1st International Symposium on Bat Migration, Berlin 2009

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Along with 300 other bat enthusiasts from all over the world, I attended an excellent symposium in January this year and would like to share some of the salient points relating to bats and wind farms which should become increasingly relevant to ecologists in the UK.

Paul Cryan, from the United States Geological Survey (USGS) at Fort Collins Science Center, gave a very interesting talk about wind farms and their impact upon migratory bats in northern USA. Here's a short summary of the main points he made.

Forty-five bat species inhabit the USA and many make short-distance movements between summer and winter quarters. However, four of these species may have longer migratory pathways than any other terrestrial mammal in the Northern Hemisphere. These four species, commonly referred to as 'tree bats', because they roost in the foliage or trunks of trees, are hoary bats *Lasiurus cinereus*, eastern and western red bats (*L. borealis* and *L. blossevillii*, respectively), and silver-haired bats *Lasionycteris noctivagans*.

Bat fatalities have now been documented at nearly every wind facility in North America where adequate surveys for bats have been conducted, and several of these sites are estimated to cause the deaths of thousands of bats per year.

Bat fatalities data have been gathered for 10% of the wind farms. Currently, migratory tree bats compose more than three quarters of the bat fatalities observed at wind energy sites. Out of the 4,762 dead bats recorded, approximately half were hoary bats and a quarter were red bats and silver-haired bats. The majority were male, with peak fatalities in mid August to mid September. The wind farms were located on mountain ridges or on flat agricultural land indicating that there does not seem to be any connection between local habitat characteristics and fatalities. However, there are higher fatalities in the east.

The seasonal peak in fatalities coincides with periods of both autumn migration and mating behaviour of tree bats, indicating that behaviour plays a key role in the susceptibility of bats to wind turbines, and that migratory tree bats might actually be attracted to wind turbines.

A number of hypotheses have been developed to answer the question of why bats collide with wind turbines:

Ultimate causes			
Random collision	**Coincidental Collision**	**Coincidental Collision**	**Attraction**
No difference in vulnerability	Vulnerable while migrating	Vulnerable while sedentary	Vulnerable when risky behaviour elicited by wind turbines
	Clump in time and space Fly higher Less likely to echolocate	Increased feeding activity Increased mating activity Lack of flight experience	Attraction to: Lights Sound Blade motion Insect aggregation

Another possibility is that tree bats regard wind turbines to be the tallest tree in the habitat.

Some of the species that die in smaller numbers at wind turbines are not known to migrate, although migratory habits of many bat populations are unknown and some of these species may actually do so.

Little was known until recently about bat migration. Although banding was undertaken in the USA between 1932 and 1972 (1.5 million bats of 36 species ringed), 22 species suffered high mortality and in 1972, a moratorium put a stop to banding.

One new research tool that is particularly well-suited to studying the origins of bats killed at wind turbines is stable isotope analysis. One element that is useful for such analysis is hydrogen. The stable hydrogen isotope ratio of local precipitation and groundwater is relatively constant in a localized area, but changes with latitude and elevation. In general, the isotope ratios of local precipitation are incorporated into the tissues of animals (hair, wing membrane and claws) inhabiting that area. Research using this technique will begin to be published soon.

You can read more at: www.fort.usgs.gov/BatsWindmills/

Pipistrelle bat
Photo: Katia Bresso

More Snippets From the Conference

What About Europe?

In Europe, 1,267 dead bats have been found since 1998 at wind farm sites. 19 species, out of the 38 existing in the European Union, have been killed by wind farms. In Germany and France, the fatalities peak in August to October. In Portugal, it peaks in May and

Romney Marsh Wind Farm
Photo: Katia Bresso

June.

It is thought that 55% of the dead bats are possible migrants including noctules *Nyctalus noctula*, which have been recorded to have flown over 1,600 km and Nathusius' pipistrelle bats *Pipistrellus nathusii*, which have been recorded to have flown over 1,900 km. Current surveys describe seasonal bat migrations between north-eastern and southern Europe. This information was extracted from the review of banding data (one million bats in 35 countries in Europe between 1932 and 2004).

However, the remaining 35% mainly comprise resident species. Therefore it is thought that although wind farm mortality seems to mainly impact migratory species, resident species may also be impacted when a wind farm is located close to habitats such as woodland or wetland. Therefore, a minimum distance of 200 m to woodland may be a valuable conservation tool to prevent fatalities.

Additionally, a German study looking at the recovery of dead bats, found that the radius to be searched should approximately equate to the height of the turbine.

For more information see: www.eurobats.org/publications/publication%20series/pubseries_no3_english.pdf

Technology Corner

DeTect (www.detect-inc.com) is an American firm which has developed the MERLIN Avian Radar System, the most advanced and proven system available for wind energy project avian survey, risk assessment, monitoring and real-time risk mitigation. Over 40 systems are operating worldwide.

The same company is currently developing a similar system for bats: the VESPER XVP Vertical Profiler Radar (on the commercial market in late-2009). It is a digital X-band fixed-beam vertical profile radar developed to provide differentiation of bird and bat targets in radar data. The system uses advanced signal processing to provide target identification based on wing beat frequency modulation and includes custom developed software and databases for real-time data processing.

Titley electronics (www.titley.com.au/index.htm) are currently trialling a system to allow remote check of anabat units left on site.

Research from Horn, Arnett and Kunz[1] using thermal infrared video recordings of operating turbines allowed the observation of bats actively foraging near operating turbines, rather than simply passing through turbine sites. The results indicate that bats:

1. approached both rotating and non rotating blades;
2. followed or were trapped in blade-tip vortices;
3. investigated the various parts of the turbine with repeated fly-bys;
4. were struck directly by rotating blades.

Blade rotational speed was inversely proportional to collisions, suggesting that bats may be at higher risk of fatality on nights with low wind speeds.

Seasonal 'low-wind' shutdowns during predictable nights or periods of high bat kills could reduce fatalities considerably, potentially with a modest reduction in power production and associated economic impact. Shutting down a wind turbine when wind speed is lower than 5.6 m/s showed good results for minimal cost to the developer (US$3,000 cost for August).

For more information on bats and wind energy visit: www.batsandwind.org/

The Fun Bit

Go to www.bu.edu/cecb/wind/video/ for video clips showing interaction of bats with wind turbines (using infrared technology).

Information about the bat conference: www.izw-berlin.de/de/veranstaltungen/index.html?symp%20on%20bat%20mig/Symposium%20on%20Bat%20Migration.htm~rechts

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References

[1] J Horn J, Arnett E B and Kunz T H (2008). Behavioral responses of bats to operating wind turbines. *Journal of Wildlife Management*, **72**: 123-132