

What happens when the most effective weapon to control feral cats – toxic *Eradicat*® baits – might also provide an easy meal for the carnivorous northern quoll, the very species we are trying to protect from cat predation? A partnership between Parks and Wildlife and Rio Tinto aims to understand the risks posed to northern quolls during landscape-scale cat-baiting programs in the Pilbara.

by Russell Palmer, Hannah Anderson, John Angus and Russell Thomas

Who takes the *bait*?



The landscapes of northern Australia are quietly becoming empty with the numbers of small- and medium-sized mammals rapidly declining, even in those landscapes that, from a suburban perspective, seem remote, wild and largely unchanged. The decline is occurring as much in conservation reserves as it is on pastoral land, and many factors have been implicated. From the loss of Aboriginal burning regimes, and the many large and hot fires experienced to the high-intensity grazing by both domestic and feral stock and perhaps most importantly, the rapaciousness of feral cats.

The recent *Action Plan for Australian Mammals 2012* warned that a large proportion of the threatened or near-threatened mammal species in Australia were at risk from predation by feral cats. The urgent call to action to avoid further mammal extinctions has led to feral cat control as both a policy and management priority in the Federal Government's Threatened Species Strategy for Australia.

While shooting, trapping and exclusion fencing provide a means of controlling cats on a local scale, they are expensive, labour-intensive and require continual attention in order to be effective. In the mid 1990s staff from the then Department of Conservation and Land Management started developing and researching techniques to tackle the issue at a whole-of-landscape scale. Their efforts focused on developing an effective broad-scale baiting technique incorporating a toxin specific for feral cats. Thus began the development of *Eradicat*[®], a unique patented 'sausage' bait for feral cats (see 'Controlling cats: the work continues', *LANDSCOPE*, Autumn 2013).

A CAUTIOUS BREAKTHROUGH

Eradicat[®] baits heralded a significant breakthrough in the control of feral cats in Western Australia. The bait sausages, made of kangaroo mince, chicken fat, digest and flavour enhancers, resemble a humble chipolata, but with the addition of toxic sodium fluoroacetate, commonly known as 1080. The toxin occurs naturally in many native Western Australian



Previous page
Photo montage Northern quolls are at risk from predation by feral cats.
Photos – Jiri Lochman

Above Northern quoll release in the Pilbara.
Photo – Parks and Wildlife

Right *Eradicat*[®] baits have been developed to help control feral cats.
Photo – Hamish Robertson/Parks and Wildlife



“The urgent call to action to avoid further mammal extinctions has led to feral cat control as both a policy and management priority in the Federal Government's Threatened Species Strategy for Australia.”

plants. Native animals have evolved with these species and have a high degree of tolerance to sodium fluoroacetate, while introduced species such as cats and foxes are highly susceptible to the compound.

Approval from the Australian Pesticide and Veterinary Medicines Authority to use *Eradicat*[®] in an operational capacity in WA was granted in 2014 after many years of research and development of the bait's formulation and production, followed by trials to determine how to maximise baiting efficiency across a range of climate zones and habitat types. Yet a question remained as to the potential risks of operational baiting programs on native carnivores, particularly the dasyurids,

which in WA includes quolls, phascogales, *Pseudantechinus*, dunnarts and mulgara. Because of these risks, *Eradicat*[®] is not registered for operational use in areas where the effects on potential non-target species have not been quantified.

Laboratory studies have shown that the northern quoll (*Dasyurus hallucatus*) is theoretically at high risk of accidental poisoning from operational baiting programs, but whether this theoretical risk translated to a significant real risk on the ground is not known. In WA, two distinct populations of northern quolls are found in the Kimberley and Pilbara regions, and they are the largest predatory marsupials remaining in the north of Australia.



Hear more about the project

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Above Sean Garretson radiotracking above Cane River Gorge on Red Hill.
Photo – John Angus/Parks and Wildlife

Northern quolls are opportunistic, generalist and somewhat fearless predators. They take a wide variety of prey ranging from small mammals to frogs and insects. Their unfussy and bold attitude towards their prey also means that they are the mammal most seriously affected by the spread of the cane toad (*Rhinella marina*) across the north of Australia. Northern quolls are able to kill and ingest cane toads of sufficient size, which means that the dose of toxin they receive is fatal. Their populations have collapsed and they have become locally extinct across much of the Northern Territory, as cane toads have continued their expansion westwards. Cane toads are yet to arrive in the Pilbara, and so this area and a number of Kimberley islands are considered to be potential strongholds for the long-term conservation of northern quolls.

Cane toads are not the only threat to northern quolls, feral cats pose a significant risk to the species' populations, and have been implicated in the long-term decline of populations in the Northern Territory before the arrival of cane toads. Any attempt to ensure the long-term conservation of northern quolls must address the management of feral cats as well as that of cane toads.

THE YARRALOOOLA PARTNERSHIP

A new partnership between Parks and Wildlife and Rio Tinto focusing on the management of introduced predators on the 150,000-hectare Yarraloola Land Management Area (LMA) has provided an opportunity to test the likelihood of fatalities to northern quolls during an operational baiting program for feral cats. The Yarraloola LMA is the defined offset area for Rio Tinto's Yandicoogina Junction South West and Oxbow Iron Ore Expansion Project. The offset conditions approved by the State and Federal governments require that introduced predators are controlled

across the Yarraloola LMA. Feral cats are a specific focus of the program because of their significant impacts on native fauna, in particular mammals.

The effectiveness of *Eradicat*[®] bait meant that its use was considered a core component of feral cat control across the Yarraloola LMA. The optimal time to lay baits is during the cool winter months, when bait uptake by feral cats is greatest owing to the low abundance and activity of prey, particularly reptiles, and bait degradation from wet weather and ant activity is lower.

However, for northern quolls, these cooler winter months are when males are readying themselves for the breeding season that begins around August. During this time, males roam far beyond their normal home ranges in search of additional food and potential mates. The intensity of the breeding season places such physical stress on male northern quolls that their immune systems collapse and the majority of males die after mating. Most females rarely breed more than once, and few live beyond two years.

These life-history traits make northern quolls particularly susceptible to local



extinction, especially when the predators of northern quolls are abundant. But what if the toxic baits used to kill cats in order to protect northern quolls turned out to be more lethal to the quolls than the cats themselves? The impact of both predation and poisoning posed a real risk to the survival of northern quolls within the Yarraloola LMA. No form of operational baiting could go ahead until a research program quantified the actual risk of an *Eradicat*[®] baiting program to northern quolls.

YEAR 1: CHASING THE SIGNAL

The first field season of this research project in 2015 focused on using radio telemetry to track the survival and health of northern quolls within two 20,000-hectare trial areas: one on the Yarraloola LMA that was baited with *Eradicat*[®] and the other on the Red Hill pastoral lease that acted as an unbaited control site. Following the normal cat baiting protocol, baits were dropped from an aircraft in clusters of 50 per square kilometre.

The team caught and fitted radio collars to 21 northern quolls on Yarraloola and 20 on Red Hill. The collars were fitted with mortality sensors that double the pulse rate of their transmitted tone when the collar has been motionless for more

than 10 hours, enabling researchers to assess whether quolls were dead or alive. The animals were tracked intensively after baiting within and across some of the most difficult terrain in the Pilbara.

The denning behaviour of northern quolls means that they live not just 'on' the geological formations of the Pilbara but also 'within' them, as they shelter within crevices in the walls of mesas and gorges. This posed great challenges for finding and following animals using radio telemetry. The signal from the radio collar on an animal high in the landscape and in a shallow shelter could be picked up as much as four kilometres away, yet the signal from a quoll resting in a deep shelter could be inaudible from as little as 10 metres away. This meant that some quolls were not located for periods of several weeks or even months – leaving the team uncertain of whether they had moved location or were simply sheltering deep in caves and crevices. Other individuals seemed to appear and disappear in real time as the research team tracked the signals from the collars. This may be the first indication that northern quolls bask on rock faces in the cooler winter months, quickly retreating to the safety of their dens when disturbed.

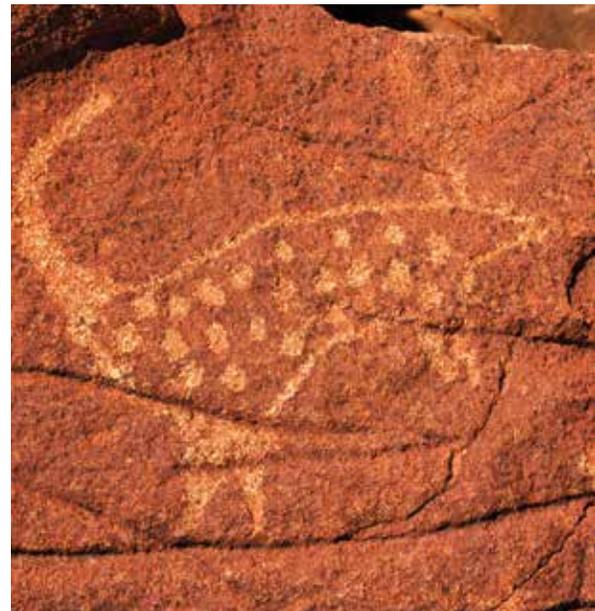
After five months of extremely challenging field work throughout the

Above left Billy Ross, a PhD student at Charles Darwin University who also works on the project, discovering that northern quolls are quite hefty following good wet season rains. *Photo – Nicolas Rakotopare*

Above top Feral cat caught on camera.

Above A northern quoll snapped by a camera trap smelling the feral cat scent. *Photos – Parks and Wildlife*

Pilbara winter and spring, all of the radio-collared quolls on both Yarraloola and Red Hill were recaptured or were tracked to where they had died. Dead quolls were photographed in position and the immediate area searched for signs of the cause of death, including any vomit that would suggest the quolls had been poisoned by *Eradicat*[®] baits. The corpses were collected and returned to Perth, where swabs for predator DNA were taken from the collars and soft tissue in the mouths of the quolls examined for indications of poisoning. Maps comparing the movement of male and female quolls with the estimated spread of *Eradicat*[®] baits on the ground within the Yarraloola LMA showed that northern quolls would have been exposed to baits during the trial. Five of the 20 quolls followed on the unbaited Red Hill site died during the



study period: two from cat predation, two from either dingo or fox predation, and one appeared to have been killed by a cat but no DNA was recovered from the collar. On Yarraloola, five of the 21 quolls that were tracked died, with cats confirmed as the cause of death for four. The fifth quoll showed signs of having been killed by a cat but its collar was not retrieved for DNA testing. Monitoring of the number of pouch young produced on each site showed that there was no impact of sub-lethal doses of sodium fluoroacetate on reproductive success.

The outcomes of the first year of field work showed that operational baiting for feral cats is unlikely to be detrimental to northern quolls and that predation by an unmanaged population of feral cats is a significant risk factor in the long-term decline of northern quoll numbers within the Yarraloola LMA.

YEAR 2: CAUGHT ON CAMERA

Based on the evidence of low risk to northern quolls gained from the first year of research, Parks and Wildlife applied to the Australian Pesticide and Veterinary Medicines Authority for a permit to expand the area baited annually with *Eradicat*[®] on the Yarraloola LMA to about 145,000 hectares, until 2019. In

the second phase of the project, research has shifted towards the operation of the baiting program and measuring its success in reducing cat numbers. Northern quoll numbers will continue to be monitored each year through an extensive trapping program carried out each September.

Feral cats are highly secretive animals, and in the Pilbara they are largely nocturnal, occur at low densities and roam over large areas. This makes them a notoriously difficult animal to monitor using traditional survey methods. The recent availability of affordable and high-quality camera traps has allowed for efficient and robust monitoring of feral cats but, again, the rugged mesas and ranges of the Pilbara provide particular challenges. Cat monitoring programs carried out in more subdued landscapes use a grid network for the placement of camera traps – a monitoring design not possible at our sites in the Pilbara. Instead, we used mapping tools to generate a series of semi-random points situated within walking distance of roads and tracks where camera traps were placed. Each camera was placed at least three kilometres from its nearest neighbour to avoid having a cat appear on multiple cameras during a sampling period. Sixty camera traps were set on both the Yarraloola

Above left The vastness of the Pilbara, while beautiful, provides challenges for surveys. *Photo – Nicolas Rakotopare*

Above Aboriginal art suggests that the complex rocky habitats have been used by the quolls for millenia in the Pilbara. *Photo – Judy Dunlop/Parks and Wildlife*

LMA (baited) and Red Hill (not baited) sites for 25 nights both before and after baits were distributed from an aeroplane.

Researchers usually provide a food lure with each camera trap to entice an animal into the camera's field of view, but during cat baiting programs non-food lures are preferred so that the detection of cats on the camera traps is independent of the provision of the food baits. But how to catch the attention of a cautious cat and entice it to the camera? Feral cats may be ruthless hunters that are decimating our native wildlife but, as it turns out, they are just as curious as your average suburban moggie about a bit of silvery tinsel and a few turkey feathers blowing in the wind. We also used a scent lure – in this case an oil suspension containing cat urine and the compound secreted from a cat's anal gland – to make the area a few metres in front of the camera traps irresistible to feral cats.



Unfortunately, the tinsel, feathers and scent of a cat's bottom also proved irresistible to the cattle of the pastoral leases. After they had nibbled at the tinsel and had a slurp of the scent lure, many cattle considered the camera worthy of a good lick or the stake holding the lure to be an excellent scratching post. We returned at times to find our cameras face up to the sky, taking thousands of unwanted pictures of cattle bellies or passing clouds or, even worse, face down into the dirt. This unexpected bovine attention necessitated a design rethink and subsequent investment in sturdier pegs and poles.

THE FUTURE: DARKER FOR CATS, BRIGHTER FOR QUOLLS

Although the program is in its infancy, our results have been positive – no mortality of northern quolls have been detected due to the baiting and only seven cats were recorded on the camera traps after baiting in the Yarraloola LMA in 2016. The preferred habitat of feral cats was flat, open country and they tended to avoid

the mesa formations that are the preferred habitat of northern quolls. The camera data showed that there was, however, some overlap between the movements of feral cats and northern quolls in the lower parts of the landscape during the breeding season when male quolls travel widely – some up to 20 kilometres – in search of a mate.

Our camera traps have also shown that northern quolls do indeed take some of the baits, but their encounters with the toxic baits on Yarraloola appear to be non-lethal and they learn from what is likely to have been an unpleasant digestive experience. When we placed non-toxic sausages manufactured in the same way as *Eradicat*® baits in our control study area at Red Hill, quolls did their utmost to drag the tethered sausages away from the camera. When we placed the same toxin-free sausages at Yarraloola a month after baiting with toxic sausages, they were ignored by all but one northern quoll. Just as northern quolls learn not to consume cane toads after an unsavoury encounter with a cane toad sausage, they appear to have the ability to learn not to eat sodium fluoroacetate baits laid during operational baiting programs. These early results make us optimistic that landscape-scale control of feral cats in the Pilbara is possible and will lead to better conservation outcomes for not only northern quolls, but other threatened fauna such as bilbies.

Above Northern quolls survive in the mesa formations found in the Pilbara as the feral cats prefer to hunt on the flat open plains.
Photo – Judy Dunlop/Parks and Wildlife

Left Researchers are having to rethink how to 'bovine proof' their equipment after inquisitive cattle – attracted to the anal gland scent – are reeking havoc on cameras and lures.
Photo – Parks and Wildlife

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The authors would like to acknowledge Dr Viki Cramer for her assistance in writing this article. They also thank Digby and Leanne Corker for granting them access to Red Hill Station and the Kuruma and Marthudunera Traditional Owners for access to their traditional lands. Australian Premium Iron provided accommodation and other support for our field teams operating on Red Hill.