

Bats anticipate optimal weather conditions

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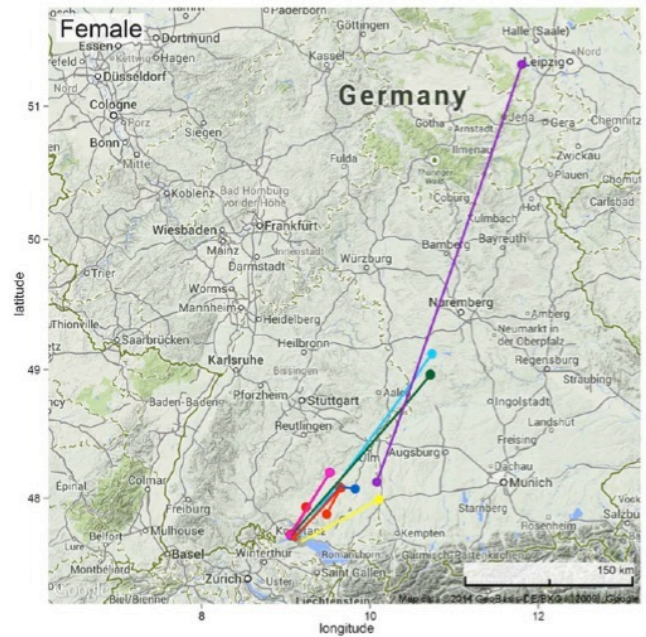
Common noctule (*Nyctalus noctula*). Credit: MPI f. Ornithology/ K. Safi

Millions of animals fly, swim or walk around the Earth every year. To ensure that they reach their destination, they need to perceive precise changes in environmental conditions and choose the right moment to set off on their journey. Bats, too, are influenced by environmental factors. Every spring, common noctules in southern Germany set off for their summer territories. Researchers at the Max Planck Institute for Ornithology in Radolfzell have been studying what conditions trigger this migration. They discovered that the decision to set off depends on a combination of wind speed, wind direction and air pressure. The researchers have developed a model that allows them to predict when the bats will start their migration.

Flocks of birds in the skies are a familiar autumn sight, as they head south to overwinter. But every year millions of other animals – from crabs and insects to fish and mammals – set off on a similar migration. There are a range of different factors which determine when they set off. Migratory birds, for example, need to have gained sufficient weight since the previous winter. When they depart is also

affected by day length, [wind conditions](#) and [air pressure](#). Bat migration, by contrast, is less well understood.

A Group headed by Dina Dechmann at the Max Planck Institute for Ornithology in Radolfzell has been studying the migratory behaviour of the common noctule (*Nyctalus noctula*). There are more than 1300 bat species, but very few travel long distances. The common noctule is one which does. It is mainly female noctules that make these journeys, which can be several hundred kilometres long. Every spring, after waking from hibernation, they fly northeast to insect-rich regions, always to the same colony, where they give birth to and raise their young. In autumn, the females fly southwest, back to their winter territories, where they mate and prepare for hibernation. Choosing the right time to set off in the spring is important for the [bats](#), as they need to build up sufficient fat reserves for their long journey, but, owing to their advanced pregnancy, cannot delay too long.



Credit: Dechmann et al., PLoS ONE, 2014

To observe the bats in the wild, they were caught in the vicinity of their overwintering sites, measured, weighed, fitted with transmitters and then released. On subsequent days, the researchers flew over the area every morning in an aircraft to see which bats had set off in which direction during the night. They also recorded weather data such as [wind speed](#) and direction, air temperature and [pressure](#), relative humidity, and cloud cover.

Provided by Max Planck Society

Unlike birds, bats can gain sufficient weight in just a few nights, and is therefore not a major factor in determining when they set off on their migration. Instead, common noctules choose the right [night](#) to set off based on weather conditions. The researchers were able to observe that more bats set off on nights with clear weather and favourable wind conditions to assist their flight (high air pressure with tailwinds). If, however, there was a weak headwind in the direction of migration, many bats also set off on nights with low atmospheric pressure. "Rising air pressure means improving weather," explains Dechmann.

Apparently, the bats weigh the weather conditions differently across the migration season: "Early on in the [migration](#) season, having really strong tail winds is important. Later on, it is important to have nights with high pressure and clear nights regardless of the wind [conditions](#). They only migrate on nights with low pressure and bad weather, if there are favorable tail winds and weak head winds", explains Teague O'Mara from the Max Planck Institute in Radolfzell.

Using the data obtained, the researchers developed a model which allows them to predict on which nights the common noctules are most likely to depart. This could be of help for bat conservation, as large numbers of migrating bats are killed by collisions with wind turbines. "If we can predict on which nights there are likely to be a lot of migrating bats, we could dramatically reduce the number of deaths by turning off some [wind](#) turbines," says Dechmann.

More information: Determinants of spring migration departure decision in a bat. *Biology Letters*; 20 September, 2017

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