

# BIORESOURCE CONSULTANTS

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November 10, 2003

Andrew N. Young  
Development Planning Division  
Alameda County Community Development Agency  
224 W. Winton Ave.  
Hayward, CA 94544

*RE: Proposed CUP renewals for wind turbines and bird kills in the Altamont Pass WRA*

Dear Mr. Young:

CALifornians for Renewable Energy (CARE) requested that BioResource Consultants (BRC) prepare this expert comment letter on the proposed re-issuance of conditional use permits (CUPs) for the maintenance and operations of existing wind turbines in the Altamont Pass Wind Resources Area (APWRA). The qualifications of Dr. Smallwood and Mr. Thelander for commenting on the proposed re-issuance of CUPs are summarized in their short biographies and Curriculum Vitas, which are attached.

Dr. Smallwood earned his Ph.D. in Ecology and has 18 years of professional experience with wildlife interactions with human facilities and activities. He has performed extensive field work at the APWRA since 1999, and has been the senior analyst for BRC on its research intended to identify the factors associated with avian fatalities and to provide the basis upon which new, more effective mitigation measures can be developed.

Mr. Thelander has a Master's degree in biology and has over 25 years of experience with natural resource consulting on interdisciplinary projects in California and throughout the western United States. He has extensive experience with environmental permitting processes and compliance regulations, state and federal endangered species legislation, NEPA/CEQA, Clean Water Act, and others regulatory processes associated with energy facilities and natural resources and endangered species management. He has been involved with research on avian fatalities in the APWRA and elsewhere since 1989, and most recently as the Principal Investigator for research contracts funded by NREL and the California Energy Commission.

## **New Information**

Since the original CUPs were issued some 20 years ago, research at the APWRA has produced the world's largest data set of avian fatalities caused by wind turbines and ancillary structures. More research reports of avian mortality at the APWRA have been published than for any other wind farm. Richard Anderson and James Estep (California Energy Commission biologists)

published the first report of independent research performed at the APWRA in 1988<sup>1</sup>, followed by another report by Estep in 1989<sup>2</sup>. Judd Howell senior-authored four reports starting in 1991<sup>3</sup>, and Susan Orloff senior-authored two reports that were based on nearly 300 fatalities they recorded<sup>4</sup>. W. Granger Hunt, Ph. D., (University of California at Santa Cruz, Predatory Bird Research Group) published at least five reports of research he performed on golden eagles at the APWRA<sup>5</sup>. His research was funded by NREL and the California Energy Commission. Lourdes

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<sup>1</sup> Anderson, R. L. and J. A. Estep. 1988. Wind energy development in California: impacts, mitigation, monitoring, and planning. California Energy Commission, Sacramento. 12 pp.

<sup>2</sup> Estep, J. 1989. Avian mortality at large wind energy facilities in California: identification of a problem. Staff report no. P700-89-001. California Energy Commission, Sacramento.

<sup>3</sup> Howell, J.A. and J.E. Didonato. 1991. Assessment of avian use and mortality related to wind turbine operations, Altamont Pass, Alameda and Contra Costa Counties, California, September 1998 through August 1989. Final report submitted to U.S. Windpower, Inc., Livermore, California. 168 pp.

Howell, J.A., J. Noone, and C. Wardner. 1991. Visual experiment to reduce avian mortality related to wind turbine operations, Altamont Pass, Alameda and Contra Costa counties, California, April 1990 through March 1991. Final report. Prepared for U.S. Windpower, Inc., Livermore, California.

Howell, J.A. and J. Noone. 1992. Examination of avian use and mortality at a U.S. Windpower wind energy development site, Montezuma Hills, Solano County, California. Final report. Prepared for Solano County Department of Environmental Management, Fairfield, California.

Howell, J. A. 1997. Avian mortality at rotor swept area equivalents, Altamont Pass and Montezuma Hills, California. Transactions of the Western Section of the Wildlife Society 33:24-29.

<sup>4</sup> Orloff, S., and A. Flannery. 1992. Wind turbine effects on avian activity, habitat use, and mortality in Altamont Pass and Solano County Wind Resource Areas: 1989-1991. Report to California Energy Commission, Sacramento, California.

Orloff, S., and A. Flannery. 1996. A continued examination of avian mortality in the Altamont Pass Wind Resource Area. Report to California Energy Commission, Sacramento, California.

<sup>5</sup> Hunt, G. 1994. A pilot golden eagle population project in the Altamont Pass Wind Resource Area, California. Prepared by the Predatory Bird Research Group, University of California, Santa Cruz, for the National Renewable Energy Laboratory, Golden Colorado. 212 pp.

Hunt, G., and L. Culp. 1997. The influence of high ground squirrel densities on the occurrence of golden eagles on Altamont Ownership Consortium property. Unpublished report to Altamont Ownership Consortium. 16 pp.

Hunt, W. G., R. E. Jackman, T. L. Hunt, D. E. Driscoll, and L. Culp. 1998. A population study of golden eagles in the Altamont Pass Wind Resource Area: population trend analysis 1997. Report to National Renewable Energy Laboratory, Subcontract XAT-6-16459-01. National Technical Information Service, U. S. Department of Commerce, Springfield, Virginia.

Rugge and Stacia Hoover (BRC and California State University, Sacramento) each published Master's theses and other reports from their work at the APWRA<sup>6</sup>, and Carl Thelander (BRC) senior-authored at least three reports of original research performed at the APWRA<sup>7</sup>. Dr. Smallwood published his first paper on research at the APWRA in 2001<sup>8</sup>. Culminating the last five years of research at the APWRA, Thelander and Smallwood are publishing a highly informative progress report (Thelander and Smallwood, in review), a comprehensive final report (1998-2001) to the National Renewable Energy Laboratory (in review), and another final report (1998-present) for the California Energy Commission (in prep.).

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Hunt, W. G. 2000. A population study of golden eagles in the Altamont Pass Wind Resource Area: population trend analysis 1994-1997—Executive summary. Pages 15-17 *in* Proceedings of National Avian-Wind Power Planning Meeting III, San Diego, California, May 1998. Prepared for the Avian Subcommittee of the National Wind Coordinating Committee by LGL Ltd., King City, Ontario. 202 pp.

Hunt, W. G. 2002. Golden eagles in a perilous landscape: Predicting the effects of mitigation for wind turbine blade-strike mortality. Consultant Report to California Energy Commission, Sacramento, California.

<sup>6</sup> Rugge, L. M. 2001. An avian risk behavior and mortality assessment at the Altamont Pass Wind Resource Area in Livermore, California. M.S. Thesis, California State University, Sacramento. 156 pp.

Hoover, S. L. 2001. The response of raptors and other prey to topographical features at the Altamont Wind Resource Area. M.S. Thesis, California State University, Sacramento. 83 pp.

Hoover, S. L., M. L. Morrison, C. Thelander, and L. Rugge 2001. Response of raptors and other prey to topographical features at the Altamont Wind Resource Area. Pages 16-21 *in* S. S. Schwartz, ed., Proceedings of National Avian-Wind Power Planning Meeting IV, Carmel, California. Avian Subcommittee of the National Wind Coordinating Committee, Washington, D.C.

<sup>7</sup> Thelander, C.G. and L. Rugge. 2000a. Bird risk behaviors and fatalities at the Altamont Wind Resource Area. Pg. 5-14, *in* Proceedings of the National Avian-Wind Power Planning Meeting III. National Wind Coordinating Committee/RESOLVE. Washington, D.C.

Thelander, C. G., and L. Rugge. 2000b. Avian risk behavior and fatalities at the Altamont Wind Resource Area: March 1998 to February 1999. Report to National Renewable Energy Laboratory, Subcontract TAT-8-18209-01. National Technical Information Service, U. S. Department of Commerce, Springfield, VA.

Thelander, C. G. and L. Rugge. 2001. Examining relationships between bird risk behaviors and fatalities at the Altamont Wind Resource Area: a second year's progress report Pages 5-14 *in* S. S. Schwartz, ed., Proceedings of the National Avian-Wind Power Planning Meeting IV. Avian Subcommittee of the National Wind Coordinating Committee, Washington, D.C., 179 pp.

<sup>8</sup> Smallwood, K. S., L. Rugge, S. Hoover, M. L. Morrison, C. G. Thelander. 2001. Intra- and inter-turbine string comparison of fatalities to animal burrow densities at Altamont Pass. Pages 23-37 *in* S. S. Schwartz, ed., Proceedings of the National Avian-Wind Power Planning Meeting IV. RESOLVE, Inc., Washington, D.C.

Our findings were presented at professional meetings, including at the Annual Meeting of the Western Section of the Wildlife Society in Visalia, CA, in February, 2002. We presented professional papers on our findings at each of the past four national conferences (2000 in Palm Springs, CA; 2001 in Burlington, VT; 2002 in Portland, OR; and 2003 in Austin, TX) of the American Wind Energy Association (AWEA). Proceedings of these presentations were published and widely distributed; plus, representatives of the current APWRA permit-holders attended those meetings.

We presented results at the National Wind Coordinating Committee meetings in Carmel, CA (May, 2000), and at the annual meeting of the Raptor Research Foundation in Anchorage, AK, in September 2003. Daryl Gray, Alameda County staff, attended at least one of these meetings (Carmel). Andrew Young of Alameda County also attended recent meetings between BRC, APWRA permit-holders, the U.S. Fish and Wildlife Service, and the CEC. The first of these meetings was held in October of 2002, the second in April, 2003, and the third was in August, 2003. At these meetings we presented our key findings and discussed the effectiveness of ongoing and proposed new mitigation measures. Steve Steinhour of SeaWest Corporation requested that we submit our methodology to review by SeaWest's consultants (WEST, Inc.). These consultants agreed that our methodology was scientifically sound and consistent with accepted methods.<sup>9</sup>

We have informed the APWRA permit-holders and Alameda County staff of our research, our most important results, and about the implications of our results for mitigation methods and reducing bird fatalities. We informed them of our conclusions that their ongoing mitigation measures are ineffective, and that rodent control measures being used currently are exacerbating the avian mortality problem. At their request, we informed them of some proposed new mitigation measures that, if implemented, can substantially reduce avian mortality (Attachment A). Much new information was made available to Alameda County staff and the wind farm operators since the issuance of the original CUPs for the operations of wind turbines at the APWRA. We request that Alameda County include as part of its administrative record all of the new information in the reports and presentations we just cited, and that this information be carefully considered before issuing new conditional use permits.

### **What is the New Information?**

During the past five years, we recorded 1,189 bird fatalities after performing searches at more than 4,000 wind turbines, including 2,500 turbines added to our search rotations in the last six months of our study (Table 1). Our estimates of mortality were conservative (minimums) because we know we failed to record additional carcasses that were either scavenged by animals, picked up by APWRA personnel, or occurred elsewhere when injured birds flew or hopped to areas outside our search radius. We propose that our estimates are probably about 50% of the true values.

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<sup>9</sup> Anderson, R., M., Morrison, K. Sinclair, D. Strickland. 1999. Studying wind energy and bird interactions: a guidance document. National wind coordinating committee. Wash., DC. 87 pp.

Based on our sample, we estimated bird mortality caused by wind turbine collisions at the APWRA to be a minimum of 1,081 birds per year, or (assuming a constant rate) about 22,000 to 44,000 birds over the past 20 years of wind turbine operations. We conservatively estimate that the APWRA wind turbines annually kill no less than 20 golden eagles, totaling 400 to 800 eagles over the past 20 years. We estimate that the APWRA wind turbines annually kill at least 149 red-tailed hawks, totaling 2,980 to 5,960 red-tailed hawks over the past 20 years. We estimate that the APWRA wind turbines annually kill at least 135 burrowing owls, totaling 2,700 to 5,400 burrowing owls over the past 20 years. Many other bird species are killed by wind turbines at the APWRA, including special-status species. The avian impact of the APWRA has been well documented and presented publicly.

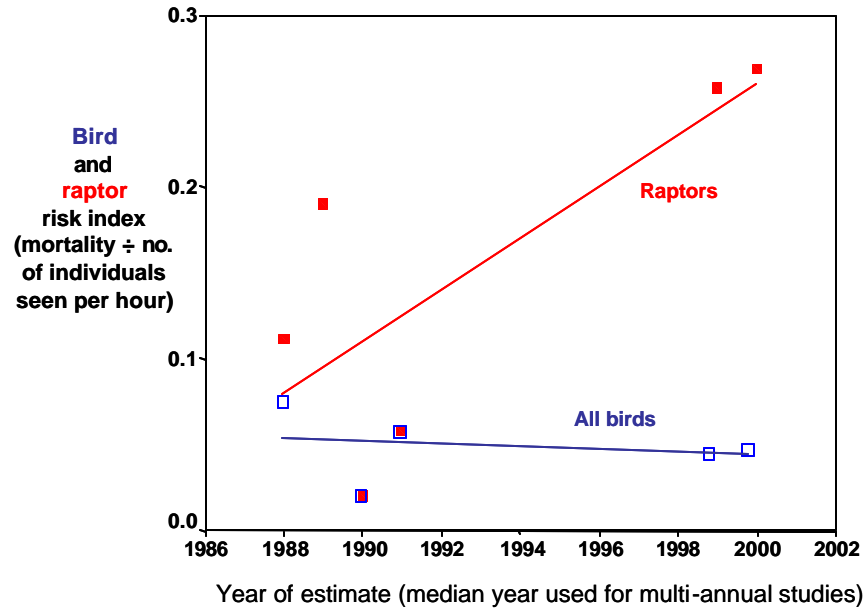
We found that wind turbine-caused raptor mortality was greater at the APWRA than at any other wind farm in the world, based on published reports. One reason for this extreme mortality is that the Altamont Pass is an important migration route for raptors. Each fall and spring, raptors move through the Altamont Pass, many coming from or going to locations all over the western US. The Altamont Pass is unusual in its intensive use by raptors, and so the wind turbines have been operating under unusual circumstances relative to conditions at other wind farms.

Our study has revealed that ongoing mitigation measures are ineffective. The industry-proposed Wildlife Reporting and Response System (WRRS) reports only one-eighth (13%) the number of birds we found killed in the APWRA, and it is scientifically indefensible as a monitoring tool. Perch guards on wind towers are ineffective because, as we reported, perching on wind towers appears not to contribute significantly to bird collisions. Artificial perches cannot significantly reduce the avian mortality problem because birds already have thousands of artificial perches in wind towers and ancillary structures to choose from. Finally, the rodent control program implemented in 1997 failed to reduce avian mortality. In fact, it is associated with an increase in raptor mortality at turbines in the APWRA, and an increase in raptor risk (see Figure 1).

Figure 1 reveals the cumulative impacts the APWRA is causing in terms of raptor mortality. The operations of wind turbines at the APWRA have repeatedly removed individuals from local and regional populations of multiple species, hence depleting local populations and regional source populations of these species. The number of raptors observed during point counts has declined since the earliest studies performed by Howell and continuing through the studies of Orloff and then our studies. However, mortality has remained relatively constant, meaning that the proportion of visiting raptors killed by wind turbines at the APWRA recently increased substantially while the total number of raptors decreased. According to the National Research Council, the repeated removal of organisms causing depletion is considered a cumulative impact.<sup>10</sup> Because the APWRA's cumulative impacts appear to be significant (Figure 1), the renewal of the conditional use permits is being considered in the presence of new and unusual circumstances.

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<sup>10</sup> National Research Council. 1986. Ecological knowledge and environmental problem-solving: concepts and case studies. National Academy Press, Washington, D.C.



**Figure 1.** The risk index (mortality ÷ individuals counted per hour) of birds at the APWRA has tended to decline during the past 15 years, whereas the risk to raptors has increased substantially.

The rodent control program increased the degree of clustering of small mammals at wind turbines, hence attracting foraging raptors to the vicinity of wind turbines. More raptors than expected by chance were killed by wind turbines on parcels where rodent poison was distributed by Alameda County with funding from the holders of the conditional use permits to operate wind turbines in the APWRA. This is contrary to the stated goals of the rodent control program as mitigation. We also recorded raptor flights within 50 meters of wind turbines at 8 to 10 times the frequency expected by chance. The rodent control program appears to be totally ineffective, at best.

We also note that the rodent control program was never subjected to environmental review. It was not certified under an EIR or a negative declaration. There has been no public review of this program. In addition to the effects on bird kills, it may possibly adversely affect California red-legged frogs (Figure 2), California tiger salamanders (Figure 3), burrowing owls, San Joaquin kit foxes (Figure 4), and other special-status and sensitive species. Thus, the implementation of the rodent control program is a new circumstance at the APWRA, and one that may be causing cumulative impacts to non-target, special-status species.

Our research and the research of others at the APWRA revealed that bird mortality is substantial, has not lessened through time (e.g., Figure 1), that it has been underestimated historically, and that the industry's mitigation measures have been ineffective.



**Figure 2.** California red-legged frog observed in a pond at the APWRA (©Brian Karas).



**Figure 3.** California tiger salamander in the APWRA (©Brian Karas).



**Figure 4.** San Joaquin kit fox has long been known to reside at the APWRA. The San Joaquin kit fox, like other canids, is sensitive to the anti-coagulant poisons used to abate ground squirrels with funding provided by wind turbine operators at the APWRA. (© BioResource Consultants)

## Proposed mitigation measures

In our meetings with the permit-holders, US Fish and Wildlife Service, CEC, and Alameda County staff, we offered mitigation measures that we concluded would likely reduce avian mortality. These measures were presented orally, and some were in writing.

- \* We suggested that the rodent control program be discontinued.
- \* We suggested that small mammals be encouraged away from wind turbines, and discouraged near wind turbines by reducing lateral and vertical edge on and about the tower laydown areas.
- \* We also suggested that vegetation be allowed to grow tall near wind turbines so that raptors would have less visibility of small mammal presence on the ground near turbines.
- \* We suggested that cattle be prevented from congregating at wind turbines, which they do a great deal.
- \* We proposed that rock piles near wind turbines should be moved to locations farther away.
- \* We suggested that wind turbines in canyons be relocated to areas outside canyons, and that isolated wind turbines be relocated and clustered up with groups of other wind turbines.
- \* We suggested that lattice towers may be preferable to tubular towers because they are visually busier and may be perceived by birds as more of an obstacle to flight.
- \* We suggested that derelict and non-operating turbines be removed or that their towers be laid down.
- \* We proposed that wind turbines at the edge of the wind farm and at the ends of turbine rows be given special attention, such as the Hodos<sup>11</sup> painting scheme or physical structures erected to divert bird flights further from the ends of turbine rows or the edges of turbine clusters.
- \* We suggested the Hodos painting scheme be implemented on an experimental basis.
- \* We suggested all power poles be retrofitted to APLIC compliance standards (we found numerous electrocuted birds under unsafe electrical distribution poles at the APWRA during our study).

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<sup>11</sup> Hodos, W., A. Potocki, T. Storm, and M. Gaffney. 2001. Reduction of motion smear to reduce avian collisions with wind turbines. Pages 88-105 in S. S. Schwartz, ed., Proceedings of National Avian-Wind Power Planning Meeting IV, Carmel, California. Avian Subcommittee of the National Wind Coordinating Committee, Washington, D.C.



\* Also, we suggested the WRRS monitoring methodology for avian fatalities be replaced by a scientifically-defensible and independent monitoring program.

Not only was substantial new information provided to the permit-holders on the avian impacts of the APWRA, but also we informed Alameda County and the permit-holders of the ineffectiveness of ongoing mitigation measures and we suggested a suite of proposed new mitigation measures that are founded in scientific research results more so than the original measures.

We trust that these facts will be useful. Thank you for your consideration,



Shawn Smallwood, Ph.D.



Carl G. Thelander

**Table 1.** List of bird fatalities (n = 1,189) found by BRC during carcass searches between March 1998 and May 2003 at the APWRA while conducting research funded by the National Renewable Energy Laboratory (NREL) and the California Energy Commission (CEC).

Species	Date carcass found	Cause of death
Rock dove	6-May-98	Collision with turbine
Red-tailed hawk	11-May-98	Collision with turbine
American kestrel	12-May-98	Collision with turbine
Golden eagle	21-May-98	Collision with turbine
<i>Buteo</i> species	22-May-98	Unknown
Mallard	26-May-98	Collision with turbine
Red-tailed hawk	27-May-98	Collision with turbine
Rock dove	3-Jun-98	Collision with turbine
Violet-green swallow	3-Jun-98	Collision with turbine
Rock dove	5-Jun-98	Unknown
Golden eagle	9-Jun-98	Collision with turbine
Mourning dove	9-Jun-98	Collision with turbine
Barn owl	10-Jun-98	Collision with turbine
Golden eagle	10-Jun-98	Collision with turbine
American kestrel	23-Jun-98	Collision with turbine
Red-tailed hawk	24-Jun-98	Collision with turbine
European starling	30-Jun-98	Collision with turbine
Horned lark	1-Jul-98	Collision with turbine
Rock dove	1-Jul-98	Collision with turbine
Golden eagle	2-Jul-98	Collision with turbine
Rock dove	2-Jul-98	Collision with turbine
Burrowing owl	8-Jul-98	Collision with turbine
blackbird species	9-Jul-98	Collision with turbine
Red-tailed hawk	14-Jul-98	Collision with turbine
Horned lark	21-Jul-98	Collision with turbine
Western meadowlark	22-Jul-98	Collision with turbine
Horned lark	28-Jul-98	Collision with turbine
Ring-billed Gull species	29-Jul-98	Collision with turbine
Barn owl	30-Jul-98	Collision with turbine
Rock dove	30-Jul-98	Collision with turbine
Rock dove	31-Jul-98	Collision with turbine
Western meadowlark	6-Aug-98	Collision with turbine
Horned lark	17-Aug-98	Collision with turbine
Cliff swallow	19-Aug-98	Collision with turbine
Rock dove	19-Aug-98	Collision with turbine
Red-tailed hawk	19-Aug-98	Collision with turbine
Red-tailed hawk	19-Aug-98	Collision with turbine
Horned lark	3-Sep-98	Collision with turbine

Black-throated gray warbler	4-Sep-98	Electrocution
Hoary bat	4-Sep-98	Collision with turbine
Townsend's warbler	4-Sep-98	Electrocution
Western meadowlark	4-Sep-98	Collision with turbine
Passerine species	10-Sep-98	Unknown
Burrowing owl	14-Sep-98	Collision with turbine
Burrowing owl	21-Sep-98	Collision with turbine
Cliff swallow	21-Sep-98	Collision with turbine
Golden eagle	25-Sep-98	Collision with turbine
European starling	26-Sep-98	Collision with turbine
Red-tailed hawk	2-Oct-98	Collision with turbine
Burrowing owl	3-Oct-98	Predation
Red-tailed hawk	10-Oct-98	Collision with turbine
Rock dove	16-Oct-98	Collision with turbine
Golden eagle	30-Oct-98	Collision with turbine
Red-tailed hawk	30-Oct-98	Collision with turbine
Rock dove	7-Nov-98	Collision with turbine
Red-tailed hawk	7-Nov-98	Collision with turbine
Red-tailed hawk	16-Nov-98	Collision with turbine
<i>Buteo</i> species	17-Nov-98	Collision with turbine
American kestrel	21-Nov-98	Collision with turbine
Red-tailed hawk	21-Nov-98	Collision with turbine
Rock dove	4-Dec-98	Collision with turbine
Western meadowlark	22-Dec-98	Unknown
European starling	4-Jan-99	Collision with turbine
Red-tailed hawk	4-Jan-99	Collision with turbine
European starling	5-Jan-99	Collision with turbine
Rock dove	5-Jan-99	Unknown
<i>Buteo</i> species	11-Jan-99	Collision with turbine
Red-tailed hawk	11-Jan-99	Collision with turbine
Red-tailed hawk	11-Jan-99	Collision with turbine
<i>Buteo</i> species	12-Jan-99	Unknown
<i>Buteo</i> species	12-Jan-99	Unknown
<i>Buteo</i> species	12-Jan-99	Unknown
<i>Buteo</i> species	12-Jan-99	Collision with turbine
Red-tailed hawk	12-Jan-99	Collision with turbine
Passerine species	13-Jan-99	Unknown
Rock dove	13-Jan-99	Collision with turbine
Rock dove	13-Jan-99	Collision with turbine
Rock dove	13-Jan-99	Collision with turbine
Red-tailed hawk	13-Jan-99	Collision with turbine
<i>Buteo</i> species	19-Jan-99	Collision with turbine
Western meadowlark	20-Jan-99	Collision with turbine
<i>Buteo</i> species	25-Jan-99	Collision with turbine
Golden eagle	25-Jan-99	Collision with turbine

Passerine species	26-Jan-99	Unknown
Red-tailed hawk	26-Jan-99	Electrocution
House finch	2-Feb-99	Collision with turbine
<i>Buteo</i> species	8-Feb-99	Collision with turbine
Western meadowlark	8-Feb-99	Unknown
Prairie falcon	9-Feb-99	Collision with turbine
Western meadowlark	9-Feb-99	Collision with turbine
Barn owl	10-Feb-99	Collision with turbine
Unidentified bird species	15-Feb-99	Collision with turbine
<i>Buteo</i> species	16-Feb-99	Collision with turbine
Barn owl	17-Feb-99	Collision with turbine
Red-tailed hawk	17-Feb-99	Collision with turbine
Western meadowlark	17-Feb-99	Collision with turbine
American kestrel	22-Feb-99	Collision with turbine
Rock dove	22-Feb-99	Collision with turbine
Red-tailed hawk	22-Feb-99	Collision with turbine
Red-tailed hawk	22-Feb-99	Collision with turbine
European starling	25-Feb-99	Collision with turbine
Rock dove	28-Feb-99	Collision with turbine
Red-winged blackbird species	16-Mar-99	Unknown
Western meadowlark	22-Mar-99	Unknown
American kestrel	30-Mar-99	Collision with turbine
Mallard	14-Apr-99	Collision with turbine
Red-tailed hawk	22-Apr-99	Collision with turbine
Great-horned owl	5-May-99	Collision with turbine
Rock dove	5-May-99	Collision with turbine
European starling	6-May-99	Collision with turbine
Rock dove	6-May-99	Collision with turbine
Western meadowlark	6-May-99	Collision with turbine
Northern harrier	12-May-99	Collision with turbine
Mallard	13-May-99	Collision with turbine
Rock dove	13-May-99	Collision with turbine
Burrowing owl	14-May-99	Collision with turbine
Western meadowlark	21-May-99	Collision with turbine
Rock dove	27-May-99	Collision with turbine
Red-tailed hawk	27-May-99	Collision with turbine
Western meadowlark	3-Jun-99	Collision with turbine
Western meadowlark	9-Jun-99	Unknown
Cliff swallow	10-Jun-99	Collision with turbine
Horned lark	10-Jun-99	Collision with turbine
Brewer's blackbird species	11-Jun-99	Collision with turbine
Rock dove	11-Jun-99	Collision with turbine
Red-winged blackbird species	11-Jun-99	Collision with turbine
Western meadowlark	11-Jun-99	Collision with turbine
Horned lark	17-Jun-99	Collision with turbine

Rock dove	17-Jun-99	Collision with turbine
Red-tailed hawk	17-Jun-99	Collision with turbine
Western meadowlark	18-Jun-99	Collision with turbine
Brewer's blackbird species	23-Jun-99	Collision with turbine
Western meadowlark	23-Jun-99	Collision with turbine
Mallard	24-Jun-99	Collision with turbine
Red-tailed hawk	24-Jun-99	Collision with turbine
European starling	25-Jun-99	Collision with turbine
Western meadowlark	25-Jun-99	Collision with turbine
Barn owl	30-Jun-99	Electrocution
European starling	30-Jun-99	Collision with turbine
Western meadowlark	1-Jul-99	Collision with turbine
Western meadowlark	8-Jul-99	Collision with turbine
Rock dove	14-Jul-99	Collision with turbine
Western meadowlark	14-Jul-99	Collision with turbine
Burrowing owl	15-Jul-99	Collision with turbine
European starling	15-Jul-99	Collision with turbine
Loggerhead shrike	22-Jul-99	Collision with turbine
House finch	28-Jul-99	Collision with turbine
American kestrel	30-Jul-99	Collision with turbine
Mallard	4-Aug-99	Predation
Red-tailed hawk	4-Aug-99	Collision with turbine
Burrowing owl	5-Aug-99	Collision with turbine
Red-tailed hawk	6-Aug-99	Collision with turbine
Burrowing owl	10-Aug-99	Collision with turbine
Barn owl	11-Aug-99	Collision with turbine
Rock dove	11-Aug-99	Collision with turbine
Rock dove	18-Aug-99	Collision with turbine
Rock dove	19-Aug-99	Collision with turbine
Rock dove	25-Aug-99	Collision with turbine
Rock dove	25-Aug-99	Collision with turbine
Rock dove	25-Aug-99	Collision with turbine
Red-tailed hawk	25-Aug-99	Collision with turbine
Red-tailed hawk	26-Aug-99	Collision with turbine
Red-tailed hawk	27-Aug-99	Collision with turbine
Golden eagle	31-Aug-99	Electrocution
Horned lark	31-Aug-99	Collision with turbine
Rock dove	31-Aug-99	Collision with turbine
Burrowing owl	1-Sep-99	Collision with turbine
American kestrel	7-Sep-99	Collision with turbine
Burrowing owl	7-Sep-99	Predation
Barn owl	8-Sep-99	Collision with turbine
Burrowing owl	8-Sep-99	Collision with turbine
Burrowing owl	8-Sep-99	Collision with turbine
Golden eagle	8-Sep-99	Collision with turbine

Hoary bat	8-Sep-99	Collision with turbine
Horned lark	8-Sep-99	Collision with turbine
Rock dove	8-Sep-99	Collision with turbine
Red-tailed hawk	8-Sep-99	Collision with turbine
Red-tailed hawk	8-Sep-99	Collision with turbine
Red-tailed hawk	8-Sep-99	Collision with turbine
Tricolored blackbird species	8-Sep-99	Collision with turbine
Unidentified bird species	8-Sep-99	Collision with turbine
Rock dove	9-Sep-99	Collision with turbine
Red-tailed hawk	9-Sep-99	Collision with turbine
Burrowing owl	14-Sep-99	Unknown
European starling	14-Sep-99	Collision with turbine
Rock dove	14-Sep-99	Collision with turbine
Rock dove	14-Sep-99	Collision with turbine
Red-tailed hawk	14-Sep-99	Collision with turbine
Red-tailed hawk	14-Sep-99	Collision with turbine
Red-tailed hawk	14-Sep-99	Collision with turbine
Burrowing owl	15-Sep-99	Collision with turbine
Burrowing owl	15-Sep-99	Collision with turbine
Rock dove	15-Sep-99	Collision with turbine
Rock dove	15-Sep-99	Collision with turbine
Red-tailed hawk	15-Sep-99	Collision with turbine
Barn owl	16-Sep-99	Collision with turbine
Burrowing owl	16-Sep-99	Collision with turbine
Western meadowlark	16-Sep-99	Collision with turbine
Red-tailed hawk	18-Sep-99	Collision with turbine
Barn owl	21-Sep-99	Collision with turbine
Red-tailed hawk	21-Sep-99	Collision with turbine
Western meadowlark	21-Sep-99	Unknown
Horned lark	22-Sep-99	Collision with turbine
Burrowing owl	23-Sep-99	Unknown
Burrowing owl	23-Sep-99	Collision with turbine
Red-tailed hawk	23-Sep-99	Collision with turbine
Burrowing owl	28-Sep-99	Collision with turbine
Horned lark	29-Sep-99	Collision with turbine
Rock dove	29-Sep-99	Collision with turbine
Rock dove	29-Sep-99	Collision with turbine
Red-tailed hawk	29-Sep-99	Collision with turbine
American kestrel	30-Sep-99	Collision with turbine
Rock dove	30-Sep-99	Collision with turbine
Red-tailed hawk	30-Sep-99	Collision with turbine
Red-tailed hawk	30-Sep-99	Collision with turbine
Red-tailed hawk	4-Oct-99	Collision with turbine
Red-tailed hawk	5-Oct-99	Collision with turbine
Barn owl	6-Oct-99	Collision with turbine

Burrowing owl	6-Oct-99	Collision with turbine
<i>Buteo</i> species	6-Oct-99	Collision with turbine
Hoary bat	6-Oct-99	Collision with turbine
House finch	6-Oct-99	Unknown
Rock dove	6-Oct-99	Collision with turbine
Red-tailed hawk	6-Oct-99	Collision with turbine
Red-tailed hawk	6-Oct-99	Collision with turbine
Barn owl	7-Oct-99	Collision with turbine
Burrowing owl	7-Oct-99	Collision with turbine
<i>Buteo</i> species	7-Oct-99	Unknown
Burrowing owl	8-Oct-99	Collision with turbine
Golden eagle	8-Oct-99	Collision with turbine
Western meadowlark	12-Oct-99	Unknown
Rock dove	13-Oct-99	Collision with turbine
Burrowing owl	14-Oct-99	Collision with turbine
Burrowing owl	14-Oct-99	Collision with turbine
Rock dove	14-Oct-99	Collision with turbine
Western meadowlark	14-Oct-99	Collision with turbine
Western meadowlark	14-Oct-99	Unknown
Burrowing owl	20-Oct-99	Unknown
Rock dove	20-Oct-99	Collision with turbine
Red-tailed hawk	20-Oct-99	Collision with turbine
Red-tailed hawk	20-Oct-99	Collision with turbine
Western meadowlark	20-Oct-99	Collision with turbine
Western meadowlark	20-Oct-99	Collision with turbine
Red-tailed hawk	21-Oct-99	Collision with turbine
Western meadowlark	21-Oct-99	Collision with turbine
Western meadowlark	21-Oct-99	Unknown
Western meadowlark	21-Oct-99	Predation
Western meadowlark	21-Oct-99	Collision with turbine
American kestrel	26-Oct-99	Collision with turbine
Rock dove	26-Oct-99	Collision with turbine
White-tailed kite	26-Oct-99	Collision with turbine
Red-tailed hawk	27-Oct-99	Collision with turbine
Red-tailed hawk	27-Oct-99	Collision with turbine
Western meadowlark	27-Oct-99	Collision with turbine
Western meadowlark	27-Oct-99	Collision with turbine
Western meadowlark	28-Oct-99	Collision with turbine
Rock dove	2-Nov-99	Collision with turbine
Red-tailed hawk	2-Nov-99	Collision with turbine
Red-tailed hawk	2-Nov-99	Collision with turbine
Golden eagle	3-Nov-99	Collision with turbine
Rock dove	3-Nov-99	Collision with turbine
Red-tailed hawk	3-Nov-99	Collision with turbine
Red-tailed hawk	3-Nov-99	Collision with turbine

Burrowing owl	4-Nov-99	Unknown
Passerine species	4-Nov-99	Collision with turbine
Rock dove	4-Nov-99	Collision with turbine
Red-tailed hawk	4-Nov-99	Collision with turbine
European starling	9-Nov-99	Collision with turbine
Rock dove	9-Nov-99	Collision with turbine
Red-tailed hawk	9-Nov-99	Collision with turbine
Red-tailed hawk	9-Nov-99	Collision with turbine
Barn owl	10-Nov-99	Collision with turbine
European starling	10-Nov-99	Collision with turbine
European starling	10-Nov-99	Collision with turbine
Mallard	10-Nov-99	Collision with turbine
Ring-billed gull species	10-Nov-99	Collision with turbine
Rock dove	10-Nov-99	Collision with turbine
Red-tailed hawk	10-Nov-99	Collision with turbine
Red-tailed hawk	10-Nov-99	Collision with turbine
Western meadowlark	10-Nov-99	Collision with turbine
Red-tailed hawk	16-Nov-99	Collision with turbine
Red-tailed hawk	16-Nov-99	Collision with turbine
Red-tailed hawk	16-Nov-99	Collision with turbine
European starling	17-Nov-99	Collision with turbine
European starling	17-Nov-99	Collision with turbine
Red-tailed hawk	17-Nov-99	Collision with turbine
Red-tailed hawk	17-Nov-99	Collision with turbine
Unidentified raptor species	18-Nov-99	Collision with turbine
Red-tailed hawk	18-Nov-99	Collision with turbine
Red-tailed hawk	18-Nov-99	Unknown
Red-tailed hawk	18-Nov-99	Collision with turbine
Red-tailed hawk	18-Nov-99	Collision with turbine
Barn owl	22-Nov-99	Collision with turbine
European starling	22-Nov-99	Collision with turbine
Golden eagle	22-Nov-99	Unknown
Barn owl	23-Nov-99	Collision with turbine
House finch	23-Nov-99	Collision with turbine
Barn owl	24-Nov-99	Collision with turbine
Red-tailed hawk	24-Nov-99	Collision with turbine
Red-tailed hawk	24-Nov-99	Collision with turbine
Red-tailed hawk	24-Nov-99	Collision with turbine
Barn owl	3-Dec-99	Unknown
Burrowing owl	3-Dec-99	Predation
Burrowing owl	3-Dec-99	Collision with turbine
Red-tailed hawk	3-Dec-99	Collision with turbine
Red-tailed hawk	3-Dec-99	Collision with turbine
Red-tailed hawk	4-Dec-99	Collision with turbine
Red-tailed hawk	7-Dec-99	Collision with turbine



Red-tailed hawk	7-Dec-99	Collision with turbine
Red-tailed hawk	7-Dec-99	Collision with turbine
Red-tailed hawk	7-Dec-99	Collision with turbine
Burrowing owl	8-Dec-99	Unknown
Burrowing owl	8-Dec-99	Collision with turbine
Burrowing owl	8-Dec-99	Collision with turbine
House finch	8-Dec-99	Predation
House finch	8-Dec-99	Predation
Barn owl	9-Dec-99	Collision with turbine
Burrowing owl	9-Dec-99	Collision with turbine
Red-tailed hawk	9-Dec-99	Collision with turbine
American kestrel	14-Dec-99	Collision with turbine
Barn owl	14-Dec-99	Collision with turbine
American kestrel	15-Dec-99	Collision with turbine
Rock dove	15-Dec-99	Collision with turbine
Rock dove	15-Dec-99	Collision with turbine
Rock dove	15-Dec-99	Collision with turbine
Rock dove	15-Dec-99	Collision with turbine
Red-tailed hawk	15-Dec-99	Collision with turbine
American kestrel	16-Dec-99	Collision with turbine
American kestrel	16-Dec-99	Collision with turbine
Western meadowlark	16-Dec-99	Unknown
Western meadowlark	16-Dec-99	Collision with turbine
Red-tailed hawk	17-Dec-99	Collision with turbine
Red-tailed hawk	17-Dec-99	Collision with turbine
Burrowing owl	21-Dec-99	Collision with turbine
Burrowing owl	21-Dec-99	Collision with turbine
Red-tailed hawk	21-Dec-99	Collision with turbine
Mallard	23-Dec-99	Collision with turbine
Mountain bluebird	23-Dec-99	Collision with turbine
Barn owl	28-Dec-99	Collision with turbine
Red-tailed hawk	28-Dec-99	Collision with turbine
Barn owl	29-Dec-99	Collision with turbine
Barn owl	30-Dec-99	Collision with turbine
Burrowing owl	30-Dec-99	Collision with turbine
Burrowing owl	5-Jan-00	wire strike
Red-tailed hawk	5-Jan-00	Collision with turbine
Burrowing owl	6-Jan-00	Predation
Burrowing owl	6-Jan-00	Collision with turbine
Northern harrier	6-Jan-00	Collision with turbine
Passerine species	6-Jan-00	Collision with turbine
Red-tailed hawk	6-Jan-00	Collision with turbine
Red-tailed hawk	6-Jan-00	Collision with turbine
Red-tailed hawk	6-Jan-00	Collision with turbine
Red-tailed hawk	6-Jan-00	Collision with turbine

Red-tailed hawk	6-Jan-00	Collision with turbine
American kestrel	11-Jan-00	Collision with turbine
Western meadowlark	11-Jan-00	Collision with turbine
Western meadowlark	11-Jan-00	Collision with turbine
Western meadowlark	11-Jan-00	Collision with turbine
Barn owl	12-Jan-00	Unknown
Common raven	12-Jan-00	Collision with turbine
Golden eagle	12-Jan-00	Unknown
Mallard	12-Jan-00	Collision with turbine
Red-tailed hawk	12-Jan-00	Collision with turbine
Rock dove	19-Jan-00	Collision with turbine
Western meadowlark	19-Jan-00	Collision with turbine
Western meadowlark	19-Jan-00	Collision with turbine
Red-tailed hawk	20-Jan-00	Collision with turbine
Burrowing owl	1-Feb-00	Collision with turbine
Red-winged blackbird species	1-Feb-00	Unknown
Burrowing owl	2-Feb-00	Collision with turbine
Burrowing owl	2-Feb-00	Collision with turbine
Mallard	2-Feb-00	Collision with turbine
Western meadowlark	2-Feb-00	Collision with turbine
Western meadowlark	2-Feb-00	Unknown
Burrowing owl	3-Feb-00	Unknown
Mourning dove	3-Feb-00	Unknown
Red-tailed hawk	3-Feb-00	Collision with turbine
Red-tailed hawk	4-Feb-00	Collision with turbine
Barn owl	8-Feb-00	Unknown
<i>Buteo</i> species	8-Feb-00	Collision with turbine
Common raven	8-Feb-00	Collision with turbine
Golden eagle	8-Feb-00	Collision with turbine
Red-tailed hawk	8-Feb-00	Unknown
Barn owl	9-Feb-00	Collision with turbine
Great-horned owl	15-Feb-00	Collision with turbine
Red-tailed hawk	15-Feb-00	Collision with turbine
Unidentified bird species	15-Feb-00	Collision with turbine
American kestrel	16-Feb-00	Collision with turbine
Northern flicker	16-Feb-00	Collision with turbine
Red-tailed hawk	16-Feb-00	Collision with turbine
Burrowing owl	17-Feb-00	Collision with turbine
<i>Buteo</i> species	17-Feb-00	Collision with turbine
American kestrel	21-Feb-00	Collision with turbine
Western meadowlark	23-Feb-00	Collision with turbine
Red-tailed hawk	28-Feb-00	Collision with turbine
Western meadowlark	28-Feb-00	Predation
Western meadowlark	29-Feb-00	Collision with turbine
Rock dove	1-Mar-00	Collision with turbine

Red-tailed hawk	1-Mar-00	Collision with turbine
Western meadowlark	8-Mar-00	Predation
Ring-billed gull species	9-Mar-00	Collision with turbine
American kestrel	14-Mar-00	Collision with turbine
American kestrel	15-Mar-00	Unknown
Burrowing owl	15-Mar-00	Collision with turbine
<i>Buteo</i> species	15-Mar-00	Collision with turbine
Rock dove	15-Mar-00	Collision with turbine
Wild turkey	15-Mar-00	Unknown
Great-horned owl	22-Mar-00	Collision with turbine
Rock dove	27-Mar-00	Collision with turbine
Great-horned owl	29-Mar-00	Collision with turbine
American kestrel	30-Mar-00	Collision with turbine
Rock dove	30-Mar-00	Collision with turbine
Red-tailed hawk	4-Apr-00	Unknown
Red-tailed hawk	6-Apr-00	Collision with turbine
Mallard	11-Apr-00	Collision with turbine
Mallard	11-Apr-00	Collision with turbine
Great-horned owl	20-Apr-00	Collision with turbine
Western meadowlark	24-Apr-00	Collision with turbine
<i>Buteo</i> species	7-Jun-00	Collision with turbine
European starling	7-Jun-00	Unknown
Mallard	7-Jun-00	Collision with turbine
Red-tailed hawk	9-Jun-00	Collision with turbine
Golden eagle	15-Jun-00	Collision with turbine
Red-tailed hawk	15-Jun-00	Collision with turbine
Brewer's blackbird species	23-Jun-00	Collision with turbine
European starling	23-Jun-00	Collision with turbine
Mallard	23-Jun-00	Collision with turbine
Mourning dove	23-Jun-00	Unknown
Rock dove	23-Jun-00	Collision with turbine
Western meadowlark	23-Jun-00	Collision with turbine
American kestrel	24-Jun-00	Collision with turbine
Rock dove	24-Jun-00	Collision with turbine
Western meadowlark	25-Jun-00	Unknown
Rock dove	30-Jun-00	Collision with turbine
Rock dove	15-Jul-00	Unknown
Red-tailed hawk	15-Jul-00	Collision with turbine
Black-crowned night heron	16-Jul-00	Collision with turbine
Barn owl	12-Aug-00	Collision with turbine
Burrowing owl	12-Aug-00	Collision with turbine
Burrowing owl	13-Aug-00	Collision with turbine
Mallard	13-Aug-00	Collision with turbine
Golden eagle	18-Aug-00	Collision with turbine
Rock dove	18-Aug-00	Collision with turbine

Rock dove	18-Aug-00	Collision with turbine
Rock dove	18-Aug-00	Collision with turbine
Rock dove	24-Aug-00	Collision with turbine
American kestrel	25-Aug-00	Collision with turbine
American kestrel	25-Aug-00	Collision with turbine
Barn owl	25-Aug-00	Collision with turbine
Golden eagle	26-Aug-00	Collision with turbine
Hoary bat	31-Aug-00	Unknown
Mourning dove	31-Aug-00	Collision with turbine
Great-horned owl	1-Sep-00	Collision with turbine
American kestrel	8-Sep-00	Unknown
Burrowing owl	8-Sep-00	Collision with turbine
Red-tailed hawk	9-Sep-00	Collision with turbine
Rock dove	10-Sep-00	Collision with turbine
American kestrel	15-Sep-00	Collision with turbine
Red-tailed hawk	27-Sep-00	Collision with turbine
Unidentified bird species	9-Oct-00	Collision with turbine
Mallard	9-Oct-00	Collision with turbine
Black-crowned night heron	10-Oct-00	Collision with turbine
Red-tailed hawk	16-Nov-00	Collision with turbine
Burrowing owl	17-Nov-00	Unknown
<i>Buteo</i> species	17-Nov-00	Collision with turbine
Barn owl	1-Dec-00	Collision with turbine
Red-tailed hawk	1-Dec-00	Collision with turbine
Red-tailed hawk	1-Dec-00	Collision with turbine
<i>Buteo</i> species	5-Dec-00	Collision with turbine
Red-tailed hawk	5-Dec-00	Collision with turbine
Red-tailed hawk	5-Dec-00	Electrocution
Unidentified bird species	5-Dec-00	Collision with turbine
Ring-billed Gull species	6-Dec-00	Collision with turbine
House finch	14-Dec-00	Collision with turbine
Burrowing owl	15-Dec-00	Collision with turbine
House finch	15-Dec-00	Collision with turbine
Burrowing owl	20-Dec-00	Collision with turbine
European starling	20-Dec-00	Collision with turbine
House finch	20-Dec-00	Collision with turbine
Mallard	20-Dec-00	Collision with turbine
Passerine species	20-Dec-00	Collision with turbine
Burrowing owl	21-Dec-00	Collision with turbine
Mallard	21-Dec-00	Collision with turbine
Red-tailed hawk	22-Dec-00	Collision with turbine
Burrowing owl	3-Jan-01	Collision with turbine
Western meadowlark	3-Jan-01	Collision with turbine
Barn owl	4-Jan-01	wire strike
American kestrel	9-Jan-01	Collision with turbine

Rock dove	11-Jan-01	Collision with turbine
Western meadowlark	11-Jan-01	Collision with turbine
Rock dove	17-Jan-01	Collision with turbine
Rock dove	17-Jan-01	Collision with turbine
Rock dove	17-Jan-01	Collision with turbine
<i>Buteo</i> species	18-Jan-01	Collision with turbine
Red-tailed hawk	18-Jan-01	Collision with turbine
American kestrel	23-Jan-01	Collision with turbine
Burrowing owl	23-Jan-01	Collision with turbine
House finch	23-Jan-01	Collision with turbine
Loggerhead shrike	23-Jan-01	Collision with turbine
Western meadowlark	23-Jan-01	Collision with turbine
House finch	24-Jan-01	Unknown
House finch	24-Jan-01	Collision with turbine
House finch	24-Jan-01	Collision with turbine
Golden eagle	25-Jan-01	Collision with turbine
House finch	25-Jan-01	Collision with turbine
Red-tailed hawk	25-Jan-01	Collision with turbine
Unidentified raptor species	30-Jan-01	Collision with turbine
California gull	31-Jan-01	Unknown
Golden eagle	31-Jan-01	Collision with turbine
Mallard	31-Jan-01	Collision with turbine
Mallard	31-Jan-01	Collision with turbine
Unidentified raptor species	31-Jan-01	Collision with turbine
Burrowing owl	1-Feb-01	Collision with turbine
Western meadowlark	1-Feb-01	Collision with turbine
American kestrel	6-Feb-01	Collision with turbine
Burrowing owl	6-Feb-01	Collision with turbine
Great-horned owl	6-Feb-01	Collision with turbine
Red-tailed hawk	6-Feb-01	Unknown
Burrowing owl	7-Feb-01	Collision with turbine
Rock dove	7-Feb-01	Collision with turbine
Western meadowlark	7-Feb-01	Collision with turbine
Western meadowlark	7-Feb-01	Collision with turbine
Western meadowlark	7-Feb-01	Collision with turbine
Western meadowlark	7-Feb-01	Collision with turbine
American kestrel	8-Feb-01	Collision with turbine
Red-tailed hawk	8-Feb-01	Collision with turbine
Red-tailed hawk	8-Feb-01	Collision with turbine
Unidentified bird species	8-Feb-01	Collision with turbine
Western meadowlark	8-Feb-01	Collision with turbine
Western meadowlark	8-Feb-01	Collision with turbine
<i>Buteo</i> species	14-Feb-01	Collision with turbine
Rock dove	14-Feb-01	Collision with turbine
Red-tailed hawk	14-Feb-01	Collision with turbine

Western meadowlark	14-Feb-01	Collision with turbine
Rock dove	15-Feb-01	Collision with turbine
Red-tailed hawk	15-Feb-01	Collision with turbine
Western meadowlark	15-Feb-01	Collision with turbine
Western meadowlark	15-Feb-01	Collision with turbine
Mallard	1-Mar-01	Collision with turbine
Mourning dove	1-Mar-01	Collision with turbine
Red-tailed hawk	1-Mar-01	Collision with turbine
Red-tailed hawk	1-Mar-01	Collision with turbine
California gull	6-Mar-01	Collision with turbine
Barn owl	7-Mar-01	Collision with turbine
Great-horned owl	7-Mar-01	Collision with turbine
Rock dove	7-Mar-01	Collision with turbine
European starling	8-Mar-01	Collision with turbine
Red-tailed hawk	8-Mar-01	Unknown
Mountain bluebird	13-Mar-01	Unknown
Red-tailed hawk	13-Mar-01	Collision with turbine
Northern flicker	14-Mar-01	Collision with turbine
Rock dove	14-Mar-01	Collision with turbine
California gull	22-Mar-01	Collision with turbine
Red-tailed hawk	22-Mar-01	Collision with turbine
California gull	29-Mar-01	Collision with turbine
Great-horned owl	29-Mar-01	Collision with turbine
Golden eagle	29-Mar-01	Collision with turbine
Mallard	29-Mar-01	Collision with turbine
Red-winged blackbird species	29-Mar-01	Collision with turbine
<i>Buteo</i> species	4-Apr-01	Collision with turbine
European starling	4-Apr-01	Collision with turbine
European starling	4-Apr-01	Collision with turbine
Red-tailed hawk	4-Apr-01	Collision with turbine
Passerine species	5-Apr-01	Collision with turbine
Burrowing owl	11-Apr-01	Collision with turbine
European starling	11-Apr-01	Collision with turbine
House finch	11-Apr-01	Predation
<i>Buteo</i> species	12-Apr-01	Collision with turbine
Mallard	12-Apr-01	Collision with turbine
Mallard	12-Apr-01	Unknown
Red-winged blackbird species	12-Apr-01	Collision with turbine
Loggerhead shrike	16-Apr-01	Collision with turbine
Western meadowlark	16-Apr-01	Collision with turbine
European starling	18-Apr-01	Collision with turbine
Rock dove	18-Apr-01	Collision with turbine
Rock dove	18-Apr-01	Collision with turbine
Red-tailed hawk	18-Apr-01	Collision with turbine
Barn owl	25-Apr-01	Collision with turbine

Barn owl	25-Apr-01	Collision with turbine
Western meadowlark	26-Apr-01	Collision with turbine
Mallard	30-Apr-01	Collision with turbine
California gull	1-May-01	Collision with turbine
Rock dove	15-Jun-01	Collision with turbine
Rock dove	18-Jun-01	Collision with turbine
Unidentified bird species	18-Jun-01	Collision with turbine
Burrowing owl	19-Jun-01	Collision with turbine
European starling	25-Jun-01	Collision with turbine
Rock dove	25-Jun-01	Collision with turbine
Rock dove	2-Jul-01	Collision with turbine
Rock dove	2-Jul-01	Collision with turbine
Western meadowlark	2-Jul-01	Collision with turbine
Golden eagle	3-Jul-01	Collision with turbine
Mallard	3-Jul-01	Collision with turbine
Passerine species	4-Jul-01	Collision with turbine
Great-horned owl	9-Jul-01	Collision with turbine
Common raven	10-Jul-01	Collision with turbine
Passerine species	10-Jul-01	Collision with turbine
Common raven	16-Jul-01	Collision with turbine
Common raven	16-Jul-01	Collision with turbine
Common raven	16-Jul-01	Collision with turbine
Great-horned owl	16-Jul-01	Collision with turbine
Rock dove	17-Jul-01	Collision with turbine
Rock dove	17-Jul-01	Collision with turbine
Western meadowlark	17-Jul-01	Collision with turbine
Common raven	18-Jul-01	Collision with turbine
Gull species	18-Jul-01	Collision with turbine
Rock dove	18-Jul-01	Collision with turbine
Rock dove	18-Jul-01	Collision with turbine
Burrowing owl	23-Jul-01	Collision with turbine
Burrowing owl	23-Jul-01	Collision with turbine
Burrowing owl	23-Jul-01	Collision with turbine
European starling	23-Jul-01	Collision with turbine
Rock dove	23-Jul-01	Collision with turbine
Mallard	24-Jul-01	Collision with turbine
Rock dove	24-Jul-01	Collision with turbine
Rock dove	24-Jul-01	Collision with turbine
Rock dove	24-Jul-01	Collision with turbine
Unidentified bird species	24-Jul-01	Collision with turbine
American kestrel	25-Jul-01	Collision with turbine
Mallard	25-Jul-01	Collision with turbine
Unidentified raptor species	25-Jul-01	Electrocution
Rock dove	25-Jul-01	Collision with turbine
Rock dove	25-Jul-01	Collision with turbine

Rock dove	25-Jul-01	Collision with turbine
Rock dove	25-Jul-01	Collision with turbine
Rock dove	25-Jul-01	Collision with turbine
Rock dove	25-Jul-01	Collision with turbine
Rock dove	25-Jul-01	Collision with turbine
Unidentified bird species	25-Jul-01	Collision with turbine
Unidentified bird species	25-Jul-01	Collision with turbine
Unidentified bird species	25-Jul-01	Collision with turbine
Unidentified raptor species	31-Jul-01	Collision with turbine
Red-tailed hawk	1-Aug-01	Collision with turbine
Barn owl	6-Aug-01	Collision with turbine
Barn owl	7-Aug-01	Unknown
Brewer's blackbird species	7-Aug-01	Unknown
Burrowing owl	7-Aug-01	Collision with turbine
Rock dove	7-Aug-01	Collision with turbine
Red-tailed hawk	7-Aug-01	Unknown
Mallard	8-Aug-01	Unknown
Rock dove	8-Aug-01	Unknown
Turkey vulture	8-Aug-01	Collision with turbine
Burrowing owl	13-Aug-01	Unknown
Mallard	13-Aug-01	Unknown
Rock dove	14-Aug-01	Collision with turbine
Turkey vulture	14-Aug-01	Collision with turbine
Barn owl	20-Aug-01	Collision with turbine
Burrowing owl	22-Aug-01	Unknown
Rock dove	22-Aug-01	Collision with turbine
Rock dove	22-Aug-01	Collision with turbine
Red-tailed hawk	22-Aug-01	Collision with turbine
Barn owl	28-Aug-01	Collision with turbine
California gull	29-Aug-01	Collision with turbine
Common raven	29-Aug-01	Collision with turbine
Horned lark	29-Aug-01	Collision with turbine
Rock dove	29-Aug-01	Collision with turbine
Unidentified bird species	29-Aug-01	Unknown
Western meadowlark	29-Aug-01	Collision with turbine
European starling	30-Aug-01	Collision with turbine
Rock dove	1-Sep-01	Collision with turbine
Brown-headed cowbird	6-Sep-01	Collision with turbine
European starling	6-Sep-01	Collision with turbine
European starling	6-Sep-01	Collision with turbine
Pacific-slope flycatcher	6-Sep-01	Collision with turbine
Rock dove	6-Sep-01	Collision with turbine
Rock dove	6-Sep-01	Collision with turbine
Red-tailed hawk	6-Sep-01	Collision with turbine
Western meadowlark	6-Sep-01	Collision with turbine



Rock dove	7-Sep-01	Collision with turbine
Rock dove	7-Sep-01	Collision with turbine
European starling	11-Sep-01	Collision with turbine
Rock dove	11-Sep-01	Collision with turbine
Rock dove	12-Sep-01	Collision with turbine
Rock dove	12-Sep-01	Collision with turbine
Rock dove	13-Sep-01	Collision with turbine
Barn owl	19-Sep-01	Collision with turbine
Common raven	19-Sep-01	Collision with turbine
Rock dove	19-Sep-01	Collision with turbine
Unidentified bird species	19-Sep-01	Collision with turbine
American kestrel	20-Sep-01	Collision with turbine
Great-horned owl	20-Sep-01	Collision with turbine
Turkey vulture	20-Sep-01	Collision with turbine
Unidentified bird species	20-Sep-01	Collision with turbine
Western meadowlark	20-Sep-01	Collision with turbine
Loggerhead shrike	21-Sep-01	Collision with turbine
Prairie falcon	21-Sep-01	Collision with turbine
Western meadowlark	28-Sep-01	Collision with turbine
Western meadowlark	29-Sep-01	Unknown
House finch	5-Nov-01	Collision with turbine
American kestrel	6-Nov-01	Collision with turbine
Barn owl	6-Nov-01	Collision with turbine
Rock dove	6-Nov-01	Unknown
Red-tailed hawk	6-Nov-01	Collision with turbine
Red-tailed hawk	7-Nov-01	Collision with turbine
Gull species	13-Nov-01	Collision with turbine
Unidentified bird species	14-Nov-01	Collision with turbine
Double-breasted cormorant	14-Nov-01	Collision with turbine
European starling	14-Nov-01	Collision with turbine
Red-winged blackbird species	14-Nov-01	Collision with turbine
Red-tailed hawk	15-Nov-01	Collision with turbine
Brewer's blackbird species	19-Nov-01	Collision with turbine
Brewer's blackbird species	20-Nov-01	Collision with turbine
Brewer's blackbird species	20-Nov-01	Collision with turbine
Gull species	20-Nov-01	Collision with turbine
Horned lark	20-Nov-01	Collision with turbine
Rock dove	20-Nov-01	Collision with turbine
Red-tailed hawk	20-Nov-01	Unknown
Brewer's blackbird species	21-Nov-01	Collision with turbine
European starling	21-Nov-01	Collision with turbine
Horned lark	21-Nov-01	Collision with turbine
American kestrel	26-Nov-01	Collision with turbine
Red-tailed hawk	27-Nov-01	Collision with turbine
Unidentified bird species	28-Nov-01	Collision with turbine

Mourning dove	28-Nov-01	Collision with turbine
American kestrel	3-Dec-01	Collision with turbine
Horned lark	3-Dec-01	Collision with turbine
Burrowing owl	4-Dec-01	Collision with turbine
Horned lark	4-Dec-01	Collision with turbine
Rock dove	4-Dec-01	Collision with turbine
Rock dove	4-Dec-01	Collision with turbine
Red-tailed hawk	4-Dec-01	Collision with turbine
Western meadowlark	5-Dec-01	Collision with turbine
Mourning dove	11-Dec-01	Predation
Rock dove	11-Dec-01	Unknown
American kestrel	12-Dec-01	Collision with turbine
Say's phoebe	12-Dec-01	Predation
Unidentified bird species	17-Dec-01	Collision with turbine
Burrowing owl	17-Dec-01	Collision with turbine
Golden eagle	18-Dec-01	Collision with turbine
Red-tailed hawk	18-Dec-01	Collision with turbine
Brewer's blackbird species	19-Dec-01	Collision with turbine
Mallard	19-Dec-01	Unknown
Red-tailed hawk	19-Dec-01	Collision with turbine
American kestrel	2-Jan-02	Collision with turbine
Rock dove	2-Jan-02	Collision with turbine
Western meadowlark	2-Jan-02	Collision with turbine
Western meadowlark	3-Jan-02	Collision with turbine
Western meadowlark	4-Jan-02	Collision with turbine
Unidentified bird species	7-Jan-02	Collision with turbine
European starling	7-Jan-02	Collision with turbine
Unidentified hawk species	7-Jan-02	Collision with turbine
House finch	7-Jan-02	Collision with turbine
Mourning dove	7-Jan-02	Collision with turbine
Mourning dove	7-Jan-02	Collision with turbine
Mourning dove	7-Jan-02	Unknown
Passerine species	7-Jan-02	Collision with turbine
Passerine species	7-Jan-02	Collision with turbine
Passerine species	7-Jan-02	Collision with turbine
Red-tailed hawk	7-Jan-02	Collision with turbine
European starling	8-Jan-02	Collision with turbine
Red-tailed hawk	8-Jan-02	Collision with turbine
European starling	9-Jan-02	Collision with turbine
Mourning dove	9-Jan-02	Collision with turbine
Passerine species	9-Jan-02	Collision with turbine
Passerine species	9-Jan-02	Collision with turbine
Rock dove	9-Jan-02	Collision with turbine
American kestrel	14-Jan-02	Collision with turbine
Horned lark	14-Jan-02	Collision with turbine

Red-tailed hawk	14-Jan-02	Unknown
Burrowing owl	15-Jan-02	Collision with turbine
Red-tailed hawk	15-Jan-02	Collision with turbine
American kestrel	16-Jan-02	Collision with turbine
European starling	16-Jan-02	Collision with turbine
Mourning dove	16-Jan-02	Collision with turbine
Western meadowlark	16-Jan-02	Collision with turbine
European starling	17-Jan-02	Unknown
Mourning dove	17-Jan-02	Collision with turbine
Mourning dove	17-Jan-02	Collision with turbine
Mourning dove	17-Jan-02	Collision with turbine
Rock dove	17-Jan-02	Collision with turbine
Rock dove	17-Jan-02	Unknown
American crow	21-Jan-02	Collision with turbine
Unidentified bird species	21-Jan-02	Collision with turbine
Mourning dove	21-Jan-02	Collision with turbine
Mourning dove	21-Jan-02	Collision with turbine
Northern flicker	21-Jan-02	Collision with turbine
Unidentified raptor species	21-Jan-02	Collision with turbine
Unidentified raptor species	21-Jan-02	Collision with turbine
Unidentified bird species	22-Jan-02	Collision with turbine
Mallard	22-Jan-02	Collision with turbine
Rock dove	22-Jan-02	Collision with turbine
Red-tailed hawk	22-Jan-02	Collision with turbine
Mourning dove	23-Jan-02	Unknown
Mourning dove	28-Jan-02	Collision with turbine
Unidentified bird species	29-Jan-02	Collision with turbine
Mourning dove	29-Jan-02	Collision with turbine
Rock dove	29-Jan-02	Collision with turbine
Barn owl	4-Feb-02	Collision with turbine
California gull	4-Feb-02	Unknown
Rock dove	11-Feb-02	Unknown
Red-tailed hawk	11-Feb-02	Collision with turbine
Mourning dove	12-Feb-02	Collision with turbine
Red-tailed hawk	12-Feb-02	Collision with turbine
American crow	13-Feb-02	Electrocution
Gull species	13-Feb-02	Unknown
Burrowing owl	18-Feb-02	Collision with turbine
Mourning dove	18-Feb-02	Unknown
Savanna sparrow	20-Feb-02	Collision with turbine
Western meadowlark	20-Feb-02	Collision with turbine
Prairie falcon	21-Feb-02	Collision with turbine
Red-winged blackbird species	21-Feb-02	Unknown
Rock dove	25-Feb-02	Collision with turbine
Horned lark	27-Feb-02	Collision with turbine

Mourning dove	27-Feb-02	Collision with turbine
Red-tailed hawk	28-Feb-02	Collision with turbine
American kestrel	4-Mar-02	Collision with turbine
Cockatiel	4-Mar-02	Collision with turbine
Mourning dove	4-Mar-02	Collision with turbine
American kestrel	5-Mar-02	Collision with turbine
Mourning dove	5-Mar-02	Collision with turbine
Rock dove	5-Mar-02	Collision with turbine
Rock dove	5-Mar-02	Collision with turbine
Rock dove	5-Mar-02	Collision with turbine
Rock dove	5-Mar-02	Collision with turbine
Rock dove	5-Mar-02	Collision with turbine
Rock dove	5-Mar-02	Collision with turbine
Rock dove	5-Mar-02	Collision with turbine
European starling	11-Mar-02	Entrapped in turbine
Red-tailed hawk	11-Mar-02	Collision with turbine
Rock dove	19-Mar-02	Collision with turbine
Mallard	20-Mar-02	Unknown
Mallard	25-Mar-02	Unknown
Red-winged blackbird species	26-Mar-02	Collision with turbine
Rock dove	3-Apr-02	Collision with turbine
Rock dove	3-Apr-02	Collision with turbine
Lesser yellowlegs	8-Apr-02	Collision with turbine
American crow	10-Apr-02	Collision with turbine
American kestrel	10-Apr-02	Collision with turbine
Barn owl	10-Apr-02	Collision with turbine
European starling	10-Apr-02	Unknown
American avocet	15-Apr-02	Unknown
American avocet	15-Apr-02	Unknown
Unidentified bird species	15-Apr-02	Unknown
Mallard	15-Apr-02	Collision with turbine
Rock dove	15-Apr-02	Collision with turbine
European starling	16-Apr-02	Collision with turbine
Yellow warbler	22-Apr-02	Collision with turbine
American kestrel	23-Apr-02	Collision with turbine
Red-winged blackbird species	23-Apr-02	Collision with turbine
Western meadowlark	24-Apr-02	Collision with turbine
Red-tailed hawk	1-May-02	Collision with turbine
Burrowing owl	6-May-02	Automobile
European starling	6-May-02	Collision with turbine
Red-tailed hawk	6-May-02	Collision with turbine
Unidentified bird species	8-May-02	Unknown
Cliff swallow	13-May-02	Collision with turbine
Horned lark	13-May-02	Unknown
Western meadowlark	13-May-02	Collision with turbine

Unidentified bird species	14-May-02	Unknown
Rock dove	14-May-02	Collision with turbine
American kestrel	15-May-02	Collision with turbine
Rock dove	15-May-02	Unknown
American crow	16-May-02	Collision with turbine
Cliff swallow	16-May-02	Collision with turbine
Rock dove	16-May-02	Collision with turbine
Rock dove	16-May-02	Collision with turbine
Rock dove	16-May-02	Collision with turbine
Rock dove	16-May-02	Collision with turbine
Rock dove	21-May-02	Collision with turbine
Mallard	22-May-02	Unknown
Northern mockingbird	22-May-02	Collision with turbine
Rock dove	22-May-02	Unknown
Red-winged blackbird species	22-May-02	Collision with turbine
Turkey vulture	22-May-02	Collision with turbine
Gull species	28-May-02	Collision with turbine
Rock dove	29-May-02	Collision with turbine
European starling	30-May-02	Collision with turbine
Rock dove	30-May-02	Collision with turbine
Rock dove	30-May-02	Collision with turbine
Rock dove	30-May-02	Collision with turbine
Rock dove	30-May-02	Collision with turbine
Red-winged blackbird species	30-May-02	Collision with turbine
American kestrel	3-Jun-02	Collision with turbine
Great-horned owl	3-Jun-02	Collision with turbine
Horned lark	4-Jun-02	Collision with turbine
Mourning dove	4-Jun-02	Collision with turbine
Western meadowlark	4-Jun-02	Unknown
Horned lark	5-Jun-02	Collision with turbine
Rock dove	5-Jun-02	Collision with turbine
Burrowing owl	6-Jun-02	Collision with turbine
European starling	10-Jun-02	Collision with turbine
Red-winged blackbird species	12-Jun-02	Collision with turbine
Western meadowlark	18-Jun-02	Unknown
Common raven	19-Jun-02	Collision with turbine
Rock dove	19-Jun-02	Collision with turbine
Rock dove	19-Jun-02	Collision with turbine
Northern harrier	20-Jun-02	Collision with turbine
Rock dove	20-Jun-02	Collision with turbine
Red-tailed hawk	20-Jun-02	Collision with turbine
Red-tailed hawk	20-Jun-02	Collision with turbine
Mourning dove	24-Jun-02	Collision with turbine
Rock dove	24-Jun-02	Collision with turbine
Rock dove	24-Jun-02	Collision with turbine

Mourning dove	25-Jun-02	Collision with turbine
Rock dove	26-Jun-02	Collision with turbine
American crow	27-Jun-02	Collision with turbine
Rock dove	1-Jul-02	Collision with turbine
Rock dove	1-Jul-02	Collision with turbine
Red-tailed hawk	1-Jul-02	Collision with turbine
Rock dove	2-Jul-02	Collision with turbine
Barn owl	8-Jul-02	Collision with turbine
European starling	8-Jul-02	Collision with turbine
Golden eagle	8-Jul-02	Collision with turbine
Rock dove	8-Jul-02	Collision with turbine
Rock dove	9-Jul-02	Collision with turbine
Brewer's blackbird species	10-Jul-02	Collision with turbine
American kestrel	15-Jul-02	Collision with turbine
American avocet	23-Jul-02	Collision with turbine
Mourning dove	24-Jul-02	Collision with turbine
Rock dove	5-Aug-02	Collision with turbine
Rock dove	6-Aug-02	Collision with turbine
Rock dove	6-Aug-02	Collision with turbine
Rock dove	6-Aug-02	Collision with turbine
Burrowing owl	7-Aug-02	Unknown
European starling	7-Aug-02	Collision with turbine
Horned lark	7-Aug-02	Collision with turbine
Mourning dove	7-Aug-02	Collision with turbine
Rock dove	7-Aug-02	Collision with turbine
Rock dove	7-Aug-02	Collision with turbine
Rock dove	7-Aug-02	Collision with turbine
Rock dove	7-Aug-02	Collision with turbine
Rock dove	7-Aug-02	Collision with turbine
Unidentified bird species	12-Aug-02	Unknown
European starling	12-Aug-02	Collision with turbine
Golden eagle	14-Aug-02	Electrocution
Red-tailed hawk	14-Aug-02	Collision with turbine
Burrowing owl	19-Aug-02	Collision with turbine
European starling	19-Aug-02	Collision with turbine
Western kingbird	19-Aug-02	Collision with turbine
Rock dove	20-Aug-02	Collision with turbine
Red-tailed hawk	20-Aug-02	Collision with turbine
American crow	26-Aug-02	Unknown
Golden eagle	26-Aug-02	Collision with turbine
Barn owl	15-Oct-02	Collision with turbine
Unidentified bird species	15-Oct-02	Collision with turbine
Burrowing owl	15-Oct-02	Collision with turbine
Golden eagle	15-Oct-02	Collision with turbine
Unidentified bird species	16-Oct-02	Collision with turbine

Rock dove	16-Oct-02	Collision with turbine
Western meadowlark	16-Oct-02	Collision with turbine
Brewer's blackbird species	21-Oct-02	Collision with turbine
European starling	21-Oct-02	Collision with turbine
European starling	23-Oct-02	Collision with turbine
Rock dove	23-Oct-02	Collision with turbine
Rock dove	23-Oct-02	Collision with turbine
Golden eagle	28-Oct-02	Collision with turbine
Red-tailed hawk	28-Oct-02	Collision with turbine
Red-tailed hawk	28-Oct-02	Collision with turbine
American kestrel	29-Oct-02	Collision with turbine
European starling	29-Oct-02	Collision with turbine
Red-tailed hawk	29-Oct-02	Collision with turbine
Savanna sparrow	29-Oct-02	Unknown
Golden eagle	30-Oct-02	Collision with turbine
Northern flicker	30-Oct-02	Collision with turbine
Northern flicker	30-Oct-02	Collision with turbine
Red-tailed hawk	30-Oct-02	Collision with turbine
Red-tailed hawk	30-Oct-02	Collision with turbine
Western meadowlark	30-Oct-02	Collision with turbine
Brown-headed cowbird	31-Oct-02	Unknown
European starling	31-Oct-02	Unknown
Red-tailed hawk	4-Nov-02	Collision with turbine
Red-tailed hawk	4-Nov-02	Collision with turbine
American kestrel	5-Nov-02	Collision with turbine
Rock dove	5-Nov-02	Collision with turbine
Rock dove	5-Nov-02	Collision with turbine
American kestrel	6-Nov-02	Collision with turbine
Ferruginous hawk	6-Nov-02	Collision with turbine
Ferruginous hawk	6-Nov-02	Collision with turbine
Red-tailed hawk	6-Nov-02	Collision with turbine
Red-tailed hawk	11-Nov-02	Collision with turbine
Cattle egret	12-Nov-02	Collision with turbine
European starling	12-Nov-02	Collision with turbine
Golden eagle	12-Nov-02	Collision with turbine
Golden eagle	12-Nov-02	Collision with turbine
Red-tailed hawk	12-Nov-02	Collision with turbine
Red-tailed hawk	12-Nov-02	Collision with turbine
Golden eagle	13-Nov-02	Collision with turbine
Red-tailed hawk	13-Nov-02	Collision with turbine
Red-tailed hawk	13-Nov-02	Collision with turbine
Red-tailed hawk	13-Nov-02	Collision with turbine
Red-tailed hawk	13-Nov-02	Collision with turbine
Red-tailed hawk	13-Nov-02	Collision with turbine
Red-tailed hawk	14-Nov-02	Collision with turbine

Red-tailed hawk	14-Nov-02	Collision with turbine
Red-tailed hawk	14-Nov-02	Collision with turbine
American kestrel	18-Nov-02	Collision with turbine
European starling	18-Nov-02	Collision with turbine
Red-tailed hawk	18-Nov-02	Collision with turbine
Red-tailed hawk	18-Nov-02	Unknown
Golden eagle	19-Nov-02	Collision with turbine
Golden eagle	19-Nov-02	Collision with turbine
Barn owl	20-Nov-02	Collision with turbine
Unidentified bird species	20-Nov-02	Collision with turbine
Golden eagle	20-Nov-02	Collision with turbine
Rock dove	20-Nov-02	Collision with turbine
Western meadowlark	20-Nov-02	Unknown
Unidentified bird species	21-Nov-02	Collision with turbine
European starling	21-Nov-02	Collision with turbine
Rock dove	21-Nov-02	Collision with turbine
Rock dove	21-Nov-02	Collision with turbine
Rock dove	21-Nov-02	Collision with turbine
Rock dove	21-Nov-02	Collision with turbine
Red-tailed hawk	21-Nov-02	Unknown
Red-tailed hawk	21-Nov-02	Collision with turbine
Great-horned owl	2-Dec-02	Collision with turbine
Golden eagle	2-Dec-02	Collision with turbine
House sparrow	2-Dec-02	Collision with turbine
Mourning dove	2-Dec-02	Collision with turbine
Rock dove	2-Dec-02	Unknown
Barn owl	3-Dec-02	Collision with turbine
Unidentified bird species	3-Dec-02	Collision with turbine
Unidentified bird species	3-Dec-02	Collision with turbine
Rock dove	3-Dec-02	Collision with turbine
Rock dove	3-Dec-02	Collision with turbine
Red-tailed hawk	3-Dec-02	Collision with turbine
Unidentified bird species	4-Dec-02	Collision with turbine
Common raven	4-Dec-02	Collision with turbine
European starling	4-Dec-02	Collision with turbine
Ring-necked duck	4-Dec-02	Collision with turbine
Red-tailed hawk	4-Dec-02	Collision with turbine
Great-horned owl	5-Dec-02	Collision with turbine
Western meadowlark	5-Dec-02	Collision with turbine
Unidentified raptor species	9-Dec-02	Collision with turbine
Red-tailed hawk	9-Dec-02	Unknown
Red-tailed hawk	10-Dec-02	Collision with turbine
Unidentified bird species	11-Dec-02	Collision with turbine
Unidentified raptor species	11-Dec-02	Collision with turbine
Red-tailed hawk	11-Dec-02	Collision with turbine



Red-tailed hawk	11-Dec-02	Collision with turbine
Red-tailed hawk	11-Dec-02	Collision with turbine
Gull species	12-Dec-02	Collision with turbine
Rock dove	12-Dec-02	Collision with turbine
Red-tailed hawk	12-Dec-02	Collision with turbine
Red-tailed hawk	12-Dec-02	Collision with turbine
Mountain bluebird	18-Dec-02	Collision with turbine
Barn owl	2-Jan-03	Collision with turbine
Golden eagle	2-Jan-03	Collision with turbine
Barn owl	3-Jan-03	Collision with turbine
European starling	3-Jan-03	Collision with turbine
Golden eagle	6-Jan-03	Collision with turbine
Golden eagle	7-Jan-03	Collision with turbine
Red-tailed hawk	7-Jan-03	Collision with turbine
Turkey vulture	7-Jan-03	Collision with turbine
Western meadowlark	7-Jan-03	Collision with turbine
Great-horned owl	8-Jan-03	Collision with turbine
Golden eagle	8-Jan-03	Collision with turbine
Unidentified raptor species	8-Jan-03	Collision with turbine
Turkey vulture	8-Jan-03	Collision with turbine
Unidentified raptor species	9-Jan-03	Collision with turbine
Red-tailed hawk	9-Jan-03	Collision with turbine
Western meadowlark	9-Jan-03	Collision with turbine
Passerine species	13-Jan-03	Collision with turbine
Unidentified raptor species	13-Jan-03	Collision with turbine
Red-tailed hawk	13-Jan-03	Collision with turbine
Mourning dove	14-Jan-03	Collision with turbine
Western meadowlark	14-Jan-03	Unknown
Western meadowlark	14-Jan-03	Collision with turbine
European starling	15-Jan-03	Collision with turbine
American kestrel	16-Jan-03	Collision with turbine
Unidentified bird species	16-Jan-03	Collision with turbine
Unidentified bird species	20-Jan-03	Collision with turbine
Unidentified bird species	20-Jan-03	Collision with turbine
Brewer's blackbird species	20-Jan-03	Collision with turbine
Red-tailed hawk	20-Jan-03	Collision with turbine
Red-tailed hawk	20-Jan-03	Collision with turbine
Golden eagle	21-Jan-03	Collision with turbine
Golden eagle	21-Jan-03	Collision with turbine
Mourning dove	21-Jan-03	Unknown
Mourning dove	21-Jan-03	Collision with turbine
Red-tailed hawk	21-Jan-03	Collision with turbine
Red-tailed hawk	21-Jan-03	Collision with turbine
Western meadowlark	21-Jan-03	Unknown
Barn owl	22-Jan-03	Collision with turbine

European starling	22-Jan-03	Collision with turbine
Golden eagle	22-Jan-03	Collision with turbine
Mourning dove	22-Jan-03	Collision with turbine
Western meadowlark	22-Jan-03	Collision with turbine
American kestrel	27-Jan-03	Collision with turbine
American kestrel	27-Jan-03	Collision with turbine
American kestrel	29-Jan-03	Collision with turbine
American kestrel	29-Jan-03	Collision with turbine
European starling	29-Jan-03	Unknown
Mountain bluebird	29-Jan-03	Collision with turbine
Unidentified raptor species	29-Jan-03	Collision with turbine
Unidentified raptor species	29-Jan-03	Collision with turbine
Western meadowlark	29-Jan-03	Collision with turbine
Golden eagle	30-Jan-03	Unknown
Red-tailed hawk	30-Jan-03	Collision with turbine
Golden eagle	3-Feb-03	Collision with turbine
Barn owl	4-Feb-03	Collision with turbine
Barn owl	4-Feb-03	Collision with turbine
Unidentified bird species	4-Feb-03	Collision with turbine
Great-horned owl	4-Feb-03	Collision with turbine
Western meadowlark	4-Feb-03	Collision with turbine
Mountain bluebird	5-Feb-03	Collision with turbine
Red-tailed hawk	5-Feb-03	Collision with turbine
American kestrel	6-Feb-03	Collision with turbine
Unidentified bird species	6-Feb-03	Collision with turbine
Unidentified bird species	6-Feb-03	Collision with turbine
European starling	6-Feb-03	Collision with turbine
Golden eagle	6-Feb-03	Collision with turbine
Gull species	6-Feb-03	Collision with turbine
Rock dove	6-Feb-03	Collision with turbine
Rock dove	6-Feb-03	Collision with turbine
Red-tailed hawk	6-Feb-03	Collision with turbine
Gull species	10-Feb-03	Collision with turbine
Red-tailed hawk	10-Feb-03	Collision with turbine
Red-tailed hawk	10-Feb-03	Collision with turbine
Red-tailed hawk	10-Feb-03	Collision with turbine
Red-tailed hawk	10-Feb-03	Collision with turbine
Red-tailed hawk	10-Feb-03	Collision with turbine
Western meadowlark	10-Feb-03	Collision with turbine
American crow	11-Feb-03	Electrocution
Brewer's blackbird species	11-Feb-03	Collision with turbine
Common raven	11-Feb-03	Collision with turbine
European starling	11-Feb-03	Collision with turbine
Golden eagle	11-Feb-03	Collision with turbine
Rock dove	11-Feb-03	Unknown

Unidentified bird species	17-Feb-03	Collision with turbine
Great-horned owl	17-Feb-03	Collision with turbine
Golden eagle	17-Feb-03	Collision with turbine
Red-tailed hawk	18-Feb-03	Collision with turbine
Barn owl	25-Feb-03	Collision with turbine
European starling	26-Feb-03	Collision with turbine
Burrowing owl	27-Feb-03	Collision with turbine
Golden eagle	27-Feb-03	Unknown
Unidentified raptor species	27-Feb-03	Collision with turbine
Burrowing owl	3-Mar-03	Collision with turbine
Golden eagle	4-Mar-03	Collision with turbine
Gull species	4-Mar-03	Collision with turbine
Red-tailed hawk	4-Mar-03	Collision with turbine
Golden eagle	5-Mar-03	Collision with turbine
Golden eagle	5-Mar-03	Collision with turbine
Gull species	5-Mar-03	Collision with turbine
Passerine species	5-Mar-03	Collision with turbine
Western meadowlark	5-Mar-03	Collision with turbine
American kestrel	6-Mar-03	Entrapped in turbine
Golden eagle	6-Mar-03	Collision with turbine
Loggerhead shrike	6-Mar-03	Entrapped in turbine
Red-tailed hawk	6-Mar-03	Collision with turbine
Barn owl	10-Mar-03	Unknown
Barn owl	10-Mar-03	Collision with turbine
Unidentified bird species	10-Mar-03	Collision with turbine
Unidentified bird species	10-Mar-03	Collision with turbine
Horned lark	10-Mar-03	Collision with turbine
Red-tailed hawk	10-Mar-03	Collision with turbine
Golden eagle	11-Mar-03	Collision with turbine
Barn owl	12-Mar-03	Collision with turbine
Golden eagle	12-Mar-03	Collision with turbine
Gull species	12-Mar-03	Collision with turbine
Gull species	12-Mar-03	Collision with turbine
Rock dove	12-Mar-03	Collision with turbine
Rock dove	12-Mar-03	Collision with turbine
Red-tailed hawk	12-Mar-03	Collision with turbine
European starling	17-Mar-03	Collision with turbine
Gull species	17-Mar-03	Unknown
Gull species	17-Mar-03	Unknown
Gull species	17-Mar-03	Collision with turbine
Gull species	17-Mar-03	Collision with turbine
Western meadowlark	17-Mar-03	Collision with turbine
American kestrel	18-Mar-03	Collision with turbine
Golden eagle	18-Mar-03	Collision with turbine
European starling	19-Mar-03	Collision with turbine

Unidentified raptor species	19-Mar-03	Collision with turbine
Red-tailed hawk	19-Mar-03	Unknown
Red-tailed hawk	19-Mar-03	Collision with turbine
Unidentified bird species	20-Mar-03	Collision with turbine
European starling	20-Mar-03	Collision with turbine
Red-tailed hawk	20-Mar-03	Collision with turbine
American kestrel	24-Mar-03	Unknown
Burrowing owl	24-Mar-03	Collision with turbine
European starling	24-Mar-03	Collision with turbine
Gull species	24-Mar-03	Collision with turbine
Gull species	24-Mar-03	Collision with turbine
Rock dove	24-Mar-03	Collision with turbine
Unidentified raptor species	25-Mar-03	Collision with turbine
Rock dove	26-Mar-03	Collision with turbine
Red-tailed hawk	26-Mar-03	Collision with turbine
Mallard	1-Apr-03	Collision with turbine
Rock dove	2-Apr-03	Collision with turbine
Western meadowlark	2-Apr-03	Collision with turbine
European starling	3-Apr-03	Collision with turbine
Northern flicker	3-Apr-03	Collision with turbine
Red-tailed hawk	3-Apr-03	Collision with turbine
House finch	8-Apr-03	Automobile
American kestrel	9-May-03	Collision with turbine
American kestrel	13-May-03	Collision with turbine
Golden eagle	14-May-03	Collision with turbine
Red-tailed hawk	14-May-03	Collision with turbine

**Attachment A.** Letter of April 9, 2003, in which BRC reported preliminary results that we felt were directly relevant to the mitigation measures we offered at this and other meetings with the permit holders and Alameda County staff.

# BIORESOURCE CONSULTANTS

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FROM: Carl Thelander, Shawn Smallwood, Ph.D.  
Ref: 10 April Meeting at USFWS

9 April 2003

What follows is a brief summary of topic to be discussed at the upcoming meeting.

## *Tasks completed in 2002-2003*

As of 5 April, BRC has nearly completed two fatality search rotations at 2,513 turbines that were not searched by previously. These rotations began in October 2002, and include multiple tower/turbine designs that we did not monitor previously for avian mortality.

At these turbines, we have recorded the following fatalities:

28	golden eagles
41	red-tailed hawks
2	ferruginous hawks
25	other <i>Buteo</i> hawks yet to be identified to species
3	great horned owls
12	barn owls
4	burrowing owls
13	American kestrels
2	turkey vultures
	and numbers of various other non-raptor species

We have performed avian behavior and intensity of use surveys at nearly 200 strings of wind turbines since November 2002. These surveys have so far produced more than 3,000 observational records, including the locations of the birds relative to the wind turbines, their behaviors, and flight heights. These data will factor into the construction of the predictive model, but no analyses have yet been performed on them.

Data collected on burrowing animal distributions and abundance within 90 m of 81 turbine strings are currently being processed by our GIS coordinator, and will be analyzed shortly. These data will also factor into our development of a predictive model.

We recorded additional data on the physiography and land use around the turbines monitored through August 2002. These variables included an edge index, which characterized the lateral and vertical edge within 40 m of the tower (e.g., roads and cuts into hillsides for laydown areas), and estimates of vegetation height, rabbit abundance, cattle intensity of use of the area, lizard abundance, and intensity and duration of rodent abatement efforts.

Avian fatality data used for model construction thus far have consisted of those collected through September 2001 at 205 turbine strings, or 1,536 turbines. Data collected through August 2002 will be added shortly, and will contribute to a final draft of the model. These data include 225 records, including:

3	golden eagles
18	red-tailed hawks
1	great horned owl
9	burrowing owls
2	barn owls
12	American kestrels, and
1	prairie falcon.

The total fatality count on the 1,536 turbines monitored through August 2002 was 873.

The model will be species-specific because we are finding substantial differences in the patterns of fatalities by species.

Some early findings include:

- Preliminarily, the average mortality among turbine strings was estimated as 0.0037 golden eagles per turbine per year, 0.0275 red-tailed hawks per turbine per year, and 0.025 burrowing owls per turbine per year, as examples.
- For most species, fall is the worst season for turbine-caused mortality. For horned larks, summer was by far the worst season.
- For some species, the type of turbine or tower factors prominently. KVS-33 turbines killed nearly 13 times more American kestrels than expected by chance, although most of the fatalities occurred at Bonus tubular, diagonal lattice, and horizontal lattice towers.
- EnerTech and vertical axis towers associated with disproportionately more burrowing owl fatalities, although most were killed by Bonus tubular turbines. Disproportionately more golden eagles were killed by Bonus tubular and EnerTech turbines.
- End turbines killed disproportionately more burrowing owls but the position of the turbine in the string did not relate to fatalities of any other species.
- Golden eagles were killed more often than expected by chance on canyon slopes.
- Although not yet analyzed with respect to fatalities, the physiographic and land use variables are intriguing and include the following results (examples only).
- Vegetation height near the turbines was greater on ridgetops than most other types of physical relief considered, and was greater on south-facing and northwest-facing slopes. It also was

greater within canyons, and where there was lots of vertical edge near the tower, and it correlated positively with the number of cattle pats along a transect 20 meters from the turbine string.

- The intensity of use by cattle of laydown areas, as inferred from the number of cattle pats along two transects, was greatest on ownerships where rodenticides were deployed less than thoroughly and only periodically. Cattle pats were significantly more abundant at turbines than at 20-40 meters away on ownerships that deployed rodenticides, but there was no difference in abundance where no rodent control programs were implemented.
- Cattle use intensity was greater on ridgetops and ridgelines, and on west- and northwest-facing slopes and on flat areas with no slope aspect. It was greater nearby Bonus tubular towers and vertical axis towers, and was least where there was lots of vertical edge.
- Cottontail abundance was twice as great on ownerships where no rodenticides were deployed, and there was no apparent clustering of cottontails near the towers. However, where rodenticides were heavily deployed, cottontails were more abundant at the towers than 20-40 meters away. Cottontail abundance correlated negatively with cattle pat abundance, and was greater at vertical axis, Micon-65 and Enertech towers, as well as on plateaus, slopes, and swales, and on southwest-facing slopes and where there was some lateral edge.
- Lizard abundance was greatest on ownerships that deployed no rodenticides, and was greater on swales and on southeast- and southwest-facing slopes. It was also greatest at Holocomb turbines.

The following summary figures will be the basis for a discussion about our progress on developing the predictive model.



**INDEX**



**FACTOR**



**FINAL SCORE**

**Index Score/  
High Possible Score**

**Average of  
Index Ratings**

**Average of  
Factor Scores**

*Tower type*  
*Rotor diameter*  
*Rotor tip speed*  
*Color scheme*  
*Power generated*  
*Rotor height*  
*Perch surfaces*  
*Orientation to wind*



**TURBINE/TOWER  
DESIGN**

*Platform overhang*  
*Rock piles*  
*Vertical/lateral edge*  
*Use by cattle*



**LAYDOWN AREA**

*Relative abundance*  
*Height distribution of flights*  
*Distribution of time flying or perching*  
*Use of towers as perches*  
*Proximity of flights to turbines*



**BEHAVIOR**

*Slope aspect*  
*Elevation*  
*Slope steepness*  
*Proximity to ponds/streams*  
*Proximity to derelict turbines*  
*Number of other towers within 300 m*  
*Position in string*  
*Physical relief*



**TURBINE  
PLACEMENT**

*Windwall (yes, no)*  
*Windswept area (sum of rotorswept  
area for all turbines in the string)*  
*Number of turbines in string*  
*Non-op turbines as % of string*



**WINDFARM  
CONFIGURATION**

*Level of rodent control (indexed to intensity)*  
*Grazing intensity*  
*Vegetation height in September*  
*Number of cattle pats*  
*Lizard abundance*  
*Cottontail abundance*  
*Degree of rodent clustering near towers*  
*Rodent activity level*



**RANGE  
MANAGEMENT**

*Inter-annual trend & variation*  
*Season of the year*



**Seasonal/Annual**



**PREDICTION  
OF  
MORTALITY**