Bat deaths from wind turbines explained

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Extreme pressure changes near blades injures bat lungs, U of C study finds

The majority of bats killed at wind turbines are the migratory bats that roost in trees, according to PhD candidate and project leader Erin Baerwald. /Photo by Grady Semmens

Watch the video. [javascript: openPlayer(443, 84);]

The mystery of why large numbers of migratory bats are killed by certain turbines of southern Alberta's wind farms every year may have been solved by a comprehensive University of Calgary research project that has yielded answers to the problem.

A bat mortality study supervised by U of C biology professor Robert Barclay that began in 2006 has determined that the vast majority of bats found dead below turbines near Pincher Creek suffered severe injuries to their respiratory systems consistent with a sudden drop in air pressure – called barotrauma – that occurs when the animals get close to turbine blades. The results will be published in the August 26 online edition of Current Biology. The study shows that 90 per cent the bats examined after death showed signs of internal hemorrhaging consistent with barotraumas while only about half of the bats showed any evidence of direct contact with the blades.

"Because bats can detect objects with echolocation, they seldom collide with man-made structures," said PhD candidate and project leader Erin Baerwald. "An atmospheric-pressure drop at wind-turbine blades is an undetectable—and potentially unforeseeable—hazard for bats, thus partially explaining the large number of bat fatalities at these specific structures," Baerwald explains. "Given that bats are more susceptible to barotrauma than birds, and that bat fatalities at wind turbines far outnumber bird fatalities at most sites, wildlife fatalities at wind turbines are now a bat issue, not a bird issue."

The respiratory systems of bats and birds differ in important ways, in terms of both their structure and their function. Bats' lungs, like those of other mammals, are balloon-like, with two-way airflow ending in thin flexible sacs surrounded by capillaries, the researchers explained. When outside pressure drops, those sacs can over-expand, bursting the capillaries around them. Bird lungs, on the other hand, are more rigid and tube-like, with one-way circular airflow passing over and around

capillaries. That rigid system can better withstand sudden drops in air pressure.

Nine species of bats are found in Alberta, three of which migrate through the province each year. The majority of bats killed at wind turbines are the migratory bats that roost in trees, including hoary bats, eastern red bats, and silver-haired bats. While little is known about their population sizes, the researchers said their deaths could have far-reaching consequences. Bats typically live for many years, in some cases reaching ages of 30 or more. Most also have just one or two pups at a time, and not necessarily every year.

"Slow reproductive rates can limit a population's ability to recover from crashes and thereby increase the risk of endangerment or extinction," said Barclay, noting that migrating animals tend to be more vulnerable in the first place.

All three species of migratory bats killed by wind turbines fly at night, eating thousands of insects —including many crop pests—per day as they go. Therefore, bat losses in one area could have very real effects on ecosystems miles away, along the bats' migration routes.

Baerwald said there is no obvious way to reduce the pressure drop at wind turbines without severely limiting their use. Because bats are more active when wind speeds are low, one strategy may be to increase the wind speed at which turbine blades begin to rotate during the bats' fall migration period.

The study was initiated by TransAlta after the company's wind farm operators noticed bat carcasses below turbines and approached Barclay, an internationally-recognized bat expert, for advice.

"It was important for us to determine as much as we could about this issue," said Jason Edworthy, Director, Stakeholder Relations for TransAlta. "Ultimately, it's a situation we're working hard to alleviate. Ongoing research with the University is seeing some real results in terms of mitigation of collisions."

The paper "Barotrauma is a significant cause of bat fatalities at wind turbines" by Erin F. Baerwald, Genevieve H. D'Amours, Brandon J. Klug and Robert M.R. Barclay will be available online at: www.current-biology.com

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