RESULTS SUMMARY

October 14, 2020

Are Bat Activity and Mortality Best Predicted by Weather Measured On-Site or at Off-Site Regional Airports?

A study recently published as an AWWI Technical Report investigates whether bat activity and mortality at wind energy facilities correlate with regional weather data, and whether these data could optimize wind turbine curtailment strategies that reduce bat collision fatalities.

Curtailing the operation of wind turbines when wind speeds are low is a common and effective method of reducing bat collision mortality. However, bats are not always present or killed during periods of lower wind speeds, and a better understanding of the factors that influence bat activity and mortality could focus curtailment when bat collision risk is higher. Previous unpublished investigations at a wind energy facility in Illinois documented relationships between precipitation occurring on-site and bat fatalities recorded 48 hours later. The lag time was hypothesized to result from bat movements initiating outside the wind facility, triggered by broader weather fronts in the region.

This study sought to answer the questions:

- Can off-site weather data predict bat activity and collision fatalities at wind energy facilities better than on-site weather data?
- If so, which weather variables evaluated in the study are most strongly correlated to collision fatalities, and thus for optimizing wind turbine curtailment strategies?
- Is bat activity and/or bat mortality concentrated during certain portions of the night?

The full report is available online at www.awwi.org/resources/patterns-of-bat-activity-and-mortality.

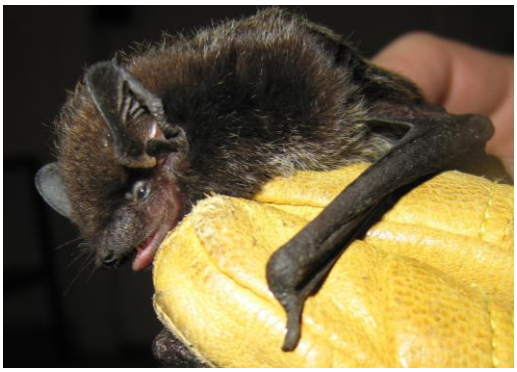
KEY TAKEAWAYS

- Other than wind speed, **on-site weather was generally a poor predictor of bat activity and fatalities,** although relative humidity, temperature, moonlight, and precipitation had minor influences on the predicted model outputs of bat activity.
- **Off-site weather variables were most influential in predicting the activity of hoary and eastern red bats at the wind facility**.
- Utilizing a **combination of on-site variables such as wind speed and temperature and off-site measurement of broader weather fronts** may improve predictions of periods of heightened bat collision risk, leading to smarter approaches to curtailment for key bat species.
- Accounting for the wind facility's **distance from roosting habitat** may inform the **distance at which weather fronts predict the timing of heightened collision bat risk.**

Facilitating timely and responsible development of wind energy while protecting wildlife and wildlife habitat

AREAS FOR FUTURE RESEARCH

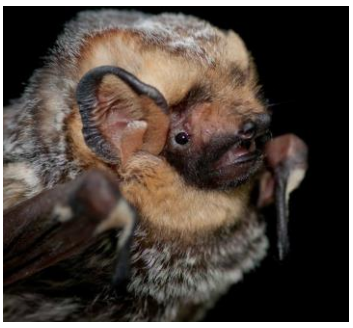
- Replicate results at other wind facilities throughout the region to further evaluate the hypotheses developed from this research, and, if promising, refine models built for other species of interest.
- Refine ability to know when a fatality occurred through additional investment and product development in technologies designed to determine the timing of a fatality incident. Until fatality timing can be measured more reliably, future analyses could strive to characterize how maximum or minimum values for one or more of these variables are good predictors of collision fatalities.



STUDY DESIGN

Anabat acoustic detectors were mounted on 12 turbines at two Illinois wind facilities, Pilot Hill and Kelly Creek (PHWF & KCWF), and the data were used to model bat activity. Bat carcass surveys were implemented at 15 PHWF turbines during the fall (August 1 – October 15, 2018), the annual period when bat mortality is highest in most regions of the U.S. An early prototype of NRG Systems' Bat and Avian Mortality Monitoring System (BAMM), a camera-based carcass detection system, was mounted on 10 PHWF turbines to determine the timing of the previous night's bat fatalities. Barometric pressure and wind direction from 12 different airports located within 100 miles of both wind facilities were used as measures of potential high- and low-pressure systems that could pass through the region and trigger bat activity and migration. Weather variables collected from on-site meteorological towers and turbine sensors were included as potential covariates, including day of study, wind speed, air temperature, wind direction, precipitation, relative humidity, and barometric pressure. Researchers used regression analyses to determine potential relationships between (1) bat activity and collision fatalities, (2) bat acoustic activity and environmental variables both onsite and at surrounding airports, and (3) bat fatalities and both on- and off-site environmental variables. Statistical models were built to determine the most likely correlations between weather, activity, and collision fatalities.

STUDY RESULTS



No bat activity was recorded until 90–120 min after sunset. Both wind facilities are located 10-19 km from the nearest forested areas. The authors hypothesize that distance to potential roosting habitat influenced a predictive model's time-of-night variable. Activity models performed well for hoary bats and eastern red bats; fatality models performed well for hoary bats but poorly for eastern red bats. The most influential variables for eastern red bat and hoary bat activity at the wind facilities included changing wind direction and barometric pressure changes recorded at off-site airports. Silver-haired activity and fatality models performed poorly.

CITATION

Good, R., G. Iskali, R. Clark, P. Rabie, K. DuBridge, and K. Murray. 2020. AWWI Technical Report: Are Bat Activity and Mortality Best Predicted by Weather Measured On-Site or at Off-Site Regional Airports? Washington, DC. Available at www.awwi.org.