How tracking technology is transforming our understanding of animal behavior

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Credit: Daniel Frank from Pexels

Biologging is the practice of attaching devices to animals so that scientific data can be collected. For decades, basic biologgers have been used to relay physiological data including an animal's heart rate or body

temperature. But now, new technologies are affording scientists a more advanced insight into the behavior of animals as they move through their natural environment undisturbed.

The tracking of individual animals also provides access to remote locations that are difficult to study. In particular, science has only a limited knowledge of marine environments—the surface of the moon has been mapped and studied more extensively than our own ocean floor.

But researchers have recently fitted small video cameras to the dorsal fins of tiger sharks in the Bahamas. The footage led to the discovery of the world's largest known seagrass ecosystem, and has extended the total known seagrass coverage by more than 40%. Seagrass ecosystems are important carbon stores, home to thousands of marine species, and can provide a buffer against coastal erosion. Conservationists are now better placed to protect these important ecosystems as a result of biologging.

Here are four more examples of humans working with animals—from dragonflies and ospreys to hedgehogs and jaguars—to improve our understanding of wildlife behavior and numbers around the world, and how best to protect them.

1. Hedgehog protection

Rural hedgehog populations in Britain declined by up to 75% between 1981 and 2020. Conservationists require more information on their movement and behavior to inform future efforts to protect this endangered species.

Between 2016 and 2019, 52 hedgehogs were fitted with GPS trackers programmed to record the location of the hedgehog every five minutes throughout the night. The tracking data indicated that male hedgehogs

traveled longer distances than females, and would often move several kilometers to find a mate. Male hedgehogs are therefore more vulnerable to road mortality. Research like this can inform strategies such as building wildlife tunnels that enable hedgehogs to bypass busy roads.

Tracking data has also revealed that rural hedgehogs travel further each night in search of food than urban hedgehogs. This highlights the importance of urban gardens as a hedgehog habitat, and supports the use of hedgehog tunnels to connect gardens.

These studies used GPS trackers that store data on the device, meaning each animal had to be recaptured to retrieve the information. This is fine for animals such as hedgehogs that do not roam far, but it can be a challenge when studying migratory animal species.

2. Osprey migration

Scientists studied birds prior to biologging by fitting them with wing tags so they could be identified individually from a distance. But information about their location relied on researchers repeatedly finding the same bird.

Ospreys are migratory birds of prey that feed primarily on fish. They were persecuted into extinction in the UK in the 1800s, before being reintroduced to England in 1996. However, the absence of accurate data regarding ospreys' movement has made it difficult to identify their wintering grounds and migratory stopover sites.

Two UK conservation charities, the RSPB and the Roy Dennis Wildlife Foundation, began osprey satellite tracking projects around 2007. Data on an osprey's location, orientation, altitude and speed has provided researchers with information about their migration routes and wintering grounds.

Credit: Daniel Frank from Pexels

Such information has aided measures to protect ospreys throughout their migratory range. These include education programs to inspire young conservationists in the UK and Gambia, countries at opposite ends of an osprey's migratory pathway.

Biologging has also unveiled peculiarities in the behavior of ospreys. For example, one bird was found to have hitched a ride on cargo ships during its annual migration.

3. Flying insects

Biologging devices are generally large to account for a battery. So while attaching them to larger animals is relatively straightforward, studying insects has required the development of miniature devices.

Insects are among the world's smallest flying migrants—monarch butterflies and green darner dragonflies migrate south from Canada to the US each year. Researchers fitted small automated radio transmitters (weighing less than 300mg) to these insects.

Their movement over long distances was then monitored through a network of more than 1,500 automated receiver towers spread across the American continent. The towers record the biologgers within a 10km proximity.

The data revealed that the insects traveled distances of up to 143km each day at speeds of over 20 meters per second. This exceeded known daily traveling distances for the darner dragonfly. Warmer temperatures and wind assistance also allowed the insects to migrate at a faster pace.

4. Tracking from space

The Icarus project involves researchers attaching transmitters to a variety of animal species. These transmitters send data to a receiver in space which then transmits the information back to a ground station, from where it is sent to relevant researchers.

This reduces the delay for data processing and device relocation, and allows the immediate availability of behavioral and physiological data on a global scale. Since March 2021, the project has tracked the movements of 15 species worldwide, including the Saiga Antelope, fruit bats and Jaguars.

The information can be used to predict the impacts of environmental change. Identifying which habitat types are selected or avoided can reveal the most productive habitats for endangered species. The behavioral response of animals to ecological changes, such as a warmer Arctic, can also be monitored.

Data from the project may allow scientists to use certain animal species to predict disaster events. For example, research has found that some animals exhibited behavioral changes immediately before Japan's 2011 earthquake.

Icarus researchers also suggest that disease transmission hotspots could be identified using biologgers, which could help to map the spread of viruses.

Biologging has allowed for the protection of various animal species and environments by widening our knowledge of animal behavior. But remote animal tracking may also allow humanity to be better protected from natural disasters in the future.

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