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Avian Risk and Fatality Protocol

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Introduction

The death of birds in wind power developments has been documented throughout the world. Even a small number of deaths could have a significant impact on a local population of breeding birds. Additionally, the death of birds raises concerns among the public about the environmental impact of wind power developments. It is imperative that new wind power developments be placed in locations of relatively low risk to birds, and that existing wind developments assess any negative impacts to birds.

The numbers of birds in an area will vary seasonally, and within a season, will vary according to weather conditions. For example, birds of prey (raptors) often congregate locally during winter, substantially raising the potential negative impact of a wind power development on bird populations. Studies of bird use at wind power developments must be conducted throughout the year and in various weather conditions.

The addition of wind turbines obviously adds an obstacle for birds. Research has shown that birds will fly into the rotating blades. However, no specific information is available on the relative risk that different types of towers (e.g., lattice or tubular), blade sizes, and rotation rates have on bird fatalities. Thus, studying birds in wind power developments will help resolve the role that equipment type has on bird behavior and deaths.

The protocol described herein is designed to assist with the placement of wind power developments, and to document bird behavior and fatalities resulting from existing wind power developments. A standardized protocol will assist with comparing data among potential and existing development locations. Furthermore, this protocol is based on standard methods being used in other studies of bird behavior. The data collected will only be useful if observers follow each method carefully.

In addition, the data collected using this protocol will likely be used by a permitting or other regulatory agency in evaluating the avian impacts at the site. As such, knowledge of how the data will be used and how it should be presented should be clarified before the field work commences.

Goal

The goal of this protocol is to help users evaluate the potential risk of bird fatalities due to wind power development and to document actual bird fatalities. This protocol is for initial examination of bird use of a proposed wind development area or bird use and fatalities in an existing development.

Objectives

Specific objectives apply to both planned (pre-construction surveys) and existing (post-construction surveys) wind developments:

1. Determine the passage rates of birds near turbines or proposed turbine sites.
2. Determine the influence of weather and other environmental conditions on passage rates and risk.
3. Identify periods of relatively low and high potential risk to birds.
4. Develop a database suitable for post-development monitoring and comparison with pre-development data.
5. Quantify bird fatalities in wind power plants.

Definitions

Observation points: Location from which turbines or proposed turbine locations are observed for bird activity.

Passage rate**:** Frequency at which birds pass a turbine or turbine string. Calculated as bird passes per unit time (e.g., passes/30 min) within predetermined distance categories. Passes within the plane of blade rotation are of particular interest.

Primary zone of risk: The volume defined by a rotating turbine blade.

Sampling period: The 30-min period used to observe birds at a turbine site. This period may be modified (e.g., shortened if emphasis is on passerine and passerine-like bids, longer if emphasis is on relatively rare raptors). However, study-wise standardization of the period is essential.

Sampling session: A group of sampling periods.

Sampling strata: A grouping of user-defined sampling sessions for combining data into strata (e.g., by season and time of day) for analyses.

Turbine string: A group of adjacent turbines separated from other turbines by some user-defined distance.

Methods

Observation Points
Observation points will be location-specific based on project size and topography. One or a group (e.g., a string or parts of multiple strings) of turbines or planned turbine sites may be observed simultaneously. The number of observation points is based on the number of turbines and the ability of an observer to watch turbines from a single point.

Determine Passage Rate
An observer records the site location and environmental conditions at the start of the period, and then records all passages for exactly 30 min. The observer then moves to the next turbine or turbine group and begins a new 30 min period. The order of sampling turbines will be varied to ensure that all turbines are sampled across the same set of times (morning through evening) and weather conditions. The goal is to sample birds and their behaviors during various times of day as well as during different seasons.

Sampling Intensity
Sampling intensity must be based on the size of the project, suspected potential for bird mortality, and financial resources. Ideally, sampling of each turbine or group of turbines in other studies has occurred once every 2 weeks for 1 year. Sampling use and fatalities at the same time interval improves the likelihood of correlation between bird behavior and mortality (carcass searches described below). Sampling intensity may be increased during migration periods, or during periods in which species of concern are active in the area (e.g., raptor breeding season). This intensity is probably the minimum needed to stratify analyses by season and some major weather conditions within a season. Ultimately, sampling intensity should be based on an analysis of data collected during the first few months of study.

Sampling Protocol for a Turbine Site (see sampling protocol for bird use)
The distance at which birds pass turbines should be recorded. Estimates of distance at nearest pass could be recorded, or passages could be placed into categories:

- Zone A: Within the blade sphere
- Zone B: Close to the blades including passes that are along the edge of the rotation
- Zone C: Not in the blade sphere but below the bottom tip of the blade
- Zone D: Out of and well above the top of the blade.

If estimated distances are recorded, it is recommended that this data be placed into categories (e.g., passage within the plane of the blade or passage within 25 m of blade sphere) to aid in presentation of results and analyses. Or, data can be recorded relative to the diameter of the rotor (i.e., a pass within 25%, 50%, or 100% of the rotor swept area).

To aid in data recording, the turbine base, and the ground locations for the edges of zones A and B should be flagged. Heights must be estimated: observers should practice by estimating heights of known objects with a clinometer (e.g., trees, towers, and buildings). The observer should sit at any location that assists in data recording. The observer should minimize movements during the observation period to avoid influencing bird behavior.

For pre-construction surveys, estimates of bird distances and heights from planned turbine sites should be recorded (rather than estimating the categories given above). This data can be post-stratified into categories based on the size of the turbines actually constructed.

Carcass Searches
Searches for dead or injured birds should take place at least every 2 weeks. Previous work has indicated that up to 80% of bird carcasses may be scavenged within 2 weeks of death. This value is a rough average that varies widely by location. More frequent searches are highly recommended.

An area of 50-m radius around each turbine should be carefully searched by foot. Care must be taken to search tall clumps of grass, shrubs, and openings of animal burrows. Observers should slowly search sectors (i.e., northwest quarter and northeast quarter) around the turbine. All carcasses should be placed in a plastic bag, labeled as to location and date (turbine number, distance and direction from turbine base), and preserved (refrigerated or frozen) until identified. Feather spots (e.g., a group of feathers attached to skin) and body parts should also be collected. Observers should first consult with local government wildlife personnel (state and U.S. Fish and Wildlife Service) to determine handling procedures for injured birds and any dead birds with protected status.

Analyses

Samples from each observation point will be averaged for each designated sampling stratum. Analyses may include the following:

1. Summaries of passage rates (passes/30 min) by zone and zone by strata for individual turbines, strings, and other relevant turbine combinations. Graphs of point estimates and confidence intervals will aid in interpretation. Or, the mean, standard deviation, and range of passage distances can be calculated. These

analyses will provide information on the relative risk for different turbines and different environmental conditions.

2. The effect of zone or selected strata on frequency of passage may be examined using one-way or factorial analysis of variance (ANOVA) procedures (possibly with repeated measure analysis). For example, in a 4x2 factorial analysis to test the effect of zone (A, B, C, D) and season (spring, summer) on passage rate, a significant interaction would indicate that the difference in passage rate between zones changes as the seasons change.

3. The influence of environmental conditions on passage rate can be analyzed both by ANOVA and regression procedures. Factors can be added to the analyses in step (2); however, more than three interaction terms become too complex to interpret. Additionally, regression procedures may be used to evaluate the influence of environmental conditions singly (simple regression) and in combination (multiple regression).

4. Indices of mortality can be calculated as the number of dead birds divided by a measure of bird use of the sample area. For example, for the project as a whole or some subset of the turbines, the number of carcasses found during a specified period (e.g., three month summer period) can be divided by the rate at which birds pass turbines (e.g., rate of passage through zone A). It is important to note that, because of scavenging, the number of carcasses located is not an absolute count of fatality. Thus, the greatest utility of these data is to compare relative mortality between areas and over time.

Indices of Risk

The potential risk of death to birds can be estimated as follows. First, assume that some portion (0%-100%) of the birds passing through Zone A will be killed. We can then compare this risk with (1) local and regional legal status (e.g., threatened or endangered) and (2) estimated population size. For example, if we knew that a species of interest numbered 1000 individuals in the region of interest, and 10 birds passed through Zone A during the period of interest (e.g., migration or breeding period), we can estimate that 1% of the population may be killed by the turbines. This analysis is confounded because we do not know if the same bird passes through the zone of risk on different sampling periods. Nevertheless, we can calculate ranges of probabilities given different stated assumptions.

At a minimum, the data collected using this protocol will provide information on relative risk among species. This risk may then be evaluated qualitatively based on expert opinion regarding the potential impacts to the population. Additionally, the data will allow quantification of low and high periods of risk in relation to season and environmental conditions. For example, it is possible that certain species fly lower or higher during severe weather conditions or during certain times of day or year.

SAMPLING PROTOCOL

Bird Use at Wind Power Development Sites

Location: _____
(Observation point number)
should add types of towers (e.g., lattice or tubular)
Date: _____
in a form appropriate for sorting in the data base software (i.e., 021496)

Start time: _____
24-hour clock

Weather
Temperature: _____°C

Visibility: _____
Distance bird can be seen, in m

Wind: _____
Speed and direction; max. gusts can be recorded if desired

Precipitation: _____
Record as N (none), L (light), M (moderate), H (heavy), F (fog)

Observer: _____
initials

Primary Data

Species: _____
4-letter code (e.g., red-tailed hawk = RTHA; golden eagle = GOEA)

No. species in same zone: _____
Record number of same species at same time in same zone

Direction: _____
Direction of flight (0°-360°)

Zone: _____
A,B,C, and D

Record number: _____
Record as '1' for each new bird; record as '2' if same bird re-passes rotor plane during same sampling period; and so forth.

Secondary Data

If time allows, can record:

Sex: M (male), F (female), U (unknown).
Age: A (adult), SA (subadult), I (immature), U (unknown)

Bird Mortality

Location: _____
Turbine number
should add types of towers (e.g., lattice or tubular)

Date: _____
in a form appropriate for sorting in the database software (i.e., 021496)

Start time: _____
24-hour clock

Weather
Temperature: _____°C

Precipitation: _____
Record as N (none), L (light), M (moderate), H (heavy), F (fog)

Snow cover: _____% ground covered

Observer: _____
initials

Primary data

Species: _____
4-letter code

Sex: M or F; unknown

Age: _____
Adult, immature (be as specific as possible)

Dead: Y or N

Estimated time since death: _____
in days

Description of bird (e.g., broken or missing body parts): _____

Disposition of bird: _____

Distance of carcass from turbine: _____m

Notes on bird: _____
(e.g., condition and location)

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