

## A Generalized Estimator for Estimating Bird and Bat Mortality at Wind Energy Facilities: Why One Is Needed and What It Will Do

### The Problem

Fatality estimates are a fundamental tool for studying the impacts of wind turbines on wildlife and how to minimize such impacts. How then to develop the most accurate, cost-effective, and comparable estimates possible?

Multiple methods for statistically estimating bird and bat fatalities at wind energy facilities have been developed over the last 20 years, and several are still in wide use. Examples include Shoenfeld (2004), Huso (2010), Huso et al. (2012), Korner-Nievergelt et al (2013), Perón et al (2013) Wolpert (2013). Such methods adjust raw survey data to account for carcasses missed due to scavenging by other animals, natural decay, unsearchable areas, the fact that searchers may miss some carcasses, and other factors.

Guidance regarding which method is most appropriate to use for a given set of circumstances is not always available and, even when it is available, is not always followed. Guidance may not be well understood or appreciated by practitioners, or there may be disagreement or confusion regarding the applicability of a method for a given set of circumstances. As a result, a method may be misapplied, leading to biased results that can either over- or under-estimate fatality rates. In addition, disagreement over which method is most appropriate can lead to conflicts during project permitting and compliance.

Time and resources are limited, and not every owner — or agency — has a statistician available to advise which method is most appropriate for each

project or study design scenario.

And, having multiple methods in use limits the ability to make comparisons among projects, or draw the kinds of meaningful conclusions regarding geographic or temporal trends that are critical for making informed decisions regarding future development.



### Project At-a-Glance: Why GenEst?

# Accurate and comparable bird and bat fatality estimates are key

- To understand which species are most affected, where, when, and at what rate
- To support effective research to avoid and minimize impacts, and better conserve wildlife
- To facilitate compliance with permits

#### Currently, many different estimating methods, or "estimators," may provide many different answers

- Practitioners must decide which is the most appropriate estimator
- Interpreting differing results from different estimators is problematic
- Results from different studies cannot be compared

# The GenEst solution: One estimator that accommodates all assumptions

- Saves time and money
- · Easy to use, and to interpret results
- Provides comparable results across projects and unbiased estimates to inform development and operational decisions

#### Transition to GenEst is user-friendly

- No changes in monitoring protocols
- · Won't increase monitoring effort
- No new prescriptive monitoring objectives

Note: GenEst is not an evidence of absence type estimator and is not intended for use when fatalities are low or few carcasses are found.

## The Solution

The statisticians who developed several of the estimators in current use are now working together to combine them into a *Generalized Fatality Estimator*.

The single estimator can replace earlier estimators, eliminate confusion about which is most applicable for a given situation, and offer user-friendly software to carry out the complex calculations.

The Generalized Fatality Estimator — or GenEst — will allow the end-user to test assumptions regarding input parameters, and select the approach that best reflects their particular situation and data. Having flexible parameter inputs will allow GenEst to yield statistically valid, low-bias results across a wide spectrum of study designs with greatly reduced potential for user error.

The goals of this collaborative project are to:

- Provide guidance on study design to *increase efficiency* and *reduce costs* of fatality studies;
- Standardize carcass searches and data analyses;
- Reduce bias and thereby *improve the accuracy* of fatality estimates (rates) generated from carcass searches.

GenEst will be coded into free, publicly available software accompanied by a comprehensive user's guide.

## We seek funding for:

- 1. A research associate for primary code-writing
- 2. Face-to-face meetings to test the product
- 3. Workshops on software use

### Who are we?

We are a consortium of statisticians and biologists from academia, non-governmental organizations, U.S. federal agencies, consulting firms, and private industry. Each of us has been involved in development or intensive use of earlier estimators. For more information or guidance on how you can help, please contact Taber Allison, AWWI (tallison@awwi.org; 202-330-3191).





## References

Huso, M.M.P. 2010. An Estimator of Wildlife Fatality from Observed Carcasses. Environmetrics. Wiley Blackwell. DOI:10.1002/env.1052

Huso, M., N. Som, and L. Ladd. 2012. Fatality estimator user's guide: U.S. Geological Survey Data Series 729, 22 p.

Korner-Nievergelt, F., R Brinkmann, I Niermann, and O. Behr. 2013. Estimating bat and bird mortality occurring at wind energy turbines from covariates and carcass searches using mixture models. PLoS ONE: doi: 10.1371/journal.pone.0067997

Peron, G., J.E. Hines, J.D. Nichols, W.L. Kendall, K.A. Peters, and D.S. Mizrahi. 2013. Estimation of bird and bat mortality at wind-power farms with superpopulation models. Journal of Applied Ecology doi: 10.1111/1365-2664.12100

Shoenfeld, P. S. 2004. Suggestions Regarding Avian Mortality Extrapolation. Prepared for the Mountaineer Wind Energy Center Technical Review Committee.

Wolpert, R. L. 2012. A partially periodic equation for estimating avian mortality rates. Appendix A In Improving Methods for estimating fatality of birds and bats at wind energy facilities. California Wind Energy Association.