‘A 99.5% decline’: what caused Australia’s bogong moth catastrophe?

The loss of any species is a tragedy, but the rapid disappearance of bogong moths has much wider effects

Thousands of bogong moths swarm around floodlights at Newcastle International Sports Centre in 2005. Photograph: Fairfax Media/Getty Images

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It’s conventional wisdom among wildlife lovers that the more charismatic an animal is, the higher its profile. Cute and cuddly species – fuzzy mammals and colourful birds – grab the public’s attention, while less obviously appealing

animals struggle in obscurity. In eastern Australia one famous insect is an exception to this rule.

In appearance, the bogong moth is perfectly average: it doesn't stand out from all the other anonymous moths of the night in size or colour. It's small, but not remarkably small, and brown, but a drab mousy brown. You wouldn't look twice at it, but for one thing: the sheer numbers in which it congregates.

When I was growing up in Canberra carpets of bogongs covered the walls of Parliament House seemingly every year. Footage of them being swept off the white walls in their thousands live in my mind's eye. My mother, who worked in Parliament House, recalls that bogongs used to flutter all over the green seats of the House of Representatives.

'Really sad moment': bogong moth among 124 Australian additions to endangered species list
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They were such a common and reliable sight that the journal of the city's environment centre, where I volunteered briefly while studying at the Australian National University, was named after them.

More significantly, bogongs are part of the deep history of this continent: in February cooked bogong remains were found on 2,000-year-old grinding stones in a cave in the Australian Alps, in Gunaikurnai country, believed to be the oldest archaeological evidence anywhere in the world of insects as a food source.

Every year the moths, which weigh only a third of a gram, fly as far as 1,000km, from southern Queensland to the mountains of Victoria – including Mount Bogong, the state's highest peak.

But these amazing insects are in trouble. In 2019, after decades of gradual decline in the population, scientists reported a sudden catastrophic drop: mountain caves that were once dense with mind-boggling numbers of the insects – as many as 17,000 moths per square metre – now contained so few that they could be counted on just one hand.

A miracle of navigation

A bogong's first migration is south: the adult moths emerge from the ground in Queensland where they have lived as caterpillars through the coldest months of the year, then as the season turns fly south to the Victorian mountains, where they spend the summer sheltering in caves and crevices, not eating but relying on fat reserves. Then, before the snows arrive, they fly back to Queensland to breed and create a new generation of caterpillars which will continue the cycle the next year.

A bogong moth flies into Rafael Nadal during the 2017 Australian Open. Photograph: Lukas Coch/AAP

Ken Green, a professor at the Australian National University and an expert on the moths, says they are able to navigate over their long migrations in several different ways, each moth following the route for the first time in its short life. Perhaps most remarkably, they can sense the earth's magnetic fields – but this is energy-sapping, so once they have got their bearings "they'll switch off their magnetic sensors", Green says.

If the night sky is clear they can instead navigate by the stars.

"The Milky Way is brighter in the south than it is in the north, so when they're migrating in spring they just head for the brightest bit which brings them south, and when they turn to go home again they swap to the northern end of the Milky Way," Green says. And if the stars aren't visible, "they can pick where the moon is even when it's seven degrees below the horizon".

The long migration has given rise to numerous theories about the causes of the decline in moth numbers, which has been so dramatic that it caught even the International Union for Conservation of Nature (IUCN) by surprise.

“When we had the meeting with the IUCN”, Green says, “they said ‘so you said there’s been a crash in numbers, would this be 60%, 40%, 20%?’ I said ‘No, based on our numbers we’re talking about a 99.5% decline.”

Green’s research has found that land-clearing for crops in the Murray-Darling basin, the main winter breeding ground for the moths, has removed about a quarter of a billion specimens annually from the mountains compared with pre-European levels. He says changing farm practices probably drove some of the decline in moth numbers observed between 1980 and 2016, but the sudden crash from 2017 was most likely due to severe drought in the breeding grounds.

Bogong moths at Parliament House in Canberra during their annual migration from Queensland to the Snowy Mountains in 2007. Photograph: Alan Porritt/AAP

Marissa Parrott from Zoos Victoria adds other potential factors, including the increased use of pesticides such as neonicotinoids in Australia (some of which are banned in other countries), increased light pollution, which disrupts the moths’ migration, the destruction of habitat and flowering plants on their migration routes and a climate that is becoming warmer and drier.

Cascading effects

The loss of any species is a tragedy in its own right, but the rapid disappearance of bogong moths has much wider effects. Like many insects, bogongs are near

the bottom of the food chain. They are a major food source for another critically endangered animal, the mountain pygmy-possum, and a boon for the entire alpine ecosystem.

The moths provide a necessary feast for mountain pygmy-possums awakening from hibernation, Parrott says, and are also a key food source for "birds, other mammals … reptiles and frogs, many of which are endangered in alpine regions".

"Even other invertebrates, such as ants and spiders, are seen feasting on the moths. The nutrients left every year by the moths are also important to the alpine soil and plants."

There are even two parasitic nematode species that depend entirely on bogong moths for their survival, Green says.

Bogongs are a major food source for another critically endangered animal, the mountain pygmy-possum. Photograph: Bloomberg/Getty Images

The moths are important not just as a food source – it's also what they feed on themselves. Bogongs are nectar-eaters, which makes them potentially important pollinators. Parrott warns that we don't yet know the effect that the sudden loss

of millions and millions of pollinating moths could have on the plants along their migration route.

“Given the sheer number of moths and the number of flowers they would visit, there should be strong concern about this,” she says.

Given the high reproductive rate of insects, there’s a chance that bogong numbers could recover – each female can lay up to 2,000 eggs. But the moths can’t do it all on their own.

Parrott says that “further support of their habitat, and less destructive agricultural practices are required”.

“Everyone can help by not using insecticides, turning unnecessary outdoor lights off for the moths, and planting native flowers that support the moths such as correa, eucalypts, tea tree, grevillea.”

And everyone along the bogong moth migration route can help scientists track them by logging their sightings on Zoos Victoria’s Moth Tracker. If we again see bogongs in their millions, knowing how close they’ve come to disappearing, perhaps we might have a newfound appreciation of these small, brown, nondescript, spectacular animals.