National Avian Wind Power Planning Meeting IV

May 16-17, 2000

Carmel, California

MEETING SUMMARY

Introduction

The National Avian Wind Power Planning Meeting took place at the Carmel Mission Inn in Carmel, California on May 16-17, 2000. The meeting was the fourth in a series that the Avian Subcommittee of the National Wind Coordinating Committee (NWCC) has convened as part of the Subcommittee's efforts to address and build consensus on issues of public policy, scientific research, and stakeholder/public involvement related to avian/wind power interactions. Participants in the meeting included representatives of industry, academia, conservation interests, federal and state government agencies, and other interested parties (see Attachment A of this meeting summary for a list of meeting participants).

The purpose of the meeting was to

- share research results and update research conducted on avian wind interactions
- identify questions and issues related to the research results
- develop conclusions about some avian/wind power issues, and
- identify questions and issues for future avian research.

The meeting consisted of a series of presentations and discussion regarding research related to interactions between birds and wind turbines in the following topic areas:

- Site Studies
- Avian Visual Studies
- Mortality Reduction, Impact Avoidance, and Deterrent Considerations
- Other Research Topics.

Presenters were asked to provide an overview of their studies to date, briefly describing the focus of the studies, timeline, the methodology used, data analysis, and, in particular, to emphasize any conclusions that can be drawn from the studies. An open discussion period followed each set of presentations, during which participants explored the implications and significance of the studies for future planning for wind power production.

Towards the end of the meeting, participants drew on the information presented and discussed to identify 1) overall conclusions that can be drawn regarding what we know (and don't know) about avian-wind turbine interactions, and 2) promising areas of study that have the potential for meaningful contribution to continued improvement in the planning and management of wind power generation that minimizes negative impacts on avian species.

Summary

This summary does not attempt to reflect the details of all of the presentations given at the meeting – these will be summarized in detail in a proceedings document that is being developed separately. Rather, this summary attempts to capture the key issues raised and the discussion highlights, leading to conclusions and identification of priority areas for future exploration.

Presentation Discussion Highlights

Presentations stimulated productive and interesting discussions among participants. Highlights of these discussions are summarized below. The order in which they appear is no indication of priority.

Species Impacts

It was a general conclusion among meeting attendees that raptors seem disproportionately vulnerable (at risk) and less able to avoid collisions with wind turbines than non-raptors. It was suggested, however, that there might be differences among raptor species. In contrast to raptor vulnerability, some bird groups appear *less* prone to collisions with wind towers (independent of exposure), including vultures, ravens, waterfowl, and shorebirds. In addition, one presenter noted that passerines being killed in large numbers appear to be migrants traveling in large flocks mostly at night and often associated with weather events, with peaks in the fall and spring. However, it was noted that some resident passerine species are also being killed (e.g. meadowlarks at Altamont Pass WRA). It was further noted that due to the fact that smaller birds are scavenged rapidly, they are likely to be under-represented in most fatality surveys.

Tower Type and Size, Number of Towers, and Tower Placement

Several participants questioned if and to what extent tower type (tubular, lattice), size, or location impacts avian species. The general conclusion was that uncertainty continues to surround these issues, but questions continue arise and observations are being made that warrant further investigation. For instance, the fact that 100% of the fatalities at Altamont occurred at 25% of the turbines – an apparently non-random distribution.

With regard to tower type, presenters stated that guyed meteorological towers appear more likely to kill birds per structure than wind turbines, although added that this hypothesis needs confirmation. A question was raised regarding whether lattice towers provide greater opportunities for perching and therefore lead to greater use, but studies specifically of tubular towers do not support this idea. It was generally agreed that no firm conclusions can be drawn relating tower types to avian fatalities.

Research conducted at the Buffalo Ridge wind resource area (WRA) considers the question of tower size, seeking to determine if larger and slower turbines have potential for less impact. This research showed that impacts of different size turbines may depend on the species and whether they are diurnal or nocturnal. Large turbines appear to be problematic for passerines migrating at night. It was noted that this research was conducted in an area where there are not many raptors. Researchers at Altamont Pass

are also considering the question of tower size. Some anticipated changes at Altamont Pass include the removal of turbines in high-risk areas and using fewer larger turbines to replace several smaller turbines. Researchers are hoping to document any changes in bird mortality to assess the impact of this change.

With regard to tower placement, some observations may indicate higher numbers of collisions associated with gaps in turbine strings. More study is needed of the gaps, and to assess any significant differences between mid-string points, end-string turbines and gaps, including analysis by species. Meeting attendees agreed that a closer look gaps in turbine strings may reveal promising information since preliminary results indicate that there are higher fatalities for raptors in gaps occurring within turbines strings rather than between or at the ends of strings.

Avian Vision and Turbine Blade Conspicuity

Research on the ability of birds to see moving turbine blades generated interest among meeting participants. It has been demonstrated that birds are able to distinguish the presence of turbines in photos, including in photos showing groups of turbines, isolated turbines, and parts of turbines.

Research has revealed that as a bird approaches a turbine there comes a point at which they experience what is known as retinal blur – in which the moving blades become effectively invisible or transparent. The closer the eye is to the moving blades, the greater the speed at which the visual image passes across the retina. This image can only be processed up to a certain velocity beyond which it can no longer be perceived. At greater distances, the visual signal of the blades does not pass across the retina as fast, thereby rendering the blades more visible.

It was further explained that protocols can be developed for testing conspicuity of blade patterns for birds. By the placement of different black and white patterns that are staggered across the three turbine blades it may be possible effectively to provide more rest time between blade passages so that the blades can be perceived at closer distances.

In conclusion, it appears that tip velocity (rather than RPM), and the distance of the bird from the moving turbines are the critical factors to the birds' ability to see the moving turbines, suggesting that larger, slower blades might be less hazardous than faster blades. There was general interest in and support for additional exploration in this area.

Avian Acoustical Data Monitoring (Hearing)

Participants expressed an interest in learning if 'noiser' blades result in fewer fatalities. Laboratory studies have shown that birds do not hear outside the range of human hearing. This means there is no way to produce an acoustic "scarecrow" or acoustic deterrent to scare away birds that is not also audible to humans. However, it may be possible to modify blade noise so that moving blades are easier for birds to detect and localize. In general, birds appear not to hear or locate acoustic objects as accurately as do humans. As a rule of thumb, birds listening in ambient environmental noise need to be a third to half as close to a sound source to hear it as humans do. It was suggested that there may be a 'dead spot' between where the blade is no longer visible to birds (because of motion smear) and not yet audible

because of masking by environmental noise). Minor alterations in the spectral signature of blade noise might make a significant difference in eliminating such a dead spot (i.e. at close range) without any change in the overall noise level measured at a distance where environmental impact assessments are typically made. One idea from the group was to consider targeting a strategy that blends visual and acoustical work to eliminate trouble spots.

The Role of Avian Prey in Avian-Turbine Interactions

The potential for reducing avian risk by the manipulation of avian prey was discussed. Preliminary study results look promising, however further research is needed in this area. There is a need to evaluate the relationship between avian use of an area (as for hunting prey) and risk of collision, and then check assumptions. Overall the goal is to reduce fatalities, but eliminating prey to reduce raptor use of an area may not necessarily be the best, nor most acceptable, way to reduce avian fatalities due to collisions with turbines. An implication for the species of concern is that if you remove their food source reduced population is an indirect effect. Also, it is important to consider unintended consequences, as on non-target species.

One suggestion to reduce risk was to manage habitat rather than directly managing prey species. An example would be to increase vegetation at the base of towers to discourage gophers from burrowing around turbines, because studies have shown that hawk fatalities are significantly associated with the degree of clustering of gopher burrows around the bases of turbine towers.

Potential Deterrents

In addition to risk reduction strategies stemming from new and emerging understanding of avian visual and acoustic acuity and characteristics, and potential manipulation of prey, there have been efforts to consider other risk reduction mechanisms, including deterrents. Work with captive young California Condors is being conducted, using negative reinforcement to teach condors not to land on electrical transmission towers. It was suggested that similar work might be done to condition condors to avoid wind turbines. The long-term effectiveness of this conditioning is uncertain, however, as once the condors are released into the wild, the conditioning may "wear off" without repeated reinforcement. It is acknowledged that there is the potential for condors to venture into Altamont Pass (and potentially other WRAs) when released in the planned release area.

The use of significant changes in noise levels as a deterrent may be impractical, particularly in areas close to human habitation. Much effort has gone into making wind turbines as quiet as possible. But, since the bulk of the blade noise contributing to a reading on a sound level meter is at low frequencies, it may be possible to make minor changes in the high frequency acoustic characteristics of blade noise that render a moving blade more audible to birds without affecting overall noise level.

Bats Ecology and Wind Turbine Considerations

The subject of bats and their fatal interactions with wind turbines was a subject that elicited significant interest among participants. Bat fatalities due to collisions with wind turbines have been observed incidentally, and sometimes recorded, in conjunction with a number of avian studies, but not as the specific focus of research. Our knowledge regarding bats and wind-turbines is roughly equivalent to where we were ten years ago with birds. Some of the observations that have been made include:

- Tree bats seem to be disproportionately affected compared to cave bats
- There seem to be seasonal peaks (late summer and fall)
- Bats may "turn-off" their echo-locating while migrating to conserve energy, making them more vulnerable to collisions
- More collisions seem to occur during bad weather events

In order to further our understanding about bats, meeting attendees expressed a need for standard metrics and methods specifically for research on bats, noting that experts in bat ecology and statistics are needed to develop this guidance. It was also suggested that we may be able to learn something about bats by going back and looking at bat data collected in avian studies. However, there is a need to learn more about the intensity of site utilization by bats in order to get a sense of the actual significance of bat collisions to their populations. At this point, we have no idea about utilization. Some participants noted that a great deal of effort should not be spent on examining the role of weather events, since this is something that cannot be controlled for.

Site Specificity and Siting of Wind Facilities

With regard to avian interactions, many considerations are site-specific and species-specific and a function of the relationship between site characteristics and species behavior. Participants emphasized that due to the unique nature of each site, what is transferable from what has been learned from one site to another is an understanding of what questions to ask that will provide the information that will allow us to minimize risk to flighted vertebrates (birds and bats). Based on what we have learned thus far, we are getting better at forecasting problem sites or problem areas within sites. Site selection is perhaps the key factor in reducing or minimizing avian fatalities, followed by configuration of the equipment at the site. The need for a hierarchy of screening questions to consider when selecting sites in order to reduce fatality numbers and reduce risk was highlighted. Considerations would include species presence and relative abundance; utilization and behaviors; habitat and topography (identification of high use areas). Clearly, less birds will be killed if facilities are sited where there are fewer birds (including siting of transmission corridors). Equipment selection and other wind plant characteristics should be considered in the context of information gathered about the species, and their patterns of utilization at the site. The quality and rigor of the studies done to answer these questions will be critical to achieving desired outcomes.

Effectiveness of Standard Methods and Metrics

Meeting attendees discussed the effectiveness of standard methods and metrics used in avian research. The group agreed that good basic design principles have been established in the document. It was further agreed that more time is needed to gain experience with field application of the standard methods and metrics before making judgments. They indicated that 1-2 years of experience with them is needed, and feedback needs to be gathered before any attempt is made to revise and improve them.

The following specific points were made based on experience to date with the standard methods and metrics:

- The methods and metrics for nocturnal surveys are weak and need specific attention. Likewise, for bat surveys.
- Regarding carcass removal or deterioration time - using mallards as a standard probably results in overestimating the speed of removal and biases results. Preference was expressed for using raptor carcasses as a standard instead. However, large raptor carcasses tend to stay longer than those of small songbirds, but this may be site-specific. Using frozen carcasses is not a promising option as experience has shown that they go largely untouched by scavengers.
- The recommended 60 meter search area for carcasses seems to be adequate.

It was suggested that a mechanism be established for soliciting input from the field on the usefulness and applicability of the standard methods and metrics document for use in future review and revision.

Understanding the Significance of the Problem

There continues to be significant discussion of the fact that there is inadequate understanding of the extent to which avian fatalities associated with wind power generation facilities are actually significant to avian populations. In addition to uncertainty about the specific significance of avian-wind turbine interaction, questions remain about the relative impact of wind turbines compared to other sources of avian fatalities such as transmission lines, radio towers, buildings, etc.. Some support the need to define the level of 'take' that is acceptable for avian species interactions with wind turbines.

It was acknowledged that where threatened and endangered species are concerned, a target of zero is likely to be the rule. Under the Endangered Species Act, incidental take permits may be issued. However, there is no such accommodation for takings under the Migratory Bird Treaty Act (MBTA), under which the U.S. Fish and Wildlife Service (USFWS) is responsible for protecting migratory birds. Currently 200 species of migratory birds are in decline in the U.S.. Under the MBTA it is illegal to kill birds. In addition to being big business in the U.S. today (birding is the fastest growing hobby after gardening), two thirds of flowering plants (including agriculturally important species) are pollinated by birds, bats and insects. Birds also play a critical role in the distribution of seeds. Reducing and/or minimizing anthropogenic sources of fatalities is an issue regardless of relative contribution of different specific causes. However, there is much to be gained from sharing information across industries in order to maximize the combined ability to reduce risk.

What We Have Learned

In an attempt to summarize what we have learned about avian wind power interactions, the following brief list was generated:

- In addition to being killed by collisions with other constructed structures, birds and bats are also killed by collisions with wind turbines
- Bird impacts can be significant or insignificant
- Raptors are a high risk bird group
- Bird use, mortality, and risk vary between and within wind resource areas
- It is a site-specific issue
- There is no conclusive data as to whether a) large or small turbines reduce risk, or b) tube or lattice towers reduce risk
- Nothing is known for sure that significantly reduces avian fatalities
- Avoidance of areas with high bird use is the only proven way to avoid high levels of avian fatalities

Areas Needing Further Exploration or Research

The group acknowledged that they are in a continual learning process and agreed that what is recommended today may not be recommended tomorrow. We will know when we have enough information about avian interactions when we have reasonable predictive capability with regard to siting to minimize and mitigate impacts.

Drawing on the presentations and discussions, and on their own individual expertise and experience, participants dedicated some time to compiling a list of areas where they believe future research is needed and in which additional exploration is likely to yield useful information for improving our predictive capabilities. Following the meeting, participants engaged in a process to indicate the relative priority importance of these items.[1] The resulting prioritized list is presented below. The number in brackets preceding each item indicates the number of votes it received.

However, subsequent to the meeting the NWCC facilitator, RESOLVE, has received correspondence from NWCC members from industry that *it is not a high priority* for the NWCC to develop nocturnal survey methods and metrics for birds and bats. In their experience with permitting and environmental compliance for many domestic projects, these issues have not been raised. These parties believe that there are other more appropriate topics for the NWCC to address. They also pointed out that comment was submitted when the National Avian Wind Power Planning meeting IV meeting summary was first circulated. Further, the parties at the meeting and those who responded to the informal tally after the meeting, were not necessarily a representative group of all researchers, practitioners etc. nor was there necessarily a balance of representation from the permitting and environmental compliance perspective. Therefore, the list below should not be used to set research priorities, but could be used as a starting point for discussion about priorities.

[1] Using email communication, the prioritization process worked as follows: each participant was allowed six points to assign to the items of their choice (no more than three points allowed to be assigned to any single item).

[22] Need to get a better understanding of significance of numbers of individual birds killed to their populations (species-specific) so that actions or remedies can be focused on the most significant problems

[20] Development of nocturnal survey methods and metrics (for birds and bats)

[16] Increase and/or expand avian vision studies--including field applications

[13] Prey management (relationship between prey abundance & fatalities and potential for managing prey)

[13] Extent to which other features associated with wind plants contribute to avian risk (use by prey species)

[12] Relative impacts of large vs. small turbines (new vs. old)

[12] Evaluate whether risk-reducing devices or actions work or not

[11] Develop estimates on distance from blade at which birds can hear it (need information regarding acoustic signature of blade noise) – and assess implications for role of acoustics in bird avoidance of blades

[9] Need Interim evaluation of actions currently being implemented (as at Altamont)

[9] Standardization of self-monitoring studies

[7] Evaluation of aversion training (condors) as a risk reduction strategy.

[6] Need more/better integration with permitting process

[6] Meta analysis of existing data

[6] Gaps in tower strings (including species-specific implications at Altamont)

[5] Extent to which risk is reduced by turning turbine off (for different species)

[3] What considerations need to be addressed in re-powering decision-making and planning

[2] Information regarding operational status of turbines would be helpful in determining risk (need from operator).

[2] Calibration studies on carcass removal speed

Attachment A **List of Meeting Participants**
Attachment B **Meeting Agenda**
Attachment C **Post-Meeting Comments on Priority Areas**

Attachment A

National Avian Wind Power Planning Meeting IV

May 16-17, 2000
Carmel, California

MEETING ATTENDEES

Dick Anderson, California Energy Commission
Don Bain, Oregon Office of Energy
R.T. "Hap" Boyd, Enron Wind Corporation
Charles Bragg, National Audubon Society
Steven Buckley, Alameda County Planning Department
Richard Carlton, Electric Power Research Institute
Jim Davis, Ventana Wilderness Society
Robert Dooling, University of Maryland College Park
Thomas Gray, American Wind Energy Association
Darryl Gray, Alameda County Planning Department
Larry Hartman, Minnesota Environmental Quality Board, MN Planning
William Hodos, University of Maryland College Park
Stacia Hoover, BioResource Consultants
Grainger Hunt, Predatory Bird Research Group
Brian Keeley, Bat Conservation International, Inc.
Todd Mabee, ABR Inc.
Jim Maloney, Eugene Water & Electric Board
Lawrence Mayer, Banner Health Research Institute
Gail McEwen, Oregon Department of Fish and Wildlife
Hugh McIsaac, Department of Biological Science
Thomas Meehan, Oregon Office of Energy
Kimia Mizany, UC Santa Cruz
Michael Morrison, Dept. of Biological Sciences, Cal. State University
Charles Nicholson, Tennessee Valley Authority
John F. Nunley III, Wyoming Business Council, Energy Office
Michael C. Robinson, National Renewable Energy Laboratory
Lourdes Rugge, BioResource Consultants
Sharon Sarappo, Northern States Power
Susan Savitt Schwartz, Writing & Editing Services
Karin Sinclair, National Renewable Energy Laboratory
Shawn Smallwood, BioResource Consultants
Robert Snow, U.S. Fish and Wildlife Service
Kelly Sorenson, Ventana Wilderness Society
Steve Steinhour, SeaWest
Joan Stewart, Altamont Infrastructure Co.
Dale Strickland, Western Ecosystems Technology, Inc.
Carl Thelander, BioResource Consultants
Rick Thompson, Public Service Company of Colorado
Steve Ugoretz, Wisconsin Department of Natural Resources Energy Team
Rick Williams, Duke Engineering & Services

Facilitators: Lee Langstaff, RESOLVE, Inc.
Lori Riggs, RESOLVE, Inc.

Attachment B

National Avian-Wind Power Planning Meeting IV

Agenda

May 16-17, 2000
Carmel Mission Inn
3665 Rio Road
Carmel, California

Purpose of Meeting:

- Share research results and update research conducted on avian wind interactions
- Identify questions/issues stakeholders have about research results
- Develop conclusions about some avian/wind issues
- Identify questions/issues stakeholders have for future avian research

Tuesday, May 16, 2000

8:00 – 8:30 Continental Breakfast

8:30-8:45 **Welcome and Introductions** *Lee Langstaff, RESOLVE*

- Introductions
- Review purpose of meeting
- Review product we want to develop at the meeting

8:45-9:05 **Setting the Context: Overview of Avian/wind Power**

History and Overview of Studies Conducted to Date *– Dick Anderson, CA Energy Commission, and Chair of NWCC Avian Subcommittee*

- History and conclusions of past three meetings
- What studies have been conducted or are currently being conducted

9:05-12:00 **SESSION I – Site Studies – What are we observing at existing sites?**

Overview of each study, (brief overview of methodology used in study, what is being studied, data analysis, timeline, conclusions if any)

Altamont Pass Wind Resource Area

9:05 – 9:35 Carl Thelander
9:35 – 10:05 Grainger Hunt
10:05 – 10:20 BREAK
10:20 – 10:40 Stacia Hoover & Shawn Smallwood – Prey Studies
10:40 – 11:10 Discussion: what questions or issues are raised and what conclusions can be drawn from these studies?

Other Site Studies

11:10 – 11:40 Buffalo Ridge/[Vansycle] – Dale Strickland, WEST
11:40 – 12:10 San Gorgonio Pass/Techachapi - Dick Anderson

12:10 – 12:20 Kewaunee, WI – Steve Ugoretz
12:20 – 12:40 Discussion: what questions or issues are raised and what conclusions can be drawn from these studies?

12:40 – 1:40 LUNCH

1:40 – 3:10 SESSION II – Avian Visual Studies: What are we learning about avian vision that can help us better understand avian-wind power interactions?

1:40 – 2:10 Hugh McIsaac, Denver University
2:10 – 2:40 Bill Hodos, University of Maryland
2:40 – 3:10 Discussion: what questions or issues are raised and what conclusions can be drawn from these studies?

3:10 – 3:30 BREAK

3:30 - 5:30 SESSION III – Mortality Reduction, Impact Avoidance, and Deterrent Considerations: What are we learning about how to reduce avian fatalities due to avian-wind power interactions?

3:30–4:00 Foot Creek Rim – Dale Strickland, WEST
4:00-4:30 Acoustical Data Monitoring - Bob Dooling
4:30 – 5:00 Altamont - Daryl Gray, Alameda County
5:00 – 5:30 Discussion: what questions or issues are raised and what conclusions can be drawn from these efforts?

5:30 – 6:30 Summary of What We Heard Today, Conclusions/Observations

6:30 Adjourn for the day

Time TBD Reception (cash bar)

Wednesday, May 17, 2000

8:00 – 8:30 Continental Breakfast

8:30-8:45 Overview of the Day

8:30 – 12:00 SESSION IV - Other Research Topics

8:45-10:00 ***Bat Ecology and Wind Turbine Considerations***
- *Panel: Brian Keeley, Steve Ugoretz, Dale Strickland*
- *Discussion: what are the implications of this information for site selection, monitoring and evaluation?*

10:00 – 10:15 BREAK

10:15-12:00 ***Improved/alternate Techniques for Use in Avian Research***
*10:15-10:45 Monitoring – **[TBD]***
10:45-11:30 Bird Activity Monitoring - Rick Carlton, EDM
11:30-12:00 Discussion: what questions or issues are raised and what conclusions can be drawn ?

12:00-1:00 LUNCH

1:00-2:00 ***Taking account of differences at each site***
- *Panel: Dick Anderson, Mike Morrison, Dale Strickland*
- *Discussion: what questions or issues are raised and what conclusions can be drawn?*

2:00-2:30 ***California Condor Reintroduction - Potential Wind-Power Related Impacts***
- *Jim Davis & Kelly Sorenson – Ventana Wilderness Society*

2:30 – 2:40 ***Comparison to other Stationary Structures***
- *Steve Ugoretz*

2:40 – 3:00 ***U.S. Fish and Wildlife Service Perspective, Concerns, Recommendations –[TBD]***

3:00 – 3:30 Discussion: What questions or issues are raised and what conclusions can be made?

3:30-3:45 BREAK

3:45-6:30 Review of What We Have Learned

1. *Effectiveness of the standard M&M,*
2. *Comparisons of collision fatality trends between ecoregions and bird groups;*
3. *Conclusions about patterns of collision fatalities related to site and technology factors.*

(Format to be determined)
- What Have We Learned – long vs. short term studies
- What are the next steps to achieve standardization in studies?
- How do we know when we have enough information?
- What do we still need to learn, work on?
- How can we get that information?

6:30 ADJOURN

Thursday, May 18

8:00-9:30 Breakfast Meeting of NWCC Avian Subcommittee
Open to interested individuals to discuss future role and activities of the Subcommittee

Attachment C

Post-Meeting Comments from AWPP Participants on Priority Items

In addition to ranking the items under consideration, some meeting participants commented on one or more of the items or offered overarching comments. Their comments are shown below.

[22] Need to get handle on significance of numbers of individual birds killed to their populations (species-specific). Actions/remedies need to focus on most significant

- This is a critical issue for focusing and prioritizing future research. There is no end of interesting research problems that can be pursued, but few have relevance to the original reason for this group's existence, which was to get a handle on the problem in Altamont Pass, determine whether it is a problem for wind plants generally, and if so, what to do about it.

  AWEA's view is that further research is warranted at wind sites where there is an indication that population problems exist (i.e., where a preliminary examination shows that the number of kills of a species is sufficient to present a threat to the population), and should be focused on assessment and mitigation at those sites.

- I agree that this can put the number of windplant-related deaths in a useful context, and could be broadly applicable if a range of sites/areas are studies, not just the Altamont.

- Although the Migratory Bird Treaty Act doesn't allow any "take", it will be important to the industry in future discussions with the USFWS to have this information for specific sensitive species. This isn't to imply that population studies are necessary for relatively common species.

[20] Nocturnal survey methods and metrics (birds and bats)

- I consider the bat issue of more concern than the bird issue. The existing data still supports the original assumption that raptors are at greatest risk from collisions with turbines. However, so little is known about the relative abundance of bats within wind plants it is impossible to put bat fatalities in perspective.

- At present, AWEA is particularly negative on this item. There is no justification for developing an exhaustive set of procedures for such studies in the absence of serious evidence that a significant problem exists somewhere (and preferably multiple sites) that must be investigated at night.

- While I disagree that nocturnal use and resultant mortalities is an issue, it is pretty site specific and complex, so it may not be appropriate for this group to study.

[12] Relative impacts of large vs. small turbines (new vs. old)

- Tucker's studies indicating that larger, slower rotating turbines are safer could have broad application for new projects, where the bulk of the permitting issues are relevant. Confirmation or refutation of this theory would be useful.

- If effective visual deterrence measures were developed, they would have broad application in this industry and others.

- I agree that visual deterrence measures would have broad utility.

[12] Evaluate whether risk-reducing devices or actions work or not

- Preliminary data on some risk-reducing measures required by regulators suggest benefits aren't as obvious as assumed. Regulators should be cautious when requiring industry to implement untested mitigation measures. While some of these measures will no doubt reduce risk to birds, some of the measures may have no effect and thus are a waste of money and some measures might actually increase risk to birds. I suggest this item be expanded to include an evaluation of all risk reduction measures and include the following items: 4./5. Prey management (relationship between prey abundance & fatalities), 6./7. Large vs. small turbines (new vs. old), and 9./10. Need interim evaluation of actions currently being implemented (as at Altamont). As another example, industry is assuming that larger fewer turbines may be better than numerous smaller turbines. However, preliminary data at some sights suggest that more night migrating songbirds are colliding with the larger turbines. The significance of this increased fatality rate should be evaluated if the use of larger turbines is to be considered a method of mitigating risk to birds.

[11] Estimates on distance from blade at which birds can hear it (need info re acoustic signature of noise) - assess implications for role of acoustics in bird avoidance of blades

- Evidence to date suggests that of the relatively few kills at most wind plants, a significant number are nocturnal. This in turn suggests that research on acoustic deterrence measures is worthwhile

- I agree this could be very useful, and further feel that the studies should include new turbines as well as older, noisier, more tonal turbines.

[6] Need more/better integration with permitting process

- Nearly every permitting process is different across the US, so better integration is difficult. And, that integration is what the better consultants provide. The only commonalties across the US are the US Fish & Wildlife Service and BLM, and they differ from region to region

and individual to individual in local offices. The USFWS as a group are somewhat independent thinkers, so I don't see a lot of value coming out of this unless a MAJOR effort is launched with substantial peer review by nearly all the USFWS key participants. Since only a handful are highly interested in this topic, it seems likely to yield little.

[6] Meta analysis of existing data

- Meta analysis of existing data regarding turbine types, plant characteristics, etc. will be valuable but we may not have enough spatial and temporal replication of new generation wind plants and turbine types at this point.

[5] Extent to which risk is reduced by turning turbine off (for different species)

- If turning turbines off is a mitigation measure required by agencies, projects become non-financeable, bringing new development to a halt.

[2] Calibration studies on carcass removal speed

- I believe there are already sufficient carcass removal protocols.

General Comments from AWPP IV participants

- I give higher priority to those items that should tell us something about wind projects in general, rather than to those items that focus primarily on a single project or location. However, many of the items are a combination of both.

- As a utility representative, my interests are most focused on identifying methodologies that help reduce avian/environmental risks at potential new wind sites. Preventative medicine during the site evaluation and selection process seems to be the best solution to avoid an Altamont type situation.

- On one level, the large-versus-small comparison may only be practicable in the Altamont. There aren't enough mortalities anywhere else to produce statistically significant numbers to compare.

  At the same time, a comparison of nocturnal kills at large-versus-small turbines might be useful as a comparison to Tucker's calculations, since a nighttime strike is probably more purely a function of probability. Confounding factors like visual recognition not as applicable.

  In general, the agenda is an Altamont agenda, which is valid to a point, but only to a point. I agree with our placing emphasis on issues applicable there as well as elsewhere.