ECOLOGY

Small mammals vanish in northern Australia

Scientists are struggling to rein in the culprit: feral cats, aided by fire

By **Dyani Lewis**, *in Kakadu National Park*

Just after dawn, Danielle Stokeld sets out on foot to inspect small mammal traps nestled among spindly eucalyptuses and pandanus pines in Kakadu National Park in Australia's far north. In spite of knee-high spear grass, the ecologist with the Northern Territory's Department of Land Resource Management zips through her 2.4-kilometer route, managing to check all 117 traps in less than an hour. The reason for her alacrity: Every last trap is empty.

Back at Kakadu's South Alligator ranger station later on that cool July morning, other researchers say they have fared no better. After 2 weeks of trapping, the dire reality is becoming clear. From 4000 traps at six sites, all the researchers were able to snare were a single delicate mouse and two northern quolls—spotted hedgehog-sized marsupials with long fleshy tails.

In northern Australia, mammal populations are in free fall. Over the past 2 decades, scientists have documented sharp declines in quolls, bandicoots, and other native fauna. The plight of these animals has grown so desperate that in July, the Australian government appointed the nation's first threatened species commissioner, Gregory Andrews, a Department of the Environment staffer now tasked with devising broad approaches to stem the tide of extinctions. The solutions are not obvious, but mounting evidence points to the arch villain: feral cats, aided and abetted by fire.

The European influx beginning 2 centuries ago turned the island continent into a crucible of extinction. Since then, 29 land animal species have gone extinct, including, most famously, the thylacine, or Tasmanian tiger, which winked out early last century. Other vanished fauna include species of bettongs, bandicoots, potoroos, bilbies, and wallabies. Australia's losses represent about a third of the world's mammal extinctions over the past 500 years. Many disappeared before 1950, after getting squeezed out of habitats and falling prey to invaders including cats and European red foxes. Another invader, the cane toad, has been a bane to northern quolls, which eat the toads and succumb to poison they secrete.

Other species are barely hanging on: Some 55 endemic land mammals—20% of Australia's total—are threatened with extinction. "You look at the outback and see how vast and natural it seems to be," says John Woinarski, a conservation biologist at Charles Darwin University (CDU), Casuarina. "But we've clearly fractured its ecological processes."

As losses accumulated in southern and central Australia, the sparsely populated north appeared to offer a safe haven. Bigger than Alaska, the tropical savannas that span parts of Western Australia, the Northern Territory, and Queensland have vast tracts of intact vegetation and, importantly, have proven inhospitable to the red fox. But the sanctuary was illusory. In the late 1980s, when Woinarski began his studies in the Northern Territory, 200 traps would catch 30 or 40 animals overnight. Nowadays, a typical haul is zero. "It's heartbreaking," he says. "Things that were there a decade before have just disappeared."

Northern quolls are in decline in Kakadu National Park.

PHOTO: © NT GOVERNMENT DEPARTMENT OF LAND AND RESOURCE MANAGEMENT/PHOTO BY ALARIC FISHER

Feral cats are undeniably the chief culprit. In a paper published online last month in the *Journal of Applied Ecology*, Woinarski and colleagues showed that cats unleashed in an experimental enclosure can extirpate the long-haired rat, a native of northern Australia's savannas. And after dissecting a feral cat shot by a Kakadu ranger, Stokeld found in its stomach the remains of a dusky rat, four grassland mosaic-tailed rats, and two fawn antechinuses, a carnivorous marsupial. The nonprofit Australian Wildlife Conservancy (AWC) estimates that every day in Australia, an astounding 75 million animals fall prey to roughly 15 million feral cats.

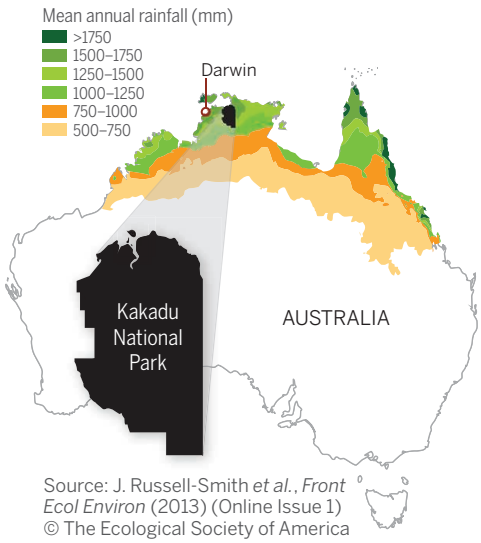
But scientists doubt that the cats, which began fanning out across Australia soon after European settlers first arrived in 1788, are acting alone. The recent declines, says Chris Johnson, an ecologist at the University of Tasmania, Hobart, beg the question, "Why now?"

The answer may be changing fire regimes. Before Europeans arrived, aboriginal Australians would burn small patches or pathways of bush to create conditions ideal for hunting or for moving more easily through the landscape. As aboriginal populations dwindled, "nastier" fires that burned hotter and left bigger fire scars became the norm, says Jeremy Russell-Smith, a fire ecologist at CDU. In recent unpublished research using GPS tracking in northwestern Australia, Sarah Legge, chief scientist at AWC, revealed that more widespread burning helps feral cats pick off critters exposed by the loss of ground cover.

To deprive the cats of their hunting grounds, AWC has implemented an intensive fire management regime at the Mornington Wildlife Sanctuary in northwestern

The dead zone

Small mammals are vanishing from tropical northern Australia.



Source: J. Russell-Smith *et al.*, *Front Ecol Environ* (2013) (Online Issue 1)

Australia's Kimberley region, intended to safeguard unburned vegetation. The reserve has also assiduously culled feral herbivores such as cattle, horses, and donkeys that thin the vegetation. As a result, native rodent and marsupial numbers have shot up fourfold in some habitats over just 3 years.

Curtailing feral cat populations is a more formidable challenge. One promising approach is an experimental bait containing para-aminopropiophenone, a chemical that converts hemoglobin in the bloodstream into methemoglobin, which cannot transport oxygen. In a trial with the bait in central Australia last year, feral cat numbers fell by more than 50%. However, trials in other areas didn't go so well, perhaps due to a greater abundance of live prey, which the cats favor over bait, or heavy rainfall that dampened the bait's appeal.

Some species may end up making their last stands on islands or in mainland arks fenced off from predators. In 2003, 64 captive-bred northern quolls were released on two islands free of cane toads off Australia's northern coast. A decade on, each island has several thousand quolls, says Dion Wedd, a curator at the Territory Wildlife Park in Berry Springs who was involved in the breeding program. Still, most scientists see such refuges as a last resort. Says Alaric Fisher, an ecologist at the Department of Land Resource Management: "We need [approaches] that work outside of fences." ■

Dyani Lewis is a writer in Melbourne, Australia.

JAPAN

RIKEN shrinks troubled center

Japan's developmental biology powerhouse brought to knees by misconduct revelations

By **Dennis Normile**, *in Tokyo*

Two discredited papers have subjected a leading Japanese research center to an extraordinary form of collective punishment. On 27 August, chemist Ryoji Noyori, president of RIKEN, Japan's biggest research institution, announced that its Center for Developmental Biology (CDB) in Kobe will be stripped of half of its 500-plus staff, renamed, and put under new management.

The hammer blow to the 14-year-old CDB is coming under heavy fire. Some outsiders see it as an overreaction to the research fiasco, in which CDB's Haruko Obokata and colleagues announced what would have been a revolutionary new way to produce stem cells. They say RIKEN is needlessly sacrificing a research powerhouse that has produced groundbreaking results. RIKEN officials say they have received more than 170 letters from scientists worldwide lobbying to keep the CDB intact. "I worry the downsizing will lead to a deterioration of research activity," says CDB director Masatoshi Takeichi. "But I hope that the reform will give it a fresh start as a new, more dynamic research institute," he says.

Critics are calling for Ryoji Noyori to step down.

PHOTO: ASSOCIATED PRESS

The papers at fault, published online in *Nature* on 29 January, reported that exposing mature mouse cells to a mild acid solution produced stem cells capable of developing into all tissue types. This stimulus-triggered acquisition of pluripotency (STAP) method was far simpler than other ways of creating stem cells. But the claims quickly unraveled (*Science*, 21 March, p. 1299). On 1 April, a RIKEN committee pronounced Obokata guilty of misconduct for falsifications and fabrications in the papers. The authors retracted the papers on 2 July. Then in a tragic turn, Yoshiki Sasai, one of the senior co-authors, committed suicide on 5 August. A RIKEN team trying to replicate the STAP method reported last week that it has so far failed to do so.

Meanwhile, a RIKEN-appointed outside committee on 12 June recommended dismantling CDB in order to head off a recurrence of such misconduct. The committee laid most of the blame on Obokata's shoulders, but it also found that lax oversight and a push for breakthrough results by top management set the stage for disaster.

Norio Nakatsuji, a stem cell scientist at Kyoto University, blames CDB management for what he calls "hyperpromotion" of the STAP findings, which turned Obokata into a media sensation. Nakatsuji believes CDB orchestrated the hype to build a case for more funding. Critics also fault RIKEN's initial response when questions arose about the STAP papers. The first investigating committee never asked why senior co-authors endorsed such a sloppy paper, says Robert Geller, a geophysicist at the University of Tokyo. Others say management shortcomings stretch to the top. "RIKEN's leaders, including Professor Noyori, must resign," says Masahiro Kami, a medical doctor at the University of Tokyo who follows ethical issues.

Asked about this at the 27 August press conference, Noyori replied that "it is the responsibility of the president to lead the charge in executing" the reform. Many of the reform's details are still hazy, but Noyori said that RIKEN will form a new institute around 250 CDB researchers, with the remaining staff moved to other RIKEN facilities. RIKEN will recruit a new director.

For those at the lab bench, "Downsizing and renaming the center in such a negative way is discouraging," says Shigeo Hayashi, a developmental biologist and CDB principal investigator. While waiting for the new institute to take shape, he says that he and his colleagues are "making every effort" to keep their research going. And Hayashi doesn't want others to share their fate. "I really hope that this will not set a precedent of making the penalty for fraudulent papers organizational upheaval." ■