

# Bats use polarized light to navigate

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Greater mouse-eared bat, *Myotis myotis*, from Bulgaria. Credit: Stefan Greif

Scientists have discovered that greater mouse-eared bats use polarisation patterns in the sky to navigate – the first mammal that's known to do this.

The bats use the way the Sun's light is scattered in the atmosphere at sunset to calibrate their internal magnetic compass, which helps them to fly in the right direction, a study published in *Nature Communications* has shown.

Despite this breakthrough, researchers have no idea how they manage to detect polarised light.

'We know that other animals use polarisation patterns in the sky, and we have at least some idea how they do it: bees have specially-adapted photoreceptors in their eyes, and birds, fish, amphibians and reptiles all have cone cell structures in their eyes which may help them to detect polarisation,' says Dr Richard Holland of Queen's University Belfast, co-author of the study.

'But we don't know which structure these bats might be using.'

Polarisation patterns depend on where the sun is in the sky. They're clearest in a strip across the sky  $90^\circ$  from the position of the sun at sunset or sunrise.

But animals can still see the patterns long after sunset. This means they can orient themselves even when they can't see the sun, including when it's cloudy. Scientists have even shown that dung beetles use the polarisation pattern of moonlight for orientation.

A hugely diverse range of creatures – including bees, anchovies, birds, reptiles and amphibians – use the patterns as a compass to work out which way is north, south, east and west.

'Every night through the spring, summer and autumn, bats leave their roosts in caves, trees and buildings to search for insect prey. They might range hundreds of kilometres in a night, but return to their roosts before sunrise to avoid predators. But, until now, how they achieved such feats of navigation wasn't clear,' says Stefan Greif of Queen's University Belfast, lead author of the study.

Even so, previous studies suggested that bats might detect polarisation

patterns when they emerge from their caves at dusk.

'Most people are familiar with bats using echolocation to get around. But that only works up to about 50 metres, so we knew they had to be using another of their senses for longer range navigation,' says Greif.

In a bid to shed light on the matter, Holland, Greif and colleagues from Tel Aviv University showed 70 adult, female mouse-eared bats one of two different types of polarisation patterns at sunset.

They then took them to one of two release sites in Bulgaria about 20 to 25 kilometres from their home roost. They released the bats at 01:00 AM – when no [polarisation](#) is visible – and followed the direction they set off in using small radio transmitters attached to their backs.

They found the bats that had been shown a shifted pattern of polarised light headed off in a direction shifted at right angles from the controls released at the same time.

Bats probably use a suite of senses, including the position of the Sun or the stars, the Earth's magnetic field, smells, sight, and of course, echolocation to navigate.

Many bat species are declining across Europe, despite being protected. Ironically, wind turbines are seriously harming their populations.

'We know that bats must be 'seeing' the turbines, but it seems that the air pressure patterns around working turbines give the bats what's akin to the bends,' says Holland.

'It's most common in migratory species, with around 300,000 bats affected every year in Europe alone. You just find [bats](#) dead at the bottom of these turbines. One option is to reduce turbine activity during

times of peak migration.'

Bats provide a vital service that tends to be overlooked – they're natural pest controllers. It's estimated that they save us millions of pounds in pesticides by eating insects.

'Anything we can do to understand how they get about, how they move and navigate will be step forward in helping to protect them,' adds Holland.

Provided by Natural Environment Research Council

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