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Interactive comment

Interactive comment on "Experimental Investigation of Aerodynamic Characteristics of Bat Carcasses after Collision with a Wind Turbine" *by* Shivendra Prakash and Corey D. Markfort

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Dear Reviewer 1,

We thank the reviewer for a thoughtful review of our manuscript and providing valuable suggestions to highlight the impact of the research. We have provided a response to the comment below. The changes in response are added to the revised manuscript and have been marked in red for your convenience.

Best regards,

Shivendra Prakash and Corey D. Markfort

Response to Reviewer 1

Comment: Hundreds of thousands of bats are killed every year by spinning wind turbines. And the problem is increasing as the number of turbines increase world-wide. It is important to quantify the species and number of bats hit by the rotor blades to be able to evaluate the conservation aspects and potentially mitigate collisions. To determine the area that should be searched for dead bats under each turbine, this paper calculates the drag coefficient and develop ballistic models for real dead bats dropped a high building and simultaneously surveyed by high-speed video. By making the first drag coefficient calculations of bats and implement them in models of fall distribution around turbines makes this paper useful and important in estimating the radius that must be searched. However, the experimental design was not optimal and some uncertainty in estimating drag coefficients were found. The paper is well written and I have only minor comments.

Response: We thank the reviewer for commenting on the novelty of the research and impact it may have in addressing the challenge of determining the required fall radius around wind turbines to guide search efforts and carcass count estimation. Due to the limitations identified with obtaining empirical data on bat carcass aerodynamics, we acknowledge the main complication that falling carcasses rarely reach terminal velocity and therefore accelerations must be accounted for in the analysis. This is emphasized in the paper and a systematic analysis of the accelerating carcasses is provided.

Comment: Abstract and Conclusion: I would recommend to include the fall radius and how the radius of this study should be implemented in bat conservation.

Response: Thank you for the suggestion. We agree it is important to include details about how drag affects fall radius in both the Abstract and Conclusion section. We have appended the following text to the Abstract and Conclusion in the revised manuscript to emphasize the utility of obtaining the first estimates for bat carcass drag coefficients in order to make more robust estimations of fall radius, which impact implementation of bat conservation.

Addition to the Abstract: The maximum range for bats falling after impact with a typical utility-scale onshore wind turbine was computed using the ballistic model. Based on the range of drag coefficient found in this research, Hoary and Evening bats are estimated to fall up to 109 m and 75 m, respectively. The ballistic model can be used to obtain fall distribution histograms for bats, employing the measured range of drag coefficient, to guide carcass survey efforts and correct survey data for limited or unsearched areas.

Additions to the Conclusion: For Hoary bat (heaviest bat) and Evening bat (lightest bat), the sensitivity of the bat carcass fall distribution generated from the ballistic model was investigated based on measured carcass mass and range of drag coefficient to determine the range of the maximum fall. Hoary bat, assuming the smallest Cd (0.70), resulted in a maximum fall distance of 109 m, whereas Evening bat with largest Cd (1.23) resulted in a maximum fall distance of 68 m.

The ballistic model framework proposed by HM10 generates 1D carcass fall zone histogram in the reference frame of the wind turbine rotor. The modelling framework can be extended by incorporating meteorological conditions such as wind speed and direction, resulting in a 2D fall zone histogram, representing the distribution of carcasses falling around the base of the turbine for a given period of time. Accounting for the distribution of wind direction, the model can be used to translate the histogram from the reference frame of the turbine to the reference frame of Earth. The resulting histogram can be compared to the carcass fall positions recorded in field surveys to validate the ballistic model, and guide search efforts. The model results may also be useful for correcting survey data for limited or unsearched areas, for example, when carcass surveys are conducted only on road and pads, or for a limited radius around turbines.

Please also note the supplement to this comment:
https://www.wind-energ-sci-discuss.net/wes-2019-33/wes-2019-33-AC1-

supplement.pdf

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