted percentage of large carcasses remaining each day into the removal/scavenging trial was calculated using a step function. Because of the limited sample size, only 2 carcass removals, no attempt was made to fit a curve to those data. Across the nine week period evaluated for this study, our results were similar to those derived from the metadata summarized by Smallwood (2007) for medium/large birds (Table 2). In general, the predicted number of large carcasses remaining at the APWRA was lower than that predicted by Smallwood (2007) for the first several weeks, and higher for the last several weeks.

Conclusions

1. Vertebrate scavenging at the APWRA had little effect on the detectability of large bird carcasses because the residual evidence from vertebrate scavenging (i.e., the remains of body parts or feathers) allowed surveyors to locate and identify scavenged carcasses.

2. Few large carcasses were removed by scavengers at APWRA without leaving residual evidence. When scavenger removal without residual evidence did occur, it took place within one week after a fatality.

3. The predicted percentage of large bird carcasses remaining each day into the APWRA removal/scavenging trial was similar to Smallwood's (2007) metadata analysis for medium/large birds.

References

Altamont Pass Avian Monitoring Team. 2008. Altamont Pass Wind Resource Area Bird Fatality Study. July. (ICF J&S 61119.06.) Portland, OR. Prepared for Altamont County Community Development Agency

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Smallwood, K. S. 2007.Estimating wind turbine-caused bird mortality. Journal of Wildlife Management 71(8): 2781-2791.

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Table 1. Details of bird carcasses monitored for the APWRA removal/scavenging trials.

Season	Species[a]	Fatality number	Plot	Turbine	Date of first find	Carcass condition at first find[b]	Days until first evidence of scavenging	Days carcass or remains were detectible	Total days monitored
Fall/Win	RTHA	20051206-09		1075	12/6/2005	I - Electrocution placed in field	No vert scavenging	Entire study period	64
Spring	GHOW	20070412-02	165	1560	4/12/2007	I	8	8	7
Spring	RTHA	20070502-05		WTG-30	5/2/2007	I	13	Entire study period	62
Spring	RTHA	20070507-02	42	997	5/7/2007	I	29	Entire study period	57
Summer	RTHA	20070611-05	123	920	6/11/2007	I	51	Entire study period	64
Summer	BNOW	20070723-04	92	1185	7/23/2007	I	7	Entire study period	57
Summer	TUVU	20070724-03	81	6061	7/24/2007	I	39	Entire study period	60
Summer	RTHA	20070801-02	132	627	8/1/2007	I	29	Entire study period	63[c]
Summer	RTHA	20070809-04	123	910	8/9/2007	Missing head	35	Entire study period	66
Summer	RTHA	20070815-09	34	1299	8/15/2007	I	22	Entire study period	64
Fall	GHOW	20070927-01	47	1163	9/27/2007	Missing left leg & tail	No vert scavenging	Entire study period	64[c]
Fall	RTHA	20071009-19	98	4735	10/9/2007	I	No vert scavenging	Entire study period	64[c]
Fall	CORA	20071009-18	98	4745	10/9/2007	I	3	Entire study period	63[c]
Fall	TUVU	20071018-10	47	1183	10/18/2007	I	No vert scavenging	Entire study period	64[c]
Fall	RTHA	20071106-01	93	1151	11/6/2007	I	52	Entire study period	61[c]
Fall	RTHA	20071107-01	87	1209	11/7/2007	I	6	Entire study period	60[c]
Fall/Win	RTHA	20071120-01	141	248	11/20/2007	I	2	2	1
Winter	RTHA	20071224-01		WTG-11	12/24/2007	I	4	Entire study period	60[c]
Winter	RTHA	20080107-07	105	1110	1/7/2008	I	No vert scavenging	Entire study period	60[c]
Winter	RTHA	20080131-05	98	4746	1/31/2008	Head detached	No vert scavenging	Entire study period	64[c]
Winter	RTHA	20080212-07	54	V2-11	2/12/2008	I	No vert scavenging	Entire study period	59[c]
Win/Spr	RTHA	20080226-04	122	1336	2/26/2008	I	No vert scavenging	Entire study period	62[c]
Win/Spr	RTHA	20080228-01		WTG-5	2/28/2008	I	No vert scavenging	Entire study period	60[c]
Spring	RTHA	20080306-07	54	V4-15	3/6/2008	I	No vert scavenging	Entire study period	63[c]
Spring	RTHA	20080307-02	103	6484	3/07/008	I	No vert scavenging	Entire study period	68
Spring	RTHA	20080307-04	103	6477	3/7/2008	I	No vert scavenging	Entire study period	63[c]
Spring	RTHA	20080313-01	137	304	3/13/2008	I	28	Entire study period	61[c]
Spring	GHOW	20080318-01	148	193	3/18/2008	I	5	Entire study period	58
Spring	RTHA	20080319-01	54	V4-32	3/19/2008	I	No vert scavenging	Entire study period	65[c]
Spr/Sum	RTHA	20080526-06	103	6437	5/26/2008	I	No vert scavenging	Entire study period	61[c]
Summer	TUVU	20080609-01		WTG-12	6/9/2008	Missing legs & tail; R wing detached	37	Entire study period	58[c]
Summer	CORA	20080611-06	94	1227	6/11/2008	I	58	Entire study period	58[c]

[a] RTHA = red-tailed hawk; GHOW = great horned owl; BNOW = barn owl; TUVU = turkey vulture; CORA = common raven.

[b] I = Carcass intact.

[c] Carcass monitored for more than 9 weeks.

Table 2. Comparison of scavenger probabilities generated from the Altamont Pass carcass removal/scavenging trials and Smallwood (2007).

Days Dead	Large Birds (This Study)	Medium/Large Birds (Smallwood 2007)	Days Dead	Large Birds (This Study)	Medium/Large Birds (Smallwood 2007)
1	1	1	44	0.9375	0.912872841
2	0.96875	1	45	0.9375	0.911847714
3	0.96875	1	46	0.9375	0.910843033
4	0.96875	1	47	0.9375	0.909857990
5	0.96875	0.996402127	48	0.9375	0.908891825
6	0.96875	0.990983612	49	0.9375	0.907943821
7	0.96875	0.986128927	50	0.9375	0.907013300
8	0.9375	0.981728213	51	0.9375	0.906099624
9	0.9375	0.977701368	52	0.9375	0.905202188
10	0.9375	0.973988092	53	0.9375	0.904320419
11	0.9375	0.970541794	54	0.9375	0.903453774
12	0.9375	0.967325695	55	0.9375	0.902601739
13	0.9375	0.964310230	56	0.9375	0.901763825
14	0.9375	0.961471257	57	0.9375	0.900939568
15	0.9375	0.958788801	58	0.9375	0.900128525
16	0.9375	0.956246138	59	0.9375	0.899330275
17	0.9375	0.953829119	60	0.9375	0.898544419
18	0.9375	0.951525665	61	0.9375	0.897770574
19	0.9375	0.949325378	62	0.9375	0.897008375
20	0.9375	0.947219242	63	0.9375	0.896257475
21	0.9375	0.945199383	64	0.9375	0.895517539
22	0.9375	0.943258888	65	0.9375	0.894788251
23	0.9375	0.941391651	66	0.9375	0.894069306
24	0.9375	0.939592249	67	0.9375	0.893360412
25	0.9375	0.937855848	68	0.9375	0.892661290
26	0.9375	0.936178116			
27	0.9375	0.934555158			
28	0.9375	0.932983457			
29	0.9375	0.931459828			
30	0.9375	0.929981375			
31	0.9375	0.928545461			
32	0.9375	0.927149672			
33	0.9375	0.925791797			
34	0.9375	0.924469804			
35	0.9375	0.923181822			
36	0.9375	0.921926122			
37	0.9375	0.920701107			
38	0.9375	0.919505294			
39	0.9375	0.918337307			
40	0.9375	0.917195867			
41	0.9375	0.916079779			
42	0.9375	0.914987928			
43	0.9375	0.913919275			