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JONATHAN WEBB

Northern-quoll populations have declined by more than 75% since the introduction of poisonous cane toads, which the quolls mistake for food.

ECOLOGY

Evolution experiment aims to save Australian marsupial

If it succeeds in quolls, the conservation strategy could also help protect Tasmanian devils.

BY APRIL REESE

On an island off Australia's north-central coast, researchers are conducting an unprecedented experiment: mixing endangered animals that have evolved genetic defences against their biggest foe with those that haven't, in the hope that their offspring will take after the wiser parent.

The subject of the experiment is one of Australia's most imperilled marsupials, the northern quoll (*Dasyurus hallucatus*). This squirrel-sized carnivore is struggling to survive a decades-long onslaught of poisonous and invasive cane toads, which quolls mistake for prey, with devastating results. The team has tested the match-making technique in captive-bred quolls, and reported the results last month (E. Kelly and B. L. Phillips *Conserv. Biol.* http://doi.org/csf2; 2018).

The researchers are now testing the technique in wild animals on Indian Island and, if the experiment is successful, it could provide some of the first real-world evidence that targeted gene flow — which involves pushing an adaptive trait through an at-risk population to boost resiliency — could be used to save an endangered species.

Australia, which has the world's highest mammal extinction rate, is desperate for new conservation tools, says Euan Ritchie, a wildlife ecologist at Deakin University in Melbourne. The quoll research is exciting, he says, because it "provides hope we can still achieve conservation wins, even for the most challenging and pressing of situations". The real test will be the ongoing wild trial. If targeted gene flow works, the ▶

research team says it could help other threatened species, too — including Tasmanian devils and corals on the Great Barrier Reef.

In the 80 years since agriculture officials introduced the cane toad (*Rhinella marina*) to northeastern Australia to control a sugarcane-devouring beetle, the amphibians have spread across the state of Queensland, the Northern Territory and large chunks of Western Australia. Their rapid advance has devastated northern-quoll populations, which have shrunk by more than 75%.

Ecologists Ella Kelly and Ben Phillips knew from their previous research that some quoll populations in Queensland had developed an aversion to the toads over the years (E. Kelly and B. L. Phillips *Behav. Ecol.* **28**, 854–858; 2017). The researchers, both at the University of Melbourne, wondered whether the trait could be successfully bred into vulnerable quoll populations that cane toads hadn't yet reached. That could make those 'naive' quolls more resilient to toad invasions, if enough animals in a given group have the trait.

To test this idea, the scientists bred animals in captivity, mixing northern quolls from a toad-infested area of Queensland that displayed an aversion to toads with naive quolls from a toad-free island in the Northern Territory. Kelly and Phillips then exposed the resulting offspring to a toad leg to gauge whether the young quolls recognized the threat. They found that most of the young quolls wouldn't touch the toad legs.

The finding suggests that the trait is inherited, rather than taught by mother quolls, and may be dominant, the researchers say. "That's the first hurdle that needs to be jumped in showing targeted gene flow," Phillips says. "Without a genetic basis, there is no point in introducing [toad-smart quolls] into the population. And we found there is a genetic basis."

The captive-quoll study is an important step towards demonstrating that targeted gene flow is a viable strategy to aid quoll conservation, says Sarah Fitzpatrick, a conservation biologist at Michigan State University's Kellogg Biological Station in Hickory Corners. "Many behaviours are plastic, and therefore are not necessarily controlled by certain genes," she says. "If this were the case for toad-eating behaviour, targeted gene flow would not work."

Buoyed by the results of the captive study, Kelly and Phillips, along with University of Melbourne colleague Chris Jolly, decided in May 2017 to see whether toad-smart and naive quolls would produce toad-smart offspring in the wild. They released 54 quolls on toad-infested Indian Island — a mix of naive Northern Territory quolls, toad-averse quolls from Queensland and hybrid offspring.

When the researchers returned in April this year to check on the quolls, they found good and bad news. Many fewer quolls survived than the team had anticipated — just 16 animals, according to the researchers' population estimate. But encouragingly, the group included offspring that seemed to be toad-smart, which would suggest that they had inherited the trait from their parents. The team is now analysing genetic samples taken from the survivors.

Kelly and Phillips plan to return to the site again next April, to see how the remaining quolls fare.

As the experiment continues, the pair is seeking permission from wildlife officials in Western Australia to introduce northern quolls with the toad-smart trait into populations in the path of the cane-toad diaspora to gird them against future invasions. "It would be a tragedy not to try," Phillips says. ■

ASTRONOMY

NASA aims for Sun's corona

The Parker Solar Probe will make humanity's closest approach to its home star.

BY ALEXANDRA WITZE

Step aside, Icarus: NASA has made a spacecraft that can fly through the Sun's atmosphere without melting.

On 6 August, if all goes to plan, the US$1.5-billion Parker Solar Probe will lift off from a launch pad at Florida's Cape Canaveral. Just three months later, it will whizz much closer to the Sun than any spacecraft has ever come, to take the first-ever direct measurements of the star's maelstrom of energy.

But that's just the beginning. Over the next 7 years, the craft will loop around the Sun another 23 times, passing nearer and nearer — ultimately flying about 6.2 million kilometres above the surface, well within the solar corona. That's nearly seven times closer than the record mark set by the German Helios 2 spacecraft in 1976.

The Parker Solar Probe aims to answer some of the biggest outstanding questions about the Sun, such as how its corona is heated to millions of degrees while the surface beneath it stays relatively cool[1]. The spacecraft will also visit the birthplace of the solar wind, a flood of energetic particles that streams out into the Solar System at speeds of up to 800 kilometres a second. When the solar wind slams into Earth, it generates beautiful polar aurorae, but it can also disrupt satellite communications and navigation systems.

"We're going to be right where all the interesting stuff happens," says Nicola Fox, a solar physicist at the Johns Hopkins University Applied Physics Laboratory (APL) in Laurel, Maryland, and the mission's project scientist.

Data from the deep-diving probe should allow researchers to improve their understanding of the complex picture of how particles, magnetic fields and energy combine in the Sun. "This is going to be such a game-changer," says Nicholeen Viall, a solar physicist at NASA's Goddard Space Flight Center in Greenbelt, Maryland.

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