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INSIDE JEB

A new way of measuring sleep in geese

Photo of a barnacle goose family in a small, abandoned fisherman's village, Tobseda, Russia. Photo credit: S. J. van Hasselt.

Sleep isn't an option, it's a necessity; but what exactly sleep does for an animal remains a mystery. Most studies of sleep happen in a laboratory because discovering whether an animal in the wild is asleep or just not moving requires the difficult task of measuring brainwaves in nature. This problem got Sjoerd van Hasselt, Theunis Piersma and Peter Meerlo, all from the University of Groningen, The Netherlands, thinking that there might be a better way to gauge an animal's sleep than just observing whether it's moving or not. Their solution was to measure the head movements and brainwaves of barnacle geese (*Branta leucopsis*) simultaneously, in a 48 m^2 outdoor aviary in The Netherlands, to see whether the animals' head movements could tell them if the geese were asleep.

van Hasselt explains that some animals can be active while actually being partially asleep; for example, birds can fly, dolphins can swim and ruminants can chew. And being awake doesn't necessarily mean that an animal is moving. So, the team recorded the brainwaves and head movements of barnacle geese in their enclosure between February and March (winter) 2018, and then again the following June (summer), as the researchers knew that the sleep patterns of animals can be different depending on the season, especially for those, such as barnacle geese, that live near the North Pole during the summer. Once the brainwaves were recorded, the team categorized whether the geese were awake, in light sleep or in deep sleep by how active the brain was. The researchers found that the geese had a clear pattern of activity during the winter, with brainwaves and head movements both decreasing as the night settled in; but it was difficult to tell from this information whether the animal was in light sleep.

However, in the summer, the geese didn't show the same activity patterns. According to the team's measurements, the geese were just as active at night as during the day. van Hasselt suggests, 'Because barnacle geese no longer have a clear rhythm of waking and sleeping, they can eat at any time of the day', as Arctic summers are notorious for the sun never setting. 'Another reason for the loss of a daily rhythm might be that the geese are molting and breeding during the summer. During that period, they are more vulnerable to predators, and they can protect themselves and their young by being vigilant at any time of the day', says van Hasselt, explaining that geese can't fly while shedding their feathers.

In the summer, the brainwaves were matched by the geese's head movements, but in winter, the geese were often awake during the day, but not moving. However, it was still relatively easy for the team to determine whether the geese were awake or in deep sleep by their level of movement, but it was harder to tell whether the birds were awake or just in light sleep. The researchers suggest that this new method of recording an animal's head movements may be useful for learning more about the sleep–wake patterns of other migrating birds using only small head-mounted trackers, as it is a good substitute for measuring brainwaves, just not so useful for indicating what type of sleep (light or deep) the geese are in. Either way, these geese can sleep soundly with the knowledge that they have been helping to unravel the mystery of why animals need sleep.

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